Levee Certification Package
Scatter Wash Levees Near W. 39th Avenue and SR L101
North Levee ID # 1901064146 and South Levee ID # 1901064147
Maricopa County, Arizona

Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Prepared by:

amec

AMEC Environment & Infrastructure, Inc.
Phoenix, Arizona

July 21, 2014

AMEC Project No. 37-2014-2002

U.S. Department of Homeland Security
Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

January 26, 2015

Frank Brown, P.E., CFM
Senior Civil Engineer
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Dear Mr. Brown:

This correspondence is in reference to the July 23, 2014, letter and data submission to the U.S. Department of Homeland Security's Federal Emergency Management Agency (FEMA) regarding certification of the city of Phoenix and Maricopa County portions of the Scatter Wash Levee System in order to meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10). The submitted data has been approved, and the levees are considered accredited. The pertinent information regarding the specific levees is listed below.

Identifier: Scatter Wash Levee System (Levee ID Nos. 1901064146 and 1901064147)

Flooding Source: Scatter Wash

FIRM Panel Affected: 04013C1270L

In support of the Agua Fria Levee System segment certifications the following information was submitted:

- A Levee Certification Package "Scatter Wash Levees Near W. 39th Avenue and SR L101, North Levee ID# 1901064146 and South Levee ID# 1901064147, prepared by AMEC Environment & Infrastructure dated July 21, 2014.

The Technical Data Notebook prepared by AMEC Environment & Infrastructure, Inc.was reviewed to verify 44 CFR 65.10 compliance. The following is a summary of the review:

1. Freeboard: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(1).
2. Closures: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(2).
3. Embankment Protection: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(3).

4. Embankment and Foundation Stability: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(4).
5. Settlement: Analysis and Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(b)(5).
6. Maintenance Plans and Criteria: Supporting Documentation was reviewed and found to be in compliance with 44 CFR 65.10(d).

All of the above documentation and data, along with the previously submitted documentation, have been reviewed and based on receipt of this information the Scatter Wash Levee System (Levee ID Nos. 1901064146 and 1901064147) as shown on the attached Scatter Wash Levee System Map, meets the minimum certification criteria outlined in 44 CFR 65.10. Therefore, we plan to continue to accredit this levee system on the new Digital Flood Insurance Rate Map (FIRM) as providing protection from the 1-percent-annual-chance (base) flood. The area protected from the base flood by this levee will continue to be mapped as a shaded Zone X and a note will be placed in that area warning of the flood risk that still exists.

Please be advised that levee systems and the estimated level of protection provided by these systems can and do change with time. Future map updates may require the levee system to be certified again at the time of update. Also, design, construction, operation, and/or maintenance documents may be requested at any time. Deviations from the documentation and data submitted to FEMA could result in the levee system no longer being mapped as providing protection from the base flood on future FIRMs. If at any point additional information is provided to FEMA that shows the levee system no longer meets certification criteria as outlined in 44 CFR 65.10, we will contact the levee owner and community about the possibility of de-accrediting the levee system.

Even though we have mapped the referenced levees as providing protection from the 1-percent-annual-chance flood, it is important to note that levees are only designed to provide a specific level of protection. They can be overtopped or fail in larger flood events. Levee systems require regular maintenance and periodic upgrades to retain their level of protection. When levees do fail, they fail catastrophically, and damage may be more significant than if the levee was not there. Therefore, we encourage you to annually discuss the status and condition of your levees with your governing body. Additionally, it is highly recommended that you consider this risk in your local emergency management plans, including creating evacuation plans for this area.completed.

Everyone should understand the risk to life and property that resides behind levees—risk that even the best flood-control system can not completely eliminate. For this reason, FEMA encourages people to understand their risk. The National Flood Insurance Program (NFIP) was created to reduce flood damages by identifying flood risks, encouraging sound community floodplain management practices, and providing flood insurance to lessen the financial impact of flooding. Through the NFIP, property owners in participating communities are able to purchase flood insurance that will insure against flood losses. We hope that you will encourage property owners to purchase flood insurance.

If you have additional questions regarding this matter, please contact me, either by telephone at (510) 627-7274, or by email at robert.bezek@fema.dhs.gov.

Sincerely,

Robert J. Bezek, CFM
Regional Engineer
Mitigation Division

Enclosure:
Scatter Wash Levee System Map

Copies Furnished (w/out enclosures):
Brian Cosson, ADWR, NFIP Coordinator
Alex Coronel, AMEC Environment & Infrastructure, Inc.
Tony Freiman, AMEC Environmentl & Infrastructure, Inc.
Ray Dovalina, Acting Deputy Street Transportation Director, City of Phoenix
Hasan Mushtaq, Floodplain Manager, City of Phoenix

FEMA

Maricopa County - Upstream Scatter Wash PAL

FLOOD MAP MODERNIZATION

0 250 500 1,000 Feet

N

Created by: Michael Baker Jr., Inc.
Contact: Pascal Akl (510) 879-0954
Date Created: January, 2012

U.S Department of Homeland Security
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

December 15, 2014

Frank Brown
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, AZ 85009

RE: Receipt of Code of Federal Regulations, Title 44, Section 65.10 Data Submission for Provisionally Accredited Levees – Levee IDs #1901064146 and 1901064147 along Scatter Wash

Dear Mr. Brown:

This correspondence is to confirm receipt of your July 23, 2014, letter regarding the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) data submission for the Provisionally Accredited Levees along Scatter Wash with identification numbers 1901064146 and 1901064147 in the City of Phoenix. The following information was submitted in support of certification for this levee:

- A Levee Certification Package "Scatter Wash Levees Near W. 39th Avenue and SR L101, North Levee ID# 1901064146 and South Levee ID# 1901064147, prepared by AMEC Environment & Infrastructure dated July 21, 2014.

The information enclosed with the July 23, 2014, letter is under review. We will contact you if additional data is required to complete this review. If you have any questions regarding this matter, please do not hesitate to contact me by telephone at (510) 627-7274, or by e-mail at robert.bezek@dhs.gov. If you have any specific questions regarding the levee certification review please contact Sarah Houghland, from BakerAECOM, by telephone at (720) 514-1129, or by e-mail at slhoughland@mbakerintl.com.

Sincerely,

Robert J. Bezek, CFM
Regional Engineer
Mitigation Division

Copies Furnished:
Brian Cosson, ADWR, NFIP Coordinator
Alex Coronel, AMEC Environment & Infrastructure, Inc.
Tony Freiman, AMEC Environmentl & Infrastructure, Inc.
Ray Dovalina, Acting Deputy Street Transportation Director, City of Phoenix
Hasan Mushtaq, Floodplain Manager, City of Phoenix

Flood Control District
of Maricopa County

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601

July 23, 2014

Robert J. Bezek, CFM
Regional Engineer
Mitigation Division, FEMA Region IX
U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: **Levee Certification Package for Scatter Wash Levees, PAL ID# 1901064146 & 1901064147, July 2014**

Dear Mr. Bezek (Bob):

This letter is in response to the Provisionally Accredited Levee (PAL) agreement (attached) which the District entered into with the Federal Emergency Management Agency in July 2012, for the Scatter Wash Levees. The City of Phoenix is the impacted community. The enclosed submittal package is the Levee Certification Package, Scatter Wash Levees Near W. 39th Avenue and SR L101, North Levee ID# 1901064146 and South Levee ID# 1901064147, dated July 2014.

The Scatter Wash channel turns in this area, and by convention the west and north portions are called the north levee, and similar logic is utilized for the south levee. These levees tie into high ground on the upstream end at an incised channel south of the Loop 101 highway. At the downstream end, the South Levee ties into the high ground that is joined to an existing natural hill rising above the floodplain. The North Levee ties into the existing (and soon to be accredited) City of Phoenix Scatter Wash North Levee ID#46 (renamed to #1901064003) on the downstream end.

Results from an Interior Drainage Study are presented in Section 2.6.2 (B)(6), with supporting calculations shown in Appendix I of the Levee Certification Package. In this analysis, the flooding sources were investigated and the flooding extent was delineated assuming coincident peak flows for the 1% annual chance flood in both Scatter Wash and the interior drainage basin area. For the two ponding areas identified as a result of the Interior Drainage Analysis, the District asks that FEMA conduct future discussions with us and the City to determine the appropriateness of mapping landside floodplains at these ponding areas. The District is not certain that it would be worthwhile to show the north pond and it seems to me that the City does not want a FEMA-mapped floodplain for the south pond since the average depth for the entire ponding area was found to be approximately 0.8 ft. (less than one foot).

We ask that FEMA agree with the District that these Scatter Wash Levees are in full compliance with 44CFR §65.10 to provide protection from flooding during the 1 percent annual chance flood, and request that these levees be moved from Provisionally Accredited to Accredited status on the FIRM Panel. Furthermore, we ask that FEMA change the location of the levee symbols on FIRM Panel 1270L, as proposed in Figure 2 of the Levee Certification application.

If you have questions concerning this submittal, please call me at 602-506-4617.

Sincerely,

F Brown

Frank Edward Brown, P.E., CFM
Senior Civil Engineer, Mitigation Planning & Technical Programs Branch,
Floodplain Management and Services Division

Cc: Sarah Houghland, Michael Baker Corporation (1 CD/DVD disk)
Brian Cosson, ADWR, NFIP Coordinator
Alex Coronel, AMEC Environment & Infrastructure
Tony Freiman, AMEC Environment & Infrastructure
Ray Dovalina, Acting Deputy Street Transportation Director, City of Phoenix
Hasan Mushtaq, Floodplain Manager, City of Phoenix

U.S Department of Homeland Security
FEMA Region IX
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

July 7, 2014

Mr. William Wiley
Chief Engineer and General Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Dear Mr. Wiley:

This letter acknowledges the receipt of an email dated July 2, 2014, from your staff notifying the U.S. Department of Homeland Security's, Federal Emergency Management Agency (FEMA) Region IX of the delay in the certification process for the Scatter Wash levees (Levee ID Numbers 1901064146 and 1901064147). The Provisionally Accredited Levee (PAL) period officially expired on July 5, 2014. The Flood Control District of Maricopa County (FCDMC) will require additional time to complete the analysis to show that the levees are in full compliance with the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) titled "Mapping of Areas Protected by Levee Systems." You anticipate the levee certification package will be submitted for review in July 2014.

If the information cannot be submitted, our office will plan to initiate a new engineering analysis and mapping project for the Scatter Wash levee system. The project would follow the levee analysis and mapping procedures for non-accredited levees released by FEMA in July 2013. As a result, FEMA will not issue a determination letter finalizing the flood elevations for the Scatter Wash until updated analyses of the Scatter Wash that meet FEMA guidelines are available. Levee certification data can also be submitted through the Letter of Map Revision process at any time after that to have the Digital Flood Insurance Rate Map (DFIRM) changed to show the levee as fully accredited.

FEMA is not seeking changes to 44 CFR 65.10, which describes the information needed to recognize a levee system as providing protection from the base flood. Communities and levee owners continue to be required to provide structural certification of a levee system recognized on a FIRM. If Maricopa County is preparing levee certification documentation, please continue your progress on these activities and inform FEMA of any schedule updates and milestones reached.

FEMA floodplain management and engineering staff will continue to coordinate with County staff to discuss the mapping project, and ensure local officials understand the

project tasks and timeline. Although mapping current flood hazards is an ongoing challenge, we will continue to work closely with the communities in Maricopa County to develop accurate flood hazard information, and make residents aware of the risks they face, the availability of flood insurance, and steps to lower their flood risk.

Communities are encouraged to increase floodplain management efforts and promote the purchase of flood insurance for all homes and businesses in areas impacted by levee systems, including those areas with certified and accredited levee systems. Levee systems are designed and built to provide a certain level of flood protection and to reduce the risks associated with flooding events; however these systems can be overtopped or fail during flood events that exceed the design-level storm. Additionally, it is highly recommended that you consider this risk when updating your local emergency management and community mitigation plans, including creating evacuation routes and sheltering strategies for a potential flood event in this area.

If you have questions or need additional information regarding the levee certification or flood mapping for your community, please contact me by telephone at (510) 627-7274, or by e-mail at robert.bezek@fema.dhs.gov.

Sincerely,

Robert J. Bezek, CFM
Regional Engineer
Mitigation Division

Enclosures:

- Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems
- Levee Analysis and Mapping Procedure

cc: Tim Murphy, Floodplain Delineation Branch Manager, FCDMC
Frank Brown, Senior Civil Engineer, FCDMC
Kathryn Gross, Hydrologist, FCDMC
Ed Zuercher, City Manager, City of Phoenix
Wylie Bearup, City Engineer, City of Phoenix
Hassan Mushtaq, Floodplain Administrator, City of Phoenix
Brian Cosson, AZ DWR, NFIP State Coordinator

U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA. 94607-4052

FEMA

FLOOD CONTROL DISTRICT
RECEIVED
APR 24 '14

	GH & GM		FINANCE
	PIO		R.E.D.
	ADMIN		O & M
X	FMS		P & PM
	ENG		FILE
	CONTRACTS		

ROUTING tmm

April 21, 2014

Mr. Timothy S. Phillips
Chief Engineer and General Manager
Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Dear Mr. Phillips:

In accordance with the Provisionally Accredited Levee (PAL) agreement (copy enclosed), July 5, 2014, is the date in which the Flood Control District of Maricopa County (FCDMC) is to have submitted all data and documentation required to demonstrate that the Scatter Wash levees (ID Numbers 1901064146 and 1901064147) are in full compliance with the National Flood Insurance Program (NFIP). While it is our understanding that the FCDMC is making progress towards meeting this date, we want to remind you of the obligation to fulfill the requirements identified in the PAL agreement.

As you are aware, it is the responsibility of the party seeking recognition of a levee system to provide the data and documentation defined and outlined in 44 CFR 65.10. Specifically, the design and construction data provided must be certified by a registered professional engineer or by a Federal agency with responsibility for levee design. Please notify us if you are not able to submit the required data and documentation by July 5, 2014, so we can consider alternatives. If the information cannot be submitted, our office will plan to initiate a new engineering analysis and mapping project for the Scatter Wash levee system. The project would follow the levee analysis and mapping procedures for non-accredited levees released by the Federal Emergency Management Agency (FEMA) in July 2013.

Your continued cooperation on this project is appreciated. All submittals can be sent to me at the above address. Please do not hesitate to contact me if you have any questions or wish to discuss this effort in more detail. I can be reached by telephone at (510) 627-7274, or by e-mail at Robert.Bezek@fema.dhs.gov.

Sincerely,

Robert J. Bezek,
Mitigation Engineer

Enclosures: Levee Status Table
Signed PAL Agreement
Levee Analysis and Mapping Procedure

cc: Tim Murphy, Floodplain Delineation Branch Manager, FCDMC
Frank Brown, Senior Civil Engineer, FCDMC
Kathryn Gross, Hydrologist, FCDMC
David Cavazos, City Manager, City of Phoenix
Wylie Bearup, City Engineer, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix
Brian Cosson, State Coordinator, NFIP

Flood Control District of Maricopa County Levee Status Table

March 16, 2012

ID	Type	USACE Program Levee	Community	Levee Status	Flooding Source	Description/Location	Approximate Length (Miles)	Operator/ Organization
1901064146	Levee	No	Phoenix Unincorporated Areas	May be PAL A Eligible	Scatter Wash	North bank, southwest from Loop 101 and west of North 37th Avenue	0.30	FCDMC
1901064147	Levee	No	Phoenix Unincorporated Areas	May be PAL A Eligible	Scatter Wash	South bank, southwest from Loop 101 and west of North 37th Avenue	0.30	FCDMC

PAL A: Levees not in USACE program that are shown as providing base flood protection on an effective FIRM or LOMR, and may be eligible for PAL.

Letter of Agreement and Request for Provisionally Accredited Levee (PAL) Designation and Agreement to Provide Adequate Compliance with the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10)

PAL Agreement Form for Maricopa County

We, the undersigned, have received a letter from FEMA dated April 5, 2012 with an enclosed *"Levee Status Map"* and *"Levee Status Table"* and two enclosed documents titled *"Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10)"* and *"Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems."* We understand that FEMA is in the process of providing an updated Flood Insurance Rate Map for Maricopa County, AZ and that the flood hazards around the levees identified on the *Levee Status Map* and *Levee Status Table* with unique levee ID numbers 1901064146 and 1901064147 will be remapped to reflect that these levees have been designated a PAL. These levees or levee system are also known as the Scatter Wash Levee System.

To the best of our knowledge, the levees identified above meet the criteria of 44 CFR 65.10 and have been maintained in accordance with an adopted operation and maintenance plan. For Scenario A (non-USACE Program) levees, this must be evidenced by an attached Operation and Maintenance Plan and records of levee maintenance and operation, as well as Test Records of Mechanized Interior Drainage System. We hereby submit to FEMA within 90 days (before July 5, 2012) our agreement to provide FEMA with all the necessary information to show that the levees identified above comply with 44 CFR 65.10. We understand that this documentation will be provided before July 5, 2014. Providing the information described in 44 CFR 65.10 will allow FEMA to move forward with the flood mapping for Maricopa County. We fully understand that if complete documentation of compliance with 44 CFR 65.10 is not provided within the designated timeframe of 24 months, FEMA will initiate a revision to the Flood Insurance Rate Map for Maricopa County to redesignate the area as floodprone.

Levee Owner Representative (signature): _____ Date: 6/7/2012

Levee Owner Representative (print name): TIMOTHY S PHILLIPS

Levee Owner Title/Organization (print): CHIEF ENGINEER & GM

Community CEO (signature): _____ Date: 6/20/12

Community CEO (print name): Wylie Bearup, City Engineer

Community Name (print): City of Phoenix

Other, if applicable (signature): _____ Date: _____

Other, if applicable (print name): _____

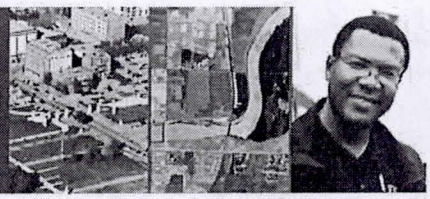
Required Attachments for Scenario A (non-USACE Program) Levees only:

- Operation and Maintenance Plan and Records
- Test Records of Mechanized Interior Drainage System

Instructions for Completing this Form:

- On this PAL Agreement Form, fill-in the levee ID numbers and levee(s) name/description for which the Provisionally Accredited Levee (PAL) designation is requested. A separate PAL Agreement Form is recommended for each unique levee owner/levee system. Make copies of this blank form to request PAL designation for multiple levee systems, as necessary.
- This document is available on-line (in a PDF format that can be filled-in electronically) via the link named "Generic PAL Agreement Form for Region IX" at http://www.bakeraecom.com/index.php/region-ix/levees-by-county/fact-sheets/

FEMA



New Levee Approach in Development

Background

As part of the National Flood Insurance Program, FEMA is responsible for analyzing and identifying the flood hazard associated with the 1-percent-annual-chance flood event or base flood event. The flood hazard associated with this event is shown on Flood Insurance Rate Maps (FIRMs). Currently if a levee or other flood protection system does not meet the requirements detailed in the Code of Federal Regulations (CFR) Title 44, Chapter 1, Section 65.10 (44CFR65.10), they are not "accredited" and FEMA maps the area as if the system does not exist. This approach is commonly referred to as the "without levee" approach.

In March 2011, Administrator Fugate committed to replace the singular "without levee" approach with an approach that is more sound, credible, and cost effective. FEMA had previously received inquiries from stakeholders expressing their concerns about FEMA's "without levee" approach. The U.S. Congress echoed this concern earlier this year when members of both the House and Senate asked FEMA to consider discontinuing the use of their current approach. Given the significant technological advances in data collection and flood hazard modeling in the recent years, FEMA acknowledged that creating an approach with many options that can be applied to a variety of situations would better meet the needs of the American public and provide more precise results.

The objective of this effort was to create an approach that would be flexible, collaborative and feasible. FEMA would also set out to determine the best way to replace the current analysis with a new approach to map non-accredited levees.

The Process

FEMA convened a multidisciplinary Project Team with representatives from FEMA, the U.S. Army Corps of Engineers (USACE), and experts from the academic and engineering communities to develop the new approach. The Project Team explored a spectrum of options, evaluated analysis and mapping methods for multiple levee scenarios, assessed their feasibility, and tested them in simulations using real life situations. FEMA engaged internal and external stakeholders during the development of the approach, and shortly following asked independent experts and community officials for feedback.

Levee-Impacted Studies

On-going flood studies with at least one levee system categorized as non-accredited may be impacted by the new levee approach.

A "non-accredited" levee is one that does not provide protection from the base flood per the criteria of 44CFR65.10. This includes de-accredited levees as well.

For more information on the development of the proposed approach please visit:

Levee Systems

Need more information on levee systems? Please visit the levee dedicated pages at:
http://www.fema.gov/plan/prevent/fhm/lv_intro.shtm

FEMA Library

The FEMA Library is a database of publicly available FEMA resources, including:
www.fema.gov/plan/prevent/fhm/lv_lamp.shtm

NFIP and Levees: An Overview Fact Sheet
http://www.fema.gov/library/viewRecord.do?id=2609

Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems
http://www.fema.gov/library/viewRecord.do?id=2741

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Independent Scientific Body

Following the testing process, an Independent Scientific Body (ISB) made up of recognized experts and certified professional engineers was convened by the National Institute of Building Sciences (NIBS) to review the methods and provide comments.

Community Roundtable

After the ISB, FEMA convened a Community Roundtable with local officials, engineers, floodplain managers, and levee owners from throughout the U.S. to gather their feedback on the revised methods. This interaction allowed FEMA and community representatives to meet together, review the approaches, and identify how implementation would affect communities.

Public Review

Now, the Public Review and Comment Period allows the public to review the new levee mapping and analysis approach and provide feedback.

- FEMA announces the Public Review Period in the Federal Register and publishes a document, "The Revised Analysis and Mapping Procedures for Non-Accredited Levees: Proposed Approach for Public Review," which details the proposed approach.
- The public is welcomed to visit www.regulations.gov and search for "FEMA-2011-0025" to read the Federal Register Notice and download the proposed approach.
- The Public has 45-days to review the proposed approach and provide comments.
- FEMA holds online forums to orally present the approach.

Documents for Public Review

"The Revised Analysis and Mapping Procedures for Non-Accredited Levees: Proposed Approach for Public Review" available at www.regulations.gov includes an overview of the following proposed procedures to suit a variety of levee situations:

- **Sound Reach** – A continuous section of a levee system designed and constructed to withstand, and provide protection from, the 1-percent-annual-chance flood event, in accordance with sound engineering practices.
- **Freeboard Deficient** – A section of a levee system that would be considered sound, except that it does not have adequate freeboard.
- **Overtopping** – A section of levee for which the 1-percent-annual-chance flood elevation is determined to be higher than the top (crest elevation) of the levee.
- **Structural-Based Inundation** – A continuous section of a levee that is determined to have structural issues or otherwise appear to be susceptible to failure of the section.
- **Natural Valley** – A section of a levee system that would not obstruct the river from flowing on the landward side of the levee during the 1-percent-annual-chance flood.

In addition as part of the proposed approach, FEMA looks to collaborate with local communities and levee owners in Local Levee Working Groups to collect the available information to support these procedures and get input on the procedure to be used.

How to Submit Comments for Public Review

Since the public comment period is an official federal process for collecting and managing public feedback, it is important that all comments are submitted through the formal process for review and possible inclusion. Please follow the steps below to read the approach and submit comments:

1. Visit www.regulations.gov.
2. Search "FEMA-2011-0025" and read the Federal Register Notice.
3. Download and read "The Revised Analysis and Mapping Procedures for Non-Accredited Levees: Proposed Approach for Public Review."
4. Follow the directions provided at www.regulations.gov for comment submission.
5. You can also submit comments at www.nfip-levee.com.

Online Forums

In addition to the documents online for public review, FEMA will also hold three online forums in the form of webinars to present the approach and answer clarifying questions. Participation is limited to 300 guests for each webinar, and invitations will be extended on a first-come-first-served basis. For forum dates and times and to request an invitation, refer to the Federal Register Notice at www.regulations.gov or visit www.fema.gov/plan/prevent/fhm/lv_lamp.shtm.

RiskMAP
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U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

FEMA

August 17, 2012

Mr. Timothy S. Phillips, P.E.
Chief Engineer and General Manager
Flood Control District of Maricopa County
2801 W. Durango St.
Phoenix, Arizona 85009

Dear Mr. Phillips:

This letter confirms the Provisionally Accredited Levee (PAL) status requested by your correspondence dated June 21, 2012, for the levees listed below, that are also identified on the enclosed Levee Status table.

- Levees with ID Nos. 1901064146 and 1901064147, along Scatter Wash.

The flood hazard information presented on the effective Flood Insurance Rate Map (FIRM) and in the effective Flood Insurance Study (FIS) report for Maricopa County, AZ is based, in some areas, on flood protection provided by these levees. Based on the information available and on the mapping standards of the National Flood Insurance Program (NFIP) at the time that the FIS was performed, FEMA accredited the levees with providing protection from the flood that has a 1-percent-chance of being equaled or exceeded in any given year. This 1-percent-annual-chance flood is referred to as the base flood.

The Department of Homeland Security's, Federal Emergency Management Agency (FEMA) is currently in the process of producing a countywide FIS report and Digital Flood Insurance Rate Map (DFIRM) for Maricopa County, AZ. Providing communities with up-to-date, accurate and reliable flood hazard information on DFIRMs is one of the primary goals of FEMA's Map Modernization program. As part of this process, FEMA sent you a letter dated April 5, 2012, to provide you the opportunity to receive a Provisionally Accredited Levee (PAL) designation for these levees. FEMA received your signed PAL agreement (enclosed) and the required attachments for these levees. Based on this response, your signed PAL agreements are acceptable.

The 2-year PAL period for these levees started on July 5, 2012. FEMA will designate these levees as PALs on the new countywide DFIRM for Maricopa County during the 2-year PAL period to convey to map users that formal levee certification verification is underway. FEMA recommends that levee owners and community officials undertake outreach efforts to inform affected property owners that this verification process is underway. FEMA also encourages the purchase of flood insurance for the area landward of the levees, even though coverage is not federally required.

All necessary documentation to show that these levees meet the criteria of the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10) must be provided by the end of the 2-year PAL period on July 5, 2014. If you are unable to submit documentation by this deadline or if the submitted documentation is determined to be inadequate, FEMA will initiate a map revision to re-designate certain areas on the landward side of the levees as floodprone. Certification by a

Registered Professional Engineer must accompany the submitted 44 CFR 65.10 data. You must submit a progress report to FEMA within 1 year of the start of the 2-year PAL period to document progress toward obtaining data and documentation to comply with 44 CFR 65.10.

Key milestones and dates are provided in the table below.

Date	Milestone
4/5/2012	Date of FEMA PAL offer letter
6/21/2012	Date that community/levee owner sent the PAL Agreements to FEMA
7/5/2012	90-day deadline of PAL offer period and start date of 2-year PAL period
7/5/2013	1-year deadline for submitting progress report to FEMA
7/5/2014	2-year deadline for submitting all 44 CFR 65.10 data to FEMA

If you have questions or need additional information regarding flood mapping, please contact Robert Bezek, Regional Engineer, by telephone at (510) 627-7274.

Sincerely,

Sally Ziolkowski

Sally Ziolkowski, Director
Mitigation Division

Enclosures:

- Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems
- Signed PAL agreement
- Levee Status table

cc: Max Wilson, Chairman, Maricopa County Board of Supervisors
Tim Murphy, Floodplain Delineation Branch Manager, FCDMC
Frank Brown, Senior Civil Engineer, FCDMC
Kathryn Gross, Hydrologist, FCDMC
Greg Stanton, Mayor, City of Phoenix
David Cavazos, City Manager, City of Phoenix
Wylie Bearup, City Engineer, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix
Brian Cosson, State Coordinator, NFIP
Colonel R. Mark Troy, USACE, Los Angeles District
Senator Kyl State Office
Senator McCain State Office
Representative Franks District Office

Flood Control District
of Maricopa County

Board of Directors
Fulton Brock, District 1
Don Stapely, District 2
Andrew Kunasek, District 3
Max Wilson, District 4
Mary Rose Wilcox, District 5

www.fcd.maricopa.gov

2801 West Durango Street
Phoenix, Arizona 85009
Phone: 602-506-1501
Fax: 602-506-4601
TT: 602-505-5897

June 21, 2012

Sally Ziolkowski, Director
FEMA Region IX Mitigation Division
U.S. Department of Homeland Security
1111 Broadway, Suite 1200
Oakland, CA 94607-4052

Subject: PAL Agreement Form for Scatter Wash Levees, PAL ID#1901064146 & 1901064147

Dear Ms. Ziolkowski:

Enclosed is the executed PAL Agreement Form for Scatter Wash Levees, PAL ID#1901064146 & 1901064147, a disk that contains the District's Operation and Maintenance Manual and inspection records, and a disk file list. These levees are located about 1,600 feet south of the Loop 101 Highway. These documents serve as official request that FEMA label the levees as provisionally accredited on Maricopa County DFIRM's and are a statement that, to the best of the District's knowledge, the levees meet the criteria of 44 CFR §65.10 as providing protection from flooding during the 1 percent annual chance flood.

The documents on the enclosed disk are listed on the file inventory list (copy attached). Each year, these levees receive a maintenance inspection and a comprehensive annual inspection. Interior drainage systems and channel inflow points are inspected for functionality as part of these inspections. The last 10 years of inspection reports are provided. If your staff have any questions concerning this submittal, please have them contact Frank Brown at 602-506-4617 or FrankBrown@mail.maricopa.gov.

Sincerely,

Timothy S. Phillips, P.E.
Chief Engineer and General Manager

Enclosures: PAL Agreement, File Inventory List and 1 CD computer disk

Cc: Robert J. Bezek, Regional Engineer, FEMA Region IX (Agreement & File List)
Sarah Houghland, Michael Baker Corporation (with all Enclosures)
Brian Cosson, ADWR, NFIP Coordinator
David Cavazos, City Manager, City of Phoenix
Wylie Bearup, City Engineer, City of Phoenix
Hasan Mushtaq, Floodplain Administrator, City of Phoenix

Letter of Agreement and Request for Provisionally Accredited Levee (PAL) Designation and Agreement to Provide Adequate Compliance with the Code of Federal Regulations, Title 44, Section 65.10 (44 CFR 65.10)

PAL Agreement Form for Maricopa County

We, the undersigned, have received a letter from FEMA dated April 5, 2012 with an enclosed *"Levee Status Map"* and *"Levee Status Table"* and two enclosed documents titled *"Title 44 of the Code of Federal Regulations (CFR), Section 65.10 (44 CFR 65.10)"* and *"Requirements of 44 CFR Section 65.10: Mapping of Areas Protected by Levee Systems."* We understand that FEMA is in the process of providing an updated Flood Insurance Rate Map for Maricopa County, AZ and that the flood hazards around the levees identified on the *Levee Status Map* and *Levee Status Table* with unique levee ID numbers 1901064146 and 1901064147 will be remapped to reflect that these levees have been designated a PAL. These levees or levee system are also known as the Scatter Wash Levee System.

To the best of our knowledge, the levees identified above meet the criteria of 44 CFR 65.10 and have been maintained in accordance with an adopted operation and maintenance plan. For Scenario A (non-USACE Program) levees, this must be evidenced by an attached Operation and Maintenance Plan and records of levee maintenance and operation, as well as Test Records of Mechanized Interior Drainage System. We hereby submit to FEMA within 90 days (before July 5, 2012) our agreement to provide FEMA with all the necessary information to show that the levees identified above comply with 44 CFR 65.10. We understand that this documentation will be provided before July 5, 2014. Providing the information described in 44 CFR 65.10 will allow FEMA to move forward with the flood mapping for Maricopa County. We fully understand that if complete documentation of compliance with 44 CFR 65.10 is not provided within the designated timeframe of 24 months, FEMA will initiate a revision to the Flood Insurance Rate Map for Maricopa County to redesignate the area as floodprone.

Levee Owner Representative (signature): _____ Date: 6/7/2012

Levee Owner Representative (print name): TIMOTHY S PHILLIPS

Levee Owner Title/Organization (print): CHIEF ENGINEER & GM

Community CEO (signature): _____ Date: 6/20/12

Community CEO (print name): Wylie Bearup, City Engineer

Community Name (print): City of Phoenix

Other, if applicable (signature): _____ Date: _____

Other, if applicable (print name): _____

Required Attachments for Scenario A (non-USACE Program) Levees only:

- Operation and Maintenance Plan and Records
- Test Records of Mechanized Interior Drainage System

Instructions for Completing this Form:

- On this PAL Agreement Form, fill-in the levee ID numbers and levee(s) name/description for which the Provisionally Accredited Levee (PAL) designation is requested. A separate PAL Agreement Form is recommended for each unique levee owner/levee system. Make copies of this blank form to request PAL designation for multiple levee systems, as necessary.
- This document is available on-line (in a PDF format that can be filled-in electronically) via the link named "Generic PAL Agreement Form for Region IX" at http://www.bakeraecom.com/index.php/region-ix/levees-by-county/fact-sheets/

Levee Certification Package
Scatter Wash Levees Near W. 39th Avenue and SR L101
North Levee ID# 1901064146 and South Levee ID # 1901064147
Maricopa County, Arizona

Prepared for:

Flood Control District of Maricopa County
2801 West Durango Street
Phoenix, Arizona 85009

Prepared by:

AMEC Environment & Infrastructure, Inc.
4600 East Washington Street, Suite 600
Phoenix, AZ 85034

AMEC Job Number 37-2014-2002
July 21, 2014

Registered Professional Engineer (Civil)
CERTIFICATE NO.
40209
ALEX F.
CORONEL
Date Signed 7/21/14
ARIZONA, U.S.A.
Expires 12/31/15

For Title 44 CFR 65.10 Criteria
Certification Excluding Geotechnical
(See Sections 2.4, 2.5 and Appendix H of this Report)

Registered Professional Engineer (Civil)
CERTIFICATE NO.
23982
TONY J.
FREIMAN
Date Signed 7/21/2014
ARIZONA, U.S.A.
Expires 12/31/2014

For Title 44 CFR65.10 Criteria
Geotechnical Certification
(See Sections 2.4, 2.5 and Appendix H of this Report)

July 21, 2014
AMEC Job No. 37-2014-2002

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Attn: Frank E. Brown, PE, Project Manager

Re: Scatter Wash Levee Certification
Maricopa County, Arizona

AMEC Environment & Infrastructure, Inc. (AMEC) has completed the authorized levee certification study in general accordance with our technical Scope of Services dated February 3, 2014. The purpose of this study was to determine compliance of the subject levee with the criteria set forth in Section 65.10 of the NFIP regulations (44 CFR 65.10). Based on our findings from this study, we have determined the following:

- The subject levee system meets the requirements of Subsection 1) Freeboard for riverward flooding in Scatter Wash. However, interior drainage ponding reaches an elevation within one-half foot of the top of the levee near River Mile 0.9, on the interior side of the levee. Section 2.1 of this report provides additional detail.
- The subject levee system meets the requirements of Subsection 2) Closures.
- The subject levee system meets the requirements of Subsection 3) Embankment Protection.
- The subject levee system meets the requirements of Subsection 4) Embankment and Foundation Stability.
- The subject levee system meets the requirements of Subsection 5) Settlement.
- The subject levee system meets the requirements of Subsection 6) Interior Drainage.

Enclosed with this letter you will find documentation of each of the evaluations made in support of this assessment for certification, the criteria used, assumptions made and the analyses conducted to assist with the final determination.

Should you have any questions, feel free to contact us.

Respectfully submitted,

AMEC Environment & Infrastructure, Inc.

Alex Coronel, PE, CFM
Project Manager

Tony Freiman, PE
Project Geotechnical Engineer

AMEC Environment and Infrastructure, Inc.
4600 East Washington Street, Suite 600
Phoenix, Arizona 85034-1917
Tel (602) 733-6100
Fax (602) 733-6000
www.amec.com

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1.0 BACKGROUND AND PROJECT PURPOSE

1.1 Background

The Scatter Wash Levees are operated and maintained by the Flood Control District of Maricopa County (District). They are located in Township 4 North, Range 2 East, Section 27, of the Gila and Salt River Baseline and Meridian; within the City of Phoenix just south of the Loop 101 Highway (L101) with a downstream limit approximately 0.4 miles upstream of 43rd Avenue **(see Figure 1).** Along Scatter Wash, the levees occur from about River Mile 0.88 to River Mile 1.21.

The upstream longer portion of these levees, identified as ID #1901064146 (North Levee) & 1901064147 (South Levee), were built by the Arizona Department of Transportation (ADOT) in 1991 as part of the construction of the Outer L101 from 59th to 35th Avenue. The downstream shorter portion of these levees were constructed by the City of Phoenix for the city project ST-914085, which also installed two levee penetrations, on each levee bank. Both agencies, through intergovernmental agreements, turned over the constructed segments to the District for operation and maintenance. The levee crests have an all-weather gravel surface. Gates are present to restrict motorized access to only authorized personnel. The levee crests and channel bottom are also used for equestrian, bicycling and pedestrian recreational activities.

Currently Levee ID #1901064146 & 1901064147 are Provisionally Accredited by the Federal Emergency Management Agency (FEMA) and are shown as providing protection from the 1 percent annual-chance-flood on the most recent Flood Insurance Rate Map (FIRM Panel No. 04013C1270L). The Provisionally Accredited Levee (PAL) agreement between the District, the City of Phoenix and FEMA is due to expire on July 5, 2014. In order for Levees ID #1901064146 & 1901064147 to continue to be shown as providing flood protection on the FIRM Panels beyond the PAL expiration date, certification of the levees must be provided indicating that the levees meet the criteria of *Title 44 of the Code of Federal Regulations, Section 65.10* (44 CFR 65.10).

Even though the City of Phoenix constructed a portion of the levees, the levees are entirely within incorporated City of Phoenix and the City was a signator on the Provisionally Accredited Levee Agreement, the District is responsible for levee certification, and maintaining that certification throughout the life of the levees.

1.2 Project Purpose

The purpose of this project is to provide certification documentation in support of the FEMA accreditation of Levee ID #1901064146 & 1901064147.

The evaluation criteria follow the National Flood Insurance Program levee requirements established in 44 CFR 65.10. Certification requirements and the results with supporting analysis to determine compliance with specified criteria are presented in Section 2 of this report.

The FEMA MT2 Form 3 – Riverine Structures is included as **Appendix A.**

1.3 Data Collection and Field Reconnaissance

1.3.1 Data Collection

1.3.1.1 Studies

The District provided AMEC with much of the documentation needed to assess compliance with 44 CFR 65.10, including design documents, as-builts, Effective and Ongoing Flood Insurance Studies (FIS), and the City of Phoenix Scatter Wash Levee Certification Report. Additionally, AMEC personnel visited the local ADOT office and obtained project as-built drawings. Project as-built drawings are included in **Appendix B.**

1.3.1.2 Mapping

A Digital Elevation Model (DEM) was provided by the District. The mapping was prepared by AeroTech Mapping Technologies, flight date January 31, 2013 at a photographic scale of 1:6,600 / 1" = 550'. The final mapping product scale is 1" = 200' with a 2 foot contour interval, and is placed on NAVD 1988 datum. The top of levee and toe of levee were field surveyed with GPS/RTK methods and placed into the mapping models, such that this data became an integral part of the mapping solution. The data was collected in support of the District's current Floodplain Re-Delineation Study that includes the study area.

1.3.1.3 Field Survey

Supplemental field survey in support of the hydrologic modeling and split flow analysis was collected at the intersection of 35th Avenue and Behrend Drive, 37th Avenue and Behrend Drive, 37th Drive and Behrend Drive, 38th Avenue and Behrend Drive, and 39th Avenue and Bowen Avenue. Field survey notes are included in **Appendix C.**

1.3.2 Field Reconnaissance

AMEC's initial field reconnaissance took place on Wednesday February 26, 2014. The field reconnaissance staff consisted of a multidisciplinary team (hydraulic and geotechnical) that walked the length of both levees. The field reconnaissance team was composed of the District Project Manager - Frank Brown, PE, the District Operations and Maintenance Inspection Supervisor - Bill Leal, Alex Coronel, PE, CFM, and Tony Freiman, PE, both of AMEC.

Visual observation of the levees did not reveal any significant signs of erosion or distress. The crest of the structure was clear of vegetation. Vegetation found at the embankment slopes consisted primarily of small desert bushes. Most of the river-side levee embankment is concrete lined and the lining demonstrated no visible signs of distress. The downstream 250 feet of both the north and south levees is riprap lined on the river-side. In general, the structure was in acceptable condition.

A partially developed subdivision known as Vision Hill Estates is located towards the downstream end of the south levee just south and east of an existing levee penetration at levee Station 378+55. A subdivision drainage channel was observed to outfall perpendicular to the dry side levee embankment.

A site assessment photo log and field notes are included in **Appendix D.**

A supplemental field reconnaissance was performed on June 19th, 2014 to verify split flow calculations and finalize interior drainage area boundaries. Select photos from this visit are included in support of the split flow analysis in **Appendix I.**

1.4 Report Format

This report contains the following sections:

Section 2.0: 44 CFR 65.10 Requirements and Supporting Analysis

Section 3.0: Certification Statements

Section 4.0: References

2.0 CERTIFICATION REQUIREMENTS AND SUPPORTING ANALYSIS

It is the levee owner's or community's responsibility to provide data and documentation to show that a levee meets the requirements of Section 65.10 of the National Flood Insurance Program (NFIP) regulations. The FEMA requirements in Section 65.10 are separated into five categories including; a) General Criteria, b) Design Criteria, c) Operations Plans and Criteria, d) Maintenance Plans and Criteria, and e) Certification Requirements. This section (Section 2.0) of the report lists the specific requirements and supporting analysis with respect to subsections b (Design Criteria), c (Operations Plans and Criteria) and d (Maintenance Plans and Criteria). Section 4.0 of this report contains a certification statement in accordance with subsection e.

2.1 Design Criteria - Section 65.10(B)(1) Freeboard

2.1.1 (B)(1) Freeboard - Criteria

For Riverine Levees:

A minimum freeboard of 3 feet above the water-surface level of the base flood must be provided.
An additional 1 foot above the minimum is required within 100 feet on either side of structures (e.g., bridges) riverward of the levee or wherever the flow is constricted.
An additional 0.5 foot above the minimum at the upstream end of the levee, tapering to not less than the minimum at the downstream end of the levee is also required.

2.1.2 (B)(1) Freeboard - Analysis

2.1.2.1 Effective Hydrology

AMEC obtained existing hydrologic studies pertinent to the Scatter Wash Levee, including the *Letter of Map Revision Request Scatter Wash, SR101L to I-17* (FIS LOMR), prepared for the District and submitted for FEMA review in February of 2014, and assigned FEMA Case No. 14-09-2027P.

The results from the FIS LOMR demonstrate that the Scatter Wash North Branch at SR 101L has an effective discharge of 2,760 cfs. A revised (corrected) effective discharge of 2,707 cfs was determined; however since the study is currently under review, the flow from the effective FIS HEC-1 model, was used for the freeboard analysis. The flow rate of 2,760 cfs is the same flow rate utilized by the City of Phoenix for Levee Certification for Levee ID #46.

2.1.2.2 Hydraulic Analysis

Scatter Wash was studied using steady-state hydraulic analyses. Approximately 0.94 linear miles were modeled along the entire length of the levee system from 43rd Avenue to the L101, including culvert structures at 43rd Avenue and L101. Scatter Wash was studied using the U.S. Army Corps of Engineers (USACE) hydraulic computer model Hydrologic Engineering Center River Analysis System (HEC-RAS) Version 4.1.0. Basic modeling data for the detailed hydraulic analysis was prepared using HEC-GeoRAS, a Geographic Information Systems (GIS)

interface developed by HEC for the preparation of hydraulic models. For this analysis, a flood profile was computed for the 100-year recurrence interval flood event.

Hydraulic cross-sections were placed using the project topographic mapping and engineering judgment. The cross section geometry was derived from the detailed mapping described in Section 1.3.1.2.

Tie-in/Use of Existing Models

AMEC leveraged existing hydraulic models prepared in support of a levee certification project immediately downstream of this project and a floodplain re-delineation study immediately upstream of this project. The specific data leveraged is described as follows:

Geometry data from the downstream limit of the model (just west of 43rd Avenue) to the end of the section of the levee owned by the City of Phoenix, Cross Sections 0.352 to 0.852, inclusive of the culvert at 43rd Avenue, was extracted from the model named "Scatterwash Levee Certification 0611" (Phoenix Certification Model) included in the report titled "Scatter Wash Levee Certification From 43rd Avenue to 39th Drive City of Phoenix Project No. ST 83130297" dated June 2011. The subject model was created in the NGVD29 vertical datum. The appropriate conversion factor of +1.867 feet (NGVD29 to NAVD88) was obtained from the NOAA Vertcon website and used to shift the final model elevations.

Geometry data from the upstream limit of the model (just east of the L101 Highway) to the limits of the Scatter Wash Floodplain Re-delineation Study, cross sections 1.036 to 1.342, inclusive of the culvert at the L101 Highway, was extracted from the model named "Scatter Wash Floodplain Study" (Re-delineation Model) (FCD Contract Number 2013C002 WA#1).

No model parameters within the limits of the models described above were altered.

Only sections 0.892 and 0.932 are unique to this study. Hydraulic tie-in, within 0.05 feet, to the Floodplain Re-delineation study occurs at Cross Section 1.195.

Hydraulic Modeling Assumptions

Within the limits unique to this levee certification project:

- Contraction and expansion coefficients of 0.1 and 0.3 respectively were utilized.
- Manning's "n" roughness coefficients were assigned using engineering judgment based on 2013 aerial photography and field reconnaissance with reference to Chapter 7 of the Drainage Design Manual for Maricopa County, AZ, August 15, 2013 (DDM-Hydraulics).
- A channel bottom roughness coefficient of 0.044 was used at Cross Section 0.892 nearest the City of Phoenix Section of the channel.
- A channel bottom roughness coefficient of 0.028 was used at Cross Section 0.932.
- A channel bank roughness coefficient of 0.018 was used for the concrete lined bank sections.

- A channel bank roughness coefficient of 0.047 was used for the riprap lined sections.
- An overbank roughness coefficient of 0.045 was used and is inconsequential since all flow is contained between the levees.
- The roughness coefficients for other channels are explained in Section 2.3.2.3.3.

The downstream boundary condition was unchanged from that used in the Phoenix Certification Model.

The HEC-RAS input and output files are included in **Appendix E.**

A hydraulic work-map for the Scatter Wash modeling in included as **Figure 2.**

2.1.3 (B)(1) Freeboard - Determination

The water surface elevation of the 1%-annual-chance base flood obtained from the project HEC-RAS model was compared to the top of levee elevation. AMEC observed that at certain sections the computed water surface elevation is below the adjacent levee toe grade elevation on the dry side and is therefore not in a true levee condition. Tables 2.1 – 1.0 and 2.1 - 2.0 below tabulate the results of the freeboard evaluation for the north and south levee respectively.

Table 2.1 - 1.0 – Available Freeboard – North Levee

River Mile	*CWSEL	Levee Elevation	Freeboard	Required Freeboard	Landside Ground Elevation	Levee Condition?
	ft	ft	ft	ft	ft	
0.892	1332.75	1337.55	4.80	3.0	1331.5	Yes
0.932	1333.38	1338.49	5.11	3.0	1332.9	Yes
1.036	1334.28	1338.98	4.70	3.0	1336.2	No
1.141	1335.74	1341.37	5.63	3.0	1339.5	No
1.198	1337.23	1343.08	5.85	4.0	1339.7	No

Note: Computed Water Surface Elevation (CWSEL) was extracted from the HEC-RAS model (ScatterWashFINAL.prj, Plan Title: FINAL (p03)) included in Appendix E of this report.

Table 2.1 - 2.0 – Available Freeboard – South Levee

River Mile	CSWEL	Levee Elevation	Freeboard	Required Freeboard	Landside Ground Elevation	Levee Condition?
	ft	ft	ft	ft	ft	
0.892	1332.75	1336.96	4.21	3.0	1334.3	No
0.932	1333.38	1338.71	5.33	3.0	1332.5	Yes
1.036	1334.28	1338.77	4.49	3.0	1334.5	No
1.141	1335.74	1341.42	5.68	3.0	1339.0	No
1.198	1337.23	1343.1	5.87	4.0	1340.7	No

Note: Computed Water Surface Elevation (CWSEL) was extracted from the HEC-RAS model (ScatterWashFINAL.prj, Plan Title: FINAL (p03)) included in Appendix E of this report.

In addition to the summary provided above, the freeboard profile, included in **Appendix E** shows that the minimum freeboard requirements are met along the entire levee profiles (between HEC-RAS cross sections) with the lowest freeboard of 3.6 feet being along the south levee about 65 feet upstream of HEC-RAS Station 0.892.

A profile of the North and South Levee dry side toe elevation was produced and compared to the computed water surface elevation to determine the sections of levee that are in a non-levee condition. The levee toe profile is included in **Appendix E.**

The Scatter Wash levee meets the FEMA criteria for certification with respect to (B)(1) – Freeboard as it relates to water surface elevations on the riverward or "wet" side of the levee.

Ponding Along South Levee (~River Mile 0.932)

As documented in Section 2.6 of this report, there is a ponding area near River Mile 0.932 that temporarily stores runoff along the interior of the South Levee that reaches an elevation of about 0.4 feet below the low levee crest. Although not due to runoff in Scatter Wash this could be considered a freeboard deficiency. AMEC analyzed this condition to assess the most likely conditions under which the levee could fail and make a qualitative assessment of the consequences of a potential failure.

Potential Failure Modes

The levee could fail due to either overtopping of the embankment or the ponded water could cause geotechnical levee instability due to the seepage through the embankment.

Overtopping:

To understand the potential overtopping scenario it is critical to understand the specifics of the area in question. As detailed in the reservoir routing analysis described in Section 2.6, the ponding area can be evacuated by flow through the two 24" pipes that will operate under a

differential head for depths exceeding 1333.2, the 100-year computed water surface in Scatter Wash, at the pipe outlet. Also, at depths exceeding an elevation of 1335.9 flows can escape south along 39th Avenue.

The detailed reservoir routing analysis, assuming 100-year flow conditions in Scatter Wash, shows that the levee will not overtop in this scenario. Should the pipes become clogged or back to back events were to occur in the interior drainage area while a 100-year depth is maintained in Scatter Wash it is possible that the levee could overtop. The likelihood of overtopping is further mitigated by the capacity of the overflow weir at 39th Avenue to extract flow from the system. At the overflow elevation of 1336.5 the weir alone has a discharge capacity of about 105 cfs that, according to the project hydrology, lies between a 25 and 50-year event on the interior drainage area contributing watershed.

Embankment and Foundation Stability

The area in question was analyzed as a control cross section in the project Geotechnical Investigation and Analysis Report provided as Appendix H. At this section the levee was found to operate with adequate factors of safety for all analyzed loading conditions and assumptions. More detail can be found in Appendix H.

Consequences of Failure

The Scatter Wash Levee System is intended to provide protection to adjacent properties from flood flows in Scatter Wash. If the levee were to fail at the location in question the flood flows in Scatter Wash could escaped out into the south interior drainage area. As can be seen by inspection of Figure 6, the computed water surface elevation in Scatter Wash at this location is about 1333.5 feet or about 2.5 feet lower than the maximum expected ponding elevation. What can be concluded from this is that a levee failure at this location would decrease the extents of flooding in the protected area. It should be noted that at this location the south levee ties into an existing natural high ground (Vision Hill) and therefore any flow that escapes the banks of Scatter Wash will be immediately re-directed back into the floodway by natural topography. Vision Hill is a naturally occurring high point, whose top is 140 feet above the levee crest.

2.2 Design Criteria - Section 65.10(B)(2) Closures

2.2.1 (B)(2) Closures - Criteria

The levee closures requirement is that all openings must be provided with closure devices that are structural parts of the system during operation and design according to sound engineering practice.

2.2.2 (B)(2) Closures - Analysis

Two levee penetrations were observed during the field visit on February 26, 2014, one on the north levee and one on the south levee. The levee penetrations are tabulated below:

Table 2.2 - 1.0 – Levee Openings

Levee Station	River Mile	Opening Size	Structure Type	Closure Type
377+00 (North)	0.892	18 inch	Concrete Pipe	Flap Gate
378+55 (South)	0.919	2 – 24 inch	Concrete Pipe	Flap Gate

During the field visit the structures were photographed and the flap gates were opened and closed by District Staff. The flap gates were observed to seat properly and opened and closed with minimal effort. All pipes were clean and free of flow-reducing debris. Photographic documentation of the structures is shown below.

Station 377+00 (North) Open

Station 377+00 (North) Closed

Station 378+55 (South) Open (Left Pipe)

Station 378+55 (South) Open (Right Pipe)

Station 378+55 (South) Closed

Two additional penetrations, including a 96" diameter storm drain that collects drainage from the L101 Highway and an 18" RCP that collects roadway drainage from Beardsley Road, are located through the south wing-wall of the culvert structure at the L101 Highway. As depicted on the annotated ADOT as-built drawings and as observed during the field visit neither of these two structures have associated closure devices. AMEC compared the computed water surface elevation in Scatter Wash to the pipe profile elevation on the as-built drawings and confirmed that the projected water surface is fully contained within the structures and will not cause any interior ponding. In addition, these 2 ADOT drainage pipes are located in an incised channel

portion of the Scatter Wash, and closure devices are not required. The annotated ADOT as-built drawings are included in **Appendix F**

2.2.3 (B)(2) Closures - Determination

Based on visual observations the closure devices associated with the Scatter Wash North and South Levees are structural parts of the system, are in good working order and there is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements and meet the FEMA criteria for certification with respect to (B)(2) – Closures.

2.3 Design Criteria - Section 65.10(B)(3) Embankment Protection

2.3.1 (B)(3) Embankment Protection - Criteria

Engineering analysis must be submitted to demonstrate that no appreciable erosion of the levee embankment can be expected during the base flood, as a result of either currents or waves, and that anticipated erosion will not result in failure of the levee embankment or foundation directly or indirectly through the reduction of the seepage path and subsequent instability.

2.3.2 (B)(3) Embankment Protection – Analysis

2.3.2.1 Comparison of Maximum Shear Stress Versus Permissible Shear Stress

AMEC created an additional plan (Plan Title: FINAL_TS) in the project RAS model and modified the geometry by moving the channel bank stations to the levee toe in order to isolate the maximum shear stress along the levee face. It was found the maximum shear stress along the rock lined portion of the channel occurs at Station 0.892 with a value of 0.42 lb/sq ft; the maximum shear stress along the concrete lined portion of the levee occurs at Station 1.141 with a value of 0.47 lb/sq ft. Per Table 7D-1 of the ADOT Highway Drainage Design Manual (Hydraulics), both the existing concrete and riprap (D_{50} = 12") lining with permissible shear strengths of >20.0 lb/sq ft and 5.0 lb/sq ft, respectively, are not expected to erode during passage of the base flood.

The HEC-RAS input and output files are included in **Appendix G.**

2.3.2.2 Scour Depth Calculation and Comparison to Toe-Down Depth

The total anticipated scour depth along the Scatter Wash channel was estimated using the procedures outlined in Chapter 11 of the DDM-Hydraulics. The total estimated scour depth was then compared to the toe-down depth as documented in the project as-built drawings. Three cross sections were chosen for analysis; one towards the downstream reach of the project within the riprap lined portion of the levee at Station 0.932, one towards the center of the reach at Station 1.036 and one towards the upstream end of the reach at Station 1.139.

The calculation of long term scour requires hydraulic parameters for 10 year flows. According to guidance in Chapter 6 of the Drainage Design Manual for Maricopa County, Hydrology (DDM-Hydrology), a ratio of 0.35 was applied to the 100-year discharge to obtain the 10-year flows.

The channel bottom soil makeup was obtained from the Soil Survey of Maricopa County, Arizona, Central Part (USDA, 1977). The soil is classified as Antho-Brios sandy loam. Per Table 5 of the report a d_{50} estimate of 0.42 mm (No. 40 Sieve) was used for analysis.

The total scour potential is calculated by a sum of 6 individual scour components: general scour, low-flow incisement, bed-form scour, bend scour, local scour and long term scour.

$Zt = SF (Zgs + Za + ½ Zlft + Zb + Zls + Zlt)$

where, Zt = total scour depth
Zgs = General Scour depth (ft)
Za = Bed-form scour depth ft)
Zlft = Low-flow thalweg scour depth (ft)
Zb = bend scour depth (ft)
Zls = Local scour depth (ft)
Zlt = Long term scour depth.

There are no bridges or other flow constrictions within the project site, so the local scour depth is zero.

- The general scour estimates bed changes due to a single event. For this project the 100-year event is considered. The Lacey equation (1981) recommended by the DDM-Hydraulics was used.

- The bed form scour is the dune development along the channel bottom during peak flow events.

- The bend scour occurs at the out bank side of the channel which is caused by the secondary flow in the bendway section. The project section of Scatter Wash is located immediately downstream of an entry of the bend with a curvature radius of approximately 1150 ft. Since the Lacey Equation considers the effects of bend, through use of the bend factor, no separate calculation for bend scour was performed. The effects of the bend are most pronounced near HEC-RAS Cross Sections of 0.983 to 1.034 where a bend factor of 0.5 was used. At the cross section of 1.139, a bend factor of 0.25, for no bend or near straight channel section, was used.

- The low-flow thalweg is a small channel within the bottom of the main channel which is formed by the predominance of a low-flow condition of low flows that persist after a flood. According to the DDM-Hydraulics, the low flow incisement should not be less than 1 foot and possibly in excess of 2 feet. The low flow thalweg for this project, based on field observations, is 2 feet in the riprap lined section of the channel and 1 foot elsewhere.

- In contrast to the scour components described above, the long-term scour describes the gradual degradation along the channel over a long period of time. The long-term degradation is computed using the Zeller-Fullerton equation, as described in the DDM-Hydraulics, considering a sediment laden flow condition. A sediment laden condition is appropriate since there are no known reservoirs or gravel mining operations in the tributary watershed that would rob the stream of sediment. The applied long term scour component at all Cross-Sections is zero since the sediment transport rate at the upstream supply sections is larger than the transport rate through the study reach.

The detailed scour depth calculations are provided in **Appendix G**.

The results of the scour analysis are presented in Table 2.3 – 1.0 below:

Table 2.3 - 1.0 – Toe Scour Analysis

Levee/ River Mile	*Calculated Scour Components (FS = 1.3)	Long Term Scour Depth (FS = 1.3)	Total Scour Depth	As-built Toe-Down Depth
1.139	3.8	0	3.8	8.5
1.034	5.9	0	5.8	8.5
0.932	7.2	0	7.2	8.5

*Calculated Scour Components include: General Scour (including bend scour), Bed Form Scour and Low Flow Thalweg.

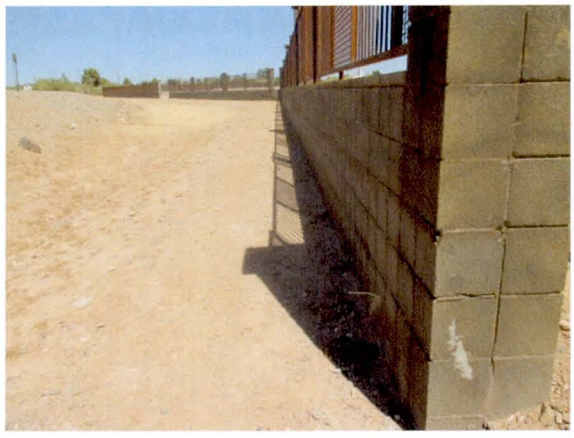
As shown above the as-built toe-down depth is greater than the estimated scour depth at all three levee stations.

2.3.2.3 Dry Side Embankment – River Station ~ 0.9 to 1.0

2.3.2.3.1 Background

Development (Vision Hill Estates) has occurred adjacent to the south levee approximately between River Miles 0.9 and 1.0. As a result of the grading (fill) and existing improvements (grouted riprap channel) at this location, available storage has been removed and subdivision drainage has been re-routed to impinge nearly perpendicular to the levee embankment. From the outlet of channel to the levee penetration, flows are conveyed in a channel parallel to the levee that consists of the levee embankment on the right (north) side and the subdivision boundary wall on the left (south) side. Based on field observations, the subdivision wall is made of block and acts as a retaining wall with intermittent concrete reinforcement to elevations above the adjacent pad. As a conservative assumption in the hydraulic analysis, AMEC assumed that this wall would remain in place during flood events and included the wall in the Side Channel cross sections.

Typical Wall Concrete Reinforcement



Near Side Channel Sta. 120 Looking East

As documented in Section 2.6 (Interior Drainage) the south levee culverts at River Mile 0.919 are not sized to pass the 100-year discharge to Scatter Wash, at the peak rate of inflow, from the contributing interior drainage area. In fact the analysis shows that the headwater elevation at the culverts will reach an elevation of about 1335.9 before impounded flow begins to escape south at a high point in 39th Avenue just south of the intersection with Bowen Avenue. At this elevation the water is effectively equal to the top of levee elevation.

Since it is obvious that in a 100-year, regulatory discharge, event the headwater at the culvert would dictate ponding and drown out any potential localized scour development at the Vision Hills Estates Channel (VHEC), the analysis at this location was performed assuming a free outflow condition (no backwater from the culverts at River Mile 0.919) and at a more frequent return interval (10-year event) to assess the potential long term effects of the flow from this perpendicular channel.

2.3.2.3.2 Hydrology

The calculated 10-year peak discharge within the VHEC is 20.9 cfs. At the channel along the levee toe (called Side Channel in this report), the 10-year discharge is 25 cfs (See Section 2.6 and **Appendix I** for Interior Drainage Area Hydrology). The flow in VHEC was added at Side Channel model Station 400 (total flow of 45.9 cfs).

2.3.2.3.3 Hydraulics

A HEC-RAS backwater model of both the VHEC and the channel between the levee embankment (Side Channel) and subdivision wall were created to assess the potential for scour along the Scatter Wash Levee dry side.

General HEC-RAS modeling assumptions are described in Section 2.1.2.2 of this report.

Manning's "n" roughness coefficients were assigned using engineering judgment based on 2013 aerial photography and field reconnaissance with reference to Chapter 7 of the DDM-Hydraulics.

A channel bottom roughness coefficient of 0.028 was used for the grouted riprap lined VHEC.
A channel bottom roughness coefficient of 0.022 was used to model the channel bottom formed between the dry side levee embankment and the Vision Hill Estates subdivision boundary.
A roughness coefficient of 0.04 was assumed for the dry side levee embankment.

The starting water surface elevation for the VHEC model is based on normal depth. This is a conservative assumption as the Side Channel drainage area is directly adjacent to the VHEC drainage area and both channels will flow concurrently.

The starting water surface elevation for the Side Channel was set to the 10-year head water elevation at the outlet pipes assuming free outfall conditions (no flow in Scatter Wash).

HEC-RAS input and output files are located in **Appendix G.**

Culvert calculations for the outlet pipe are included in **Appendix I.**

A hydraulic work-map for the VHEC and Side Channel modeling in included as **Figure 3.**

2.3.2.3.4 Embankment Assessment

Side Channel

The maximum velocities in the side channel occur in the constricted portion of the channel nearest the culvert entrance from Cross Sections 100 to 150, and range from 2.5 to 4.1 feet per second (fps). Upstream of this section the maximum velocity along the channel is 1.7 fps at Cross Section 400. Per Table 7C of the ADOT Highway Drainage Design Manual (Hydraulics, 2007), the maximum permissible velocity along the dry side levee embankment is 1.7 fps for Sandy Loam. In conjunction with potential future improvements to the existing levee penetration and/or ponding area at south levee Station 378+55 (RM 0.919) or as a stipulation to any Right of Way use permit granted at this location, the District should cause this 50 foot long reach of channel to be armored with riprap or approved equal.

Vision Hill Estates Channel (VHEC)

The VHEC discharges perpendicular to the levee toe. The outlet from the grouted riprap channel was treated equivalent to the outlet from a culvert to determine the susceptibility to scour of the adjacent levee toe. The methodology in Chapter 5 of the Hydraulic Engineering Circular No. 14 was used.

The calculations included in **Appendix G** indicate that a scour hole with a depth of 1.7 feet, a width of about 14 feet and a length of about 20 feet could develop at this location. The levee toe is located about 20 feet from the channel outlet. In conjunction with potential future improvements to the existing levee penetration and/or ponding area at south levee Station 378+55 (RM 0.919) or as a stipulation to any Right of Way use permit granted at this location, the District should cause this location to be armored with riprap or approved equal.

2.3.3 (B)(3) Embankment Protection - Determination

Based on a visual observation of the north and south levee embankments and the scour analysis documented is Section 2.3.2, no appreciable erosion of the levee embankment can be expected during the base flood and the as-built toe down elevations are deeper than the estimated maximum scour depths.

Improvements to the Side Channel directly upstream of the outlet pipes and at the outlet from the VHEC are recommended and could be performed in conjunction with any improvements to the levee penetration/ponding area at south levee Station 378+55 (RM 0.919).

There is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements with respect to (B)(3) – Embankment Protection.

2.4 Design Criteria - Section 65.10(B)(4) Embankment and Foundation Stability

2.4.1 (B)(4) Embankment and Foundation Stability - Criteria

Engineering analyses that evaluate levee embankment stability must be submitted.

The analyses provided shall evaluate expected seepage during loading conditions associated with the base flood and shall demonstrate that seepage into or through the levee foundation and embankment will not jeopardize embankment or foundation stability.

An alternative analysis demonstrating that the levee is designed and constructed for stability against loading conditions for Case IV as defined in USACE Engineering Manual 1110-2-1913, Chapter 6, Section II, may be used.

The factors that shall be addressed in the analysis include:

Depth of flooding;
Duration of flooding;
Embankment geometry and length of seepage path at critical locations;
Embankment and foundation materials;
Embankment compaction;
Penetrations;
Other design factors affecting seepage (e.g., drainage layers); and
Other design factors affecting embankment and foundation stability (e.g. berms).

2.4.2 (B)(4) Embankment and Foundation Stability – Analysis

AMEC evaluated Scatter Wash Levee for embankment and foundation stability. The analysis is documented in a report titled *Geotechnical Investigation and Analysis Report Scatter Wash Levees North and South Banks, Maricopa County, Arizona* and is included as **Appendix H** of this report.

2.4.3 (B)(4) Embankment and Foundation Stability - Determination

Based on the findings of the geotechnical evaluation performed by AMEC and included as **Appendix H,** there is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements for slope stability and seepage.

2.5 Design Criteria - Section 65.10(B)(5) Settlement

2.5.1 (B)(5) Settlement - Criteria

Engineering analyses must be submitted to assess the potential and magnitude of future losses of freeboard as a result of levee settlement and demonstrate that freeboard will be maintained within the minimum freeboard standards set forth in B(1).

The analysis must address:

Embankment Loads.
Compressibility of embankment soils,
Compressibility of foundation soils.
Age of the levee system, and
Construction compaction methods.

A detailed settlement analysis using procedures such as those described in USACE Engineering Manual EM 1110-1-1904 must be submitted.

2.5.2 (B)(5) Settlement – Analysis

AMEC evaluated Scatter Wash Levee for settlement. The analysis is documented in a report titled *Geotechnical Investigation and Analysis Report Scatter Wash Levees North and South Banks, Maricopa County, Arizona* and is included as **Appendix H** of this report.

2.5.3 (B)(5) Settlement - Determination

Based on the findings of the geotechnical evaluation performed by AMEC and included as **Appendix H**, there is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements for ground subsidence/settlement.

2.6 Design Criteria - Section 65.10(B)(6) Interior Drainage

2.6.1 (B)(6) Interior Drainage - Criteria

An analysis must be submitted that identifies the source(s) of such flooding; the extent of the flooded area; and, if the average depth is greater than 1 foot, the water-surface elevation(s) of the base flood. This analysis must be based on the joint probability of interior and exterior flooding and the capacity of facilities (such as drainage lines and pumps) for evacuating interior floodwaters. Interior drainage systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof.

For areas of interior drainage that have average depths greater than 1 foot, mapping must be provided depicting the extents of the interior flooding, along with supporting documentation.

2.6.2 (B)(6) Interior Drainage – Analysis

2.6.2.1 Background

AMEC completed an assessment of the interior drainage for the Scatter Wash Levees. A total of four potential ponding areas were identified, one on the north levee (N1) and three on the south levee (S1, S2 and S3) and are depicted on Figures 4a and 4b. Two of the four potential ponding areas have associated drainage structures that penetrate the levee and drain the areas by gravity flow (N1 and S3). Ponding areas S1 and S2 do not have a gravity outfall.

Per FEMA criteria, ponding areas with an average depth of greater than 1 foot must be delineated and depicted on the FIRM panel. In order to determine the average ponding elevation at each of the potential ponding areas an estimate of both the peak flow rate and peak runoff volume are required. Per the scope of work for this project, a joint probability analysis of interior and exterior flooding was not completed. AMEC did compare the exterior drainage basin size and time to peak to the interior drainage values and found that the exterior drainage area of 13.92 square miles and time to peak of 13.07 hours is much larger than the associated interior values. Also, as discussed in Sections 2.6.2.5 and 2.6.2.6 below, the ponding areas

were assessed for the two extreme conditions of 100-year flow depth in Scatter Wash and no flow in Scatter Wash and the resulting ponding depths were not significantly different.

2.6.2.2 Hydrology

Peak Flows

The total interior drainage contributing drainage area was determined to be less than 160 acres therefore the Rational Method was used to determine the peak flow rates. All of the interior drainage basins were delineated using the elevation contours provided by FCDMC and ArcMap. The flow length, area and elevation data was then entered into the Drainage Design Management System for Windows (DDMSW) where the peak discharges were calculated according to Chapter 3 of the Drainage Design Manual for Maricopa County, Hydrology (DDMMC Hydrology).

Drainage sub-basin delineations, and land use are depicted on **Figures 4a and 4b**.

Drainage sub-basin delineations, flow paths and a graphical depiction of the contributing drainage area to each identified pond are depicted on **Figure 4b**.

Drainage sub-basins are named according to the potential ponding area that they drain to (N1, S1, S2 and S3), followed by the letter:

"D" for "direct" if the sub-basin drains directly to a potential ponding area (Example: Sub-basin S2-D1, drains directly (D) to Pond S2),

"O" for "overflow" if the area is intercepted by an existing depression (retention basin) prior to overflowing to the potential ponding area (Example: Sub-basin N1-O1, drains first to a stormwater retention basin that overflows (O) to Pond N1),

"SP" for "split" if a portion of the flow generated on the sub-basin can split towards a potential ponding area (Example: Sub-basin S3-SP2, concentrates at the intersection of 35th Avenue and Behrend Drive where flow splits (SP) south (out of the system) and also west towards Pond S3.

Drainage sub-basins with the prefix "NC" and sub-basin S3-O1 were delineated and later found to be non-contributing areas. S3-O1 is not contributing because all runoff within the basin boundaries is captured within multiple drywells and the large retention park area. AMEC compared the available retention volume in the school ball fields to the volume generated on site and found the fields to have sufficient volume to store the 100-year event and justify removal of this area from the analysis at the levee.

The rational method peak flow rates calculated by DDMSW for select drainage basins are tabulated below:

Table 2.6 - 1.0 – Peak Flows before any Flow Spit – 100-year

Sub-basin	Drainage Area (acres)	Time of Concentration (min)	Runoff Coefficient	Rainfall Intensity (in/hr)	Peak Flow (cfs)

N1-O1	6.7	10	.70	6.71	31.5
N1-D1	8.8	9	.70	6.83	42.3
S1-D1	3.3	5	.60	8.68	17.3
S2-D1	10.5	10	.78	6.51	53.4
S3-SP2	20.9	15	.70	5.42	79.1
S3-SP1	24.1	15	.83	5.57	111.6
S3-D1	29.6	19	.65	4.94	94.9

The DDMSW input and output files are included in **Appendix I.**

Runoff Volume

According to Chapter 3 of the DDM-Hydrology the rational method peak runoff volume can be estimated as the rainfall depth converted to feet multiplied by the contributing drainage area in acres and the rational method runoff coefficient.

The calculated rational method runoff volumes for select drainage basins are tabulated below:

Table 2.6 - 2.0 – Peak Runoff Volumes before any Flow Split– 100 year

Sub-basin	Drainage Area (acres)	Runoff Coefficient	100-year, 2-hour Rainfall Depth (in)	Peak Runoff Volume (acre-ft)
N1-O1	6.7	.70	2.55	1.00
N1-D1	8.8	.70	2.55	1.32
S1-D1	3.3	.60	2.55	0.42
S2-D1	10.5	.78	2.55	1.74
S3-SP2	20.9	.70	2.55	3.11
S3-SP1	24.1	.83	2.55	4.25
S3-D1	29.6	.65	2.55	4.09

2.6.2.3 Flow Attenuation at Existing Depressions (Retention Basins)

Four retention basins, within sub-basins S1-D1, S2-D1, N1-O1 and N1-D1, were identified by field reconnaissance and by a review of available aerial photographs. The available retention volume in each of these basins was calculated from the project topography.

The available storage volumes are tabulated below:

Table 2.6 - 3.0 – Available Retention Volume at Ponding Locations

Pond Location	Available Volume (acre-ft)
N1-O1	0.98
N1-D1	1.28*

S1-D1	0.23
S2-D1	0.07
S3-D1	2.90**

*Note: Volume reported at N1-D1 is at the elevation of the overflow weir at the berm (EL. 1331.8)
**Note: Volume reported at S3-D1 is at the elevation of the overflow weir on 39th Avenue (EL. 1335.9)

In order to determine the potential flow attenuation afforded by the existing retention areas, a relationship between the peak flow and volume was required. AMEC utilized a triangular hydrograph with the time to peak and peak flow established from the rational method hydrology and the tailing/falling limb of the hydrograph modified so that the total volume of runoff would be equal to the rational method volume listed in Table 2.6 – 2.0.

With the hydrographs established, the attenuated flows were calculated by determining the time at which the storage volume of a certain retention basin was filled. The flow that corresponded with this time was the new attenuated flow downstream unless the storage volume occurred on the rising limb of the hydrograph, in which case, there would be no flow attenuation. Table 2.6 – 4.0 shows the attenuated flows used for analysis.

Table 2.6 – 4.0 Attenuated Flows at Ponding Locations

Sub-basin	Peak Flow	Peak Flow Plus Upstream Flow	Attenuated Flow
	cfs	cfs	cfs
N1-O1	31.5	-	5.0
N1-D1	42.3	47.3	23.7
S1-D1	17.3	-	12.6
S2-D1	53.4	66.0	66.0

The attenuated peak flow rate at sub-basin N1-D1 of 23.7 cfs was used in the final ponding analysis at the north levee penetration near River Mile 0.892.

2.6.2.4 Determination of Flow Splits – Peak Flow Rate and Runoff Volume at South Levee Penetration

Flow Splits to South Levee

Through a review of the project topography and aerial photography and as indicated during the project field reconnaissance, AMEC identified several locations where flow could split south and away from the south levee embankment. The District collected field survey at the potential split locations. The field survey data is included in **Appendix C.**

The potential split locations are located along Behrend Drive at the intersections with 35th Avenue, 37th Avenue, 37th Drive and 38th Ave. These locations are depicted graphically on Figures 5a and 5b.

AMEC performed a split flow analysis at each location. The calculations and split flow assumptions are provided in **Appendix I.**

Peak Flow Rates at South Levee

AMEC used the results of the split flow analysis to determine a total composite flow area that reports to the south levee penetration. The estimated total composite drainage area was then used to determine the rational method peak flow rate at the levee penetration. A new travel path was estimated that runs from the east limit to basin S3-SP2 and through S3-SP1 and S3-D1 to the levee penetration. A composite runoff coefficient was estimated from the land use percentages resulting from the flow splits.

The results of the split flow analysis to determine the total contributing drainage area and composite runoff coefficient are tabulated below:

Table 2.6 – 5.0 Composite DDMSW Inputs

NAME	Basin Area	Contributing Area %	Contributing Area	Total Area	Land Use Area		Land Use Code	C
					%	ac		
S3-SP2	20.86	28.4%	5.92	5.92	100	5.92	140	0.70
S3-SP1	24.14	31.5%	7.60	13.53	90	6.84	160	0.82
S3-SP1					10	0.76	520	0.95
S3-D1	29.57	100.0%	29.57	43.10	50	14.79	130	0.60
S3-D1					25	7.39	140	0.70
S3-D1					25	7.39	730	0.70
S2-D1	10.53	100.0%	10.53	53.63	20	2.11	530	0.95
S2-D1					30	3.16	220	0.95
S2-D1					50	5.27	130	0.60
S1-D1	3.32	73.0%	2.42	56.05	100	2.42	130	0.60
Totals / Composite	88.42		56.05			56.05		0.70

*Land Use Code List: 130-Large Lot Residential; 140-Medium Lot Residential; 160-Very Small Lot Residential; 220-Neighborhood Commercial; 520-Educational; 530-Institutional; 730-Passive Open Space

The resulting peak flow rate at the south levee penetration (DDMSW sub-basin SO.PEN) is 148 cfs and has a time of concentration of 30 minutes (0.50 hours).

The total incoming runoff volume at the south levee penetration was determined by the rational method to be 8.33 acre-feet (V = C * P/12 * A; V = 0.70 * (2.55 in / 12 in) * 56.05 acres). The current available pond volume may not be able to accommodate the incoming runoff volume.

2.6.2.5 Ponding Area Delineation – North Levee

By review of the project topography it was determined that the ponding depth at the North levee penetration will be controlled by both the capacity of the culvert and the depth over which flow could escape over a high point "weir" in the embankment and travel west away from the

penetration. Since the head will be a function of the concurrent capacity of both the culvert and weir, AMEC determined that the worst case for ponding would be the condition in which no flow is allowed through the culvert.

As described in Section 2.6.2.3, the drainage areas that contribute flow to the retention basin are basins N1-O1 and N1-D1. These two basins are comprised of the small residential development to the north of Scatter Wash. As discussed above, the flap gate to the culvert was assumed closed.

An attenuated discharge of 23.7 cfs (see Table 2.6 - 4 .0) and a weir coefficient of 2.5 was used in software program Hydraulic Toolbox to calculate the weir depth. The weir geometry was estimated from the project topography with a crest elevation of 1331.75. The ponding elevation was calculated as the weir elevation plus the calculated head required to pass the attenuated discharge.

As depicted on Figure 6, the ponding elevation at the north levee is 1332.1 ft and does not inundate any structures. The flow that passes over the weir will travel west into an adjacent retention basin and likely then overtop, continuing westward before being carried away from the levee in subdivision street right of way with an ultimate outfall to Scatter Wash west of 43rd Avenue.

Basin Drain Time Calculation

The time required to drain the north pond was calculated with the following assumptions:

- The volume to be drained is equal to the volume stored between the overflow weir elevation (1331.75) and the invert of the pipe culvert at the levee (1329.88). This ignores the volume stored in the subdivision retention basin below the invert of the pipe culvert through the levee. This is an appropriate assumption since the volume stored below the pipe invert elevation does not directly pond against the levee embankment.

- The flow in Scatter Wash has receded so that there is no tailwater on the pipe for culvert calculations.

- The average discharge capacity through the pipe can be estimated as the discharge capacity half way between the overflow and pipe invert elevation.

- The drain time is calculated as the volume to be drained divided by the average discharge rate.

Drain time calculations are included in **Appendix I** and the result is reported in **Table 2.6 – 6.0.**

2.6.2.6 South Levee Ponding Areas

As depicted on Figure 6, the low top of levee elevation adjacent to the south penetration is approximately 1336.5; there is a grade break in 39th Avenue with an elevation, based on survey data, of about 1335.9 beyond which ponded water will flow south and out of the ponding area. The invert elevation of the dual 24 inch pipes is 1331.29 on the inlet side.

The ponding at the south levee penetration was determined for two flow conditions including:

1. 100-year CWSEL in Scatter Wash.
2. No flow in Scatter Wash

A 100-year computed water surface elevation of 1333.20 was interpolated from the HEC-RAS model between Stations 0.892 and 0.932 and was used as the tail-water elevation for the culvert calculations for condition 1.
By analyzing both conditions the sensitivity of the final ponding elevation to the tail-water condition could be determined.

AMEC analyzed the system to account for the reservoir routing that is occurring at this location. The methodology for flood routing through detention facilities described in Section 8.8 of the Drainage Design Manual for Maricopa County, Volume II, Hydraulics (1996) was used to estimate the ponding elevation at the structure. This previous version of the DDM-Hydraulics was referenced as the detailed reservoir routing procedure is not covered in the 2013 edition.

A stage outflow curve was estimated for the culverts using HY-8 and the capacity of the overflow weir at 39th Avenue was calculated with the software program Hydraulic Toolbox.

The stage storage data was estimated from the project topography supplemented with project specific ground survey. A storage-outflow function was calculated and used to graphically estimate the outflow from the reservoir given inflow and storage data over a specified time step (5 minutes). The result of the analysis shows that a maximum stage of about 1336.0 will occur in the ponding area for condition 1 and a maximum stage of about 1136.0 for condition 2, suggesting that the final ponding elevation is not significantly affected by the flow condition in Scatter Wash but rather is controlled by the relationship of available storage, overflow south along 39th Avenue and to a lesser extent the capacity of the culverts.

Stage-storage curves, HY-8 Culvert Analysis and Hydraulic Toolbox output files and the reservoir routing calculations are included in **Appendix I.**

Basin Drain Time Calculation

The time required to drain the south pond was calculated with the following assumptions:

- The volume to be drained is equal to the volume stored between the overflow weir elevation (1335.9) and the invert of the pipe culvert at the levee (1331.29).
- The flow in Scatter Wash has receded so that there is no tailwater on the pipe for culvert calculations.
- The average discharge capacity through the pipe can be estimated as the discharge capacity half way between the overflow and pipe invert elevation.
- The drain time is calculated as the volume to be drained divided by the average discharge rate.

Drain time calculations are included in **Appendix I** and the result is reported in **Table 2.6 – 6.0.**

2.6.3 (B)(6) Interior Drainage - Determination

Per FEMA criteria, interior ponding areas with an average depth of greater than 1 foot must be mapped. The average ponding elevation was calculated as the stored volume divided by the corresponding pond surface area. Both storage volume and surface area were calculated from the project DEM described in Section 1.3.1.2 of this report.

As summarized in Table 2.6 – 6.0 below, one location (pond N1-D1) results in an average ponding depth greater than 1 foot. The pond at N1-D1 has been delineated, on Figure 6, as part of this project. Ponding data for Pond S3-D1 is also depicted on Figure 6 to provide supporting documentation for the discussion provided in Section 2.1.3 of this report.

Table 2.6 – 6.0 Critical Pond Statistics

Pond Name	Pond Location	Surface Area	Stored Volume	Water Surface Elevation	Maximum Depth	Approximate Average Depth	Pond Drain Time
		acre	acre-ft	ft	ft	ft	hrs
N1-D1	North of North Levee Outlet	0.57	1.49	1332.1	4.3	2.63	1.9
S1-D1	Northernmost pond that overflows to S2	0.28	0.23	1338.9	1.2	0.82	N/C
S2-D1	North of S3 and captures overflow from S1	0.17	0.07	1337.2	0.8	0.41	N/C
S3-D1	South of South Levee Outlet	3.91	3.27	1336.0	4.7	0.84	1.1

Note: N/C = not calculated.

2.7 Design Criteria - Section 65.10(B)(7) Other Design Criteria

2.7.1 (B)(7) Other Design Criteria - Criteria

In unique situations, such as those where the levee system has relatively high vulnerability, FEMA may require that other design criteria and analysis be submitted to show that the levees provide adequate protection. In such situations, sound engineering practice will be the standard on which FEMA will base its determinations. FEMA also will provide the rationale for requiring this additional information.

There are no known unique conditions at the Scatter Wash Levee system.

2.8 Operations Plan and Criteria - Section 65.10(C)

2.8.1 Operations Plan and Criteria – Criteria

For a levee system to be recognized, the operational criteria must be as described below. All devices or mechanical systems for internal drainage, whether manual or automatic, must be operated in accordance with an officially adopted operation manual, a copy of which must be provided to FEMA by the operator when levee or drainage system recognition is being sought or when the manual for a previously recognized system is revised in any manner. All operations must be under the jurisdiction of a Federal or State agency, an agency created by Federal or State law, or an agency of a community participating in the NFIP.

(C)(1) Closures

Operations Plans for closure must include the following:

- *Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operations activities and demonstration that sufficient flood warning time exists for the completed operation of all closure structures, including necessary sealing, before floodwaters reach the base of the closure;*

- *A formal plan of operation, including specific actions and assignments of responsibility by individual name or title; and*

- *Provision for periodic operation, at not less than 1-year intervals, of the closure structure(s) for testing and training purposes.*

(C)(2) Interior Drainage Systems

Interior drainage systems associated with levee systems usually include storage areas, gravity outlets, pumping stations, or a combination thereof. FEMA will recognize these drainage systems on NFIP maps for flood protection purposes only if the following minimum criteria are included in the operation plan:

- *Documentation of the flood warning system, under the jurisdiction of Federal, State, or community officials, that will be used to trigger emergency operation activities and demonstration that sufficient flood warning time exists to permit activation of mechanized portions of the drainage system;*

- *A formal plan of operation, including specific actions and assignments of responsibility by individual name or title;*

- *Provision for manual backup of the activation of automatic systems; and*

- *Provisions for periodic inspection of interior systems and periodic operation of any mechanized portions for testing and training purposes; no more than 1 year shall elapse between either the inspections or the operations.*

(C)(3) Other Operations Plans and Criteria

FEMA may require other operating plans and criteria to ensure that adequate protection is provided in specific situations. In such cases, sound emergency management practice will be the standard upon which FEMA determinations will be based.

2.8.2 Operations Plan and Criteria – Analysis

The Scatter Wash Levees are operated and maintained by the Flood Control District of Maricopa County. The District's standards for operations are outlined in the document titled, *Standard Operating Procedures (SOP's), Deficiency Levels, Maintenance Standards, and Standard Drawings* **(Included in Appendix J).**

- Flood Warning: the Flood Control District has installed, operates and maintains a robust system of both stream and rainfall gages to provide real time rainfall data. The nearest rain gage is about 1 mile away at the Adobe Dam (FCDMC ALERT Station #5535); however this gage is not within the Scatter Wash watershed. The nearest rain gage in the project watershed is at Deer Valley Airport (FCDMC ALERT Station #5550) about 4.5 miles north east of the project. It should be noted that none of the closure devices on the levee structure require manual operation.

- A formal operations plan including specific actions and assignments of responsibility for emergency flood emergencies is documented as SOP #18 in the above referenced document.

- Periodic operation of the levee closures and interior drainage structures is documented as SOP #9 of the above referenced document. According to District maintenance staff the Scatter Wash Levee interior drainage structures are inspected quarterly, with written reports prepared for each levee visit. Any restrictive debris is removed immediately at the time of inspection. If large debris, such as excessive weeds and sediment is identified then a work order for removal is immediately initiated.

2.8.3 Operations Plan and Criteria – Determination

Based on a review of the available operations plan for the Scatter Wash Levee, there is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements.

2.9 Maintenance Plans and Criteria - Section 65.10(D)

2.9.1 Maintenance Plans and Criteria – Criteria

For a levee system to be recognized as providing protection from the base flood, the following maintenance criteria must be met:

- *Levee systems must be maintained in accordance with an officially adopted maintenance plan, and a copy of this plan must be provided to FEMA by the owner of the levee system when recognition is being sought or when the plan for a previously recognized system is revised in any manner.*

- *All maintenance activities must be under the jurisdiction of a(n);*

    - *Federal or State Agency;*

- *Agency created by Federal or State law; or*
- *Agency of a community participating in the NFIP that must assume ultimate responsibility for maintenance.*

- *The maintenance plan must document the formal procedure that ensures that the stability, height, and overall integrity of the levee and its associated structures and systems are maintained.*
- *At a minimum, the maintenance plan shall specify:*
  - *Maintenance activities to be performed;*
  - *Frequency of their performance; and*
  - *Person by name or title responsible for their performance.*

2.9.2 Maintenance Plan and Criteria – Analysis

The Scatter Wash Levees are operated and maintained by the Flood Control District of Maricopa County. The District's standards for operations are outlined in the document titled, *Standard Operating Procedures (SOP's), Deficiency Levels, Maintenance Standards, and Standard Drawings* **(Included in Appendix J).**

- Periodic inspection requirements are documented as SOP #9 of the above referenced document. The Scatter Wash Levee is slated for annual inspection.
- Maintenance standards specific to County owned levee systems are documented in the *Deficiency and Maintenance Standards*, Section II of the above referenced document. Section #13 levees lists the following specific maintenance requirements: Operations and Maintenance Division Section Number 13 "Levees". Specific maintenance requirements include:
  - General right-of-way
    - Removal of trash and debris,
    - Repair of fencing damage,
    - Rodent (burrowing animal) control.
  - Concrete/soil cement structures
    - Repair of structural damage,
    - Repair of erosion damage,
    - Repair of damaged facing,

        - Graffiti removal.
    - Earthen Levee
        - Repair of rilling erosion,
        - Re-grading (back to design elevations) or access roads and crest,
        - Re-installing missing or displaced slope protection.
    - Removal of deep rooted vegetation
    - Document transverse or longitudinal cracks.
- Annual inspection reports are included in **Appendix J**.

2.9.3 Operations Plan and Criteria – Determination

Based on a review of the available maintenance plan for the Scatter Wash Levee, there is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements.

3.0 TITLE 44 CFR 65.10 COMPLIANCE EVALUATION SCATTER WASH LEVEE – CERTIFICATION STATEMENT

3.1 Certification

(E) Certification requirements.
Data submitted to support that a given levee system complies with the structural requirements set forth in paragraphs (b)(1) through (7) of this section must be certified by a registered professional engineer. Also, certified as-built plans of the levee must be submitted. Certifications are subject to the definition given at § 65.2 of this subchapter. In lieu of these structural requirements, a Federal agency with responsibility for levee design may certify that the levee has been adequately designed and constructed to provide protection against the base flood.

Certification for the Levee System has been evaluated per the requirements of 44 CFR § 65.10. For the purpose of this levee assessment report and certification documentation, the term certification is subject to the definition given in 44 CFR Section 65.2 of the NFIP regulations, as follows:

§ 65.2 Definitions.

(b) ***For the purpose of this part. A certification by a registered professional engineer or other party does not constitute a warranty or guarantee of performance, expressed or implied.*** *Certification of data is a statement that the data is accurate to the best of the certifier's knowledge. Certification of analyses is a statement that the analyses have been performed correctly and in accordance with sound engineering practices. Certification of structural works is a statement that the works are designed in accordance with sound engineering practices to provide protection from the base flood. Certification of "as built" conditions is a statement that the structure(s) has been built according to the plans being certified, is in place, and is fully functioning.*

(c) For the purposes of this part, "reasonably safe from flooding" means base flood waters will not inundate the land or damage structures to be removed from the Special **Flood Hazard Area** *(***SFHA***) and that any subsurface waters related to the base flood will not damage existing or proposed buildings."*

The Scatter Wash Levees are identified in Figure 1 and described in Section 1.0 of this report. AMEC has evaluated the levee system as shown in Figure 1 for compliance with the requirements in 44 CFR Section 65.10 of the NFIP regulations, as follows:

44 CFR 65.10 Criteria	Appears Compliant	Appears Noncompliant	Not Applicable	Remarks/Report Section
Freeboard	X			Interior drainage can pond to within 0.5 feet of the levee crest. / Sections 2.1 and 2.6.
Closures	X			Section 2.2
Embankment Protection	X			Recommend improvements near River Mile 0.919. / Section 2.3
Embankment and Foundation Stability	X			Section 2.4 and Appendix H
Settlement	X			Section 2.5 and Appendix H
Interior Drainage	X			Section 2.6
Operation Plans	X			Section 2.8
Maintenance Plans	X			Section 2.9

Note: Freeboard Compliance Evaluation is based upon the detailed HEC-RAS

The certifications are valid as of the signed date of the certification. These certifications do not constitute a warranty or guarantee of performance, expressed or implied, of the levee system. Furthermore, it should be noted that these certifications are a snapshot in time of the overall condition of the levee system. Levee systems are dynamic in nature and change over time, due to changing weather patterns, land use, runoff events, design life, acts of vandalism, authorized or unauthorized modifications, and operations and maintenance practices; none of which can be controlled by AMEC. Therefore, this certification under the definitions of Section 65.2 is simply a statement that the levee systems meets or does not meet the requirements of Section 65.10 as of the date of the certification signatures. Any future use of this certification documentation may require an assessment by a registered professional engineer to determine whether all or portions of this certification are still valid.

4.0 REFERENCES

Flood Control District of Maricopa County, Drainage Design Manual – Hydrology, 2013.

Flood Control District of Maricopa County, Drainage Design Manual – Hydraulics, 2013.

Flood Control District of Maricopa County, Drainage Design Manual, Volume II, Hydraulics (1996).

Flood Control District of Maricopa County, Drainage Design Management System (DDMSW) v.4.6.0, August, 2010.

Arizona Department of Transportation, Highway Drainage Design Manual, Hydraulics, 2007.

Federal Highway Administration, "Hydraulic Design of Energy Dissipators for Culverts and Channels,", Hydraulic Engineering Circular No. 14, Chapter 5, FHWA-EPD-86-110, 1983, Revised 1995.

HEC-RAS model, Hydrologic Engineering Center, version.4.1.1. 2009.

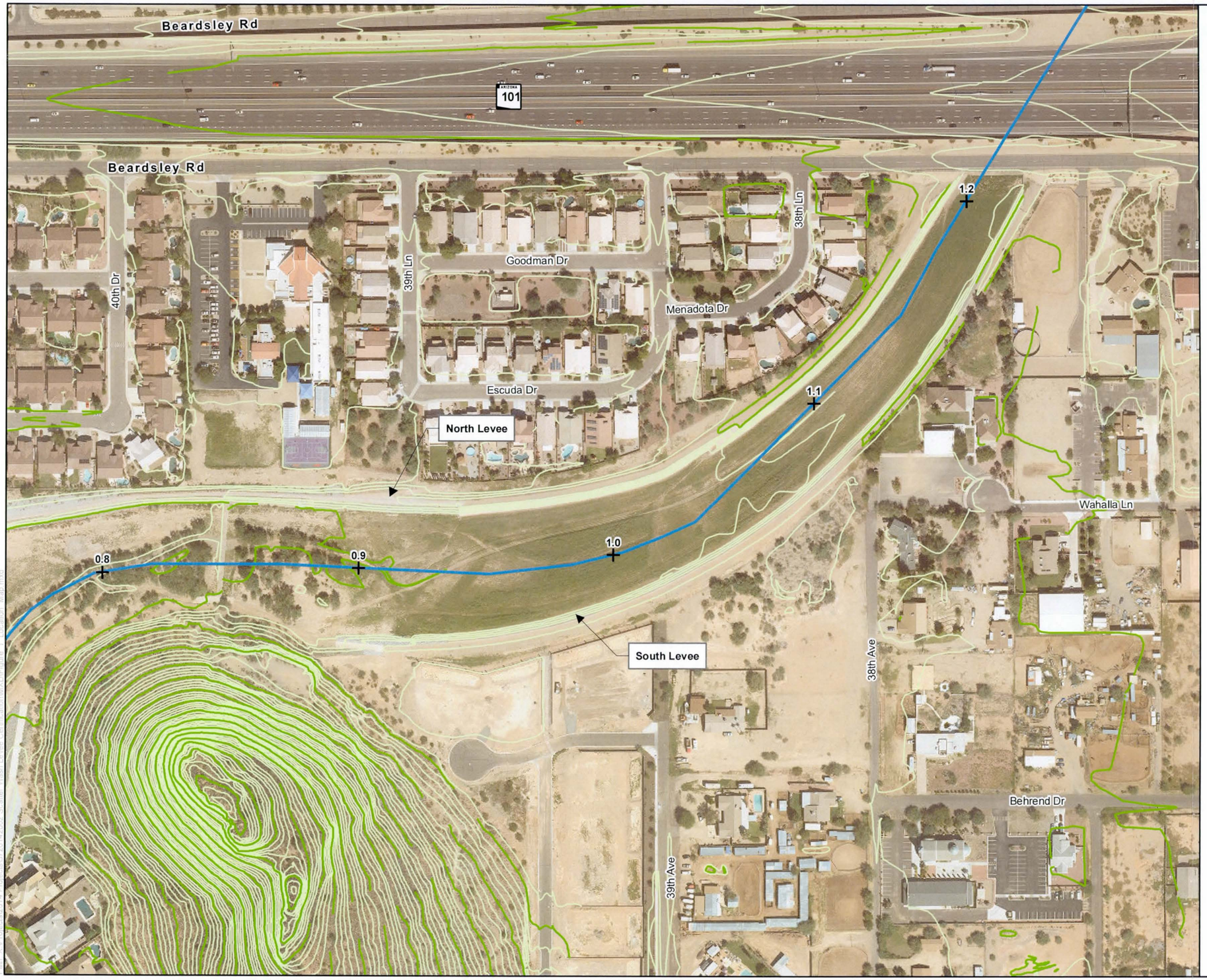
HEC-1 Model, ACDC Area Drainage Master Study, Scatter Wash Watershed, 344-100.OUT, KHE JOB NO. 0344, last revised October 24, 1994.

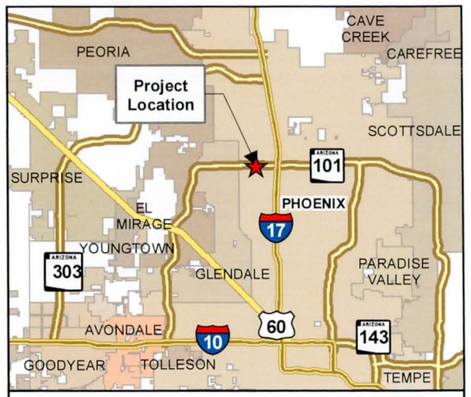
Scatter Wash, Floodplain Delineation Study, FCD Contract NO. 2013C002 WA#1, FEMA Case No. 14-09-2027P. December 16, 2013.

Letter of Map Revision Request Scatter Wash, SR101L to I-17 (FIS LOMR). February, 2014.

Drainage Report for Vision Hill Estates. Allen Consulting Engineers, Inc., April 3, 2014.

FIGURES





Area of Detail

Legend

- River Mile Station

Topography (NAVD 88)

- Index Contour (10')
- Interval Contour (2')
- Scatter Wash Centerline

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

0 100 200 400 Feet

N

Scatter Wash Levee Certification

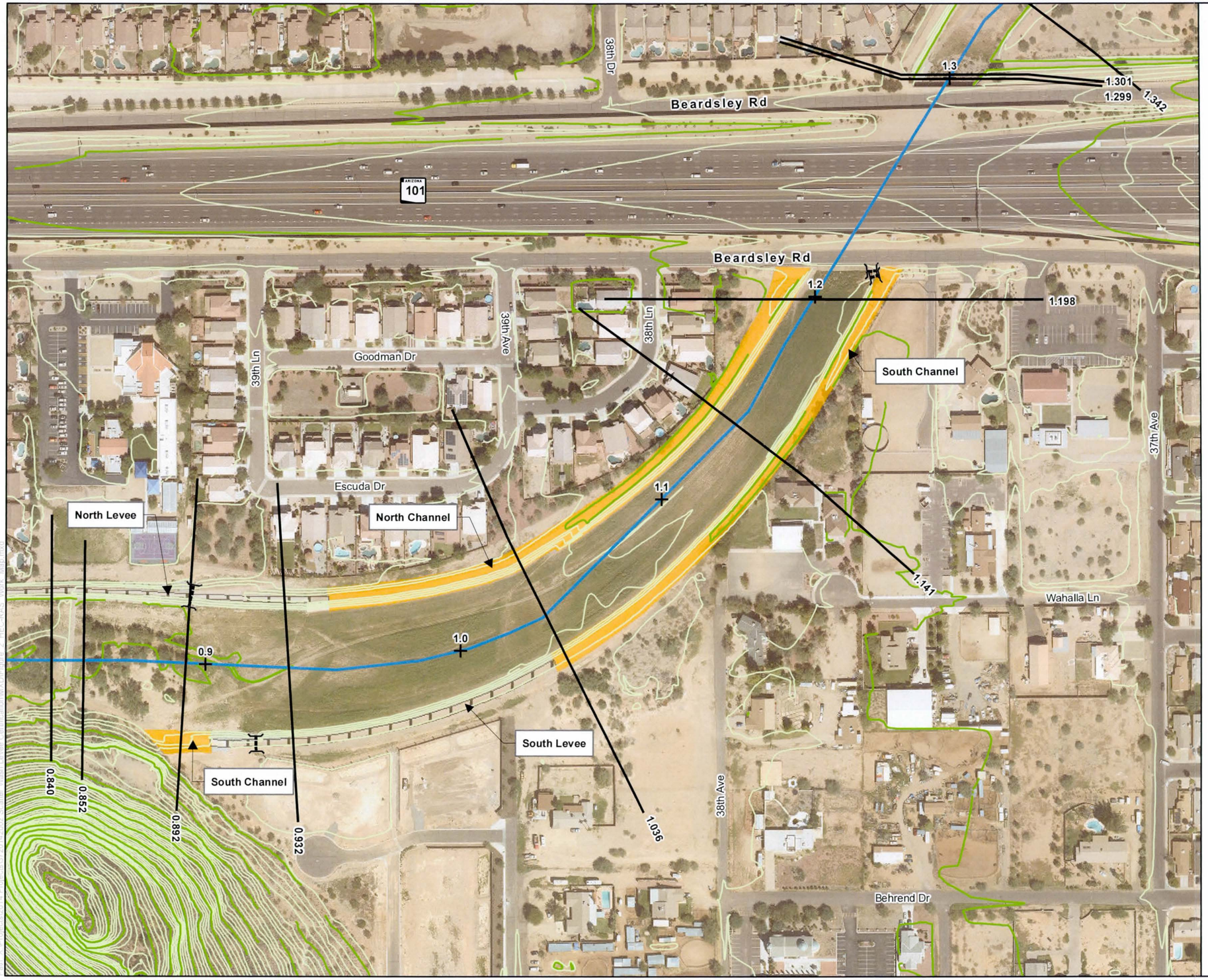
Location Map

FIGURE 1

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 200'

The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number 37-2014-2002. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. AMEC assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

J:\Projects\37-2014-2002 Scatter Wash Levee Certification\MXD\Figure 1 Location Map.mxd



Area of Detail

Legend

- River Mile Station
- HEC-RAS Cross-Section Location
- Scatter Wash Centerline
- Existing Penetrations

Topography (NAVD 88)

- Index Contour (10')
- Interval Contour (2')
- Non-Levee Area
- Levee Area

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

0 100 200 400 Feet

N

Scatter Wash Levee Certification

HEC-RAS Workmap

FIGURE 2

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 200'

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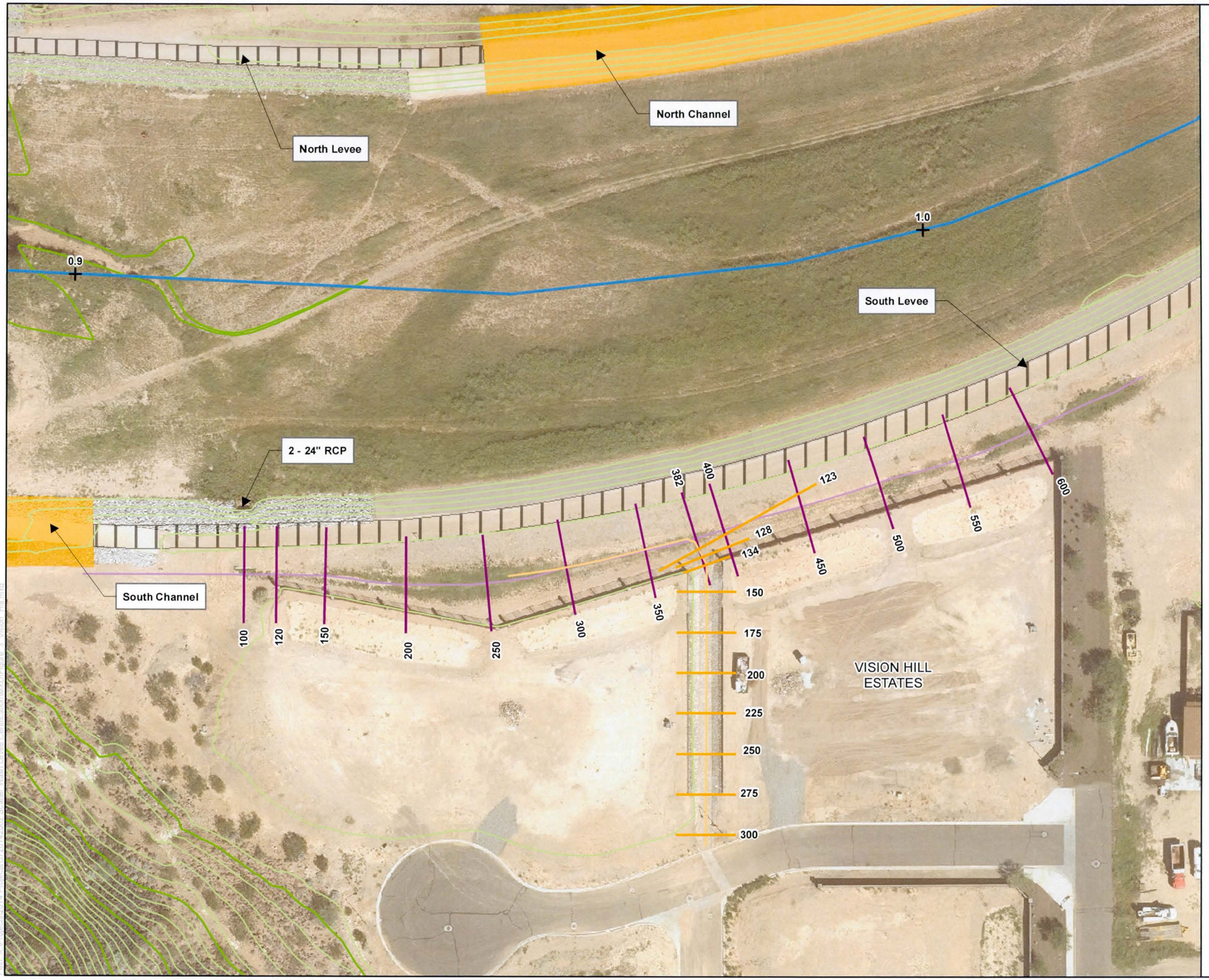

Area of Detail

Legend

- River Mile Station
- Scatter Wash Centerline
- Vision Hill Channel Centerline
- HEC-RAS Cross-Sections Vision Hill Channel
- Side Channel Centerline
- HEC-RAS Cross-Section Side Channel

Topography (NAVD 88)

- Index Contour (10')
- Interval Contour (2')
- Non-Levee Area
- Levee Area

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

N

0 30 60 120 Feet

Scatter Wash Levee Certification

Vision Hill Estates Channel and Side Channel

FIGURE 3

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 60'

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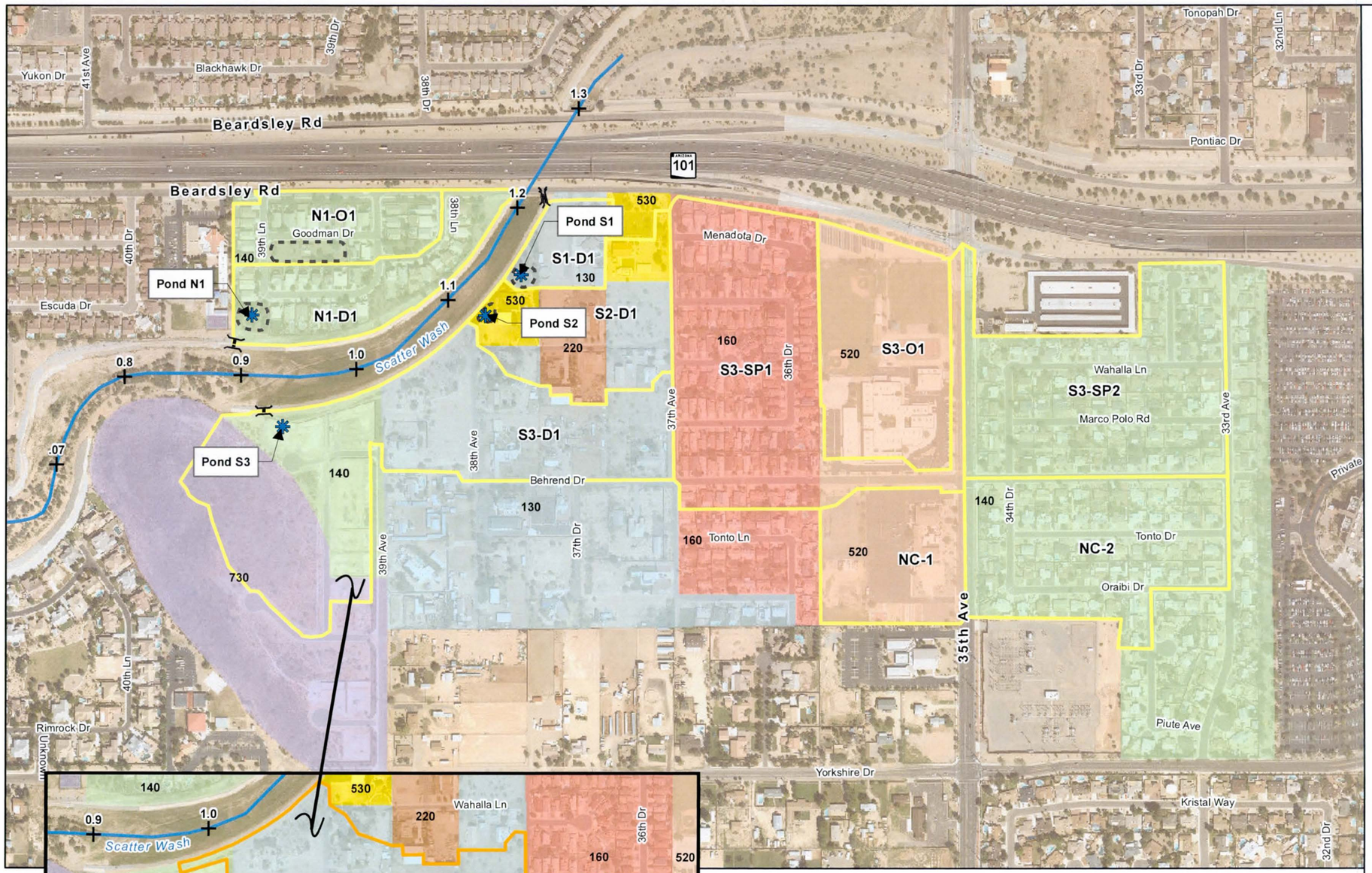
Path: K:\Projects\37014\GIS\Scatter Wash Levee Certification\MXD\Fig 3 Vision Hill.mxd



Area of Detail

Legend

- Potential Ponding Areas
- Penetrations
- Scatter Wash Centerline
- Existing Retention Basins
- River Mile Station

Land Use Code

- **130** Large Lot, Residential
- **140** Medium Lot, Residential
- **160** Very Small Lot, Residential
- **220** Neighborhood Commercial
- **520** Educational
- **530** Institutional
- **730** Passive Open Space

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

0 250 500 1,000 Feet

N

Scatter Wash Levee Certification

Interior Drainage Analysis
Rational Method - Land Use

FIGURE 4a

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 500'

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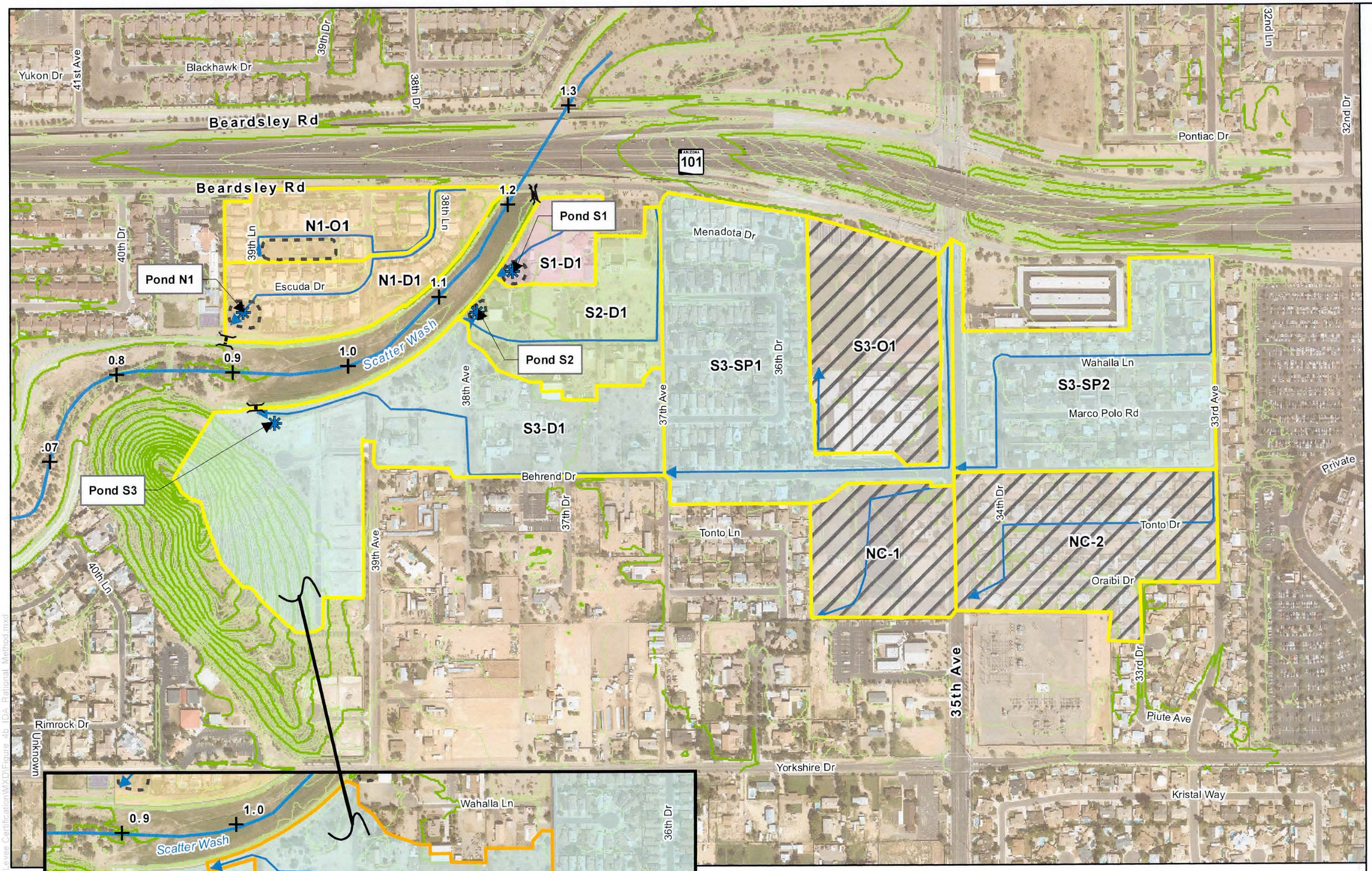

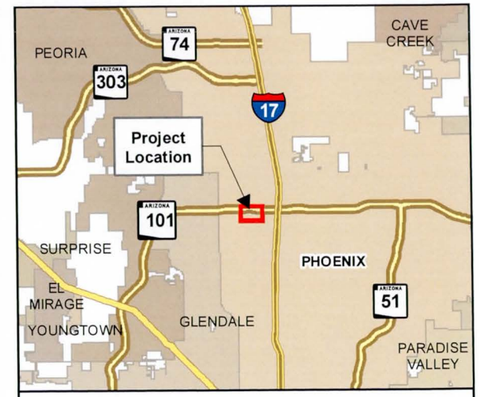

Area of Detail

Legend

- Potential Ponding Areas
- River Mile Station
- Penetrations
- Scatter Wash Centerline
- Flow Length and Direction
- Drainage Basins
- Existing Retention Basin

Topography (NAVD 88)

- Index Contour (10')
- Interval Contour (2')

Contribution to Ponding

- Drainage to Pond N1
- Drainage to Pond S1
- Drainage to Pond S2
- Drainage to Pond S3
- Does Not Contribute

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

N

0 250 500 1,000 Feet

Scatter Wash Levee Certification

Interior Drainage Analysis Rational Method - Hydrology

FIGURE 4b

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 500'

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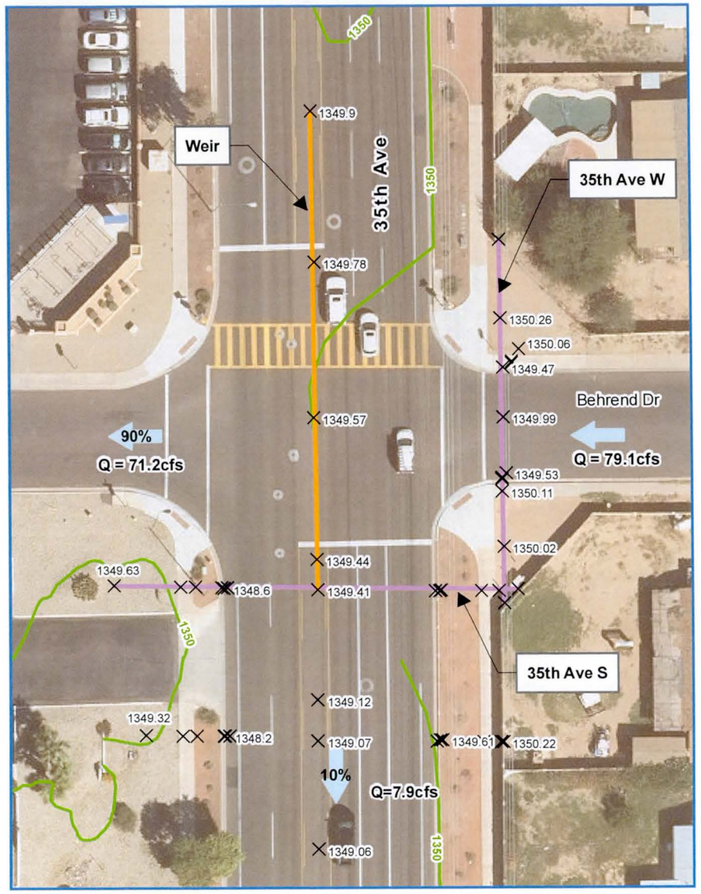
Path: X:\Projects\2014 Projects\37201420002 Scatter Wash Certification\MXD\Figure 4b IDA Rational Method.mxd

37th Ave

Path: X:\Projects\2014 Projects\37-2014-2002 Scatter Wash Levee Certification\MXD\Figure_5a_IDA_Flow Split.mxd

35th Ave



Cross Section for 37th Ave West

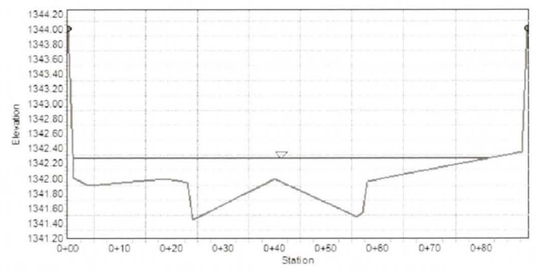
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.83	ft
Discharge	59.14	ft^3/s

Cross Section Image



Cross Section for 35th Ave West

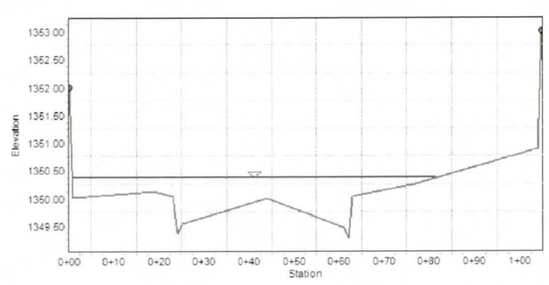
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	1.09	ft
Discharge	79.10	ft^3/s

Cross Section Image



Area of Detail

Legend

- Flow Direction and Percentage of Flow Split
- Survey Point
- Split Cross-Section
- Weir

Topography (NAVD 88)

- Index Contour (10')
- Interval Contour (2')

Note: All flows are 100-year in cubic feet per second (cfs)

References:

Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

Survey Points: Collected on 4/30/2014 by Flood Control District of Maricopa County, NAVD 88.

0 25 50 100 Feet

N

Scatter Wash Levee Certification

Interior Drainage Analysis Flow Splits

FIGURE 5a

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 50'

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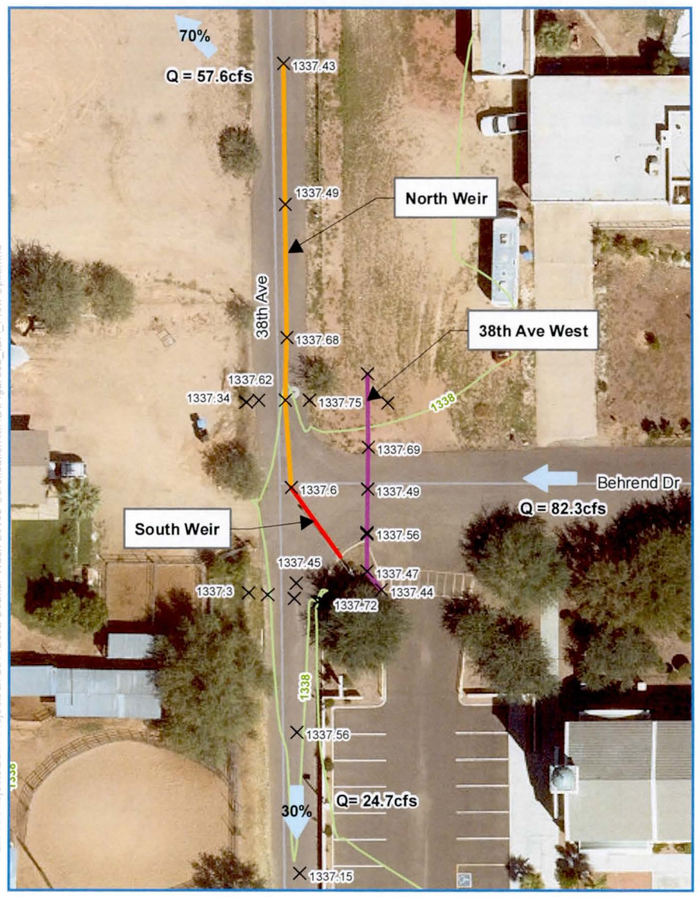
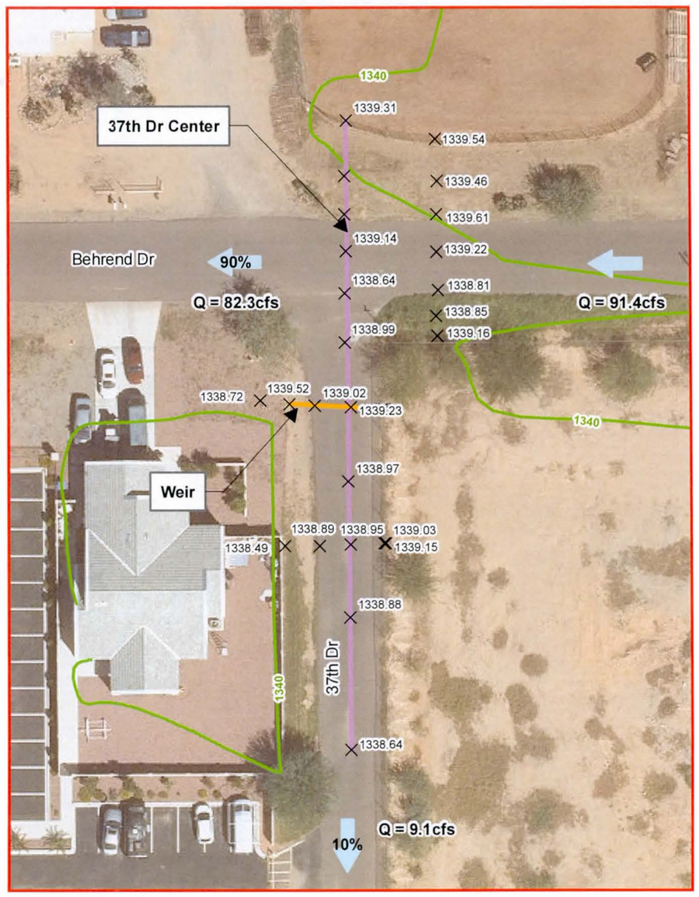
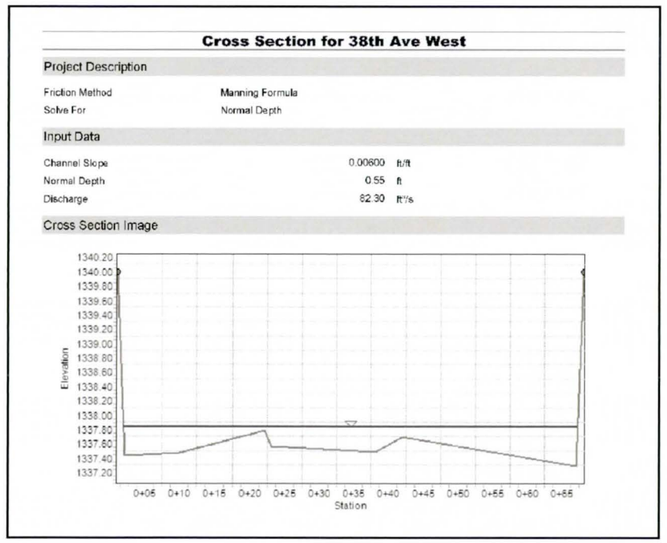
38th Ave



37th Dr



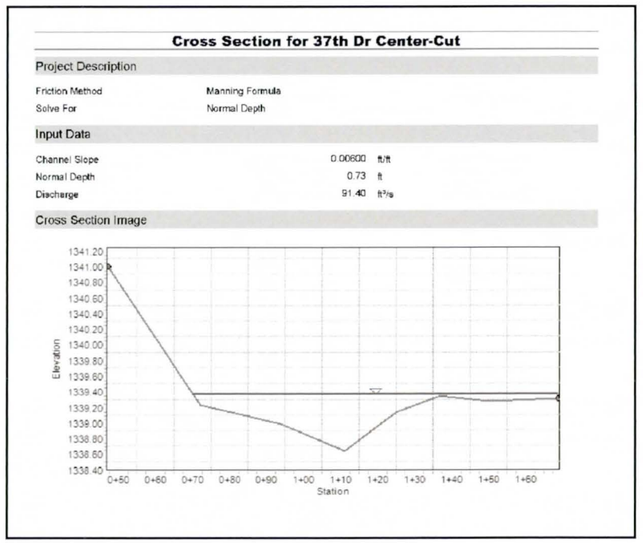


Cross Section for 38th Ave West

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.00600	ft/ft
Normal Depth	0.55	ft
Discharge	82.30	ft³/s

Cross Section Image

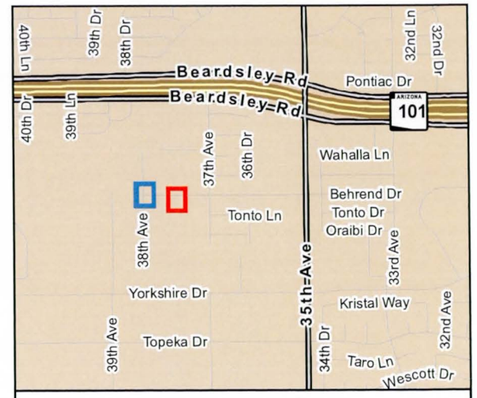


Cross Section for 37th Dr Center-Cut

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.00600	ft/ft
Normal Depth	0.73	ft
Discharge	91.40	ft³/s

Cross Section Image



Area of Detail

Legend

- Flow Direction and Percentage of Flow Split
- Survey Point
- Split Cross-Section
- North Weir
- South Weir

Topography (NAVD 88)

- Index Contour (10')
- Interval Contour (2')

Note: All flows are 100-year in cubic feet per second (cfs).

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013.

Survey Points: Collected on 4/30/2014 by Flood Control District of Maricopa County, NAVD 88.

0 25 50 100 Feet

N

Scatter Wash Levee Certification

Interior Drainage Analysis
Flow Splits

FIGURE 5b

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 50'

amec

The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number 37-2014-2002. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. AMEC assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

Path: X:\Projects\2014 Projects\37-2014-2002 Scatter Wash Levee Certification\MXD\Figure5b_IDA_Flow Split.mxd

Q_{100}Total = **47.3cfs**
Vol_{100}Total = **1.34 acre-feet**

Escuda Dr

Pond N1*
CWSEL = 1332.1'
Avg Depth = 2.6'
Stored Volume = 1.49 acre-ft

Weir Overflow EL @ ≈ 1331.8'

North Levee

NorthChannel

1.1

1335

1 - 18" RCP
Sta 377+00
Inlet Invert 1329.88'

1332

1.0

0.9

1334

South Levee

South Channel

Low Top of Levee
Approximate Elevation: 1336.5'

2 -24" RCP
Sta 378+55
Inlet Invert = 1331.29'

South Channel

Pond S3*
CWSEL = 1336.0'
Avg Depth = 0.8'
Stored Volume = 3.27 acre-ft

VISION HILL ESTATES

39th Ave

Weir Flow

Weir Overflow EL @ ≈ 1335.9'

Q_{100}Total = **146cfs**
Vol_{100}Total = **8.3 acre-feet**

Area of Detail

Legend

- River Mile Station
- Base Flood Elevation (BFE)
- Scatter Wash Centerline
- Existing Penetrations

Topography (NAVD 88)
- Index Contour (10')
- Interval Contour (2')
- Ponding Contours
- N1 and S3 Ponds
- Non-Levee Area
- Levee Area

NOTE: * Pond statistics reported with respect to weir overflow/reservior routing analysis (Appendix I)
CWSEL = Computed Water Surface Elevation
cfs = cubic feet per second

References:
Topographic Data: AeroTech Mapping Technologies. Flight Date 1/31/2013.

Aerial Imagery: Flood Control District of Maricopa County, 2013

0 50 100 200 Feet

N

Scatter Wash Levee Certification

Interior Drainage Analysis
Ponding

FIGURE 6

Job No.	37-2014-2002
PM:	AC
Date:	7/21/2014
Scale:	1" = 100'

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APPENDIX A

MT-2 FORM 3

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program; Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Scatter Wash

Note: Fill out one form for each flooding source studied.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization.....complete Section B
Bridge/Culvert.....complete Section C
Dam.....complete Section D
Levee/Floodwall.....complete Section E
Sediment Transport.....complete Section F (if required)

Description of Modeled Structure

1. Name of Structure: Scatter Wash North Levee PAL ID#1901064146

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☒ Levee/Floodwall ☐ Dam

Location of Structure: From Loop 101 Highway south and west to about 0.4 miles upstream of 43rd. Avenue (total length of about 0.33 mi.)

Downstream Limit/Cross Section: 0.892

Upstream Limit/Cross Section: 1.198

2. Name of Structure:

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

3. Name of Structure:

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: SECTION IS NOT APPLICABLE

Name of Structure: _____

1. Hydraulic Considerations

The channel was designed to carry _____ (cfs) and/or the _____-year flood.

The design elevation in the channel is based on (check one):

☐ Subcritical flow ☐ Critical flow ☐ Super critical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The Channelization includes (check one):

☐ Levees [Attach Section (E Levee/Floodwall)] ☐ Drop structures ☐ Super elevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/design basin [Attach Section D (Dam/Basin)] ☐ Energy dissipater

☐ Weir ☐ Other (describe): _____

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: SECTION IS NOT APPLICABLE

Name of Structure: _____

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
If different hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

☐ Dimensions (height, width, span, radius, length)
☐ Shape (culverts only)
☐ Material
☐ Beveling or Rounding
☐ Wing Wall Angle
☐ Skew Angle
☐ Distance Between Cross Sections
☐ Erosion Protection
☐ Low Chord Elevations - Upstream and Downstream
☐ Top of Road Elevations - Upstream and Downstream
☐ Structure Invert Elevations - Upstream and Downstream
☐ Stream Invert Elevation - Upstream and Downstream
☐ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM/BASIN

Flooding Source: SECTION IS NOT APPLICABLE

Name of Structure: _____

1. This request is for (check one): ☐ Existing dam/basin ☐ New dam ☐ Modification of existing dam/basin

2. The dam/basin was designed by (check one): ☐ Federal agency ☐ State agency ☐ Private organization ☐ Local government agency

   Name of the agency or organization: _____

3. The dam was permitted as (check one): ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number _____ Permit Agency or Organization: _____

   ☐ Local Government Dam ☐ Private Dam

Provide related drawings, specifications and supporting design information.

4. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2)

Was the dam/basin designed using critical duration storm? (Must account for the maximum volume of runoff)

☐ Yes, provide supporting documents with your completed Form 2.

☐ No, provide written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

FEQUENCY (% annual chance)	Stillwater Elevation Behind the Dam/Basin FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

7. Please attach a copy of the formal Operation and Maintenance Plan.

E. LEVEE/FLOODWALL

1. System Elements

   a. This Levee/Floodwall analysis is based on (check one): ☐ upgrading of an existing levee/ floodwall system ☐ a newly constructed levee/ floodwall system ☒ reanalysis of an existing levee/ floodwall system

   b. Levee elements and locations are (check one):

   ☒ earthen embankment, dike, berm, etc. Station 0.892 to 1.198

   ☐ structural floodwall Station _____ to _____

   ☐ other (describe): _____ Station _____ to _____

   c. Structural Type (check one): ☐ monolithic cast-in place reinforced concrete ☐ reinforced concrete masonry block ☐ sheet piling

   ☒ other (describe): Earth protected by concrete or riprap.

   d. Has the levee/floodwall system been certified by a Federal agency to provide protection from the base flood? ☐ Yes ☒ No

   If Yes, by which agency? _____

   e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

   1. Plan of the levee embankment and floodwall structures — Sheet Numbers See Attached
   2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. — Sheet Numbers See Attached
   3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. — Sheet Numbers See Attached

4. A layout detail for the embankment protection measures. Sheet Numbers _____

5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers _____

2. Freeboard

a. The minimum freeboard provided above the BFE is:

3.6 feet near river mile 0.91, See Freeboard Profile in Appendix E of Report.

Riverine

3.0 feet or more at the downstream end and throughout	☒ Yes	☐ No
3.5 feet or more at the upstream end	☒ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☒ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater)	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☒ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Opening through the levee system (check one): ☒ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device
0.893 (377+00)	Right - North Levee	18" RCP	1329.88	Flap Gate
0.920 (378+55)	Left - South Levee	2 - 24" RCP	1331.29	2 Flap Gates

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data
In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers (USACE) EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope land side is: @riprap 3.4:1, @concrete 3:1

b. The maximum levee slope flood side is: @riprap 1.1:1, @concrete 2:1

c. The range of velocities along the levee during the base flood is: 4.0 (min.) to 8.1 (max.)

d. Embankment material is protected by (describe what kind): Reinforced Concrete and Stone Riprap

e. Riprap Design Parameters (check one): ☐ Velocity ☒ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap D_{100}	Stone Riprap D_{50}	Stone Riprap Thickness	Depth of Toedown
Sta 0.892 (South) to 0.932 (South)	1.1:1	4.76	4.3	Straight	24	12	18	7.5
Sta 0.892 (North) to 0.992 (North)	2.5:1	4.76	4.3	Straight	24	12	18	8.0
Sta 0.932 (South) to 1.156 (South)	2:1	3.50	5.0	Curve			Concrete	8.5
Sta 0.992 (North) to 1.156 (North)	2:1	3.50	5.0	Curve			Concrete	8.5
Sta 1.156 (South) to 1.198 (South)	2:1	4.83	8.1	Straight			Concrete	10
Sta 1.156 (North) to 1.198 (North)	2:1	4.83	8.1	Straight			Concrete	10

(Extend table on an added sheet as needed and reference each entry)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☒ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

See shear stress and scour depth analysis is included in Section 2.3 of the report.

Attach engineering analysis to support construction plans.

5. Embankment and Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:
Four representative levee cross sections were selected for analysis along the north and south banks of the Scatter Wash. See attached table for more information on basis for selection.

☒ Overall height: Sta.: See attached , height _____ ft.

☒ Limiting foundation soil strength

Strength ϕ = See attached degrees, c = _____ psf

Slope: SS = See attached (h) to _____ (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

The slopes were analyzed using the general limit equilibrium method that produces a circular failure surface.

c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria Min.
I	End of construction	1.77 at South Levee Station 183+00 (Case 1B)	1.3
II	Sudden drawdown	1.12 at South Levee Station 183+00 (Case 2B)	1.0
III	Critical flood stage	Not applicable	1.4
IV	Steady seepage at flood stage	2.56 at South Levee Station 183+00 (Case 3A)	1.4
VI	Earthquake (Case I)	1.61 at South Levee Station 183+00 (Case 4B)	1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

5. Embankment and Foundation Stability (continued)

d. Was a seepage analysis for the embankment performed? ☒ Yes ☐ No

If Yes, describe methodology used: SEEP/W was used to evaluate seepage under and through the levee for each section.

e. Was a seepage analysis for the foundation performed? ☒ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☒ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☒ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is N/A hours.

Attach engineering analysis to support construction plans.

6. Floodwall and Foundation Stability N/A

a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) ☐ Other (specify): _____

b. Stability analysis submitted provides for: ☐ Overturning ☐ Sliding If not, explain: _____

c. Loading included in the analysis were: ☐ lateral earth @ P_A= _____ psf; Pp = _____ psf

☐ Surcharge-Slope @ _____, ☐ surface _____ psf

☐ Wind @ Pw = _____ psf

☐ Seepage (Uplift): _____ ☐ Earthquake @ Peq = _____ %g

☐ 1%-annual-chance significant wave height _____ ft.

☐ 1%-annual-chance significant wave period _____ sec.

d. Summary of Stability Analysis Results: Factors of Safety.
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept. 1986; USACE EM 1110-2-2502)
Note: (Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation.
Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specific construction elevations to maintain the established freeboard margin? ☒ Yes ☐ No

b. The computed range of settlement is 0.016 ft. to 0.017 ft.

7. Settlement (continued)

c. Settlement of the levee crest is determined to be primarily from: ☒ Foundation consolidation ☐ Embankment compression

☐ Other (describe): _____

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: 15.5 acres

Draining to ponding area: Attached acres

b. Relationships Established

Ponding elevation vs. storage	☒ Yes	☐ No
Ponding elevation vs. gravity flow	☒ Yes	☐ No
Differential head vs. gravity flow	☒ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☒ No

d. Specify the discharge capacity of the head pressure conduit: 21.2 cfs

e. Which flooding conditions were analyzed?

* Gravity flow (Interior Watershed)	☒ Yes	☐ No
* Common storm (River Watershed)	☒ Yes	☐ No
* Historical ponding probability	☒ Yes	☐ No
* Coastal wave overtopping	☐ Yes	☒ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☒ Yes ☐ No If No, attach explanation

g. The rate of seepage through the levee system for the base flood is N/A cfs

h. The length of levee system used to drive this seepage rate in item g: N/A ft.

i. Will pumping plants be used for interior drainage? ☐ Yes ☒ No

If Yes, include the number of pumping plants: _____ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

8. Interior Drainage (continued)

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104 and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☒ is not a problem

Hydrocompaction ☐ is ☒ is not a problem

Heave differential movement due to soils of high shrink/swell ☐ is ☒ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Not Applicable

Attach supporting documentation.

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities flood side of the structure?

☐ Yes ☐ No Attach supporting documentation.

d. Sediment Transport Considerations:

Was sediment transport considered? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

10. Operational Plan and Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations? ☒ Yes ☐ No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?

☒ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?

☒ Yes ☐ No If the answer is No to any to the above, please attach supporting documentation.

11. Maintenance Plan

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations?

☒ Yes ☐ No If No please attach supporting documentation.

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

CERTIFICATION OF THE LEVEE DOCUMENTATION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statements may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Alex Coronel	40209	12-31-15
Certifier's Name	License No.	Expiration Date
AMEC Environment and Infrastructure	602-733-6000	1-602-733-6100
Company Name	Telephone No.	Fax No.
Signature	7/21/2014 Date	alex.coronel@amec.com E-Mail Address

Registered Professional Engineer (Civil) CERTIFICATE NO. 40209 ALEX F. CORONEL Date Signed 7/21/14 ARIZONA, U.S.A. Expires 12/31/15

F. SEDIMENT TRANSPORT

Flooding Source: Scatter Wash

Name of Structure: PAL ID#1901064146

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or base on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet

Debris load associated with the base flood discharge: Volume _____ acre-feet

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

CERTIFICATION OF THE LEVEE DOCUMENTATION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statements may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Tony Freiman	23982	12-31-14
Certifier's Name	License No.	Expiration Date
AMEC Environment and Infrastructure	602-733-6000	1-602-733-6100
Company Name	Telephone No.	Fax No.
Tony J Freiman 7-21-2014	7/21/2014	tony.freiman@amec.com
Signature	Date	E-Mail Address

Registered Professional Engineer (Civil) CERTIFICATE NO. 23982 TONY J. FREIMAN Date Signed 7-21-2014 ARIZONA, U.S.A. Expires 12/31/2014

F. SEDIMENT TRANSPORT

Flooding Source: Scatter Wash

Name of Structure: PAL ID#1901064146

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or base on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet

Debris load associated with the base flood discharge: Volume _____ acre-feet

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

DEPARTMENT OF HOMELAND SECURITY
FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. NO. 1660-0016
Expires February 28, 2014

PAPERWORK BURDEN DISCLOSURE NOTICE

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Department of Homeland Security, Federal Emergency Management Agency, 1800 South Bell Street, Arlington, VA 20598-3005, Paperwork Reduction Project (1660-0016). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

PRIVACY ACT STATEMENT

AUTHORITY: The National Flood Insurance Act of 1968, Public Law 90-448, as amended by the Flood Disaster Protection Act of 1973, Public Law 93-234.

PRINCIPAL PURPOSE(S): This information is being collected for the purpose of determining an applicant's eligibility to request changes to National Flood Insurance Program (NFIP) Flood Insurance Rate Maps (FIRM).

ROUTINE USE(S): The information on this form may be disclosed as generally permitted under 5 U.S.C § 552a(b) of the Privacy Act of 1974, as amended. This includes using this information as necessary and authorized by the routine uses published in DHS/FEMA/NFIP/LOMA-1 National Flood Insurance Program; Letter of Map Amendment (LOMA) February 15, 2006, 71 FR 7990.

DISCLOSURE: The disclosure of information on this form is voluntary; however, failure to provide the information requested may delay or prevent FEMA from processing a determination regarding a requested change to a NFIP Flood Insurance Rate Maps (FIRM).

Flooding Source: Scatter Wash

Note: Fill out one form for each flooding source studied.

A. GENERAL

Complete the appropriate section(s) for each Structure listed below:

Channelization.....complete Section B
Bridge/Culvert.....complete Section C
Dam.....complete Section D
Levee/Floodwall.....complete Section E
Sediment Transport.....complete Section F (if required)

Description of Modeled Structure

1. Name of Structure: Scatter Wash South Levee PAL ID#1901064147

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☒ Levee/Floodwall ☐ Dam

Location of Structure: From Loop 101 Highway south and west to about 0.4 miles upstream of 43rd. Avenue (total length of about 0.33 mi.)

Downstream Limit/Cross Section: 0.892

Upstream Limit/Cross Section: 1.198

2. Name of Structure:

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

3. Name of Structure:

Type (check one): ☐ Channelization ☐ Bridge/Culvert ☐ Levee/Floodwall ☐ Dam

Location of Structure:

Downstream Limit/Cross Section:

Upstream Limit/Cross Section:

NOTE: FOR MORE STRUCTURES, ATTACH ADDITIONAL PAGES AS NEEDED.

B. CHANNELIZATION

Flooding Source: SECTION IS NOT APPLICABLE

Name of Structure: _____

1. Hydraulic Considerations

The channel was designed to carry _____ (cfs) and/or the _____-year flood.

The design elevation in the channel is based on (check one):

☐ Subcritical flow ☐ Critical flow ☐ Super critical flow ☐ Energy grade line

If there is the potential for a hydraulic jump at the following locations, check all that apply and attach an explanation of how the hydraulic jump is controlled without affecting the stability of the channel.

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions

☐ Other locations (specify): _____

2. Channel Design Plans

Attach the plans of the channelization certified by a registered professional engineer, as described in the instructions.

3. Accessory Structures

The Channelization includes (check one):

☐ Levees [Attach Section (E Levee/Floodwall)] ☐ Drop structures ☐ Super elevated sections

☐ Transitions in cross sectional geometry ☐ Debris basin/design basin [Attach Section D (Dam/Basin)] ☐ Energy dissipater

☐ Weir ☐ Other (describe): _____

4. Sediment Transport Considerations

Are the hydraulics of the channel affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

C. BRIDGE/CULVERT

Flooding Source: SECTION IS NOT APPLICABLE

Name of Structure: _____

1. This revision reflects (check one):

☐ Bridge/culvert not modeled in the FIS

☐ Modified bridge/culvert previously modeled in the FIS

☐ New analysis of bridge/culvert previously modeled in the FIS

2. Hydraulic model used to analyze the structure (e.g., HEC-2 with special bridge routine, WSPRO, HY8): _____
If different hydraulic analysis for the flooding source, justify why the hydraulic analysis used for the flooding source could not analyze the structures. Attach justification.

3. Attach plans of the structures certified by a registered professional engineer. The plan detail and information should include the following (check the information that has been provided):

☐ Dimensions (height, width, span, radius, length)
☐ Shape (culverts only)
☐ Material
☐ Beveling or Rounding
☐ Wing Wall Angle
☐ Skew Angle
☐ Distance Between Cross Sections
☐ Erosion Protection
☐ Low Chord Elevations - Upstream and Downstream
☐ Top of Road Elevations - Upstream and Downstream
☐ Structure Invert Elevations - Upstream and Downstream
☐ Stream Invert Elevation - Upstream and Downstream
☐ Cross-Section Locations

4. Sediment Transport Considerations

Are the hydraulics of the structure affected by sediment transport? ☐ Yes ☐ No

If Yes, then fill out Section F (Sediment Transport) of Form 3. If no, then attach an explanation.

D. DAM/BASIN

Flooding Source: SECTION IS NOT APPLICABLE

Name of Structure: _____

1. This request is for (check one): ☐ Existing dam/basin ☐ New dam ☐ Modification of existing dam/basin

2. The dam/basin was designed by (check one): ☐ Federal agency ☐ State agency ☐ Private organization ☐ Local government agency

   Name of the agency or organization: _____

3. The dam was permitted as (check one): ☐ Federal Dam ☐ State Dam

   Provide the permit or identification number (ID) for the dam and the appropriate permitting agency or organization

   Permit or ID number _____ Permit Agency or Organization: _____

   ☐ Local Government Dam ☐ Private Dam

Provide related drawings, specifications and supporting design information.

4. Does the project involve revised hydrology? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2)

Was the dam/basin designed using critical duration storm? (Must account for the maximum volume of runoff)

☐ Yes, provide supporting documents with your completed Form 2.

☐ No, provide written explanation and justification for not using the critical duration storm.

5. Does the submittal include debris/sediment yield analysis? ☐ Yes ☐ No

   If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why debris/sediment analysis was not considered?

6. Does the Base Flood Elevation behind the dam/basin or downstream of the dam/basin change? ☐ Yes ☐ No

   If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

FEQUENCY (% annual chance)	Stillwater Elevation Behind the Dam/Basin FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

7. Please attach a copy of the formal Operation and Maintenance Plan.

E. LEVEE/FLOODWALL

1. System Elements

   a. This Levee/Floodwall analysis is based on (check one): ☐ upgrading of an existing levee/ floodwall system ☐ a newly constructed levee/ floodwall system ☒ reanalysis of an existing levee/ floodwall system

   b. Levee elements and locations are (check one):

   ☒ earthen embankment, dike, berm, etc. Station 0.892 to 1.198

   ☐ structural floodwall Station _____ to _____

   ☐ other (describe): _____ Station _____ to _____

   c. Structural Type (check one): ☐ monolithic cast-in place reinforced concrete ☐ reinforced concrete masonry block ☐ sheet piling

   ☒ other (describe): Earth protected by concrete or riprap.

   d. Has the levee/floodwall system been certified by a Federal agency to provide protection from the base flood? ☐ Yes ☒ No

   If Yes, by which agency? _____

   e. Attach certified drawings containing the following information (indicate drawing sheet numbers):

   1. Plan of the levee embankment and floodwall structures — Sheet Numbers See Attached
   2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. — Sheet Numbers See Attached
   3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. — Sheet Numbers See Attached

4. A layout detail for the embankment protection measures. Sheet Numbers _____

5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers _____

2. Freeboard

a. The minimum freeboard provided above the BFE is:

3.6 feet near river mile 0.91, See Freeboard Profile in Appendix E of Report.

Riverine

3.0 feet or more at the downstream end and throughout	☒ Yes	☐ No
3.5 feet or more at the upstream end	☒ Yes	☐ No
4.0 feet within 100 feet upstream of all structures and/or constrictions	☒ Yes	☐ No

Coastal

1.0 foot above the height of the one percent wave associated with the 1%-annual-chance stillwater surge elevation or maximum wave runup (whichever is greater)	☐ Yes	☐ No
2.0 feet above the 1%-annual-chance stillwater surge elevation	☐ Yes	☐ No

Please note, occasionally exceptions are made to the minimum freeboard requirement. If an exception is requested, attach documentation addressing paragraph 65.10(b)(1)(ii) of the NFIP Regulations.

If No is answered to any of the above, please attach an explanation.

b. Is there an indication from historical records that ice-jamming can affect the BFE? ☐ Yes ☒ No

If Yes, provide ice-jam analysis profile and evidence that the minimum freeboard discussed above still exists.

3. Closures

a. Opening through the levee system (check one): ☒ exists ☐ does not exist

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device
0.893 (377+00)	Right - North Levee	18" RCP	1329.88	Flap Gate
0.920 (378+55)	Left - South Levee	2 - 24" RCP	1331.29	2 Flap Gates

(Extend table on an added sheet as needed and reference)

Note: Geotechnical and geologic data
In addition to the required detailed analysis reports, data obtained during field and laboratory investigations and used in the design analysis for the following system features should be submitted in a tabulated summary form. (Reference U.S. Army Corps of Engineers (USACE) EM-1110-2-1906 Form 2086.)

4. Embankment Protection

a. The maximum levee slope land side is: @riprap 3.4:1, @concrete 3:1

b. The maximum levee slope flood side is: @riprap 1.1:1, @concrete 2:1

c. The range of velocities along the levee during the base flood is: 4.0 (min.) to 8.1 (max.)

d. Embankment material is protected by (describe what kind): Reinforced Concrete and Stone Riprap

e. Riprap Design Parameters (check one): ☐ Velocity ☒ Tractive stress
Attach references

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap D_{100}	Stone Riprap D_{50}	Stone Riprap Thickness	Depth of Toedown
Sta 0.892 (South) to 0.932 (South)	1.1:1	4.76	4.3	Straight	24	12	18	7.5
Sta 0.892 (North) to 0.992 (North)	2.5:1	4.76	4.3	Straight	24	12	18	8.0
Sta 0.932 (South) to 1.156 (South)	2:1	3.50	5.0	Curve			Concrete	8.5
Sta 0.992 (North) to 1.156 (North)	2:1	3.50	5.0	Curve			Concrete	8.5
Sta 1.156 (South) to 1.198 (South)	2:1	4.83	8.1	Straight			Concrete	10
Sta 1.156 (North) to 1.198 (North)	2:1	4.83	8.1	Straight			Concrete	10

(Extend table on an added sheet as needed and reference each entry)

f. Is a bedding/filter analysis and design attached? ☐ Yes ☒ No

g. Describe the analysis used for other kinds of protection used (include copies of the design analysis):

See shear stress and scour depth analysis is included in Section 2.3 of the report.

Attach engineering analysis to support construction plans.

5. Embankment and Foundation Stability

a. Identify locations and describe the basis for selection of critical location for analysis:
Four representative levee cross sections were selected for analysis along the north and south banks of the Scatter Wash. See attached table for more information on basis for selection.

☒ Overall height: Sta.: See attached , height _____ ft.

☒ Limiting foundation soil strength

Strength ϕ = See attached degrees, c = _____ psf

Slope: SS = See attached (h) to _____ (v)

(Repeat as needed on an added sheet for additional locations)

b. Specify the embankment stability analysis methodology used (e.g., circular arc, sliding block, infinite slope, etc.):

The slopes were analyzed using the general limit equilibrium method that produces a circular failure surface.

c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria Min.
I	End of construction	1.77 at South Levee Station 183+00 (Case 1B)	1.3
II	Sudden drawdown	1.12 at South Levee Station 183+00 (Case 2B)	1.0
III	Critical flood stage	Not applicable	1.4
IV	Steady seepage at flood stage	2.56 at South Levee Station 183+00 (Case 3A)	1.4
VI	Earthquake (Case I)	1.61 at South Levee Station 183+00 (Case 4B)	1.0

(Reference: USACE EM-1110-2-1913 Table 6-1)

5. Embankment and Foundation Stability (continued)

d. Was a seepage analysis for the embankment performed? ☒ Yes ☐ No

If Yes, describe methodology used: SEEP/W was used to evaluate seepage under and through the levee for each section.

e. Was a seepage analysis for the foundation performed? ☒ Yes ☐ No

f. Were uplift pressures at the embankment landside toe checked? ☒ Yes ☐ No

g. Were seepage exit gradients checked for piping potential? ☒ Yes ☐ No

h. The duration of the base flood hydrograph against the embankment is N/A hours.

Attach engineering analysis to support construction plans.

6. Floodwall and Foundation Stability N/A

a. Describe analysis submittal based on Code (check one): ☐ UBC (1988) ☐ Other (specify): _____

b. Stability analysis submitted provides for: ☐ Overturning ☐ Sliding If not, explain: _____

c. Loading included in the analysis were: ☐ lateral earth @ P_A= _____ psf; Pp = _____ psf

☐ Surcharge-Slope @ _____, ☐ surface _____ psf

☐ Wind @ Pw = _____ psf

☐ Seepage (Uplift): _____ ☐ Earthquake @ Peq = _____ %g

☐ 1%-annual-chance significant wave height _____ ft.

☐ 1%-annual-chance significant wave period _____ sec.

d. Summary of Stability Analysis Results: Factors of Safety.
Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

Loading Condition	Criteria (Min)		Sta	To	Sta	To
	Overturn	Sliding	Overturn	Sliding	Overturn	Sliding
Dead & Wind	1.5	1.5				
Dead & Soil	1.5	1.5				
Dead, Soil, Flood, & Impact	1.5	1.5				
Dead, Soil, & Seismic	1.3	1.3				

(Ref: FEMA 114 Sept. 1986; USACE EM 1110-2-2502)
Note: (Extend table on an added sheet as needed and reference)

e. Foundation bearing strength for each soil type:

Bearing Pressure	Sustained Load (psf)	Short Term Load (psf)
Computed design maximum		
Maximum allowable		

f. Foundation scour protection ☐ is, ☐ is not provided. If provided, attach explanation and supporting documentation.

Attach engineering analysis to support construction plans.

7. Settlement

a. Has anticipated potential settlement been determined and incorporated into the specific construction elevations to maintain the established freeboard margin? ☒ Yes ☐ No

b. The computed range of settlement is 0.016 ft. to 0.017 ft.

7. Settlement (continued)

c. Settlement of the levee crest is determined to be primarily from: ☒ Foundation consolidation ☐ Embankment compression

☐ Other (describe): _____

d. Differential settlement of floodwalls ☐ has ☐ has not been accommodated in the structural design and construction.

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: 56.1 acres

Draining to ponding area: Attached acres

b. Relationships Established

Ponding elevation vs. storage	☒ Yes	☐ No
Ponding elevation vs. gravity flow	☒ Yes	☐ No
Differential head vs. gravity flow	☒ Yes	☐ No

c. The river flow duration curve is enclosed: ☐ Yes ☒ No

d. Specify the discharge capacity of the head pressure conduit: 62.3 cfs

e. Which flooding conditions were analyzed?

* Gravity flow (Interior Watershed)	☒ Yes	☐ No
* Common storm (River Watershed)	☒ Yes	☐ No
* Historical ponding probability	☒ Yes	☐ No
* Coastal wave overtopping	☐ Yes	☒ No

If No for any of the above, attach explanation.

f. Interior drainage has been analyzed based on joint probability of interior and exterior flooding and the capacities of pumping and outlet facilities to provide the established level of flood protection. ☒ Yes ☐ No If No, attach explanation

g. The rate of seepage through the levee system for the base flood is N/A cfs

h. The length of levee system used to drive this seepage rate in item g: N/A ft.

i. Will pumping plants be used for interior drainage? ☐ Yes ☒ No

If Yes, include the number of pumping plants: _____ For each pumping plant, list:

	Plant #1	Plant #2
The number of pumps		
The ponding storage capacity		
The maximum pumping rate		
The maximum pumping head		
The pumping starting elevation		
The pumping stopping elevation		
Is the discharge facility protected?		
Is there a flood warning plan?		
How much time is available between warning and flooding?		

Will the operation be automatic? ☐ Yes ☐ No

8. Interior Drainage (continued)

If the pumps are electric, are there backup power sources? ☐ Yes ☐ No

(Reference: USACE EM-1110-2-3101, 3102, 3103, 3104 and 3105)

Include a copy of supporting documentation of data and analysis. Provide a map showing the flooded area and maximum ponding elevations for all interior watersheds that result in flooding.

9. Other Design Criteria

a. The following items have been addressed as stated:

Liquefaction ☐ is ☒ is not a problem

Hydrocompaction ☐ is ☒ is not a problem

Heave differential movement due to soils of high shrink/swell ☐ is ☒ is not a problem

b. For each of these problems, state the basic facts and corrective action taken:

Not Applicable

Attach supporting documentation.

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities flood side of the structure?

☐ Yes ☐ No Attach supporting documentation.

d. Sediment Transport Considerations:

Was sediment transport considered? ☐ Yes ☒ No

If Yes, then fill out Section F (Sediment Transport). If No, then attach your explanation for why sediment transport was not considered.

10. Operational Plan and Criteria

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations? ☒ Yes ☐ No

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?

☒ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?

☒ Yes ☐ No If the answer is No to any to the above, please attach supporting documentation.

11. Maintenance Plan

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP regulations?

☒ Yes ☐ No If No please attach supporting documentation.

12. Operations and Maintenance Plan

Please attach a copy of the formal Operations and Maintenance Plan for the levee/floodwall.

CERTIFICATION OF THE LEVEE DOCUMENTATION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statements may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Alex Coronel	40209	12-31-15
Certifier's Name	License No.	Expiration Date
AMEC Environment and Infrastructure	602-733-6000	1-602-733-6100
Company Name	Telephone No.	Fax No.
Signature	7/21/2014 Date	alex.coronel@amec.com E-Mail Address

Registered Professional Engineer (Civil) CERTIFICATE NO. 40209 ALEX F. CORONEL Date Signed 7/21/14 ARIZONA, U.S.A. Expires 12/31/15

F. SEDIMENT TRANSPORT

Flooding Source: Scatter Wash

Name of Structure: PAL ID#1901064147

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or base on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet

Debris load associated with the base flood discharge: Volume _____ acre-feet

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

CERTIFICATION OF THE LEVEE DOCUMENTATION

This certification is to be signed and sealed by a licensed registered professional engineer authorized by law to certify elevation information data, hydrologic and hydraulic, and any other supporting information as per NFIP regulations paragraph 65.10(e) and as described in the MT-2 Forms Instructions. All documents submitted in support of this request are correct to the best of my knowledge. I understand that any false statements may be punishable by fine or imprisonment under Title 18 of the United States Code, Section 1001.

Tony Freiman	23982	12-31-14
Certifier's Name	License No.	Expiration Date
AMEC Environment and Infrastructure	602-733-6000	1-602-733-6100
Company Name	Telephone No.	Fax No.
Signature 7/21/2014	7/24/2014	tony.freiman@amec.com
	Date	E-Mail Address

Registered Professional Engineer (Civil) CERTIFICATE NO. 23982 TONY J. FREIMAN STATE OF ARIZONA, U.S.A. Expires 12/31/2014

F. SEDIMENT TRANSPORT

Flooding Source: Scatter Wash

Name of Structure: PAL ID#1901064147

If there is any indication from historical records that sediment transport (including scour and deposition) can affect the Base Flood Elevation (BFE); and/or base on the stream morphology, vegetative cover, development of the watershed and bank conditions, there is a potential for debris and sediment transport (including scour and deposition) to affect the BFEs, then provide the following information along with the supporting documentation:

Sediment load associated with the base flood discharge: Volume _____ acre-feet

Debris load associated with the base flood discharge: Volume _____ acre-feet

Sediment transport rate _____ (percent concentration by volume)

Method used to estimate sediment transport: _____

Most sediment transport formulas are intended for a range of hydraulic conditions and sediment sizes; attach a detailed explanation for using the selected method.

Method used to estimate scour and/or deposition: _____

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport: _____

Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

If a sediment analysis has not been performed, an explanation as to why sediment transport (including scour and deposition) will not affect the BFEs or structures must be provided.

Additional Information MT-2 Form 3 – Section E Levee/Floodwall Scatter Wash Levee ID#1901064146 (North Levee) and ID#1901064147 (South Levee)

Section E

Subsection 1 – System Elements

Item e: Certified Drawings

The as-built drawings for the levees are covered by three different sets of plans. Hard copy, reduced size print outs of the plans are included in Appendix B of the Final Certification Report. The as-builts included are as follows:

1. Scatter Wash Channel Plan and Profile Drawings (C-6.5, C-6.6 and C-6.8), Arizona Department of Transportation (ADOT), 1991
2. Scatter Wash Channelization 43RD Avenue to 39th Avenue, Index No.914085, City of Phoenix Street Transportation Department, 1993
3. Scatter Wash Levee Certification Assignment #3, FCD Contract No. 2008C040, Flood Control District of Maricopa County, 2011

Subsection 4 – Embankment Protection

Item f: Bedding/Filter Analysis

A bedding/filter analysis for this existing levee was not available.

Subsection 5 – Embankment and Foundation Stability

Item a: Identify locations and describe the basis for selection of critical location for analysis.

River Mile	Station	Overall Height, ft	Riverside Slope	Landside Slope	Basis for Selection
	Scatter Wash Levee North				
0.932	183+00	7.7	2.5H to 1V	3H to 1V	Levee condition, rip-rap lined riverside
1.036	189+00	8	2H to 1V	3.5H to 1V	Height and slope of the embankment, concrete lined riverside
	Scatter Wash Levee South				
0.920	183+00	7.4	1.1H to 1V	3H to 1V	Levee condition, rip-rap lined riverside, slope of embankment
1.141	193+00	7.6	2H to 1V	3H to 1V	Height and slope of the embankment, concrete lined riverside

Description	Moist Unit Weight,γ (pcf)	Effective Friction Angle,Φ' (deg)	Effective Cohesion, c' (psf)	Saturated Hydraulic Conductivity, K_{sat} (cm/s)
Embankment	110	33	100	1×10^{-5}
Foundation	115	34	0	1×10^{-3}

Item h: The duration of the base flood hydrograph against the embankment is

An assumed steady-state seepage condition was assumed. This condition is very conservative, as the ephemeral flows in Scatter Wash Channel are too short a duration to develop saturation of the levee embankments.

Subsection 8 – Interior Drainage

Item a: Specify the size of each interior watershed

North Levee PAL ID# 1901064146 – Total area draining to pond is equivalent to sub-basin N1-D1 (8.8 acres) and overflow from sub-basin N1-O1. See Section 2.6.2 of the report and Appendix I for additional detail.

South Levee PAL ID# 1901064147 – See split flow analysis discussed in Section 2.6.2 of the report and Appendix I for additional detail.

Item d: Specify the discharge capacity of the head pressure conduit

North Levee PAL ID# 1901064146 – Discharge capacity reported at levee overtopping elevation. See Appendix I of report for analysis.

South Levee PAL ID# 1901064147 – Discharge capacity reported at levee overtopping elevation. See Appendix I of report for analysis.

Item g: The rate if seepage through the levee system for the base flood is

South Levee PAL ID# 1901064147 – Interior ponding is considered at Cross Section No. 3, Case b described in the Final Geotechnical Report included as Appendix H.

Subsection 9 – Other Design Criteria

Item d: Sediment Transport Considerations

AMEC assumes that sediment transport was considered in the original design of the levee. Further, based on field observations, it does not appear that significant scour or deposition is occurring along the studied reach.

APPENDIX B

AS-BUILT DRAWINGS

Change Order No. 24

CURVE DATA				
No.	R	Δ	T	L
①	1,150.40'	70°42'37"	816.19'	1,419.74'
②	1,090.10'	34°52'23"	342.38'	663.49'
③	1,500.30'	25°31'15"	339.77'	668.27'
④	1,299.70'	26°14'57"	303.04'	595.44'
⑤	1,168.10'	45°02'56"	484.43'	918.42'

FAP/A. DESIGN	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RBM-600-0-504	1928	295	5-24-93 DES.
		101 L MA 16			

Channel Cat

Top of Bank 15' Varies Varies Top of Bank

Conc. Channel Lining (see Typical Section)

Profile Grade

3:1 2 2 1 3:1

Bed Note 3

Typical Section

** Sta 192+00 to Sta 194+50 Slope to Exst. Gnd. at the Drainge Easmt. Use Soil Cement to Treat the Slopes.

For Channel Bank Reinforcing Steel, See Typical Section, This Sheet

Varies 0-10' #4 @ 12" (Typ) #4 @ 10" (Typ) 'A' Bars @ 12" 'B' Bars @ 12" Varies 8.5' 5'-3" 1'-6" 5'-0"

SECTION D-D

Bed Note 3

Top of Bank 2'-0" 6" 6" 3:1 #4 @ 10" #4 @ 12" 2 1 Varies 5'-0" 3'-0" Begin Conc. Channel Lining (Typ.)

Sta. 183+60 Sta. 185+40 Sta. 187+80 Sta. 193+80 80' Min. 110' Max.

SECTION C-C

Bed Note 3

NOTES:

1) Concrete shall be Class 'B' f'c = 3000 psi.

2) Reinforcing Steel shall be Gr. 60 conforming to Section 605.

3) Contractor to select Lining form (uniform slope or vert. wall) below channel invert.

TYPICAL SECTION CONCRETE CHANNEL LINING

N

North Line

TCE

Sta 196+00

Basin Maintenance Ramp, See D-10 Dwg #a C-5.05

PT Sta 195+18.10

R=605.58' 30' Drainage Easement

E-82 E-83 E-84 E-85 E-86 E-87 E-88 E-89

Abandoned 3" Water Service

18" Rip Rap, Thickness 42" Placed on Fabric Filter

TB=1336.0'

Abandon Exst 6" Waterline to Block

Salvage Exst Fire Hydrant

Begin Channel RT Bank PC Sta 181+02.91 Rt

Begin Channel Cat ℄ PC Sta. 181+23.44 (N 970587.17, E 430666.18')

EL. 132710 EL. 132725 EL. 132745

Excavation Limits

Begin Channel LT Bank PC Sta. 181+51.18 Rt

Begin Conc. Channel Lining Sta. 183+60, 91' Lt.

18" Rip Rap, Thickness 42" Placed on Fabric Filter

Begin Conc. Channel Lining Sta. 183+60, 133' Rt.

TB=1336.0'

Begin TIH Ditch Sta 182+00, Rt. FL. = 1329.0 (Adjust to Exist. Gnd.)

End Dirt Ditch Sta 190+00, FL=1332.0

Cut & Plug Exst 36" Waterline Bet UC-89

Drainage Esm.

Dirt Ditch 1' (Min) 10' (Max) 8' 15' 4 1 4 4

Exst End

Conc. Channel Lining (see Typ Section Above) See Note 3 Typical Section

SECTION-A-A

Fill Low Flow Channel (Grade to Drain)

End Berm, South Bank Sta to 192+00, Rt

Note: Change Order No. 22 Revisions Include Channel Realignment, Higher Banks, and Deeper Toe-Down to Meet Maricopa County Flood Control District Requests.

Change Order No. 24

DeLEUW CATHER The Leeds, Gardner & Company Engineers and Planners

TABLE OF DRAINAGE ESM POINTS				
POINT	N	E	STATION	OFFSET
E-80	971004.46	431778.95	POT 1182+97.20	399.10' Rt
E-81	970711.40	431116.08	POT 1176+32.08	627.02' Rt
E-82	970814.93	430664.26	POT 1171+81.08	520.00' Rt
E-83	970532.97	430665.76	POT 1171+80.40	801.96' Rt
E-84	970199.19	430666.72	POT 1171+78.78	1135.79' Rt
E-85				
E-86	970145.17	430956.38	POT 1174+68.00	1194.00' Rt
E-87	970253.05	431527.45	POT 1178+39.88	1086.99' Rt
E-88	970416.99	431579.28	POT 1180+91.00	925.00' Rt
E-89	970890.74	431966.91	POT 1183+81.28	454.27' Rt

Indicates Addendum No.1 Revisions

Indicates Change Order No. 10 Revisions 7-16-90

Indicates Change Order No. 28 Revisions 2-5-91

Indicates Change Order No. 24 Revisions 5-2-91

DESIGNED M.A.L. DRAWN L.T. CHECKED G.L. APPROVED R.E.J.

STANLEY CONSULTANTS OF ARIZONA, INC.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-0-504 88TH AVE TO 35TH AVE

SCATTER WASH CHANNEL
PLAN
STA 180+00 TO STA 198+00

ROUTE 101L | MILEPOST | LOCATION OR STRUCTURE NO. | DWG. NO. C-6.5

TRACS NO. H0797 08C RBM-600-0-504 Sheet 132B of 295

Change Order No._____

TABLE OF DRAINAGE ESM POINTS					
POINT	N	E	STATION	OFFSET	
E-40	971618.09	432122.01	POT 1186+45	271.87' Lt	Med Cst ℄ to E
E-41	971852.34	432265.15	POT 1187+90	515.60' Lt	Med Cst ℄ to E
E-42	971626.67	432486.96	POT 1189+50	278.09' Lt	Med Cst ℄ to E
E-43	971785.13	432625.74	POT 1191+50	435.00' Lt	Med Cst ℄ to E

NOTE:
Use of Shotcrete is Permitted for Construction of Transition Walls

CURVE DATA				
No.	R	Δ	T	L
①	700.00	41°00'	261.72'	500.91'
②	450.00	57°00'	244.33'	447.68'
③	1000.00	25°00'	221.69'	436.33'

*Place Filter Fabric Beneath Rip-Rap

FHWA REGION	STATE	PROJECT NO	SHEET NO	TOTAL SHEETS	ADS NO
9	ARIZ	RBM-600-D 504	183	225	
		101 L MA 16			

263-1100

For Channel Bank Reinforcing Steel, See Typical Section, Dwg No. C-6.5

SECTION C-C

Channel Cst ℄ Sta 200+00
Med Cst ℄ Sta 1186+20
Construct 9-10'x6'x430' LF CBC, 1-10'x8'x430 LF CBC
Sk 30° Rt

*Place Dumped Rock Rip Rap, Thickness = 54"

Fill Exst Low Flow Channel

Grouted Rip Rap

Grouted Rip Rap Varies 12"-23'

SECTION B-B
(2" min cover of grout above Rip Rap)

See Dwg No. C-5.11
For 96" SD

*Place Dumped Rock 18" Rip Rap, Thickness = 54"

See DH D-1
Dwg No. C-5.31

Barrier Wall See Dwg C-9.9

Match Line

Sta 196+00

Sta 209+00

PC Sta 203+51.47

PT Sta 207+47.68 RP0.25 Rt

Begin Maintenance Ramp (see Dtl. Dwg No. C-5.34)

PT Sta 209+52.38

Concrete Ditch (see typical Section Dwg No C-6.5)

Cst Conc Channel Lining (see Typical Section Dwg No C-6.5)

TCE

Limit of Channel Fill

Grade to Drain

Grade to Drain

Channel Cst ℄ 5

Varies (See Plan)

Varies (See Plan)

Profile Grade

Exst Grd

End Grd

Section A-A

△ Indicates Change Order No. Revisions 7-16-90

△ Indicates Addendum No 1 Revision 6-4-90

DESIGN	M.A.L.
DRAWN	J.F.
CHECKED	G.L.
APPROVED	R.E.J.

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-D-504 59TH AVE TO 35TH AVE

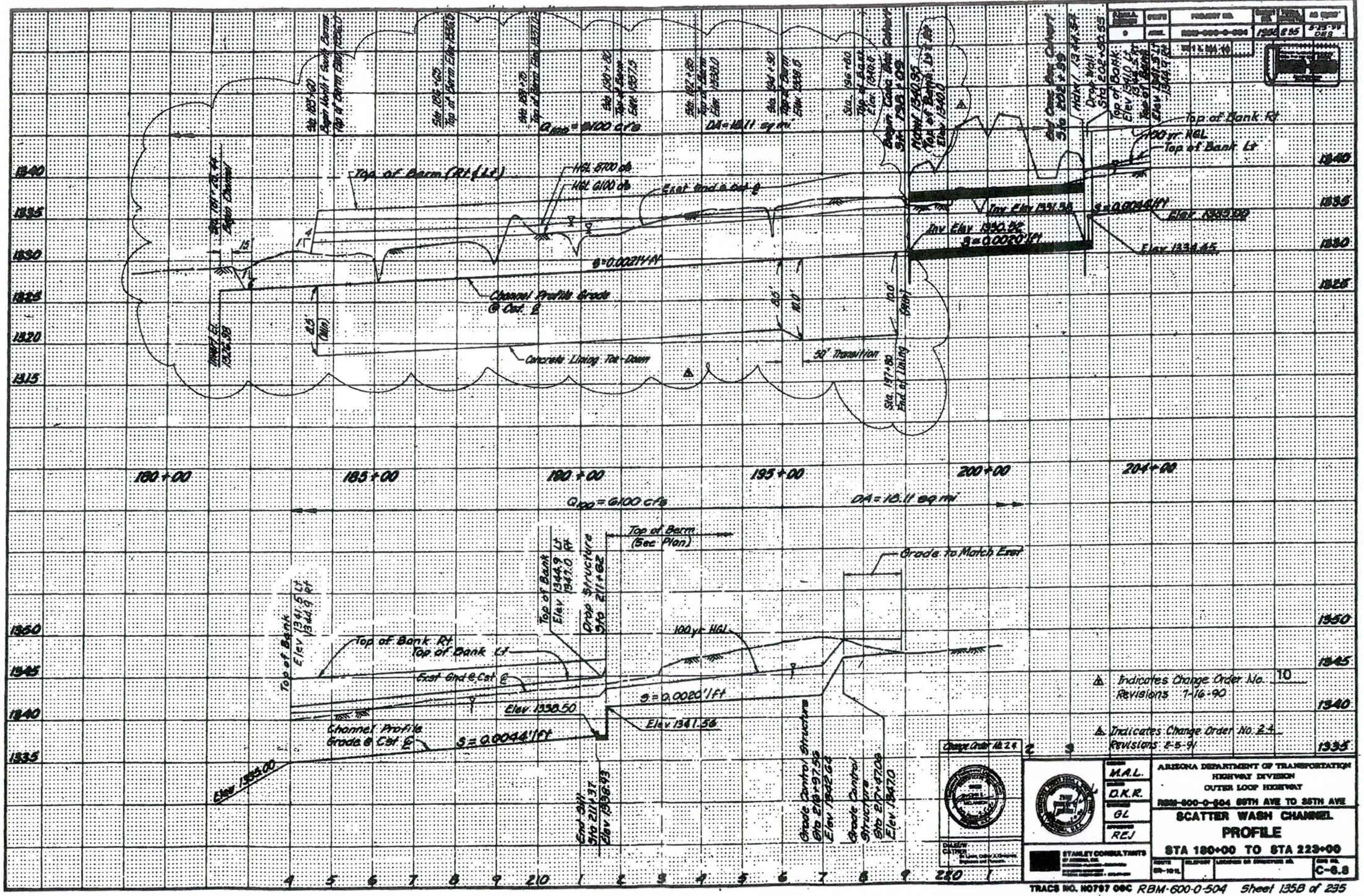
SCATTER WASH CHANNEL
PLAN
STA 196+00 TO STA 209+00

STANLEY CONSULTANTS OF ARIZONA, INC.

ROUTE	MILEPOST	LOCATION OF STRUCTURE NO	DWG NO
SH-101L			C-6.6

TRACS NO. H0797 06F

Change Order No. 24



△ Indicates Change Order No. 10
Revisions: 7-16-90

△ Indicates Change Order No. 24
Revisions: 2-5-91

Change Order No. 24

M.A.L.
D.K.R.
GL
REJ

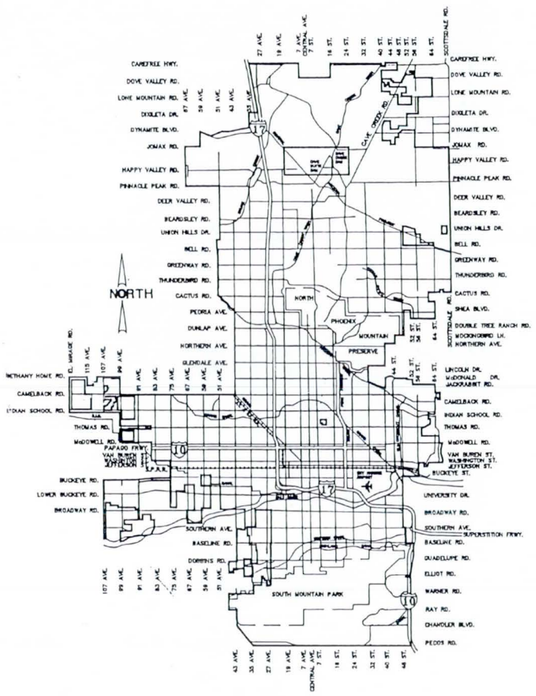
ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-0-504 96TH AVE TO 35TH AVE

SCATTER WASH CHANNEL
PROFILE
STA 180+00 TO STA 223+00

STANLEY CONSULTANTS

DWG. NO. C-6.8

TRACS NO. H0797 00C RBM-600-0-504 Sheet 135B of 235



VICINITY MAP

APPROVED _____ DATE _____
ASSISTANT STREET TRANSPORTATION DIRECTOR

APPROVED _____ DATE _____
DEPUTY STREET TRANSPORTATION DIRECTOR

CITY OF PHOENIX
STREET TRANSPORTATION DEPARTMENT
DESIGN & CONSTRUCTION MANAGEMENT DIVISION

SCATTER WASH CHANNELIZATION
43RD. AVENUE 12" WATER MAIN
P - 914085 & W - 897728

1994

FAP/S.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

DATE _____ CONSULTING ENGINEER

DESIGN: DRAWN: CHECKED:

MAYOR
THELDA WILLIAMS

CITY MANAGER
FRANK FAIRBANKS

CITY COUNCIL

DISTRICT NO.1	THELDA WILLIAMS
DISTRICT NO.2	FRANCES EMMA BARWOOD
DISTRICT NO.3	
DISTRICT NO.4	CRAIG TRIBKEN
DISTRICT NO.5	JOHN NELSON
DISTRICT NO.6	SAL DiCICCIO
DISTRICT NO.7	SALOMON LEIJA
DISTRICT NO.8	CODY WILLIAMS

CENTRAL FILES
DRAWER # 43

Two working days before you dig.
CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center

LOG NUMBER

	NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZ. DEPT. OF TRANSPORTATION			
ARIZONA PUBLIC SERVICE			
CABLE T.V.			
COUNTY HIGHWAY DEPT.			
MOUNTAIN BELL			
SALT RIVER POWER DISTRICT			
S.R.V.W.U.A.			
SOUTHWEST GAS			
WATER & WASTEWATER			

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

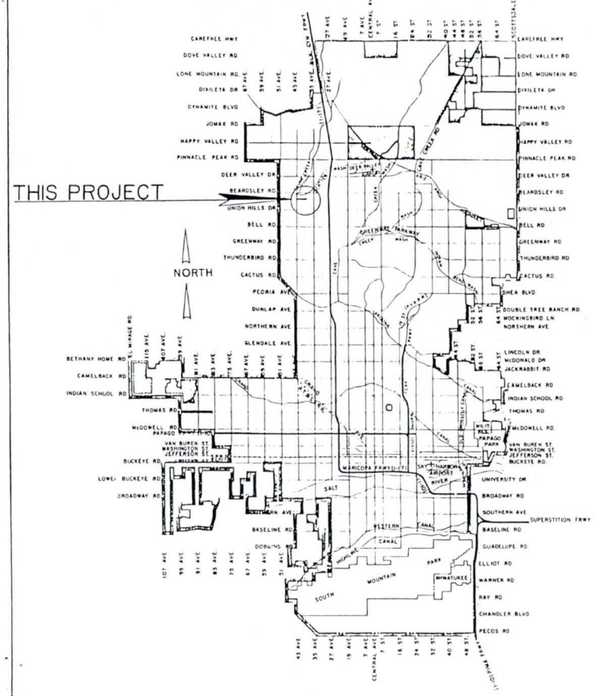
EA ENGINEERING ALLIANCE, CONSULTING ENGINEER

DES: D.E.F. | DR: J.S.S. | CK: J.S.P. | DATE:

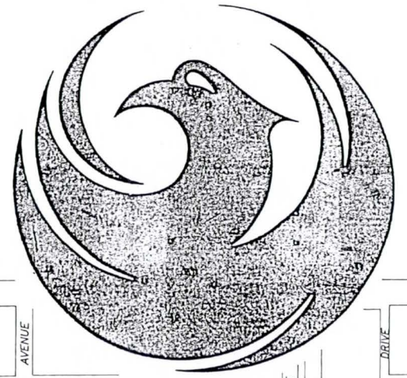
LENGTH OF PROJECT

CITY OF PHOENIX
STREET TRANSPORTATION DEPARTMENT
DESIGN & CONSTRUCTION MANAGEMENT DIVISION

SCATTER WASH CHANNELIZATION
43RD. AVENUE TO 39TH. AVENUE
INDEX NO. 914085
1993



VICINITY MAP



MAYOR

THELDA WILLIAMS

CITY MANAGER

FRANK FAIRBANKS

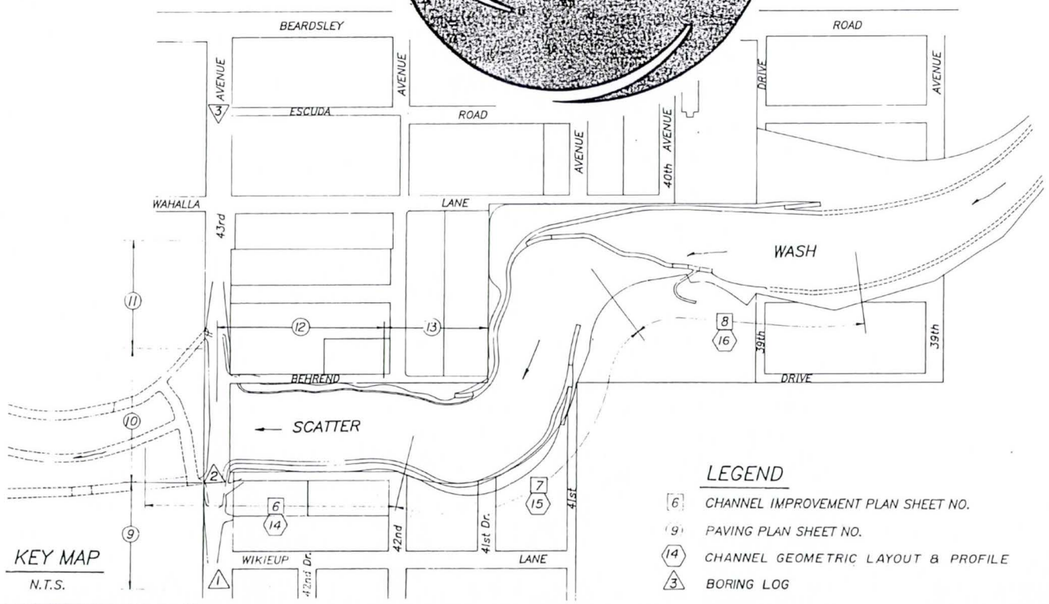
CITY COUNCIL

DISTRICT	NO. 1	THELDA WILLIAMS
DISTRICT	NO. 2	FRANCES EMMA BARWOOD
DISTRICT	NO. 3	
DISTRICT	NO. 4	CRAIG TRIBKEN
DISTRICT	NO. 5	JOHN NELSON
DISTRICT	NO. 6	SAL DICICCIO
DISTRICT	NO. 7	SALOMON LEIJA
DISTRICT	NO. 8	CODY WILLIAMS

43RD. AVE. TO 39TH. AVE 914085

APPROVED _____ ASSISTANT STREET TRANSPORTATION DIRECTOR — DATE _____

APPROVED _____ DEPUTY STREET TRANSPORTATION DIRECTOR — DATE 5-24-94



SHEET INDEX

SHEET NO. 1	COVER SHEET
SHEET NO. 2	LEGEND AND NOTES
SHEET NO. 2A	SOIL BORING LOG
SHEET NO. 3-4	TYPICAL SECTION & DETAIL & QUANTITIES
SHEET NO. 5	CONCRETE RETAINING WALL DETAIL
SHEET NO. 6-8	CHANNEL IMPROVEMENT PLAN
SHEET NO. 9-13	PAVING PLAN & PROFILE
SHEET NO. 14-16	CHANNEL GEOMETRIC LAYOUT & PROFILE
SHEET NO. 17-18	COORDINATE SHEET
SHEET NO. 19	CROSS SECTION
SHEET NO. 20-23	LANDSCAPE PLANS
SHEET NO. 24-28	IRRIGATION PLANS
SHEET NO. 29-35	WATER PLANS

LEGEND

- [6] CHANNEL IMPROVEMENT PLAN SHEET NO.
- (9) PAVING PLAN SHEET NO.
- (14) CHANNEL GEOMETRIC LAYOUT & PROFILE
- 3 BORING LOG

Two working days before you dig, CALL FOR THE BLUE STAKES 263-1100 Blue Stake Center

LOG NUMBER

	NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZ. DEPT. OF TRANSPORTATION			
ARIZONA PUBLIC SERVICE			
CABLE T.V.			
COUNTY HIGHWAY DEPT.			
MOUNTAIN BELL			
SALT RIVER POWER DISTRICT			
S.R.V.W.U.A.			
SOUTHWEST GAS			
WATER & WASTEWATER DEPT.			

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43RD. AVE. TO 39TH AVE.

LEGEND

- BENCHMARK
- NEW SURVEY MONUMENT - M.A.G. DETAIL 120-1 TYPE "B"
- NEW SURVEY MONUMENT - M.A.G. DETAIL 120-1 TYPE "A"
- COMBINED CURB & GUTTER - M.A.G. DETAIL 220 TYPE "A"
- PVMT. REPLACEMENT TYPE B SQ. YD. - M.A.G. DETAIL 200
- EXISTING CONCRETE PAVEMENT
- CONCRETE SIDEWALK - STD. DETAIL P-1230
- CONCRETE DRIVEWAY OR ALLEY ENT. PER DETAIL NO. ON PLANS
- DET. P-1233 / DET. P-1234 / DET. P-1235 / DET. P-1236 STD. DET. SIDEWALK RAMPS
- AVERAGE GROUND ELEVATION AT ℄
- BACKFILL TYPE
- EXISTING DITCH
- IRR — EXISTING IRRIGATION LINE (NOTE PRIVATE, SALT RIVER OR R.I.D.)
- EXISTING IRRIGATION STRUCTURE
- EXISTING IRRIGATION STANDPIPE
- IRRIGATION STANDPIPE - M.A.G. DETAIL 503
- IRRIGATION VALVE - M.A.G. DETAIL 506 W/ CONC. SCOURING BASIN
- IRRIGATION BERM
- NEW IRRIGATION STRUCTURE PER W.U.A. DRAWINGS
- NEW JUNCTION BOX M.A.G. DETAIL 504
- W — EXISTING WATER LINE
- EXISTING WATER VALVE - ADJUST EXIST. VALVE BOX - M.A.G. DETAIL 391-1
- EXISTING WATER METER & BOX TO BE MOVED & BOX ADJUSTED TO GRADE BY CONTRACTOR
- EXISTING FIRE HYDRANT
- NEW OR RELOCATED FIRE HYDRANT BY CONTRACTOR
- EXISTING WATER VALVE OPERATING NUT ELEVATION
- S — EXISTING SEWER LINE
- EXISTING MANHOLE - ADJUST TO GRADE - M.A.G. DETAIL 422
- NEW MANHOLE
- CATCH BASIN, GUTTER INLET (LENGTH TO SCALE)
- CATCH BASIN, CURB INLET (LENGTH TO SCALE)
- CATCH BASIN, CURB & GUTTER INLET (LENGTH TO SCALE)
- SD — EXISTING STORM DRAIN
- NEW PIPE FOR STORM DRAIN OR IRRIGATION LINE
- G — EXISTING GAS LINE
- T — EXISTING TELEPHONE BURIED CABLE
- 4D — EXISTING UNDERGROUND TELEPHONE DUCTS (SPECIFY NUMBER)
- EXISTING STREET SIGN
- EXISTING TRAFFIC SIGN
- EXISTING UTILITY POLE
- EXISTING WIRE FENCE
- EXISTING WOOD FENCE
- MAIL BOX
- DOWN ANCHOR
- STREET LIGHT
- EXISTING TREE OR STUMP TO BE REMOVED - MORE THAN 12" DIA.
- EXISTING PALM TO BE TRANSPLANTED BY CONTRACTOR
- EASEMENT LINE
- EXISTING OR NEW R/W LINE
- PAVEMENT CENTER LINE AND OR MONUMENT LINE (℄ AND/OR Ⓜ)
- EXISTING TREE TO BE REMOVED (NON PAY ITEM)
- EXISTING TREE TO REMAIN

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CKD BY	DATE
9.	DELETED DEPRESS D/W NOTE	F.L.Z.	J.M.F.	7-86
10.	ADDED STORM SEWER M.H. NOTE	F.L.Z.	J.M.F.	7-86
11	ADDED CATCH BASIN ACCESS NOTE	J.A.C.	J.F.	3-87
12.	CHANGED C.B. STATIONING NOTE	A.P.H.	L.D.E.	9-87
13.	CHANGED C.B. ACCESS FRAME & COVER NOTE	F.L.Z.	J.E.	4-88

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CKD BY	DATE
5.	CHANGED EXIST. WATER METER & BOX LEGEND	F.L.Z.	J.M.F.	7-86
6.	CHANGED NEW OR RELOCATED FIRE HYDRANT LEGEND	F.L.Z.	J.M.F.	7-86
7.	CHANGED EXIST. TEL. LEGEND	F.L.Z.	J.M.F.	7-86
8.	ADDED EXIST. TEL. DUCTS LEGEND	F.L.Z.	J.M.F.	7-86

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CKD BY	DATE
1.	CHANGES TO WORDS	H.F.W.		11/1/78
2.	CHANGE TO M.A.G. DETAILS	P.F.R.	K.R.R.	2-21-79
3	CHANGED WORDING IN 3RD NOTE	A.P.H.		7-19-82
4	CHANGED DET. IN 19TH NOTE	A.P.H.		2-3-83

NOTES

ALL CONSTRUCTION SHALL CONFORM TO THE LATEST EDITION OF THE MARICOPA ASSOCIATION OF GOVERNMENTS (M.A.G.) UNIFORM STANDARD DETAILS AND UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION EXCEPT AS SUPERSEDED BY CITY OF PHOENIX SUPPLEMENTAL STANDARD DETAILS FOR PUBLIC WORKS CONSTRUCTION OR AS MODIFIED HEREIN.

ALL STORM SEWER MANHOLES ARE TO BE CONSTRUCTED WITHOUT STEPS.

CORRUGATED METAL PIPE SHALL BE BEDDED WITH SELECT MATERIAL, TYPE "B" PER SECTION 702 IN ACCORDANCE WITH M.A.G. DETAIL 510 ON NON F.H.W.A. PROJECTS, AND IN ACCORDANCE WITH SPECIAL DETAIL 233A ON F.H.W.A. PROJECTS.

PIPE CONNECTIONS TO EXISTING CONCRETE PIPE MAINS SHALL BE MADE IN ACCORDANCE WITH DETAILS CALLED OUT ON THE PLANS. CONNECTION TO MAINS SHALL NOT BE CLOSER THAN 5' CENTER TO CENTER.

PIPE CONNECTIONS TO NEW AND/OR EXISTING CORRUGATED PIPE MAINS SHALL BE MADE IN ACCORDANCE WITH M.A.G. DETAIL 510.

PIPE CONNECTIONS TO NEW PRECAST CONCRETE PIPE MAINS, SHALL BE MADE WITH FACTORY MADE WYES OR TEES. THE DETAIL OF THE FITTINGS MUST BE SUBMITTED TO THE ENGINEER FOR APPROVAL PRIOR TO MANUFACTURE. PIPE CONNECTIONS TO NEW CAST IN PLACE CONCRETE PIPE MAINS SHALL BE MADE PER C.O.P. DETAIL P-1576.

CATCH BASIN CONNECTOR PIPES SHALL BE LAID ON A STRAIGHT ALIGNMENT AND SLOPE UNLESS OTHERWISE SPECIFIED. IF BREAKS IN ALIGNMENT OR SLOPE ARE NECESSARY TO MEET FIELD CONDITIONS. THE MAXIMUM DEFLECTION SHALL BE 22-1/2°. THE BEND SHALL BE MADE ACCORDING TO M.A.G. DETAIL 505.

CONNECTOR PIPES SHALL CONNECT TO CATCH BASIN WALLS AT AN ANGLE NOT TO EXCEED 22-1/2° FROM PERPENDICULAR.

FACILITIES WHICH ARE NOT SPECIFICALLY LOCATED WITH ACTUAL VERTICAL AND HORIZONTAL CONTROLS, ARE LOCATED ONLY APPROXIMATELY AND TO THE BEST AVAILABLE INFORMATION PROVIDED BY THE VARIOUS OWNERS OF THE FACILITIES, AND SUPPLEMENTED BY VISUAL SURFACE INFORMATION WHERE APPROPRIATE. ACCURACY, LOCATION AND COMPLETENESS OF THIS INFORMATION SHALL BE VERIFIED BY THE CONTRACTOR PRIOR TO INITIATION OF CONSTRUCTION.

DURING CONSTRUCTION, THE CONTRACTOR SHALL CONTACT BLUESTAKE TO FIND AND FLAG UNDERGROUND UTILITIES. THE CONTRACTOR SHALL CONTACT OTHER APPROPRIATE UTILITIES DIRECTLY IF THEY ARE NOT ON BLUESTAKE SYSTEM.

VERTICAL CONTROL IS BASED ON NATIONAL GEODETIC SURVEY

STATIONS SHOWN ON PROFILE ARE ALONG CENTERLINE OF CONDUIT, OR ON A LINE NORMAL TO CENTERLINE OF CONDUIT.

REINFORCED AND NON-REINFORCED CONCRETE PIPE SHALL BE BEDDED IN ACCORDANCE WITH DETAIL SHOWN ON THESE PLANS, OR M.A.G. SPECIFICATIONS, WHICHEVER APPLIES.

ASBESTOS CEMENT PIPE SHALL BE BEDDED IN ACCORDANCE WITH DETAIL SHOWN ON THESE PLANS OR M.A.G. STANDARD SPECIFICATION WHICHEVER APPLIES.

STATIONING OF CATCH BASINS ARE FROM THE CENTERLINE OF THE STREET TO THE CENTERLINE OF THE CATCHBASIN, UNLESS OTHERWISE SPECIFIED.

ELEVATIONS SHOWN FOR CATCH BASINS ARE AT TOP OF THE PROPOSED CURB AT THE CENTERLINE OF THE CATCH BASIN, UNLESS OTHERWISE SPECIFIED.

SANITARY SEWER MAINS AND TAPS CROSSING OVER STORM DRAIN SHALL BE SUPPORTED PER M.A.G. DETAIL 403-1 OR 403-2. OTHER UTILITIES SHALL BE SUPPORTED PER M.A.G. DETAIL 403-1, 403-2 OR 403-3 AS NOTED ON THE PLANS OR AS REQUIRED BY THE ENGINEER.

ALL EXISTING PRECAST CONCRETE SAFETY CURBS AND ALL EXISTING WOODEN PARKING CURBS, WHICH ARE INSIDE THE RIGHT OF WAY AND APPROXIMATELY PARALLEL TO THE NEW CURB LINE, SHALL BE RESET ON THE RIGHT OF WAY DIRECTLY OPPOSITE THEIR EXISTING LOCATION, WITH THE BACK EDGE ON THE RIGHT OF WAY LINE. ALL OTHER PRECAST CONCRETE SAFETY CURBS INSIDE THE STREET RIGHT OF WAY SHALL BE SALVAGED FOR THE OWNER AND STOCK PILED FOR THE OWNER AT THE RIGHT OF WAY LINE.

EXISTING PRECAST CONCRETE SAFETY CURBS OUTSIDE THE RIGHT OF WAY, WHICH ARE DISTURBED BY NEW CONSTRUCTION SHALL BE RESET IN THEIR ORIGINAL POSITION BY THE CONTRACTOR.

ALL EXISTING DRIVEWAYS AND ALL EXISTING ALLEYS SHALL BE GRADED TO MATCH THE NEW WORK IN ACCORDANCE WITH STD. DETAIL P-1164, UNLESS OTHERWISE SPECIFIED. EXISTING SURFACING SHALL BE REMOVED AND REPLACED AS NECESSARY.

UNLESS OTHERWISE PROVIDED ON THE PLANS, EXISTING A.C. OR P.C.C. DRIVEWAYS AND SIDEWALKS WHICH FALL WITHIN OR ABUT THE R/W SHALL BE CONNECTED TO THE NEW WORK AS FOLLOWS:

THE SPACE BETWEEN THE BACK OF NEW DRIVEWAY ENTRANCES AND EXISTING A.C. DRIVEWAYS SHALL BE FILLED WITH A MINIMUM OF 3" D1/2 A.C.S.C.. WHERE EXISTING PAVEMENT AND BASE THICKNESS EXCEED THE MINIMUMS, MATCH THE EXISTING.

THE SPACE BETWEEN THE BACK OF NEW SIDEWALKS AND EXISTING PRIVATE SIDEWALKS, AND THE SPACE BETWEEN THE BACK OF NEW DRIVEWAY ENTRANCES AND EXISTING P.C.C. DRIVEWAYS SHALL BE FILLED WITH P.C.C. THE THICKNESS AND CLASS SHALL MATCH THAT OF THE NEW SIDEWALK OR DRIVEWAY ENTRANCE.

ENGINEERING ALLIANCE CONSULTING ENGINEER

NOTES cont.

UNLESS OTHERWISE PROVIDED ON THE PLANS, THE SPACE BETWEEN THE BACK OF THE NEW SIDEWALKS, AND EXISTING A.C. PARKING LOTS, WHICH FALL WITHIN OR ABUT THE R/W SHALL BE FILLED WITH 2" A.C.S.C. ON NATIVE SOIL.

EXISTING IRRIGATION BERMS DISTURBED BY NEW CONSTRUCTION SHALL BE RECONSTRUCTED AS SHOWN ON PLANS.

M.A.G. ALLEY ENTRANCE DETAILS 260, 261, 262 AND 263, WHICH ARE INDICATED TO BE MODIFIED ON THESE PLANS SHALL BE CONSTRUCTED ACCORDING TO THE DETAIL NUMBER EXCEPT THAT THE SLAB SHALL BE 9" THICK. DRIVEWAYS DESIGNATED ON THE PLANS AS M.A.G. DETAILS 250 AND 251 SHALL BE RESIDENTIAL DRIVEWAYS 5" THICK. ALL OTHER DRIVEWAYS SHALL BE CITY OF PHOENIX DETAIL P-1255.

CATCH BASIN ACCESS FRAME AND COVERS SHALL BE CONSTRUCTED PER C.O.P. DETAIL P-1561.

STRUCTURAL NOTES

DIMENSIONS FOR DEPTH OF REINFORCING STEEL ARE FROM FACE OF CONCRETE TO CENTER OF BARS.

ALL EXPOSED EDGES OF CONCRETE SHALL BE BEVELED OR ROUNDED.

ALL EXPOSED CONCRETE SURFACES SHALL BE FINISHED IN ACCORDANCE WITH ARIZONA DEPT. OF TRANSPORTATION STANDARD SPECIFICATION 601-3.05 - FINISHING FORMED CONCRETE, UNLESS OTHERWISE SPECIFIED.

PAVEMENT LEGEND

- EXISTING PAVEMENT TO REMAIN
- NEW A.C. D/W CONNECTIONS (3" D 1/2 A.C.S.C. OR MATCH EXIST. IF GREATER).
- 1 1/2" A.C.S.C. (D 1/2) / 5" A.C.B.C. (A 1 1/2)

263-1100

LEGEND AND NOTES

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43RD. AVE. TO 39TH AVE.

ST-914085

SHEET NO.	TOTAL SHEETS	AS BUILT
2	35	

43 RD. AVE.
PHOENIX STREETS-MARICOPA CO.
UNION HILLS DR. TO BEARDSLEY RD.

FHWA REGION	STATE	PROJ NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE CONSULTING ENGINEER

DES R.S.B.	DR J.S.S.	CK J.S.P.	DATE 12/92

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV BY	CK'D BY	DATE

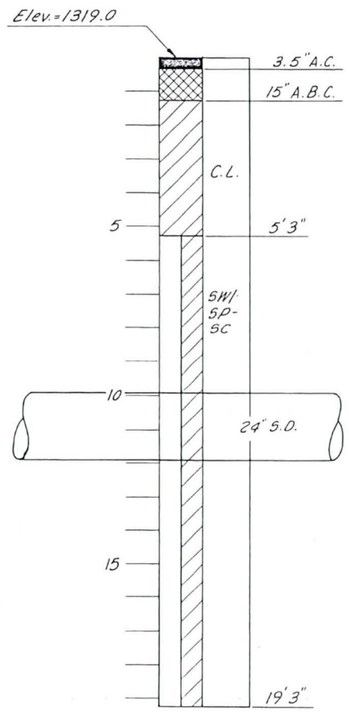
REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV BY	CK'D BY	DATE

BORING NO. 1

STA. 38 + 80, 4'LT.

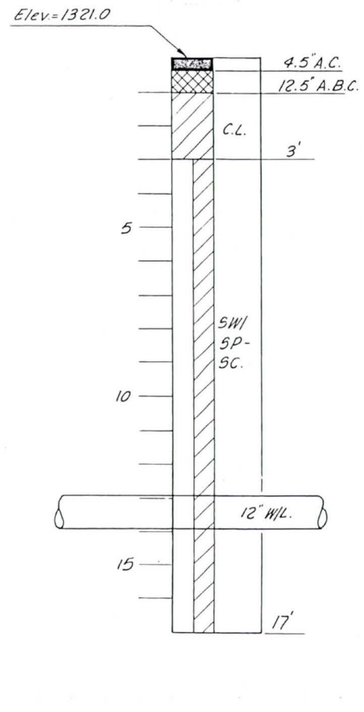
43 RD AVE.



BORING NO. 2

STA. 46+25', 0' RT.

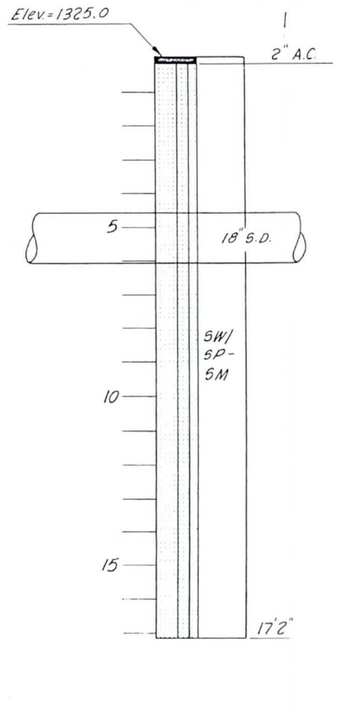
43 RD AVE.



BORING NO. 3

STA. 58+97, 8' RT.

43 RD AVE.



NOTE:

BORINGS, CLASSIFICATIONS AND RESISTIVITY TESTS BY THOMAS-HARTIG & ASSOCIATES. INVESTIGATION REPORT DATED JANUARY 3, 1991 (PROJECT NO. 91-0236).

THE INFORMATION SHOWN ON THIS SHEET DOES NOT CONSTITUTE A PART OF THE CONTRACT AND IS INCLUDED FOR THE CONTRACTOR'S CONVENIENCE ONLY. IT IS NOT INTENDED TO IMPLY THAT THE CHARACTER OF MATERIAL IS THE SAME AS THAT SHOWN IN THE LOGS AT ANY POINT OTHER THAN WHERE THE BORING WAS MADE. THE CONTRACTOR SHALL SATISFY HIMSELF REGARDING THE CHARACTER AND AMOUNT OF ROCK, GRAVEL, SAND, SILT, CLAY AND WATER TO BE ENCOUNTERED IN THE WORK TO BE PERFORMED.

RESULTS:

Location	Depth Interval (feet)	Resistivity (ohm-cm)
28' east of 1	0' - 18'	6,722
	0' - 9'	4,826
25' east of 2	0' - 18'	7,997
	0' - 9'	7,394
20' east of 3	0' - 18'	13,685
	0' - 9'	16,839

LEGEND OF SOIL TYPES

ASPHALT CONCRETE AND AGGREGATE BASE COURSE (See individual logs for thicknesses.)

SANDY CLAY (CL); light reddish brown; hard; damp; medium to high plasticity; sand portion is fine grained; trace of course sand to fine gravel.

SAND TO CLAYEY SAND (SW/SP-SC); light brown; very dense; slightly damp; no to low plasticity; fine to coarse grained; trace of fine to medium gravel; trace of light cementation.

SAND TO SILTY SAND (SW/SP-SM); light brown; dense to very dense; slightly damp; no plasticity; fine to coarse grained; trace of fine to medium gravel; trace of light cementation.

RESULTS

Sample	LL	PI	Sieve Size - Accumulative % Passing 200	100	50	30	16	8	4	3/8"	3/4"	2"	3"	Class
1, 0' - 4'	42	22	68											CL
2, 9' - 16'	25	8	11											SW/SP -SC
3, 6' - 12'		** NP	8											SW/SP -SM

SOIL BORING LOG

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

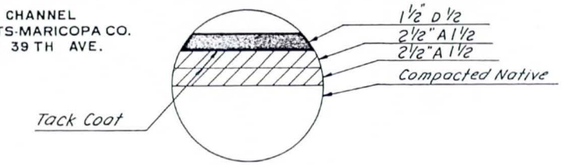
SCATTER WASH CHANNEL

43RD AVE TO 39TH AVE

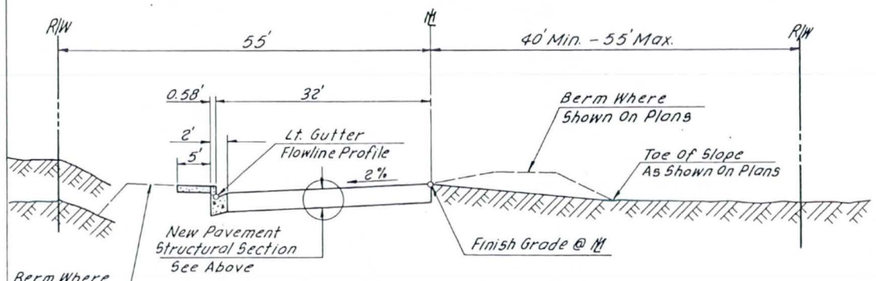
ST-914085

DR J.S.S. DATE 12/92	DES R.S.B. DATE 12/92	CK J.S.P. DATE 12/92	SHEET NO 2A	TOTAL SHEETS 35	AS BUILT

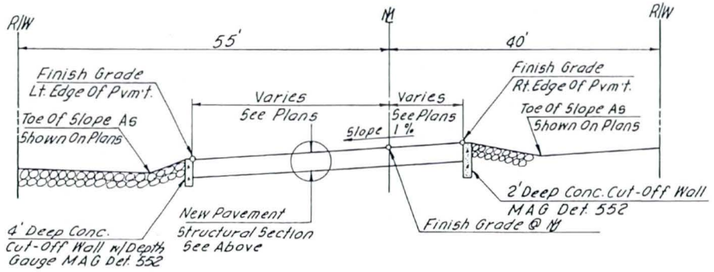
SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43RD. AVE. TO 39TH AVE.



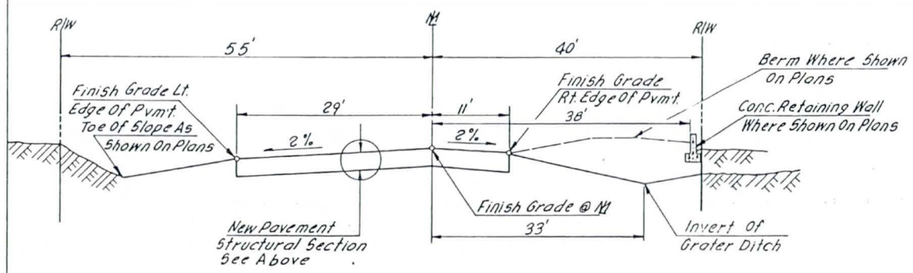
43rd AVENUE
TYPICAL PAVEMENT SECTION
N.T.S.



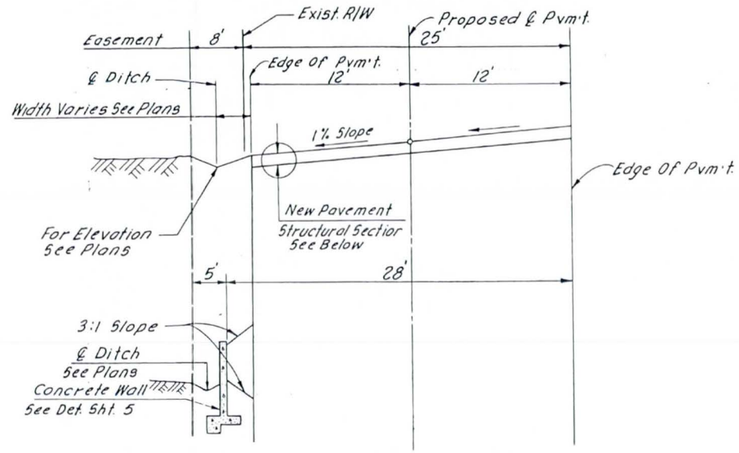
TYPICAL SECTION - 43 RD. AVE.
Sta. 43+00 to 45+88.4 Lt.



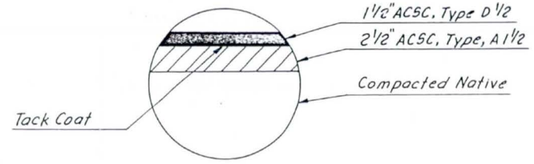
TYPICAL SECTION - 43RD. AVE.
Sta. 46+30 to Sta. 50+25 Lt.
Sta. 46+30 to Sta. 49+72.40' Rt.



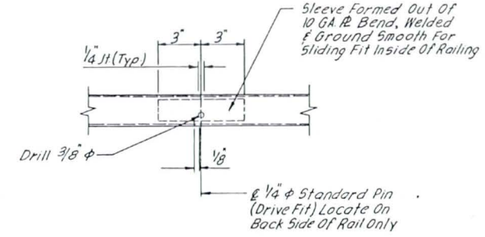
Sta. 50+25 to Sta. 54+00 Lt.
Sta. 49+72 to Sta. 54+00 Rt.



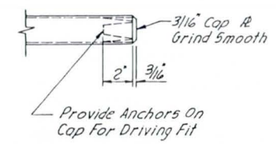
TYPICAL SECTION BEHREND DRIVE



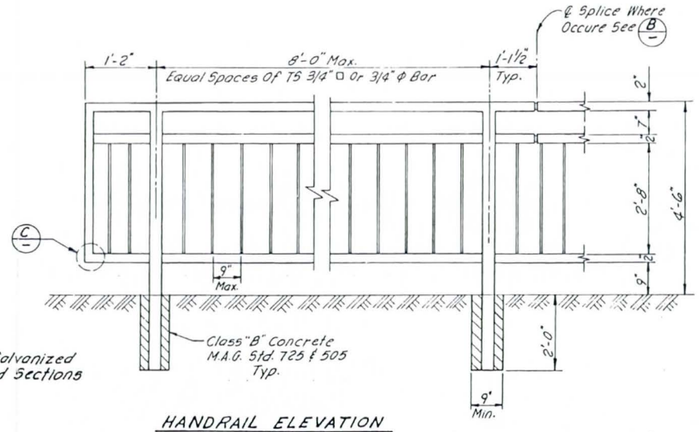
BEHREND DRIVE
TYPICAL PAVEMENT SECTION
N.T.S



(B) TYPICAL HANDRAIL SPLICE DETAIL



(C) TYPICAL HANDRAIL END CAP DETAIL



NOTE:
Hot Dip Galvanized
Assembled Sections

HANDRAIL ELEVATION
N.T.S.

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

EA ENGINEERING ALLIANCE CONSULTING ENGINEER

DES. D.E.F.	DR. J.S.S.	CK. J.S.P.	DATE

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39TH AVE.
ST-914085

DR. J.S.S. DATE:	DES. D.E.F. DATE:	CK. J.S.P. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
			3	35	

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43RD. AVE. TO 39TH. AVE.

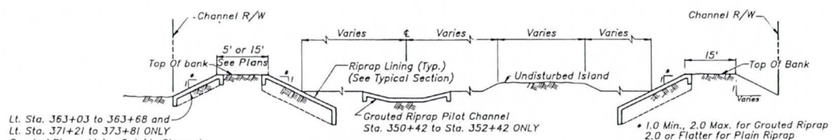
FHWA REGION	STATE	PROJ. NO.	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE — CONSULTING ENGINEER

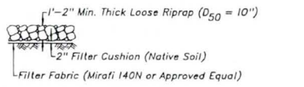
DES D.E.F.	DR J.S.S.	CK D.E.F.	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD BY	DATE



COMPOSITE SECTION RIPRAP LINING



RIPRAP DETAIL

RIPRAP GRADATION

D_{50} = 10"

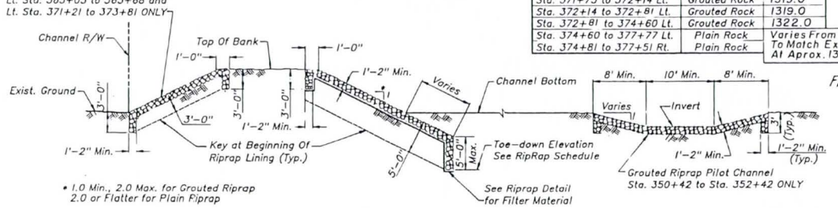
SIZE OF STONE	% OF TOTAL WEIGHT SMALLER THAN THE GIVEN SIZE
18"	100–85
15"	85–70
10"	50–30
7"	20–5
3"	5–0

See Landscaping Plans for Larger Stones

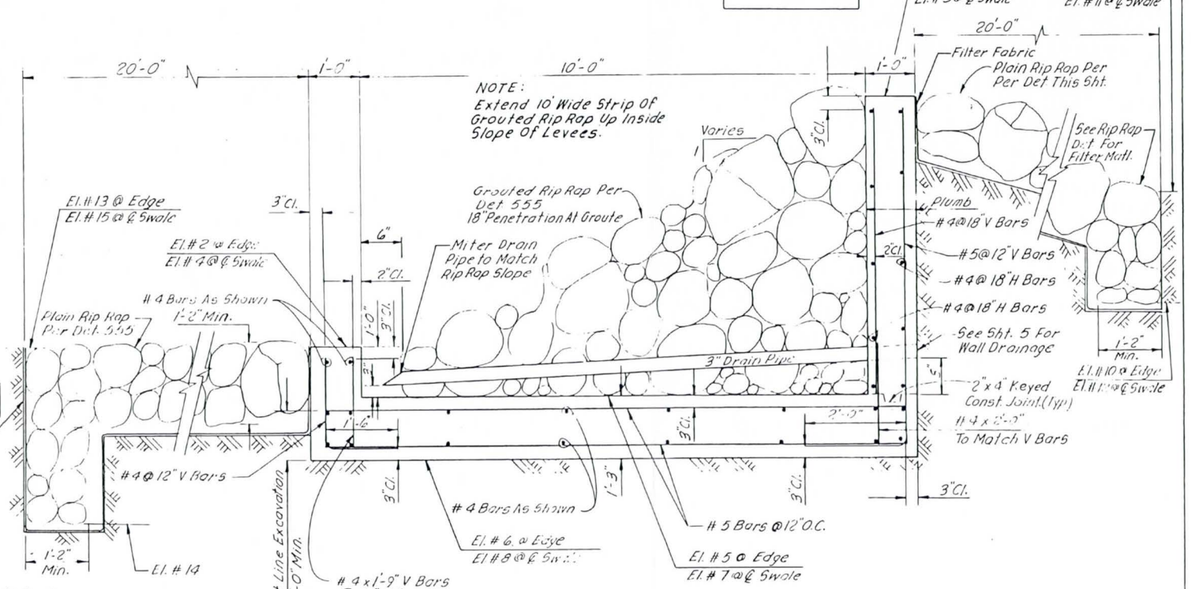
RIPRAP SCHEDULE

LOCATION	TYPE	TOE-DOWN ELEVATION
Sta. 351+02 to 351+43	Grouted Rock	1310.0
Sta. 351+43 to 351+47	Grouted Rock	----
Sta. 351+89 to 356+68	Plain Rock	1310.0
Sta. 356+68 to 357+38	Plain Rock	1310.0
Sta. 357+38 to 357+48	Grouted Rock	----
Sta. 357+48 to 365+23 Lt.	Plain Rock	1317.0
Sta. 357+48 to 366+91 Rt.	Plain Rock	1317.0
Sta. 365+23 to 365+55 Lt.	Grouted Rock	1317.0
Sta. 365+55 to 369+23 Lt.	Plain Rock	1319.0
Sta. 369+23 to 369+79 Lt.	Grouted Rock	1319.0
Sta. 369+79 to 371+34 Lt.	Plain Rock	1319.0
Sta. 371+75 to 372+14 Lt.	Grouted Rock	1319.0
Sta. 372+14 to 372+81 Lt.	Grouted Rock	1319.0
Sta. 372+81 to 374+60 Lt.	Grouted Rock	1322.0
Sta. 374+60 to 377+77 Lt.	Plain Rock	Varies From 1322.0 Lt. & Rt. To Match Exist. Str. Toe-Down At Aprox. 1319.0
Sta. 374+81 to 377+51 Rt.	Plain Rock	

Grouted Riprap Outside Channel Applies
Lt. Sta. 363+03 to 363+68 and
Lt. Sta. 371+21 to 373+81 ONLY

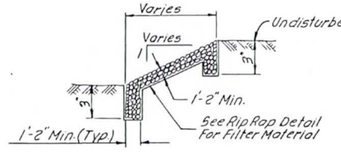


Filter Fabric



SECTION A–A

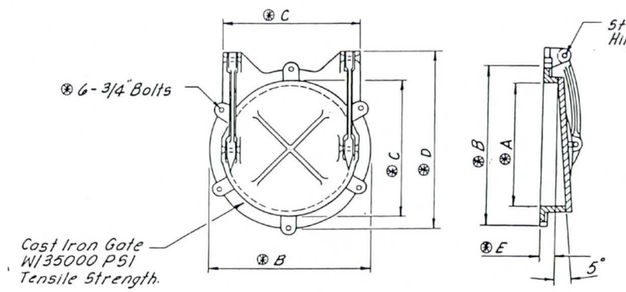
TYPICAL SECTION RIPRAP LINING



ISLAND SIDE RIPRAP (Where Shown On Plan)

ELEVATION TABLE

LOCATION	#1	#2	#3	#4	#5	#6	#7	#8	#9	#10	#11	#12	#13	#14	#15
Sta. 357+	1323.60	1318.70	1321.60	1317.20	1317.70	1316.45	1316.20	1314.95	1322.70	1317.0	1321.40	1317.0	1318.70	1310.0	1317.20
Sta. 372+	1328.10	1325.80	1326.00	1325.10	1324.80	1323.55	1324.10	1322.85	1327.40	1322.0	1326.33	1322.0	1326.00	1319.0	1324.99



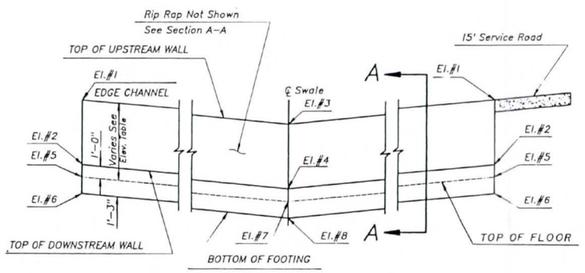
Size	A	B	C	D	E
18"	18"	21 1/4"	19"	22 3/4"	1"
21"	21"	24 3/4"	22"	26 1/2"	1"
24"	24"	28 1/4"	25 1/4"	30 1/4"	1 1/4"

℄ Varies With Manufacturer

AUTOMATIC FLAP GATE WITH OFF-VERTICAL CLOSURE

N.T.S

Install Watermon Model F-10, Hydro Medium Duty, Neenah Model R-5050 Type SF Off-Vertical Closure, Or Approved Equal



DROP STRUCTURE ELEVATION LOOKING UPSTREAM

N.T.S.

See Sheet 5 For Chamfer Detail, General Notes, Joint Note & Typical Expansion Joint Detail.

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH AVE.
ST-914085

DR J.S.S. DATE	DES D.E.F. DATE	CK D.E.F. DATE	SHEET NO	TOTAL SHEETS	AS BUILT
			4	35	

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43RD. AVE. TO 39TH AVE.

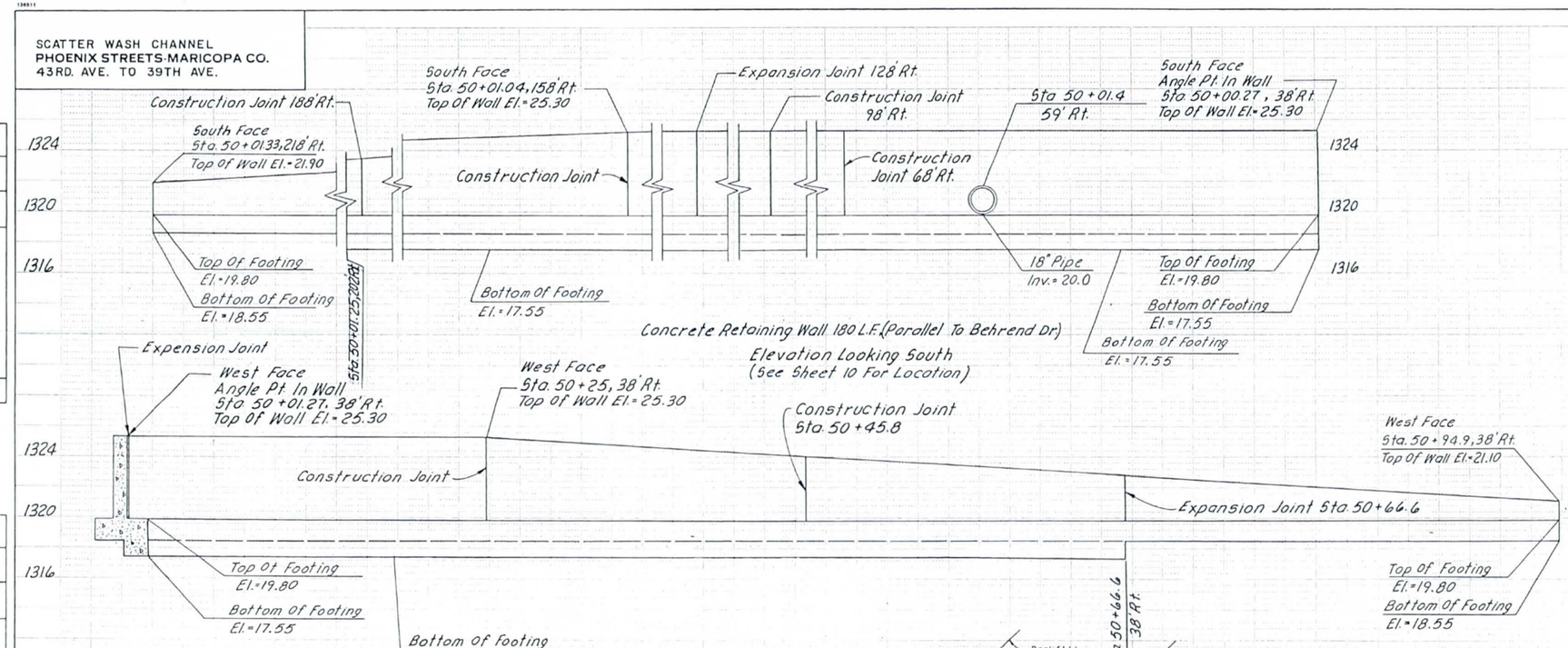
F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

ENGINEERING ALLIANCE CONSULTING ENGINEER

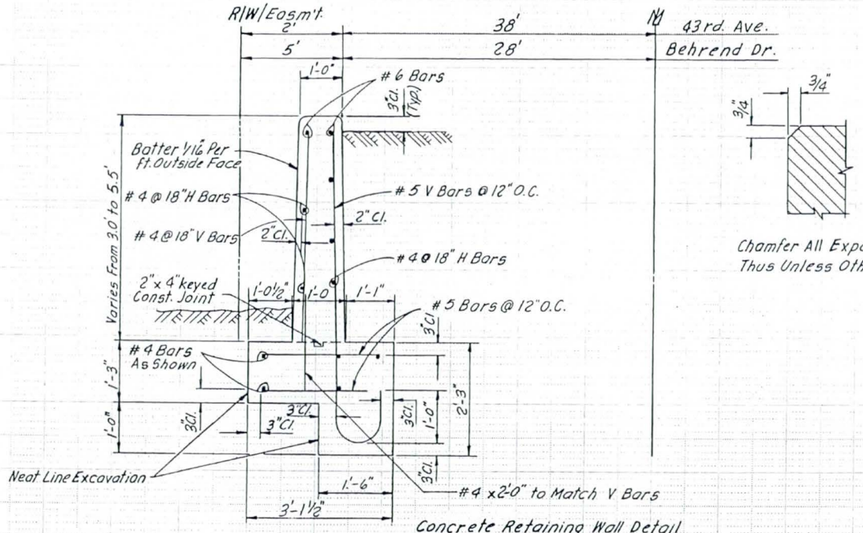
DES. D.E.F. | DR: J.S.S. | CK: J.S.P. | DATE:

REVISION BY CITY OF PHOENIX

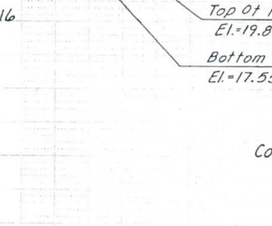
NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

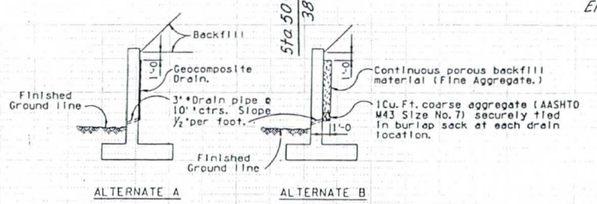


Concrete Retaining Wall 93.6 L.F.(Parallel To 43rd. Ave.)
Elevation Looking West
(See Sheet 10 For Location)

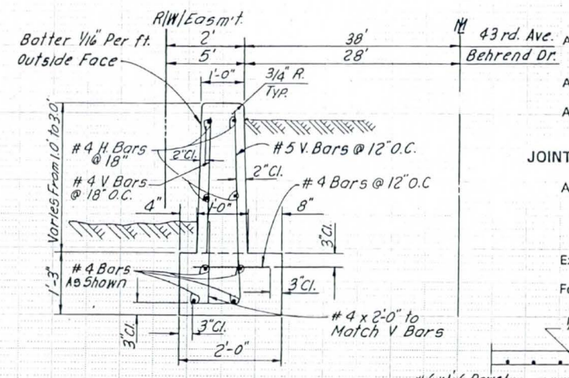


Concrete Retaining Wall Detail
Sta. 50+01.25, 202'Rt. to Sta. 50+00.27, 38'Rt. (Parallel to Behrend Dr.)
Sta. 50+01.27, 38'Rt. to Sta. 50+66.6, 38'Rt. (Parallel to 43rd Ave.)

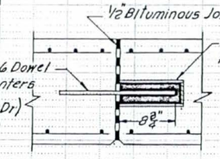




WALL DRAINAGE



Concrete Retaining Wall Detail
Sta. 50+01.33, 218'Rt. To Sta. 50+01.25, 202'Rt. (Parallel to Behrend Dr.)
Sta. 50+66.6, 38'Rt. To Sta. 50+94.9, 38'Rt. (Parallel to 43rd Ave.)



Typical Expansion Joint Detail

GENERAL NOTES:

Construction - Arizona Department of Transportation Standard Specifications for Road and Bridge Construction, 1990.

Design - AASHTO Standard Specifications for Highway Bridges, 1983 Edition, and 1984 and 1985 Supplements.

Dead Load - Weight of backfill = 120 P.C.F. Angle of Internal Friction = 33° 15'.

All Concrete shall be Class 'S', f'c = 3000 psi.

Reinforcing Steel shall conform to ASTM Specification A615. Bar size #6 and smaller shall be designed as Grade 40 and furnished as Grade 40 or Grade 60, fs = 20,000 psi.

All bend dimensions for reinforcing steel shall be out to out of bars. All placement dimensions for reinforcing steel shall be to center of bars except as noted.

All reinforcing steel shall have 2" clear cover unless noted otherwise.

All retaining walls shall have wall drainage per detail left.

JOINT NOTE:

All Retaining Walls shall have formed Construction Joints spaced at not more than 30'-0" apart or as shown. Reinforcing Steel shall project 1'-6" through the joint. The joint shall be made with ¼" plywood bulkhead which shall be left in place.

Expansion Joints shall be provided at intervals not exceeding 90'-0".

Footings may be continuous with no joint.

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH AVE.
ST – 914085

DES. D.E.F. DATE:	DR. J.S.S. DATE:	CK. J.S.P. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE 1"= 4 HORIZONTAL / 4 VERTICAL			5	35	

SCATTER WASH CHANNEL
PHOENIX STREETS—MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE

DES: DEF	DR: DEF	CK: JSP	DATE: 2/27/94

See Sheet 11 For Pipe Culvert

Construct Grouted RipRap per Detail Sheet 4 (Typical)

Construct Grouted RipRap Pilot Channel per Detail Sheet 4

Excavation Limit

See Sheet 10 For Pipe Culv.

Construct RipRap per Detail Sheet 4 (Typical)

See Sheet 5 & 10 For Conc. Wall

See Sheet 10 For Pipe Culv.

Construct Drop Structure per Detail Sheet 4

BEHREND DRIVE

5' Path

AVENUE

43rd

Construction Baseline

SCATTER WASH

See Detail A

See Detail B

15' Service Road

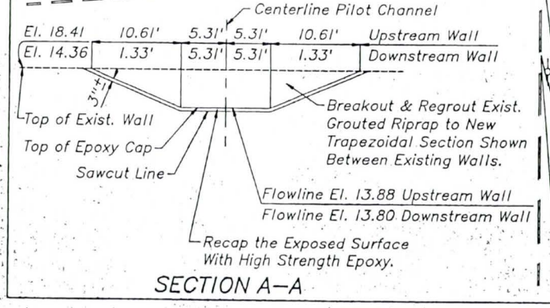
Sawcut & Recap Exist. Reinf. Conc. Walls to Elevations Shown in Detail Below.

LOCATION OF ABANDON WELL

Construct 9" Conc. Paving with Broom Finish. See Detail Right.

MATCHLINE SHEET 7 STA 359+00

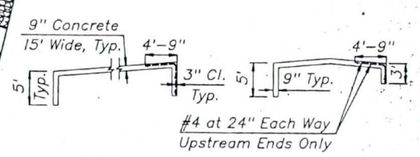
Scale: 1" = 40'



SECTION A—A

LEGEND

- Plain RipRap
- Grouted RipRap
- 9" Conc. Paving w/Broom Finish
- 1323 Existing Contours
- 1326 Finished Contours



DETAIL A DETAIL B

CONC. PAVING DETAIL
SECTION LOOKING NORTH

For Channel Geometric Layout & Profile, See Sheet 14.

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST-914085

DR: DEF DATE: 2/94	DES: DEF DATE: 2/94	CK: JSP DATE: 2/94	SHEET NO. 6	TOTAL SHEETS 35	AS BUILT

SCATTER WASH CHANNEL
PHOENIX STREETS—MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE

DES: DEF	DR: DEF	CK: JSP	DATE: 1/31/94

LEGEND

- Plain RipRap
- Grouted RipRap
- 9" Conc. Paving w/Broom Finish
- --1323-- Existing Contours
- —1326— Finished Contours

Scale: 1" = 40'

Construct 9" Conc. Paving with Broom Finish. 3' Deep Cut-off Walls Both Ends. See Sheet 6, Detail B.

Install 170 L.F. New Handrail. See Detail Sheet 3.

Construct Grouted RipRap per Detail Sheet 4

MATCHLINE SHEET 6 STA. 359+00

5' Path

SCATTER

BEHREND DR.

WAHALLA LANE

15' Service Road

Construction Baseline

361+00 362+00 363+00 364+00 365+00 366+00 367+00 368+00

WASH

MATCHLINE SHEET 8 STA. 369+00

41st DRIVE

41st AVE

Inv.=23.60

Inv.=25.20

Install 38 L.F. New Handrail. See Detail Sheet 3.

Construct RipRap per Detail Sheet 4 (Typical)

Sta. 363+47, 122.8' Rt. to Sta. 363+61, 187.6' Rt.
Install 68 L.F. New 18" R.G.R.C.P. Class IV.
Install 2—Straight Type Headwalls per M.A.G. Detail 501.
Install Automatic Flap Gate at West End with Off-Vertical Closure. See Det. Sheet 4

Construct 9" Conc. Paving with Broom Finish. 3' Deep Cut-off Walls Both Ends. See Sheet 6, Detail B.

10 Yo
450
919.200

For Channel Geometric Layout & Profile, See Sheet 15.

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST-914085

DR: DEF DATE: 1/94	DES: DEF DATE: 1/94	CK: JSP DATE: 1/94	SHEET NO.	TOTAL SHEETS	AS BUILT
			7	35	

SCATTER WASH CHANNEL
PHOENIX STREETS–MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE

DES: DEF	DR: DEF	CK: JSP	DATE: 2/27/94

41st AVENUE

40th AVENUE

WAHALLA LANE

15' Service Road

SCATTER WASH

Construction Baseline

Sta. 370+59, 117.2' Lt. to 370+65, 158.6' Lt.
Install 42 L.F. New 18" R.G.R.C.P. Class III.
Install 2–Straight Type Headwalls
per M.A.G. Detail 501.
Install Automatic Flap Gate at South End with
Off–Vertical Closure. See Detail Sheet 4

Construct Grouted RipRap
per Detail Sheet 4

Construct Grouted RipRap
per Detail Sheet 4

Construct RipRap
per Detail Sheet 4 (Typical)

Install 78 L.F. New Handrail.
See Detail Sheet 3.

Install 360 L.F. New Handrail.
See Detail Sheet 3.

Construct Drop Structure
per Detail Sheet 4

Install 304 L.F. New Handrail.
See Detail Sheet 3.

Sta. 375+30, 109.2' Lt. to 147.2' Lt.
Install 38 L.F. New 18" R.G.R.C.P. Class III.
Install 2–Straight Type Headwalls
per M.A.G. Detail 501.
Install Automatic Flap Gate at South End with
Off–Vertical Closure. See Detail Sheet 4

Remove 298 S.Y. Plain Riprap

Inv.=27.10

Inv.=27.90

Inv.=25.40

Inv.=27.80

Inv.=28.15

Inv.= 29.05

Sta. 376+79.7, 152.1' Rt. to Sta. 376+84, 186.7' Rt.
Install 70 L.F. New 24" R.G.R.C.P. Class III.
Install 2–Straight Type Headwalls
per M.A.G. Detail 501.
Install Automatic Flap Gate at North End with
Off–Vertical Closure. See Detail Sheet 4

See Detail A Sheet 6

See Detail B Sheet 6

5' Path

Construct 9" Conc. Paving
with Broom Finish.
See Detail Sheet 6.

Construct 9" Conc. Paving with Broom
Finish. 3' Deep Cut–off Walls Both Ends.
No Reinforcing Steel. See Sheet 6, Detail B.

Remove 110 S.Y. Plain Riprap

39th DR

MATCHLINE SHEET 7 STA. 369+00

For Channel Geometric Layout
& Profile, See Sheet 16.

Scale: 1" = 40'

LEGEND

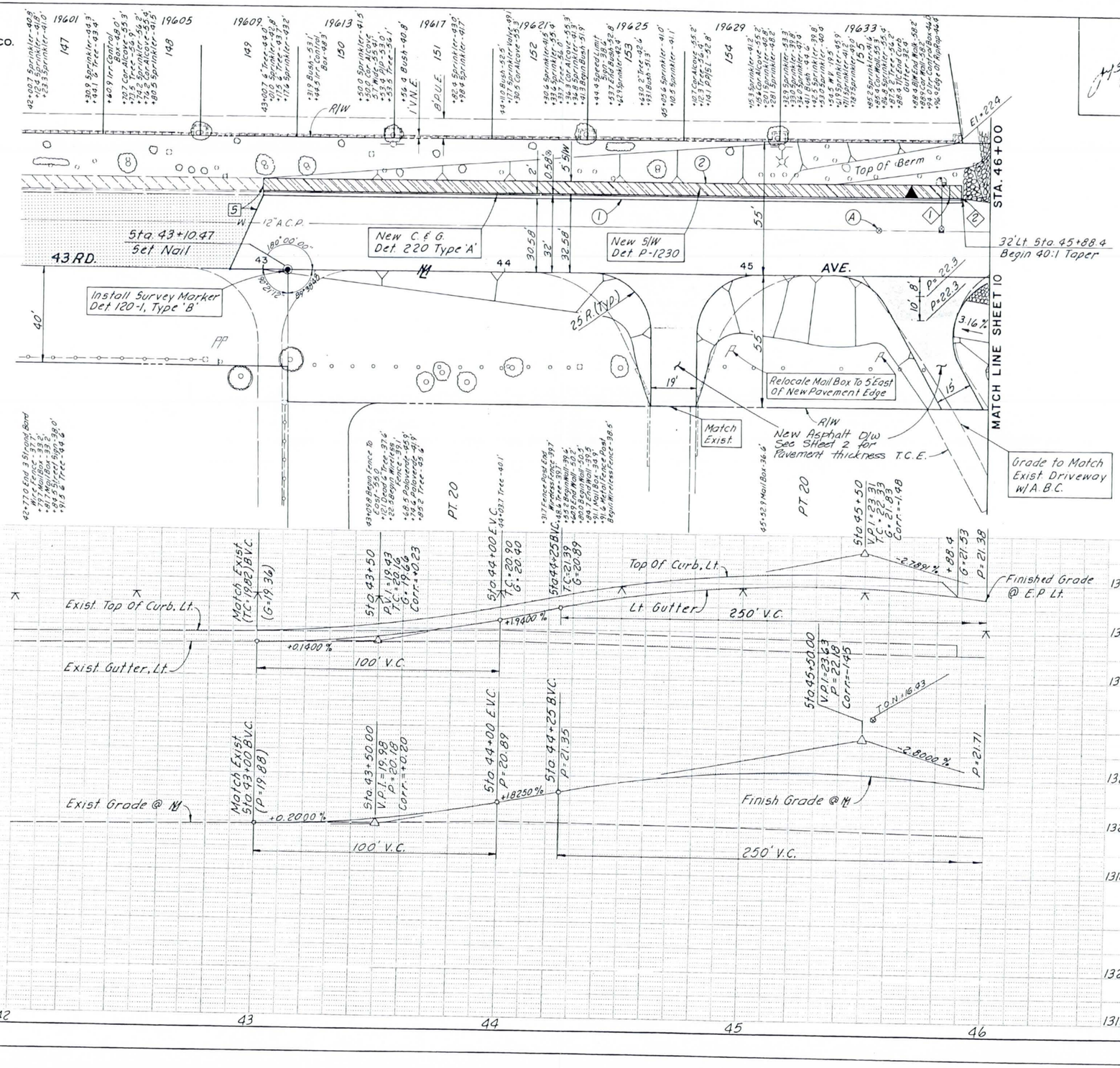
- Plain RipRap
- Grouted RipRap
- 9" Conc. Paving w/Broom Finish
- --1323-- Existing Contours
- —1326— Finished Contours

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST–914085

DR: DEF DATE: 2/94	DES: DEF DATE: 2/94	CK: JSP DATE: 2/94	SHEET NO.	TOTAL SHEETS	AS BUILT
			8	35	

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43 RD. AVE. TO 39TH AVE.



▲ T.B.M.
Scribed "□" on
Top Of Curb
Sta. 45+68.32.6' Lt.
Elev.=1319.64

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

ENGINEERING ALLIANCE — CONSULTING ENGINEER

DES. R.S.B.	DR. J.S.S.	CK. J.S.P.	DATE

5 Sawcut & Match Exist.

Construction Notes

1. Sta. 45+83.4, Transition C. & G. From H=6" to H=0" in 5'.
2. Sta. 45+88.4, End C. & G. & S/W

Sawcut & Remove C. & G.

No.	Sta. to Sta.	Type	Quan.	Unit
1	43+00 to 45+88.4 Lt.	C. & G.	289	L.F.

Sawcut & Remove S/W.

No.	Sta. to Sta.	Type	Quan.	Unit
2	43+00 to 45+88.4 Lt.	S/W	1442	S.F.

Quantities

Conc. C & G. Det. 220 Type 'A'	289 L.F.
Conc. S/W, Det. P-1230	1442 S.F.
Survey Marker, Det. 120-1 Type 'B'	1 Ea.
Adj. W/V., Det. 391-1 Type 'A'	1 Ea.

43 RD. AVE. PAVING

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL

43 RD. AVE. TO 39 TH AVE.

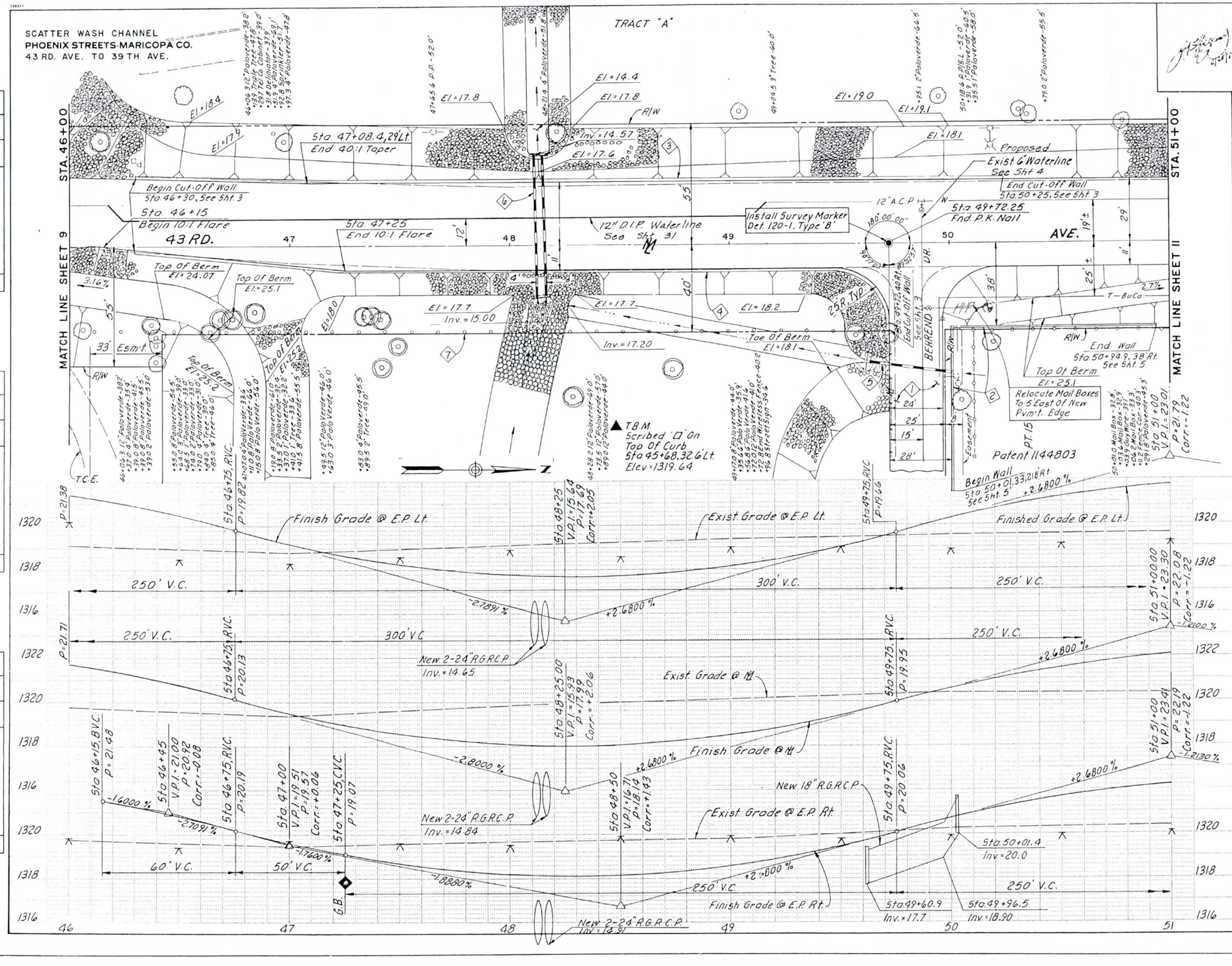
ST – 914085

DES. R.S.B.	DR. J.S.S.	CK. J.S.P.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE			
SCALE 1"= 20 HORIZONTAL, 2 VERTICAL			9	35	

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43 RD. AVE. TO 39 TH AVE.



F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

EA ENGINEERING ALLIANCE — CONSULTING ENGINEER

DES. R.S.B.	DR. J.S.S.	CK. J.S.P.	DATE

Construction Notes

1. See Sht 12 For Behrend Dr Plan & Profile.
2. Sta 50+01.33, 218' Rt. to Sta 50+94.9, 38' Rt. Construct Retaining Wall. See Profile Sht. 5.
3. Sta 46+30, 30.96' Lt. to Sta 50+25, 29' Lt. Construct Concrete Cut-Off Wall Per M.A.G. Det. 552. See Sht. 3
4. Sta 46+30, 15' Rt. to Sta 49+72, 40' Rt. Construct Concrete Cut-Off Wall Per M.A.G. Det. 552. See Sht. 3
5. Sta 49+60.9, 53.5' Rt. to Sta 50+01.4, 59' Rt. Install 41 L.F. New 18" R.G.R.C.P. CL. IV At South End Of 18" Pipe. Install Straight Type Headwall, Per M.A.G. Det 501 With Automatic Flap Gate With Off-Vertical Closure See Det. Sht. 4
6. Sta. 48+14.0, 41' Lt. to 24' Rt. Install 130 L.F. New 24" R.G.R.C.P. CL. IV Install 2 Ea Straight Double-Pipe Type Headwall, Per M.A.G. Det 501-2.
7. Sta 46+00, Rt to Sta 49+72, Rt Remove Exist. Fence Post.

Quantities

Survey Marker Det 120-1 Type 'B' 1 Ea.

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

NO	DESCRIPTION	REV. BY	CK'D BY	DATE

43 RD. AVE. PAVING

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

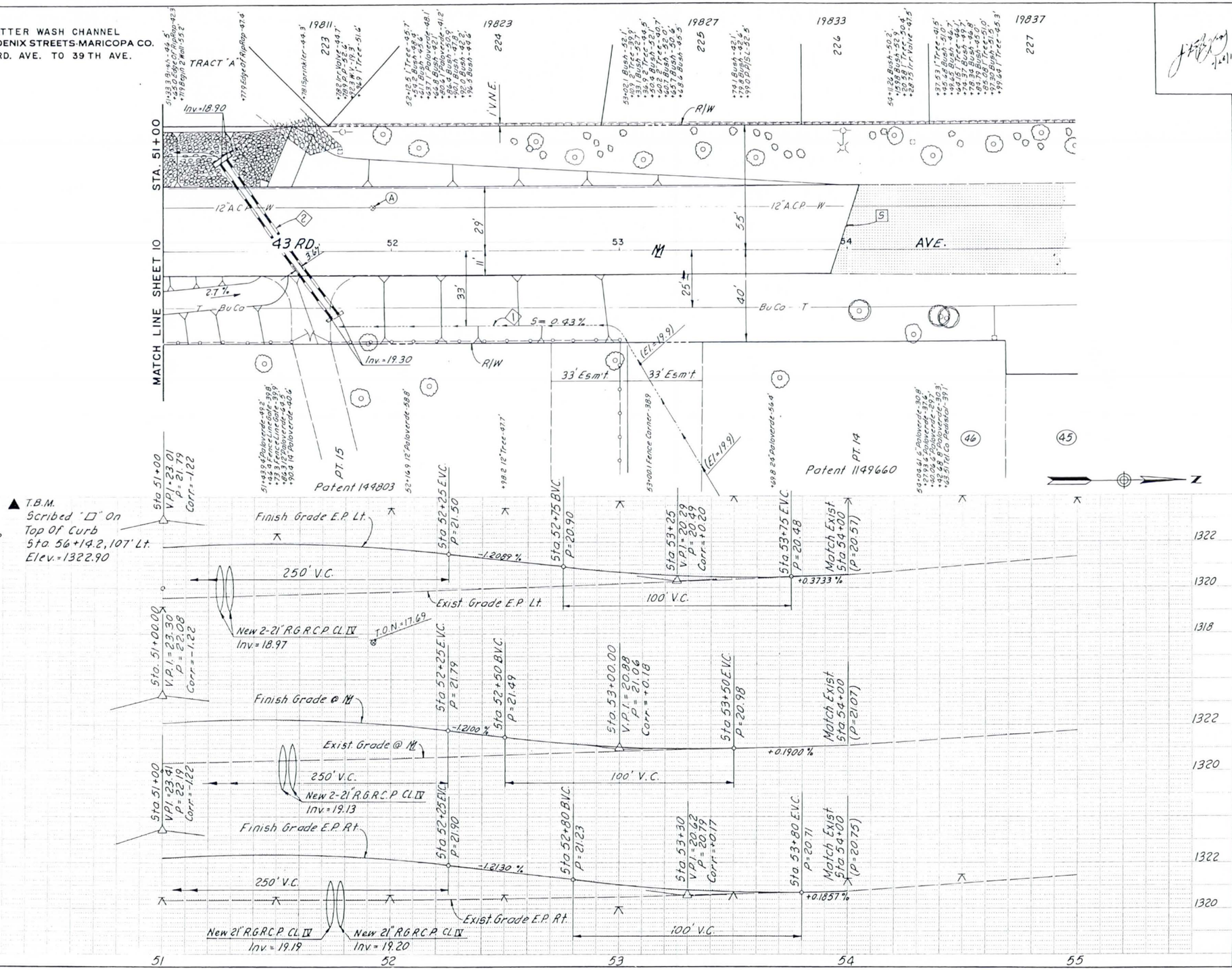
SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH AVE.
ST – 914085

DES. R.S.B.	DR. J.S.S.	CK. J.S.P.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE:	DATE:	DATE:	10	35	

SCALE 1" = 20 HORIZONTAL, 2 VERTICAL

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43 RD. AVE. TO 39 TH AVE.

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CKD BY	DATE



▲ T.B.M.
Scribed "□" On
Top Of Curb
Sta. 56+14.2, 107' Lt.
Elev.=1322.90

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE CONSULTING ENGINEER

DES. R.S.B.	DR. J.S.S.	CK. J.S.P.	DATE

5 Sawcut & Match Exist.

Construction Notes

1. Sta 51+77 to Sta 53+10, Rt.
   140 L.F. New Grader Ditch.
2. Sta 51+26.5, 39' Lt. to Sta 51+77, 30' Rt.
   Install 172 L.F. New 21" R.G.R.C.P.
   Class IV. Install 2- Straight Type
   Headwalls Per M.A.G. Det. 501.
   Install Automatic Flap Gates At
   West End With Off Vertical Closure.
   See Det. Sht. 4.

Quantities

Adj W/V, Det 391-1 Type 'A'	1 Ea.

43 RD. AVE. PAVING
CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39TH AVE.
ST-914085

DES. R.S.B. DATE	DR. J.S.S. DATE	CK. J.S.P. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE 1"= 50 HORIZONTAL, 5 VERTICAL			11	35	

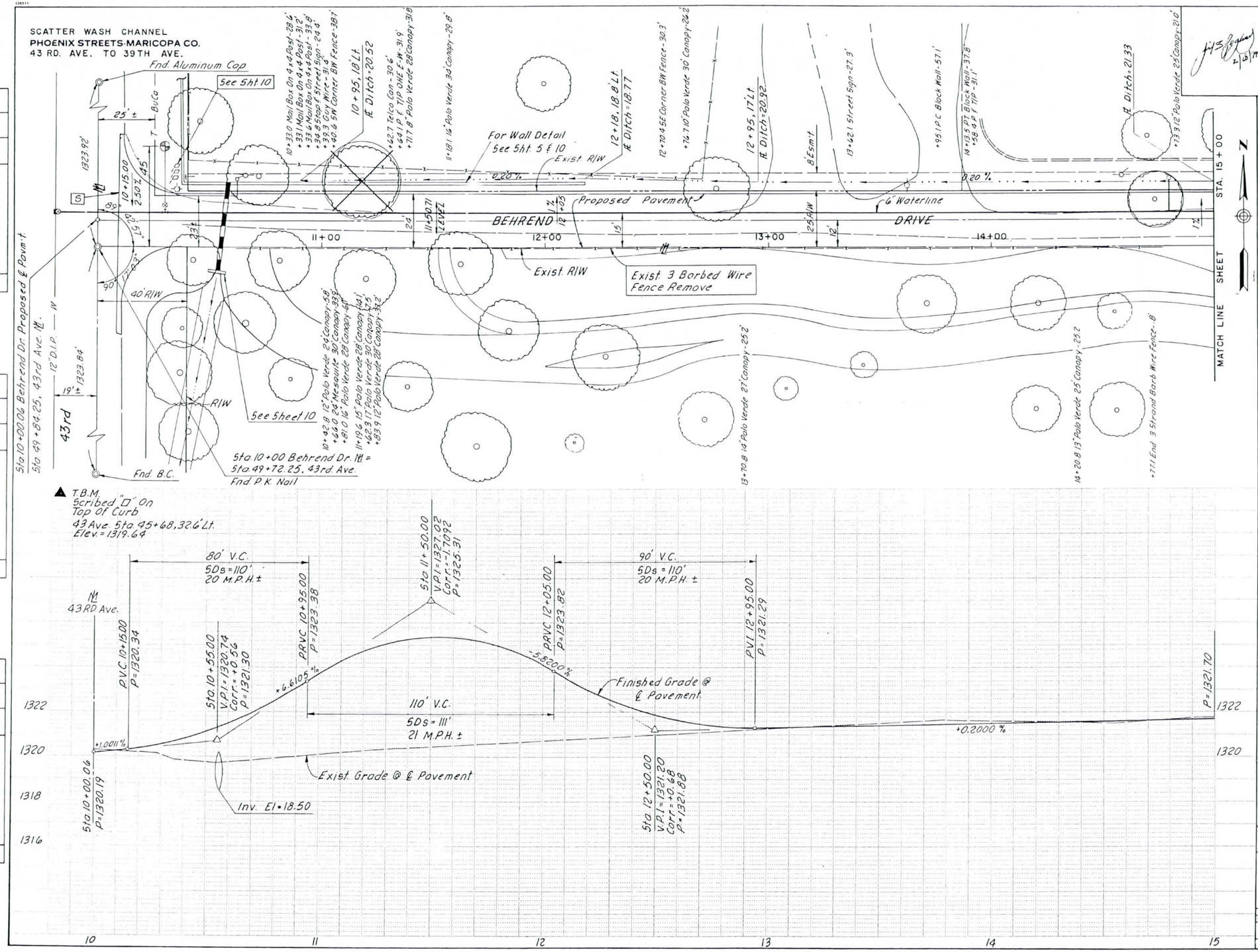
SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43 RD. AVE. TO 39TH AVE.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

ENGINEERING ALLIANCE, CONSULTING ENGINEER

DES. D.E.F.	DR. J.S.S.	CK. J.S.P.	DATE
			2/15/19

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CK'D BY	DATE



REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

BEHREND DR. PAVING

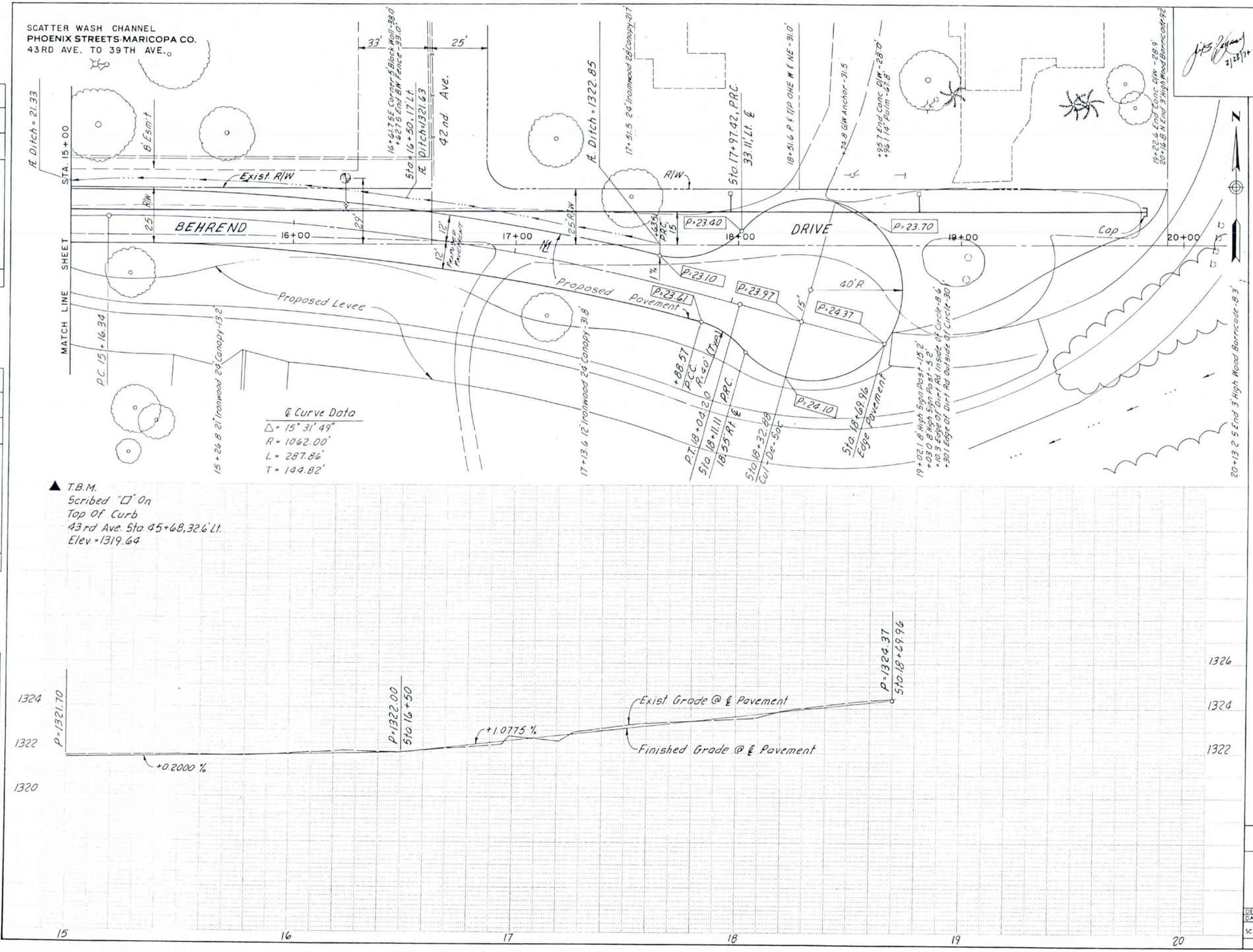
CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH AVE.
ST - 914085

DES. D.E.F.	DR. J.S.S.	CK. J.S.P.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE	DATE	DATE	12	35	

SCALE 1" = 20 HORIZONTAL / 2 VERTICAL

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43RD AVE. TO 39TH AVE.



℄ Curve Data
Δ = 15° 31' 49"
R = 1062.00'
L = 287.86'
T = 144.82'

▲ T.B.M.
Scribed "□" On
Top Of Curb
43rd Ave. Sta 45+68, 32.6' Lt.
Elev. = 1319.64

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX				
NO.	DESCRIPTION	REV BY	CK'D BY	DATE

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

EA ENGINEERING ALLIANCE, CONSULTING ENGINEER

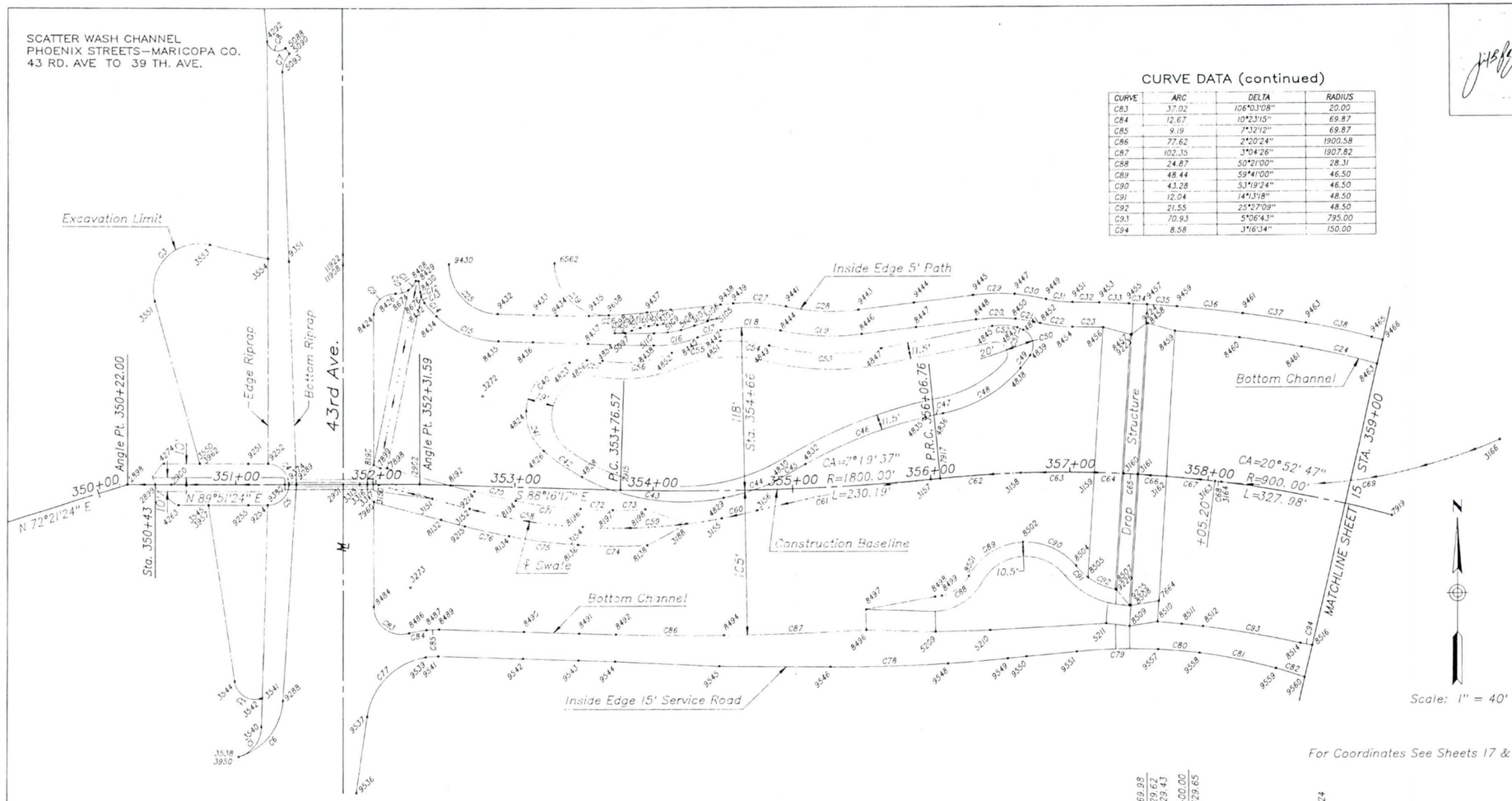
DES. D.E.F.	DR. J.S.S.	CK. J.S.P.	DATE
			7/28/74

BEHREND DR. PAVING
CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH AVE.
ST-914085

DES. D.E.F. DATE	DR. J.S.S. DATE	CK. J.S.P. DATE	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE 1" = 20 HORIZONTAL, 2 VERTICAL			13	35	

SCATTER WASH CHANNEL
PHOENIX STREETS–MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.

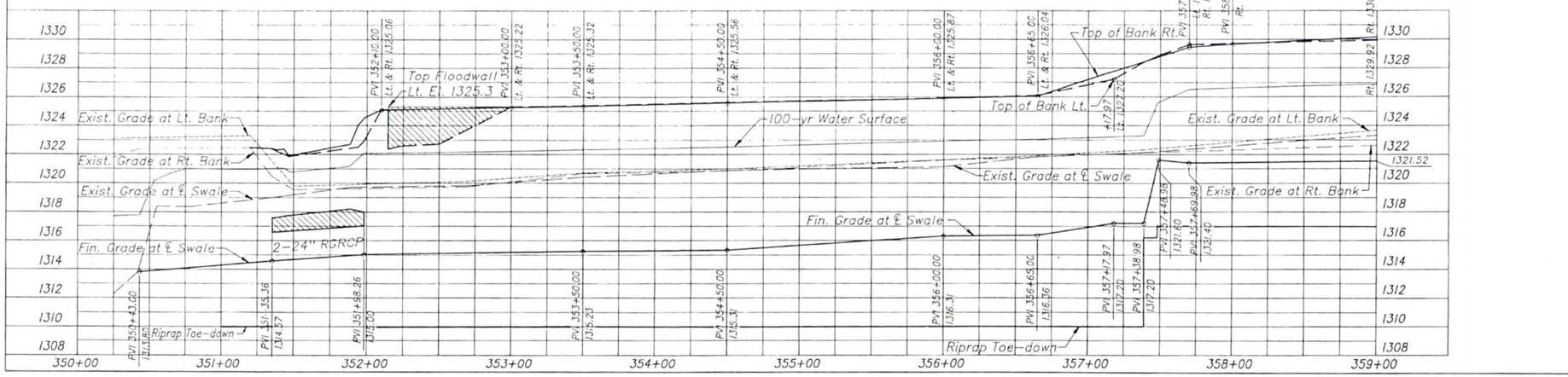


Scale: 1" = 40'

For Coordinates See Sheets 17 & 18.

CURVE DATA (continued)

CURVE	ARC	DELTA	RADIUS
C83	37.02	106°03'08"	20.00
C84	12.67	10°23'15"	69.87
C85	9.19	7°32'12"	69.87
C86	77.62	2°20'24"	1900.58
C87	102.35	3°04'26"	1907.82
C88	24.87	50°21'00"	28.31
C89	48.44	59°41'00"	46.50
C90	43.28	53°19'24"	46.50
C91	12.04	14°13'18"	48.50
C92	21.55	25°27'09"	48.50
C93	70.93	5°06'43"	795.00
C94	8.58	3°16'34"	150.00



F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE

DES: DEF DR: DEF CK: JSP DATE: 2/26/94

CURVE DATA

CURVE	ARC	DELTA	RADIUS
C1	29.10	72°29'56"	23.00
C2	24.93	95°12'37"	15.00
C3	68.61	119°07'32"	33.00
C4	23.37	89°15'44"	15.00
C5	23.76	90°44'16"	15.00
C6	54.89	69°52'52"	45.00
C7	14.41	41°16'11"	20.00
C8	16.97	121°31'29"	8.00
C9	24.37	93°05'23"	15.00
C10	9.82	37°29'48"	15.00
C11	8.75	33°25'25"	15.00
C12	3.21	10°50'04"	17.00
C13	5.24	17°39'44"	17.00
C14	12.96	10°54'57"	68.04
C15	42.19	41°25'18"	68.04
C16	32.18	24°07'39"	76.42
C17	17.64	11°11'56"	90.24
C18	43.07	23°35'48"	104.58
C19	58.69	18°52'33"	178.14
C20	28.52	12°51'30"	127.08
C21	18.08	8°09'14"	127.08
C22	23.38	13°23'55"	100.00
C23	22.21	1°15'58"	1005.00
C24	55.61	6°36'13"	482.50
C25	55.35	87°50'38"	36.10
C26	42.01	4°48'51"	500.00
C27	38.02	18°32'18"	117.50
C28	52.62	19°58'20"	150.95
C29	30.12	11°56'16"	144.58
C30	22.90	9°04'28"	144.58
C31	19.29	13°23'55"	82.50
C32	19.47	7°05'27"	1022.49
C33	21.27	1°11'31"	1022.51
C34	13.08	0°43'58"	1022.49
C35	21.76	1°13'09"	1022.51
C36	47.70	2°40'23"	1022.50
C37	45.67	2°33'34"	1022.50
C38	48.61	5°34'14"	500.00
C39	60.67	92°09'05"	37.72
C40	50.93	79°57'08"	36.50
C41	32.67	51°17'00"	36.50
C42	33.43	12°25'21"	154.18
C43	105.15	39°04'21"	154.18
C44	40.06	14°53'17"	154.18
C45	23.91	6°49'32"	200.73
C46	93.24	15°42'24"	340.13
C47	12.93	2°10'42"	340.13
C48	65.94	37°34'46"	100.53
C49	11.53	6°34'16"	100.53
C50	21.64	99°12'24"	12.50
C51	4.79	7°30'56"	36.50
C52	18.49	29°01'05"	36.50
C53	81.37	25°45'56"	180.95
C54	35.08	18°18'55"	109.73
C55	36.31	18°57'43"	109.73
C56	50.84	32°33'56"	89.45
C57	11.31	15°43'13"	41.22
C58	82.78	11°29'03"	413.00
C59	100.45	13°56'09"	413.00
C60	26.13	3°37'32"	413.00
C61	126.87	8°04'37"	900.00
C62	65.05	4°08'29"	900.00
C63	52.97	3°22'21"	900.00
C64	21.01	1°20'14"	900.00
C65	10.00	0°38'12"	900.00
C66	21.00	1°20'13"	900.00
C67	35.22	2°14'32"	900.00
C68	4.71	0°40'31"	400.00
C69	205.85	29°29'10"	400.00
C70	30.49	4°22'05"	400.00
C71	47.18	6°45'27"	400.00
C72	23.59	3°22'43"	400.00
C73	23.59	3°22'43"	400.00
C74	50.24	6°45'27"	426.00
C75	50.24	6°45'27"	426.00
C76	32.48	4°22'05"	426.00
C77	64.22	72°58'34"	50.42
C78	84.88	4°07'33"	1178.77
C79	58.63	8°40'04"	387.55
C80	30.16	4°27'31"	387.55
C81	56.11	8°17'42"	387.55
C82	21.46	2°33'02"	482.00

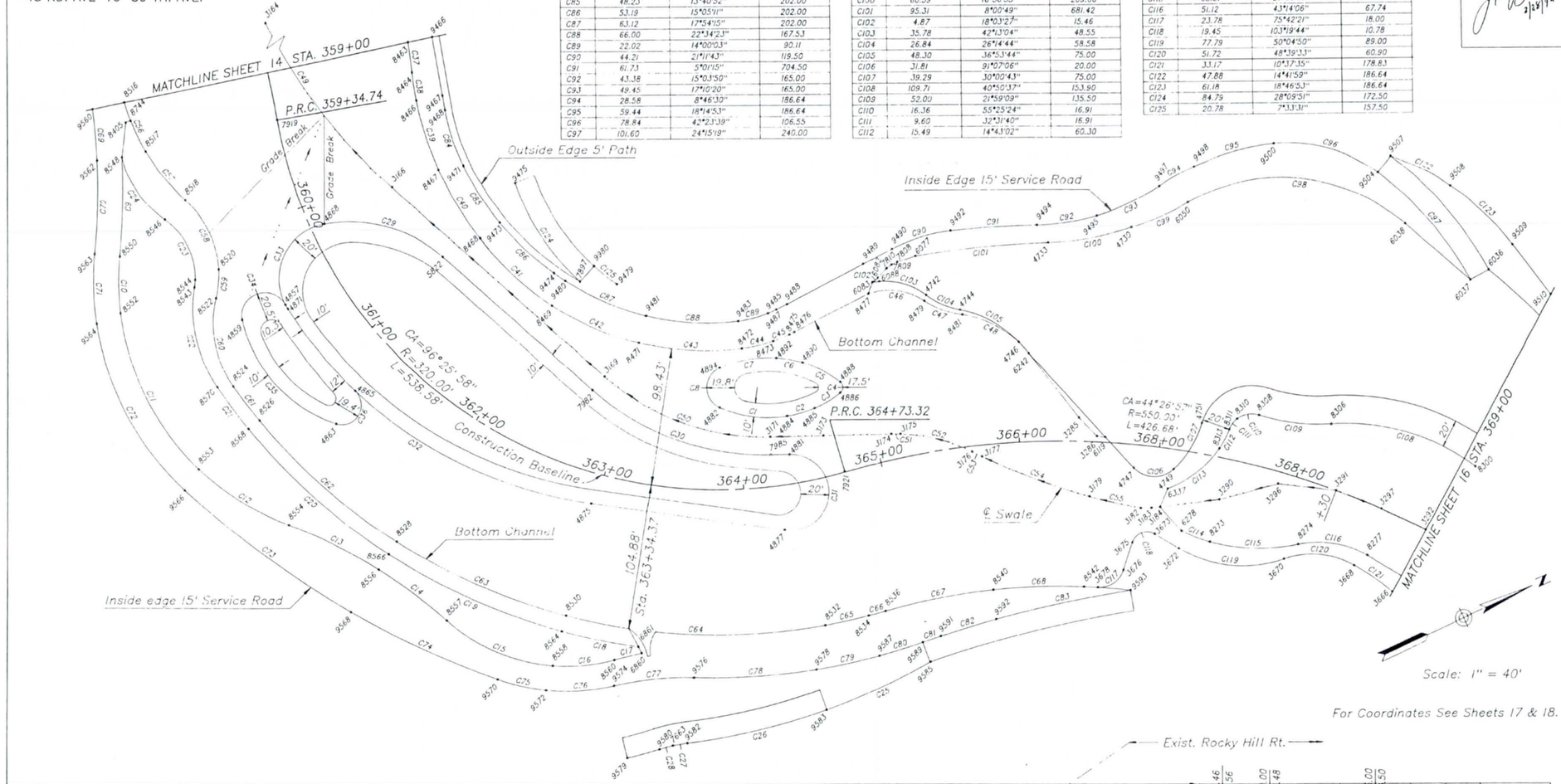
CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

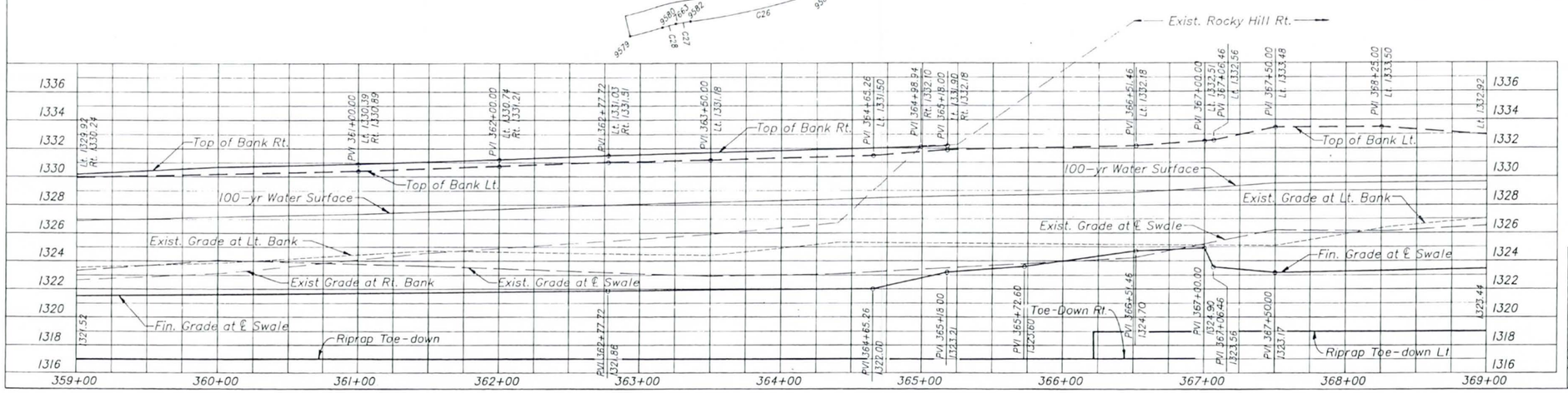
SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST–914085

DR: DEF	DES: DEF	CK: JSP	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE: 2/94	DATE: 2/94	DATE: 2/94			

CHANNEL GEOMETRIC LAYOUT & PROFILE — 14 — 35

SCATTER WASH CHANNEL
PHOENIX STREETS—MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.





CURVE DATA (continued)

CURVE	ARC	DELTA	RADIUS
C83	97.94	6°43'10"	835.16
C84	42.14	16°05'54"	150.00
C85	48.23	13°40'52"	202.00
C86	53.19	15°05'11"	202.00
C87	63.12	17°54'15"	202.00
C88	66.00	22°34'23"	167.53
C89	22.02	14°00'03"	90.11
C90	44.21	21°11'43"	119.50
C91	61.73	5°01'15"	704.50
C92	43.38	15°03'50"	165.00
C93	49.45	17°10'20"	165.00
C94	28.58	8°46'30"	186.64
C95	59.44	18°14'53"	186.64
C96	78.84	42°23'39"	106.55
C97	101.60	24°15'19"	240.00

CURVE DATA (continued)

CURVE	ARC	DELTA	RADIUS
C98	165.73	70°20'21"	135.00
C99	44.08	12°05'01"	209.00
C100	60.59	16°36'33"	209.00
C101	95.31	8°00'49"	681.42
C102	4.87	18°03'27"	15.46
C103	35.78	42°13'04"	48.55
C104	26.84	26°14'44"	58.58
C105	48.30	36°53'44"	75.00
C106	31.81	9°07'06"	20.00
C107	39.29	30°00'43"	75.00
C108	109.71	40°50'37"	153.90
C109	52.00	21°59'09"	135.50
C110	16.36	55°25'24"	16.91
C111	9.60	32°31'40"	16.91
C112	15.49	14°43'02"	60.30

CURVE DATA (continued)

CURVE	ARC	DELTA	RADIUS
C113	47.51	34°01'40"	80.00
C114	21.56	9°29'13"	130.21
C115	63.51	27°56'47"	130.21
C116	51.12	43°14'06"	67.74
C117	23.78	75°42'21"	18.00
C118	19.45	103°19'44"	10.78
C119	77.79	50°04'50"	89.00
C120	51.72	48°39'33"	60.90
C121	33.17	10°37'35"	178.83
C122	47.88	14°41'59"	186.64
C123	61.18	18°46'53"	186.64
C124	84.79	28°09'51"	172.50
C125	20.78	7°33'31"	157.50

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

EA ENGINEERING ALLIANCE

DES: DEF	DR: DEF	CK: JSP	DATE: 2/25/94

CURVE DATA

CURVE	ARC	DELTA	RADIUS
C1	48.89	33°12'00"	84.37
C2	20.41	13°51'39"	84.37
C3	21.55	14°38'10"	84.37
C4	9.14	104°46'33"	5.00
C5	30.53	20°44'05"	84.37
C6	18.98	12°53'21"	84.37
C7	41.34	28°04'21"	84.37
C8	35.66	131°49'51"	15.50
C9	70.56	8°05'10"	500.00
C10	40.82	12°29'28"	187.26
C11	127.35	38°57'54"	187.26
C12	76.33	23°21'21"	187.26
C13	72.50	11°36'25"	357.89
C14	61.04	9°46'19"	357.89
C15	83.97	37°34'29"	128.04
C16	44.44	19°53'10"	128.04
C17	20.14	3°15'31"	354.15
C18	55.71	7°18'25"	436.87
C19	136.28	17°52'22"	436.87
C20	136.00	17°50'11"	436.87
C21	37.37	4°54'02"	436.87
C22	74.78	42°50'51"	100.00
C23	50.50	57°52'31"	50.00
C24	54.62	41°43'29"	75.00
C25	82.03	10°16'24"	457.50
C26	101.62	12°43'34"	457.50
C27	10.56	5°29'58"	110.00
C28	9.89	5°08'58"	110.00
C29	91.11	52°12'12"	100.00
C30	138.25	43°06'10"	183.77
C31	91.29	189°30'16"	27.60
C32	266.53	49°15'41"	310.00
C33	78.28	112°08'01"	40.00
C34	47.36	164°26'58"	16.50
C35	104.92	60°06'55"	100.00
C36	37.73	154°25'11"	14.00
C37	21.89	2°35'57"	482.50
C38	20.46	5°02'00"	232.95
C39	51.93	12°46'22"	232.95
C40	57.66	14°10'56"	232.95
C41	70.58	19°54'51"	203.06
C42	68.00	19°11'11"	203.06
C43	73.68	20°47'22"	203.06
C44	22.99	13°10'21"	100.00
C45	12.44	7°07'44"	100.00
C46	41.85	53°13'40"	45.05
C47	29.20	26°56'49"	62.08
C48	45.40	38°55'41"	66.82
C49	205.85	29°29'10"	400.00
C50	128.44	43°05'28"	170.77
C51	6.57	3°04'10"	122.64
C52	53.21	24°51'38"	122.64
C53	7.82	0°57'24"	468.17
C54	81.73	10°00'09"	468.18
C55	37.61	4°36'08"	468.18
C56	38.71	14°47'14"	150.00
C57	44.81	17°06'55"	150.00
C58	56.14	44°40'32"	72.00
C59	20.84	16°34'54"	72.00
C60	66.34	48°43'42"	78.00
C61	30.50	4°06'42"	425.00
C62	132.81	17°54'18"	425.00
C63	132.81	17°54'18"	425.00
C64	185.94	25°04'01"	425.00
C65	31.88	4°17'50"	425.00
C66	12.37	1°40'06"	425.00
C67	78.22	10°04'17"	445.00
C68	64.73	8°20'04"	445.00
C69	37.38	4°26'37"	482.00
C70	66.62	7°55'09"	482.00
C71	50.32	14°02'50"	205.26
C72	137.51	38°23'07"	205.26
C73	148.47	13°05'13"	650.00
C74	115.49	10°10'49"	650.00
C75	35.73	14°01'03"	146.04
C76	48.76	19°07'55"	146.04
C77	57.39	15°17'41"	215.00
C78	87.11	11°10'44"	446.48
C79	46.04	5°54'29"	446.48
C80	32.67	4°11'34"	446.48
C81	13.76	0°56'38"	835.16
C82	40.95	2°48'35"	835.16

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST-914085

DR: DEF DATE: 2/94	DES: DEF DATE: 2/94	CK: JSP DATE: 2/94	SHEET NO.	TOTAL SHEETS	AS BUILT
CHANNEL GEOMETRIC LAYOUT & PROFILE			15	35	

SCATTER WASH CHANNEL
PHOENIX STREETS—MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.

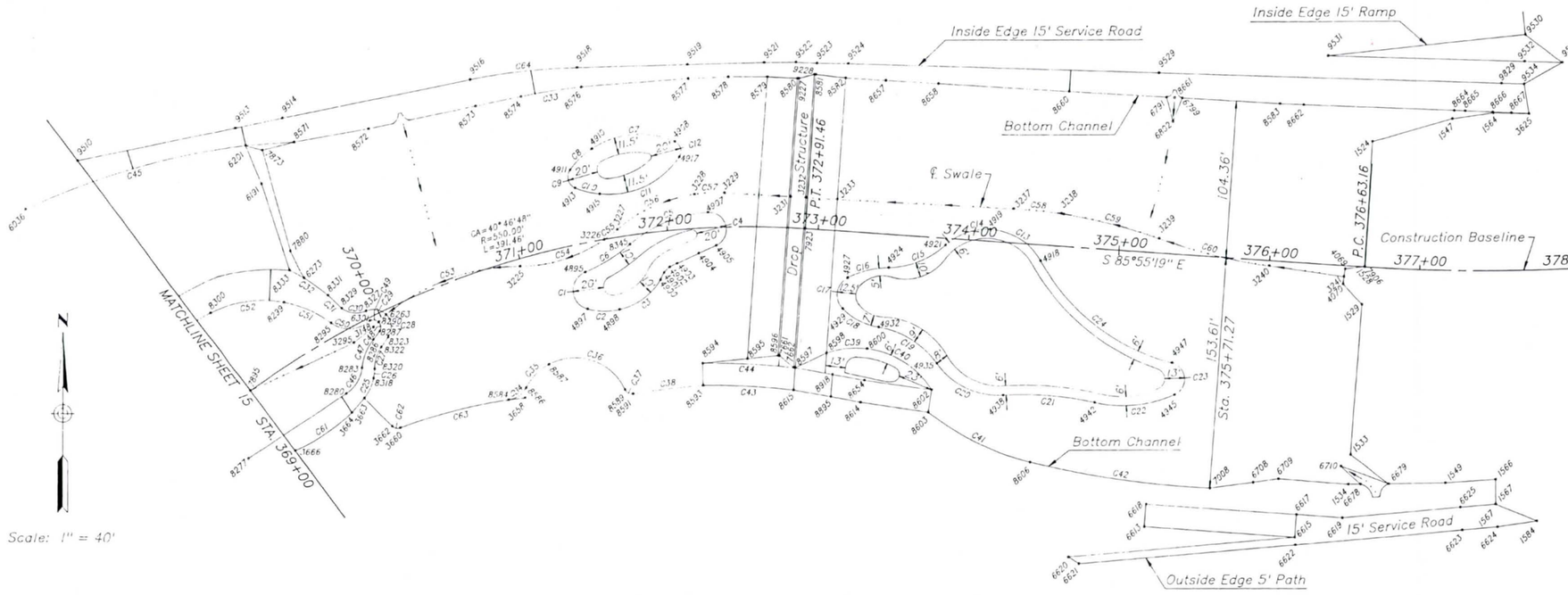
F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE

DES: DEF | DR: DEF | CK: JSP | DATE: 2/27/94

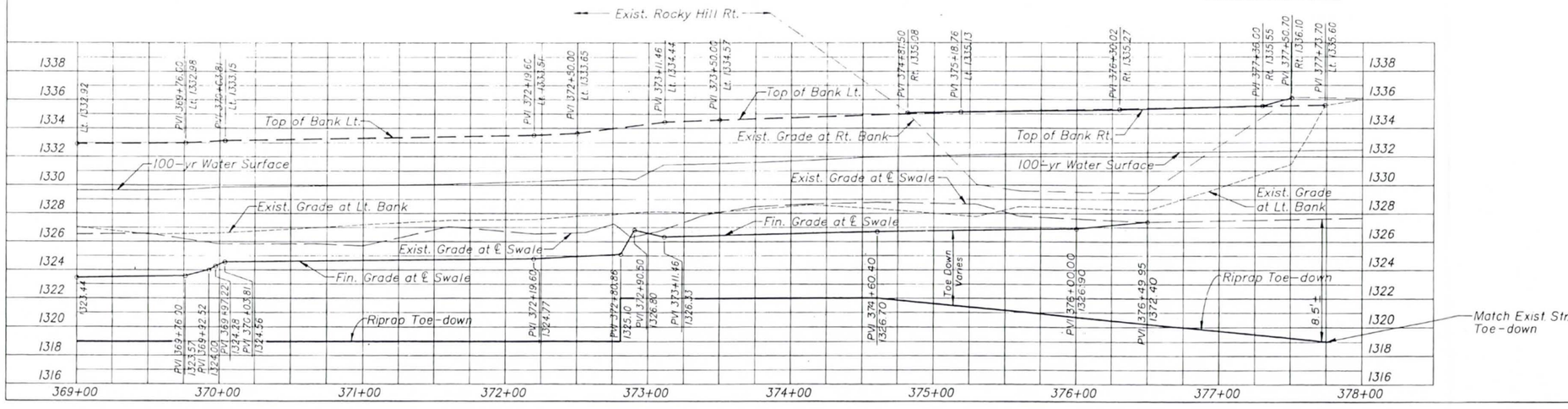
CURVE DATA

CURVE	ARC	DELTA	RADIUS
C1	32.14	141°38'53"	13.00
C2	21.26	28°25'13"	42.86
C3	34.44	46°02'17"	42.86
C4	31.92	158°55'27"	11.51
C5	56.71	37°20'44"	87.00
C6	35.14	17°49'04"	113.00
C7	57.58	58°24'42"	56.48
C8	20.35	20°38'39"	56.48
C9	14.29	102°21'43"	8.00
C10	16.80	17°02'36"	56.48
C11	61.13	62°00'43"	56.48
C12	12.16	99°31'36"	7.00
C13	41.24	57°44'21"	40.92
C14	32.37	45°19'33"	40.92
C15	41.52	41°17'04"	57.62
C16	28.07	26°07'13"	61.57
C17	24.29	107°39'48"	12.93
C18	27.10	36°01'24"	43.10
C19	46.66	45°44'40"	58.44
C20	51.68	58°48'12"	50.36
C21	60.54	16°24'21"	211.43
C22	54.04	36°13'46"	85.46
C23	28.17	141°51'30"	11.38
C24	113.22	46°54'56"	138.27
C25	14.99	26°26'18"	32.48



CURVE DATA (continued)

CURVE	ARC	DELTA	RADIUS
C26	6.39	11°16'05"	32.48
C27	15.49	33°29'37"	26.50
C28	16.38	79°30'55"	11.81
C29	14.26	69°10'08"	11.81
C30	17.11	61°14'33"	16.01
C31	12.70	13°23'23"	54.34
C32	30.46	14°31'32"	120.16
C33	40.68	5°58'37"	390.00
C34	14.65	55°56'48"	15.00
C35	22.49	35°30'38"	36.29
C36	59.66	94°11'48"	36.29
C37	6.61	75°42'05"	5.00
C38	46.58	5°59'50"	445.00
C39	27.20	26°33'45"	58.67
C40	52.60	51°22'09"	58.67
C41	76.02	24°43'22"	176.17
C42	120.52	10°56'56"	630.66
C43	60.05	7°46'50"	442.18
C44	61.33	7°41'10"	457.18
C45	152.20	18°07'37"	481.08
C46	20.86	50°54'20"	23.48
C47	20.83	33°37'33"	35.50
C48	6.61	77°15'12"	4.90
C49	6.28	73°24'25"	4.90
C50	28.11	80°32'14"	20.00
C51	34.38	26°20'55"	74.76
C52	50.05	38°21'30"	74.76
C53	96.22	38°59'15"	141.41
C54	59.67	34°11'10"	100.00
C55	10.88	6°13'58"	100.00
C56	57.09	32°42'35"	100.00
C57	19.87	11°22'59"	100.00
C58	31.83	5°23'23"	338.42
C59	66.93	11°19'27"	338.65
C60	75.22	11°46'57"	365.77
C61	45.65	18°55'42"	138.17
C62	5.81	66°32'08"	5.00
C63	85.40	15°31'17"	315.23
C64	71.70	10°08'05"	405.35



For Coordinates See Sheets 17 & 18.

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST—914085

DR: DEF	DES: DEF	CK: JSP	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE: 2/94	DATE: 2/94	DATE: 2/94			

CHANNEL GEOMETRIC LAYOUT & PROFILE | 16 | 35

SCATTER WASH CHANNEL
PHOENIX STREETS—MARICOPA CO.
43 RD. AVE TO 39 TH. AVE.

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ				

ENGINEERING ALLIANCE

DES: DEF | DR: DEF | CK: JSP | DATE: 2/27/94

2/28/94

PT. #	NORTH	EAST	ELEV.	DESCRIPTION
1524	70455.2774	30797.6693	1327.70	EX GRD
1528	70371.9888	30791.7312	1327.40	EX GRD
1529	70347.0521	30789.9534	1327.50	EX GRD
1533	70247.3053	30782.8419	1328.20	EX GRD
1534	70227.6551	30781.4410	1328.10	BOT CHAN RT
1547	70470.2785	30851.7991	1327.90	BOTTOM
1549	70228.3327	30846.6804	1328.10	SOUTH EDGE
1564	70474.0565	30879.1438	1328.00	BOTTOM
1566	70230.6278	30880.3427	1328.08	TOE OF CHAN
1567	70214.2845	30880.4232	1336.16	TOP
1584	70203.0985	30907.6271	1335.69	TOP
2898	69698.5379	28528.9267	0.00	ANGLE PT CHANNEL 20' WEST OF WEST WALL
2899	69698.5880	28548.9267	1313.80	CL CHANNEL @ WEST WALL
2900	69698.6170	28560.5157	0.00	CL CHANNEL @ EAST WALL
2901	69698.9247	28683.5178	0.00	CL CHAN @ 43RD ML 48+14.00
2902	69699.0623	28738.5176	0.00	ANGLE PT CHANNEL 55' RT ML 43RD AVE
3148	70333.3669	30135.2423	1324.00	CL SWALE/RP CATCHMENT
3150	69698.6223	28709.9008	1315.01	CL SWALE
3151	69688.2597	28747.7469	1315.06	CL SWALE
3152	69681.0937	28774.6098	1315.09	CL SWALE
3154	69667.8889	28856.1897	1315.20	CL SWALE
3155	69674.0334	28956.2058	1315.30	CL SWALE
3156	69679.5982	28981.7359	1315.47	CL SWALE
3157	69701.7649	29106.5504	1316.30	CL SWALE
3158	69706.2582	29171.4355	1316.36	CL SWALE
3159	69706.4471	29224.4017	1317.20	CL SWALE
3160	69705.6588	29245.3932	1317.20	CL SWALE
3161	69705.1115	29255.3785	1321.60	CL SWALE
3162	69703.6011	29276.3251	1321.40	CL SWALE
3163	69699.9725	29311.3555	1321.44	CL SWALE
3164	69699.4226	29316.0382	1321.44	CL SWALE
3165	69707.0504	29449.6177	1321.58	CL SWALE
3166	69729.1058	29517.4513	1321.65	CL SWALE
3169	69808.9380	29704.3739	1321.86	CL SWALE
3171	69897.1219	29793.5726	1321.97	CL SWALE
3173	69931.6560	29808.7913	1322.00	CL SWALE
3174	69976.1491	29828.3986	1323.06	CL SWALE
3175	69982.0871	29831.2077	1323.20	CL SWALE
3176	70022.9531	29864.6346	1323.55	CL SWALE
3177	70027.8439	29870.7338	1323.60	CL SWALE
3179	70084.7993	29929.2086	1324.70	CL SWALE
3182	70114.2413	29952.5874	1324.87	CL SWALE
3183	70121.2088	29955.6588	1324.90	CL SWALE
3184	70126.9798	29957.6855	1323.55	CL SWALE
3188	69670.2174	28931.3884	1315.28	CL SWALE
3225	70373.8069	30232.3248	1324.62	CL SWALE
3226	70391.4398	30288.4028	1324.69	CL SWALE
3227	70398.0836	30297.0099	1324.70	CL SWALE
3228	70421.3718	30348.2864	1324.77	CL SWALE
3229	70422.1953	30368.1039	1324.87	CL SWALE
3231	70419.6596	30411.9241	1325.10	CL SWALE
3232	70419.0818	30421.9083	1326.80	CL SWALE
3233	70417.8685	30442.8751	1326.33	CL SWALE
3237	70411.1009	30559.8244	1326.62	CL SWALE
3238	70407.7716	30591.4718	1326.70	CL SWALE
3239	70391.1955	30656.2079	1326.80	CL SWALE
3240	70372.8616	30729.0195	1326.90	CL SWALE
3241	70365.6938	30778.5031	1327.40	CL SWALE
3272	69762.7232	28783.8671	1317.70	BREAK POINT
3273	69624.0000	28732.2000	1317.60	BREAK POINT
3285	70102.2000	29874.7000	1324.80	BOT CHAN LT
3286	70108.1000	29892.2000	1324.90	BOT CHAN LT
3290	70167.5745	29970.7255	1323.17	CL SWALE
3291	70245.4580	30000.2959	1323.31	CL SWALE
3292	70290.7474	30053.6087	1323.44	CL SWALE
3295	70323.0570	30122.2968	1323.57	CL SWALE
3296	70210.0658	29978.1618	1323.24	CL SWALE
3297	70268.9512	30026.2315	1323.37	CL SWALE
3315	69698.9547	28695.5178	1318.14	EDGE EAST @ CHANNEL CST BASELINE
3316	69698.9686	28701.0570	1317.78	GRADE BRK CHANNEL CST BASELINE
3317	69698.9789	28705.1852	1315.00	FL 2-24' PIPES
3473	70450.3326	30332.2970	1326.09	RP TOE I8
3474	69885.2161	29749.2156	1324.47	RP I5
3538	69501.6856	28609.5594	1318.77	MATCH
3539	69523.7794	28603.1669	1318.72	RP CST LIMIT
3540	69523.2320	28626.1604	1318.57	MATCH
3541	69544.0956	28626.6572	1318.48	MATCH
3542	69543.7000	28625.0404	1318.49	MATCH
3543	69558.2703	28621.4755	1318.48	RP CST LIMIT
3544	69556.0432	28606.6417	1318.66	MATCH
3545	69683.6844	28587.4786	1318.35	MATCH
3550	69713.6684	28581.0729	1318.34	MATCH
3551	69830.9244	28548.4748	1318.55	MATCH
3552	69839.7635	28580.2690	1318.69	RP CST LIMIT
3553	69871.8396	28588.0227	1318.88	MATCH
3554	69861.7303	28629.8440	1318.98	MATCH
3625	70473.5452	30902.7009	1327.99	CST LIMIT
3658	70285.7797	30235.8538	1325.00	CST LIMIT
3659	69972.1343	30267.4485	0.00	RP CST LIMIT
3660	70265.8867	30153.0754	1325.78	CST LIMIT
3661	70270.5460	30151.2613	1325.72	RP CST LIMIT
3662	70267.0267	30147.7097	1326.82	CST LIMIT
3663	70285.6463	30129.2596	1326.51	CST LIMIT
3664	70276.1329	30121.1185	1326.67	CST LIMIT
3665	70376.2548	30025.9010	1326.05	RP CST LIMIT
3666	70250.6597	30083.4913	1326.90	CST LIMIT
3667	70088.1071	30158.0281	0.00	RP CST LIMIT
3668	70234.1269	30054.7939	1326.26	CST LIMIT
3669	70184.4012	30089.9494	0.00	RP CST LIMIT
3670	70190.8523	30029.3942	1325.19	CST LIMIT
3671	70200.2800	29940.8978	1323.60	RP CST LIMIT
3672	70126.3582	29990.4564	1326.72	CST LIMIT
3673	70115.2211	29973.8442	1326.78	CST LIMIT
3674	70106.2643	29979.8490	0.00	RP CST LIMIT
3675	70098.3564	29972.5178	1326.59	CST LIMIT
3676	70084.1791	29987.8105	1326.44	CST LIMIT
3677	70070.9789	29975.5730	1325.81	RP CST LIMIT
3678	70062.3794	29991.3860	1326.14	CST LIMIT
3950	69501.6856	28609.5594	1318.77	BOT RIPRAP
3957	69683.6844	28587.4786	1318.35	TOP
3962	69713.6684	28581.0729	1318.34	TOP
4069	70370.6433	30779.2198	1327.38	CST LIMIT
4070	70360.7454	30777.7863	1327.43	CST LIMIT

PT. #	NORTH	EAST	ELEV.	DESCRIPTION
4263	69683.6304	28565.8840	1318.41	TOP
4274	69713.6036	28555.1474	1318.42	TOP
4292	70018.0458	28629.1100	1319.30	BOT RIPRAP
4729	70222.7992	29561.0601	0.00	RP I6
4730	70194.3675	29768.1180	1325.29	I6
4732	70218.8602	29560.5581	0.00	RP I6
4733	70136.0602	29752.4569	1324.89	I6
4734	69866.1008	30378.1192	0.00	RP I6
4738	70008.7781	29709.2022	1331.89	RP I6
4741	69998.2898	29771.9345	1324.00	RP I6
4742	70041.2457	29749.3036	1325.34	I6
4743	70093.0759	29721.9973	1331.64	RP I6
4744	70058.6645	29769.4089	1325.34	I6
4745	70014.6100	29830.1066	1323.67	RP I6
4746	70086.2821	29808.0134	1324.78	I6
4747	70121.9972	29923.8760	1325.64	I6
4748	70141.1097	29917.9845	1325.75	RP I6
4749	70147.3732	29936.9784	1325.96	I6
4750	70123.8853	29865.7512	1325.53	RP I6
4751	70179.8504	29915.6801	1325.74	I6
4823	69786.8038	28846.5576	1316.49	TOE I1
4824	69751.8527	28815.2837	1316.45	TOE I1
4825	69750.6772	28851.7648	1320.48	RP TOE I1
4826	69722.9482	28828.0298	1316.33	TOE I1
4827	69840.0823	28928.2924	1324.11	RP TOE I1
4828	69704.1220	28855.5752	1316.19	TOE I1
4829	69688.6958	28957.5349	1316.11	TOE I1
4830	69701.2912	28995.4492	1316.48	TOE I1
4831	69881.9764	28908.0211	1322.67	RP TOE I1
4832	69712.9626	29016.3038	1316.74	TOE I1
4833	69416.1486	29182.4005	0.00	RP TOE I1
4835	69746.8441	29102.8572	1317.60	TOE I1
4836	69749.6285	29115.4843	1317.64	TOE I1
4837	69848.1968	29095.7055	1323.35	RP TOE I1
4838	69782.1428	29171.4932	1317.80	TOE I1
4839	69791.2495	29178.5542	1317.84	TOE I1
4840	69798.3301	29168.2530	1320.44	RP TOE I1
4841	69809.6315	29173.5944	1317.89	TOE I1
4842	69776.6320	29157.9979	1319.78	RP TOE I1
4843	69811.3880	29169.1441	1317.90	TOE I1
4844	69776.6314	29157.9977	1319.78	RP TOE I1
4845	69812.4319	29150.8852	1317.88	TOE I1
4847	69796.5482	29070.9358	1317.57	TOE I1
4848	69974.0289	29035.6754	0.00	RP TOE I1
4849	69798.8660	28990.2810	1316.89	TOE I1
4850	69692.6493	28962.7544	1317.29	RP TOE I1
4851	69802.1353	28955.5084	1316.61	TOE I1
4852	69793.8395	28920.3252	1316.57	TOE I1
4853	69876.3323	28885.7359	1323.90	RP TOE I1
4854	69788.1912	28870.4839	1316.51	TOE I1
4855	69747.5756	28863.4558	1320.50	RP TOE I1
4856	69788.5762	28859.2165	1316.50	TOE I1
4857	69623.9071	29560.6198	1323.06	TOE I3
4858	69607.4247	29561.3814	1323.47	RP I3
4859	69591.3415	29557.6965	1323.13	TOE I3
4860	69688.8178	29580.0301	1323.92	RP I3
4863	69620.8861	29653.4169	1323.23	TOE I3
4864	69630.3961	29643.1427	1323.64	RP I3
4865	69643.4102	29637.9818	1323.12	TOE I3
4867	69648.6694	29616.8175	1323.85	RP I4
4868	69673.9945	29520.0774	1322.99	TOE I4
4869	69663.8645	29558.7734	1323.79	RP I4
4871	69624.2034	29563.9692	1323.06	TOE I4
4872	69931.5770	29523.7019	0.00	RP I4
4875	69761.4921	29782.8758	1323.30	TOE I4
4877	69877.6446	29859.1020	1323.41	TOE I4
4879	69892.7877	29836.0272	1325.43	RP I4
4881	69903.9126	29810.7686	1322.81	TOE I4
4882	69873.5028	29759.3666	1322.76	I5
4883	69937.2582	29704.1146	1331.43	RP I5
4884	69914.1639	29785.2577	1323.03	I5
4885	69934.2752	29788.4274	1323.40	I5
4886	69955.6759	29786.4452	1323.80	I5
4887	69954.5844	29781.5658	1324.21	RP I5
4888	69959.0240	29779.2660	1323.85	I5
4889	69884.1137	29818.0719	1324.98	RP I5
4890	69940.4331	29755.2580	1323.50	I5
4891	69884.1128	29818.0729	1324.98	RP I5
4892	69925.0023	29744.2776	1323.20	I5
4894	69885.4644	29733.7175	1322.86	I5
4895	70369.7596	30275.7790	1325.25	TOE I7
4896	70357.7897	30280.8508	1326.53	RP TOE I7
4897	70345.2558	30277.4010	1325.32	TOE I7
4898	70344.8229	30298.4391	1325.40	TOE I7
4899	70386.5795	30288.7748	1324.89	RP TOE I7
4900	70364.5492	30325.5399	1325.49	TOE I7
4901	70369.2663	30327.8757	1325.50	TOE I7
4902	70373.0793	30331.7335	1325.52	TOE I7
4903	70375.3887	30336.5772	1325.54	TOE I7
4904	70381.9753	30351.0145	1325.60	TOE I7
4905	70387.2503	30362.5768	1325.63	TOE I7
4906	70397.7198	30357.8031	1326.58	RP TOE I7
4907	70409.2060	30357.1135	1325.53	TOE I7
4908	70456.7077	30335.1880	1325.60	TOE I8
4909	70405.2709	30311.8628	1324.87	RP TOE I8
4910	70452.0834	30280.2652	1325.50	TOE I8
4911	70437.9374	30265.7898	1325.46	TOE I8
4912	70433.3103	30272.3159	1325.81	RP TOE I8
4913	70425.9449	30269.1932	1325.42	TOE I8
4914	70477.9434	30291.2389	1325.63	RP TOE I8
4915	70421.7670	30285.4019	1325.45	TOE I8
4917	70446.4264	30338.1058	1325.56	TOE I8
4918	70376.5706	30577.7067	1327.49	TOE I10
4919	70397.5541	30544.2227	1327.38	TOE I10
4920	70356.6961	30541.9350	1328.50	RP TOE I10
4921	70387.0492	30514.4886	1327.38	TOE I10
4922	70429.7861	30475.8442	1326.59	RP TOE I10
4924	70372.1742	30476.6856	1327.28	TOE I10
4926	70310.6144	30477.5847	1327.76	RP TOE I10
4927	70365.4913	30449.6752	1327.25	TOE I10
4928	70353.9672	30455.5362	1327.95	RP TOE I10
4929	70344.8858	30446.3337	1327.29	TOE I10
4931	70375.1573	30477.0089	1327.23	RP TOE I10

PT. #	NORTH	EAST	ELEV.	DESCRIPTION
4932	70332.6339	30470.0027	1327.44	TOE I10
4934	70274.9746	30460.5026	1327.89	RP TOE I10
4935	70308.4085	30508.4298	1327.57	TOE I10
4937	70337.2199	30549.7309	1327.44	RP TOE I10
4938	70286.9676	30552.9831	1327.64	TOE I10
4939	70075.9813	30566.6377	0.00	RP TOE I10
4942	70282.2339	30613.1300	1327.73	TOE I10
4943	70365.6040	30631.9228	1327.16	RP TOE I10
4945	70287.2461	30666.0370	1327.81	TOE I10
4946	70297.6777	30661.4954	1328.86	RP TOE I10
4947	70308.6869	30664.3662	1327.71	TOE I10
4948	70442.4816	30699.2549	1327.52	RP TOE I10
5039	69601.1700	29546.1129	1323.11	
5085	70019.3716	28636.9994	0.00	RP BOT RIPRAP
5088	70013.3398	28642.2546	1318.90	BOT RIPRAP
5090	70009.3124	28645.2177	1318.90	BOT RIPRAP
5093	69996.1783	28640.0987	1318.83	BOT RIPRAP
5096	69995.9485	28660.0974	0.00	RP BOT RIPRAP
5097	69807.9502	28886.9054	1320.76	EDGE I0
5098	69808.1699	28879.3683	1320.73	EDGE I0
5099	69808.4686	28885.6247	1320.75	EDGE I0
5100	69810.0600	28891.6828	1320.77	EDGE I0
5101	69811.9915	28897.6505	1320.79	EDGE I0
5102	69813.3386	28903.7767	1320.81	EDGE I0
5103	69814.0792	28909.8733	1320.82	EDGE I0
5105	69818.4126	28952.9276	1320.94	EDGE I0
5106	69816.6904	28945.9435	1320.92	EDGE I0
5107	69813.4662	28936.5447	1320.91	EDGE I0
5108	69810.2889	28927.1340	1320.89	EDGE I0
5109	69808.4288	28917.3776	1320.87	EDGE I0
5110	69807.9276	28907.5084	1320.84	EDGE I0
5209	69591.4522	29110.2145	1321.44	COR RAMP
5210	69592.5751	29149.3285	1321.67	BOT CHAN RT
5211	69597.6218	29232.7567	1322.20	COR RAMP
5822	69740.6333	29577.5409	1322.98	TOE I4
6007	69977.3911	30111.6192	0.00	RP I6
6011	70248.3822	29904.1082	1325.63	RP I6
6036	70411.6924	29904.6772	1326.54	COR RAMP
6037	70396.7186	29905.5636	1326.34	COR RAMP
6038	70371.7819	29849.3588	1325.33	I6
6050	70238.3424	29769.4821	1325.25	I6
6077	70046.2009	29720.9317	1325.06	I6
6082	70014.9003	29723.4015	1325.34	I6
6083	70010.1974	29724.5998	1325.40	I6
6088	70014.8958	29726.3099	1325.38	I6
6119	70113.2204	29895.4033	1324.91	BOT CHAN LT
6191	70428.8213	30060.7997	1326.30	I6
6201	70454.5223	30050.0690	1326.70	I6
6242	70089.3535	29817.9773	1324.90	BOT CHAN LT
6263	70341.7513	30143.5574	1324.50	CATCHMENT TOP, CL SWALE
6273	70366.1073	30089.0266	1325.71	CATCHMENT TOP
6278	70133.3812	29980.1205	1323.89	CATCHMENT BOT
6301	70337.6679	30132.8930	1324.14	CATCHMENT BOT
6337	70137.5743	29947.9093	1324.04	CATCHMENT BOT
6561	69858.5965	28873.3361	0.00	RP BERM LT
6562	69858.3120	28835.6172	1325.32	PC BERM LT
6613	70199.8864	30646.4244	1329.43	COR RAMP
6615	70192.6445	30746.1618	1335.27	COR RAMP
6617	70207.6051	30747.2481	1335.27	COR RAMP
6618	70214.8470	30647.5107	1329.37	COR RAMP
6619	70205.4000	30777.6165	1335.35	ANG PT TOP
6620	70179.6980	30596.3510	1335.08	MATCH TOP
6621	70175.2755	30603.2491	1335.09	MATCH TOP
6622	70187.6631	30746.5923	1335.27	TOP
8623	70197.3083	30858.2024	1335.55	TOP
6624	70199.3402	30881.7146	1335.70	TOP
6625	70212.2526	30856.9109	1335.55	TOP 377+30
6678	70227.7369	30789.3179	1328.10	BOT CHAN RT
6679	70227.9296	30807.8658	1328.10	BOTTOM
6708	70229.0603	30718.7361	1327.98	BOT CHAN RT
6709	70231.3866	30735.1618	1327.93	BOT CHAN RT
6710	70239.6860	30776.5060	1328.00	FL DITCH
6791	70485.4668	30661.5564	1327.87	BOTTOM LT
6799	70484.8215	30671.9417	1327.89	BOTTOM LT
6802	70469.4023	30665.6395	1327.70	END DITCH FROM PIPE
6860	69748.6070	29896.1560	1325.05	TERRACE
6861	69748.3703	29890.8990	1324.97	TERRACE
7008	70225.2596	30689.7233	1327.96	BOT CHAN RT
7661	70313.9940	30404.3907	1325.80	DROP
7662	70305.7583	30413.8289	1328.10	DROP
7663	69740.7692	29965.6814	1328.20	PARK RAMP
7664	69613.7513	29270.7399	1322.62	
7808	70032.4571	29719.2535	1325.15	I6
7809	70027.9491	29719.1827	1325.19	I6
7810	70023.5291	29720.0943	1325.23	I6
7873	70451.4000	30061.3000	1326.00	BOT CHAN LT
7880	70383.9683	30080.0874	1326.00	BOT CHAN LT
7895	70290.7474	30053.6087	0.00	369+00 CL CHANNEL
7897	69821.9166	29635.2351	1330.84	COR RAMP
7898	69710.4054	28715.1666	1317.56	TOP DITCH/EDGE SWALE
7899	69710.4284	28710.0759	1317.20	FL DITCH/EDGE SWALE
7902	71519.4438	30873.9954	0.00	RP CL CHANNEL
7903	70949.5182	31873.2977	0.00	PT CL CHANNEL
7906	70371.9564	30792.1856	0.00	PC CL CHANNEL
7915	69694.6888	28883.4313	0.00	CL CHANNEL
7916	71493.8696	28937.7306	0.00	RP CL CHANNEL
7917	69702.4552	29113.3286	0.00	CL CHANNEL
7918	68806.7481	29201.1276	0.00	RP CL CHANNEL
7919	69674.9265	29438.3327	0.00	CL CHANNEL
7920	69983.6121	29522.6723	0.00	RP CL CHANNEL
7921	69934.3872	29838.8635	0.00	CL CHANNEL
7922	69849.7818	30382.3172	0.00	RP CL CHANNEL
7923	70398.3893	30421.4301	0.00	PT CL CHANNEL
7927	70080.1394	28881.0595	0.00	RP SWALE
7933	68806.7481	29201.1276	0.00	RP SWALE
7960	69686.0615	28705.5501	1317.70	EDGE SWALE
7982	69796.9827	29709.4799	1323.15	TOE I4
7983	69965.9889	29637.2995	0.00	RP I4/SWALE
7985	69891.9143	29805.4841	1322.86	TOE I4
7990	69926.6939	29940.6224	0.00	RP CL SWALE
7994	70390.4239	29574.5501	0.00	RP CL SWALE
8002	70096.9612	29360.3450	0.00	RP CL SWALE
8132	69673.1118	28754.0945	1316.92	EDGE SWALE

PT. #	NORTH	EAST	ELEV.	DESCRIPTION
8134	69661.3657	28802.9275	1316.94	EDGE SWALE
8136	69655.0814	28852.7456	1315.50	EDGE SWALE
8138	69654.7026	28902.9570	1315.50	EDGE SWALE
8190	69712.9887	28705.4827	1317.70	EDGE SWALE
8192	69698.2418	28760.7642	1316.92	EDGE SWALE
8194	69686.9247	28807.6961	1316.94	EDGE SWALE
8196	69681.0239	28854.4736	1315.50	EDGE SWALE
8197	69680.1508	28878.0418	1315.50	EDGE SWALE
8198	69680.6682	28901.6205	1315.80	EDGE SWALE
8272	70233.7912	29897.2235	1325.61	RP CATCHMENT BOT
8273	70148.4178	29995.5365	1323.70	CATCHMENT BOT
8274	70204.4477	30024.0818	1323.82	CATCHMENT BOT
8275	70189.1811	30090.0826	0.00	RP CATCHMENT BOT
8277	70245.5135	30052.4551	1323.92	CATCHMENT BOT
8280	70288.8379	30117.3165	1324.07	CATCHMENT BOT
8281	70308.3639	30104.2740	1323.58	RP CATCHMENT BOT
8283	70306.1731	30127.6528	1324.10	CATCHMENT BOT
8285	70302.8613	30162.9950	1325.02	RP CATCHMENT BOT
8286	70325.1903	30135.4006	1324.13	CATCHMENT BOT
8287	70330.7687	30139.3978	1324.14	CATCHMENT BOT
8290	70336.8467	30138.6933	1324.15	CATCHMENT BOT
8294	70352.1613	30119.1111	1324.83	RP CATCHMENT BOT
8295	70336.1842	30107.0807	1324.09	CATCHMENT BOT
8298	70276.4627	30062.1122	1323.65	RP CATCHMENT BOT
8299	70349.9382	30075.9025	1324.06	CATCHMENT BOT
8300	70342.6362	30027.3286	1323.99	CATCHMENT BOT
8303	70206.4120	30098.9337	0.00	RP CATCHMENT BOT
8306	70262.6361	29955.6746	1323.81	CATCHMENT BOT
8307	70312.1404	29829.5372	1325.46	RP CATCHMENT BOT
8308	70219.0134	29927.9683	1323.73	CATCHMENT BOT
8309	70207.3922	29940.2514	1323.57	RP CATCHMENT BOT
8310	70203.8739	29923.7122	1323.70	CATCHMENT BOT
8311	70195.5325	29928.1985	1323.74	CATCHMENT BOT
8312	70153.2421	29885.2196	1325.50	RP CATCHMENT BOT
8313	70183.2261	29937.5323	1323.76	CATCHMENT BOT
8314	70143.4440	29868.1250	1325.48	RP CATCHMENT BOT
8317	70285.6463	30129.2596	1326.51	CST LIMIT
8318	70299.1620	30135.4246	1325.10	CATCHMENT TOP
8319	70305.5267	30103.5731	1323.62	RP CATCHMENT TOP
8320	70305.5084	30136.0543	1325.00	CATCHMENT TOP
8321	70305.4935	30162.5513	1325.00	RP CATCHMENT TOP
8322	70320.1282	30140.4624	1324.82	CATCHMENT TOP
8323	70326.7175	30144.9982	1324.77	CATCHMENT TOP
8327	70344.1199	30130.3631	1324.72	CATCHMENT TOP
8328	70358.6995	30123.7457	1324.78	RP CATCHMENT TOP
8329	70345.8840	30114.1479	1324.96	CATCHMENT TOP
8330	70389.3771	30146.7208	1324.74	RP CATCHMENT TOP
8331	70354.6093	30104.9614	1325.24	CATCHMENT TOP
8332	70263.2451	30026.9203	1323.42	RP CATCHMENT TOP
8333	70371.2625	30079.5518	1325.96	CATCHMENT TOP
8339	70232.3999	30233.2181	0.00	RP CL SWALE
8341	70473.8049	30231.6931	1325.70	RP TOE I7
8345	70388.2399	30305.5011	1325.36	TOE I7
8386	70473.8049	30231.6931	0.00	RP CL SWALE
8389	70322.3624	30362.3268	1325.73	RP CL SWALE/TOE I7
8399	70073.2487	30540.2813	0.00	RP CL SWALE
8401	70073.0138	30540.2453	0.00	RP CL SWALE
8403	70734.8502	30781.4541	0.00	RP CL SWALE
8405	69576.1316	29394.5512	1324.00	COR RIPRAP
8424	69821.6975	28705.2107	1318.16	BOT CHAN LT
8425	69821.7351	28720.2107	1318.13	RP BOT CHAN LT
8426	69836.7152	28720.9817	1318.20	BOT CHAN LT
8427	69851.6954	28721.7527	1320.31	RP BOT CHAN LT
8428	69846.0699	28735.6579	1317.80	BOT CHAN LT
8429	69845.8253	28737.6429	1317.80	BOT CHAN LT
8430	69837.7251	28738.7775	1318.04	BOT CHAN LT
8431	69840.0833	28755.6131	1321.46	RP BOT CHAN LT
8432	69829.9783	28741.9423	1318.17	BOT CHAN LT
8433	69870.4194	28796.6544	1324.42	RP BOT CHAN LT
8434	69820.3495	28750.5904	1318.15	BOT CHAN LT
8435	69802.3982	28795.2389	1318.14	BOT CHAN LT
8436	69801.6492	28820.0579	1318.14	BOT CHAN LT
8437	69800.4425	28860.0397	1316.60	BOT CHAN LT
8438	69799.1416	28907.3656	1316.60	BOT CHAN LT
8439	69875.5281	28909.4654	1322.69	RP BOT CHAN LT
8440	69804.9566	28938.7734	1316.60	BOT CHAN LT
8441	69721.6197	28973.3829	1321.00	RP BOT CHAN LT
8442	69810.0915	28955.6179	1316.60	BOT CHAN LT
8443	69707.5626	28976.2055	1320.95	RP BOT CHAN LT
8444	69809.7597	28998.3814	1317.00	BOT CHAN LT
8445	69983.8446	29036.1563	0.00	RP BOT CHAN LT
8446	69806.9008	29056.7330	1317.53	BOT CHAN LT
8447	69811.8774	29096.2310	1317.90	BOT CHAN LT
8448	69817.3040	29139.3013	1317.90	BOT CHAN LT
8449	69691.2244	29155.1867	1316.78	RP BOT CHAN LT
8450	69817.6775	29167.7576	1318.00	BOT CHAN LT
8451	69691.2246	29155.1867	1316.78	RP BOT CHAN LT
8452	69814.6161	29185.5658	1318.13	BOT CHAN LT
8453	69911.7166	29209.4719	0.00	RP BOT CHAN LT
8454	69811.7194	29208.7168	1318.44	BOT CHAN LT
8455	68806.7481	29201.1276	0.00	RP BOT CHAN LT
8456	69811.3064	29230.9198	1318.70	BOT CHAN LT
8457	69806.0348	29250.6308	1318.70	BOT CHAN LT
8458	69814.1460	29263.1581	1323.60	BOT CHAN LT
8459	69808.4207	29282.8408	1322.70	BOT CHAN LT
8460	69803.5286	29329.3989	1322.70	BOT CHAN LT

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39 TH. AVE.
ST—914085

DR: DEF	DES: DEF	CK: JSP	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE: 2/94	DATE: 2/94	DATE: 2/94			
COORDINATES			17	35	

138511

SCATTER WASH CHANNEL
PHOENIX STREETS-MARICOPA CO.
43RD. AVE. TO 39TH AVE.

REVISION BY CITY OF PHOENIX

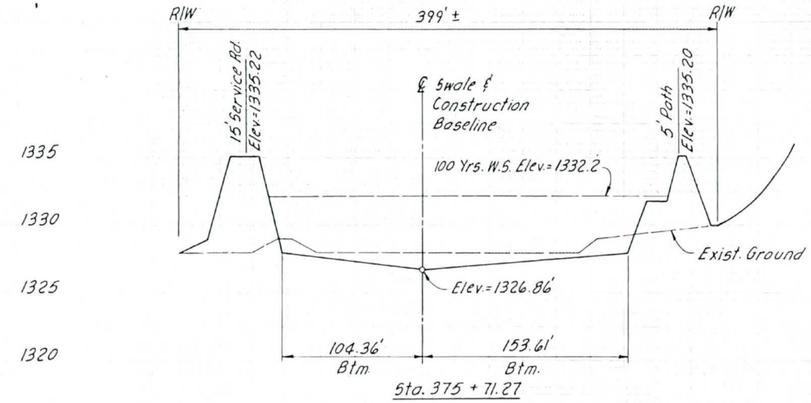
NO.	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

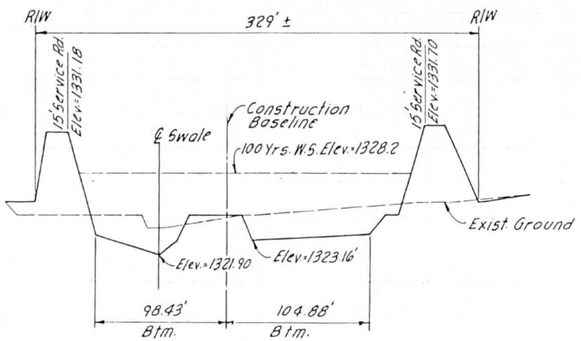
NO	DESCRIPTION	REV. BY	CK'D BY	DATE

REVISION BY CITY OF PHOENIX

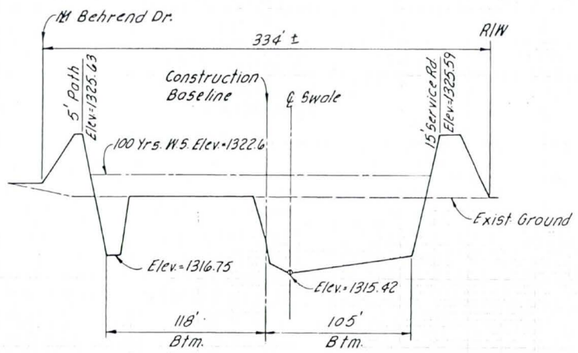
NO	DESCRIPTION	REV. BY	CK'D BY	DATE



Sta. 375 + 71.27



Sta. 363+34.37



Sta. 354+66

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

ENGINEERING ALLIANCE — CONSULTING ENGINEER

DES: R.J.M.	DR: J.S.S.	CK: J.S.P.	DATE: 2-94

CROSS SECTION
CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43 RD. AVE. TO 39TH AVE.
ST-914085

DES. R.J.M.	DR. J.S.S.	CK. J.S.P.	SHEET NO.	TOTAL SHEETS	AS BUILT
DATE 2-94	DATE 2-94	DATE 2-94	19	35	
SCALE 1" = 50 HORIZONTAL, 5 VERTICAL					

NO

F.H.W.A. REGION	STATE	PROJ. NO.	NO. TOTAL	AS BUILT
9	ARIZ			

CONSULTING ENGINEER

DES	DR:	CK:	DATE:

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

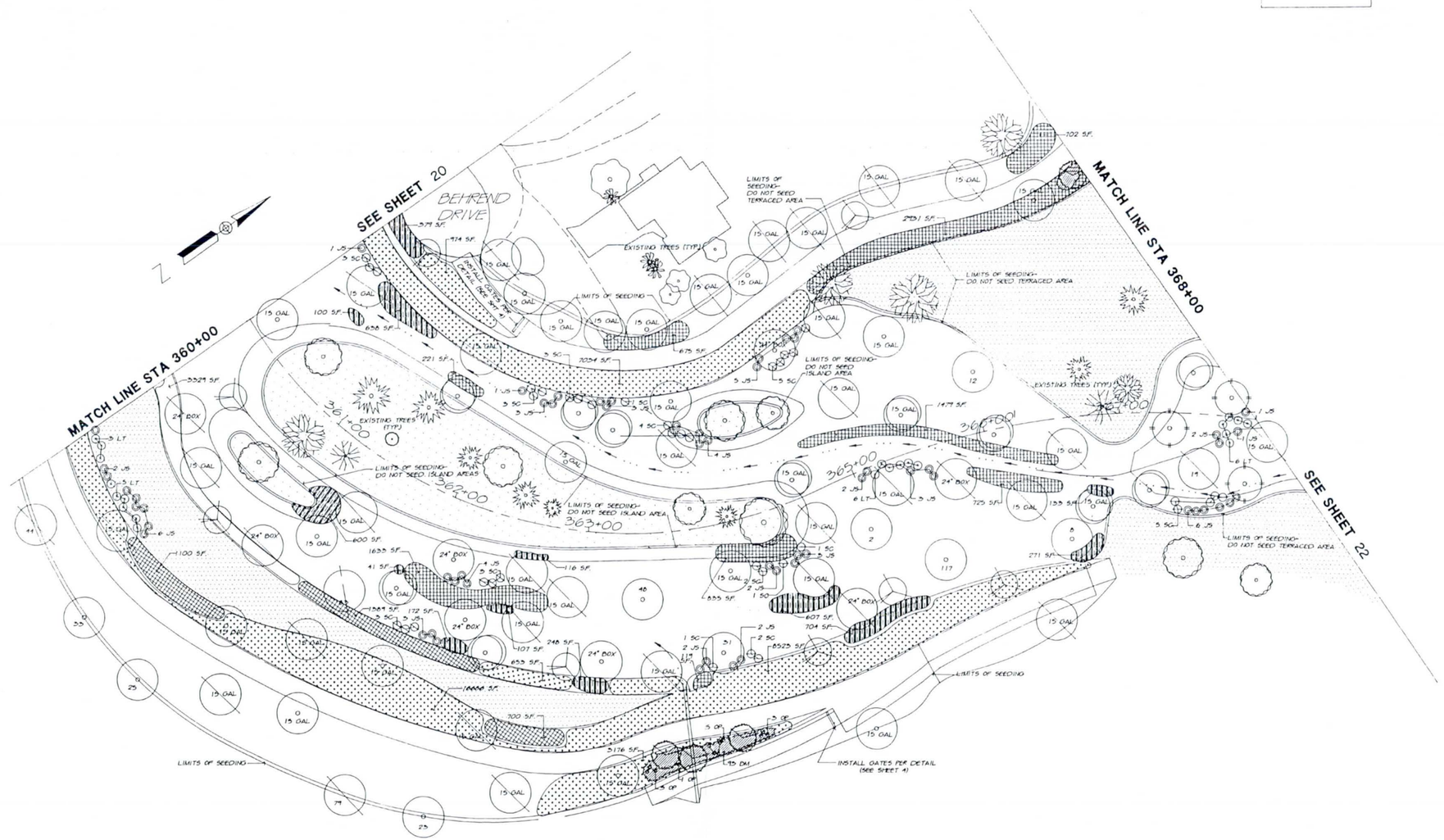
REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

SCATTER WASH CHANNEL
PHOENIX STREETS–MARICOPA CO.
43RD AVE. TO 39TH AVE.



PLANT LIST		
TREES	BOTANICAL NAME	COMMON NAME
	CELTIS PALLIDA	HACKBERRY
	CERCIDIUM FLORIDUM	PALO VERDE
	CHILOPSIS LINEARIS	WILLOW
	POPULUS FREMONTII	COTTONWOOD
	PROSOPIS CHILENSIS	MESQUITE
	PSOROTHAMNUS SPINOSA	SMOKE TREE
SHRUBS	(ABBREVIATION)	
	OPUNTIA PHAEACANTHA	OPUNTIA
	LARREA TRIDENTATA	CREOSOTE
	SIMMONDSIA CHINENSIS	JOJOBA
	JUSTICIA SPICIGERA	CHUPAROSA
	BAILEYA MULTIRADIATA	DESERT MARIGOLD
	CASSIA COVESSI	DESERT SENNA

LEGEND
- SLOPE A
- SLOPE B
- SLOPE C
- UNDISTURBED AREA
- TERRACE
- RIP-RAP LOW FLOW CHANNEL

10
22
3-7-2000

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43RD AVE. TO 39TH AVE.
ST - 914085

DR. C.B. DATE: 2,94	DES. DATE:	CK. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 40'			21	35	

SCATTER WASH CHANNEL
PHOENIX STREETS–MARICOPA CO.
43RD AVE. TO 39TH AVE.

F.H.W.A. REGION	STATE	PROJ. NO.		TOTAL	AS BUILT
9	ARIZ				

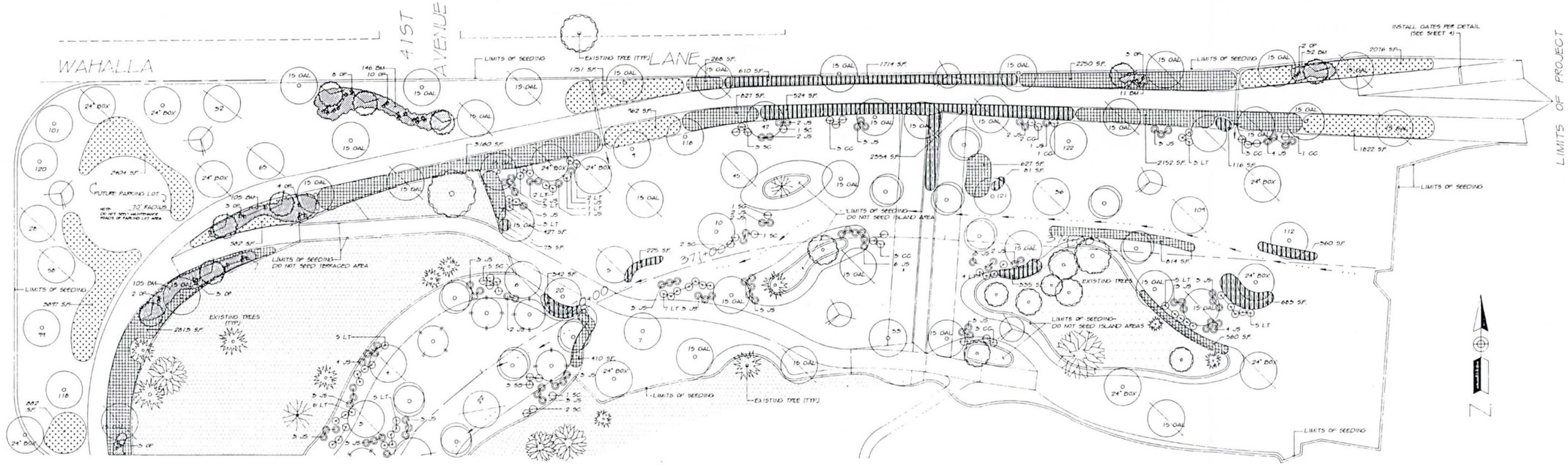
CONSULTING ENGINEER
DES | DR: | CK: | DATE:

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE



PLANT LIST

TREES	BOTANICAL NAME	COMMON NAME
	CELTIS PALLIDA	HACKBERRY
	CERCIDIUM FLORIDUM	PALO VERDE
	CHILOPSIS LINEARIS	WILLOW
	POPULUS FREMONTII	COTTONWOOD
	PROSOPIS CHILENSIS	MESQUITE
	PSOROTHAMNUS SPINOSA	SMOKE TREE
SHRUBS	(ABBREVIATION)	
	OPUNTIA PHAEACANTHA	OPUNTIA
	LARREA TRIDENTATA	CREOSOTE
	SIMMONDSIA CHINENSIS	JOJOBA
	JUSTICIA SPICIGERA	CHUPAROSA
	BAILEYA MULTIRADIATA	DESERT MARIGOLD
	CASSIA COVESSI	DESERT SENNA

LEGEND
SLOPE A
SLOPE B
SLOPE C
UNDISTURBED AREA
TERRACE
RIP-RAP LOW FLOW CHANNEL

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT
SCATTER WASH CHANNEL
43RD AVE. TO 39TH AVE.
ST - 914085

DR DATE: 2/94	C.R.	DES DATE:	CK DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 40'				22	35	

SCATTER WASH CHANNEL
PHOENIX STREETS–MARICOPA CO.
43RD AVE. TO 39TH AVE.

SCATTER WASH NOTES AND DETAILS

NOTE: DO NOT SEED ISLAND AREAS AS SHOWN ON PLANS.

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ				

CONSULTING ENGINEER

DES	DR:	CK:	DATE:

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

LEGEND

- SLOPE A
- SLOPE B
- SLOPE C
- UNDISTURBED AREA
- TERRACE
- RIP-RAP LOW FLOW CHANNEL

PLANT LIST

TREES	BOTANICAL NAME	COMMON NAME	TOTAL QTY.	SIZE
	CELTIS PALLIDA	HACKBERRY	9	24" BOX
	CERCIDIUM FLORIDUM	PALO VERDE	11 52	24" BOX 15 GAL
	CHILOPSIS LINEARIS	WILLOW	42	15 GAL
	POPULUS FREMONTII	COTTONWOOD	7	24" BOX 15 GAL
	PROSOPIS CHILENSIS	MESQUITE	24 74	24" BOX 15 GAL
	PSOROTHAMNUS SPINOSA	SMOKE TREE	19	15 GAL
SHRUBS	(ABBREVIATION)			
	OPUNTIA PHAEACANTHA	OPUNTIA	101	5 GAL
	LARREA TRIDENTATA	CREOSOTE	87	5 GAL
	SIMMONDSIA CHINENSIS	JOJOBA	113	1 GAL
	JUSTICIA SPICIGERA	CHUPAROSA	222	1 GAL
	BAILEYA MULTIRADIATA	DESERT MARIGOLD	868	1 GAL
	CASSIA COVESSI	DESERT SENNA	16	1 GAL

SEED MIXES

BOTANICAL NAME	COMMON NAME	#S/ACRE
SEED MIX 1 (FOR GRADED RIPARIAN AREAS)		
ACACIA GREGGI	CATCLAW	2.0
AMBROSIA AMBROSIOIDES	CANYON RAGWEED	3.0
AMBROSIA DETOIDEA	BURSAGE	3.0
CASSIA COVESSI	DESERT SENNA	2.0
CERCIDIUM FLORIDUM	BLUE PALO VERDE	3.0
LUPINUS SUCCULENTUS	ARROYO LUPINE	1.0
LYCIUM ANDERSONII	WOLFBERRY	1.0
OLNEYA TESOTA	IRONWOOD	3.0
PENSTEMON PARRYI	BEARDTONGUE	0.5
PROSOPIS GLANDULOSA	MESQUITE	3.0
SPHAERALCEA AMBIGUA	GLOBE MALLOW	0.5
SPOROBOLUS CRYPTANDRUS	SAND DROPSEED	1.0
TOTAL		23.0

SEED MIXES

BOTANICAL NAME	COMMON NAME	#S/ACRE
SEED MIX 2 (FOR GRADED SLOPES)		
AMBROSIA DETOIDEA	BURSAGE	3.0
ARISTIDA PURPUREA	PURPLE THREE-AWN	1.0
ATRIPLEX CANESCENS	FOUR-WING SALT-BUSH	2.0
BAILEYA MULTIRADIATA	DESERT MARIGOLD	2.0
CERCIDIUM MICROPHYLLUM	FOOTHILL PALO VERDE	3.0
KALLSTROEMIA GRANDIFLORA	ARIZONA POPPY	1.0
LUPINUS SPARCIFLORA	LUPINE	1.0
PENSTEMON PARRYI	PENSTEMON	1.0
PHACELIA CAMPANULARIA	BLUE BELLS	1.0
PROSOPIS GLANDULOSA	MESQUITE	3.0
SPHAERALCEA AMBIGUA	GLOBE MALLOW	1.5
TOTAL		19.5

BOULDER MIXES

	L	H	W	WT/ROCK	#ROCKS/100 SF
SLOPE A	(1:1 TO 2:1 SLOPES) BOULDER MIX				
1.	2X	2X	3'	1 TON	13
2.	2X	1X	1'	1/2 TON	8
SLOPE B	(2:1 TO 3:1 SLOPES) BOULDER MIX				
1.	2X	2X	3'	1 TON	3
2.	2X	2X	1'	1/2 TON	18
SLOPE C	(3:1 SLOPES AND FLATTER) BOULDER MIX				
1.	2X	1X	2'	1/2 TON	15

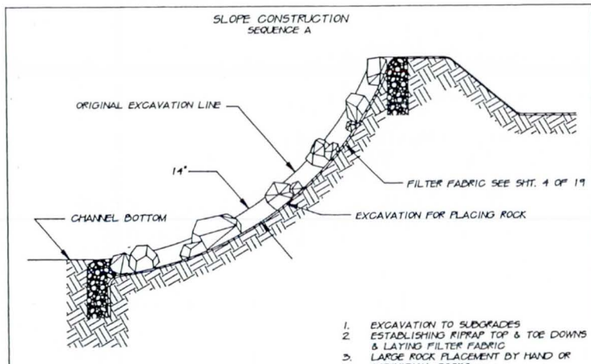
LIST OF BOXED TREES TO BE TRANSPLANTED AT SCATTER WASH FROM 41ST AVENUE & YORKSHIRE DRIVE

BOX SIZE	# OF TREE	SPECIES
66"	3	BLUE PALO VERDE
60"	1	BLUE PALO VERDE
54"	7	BLUE PALO VERDE
48"	3	BLUE PALO VERDE
42"	5	BLUE PALO VERDE
36"	13	BLUE PALO VERDE
66"	1	NATIVE MESQUITE
54"	1	NATIVE MESQUITE
48"	8	NATIVE MESQUITE
42"	1	NATIVE MESQUITE
36"	5	NATIVE MESQUITE

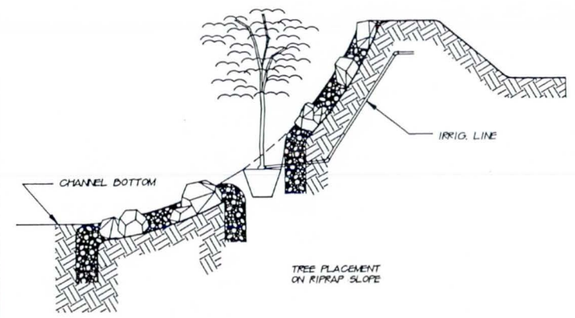
LIST OF HACKBERRIES TO BE TRANSPLANTED AT SCATTER WASH FROM MOUNTAIN VIEW COMMUNITY CENTER

TREE ID. #	BOX SIZE	SPECIES
1737	42	HACKBERRY
1738	42	HACKBERRY
1739	42	HACKBERRY
1979	42	HACKBERRY
1986	36	HACKBERRY
1987	36	HACKBERRY
1988	42	HACKBERRY
1990	36	HACKBERRY
1991	36	HACKBERRY
1992	36	HACKBERRY
1993	36	HACKBERRY
1994	36	HACKBERRY
2000	30	HACKBERRY

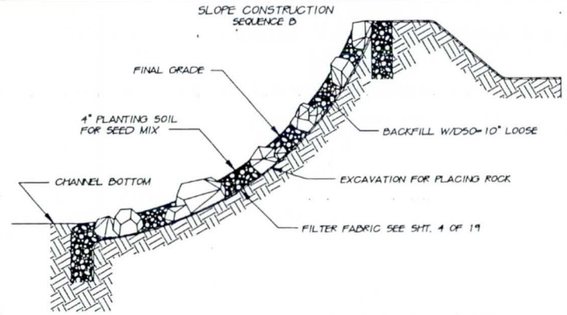
SLOPE CONSTRUCTION SEQUENCE A



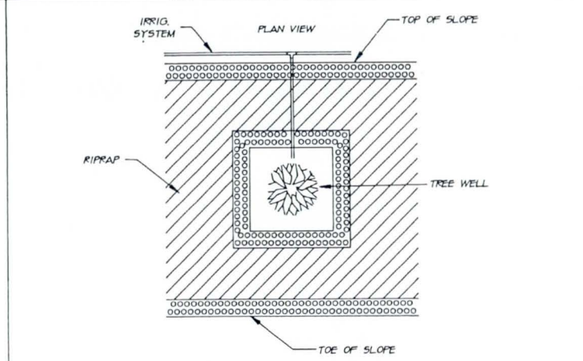
1. EXCAVATION TO SUBGRADES
2. ESTABLISHING RIPRAP TOP & TOE DOWNS & LAYING FILTER FABRIC
3. LARGE ROCK PLACEMENT BY HAND OR INDIVIDUAL ROCKS

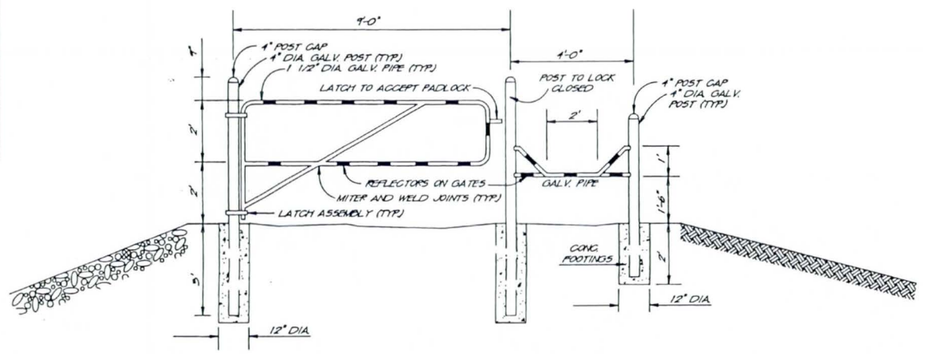


SLOPE CONSTRUCTION SEQUENCE B



1. BACKFILL D50 10" LOOSELY
2. 4" PLANTING SOIL W/AMENDMENTS
3. WASHIN SOIL PLANTING
4. REVEGATATION





DRIVE GATE DETAIL
(TYP. @ ALL LOCATIONS)
PROVIDE A 2ND POST TO LOCK GATE OPEN

EQUESTRIAN TRAIL DETAIL
(TYP. @ ALL LOCATIONS)

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43RD AVE. TO 39TH AVE.
ST - 914085

DR C.B. DATE: 2/94	DES. DATE:	CK. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1" = 40'			23	35	

SCATTER WASH CHANNEL
43rd AVE. to 39th AVE.
PHOENIX STREETS–MARICOPA CO.

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ				

CONSULTING ENGINEER

DES	DR:	CK:	DATE:

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

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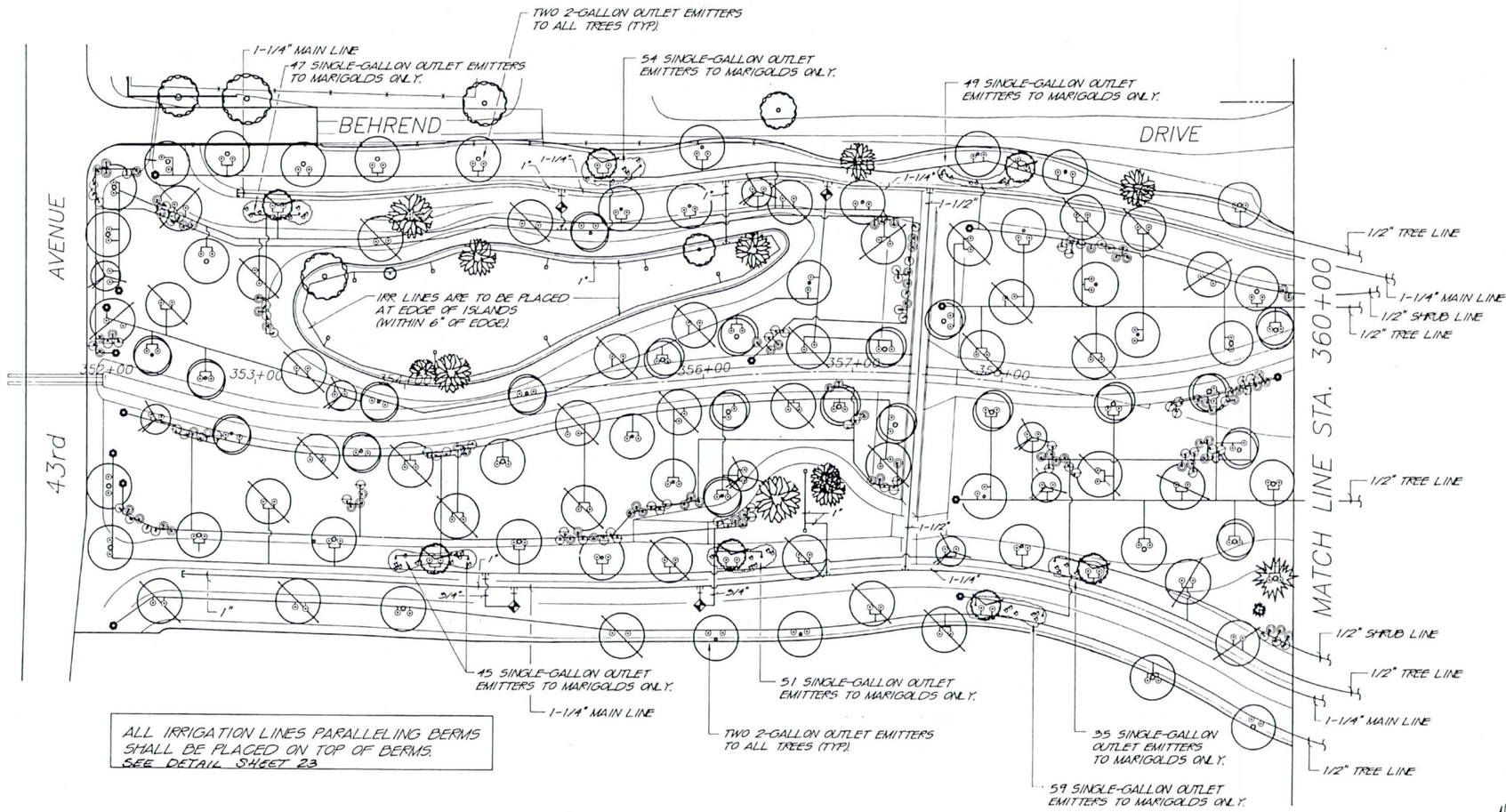

ALL IRRIGATION LINES PARALLELING BERMS SHALL BE PLACED ON TOP OF BERMS.
SEE DETAIL SHEET 23

City of Phoenix

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CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43rd AVE. to 39th AVE.
ST-914085

DR DATE:	DES DATE:	CK DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1"=40'	HORIZONTAL		24	35	
	VERTICAL				

SCATTER WASH CHANNEL
43rd AVE. to 39th AVE.
PHOENIX STREETS–MARICOPA CO.

F.H.W.A. REGION	STATE	PROJ. NO.	NO. TOTAL	AS BUILT
9	ARIZ			

CONSULTING ENGINEER

DES	DR:	CK:	DATE:

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE

REVISION BY CITY OF PHOENIX

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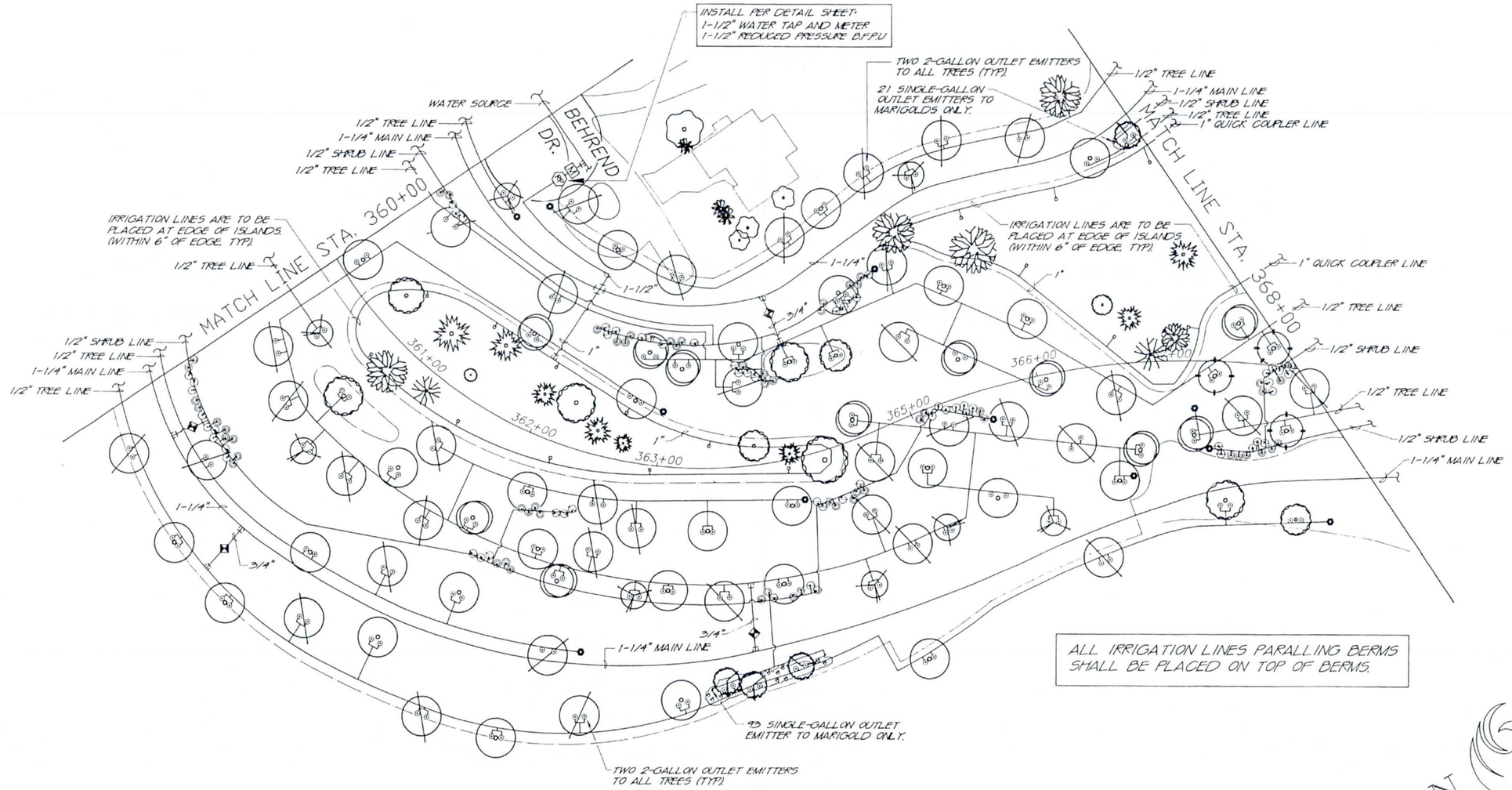
REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV BY	CKD BY	DATE



ALL IRRIGATION LINES PARALLING BERMS SHALL BE PLACED ON TOP OF BERMS.

N

City of Phoenix

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH CHANNEL
43RD AVE. TO 39TH AVE.
ST-914085

DR. DATE:	DES. DATE:	CK. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
SCALE: 1"=40'	HORIZONTAL		25	35	
	VERTICAL				

SCATTER WASH CANNEL
43rd AVE. to 39th AVE.
PHOENIX STREETS–MARICOPA CO.

F.H.W.A. REGION	STATE	PROJ. NO.	NO.	TOTAL	AS BUILT
9	ARIZ				

REGISTERED LANDSCAPE ARCHITECT — 6807 — DENNIS B. SCHOLTZ — 3-21-94 — ARIZONA, U.S.A.

CONSULTING ENGINEER

DES	DR:	CK:	DATE:

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CKD. BY	DATE

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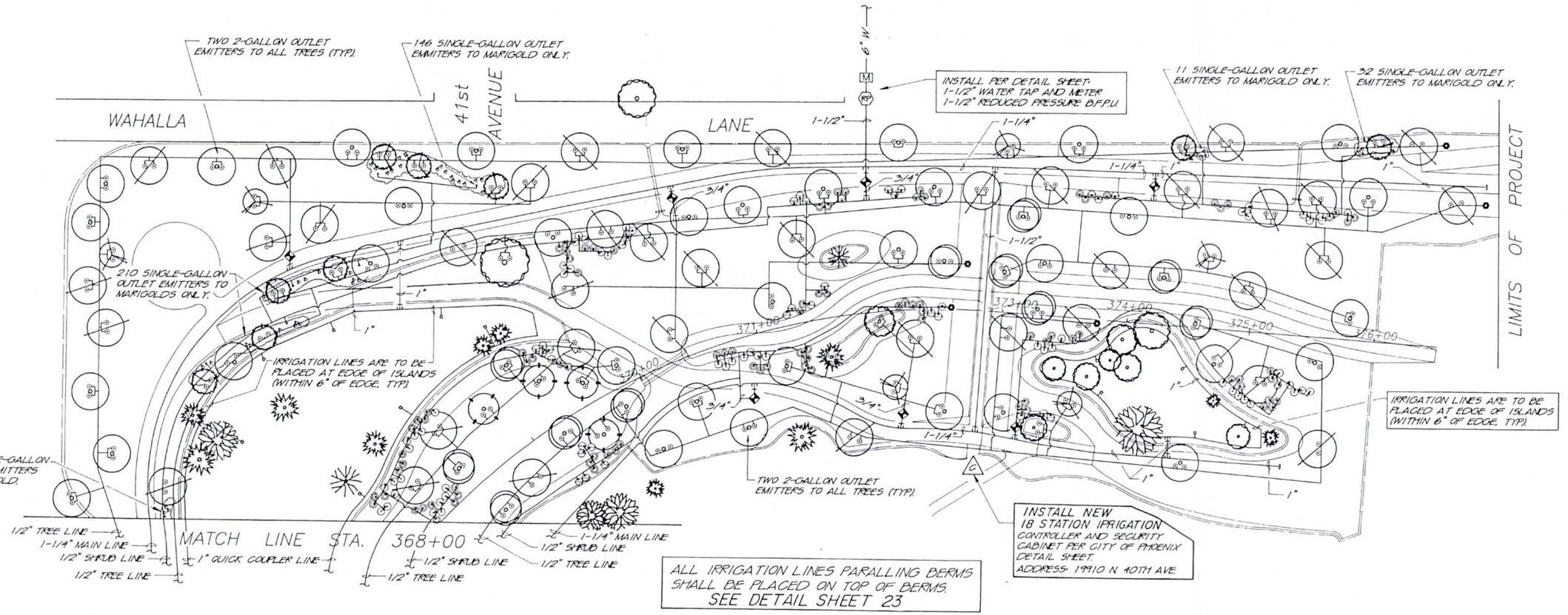
NO.	DESCRIPTION	REV. BY	CKD. BY	DATE



ALL IRRIGATION LINES PARALLING BERMS SHALL BE PLACED ON TOP OF BERMS. SEE DETAIL SHEET 23

City of Phoenix

N

CITY OF PHOENIX, ARIZONA
STREET TRANSPORTATION DEPARTMENT

SCATTER WASH C-ANNEL
43RD AVE. TO 39TH AVE.
ST-914085

DR. DATE:	DES. DATE:	CK. DATE:	SHEET NO.	TOTAL SHEETS	AS BUILT
			26	35	

SCALE 1"=40' HORIZONTAL VERTICAL

F.H.W.A REGION	STATE	PROJ NO	SHEET NO	TOTAL SHEETS	AS BUILT
9	ARIZ				

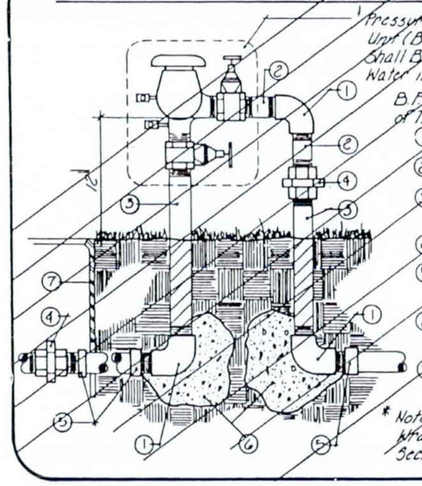
CONSULTING ENGINEER

DES	DR	CK	DATE

PHOENIX STREETS-MARICOPA CO.

IRRIGATION DETAILS

"PRESSURE TYPE" BACKFLOW PREVENTION UNIT — (P)



"Pressure Type" Backflow Prevention Unit (B.F.P.U.) Bottom of B.F.P.U. Shall Be 12" Higher Than Highest Water in System. (Brass)

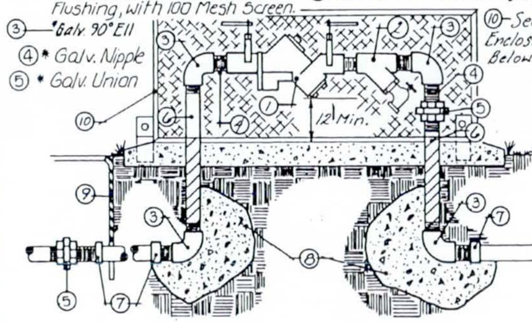
B.F.P.U. Assembly Shall Consist of The Following:

1. * Galv. 90° Ell (Fipt X Fipt)
2. 6" Long Galv. Nipple
3. * Galv. Nipple (length as Required)
4. Galv. Union
5. P.V.C. Male Adapter Mipt X Slip
6. 1/2 Cubic Foot Conc. Min. Thrust Block
7. Conc Meter Box Installed By City of Phoenix

* Note: For Corrosion Protection Wrap Below Fin. Grade Per Mag Sec. 753.2

"REDUCED PRESSURE" BACKFLOW PREVENTION UNIT — (RP)

1. Reduced Pressure Backflow Prevention Unit. (Brass)
2. Provide CMB Model 3131 Bronze "Y" Strainer with Hose Bib for Flushing, with 100 Mesh Screen.
3. * Galv. 90° Ell
4. * Galv. Nipple
5. * Galv. Union
6. Galv. Risers (Lenth as Req'd)
7. Sched 80 P.V.C. Male Adaptor (Mipt X Slip)
8. 1/2 Cubic Foot Conc. Min Thrust Block
9. Conc. Meter Box Installed By City of Phoenix.
10. Security Enclosure See Below.

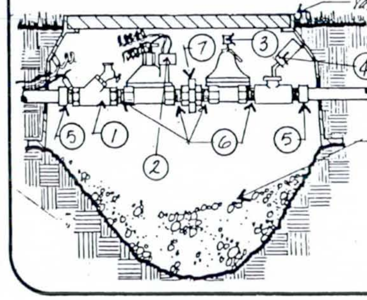


* Note: For Corrosion Protection Wrap Below Fin. Grade Per Mag Sec. 753.2

BRASS EMITTER CONTROL ASSEMBLY — (E)

1. Provide CMB Model 3131 Bronze "Y" Strainer W/Hose Bib and 100 Mesh Screen.
2. Electric Remote Control Valve (See Solenoid Valve Detail).
3. Pressure Regulator With Adjustable Outlet Pressure of 10 to 35 P.S.I.
4. Install a 0 to 60 P.S.I. Liquid Filled Pressure Gauge on the Outlet Side of the Pressure Regulator.
5. Male Adapter (Sch. 80 P.V.C.)
6. Nipple (Sched. 80 P.V.C. Length as Required).
7. Union (Galv.)

One Emitter Per Box. And all Hardware On Box to be Stainless Steel. Any & All Bolts on Cover to Have Washers.



Valve Box With Locking Bolt Cover. Shall Be Sufficient Size to Accomomodate All Control Equipment. Set Top of Valve Box 1/2" Above Fin. Grade.

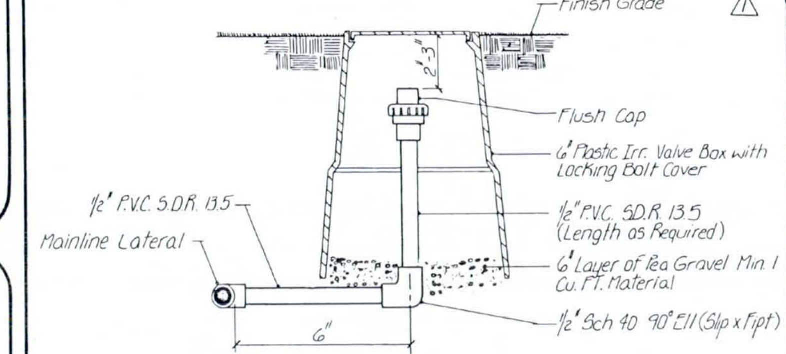
Provide 15" Min. Deep Drainage Sump, With 6" Layer of Pea Gravel (Min. Pea Gravel 2 Cu. FT) Provide Min. 6" Clearance Between Cleanout Valve and Top of Pea Gravel.

NOTES

1. Sleeve all Driveways That are Crossed With Irrigation Pipe or Control Wire Use Schedule 40 Pipe. Size as Follows Unless Otherwise Noted on Plans.

Irrigation Pipe	Sleeve
1/2" To 1 1/4"	2"
1 1/2" To 2"	3"
Control Wire	2"

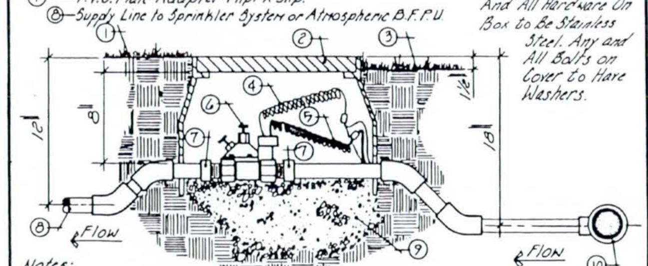
AUTOMATIC FLUSH CAP



SOLENOID VALVE

1. Finished-grade (For non-irrigated Areas)
2. Plastic irr. Valve Box W/Locking Bolt Cover. *
3. Finished-grade (For irrigated Areas)
4. No. 14 Control Wire (Orange)
5. No. 12 Common Wire to Other Valves on Same Controller. (White)
6. Electric remote Control Valve (Brass)
7. P.V.C. Male Adapter Mipt X Slip.
8. Supply Line to Sprinkler System or Atmospheric B.F.P.U.
9. 6" Layer of Pea Gravel Min. 1 Cu. F.T. Material.
10. Main Line Lateral From Pressure B.F.P.U. of Meter.

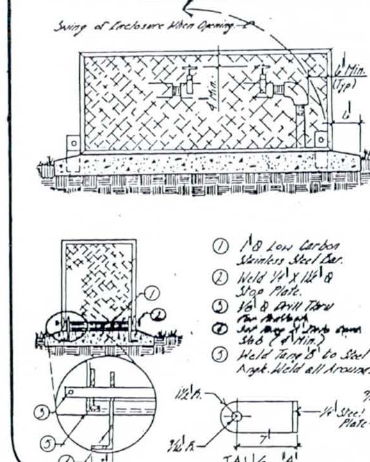
* One Valve Per Box. And All Hardware On Box to Be Stainless Steel. Any and All Bolts on Cover to Have Washers.



Notes:

- Provide Expansion Coils at each Wire Connection in Valve Box. (Wrap Around 1/2" Pipe 15 Times)
- Step-Up Valve W/45° Fittings to Maintain 6" Btwn. Valve and Top of Box.
- Emboss Cover W/1/2" No. Which Correspond to Valve No. Irrigation Plan

B.F.P.U. SECURITY ENCLOSURE

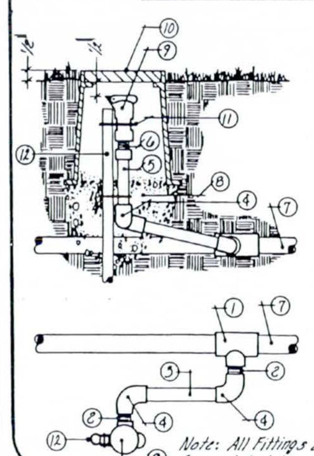


1. 1" Ø Low Carbon Stainless Steel Bar.
2. Weld 1/4" X 1 1/2" Ø Stop Plate.
3. 1/2" Ø Drill Thru For Padlock.
4. Set Bar 4" Into Conc. Slab (4" Min.)
5. Weld Tang 'B' to Steel Angle. Weld all Around.

Construction Notes

1. The Contractor Shall Verify Dim. Prior to Construction of Enclosure.
2. The Enclosure Shall Be Built With 1"X1"X1/8" Steel Angles on all 4 Corner. Top and Bottom.
3. Fabric Shall Be 14 Ga. Expanded Metal on the Top and all 4 Sides. Weld 1"X1/4" Stiffener Bar Inside of Enclosure as Required.
4. Paint Specs. For Enclosure Shall Conform to Adot Spec. Sec. Primer Coat Paint # 118, No. 7.0 (Zinc Chromate) Desert Tan HYLUX Enamel.
5. The Contractor Shall Verify the Exact Location of Enclosure to Assure Equip. Clearance When Opening.
6. The Enclosure Shall Sit on a Class 'B' Conc. Slab. The Slab Shall Have 6" Conc. ... on all 4 Sides. Top of Slab Shall be 1" Above Fin. Gr.
7. Grind all Weld Spots Smooth.

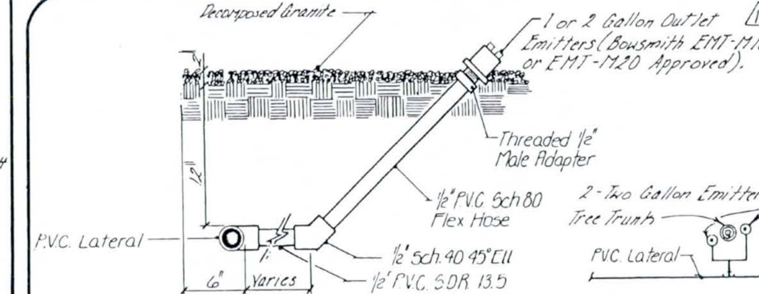
QUICK COUPLER VALVE



1. Tee or Ell (Slip X Fipt)
2. 3" Long Nipple
3. 12" Min. Length Nipple.
4. 90° Ell (Slip X Fipt)
5. 6" Min. Length Nipple
6. Male Adapter (Slip X Fipt)
7. Irrigation Mainline
8. 6" Layer of Pea Gravel. Min. 1 Cu Ft. Material.
9. 1" Brass Quick Coupler Valve.
10. 10" Circular Plastic Valve Box W/Bolt Down Locking Cover. Set Top of Valve Box 1/2" Above Fin Gr.
11. Stainless Steel Strap.
12. 1/4" Galv. Pipe Section 18" Long.

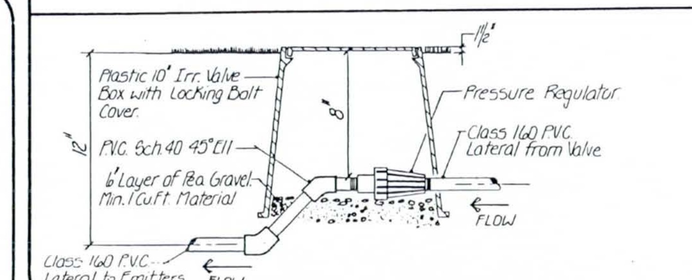
Note: All Fittings and Nipples Shall be Sched. 80.
· Compact Soil Around Quick Coupler to Same Density as Adjacent Soil.

EMITTER DETAIL

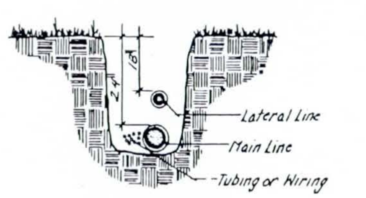


1-Two Gallon Outlet Emitter
1-One Gallon Outlet Emitter.

PRESSURE REGULATOR

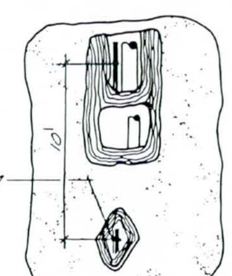


TRENCHING DETAIL



SECTION 'A'

All Pipe Installation. Trench Excavation, Back Filling and Compaction Shall Conform With Mag Sec. 401 3 and 601.

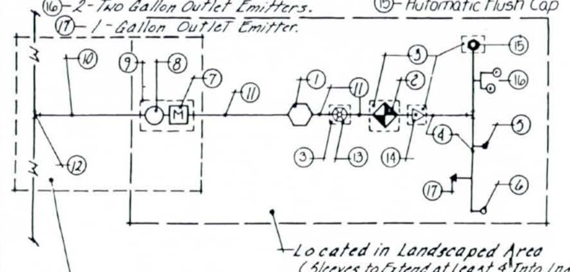


Tape and Bundle Tubing or Wiring at 10'-0" Interval

Note:
Depth Dimension May Vary Where Indicated on Irr. Plan

WATER SYSTEM SCHEMATIC

1. Pressure Type Backflow Preventer
2. Electric Valve
3. Plastic Valve Box W/Locking Cover *
4. P.V.C. Lat. - 1/2" Class 315, 3/4"-1" Class 200, 1 1/4" Class 160.
5. 1/2 G.P.M. Pressure Compensation Bubbler
6. 1/4 G.P.M. Pressure Compensation Bubbler
7. Water Meter Installed By City of Phx.
8. Curb Stop, Installed By City
9. Conc Meter Box, Installed By City
10. Water Main.
11. Sched. 80 P.V.C.
12. Water Tap
13. Gate Valve
14. Pressure Regulator
15. Automatic Flush Cap
16. 2-Two Gallon Outlet Emitters.
17. 1-Gallon Outlet Emitter.

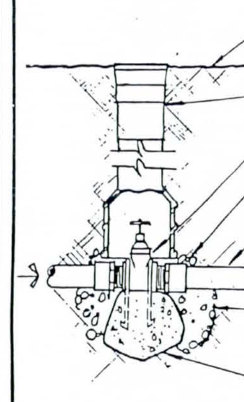


Located in Landscaped Area (Sleeves to Extend at Least 4" Into Lndscp. Area)

To Be Installed By The City of Phoenix

* Note: One Valve Box Per Valve.

GATE VALVE AND BOX DETAIL



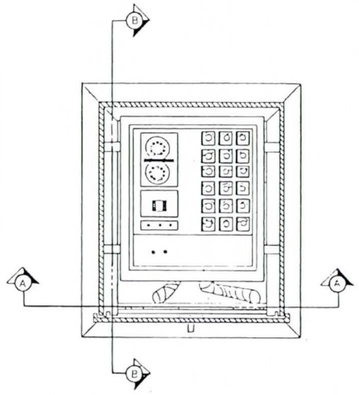
REVISION BY CITY OF PHOENIX				
NO	DESCRIPTION	REV BY	CKD BY	DATE
1	Revision, Change or Addition	A.E.	D.P.S.	2/90

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

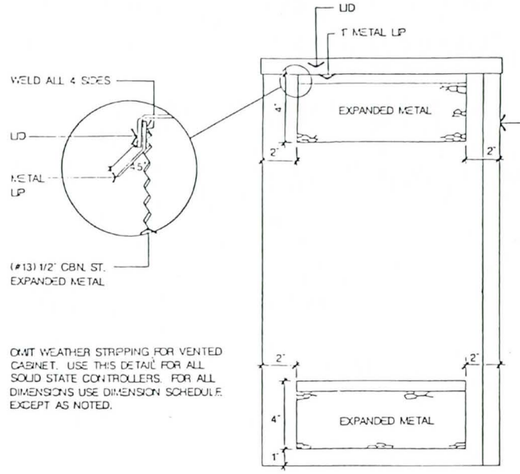
SCATTER WASH CHANNEL
43RD AVE. TO 39TH AVE.
ST-914085

DR DATE	DES DATE	CK DATE	SHEET NO	TOTAL SHEETS	AS BUILT
			27	35	

PHOENIX STREETS-MARICOPA CO.

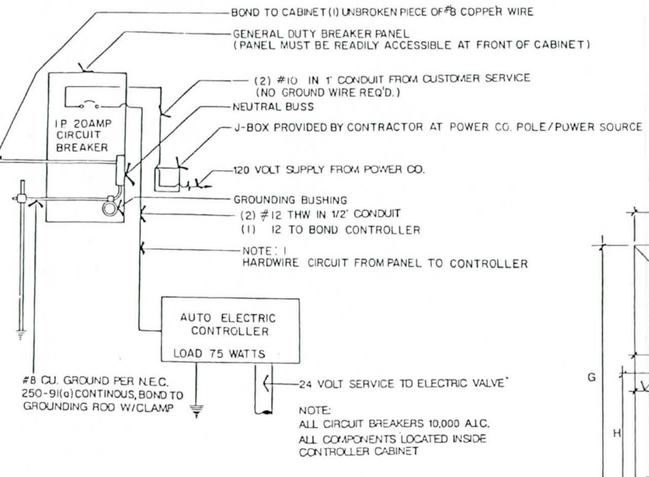


1 PLAN VIEW
N.T.S.



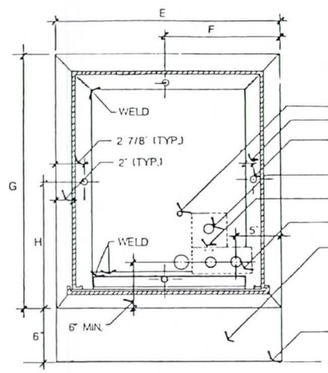
OMIT WEATHER STRIPPING FOR VENTED CABINET. USE THIS DETAIL FOR ALL SOLID STATE CONTROLLERS. FOR ALL DIMENSIONS USE DIMENSION SCHEDULE EXCEPT AS NOTED.

2 VENTING SECURITY CABINET
N.T.S.



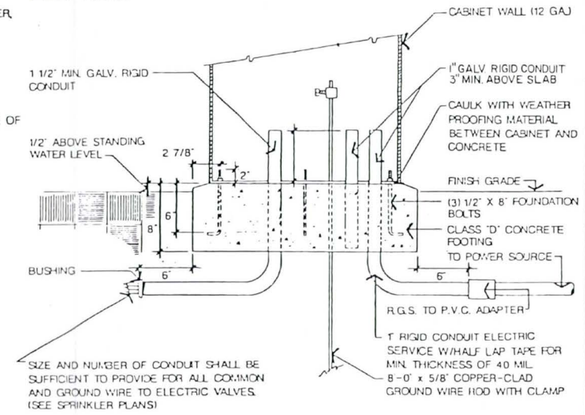
3 ELECTRIC SERVICE SCHEMATIC
N.T.S.

SECURITY CABINET



NOTE: 2
CONCRETE TO BE LEVEL TO PERMIT ENCLOSURE TO SIT SQUARE ON PAD
NOTE: 6
LOCATION OF CONDUITS AND GROUND ROD SHALL VARY ACCORDING TO TYPE OF BREAKER PANEL USED. CONTRACTOR SHALL DETERMINE LOCATIONS. BOTH CONDUCTS SHALL SERVE AS SUPPORTS FOR PANEL BREAKER.

4 CONCRETE BASE DETAIL
N.T.S.



SECTION A-A (FRONTAL VIEW) CONTROLLER MUST BE BONDED TO NEUTRAL BUSS

SECTION B-B (SIDE VIEW)

5 SECURITY CABINET SECTIONS
N.T.S.

3 CLOCK CABINET

2 CLOCK CABINET

NOTE: 4
(PAINT SPECIFICATIONS) CONFORM TO A.D.O.T. SPECS. SEC. PRIMER COAT PAINT # 718, No. I.D. (ZINC CHROMATE) DESERT TAN HY-LUX ENAMEL.

NOTE: 5
IN SECURITY CABINET WITH MORE THAN ONE CLOCK THESE DETAILS AND NOTES SHALL APPLY.

6 NOTES *MAIN BONDING JUMPER
N.E.C. 250-79 a,b,c thru bolt / green

7 ISOMETRIC VIEW OF SECURITY CABINET
N.T.S.

NOTE:
IF USING APPROVED SOLID STATE CONTROLLER, CABINET MUST BE VENTED. OMIT WEATHER STRIPPING FOR VENTED CABINET

8 FRONTAL VIEW CABINET BASE DETAIL
N.T.S.

CLOCK SIZE		VARIABLE DIMENSIONS OF SECURITY CABINET													
QTY.	MAX. HT. & WTH.	A	B	C	D	E	F	G	H	I	J	K	L	M	N
	6' X 8'	1'-6"	1'-2"			1'-10"	11"	1'-6"	9						
	11' X 14'	1'-6"	1'-7"			1'-10"	11"	1'-11"	11 1/2"						
	19' X 17'	1'-10"	2'-2"			2'-2"	1'-1"	2'-6"	1'-3"						
	19' X 17'	3'-4"	2'-2"			3'-8"	•	2'-6"	1'-3"						
		4'-11"	2'-2"			5'-3"	•	2'-6"	1'-3"						

IRRIGATION DETAILS

CITY OF PHOENIX, ARIZONA
ENGINEERING DEPARTMENT

SCATTER WASH CHANNEL
43RD AVE. TO 39TH AVE.
ST-914085

DR. ABA.	CHK. ABA.	CHK. QPS.	SHEET NO.	TOTAL SHEETS	AS BUILT
			28	35	

REVISION BY CITY OF PHOENIX

NO.	DESCRIPTION	REV. BY	CK'D	DATE
1	Changes in Cabinet	ABA	ABA	2-96
2	Minor Changes	ABA	ABA	8-96
3	Revised	ABA		10-96

CITY OF PHOENIX
STREET TRANSPORTATION DEPARTMENT
DESIGN & CONSTRUCTION MANAGEMENT DIVISION

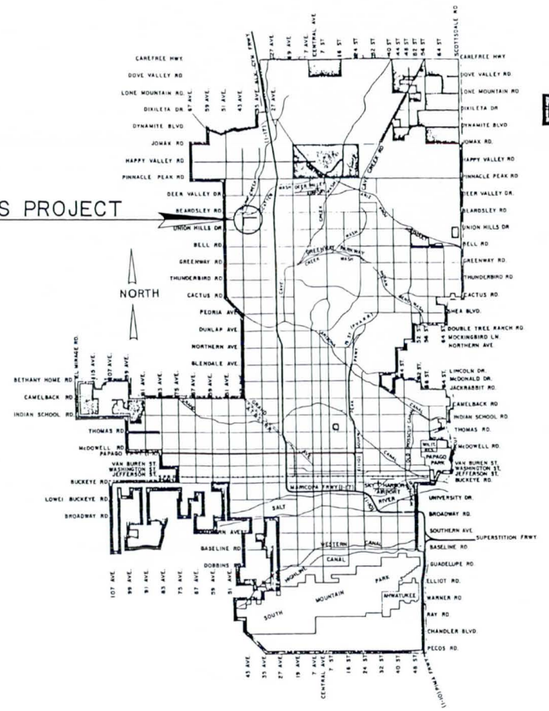
43RD. AVENUE 12" WATER MAIN
SCATTER WASH TO BEARDSLEY ROAD
INDEX NO. W-897728
1993

F.H.W.A. REGION	STATE	PROJ. NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.				

EA ENGINEERING ALLIANCE CONSULTING ENGINEER

DES: D.E.F. DR: J.S.S. CK: J.S.P. DATE:

LENGTH OF PROJECT



VICINITY MAP

APPROVED _____ 2-14-94
FOR WATER SERVICES DIRECTOR — DATE

APPROVED _____ 3-29-94
DEPUTY STREET TRANSPORTATION DIRECTOR — DATE

APPROVED Joseph E. Jason, P.E. 2-2-94
ENVIRONMENTAL HEALTH SERVICES — DATE

MAYOR

THELDA WILLIAMS

CITY MANAGER

FRANK FAIRBANKS

CITY COUNCIL

DISTRICT NO. 1 THELDA WILLIAMS
DISTRICT NO. 2 FRANCES EMMA BARWOOD
DISTRICT NO. 3
DISTRICT NO. 4 CRAIG TRIBKEN
DISTRICT NO. 5 JOHN NELSON
DISTRICT NO. 6 SAL DICICCIO
DISTRICT NO. 7 SALOMON LEIJA
DISTRICT NO. 8 CODY WILLIAMS

SCATTER WASH TO BEARDSLEY ROAD W-897728

Two working days before you dig, CALL FOR THE BLUE STAKES
263-1100
Blue Stake Center

LOG NUMBER

	NO SERVICES WITHIN PROJECT	PLANS REVIEWED BY	PERMIT RECEIVED
ARIZ. DEPT. OF TRANSPORTATION			
ARIZONA PUBLIC SERVICE			
CABLE T.V.			
COUNTY HIGHWAY DEPT.			
MOUNTAIN BELL			
SALT RIVER POWER DISTRICT			
S.R.V.W.U.A.			
SOUTHWEST GAS			
WATER & WASTEWATER DEPT.			

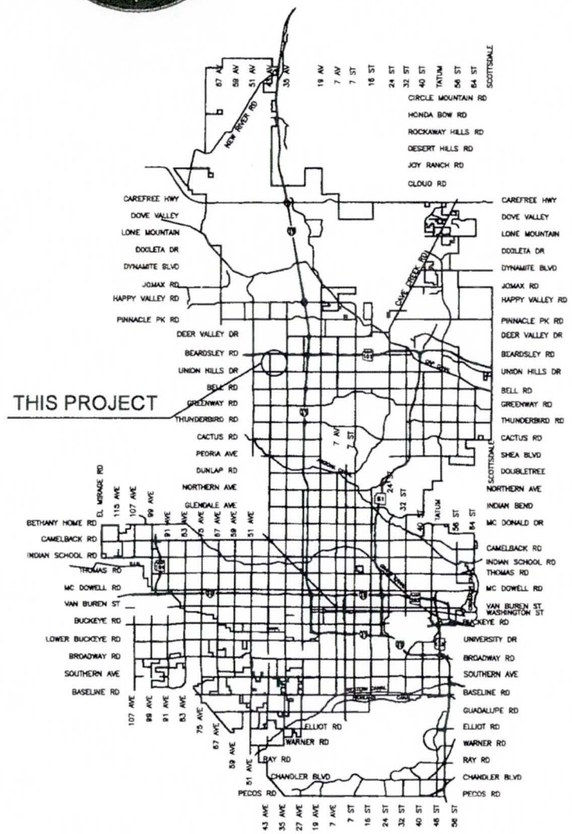
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

PLANS FOR THE CONSTRUCTION OF

SCATTER WASH LEVEE CERTIFICATION, ASSIGNMENT #3

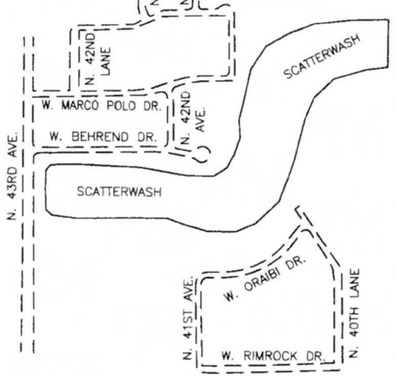
FCD CONTRACT NO. 2008C040

JUNE 15, 2011



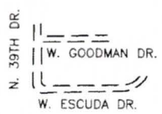
VICINITY MAP

NTS



KEY MAP

NTS



AS-BUILT CERTIFICATION

I HEREBY CERTIFY THAT THE "RECORD DRAWING" MEASUREMENTS AND AS BUILT ELEVATIONS AS SHOWN HEREON WERE MADE UNDER MY SUPERVISION OR AS NOTED AND ARE CORRECT TO THE BEST OF MY KNOWLEDGE AND BELIEF.

EDWIN M. BALLIET	7/16/11
REGISTERED LAND SURVEYOR NAME	DATE
31587	EXPIRES 9/30/2012
REGISTRATION NUMBER	DATE
RECEIVED BY (FIELD ENGINEER)	DATE

REGISTERED LAND SURVEYOR CERTIFICATE NO. 31587 EDWIN M. BALLIET 7/16/11 ARIZONA U.S.A.

SEAL

J2 engineering and environmental design
4649 east cotton gin loop, suite B2
phoenix, arizona 85040
phone: 602.438.2221
www.j2design.us

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

ISSUE RECOMMENDED BY:

PROJECT MANAGER — DATE

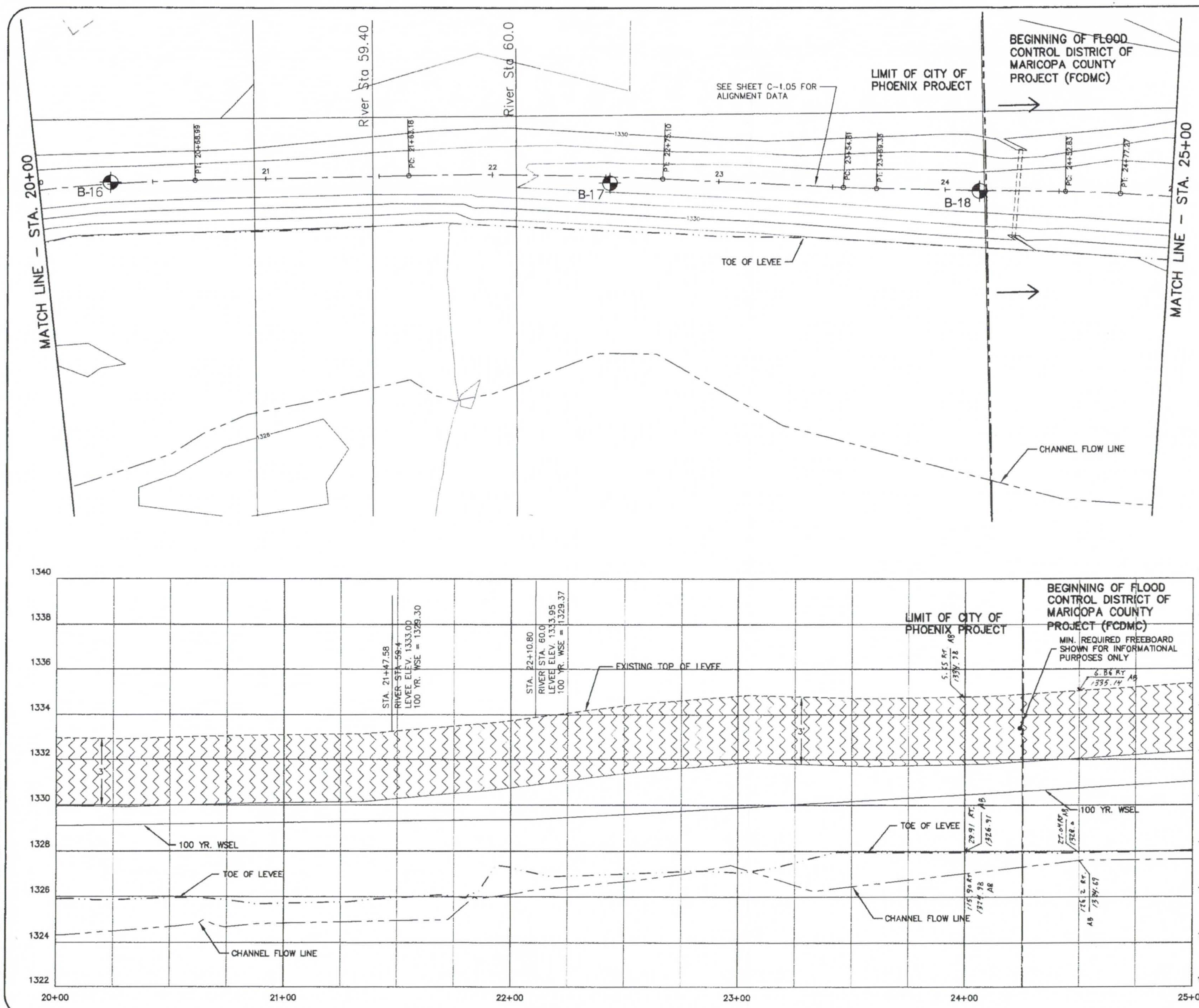
ISSUED FOR PUBLIC BIDDING BY:

CHIEF ENGINEER & GENERAL MANAGER — DATE

BOARD OF DIRECTORS OF THE FLOOD CONTROL DISTRICT

ANDY KUNASEK - CHAIRMAN

DISTRICT 1	FULTON BROCK
DISTRICT 2	DON STAPLEY
DISTRICT 3	ANDY KUNASEK
DISTRICT 4	MAX WILSON
DISTRICT 5	MARY ROSE WILCOX



Note:
For Boring Logs See Scatter Wash Levee Geotechnical Investigation and Analysis Report, Dated Oct. 7, 2009 by AMEC Earth & Environmental, Inc., Tempe, Arizona (AMEC Job No. 09-117-01027)"

0 10' 20' 40'
SCALE: 1"=20'

Revisions	Date

Expires 9/30/2012

Seal

Designed By: MRK

Drawn By: KRS/KSJ

Checked By: JJH

Date: 8/27/10

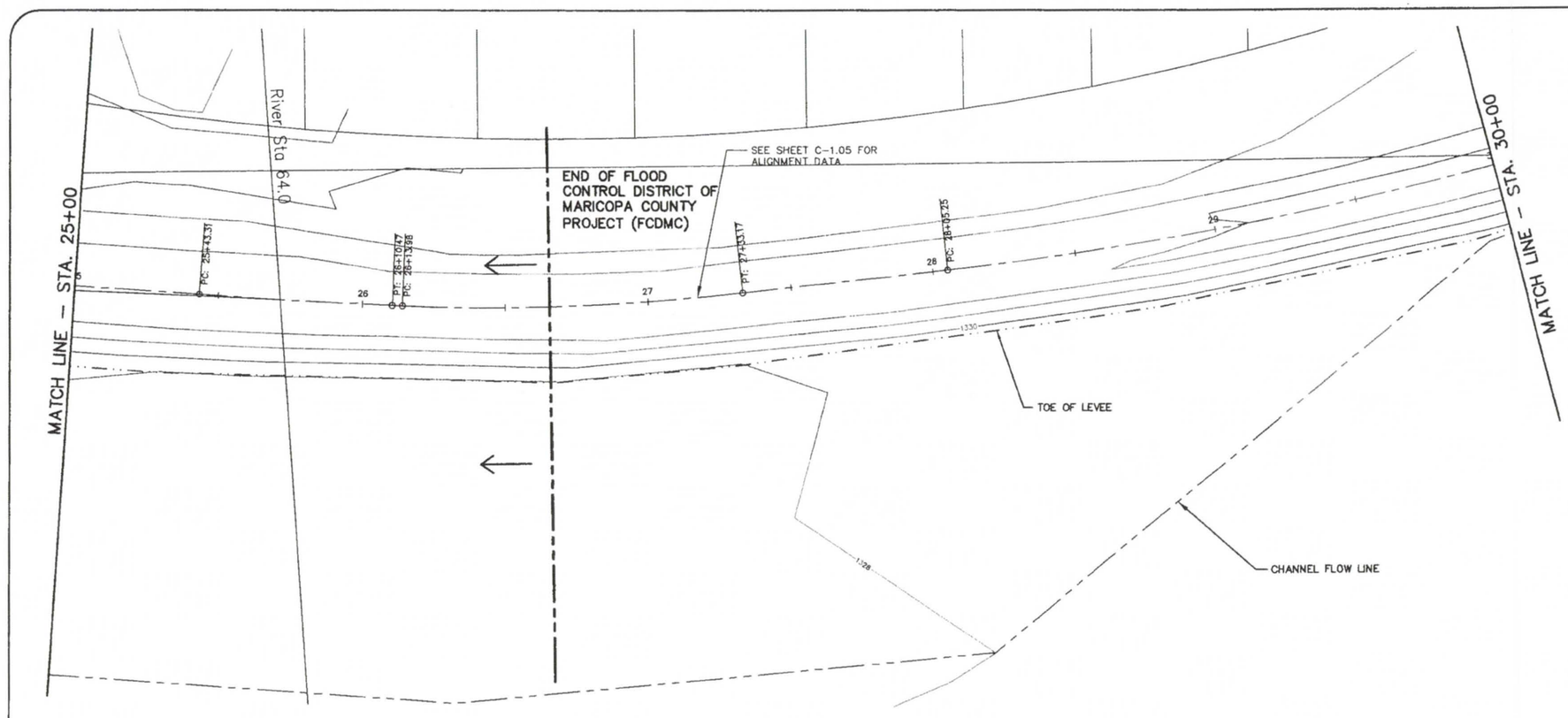
J2 Project No.: 08.0222
FCDMC
Contract # 2008C040
Assignment # 3

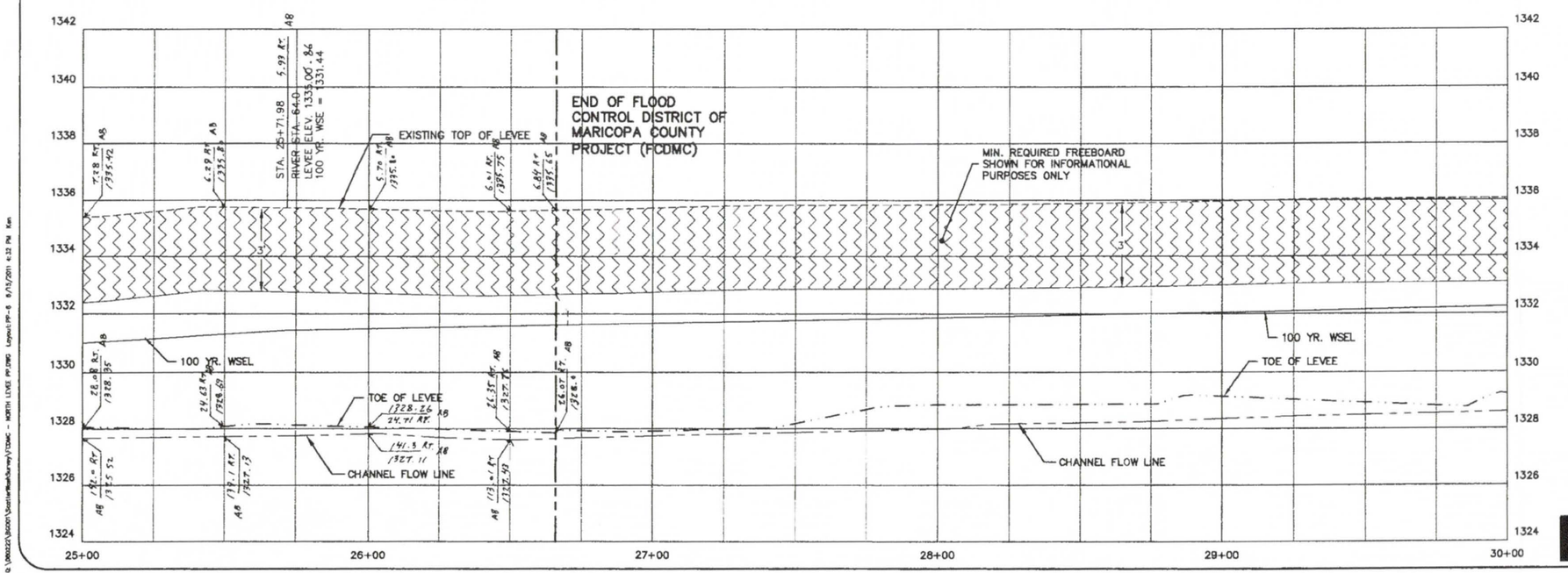
PER CITY OF PHOENIX ORDINANCE G-4396, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX

Title: PLAN AND PROFILE
NORTH LEVEE STA. 20+00 TO 125+00
SCATTER WASH LEVEE CERTIFICATION

J2 engineering and environmental design
4649 east cotton gin loop, suite B2
phoenix, arizona 85040
phone: 602.438.2221
www.j2design.us

Sheet
C-2.05





Revisions	Date

30140
MATTHEW R. KAPFER
ARIZONA U.S.A.
Expires 9/30/2012
Seal

Designed By:	MRK
Drawn By:	KRS/KSJ
Checked By:	JJH
Date:	8/27/10
J2 Project No.:	08.0222
FCDMC Contract # 2008C040 Assignment # 3	

PER CITY OF PHOENIX ORDINANCE G-4398, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX.

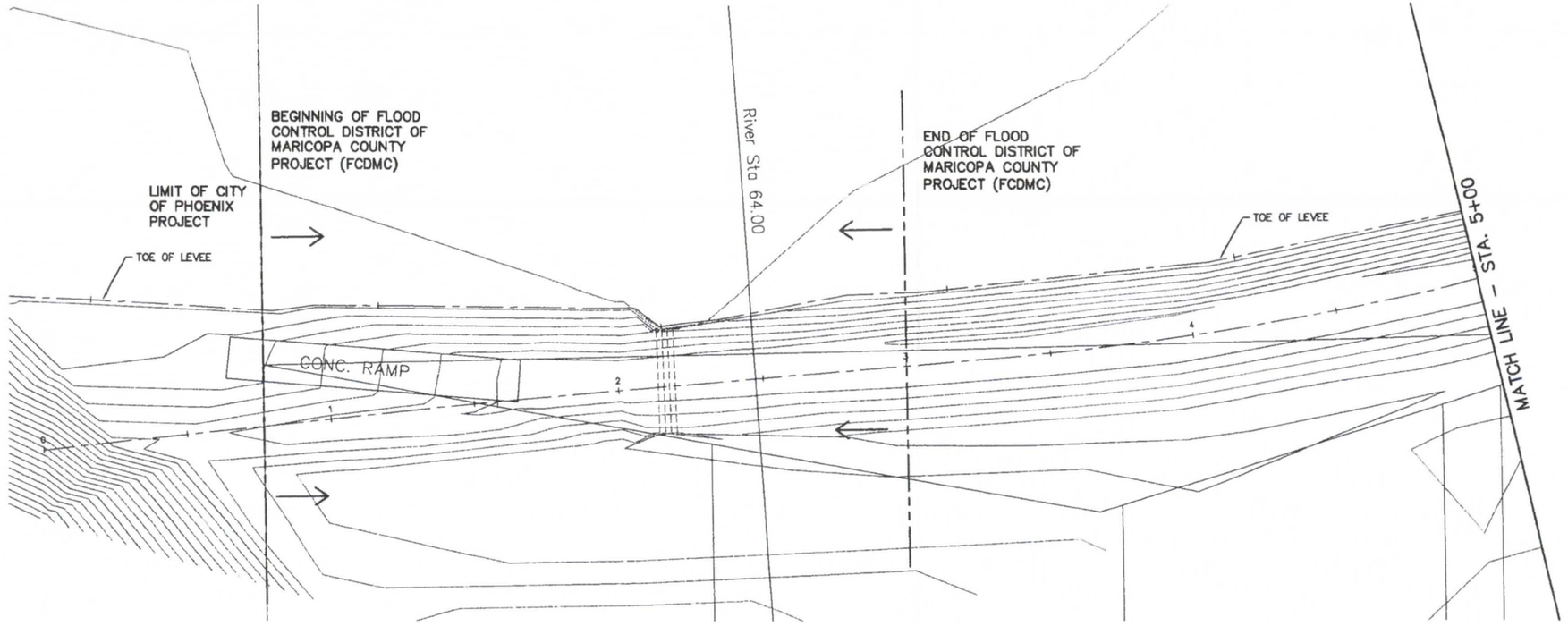
Title: LAYOUT PLAN
NORTH LEVEE STA. 0+00.00 TO 19+53.26
SCATTER WASH LEVEE CERTIFICATION

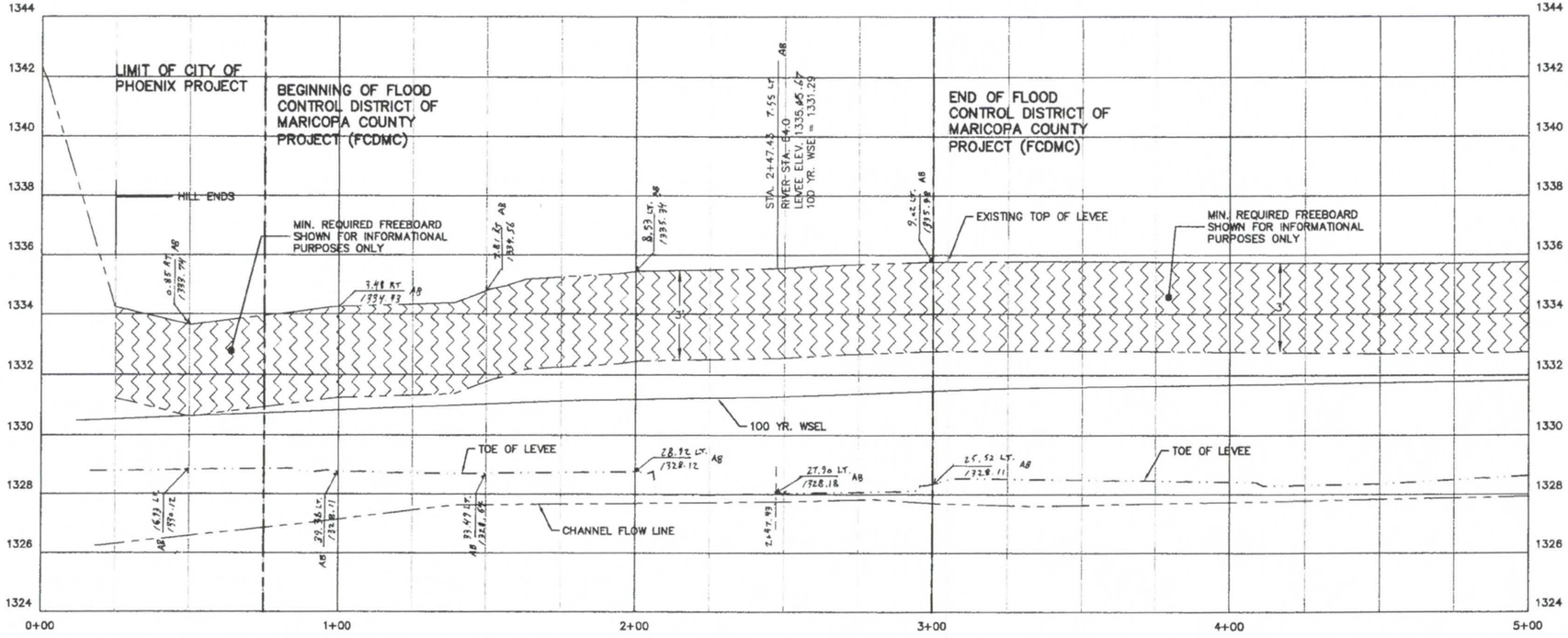
0 5' 10' 20'
HORZI. SCALE: 1"=10'

J2 engineering and environmental design
4649 east cotton gin loop, suite B2
phoenix, arizona 85040
phone: 602.438.2221
www.j2design.us

Sheet
C-2.06

G:\08022\LSD201\SiteWorkSurvey\FCDMC - NORTH LEVEE PP.DWG Layout: PP-8 8/15/2011 4:32 PM Ken





Revisions	Date

50140
MATTHEW R KAPFER
ARIZONA, U.S.A.
Expires 9/30/2012
Seal

Designed By:	MRK
Drawn By:	KRS/KSJ
Checked By:	JJH
Date:	8/27/10
J2 Project No.:	08.0222
FCDMC Contract # 2008C040 Assignment # 3	

PER CITY OF PHOENIX ORDINANCE G-4386, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX.

Title: PLAN AND PROFILE
SOUTHEAST LEVEE STA. 0+00 TO 5+00
SCATTER WASH LEVEE CERTIFICATION

0 10' 20' 40
SCALE: 1"=20'

J2 engineering and environmental design
4649 east cotton gin loop, suite B2
phoenix, arizona 85040
phone: 602.438.2221
www.j2design.us

Sheet
C-3.05

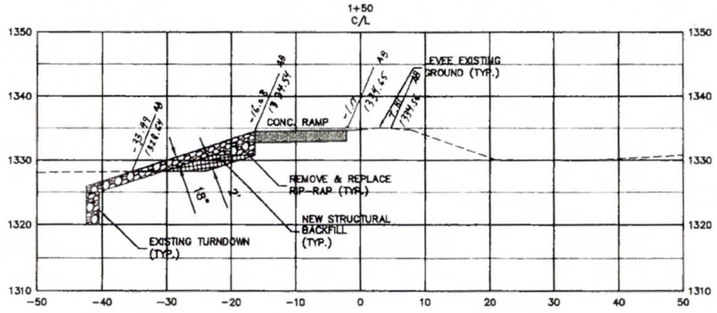
SOUTHEAST LEVEE SECTION VIEWS
STA. 0+50 TO 3+00

LEGEND

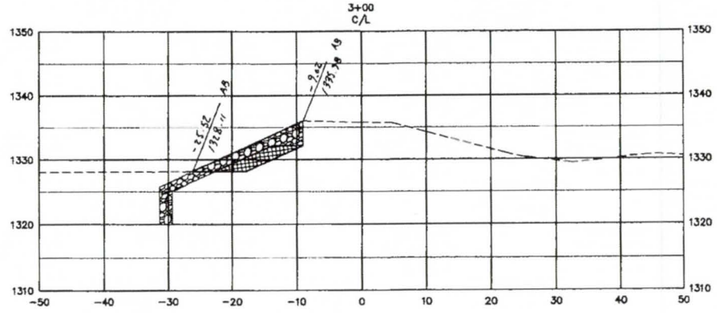
REMOVE AND REPLACE RIP-RAP

NEW STRUCTURAL BACKFILL

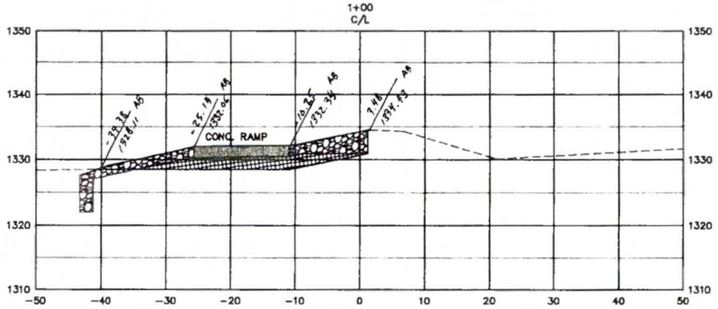
1+50
C/L



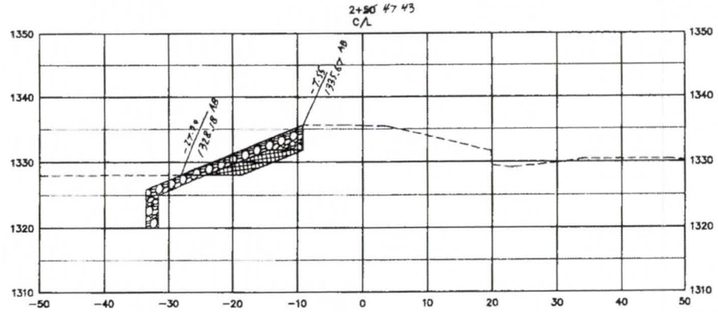
3+00
C/L



1+00
C/L



2+50
C/L



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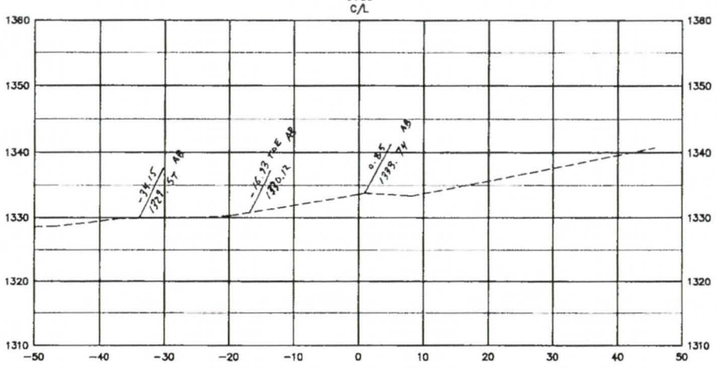

2+00
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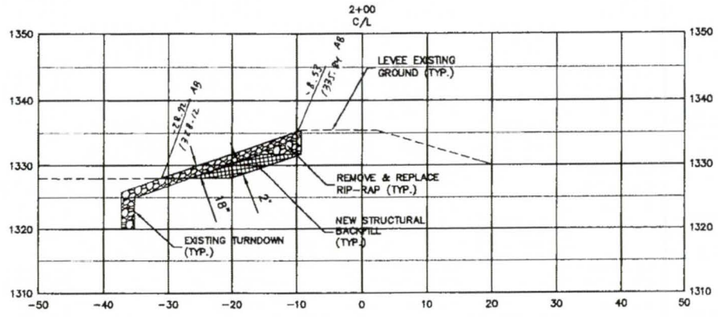


Revisions	Date

50140
MATTHEW R KAPFER
Expires 9/30/2012
Seal

Designed By:	MRK
Drawn By:	KRS/KSJ
Checked By:	JJH
Date:	8/27/10
J2 Project No.:	08.0222
FCDMC Contract # 2008C040 Assignment # 3	

PER CITY OF PHOENIX ORDINANCE G-4396, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX.

Title: LEVEE SECTION VIEWS
SOUTHEAST LEVEE STA. 0+50 TO 3+00

SCATTER WASH LEVEE CERTIFICATION

Sheet
C-6.15

Q:\080222\80001\ScatterWashSurvey\FCDMC - Levee Sections-Revised.DWG Layout:Southeast Sections - 1 6/15/2011 4:23 PM Ken

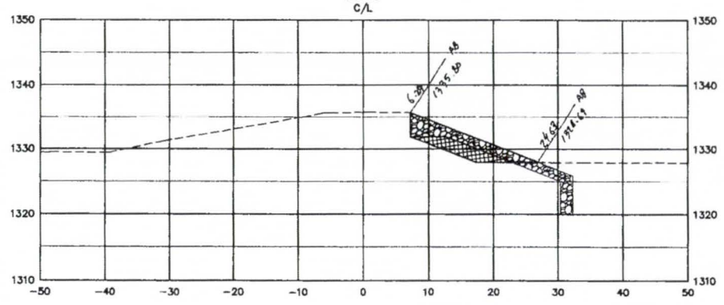
NORTH LEVEE SECTION VIEWS
STA. 24+50 TO 26+50

LEGEND

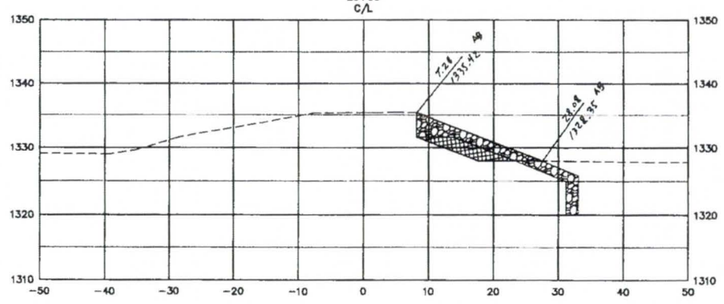
REMOVE AND REPLACE RIP-RAP

NEW STRUCTURAL BACKFILL

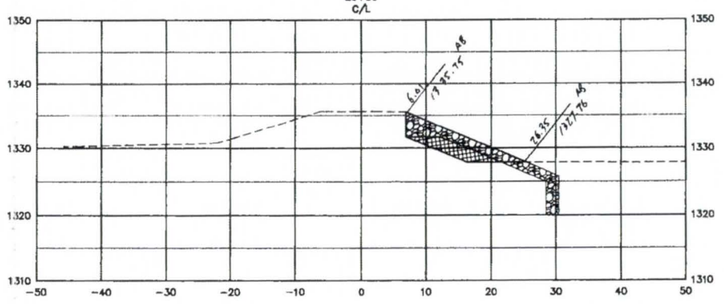
25+50
C/L



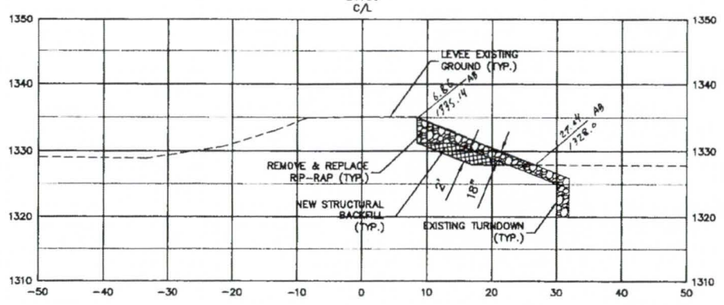
25+00
C/L



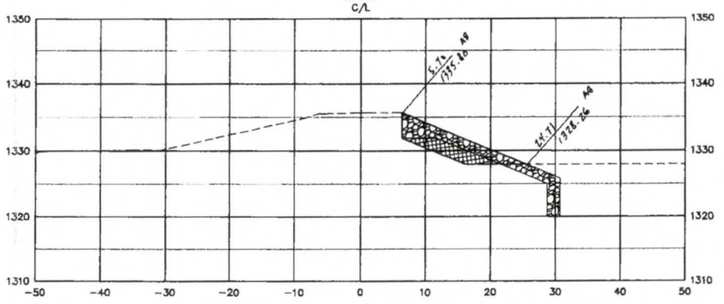
26+50
C/L



24+50
C/L



26+00
C/L



Revisions	Date

50140
MATTHEW R KAPPER
PROFESSIONAL ENGINEER
ARIZONA U.S.A.

Expires 9/30/2012

Seal

Designed By: MRK
Drawn By: KRS/KSJ
Checked By: JJH
Date: 8/27/10
J2 Project No.: 08.0222

FCDMC
Contract # 2008C040
Assignment # 3

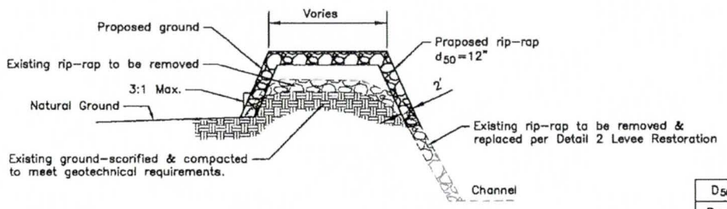
PER CITY OF PHOENIX ORDINANCE G-4385, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX.

Title: LEVEE SECTION VIEWS
NORTH LEVEE STA. 24+50 TO 26+50

SCATTER WASH LEVEE CERTIFICATION

Sheet
C-6.09

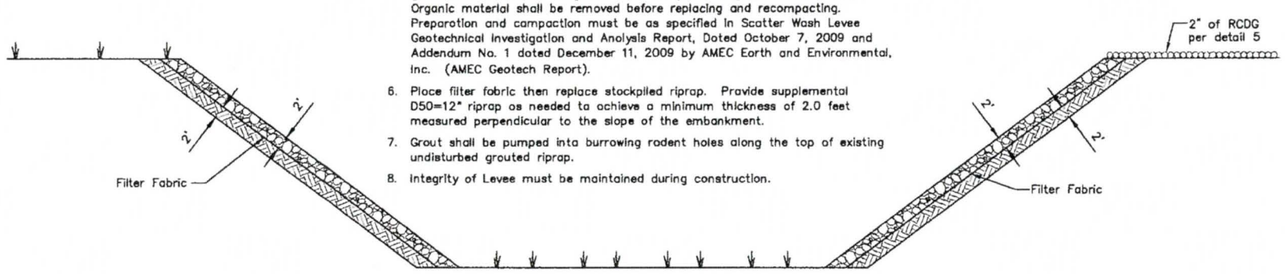
O:\080222\80001\ScatterWashSurvey\FCDMC - Levee Sections-Revised.DWG Layout:North Sections - 3 6/15/2011 4:41 PM Ken



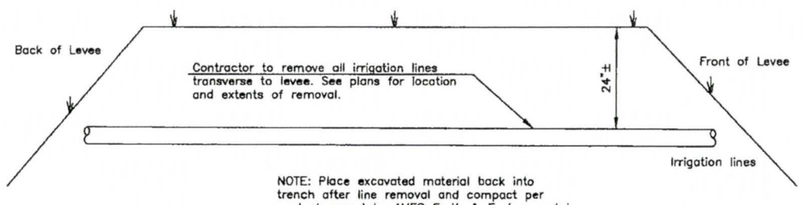
D_{50} = 12" Riprap	
Percent Passing	Sieve Size
100	24"
40-60	12"
0-10	4"

DETAIL 1: SECTION FOR RAISING BERM STA. 0+00 TO STA. 1+40
NTS

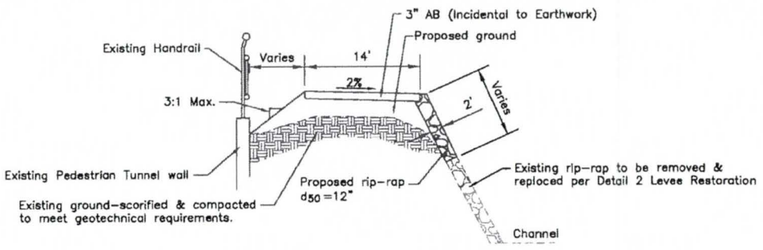
NOTE:
1. From interior top to interior toe of levees, remove and stockpile all ungrouted riprap. Riprap is anticipated to be approximately 2.0 feet thick, but may vary.
2. Excavate 2.0 feet of soil measured perpendicular to the slope as shown on plans. Remove all irrigation lines encountered during this process.
3. Where the irrigation lines are covered by grouted riprap, they should be cut at the edge of the grouted riprap; those portions of the pipes covered by grauted riprap are to remain in place.
4. Excavate to remove irrigation lines that transverse through the levees as shown on plans.
5. All excavated material must pass through a screen with a 2 inch by 2 inch grid size to remove all irrigation lines and particles greater than 2 inches. Organic material shall be removed before replacing and recompacting. Preparation and compaction must be as specified in Scatter Wash Levee Geotechnical Investigation and Analysis Report, Dated October 7, 2009 and Addendum No. 1 dated December 11, 2009 by AMEC Earth and Environmental, Inc. (AMEC Geotech Report).
6. Place filter fabric then replace stockpiled riprap. Provide supplemental D50=12" riprap as needed to achieve a minimum thickness of 2.0 feet measured perpendicular to the slope of the embankment.
7. Grout shall be pumped into burrowing rodent holes along the top of existing undisturbed grouted riprap.
8. Integrity of Levee must be maintained during construction.



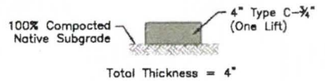
DETAIL 2: LEVEE RESTORATION
NTS



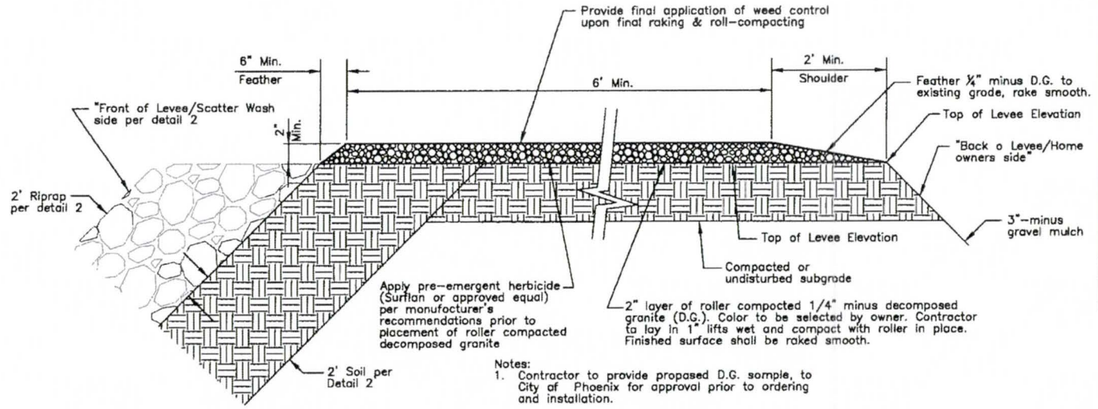
DETAIL 3: IRRIGATION LINE REMOVAL DETAIL
NTS



DETAIL 4: SECTION FOR MAINTENANCE ROAD
NTS



DETAIL 6: PAVEMENT SECTION ASPHALT ENTRANCE
NTS



Notes:
1. Contractor to provide propased D.G. sample, to City of Phoenix for approval prior to ordering and installation.

DETAIL 5: ROLLER COMPACTED DECOMPOSED GRANITE (RCDG)
NTS

Revisions	Date

Seal

Designed By:	MRK
Drawn By:	KRS/KSJ
Checked By:	JJH
Date:	8/27/10
J2 Project No.:	08.0222
City of Phoenix Project Number:	ST 83120043

PER CITY OF PHOENIX ORDINANCE G-4368, THESE PLANS ARE FOR OFFICIAL USE ONLY AND MAY NOT BE SHARED WITH OTHERS EXCEPT AS REQUIRED TO FULFILL THE OBLIGATIONS OF YOUR CONTRACT WITH THE CITY OF PHOENIX.

Title: DETAIL SHEET
SCATTER WASH LEVEE CERTIFICATION
FROM 43RD AVENUE TO 39TH AVENUE
PHOENIX, ARIZONA 85004
CITY OF PHOENIX PROJECT NO.: ST 83120043

Sheet
C-5.01

CITY OF PHOENIX STREET MAINTENANCE DIVISION

Q:\082222\8D001\ScatterWashSurvey\C3D-SCATTER WASH TOPO.dwg Layout:DETAILS 11/8/2010 3:01 PM Ken

APPENDIX C

SURVEY FIELD NOTES

Scatter Wash Mapping 4-30-14
Additional Topo requested along Behrend Dr.

Meta Data:
Vertical Datum: NAVD 88
Coordinate System: US State Plane 1983
Zone: Arizona Central 0202
Datum: NAD 1983 (2011)
Geoid Model: Geoid09AZ

LEGEND

BC	Back of Curb
CL	Centerline
EOR	Edge of Road
EOW	Edge of Walk
G	Gutter
NG	Natural Ground

Point #	Northing	Easting	Elevation	Description
6000	969685.2	633627.2	1349.32	NG
6001	969684.9	633639.7	1349.01	EOW
6002	969685	633644.6	1348.97	EOW
6003	969684.9	633653.7	1348.64	BC
6004	969684.9	633654.2	1348.2	G
6005	969685	633655.6	1348.32	EOR
6006	969683.2	633686.1	1349.07	CL
6007	969683	633726.6	1349.03	EOR
6008	969683.3	633727.8	1348.86	G
6009	969683.4	633728.4	1349.61	BC
6010	969682.7	633742.5	1350.03	EOW
6011	969682.6	633748.4	1350.04	EOW
6012	969682.6	633749.3	1350.22	NG @ WALL
6013	969734.6	633754.4	1350.31	NG @ WALL
6014	969734.3	633747.9	1350.16	EOW
6015	969734.1	633742	1350.06	EOW
6016	969734.4	633728.2	1349.69	BC
6017	969734.2	633727.6	1349.19	G
6018	969734.1	633726.3	1349.11	EOR
6019	969734.7	633686.2	1349.41	CL
6020	969735.3	633655.3	1348.63	EOR
6021	969735.2	633654	1348.6	G
6022	969735.4	633653.4	1348.87	BC
6023	969735.7	633644.3	1349.32	EOW
6024	969735.7	633639.3	1349.24	EOW
6025	969736.3	633616.4	1349.63	NG
6026	969646.3	633686.3	1349.06	CL
6027	969697.2	633686	1349.12	CL
6028	969744.8	633686	1349.44	CL
6029	969793.3	633685.3	1349.57	CL
6030	969846.1	633685.7	1349.78	CL
6031	969897.4	633684.7	1349.9	CL
6032	969948.4	633684.3	1350.04	CL

EXPIRES 6-30-16

6033	969999.1	633684.6	1350.1	CL
6034	969853.5	633748.8	1350.79	NG @ WALL
6035	969826.9	633749	1350.26	NG
6036	969816.4	633755.1	1350.06	EOW
6037	969812.2	633752.8	1350.03	BC
6038	969811.6	633752.8	1349.28	G
6039	969793.1	633749.8	1349.99	CL
6040	969772.7	633749.3	1349.37	G
6041	969772.1	633749.3	1350.03	BC
6042	969768	633749.2	1350.11	EOW
6043	969749.2	633749.8	1350.02	NG
6044	969729.8	633749.7	1350.33	NG @ WALL
6045	969774.1	633750.7	1349.53	EOR
6046	969810.2	633749.6	1349.47	EOR
6047	969823	633819.7	1350.39	NG @ WALL
6048	969816.7	633819.5	1350.38	EOW
6049	969812.8	633819.4	1350.31	BC
6050	969812.1	633819.5	1349.77	G
6051	969810.9	633819.6	1349.81	EOR
6052	969793	633819.7	1350.39	CL
6053	969774.5	633820	1349.88	EOR
6054	969773.3	633820.1	1349.89	G
6055	969772.6	633820.1	1350.26	BC
6056	969768.7	633820.1	1350.34	EOW
6057	969762.4	633820.1	1350.46	NG @ WALL
6058	969687.1	632326.9	1340.57	NG @ WALL
6059	969687.3	632349.2	1340.48	NG
6060	969687.2	632365.4	1340.7	NG
6061	969687.3	632370.3	1341.48	EOR
6062	969687.1	632378.6	1341.6	CL
6063	969687	632387.4	1341.26	EOR
6064	969687.2	632388.6	1341.2	G
6065	969687.1	632389.1	1341.67	BC
6066	969687.2	632393.1	1341.81	EOW
6067	969687	632395.5	1341.86	NG @ WALL
6068	969741.6	632409.9	1341.89	NG
6069	969741.3	632392.7	1341.85	EOW
6070	969741.3	632388.8	1341.76	BC
6071	969741.3	632388.3	1341.27	G
6072	969741.2	632378.4	1341.84	CL
6073	969741.4	632370.7	1341.76	EOR
6074	969741.4	632365.1	1341.21	NG
6075	969742.9	632348.3	1340.91	NG
6076	969744.8	632326.5	1340.98	NG @ WALL
6077	969738.9	632408.3	1342	NG
6078	969757.1	632408	1341.98	EOW
6079	969761.1	632407.9	1341.93	BC

6080	969761.7	632407.9	1341.43	G
6081	969777.8	632407.4	1341.98	CL
6082	969794.2	632406.5	1341.47	EOR
6083	969795.5	632406.3	1341.53	G
6084	969796.2	632406.3	1341.94	BC
6085	969799.8	632406.1	1342.01	EOW
6086	969825.4	632405.3	1342.34	NG
6087	969898.7	632370.2	1342.02	CL
6088	969852.8	632370.3	1342	CL
6089	969807.1	632371.4	1341.83	CL
6090	969776.4	632376.3	1342.07	CL
6091	969727.8	632378.7	1341.7	CL
6092	969682.2	632377.6	1341.72	CL
6093	969636.6	632377.6	1341.48	CL
6094	969593.5	632377.8	1341.55	CL
6095	969752.2	631963.5	1339.16	NG @ FENCE
6096	969759	631962.9	1338.85	NG
6097	969767.7	631963.8	1338.81	EOR
6098	969780.7	631963.2	1339.22	CL
6099	969793.5	631963.3	1339.61	EOR
6100	969804.6	631963.5	1339.46	NG
6101	969818.8	631962.9	1339.54	NG @ FENCE
6102	969825.2	631932.5	1339.31	NG @ FENCE
6103	969806.4	631931.7	1339.28	NG
6104	969793.4	631931.8	1339.35	EOR
6105	969781	631932.3	1339.14	CL
6106	969766.8	631931.8	1338.64	CL
6107	969750	631931.6	1338.99	CL
6108	969702.7	631932.8	1338.97	CL
6109	969656.5	631933.3	1338.88	CL
6110	969611.4	631933.5	1338.64	CL
6111	969680.7	631910.9	1338.49	NG @ WALL
6112	969680.7	631923.1	1338.89	EOR
6113	969681.1	631933.5	1338.95	CL
6114	969681.8	631945	1339.15	EOR
6115	969681.8	631945.4	1339.03	NG @ FENCE
6116	969727.3	631945.2	1339.28	NG @ FENCE
6117	969727.3	631944.2	1339.26	EOR
6118	969727.9	631933.7	1339.23	CL
6119	969728.5	631921.4	1339.02	EOR
6120	969729	631912.8	1338.72	NG
6121	969730.1	631902.7	1339.52	NG
6122	969748.3	631504.3	1337.47	NG
6123	969761	631504.4	1337.79	BC
6124	969761.7	631504.5	1337.56	G
6125	969776.3	631504.7	1337.49	CL
6126	969790.6	631504.9	1337.69	EOR

6127	969815.7	631504.6	1337.29	NG
6128	969805.5	631511.6	1337.36	NG
6129	969806.7	631484.8	1337.75	EOR
6130	969806.6	631476.7	1337.74	CL
6131	969806.7	631467.5	1337.62	EOR
6132	969806	631463.3	1337.34	NG @ FENCE
6133	969741.1	631464	1337.42	NG @ FENCE
6134	969740.4	631470.6	1337.3	EOR
6135	969739	631479.6	1337.41	CL
6136	969737.8	631487.5	1337.31	EOR
6137	969737.7	631489.4	1337.27	G
6138	969737.5	631490	1337.72	BC
6139	969742.1	631509.4	1337.44	NG
6140	969645.4	631481.8	1337.15	CL
6141	969693.5	631480.7	1337.56	CL
6142	969744.4	631480.4	1337.45	CL
6143	969776.8	631478.6	1337.6	CL
6144	969827.9	631477	1337.68	CL
6145	969873.3	631476.6	1337.49	CL
6146	969921.1	631476.2	1337.43	CL
6147	969906.2	630811.5	1334.92	BC
6148	969914	630833.5	1335.18	BC
6149	969918.9	630855.6	1335.33	BC
6150	969920.3	630879.7	1335.44	BC
6151	969920.3	630903.4	1335.79	BC
6152	969920.5	630928	1335.92	BC
6153	969920.7	630951.7	1336.18	BC
6154	969920.9	630974.2	1336.29	BC
6155	969921	630996.7	1336.22	BC
6156	969906.3	630997.6	1336.16	CL
6157	969906.8	630972.7	1336.14	CL
6158	969907.4	630948.1	1335.98	CL
6159	969907.5	630922.9	1335.79	CL
6160	969907.4	630897.8	1335.61	CL
6161	969907.1	630874	1335.4	CL
6162	969903.6	630851	1335.27	CL
6163	969897.8	630829.3	1334.94	CL
6164	969893.7	630816	1334.8	CL
6165	969880.1	630825.3	1335.29	BC
6166	969887.6	630846.9	1335.19	BC
6167	969891	630870.2	1335.49	BC
6168	969891.3	630896.2	1335.76	BC
6169	969891.5	630921.9	1335.86	BC
6170	969891.7	630946.8	1336.17	BC
6171	969891.8	630972.4	1336.41	BC
6172	969891.9	630995.7	1336.44	BC
6173	969870.1	631003.7	1336.28	NG

6174	969884.7	631003.2	1336.54	EOW
6175	969891.9	631003.5	1336.52	BC
6176	969892.3	631003.4	1336.02	G
6177	969893.9	631003.2	1335.98	EOR
6178	969905.6	631003.4	1336.09	CL
6179	969918.9	631002.8	1335.96	EOR
6180	969920.5	631002.7	1335.94	G
6181	969921	631002.7	1336.45	BC
6182	969927.8	631002.3	1336.53	EOW
6183	969954.9	631002.1	1337.29	NG
6184	969921.1	631008.8	1335.96	BC
6185	969920.6	631009	1335.9	G
6186	969921.2	631013.7	1335.8	G
6187	969921.7	631013.7	1335.87	BC
6188	969924.3	631019.1	1336.52	BC
6189	969923.8	631019.3	1336.07	G
6190	969930.7	631026.1	1336.04	G
6191	969930.9	631025.6	1336.48	BC
6192	969936.5	631027.8	1335.99	BC
6193	969936.5	631028.3	1335.96	G
6194	969941.5	631027.8	1336.05	BC
6195	969941.5	631028.5	1335.94	G
6196	969892.3	631009.5	1335.98	G
6197	969891.7	631009.5	1336.04	BC
6198	969890.9	631014.3	1335.91	BC
6199	969891.5	631014.4	1335.81	G
6200	969888.9	631020.2	1335.98	G
6201	969888.4	631019.8	1336.44	BC
6202	969882.9	631025.3	1336.25	BC
6203	969883.3	631025.5	1335.75	G
6204	969877.4	631027.8	1335.59	BC
6205	969877.5	631028.3	1335.61	G
6206	969872.3	631029	1335.49	G
6207	969872.3	631028.5	1335.56	BC
6208	969866.6	631028.4	1335.81	BC
6209	969866.5	631029	1335.41	G
6210	969817.6	631029.3	1335.44	G
6211	969817.6	631028.7	1335.88	BC
6212	969767.5	631029.5	1335.33	G
6213	969767.5	631028.9	1335.82	BC
6214	969718.7	631029.7	1335.11	G
6215	969718.7	631029.1	1335.65	BC
6216	969718.2	631042.7	1335.56	CL
6217	969718.3	631053.8	1335.42	EOR
6218	969769.7	631053.7	1335.68	EOR
6219	969769.8	631042.4	1335.7	CL
6220	969818.9	631042	1335.85	CL

6221	969818.9	631053.5	1335.78	EOR
6222	969869	631053.7	1335.84	EOR
6223	969870.9	631041.7	1336.04	CL
6224	969905.4	631042	1336.08	CL
6225	969905.4	631052.8	1336.09	EOR
6226	969942.7	631052.3	1336.01	EOR
6227	969941.6	631042.2	1336.24	CL

APPENDIX D

SITE ASSESSMENT PHOTO LOG AND FIELD NOTES

Levee Identification

Levee ID No.	Scatter Wash North and South
Facility Type	Levee
Station From:	
Station To:	

Note: Facility Type refers to Training Levee, Protection Levee, Floodwall, etc.

Site Visit Details

Observer Name	Alex Coronel
	Tony Freiman
Date:	2/26/2014
Weather:	Clear

Observation Notes

Item Letter	Item No.	Dryside (D), Wetside(W), and/or Crest (C)	Location/Observations/Remarks	Photo Dir US, DS, TS, AS	Photo # (if applicable)	GPS PT
EL	N	C	Sta 390+90	DS, US	0297, 0298	173
EL	N	C	West Edge of Headwall	DS, Dry Side	0299, 0300	174
EL	N	C	Alert Gage - Pressure Transducer		0301	175
EL	N	C	Sta 390+00			176
EL	N	D	Multiple Gopher Holes 16"-24" Deep, 4 Fresh/ Numerous Former		0302, 0303	177
			Geotechnical X-Section /2:1/ L=17.5'/ Crest=16'/ 4:1 BS			
EL	N	D	Gopher Holes = 14" Diameter Tree 5' From Toe	DS, US	0304,0305	178
EL	N		Sta 385+00	Ramp	0306, 0307	179
			Beginning of Ramp			180
EL	N	D	Dry Side Depression		0308	181
EL	N	D	Sta 380+00: Geotechnical X-Section	Across, DS	0309, 0310	182
EL	N		26.2º 17' Slope/ 13.5' Crest/ 2:1 13'	US	0311	
EL	N	D	2' Deep Gopher Hole			183
EL	N	C	Start of Rock Rip Rap = 12" D50	DS Face, DS Crest	0312, 0313	184
				Across	0314	
			ID- Culdesac Swale		0315	
			18" ID Structure @ Sta 377+00	Culv, BPM	0316, 0317	185
			Flap Gate Functioning Properly, Open and Seats Well	Basin	0318	
				Open, Closed	0319, 0320	
			Start of Low Flow Channel (10' Drop = 2' Deep)	US, DS	0321, 0322	186
				N,S	0323, 0324	

EL	S	C	Tie-In to High Ground	DS, US	0325, 0326	188
EL	S	C	Start of Ramp			189
EL	S	C	2-24" Flap Gates @ Sta 378+55, Pipes Clean, Opens and Seats Properly	US Open, DS Open	0327, 0328	190
				Closed, Inlet	0329, 0330	191
EL	S	C	Geotech Section Wet			192
EL	S	C	Geotech Section Dry			193
EL	S	C	Begin Rip Rap			195
EL	S	C	Vision Hills Channel Intersection With Levee	Into Chan, Into Levee	0326, 0327	196
				US, DS	0338, 0339	
EL	S	D	Rodent Activity			197
EL	S		385+00			198
EL	S		Interior Ponding Area	DS, US	0341, 0342	199
			ID Pondomg Area and Rodent Activity		0343-0349	200
EL	S	D	Beginning of Fully Grouted Riprap on Dry Side		0350, 0353	202
			Geotechnical X-Section			201
EL	S		Sta 390+00 Toe of Slope in Private Property	Toe	0354	
				DS, US	0355, 0356	203
EL	S	D	End of Riprap (Grouted)	US, DS	0357, 0358	204
			Lowest Point in Shallow Basin	DS Basin	0359	

NOTE: For location, include Station (if possible) or distance/direction from known feature

PHOTOGRAPHIC LOG

Photo No. 0297: GPS Pt. 173

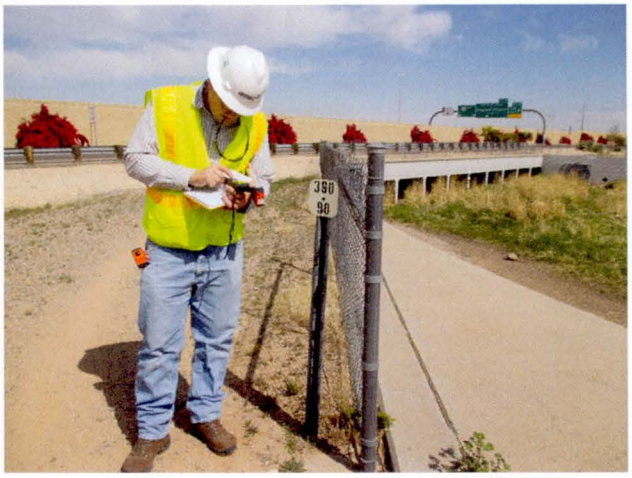


Photo No. 0298: GPS Pt. 173

Photo No. 0299: GPS Pt. 174

Photo No. 0300: GPS Pt. 174

Scatter Wash Levee Field Reconnaissance

Site Visit – February 26, 2014

PHOTOGRAPHIC LOG

Photo No. 0301: GPS Pt. 175

Photo No. 0302: GPS Pt. 177

Photo No. 0303: GPS Pt. 177

Photo No. 0304: GPS Pt. 178

AMEC Job No. 3720142002	Reviewed By:	Prepared By: R. Record	amec

Scatter Wash Levee Field Reconnaissance

Site Visit – February 26, 2014

PHOTOGRAPHIC LOG

Photo No. 0305: GPS Pt. 178

Photo No. 0306: GPS Pt. 179

Photo No. 0307: GPS Pt. 179

Photo No. 0308: GPS Pt. 181

AMEC Job No. 3720142002	Reviewed By:	Prepared By: R. Record	amec

PHOTOGRAPHIC LOG

Photo No. 0309: GPS Pt. 182

Photo No. 0310: GPS Pt. 182

Photo No. 0311: GPS Pt. 183

Photo No. 0312: GPS Pt. 184

PHOTOGRAPHIC LOG

Photo No. 0313: GPS Pt. 184

Photo No. 0314: GPS Pt. 184

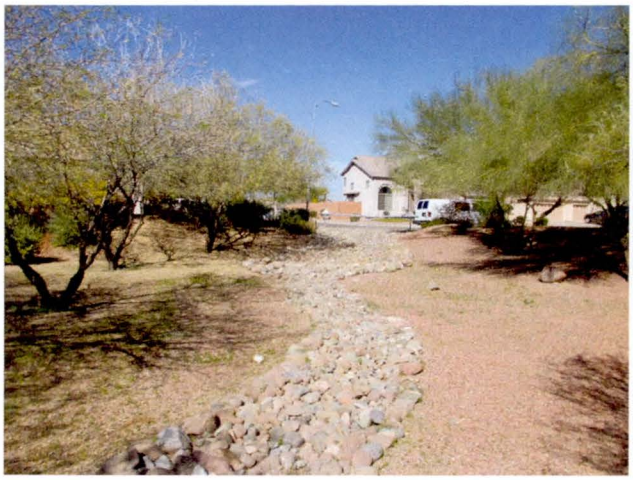


Photo No. 0315: GPS Pt. 184

Photo No. 0316: GPS Pt. 185

Scatter Wash Levee Field Reconnaissance

Site Visit – February 26, 2014

PHOTOGRAPHIC LOG

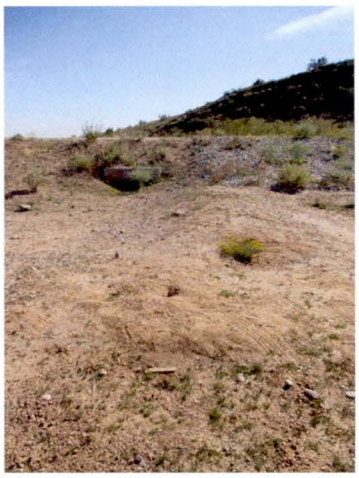


Photo No. 0317: GPS Pt. 185

Photo No. 0318: GPS Pt. 185

Photo No. 0319: GPS Pt. 185

Photo No. 0320: GPS Pt. 185

AMEC Job No. 3720142002	Reviewed By:	Prepared By: R. Record	amec

PHOTOGRAPHIC LOG

Photo No. 0321: GPS Pt. 186

Photo No. 0322: GPS Pt. 186

Photo No. 0323: GPS Pt. 186

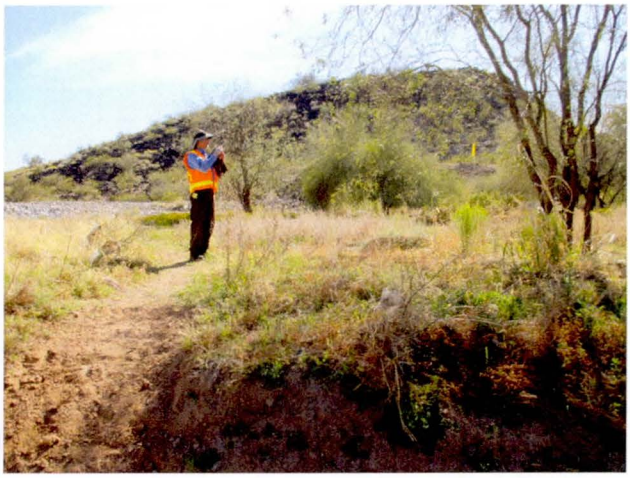


Photo No. 0324: GPS Pt. 186

PHOTOGRAPHIC LOG

Photo No. 0325: GPS Pt. 188

Photo No. 0326: GPS Pt. 188

Photo No. 0327: GPS Pt. 190

Photo No. 0328: GPS Pt. 190

PHOTOGRAPHIC LOG

Photo No. 0329: GPS Pt. 191

Photo No. 0330: GPS Pt. 191

Photo No. 0331

Photo No. 0332

AMEC Job No. 3720142002	Reviewed By:	Prepared By: R. Record	amec

Scatter Wash Levee Field Reconnaissance
Site Visit – February 26, 2014

PHOTOGRAPHIC LOG

Photo No. 0333

Photo No. 0334

Photo No. 0335

Photo No. 0336: GPS Pt. 196

AMEC Job No. 3720142002	Reviewed By:	Prepared By: R. Record	amec

PHOTOGRAPHIC LOG

Photo No. 0337: GPS Pt. 196

Photo No. 0338: GPS Pt. 196

Photo No. 0339: GPS Pt. 196

Photo No. 0341: GPS Pt. 199

PHOTOGRAPHIC LOG

Photo No. 0342: GPS Pt. 199

Photo No. 0343: GPS Pt. 200

Photo No. 0344: GPS Pt. 200

Photo No. 0345: GPS Pt. 200

PHOTOGRAPHIC LOG

Photo No. 0346: GPS Pt. 200

Photo No. 0347: GPS Pt. 200

Photo No. 0348: GPS Pt. 200

Photo No. 0349: GPS Pt. 200

PHOTOGRAPHIC LOG

Photo No. 0350: GPS Pt. 202

Photo No. 0351: GPS Pt. 202

Photo No. 0352: GPS Pt. 202

Photo No. 0353: GPS Pt. 202

PHOTOGRAPHIC LOG

Photo No. 0354: GPS Pt. 201

Photo No. 0355: GPS Pt. 203

Photo No. 0356: GPS Pt. 203

Photo No. 0357: GPS Pt. 204

Scatter Wash Levee Field Reconnaissance

Site Visit – February 26, 2014

PHOTOGRAPHIC LOG

Photo No. 0358: GPS Pt. 204

Photo No. 0359: GPS Pt. 204

AMEC Job No. 3720142002	Reviewed By:	Prepared By: R. Record	amec

APPENDIX E

SCATTER WASH – FREEBOARD ANALYSIS

HEC – RAS
SCATTER WASH

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Scatter Wash FINAL
Project File : ScatterWashFINAL.prj
Run Date and Time: 7/17/2014 3:10:30 PM

Project in English units

Project Description:
Scatter Wash Levee Certification - SR 101L to City of Phoenix Levee ID#46
Click Here-------->

FCD Contract Number: 2011C005 WA#14

Study
contractor firm name: AMEC Environment & Infrastructure, Inc.

Latest run
date: June 27, 2014

The purpose of this study is to calculate the required
water surface profiles and hydraulic properties to provide certification
documentation in support of FEMA accreditation of the levees along the north
and south banks of Scatter Wash between SR 101L and the City of Phoenix Levee
ID#46. Levees within this reach are identified by FEMA as Levee ID #1901064146
& 1901064147.

Geometry data for cross sections 0.352 to 0.852, inclusive of
the culvert at 43rd Avenue, was extracted from the model named "Scatterwash
Levee Certification 0611" included in the report titled "Scatter Wash Levee
Certification From 43rd Avenue to 39th Drive City of Phoenix Project No. ST
83130297" dated June 2011. The subject model was created in the NGVD29
vertical datum. A factor of 1.867 feet was added to all elevations to convert
the model to NAVD88 vertical datum. Extracted Model Project: "Scatter Wash
Levee Certification 0611", SWLeveeCert0611.prj
Extracted Model Plan: "Matches
Report - Normal Depth Bndr Cond.", SWLeveeCert0611.p04
Note: cross section
notes preceded by "Original Model Comment:" found in the cross section data
editor are exactly as written by the original modeler.

Geometry data for
cross sections 1.036 to 1.342, inclusive of the culvert at the L101 Highway,
was extracted from the model named "Scatter Wash Floodplain Study" prepared for
the Scatter Wash Floodplain Re-Delineation Study (FCD Contract Number 2013C002
WA#1).
Extracted Model Project: "Scatter Wash Floodplain Study",
ScatterWash.prj
Extracted Model Plan: "Scatter Wash.", ScatterWash.p01
Note:
cross section notes preceded by "Original Model Comment:" found in the cross
section data editor are exactly as written by the original modeler.

Vertical
datum of model geometry: NAVD 1988
Horizontal Projection: NAD83. Arizona
Coordinate System, Central Zone, 1992 Epoch

Base map date: January 31,
2013

Base map contractor: AeroTech Mapping Technologies, LLC

This model
was run using HEC-RAS program version 4.1.0.

Source of Effective Hydrology:
Scatter Wash Letter of Map Revision, October 1995, developed by
Kaminski-Hubbard Engineering for the City of Phoenix, Index No. ST-951350.
This flow rate is reported in teh Flood Insurance Study for Maricopa County

2013, Summary of Discharges Table, Volume 1.

Flow Profile 2 is equivalent to
the 10-year storm using a ratio of 35% of the 100-year storm per guidance in
Section 6.2 of the Drainage Design Manual for Maricopa County, Hydrology,
2013.

PLAN DATA

Plan Title: FINAL
Plan File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.p03

Geometry Title: FINAL
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.g05

Flow Title : SWLC
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.f01

Plan Summary Information:

Number of:	Cross Sections	= 23	Multiple Openings	=	0
	Culverts	= 2	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

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

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: SWLC
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.f01

Flow Data (cfs)

River	Reach	RS	Q100 - Effective	Q1- 35% Q100
Scatter_Wash	One	1.342	2760	966

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Scatter_Wash	One	Q100 - Effective		Normal S = 0.005
Scatter_Wash	One	Q1- 35% Q100		Normal S = 0.005

GEOMETRY DATA

Geometry Title: FINAL
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.g05

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.342

INPUT
Description: Floodplain Redelineation Section 1.339

Original Model
Comment:
7069

Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9671.28	1349.21	9677.68	1349.11	9684.09	1348.94	9690.49	1348.6	9699.88	1348.06
9703.3	1347.87	9715.34	1346.4	9726.74	1344.98	9738.78	1343.6	9744.61	1342.9
9746.03	1342.26	9747.03	1342.19	9748.03	1342.06	9748.03	1341.96	9748.03	1341.86
9748.03	1341.73	9749.03	1341.66	9750.03	1341.57	9750.03	1341.47	9750.03	1341.35
9751.44	1341.02	9752.44	1340.66	9753.85	1340.11	9756.68	1339.28	9756.68	1339.04
9756.68	1338.99	9756.68	1338.94	9758.92	1338.94	9760.33	1338.93	9761.33	1338.93
9762.33	1338.93	9763.75	1338.93	9765.16	1338.93	9768.77	1338.92	9774.42	1340.44
9783.64	1342.68	9788.64	1342.66	9792.25	1342.67	9809.28	1342.68	9811.51	1342.63
9812.93	1342.63	9814.34	1342.62	9814.34	1342.61	9820.75	1342.54	9824.35	1342.54
9827.18	1342.57	9830.79	1342.63	9833.02	1342.69	9841.62	1342.95	9844.45	1342.99
9845.87	1343	9850.87	1343	9865.87	1342.98	9905.27	1342.99	9919.49	1342.98
9928.09	1344.37	9928.09	1344.46	9929.5	1344.49	9939.5	1344.89	9940.82	1344.84
9943.11	1344.77	9948.11	1344.71	9954.51	1342.61	9956.75	1341.76	9958.73	1340.68
9959.58	1340.22	9963.18	1339.03	9972.4	1338.76	9978.23	1338.57	9993.23	1338.15
9998.23	1337.64	9999.65	1337.5110001.88		1337.6910004.71		1337.9210033.31		1337.98
10083.31	1338.0410084.48		1338.5110089.72		1340.6110093.32		1342.0510096.15		1343.52
10104.75	1347.3110105.75		1347.1710107.17		1346.8510116.07		1346.9810118.57		1347.01
10121.4	1347.0710123.63		1347.1610124.63		1347.1910127.46		1346.6310141.06		1343.62
10156.06	1344.1810157.48		1344.2610159.93		1344.5510161.08		1344.6910163.91		1345.03
10165.32	1345.0410167.56		1345.0510186.77		1345.2210191.24		1345.2110240.45		1345.01
10246.28	1344.9610247.69		1344.8510252.69		1344.68				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9671.28	.018	9699.88	.05	9744.61	.018	9783.64	.05	9940.82	.028
10116.07	.08510159.93		.03						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

9963.1810084.48		183.19	215.38	246.46	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9726.28	9813.451345.052		F
10160.7410252.691344.709			F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
10189.9110252.691345.229		

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1341.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.20	Wt. n-Val.	0.028	0.028	0.028
W.S. Elev (ft)	1340.65	Reach Len. (ft)	183.19	215.38	246.46
Crit W.S. (ft)	1340.64	Flow Area (sq ft)	3.85	306.85	5.70
E.G. Slope (ft/ft)	0.008089	Area (sq ft)	33.24	306.85	5.70
Q Total (cfs)	2760.00	Flow (cfs)	16.12	2716.81	27.07
Top Width (ft)	153.83	Top Width (ft)	27.19	121.30	5.33
Vel Total (ft/s)	8.72	Avg. Vel. (ft/s)	4.19	8.85	4.75
Max Chl Dpth (ft)	3.14	Hydr. Depth (ft)	0.88	2.53	1.07
Conv. Total (cfs)	30687.0	Conv. (cfs)	179.2	30206.7	301.0
Length Wtd. (ft)	215.49	Wetted Per. (ft)	4.69	121.45	5.75
Min Ch El (ft)	1337.51	Shear (lb/sq ft)	0.41	1.28	0.50
Alpha	1.02	Stream Power (lb/ft s)	10252.69	0.00	0.00
Frctn Loss (ft)	1.81	Cum Volume (acre-ft)	2.85	64.74	1.46
C & E Loss (ft)	0.01	Cum SA (acres)	1.68	23.09	0.92

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1340.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.028	0.028	0.028
W.S. Elev (ft)	1339.57	Reach Len. (ft)	183.19	215.38	246.46
Crit W.S. (ft)	1339.38	Flow Area (sq ft)	0.44	175.76	1.39
E.G. Slope (ft/ft)	0.006492	Area (sq ft)	9.05	175.76	1.39
Q Total (cfs)	966.00	Flow (cfs)	0.75	961.54	3.71
Top Width (ft)	141.04	Top Width (ft)	17.10	121.30	2.64
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	1.72	5.47	2.66
Max Chl Dpth (ft)	2.06	Hydr. Depth (ft)	0.27	1.45	0.53
Conv. Total (cfs)	11988.7	Conv. (cfs)	9.3	11933.4	46.0
Length Wtd. (ft)	215.43	Wetted Per. (ft)	1.71	121.45	2.84
Min Ch El (ft)	1337.51	Shear (lb/sq ft)	0.10	0.59	0.20
Alpha	1.01	Stream Power (lb/ft s)	10252.69	0.00	0.00
Frctn Loss (ft)	1.80	Cum Volume (acre-ft)	1.00	34.35	0.44
C & E Loss (ft)	0.02	Cum SA (acres)	0.97	22.01	0.53

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

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.301

INPUT
Description: Floodplain Redelineation Section 1.298

Original Model
Comment:
6854 Top of vertical drop structure at culvert entrance
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9683.54	1347.41	9714.68	1346.73	9722.75	1346.57	9734.79	1346.29	9744.84	1346.09
9750.84	1345.94	9757.91	1345.79	9776.02	1345.37	9780.02	1345.29	9801.12	1344.79
9805.12	1344.69	9806.12	1344.69	9815.12	1344.48	9817.12	1344.46	9836.22	1344.03
9843.29	1343.92	9844.29	1343.92	9858.29	1343.81	9869.29	1343.8	9883.29	1343.7
9897.29	1343.55	9905.29	1343.47	9913.48	1343.45	9916.29	1343.45	9924.29	1343.36
9930.29	1342.73	9932.29	1341.94	9934.01	1340.94	9940.29	1337.26	9941.29	1336.43
10054.29	1336.4310054.29	1336.2410055.29	1336.1810056.29	1336.1210059.29	1335.76				
10062.29	1335.5710063.29	1335.4610065.29	1335.3510065.29	1336.5310065.29	1337.71				
10067.29	1337.8110067.94	1337.8710070.29	1338.1210074.29	1339.7610076.29	1340.48				
10080.29	1345.4210080.29	1345.8110081.29	1345.8410082.29	1345.8410082.29	1345.85				
10083.29	1345.8510083.29	1345.8210084.29	1345.7810092.13	1345.7310098.29	1345.69				
10104.29	1345.6210111.57	1345.5610114.73	1345.36 10117.9	1345.1510124.22	1344.87				
10125.22	1344.8610127.46	1344.6910128.46	1344.6610131.62	1344.4810132.62	1344.43				
10133.62	1344.41 10139.7	1344.21 10139.7	1344.1910146.03	1343.9810146.03	1343.97				
10147.03	1343.9610153.35	1343.7910154.77	1343.7510159.86	1343.61 10170.3	1343.29				
10175.69	1343.1710177.93	1343.1210185.21	134310195.65	1342.8410199.77	1342.72				
10208.31	1342.5510218.75	1342.3410228.24	1342.1710230.24	1342.8810237.23	1344.73				
10237.52	1344.8110242.91	1344.7210242.91	1344.7110243.91	1344.7110249.29	1344.64				
10249.29	1344.6510250.29	1344.6510254.41	1344.610255.83	1344.6110257.83	1344.62				
10257.83	1344.6410265.11	1344.5810266.11	1344.610267.11	1344.610268.11	1344.6				
10269.11	1344.610273.58	1344.5710276.58	1344.5710277.58	1344.5610278.58	1344.54				
10283.97	1344.610317.21	1344.4710319.44	1344.4810321.68	1344.4810334.05	1344.23				
10334.05	1344.2210335.46	1344.21 10345.9	1344.2610353.18	1344.2310369.95	1344.17				

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9683.54	.05	9913.48	.02810092.13		.08510237.23		.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9934.0110067.94 10.52 10.61 10.24 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9683.54	9924.29	1352.06	F
10080.2910369.95	1349.6		F

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10175.9610187.441343.19110208.46			10221.21342.576			10248.610278.21		1344.67
10299.2410320.271344.53710338.7110369.951344.212								

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1340.04	Element			
Vel Head (ft)	1.18	Wt. n-Val.		0.028	0.028
W.S. Elev (ft)	1338.85	Reach Len. (ft)	10.52	10.61	10.24
Crit W.S. (ft)	1338.85	Flow Area (sq ft)		314.51	2.67
E.G. Slope (ft/ft)	0.008680	Area (sq ft)		314.51	2.67
Q Total (cfs)	2760.00	Flow (cfs)		2750.41	9.59
Top Width (ft)	134.50	Top Width (ft)		130.37	4.13
Vel Total (ft/s)	8.70	Avg. Vel. (ft/s)		8.75	3.60
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		2.41	0.64
Conv. Total (cfs)	29625.1	Conv. (cfs)		29522.2	103.0
Length Wtd. (ft)	10.61	Wetted Per. (ft)		133.69	4.29
Min Ch El (ft)	1335.35	Shear (lb/sq ft)		1.27	0.34
Alpha	1.01	Stream Power (lb/ft s)	10369.95	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	2.78	63.21	1.44
C & E Loss (ft)	0.42	Cum SA (acres)	1.62	22.46	0.90

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1338.22	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.62	Wt. n-Val.		0.028	
W.S. Elev (ft)	1337.60	Reach Len. (ft)	10.52	10.61	10.24
Crit W.S. (ft)	1337.60	Flow Area (sq ft)		153.28	
E.G. Slope (ft/ft)	0.011144	Area (sq ft)		153.28	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	125.58	Top Width (ft)		125.58	
Vel Total (ft/s)	6.30	Avg. Vel. (ft/s)		6.30	
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)		1.22	
Conv. Total (cfs)	9150.9	Conv. (cfs)		9150.9	
Length Wtd. (ft)	10.61	Wetted Per. (ft)		128.46	
Min Ch El (ft)	1335.35	Shear (lb/sq ft)		0.83	
Alpha	1.00	Stream Power (lb/ft s)	10369.95	0.00	0.00
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	0.99	33.53	0.44
C & E Loss (ft)	0.23	Cum SA (acres)	0.94	21.40	0.52

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.299

INPUT
Description: Floodplain Redelineation Section 1.296

Original Model
Comment:
6843 Upstream of SR 101L culvert
Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9681.95	1347.98	9683.95	1347.95	9711.12	1347.56	9722.16	1347.45	9729.16	1347.36
9744.29	1347.24	9747.29	1347.21	9756.35	1347.13	9762.35	1347.01	9762.46	1347.01
9763.35	1346.98	9778.48	1346.66	9784.48	1346.53	9797.52	1346.24	9801.64	1346.17
9811.69	1345.94	9819.69	1345.77	9833.84	1345.47	9838.84	1345.35	9849.88	1345.12
9858.88	1345.05	9861.88	1345.02	9864.88	1344.99	9888.88	1344.81	9891.88	1344.78
9911.81	1344.74	9916.88	1344.73	9916.88	1344.72	9919.88	1344.68	9920.88	1344.67
9924.88	1344.29	9929.88	1343.48	9931.88	1343.23	9931.88	1343.11	9932.6	1342.98
9932.88	1342.93	9936.88	1340.58	9939.95	1333.4310049.95		1333.4310052.45		1333.36
10062.45	1333.3610063.88		1334.6210063.88		1334.8210063.88		1338.2610064.88		1338.7
10066.12	1338.6910069.88		1338.6710070.88		1339.1810071.88		1340.3310073.88		1345.8
10083.88	1345.7210086.54		1345.710097.88		1345.5810106.43		1345.5110109.43		1345.35
10112.59	1345.1810125.24		1344.6210125.24		1344.610127.24		1344.4910128.65		1344.42
10130.65	1344.3110132.89		1344.19 10134.3		1344.14 10137.3		1344.0410138.72		1343.98
10141.72	1343.8910143.13		1343.8410144.13		1343.810147.29		1343.7310149.53		1343.72
10152.69	1343.6310159.97		1343.5610165.07		1343.4110174.56		1343.1810194.48		1342.86
10207.13	1342.6610217.57		1342.4510221.69		1342.3810228.02		1342.2810236.26		1342.12
10240.39	1342.0610246.71		1341.9410246.71		1341.9210249.87		1341.92 10256.2		1343.31
10260.54	1344.33 10261.3		1344.5110264.46		1344.4810264.46		1344.4910265.46		1344.49
10273.71	1344.4410274.71		1344.4410274.71		1344.4310284.19		1344.52 10300		1344.46
10313.61	1344.5210315.61		1344.5310315.61		1344.5110316.61		1344.4910327.05		1344.31
10334.66	1344.2910341.94		1344.3210362.82		1344.22				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9681.95	.018	9762.46	.05	9911.81	.02810086.54		.08510260.54		.03

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9936.8810066.12 517.59 532.96 522.53 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9681.95	9920.88	1352.06	F
10073.8810362.82		1349.6	F

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10172.611	10179.92	1343.235	10205.31	10211.66	1342.693	10245.32	10269.45	1344.468
10294.55	10310.42	1344.504	10332.34	10362.82	1344.294			

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1338.49	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.34	Wt. n-Val.		0.028		
W.S. Elev (ft)	1338.15	Reach Len. (ft)	517.59	532.96	522.53	
Crit W.S. (ft)	1335.92	Flow Area (sq ft)		589.85		
E.G. Slope (ft/ft)	0.001068	Area (sq ft)		589.85		
Q Total (cfs)	2760.00	Flow (cfs)		2760.00		
Top Width (ft)	125.96	Top Width (ft)		125.96		
Vel Total (ft/s)	4.68	Avg. Vel. (ft/s)		4.68		
Max Chl Dpth (ft)	4.79	Hydr. Depth (ft)		4.68		
Conv. Total (cfs)	84465.4	Conv. (cfs)		84465.4		
Length Wtd. (ft)	532.96	Wetted Per. (ft)		133.08		
Min Ch El (ft)	1333.36	Shear (lb/sq ft)		0.30		
Alpha	1.00	Stream Power (lb/ft s)	10362.82	0.00	0.00	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.78	63.10	1.44	
C & E Loss (ft)		Cum SA (acres)	1.62	22.43	0.90	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1336.01	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.16	Wt. n-Val.		0.028		
W.S. Elev (ft)	1335.85	Reach Len. (ft)	517.59	532.96	522.53	
Crit W.S. (ft)	1334.67	Flow Area (sq ft)		300.69		
E.G. Slope (ft/ft)	0.001177	Area (sq ft)		300.69		
Q Total (cfs)	966.00	Flow (cfs)		966.00		
Top Width (ft)	124.97	Top Width (ft)		124.97		
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)		3.21		
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)		2.41		
Conv. Total (cfs)	28160.0	Conv. (cfs)		28160.0		
Length Wtd. (ft)	532.96	Wetted Per. (ft)		128.26		
Min Ch El (ft)	1333.36	Shear (lb/sq ft)		0.17		
Alpha	1.00	Stream Power (lb/ft s)	10362.82	0.00	0.00	
Frctn Loss (ft)		Cum Volume (acre-ft)	0.99	33.48	0.44	
C & E Loss (ft)		Cum SA (acres)	0.94	21.37	0.52	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: Scatter_Wash
REACH: One RS: 1.251

INPUT
Description: 6603 SR 101L
9-10'x6' RCBC spaced at 1'
1-10'x9' RCBC
Distance from Upstream XS = 15
Deck/Roadway Width = 430
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 29

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
9681.951	354.722	9733.548	1354.021	9853.398	1352.509
9930.381	1352.06	9930.905	1352.057	9943.174	1351.98
9943.582	1351.978	9955.764	1351.902	9956.252	1351.899
9968.182	1351.825	9968.791	1351.822	9981.101	1351.745
9982.722	1351.735	9993.141	1351.671	9993.442	1351.669
10005.74	1351.593	10006.2	1351.59	10018.44	1351.514
10018.71	1351.512	10031.06	1351.436	10031.67	1351.432
10043.68	1351.357	10044.15	1351.354	10055.74	1351.282
10056.59	1351.277	10260.38	1350.004	10397.07	1349.469
10557.67	1349.035	10681.95	1349		

Upstream Bridge Cross Section Data
Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9681.95	1347.98	9683.95	1347.95	9711.12	1347.56	9722.16	1347.45	9729.16	1347.36
9744.29	1347.24	9747.29	1347.21	9756.35	1347.13	9762.35	1347.01	9762.46	1347.01
9763.35	1346.98	9778.48	1346.66	9784.48	1346.53	9797.52	1346.24	9801.64	1346.17
9811.69	1345.94	9819.69	1345.77	9833.84	1345.47	9838.84	1345.35	9849.88	1345.12
9858.88	1345.05	9861.88	1345.02	9864.88	1344.99	9888.88	1344.81	9891.88	1344.78
9911.81	1344.74	9916.88	1344.73	9916.88	1344.72	9919.88	1344.68	9920.88	1344.67
9924.88	1344.29	9929.88	1343.48	9931.88	1343.23	9931.88	1343.11	9932.6	1342.98
9932.88	1342.93	9936.88	1340.58	9939.95	1333.43	10049.95	1333.43	10052.45	1333.36
10062.45	1333.36	10063.88	1334.62	10063.88	1334.82	10063.88	1338.26	10064.88	1338.7

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10066.12 1338.6910069.88 1338.6710070.88 1339.1810071.88 1340.3310073.88  1345.8
10083.88 1345.7210086.54  1345.710097.88 1345.5810106.43 1345.5110109.43 1345.35
10112.59 1345.1810125.24 1344.6210125.24  1344.610127.24 1344.4910128.65 1344.42
10130.65 1344.3110132.89 1344.19 10134.3 1344.14 10137.3 1344.0410138.72 1343.98
10141.72 1343.8910143.13 1343.8410144.13  1343.810147.29 1343.7310149.53 1343.72
10152.69 1343.6310159.97 1343.5610165.07 1343.4110174.56 1343.1810194.48 1342.86
10207.13 1342.6610217.57 1342.4510221.69 1342.3810228.02 1342.2810236.26 1342.12
10240.39 1342.0610246.71 1341.9410246.71 1341.9210249.87 1341.92 10256.2 1343.31
10260.54 1344.33 10261.3 1344.5110264.46 1344.4810264.46 1344.4910265.46 1344.49
10273.71 1344.4410274.71 1344.4410274.71 1344.4310284.19 1344.52   10300 1344.46
10313.61 1344.5210315.61 1344.5310315.61 1344.5110316.61 1344.4910327.05 1344.31
10334.66 1344.2910341.94 1344.3210362.82 1344.22

Manning's n Values        num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9681.95    .018 9762.46     .05 9911.81    .02810086.54    .08510260.54     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9936.8810066.12             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9681.95 9920.88 1352.06       F
10073.8810362.82  1349.6       F
Blocked Obstructions     num=       5
   Sta L   Sta R    Elev   Sta L   Sta R    Elev   Sta L   Sta R    Elev
10172.6110179.921343.23510205.3110211.661342.69310245.3210269.451344.468
10294.5510310.421344.50410332.3410362.821344.294

Downstream  Deck/Roadway Coordinates
    num=      33
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
 9524.161354.722        9575.7581354.021        9695.6081352.509
9918.5171350.997        9919.0441350.994         9919.151350.993
9919.3051350.992        9930.1251350.921        9931.5651350.911
9943.0251350.835        9944.0251350.829        9955.6351350.752
9956.6951350.745        9968.4551350.668        9969.1551350.663
9980.7041350.587        9981.785 1350.58        9993.2841350.504
9994.2241350.498        10005.92 1350.42        10006.981350.413
10018.441350.338         10019.51350.331        10031.091350.254
10032.181350.247        10043.751350.171        10044.351350.167
10045.38 1350.16        10056.431350.132        10102.591350.004
10239.281349.469        10399.881349.035        10524.16    1349

Downstream Bridge Cross Section Data
Station Elevation Data    num=     141
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
 9524.16 1346.56 9543.16 1346.67 9560.16  1346.7 9569.17 1346.75 9571.16 1346.76
 9580.16 1346.65 9581.16 1346.66 9585.16 1346.78 9593.16  1347.1 9594.16 1347.06
 9595.16 1346.95 9598.16 1346.34 9600.16 1346.17 9602.16 1346.07 9603.16 1346.04
 9605.16 1345.87 9612.16 1345.78 9613.16 1345.76 9614.16 1345.76 9624.16 1345.62
 9626.16 1345.58 9628.16 1345.55 9636.16 1345.39 9638.16 1345.19 9645.16 1344.92
 9647.16 1344.81 9655.16  1344.4 9656.16 1344.27 9666.16 1343.49 9669.16 1343.15
 9675.16 1342.46 9681.16 1341.98 9681.21 1341.97 9683.16 1341.82 9686.16 1341.79
 9690.16 1341.74 9694.16 1341.66 9698.16 1341.57 9706.16 1341.36 9708.22 1341.14
 9709.16 1341.05 9711.16 1340.88 9714.16 1340.82 9715.16 1340.81 9718.16 1340.76
 9721.16 1340.76 9726.16 1340.84 9729.16 1340.86 9732.16 1340.87 9740.16    1341
 9741.16 1340.95 9745.16 1340.65 9745.23 1340.65 9746.16 1340.68 9748.16 1340.83
 9766.24 1340.81 9844.22 1340.76 9851.22 1340.72 9852.22 1340.72 9855.22 1340.85
 9863.22 1342.81 9865.22 1343.19 9871.27 1343.14 9876.22  1343.1 9881.22 1343.02
 9889.22 1339.35 9896.22 1336.32 9900.28 1334.61 9901.22 1334.21 9905.291333.787
 9919.16 1332.4510029.16 1332.4510031.66  1332.410041.66  1332.410045.22 1334.07
10045.33 1334.1210050.22 1336.4410060.22 1340.7210064.22 1342.3910069.22 1342.66
10072.22 1343.0810074.34 1342.8910076.22 1342.7110086.22 1341.9310097.22 1340.74
10106.22 1339.6910111.22 1339.5810130.22 1339.3410138.22 1339.2810139.22 1339.28
10141.22 1339.2710158.22 1339.2510160.22 1339.2410162.22 1339.2510164.22 1339.11
10169.22 1338.8410172.22 1338.7410175.22 1338.6210178.22 1338.6210181.22 1338.58
10184.22 1338.5910187.22 1338.6310189.22 1338.6310193.22 1338.7810195.22 1338.89
10198.22 1339.0810201.22 1339.4810202.22 1339.7310204.46 1340.1410205.46 1340.24
10206.39 1340.2510251.46 1340.4910254.46 1340.5110287.46 1340.5710291.46 1340.55
10293.46 1340.6610297.46  1340.610301.46  1340.610310.46 1339.5610312.46  1339.3
10317.42 1338.8110319.46 1338.6110324.46 1338.6110325.46 1338.1110334.46 1338.51
10336.46 1338.5910339.46 1338.7410343.46 1338.5710354.46 1338.0710355.46 1338.57
10356.46 1338.5710358.43 1338.5610360.46 1338.5510362.46 1338.7110373.46 1339.78
10377.46 1340.1910379.46 1340.2510382.46  1340.310383.46 1340.3510417.46 1340.64
10430.46 1340.72

Manning's n Values        num=      12
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9524.16    .018 9569.17     .05 9681.21     .03 9708.22     .05 9745.23    .018
 9766.24     .03 9871.27    .018 9905.29    .02810074.34     .0510206.39     .03
10317.42    .01810358.43     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9901.2210045.33             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9524.16 9878.281346.557       F
10074.9510446.541343.016       F
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Left Levee      Station= 9865.22      Elevation= 1343.19
Right Levee     Station=10072.22      Elevation= 1343.08
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
 10232.410295.421340.62610380.4410430.46 1340.72

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box       6      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                15     430     .013     .013        0                  .4                1
Number of Barrels =  9
Upstream   Elevation =  1333.43
Centerline Stations
   Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.
 9944.95 9957.45 9969.95 9982.45 9994.9510007.4510019.9510032.4510044.95
Downstream Elevation =  1332.45
Centerline Stations
    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.
 9924.16 9936.66 9949.16 9961.66 9974.16 9986.66 9999.1610011.6610024.16

Culvert Name     Shape      Rise    Span
Culvert #2           Box       9      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                15     430     .013     .013        0                  .4                1
Upstream   Elevation =  1333.96
           Centerline Station =  10057.45
Downstream Elevation =  1332.4
           Centerline Station =  10036.66

CULVERT OUTPUT  Profile #Q100 - Effective  Culv Group:  Culvert #1

  Q Culv Group (cfs)       2511.97    Culv Full Len (ft)
  # Barrels                      9    Culv Vel US (ft/s)          6.96
  Q Barrel (cfs)             279.11   Culv Vel DS (ft/s)          5.84
  E.G. US. (ft)            1338.49    Culv Inv El Up (ft)      1333.43
  W.S. US. (ft)            1338.15    Culv Inv El Dn (ft)      1332.45
  E.G. DS (ft)             1337.48    Culv Frctn Ls (ft)          0.44
  W.S. DS (ft)             1337.23    Culv Exit Loss (ft)         0.28
  Delta EG (ft)               1.01    Culv Entr Loss (ft)         0.30
  Delta WS (ft)               0.93    Q Weir (cfs)
  E.G. IC (ft)             1338.06    Weir Sta Lft (ft)
  E.G. OC (ft)             1338.49    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       1337.44    Weir Max Depth (ft)
  Culv WS Outlet (ft)      1337.23    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         3.26    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         2.89    Min El Weir Flow (ft)    1349.61


CULVERT OUTPUT  Profile #Q1- 35% Q100  Culv Group:  Culvert #1

  Q Culv Group (cfs)         889.33   Culv Full Len (ft)
  # Barrels                      9    Culv Vel US (ft/s)          4.70
  Q Barrel (cfs)              98.81   Culv Vel DS (ft/s)          3.30
  E.G. US. (ft)            1336.01    Culv Inv El Up (ft)      1333.43
  W.S. US. (ft)            1335.85    Culv Inv El Dn (ft)      1332.45
  E.G. DS (ft)             1335.53    Culv Frctn Ls (ft)          0.26
  W.S. DS (ft)             1335.44    Culv Exit Loss (ft)         0.09
  Delta EG (ft)               0.49    Culv Entr Loss (ft)         0.14
  Delta WS (ft)               0.40    Q Weir (cfs)
  E.G. IC (ft)             1335.70    Weir Sta Lft (ft)
  E.G. OC (ft)             1336.01    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       1335.53    Weir Max Depth (ft)
  Culv WS Outlet (ft)      1335.44    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         1.59    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         1.45    Min El Weir Flow (ft)    1349.61


CULVERT OUTPUT  Profile #Q100 - Effective  Culv Group:  Culvert #2

  Q Culv Group (cfs)         248.03   Culv Full Len (ft)
```

# Barrels	1	Culv Vel US (ft/s)	7.74
Q Barrel (cfs)	248.03	Culv Vel DS (ft/s)	5.14
E.G. US. (ft)	1338.49	Culv Inv El Up (ft)	1333.96
W.S. US. (ft)	1338.15	Culv Inv El Dn (ft)	1332.40
E.G. DS (ft)	1337.48	Culv Frctn Ls (ft)	0.46
W.S. DS (ft)	1337.23	Culv Exit Loss (ft)	0.16
Delta EG (ft)	1.01	Culv Entr Loss (ft)	0.37
Delta WS (ft)	0.93	Q Weir (cfs)	
E.G. IC (ft)	1338.17	Weir Sta Lft (ft)	
E.G. OC (ft)	1338.47	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1337.17	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1337.23	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.54	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.67	Min El Weir Flow (ft)	1349.61

CULVERT OUTPUT Profile #Q1- 35% Q100 Culv Group: Culvert #2

Q Culv Group (cfs)	76.67	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	5.47
Q Barrel (cfs)	76.67	Culv Vel DS (ft/s)	2.52
E.G. US. (ft)	1336.01	Culv Inv El Up (ft)	1333.96
W.S. US. (ft)	1335.85	Culv Inv El Dn (ft)	1332.40
E.G. DS (ft)	1335.53	Culv Frctn Ls (ft)	0.28
W.S. DS (ft)	1335.44	Culv Exit Loss (ft)	0.01
Delta EG (ft)	0.49	Culv Entr Loss (ft)	0.19
Delta WS (ft)	0.40	Q Weir (cfs)	
E.G. IC (ft)	1335.84	Weir Sta Lft (ft)	
E.G. OC (ft)	1336.01	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1335.36	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1335.44	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.16	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.22	Min El Weir Flow (ft)	1349.61

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.198

INPUT
Description: Floodplain Redelineation Section 1.195

Original Model
Comment:
6310 Downstream of SR 101L culvert
Station Elevation Data num= 141

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9524.16	1346.56	9543.16	1346.67	9560.16	1346.7	9569.17	1346.75	9571.16	1346.76
9580.16	1346.65	9581.16	1346.66	9585.16	1346.78	9593.16	1347.1	9594.16	1347.06
9595.16	1346.95	9598.16	1346.34	9600.16	1346.17	9602.16	1346.07	9603.16	1346.04
9605.16	1345.87	9612.16	1345.78	9613.16	1345.76	9614.16	1345.76	9624.16	1345.62
9626.16	1345.58	9628.16	1345.55	9636.16	1345.39	9638.16	1345.19	9645.16	1344.92
9647.16	1344.81	9655.16	1344.4	9656.16	1344.27	9666.16	1343.49	9669.16	1343.15
9675.16	1342.46	9681.16	1341.98	9681.21	1341.97	9683.16	1341.82	9686.16	1341.79
9690.16	1341.74	9694.16	1341.66	9698.16	1341.57	9706.16	1341.36	9708.22	1341.14
9709.16	1341.05	9711.16	1340.88	9714.16	1340.82	9715.16	1340.81	9718.16	1340.76
9721.16	1340.76	9726.16	1340.84	9729.16	1340.86	9732.16	1340.87	9740.16	1341
9741.16	1340.95	9745.16	1340.65	9745.23	1340.65	9746.16	1340.68	9748.16	1340.83
9766.24	1340.81	9844.22	1340.76	9851.22	1340.72	9852.22	1340.72	9855.22	1340.85
9863.22	1342.81	9865.22	1343.19	9871.27	1343.14	9876.22	1343.1	9881.22	1343.02
9889.22	1339.35	9896.22	1336.32	9900.28	1334.61	9901.22	1334.21	9905.29	1333.787
9919.16	1332.45	10029.16	1332.45	10031.66	1332.41	10041.66	1332.41	10045.22	1334.07
10045.33	1334.12	10050.22	1336.44	10060.22	1340.72	10064.22	1342.39	10069.22	1342.66
10072.22	1343.08	10074.34	1342.89	10076.22	1342.71	10086.22	1341.93	10097.22	1340.74
10106.22	1339.69	10111.22	1339.58	10130.22	1339.34	10138.22	1339.28	10139.22	1339.28
10141.22	1339.27	10158.22	1339.25	10160.22	1339.24	10162.22	1339.25	10164.22	1339.11
10169.22	1338.84	10172.22	1338.74	10175.22	1338.62	10178.22	1338.62	10181.22	1338.58
10184.22	1338.59	10187.22	1338.63	10189.22	1338.63	10193.22	1338.78	10195.22	1338.89
10198.22	1339.08	10201.22	1339.48	10202.22	1339.73	10204.46	1340.14	10205.46	1340.24
10206.39	1340.25	10251.46	1340.49	10254.46	1340.51	10287.46	1340.57	10291.46	1340.55
10293.46	1340.66	10297.46	1340.61	10301.46	1340.61	10310.46	1339.56	10312.46	1339.3
10317.42	1338.81	10319.46	1338.61	10324.46	1338.61	10325.46	1338.11	10334.46	1338.51
10336.46	1338.59	10339.46	1338.74	10343.46	1338.57	10354.46	1338.07	10355.46	1338.57
10356.46	1338.57	10358.43	1338.56	10360.46	1338.55	10362.46	1338.71	10373.46	1339.78
10377.46	1340.19	10379.46	1340.25	10382.46	1340.31	10383.46	1340.35	10417.46	1340.64
10430.46	1340.72								

Manning's n Values num= 12

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9524.16	.018	9569.17	.05	9681.21	.03	9708.22	.05	9745.23	.018
9766.24	.03	9871.27	.018	9905.29	.02	10074.34	.05	10206.39	.03
10317.42	.01	10358.43	.03						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

9901.2210045.33 355.51 304.13 283.97 .3 .5
Ineffective Flow num= 2
Sta L Sta R Elev Permanent
9524.16 9878.281346.557 F
10074.9510446.541343.016 F
Left Levee Station= 9865.22 Elevation= 1343.19
Right Levee Station=10072.22 Elevation= 1343.08
Blocked Obstructions num= 2
Sta L Sta R Elev Sta L Sta R Elev
10232.410295.421340.62610380.4410430.46 1340.72

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1337.48	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.018	0.028	0.028
W.S. Elev (ft)	1337.23	Reach Len. (ft)	355.51	304.13	283.97
Crit W.S. (ft)	1334.83	Flow Area (sq ft)	10.74	670.23	10.23
E.G. Slope (ft/ft)	0.000737	Area (sq ft)	10.74	670.23	10.23
Q Total (cfs)	2760.00	Flow (cfs)	30.04	2711.67	18.29
Top Width (ft)	157.93	Top Width (ft)	7.09	144.11	6.73
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	2.80	4.05	1.79
Max Chl Dpth (ft)	4.83	Hydr. Depth (ft)	1.51	4.65	1.52
Conv. Total (cfs)	101666.2	Conv. (cfs)	1106.5	99886.1	673.7
Length Wtd. (ft)	304.41	Wetted Per. (ft)	7.71	144.58	7.41
Min Ch El (ft)	1332.40	Shear (lb/sq ft)	0.06	0.21	0.06
Alpha	1.02	Stream Power (lb/ft s)	10430.46	9865.22	10072.22
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)	2.78	62.04	1.44
C & E Loss (ft)	0.23	Cum SA (acres)	1.58	20.78	0.86

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1335.53	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.08	Wt. n-Val.	0.018	0.028	0.028
W.S. Elev (ft)	1335.44	Reach Len. (ft)	355.51	304.13	283.97
Crit W.S. (ft)	1333.67	Flow Area (sq ft)	1.79	413.25	1.84
E.G. Slope (ft/ft)	0.000466	Area (sq ft)	1.79	413.25	1.84
Q Total (cfs)	966.00	Flow (cfs)	2.19	962.32	1.50
Top Width (ft)	149.81	Top Width (ft)	2.92	144.11	2.79
Vel Total (ft/s)	2.32	Avg. Vel. (ft/s)	1.22	2.33	0.81
Max Chl Dpth (ft)	3.04	Hydr. Depth (ft)	0.61	2.87	0.66
Conv. Total (cfs)	44749.1	Conv. (cfs)	101.3	44578.4	69.4
Length Wtd. (ft)	304.17	Wetted Per. (ft)	3.17	144.58	3.08
Min Ch El (ft)	1332.40	Shear (lb/sq ft)	0.02	0.08	0.02
Alpha	1.01	Stream Power (lb/ft s)	10430.46	9865.22	10072.22
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	0.99	32.89	0.44
C & E Loss (ft)	0.12	Cum SA (acres)	0.92	19.72	0.50

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.141

INPUT
Description: Floodplain Redelineation Section 1.138

Original Model
Comment:
6007
Station Elevation Data num= 149

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9523.66	1340.1	9529.32	1340.05	9532.92	1340.06	9535.75	1339.69	9541.41	1339.17
9543.64	1339.07	9554.27	1338.65	9555.27	1338.65	9556.27	1338.65	9565.49	1338.65
9569.74	1338.62	9571.15	1338.73	9578.96	1339.68	9595.24	1339.77	9608.69	1339.85
9625.72	1339.97	9651.22	1340.06	9651.22	1340.07	9652.63	1340.06	9659.03	1340.35
9659.03	1340.37	9660.45	1340.38	9670.4	1340.27	9699.4	1339.96	9705.8	1339.93
9710.04	1339.91	9712.28	1339.89	9715.89	1341.67	9715.89	1341.87	9732.91	1341.25
9747.78	1340.82	9759.82	1340.43	9764.82	1340.29	9766.24	1340.07	9775.46	1339.97
9810.17	1339.99	9826.45	1339.46	9827.86	1339.43	9831.47	1339.37	9834.39	1339.33
9835.07	1339.32	9851.47	1339.52	9871.47	1338.98	9880.08	1339	9881.49	1338.98
9884.32	1339.99	9887.92	1341.42	9891.53	1341.19	9895.77	1340.88	9897.19	1340.71
9898.6	1340.56	9899.57	1340.07	9905.11	1337.37	9910.81	1334.44	9913.04	1332.97

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 9914.04 1333.86 9914.04 1334.09  9923.3  1333.7 9946.25 1332.75 9950.49  1332.6
  9951.9 1332.54 9956.38 1332.36 9960.62 1332.51 9994.22 1333.64 9994.22  1333.6
 9997.82 1332.71 9999.24 1332.35 9999.24 1332.3710005.64 1333.7110035.64 1333.89
10040.64 1333.9110042.06  1333.810043.47 1333.6510049.87 1332.9810049.87 1333.14
10049.87 1333.6510053.23 1334.9810054.64 1335.5310058.48 1337.0410066.29 1340.49
10067.29 1341.3710076.51 1341.0710078.38 1340.9910080.11 1340.9210083.72 1340.34
10087.96 1339.4910100.17 1339.4210113.77 1339.37 10116.6 1339.35 10121.6 1339.37
 10121.6 1339.36 10125.2 1339.3210129.44 1339.2610133.05 1339.2410158.86 1338.97
10181.06 1338.7110184.67 1338.6310187.49 1338.61 10191.1  1338.610192.51  1338.6
10193.51 1338.5210194.93 1338.4910199.93 1338.2310214.93 1337.5810214.96 1337.57
10220.76 1337.1410221.76 1337.0710222.76 1336.6110222.76 1336.5710224.17 1336.59
10224.17 1336.6110239.17 1337.0210240.17    133710241.59 1336.9610250.19 1336.82
10253.79 1336.7510254.79 1337.0610254.79 1337.25 10258.4 1337.25 10258.8 1337.26
 10259.4 1337.2710267.21 1337.7910268.62 1337.8310281.66 1338.4410287.32 1338.51
10288.73 1338.5610289.73 1338.5610293.34 1338.5310298.34  1338.610301.17  1338.7
10336.97  1339.5 10342.8 1339.5110350.61 1339.5610355.61 1339.5310361.45 1339.57
10367.85 1339.5710369.26 1339.5710370.68 1339.5710371.68 1339.5710373.09 1339.57
10374.09 1339.5710376.92 1339.1710379.75 1338.8410384.75 1339.1610394.18 1339.47
10397.01  1339.810399.84  1340.210405.67 1340.2410410.67 1340.38

Manning's n Values         num=       9
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9523.66     .03  9670.4     .03 9834.39     .06 9899.57    .018  9923.3    .028
10053.23    .01810078.38     .0310214.96    .018 10258.8     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9910.8110053.23           590.28  553.78  523.25             .1       .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9519.27  9887.91341.177       F
10068.6610422.961341.335       F
Left Levee       Station= 9887.92      Elevation= 1341.42
Right Levee      Station=10067.29      Elevation= 1341.37
Blocked Obstructions     num=       4
   Sta L   Sta R    Elev   Sta L   Sta R    Elev   Sta L   Sta R    Elev
 9713.91 9770.951341.046 9805.69 9825.741339.99110122.8310186.191339.364
10130.6710163.051339.275

CROSS SECTION OUTPUT  Profile #Q100 - Effective

  E.G. Elev (ft)           1336.74    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               1.00    Wt. n-Val.                0.018     0.027      0.018
  W.S. Elev (ft)           1335.74    Reach Len. (ft)          590.28    553.78     523.25
  Crit W.S. (ft)           1335.62    Flow Area (sq ft)          1.64    341.40       0.73
  E.G. Slope (ft/ft)      0.006843    Area (sq ft)               1.64    341.40       0.73
  Q Total (cfs)            2760.00    Flow (cfs)                 7.75   2749.75       2.50
  Top Width (ft)            146.88    Top Width (ft)             2.52    142.42       1.94
  Vel Total (ft/s)            8.03    Avg. Vel. (ft/s)           4.73      8.05       3.41
  Max Chl Dpth (ft)           3.39    Hydr. Depth (ft)           0.65      2.40       0.38
  Conv. Total (cfs)        33365.5    Conv. (cfs)                93.6   33241.5       30.3
  Length Wtd. (ft)          553.82    Wetted Per. (ft)           2.84    144.81       2.08
  Min Ch El (ft)           1332.35    Shear (lb/sq ft)           0.25      1.01       0.15
  Alpha                       1.00    Stream Power (lb/ft s)  10410.67   9887.92   10067.29
  Frctn Loss (ft)             1.89    Cum Volume (acre-ft)       2.73     58.51       1.40
  C & E Loss (ft)             0.18    Cum SA (acres)             1.54     19.78       0.83


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional
cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
        This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This
may indicate the
        need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid,
energy was used.

CROSS SECTION OUTPUT  Profile #Q1- 35% Q100

  E.G. Elev (ft)           1335.04    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.48    Wt. n-Val.                0.018     0.027
  W.S. Elev (ft)           1334.55    Reach Len. (ft)          590.28    553.78     523.25
  Crit W.S. (ft)           1334.46    Flow Area (sq ft)          0.01    173.10
  E.G. Slope (ft/ft)      0.008104    Area (sq ft)               0.01    173.10
  Q Total (cfs)             966.00    Flow (cfs)                 0.01    965.99
  Top Width (ft)            141.57    Top Width (ft)             0.22    141.34
  Vel Total (ft/s)            5.58    Avg. Vel. (ft/s)           1.02      5.58
  Max Chl Dpth (ft)           2.20    Hydr. Depth (ft)           0.06      1.22
  Conv. Total (cfs)        10730.8    Conv. (cfs)                 0.1   10730.7
  Length Wtd. (ft)          553.77    Wetted Per. (ft)           0.25    143.65
  Min Ch El (ft)           1332.35    Shear (lb/sq ft)           0.03      0.61
  Alpha                       1.00    Stream Power (lb/ft s)  10410.67   9887.92   10067.29
  Frctn Loss (ft)             1.80    Cum Volume (acre-ft)       0.98     30.84       0.43
  C & E Loss (ft)             0.10    Cum SA (acres)             0.91     18.73       0.49

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
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than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.036

INPUT
Description: Floodplain Redelineation Section 1.034

Original Model
Comment:
5461 -- Tie in to effective model
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9497.45	1336.46	9528.75	1336.41	9565.43	1336.35	9598.08	1335.91	9602.55	1335.91
9613.73	1335.85	9615.97	1335.73	9627.15	1335.51	9629.38	1335.47	9632.55	1335.36
9642.84	1335.11	9643.84	1335.1	9652.79	1335.77	9654.2	1335.83	9679.7	1335.66
9681.11	1335.66	9744.62	1335.7	9758.93	1335.67	9761.76	1335.72	9776.08	1335.66
9782.79	1335.66	9821.7	1335.57	9825.3	1334.99	9826.3	1334.71	9827.72	1334.45
9835.78	1334.89	9837.61	1334.96	9838.02	1334.98	9840.25	1335.58	9853.25	1338.77
9859.96	1338.7	9865.79	1338.65	9867.21	1338.61	9868.21	1338.6	9876.27	1334.21
9880.39	1332.23	9881.8	1331.9	9881.8	1331.93	9885.69	1331.98	9887.03	1332
9901.93	1332.18	9952.02	1331.04	9960.08	1330.94	9975.73	1330.88	9998.09	1331.01
10009.28	1331.1	10040.58	1331.17	10058.69	1330.99	10060.7	1330.98	10061.7	1331.36
10063.18	1332.07	10068.41	1334.58	10078.26	1338.64	10079.68	1338.94	10079.68	1338.98
10081.09	1338.96	10090.94	1338.71	10095.41	1337.66	10097.78	1337.02	10100.8	1336.2
10102.21	1336.64	10105.37	1336.71	10106.79	1336.76	10108.2	1336.78	10113.59	1336.65
10117.19	1336.58	10117.19	1336.54	10118.19	1336.52	10121.8	1335.79	10133.88	1335.8
10134.88	1335.81	10142.5	1335.79	10168.9	1335.54	10180.6	1335.49	10191.78	1335.37
10214.63	1335.04	10219.1	1335.01	10220.17	1335.01	10225.43	1334.98	10240.66	1334.85
10247.37	1334.62	10249.6	1334.56	10251.84	1334.56	10252.1	1334.56	10253.84	1334.57
10253.84	1334.35	10254.84	1334.07	10263.38	1334.22	10271	1334.35	10278.61	1334.06
10286.23	1333.75	10287.23	1334.14	10287.23	1334.25	10288.64	1334.26	10291.81	1334.27
10292.6	1334.28	10292.81	1334.28	10298.64	1334.58	10304.02	1334.71	10306.26	1334.83
10309.42	1334.99	10333.59	1335.26	10339.91	1335.35	10347.53	1335.32	10379.31	1335.63
10389.16	1335.63	10391.39	1335.64	10392.39	1335.62	10392.39	1335.63	10394.39	1335.63
10395.81	1336.14	10395.81	1336.17	10395.81	1336.21	10396.81	1336.7	10397.81	1336.86
10398.81	1337.07	10398.81	1337.17	10407.35	1337.01	10416.29	133	10417.29	1336.99
10419.53	1336.99	10421.77	1336.97						

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9497.45	.05	9837.61	.018	9887.03	.02	8105	8.69	.01	8097.78
10220.17	.03	10252.1	.018	10292.6	.03				

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9880.39 10063.18 580.95 546.44 499.79 .1 .3
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9486.47	9860.24	1338.64	F
10085.11	10421.77	1338.79	F

Left Levee Station= 9853.25 Elevation= 1338.77
Right Levee Station=10079.69 Elevation= 1338.98
Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10196.29	10209.36	1335.33	10332.19	10381.27	1335.62	10510	399.74	10421.77	1337.15
10420.45	10421.77	1336.99							

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1334.67	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.39	Wt. n-Val.	0.018	0.027	0.018
W.S. Elev (ft)	1334.28	Reach Len. (ft)	580.95	546.44	499.79
Crit W.S. (ft)	1333.25	Flow Area (sq ft)	4.38	541.67	5.09
E.G. Slope (ft/ft)	0.002032	Area (sq ft)	4.38	541.67	5.09
Q Total (cfs)	2760.00	Flow (cfs)	15.49	2725.59	18.92
Top Width (ft)	191.65	Top Width (ft)	4.25	182.79	4.61
Vel Total (ft/s)	5.01	Avg. Vel. (ft/s)	3.54	5.03	3.71
Max Chl Dpth (ft)	3.40	Hydr. Depth (ft)	1.03	2.96	1.11
Conv. Total (cfs)	61225.6	Conv. (cfs)	343.6	60462.3	419.6
Length Wtd. (ft)	546.38	Wetted Per. (ft)	4.72	183.11	5.11
Min Ch El (ft)	1330.88	Shear (lb/sq ft)	0.12	0.38	0.13
Alpha	1.00	Stream Power (lb/ft s)	10421.77	9853.25	10079.69
Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	2.69	52.89	1.37
C & E Loss (ft)	0.04	Cum SA (acres)	1.49	17.71	0.79

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

Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1333.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.018	0.027	0.018
W.S. Elev (ft)	1332.98	Reach Len. (ft)	580.95	546.44	499.79
Crit W.S. (ft)	1332.26	Flow Area (sq ft)	0.59	303.85	0.86
E.G. Slope (ft/ft)	0.001744	Area (sq ft)	0.59	303.85	0.86
Q Total (cfs)	966.00	Flow (cfs)	0.98	963.38	1.64
Top Width (ft)	186.25	Top Width (ft)	1.56	182.79	1.90
Vel Total (ft/s)	3.16	Avg. Vel. (ft/s)	1.67	3.17	1.90
Max Chl Dpth (ft)	2.10	Hydr. Depth (ft)	0.38	1.66	0.46
Conv. Total (cfs)	23132.3	Conv. (cfs)	23.5	23069.5	39.4
Length Wtd. (ft)	546.42	Wetted Per. (ft)	1.73	183.11	2.10
Min Ch El (ft)	1330.88	Shear (lb/sq ft)	0.04	0.18	0.04
Alpha	1.00	Stream Power (lb/ft s)	10421.77	9853.25	10079.69
Frctn Loss (ft)	0.83	Cum Volume (acre-ft)	0.97	27.81	0.43
C & E Loss (ft)	0.02	Cum SA (acres)	0.89	16.67	0.48

Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.932

INPUT
Description:
Station Elevation Data num= 90

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1336.7	56.18	1337.2	66.1	1337.29	67.39	1337.3	68	1337.31
68.45	1337.31	68.6	1337.31	68.85	1337.32	69.57	1337.32	69.89	1337.32
84.3	1337.37	94.02	1335.53	96.59	1335.02	115.4	1335.19	116.91	1335.21
118.39	1335.78	122.68	1337.41	123.78	1335.5	124.15	1334.89	125.9	1334.51
134.29	1332.69	137.96	1332.55	139.1	1332.51	144.08	1333.48	144.35	1333.52
158.31	1337.41	163.15	1338.71	167.84	1338.66	167.93	1338.66	167.94	1338.66
169.89	1338.38	175.51	1338.07	177.85	1338.47	178.5	1338.58	180.13	1337.66
187.93	1333.03	191.49	1331.06	191.84	1331.26	215.27	1331.03	241.43	1331.19
280.81	1330.18	283.57	1329.88	291.56	1330.06	314.62	1330.77	318.7	1330.09
319.52	1329.95	320.15	1330.05	324.24	1330.73	327.04	1330.76	338.97	1330.94
345.41	1330.53	348.69	1330.29	353.88	1330.9	355.93	1331.12	359.21	1330.96
383.4	1330.24	412.69	1330.54	438.24	1330.28	443.71	1332.43	444.69	1332.73
446.18	1333.55	449.32	1335.35	453.57	1336.62	457.79	1337.97	467.03	1338.36
469.49	1338.49	473.15	1337.27	484.66	1333.49	496.58	1332.9	505.25	1332.85
512.17	1332.77	519.67	1332.96	537.16	1333.24	555.51	1333.23	582.29	1333.26
584.9	1333.25	594.43	1333.26	607.24	1333.27	644.53	1332.92	646.54	1332.93
654.05	1332.96	666.33	1332.52	673.12	1332.38	675.17	1332.37	675.91	1332.37
676.04	1332.29	676.65	1331.88	677.75	1331.89	692.42	1332.12	699.4	1332.01

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	177.85	.047	191.84	.028	438.24	.047	457.79	.045

Bank Sta: Left 178.5 Right 457.79 Lengths: Left Channel 228.06 Right 212.07 198.46 Coeff Contr. .1 Expan. .3
Left Levee Station= 163.15 Elevation= 1338.71
Right Levee Station= 469.49 Elevation= 1338.49

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1333.63	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.		0.029	
W.S. Elev (ft)	1333.38	Reach Len. (ft)	228.06	212.07	198.46
Crit W.S. (ft)	1332.21	Flow Area (sq ft)		691.17	
E.G. Slope (ft/ft)	0.001663	Area (sq ft)		691.17	
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	258.52	Top Width (ft)		258.52	
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)		3.99	
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		2.67	
Conv. Total (cfs)	67673.0	Conv. (cfs)		67673.0	
Length Wtd. (ft)	212.07	Wetted Per. (ft)		260.06	
Min Ch El (ft)	1329.88	Shear (lb/sq ft)		0.28	
Alpha	1.00	Stream Power (lb/ft s)	699.40	163.15	469.49
Frctn Loss (ft)	0.59	Cum Volume (acre-ft)	2.66	45.16	1.34
C & E Loss (ft)	0.00	Cum SA (acres)	1.47	14.95	0.76

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1332.28	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.029	
W.S. Elev (ft)	1332.18	Reach Len. (ft)	228.06	212.07	198.46
Crit W.S. (ft)	1331.42	Flow Area (sq ft)		385.08	
E.G. Slope (ft/ft)	0.001350	Area (sq ft)		385.08	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	253.62	Top Width (ft)		253.62	
Vel Total (ft/s)	2.51	Avg. Vel. (ft/s)		2.51	
Max Chl Dpth (ft)	2.30	Hydr. Depth (ft)		1.52	
Conv. Total (cfs)	26290.8	Conv. (cfs)		26290.8	
Length Wtd. (ft)	212.07	Wetted Per. (ft)		254.59	
Min Ch El (ft)	1329.88	Shear (lb/sq ft)		0.13	
Alpha	1.00	Stream Power (lb/ft s)	699.40	163.15	469.49
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	0.97	23.49	0.42
C & E Loss (ft)	0.00	Cum SA (acres)	0.88	13.93	0.47

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.892

INPUT
Description:
Station Elevation Data num= 160

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1354.35	4.27	1353.6	9.7	1352.64	20.77	1350.37	20.83	1350.36
20.9	1350.35	31.71	1348.97	39.59	1347.45	52.33	1345.02	64.9	1341.92
74.04	1339.44	78.32	1338.45	93.37	1335.39	105.64	1334.4	106.68	1334.28
107.16	1334.31	109.39	1334.8	117.16	1336.49	119.76	1336.38	122.27	1336.31
123.08	1336.53	125	1336.96	131.51	1335.89	135.25	1335.32	137.43	1334.21
140.61	1332.65	145.48	1332.45	150.42	1332.56	152.98	1332.46	154.98	1332.38
158.73	1331.91	162.63	1331.43	165.24	1330.96	166.33	1330.8	167.09	1330.72
175.19	1330.69	179.1	1330.7	198.53	1330.77	214.22	1330.82	219.68	1331.66
221.61	1331.94	232.04	1331.76	237.43	1331.64	251.64	1331.32	252.91	1331.21
260.29	1330.62	271.91	1330.13	278.19	1329.89	280.91	1329.79	284.48	1329.63
300.48	1329.7	323.07	1329.98	324.79	1328.98	326.21	1328.28	326.61	1328.24
328.76	1327.99	330.6	1328.09	333.83	1328.24	334.93	1328.61	339.76	1330.29
356.82	1330.07	368.62	1329.96	385.67	1329.9	421.02	1330.34	426.83	1331.86
426.84	1331.86	426.85	1331.86	426.87	1331.86	431.1	1333.25	432.56	1334.02
433.86	1334.58	435.35	1335.22	438.86	1336.12	442.82	1337.1	446.19	1337.22
455.26	1337.51	466.2	1334.06	466.56	1333.96	467.08	1333.74	468.23	1333.01
470.01	1332.01	470.87	1331.98	473.83	1331.5	476.52	1331.48	479.92	1331.35
482.01	1331.34	488.43	1331.39	490.96	1331.44	495.77	1331.49	497.79	1331.53
503.06	1331.58	505.82	1331.45	511.24	1331.1	513.63	1330.94	514.25	1330.87
514.67	1330.82	517.99	1330.97	519.66	1330.99	529.33	1331.09	538.33	1331.08
539.82	1331.18	541.86	1331.31	546.16	1331.57	549.45	1331.65	552.34	1331.71
556.45	1331.73	570.44	1331.98	576.59	1331.47	580.08	1331.46	584.41	1331.22
589.74	1331.21	602.44	1331.29	608.64	1331.28	615.22	1331.26	621.53	1331.38
627.6	1331.7	630.26	1331.75	635	1332.62	636.16	1332.87	637.07	1333.16
639.21	1333.52	639.68	1333.68	639.93	1333.76	640.31	1333.87	640.8	1333.96
641.56	1334.1	642.19	1334.16	642.65	1334.16	642.75	1334.17	643.86	1334.18
643.9	1334.18	645.05	1334.03	645.61	1333.9	646.41	1333.72	646.6	1333.66
647.49	1333.67	648.72	1333.68	653.15	1333.64	655.34	1333.64	657.66	1333.63
662.68	1333.64	663.01	1333.65	664.95	1333.66	665.31	1333.67	667.33	1333.67
667.74	1333.68	669.74	1333.69	670.24	1333.71	670.99	1333.74	672.7	1333.76
673.64	1333.79	675.03	1333.81	676.2	1333.85	677.86	1333.9	680.05	1333.94
680.65	1333.96	681.88	1333.98	682.37	1333.98	684.14	1333.97	684.86	1333.97

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	125	.044	442.82	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
125	442.82	210.24	211.09	216.73	.1 .3

Left Levee Station= 125 Elevation= 1336.96
Right Levee Station= 455.25 Elevation= 1337.55

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1333.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.		0.044	
W.S. Elev (ft)	1332.75	Reach Len. (ft)	210.24	211.09	216.73
Crit W.S. (ft)	1331.85	Flow Area (sq ft)		643.32	
E.G. Slope (ft/ft)	0.005593	Area (sq ft)		643.32	

Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	289.15	Top Width (ft)		289.15	
Vel Total (ft/s)	4.29	Avg. Vel. (ft/s)		4.29	
Max Chl Dpth (ft)	4.76	Hydr. Depth (ft)		2.22	
Conv. Total (cfs)	36904.3	Conv. (cfs)		36904.3	
Length Wtd. (ft)	211.14	Wetted Per. (ft)		290.58	
Min Ch El (ft)	1327.99	Shear (lb/sq ft)		0.77	
Alpha	1.00	Stream Power (lb/ft s)	684.86	125.00	455.25
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)	2.66	41.91	1.34
C & E Loss (ft)	0.02	Cum SA (acres)	1.47	13.61	0.76

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1331.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.044	
W.S. Elev (ft)	1331.72	Reach Len. (ft)	210.24	211.09	216.73
Crit W.S. (ft)	1330.94	Flow Area (sq ft)		363.00	
E.G. Slope (ft/ft)	0.003845	Area (sq ft)		363.00	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	252.21	Top Width (ft)		252.21	
Vel Total (ft/s)	2.66	Avg. Vel. (ft/s)		2.66	
Max Chl Dpth (ft)	3.73	Hydr. Depth (ft)		1.44	
Conv. Total (cfs)	15578.5	Conv. (cfs)		15578.5	
Length Wtd. (ft)	211.12	Wetted Per. (ft)		253.39	
Min Ch El (ft)	1327.99	Shear (lb/sq ft)		0.34	
Alpha	1.00	Stream Power (lb/ft s)	684.86	125.00	455.25
Frctn Loss (ft)	1.75	Cum Volume (acre-ft)	0.97	21.67	0.42
C & E Loss (ft)	0.04	Cum SA (acres)	0.88	12.70	0.47

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.852

INPUT
Description: COP MOD 60 Click here for details---------->

Original Model Comment:
- Updated per
topographic survey recieved September 2009
- Areas outside the
topographic survey were deleted
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
315.67	1354.84	316.58	1354.8	316.84	1354.68	317.47	1354.38	318.36	1353.96
318.56	1353.87	318.85	1353.73	320.67	1352.87	320.98	1352.72	322.79	1351.87
324.33	1351.14	324.91	1350.87	325.79	1350.45	327.02	1349.87	328.44	1349.2
329.14	1348.87	329.31	1348.79	331.66	1347.87	332.44	1347.56	334.22	1346.87
334.71	1346.68	336.78	1345.87	337.26	1345.68	339.34	1344.87	340.44	1344.44
341.9	1343.87	343.93	1343.08	344.46	1342.87	345.7	1342.39	347.02	1341.87
347.36	1341.75	349.75	1340.87	351.66	1340.3	353.07	1339.87	355.42	1339.32
357.64	1338.87	360.54	1338.28	362.58	1337.87	364.28	1337.53	367.52	1336.87
372.14	1335.93	372.46	1335.87	372.59	1335.84	377.4	1334.87	380.56	1334.23
382.34	1333.87	386.31	1333.07	387.64	1332.87	391.41	1332.31	394.38	1331.87
398.02	1331.46	402.5	1330.87	413.01	1330.15	417.35	1329.87	430.86	1329.58
447.43	1329.32	470.79	1329.51	472.18	1329.5	472.58	1329.51	472.75	1329.44
474.04	1328.87	475.09	1328.4	477.23	1328.42	481.46	1328.52	482.64	1328.87
484.39	1329.39	486.31	1329.77	487.79	1329.87	491.2	1330.12	493.8	1330.12
497.33	1329.87	503.11	1329.09	505.58	1328.87	509.66	1328.56	511.76	1328.41
518.1	1328.37	536.71	1328.3	558.6	1328.19	571.23	1328.06	572.68	1328.06
582.76	1328.18	605.43	1328.24	616.16	1328.43	626.27	1328.8	628.18	1328.87
631.04	1329.48	632	1329.87	634.26	1330.78	634.48	1330.87	634.76	1330.98
636.91	1331.87	637.47	1332.1	639.34	1332.87	640.72	1333.44	641.76	1333.87
643.34	1334.52	644.19	1334.87	645.92	1335.58	646.49	1335.82	647.99	1335.78
658.46	1335.35	661.31	1334.87	664.97	1333.97	665.36	1333.87	667.4	1333.36
669.4	1332.87	669.67	1332.79	673.32	1331.87	674.22	1331.6	676.59	1330.87
694.66	1330.17	699.66	1329.98	702.06	1329.87	707.66	1328.88	707.91	1328.88

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
315.67	.045	417.35	.044	626.27	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
417.35	626.27	65.99	66.3	67.65	.1	.3

Right Levee Station= 646.49 Elevation= 1335.82

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1331.58	Element			
Vel Head (ft)	0.46	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1331.12	Reach Len. (ft)	65.99	66.30	67.65
Crit W.S. (ft)	1330.52	Flow Area (sq ft)	11.42	488.55	13.23
E.G. Slope (ft/ft)	0.008539	Area (sq ft)	11.42	488.55	13.23
Q Total (cfs)	2760.00	Flow (cfs)	26.95	2681.65	51.40
Top Width (ft)	234.47	Top Width (ft)	16.73	208.92	8.82
Vel Total (ft/s)	5.38	Avg. Vel. (ft/s)	2.36	5.49	3.89
Max Chl Dpth (ft)	3.06	Hydr. Depth (ft)	0.68	2.34	1.50
Conv. Total (cfs)	29867.6	Conv. (cfs)	291.7	29019.7	556.2
Length Wtd. (ft)	66.31	Wetted Per. (ft)	16.78	209.44	9.21
Min Ch El (ft)	1328.06	Shear (lb/sq ft)	0.36	1.24	0.77
Alpha	1.02	Stream Power (lb/ft s)	707.91	0.00	646.49
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	2.63	39.17	1.30
C & E Loss (ft)	0.08	Cum SA (acres)	1.43	12.41	0.74

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1330.05	Element			
Vel Head (ft)	0.48	Wt. n-Val.		0.044	0.045
W.S. Elev (ft)	1329.57	Reach Len. (ft)	65.99	66.30	67.65
Crit W.S. (ft)	1329.57	Flow Area (sq ft)		171.77	2.52
E.G. Slope (ft/ft)	0.029104	Area (sq ft)		171.77	2.52
Q Total (cfs)	966.00	Flow (cfs)		957.08	8.92
Top Width (ft)	185.14	Top Width (ft)		180.16	4.98
Vel Total (ft/s)	5.54	Avg. Vel. (ft/s)		5.57	3.54
Max Chl Dpth (ft)	1.51	Hydr. Depth (ft)		0.95	0.51
Conv. Total (cfs)	5662.4	Conv. (cfs)		5610.1	52.3
Length Wtd. (ft)	66.31	Wetted Per. (ft)		180.62	5.06
Min Ch El (ft)	1328.06	Shear (lb/sq ft)		1.73	0.90
Alpha	1.01	Stream Power (lb/ft s)	707.91	0.00	646.49
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	0.97	20.37	0.42
C & E Loss (ft)	0.12	Cum SA (acres)	0.88	11.65	0.46

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.840

INPUT
Description: COP MOD 59.4 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 101

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
222.28	1354.43	223.23	1354.5	232.84	1353.7	233.92	1353.79	243.87	1352.87
244.38	1352.91	252.76	1352.05	253.31	1351.87	254.41	1351.51	256.34	1350.87
258.94	1350.01	259.37	1349.87	260.13	1349.62	263.47	1348.87	265.44	1348.43
267.91	1347.87	270.67	1347.25	272.36	1346.87	275.44	1346.18	276.8	1345.87

280.18	1345.11	281.25	1344.87	284.09	1344.23	285.69	1343.87	288.5	1343.24
290.14	1342.87	294.4	1341.91	294.58	1341.87	294.68	1341.85	300.81	1340.87
301.34	1340.73	306.97	1339.87	307.55	1339.78	309.1	1339.55	312.11	1338.87
314.41	1338.36	316.58	1337.87	318.57	1337.42	321.04	1336.87	323.38	1336.35
325.51	1335.87	327.33	1335.46	329.97	1334.87	331.72	1334.48	334.43	1333.87
336.32	1333.45	338.9	1332.87	342.53	1332.06	343.36	1331.87	347.4	1330.96
347.83	1330.87	355.15	1329.88	355.22	1329.87	373.49	1328.87	379.05	1328.87
381.11	1328.87	383.94	1328.15	385.39	1327.87	411.64	1327.01	415.04	1326.91
418.47	1326.95	435.41	1327.27	445.49	1327.35	449.1	1327.34	458.9	1327.48
470.39	1327.65	487.98	1326.99	494.99	1326.87	495.72	1326.87	497.82	1326.87
500.6	1326.87	510.42	1326.87	538.5	1327.11	557.99	1327.6	565.02	1327.73
567.23	1327.87	568.59	1328.45	569.57	1328.87	571.05	1329.5	571.92	1329.87
573.7	1330.63	574.27	1330.87	576.31	1331.74	576.61	1331.87	577.47	1332.23
578.99	1332.87	579.62	1333.18	581.2	1333.87	582.59	1334.55	583.26	1334.87
595.63	1334.87	596.24	1334.87	596.91	1334.71	600.2	1333.87	601.64	1333.46
603.75	1332.87	605.8	1332.29	607.3	1331.87	610.69	1330.92	610.81	1330.88
610.85	1330.87								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
222.28	.045	373.49	.044	567.23	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
373.49	567.23	384.15	454.55	594.1	.1	.3

Right Levee Station= 583.26 Elevation= 1334.87

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1331.25	Element			
Vel Head (ft)	0.21	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1331.04	Reach Len. (ft)	384.15	454.55	594.10
Crit W.S. (ft)	1329.19	Flow Area (sq ft)	35.60	719.10	11.80
E.G. Slope (ft/ft)	0.002108	Area (sq ft)	35.60	719.10	11.80
Q Total (cfs)	2760.00	Flow (cfs)	65.59	2671.41	23.00
Top Width (ft)	227.64	Top Width (ft)	26.46	193.74	7.44
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)	1.84	3.71	1.95
Max Chl Dpth (ft)	4.17	Hydr. Depth (ft)	1.35	3.71	1.58
Conv. Total (cfs)	60112.5	Conv. (cfs)	1428.5	58183.1	500.9
Length Wtd. (ft)	454.72	Wetted Per. (ft)	26.57	193.90	8.09
Min Ch El (ft)	1326.87	Shear (lb/sq ft)	0.18	0.49	0.19
Alpha	1.04	Stream Power (lb/ft s)	610.85	0.00	583.26
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	2.60	38.25	1.28
C & E Loss (ft)	0.03	Cum SA (acres)	1.39	12.10	0.73

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1329.57	Element			
Vel Head (ft)	0.08	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1329.49	Reach Len. (ft)	384.15	454.55	594.10
Crit W.S. (ft)	1328.21	Flow Area (sq ft)	3.46	417.37	3.06
E.G. Slope (ft/ft)	0.001671	Area (sq ft)	3.46	417.37	3.06
Q Total (cfs)	966.00	Flow (cfs)	2.12	960.49	3.38
Top Width (ft)	208.77	Top Width (ft)	11.24	193.74	3.79
Vel Total (ft/s)	2.28	Avg. Vel. (ft/s)	0.61	2.30	1.11
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)	0.31	2.15	0.81
Conv. Total (cfs)	23632.2	Conv. (cfs)	52.0	23497.5	82.7
Length Wtd. (ft)	454.81	Wetted Per. (ft)	11.26	193.90	4.12
Min Ch El (ft)	1326.87	Shear (lb/sq ft)	0.03	0.22	0.08
Alpha	1.01	Stream Power (lb/ft s)	610.85	0.00	583.26
Frctn Loss (ft)	0.81	Cum Volume (acre-ft)	0.97	19.92	0.41
C & E Loss (ft)	0.01	Cum SA (acres)	0.88	11.37	0.45

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.754

INPUT
Description: COP MOD 54 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
80.07	1350.12	80.72	1349.87	81.46	1349.59	83.35	1348.87	84.09	1348.59

85.98	1347.87	87.95	1347.12	88.6	1346.87	89.81	1346.41	91.23	1345.87
93.8	1344.89	93.86	1344.87	93.98	1344.82	96.49	1343.87	98.23	1343.21
99.12	1342.87	101.7	1341.89	101.74	1341.87	101.8	1341.85	105.89	1340.87
108.07	1340.44	110.97	1339.87	114.98	1339.08	116.05	1338.87	117.54	1338.58
121.14	1337.87	123.49	1337.41	126.22	1336.87	130.45	1336.04	131.3	1335.87
132.3	1335.67	136.38	1334.87	139.97	1334.16	141.45	1333.87	141.62	1333.84
146.52	1332.87	147.16	1332.75	151.58	1331.87	152.6	1331.67	156.65	1330.87
158.62	1330.48	158.9	1330.41	161.14	1329.87	167.23	1329.63	184.18	1328.87
211.95	1328.29	226.54	1327.93	226.8	1327.87	229.96	1327.21	234.93	1327.27
239.95	1327.38	243.08	1327.87	243.82	1327.98	263.73	1327.87	263.9	1327.87
268.65	1326.87	268.66	1326.87	268.74	1326.85	273.43	1325.87	275.34	1325.47
278.26	1324.87	283.41	1324.87	287.5	1324.87	289.35	1325.73	289.84	1325.87
291.64	1326.82	291.74	1326.87	301.66	1326.87	308.26	1326.87	309.83	1326.87
313.44	1326.59	315.44	1326.73	337.75	1326.87	370.96	1326.87	372.8	1326.92
372.98	1326.92	391.74	1326.98	397.39	1326.99	397.96	1326.99	401.59	1326.98
415.59	1326.87	434.63	1326.71	461.08	1326.87	461.25	1326.87	461.32	1326.88
463.06	1326.94	485.57	1327.77	487.96	1327.81	488.22	1327.87	492.63	1328.8
492.84	1328.87	493.57	1329.13	495.65	1329.87	496.15	1330.05	498.46	1330.87
500.38	1331.55	501.28	1331.87	501.8	1332.06	504.09	1332.87	505.64	1333.42
506.9	1333.87	508.77	1334.53	509.72	1334.87	510.47	1334.87	511.15	1334.87
530.85	1334.07	533.84	1333.95	535.35	1333.91	536.01	1333.87	549.57	1333.15
554.53	1332.87	558.15	1332.55	565.95	1331.87	574.55	1331.12	577.36	1330.87
583.87	1330.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
80.07	.045	167.23	.044	488.22	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
167.23	488.22	543.9	520.86 509.53	.1	.3

Right Levee Station= 509.72 Elevation= 1334.87

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1330.41	Element			
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1330.29	Reach Len. (ft)	543.90	520.86	509.53
Crit W.S. (ft)	1328.45	Flow Area (sq ft)	3.61	978.73	11.71
E.G. Slope (ft/ft)	0.001559	Area (sq ft)	3.61	978.73	11.71
Q Total (cfs)	2760.00	Flow (cfs)	2.81	2738.91	18.28
Top Width (ft)	337.39	Top Width (ft)	7.81	320.99	8.59
Vel Total (ft/s)	2.78	Avg. Vel. (ft/s)	0.78	2.80	1.56
Max Chl Dpth (ft)	5.41	Hydr. Depth (ft)	0.46	3.05	1.36
Conv. Total (cfs)	69895.4	Conv. (cfs)	71.1	69361.4	463.0
Length Wtd. (ft)	521.03	Wetted Per. (ft)	7.86	321.95	8.94
Min Ch El (ft)	1324.87	Shear (lb/sq ft)	0.04	0.30	0.13
Alpha	1.01	Stream Power (lb/ft s)	583.87	0.00	509.72
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	2.42	29.39	1.12
C & E Loss (ft)	0.01	Cum SA (acres)	1.24	9.41	0.62

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1328.75	Element			
Vel Head (ft)	0.06	Wt. n-Val.		0.044	0.045
W.S. Elev (ft)	1328.68	Reach Len. (ft)	543.90	520.86	509.53
Crit W.S. (ft)	1327.59	Flow Area (sq ft)		475.01	1.57
E.G. Slope (ft/ft)	0.001925	Area (sq ft)		475.01	1.57
Q Total (cfs)	966.00	Flow (cfs)		964.77	1.23
Top Width (ft)	298.94	Top Width (ft)		295.09	3.85
Vel Total (ft/s)	2.03	Avg. Vel. (ft/s)		2.03	0.78
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)		1.61	0.41
Conv. Total (cfs)	22014.6	Conv. (cfs)		21986.7	28.0
Length Wtd. (ft)	520.89	Wetted Per. (ft)		296.03	3.94
Min Ch El (ft)	1324.87	Shear (lb/sq ft)		0.19	0.05
Alpha	1.00	Stream Power (lb/ft s)	583.87	0.00	509.72
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.95	15.27	0.38
C & E Loss (ft)	0.00	Cum SA (acres)	0.83	8.81	0.40

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.655

INPUT
Description: COP MOD 49 Click here for details---------->

Original Model Comment:
- Updated per

topographic survey recieved September 2009
- Areas outside the
topographic survey were deleted

Station Elevation Data num= 83

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
352.68	1328.87	353.79	1329.08	358.02	1329.87	358.8	1330.02	363.37	1330.87
363.51	1330.9	364.18	1331.02	369.16	1331.87	369.75	1331.97	375.03	1332.87
388.31	1332.87	397.19	1332.87	400.73	1332.01	401.32	1331.87	402.82	1331.51
405.45	1330.87	406.92	1330.52	409.62	1329.87	412.49	1329.19	413.83	1328.87
416.79	1328.17	418.04	1327.87	426.2	1327.12	429.71	1326.87	443.98	1326.11
448.55	1325.87	450.21	1325.78	463.59	1324.92	503.87	1325.55	525.23	1325.72
525.93	1325.87	526.28	1325.94	535.6	1326.45	545.68	1326.38	554.65	1326.29
592.23	1326.4	594.25	1325.87	595.19	1325.62	598.07	1324.87	599.33	1324.54
601.99	1324.79	626.23	1324.8	635.28	1324.87	637.71	1325.7	638.2	1325.87
639.02	1326.15	641.12	1326.87	643.9	1327.82	644.04	1327.87	644.14	1327.91
644.63	1328.07	646.6	1328.75	646.96	1328.87	648.97	1329.56	649.87	1329.87
651.97	1330.59	652.79	1330.87	653.55	1331.13	654.64	1331.5	655.71	1331.87
658.45	1332.81	658.56	1332.85	658.62	1332.87	661.93	1333.1	666.48	1333.14
669.39	1333.14	675.28	1332.87	676.16	1332.67	679.76	1331.87	680.25	1331.76
684.24	1330.87	688.31	1329.96	688.57	1329.9	688.72	1329.87	688.98	1329.82
689.6	1329.78	695.45	1329.23	698.8	1329.06	701.2	1328.87	705	1328.7
729.47	1327.87	731.66	1327.82	732.08	1327.82				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
352.68	.045	429.71	.044	641.12	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
429.71 641.12 622.35 536.53 466.49 .1 .3
Left Levee Station= 397.19 Elevation= 1332.87
Right Levee Station= 666.49 Elevation= 1333.14

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1329.49	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1329.31	Reach Len. (ft)	622.35	536.53	466.49
Crit W.S. (ft)	1327.42	Flow Area (sq ft)	27.21	765.47	8.66
E.G. Slope (ft/ft)	0.001961	Area (sq ft)	27.21	765.47	8.66
Q Total (cfs)	2760.00	Flow (cfs)	52.57	2693.52	13.92
Top Width (ft)	236.22	Top Width (ft)	17.71	211.41	7.11
Vel Total (ft/s)	3.44	Avg. Vel. (ft/s)	1.93	3.52	1.61
Max Chl Dpth (ft)	4.77	Hydr. Depth (ft)	1.54	3.62	1.22
Conv. Total (cfs)	62324.1	Conv. (cfs)	1187.0	60822.8	314.2
Length Wtd. (ft)	537.38	Wetted Per. (ft)	17.92	212.09	7.51
Min Ch El (ft)	1324.54	Shear (lb/sq ft)	0.19	0.44	0.14
Alpha	1.03	Stream Power (lb/ft s)	732.08	397.19	666.49
Frctn Loss (ft)	2.51	Cum Volume (acre-ft)	2.23	18.96	1.00
C & E Loss (ft)	0.07	Cum SA (acres)	1.08	6.23	0.53

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1327.84	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1327.77	Reach Len. (ft)	622.35	536.53	466.49
Crit W.S. (ft)	1326.53	Flow Area (sq ft)	4.99	440.30	1.18
E.G. Slope (ft/ft)	0.001578	Area (sq ft)	4.99	440.30	1.18
Q Total (cfs)	966.00	Flow (cfs)	3.96	961.17	0.87
Top Width (ft)	224.59	Top Width (ft)	10.55	211.41	2.63
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)	0.79	2.18	0.74
Max Chl Dpth (ft)	3.23	Hydr. Depth (ft)	0.47	2.08	0.45
Conv. Total (cfs)	24319.2	Conv. (cfs)	99.7	24197.5	22.0
Length Wtd. (ft)	536.66	Wetted Per. (ft)	10.59	212.09	2.77
Min Ch El (ft)	1324.54	Shear (lb/sq ft)	0.05	0.20	0.04
Alpha	1.01	Stream Power (lb/ft s)	732.08	397.19	666.49
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	0.92	9.80	0.37
C & E Loss (ft)	0.04	Cum SA (acres)	0.76	5.79	0.36

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,

energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.553

INPUT
Description: COP MOD 43.8 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 132

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
208.39	1324.87	210.44	1325.36	212.83	1325.87	214.77	1326.33	217.01	1326.87
219.22	1327.4	221.2	1327.87	222.71	1328.23	225.39	1328.87	227.35	1329.34
229.57	1329.87	234.36	1330.27	239.52	1330.72	242.58	1330.75	245.11	1330.78
246.61	1330.43	249	1329.87	250.67	1329.48	253.26	1328.87	256.02	1328.22
257.52	1327.87	260.58	1327.15	260.66	1327.14	260.68	1327.14	261.94	1326.87
262.3	1326.79	266.7	1325.87	267.48	1325.7	270.24	1325.13	276.03	1325.04
276.07	1325.04	279.01	1325	283.63	1325.02	284.27	1324.91	285.79	1324.89
286.62	1324.87	286.85	1324.87	286.93	1324.87	286.96	1324.87	286.99	1324.87
289.95	1324.72	297.37	1324.41	301.35	1324.37	304.42	1324.22	304.61	1324.21
305.37	1324.21	308.64	1324.18	319.66	1324.17	322.6	1324.18	326.4	1324.14
332.7	1324.07	336.5	1324.03	340.71	1323.89	341.1	1323.88	341.66	1323.87
349.99	1323.87	352.48	1323.87	359.87	1323.81	361.49	1323.84	362.83	1323.84
364.14	1323.85	364.74	1323.87	367.2	1323.87	368.01	1323.87	368.73	1323.84
372.01	1323.78	375.45	1323.87	381.2	1323.87	383.33	1324.06	385.8	1324.18
390.16	1324.08	390.37	1324.08	398.28	1323.88	405.02	1323.87	411.21	1323.94
411.31	1323.94	412.06	1324.01	413.06	1324.11	413.08	1324.1	413.29	1324.1
426.62	1323.87	431.93	1324.3	438.1	1324.15	439.59	1324.2	440.51	1324.24
446.01	1324.51	451.22	1324.69	455.16	1324.79	458.23	1324.87	460.33	1324.93
460.52	1324.87	462.93	1324.87	463.82	1324.85	464.17	1324.87	471.55	1324.87
473.9	1324.87	477.93	1325.21	479.52	1325.74	479.6	1325.71	480.02	1325.87
481.38	1326.38	482.7	1326.87	484.68	1327.61	485.38	1327.87	487.22	1328.55
488.26	1328.87	488.65	1328.99	491.54	1329.87	493.35	1330.42	494.83	1330.87
495.64	1331.02	497.94	1330.87	499.02	1330.87	499.73	1330.76	499.79	1330.76
500.4	1330.75	503.43	1330.67	503.62	1330.65	504.81	1330.6	507.2	1330.49
508.27	1330.08	508.82	1329.87	509.01	1329.8	511.45	1328.87	513.02	1328.27
514.09	1327.87	514.77	1327.61	516.72	1326.87	517.83	1326.45	518.8	1326.08
519.36	1325.87	521.43	1325.08						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
208.39	.045	276.03	.044	473.9	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
276.03	473.9	57.48	58.17	59.31	.1	.3

Left Levee Station= 245.1 Elevation= 1330.78
Right Levee Station= 495.64 Elevation= 1331.02

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1326.91	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.87	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1326.04	Reach Len. (ft)	57.48	58.17	59.31
Crit W.S. (ft)	1326.04	Flow Area (sq ft)	7.49	359.01	5.08
E.G. Slope (ft/ft)	0.022575	Area (sq ft)	7.49	359.01	5.08
Q Total (cfs)	2760.00	Flow (cfs)	30.21	2708.91	20.87
Top Width (ft)	214.56	Top Width (ft)	10.13	197.87	6.57
Vel Total (ft/s)	7.43	Avg. Vel. (ft/s)	4.03	7.55	4.11
Max Chl Dpth (ft)	2.26	Hydr. Depth (ft)	0.74	1.81	0.77
Conv. Total (cfs)	18369.4	Conv. (cfs)	201.1	18029.4	138.9
Length Wtd. (ft)	58.16	Wetted Per. (ft)	10.22	197.97	6.73
Min Ch El (ft)	1323.78	Shear (lb/sq ft)	1.03	2.56	1.06
Alpha	1.02	Stream Power (lb/ft s)	521.43	245.10	495.64
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1.98	12.04	0.93
C & E Loss (ft)	0.19	Cum SA (acres)	0.88	3.71	0.45

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4. This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1325.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1325.13	Reach Len. (ft)	57.48	58.17	59.31
Crit W.S. (ft)	1325.13	Flow Area (sq ft)	0.26	179.40	0.40
E.G. Slope (ft/ft)	0.028946	Area (sq ft)	0.26	179.40	0.40
Q Total (cfs)	966.00	Flow (cfs)	0.18	965.25	0.57
Top Width (ft)	206.69	Top Width (ft)	5.74	197.87	3.07
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)	0.71	5.38	1.44
Max Chl Dpth (ft)	1.35	Hydr. Depth (ft)	0.04	0.91	0.13
Conv. Total (cfs)	5677.8	Conv. (cfs)	1.1	5673.4	3.4
Length Wtd. (ft)	58.17	Wetted Per. (ft)	5.74	197.97	3.08
Min Ch El (ft)	1323.78	Shear (lb/sq ft)	0.08	1.64	0.23
Alpha	1.01	Stream Power (lb/ft s)	521.43	245.10	495.64
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.88	5.98	0.36
C & E Loss (ft)	0.10	Cum SA (acres)	0.64	3.27	0.33

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth for the water surface and continued on with the calculations.

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

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

Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.542

INPUT
Description: COP MOD 43.3 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 96

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
329.9	1325.49	331.91	1325.87	335.12	1326.46	337.29	1326.87	340.16	1327.4
342.67	1327.87	347.77	1328.82	348.05	1328.87	348.19	1328.9	348.46	1328.9
360.04	1329.72	362.9	1329.8	366.55	1329	367.11	1328.87	370.47	1328.11
371.56	1327.87	373.88	1327.35	375.99	1326.87	376.42	1326.77	380.42	1325.87
384.61	1324.93	384.86	1324.87	384.93	1324.85	403.84	1324.05	409.34	1323.87
411.24	1323.67	413.53	1323.43	418.88	1322.87	426.07	1322.12	428.43	1321.87
430.39	1321.66	432.29	1321.46	434.88	1320.87	439.8	1320.52	442.69	1320.15
453.68	1320.06	453.75	1320.06	453.77	1320.06	453.84	1320.06	453.97	1320.05
458.78	1319.87	462.61	1319.73	472	1319.41	483.12	1318.96	487.45	1318.98
503.87	1319.47	505.36	1319.51	511.53	1319.87	515.16	1319.87	529.54	1320.1
538.26	1320.04	540.87	1320.08	549.86	1320.21	557.64	1320.26	563.12	1320.31
571.59	1320.45	585.51	1320.61	593.03	1320.87	594.13	1320.73	595.16	1320.75
595.53	1320.87	598.5	1321.83	598.62	1321.87	598.95	1321.98	601.39	1322.87
602.67	1323.34	604.13	1323.87	605.96	1324.54	606.86	1324.87	608.97	1325.64
609.6	1325.87	610.4	1326.16	612.33	1326.87	614.38	1327.62	615.07	1327.87
617.59	1328.79	617.8	1328.87	618.14	1328.87	626.42	1328.87	631.26	1327.95
631.54	1327.87	631.86	1327.78	635.19	1326.87	638.24	1326.03	638.84	1325.87
641.49	1325.14	642.22	1324.87	643.93	1324.22	654.24	1324.16	710.79	1324.45
714.28	1324.52	818.23	1325.38	834.63	1325.71	850.43	1326.03	858.77	1326.19
876.61	1326.47								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
329.9	.045	442.69	.044	593.03	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
442.69	593.03	340.02	336.74	338.98	.1 .3

Left Levee Station= 362.89 Elevation= 1329.8
Right Levee Station= 617.8 Elevation= 1328.87

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1324.46	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.23	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1324.23	Reach Len. (ft)	340.02	336.74	338.98
Crit W.S. (ft)	1322.09	Flow Area (sq ft)	74.46	648.24	25.21
E.G. Slope (ft/ft)	0.001930	Area (sq ft)	74.46	648.24	25.21
Q Total (cfs)	2760.00	Flow (cfs)	154.77	2547.46	57.77
Top Width (ft)	205.61	Top Width (ft)	43.18	150.34	12.09
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)	2.08	3.93	2.29
Max Chl Dpth (ft)	5.27	Hydr. Depth (ft)	1.72	4.31	2.08
Conv. Total (cfs)	62819.7	Conv. (cfs)	3522.6	57982.1	1314.9
Length Wtd. (ft)	336.89	Wetted Per. (ft)	43.42	150.39	12.69
Min Ch El (ft)	1318.96	Shear (lb/sq ft)	0.21	0.52	0.24
Alpha	1.07	Stream Power (lb/ft s)	876.61	362.89	617.80
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	1.93	11.37	0.91
C & E Loss (ft)	0.00	Cum SA (acres)	0.85	3.48	0.44

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1322.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1322.15	Reach Len. (ft)	340.02	336.74	338.98
Crit W.S. (ft)	1321.01	Flow Area (sq ft)	17.23	335.32	5.97
E.G. Slope (ft/ft)	0.002313	Area (sq ft)	17.23	335.32	5.97
Q Total (cfs)	966.00	Flow (cfs)	27.55	929.60	8.85
Top Width (ft)	173.66	Top Width (ft)	16.93	150.34	6.39
Vel Total (ft/s)	2.69	Avg. Vel. (ft/s)	1.60	2.77	1.48
Max Chl Dpth (ft)	3.19	Hydr. Depth (ft)	1.02	2.23	0.93
Conv. Total (cfs)	20083.9	Conv. (cfs)	572.7	19327.2	184.0
Length Wtd. (ft)	336.80	Wetted Per. (ft)	17.06	150.39	6.63
Min Ch El (ft)	1318.96	Shear (lb/sq ft)	0.15	0.32	0.13
Alpha	1.03	Stream Power (lb/ft s)	876.61	362.89	617.80
Frctn Loss (ft)	0.98	Cum Volume (acre-ft)	0.87	5.64	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	0.63	3.03	0.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.479

INPUT
Description: COP MOD 40.0 Click here for details---------->

Original Model Comment:
 - Updated per topographic survey recieved September 2009
 - Areas outside the topographic survey were deleted

Station Elevation Data num= 90

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
115.73	1322.87	118.91	1323.22	124.92	1323.87	127.99	1324.2	134.1	1324.87
136.9	1325.18	143.29	1325.87	144.35	1325.99	144.59	1326.01	152.51	1326.87
152.7	1326.87	157.43	1326.87	162.98	1326.85	164.27	1326.43	166	1325.87
167.81	1325.28	169.05	1324.87	170.64	1324.35	172.11	1323.87	174.4	1323.12
175.17	1322.87	177.74	1322.03	178.23	1321.87	178.98	1321.63	181.28	1320.87
182.84	1320.36	183.24	1320.22	183.26	1320.22	183.35	1320.22	191.13	1319.87
194.6	1319.71	213.41	1318.87	248.45	1318.11	250.27	1318.09	250.64	1318.05
252.48	1317.87	255.53	1317.57	256.77	1317.57	258.95	1317.52	264.18	1317.54
266.12	1317.52	267.41	1317.87	269.72	1318.49	291.99	1318.86	292.72	1318.87
292.76	1318.88	293.56	1319.08	296.79	1319.87	296.98	1319.92	300.62	1320.87
303.06	1321.53	304.31	1321.87	314.99	1321.98	327.77	1322.12	337.57	1322.24
370.02	1322.43	377.58	1322.04	378.3	1321.87	382.11	1320.96	382.46	1320.87
388.4	1320.87	390.22	1320.87	392.11	1321.34	394.21	1321.87	395.89	1322.29
398.2	1322.87	401.19	1323.62	402.18	1323.87	406.16	1324.87	406.17	1324.87
406.21	1324.88	406.28	1324.9	408.43	1325.47	410.06	1325.87	410.3	1325.93
414.17	1326.87	414.86	1327.04	418.27	1327.87	419.36	1328.13	424	1328.01
427.44	1328.01	429.88	1327.93	430.19	1327.87	432	1327.49	434.99	1326.87
438.9	1326.05	439.78	1325.87	441.36	1325.54	444.58	1324.87	446.84	1324.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
115.73	.045	183.24	.044	390.22	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
183.24 390.22 45.31 45.37 46.62 .1 .3
Left Levee Station= 157.43 Elevation= 1326.87

Right Levee Station= 419.36 Elevation= 1328.13

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1323.67	Element			
Vel Head (ft)	0.24	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1323.43	Reach Len. (ft)	45.31	45.37	46.62
Crit W.S. (ft)	1321.38	Flow Area (sq ft)	15.60	675.51	13.04
E.G. Slope (ft/ft)	0.002900	Area (sq ft)	15.60	675.51	13.04
Q Total (cfs)	2760.00	Flow (cfs)	36.63	2696.61	26.76
Top Width (ft)	226.95	Top Width (ft)	9.77	206.98	10.19
Vel Total (ft/s)	3.92	Avg. Vel. (ft/s)	2.35	3.99	2.05
Max Chl Dpth (ft)	5.91	Hydr. Depth (ft)	1.60	3.26	1.28
Conv. Total (cfs)	51252.2	Conv. (cfs)	680.2	50075.0	497.0
Length Wtd. (ft)	45.38	Wetted Per. (ft)	10.28	207.71	10.51
Min Ch El (ft)	1317.52	Shear (lb/sq ft)	0.27	0.59	0.22
Alpha	1.02	Stream Power (lb/ft s)	446.84	157.43	419.36
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	1.58	6.25	0.76
C & E Loss (ft)	0.02	Cum SA (acres)	0.64	2.10	0.35

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1321.28	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1321.09	Reach Len. (ft)	45.31	45.37	46.62
Crit W.S. (ft)	1319.99	Flow Area (sq ft)	1.14	276.29	0.10
E.G. Slope (ft/ft)	0.003806	Area (sq ft)	1.14	276.29	0.10
Q Total (cfs)	966.00	Flow (cfs)	1.28	964.67	0.05
Top Width (ft)	130.39	Top Width (ft)	2.63	126.86	0.89
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	1.13	3.49	0.46
Max Chl Dpth (ft)	3.57	Hydr. Depth (ft)	0.43	2.18	0.11
Conv. Total (cfs)	15657.7	Conv. (cfs)	20.8	15636.2	0.7
Length Wtd. (ft)	45.37	Wetted Per. (ft)	2.77	127.36	0.92
Min Ch El (ft)	1317.52	Shear (lb/sq ft)	0.10	0.52	0.03
Alpha	1.00	Stream Power (lb/ft s)	446.84	157.43	419.36
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.80	3.27	0.33
C & E Loss (ft)	0.02	Cum SA (acres)	0.55	1.96	0.30

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.470

INPUT
Description: COP MOD 39.6 Click here for details---------->

Original Model Comment:
added 100'
upstream of structure for freeboard chek (4.0') min required per FEMA/44CFR65.10

Station Elevation Data num= 60

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1321.87	154.97	1322.11	162.56	1322.25	163.9	1322.25	165.12	1322.24
171.99	1322.14	180.55	1323.08	210.62	1326.47	213.62	1327.47	221.62	1327.47
223.78	1326.75	230.57	1324.67	233.15	1323.73	242.67	1320.27	246.05	1320.15
268.05	1319.23	287.56	1318.75	297.04	1318.74	304.43	1318.54	316.75	1318.43
317.49	1318.24	322.55	1317.6	325.21	1317.84	326.3	1317.8	328.16	1317.69
329.09	1317.26	333.6	1317.19	335.18	1317.63	338.19	1318.52	360.6	1318.69
364.79	1318.73	369.08	1318.7	385.95	1319.09	392.92	1320.36	403.84	1322.06
404.9	1322.07	412.84	1322.18	419.94	1322.27	435.73	1319.53	436	1319.47
436.18	1319.47	450.21	1320.11	472.85	1325.97	480.61	1328.03	482.45	1328.04
488.41	1328.09	489.43	1328.05	491.04	1327.67	503.67	1324.75	503.95	1324.74
505.73	1324.78	505.95	1324.77	507.77	1324.77	518.56	1324.71	520.11	1324.7
521.74	1324.7	533.01	1324.58	534.8	1324.86	535.08	1324.9	604.57	1324.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	246.05	.044	450.21	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
246.05	450.21	98.12	96.9	98.07	.3	.5

Left Levee Station= 221.62 Elevation= 1327.47
Right Levee Station= 488.41 Elevation= 1328.09

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1323.55	Element			

Vel Head (ft)	0.17	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1323.39	Reach Len. (ft)	98.12	96.90	98.07
Crit W.S. (ft)	1320.98	Flow Area (sq ft)	24.11	811.42	20.75
E.G. Slope (ft/ft)	0.001523	Area (sq ft)	24.11	811.42	20.75
Q Total (cfs)	2760.00	Flow (cfs)	48.11	2675.53	36.36
Top Width (ft)	228.78	Top Width (ft)	11.96	204.16	12.66
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	2.00	3.30	1.75
Max Chl Dpth (ft)	6.20	Hydr. Depth (ft)	2.02	3.97	1.64
Conv. Total (cfs)	70717.7	Conv. (cfs)	1232.7	68553.3	931.7
Length Wtd. (ft)	96.92	Wetted Per. (ft)	12.51	205.06	13.08
Min Ch El (ft)	1317.19	Shear (lb/sq ft)	0.18	0.38	0.15
Alpha	1.03	Stream Power (lb/ft s)	604.57	221.62	488.41
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	1.56	5.48	0.74
C & E Loss (ft)	0.36	Cum SA (acres)	0.63	1.88	0.34

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1321.12	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1321.00	Reach Len. (ft)	98.12	96.90	98.07
Crit W.S. (ft)	1319.87	Flow Area (sq ft)	3.42	351.56	1.54
E.G. Slope (ft/ft)	0.002575	Area (sq ft)	3.42	351.56	1.54
Q Total (cfs)	966.00	Flow (cfs)	4.16	960.37	1.47
Top Width (ft)	182.81	Top Width (ft)	5.40	173.96	3.45
Vel Total (ft/s)	2.71	Avg. Vel. (ft/s)	1.22	2.73	0.96
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)	0.63	2.02	0.45
Conv. Total (cfs)	19036.4	Conv. (cfs)	81.9	18925.4	29.1
Length Wtd. (ft)	96.90	Wetted Per. (ft)	5.53	174.67	3.56
Min Ch El (ft)	1317.19	Shear (lb/sq ft)	0.10	0.32	0.07
Alpha	1.01	Stream Power (lb/ft s)	604.57	221.62	488.41
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	0.80	2.94	0.33
C & E Loss (ft)	0.21	Cum SA (acres)	0.55	1.81	0.29

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.452

INPUT
Description: COP MOD 38.6 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 168

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
144.01	1323.87	146.96	1323.87	153.15	1324.2	162.18	1324.37	171.96	1324.87
175.57	1324.87	183.17	1324.87	190.83	1325.44	193.05	1325.47	202.26	1325.52
203.29	1325.49	213.76	1325.63	220.66	1326.17	223.59	1326.17	226.19	1326.17
228.59	1325.59	229.85	1325.47	232.96	1325.39	242.1	1325.23	248.37	1325.09
251.07	1325.1	256.58	1325.13	269.21	1324.87	278.86	1324.87	280.59	1324.74
284.43	1324.81	286.2	1324.87	286.36	1324.87	292.86	1324.87	297.34	1324.65
299.24	1324.64	299.47	1324.66	305.7	1324.09	305.73	1324.07	305.82	1324.06
306.09	1324.05	306.49	1324.03	307.32	1323.99	309.81	1323.87	309.87	1323.61
309.97	1323.22	310.06	1322.87	310.22	1322.2	310.25	1322.11	310.31	1321.87
310.45	1321.3	310.56	1320.87	310.73	1320.19	310.81	1319.87	310.97	1319.22
311.01	1319.05	311.05	1318.87	311.13	1318.64	311.38	1318.09	311.54	1318.1
313.24	1317.87	314.06	1317.87	314.88	1317.87	315.43	1317.87	317.09	1317.87
318.26	1317.87	320.15	1317.87	321.45	1317.87	322.75	1317.87	325.18	1317.87
325.83	1317.97	326.96	1317.97	328.75	1317.97	330.53	1317.97	332.23	1317.97
333.94	1317.97	335.23	1317.97	337.17	1317.97	339.1	1317.97	341.58	1317.97
344.67	1317.9	346.68	1317.89	348.75	1317.87	348.78	1317.87	349	1317.87
350.89	1317.87	351.42	1317.87	351.73	1317.87	352.07	1317.87	354.05	1317.87
354.48	1317.87	354.89	1317.87	355.69	1317.87	357.31	1317.87	358.02	1317.87
358.71	1317.87	360.39	1317.87	361.14	1317.87	361.87	1317.87	362.29	1317.87

362.47	1317.78	362.52	1317.78	362.57	1317.77	362.75	1317.87	363.94	1317.87
364.69	1317.87	367.83	1317.87	370.97	1317.87	371.67	1317.87	374.01	1317.87
374.31	1317.85	375.68	1317.87	378.45	1317.87	378.77	1317.87	379.46	1317.87
380.14	1317.87	380.77	1317.87	381.4	1317.87	382.12	1317.87	382.83	1317.87
385.83	1317.87	386.86	1317.87	387.89	1317.87	389.36	1317.87	391.24	1317.87
392.17	1317.87	394.96	1317.87	395.73	1317.87	396.54	1318.06	397.07	1318.81
397.08	1318.87	397.11	1318.98	397.14	1319.09	397.35	1319.87	397.46	1320.3
397.6	1320.87	397.72	1321.34	397.85	1321.87	398.05	1322.62	398.11	1322.87
398.21	1323.29	398.36	1323.87	398.41	1324.06	398.67	1323.91	400.36	1324.12
401.79	1324.07	403.3	1324.16	404.28	1324.22	404.39	1324.29	404.68	1324.24
406.64	1324.24	411.71	1324.6	413.81	1324.87	417.62	1325.08	430.06	1325.87
430.18	1325.88	430.79	1325.92	438.69	1326.37	439.2	1326.37	451.53	1326.18
460.87	1326.03	461.18	1326.03	461.86	1326.02	475.69	1326.08	483.57	1326.13
495.57	1326.26	497.38	1326.19	498.7	1326.16	498.91	1326.16	502.37	1326.28
502.49	1326.25	504.94	1326.18	505.41	1326.17				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
144.01	.045	313.24	.044	396.54	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
313.24	396.54	3.82	3.82	3.88	.3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
144.01	314.76	1323.43	F
396.5	505.41	1323.39	F

Left Levee Station= 226.19 Elevation= 1326.17
Right Levee Station= 438.69 Elevation= 1326.37

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1322.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.35	Wt. n-Val.		0.044	
W.S. Elev (ft)	1321.51	Reach Len. (ft)	3.82	3.82	3.88
Crit W.S. (ft)	1321.18	Flow Area (sq ft)		295.77	
E.G. Slope (ft/ft)	0.013762	Area (sq ft)	8.40	301.44	2.57
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	87.36	Top Width (ft)	2.84	83.30	1.22
Vel Total (ft/s)	9.33	Avg. Vel. (ft/s)		9.33	
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)		3.62	
Conv. Total (cfs)	23526.8	Conv. (cfs)		23526.8	
Length Wtd. (ft)	3.82	Wetted Per. (ft)		81.82	
Min Ch El (ft)	1317.77	Shear (lb/sq ft)		3.11	
Alpha	1.00	Stream Power (lb/ft s)	505.41	226.19	438.69
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1.52	4.24	0.72
C & E Loss (ft)	0.42	Cum SA (acres)	0.61	1.56	0.33

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1320.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.		0.044	
W.S. Elev (ft)	1319.53	Reach Len. (ft)	3.82	3.82	3.88
Crit W.S. (ft)	1319.53	Flow Area (sq ft)		133.75	
E.G. Slope (ft/ft)	0.023754	Area (sq ft)	3.26	136.33	0.65
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	86.36	Top Width (ft)	2.35	83.30	0.72
Vel Total (ft/s)	7.22	Avg. Vel. (ft/s)		7.22	
Max Chl Dpth (ft)	1.76	Hydr. Depth (ft)		1.64	
Conv. Total (cfs)	6267.7	Conv. (cfs)		6267.7	
Length Wtd. (ft)	3.82	Wetted Per. (ft)		81.82	
Min Ch El (ft)	1317.77	Shear (lb/sq ft)		2.42	
Alpha	1.00	Stream Power (lb/ft s)	505.41	226.19	438.69
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.79	2.40	0.33
C & E Loss (ft)	0.28	Cum SA (acres)	0.54	1.52	0.29

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated

water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program defaulted to critical depth.

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.451

INPUT
Description: COP MOD 38.5 Click here for details---------->

Original Model Comment:
US XSec for
43rd St. Culvert Click Here for Details ---------->

-
Updated per topographic survey recieved September 2009
- Areas
outside the topographic survey were deleted

Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1325.45	.99	1325.43	11.44	1325.36	17.17	1326.17	23.68	1326.17
24.9	1325.43	27.14	1325.4	30.71	1325.32	41.2	1325.14	45.84	1325.03
48.81	1325.05	52.98	1325.06	62.54	1324.87	77.23	1324.78	82.19	1324.87
83.91	1324.92	91.11	1324.87	94.92	1324.83	95.3	1324.82	95.34	1324.83
98.03	1324.58	103.47	1324.19	107.22	1324.87	108.2	1324.7	108.23	1324.57
108.4	1323.87	108.41	1323.84	108.43	1323.77	108.65	1322.87	108.78	1322.38
108.9	1321.87	108.93	1321.77	108.98	1321.58	109.09	1321.11	109.15	1320.87
109.33	1320.16	109.37	1320	109.4	1319.87	109.53	1319.37	109.65	1318.87
109.77	1318.47	109.95	1317.87	110.23	1316.95	111.45	1315.95	119.98	1315.95
145.63	1315.96	145.66	1315.94	145.71	1315.96	151.09	1316	190.76	1315.93
192.18	1316.72	192.19	1316.87	192.47	1316.99	192.65	1317.87	192.66	1317.95
192.72	1318.19	192.83	1318.71	192.87	1318.87	193.04	1319.53	193.12	1319.87
193.14	1319.95	193.38	1320.87	193.39	1320.93	193.63	1321.87	193.68	1322.08
193.88	1322.87	194.09	1323.67	194.12	1323.81	194.14	1323.87	194.15	1323.91
194.39	1324.87	196.62	1324.18	197.83	1324.33	200.47	1324.24	201.31	1324.29
201.85	1324.32	201.91	1324.36	202.07	1324.33	203.15	1324.34	209.48	1324.78
210.19	1324.87	215.88	1325.18	226.73	1325.87	227.42	1325.91	227.96	1325.95
229.41	1326.03								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	111.45	.013	190.76	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
111.45	190.76	94.79	93.97	94.02	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110.27	1323.35	F
191.6	229.41	1323.26	F

Left Levee Station= 23.68 Elevation= 1326.17
Right Levee Station= 229.4 Elevation= 1326.03

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1322.45	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.52	Wt. n-Val.	0.045	0.013	0.045
W.S. Elev (ft)	1321.93	Reach Len. (ft)	94.79	93.97	94.02
Crit W.S. (ft)	1319.30	Flow Area (sq ft)	6.48	472.97	4.84
E.G. Slope (ft/ft)	0.000238	Area (sq ft)	10.17	472.97	12.17
Q Total (cfs)	2760.00	Flow (cfs)	8.66	2744.09	7.25
Top Width (ft)	84.76	Top Width (ft)	2.56	79.31	2.88
Vel Total (ft/s)	5.70	Avg. Vel. (ft/s)	1.34	5.80	1.50
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	5.49	5.96	5.76
Conv. Total (cfs)	178796.6	Conv. (cfs)	561.1	177766.1	469.4
Length Wtd. (ft)	93.97	Wetted Per. (ft)	1.53	79.32	0.96
Min Ch El (ft)	1315.93	Shear (lb/sq ft)	0.06	0.09	0.07
Alpha	1.03	Stream Power (lb/ft s)	229.41	23.68	229.40
Frctn Loss (ft)		Cum Volume (acre-ft)	1.52	4.20	0.72
C & E Loss (ft)		Cum SA (acres)	0.61	1.55	0.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1319.25	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.25	Wt. n-Val.	0.045	0.013	0.045
W.S. Elev (ft)	1319.00	Reach Len. (ft)	94.79	93.97	94.02
Crit W.S. (ft)	1317.62	Flow Area (sq ft)	3.03	241.10	2.38
E.G. Slope (ft/ft)	0.000276	Area (sq ft)	3.75	241.10	4.82
Q Total (cfs)	966.00	Flow (cfs)	2.63	960.98	2.40

Top Width (ft)	83.29	Top Width (ft)	1.83	79.31	2.14
Vel Total (ft/s)	3.92	Avg. Vel. (ft/s)	0.87	3.99	1.01
Max Chl Dpth (ft)	3.07	Hydr. Depth (ft)	2.57	3.04	2.84
Conv. Total (cfs)	58127.9	Conv. (cfs)	158.1	57825.6	144.2
Length Wtd. (ft)	93.97	Wetted Per. (ft)	1.53	79.32	0.96
Min Ch El (ft)	1315.93	Shear (lb/sq ft)	0.03	0.05	0.04
Alpha	1.03	Stream Power (lb/ft s)	229.41	23.68	229.40
Frctn Loss (ft)		Cum Volume (acre-ft)	0.79	2.39	0.33
C & E Loss (ft)		Cum SA (acres)	0.54	1.51	0.29

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: Scatter_Wash
REACH: One RS: .442

INPUT
Description: 43rd Ave Culvert added to CEM 7-8-09 Click Here--->

6-10'x7' RCB

- Upstream and Downstream Stations adjusted by -154' to align with US & DS Cross sections

Distance from Upstream XS = 9
Deck/Roadway Width = 75
Weir Coefficient = 2.6

Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-142.5	1323.39		-86.1	1323.97		-35.2	1324.55	
22.4	1325.12		75.6	1325.53		129.9	1325.79	
232.6	1325.88		282.3	1325.74		330.4	1325.65	
376.1	1325.38							

Upstream Bridge Cross Section Data
Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1325.45	.99	1325.43	11.44	1325.36	17.17	1326.17	23.68	1326.17
24.9	1325.43	27.14	1325.4	30.71	1325.32	41.2	1325.14	45.84	1325.03
48.81	1325.05	52.98	1325.06	62.54	1324.87	77.23	1324.78	82.19	1324.87
83.91	1324.92	91.11	1324.87	94.92	1324.83	95.3	1324.82	95.34	1324.83
98.03	1324.58	103.47	1324.19	107.22	1324.87	108.2	1324.7	108.23	1324.57
108.4	1323.87	108.41	1323.84	108.43	1323.77	108.65	1322.87	108.78	1322.38
108.9	1321.87	108.93	1321.77	108.98	1321.58	109.09	1321.11	109.15	1320.87
109.33	1320.16	109.37	1320	109.4	1319.87	109.53	1319.37	109.65	1318.87
109.77	1318.47	109.95	1317.87	110.23	1316.95	111.45	1315.95	119.98	1315.95
145.63	1315.96	145.66	1315.94	145.71	1315.96	151.09	1316	190.76	1315.93
192.18	1316.72	192.19	1316.87	192.47	1316.99	192.65	1317.87	192.66	1317.95
192.72	1318.19	192.83	1318.71	192.87	1318.87	193.04	1319.53	193.12	1319.87
193.14	1319.95	193.38	1320.87	193.39	1320.93	193.63	1321.87	193.68	1322.08
193.88	1322.87	194.09	1323.67	194.12	1323.81	194.14	1323.87	194.15	1323.91
194.39	1324.87	196.62	1324.18	197.83	1324.33	200.47	1324.24	201.31	1324.29
201.85	1324.32	201.91	1324.36	202.07	1324.33	203.15	1324.34	209.48	1324.78
210.19	1324.87	215.88	1325.18	226.73	1325.87	227.42	1325.91	227.96	1325.95
229.41	1326.03								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	111.45	.013	190.76	.045

Bank Sta: Left Right Coeff Contr. Expan.
111.45 190.76 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110.27	1323.35	F
191.6	229.41	1323.26	F

Left Levee Station= 23.68 Elevation= 1326.17
Right Levee Station= 229.4 Elevation= 1326.03

Downstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-142.5	1323.39		-86.1	1323.97		-35.2	1324.55	
22.4	1325.12		75.6	1325.53		129.9	1325.79	
232.6	1325.88		282.3	1325.74		330.4	1325.65	
376.1	1325.38							

Downstream Bridge Cross Section Data
Station Elevation Data num= 72

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1323.89	6.42	1323.87	30.28	1323.8	31.93	1323.79	33.3	1323.75
38.8	1323.58	66.4	1323.84	67	1323.85	67.38	1323.85	69.58	1323.87
95.28	1324.06	98.66	1324.26	109.21	1324.87	113.75	1325.13	117.19	1325.33

```
  120.65 1315.89  126.59 1315.87  126.95 1315.87  127.18 1315.87  133.97 1315.68
  136.14 1315.68  136.75 1315.66  136.86 1315.68  138.85 1315.68  145.86 1315.68
  147.79 1315.68  150.71 1315.69  151.69 1315.64  151.84 1315.69  159.67  1315.8
  165.28 1315.87  166.76 1315.97  166.96 1315.98  167.15 1315.98  167.35 1315.98
  167.55 1315.98  171.71 1315.87  174.95 1315.84  176.12 1315.87  183.72 1315.87
  184.94 1315.87  185.07 1315.92  185.68 1316.87  185.81 1317.07  186.32 1317.87
  186.68 1318.43  186.96 1318.87  187.44 1319.61  187.61 1319.87  187.68 1319.98
  188.25 1320.87  188.72 1321.61  188.89 1321.87  189.47 1322.78  189.53 1322.87
  189.59 1322.97  190.49 1323.87  191.89 1324.81  191.95 1324.85  192.01 1324.87
  193.38 1324.98  195.02 1324.87  199.04  1324.6  202.13 1324.39  205.56 1324.16
  209.94 1323.87  213.12 1323.87  213.44 1323.87  215.16 1324.04  224.04 1324.15
  228.83 1324.15  229.41 1324.18

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
       0    .045  120.65    .056  185.07    .045

Bank Sta: Left   Right    Coeff Contr.   Expan.
        120.65  185.07             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
       0  120.31 1323.37       F
   190.5  229.41 1323.37       F
Left Levee      Station=  117.19      Elevation= 1325.33
Right Levee     Station=  193.38      Elevation= 1324.98

Upstream Embankment side slope             =       0 horiz. to 1.0 vertical
Downstream Embankment side slope           =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins        =
Energy head used in spillway design        =
Spillway height used in design             =
Weir crest shape                           = Broad Crested

Number of Culverts =  1

Culvert Name     Shape      Rise    Span
43rd Ave RCB         Box       7      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                  9      76     .013     .013        0                  .2                 1
Number of Barrels =  6
Upstream   Elevation =  1315.93
Centerline Stations
    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.
  125.92  136.75  147.58  158.42  169.25  180.05
Downstream Elevation =  1315.92
Centerline Stations
    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.
  125.92  136.75  147.58  158.42  169.25  180.05

CULVERT OUTPUT  Profile #Q100 - Effective  Culv Group:  43rd Ave RCB

  Q Culv Group (cfs)       2760.00    Culv Full Len (ft)
  # Barrels                      6    Culv Vel US (ft/s)          9.56
  Q Barrel (cfs)            460.00    Culv Vel DS (ft/s)         11.40
  E.G. US. (ft)            1322.45    Culv Inv El Up (ft)      1315.93
  W.S. US. (ft)            1321.93    Culv Inv El Dn (ft)      1315.92
  E.G. DS (ft)             1321.52    Culv Frctn Ls (ft)          0.19
  W.S. DS (ft)             1319.79    Culv Exit Loss (ft)         0.45
  Delta EG (ft)               0.93    Culv Entr Loss (ft)         0.28
  Delta WS (ft)               2.13    Q Weir (cfs)
  E.G. IC (ft)             1322.44    Weir Sta Lft (ft)
  E.G. OC (ft)             1322.45    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       1320.74    Weir Max Depth (ft)
  Culv WS Outlet (ft)      1319.96    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         7.00    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         4.04    Min El Weir Flow (ft)    1325.34


Note:    The normal depth exceeds the height of the culvert.  The program assumes that the normal depth is equal
to the height
         of the culvert.

CULVERT OUTPUT  Profile #Q1- 35% Q100  Culv Group:  43rd Ave RCB

  Q Culv Group (cfs)        966.00    Culv Full Len (ft)
  # Barrels                      6    Culv Vel US (ft/s)          6.18
  Q Barrel (cfs)            161.00    Culv Vel DS (ft/s)          6.81
  E.G. US. (ft)            1319.25    Culv Inv El Up (ft)      1315.93
  W.S. US. (ft)            1319.00    Culv Inv El Dn (ft)      1315.92
  E.G. DS (ft)             1318.84    Culv Frctn Ls (ft)          0.12
  W.S. DS (ft)             1318.29    Culv Exit Loss (ft)         0.17
  Delta EG (ft)               0.41    Culv Entr Loss (ft)         0.12
  Delta WS (ft)               0.72    Q Weir (cfs)
```

E.G. IC (ft)	1319.09	Weir Sta Lft (ft)	
E.G. OC (ft)	1319.25	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1318.54	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1318.29	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	6.22	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.00	Min El Weir Flow (ft)	1325.34

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.433

INPUT
Description: COP Mod 37.6 Click here for details---------->
DS Cross Section of 43rd Avenue Culvert

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 72

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1323.89	6.42	1323.87	30.28	1323.8	31.93	1323.79	33.3	1323.75
38.8	1323.58	66.4	1323.84	67	1323.85	67.38	1323.85	69.58	1323.87
95.28	1324.06	98.66	1324.26	109.21	1324.87	113.75	1325.13	117.19	1325.33
120.65	1315.89	126.59	1315.87	126.95	1315.87	127.18	1315.87	133.97	1315.68
136.14	1315.68	136.75	1315.66	136.86	1315.68	138.85	1315.68	145.86	1315.68
147.79	1315.68	150.71	1315.69	151.69	1315.64	151.84	1315.69	159.67	1315.8
165.28	1315.87	166.76	1315.97	166.96	1315.98	167.15	1315.98	167.35	1315.98
167.55	1315.98	171.71	1315.87	174.95	1315.84	176.12	1315.87	183.72	1315.87
184.94	1315.87	185.07	1315.92	185.68	1316.87	185.81	1317.07	186.32	1317.87
186.68	1318.43	186.96	1318.87	187.44	1319.61	187.61	1319.87	187.68	1319.98
188.25	1320.87	188.72	1321.61	188.89	1321.87	189.47	1322.78	189.53	1322.87
189.59	1322.97	190.49	1323.87	191.89	1324.81	191.95	1324.85	192.01	1324.87
193.38	1324.98	195.02	1324.87	199.04	1324.6	202.13	1324.39	205.56	1324.16
209.94	1323.87	213.12	1323.87	213.44	1323.87	215.16	1324.04	224.04	1324.15
228.83	1324.15	229.41	1324.18						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	120.65	.056	185.07	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
120.65	185.07	32.72	29.86	29.91	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	120.31	1323.37	F
190.5	229.41	1323.37	F

Left Levee Station= 117.19 Elevation= 1325.33
Right Levee Station= 193.38 Elevation= 1324.98

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1321.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.73	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1319.79	Reach Len. (ft)	32.72	29.86	29.91
Crit W.S. (ft)	1319.62	Flow Area (sq ft)	1.17	257.51	4.81
E.G. Slope (ft/ft)	0.025128	Area (sq ft)	2.79	257.51	4.81
Q Total (cfs)	2760.00	Flow (cfs)	6.85	2727.22	25.93
Top Width (ft)	68.34	Top Width (ft)	1.43	64.42	2.49
Vel Total (ft/s)	10.47	Avg. Vel. (ft/s)	5.86	10.59	5.39
Max Chl Dpth (ft)	4.15	Hydr. Depth (ft)	3.44	4.00	1.93
Conv. Total (cfs)	17411.4	Conv. (cfs)	43.2	17204.7	163.6
Length Wtd. (ft)	29.86	Wetted Per. (ft)	0.99	64.45	4.60
Min Ch El (ft)	1315.64	Shear (lb/sq ft)	1.86	6.27	1.64
Alpha	1.01	Stream Power (lb/ft s)	229.41	117.19	193.38
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	1.52	4.01	0.72
C & E Loss (ft)	0.36	Cum SA (acres)	0.61	1.40	0.32

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1318.84	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.55	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1318.29	Reach Len. (ft)	32.72	29.86	29.91
Crit W.S. (ft)	1317.70	Flow Area (sq ft)	0.66	160.46	1.80
E.G. Slope (ft/ft)	0.015021	Area (sq ft)	1.05	160.46	1.80

Q Total (cfs)	966.00	Flow (cfs)	2.03	958.58	5.39
Top Width (ft)	66.82	Top Width (ft)	0.88	64.42	1.52
Vel Total (ft/s)	5.93	Avg. Vel. (ft/s)	3.08	5.97	3.00
Max Chl Dpth (ft)	2.65	Hydr. Depth (ft)	1.93	2.49	1.18
Conv. Total (cfs)	7881.9	Conv. (cfs)	16.5	7821.3	44.0
Length Wtd. (ft)	29.86	Wetted Per. (ft)	0.99	64.45	2.81
Min Ch El (ft)	1315.64	Shear (lb/sq ft)	0.62	2.33	0.60
Alpha	1.01	Stream Power (lb/ft s)	229.41	117.19	193.38
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	0.79	2.29	0.33
C & E Loss (ft)	0.14	Cum SA (acres)	0.54	1.36	0.29

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.427

INPUT
Description: COP Model 36.9 Click Here for Details-------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted
- Added a blocked obstruction to avoid using scour hole for conveyance

Station Elevation Data num= 104

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
249.71	1322.34	253.08	1322.37	254.95	1322.38	266.38	1322.35	272.83	1322.33
287.48	1321.87	291.8	1321.73	305.93	1321.87	309.42	1321.9	310.34	1321.91
328.34	1322.08	339.06	1322.1	342.56	1322.14	347.96	1321.87	350.52	1321.87
351.43	1321.66	352.74	1321.39	353.56	1321.23	355.33	1320.87	356.14	1320.17
356.49	1319.87	356.75	1319.64	357.41	1319.07	357.56	1318.93	357.64	1318.87
358.5	1318.13	358.79	1317.87	359.95	1316.87	361.76	1316.23	362.23	1315.87
362.49	1315.75	365.05	1315.64	373.09	1314.87	380.76	1314.87	380.91	1314.87
385.1	1314.93	388.46	1314.94	394.68	1315.05	400.29	1315.07	406.53	1314.87
410.24	1314.77	412.45	1314.74	419.39	1314.69	422.69	1314.61	424.28	1314.58
430.87	1314.55	435.18	1314.64	436.86	1314.68	438.88	1314.72	441.83	1314.79
443.21	1314.82	444.01	1314.87	444.28	1314.8	445.15	1314.85	445.55	1314.87
445.68	1315.47	445.77	1315.87	445.82	1316.11	445.9	1316.44	445.96	1316.74
445.99	1316.87	446.14	1317.53	446.28	1317.87	446.45	1318.15	446.89	1318.87
446.98	1319.02	447.28	1319.52	447.49	1319.87	447.63	1320.1	447.64	1320.08
447.7	1319.97	447.84	1320.16	447.95	1320.08	448.07	1320.16	448.15	1320.21
448.75	1320.37	451.26	1320.87	459.11	1321.61	460.43	1321.77	460.92	1321.85
462.75	1321.87	474.32	1322.35	486.73	1322.87	488.52	1322.94	489.96	1322.97
507.07	1323.28	511.45	1323.27	518.31	1323.27	527.51	1323.43	537.12	1323.58
541.63	1323.59	541.74	1323.59	542.13	1323.6	544.92	1323.58	562.04	1323.85
562.46	1323.85	562.55	1323.86	562.59	1323.85	563.61	1323.82	580.46	1323.2
588.99	1322.87	590.5	1322.81	600.03	1322.76	603.17	1322.73		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
249.71	.045	350.52	.056	451.26	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
350.52 451.26 32.02 29.08 29.06 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
249.71	368.75	1323.37	F
451.75	603.17	1323.37	F

Left Levee Station= 342.56 Elevation= 1322.14
Right Levee Station= 562.04 Elevation= 1323.85

Blocked Obstructions num= 1

Sta L	Sta R	Elev
358.04	453.75	1315.18

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1320.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.00	Wt. n-Val.		0.056	
W.S. Elev (ft)	1319.62	Reach Len. (ft)	32.02	29.08	29.06
Crit W.S. (ft)	1318.57	Flow Area (sq ft)		344.09	
E.G. Slope (ft/ft)	0.013434	Area (sq ft)		382.11	
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	90.57	Top Width (ft)		90.57	
Vel Total (ft/s)	8.02	Avg. Vel. (ft/s)		8.02	
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)		4.38	
Conv. Total (cfs)	23812.8	Conv. (cfs)		23812.8	
Length Wtd. (ft)	29.08	Wetted Per. (ft)		81.69	

Min Ch El (ft)	1315.18	Shear (lb/sq ft)		3.53	
Alpha	1.00	Stream Power (lb/ft s)	603.17	342.56	562.04
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	1.52	3.79	0.71
C & E Loss (ft)	0.04	Cum SA (acres)	0.61	1.35	0.32

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1318.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.056	
W.S. Elev (ft)	1318.15	Reach Len. (ft)	32.02	29.08	29.06
Crit W.S. (ft)	1316.88	Flow Area (sq ft)		229.13	
E.G. Slope (ft/ft)	0.006203	Area (sq ft)		250.78	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	87.97	Top Width (ft)		87.97	
Vel Total (ft/s)	4.22	Avg. Vel. (ft/s)		4.22	
Max Chl Dpth (ft)	2.97	Hydr. Depth (ft)		2.95	
Conv. Total (cfs)	12264.8	Conv. (cfs)		12264.8	
Length Wtd. (ft)	29.08	Wetted Per. (ft)		79.97	
Min Ch El (ft)	1315.18	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)	603.17	342.56	562.04
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.79	2.14	0.32
C & E Loss (ft)	0.00	Cum SA (acres)	0.54	1.30	0.29

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.422

INPUT
Description: COP Model 36.6 Click Here for Details-------->

Original Model Comment:
Cross Section Updated

- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted
-
Added Block obstruction to avoid using scour hole for conveyance

Station Elevation Data num= 101

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
273.83	1319.98	277.03	1319.87	278.73	1319.64	279.55	1319.53	281.88	1319.21
283.31	1319.02	284.44	1318.87	286.13	1318.64	286.9	1318.54	288.23	1318.36
290.14	1318.1	290.63	1318.03	293.57	1318.17	295.82	1318.28	298.12	1318.39
304.68	1318.69	305.88	1318.75	306.34	1318.76	308.42	1318.87	309.88	1318.94
310.59	1318.97	314.39	1319.15	316.91	1319.22	321.12	1319.43	322.88	1319.49
323.74	1319.52	324.06	1319.53	324.23	1319.52	327.97	1319.14	329.45	1318.95
330.12	1318.87	332.11	1318.59	332.98	1318.51	334.69	1318.3	337.53	1317.95
337.75	1317.92	338.17	1317.87	340.59	1317.57	341.17	1317.5	341.32	1317.47
341.85	1317.31	342.45	1317.19	343.14	1316.87	345.67	1316.87	350.13	1316.87
350.21	1316.86	350.24	1316.86	350.34	1316.87	353.56	1317.2	354.31	1317.19
354.83	1317.18	359.38	1316.87	368.14	1316.14	369.43	1315.87	370.19	1315.71
374.19	1315.2	376.72	1314.87	380.6	1314.83	392.25	1314.7	394.04	1314.66
399.7	1314.49	409.94	1314.33	418.02	1314.16	419.91	1314.11	426.89	1314.19
435.13	1314.69	436.92	1314.87	437.65	1315.13	439.73	1315.87	440.35	1316.09
442.12	1316.72	442.54	1316.87	443.21	1317.11	445.36	1317.87	445.97	1318.09
447.28	1318.65	447.79	1318.87	449.11	1319.44	449.98	1319.81	450.11	1319.87
452.21	1320.78	452.43	1320.87	452.5	1320.9	453.88	1321.5	460.98	1321.43
483.31	1321.42	492.67	1321.61	499.85	1321.74	505.25	1321.74	506.14	1321.72
513.72	1321.7	523.82	1321.87	530.77	1321.99	541.17	1322.15	549	1322.28
553.88	1322.35	556.73	1322.4	565.8	1322.15	566.2	1322.14	566.82	1322.12
573.42	1321.87								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
273.83	.045	354.83	.056	443.21	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
354.83 443.21 64.37 58.05 57.96 .1 .3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
273.83	357	1323.37	F
459	573.42	1323.37	F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
370.11	446.74	1314.94

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1320.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.13	Wt. n-Val.		0.056	0.045
W.S. Elev (ft)	1319.00	Reach Len. (ft)	64.37	58.05	57.96
Crit W.S. (ft)	1318.48	Flow Area (sq ft)		320.40	4.83
E.G. Slope (ft/ft)	0.018180	Area (sq ft)	49.89	324.50	4.83
Q Total (cfs)	2760.00	Flow (cfs)		2739.64	20.36
Top Width (ft)	146.71	Top Width (ft)	53.46	88.38	4.88
Vel Total (ft/s)	8.49	Avg. Vel. (ft/s)		8.55	4.22
Max Chl Dpth (ft)	4.06	Hydr. Depth (ft)		3.72	0.99
Conv. Total (cfs)	20469.5	Conv. (cfs)		20318.5	151.0
Length Wtd. (ft)	59.68	Wetted Per. (ft)		86.71	5.23
Min Ch El (ft)	1314.94	Shear (lb/sq ft)		4.19	1.05
Alpha	1.01	Stream Power (lb/ft s)	573.42	0.00	0.00
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	1.50	3.56	0.71
C & E Loss (ft)	0.24	Cum SA (acres)	0.59	1.29	0.32

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1318.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.		0.056	0.045
W.S. Elev (ft)	1317.96	Reach Len. (ft)	64.37	58.05	57.96
Crit W.S. (ft)	1316.83	Flow Area (sq ft)		231.30	1.03
E.G. Slope (ft/ft)	0.006676	Area (sq ft)	14.18	233.17	1.03
Q Total (cfs)	966.00	Flow (cfs)		964.48	1.52
Top Width (ft)	108.21	Top Width (ft)	17.42	88.38	2.41
Vel Total (ft/s)	4.16	Avg. Vel. (ft/s)		4.17	1.47
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)		2.68	0.43
Conv. Total (cfs)	11823.2	Conv. (cfs)		11804.5	18.6
Length Wtd. (ft)	59.62	Wetted Per. (ft)		86.71	2.56
Min Ch El (ft)	1314.94	Shear (lb/sq ft)		1.11	0.17
Alpha	1.00	Stream Power (lb/ft s)	573.42	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.78	1.98	0.32
C & E Loss (ft)	0.04	Cum SA (acres)	0.53	1.25	0.28

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.411

INPUT
Description: COP Model 36.2

Original Model Comment:
Left Overbank
Elevations based upon original topography
Station Elevation Data num= 73

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1321.87	127.2	1321.87	127.9	1321.87	129.4	1321.87	157.1	1321.87
162.1	1321.87	185.2	1321.87	208.2	1321.87	218.8	1321.87	224.6	1321.87
290.6	1322.57	305.3	1322.57	318	1322.67	323.3	1322.77	340	1321.87
366.33	1316.87	366.81	1316.86	367.78	1316.85	374.98	1316.63	384.86	1316.33
389.83	1316.19	390.56	1316.17	393.58	1316.16	408.76	1316.2	413.82	1316.22
418.68	1316.3	419.98	1316.29	433.71	1316.15	439.88	1316.08	442.19	1316.01
444.17	1315.97	449.82	1315.87	454.94	1315.78	457.3	1315.73	466.8	1315.84
467.88	1315.85	468.6	1315.87	469.96	1315.87	470.01	1315.86	479.32	1314.87
480.51	1314.74	485.08	1314.87	493.23	1314.87	494.09	1314.87	496.87	1315.39
503.25	1315.87	512.83	1315.92	522.88	1316.52	529.16	1316.59	544.45	1316.78
546.53	1316.78	557.81	1316.82	565.96	1316.87	568.93	1317.4	570.5	1317.68
571.57	1317.87	573.51	1318.21	576.28	1318.71	576.81	1318.8	577.19	1318.87
577.77	1318.97	583.66	1319.87	586.01	1319.94	589.49	1319.97	596.05	1320.29
599.76	1320.13	607.95	1320.28	624.4	1320.53	629.25	1320.62	632.21	1320.67
634.18	1320.7	635.24	1320.75	660.05	1320.48				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	470.01	.056	503.25	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
470.01	503.25	351.76	311.27	307.63	.1	.3

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1319.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.33	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1319.01	Reach Len. (ft)	351.76	311.27	307.63
Crit W.S. (ft)		Flow Area (sq ft)	306.54	127.95	169.23
E.G. Slope (ft/ft)	0.005456	Area (sq ft)	306.54	127.95	169.23
Q Total (cfs)	2760.00	Flow (cfs)	1435.72	614.31	709.96
Top Width (ft)	223.02	Top Width (ft)	114.97	33.24	74.81
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	4.68	4.80	4.20
Max Chl Dpth (ft)	4.27	Hydr. Depth (ft)	2.67	3.85	2.26
Conv. Total (cfs)	37367.1	Conv. (cfs)	19438.0	8317.1	9612.1
Length Wtd. (ft)	321.33	Wetted Per. (ft)	115.19	33.37	75.02
Min Ch El (ft)	1314.74	Shear (lb/sq ft)	0.91	1.31	0.77
Alpha	1.01	Stream Power (lb/ft s)	660.05	0.00	0.00
Frctn Loss (ft)	1.68	Cum Volume (acre-ft)	1.24	3.26	0.60
C & E Loss (ft)	0.04	Cum SA (acres)	0.46	1.21	0.26

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

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1317.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1317.72	Reach Len. (ft)	351.76	311.27	307.63
Crit W.S. (ft)		Flow Area (sq ft)	162.05	84.90	77.12
E.G. Slope (ft/ft)	0.004773	Area (sq ft)	162.05	84.90	77.12
Q Total (cfs)	966.00	Flow (cfs)	483.79	290.05	192.16
Top Width (ft)	208.86	Top Width (ft)	108.15	33.24	67.47
Vel Total (ft/s)	2.98	Avg. Vel. (ft/s)	2.99	3.42	2.49
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)	1.50	2.55	1.14
Conv. Total (cfs)	13982.0	Conv. (cfs)	7002.5	4198.2	2781.3
Length Wtd. (ft)	321.05	Wetted Per. (ft)	108.25	33.37	67.56
Min Ch El (ft)	1314.74	Shear (lb/sq ft)	0.45	0.76	0.34
Alpha	1.04	Stream Power (lb/ft s)	660.05	0.00	0.00
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	0.65	1.77	0.27
C & E Loss (ft)	0.02	Cum SA (acres)	0.44	1.17	0.24

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

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.352

INPUT
Description: COP Model 32.5
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1321.67	56.7	1321.87	345	1321.87	375	1315.87	470	1313.87
500	1313.87	665	1315.87	690	1321.87	780	1321.87	1050	1321.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	345	.056	690	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
345	690	0	0	.1	.3

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1317.62	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.056	
W.S. Elev (ft)	1317.43	Reach Len. (ft)			
Crit W.S. (ft)	1316.17	Flow Area (sq ft)		783.42	
E.G. Slope (ft/ft)	0.005004	Area (sq ft)		783.42	
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	304.30	Top Width (ft)		304.30	
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)		3.52	
Max Chl Dpth (ft)	3.56	Hydr. Depth (ft)		2.57	
Conv. Total (cfs)	39016.6	Conv. (cfs)		39016.6	
Length Wtd. (ft)		Wetted Per. (ft)		304.67	
Min Ch El (ft)	1313.87	Shear (lb/sq ft)		0.80	
Alpha	1.00	Stream Power (lb/ft s)	1050.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1316.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.056	

W.S. Elev (ft)	1316.18	Reach Len. (ft)			
Crit W.S. (ft)	1315.34	Flow Area (sq ft)		410.72	
E.G. Slope (ft/ft)	0.005007	Area (sq ft)		410.72	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	292.85	Top Width (ft)		292.85	
Vel Total (ft/s)	2.35	Avg. Vel. (ft/s)		2.35	
Max Chl Dpth (ft)	2.31	Hydr. Depth (ft)		1.40	
Conv. Total (cfs)	13651.3	Conv. (cfs)		13651.3	
Length Wtd. (ft)		Wetted Per. (ft)		292.95	
Min Ch El (ft)	1313.87	Shear (lb/sq ft)		0.44	
Alpha	1.00	Stream Power (lb/ft s)	1050.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Scatter_Wash

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8	n9	n10	n11	n12
One	1.342	.018	.05	.018	.05	.028	.085	.03					
One	1.301	.05	.028	.085	.03								
One	1.299	.018	.05	.028	.085	.03							
One	1.251	Culvert											
One	1.198	.018	.05	.03	.05	.018	.03	.018	.028	.05	.03	.018	.03
One	1.141	.03	.03	.06	.018	.028	.018	.03	.018	.03			
One	1.036	.05	.018	.028	.018	.05	.03	.018	.03				
One	0.932	.045	.047	.028	.047	.045							
One	0.892	.045	.044	.045									
One	0.852	.045	.044	.045									
One	0.840	.045	.044	.045									
One	0.754	.045	.044	.045									
One	0.655	.045	.044	.045									
One	0.553	.045	.044	.045									
One	0.542	.045	.044	.045									
One	0.479	.045	.044	.045									
One	0.470	.045	.044	.045									
One	0.452	.045	.044	.045									
One	0.451	.045	.013	.045									
One	.442	Culvert											
One	0.433	.045	.056	.045									
One	0.427	.045	.056	.045									
One	0.422	.045	.056	.045									
One	0.411	.045	.056	.045									
One	0.352	.045	.056	.045									

SUMMARY OF REACH LENGTHS

River: Scatter_Wash

Reach	River Sta.	Left	Channel	Right
One	1.342	183.19	215.38	246.46

One	1.301	10.52	10.61	10.24
One	1.299	517.59	532.96	522.53
One	1.251	Culvert		
One	1.198	355.51	304.13	283.97
One	1.141	590.28	553.78	523.25
One	1.036	580.95	546.44	499.79
One	0.932	228.06	212.07	198.46
One	0.892	210.24	211.09	216.73
One	0.852	65.99	66.3	67.65
One	0.840	384.15	454.55	594.1
One	0.754	543.9	520.86	509.53
One	0.655	622.35	536.53	466.49
One	0.553	57.48	58.17	59.31
One	0.542	340.02	336.74	338.98
One	0.479	45.31	45.37	46.62
One	0.470	98.12	96.9	98.07
One	0.452	3.82	3.82	3.88
One	0.451	94.79	93.97	94.02
One	.442	Culvert		
One	0.433	32.72	29.86	29.91
One	0.427	32.02	29.08	29.06
One	0.422	64.37	58.05	57.96
One	0.411	351.76	311.27	307.63
One	0.352	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Scatter_Wash

Reach	River Sta.	Contr.	Expan.
One	1.342	.1	.3
One	1.301	.3	.5
One	1.299	.3	.5
One	1.251	Culvert	
One	1.198	.3	.5
One	1.141	.1	.3
One	1.036	.1	.3
One	0.932	.1	.3
One	0.892	.1	.3
One	0.852	.1	.3
One	0.840	.1	.3
One	0.754	.1	.3
One	0.655	.1	.3
One	0.553	.1	.3
One	0.542	.1	.3
One	0.479	.1	.3
One	0.470	.3	.5
One	0.452	.3	.5
One	0.451	.3	.5
One	.442	Culvert	
One	0.433	.3	.5
One	0.427	.3	.5
One	0.422	.1	.3
One	0.411	.1	.3
One	0.352	.1	.3

HEC-RAS Plan: FINAL River: Scatter_Wash Reach: One

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)	
One	1.342	Q100 - Effective	2760.00	1337.51	1340.65	1340.64	1341.85	0.008089	8.85	316.40	153.83	0.98
One	1.342	Q1- 35% Q100	966.00	1337.51	1339.57	1339.38	1340.03	0.006492	5.47	177.59	141.04	0.80
One	1.301	Q100 - Effective	2760.00	1335.35	1338.85	1338.85	1340.04	0.008680	8.75	317.17	134.50	0.99
One	1.301	Q1- 35% Q100	966.00	1335.35	1337.60	1337.60	1338.22	0.011144	6.30	153.28	125.58	1.01
One	1.299	Q100 - Effective	2760.00	1333.36	1338.15	1335.92	1338.49	0.001068	4.68	589.85	125.96	0.38
One	1.299	Q1- 35% Q100	966.00	1333.36	1335.85	1334.67	1336.01	0.001177	3.21	300.69	124.97	0.36
One	1.251		Culvert									
One	1.198	Q100 - Effective	2760.00	1332.40	1337.23	1334.83	1337.48	0.000737	4.05	691.20	157.93	0.33
One	1.198	Q1- 35% Q100	966.00	1332.40	1335.44	1333.67	1335.53	0.000466	2.33	416.89	149.81	0.24
One	1.141	Q100 - Effective	2760.00	1332.35	1335.74	1335.62	1336.74	0.006843	8.05	343.77	146.88	0.92
One	1.141	Q1- 35% Q100	966.00	1332.35	1334.55	1334.46	1335.04	0.008104	5.58	173.11	141.57	0.89
One	1.036	Q100 - Effective	2760.00	1330.88	1334.28	1333.25	1334.67	0.002032	5.03	551.14	191.65	0.52
One	1.036	Q1- 35% Q100	966.00	1330.88	1332.98	1332.26	1333.14	0.001744	3.17	305.30	186.25	0.43
One	0.932	Q100 - Effective	2760.00	1329.88	1333.38	1332.21	1333.63	0.001663	3.99	691.17	258.52	0.43
One	0.932	Q1- 35% Q100	966.00	1329.88	1332.18	1331.42	1332.28	0.001350	2.51	385.08	253.62	0.36
One	0.892	Q100 - Effective	2760.00	1327.99	1332.75	1331.85	1333.03	0.005593	4.29	643.32	289.15	0.51
One	0.892	Q1- 35% Q100	966.00	1327.99	1331.72	1330.94	1331.83	0.003845	2.66	363.00	252.21	0.39
One	0.852	Q100 - Effective	2760.00	1328.06	1331.12	1330.52	1331.58	0.008539	5.49	513.20	234.47	0.63
One	0.852	Q1- 35% Q100	966.00	1328.06	1329.57	1329.57	1330.05	0.029104	5.57	174.29	185.14	1.01
One	0.840	Q100 - Effective	2760.00	1326.87	1331.04	1329.19	1331.25	0.002108	3.71	766.49	227.64	0.34
One	0.840	Q1- 35% Q100	966.00	1326.87	1329.49	1328.21	1329.57	0.001671	2.30	423.89	208.77	0.28
One	0.754	Q100 - Effective	2760.00	1324.87	1330.29	1328.45	1330.41	0.001559	2.80	994.05	337.39	0.28
One	0.754	Q1- 35% Q100	966.00	1324.87	1328.68	1327.59	1328.75	0.001925	2.03	476.58	298.94	0.28
One	0.655	Q100 - Effective	2760.00	1324.54	1329.31	1327.42	1329.49	0.001961	3.52	801.33	236.22	0.33
One	0.655	Q1- 35% Q100	966.00	1324.54	1327.77	1326.53	1327.84	0.001578	2.18	446.47	224.59	0.27
One	0.553	Q100 - Effective	2760.00	1323.78	1326.04	1326.04	1326.91	0.022575	7.55	371.58	214.56	0.99
One	0.553	Q1- 35% Q100	966.00	1323.78	1325.13	1325.13	1325.58	0.028946	5.38	180.05	206.69	1.00
One	0.542	Q100 - Effective	2760.00	1318.96	1324.23	1322.09	1324.46	0.001930	3.93	747.91	205.61	0.33

HEC-RAS Plan: FINAL River: Scatter_Wash Reach: One (Continued)

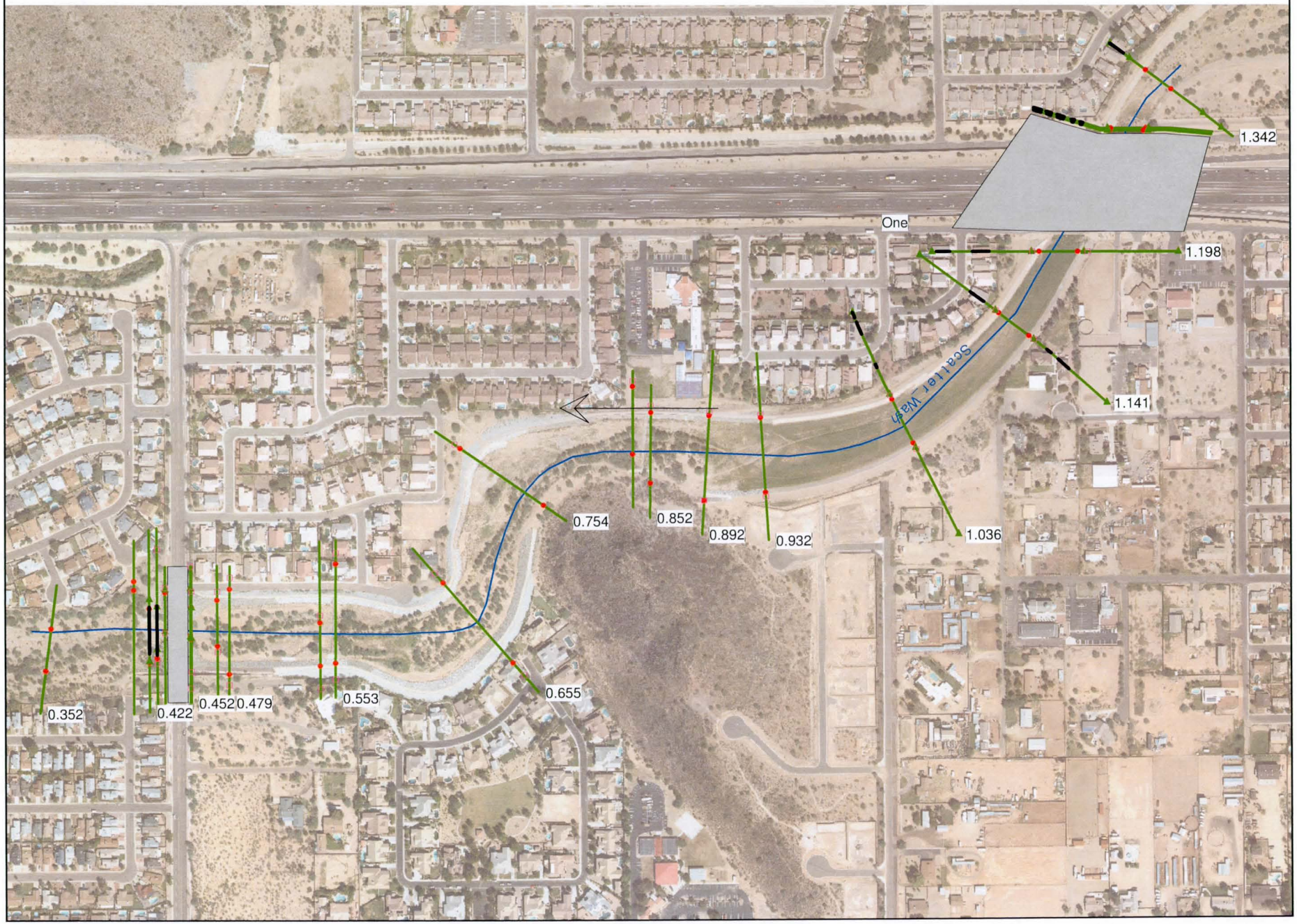
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
One	0.542	Q1- 35% Q100	966.00	1318.96	1322.15	1321.01	1322.27	0.002313	2.77	358.53	173.66	0.33
One	0.479	Q100 - Effective	2760.00	1317.52	1323.43	1321.38	1323.67	0.002900	3.99	704.15	226.95	0.39
One	0.479	Q1- 35% Q100	966.00	1317.52	1321.09	1319.99	1321.28	0.003806	3.49	277.53	130.39	0.42
One	0.470	Q100 - Effective	2760.00	1317.19	1323.39	1320.98	1323.55	0.001523	3.30	856.27	228.78	0.29
One	0.470	Q1- 35% Q100	966.00	1317.19	1321.00	1319.87	1321.12	0.002575	2.73	356.51	182.81	0.34
One	0.452	Q100 - Effective	2760.00	1317.77	1321.51	1321.18	1322.86	0.013762	9.33	295.77	87.36	0.86
One	0.452	Q1- 35% Q100	966.00	1317.77	1319.53	1319.53	1320.34	0.023754	7.22	133.75	86.36	1.00
One	0.451	Q100 - Effective	2760.00	1315.93	1321.93	1319.30	1322.45	0.000238	5.80	484.29	84.76	0.42
One	0.451	Q1- 35% Q100	966.00	1315.93	1319.00	1317.62	1319.25	0.000276	3.99	246.51	83.29	0.40
One	.442		Culvert									
One	0.433	Q100 - Effective	2760.00	1315.64	1319.79	1319.62	1321.52	0.025128	10.59	263.49	68.34	0.93
One	0.433	Q1- 35% Q100	966.00	1315.64	1318.29	1317.70	1318.84	0.015021	5.97	162.92	66.82	0.67
One	0.427	Q100 - Effective	2760.00	1315.18	1319.62	1318.57	1320.62	0.013434	8.02	344.09	90.57	0.68
One	0.427	Q1- 35% Q100	966.00	1315.18	1318.15	1316.88	1318.42	0.006203	4.22	229.13	87.97	0.43
One	0.422	Q100 - Effective	2760.00	1314.94	1319.00	1318.48	1320.13	0.018180	8.55	325.22	146.71	0.78
One	0.422	Q1- 35% Q100	966.00	1314.94	1317.96	1316.83	1318.23	0.006676	4.17	232.34	108.21	0.45
One	0.411	Q100 - Effective	2760.00	1314.74	1319.01		1319.34	0.005456	4.80	603.72	223.02	0.43
One	0.411	Q1- 35% Q100	966.00	1314.74	1317.72		1317.86	0.004773	3.42	324.07	208.86	0.38
One	0.352	Q100 - Effective	2760.00	1313.87	1317.43	1316.17	1317.62	0.005004	3.52	783.42	304.30	0.39
One	0.352	Q1- 35% Q100	966.00	1313.87	1316.18	1315.34	1316.27	0.005007	2.35	410.72	292.85	0.35

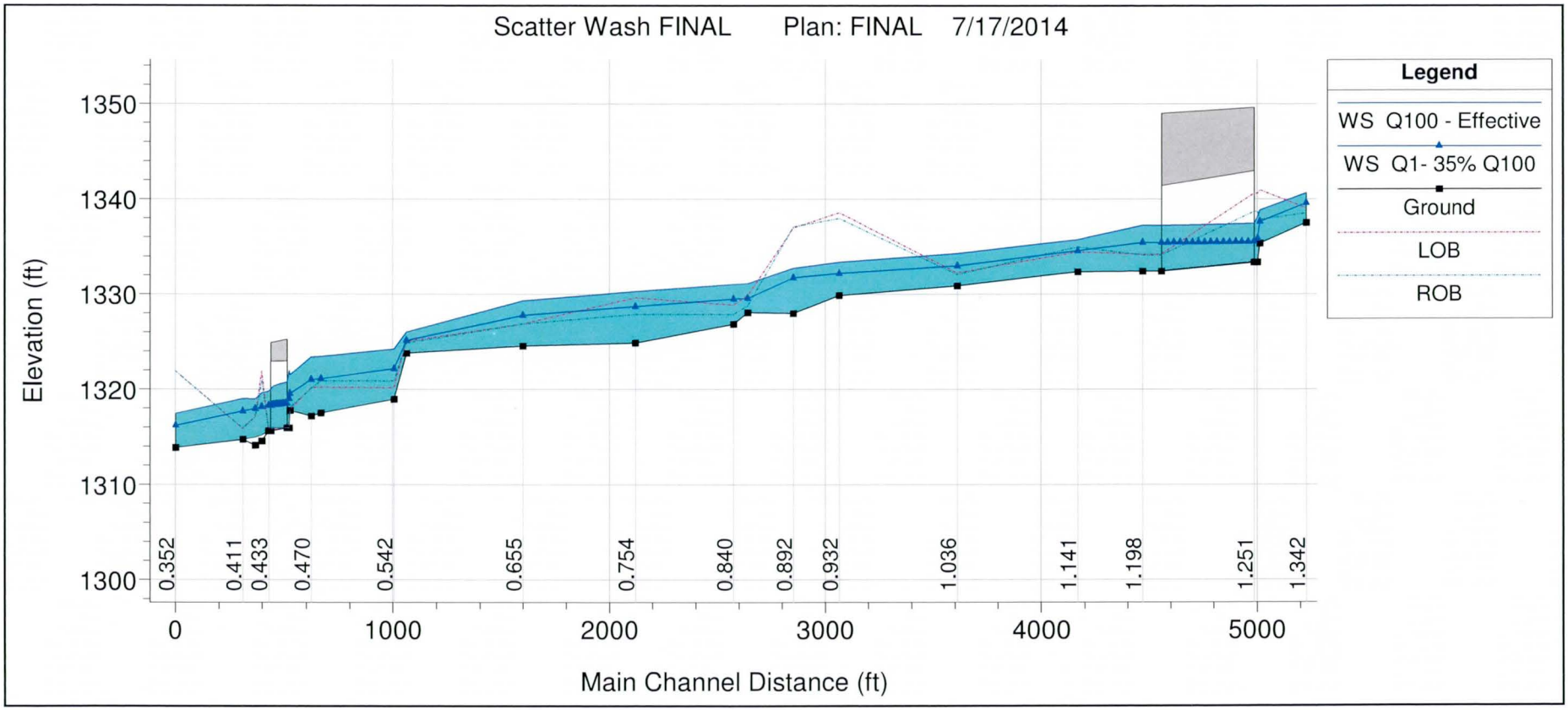
HEC-RAS Plan: FINAL River: Scatter_Wash Reach: One

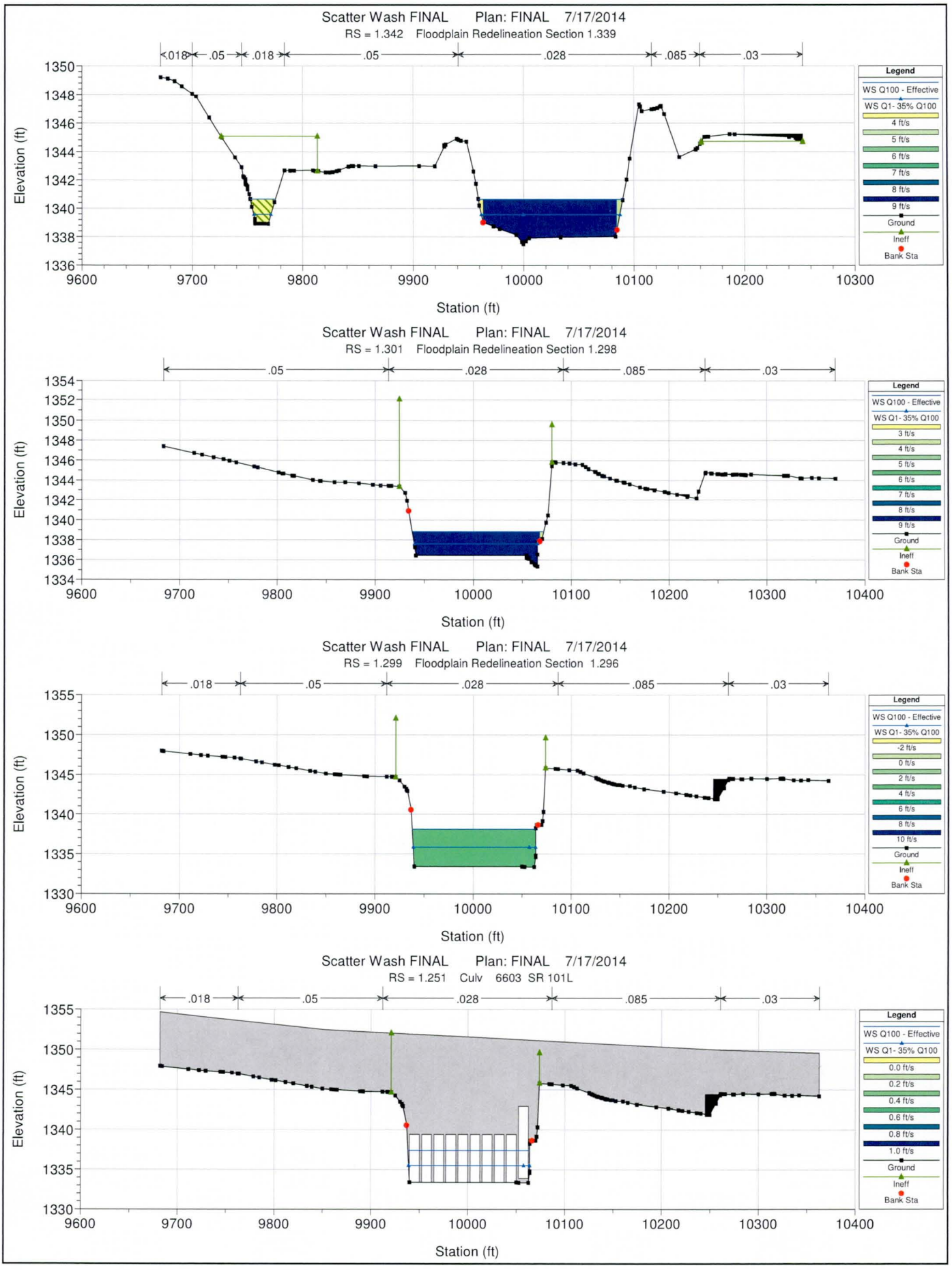
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
One	1.342	Q100 - Effective	1341.85	1340.65	1.20	1.81	0.01	16.12	2716.81	27.07	153.83
One	1.342	Q1- 35% Q100	1340.03	1339.57	0.46	1.80	0.02	0.75	961.54	3.71	141.04
One	1.301	Q100 - Effective	1340.04	1338.85	1.18	0.02	0.42		2750.41	9.59	134.50
One	1.301	Q1- 35% Q100	1338.22	1337.60	0.62	0.03	0.23		966.00		125.58
One	1.299	Q100 - Effective	1338.49	1338.15	0.34				2760.00		125.96
One	1.299	Q1- 35% Q100	1336.01	1335.85	0.16				966.00		124.97
One	1.251		Culvert								
One	1.198	Q100 - Effective	1337.48	1337.23	0.25	0.51	0.23	30.04	2711.67	18.29	157.93
One	1.198	Q1- 35% Q100	1335.53	1335.44	0.08	0.37	0.12	2.19	962.32	1.50	149.81
One	1.141	Q100 - Effective	1336.74	1335.74	1.00	1.89	0.18	7.75	2749.75	2.50	146.88
One	1.141	Q1- 35% Q100	1335.04	1334.55	0.48	1.80	0.10	0.01	965.99		141.57
One	1.036	Q100 - Effective	1334.67	1334.28	0.39	1.00	0.04	15.49	2725.59	18.92	191.65
One	1.036	Q1- 35% Q100	1333.14	1332.98	0.16	0.83	0.02	0.98	963.38	1.64	186.25
One	0.932	Q100 - Effective	1333.63	1333.38	0.25	0.59	0.00		2760.00		258.52
One	0.932	Q1- 35% Q100	1332.28	1332.18	0.10	0.45	0.00		966.00		253.62
One	0.892	Q100 - Effective	1333.03	1332.75	0.29	1.44	0.02		2760.00		289.15
One	0.892	Q1- 35% Q100	1331.83	1331.72	0.11	1.75	0.04		966.00		252.21
One	0.852	Q100 - Effective	1331.58	1331.12	0.46	0.25	0.08	26.95	2681.65	51.40	234.47
One	0.852	Q1- 35% Q100	1330.05	1329.57	0.48	0.29	0.12		957.08	8.92	185.14
One	0.840	Q100 - Effective	1331.25	1331.04	0.21	0.82	0.03	65.59	2671.41	23.00	227.64
One	0.840	Q1- 35% Q100	1329.57	1329.49	0.08	0.81	0.01	2.12	960.49	3.38	208.77
One	0.754	Q100 - Effective	1330.41	1330.29	0.12	0.91	0.01	2.81	2738.91	18.28	337.39
One	0.754	Q1- 35% Q100	1328.75	1328.68	0.06	0.91	0.00		964.77	1.23	298.94
One	0.655	Q100 - Effective	1329.49	1329.31	0.19	2.51	0.07	52.57	2693.52	13.92	236.22
One	0.655	Q1- 35% Q100	1327.84	1327.77	0.07	2.23	0.04	3.96	961.17	0.87	224.59
One	0.553	Q100 - Effective	1326.91	1326.04	0.87	0.27	0.19	30.21	2708.91	20.87	214.56
One	0.553	Q1- 35% Q100	1325.58	1325.13	0.45	0.33	0.10	0.18	965.25	0.57	206.69
One	0.542	Q100 - Effective	1324.46	1324.23	0.23	0.79	0.00	154.77	2547.46	57.77	205.61

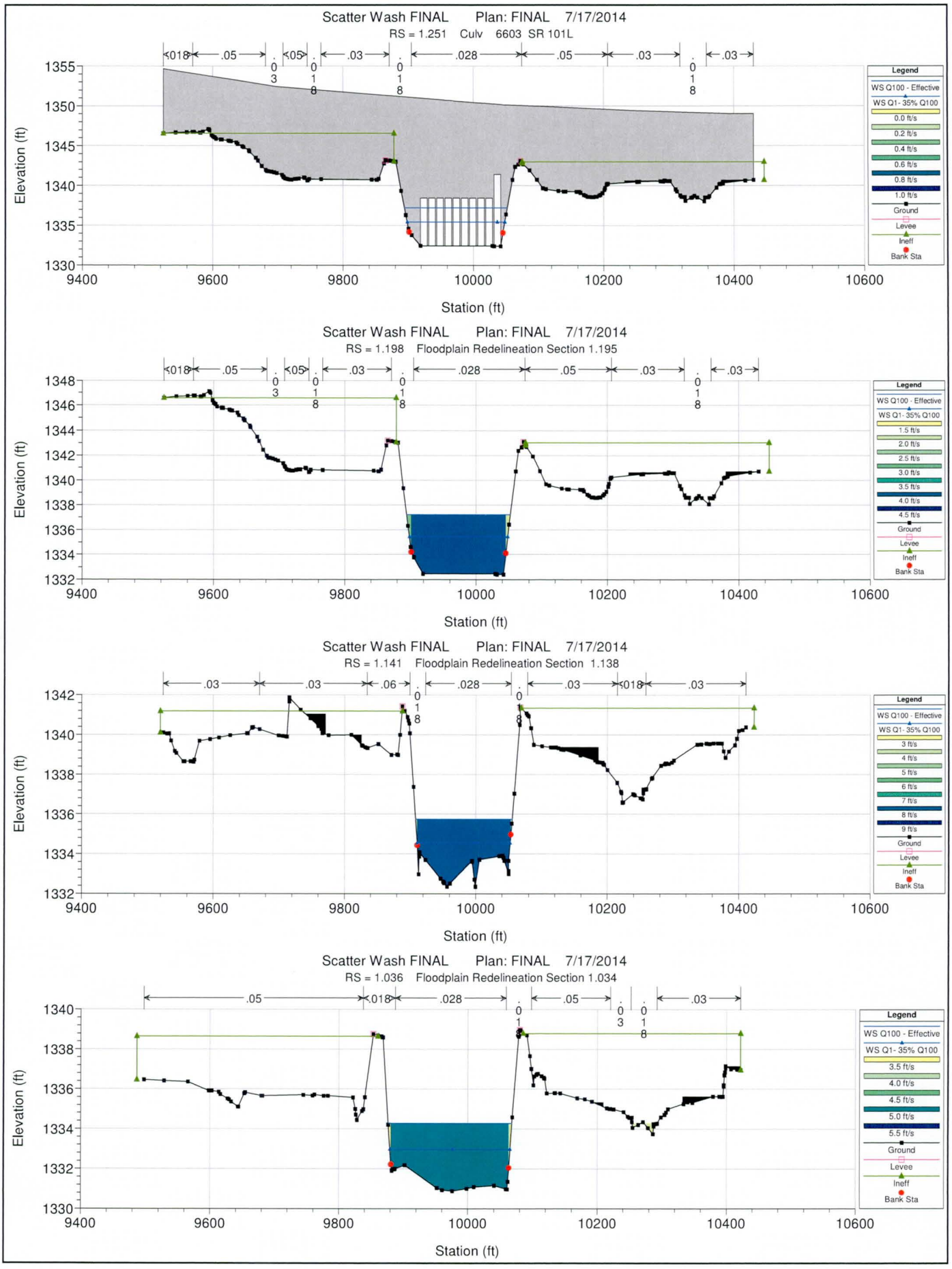
HEC-RAS Plan: FINAL River: Scatter_Wash Reach: One (Continued)

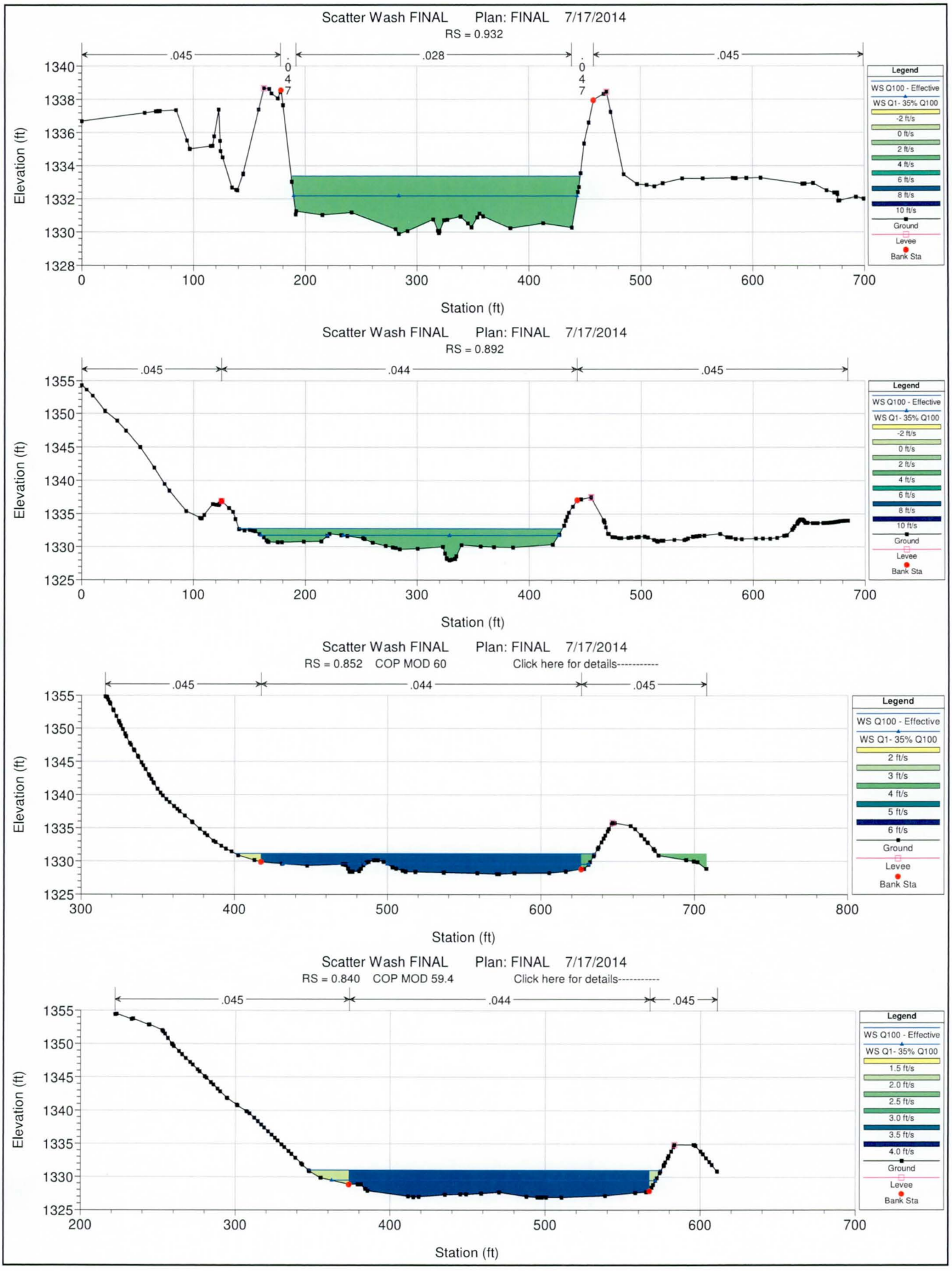
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
One	0.542	Q1- 35% Q100	1322.27	1322.15	0.12	0.98	0.01	27.55	929.60	8.85	173.66
One	0.479	Q100 - Effective	1323.67	1323.43	0.24	0.09	0.02	36.63	2696.61	26.76	226.95
One	0.479	Q1- 35% Q100	1321.28	1321.09	0.19	0.14	0.02	1.28	964.67	0.05	130.39
One	0.470	Q100 - Effective	1323.55	1323.39	0.17	0.33	0.36	48.11	2675.53	36.36	228.78
One	0.470	Q1- 35% Q100	1321.12	1321.00	0.12	0.56	0.21	4.16	960.37	1.47	182.81
One	0.452	Q100 - Effective	1322.86	1321.51	1.35	0.00	0.42		2760.00		87.36
One	0.452	Q1- 35% Q100	1320.34	1319.53	0.81	0.00	0.28		966.00		86.36
One	0.451	Q100 - Effective	1322.45	1321.93	0.52			8.66	2744.09	7.25	84.76
One	0.451	Q1- 35% Q100	1319.25	1319.00	0.25			2.63	960.98	2.40	83.29
One	.442		Culvert								
One	0.433	Q100 - Effective	1321.52	1319.79	1.73	0.54	0.36	6.85	2727.22	25.93	68.34
One	0.433	Q1- 35% Q100	1318.84	1318.29	0.55	0.27	0.14	2.03	958.58	5.39	66.82
One	0.427	Q100 - Effective	1320.62	1319.62	1.00	0.45	0.04		2760.00		90.57
One	0.427	Q1- 35% Q100	1318.42	1318.15	0.28	0.19	0.00		966.00		87.97
One	0.422	Q100 - Effective	1320.13	1319.00	1.13	0.54	0.24		2739.64	20.36	146.71
One	0.422	Q1- 35% Q100	1318.23	1317.96	0.27	0.33	0.04		964.48	1.52	108.21
One	0.411	Q100 - Effective	1319.34	1319.01	0.33	1.68	0.04	1435.72	614.31	709.96	223.02
One	0.411	Q1- 35% Q100	1317.86	1317.72	0.14	1.57	0.02	483.79	290.05	192.16	208.86
One	0.352	Q100 - Effective	1317.62	1317.43	0.19				2760.00		304.30
One	0.352	Q1- 35% Q100	1316.27	1316.18	0.09				966.00		292.85

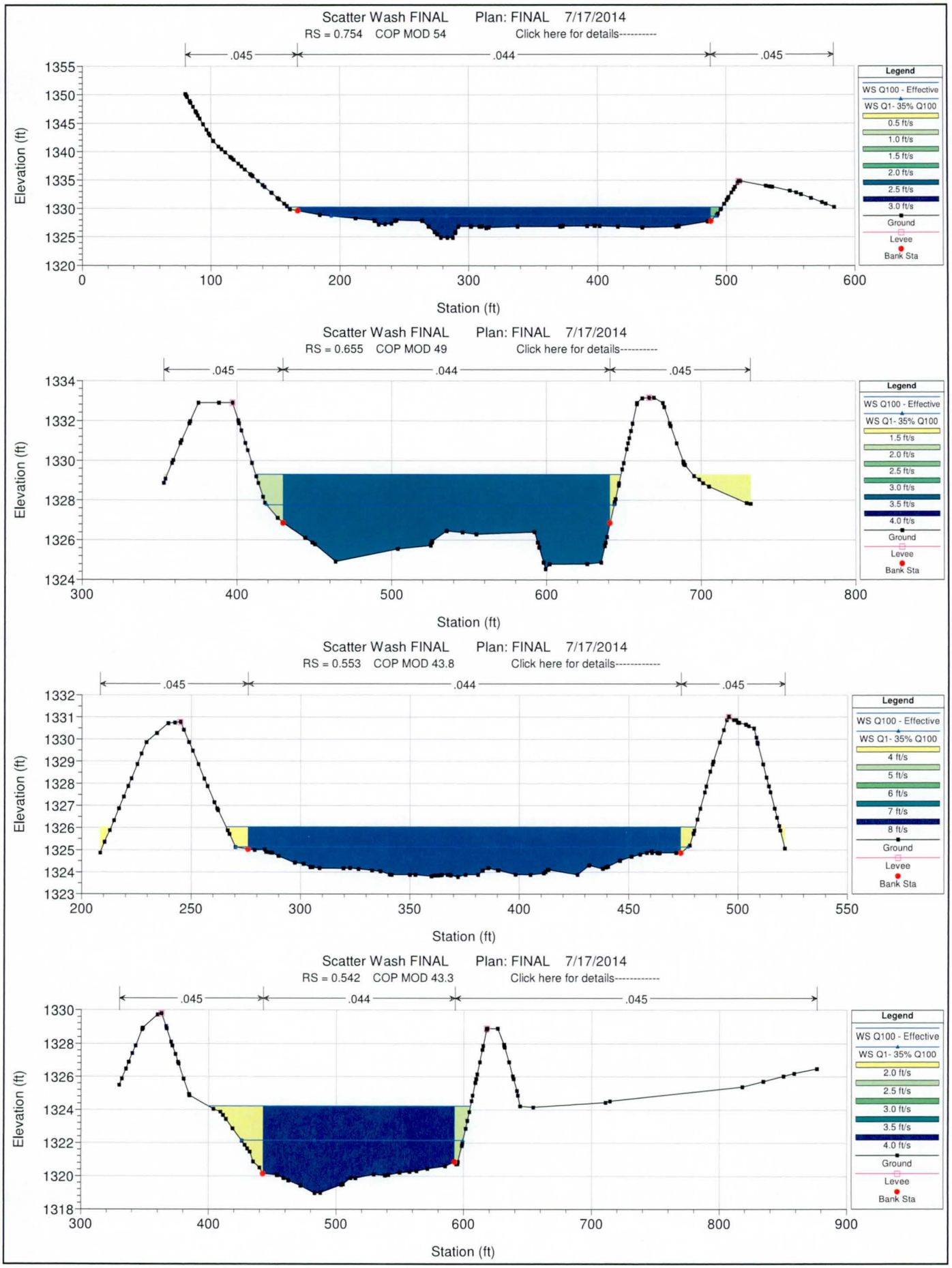

1.342
One
1.198
1.141
Scatter Wash
0.754
0.852
0.892
0.932
1.036
0.352
0.422
0.452
0.479
0.553
0.655

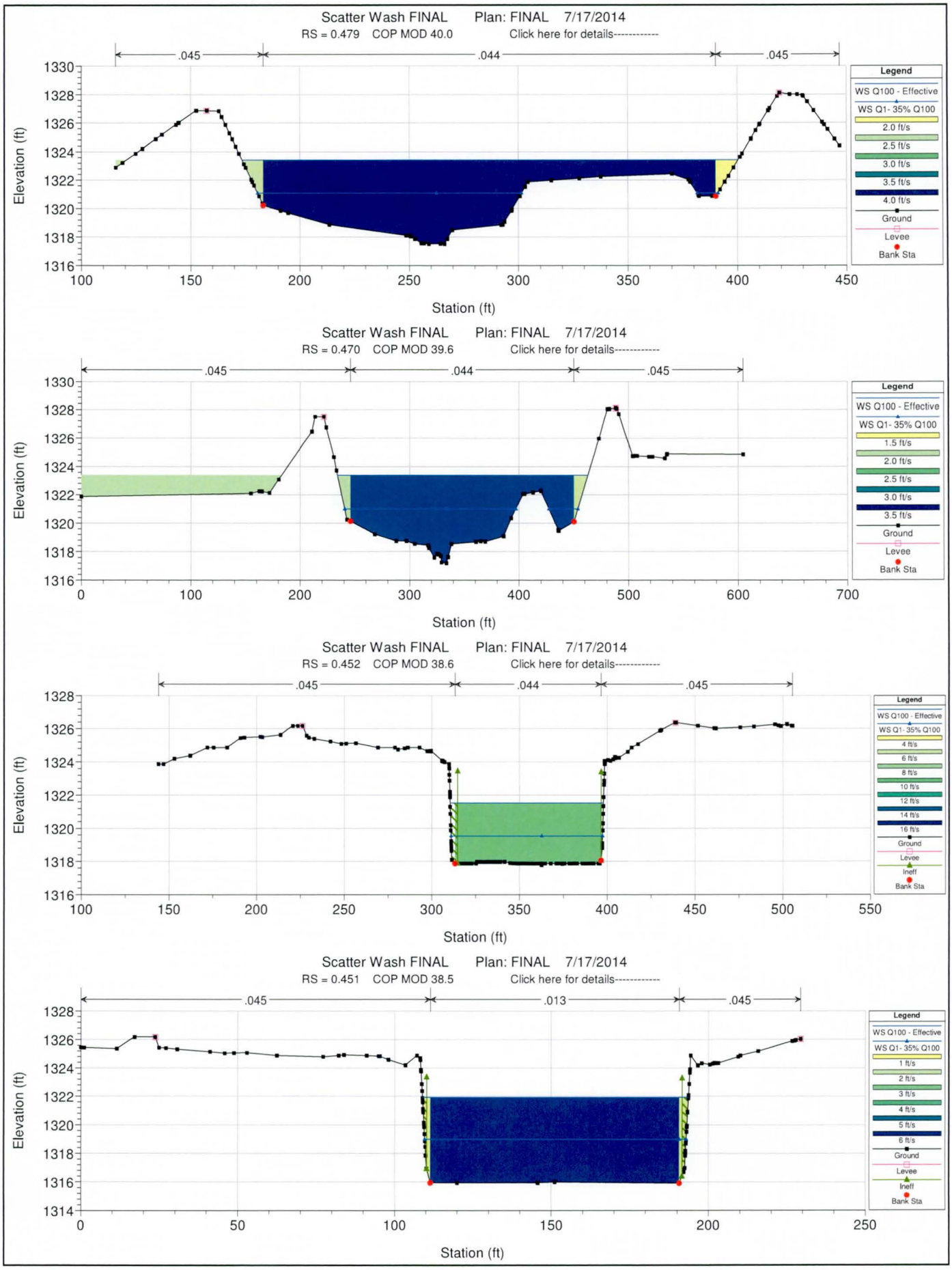

Scatter Wash FINAL Plan: FINAL 7/17/2014
Elevation (ft)
1350
1340
1330
1320
1310
1300
0.352
0.411
0.433
0.470
0.542
0.655
0.754
0.840
0.892
0.932
1.036
1.141
1.198
1.251
1.342
0
1000
2000
3000
4000
5000
Main Channel Distance (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
Ground
LOB
ROB

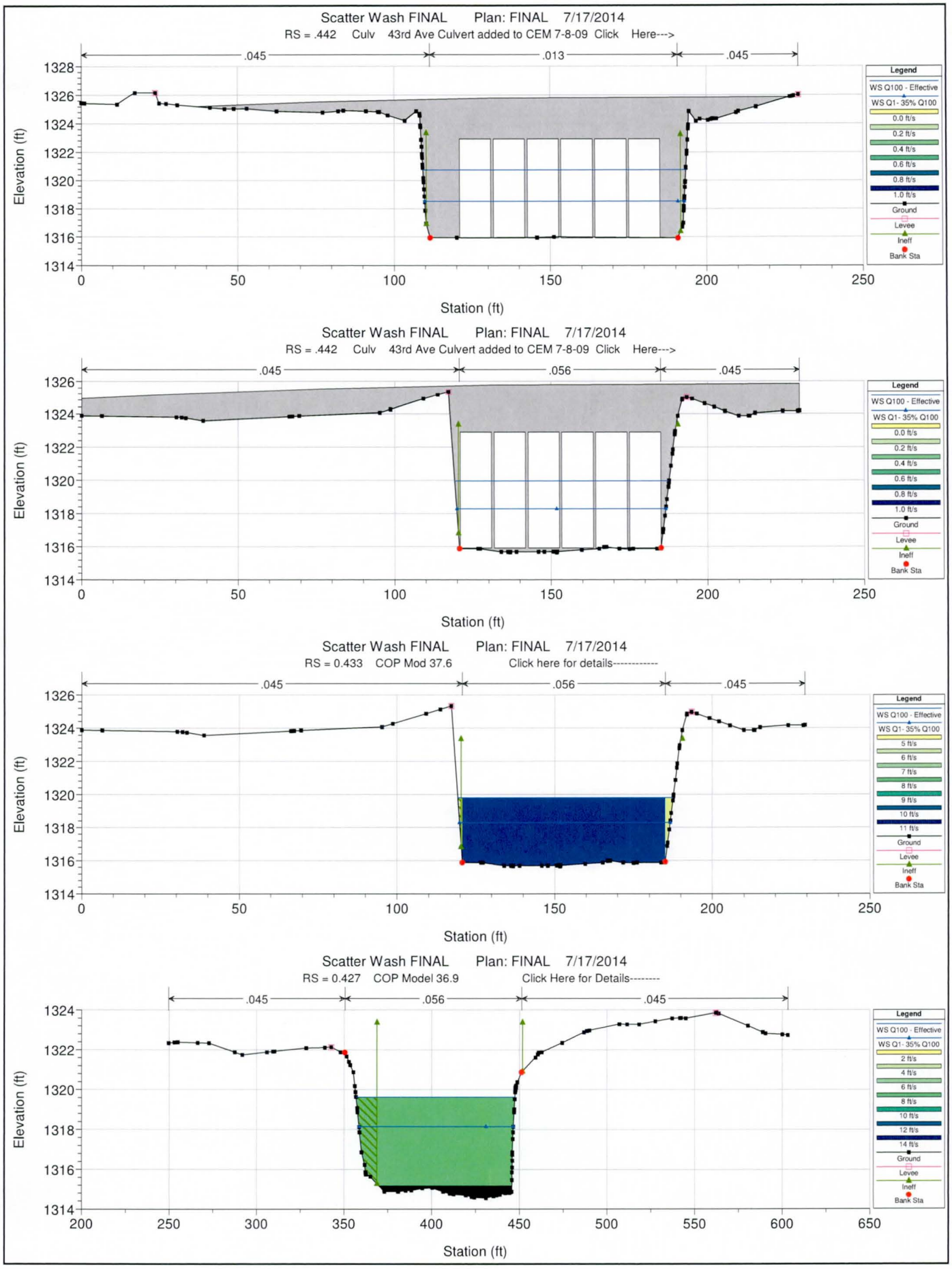

Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.342 Floodplain Redelineation Section 1.339
.018
.05
.018
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.301 Floodplain Redelineation Section 1.298
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.299 Floodplain Redelineation Section 1.296
.018
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.251 Culv 6603 SR 101L
.018
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Ineff
Bank Sta

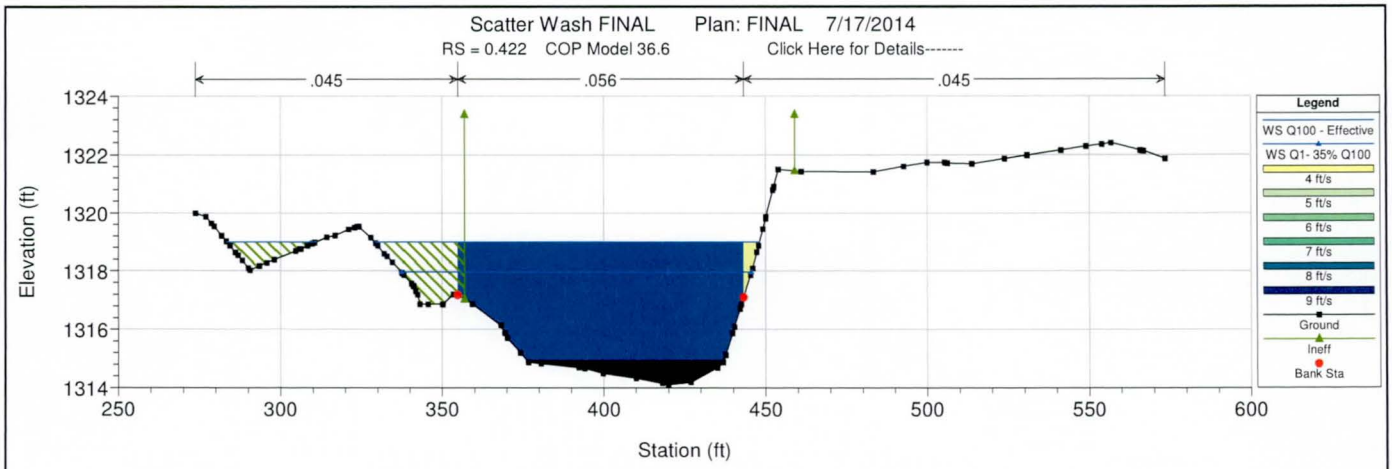

Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.251 Culv 6603 SR 101L
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.198 Floodplain Redelineation Section 1.195
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.141 Floodplain Redelineation Section 1.138
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 1.036 Floodplain Redelineation Section 1.034
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
Ground
Levee
Ineff
Bank Sta

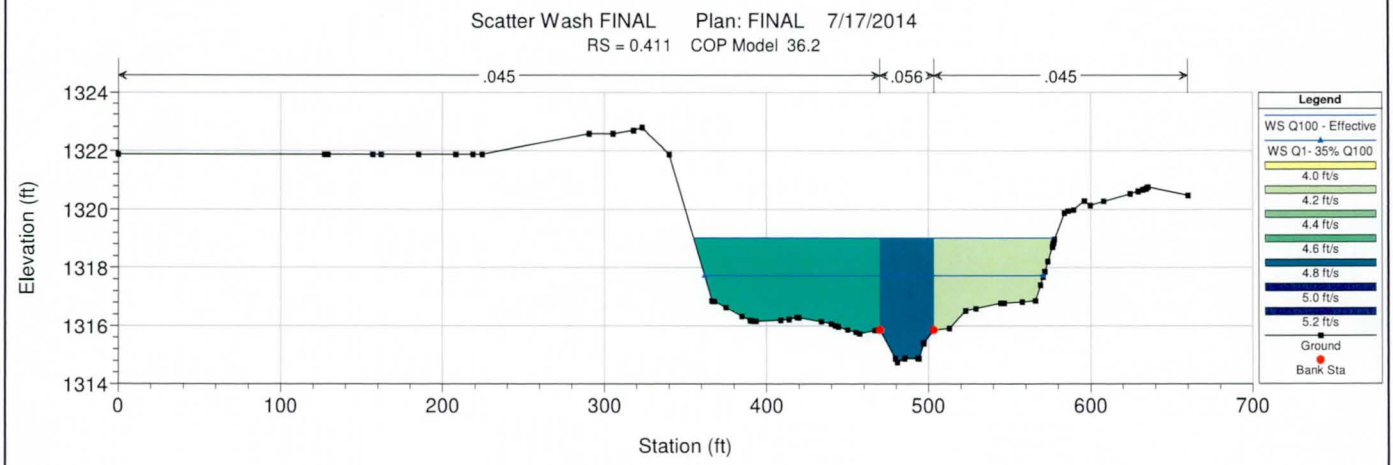

Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.932
.045
.028
.045
.047
.047
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.892
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.852 COP MOD 60
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.840 COP MOD 59.4
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta

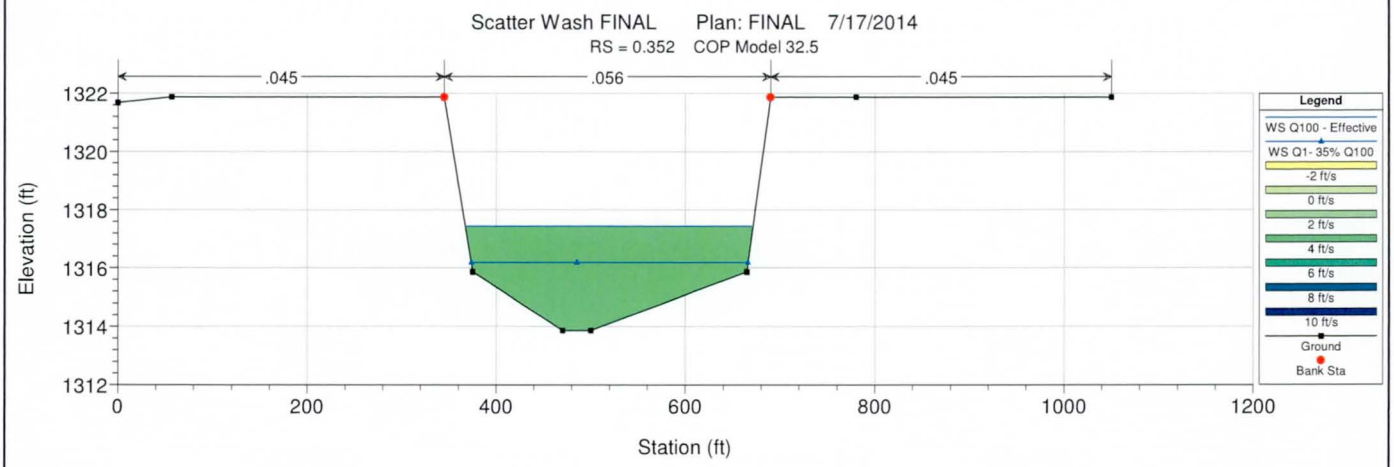

Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.754 COP MOD 54
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.655 COP MOD 49
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.553 COP MOD 43.8
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.542 COP MOD 43.3
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta


Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.479 COP MOD 40.0
Click here for details----------
.045
.044
.045
Elevation (ft)
1330
1328
1326
1324
1322
1320
1318
1316
100
150
200
250
300
350
400
450
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.470 COP MOD 39.6
Click here for details----------
.045
.044
.045
Elevation (ft)
1330
1328
1326
1324
1322
1320
1318
1316
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.452 COP MOD 38.6
Click here for details----------
.045
.044
.045
Elevation (ft)
1328
1326
1324
1322
1320
1318
1316
100
150
200
250
300
350
400
450
500
550
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
14 ft/s
16 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.451 COP MOD 38.5
Click here for details----------
.045
.013
.045
Elevation (ft)
1328
1326
1324
1322
1320
1318
1316
1314
0
50
100
150
200
250
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Levee
Ineff
Bank Sta


Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = .442 Culv 43rd Ave Culvert added to CEM 7-8-09 Click Here--->
.045
.013
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = .442 Culv 43rd Ave Culvert added to CEM 7-8-09 Click Here--->
.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.433 COP Mod 37.6 Click here for details----------
.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.427 COP Model 36.9 Click Here for Details--------
.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
14 ft/s
Ground
Levee
Ineff
Bank Sta


Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.422 COP Model 36.6
Click Here for Details-------
.045
.056
.045
Elevation (ft)
1324
1322
1320
1318
1316
1314
250
300
350
400
450
500
550
600
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Ineff
Bank Sta


Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.411 COP Model 36.2
.045
.056
.045
Elevation (ft)
1324
1322
1320
1318
1316
1314
0
100
200
300
400
500
600
700
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4.0 ft/s
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
Ground
Bank Sta


Scatter Wash FINAL Plan: FINAL 7/17/2014
RS = 0.352 COP Model 32.5
.045
.056
.045
Elevation (ft)
1322
1320
1318
1316
1314
1312
0
200
400
600
800
1000
1200
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

NOAA VERTCON

Questions concerning the VERTCON process may be mailed to NGS

Latitude: 33.6662

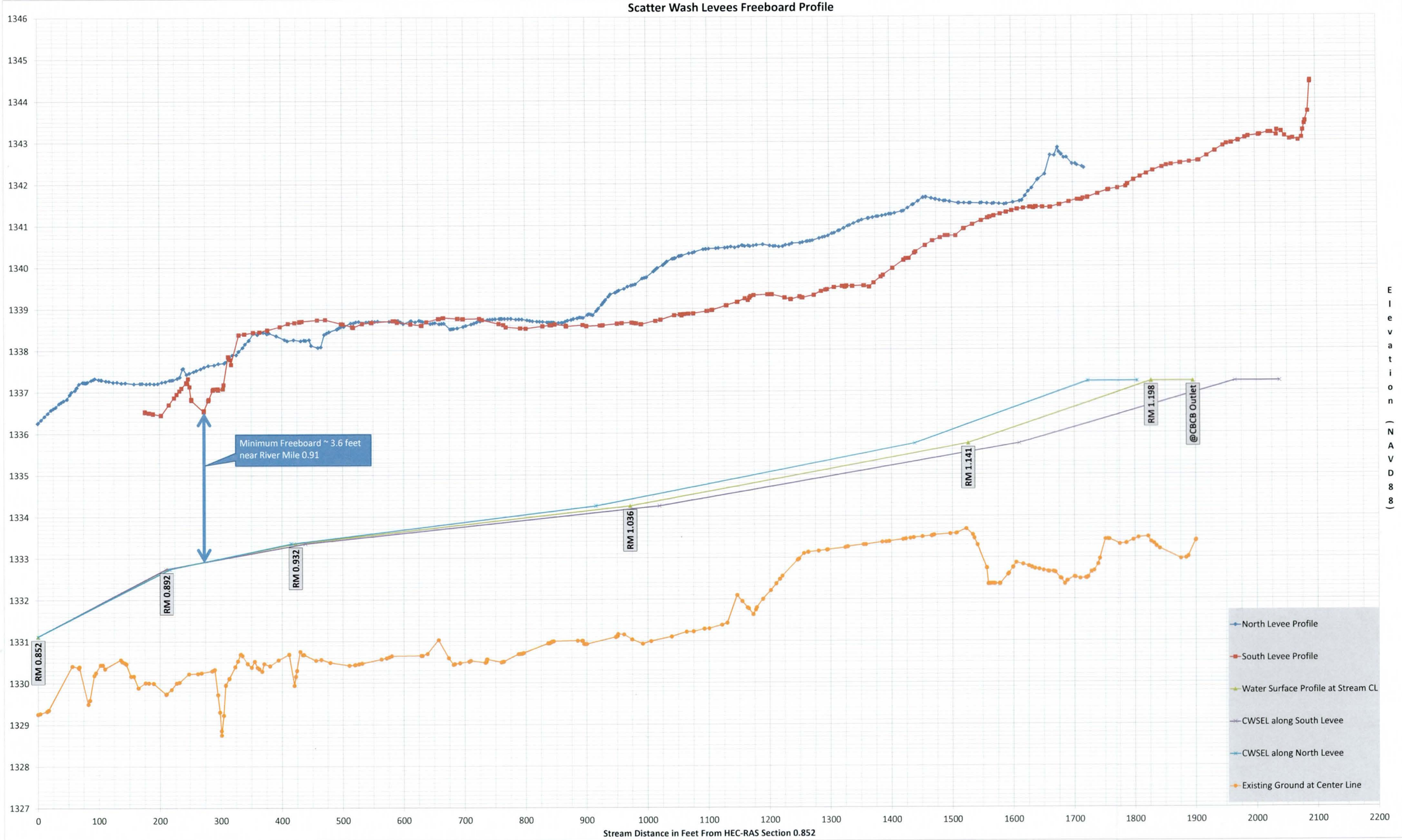
Longitude: 112.1350

NGVD 29 height:

Datum shift (NAVD 88 minus NGVD 29): 0.569 meter (1.867 Ft)

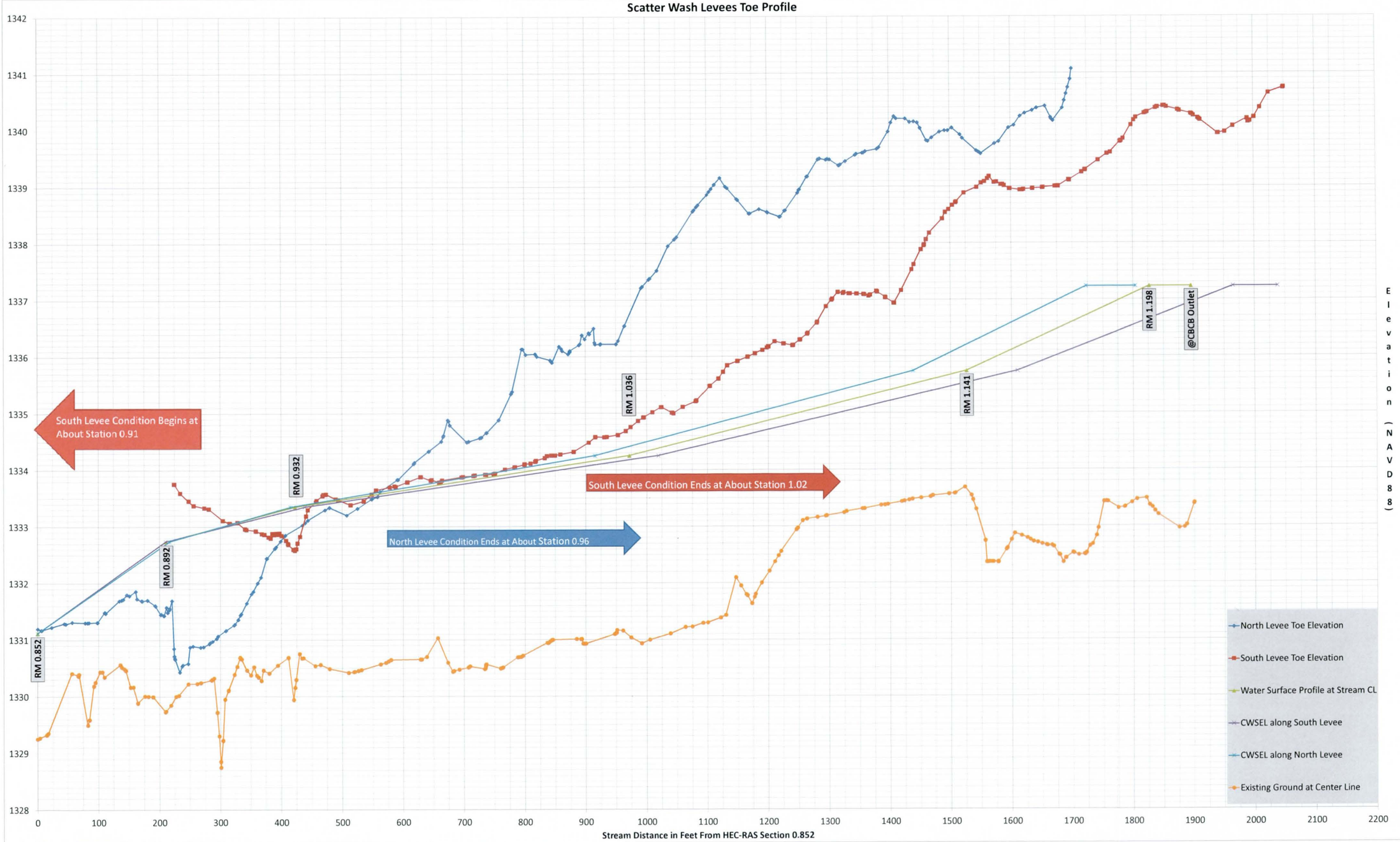
FREEBOARD PROFILE

Scatter Wash Levees Freeboard Profile



TOE PROFILE

Scatter Wash Levees Toe Profile

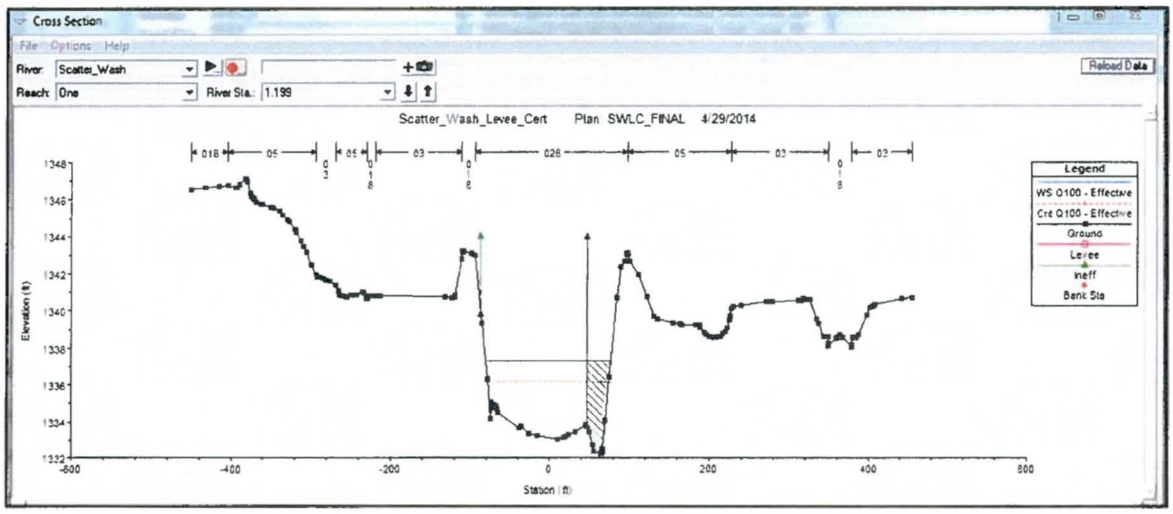


APPENDIX F

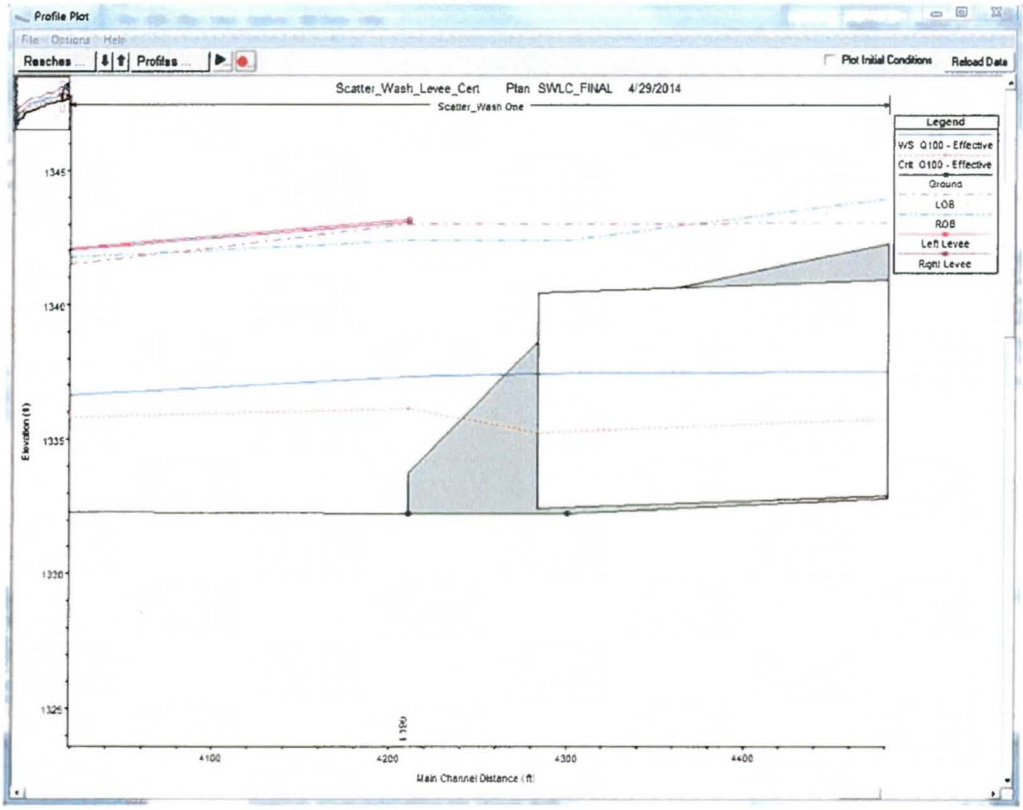
ADOT AS-BUILTS OF L101 NORTH DRAINAGE OUTFALLS TO SCATTER WASH

Analysis at ADOT Structures at L101N Headwall

HEC-RAS Cross Section



HEC-RAS Profile



100-year computed water surface elevation (CWSE) per HEC-RAS Station 1.199 = 1337.34 (NAVD88), or 1337.34 – 1.893 = 1335.45 NGVD29.

The 100-year CWSE of 1335.45 NGVD29 is plotted on the ADOT as-built drawings showing that the CWSEL is fully contained within the pipes and will not cause any interior ponding.

Change Order No. 51

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RBM-600-0-504	104A	225	5-18-95 OES

101 L MA 14

Finished Grade @ ℄ Pipe

Exist Grd @ ℄ Pipe

Outlet through HOW/ SFR Sta 1200+34.00 35.58' Rt

MH #30 SFR Sta 1200+23.71 Rim Elev 1341.8'

C-102 +40.50 Lt

MH #41 SFR Sta 1190+70.78 Rim Elev 1344.31

C-38 +124.03 Lt

C-101 +21.60 Lt

C-37 +50.37 Lt

C-39 +48 Rt

C-100 +98.30 Lt

C-40 +107.20 Lt

MH #39 SFR Sta 1202+30.72 25.24' Lt

Outlet 54" RCP 549.79'

C-30 +119.90 Lt

C-74 +139.72 Rt

C-110 +155.96 Lt

C-80 +176.00 Rt

Match Plans by 24"RCP SFR Sta 1209+17.25 26' Lt

Scatter Wash 100 yr Outlet

Inv 1330.56

Inv 1332.0

Inv 1331.00

Inv 1330.23

P-42 36"x 65' S=0.0020'/Ft

P-46 36"x 69' S=0.0020'/Ft

Inv 1332.38

Inv 1332.0

Inv 1337.0

Inv 1337.0

Inv 1338.00

Inv 1337.06

Inv 1336.41

Inv 1338.00

P-49 96"x 1182' S=0.0020'/Ft

12"W

Inv 1339.13

Inv 1341.00

12"W

Inv 1338.79 Out (Inv 1340.00 Exist 10"S (Abandoned) Plug as Necessary

Inv 1334.75

P-44 96"x 430' S=0.0006'/Ft

Exist 42"W

Elev 21'5

℄ 35th Ave

Inv 1333.00

Match New 96" Pipe Part C

1350 1345 1340 1335 1330

00 1185 00 87 88 89 1190 91 92 93 94 1195 96 97 98 99 1200 01 02 03 04 1205 06 07 08 09

SFR Cst ℄ Sta 1185+34.00 to Sta 1209+17.25

Wing Wall, See Dwg No. C-5.5 for Det

Cut off Level

℄ of C.M.P. Grade 27.78% Sta 1186+16.18 Skew N 1°44'E 90° CMP corner point (N.E.)

El 1340.69

Grade ditch @ 0.0070'/Ft

Exist Grade

Scatter Wash 100 yr CWSE

Invert El. 1331.90

Conc. lining

Inv 1333.93

P-104 18"x 88'-CSP 2 2/3"x 1/2" S=0.0445'/Ft

1340 1336 1330

Outlet, OH LIC-06 Chan Sta 1024+67.32, 31.4' Rt

Chan Bottom

Inv 1320.55

Exist Grd @ ℄ Pipes

Finished Grade @ ℄ Pipes

Inv 1324.48

Helwig, See Drainage, OH, Dwg No. C-5.6 NFF Sta 1154+50, 52' Lt TW Elev 1329.48

1330 1325 1320

P-68, P-67 2-36"x 76' S=0.0517'/Ft

SECTION O-O (See Dwg No. C-5.9)

Indicates Change Order No. 51 Revised 1-2-92

DeLEUW CATHER Delaware, Collins & Cleveland Engineers and Planners

STANLEY CONSULTANTS OF ARIZONA, INC. Engineering - Planning - Surveying

DESIGN	MAL
DRAWN	LF
CHECKED	GL
APPROVED	REJ

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-0-504 59TH AVE TO 35TH AVE

DRAINAGE PROFILE

ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG NO.
SR-101L			C-5.13

TRACS NO. H0797 06C RBM-600-0-504 Sheet 104A of 225

Change Order No. 16

F.A.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RBM-600-0-504	102A	235	8-18-93 DES
		101 L MA 16			

41st AVE ℄

43'

21.5' 21.5'

NFR Sta 1164+26.62, 44.5' Lt

TW 1331.77

TW 1331.77

Rt 1329.37

See DH D-6 Dwg C-5.33

2- 36" RCP Class II x 44'

Flow Line

Inv 1326.77

Inv 1324.96

Drop Inlet Headwall Std C-14.30

Flow Line

S-0.0044'/ft P-71, P-72

Fill Sump w/ Conc to Drain

A.C. in Headwall Elev. 1331.52

NFR Sta 1164+04.37 44.5' Lt

NFR Sta 1164+48.37 44.5' Lt

SECTION A-A

N

T4N R2E

Sct 22

DRAINAGE EASEMENT

Begin Channel Sta 87+37.37 Cst ℄ Sta 203+16.89.55' Rt (See Drainage Detail D-4, Dwg No. C-5.31)

Scatter Wash Channel See Dwg No. C-6.5 to C-6.7

Drainage Channel Sta 91+56.50 NFR Sta 1191+57.00 64' Lt

Scatter Wash (C-5.14) (1)

Drainage Channel PC Sta 94+10.60

NFR Sta 1164+48.37 Cst Drop Inlet Headwall Std C-14.30

1165 1170 1175 1180 1185 1190 1195

N 89°33'24.8"E

Deordaley

8" Road

37th AVE

NFR Sta 1164+04.37 Cst Headwall See Drainage Detail D-6 Dwg No. C-5.33

Scatter Wash Channel See Dwg No. C-6.5 to C-6.7

Mod Cst ℄ Sta 1186+20 Construct CBC See Dwgs 5-5.1 Thru 5-5.5

* NOTE:

1) Concrete Shall be Class "S" f'_c = 3000 psi

2) Reinforcing Steel Shall be Grade 60 Conforming to Section 605.

N Frt Rd ℄

44.5'

24'

Profile Grade (See "Ditch Left" N Frt Rd Profiles Dwg No. C-2.18 & C-2.21

4' 4' 5.5'

Grade To Drain

Hinge Point (See F.R Typ)

3'

1/4 1/4

SECTION B-B

Channel Cst ℄

Top of Bank, Lt

Channel Profile Grade

Top of Bank, Rt

Finished Grade

Exist Gnd

10:1

2'

4' 4'

10:1 Max

Exist Gnd

#4's @ 12" OC

#4's @ 16" OC

6" (typ)

36" (Typ)

27'

3:1

1/2

* Concrete Channel Lining

** Top of Lining to be Field Adjusted to pick up Off-site Flows.

Cst Weep Holes D-9, Dwg No. C-5.34

SECTION C-C

(3) Indicates Change Order No. 16 Revised 9-17-90

(1) As-Built

STANLEY CONSULTANTS OF ARIZONA, INC.

DESIGN	M.A.L.
DRAWN	P.R.R.
CHECKED	GL
APPROVED	REJ

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-0-504 59TH AVE TO 35TH AVE

DRAINAGE PLAN

STA 1165+00 TO STA 1195+00

ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG. NO.
SR-101L			C-5.11

TRACS NO. H0797 06C RBM-600-0-504 Sheet 102A of 235

F.H.W.A. REGION	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
9	ARIZ.	RBM-600-0-504 101 L MA 16	105	235	3-18-93 DES

Channel Cst ℄ Sta 104+17.36 = 35th Ave ℄ Sta 17+14.24
Construct 8'x5'x164' Concrete Box Culvert Skewed 16°38'47"
(See Dwg No. C-5.36)

Sta 95+08.06 = NFR 1195+00, 78' Lt
Construct 2-6'x4'x44' Concrete Box Culvert
(See Dwg No. C-5.37)

10' Maintenance Access Ramp
~~See D-10, Dwg No. C-5.34~~

Drainage Channel
PT Sta 103+03.23 = NFR 1202+84.88, 73.94' Lt

CHANNEL CURVE DATA

(4)	R	Δ	T	L
(1)	2853.57'	17°55'23"	450.00	892.63
(2)	1000.00'	16°17'48"	143.18	284.43

[1] M.H. #81 - Moved 50'-North Due to Conflict With U.S. West Fibre Optics. Also Caused Realignment of Pipe Run "P-75" 12-11-90 by JTg, Done Under F.A. #6

T4N ⊕ R2E

Sct 23

Elev 1351.9

Elev 1337.5

Elev 1338.0

Elev 1354.0

20' (Typ)

Bottom Detention Basin R/W

Chain Link Fence Type "J" (72")

Channel Bottom Transition 20' to 8'

NFR Sta 1207+51.24
118.85' Lt
Detention Outlet
See Detail D-4
Dwg No. C-5.32

Elev 1337.5

Elev 1350.2

Detail A

Pontiac Drive

Drainage Channel
PT Sta 111+90.86 =
NFR Sta 1211+22.95, 63.93' Lt
Match Drainage Channel Part C

Beardsley Road

1195 1200 1205 1210 1215 1220 1225

S 73°35'22.6"E

A.C. in Headwall
Elev. 1349.88

Drainage Channel
PC Sta 108+56.42 =
NFR Sta 1208+33.42, 54.31' Lt

Slope Protection

END CONSTRUCTION

S 89°53'10.9"E

66Cuda Dr.

33rd Dr.

S 75°30'13.6"E

96" Storm Drain
PT SFR Sta 1199+27.47
7' Lt

Match 96" Storm Drain Part C

S Frt Rd Sta 1209+17.26
26.10' Lt

35th Ave

[1] Dimension Cable Line Caused Conflict With 18" RCP Lateral "C-74" Pipe Run Grade Changed to Clear TV Cable - F.A. #6
12-11-90 by JTg

Weir Control Gr

Varies

Cone Slope Protection
(See Profile, Dwg No. C-5.12)

Channel Cst ℄

Channel Profile Gr

Finished Gnd

See Profile

Cst Jt

#4 @ 10" OC

#4 @ 16" OC

Concrete Channel Lining

*Varies Sta 104+99.36 to Sta 108+00

3" clear

SECTION A-A

See Dtl D-8, Dwg No. C-5.34 for Additional Dtls

#4 @ 16" OC

#4 @ 12" OC

Cut-Off Wall

NOTE:
1) Concrete Shall be Class "S" f'c = 3000 psi
2) Reinforcing Steel Shall be Grade 60 Conforming to Section 605.

Exst Gnd

Varies 10' Varies

SECTION B-B

Maintenance Access Ramp 10:1

3:1 (Typ)

Elev 1352.0

Top of Basin

DETAIL A

2" clear

#5 @ 12" Each Way

Elev 1346.30

Elev 1345.30

7-#5 Equally Spaced

½" Premold Expansion Joint

SECTION D-D

℄ Channel Cst Sta 108+00

Elev 1349.1

Channel Weir Structure

Elev 1346.3

SECTION C-C

[1] As-Built

DESIGN	MAL
DRAWN	P.R.R
CHECKED	GL
APPROVED	REJ

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-0-504 59TH AVE TO 35TH AVE

DRAINAGE PLAN

STA 1195+00 TO STA 1210+00

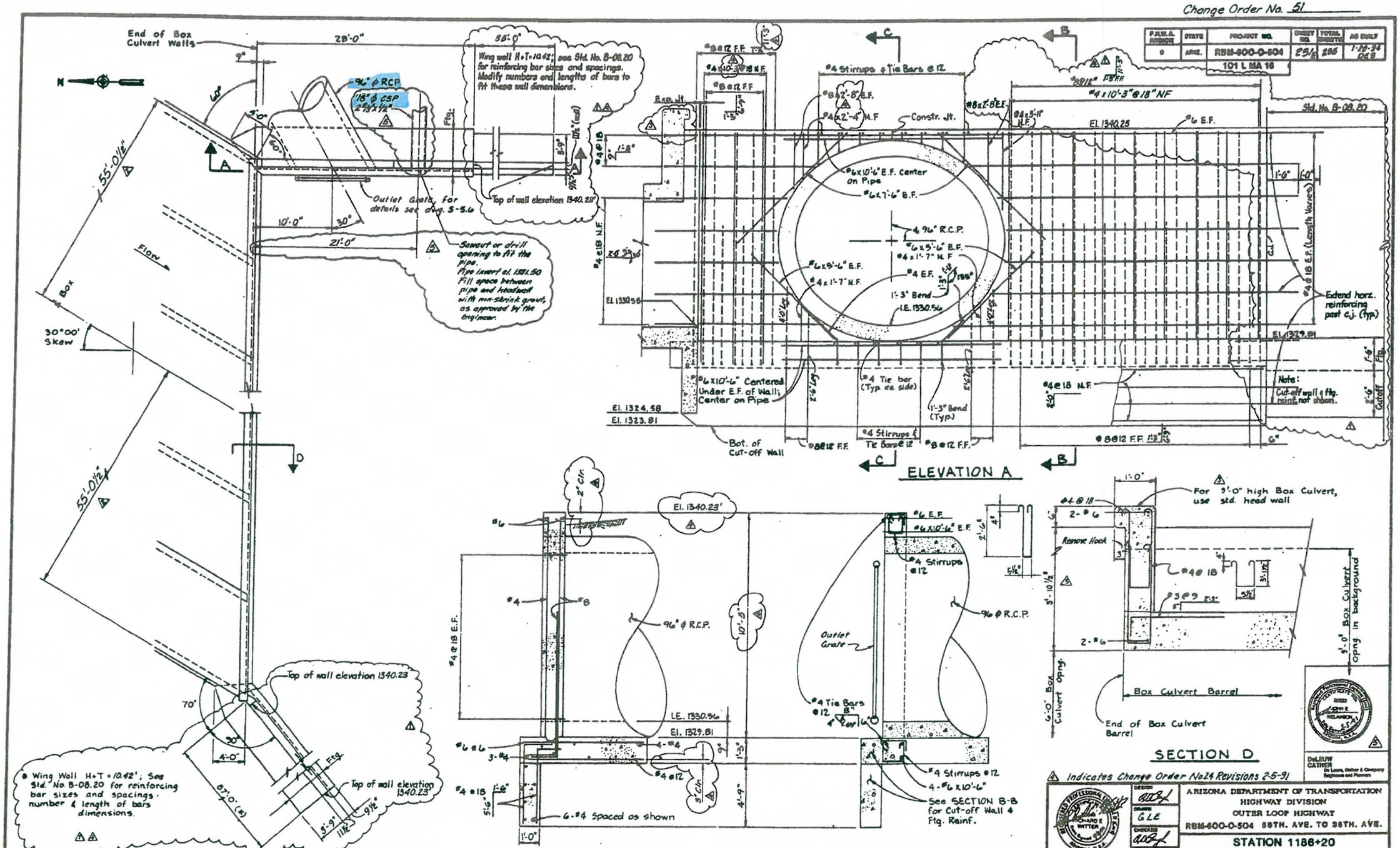
STANLEY CONSULTANTS OF ARIZONA INC.

ROUTE	MILEPOST	LOCATION OR STRUCTURE NO.	DWG. NO.
SR-101L			C-5.14

TRACS NO. H0797 06C RBM-600-0-504 Sheet 105 of 235

Change Order No. 51

F.A.H.U.A. PROJECT	STATE	PROJECT NO.	SHEET NO.	TOTAL SHEETS	AS BUILT
0	ARIZ.	RBM-600-0-504	231E	235	1-29-94 DHS
		101 L MA 16			



Indicates Change Order No. 24 Revisions 2-5-91

Indicates Addendum No. 1 Revisions 3-22-90

Indicates Change Order No. 10, Revisions 7-16-90

Indicates Change Order No. 51 Revised 1-2-92

Indicates Change Order No. 17, Revisions 11-6-90

DeLEUW CATHER
De Leuw, Cather & Company Engineers and Planners

STANLEY CONSULTANTS OF ARIZONA, INC.

DESIGN BWH
DRAWN GLE
CHECKED BWH
APPROVED REW

ARIZONA DEPARTMENT OF TRANSPORTATION
HIGHWAY DIVISION
OUTER LOOP HIGHWAY
RBM-600-0-504 59TH. AVE. TO 35TH. AVE.

STATION 1186+20

SCATTER WASH CULVERT
OUTLET WING WALLS

ROUTE	SUBROUTE	LOCATION OR STRUCTURE NO.	DWG. NO.
SR-101L	21.34		S-5.4

TRACS NO. H0787 06C RBM-600-0-504 Sheet 231E of 235

APPENDIX G

EMBANKMENT PROTECTION ANALYSIS

SCOUR DEPTH CALCULATIONS AT TOE

Client:	Flood Control District of Maricopa County
Project:	Scatter Wash Hydraulic and Geotechnical Certification for Levees
Design:	Scour Analysis
Prepared By:	YCX

Sheet	1 of 3
Date:	6/20/2014
Checked By:	

amec

Wash Name (S.S. Station)	HEC-RAS Sta:	U.S. Grade Control	D.S. Grade Control	Energy Grade Slope	Max. Design Flow (Q100)	Max Depth at Design Flow	Angel of Curve Bend	Radius of Curvature	Pier Width	Froude Number	Manning's Roughness	Maximum Top Width at Design	Flow Area at Design Flow	Channel Flow Discharge	Channel Top Flow Width	Channel Flow Area	Hydraulic Depth of Flow	Average Velocity at Design Flow	Discharge per Unit Width (100-	Discharge (10-year)	Top Width at 10-yr flow	Flow Area at 10-year Flow	Hydraulic Depth of Flow	Note
				S_e	Q_{100}	Y_{max}, FD	α	rc	bp	Fr	n	W_T, FW	A	Q_{CH}	W_{CH}	A_{CH}	Yh	Vm	q	Q_{10}, Q_{EF}	W_{10}, W_{EF}	A_{10}, A_{EF}	d, d_{10}, d_{EF}	
				ft/ft	cfs	ft	degrees	ft	ft			ft	ft^2	cfs	ft	ft^2	ft	fps	cfs/ft	cfs	ft	ft^2	ft	
Scatter Wash	0.932	Grade Control Structure	452	0.001663	2760	3.5	55	1150	n/a	0.43	0.029	259	691	2760	259	691	2.67	3.99	10.68	966	254	385	1.52	

Note: Data abstracted from the HEC-RAS model for Scatter Wash with Plan File "FINAL" and Project File "ScatterWashFINAL.prj"

General Scour: Lacey Equation : Zgs = Z(0.47[Q/f]^1/3)

Where:

Zgs = general scour depth (ft)

Q = design discharge, cfs

Dm = mean grain size, which may be approximateed by D50, (diameter where 50% is finer by dry weight) mm. D_{50} = 0.42 mm

f = Lacey's silt factor = 1.76(Dm)^1/2

Z = 0.5 0.25 for straight reach, 0.5 for moderate bend and 0.75 for severe bend.

f:	1.14

Zgs:	3.2

Bedform Scour: Zb = 0.5 dh

Where:

Zb = bedform scour, ft

dh = dune or antidune height (measured from mound top to bottom0, ft;

for Fr < 0.7, 0.15<dh/yh<0.3, for this analysis a ratio of dh / dy of 0.2 was assumed.

dh	Zb
0.70	0.35

Low Flow Incisement Scour

A low flow incisement scour of **2 feet** was used based on field observation.

$Z_{lowflow}$ =	2	feet

Long Term Degradation (Zeller-Fullerton equation):

$$Q_s = q_s W = 0.0064\left(\frac{n^{1.77} V_a^{3.32} G^{0.45}}{Y_h^{0.3} D_{50}^{0.61}}\right) W$$

Where:

Qs = total bed material discharge in cfs;

qs = total bed material discharge in cfs per unit width;

W = average width of flow, defined as the wetted area divided by flow depth (the flow depth can be the Manning's equation-based normal depth or maximum flow depth from HEC-RAS)

A = wetted flow area, ft2

Ymax = maximum flow depth, ft

n = Manning's roughness coefficient;

Va = average velocity, ft/s;

Yh = hydraulic depth, ft;

D_{50} = Median bed material size (mm)

D_{84} = Median bed material size (mm)

D_{16} = Median bed material size (mm)

G = gradation coefficient, where: $G = 1/2\ (D_{84.1}/D_{50} + D_{50}/D_{15.9})$

Sediment Transport Rate	XS-0.932 US	XS-0.892 DS
Qs	**0.14** cfs	**0.11** cfs
W	167.43 ft	97.32 ft
A	385.08 ft2	363 ft2
Ymax	2.3 ft	3.73 ft
n	0.028	0.028
Va	2.51 ft/s	2.66 ft/s
Yh	1.52 ft	1.44 ft
D_{50}	0.42 mm	0.42 mm
D_{84}	4.76 mm	4.76 mm
D_{16}	0.074 mm	0.074 mm
G	8.5	8.5

$Z_{LongTerm}$ =	0	feet

No scour occurs due to $Q_{S0.932} > Q_{S0.892}$

$$Z_{total} = FS\ (Z_{long\ term} + Z_{general} + Z_{bend} + Z_{bedform} + Z_{lowflow}) + FSI_{ocal} * Z_{local}$$

Safety Factor	Local Safety Factor	General Scour	Long Term Scour	Total Scour
1.3	1.0	7.2	0.0	7.2

Client:	Flood Control District of Maricopa County
Project:	Scatter Wash Hydraulic and Geotechnical Certification for Levees
Design:	Scour Analysis
Prepared By:	YCX

Sheet	2 of 3
Date:	6/20/2014
Checked By:	

amec

Wash Name (S.S. Station)	HEC-RAS Sta:	U.S. Grade Control	D.S. Grade Control	Energy Grade Slope	Max. Design Flow (Q100)	Max Depth at Design	Angel of Curve Bend	Radius of Curvature	Pier Width	Froude Number	Manning's Roughness	Maximum Top Width at Design	Flow Area at Design Flow	Channel Flow Discharge	Channel Top Flow Width	Channel Flow Area	Hydraulic Depth of Flow	Average Velocity at Design Flow	Discharge per Unit Width (100-year)	Discharge (10-year)	Top Width at 10-yr flow	Flow Area at 10-year Flow	Hydraulic Depth of Flow	Note
				S_e	Q_{100}	Y_{max}, FD	α	r_c	b_p	Fr	n	W_T, FW	A	Q_{CH}	W_{CH}	A_{CH}	Yh	Vm	q	Q_{10}, Q_{EF}	W_{10}, W_{EF}	A_{10}, A_{EF}	d, d_{10}, d_{EF}	
				ft/ft	cfs	ft	degrees	ft	ft			ft	ft^2	cfs	ft	ft^2	ft	fps	cfs/ft	cfs	ft	ft^2	ft	
Scatter Wash	1.036	Grade Control Structure	992	0.002032	2760	3.4	55	1150	n/a	0.52	0.027	192	551	2726	183	542	2.96	5.03	14.40	966	186	304	1.63	

Note: Data abstracted from the HEC-RAS model for Scatter Wash with Plan File "FINAL" and Project File "ScatterWashFINAL.prj"

General Scour: Lacey Equation : Zgs = Z(0.47[Q/f]^1/3)

Where:

Zgs = general scour depth (ft)

Q = design discharge, cfs

Dm = mean grain size, which may be approximateed by D50, (diameter where 50% is finer by dry weight) mm. D_{50} = 0.42 mm

f = Lacey's silt factor = 1.76(Dm)^1/2

Z = 0.5 0.25 for straight reach, 0.5 for moderate bend and 0.75 for severe bend.

f:	1.14
Zgs:	3.2

Bedform Scour: Zb = 0.5 dh

Where:

Zb = bedform scour, ft

dh = dune or antidune height (measured from mound top to bottom0, ft;
for Fr < 0.7, 0.15<dh/yh<0.3, for this analysis a ratio of dh / dy of 0.2 was assumed.

dh	Zb
0.68	0.34

Low Flow Incisement Scour

A low flow incisement scour of 1 **foot** was used based on field observation.

$Z_{lowflow}$ =	1	feet

Long Term Degradation (Zeller-Fullerton equation):

$$Q_s = q_s W = 0.0064\left(\frac{n^{1.77} V_a^{3.32} G^{0.45}}{Y_h^{0.3} D_{50}^{0.61}}\right) W$$

Sediment Transport Rate

Where:

	XS-1.034 US	XS-0.932 US
Qs = total bed material discharge in cfs;	**0.32** cfs	**0.14** cfs
qs = total bed material discharge in cfs per unit width;		
W = average width of flow, defined as the wetted area divided by flow depth (the flow depth can be the Manning's equation-based normal depth or maximum flow depth from HEC-RAS)	145.38 ft	167.43 ft
A = wetted flow area, ft2	305.3 ft2	385.08 ft2
Ymax = maximum flow depth, ft	2.1 ft	2.3 ft
n = Manning's roughness coefficient;	0.028	0.028
Va = average velocity, ft/s;	3.17 ft/s	2.51 ft/s
Yh = hydraulic depth, ft;	1.64 ft	1.52 ft
D_{50} = Median bed material size (mm)	0.42 mm	0.42 mm
D_{84} = Median bed material size (mm)	4.76 mm	4.76 mm
D_{16} = Median bed material size (mm)	0.074 mm	0.074 mm
G = gradation coefficient, where: G = 1/2 ($D_{84.1}/D_{50}$ + $D_{50}/D_{15.9}$)	8.5	8.5

$Z_{LongTerm}$ =	0	feet	No scour occurs due to $Q_{S1.034} > Q_{S0.892}$

$Z_{total} = FS\ (Z_{long\ term} + Z_{general} + Z_{bend} + Z_{bedform} + Z_{lowflow}) + FSl_{ocal} * Z_{local}$

Safety Factor	Local Safety Factor	General Scour	Long Term Scour	Total Scour
1.3	1.0	5.8	0.0	5.8

Client:	Flood Control District of Maricopa County
Project:	Scatter Wash Hydraulic and Geotechnical Certification for Levees
Design:	Scour Analysis
Prepared By:	YCX

Sheet	3 of 3
Date:	6/20/2014
Checked By:	

amec

Wash Name (S.S. Station)	HEC-RAS Sta:	U.S. Grade Control	D.S. Grade Control	Energy Grade Slope	Max. Design Flow (Q100)	Max Depth at Design	Angel of Curve Bend	Radius of Curvature	Pier Width	Froude Number	Manning's Roughness	Maximum Top Width at Design	Flow Area at Design Flow	Channel Flow Discharge	Channel Top Flow Width	Channel Flow Area	Hydraulic Depth of Flow	Average Velocity at Design Flow	Discharge per Unit Width (100-year)	Discharge (10-year)	Top Width at 10-yr flow	Flow Area at 10-year Flow	Hydraulic Depth of Flow	Note
				Se	Q_{100}	$Y_{max, FD}$	α	r_c	b_p	Fr	n	W_T, FW	A	Q_{CH}	W_{CH}	A_{CH}	Yh	Vm	q	Q_{10}, Q_{EF}	W_{10}, W_{EF}	A_{10}, A_{EF}	d, d_{10}, d_{EF}	
				ft/ft	cfs	ft	degrees	ft	ft			ft	ft^2	cfs	ft	ft^2	ft	fps	cfs/ft	cfs	ft	ft^2	ft	
Scatter Wash	1.141	Grade Control Structure	1535	0.006843	2760	3.39	18	1150	n/a	0.92	0.027	147	344	2750	142	341	2.40	8.05	18.79	966	142	173	1.22	

Note: Data abstracted from the HEC-RAS model for Scatter Wash with Plan File "FINAL" and Project File "ScatterWashFINAL.prj"

General Scour: Lacey Equation : Zgs = Z(0.47[Q/f]^1/3)

Where:

Zgs = general scour depth (ft)

Q = design discharge, cfs

Dm = mean grain size, which may be approximateed by D50, (diameter where 50% is finer by dry weight) mm. D_{50} = 0.42 mm

f = Lacey's silt factor = 1.76(Dm)^1/2

Z = 0.25 0.25 for straight reach, 0.5 for moderate bend and 0.75 for severe bend.

Note: 0.25 used through this straight reach.

f:	1.14
Zgs:	1.6

Bedform Scour: Zb = 0.5 dh

Where:

Zb = bedform scour, ft

dh = dune or antidune height (measured from mound top to bottom0, ft;

for Fr < 0.7, 0.15<dh/yh<0.3, for this analysis a ratio of dh / dy of 0.2 was assumed.

dh	Zb
0.68	0.34

Low Flow Incisement Scour

A low flow incisement scour of 1 **foot** was used based on field observation.

$Z_{lowflow}$ =	1	feet

Long Term Degradation (Zeller-Fullerton equation):

$$Q_s = q_s W = 0.0064\left(\frac{n^{1.77} Y_a^{4.32} G^{0.45}}{Y_a^{0.3} D_{50}^{0.61}}\right) W$$

Where:	Sediment Transport Rate XS-1.139 US	XS-1.034 US
Qs = total bed material discharge in cfs;	**2.19** cfs	**0.32** cfs
qs = total bed material discharge in cfs per unit width;		
W = average width of flow, defined as the wetted area divided by flow depth (the flow depth can be the Manning's equation-based normal depth or maximum flow depth from HEC-RAS)	78.69 ft	145.38 ft
A = wetted flow area, ft2	173.11 ft2	305.3
Ymax = maximum flow depth, ft	2.2 ft	2.1 ft2
n = Manning's roughness coefficient;	0.028	0.028 ft
Va = average velocity, ft/s;	5.58 ft/s	3.17
Yh = hydraulic depth, ft;	1.22 ft	1.64 ft/s
D_{50} = Median bed material size (mm)	0.42 mm	0.42 ft
D_{84} = Median bed material size (mm)	4.76 mm	4.76 mm
D_{16} = Median bed material size (mm)	0.074 mm	0.074 mm
G = gradation coefficient, where: G = 1/2 ($D_{84.1}/D_{50}$ + $D_{50}/D_{15.9}$)	8.5	8.5 mm

$Z_{LongTerm}$ =	0	feet	No scour occurs due to $Q_{S1.139} > Q_{S1.034}$

$Z_{total} = FS\ (Z_{long\ term} + Z_{general} + Z_{bend} + Z_{bedform} + Z_{lowflow}) + FSl_{ocal} * Z_{local}$

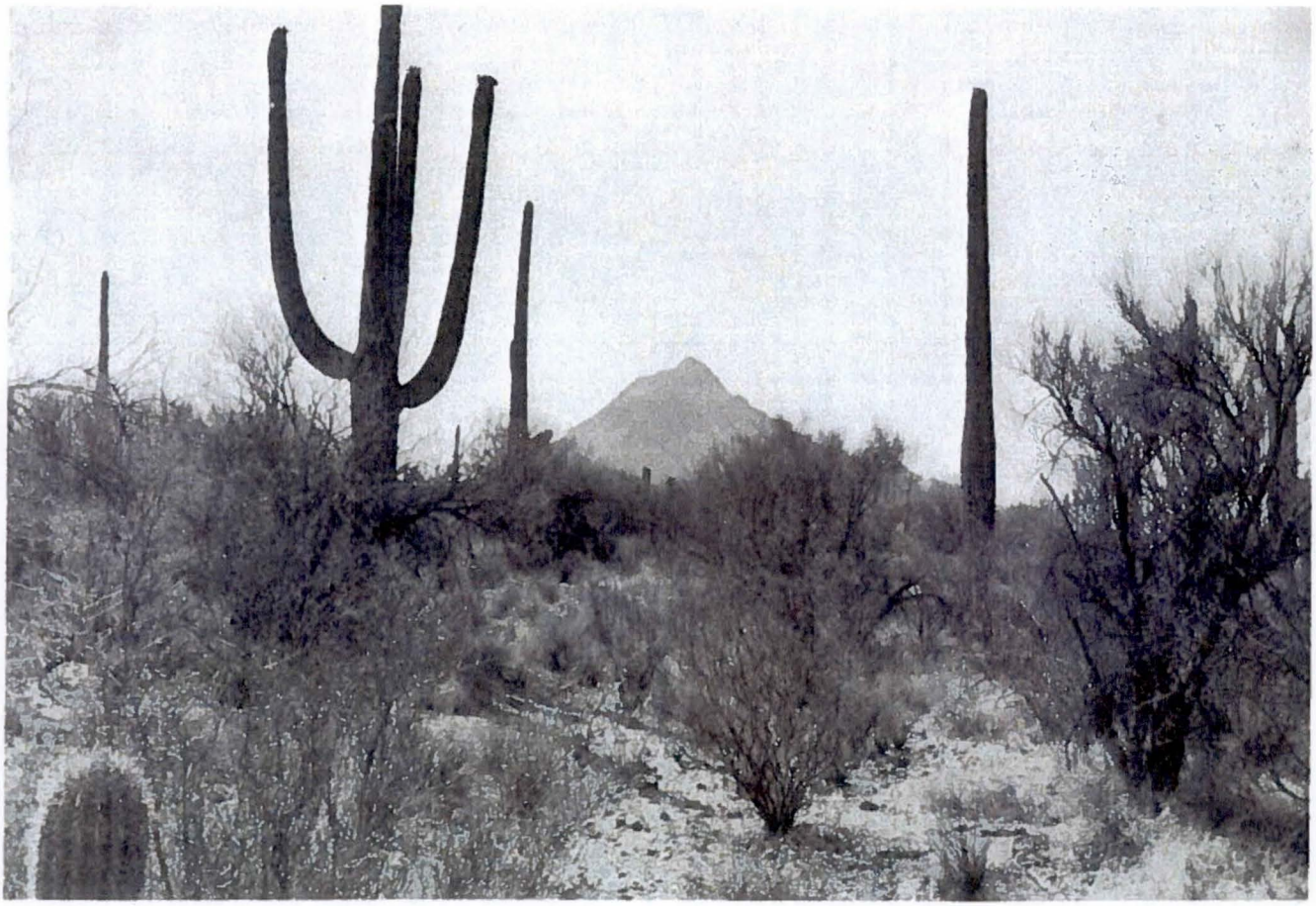
Safety Factor	Local Safety Factor	General Scour	Long Term Scour	Total Scour
1.3	1.0	3.8	0.0	3.8

SOIL DATA

SOIL SURVEY OF

Maricopa County, Arizona

Central Part



United States Department of Agriculture
Soil Conservation Service
in cooperation with
University of Arizona
Agricultural Experiment Station

a dendritic pattern of shallow stream channels spaced at 50- to 200-foot intervals.

This soil has a profile similar to the one described as representative of the series, but it is 15 to 55 percent gravel.

Included with this soil in mapping are small areas of Antho sandy loam, 0 to 1 percent slopes; Maripo sandy loam; Brios sandy loam; and Valencia gravelly sandy loam. The total extent of all included soils does not exceed 15 percent.

Runoff is slow, and the erosion hazard is slight. The available water capacity is 5 to 7 inches.

About half the acreage of this Antho soil is cultivated. Cotton, alfalfa, sorghum, barley, and citrus are the chief crops. The rest of the acreage is grazed. Capability unit IIs–4 irrigated, subclass VIIs dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland.

Antho gravelly sandy loam, 1 to 3 percent slopes (AdB).—This gently sloping soil is on the upper part of alluvial fans. Slopes are 1 to 3 percent and convex. Runoff is medium, and the erosion hazard is moderate. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 50- to 150-foot intervals. Areas are long and narrow and about 10 acres in size. They parallel stream channels.

This soil has a profile similar to the one described as representative of the series, but it is 15 to 35 percent gravel.

Included with this soil in mapping are small areas of Valencia gravelly sandy loam; Rillito sandy loam, 1 to 3 percent slopes; Carrizo gravelly sandy loam; and Coolidge gravelly sandy loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

None of the acreage of this Antho soil is cultivated. It provides some grazing. Capability unit IIe–4 irrigated, subclass VIIe dryland; Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland.

Antho-Brios sandy loams (Ae).—This nearly level mapping unit is on broad alluvial fans and in the bottoms of broad intermittent stream channels. Slopes are less than 1 percent. Runoff is slow, and the erosion hazard is slight. Surface drainage is provided by a dendritic pattern of shallow stream channels spaced at 20- to 100-foot intervals. Areas are long and narrow and about 30 acres in size.

This mapping unit is about 45 percent Antho sandy loam, 0 to 1 percent slopes; 25 percent Brios sandy loam; and 20 percent Maripo sandy loam. The Brios soil occurs as long strips, 10 to 50 feet wide, that meander through larger areas of Antho soils. These strips form a braided pattern. The Maripo soil is in transitional areas between Brios and Antho soils. Included in mapping are a few small areas of Carrizo gravelly sandy loam, Gilman fine sandy loam, Agualt loam, and Valencia sandy loam. These included soils make up about 10 percent of the mapping unit.

Only about half the acreage is cultivated, and this acreage is within fields of better soils. The rest is grazed. Irrigated crops are cotton, alfalfa, sorghum, and grapes. Capability unit IIIs–7 irrigated, subclass VIIs dryland. Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland. Brios soil in Sandy Bottom range site; horticultural group 1; wildlife habitat group 4 irrigated, 11 dryland.

Antho-Carrizo complex, 0 to 1 percent slopes (AfA).—This nearly level mapping unit is on long, narrow stream terraces that parallel stream channels, and it is cut by one or more meandering channels. Slopes are generally less than 1 percent. Runoff is slow, and the erosion hazard is slight. About 30 to 40 percent of the surface area is covered with gravel. Areas range from 10 to 50 acres in size.

This mapping unit is about 50 percent Antho sandy loam, 0 to 1 percent slopes, and 30 percent Carrizo gravelly sandy loam. The Carrizo soil is in old stream channels that meander through larger areas of Antho soils. These channels are 2 to 5 feet above the present stream channel and ½ foot to 2 feet above the rest of the area. They form a braided pattern.

Included with this unit in mapping are small areas of Maripo sandy loam, Valencia sandy loam, Vint fine sandy loam, and Gilman fine sandy loam. The total extent of all included soils seldom exceeds 20 percent.

This mapping unit is sometimes used as range following seasonal rains. Few areas are cultivated. Irrigated crops are cotton, alfalfa, and citrus. Capability unit IVs–7 irrigated, subclass VIIs dryland. Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 2 irrigated, 11 dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 6 irrigated, 12 dryland.

Antho-Carrizo complex, 1 to 3 percent slopes (AfB).—This gently sloping mapping unit is on broad alluvial fans near the base of mountains. The largest area is in the Harquahala Valley near the base of the Big Horn Mountains. Slopes range from 1 to 3 percent but are dominantly 1½ to 2 percent. Runoff is medium, and the erosion hazard is moderate. About 30 to 40 percent of the surface area is covered with gravel and cobbles. Areas are oval in shape and range from 10 to 200 acres in size.

This mapping unit is about 40 percent Antho sandy loam, 1 to 3 percent slopes; 25 percent a Carrizo gravelly sandy loam that has 1 to 3 percent slopes; and 20 percent Maripo sandy loam that has 1 to 3 percent slopes. These soils have profiles similar to the ones described as representative of their respective series, but in some areas the Antho soil has a gravelly and cobbly stratum below a depth of 40 inches and the Maripo soil is gravelly throughout. The Carrizo soil occurs as long, narrow strips in old stream channels that meander through larger areas of Antho soils. These strips form a braided pattern. The Maripo soil is in transitional areas between Antho and Carrizo soils.

Included with this unit in mapping are small areas of Valencia gravelly sandy loam and Rillito sandy loam, 1 to 3 percent slopes. The total extent of all included soils seldom exceeds 15 percent.

This mapping unit is grazed. None of the acreage is cultivated. Capability subclass VIIe dryland; Antho soil in Loam Upland range site; horticultural group 1; wildlife habitat group 11 dryland. Carrizo soil in Sandy Bottom range site; horticultural group 4; wildlife habitat group 12 dryland.

Antho-Carrizo complex, 0 to 3 percent slopes (AGB).—This nearly level to gently sloping mapping unit is on alluvial fans that are 1 to 3 miles from the mountains and in some of the broader stream channels. Slopes are

TABLE 5.—*Estimates of soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil that may that appear in the first column.

Soil series and map symbols	Hydrologic group	Depth from surface	Dominant USDA texture	Classification		Coarse fraction greater than 3 inches in diameter
				Unified	AASHTO	
		Inches				
Agualt:[1] Aa	B	0–27	Loam	ML	A–4	0
		27–60	Sand	SP	A–3	0
*Antho: AbA, AbB, AdA, AdB, Ae, AfA, AfB, AGB, AHC, AkB, AL, AM. For Brios part of Ae; Carrizo part of AfA, AfB, AGB; Tremant part of AHC, AkB; Mohall part of AkB; and Valencia part of AM; see their respective series.	B	0–60	Sandy loam or gravelly sandy loam.	SM	A–2	0
Ac	B	0–60	Sandy loam or gravelly sandy loam.	SM	A–2 or A–4	0
Avonda: An	B	0–13	Clay loam	CL	A–6	0
		13–27	Loam	ML	A–4	0
		27–60	Loamy coarse sand	SP or SM	A–3	0
Avondale:						
Ao	B	0–12	Clay loam	CL	A–6	0
		12–60	Loam	ML	A–4	0
Ap	B	0–12	Clay loam	CL	A–6	0
		12–60	Loam	ML	A–4	0
Beardsley: BE	C	0–36	Clay	CH	A–7	0
		36	Indurated silica-lime cemented hardpan.			
Brios:[1] Br, Bs, Bt	A	0–14	Sandy loam	SM	A–2	0
		14–60	Sand and gravelly sand	SP	A–1	0–5
*Calciorthids: CA2. For Torriorthents part, see Torriorthents. Too variable to be estimated.						
*Carrizo:[1] Cb, CeD, CF	A	0–5	Gravelly sandy loam	SM	A–1 or A–2	0–25
For Ebon part of CeD and Brios part of CF, see their respective series.		5–60	Very gravelly coarse sand	GW–GM, SW–SM	A–1	0–25
*Casa Grande: Cg, Ch, Ck, Cm	C	0–23	Clay loam	CL	A–6	0
For Laveen part of Cm, see Laveen series.		23–60	Loam and sandy loam	ML	A–4	0
Cashion: Cn	D	0–27	Clay	CL or CH	A–7 or A–6	0
		27–60	Loam, silt loam, and very fine sandy loam.	ML	A–4	0
*Cherioni: CO	D	0–6	Very gravelly loam	GM	A–1 or A–2	0–15
No valid estimate can be made for Rock outcrop part.		6–12	Silica-lime cemented hardpan bedrock.			
*Coolidge: Cp, CrB, Cs, CV	B	0–24	Sandy loam	SM	A–2	0
For Tremant part of Cs and Laveen part of CV, see their respective series.		24–60	Sandy loam	SC	A–2 or A–4	0
Dune land: Dn. No valid estimate can be made.						
*Ebon: EbD, EPD	C	0–38	Very cobbly clay	GC or CH	A–2 or A–7	30–85
For Pinamt part, see Pinamt series.		38–60	Very cobbly sandy clay loam.	GC	A–2	30–55

See footnotes at end of table.

significant in engineering

have different properties and limitations. For this reason it is necessary to follow carefully the instructions for referring to other series The symbol > means more than]

Percentage of material less than 3 inches in diameter passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Risk of corrosion to—	
No. 4	No. 10	No. 40	No. 200								Uncoated steel	Concrete
						Inches per hour	*Inches per inch of soil*	*pH*	*Millimhos per centimeter*			
-------	100	85–95	55–65	25–35	0–5	0. 6–2. 0	0. 15–0. 18	7. 9–8. 4	1–2	Low------	High------	Low.
95–100	85–95	55–65	0–3	-------	[2]NP	>20. 0	0. 05–0. 07	7. 9–8. 4	1–2	Low------	High------	Low.
80–100	50–75	50–60	15–30	-------	NP	2. 0–6. 0	0. 08–0. 12	7. 9–8. 4	1–2	Low------	High------	Low.
80–100	50–75	50–60	15–30	-------	NP	2. 0–6. 0	0. 08–0. 12	8. 5–9. 0	4–8	Low------	High------	High.
-------	100	90–100	70–80	30–35	11–15	0. 2–0. 6	0. 19–0. 20	7. 9–8. 4	1–2	Moderate--	High [3]-----	Low.
-------	100	95–100	55–65	25–35	NP–10	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	1–2	Low------	High------	Low.
85–95	75–90	55–65	0–10	-------	NP	6. 0–20. 0	0. 05–0. 07	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	90–100	70–80	30–35	11–15	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	1–2	Moderate--	High [3]-----	Low.
-------	100	85–95	55–65	25–35	NP–5	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	1–2	Low------	High------	Low.
-------	100	90–100	70–80	30–35	11–15	0. 2–0. 6	0. 19–0. 21	7. 9–8. 4	4–40	Moderate--	High------	High.
-------	100	85–95	55–65	25–35	NP–5	0. 6–2. 0	0. 15–0. 17	7. 9–8. 4	4–40	Low------	High------	High.
-------	100	80–90	70–80	50–60	30–40	0. 06–0. 2	0. 14–0. 16	7. 9–8. 4	1–4	High------	High------	Moderate.
95–100	85–95	50–60	25–35	-------	NP	2. 0–6. 0	0. 10–0. 12	7. 9–8. 4	1–2	Low------	Moderate--	Moderate.
70–90	50–70	30–40	0–10	-------	NP	6. 0–20. 0	0. 05–0. 07	7. 9–8. 4	1–2	Low------	Moderate--	Low.
80–95	75–85	40–50	20–30	-------	NP	2. 0–6. 0	0. 07–0. 09	7. 9–8. 4	1–2	Low------	Low------	Low.
40–60	30–50	5–40	5–10	-------	NP	>20. 0	0. 03–0. 05	7. 9–8. 4	1–2	Low------	Low------	Low.
100	95–100	80–90	65–75	30–40	15–25	0. 06–0. 2	0. 14–0. 16	8. 5–9. 6	4–8	Moderate-	High------	High.
100	95–100	65–75	50–60	30–40	5–10	0. 2–0. 6	0. 11–0. 13	8. 5–9. 6	4–15	Low------	High------	High.
-------	100	90–100	80–95	36–55	15–30	0. 06–0. 2	0. 14–0. 16	7. 9–8. 9	4–15	High------	High------	Moderate.
-------	100	85–95	60–75	25–35	NP–5	0. 6–2. 0	0. 16–0. 18	7. 9–8. 9	4–15	Low------	High------	Low.
40–65	30–50	20–40	15–30	20–30	NP–5	0. 6–2. 0	0. 10–0. 12	7. 9–8. 4	1–4	Low------	High------	Low.
95–100	85–95	60–70	25–35	25–30	2–4	2. 0–6. 0	0. 11–0. 13	7. 9–8. 4	1–2	Low------	High------	Low.
95–100	80–90	60–70	30–45	25–30	8–10	2. 0–6. 0	0. 10–0. 12	7. 9–8. 4	2–4	Low------	High------	Low.
30–75	25–70	20–65	15–60	41–60	20–40	0. 06–0. 2	0. 08–0. 10	7. 9–8. 4	1–2	Moderate-	High------	Low.
30–75	25–70	25–50	15–35	30–40	11–20	0. 2–0. 6	0. 05–0. 08	7. 9–8. 4	1–2	Low------	High------	Low.

MARICOPA COUNTY, ARIZONA, CENTRAL PART — SHEET NUMBER 11

HEC-RAS
VISION HILL ESTATES CHANNEL

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: VHEchannel_FINAL_Rev
Project File : VHEchannel_FINAL_Rev.prj
Run Date and Time: 7/14/2014 8:38:54 AM

Project in English units

Project Description:
VHE HEC-RAS model created to assess the potential for scour at the Vision Hill Estates subdivision channel outlet to the dry side embankment of the south Scatter Wash Levee.
Created by Yichun XU, AMEC, in support of the Scatter Wash Levee Certification Project

FCD Contract Number: 2011C005
WA#14

Scatter Wash Levees Near W. 39th Avenue and SR L101
North Levee ID#
1901064146 and South Levee ID # 1901064147

Latest run date: July 13, 2014

PLAN DATA

Plan Title: VHEchannel
Plan File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Vision Hill Estates Channel\VHEchannel_FINAL_Rev.p01

Geometry Title: VHEchannel
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Vision Hill Estates Channel\VHEchannel_FINAL_Rev.g01

Flow Title : VHEchannel
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Vision Hill Estates Channel\VHEchannel_FINAL_Rev.f01

Plan Description:
Vission Hill Estates Hydraulic Analysis
Existing Condition

Plan Summary Information:
Number of: Cross Sections = 9 Multiple Openings = 0
Culverts = 0 Inline Structures = 0
Bridges = 0 Lateral Structures = 0

Computational Information
Water surface calculation tolerance = 0.01
Critical depth calculation tolerance = 0.01
Maximum number of iterations = 20
Maximum difference tolerance = 0.3
Flow tolerance factor = 0.001

Computation Options
Critical depth computed only where necessary
Conveyance Calculation Method: At breaks in n values only
Friction Slope Method: Average Conveyance
Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: VHEchannel
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Vision Hill Estates Channel\VHEchannel_FINAL_Rev.f01

Flow Data (cfs)

River	Reach	RS	10-yr flow	25-yr flow	50-yr flow
VHE_Channel	VHE_Channel	275.7796	20.9	28.9	36.4

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
VHE_Channel	VHE_Channel	10-yr flow	Normal S = 0.0076	Normal S = 0.0707
VHE_Channel	VHE_Channel	25-yr flow	Normal S = 0.0076	Normal S = 0.0707

GEOMETRY DATA

Geometry Title: VHEchannel
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Vision Hill Estates Channel\VHEchannel_FINAL_Rev.g01

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 275.7796

INPUT
Description:
Station Elevation Data num= 17

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1337.58	7.35	1337.71	8.3	1337.55	8.43	1337.46	11.17	1336.48
12.6	1335.94	15.96	1334.69	16.69	1334.4	22.42	1334.42	23.21	1334.43
23.95	1334.74	24.6	1335	27.31	1336.09	29.13	1336.44	30.18	1336.53
32.99	1336.58	36.68	1336.52						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	8.3	.028	29.13	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.3	29.13	25	25	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.36	Element			
Vel Head (ft)	0.14	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.22	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		6.92	
E.G. Slope (ft/ft)	0.005951	Area (sq ft)		6.92	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	10.62	Top Width (ft)		10.62	
Vel Total (ft/s)	3.02	Avg. Vel. (ft/s)		3.02	
Max Chl Dpth (ft)	0.82	Hydr. Depth (ft)		0.65	
Conv. Total (cfs)	270.9	Conv. (cfs)		270.9	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		10.93	
Min Ch El (ft)	1334.40	Shear (lb/sq ft)		0.24	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.00	0.03	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.04	0.00

CROSS SECTION OUTPUT Profile #25-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.56	Element			
Vel Head (ft)	0.17	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.39	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		8.75	
E.G. Slope (ft/ft)	0.005809	Area (sq ft)		8.75	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	11.48	Top Width (ft)		11.48	
Vel Total (ft/s)	3.30	Avg. Vel. (ft/s)		3.30	
Max Chl Dpth (ft)	0.99	Hydr. Depth (ft)		0.76	
Conv. Total (cfs)	379.2	Conv. (cfs)		379.2	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		11.85	
Min Ch El (ft)	1334.40	Shear (lb/sq ft)		0.27	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.00	0.04	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.05	0.00

CROSS SECTION OUTPUT Profile #50-yr flow

E.G. Elev (ft)	1335.72	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.19	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.52	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		10.35	
E.G. Slope (ft/ft)	0.005709	Area (sq ft)		10.35	
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	12.18	Top Width (ft)		12.18	
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)		3.52	
Max Chl Dpth (ft)	1.12	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	481.7	Conv. (cfs)		481.7	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		12.60	
Min Ch El (ft)	1334.40	Shear (lb/sq ft)		0.29	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.12	Cum Volume (acre-ft)	0.00	0.04	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.05	0.00

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 250.7796

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1337.56	8.51	1337.66	9.41	1337.13	10.79	1336.35	12.59	1335.61
14.18	1334.95	15.97	1334.28	21.75	1334.28	23.58	1334.28	24.59	1334.83
26.69	1335.85	28.04	1336.53	29.88	1337.05	30.54	1337.2	36.68	1337.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	8.51	.028	30.54	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.51	30.54	25	25	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.13	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		8.09	
E.G. Slope (ft/ft)	0.003934	Area (sq ft)		8.09	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	11.46	Top Width (ft)		11.46	
Vel Total (ft/s)	2.58	Avg. Vel. (ft/s)		2.58	
Max Chl Dpth (ft)	0.85	Hydr. Depth (ft)		0.71	
Conv. Total (cfs)	333.2	Conv. (cfs)		333.2	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		11.82	
Min Ch El (ft)	1334.28	Shear (lb/sq ft)		0.17	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.00	0.02	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.04	0.00

CROSS SECTION OUTPUT Profile #25-yr flow

E.G. Elev (ft)	1335.43	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.13	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.30	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		10.10	
E.G. Slope (ft/ft)	0.003923	Area (sq ft)		10.10	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	12.22	Top Width (ft)		12.22	
Vel Total (ft/s)	2.86	Avg. Vel. (ft/s)		2.86	
Max Chl Dpth (ft)	1.02	Hydr. Depth (ft)		0.83	
Conv. Total (cfs)	461.4	Conv. (cfs)		461.4	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		12.65	
Min Ch El (ft)	1334.28	Shear (lb/sq ft)		0.20	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.00	0.03	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.04	0.00

CROSS SECTION OUTPUT Profile #50-yr flow

E.G. Elev (ft)	1335.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.44	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		11.83	
E.G. Slope (ft/ft)	0.003940	Area (sq ft)		11.83	
Q Total (cfs)	36.40	Flow (cfs)		36.40	

Top Width (ft)	12.83	Top Width (ft)		12.83	
Vel Total (ft/s)	3.08	Avg. Vel. (ft/s)		3.08	
Max Chl Dpth (ft)	1.16	Hydr. Depth (ft)		0.92	
Conv. Total (cfs)	579.9	Conv. (cfs)		579.9	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		13.33	
Min Ch El (ft)	1334.28	Shear (lb/sq ft)		0.22	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.00	0.03	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.04	0.00

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 225.7797

INPUT
Description:
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1337.55	1.75	1337.54	8.29	1337.58	10.2	1336.5	10.73	1336.19
12.3	1335.53	12.58	1335.41	16.11	1334.14	19.55	1334.14	23.48	1334.14
24.58	1334.8	27.23	1336.11	28.08	1336.53	29.34	1336.84	30.49	1337.15
36.68	1337.11								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	8.29	.028	30.49	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.29	30.49	25	25	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.14	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.05	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		8.50	
E.G. Slope (ft/ft)	0.003354	Area (sq ft)		8.50	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	11.48	Top Width (ft)		11.48	
Vel Total (ft/s)	2.46	Avg. Vel. (ft/s)		2.46	
Max Chl Dpth (ft)	0.90	Hydr. Depth (ft)		0.74	
Conv. Total (cfs)	360.9	Conv. (cfs)		360.9	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		11.88	
Min Ch El (ft)	1334.14	Shear (lb/sq ft)		0.15	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.00	0.02	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.03	0.00

CROSS SECTION OUTPUT Profile #25-yr flow

E.G. Elev (ft)	1335.33	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.12	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.21	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		10.50	
E.G. Slope (ft/ft)	0.003484	Area (sq ft)		10.50	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	12.29	Top Width (ft)		12.29	
Vel Total (ft/s)	2.75	Avg. Vel. (ft/s)		2.75	
Max Chl Dpth (ft)	1.07	Hydr. Depth (ft)		0.85	
Conv. Total (cfs)	489.6	Conv. (cfs)		489.6	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		12.76	
Min Ch El (ft)	1334.14	Shear (lb/sq ft)		0.18	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.00	0.02	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.03	0.00

CROSS SECTION OUTPUT Profile #50-yr flow

E.G. Elev (ft)	1335.49	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.35	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		12.22	
E.G. Slope (ft/ft)	0.003586	Area (sq ft)		12.22	
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	12.94	Top Width (ft)		12.94	
Vel Total (ft/s)	2.98	Avg. Vel. (ft/s)		2.98	
Max Chl Dpth (ft)	1.21	Hydr. Depth (ft)		0.94	
Conv. Total (cfs)	607.8	Conv. (cfs)		607.8	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		13.47	
Min Ch El (ft)	1334.14	Shear (lb/sq ft)		0.20	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	0.00	0.03	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.03	0.00

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 200.7794

INPUT
Description:
Station Elevation Data num= 18

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1337.42	2.58	1337.43	8.17	1337.47	9.96	1336.52	10.72	1336.15
12.57	1335.3	14.73	1334.3	15.7	1334	18.95	1334	21.03	1334
23.38	1334	24.24	1334.58	24.57	1334.74	27.85	1336.34	28.81	1336.61
30.44	1337.1	35.18	1337.12	36.68	1337.14				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	8.17	.028	30.44	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.17	30.44	25	25	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.06	Element			
Vel Head (ft)	0.07	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.99	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		9.74	
E.G. Slope (ft/ft)	0.002238	Area (sq ft)		9.74	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	11.85	Top Width (ft)		11.85	
Vel Total (ft/s)	2.15	Avg. Vel. (ft/s)		2.15	
Max Chl Dpth (ft)	0.99	Hydr. Depth (ft)		0.82	
Conv. Total (cfs)	441.8	Conv. (cfs)		441.8	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		12.32	
Min Ch El (ft)	1334.00	Shear (lb/sq ft)		0.11	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.00	0.01	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.02	0.00

CROSS SECTION OUTPUT Profile #25-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.25	Element			
Vel Head (ft)	0.09	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.16	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		11.74	
E.G. Slope (ft/ft)	0.002487	Area (sq ft)		11.74	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	12.54	Top Width (ft)		12.54	
Vel Total (ft/s)	2.46	Avg. Vel. (ft/s)		2.46	
Max Chl Dpth (ft)	1.16	Hydr. Depth (ft)		0.94	
Conv. Total (cfs)	579.5	Conv. (cfs)		579.5	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		13.09	
Min Ch El (ft)	1334.00	Shear (lb/sq ft)		0.14	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.00	0.02	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.02	0.00

CROSS SECTION OUTPUT Profile #50-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.40	Element			
Vel Head (ft)	0.11	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.29	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		13.44	
E.G. Slope (ft/ft)	0.002674	Area (sq ft)		13.44	
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	13.10	Top Width (ft)		13.10	
Vel Total (ft/s)	2.71	Avg. Vel. (ft/s)		2.71	
Max Chl Dpth (ft)	1.29	Hydr. Depth (ft)		1.03	
Conv. Total (cfs)	703.9	Conv. (cfs)		703.9	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		13.71	
Min Ch El (ft)	1334.00	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.00	0.02	0.00
C & E Loss (ft)	0.00	Cum SA (acres)	0.00	0.03	0.00

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 175.7794

INPUT

Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1337.21	8.18	1337.32	10.71	1336.1	10.74	1336.09	12.55	1335.17
15.44	1333.94	21.21	1333.94	23.63	1333.94	24.55	1334.63	26.52	1335.63
27.82	1336.28	29.89	1336.88	30.4	1337.03	36.15	1337.1	36.68	1337.1

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	8.18	.028	30.4	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.18	30.4	25	25	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.01	Element			
Vel Head (ft)	0.07	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.94	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		10.09	
E.G. Slope (ft/ft)	0.002044	Area (sq ft)		10.09	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	12.08	Top Width (ft)		12.08	
Vel Total (ft/s)	2.07	Avg. Vel. (ft/s)		2.07	
Max Chl Dpth (ft)	1.00	Hydr. Depth (ft)		0.84	
Conv. Total (cfs)	462.3	Conv. (cfs)		462.3	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		12.59	
Min Ch El (ft)	1333.94	Shear (lb/sq ft)		0.10	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.08	Cum Volume (acre-ft)	0.00	0.01	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.02	0.00

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

CROSS SECTION OUTPUT Profile #25-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.19	Element			
Vel Head (ft)	0.09	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.10	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		12.04	
E.G. Slope (ft/ft)	0.002346	Area (sq ft)		12.04	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	12.76	Top Width (ft)		12.76	
Vel Total (ft/s)	2.40	Avg. Vel. (ft/s)		2.40	
Max Chl Dpth (ft)	1.16	Hydr. Depth (ft)		0.94	
Conv. Total (cfs)	596.7	Conv. (cfs)		596.7	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		13.34	
Min Ch El (ft)	1333.94	Shear (lb/sq ft)		0.13	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	0.00	0.01	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.02	0.00

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

CROSS SECTION OUTPUT Profile #50-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.34	Element			
Vel Head (ft)	0.11	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.23	Reach Len. (ft)	25.00	25.00	25.00
Crit W.S. (ft)		Flow Area (sq ft)		13.70	
E.G. Slope (ft/ft)	0.002559	Area (sq ft)		13.70	
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	13.29	Top Width (ft)		13.29	
Vel Total (ft/s)	2.66	Avg. Vel. (ft/s)		2.66	
Max Chl Dpth (ft)	1.29	Hydr. Depth (ft)		1.03	
Conv. Total (cfs)	719.6	Conv. (cfs)		719.6	
Length Wtd. (ft)	25.00	Wetted Per. (ft)		13.93	
Min Ch El (ft)	1333.94	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.10	Cum Volume (acre-ft)	0.00	0.01	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.02	0.00

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

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 150.7795

INPUT
Description:
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1335.33	.55	1335.34	6.19	1336.67	8.4	1337.2	9.36	1336.86
10.72	1336.27	12.54	1335.51	14.99	1334.31	15.82	1334.03	18.37	1334.03
23.87	1334.03	24.54	1334.52	26.04	1335.3	27.86	1336.27	28.98	1336.59
30.49	1337.01	31.75	1336.87	34.31	1336.76	36.68	1336.26		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	8.4	.028	30.49	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
8.4	30.49	13.38	16.86	20.3	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1334.93	Element			
Vel Head (ft)	0.12	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.81	Reach Len. (ft)	13.38	16.86	20.30
Crit W.S. (ft)		Flow Area (sq ft)		7.46	
E.G. Slope (ft/ft)	0.004970	Area (sq ft)		7.46	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	11.11	Top Width (ft)		11.11	
Vel Total (ft/s)	2.80	Avg. Vel. (ft/s)		2.80	
Max Chl Dpth (ft)	0.78	Hydr. Depth (ft)		0.67	
Conv. Total (cfs)	296.5	Conv. (cfs)		296.5	
Length Wtd. (ft)	16.86	Wetted Per. (ft)		11.50	
Min Ch El (ft)	1334.03	Shear (lb/sq ft)		0.20	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.01	0.00

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

CROSS SECTION OUTPUT Profile #25-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.09	Element			
Vel Head (ft)	0.17	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.93	Reach Len. (ft)	13.38	16.86	20.30
Crit W.S. (ft)		Flow Area (sq ft)		8.84	
E.G. Slope (ft/ft)	0.005722	Area (sq ft)		8.84	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	11.60	Top Width (ft)		11.60	
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)		3.27	
Max Chl Dpth (ft)	0.90	Hydr. Depth (ft)		0.76	
Conv. Total (cfs)	382.0	Conv. (cfs)		382.0	
Length Wtd. (ft)	16.86	Wetted Per. (ft)		12.05	
Min Ch El (ft)	1334.03	Shear (lb/sq ft)		0.26	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.00	0.01	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.01	0.00

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

CROSS SECTION OUTPUT Profile #50-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.23	Element			
Vel Head (ft)	0.21	Wt. n-Val.		0.028	
W.S. Elev (ft)	1335.02	Reach Len. (ft)	13.38	16.86	20.30
Crit W.S. (ft)		Flow Area (sq ft)		9.97	
E.G. Slope (ft/ft)	0.006383	Area (sq ft)		9.97	
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	11.97	Top Width (ft)		11.97	
Vel Total (ft/s)	3.65	Avg. Vel. (ft/s)		3.65	
Max Chl Dpth (ft)	0.99	Hydr. Depth (ft)		0.83	
Conv. Total (cfs)	455.6	Conv. (cfs)		455.6	
Length Wtd. (ft)	16.86	Wetted Per. (ft)		12.47	
Min Ch El (ft)	1334.03	Shear (lb/sq ft)		0.32	
Alpha	1.00	Stream Power (lb/ft s)	36.68	0.00	0.00
Frctn Loss (ft)	0.15	Cum Volume (acre-ft)	0.00	0.01	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.01	0.00

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

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 133.9196

INPUT
Description: Weir Location, 6" Riprap
Station Elevation Data num= 19

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1337.39	.13	1337.39	1.22	1337.43	4.49	1337.45	4.84	1336.79
5.27	1336.53	8.8	1335.18	9.77	1334.81	11.67	1334.07	14.08	1334.11
19.99	1334.01	21.23	1334.14	22.46	1334.26	23.88	1334.9	24.61	1335.219
26.83	1336.19	26.92	1336.21	27.45	1336.6	27.94	1336.87		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.028	4.49	.028	27.94	.028

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
4.49	27.94	5.06	5.47	5.92	.1	.3

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1334.78	Element			
Vel Head (ft)	0.22	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.56	Reach Len. (ft)	5.06	5.47	5.92
Crit W.S. (ft)	1334.56	Flow Area (sq ft)		5.54	
E.G. Slope (ft/ft)	0.015578	Area (sq ft)		5.54	
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	12.71	Top Width (ft)		12.71	
Vel Total (ft/s)	3.77	Avg. Vel. (ft/s)		3.77	
Max Chl Dpth (ft)	0.55	Hydr. Depth (ft)		0.44	
Conv. Total (cfs)	167.5	Conv. (cfs)		167.5	
Length Wtd. (ft)	5.45	Wetted Per. (ft)		12.88	
Min Ch El (ft)	1334.01	Shear (lb/sq ft)		0.42	
Alpha	1.00	Stream Power (lb/ft s)	27.94	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.02	Cum SA (acres)	0.00	0.01	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.

CROSS SECTION OUTPUT Profile #25-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1334.94	Element			
Vel Head (ft)	0.27	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.67	Reach Len. (ft)	5.06	5.47	5.92
Crit W.S. (ft)	1334.67	Flow Area (sq ft)		6.97	
E.G. Slope (ft/ft)	0.014687	Area (sq ft)		6.97	
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	13.24	Top Width (ft)		13.24	
Vel Total (ft/s)	4.15	Avg. Vel. (ft/s)		4.15	
Max Chl Dpth (ft)	0.66	Hydr. Depth (ft)		0.53	
Conv. Total (cfs)	238.5	Conv. (cfs)		238.5	
Length Wtd. (ft)	5.45	Wetted Per. (ft)		13.46	
Min Ch El (ft)	1334.01	Shear (lb/sq ft)		0.47	
Alpha	1.00	Stream Power (lb/ft s)	27.94	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	0.01	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.

CROSS SECTION OUTPUT Profile #50-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.07	Element			
Vel Head (ft)	0.30	Wt. n-Val.		0.028	
W.S. Elev (ft)	1334.77	Reach Len. (ft)	5.06	5.47	5.92
Crit W.S. (ft)	1334.77	Flow Area (sq ft)		8.25	
E.G. Slope (ft/ft)	0.013912	Area (sq ft)		8.25	
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	13.70	Top Width (ft)		13.70	
Vel Total (ft/s)	4.41	Avg. Vel. (ft/s)		4.41	
Max Chl Dpth (ft)	0.76	Hydr. Depth (ft)		0.60	
Conv. Total (cfs)	308.6	Conv. (cfs)		308.6	

Length Wtd. (ft)	5.45	Wetted Per. (ft)		13.95	
Min Ch El (ft)	1334.01	Shear (lb/sq ft)		0.51	
Alpha	1.00	Stream Power (lb/ft s)	27.94	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	0.01	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 128.4475

INPUT
Description: 6" Riprap within the bank stations
Station Elevation Data num= 14

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1334.5	.1	1334.01	5	1333.85	7.25	1333.86	7.81	1333.853
9.51	1333.831	11.82	1333.8	14.91	1333.77	21.8	1333.68	23.89	1333.69
24.89	1333.7	30.13	1333.69	30.5	1333.69	35.22	1333.69		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	9.5	.022	30.5	.022

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9.5	30.5	4.09	5.37	6.66	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	5.3	1334.5	F
30.5	35.22	1334.5	F

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1334.17	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.	0.022	0.022	
W.S. Elev (ft)	1334.03	Reach Len. (ft)	4.09	5.37	6.66
Crit W.S. (ft)	1334.03	Flow Area (sq ft)	0.74	6.23	
E.G. Slope (ft/ft)	0.010606	Area (sq ft)	1.27	6.23	1.59
Q Total (cfs)	20.90	Flow (cfs)	1.63	19.27	
Top Width (ft)	35.12	Top Width (ft)	9.40	21.00	4.72
Vel Total (ft/s)	3.00	Avg. Vel. (ft/s)	2.19	3.09	
Max Chl Dpth (ft)	0.35	Hydr. Depth (ft)	0.18	0.30	
Conv. Total (cfs)	202.9	Conv. (cfs)	15.8	187.2	
Length Wtd. (ft)	5.32	Wetted Per. (ft)	4.20	21.00	
Min Ch El (ft)	1333.68	Shear (lb/sq ft)	0.12	0.20	
Alpha	1.02	Stream Power (lb/ft s)	35.22	0.00	0.00
Frctn Loss (ft)	0.06	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.00	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-yr flow

E.G. Elev (ft)	1334.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.17	Wt. n-Val.	0.022	0.022	
W.S. Elev (ft)	1334.10	Reach Len. (ft)	4.09	5.37	6.66
Crit W.S. (ft)	1334.10	Flow Area (sq ft)	1.05	7.79	
E.G. Slope (ft/ft)	0.009300	Area (sq ft)	1.97	7.79	1.94
Q Total (cfs)	28.90	Flow (cfs)	2.73	26.17	
Top Width (ft)	35.14	Top Width (ft)	9.42	21.00	4.72
Vel Total (ft/s)	3.27	Avg. Vel. (ft/s)	2.59	3.36	
Max Chl Dpth (ft)	0.42	Hydr. Depth (ft)	0.25	0.37	
Conv. Total (cfs)	299.7	Conv. (cfs)	28.3	271.4	
Length Wtd. (ft)	5.31	Wetted Per. (ft)	4.20	21.00	
Min Ch El (ft)	1333.68	Shear (lb/sq ft)	0.15	0.22	
Alpha	1.02	Stream Power (lb/ft s)	35.22	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.00	0.00	0.00

C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.00	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-yr flow

E.G. Elev (ft)	1334.36	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.20	Wt. n-Val.	0.022	0.022	
W.S. Elev (ft)	1334.16	Reach Len. (ft)	4.09	5.37	6.66
Crit W.S. (ft)	1334.16	Flow Area (sq ft)	1.28	8.93	
E.G. Slope (ft/ft)	0.009163	Area (sq ft)	2.48	8.93	2.20
Q Total (cfs)	36.40	Flow (cfs)	3.76	32.64	
Top Width (ft)	35.15	Top Width (ft)	9.43	21.00	4.72
Vel Total (ft/s)	3.56	Avg. Vel. (ft/s)	2.93	3.66	
Max Chl Dpth (ft)	0.48	Hydr. Depth (ft)	0.31	0.43	
Conv. Total (cfs)	380.3	Conv. (cfs)	39.3	341.0	
Length Wtd. (ft)	5.30	Wetted Per. (ft)	4.20	21.00	
Min Ch El (ft)	1333.68	Shear (lb/sq ft)	0.17	0.24	
Alpha	1.01	Stream Power (lb/ft s)	35.22	0.00	0.00
Frctn Loss (ft)	0.05	Cum Volume (acre-ft)	0.00	0.00	0.00
C & E Loss (ft)	0.01	Cum SA (acres)	0.00	0.00	0.00

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The cross-section end points had to be extended vertically for the computed water surface.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: VHE_Channel
REACH: VHE_Channel RS: 123.0729

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1334.17	5.6	1333.93	13.47	1333.59	20.55	1333.55	22.28	1333.51
25.86	1333.44	30.04	1333.35	34.28	1333.34	38.38	1333.33	40.8	1333.32
42.9	1333.3	47.31	1333.296	54.18	1333.29				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.022	0	.022	47.3	.022

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	47.3	110.09	123.08	136.73	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	9.3	1334.5	F
47.3	54.18	1334.5	F

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1333.75	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.022	
W.S. Elev (ft)	1333.64	Reach Len. (ft)			
Crit W.S. (ft)	1333.64	Flow Area (sq ft)		7.79	
E.G. Slope (ft/ft)	0.011704	Area (sq ft)		7.79	2.39
Q Total (cfs)	20.90	Flow (cfs)		20.90	
Top Width (ft)	41.87	Top Width (ft)		34.99	6.88
Vel Total (ft/s)	2.68	Avg. Vel. (ft/s)		2.68	
Max Chl Dpth (ft)	0.35	Hydr. Depth (ft)		0.22	
Conv. Total (cfs)	193.2	Conv. (cfs)		193.2	
Length Wtd. (ft)		Wetted Per. (ft)		34.99	
Min Ch El (ft)	1333.30	Shear (lb/sq ft)		0.16	
Alpha	1.00	Stream Power (lb/ft s)	54.18	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #25-yr flow

E.G. Elev (ft)	1333.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.14	Wt. n-Val.		0.022	
W.S. Elev (ft)	1333.69	Reach Len. (ft)			
Crit W.S. (ft)	1333.69	Flow Area (sq ft)		9.70	
E.G. Slope (ft/ft)	0.011277	Area (sq ft)		9.70	2.76
Q Total (cfs)	28.90	Flow (cfs)		28.90	
Top Width (ft)	43.11	Top Width (ft)		36.23	6.88
Vel Total (ft/s)	2.98	Avg. Vel. (ft/s)		2.98	
Max Chl Dpth (ft)	0.40	Hydr. Depth (ft)		0.27	
Conv. Total (cfs)	272.1	Conv. (cfs)		272.1	
Length Wtd. (ft)		Wetted Per. (ft)		36.23	
Min Ch El (ft)	1333.30	Shear (lb/sq ft)		0.19	
Alpha	1.00	Stream Power (lb/ft s)	54.18	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #50-yr flow

E.G. Elev (ft)	1333.90	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.15	Wt. n-Val.		0.022	
W.S. Elev (ft)	1333.75	Reach Len. (ft)			
Crit W.S. (ft)	1333.75	Flow Area (sq ft)		11.69	
E.G. Slope (ft/ft)	0.010041	Area (sq ft)		11.69	3.13
Q Total (cfs)	36.40	Flow (cfs)		36.40	
Top Width (ft)	44.36	Top Width (ft)		37.48	6.88
Vel Total (ft/s)	3.11	Avg. Vel. (ft/s)		3.11	
Max Chl Dpth (ft)	0.46	Hydr. Depth (ft)		0.31	
Conv. Total (cfs)	363.3	Conv. (cfs)		363.3	
Length Wtd. (ft)		Wetted Per. (ft)		37.49	
Min Ch El (ft)	1333.30	Shear (lb/sq ft)		0.20	
Alpha	1.00	Stream Power (lb/ft s)	54.18	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Warning: Slope too steep for slope area to converge during supercritical flow calculations (normal depth is below critical depth).
Water surface set to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

SUMMARY OF MANNING'S N VALUES

River:VHE_Channel

Reach	River Sta.	n1	n2	n3
VHE_Channel	275.7796	.028	.028	.028
VHE_Channel	250.7796	.028	.028	.028
VHE_Channel	225.7797	.028	.028	.028
VHE_Channel	200.7794	.028	.028	.028
VHE_Channel	175.7794	.028	.028	.028
VHE_Channel	150.7795	.028	.028	.028
VHE_Channel	133.9196	.028	.028	.028
VHE_Channel	128.4475	.022	.022	.022
VHE_Channel	123.0729	.022	.022	.022

SUMMARY OF REACH LENGTHS

River: VHE_Channel

Reach	River Sta.	Left	Channel	Right
VHE_Channel	275.7796	25	25	25
VHE_Channel	250.7796	25	25	25
VHE_Channel	225.7797	25	25	25

VHE_Channel	200.7794	25	25	25
VHE_Channel	175.7794	25	25	25
VHE_Channel	150.7795	13.38	16.86	20.3
VHE_Channel	133.9196	5.06	5.47	5.92
VHE_Channel	128.4475	4.09	5.37	6.66
VHE_Channel	123.0729	110.09	123.08	136.73

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: VHE_Channel

Reach	River Sta.	Contr.	Expan.
VHE_Channel	275.7796	.1	.3
VHE_Channel	250.7796	.1	.3
VHE_Channel	225.7797	.1	.3
VHE_Channel	200.7794	.1	.3
VHE_Channel	175.7794	.1	.3
VHE_Channel	150.7795	.1	.3
VHE_Channel	133.9196	.1	.3
VHE_Channel	128.4475	.1	.3
VHE_Channel	123.0729	.1	.3

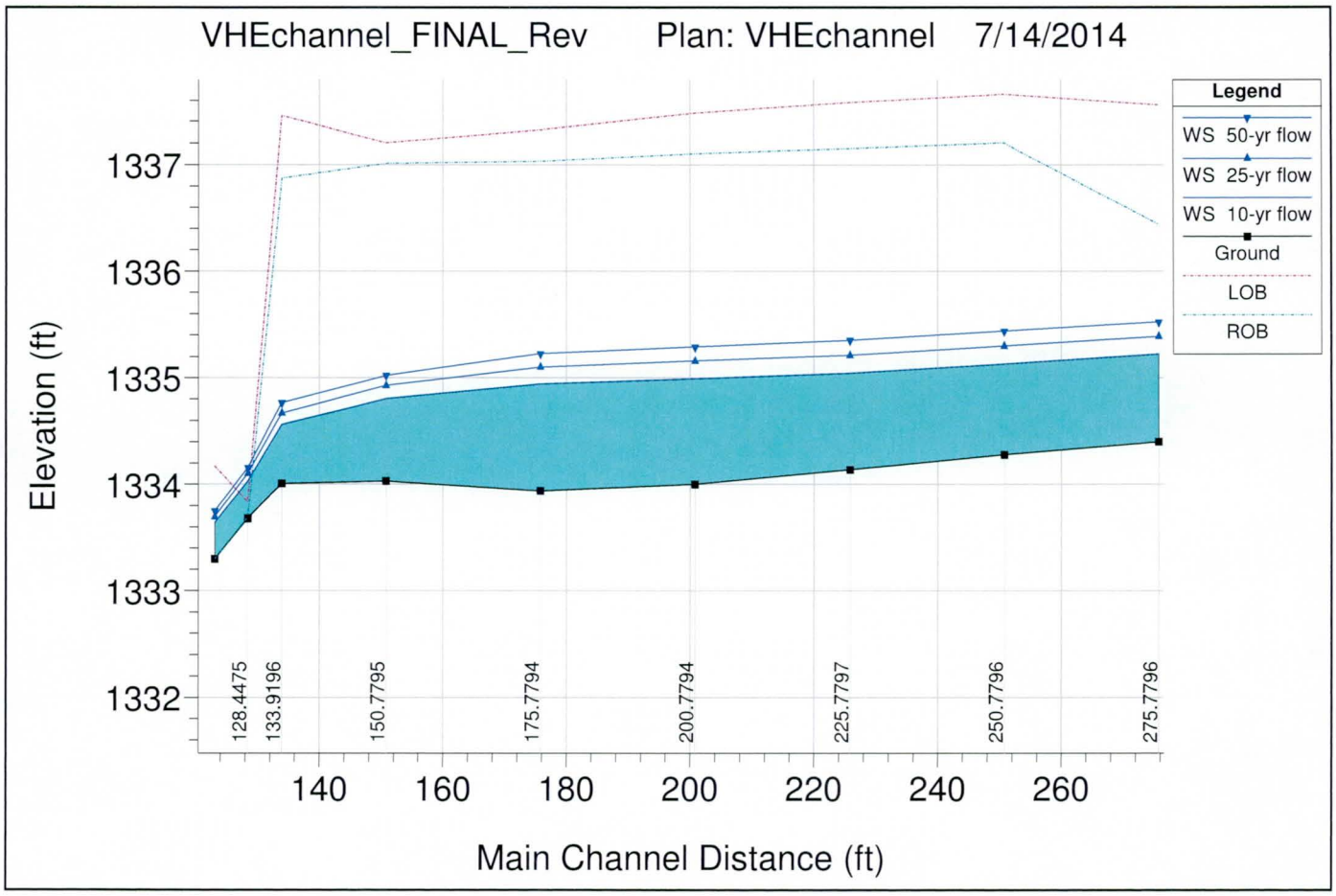
HEC-RAS Plan: VHEchannel River: VHE_Channel Reach: VHE_Channel

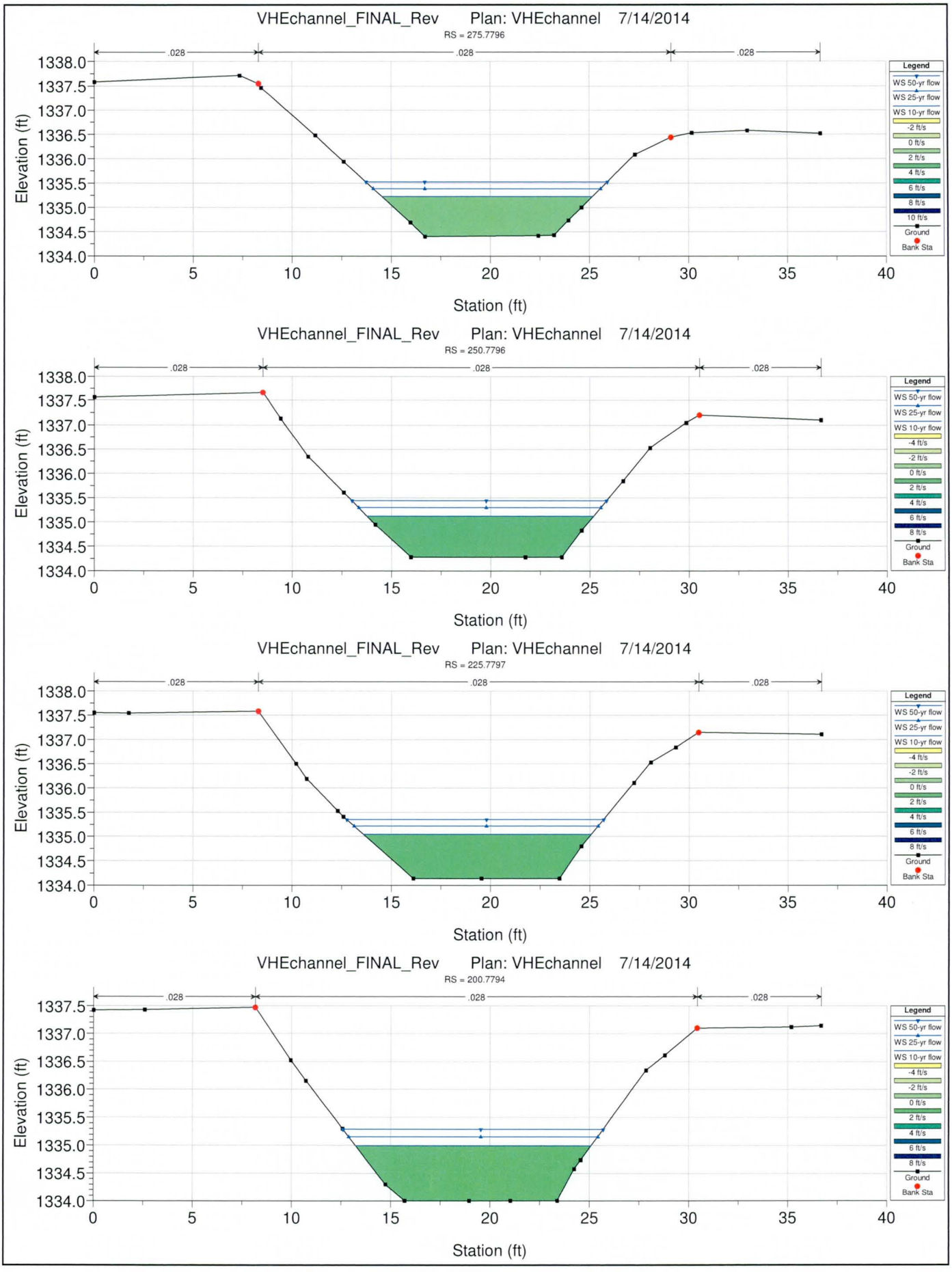
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
VHE_Channel	275.7796	10-yr flow	20.90	1334.40	1335.22		1335.36	0.005951	3.02	6.92	10.62	0.66
VHE_Channel	275.7796	25-yr flow	28.90	1334.40	1335.39		1335.56	0.005809	3.30	8.75	11.48	0.67
VHE_Channel	275.7796	50-yr flow	36.40	1334.40	1335.52		1335.72	0.005709	3.52	10.35	12.18	0.67
VHE_Channel	250.7796	10-yr flow	20.90	1334.28	1335.13		1335.23	0.003934	2.58	8.09	11.46	0.54
VHE_Channel	250.7796	25-yr flow	28.90	1334.28	1335.30		1335.43	0.003923	2.86	10.10	12.22	0.55
VHE_Channel	250.7796	50-yr flow	36.40	1334.28	1335.44		1335.58	0.003940	3.08	11.83	12.83	0.56
VHE_Channel	225.7797	10-yr flow	20.90	1334.14	1335.05		1335.14	0.003354	2.46	8.50	11.48	0.50
VHE_Channel	225.7797	25-yr flow	28.90	1334.14	1335.21		1335.33	0.003484	2.75	10.50	12.29	0.52
VHE_Channel	225.7797	50-yr flow	36.40	1334.14	1335.35		1335.49	0.003586	2.98	12.22	12.94	0.54
VHE_Channel	200.7794	10-yr flow	20.90	1334.00	1334.99		1335.06	0.002238	2.15	9.74	11.85	0.42
VHE_Channel	200.7794	25-yr flow	28.90	1334.00	1335.16		1335.25	0.002487	2.46	11.74	12.54	0.45
VHE_Channel	200.7794	50-yr flow	36.40	1334.00	1335.29		1335.40	0.002674	2.71	13.44	13.10	0.47
VHE_Channel	175.7794	10-yr flow	20.90	1333.94	1334.94		1335.01	0.002044	2.07	10.09	12.08	0.40
VHE_Channel	175.7794	25-yr flow	28.90	1333.94	1335.10		1335.19	0.002346	2.40	12.04	12.76	0.44
VHE_Channel	175.7794	50-yr flow	36.40	1333.94	1335.23		1335.34	0.002559	2.66	13.70	13.29	0.46
VHE_Channel	150.7795	10-yr flow	20.90	1334.03	1334.81		1334.93	0.004970	2.80	7.46	11.11	0.60
VHE_Channel	150.7795	25-yr flow	28.90	1334.03	1334.93		1335.09	0.005722	3.27	8.84	11.60	0.66
VHE_Channel	150.7795	50-yr flow	36.40	1334.03	1335.02		1335.23	0.006383	3.65	9.97	11.97	0.71
VHE_Channel	133.9196	10-yr flow	20.90	1334.01	1334.56	1334.56	1334.78	0.015578	3.77	5.54	12.71	1.01
VHE_Channel	133.9196	25-yr flow	28.90	1334.01	1334.67	1334.67	1334.94	0.014687	4.15	6.97	13.24	1.01
VHE_Channel	133.9196	50-yr flow	36.40	1334.01	1334.77	1334.77	1335.07	0.013912	4.41	8.25	13.70	1.00
VHE_Channel	128.4475	10-yr flow	20.90	1333.68	1334.03	1334.03	1334.17	0.010606	3.09	6.97	35.12	1.00
VHE_Channel	128.4475	25-yr flow	28.90	1333.68	1334.10	1334.10	1334.27	0.009300	3.36	8.84	35.14	0.97
VHE_Channel	128.4475	50-yr flow	36.40	1333.68	1334.16	1334.16	1334.36	0.009163	3.66	10.21	35.15	0.99
VHE_Channel	123.0729	10-yr flow	20.90	1333.30	1333.64	1333.64	1333.75	0.011704	2.68	7.79	41.87	1.00
VHE_Channel	123.0729	25-yr flow	28.90	1333.30	1333.69	1333.69	1333.83	0.011277	2.98	9.70	43.11	1.01
VHE_Channel	123.0729	50-yr flow	36.40	1333.30	1333.75	1333.75	1333.90	0.010041	3.11	11.69	44.36	0.98

HEC-RAS Plan: VHEchannel River: VHE_Channel Reach: VHE_Channel

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
VHE_Channel	275.7796	10-yr flow	1335.36	1335.22	0.14	0.12	0.01		20.90		10.62
VHE_Channel	275.7796	25-yr flow	1335.56	1335.39	0.17	0.12	0.01		28.90		11.48
VHE_Channel	275.7796	50-yr flow	1335.72	1335.52	0.19	0.12	0.01		36.40		12.18
VHE_Channel	250.7796	10-yr flow	1335.23	1335.13	0.10	0.09	0.00		20.90		11.46
VHE_Channel	250.7796	25-yr flow	1335.43	1335.30	0.13	0.09	0.00		28.90		12.22
VHE_Channel	250.7796	50-yr flow	1335.58	1335.44	0.15	0.09	0.00		36.40		12.83
VHE_Channel	225.7797	10-yr flow	1335.14	1335.05	0.09	0.07	0.01		20.90		11.48
VHE_Channel	225.7797	25-yr flow	1335.33	1335.21	0.12	0.07	0.01		28.90		12.29
VHE_Channel	225.7797	50-yr flow	1335.49	1335.35	0.14	0.08	0.01		36.40		12.94
VHE_Channel	200.7794	10-yr flow	1335.06	1334.99	0.07	0.05	0.00		20.90		11.85
VHE_Channel	200.7794	25-yr flow	1335.25	1335.16	0.09	0.06	0.00		28.90		12.54
VHE_Channel	200.7794	50-yr flow	1335.40	1335.29	0.11	0.07	0.00		36.40		13.10
VHE_Channel	175.7794	10-yr flow	1335.01	1334.94	0.07	0.08	0.01		20.90		12.08
VHE_Channel	175.7794	25-yr flow	1335.19	1335.10	0.09	0.09	0.01		28.90		12.76
VHE_Channel	175.7794	50-yr flow	1335.34	1335.23	0.11	0.10	0.01		36.40		13.29
VHE_Channel	150.7795	10-yr flow	1334.93	1334.81	0.12	0.14	0.01		20.90		11.11
VHE_Channel	150.7795	25-yr flow	1335.09	1334.93	0.17	0.15	0.01		28.90		11.60
VHE_Channel	150.7795	50-yr flow	1335.23	1335.02	0.21	0.15	0.01		36.40		11.97
VHE_Channel	133.9196	10-yr flow	1334.78	1334.56	0.22	0.07	0.02		20.90		12.71
VHE_Channel	133.9196	25-yr flow	1334.94	1334.67	0.27	0.06	0.03		28.90		13.24
VHE_Channel	133.9196	50-yr flow	1335.07	1334.77	0.30	0.06	0.03		36.40		13.70
VHE_Channel	128.4475	10-yr flow	1334.17	1334.03	0.14	0.06	0.01	1.63	19.27		35.12
VHE_Channel	128.4475	25-yr flow	1334.27	1334.10	0.17	0.05	0.01	2.73	26.17		35.14
VHE_Channel	128.4475	50-yr flow	1334.36	1334.16	0.20	0.05	0.01	3.76	32.64		35.15
VHE_Channel	123.0729	10-yr flow	1333.75	1333.64	0.11				20.90		41.87
VHE_Channel	123.0729	25-yr flow	1333.83	1333.69	0.14				28.90		43.11
VHE_Channel	123.0729	50-yr flow	1333.90	1333.75	0.15				36.40		44.36

123.0729
133.9196
150.7795
175.7794
200.7794
225.7797
250.7796
275.7796
VHE_Channel
TennahC_HV
chematic data outside default extents (see View/Set Schematic Plot Extents...)


VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
Ground
LOB
ROB
Elevation (ft)
1337
1336
1335
1334
1333
1332
128.4475
133.9196
150.7795
175.7794
200.7794
225.7797
250.7796
275.7796
140
160
180
200
220
240
260
Main Channel Distance (ft)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RS = 275.7796
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.028
.028
Elevation (ft)
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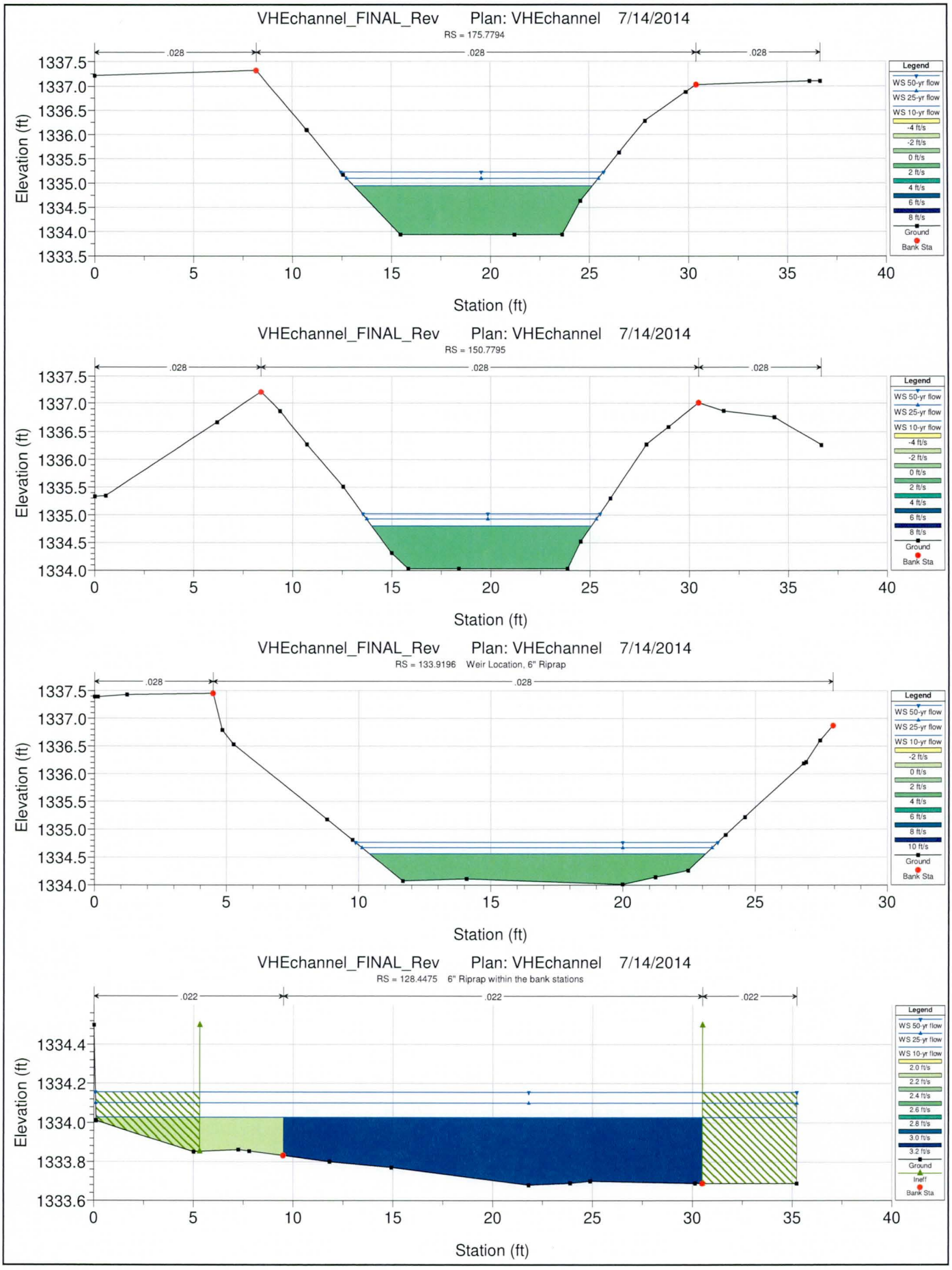
1337.5
1337.0
1336.5
1336.0
1335.5
1335.0
1334.5
1334.0
0
5
10
15
20
25
30
35
40
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 250.7796
.028
.028
.028
Elevation (ft)
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 225.7797
.028
.028
.028
Elevation (ft)
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 200.7794
.028
.028
.028
Elevation (ft)
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta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.028
.028
Elevation (ft)
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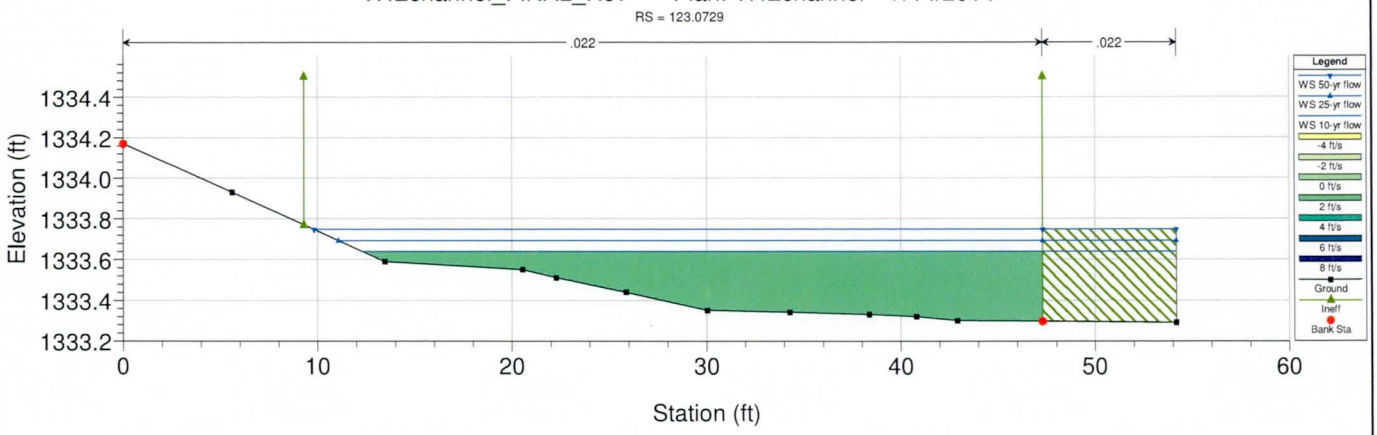
1335.5
1335.0
1334.5
1334.0
1333.5
0
5
10
15
20
25
30
35
40
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 150.7795
.028
.028
.028
Elevation (ft)
1337.5
1337.0
1336.5
1336.0
1335.5
1335.0
1334.5
1334.0
0
5
10
15
20
25
30
35
40
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Bank Sta
VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 133.9196 Weir Location, 6" Riprap
.028
.028
Elevation (ft)
1337.5
1337.0
1336.5
1336.0
1335.5
1335.0
1334.5
1334.0
0
5
10
15
20
25
30
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta
VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 128.4475 6" Riprap within the bank stations
.022
.022
.022
Elevation (ft)
1334.4
1334.2
1334.0
1333.8
1333.6
0
5
10
15
20
25
30
35
40
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
2.0 ft/s
2.2 ft/s
2.4 ft/s
2.6 ft/s
2.8 ft/s
3.0 ft/s
3.2 ft/s
Ground
Ineff
Bank Sta


VHEchannel_FINAL_Rev Plan: VHEchannel 7/14/2014
RS = 123.0729
.022
.022
Elevation (ft)
1334.4
1334.2
1334.0
1333.8
1333.6
1333.4
1333.2
0
10
20
30
40
50
60
Station (ft)
Legend
WS 50-yr flow
WS 25-yr flow
WS 10-yr flow
-4 ft/s
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
Ground
Ineff
Bank Sta

HEC-RAS
SIDE CHANNEL

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

```
X     X  XXXXXX    XXXX        XXXX       XX      XXXX
X     X  X        X    X      X   X     X  X     X
X     X  X        X           X   X    X    X    X
XXXXXXX  XXXX     X       XXX  XXXX     XXXXXX    XXXX
X     X  X        X           X  X      X    X        X
X     X  X        X    X      X   X     X    X        X
X     X  XXXXXX    XXXX       X    X    X    X   XXXXX
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PROJECT DATA
Project Title: SideChannel_FINAL_rev
Project File : SideChannel_FINAL_Rev.prj
Run Date and Time: 7/14/2014 8:38:36 AM

Project in English units

Project Description:
Side channel between the dry side south levee embankment and Vision Hilll
Estates subdivision wall created to assess the potential for scour along the
Scatter Wash Levee.

Created by Yichun XU, AMEC, in support of the Scatter
Wash Levee Certification Project

FCD Contract Number: 2011C005
WA#14

Scatter Wash Levees Near W. 39th Avenue and SR L101
North Levee ID#
1901064146 and South Levee ID # 1901064147

Latest run date: July 13, 2014

PLAN DATA

Plan Title: SideChannel
Plan File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee
Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Side Channel\SideChannel_FINAL_Rev.p03

Geometry Title: SideChannel
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee
Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Side Channel\SideChannel_FINAL_Rev.g01

Flow Title   : SideChannel
Flow File   : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee
Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Side Channel\SideChannel_FINAL_Rev.f03

Plan Summary Information:
Number of: Cross Sections =   13   Multiple Openings =   0
            Culverts   =   0   Inline Structures =   0
            Bridges   =   0   Lateral Structures =   0

Computational Information
    Water surface calculation tolerance = 0.01
    Critical depth calculation tolerance = 0.01
    Maximum number of iterations   = 20
    Maximum difference tolerance   = 0.3
    Flow tolerance factor   = 0.001

Computation Options
    Critical depth computed only where necessary
    Conveyance Calculation Method: At breaks in n values only
    Friction Slope Method: Average Conveyance
    Computational Flow Regime: Subcritical Flow

FLOW DATA

Flow Title: SideChannel
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee
Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Side Channel\SideChannel_FINAL_Rev.f03

Flow Data (cfs)

River	Reach	RS	10-yr flow
SideChannel	SideChannel	600	25
SideChannel	SideChannel	400	45.9

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
SideChannel	SideChannel	10-yr flow	Normal S = 0.0028	Known WS = 1334.77

GEOMETRY DATA

Geometry Title: SideChannel
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Side Channel\SideChannel_FINAL_Rev.g01

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 600

INPUT
Description: Vision Hill Estates Community Wall is a retaining wall with back filled up to 2-3 feet based on on-site observations. See report Section 2.3.2.3.1 for detail.

Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8.99	1337.61	11.57	1335.39	13.01	1334.14	18.42	1334.11	19.55	1334.1
25.39	1334.05	31.67	1333.76	31.77	1333.75	32.79	1333.81	39.5	1334.16
41.25	1334.26	41.8	1334.28	43.29	1334.63	49.76	1336.21	59.75	1338.64
60	1338.64								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
8.99	.025	13.01	.025	39.5	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13.01	39.5	51.97	50	47.64	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
8.99	13	1336

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.06	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.025	0.025	0.030
W.S. Elev (ft)	1335.04	Reach Len. (ft)	51.97	50.00	47.64
Crit W.S. (ft)		Flow Area (sq ft)	0.01	27.38	3.12
E.G. Slope (ft/ft)	0.000200	Area (sq ft)	0.01	27.38	3.12
Q Total (cfs)	25.00	Flow (cfs)	0.00	23.52	1.48
Top Width (ft)	31.99	Top Width (ft)	0.01	26.49	5.49
Vel Total (ft/s)	0.82	Avg. Vel. (ft/s)	0.04	0.86	0.48
Max Chl Dpth (ft)	1.29	Hydr. Depth (ft)	0.90	1.03	0.57
Conv. Total (cfs)	1767.5	Conv. (cfs)	0.0	1662.8	104.7
Length Wtd. (ft)	49.85	Wetted Per. (ft)	0.91	26.51	5.58
Min Ch El (ft)	1333.75	Shear (lb/sq ft)	0.00	0.01	0.01
Alpha	1.05	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.02	0.44	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.27	0.10

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 550

INPUT
Description:

Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
13.69	1337.7	16.8	1334.52	17.4	1333.89	21.06	1333.84	22.77	1333.82
32.43	1333.73	36.15	1333.86	38.77	1334	41.68	1334.15	53.8	1337.06
60	1338.53								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
13.69	.025	17.4	.025	38.77	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
17.4	38.77	49.75	50	50.33	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
13.69	17.4	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.05	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.		0.025	0.040
W.S. Elev (ft)	1335.03	Reach Len. (ft)	49.75	50.00	50.33
Crit W.S. (ft)		Flow Area (sq ft)		25.99	4.42
E.G. Slope (ft/ft)	0.000188	Area (sq ft)		25.99	4.42
Q Total (cfs)	25.00	Flow (cfs)		23.30	1.70
Top Width (ft)	27.96	Top Width (ft)		21.37	6.59
Vel Total (ft/s)	0.82	Avg. Vel. (ft/s)		0.90	0.39
Max Chl Dpth (ft)	1.30	Hydr. Depth (ft)		1.22	0.67
Conv. Total (cfs)	1824.4	Conv. (cfs)		1700.1	124.2
Length Wtd. (ft)	50.03	Wetted Per. (ft)		22.52	6.70
Min Ch El (ft)	1333.73	Shear (lb/sq ft)		0.01	0.01
Alpha	1.12	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.02	0.41	0.09
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.24	0.09

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 500

INPUT
Description:
Station Elevation Data num= 12

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
12.6	1337.47	13.09	1336.91	16.03	1333.83	21.12	1333.69	22.06	1333.66
30.37	1333.47	33.79	1333.71	34.15	1333.73	38.01	1334	45.52	1335.87
56.37	1338.69	60	1338.68						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
12.6	.022	16.03	.022	33.79	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
16.03	33.79	50.38	50	49.71	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
12.6	16	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.022	0.022	0.040
W.S. Elev (ft)	1335.03	Reach Len. (ft)	50.38	50.00	49.71
Crit W.S. (ft)		Flow Area (sq ft)	0.04	24.77	7.07
E.G. Slope (ft/ft)	0.000116	Area (sq ft)	0.04	24.77	7.07
Q Total (cfs)	25.00	Flow (cfs)	0.00	22.49	2.51
Top Width (ft)	26.13	Top Width (ft)	0.03	17.76	8.34
Vel Total (ft/s)	0.78	Avg. Vel. (ft/s)	0.07	0.91	0.35
Max Chl Dpth (ft)	1.56	Hydr. Depth (ft)	1.18	1.39	0.85
Conv. Total (cfs)	2320.6	Conv. (cfs)	0.2	2087.8	232.6
Length Wtd. (ft)	49.97	Wetted Per. (ft)	1.21	17.77	8.48
Min Ch El (ft)	1333.47	Shear (lb/sq ft)	0.00	0.01	0.01
Alpha	1.23	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.02	0.38	0.08
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.22	0.09

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 450

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
12.89	1337.57	14.05	1336.26	16.11	1333.9	18.59	1333.82	22.12	1333.67
30.24	1333.35	32.99	1333.55	35.04	1333.69	38.19	1333.94	56.06	1338.67
56.4	1338.76	57.02	1338.75	60	1338.73				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
12.89	.022	16.11	.022	32.99	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
16.11	32.99	49.78	50	50.13	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
12.89	16.1	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.01	Wt. n-Val.	0.022	0.022	0.040
W.S. Elev (ft)	1335.02	Reach Len. (ft)	49.78	50.00	50.13
Crit W.S. (ft)		Flow Area (sq ft)	0.01	23.97	8.88
E.G. Slope (ft/ft)	0.000112	Area (sq ft)	0.01	23.97	8.88
Q Total (cfs)	25.00	Flow (cfs)	0.00	21.65	3.35
Top Width (ft)	26.17	Top Width (ft)	0.01	16.88	9.28
Vel Total (ft/s)	0.76	Avg. Vel. (ft/s)	0.03	0.90	0.38
Max Chl Dpth (ft)	1.67	Hydr. Depth (ft)	1.12	1.42	0.96
Conv. Total (cfs)	2361.0	Conv. (cfs)	0.0	2044.3	316.6
Length Wtd. (ft)	50.02	Wetted Per. (ft)	1.12	16.90	9.44
Min Ch El (ft)	1333.35	Shear (lb/sq ft)	0.00	0.01	0.01
Alpha	1.25	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.02	0.35	0.07
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.20	0.08

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 400

INPUT
Description:
Station Elevation Data num= 13

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
8.95	1336.89	11.33	1335.61	14.54	1335.13	15.42	1333.91	19.38	1333.7
22.54	1333.53	30.98	1333.1	32.44	1333.24	35.88	1333.55	39.39	1333.92
49.34	1336.47	58.72	1338.72	60	1338.71				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
8.95	.022	15.42	.022	32.44	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
15.42	32.44	50.93	50	49.26	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
8.95	15.4	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.02	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.03	Wt. n-Val.	0.022	0.022	0.040
W.S. Elev (ft)	1334.99	Reach Len. (ft)	50.93	50.00	49.26
Crit W.S. (ft)		Flow Area (sq ft)	0.02	25.86	12.15
E.G. Slope (ft/ft)	0.000273	Area (sq ft)	0.02	25.86	12.15
Q Total (cfs)	45.90	Flow (cfs)	0.00	38.08	7.82
Top Width (ft)	28.17	Top Width (ft)	0.02	17.02	11.13
Vel Total (ft/s)	1.21	Avg. Vel. (ft/s)	0.08	1.47	0.64
Max Chl Dpth (ft)	1.89	Hydr. Depth (ft)	1.07	1.52	1.09
Conv. Total (cfs)	2780.2	Conv. (cfs)	0.1	2306.6	473.5
Length Wtd. (ft)	49.90	Wetted Per. (ft)	1.09	17.05	11.30
Min Ch El (ft)	1333.10	Shear (lb/sq ft)	0.00	0.03	0.02
Alpha	1.28	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.02	0.33	0.06
C & E Loss (ft)	0.00	Cum SA (acres)	0.02	0.18	0.06

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 382

INPUT
Description: VHE Channel Outlet.
Assuming no flow will escape from the side
channel into the VHE channel. It is conservative consideration.
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1334.07	4.3	1334.1	7.88	1334.09	101	1334.094	12.92	1334.1
14	1334.03	15.06	1333.93	201	1333.602	22.92	1333.44	25.98	1333.21
31.59	1332.9	34.09	1333.19	34.8	1333.27	39.94	1333.92	58.82	1338.38
60	1338.65								

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.022	12.92	.022	22.92	.022	34.8	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
12.92	34.8	32.93	32	31.17	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent

0 12.92 1336 F

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.01	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.		0.022	0.040
W.S. Elev (ft)	1334.99	Reach Len. (ft)	32.93	32.00	31.17
Crit W.S. (ft)	1333.88	Flow Area (sq ft)		34.41	9.57
E.G. Slope (ft/ft)	0.000167	Area (sq ft)	11.57	34.41	9.57
Q Total (cfs)	45.90	Flow (cfs)		41.39	4.51
Top Width (ft)	44.46	Top Width (ft)	12.92	21.88	9.66
Vel Total (ft/s)	1.04	Avg. Vel. (ft/s)		1.20	0.47
Max Chl Dpth (ft)	2.09	Hydr. Depth (ft)		1.57	0.99
Conv. Total (cfs)	3552.8	Conv. (cfs)		3203.6	349.2
Length Wtd. (ft)	31.92	Wetted Per. (ft)		21.94	9.82
Min Ch El (ft)	1332.90	Shear (lb/sq ft)		0.02	0.01
Alpha	1.22	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.01	0.29	0.05
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.16	0.05

Warning: The cross-section end points had to be extended vertically for the computed water surface.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 350

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
11.51	1337.39	13.5	1334.52	13.52	1334.49	13.72	1334.46	20.5	1333.72
30.97	1332.58	35.56	1333.25	37.48	1333.53	39.59	1333.83	42.79	1334.56
60	1338.48								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
11.51	.022	13.5	.022	35.56	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
13.5	35.56	50.48	50	49.77	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
11.51	13.4	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1335.00	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.022	0.022	0.040
W.S. Elev (ft)	1334.98	Reach Len. (ft)	50.48	50.00	49.77
Crit W.S. (ft)		Flow Area (sq ft)	0.04	34.82	8.71
E.G. Slope (ft/ft)	0.000174	Area (sq ft)	0.04	34.82	8.71
Q Total (cfs)	45.90	Flow (cfs)	0.01	41.80	4.10
Top Width (ft)	31.24	Top Width (ft)	0.10	22.06	9.08
Vel Total (ft/s)	1.05	Avg. Vel. (ft/s)	0.16	1.20	0.47
Max Chl Dpth (ft)	2.40	Hydr. Depth (ft)	0.39	1.58	0.96
Conv. Total (cfs)	3484.0	Conv. (cfs)	0.5	3172.6	310.9
Length Wtd. (ft)	49.98	Wetted Per. (ft)	0.49	22.23	9.25
Min Ch El (ft)	1332.58	Shear (lb/sq ft)	0.00	0.02	0.01
Alpha	1.20	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.01	0.27	0.04
C & E Loss (ft)	0.00	Cum SA (acres)	0.01	0.14	0.05

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

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 300

INPUT
Description:
Station Elevation Data num= 11

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
6.75	1337.16	8	1334.78	8.47	1334.01	15.71	1333.44	24.63	1332.73
30.14	1332.33	33.58	1332.81	36.15	1333.17	37.28	1333.33	39.46	1333.64
60	1338.25								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

```
    6.75    .025    8.47    .025   36.15     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          8.47   36.15             51.83      50   48.45             .1      .3
Blocked Obstructions     num=        1
   Sta L   Sta R    Elev
    6.75     8.4    1336

CROSS SECTION OUTPUT  Profile #10-yr flow

  E.G. Elev (ft)           1334.99    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.01    Wt. n-Val.                0.025      0.025      0.040
  W.S. Elev (ft)           1334.98    Reach Len. (ft)           51.83      50.00      48.45
  Crit W.S. (ft)                      Flow Area (sq ft)          0.06      53.00       9.25
  E.G. Slope (ft/ft)       0.000078   Area (sq ft)               0.06      53.00       9.25
  Q Total (cfs)               45.90   Flow (cfs)                 0.01      42.90       2.99
  Top Width (ft)              37.05   Top Width (ft)             0.07      27.68       9.30
  Vel Total (ft/s)             0.74   Avg. Vel. (ft/s)           0.08       0.81       0.32
  Max Chl Dpth (ft)            2.65   Hydr. Depth (ft)           0.92       1.91       0.99
  Conv. Total (cfs)          5182.0   Conv. (cfs)                 0.6     4843.3      338.1
  Length Wtd. (ft)            49.92   Wetted Per. (ft)           0.99      27.80       9.48
  Min Ch El (ft)           1332.33    Shear (lb/sq ft)           0.00       0.01       0.00
  Alpha                        1.14   Stream Power (lb/ft s)    60.00       0.00       0.00
  Frctn Loss (ft)              0.00   Cum Volume (acre-ft)       0.01       0.22       0.03
  C & E Loss (ft)              0.00   Cum SA (acres)             0.01       0.11       0.03


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

CROSS SECTION


RIVER: SideChannel
REACH: SideChannel         RS: 250

INPUT
Description:
Station Elevation Data    num=      12
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
     4.3 1337.07    4.64 1337.04    5.03 1336.56    7.65 1333.42   12.94 1333.16
   13.85 1333.12   33.53 1332.31   41.85 1333.19   42.15 1333.22   43.95 1333.41
   54.16 1335.94      60 1337.37

Manning's n Values        num=       3
     Sta   n Val     Sta   n Val     Sta   n Val
     4.3    .025    7.65    .025   42.15     .04

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
          7.65   42.15             52.36      50   48.47             .1      .3
Blocked Obstructions     num=        1
   Sta L   Sta R    Elev
     4.3     7.6    1336

CROSS SECTION OUTPUT  Profile #10-yr flow

  E.G. Elev (ft)           1334.99    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.01    Wt. n-Val.                0.025      0.025      0.040
  W.S. Elev (ft)           1334.98    Reach Len. (ft)           52.36      50.00      48.47
  Crit W.S. (ft)                      Flow Area (sq ft)          0.08      74.43       8.01
  E.G. Slope (ft/ft)       0.000036   Area (sq ft)               0.08      74.43       8.01
  Q Total (cfs)               45.90   Flow (cfs)                 0.00      44.17       1.73
  Top Width (ft)              42.70   Top Width (ft)             0.05      34.50       8.15
  Vel Total (ft/s)             0.56   Avg. Vel. (ft/s)           0.05       0.59       0.22
  Max Chl Dpth (ft)            2.67   Hydr. Depth (ft)           1.53       2.16       0.98
  Conv. Total (cfs)          7665.0   Conv. (cfs)                 0.6     7375.3      289.1
  Length Wtd. (ft)            49.92   Wetted Per. (ft)           1.58      34.57       8.36
  Min Ch El (ft)           1332.31    Shear (lb/sq ft)           0.00       0.00       0.00
  Alpha                        1.10   Stream Power (lb/ft s)    60.00       0.00       0.00
  Frctn Loss (ft)              0.00   Cum Volume (acre-ft)       0.01       0.14       0.02
  C & E Loss (ft)              0.00   Cum SA (acres)             0.01       0.08       0.02


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

CROSS SECTION


RIVER: SideChannel
REACH: SideChannel         RS: 200

INPUT
Description:
Station Elevation Data    num=      13
     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev     Sta    Elev
```

15.21	1337.29	16.56	1335.44	17.28	1334.37	21.73	1333.62	23.57	1333.31
27.35	1332.77	29.99	1332.61	33.41	1332.44	36.39	1332.87	39.13	1333.21
41.71	1333.54	56.97	1337.55	60	1338.36				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
15.21	.025	17.28	.025	39.13	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
17.28	39.13	50.96	50	49.86	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
15.21	17.2	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1334.99	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.02	Wt. n-Val.	0.025	0.025	0.040
W.S. Elev (ft)	1334.97	Reach Len. (ft)	50.96	50.00	49.86
Crit W.S. (ft)		Flow Area (sq ft)	0.04	40.97	8.00
E.G. Slope (ft/ft)	0.000133	Area (sq ft)	0.04	40.97	8.00
Q Total (cfs)	45.90	Flow (cfs)	0.01	42.52	3.37
Top Width (ft)	29.95	Top Width (ft)	0.08	21.85	8.02
Vel Total (ft/s)	0.94	Avg. Vel. (ft/s)	0.12	1.04	0.42
Max Chl Dpth (ft)	2.53	Hydr. Depth (ft)	0.54	1.87	1.00
Conv. Total (cfs)	3973.4	Conv. (cfs)	0.4	3681.0	291.9
Length Wtd. (ft)	49.99	Wetted Per. (ft)	0.62	22.04	8.23
Min Ch El (ft)	1332.44	Shear (lb/sq ft)	0.00	0.02	0.01
Alpha	1.15	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.01	Cum Volume (acre-ft)	0.01	0.08	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.04	0.02

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

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 150

INPUT
Description:
Station Elevation Data num= 15

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
19.34	1337.39	20.06	1336.5	21.24	1335.02	23.11	1334.537	27.59	1333.37
28.37	1333.17	29.42	1332.9	31.76	1332.7	32.6	1332.64	34.58	1333.3
35.44	1333.55	35.53	1333.57	38.58	1334.45	52.5	1338.64	60	1338.15

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
19.34	.025	23.1	.025	35.44	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
23.1	35.44	75.59	66.5	66.84	.1	.3

Blocked Obstructions num= 1

Sta L	Sta R	Elev
19.34	21.2	1336

CROSS SECTION OUTPUT Profile #10-yr flow

E.G. Elev (ft)	1334.97	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.07	Wt. n-Val.	0.025	0.025	0.040
W.S. Elev (ft)	1334.89	Reach Len. (ft)	75.59	66.50	66.84
Crit W.S. (ft)		Flow Area (sq ft)	0.24	19.25	3.13
E.G. Slope (ft/ft)	0.000821	Area (sq ft)	0.24	19.25	3.13
Q Total (cfs)	45.90	Flow (cfs)	0.13	43.26	2.51
Top Width (ft)	18.31	Top Width (ft)	1.37	12.34	4.61
Vel Total (ft/s)	2.03	Avg. Vel. (ft/s)	0.53	2.25	0.80
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)	0.18	1.56	0.68
Conv. Total (cfs)	1602.0	Conv. (cfs)	4.4	1510.0	87.6
Length Wtd. (ft)	66.54	Wetted Per. (ft)	1.41	12.70	4.80
Min Ch El (ft)	1332.64	Shear (lb/sq ft)	0.01	0.08	0.03
Alpha	1.17	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.07	Cum Volume (acre-ft)	0.00	0.04	0.01
C & E Loss (ft)	0.01	Cum SA (acres)	0.01	0.02	0.01

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 120

INPUT
Description: Last Channel Section

Station Elevation Data num= 21

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1336.56	7.9	1336.58	8.94	1336.63	14.88	1336.49	16.16	1336.17
22.8	1334.47	23.79	1334.23	27.51	1333.231	28.1	1333.07	28.86	1332.99
30.23	1332.83	32.19	1332.79	32.42	1332.8	34.17	1332.85	35.71	1333.64
36.44	1334.02	50.21	1338.53	50.24	1338.54	50.28	1338.55	50.33	1338.55
60	1338.1								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.025	27.5	.025	34.17	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
27.5	34.17	24.54	20	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	27.5	1336	F

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1334.89	Element			
Vel Head (ft)	0.16	Wt. n-Val.		0.025	0.040
W.S. Elev (ft)	1334.72	Reach Len. (ft)	24.54	20.00	20.00
Crit W.S. (ft)	1334.00	Flow Area (sq ft)		12.22	3.67
E.G. Slope (ft/ft)	0.001470	Area (sq ft)	4.17	12.22	3.67
Q Total (cfs)	45.90	Flow (cfs)		41.52	4.38
Top Width (ft)	16.76	Top Width (ft)	5.68	6.67	4.41
Vel Total (ft/s)	2.89	Avg. Vel. (ft/s)		3.40	1.19
Max Chl Dpth (ft)	1.93	Hydr. Depth (ft)		1.83	0.83
Conv. Total (cfs)	1197.0	Conv. (cfs)		1082.9	114.1
Length Wtd. (ft)	20.00	Wetted Per. (ft)		6.71	4.81
Min Ch El (ft)	1332.79	Shear (lb/sq ft)		0.17	0.07
Alpha	1.27	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	0.00	0.02	0.00
C & E Loss (ft)	0.03	Cum SA (acres)	0.00	0.01	0.00

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: SideChannel
REACH: SideChannel RS: 100

INPUT
Description: 2-24" Culvert
Station Elevation Data num= 16

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1333.96	2.7	1333.55	9.38	1332.76	15.12	1332.63	15.69	1332.7
18.63	1332.59	19.43	1332.56	29.48	1332.82	32.17	1332.9	33.42	1332.94
34.22	1333.69	36.54	1334.82	44.86	1337.28	49.06	1338.48	51.48	1338.36
60	1337.78								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	0	.025	33.42	.04

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
0	33.42	29.42	100	.1	.3

Ineffective Flow num= 1

Sta L	Sta R	Elev	Permanent
0	23.05	1338.51	F

CROSS SECTION OUTPUT Profile #10-yr flow

			Left OB	Channel	Right OB
E.G. Elev (ft)	1334.84	Element			
Vel Head (ft)	0.07	Wt. n-Val.		0.025	0.040
W.S. Elev (ft)	1334.77	Reach Len. (ft)			
Crit W.S. (ft)	1333.64	Flow Area (sq ft)		20.52	2.36
E.G. Slope (ft/ft)	0.000532	Area (sq ft)		63.00	2.36
Q Total (cfs)	45.90	Flow (cfs)		44.36	1.54
Top Width (ft)	36.44	Top Width (ft)		33.42	3.02
Vel Total (ft/s)	2.01	Avg. Vel. (ft/s)		2.16	0.65
Max Chl Dpth (ft)	2.21	Hydr. Depth (ft)		1.98	0.78
Conv. Total (cfs)	1989.2	Conv. (cfs)		1922.5	66.7
Length Wtd. (ft)		Wetted Per. (ft)		10.37	3.56
Min Ch El (ft)	1332.56	Shear (lb/sq ft)		0.07	0.02
Alpha	1.13	Stream Power (lb/ft s)	60.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,

energy was used.

SUMMARY OF MANNING'S N VALUES

River:SideChannel

Reach	River Sta.	n1	n2	n3	n4
SideChannel	600	.025	.025	.03	
SideChannel	550	.025	.025	.04	
SideChannel	500	.022	.022	.04	
SideChannel	450	.022	.022	.04	
SideChannel	400	.022	.022	.04	
SideChannel	382	.022	.022	.022	.04
SideChannel	350	.022	.022	.04	
SideChannel	300	.025	.025	.04	
SideChannel	250	.025	.025	.04	
SideChannel	200	.025	.025	.04	
SideChannel	150	.025	.025	.04	
SideChannel	120	.025	.025	.04	
SideChannel	100	.045	.025	.04	

SUMMARY OF REACH LENGTHS

River: SideChannel

Reach	River Sta.	Left	Channel	Right
SideChannel	600	51.97	50	47.64
SideChannel	550	49.75	50	50.33
SideChannel	500	50.38	50	49.71
SideChannel	450	49.78	50	50.13
SideChannel	400	50.93	50	49.26
SideChannel	382	32.93	32	31.17
SideChannel	350	50.48	50	49.77
SideChannel	300	51.83	50	48.45
SideChannel	250	52.36	50	48.47
SideChannel	200	50.96	50	49.86
SideChannel	150	75.59	66.5	66.84
SideChannel	120	24.54	20	20
SideChannel	100	29.42	100	100

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: SideChannel

Reach	River Sta.	Contr.	Expan.
SideChannel	600	.1	.3
SideChannel	550	.1	.3
SideChannel	500	.1	.3
SideChannel	450	.1	.3
SideChannel	400	.1	.3
SideChannel	382	.1	.3
SideChannel	350	.1	.3
SideChannel	300	.1	.3
SideChannel	250	.1	.3
SideChannel	200	.1	.3
SideChannel	150	.1	.3
SideChannel	120	.1	.3
SideChannel	100	.1	.3

HEC-RAS Plan: SideChannel River: SideChannel Reach: SideChannel Profile: 10-yr flow

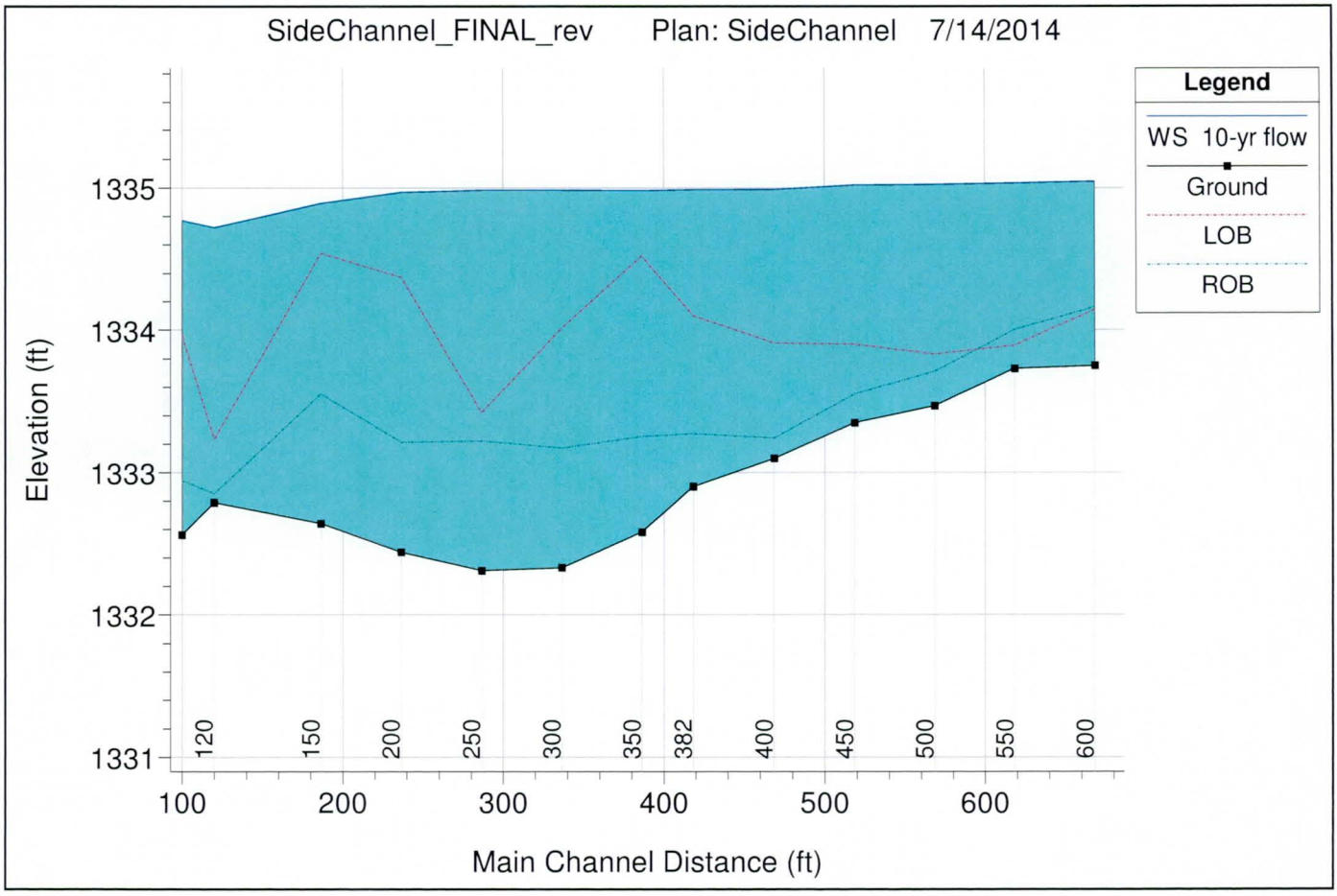
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
SideChannel	600	10-yr flow	25.00	1333.75	1335.04		1335.06	0.000200	0.86	30.50	31.99	0.15
SideChannel	550	10-yr flow	25.00	1333.73	1335.03		1335.05	0.000188	0.90	30.41	27.96	0.14
SideChannel	500	10-yr flow	25.00	1333.47	1335.03		1335.04	0.000116	0.91	31.88	26.13	0.14
SideChannel	450	10-yr flow	25.00	1333.35	1335.02		1335.03	0.000112	0.90	32.86	26.17	0.13
SideChannel	400	10-yr flow	45.90	1333.10	1334.99		1335.02	0.000273	1.47	38.03	28.17	0.21
SideChannel	382	10-yr flow	45.90	1332.90	1334.99	1333.88	1335.01	0.000167	1.20	43.98	44.46	0.17
SideChannel	350	10-yr flow	45.90	1332.58	1334.98		1335.00	0.000174	1.20	43.57	31.24	0.17
SideChannel	300	10-yr flow	45.90	1332.33	1334.98		1334.99	0.000078	0.81	62.32	37.05	0.10
SideChannel	250	10-yr flow	45.90	1332.31	1334.98		1334.99	0.000036	0.59	82.51	42.70	0.07
SideChannel	200	10-yr flow	45.90	1332.44	1334.97		1334.99	0.000133	1.04	49.01	29.95	0.13
SideChannel	150	10-yr flow	45.90	1332.64	1334.89		1334.97	0.000821	2.25	22.63	18.31	0.32
SideChannel	120	10-yr flow	45.90	1332.79	1334.72	1334.00	1334.89	0.001470	3.40	15.89	16.76	0.44
SideChannel	100	10-yr flow	45.90	1332.56	1334.77	1333.64	1334.84	0.000532	2.16	22.89	36.44	0.27

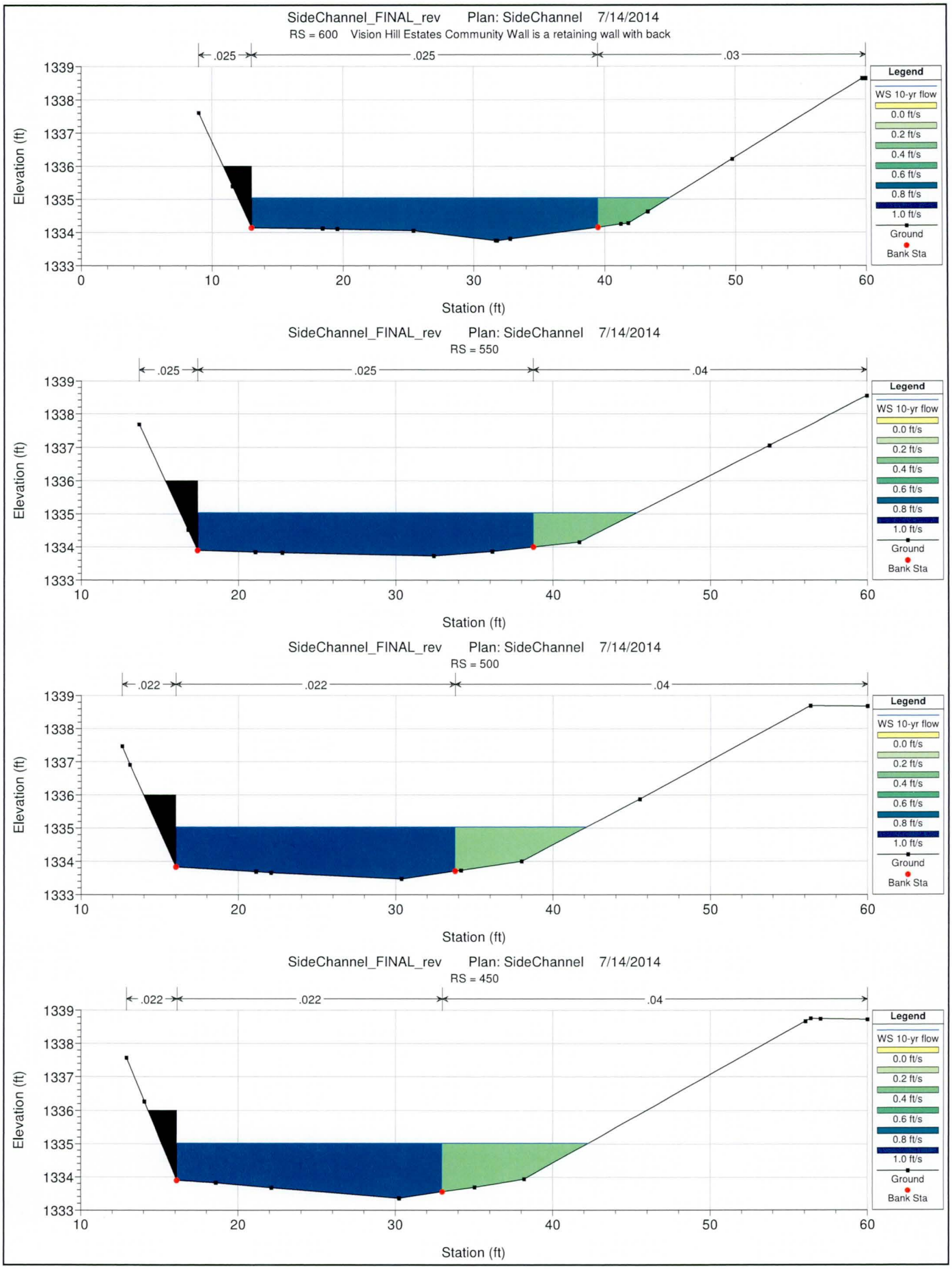
HEC-RAS Plan: SideChannel River: SideChannel Reach: SideChannel Profile: 10-yr flow

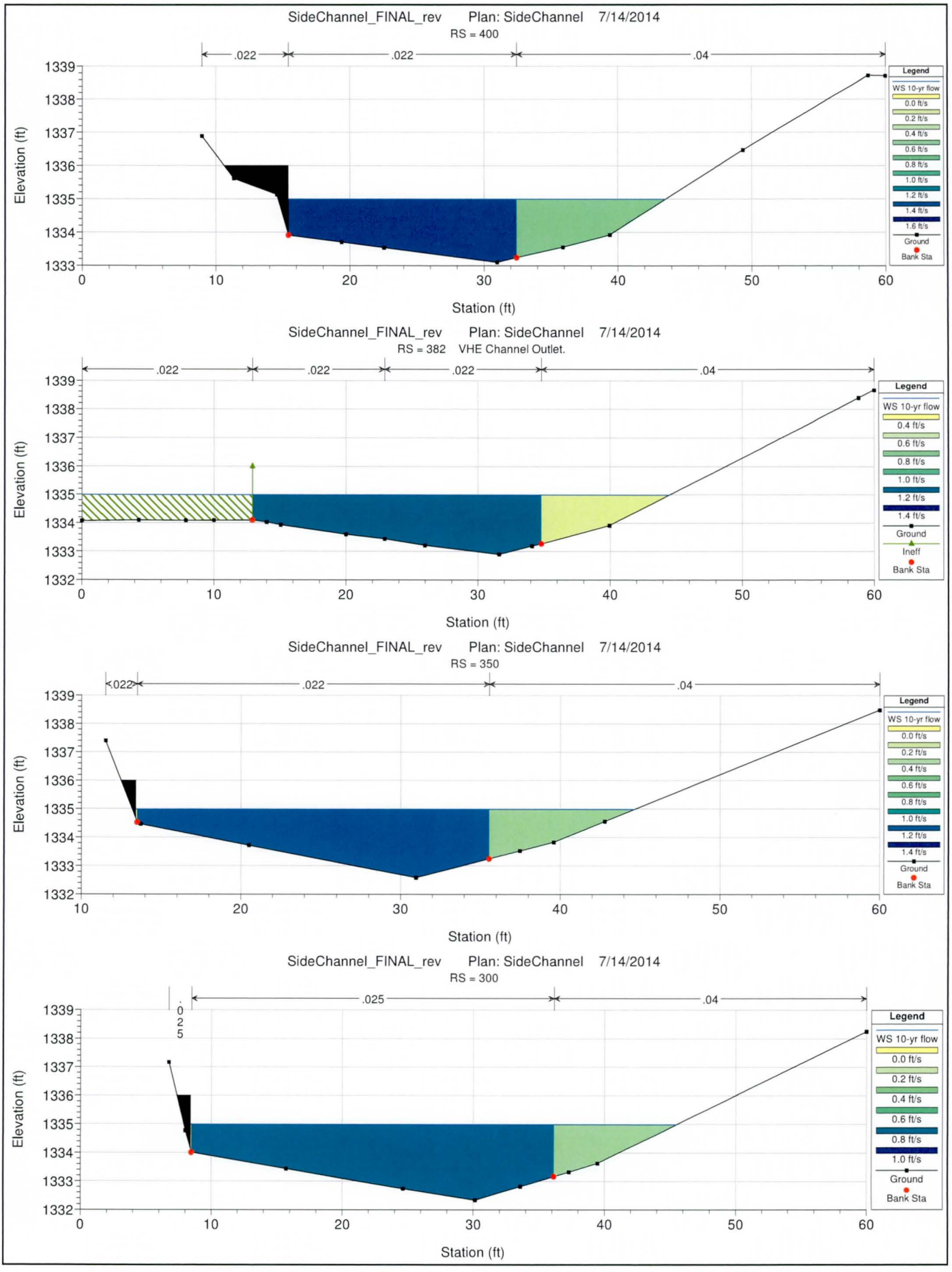
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
SideChannel	600	10-yr flow	1335.06	1335.04	0.01	0.01	0.00	0.00	23.52	1.48	31.99
SideChannel	550	10-yr flow	1335.05	1335.03	0.01	0.01	0.00		23.30	1.70	27.96
SideChannel	500	10-yr flow	1335.04	1335.03	0.01	0.01	0.00	0.00	22.49	2.51	26.13
SideChannel	450	10-yr flow	1335.03	1335.02	0.01	0.01	0.00	0.00	21.65	3.35	26.17
SideChannel	400	10-yr flow	1335.02	1334.99	0.03	0.01	0.00	0.00	38.08	7.82	28.17
SideChannel	382	10-yr flow	1335.01	1334.99	0.02	0.01	0.00		41.39	4.51	44.46
SideChannel	350	10-yr flow	1335.00	1334.98	0.02	0.01	0.00	0.01	41.80	4.10	31.24
SideChannel	300	10-yr flow	1334.99	1334.98	0.01	0.00	0.00	0.01	42.90	2.99	37.05
SideChannel	250	10-yr flow	1334.99	1334.98	0.01	0.00	0.00	0.00	44.17	1.73	42.70
SideChannel	200	10-yr flow	1334.99	1334.97	0.02	0.01	0.01	0.01	42.52	3.37	29.95
SideChannel	150	10-yr flow	1334.97	1334.89	0.07	0.07	0.01	0.13	43.26	2.51	18.31
SideChannel	120	10-yr flow	1334.89	1334.72	0.16	0.02	0.03		41.52	4.38	16.76
SideChannel	100	10-yr flow	1334.84	1334.77	0.07				44.36	1.54	36.44

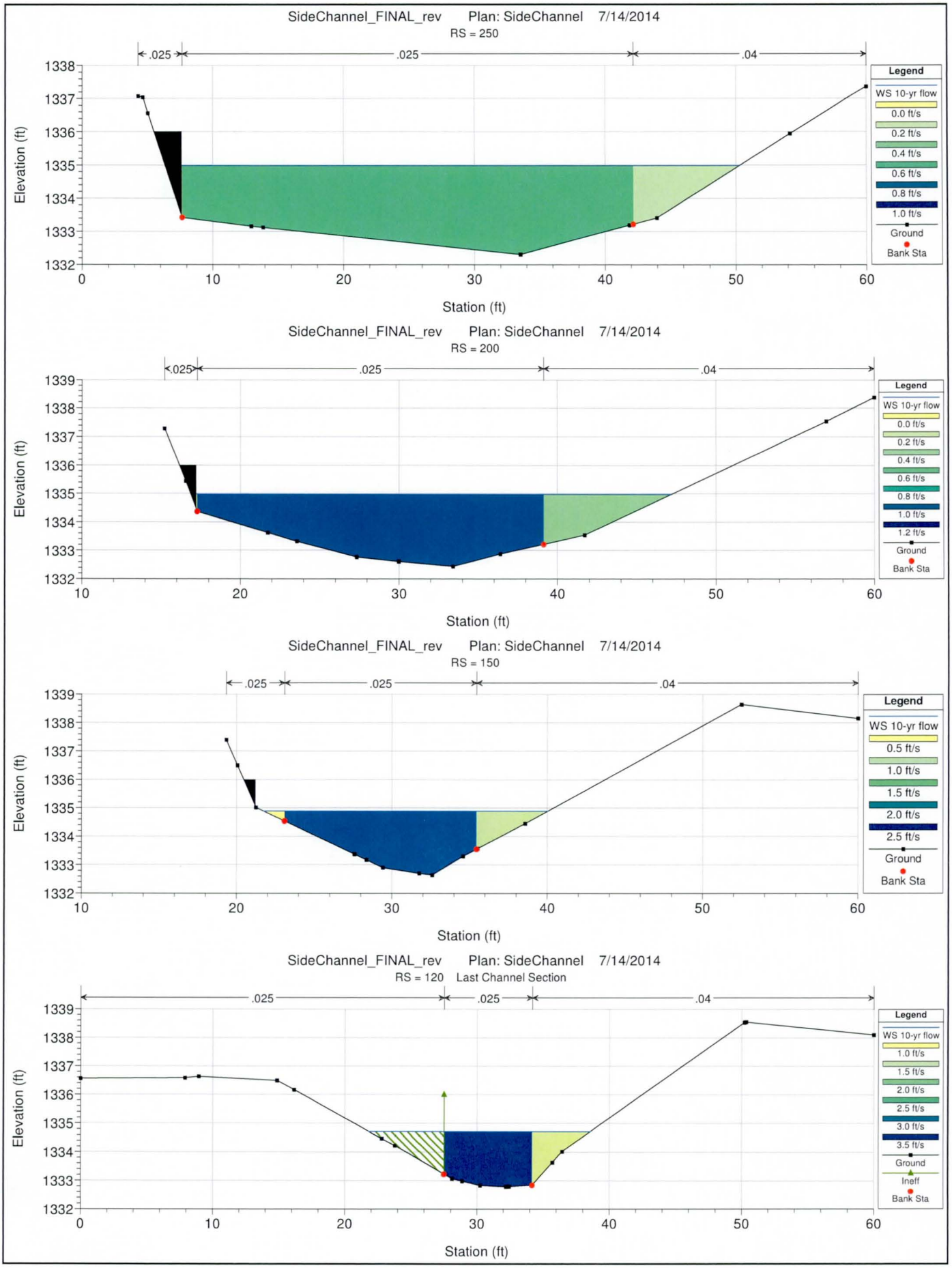
Some schematic data outside default extents (see View/Set Schematic Plot Extents...)

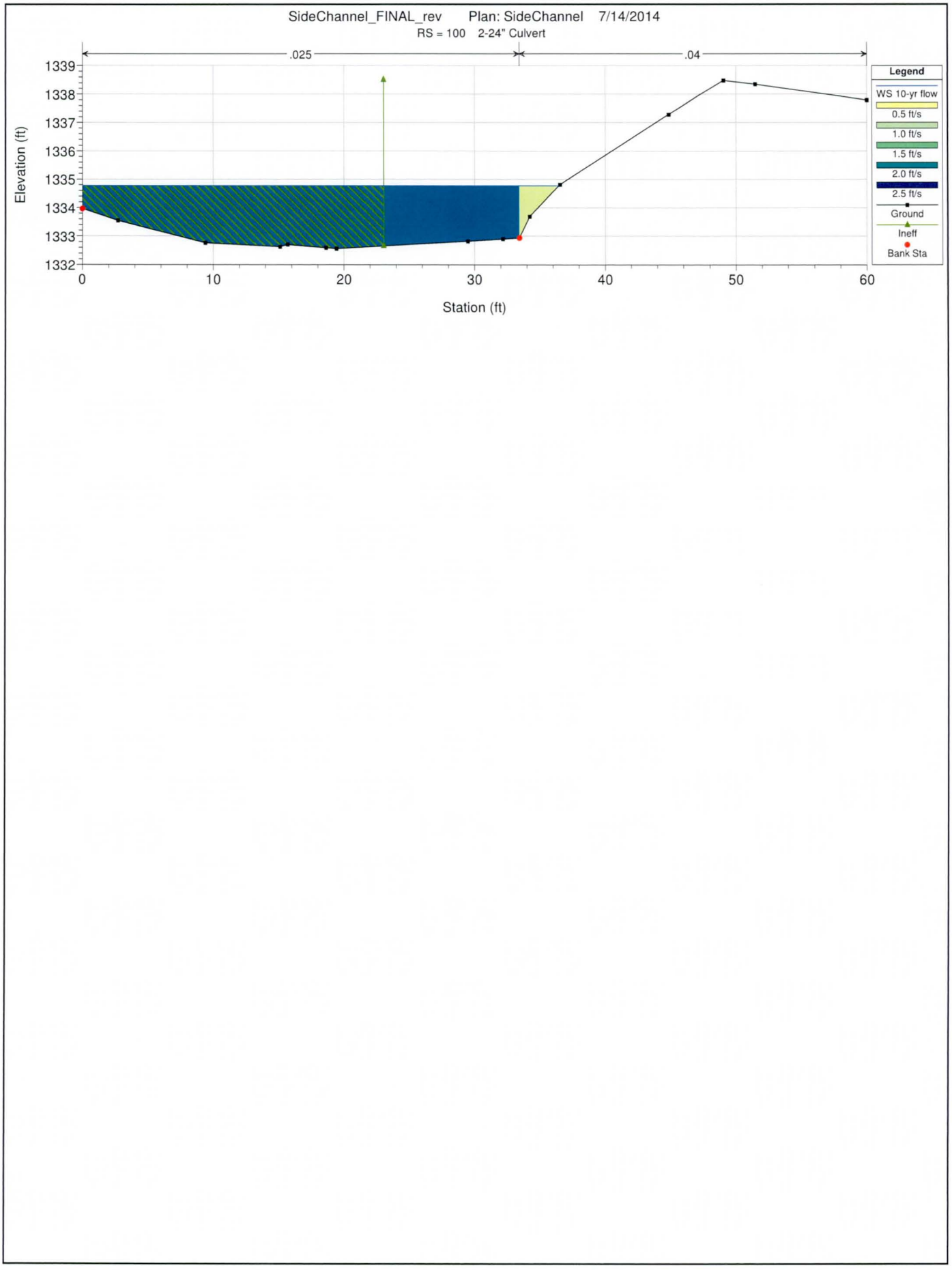
1 in Horiz. = 100 ft 1 in Vert. = 100 ft


SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
Legend
WS 10-yr flow
Ground
LOB
ROB
Elevation (ft)
1335
1334
1333
1332
1331
120
150
200
250
300
350
382
400
450
500
550
600
100
200
300
400
500
600
Main Channel Distance (ft)


SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 600 Vision Hill Estates Community Wall is a retaining wall with back
.025
.025
.03
Elevation (ft)
1339
1338
1337
1336
1335
1334
1333
0
10
20
30
40
50
60
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 550
.025
.025
.04
Elevation (ft)
1339
1338
1337
1336
1335
1334
1333
10
20
30
40
50
60
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 500
.022
.022
.04
Elevation (ft)
1339
1338
1337
1336
1335
1334
1333
10
20
30
40
50
60
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 450
.022
.022
.04
Elevation (ft)
1339
1338
1337
1336
1335
1334
1333
10
20
30
40
50
60
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 400
.022
.022
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
1.4 ft/s
1.6 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 382 VHE Channel Outlet.
.022
.022
.022
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
1.4 ft/s
Ground
Ineff
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 350
.022
.022
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
1.4 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 300
.025
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta


SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 250
.025
.025
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 200
.025
.025
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
1.2 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 150
.025
.025
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
Ground
Bank Sta
SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 120 Last Channel Section
.025
.025
.04
Elevation (ft)
Station (ft)
Legend
WS 10-yr flow
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Ineff
Bank Sta


SideChannel_FINAL_rev Plan: SideChannel 7/14/2014
RS = 100 2-24" Culvert
.025
.04
Elevation (ft)
1339
1338
1337
1336
1335
1334
1333
1332
0
10
20
30
40
50
60
Station (ft)
Legend
WS 10-yr flow
0.5 ft/s
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
Ground
Ineff
Bank Sta

SCOUR HOLE CALCULATIONS

Scour [redacted] at the Outlet of the Vision Hills Channel
Client:
Project: Scatter Wash
Data For: Erosion Protection Check for Vision Hills Channel
Prepared By: YX **Checked By:** [redacted]
Date: 6/24/2014 **Date:** 6/14/24

amec

Calculation of Scour Depth at the VHE Channel Outlet

Reference: Hydraulic Design of Energy Disipators for Culverts and Channels, FHWA, Hydraulic Cir. No. 14, September, 1983

I. HEC-RAS Model Results

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)	
VHE_Channel	133.92	10-yr flow	20.9	1334.01	1334.56	1334.56	1334.78	0.015578	3.77	5.54	12.71	1.01

II Scour Hole Geometry Dimension Calculation

Assuming the flow condition at the channel outlet is the same as the one at a culvert outlet

A Equation Used for calculation

Equation of V - 2 for Cohesiveness Material with PI = 15 or D50 = 0.15 mm cohesive sandy clay; for not Circular Shape Culvert

Eq. V-2 $$[\frac{h_s}{y_c}, \frac{h_s}{y_c}, \frac{h_s}{y_c}, or \frac{h_s}{y_c}] = \alpha_c (\frac{Q}{\sqrt{g}\, y_c^{5/2}})^{\beta} (\frac{t}{t_0})^{\theta}$$

Equation of V-4 for cohesive sandy clay with PI = 5 -16; for not Circular Shape Culvert

Eq. V-4 $$[\frac{h_s}{y_c}, \frac{h_s}{y_c}, \frac{h_s}{y_c}, or \frac{h_s}{y_c}] = \alpha_c (\frac{\rho V^2}{\tau_c})^{\beta} (\frac{t}{t_0})^{\theta}$$

B Experimental Coefficients for Culvert Outlet Scour

The channel bed material is SC with PI of 12 and SC-SM with PI of 5.

Material	PI	D50	Depth				Width				Length				Volume			
		(mm)	α	β	θ	α_e	α	β	θ	α_e	α	β	θ	α_e	α	β	θ	α_e
60% Sand	15	0.15	1.86	0.57	0.1	1.53	8.36	0.35	0.07	9.14	15.3	0.43	0.09	14.78	79.73	1.42	0.23	61.84
Clay	5 -16	Various	0.86	0.18	0.1	1.37	3.55	0.17	0.07	5.63	2.82	0.33	0.09	4.48	0.62	0.93	0.23	2.48

C Determination the Scour Hole Geometry Dimensions

1 Discharge Intensity	D.I. = $Q/g^{1/2} y_e^{5/2}$	D.I	0.37
2 Peak Discharge		Q	20.9 cfs
3 Gravity		g	32.2
4 Flow Area		A	12.71
5 Equivalent flow depth	$Ye = (A/2)^{1/2}$	Ye	2.52
6 The peak flow duration is unknown. A time period of 30 minutes is assumed.		t	30 min
7 the base time used for the experimental set		t_0	316 min
8 the Average Velocity at the outlet		V	5.54 ft/s
9 the plastic index PI		PI	5

D The scour hole dimension:

The coefficients for D50 = 0.15mm, cohesive sand clay and the equation V-2 is used.

	α	β	θ	α_e
h_s/y_e	1.86	0.57	0.1	1.53
W_s/y_e	8.36	0.35	0.07	9.14
L_s/y_e	15.3	0.43	0.09	14.78
V_s/y_e	79.73	1.42	0.23	61.84

		Scour Hole Geometry		
h_s/y_e =	0.68	Depth	h_s =	1.72 ft
W_s/y_e =	5.45	Width	W_s =	13.73 ft
L_s/y_e =	7.75	Length	L_s =	19.54 ft
V_s/y_e =	8.60	Volume	V_{se} =	21.68 ft^3

The final scour hole depth is 1.7 ft and the width is 14 ft.
The scour hole length is 19.5 ft.

Table V-1. Experimental Coefficients for Culvert Outlet Scour

MATERIAL	NOMINAL GRAIN SIZE d_{50} (mm)	SCOUR EQUATION	DEPTH h_s				WIDTH W_s				LENGTH L_s				VOLUME V_s			
			α	β	θ	α_e	α	β	θ	α_e	α	β	θ	α_e	α	β	θ	α_e
Uniform Sand	0.20	V-1 or V-2	2.72	.375	0.10	2.79	11.73	0.92	.15	6.44	16.82	0.71	0.125	11.75	203.36	2.0	0.375	80.71
Uniform Sand	2.0	V-1 or V-2	1.86	0.45	0.09	1.76	8.44	0.57	0.06	6.94	18.28	0.51	0.17	16.10	101.48	1.41	0.34	79.62
Graded Sand	2.0	V-1 or V-2	1.22	0.85	0.07	.75	7.25	0.76	0.06	4.78	12.77	0.41	0.04	12.62	36.17	2.09	0.19	12.94
Uniform Gravel	8.0	V-1 or V-2	1.78	0.45	0.04	1.68	9.13	0.62	0.08	7.08	14.36	0.95	0.12	7.61	65.91	1.86	0.19	12.15
Graded Gravel	8.0	V-1 or V-2	1.49	0.50	0.03	1.33	8.76	0.89	0.10	4.97	13.09	0.62	0.07	10.15	42.31	2.28	0.17	32.82
Cohesive Sandy Clay 60% Sand PI 15	0.15	V-1 or V-2	1.86	0.57	0.10	1.53	8.63	0.35	0.07	9.14	15.30	0.43	0.09	14.78	79.73	1.42	0.23	61.84
Clay PI 5-16	Various	V-3 or V-4	0.86	0.18	0.10	1.37	3.55	0.17	0.07	5.63	2.82	0.33	0.09	4.48	0.62	0.93	0.23	2.48

EQUATIONS:

V-1. FOR CIRCULAR CULVERTS. Cohesionless material or the 0.15mm cohesive sandy clay

$$\left[\frac{h_s}{D}, \frac{W_s}{D}, \frac{L_s}{D}, \text{ or } \frac{V_s}{D^3}\right] = \alpha\left(\frac{Q}{\sqrt{g}\,D^{5/2}}\right)^{\beta}\left(\frac{t}{t_o}\right)^{\theta}$$

where t_o = 316 min.

V-2. FOR OTHER CULVERTS SHAPES. Same material as above.

$$\left[\frac{h_s}{y_e}, \frac{W_s}{y_e}, \frac{L_s}{y_e}, \text{ or } \frac{V_s}{y_e^3}\right] = \alpha_e\left(\frac{Q}{\sqrt{g}\,y_e^{5/2}}\right)^{\beta}\left(\frac{t}{t_o}\right)^{\theta}$$

where t_o = 316 min.

V-3. FOR CIRCULAR CULVERTS. Cohesive sandy clay with PI = 5-16

$$\left[\frac{h_s}{D}, \frac{W_s}{D}, \frac{L_s}{D}, \text{ or } \frac{V_s}{D^3}\right] = \alpha\left(\frac{\rho V^2}{\tau_c}\right)^{\beta}\left(\frac{t}{t_o}\right)^{\theta}$$

where: t_o = 316 min.

V-4. FOR OTHER CULVERT SHAPES. Cohesive sandy clay with PI = 5-16

$$\left[\frac{h_s}{y_e}, \frac{W_s}{y_e}, \frac{L_s}{y_e}, \text{ or } \frac{V_s}{y_e^3}\right] = \alpha_e\left(\frac{\rho V^2}{\tau_c}\right)^{\beta}\left(\frac{t}{t_o}\right)^{\theta}$$

where: t_o = 316 min.

amec

PERMISSIBLE VEOLOCITY/SHEAR
ADOT, 2007

Appendix 7-C Permissible Velocities

Table 7C-1 Permissible Velocities

Grass and Earth-Lined Channels

Channel Slope	Lining	Permissible Velocity*
0-5%	Bermuda grass	6 ft/sec
	Reed canary grass	5 ft/sec
	Tall fescue	5 ft/sec
	Kentucky bluegrass	5 ft/sec
	Grass-legume mixture	4 ft/sec
	Red fescue	4 ft/sec
	Redtop	4 ft/sec
	Sericea lespedeza	4 ft/sec
	Annual lespedeza	4 ft/sec
Channel Slope	Lining	Permissible Velocity*
	Small grains (temp)	
5-10%	Bermuda grass	5 ft/sec
	Reed canary grass	4 ft/sec
	Tall fescue	4 ft/sec
	Kentucky bluegrass	4 ft/sec
	Grass-legume mixture	3 ft/sec
>10%	Bermuda grass	4 ft/sec
	Reed canary grass	3 ft/sec
	Tall fescue	3 ft/sec
	Kentucky bluegrass	3 ft/sec

- For highly erodible soils, decrease permissible velocities by 25%

Bare Soil

Permissible Velocities for Water Flow conditions

SOIL Types	Clear Water	w/ Fine Silts	w/ Sand & Gravel
Fine Sand (noncolloidal)	1.5 ft/sec	2.5 ft/sec	1.5 ft/sec
Sandy Loam (noncolloidal)	1.7 ft/sec	2.5 ft/sec	2.0 ft/sec
Silt Loam (noncolloidal)	2.0 ft/sec	3.0 ft/sec	2.0 ft/sec
Ordinary Firm Loam	2.5 ft/sec	3.5 ft/sec	2.2 ft/sec
Fine Gravel	2.5 ft/sec	5.0 ft/sec	3.7 ft/sec
Graded, Loam to Cobbles	3.7 ft/sec	5.0 ft/sec	5.0 ft/sec
Graded, Silt to Cobbles (noncolloidal)	4.0 ft/sec	5.5 ft/sec	5.0 ft/sec
Alluvial Silts (noncolloidal)	2.0 ft/sec	3.5 ft/sec	2.0 ft/sec
Alluvial Silts (colloidal)	3.7 ft/sec	5.0 ft/sec	3.0 ft/sec
Coarse Gravels (noncolloidal)	4.0 ft/sec	6.0 ft/sec	6.5 ft/sec
Cobbles and Shingles	4.0 ft/sec	6.0 ft/sec	6.5 ft/sec
Shales and Hard Pan	6.0 ft/sec	6.0 ft/sec	5.0 ft/sec

Source: Special Committee on Irrigation Research, American Society of American Civil Engineers, 1926

Appendix 7-D Shear Stress Capacity

Table 7D-1

Summary Of Shear Stress For Various Protection Measures

Protective Cover	Underlying Soil	t_C (lb/ft_2)
Gravel	D_{50} = 1 in	0.40
	D_{50} = 2 in	0.80
Rock	D_{50} = 6 in	2.50
	D_{50} = 12 in	5.00
6 in Gabions	Type I	35
4 in Geoweb	Type I	10
Soil Cement (8% cement)	Type I	>45
Concrete construction Blocks, granular filter underlayer	Type I	>20
Wedge-shaped blocks with drainage slot	Type I	>25

Source: FHWA-RD-89-110, HEC-15

HEC-RAS
SCATTER WASH – SHEAR STRESS

HEC-RAS Version 4.1.0 Jan 2010
U.S. Army Corps of Engineers
Hydrologic Engineering Center
609 Second Street
Davis, California

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

PROJECT DATA
Project Title: Scatter Wash FINAL
Project File : ScatterWashFINAL.prj
Run Date and Time: 7/18/2014 5:06:49 PM

Project in English units

Project Description:
Scatter Wash Levee Certification - SR 101L to City of Phoenix Levee ID#46
Click Here-------->

FCD Contract Number: 2011C005 WA#14

Study
contractor firm name: AMEC Environment & Infrastructure, Inc.

Latest run
date: June 27, 2014

The purpose of this study is to calculate the required
water surface profiles and hydraulic properties to provide certification
documentation in support of FEMA accreditation of the levees along the north
and south banks of Scatter Wash between SR 101L and the City of Phoenix Levee
ID#46. Levees within this reach are identified by FEMA as Levee ID #1901064146
& 1901064147.

Geometry data for cross sections 0.352 to 0.852, inclusive of
the culvert at 43rd Avenue, was extracted from the model named "Scatterwash
Levee Certification 0611" included in the report titled "Scatter Wash Levee
Certification From 43rd Avenue to 39th Drive City of Phoenix Project No. ST
83130297" dated June 2011. The subject model was created in the NGVD29
vertical datum. A factor of 1.867 feet was added to all elevations to convert
the model to NAVD88 vertical datum. Extracted Model Project: "Scatter Wash
Levee Certification 0611", SWLeveeCert0611.prj
Extracted Model Plan: "Matches
Report - Normal Depth Bndr Cond.", SWLeveeCert0611.p04
Note: cross section
notes preceded by "Original Model Comment:" found in the cross section data
editor are exactly as written by the original modeler.

Geometry data for
cross sections 1.036 to 1.342, inclusive of the culvert at the L101 Highway,
was extracted from the model named "Scatter Wash Floodplain Study" prepared for
the Scatter Wash Floodplain Re-Delineation Study (FCD Contract Number 2013C002
WA#1).
Extracted Model Project: "Scatter Wash Floodplain Study",
ScatterWash.prj
Extracted Model Plan: "Scatter Wash.", ScatterWash.p01
Note:
cross section notes preceded by "Original Model Comment:" found in the cross
section data editor are exactly as written by the original modeler.

Vertical
datum of model geometry: NAVD 1988
Horizontal Projection: NAD83. Arizona
Coordinate System, Central Zone, 1992 Epoch

Base map date: January 31,
2013

Base map contractor: AeroTech Mapping Technologies, LLC

This model
was run using HEC-RAS program version 4.1.0.

Source of Effective Hydrology:
Scatter Wash Letter of Map Revision, October 1995, developed by
Kaminski-Hubbard Engineering for the City of Phoenix, Index No. ST-951350.
This flow rate is reported in teh Flood Insurance Study for Maricopa County

2013, Summary of Discharges Table, Volume 1.

Flow Profile 2 is equivalent to
the 10-year storm using a ratio of 35% of the 100-year storm per guidance in
Section 6.2 of the Drainage Design Manual for Maricopa County, Hydrology,
2013.

PLAN DATA

Plan Title: FINAL_TS
Plan File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.p01

Geometry Title: FINAL_ToeShear
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.g01

Flow Title : SWLC
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.f01

Plan Description:
Channel bank statiions within the project area were moved to the interior levee
toe to isolate the shear stress along the levee embankment.

Plan Summary Information:

Number of:	Cross Sections	= 23	Multiple Openings	=	0
	Culverts	= 2	Inline Structures	=	0
	Bridges	= 0	Lateral Structures	=	0

Computational Information

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

Computation Options

Critical depth computed only where necessary	
Conveyance Calculation Method:	At breaks in n values only
Friction Slope Method:	Average Conveyance
Computational Flow Regime:	Subcritical Flow

FLOW DATA

Flow Title: SWLC
Flow File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.f01

Flow Data (cfs)

River	Reach	RS	Q100 - Effective	Q1- 35% Q100
Scatter_Wash	One	1.342	2760	966

Boundary Conditions

River	Reach	Profile	Upstream	Downstream
Scatter_Wash	One	Q100 - Effective		Normal S = 0.005
Scatter_Wash	One	Q1- 35% Q100		Normal S = 0.005

GEOMETRY DATA

Geometry Title: FINAL_ToeShear
Geometry File : H:\Water Resources\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\03-DESIGN\03-Drainage\01-Calc\HEC-RAS\HEC-RAS - July2014\Scatter Wash\ScatterWashFINAL.g01

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.342

INPUT

Description: Floodplain Redlination Section 1.339

Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9671.28	1349.21	9677.68	1349.11	9684.09	1348.94	9690.49	1348.6	9699.88	1348.06
9703.3	1347.87	9715.34	1346.4	9726.74	1344.98	9738.78	1343.6	9744.61	1342.9
9746.03	1342.26	9747.03	1342.19	9748.03	1342.06	9748.03	1341.96	9748.03	1341.86
9748.03	1341.73	9749.03	1341.66	9750.03	1341.57	9750.03	1341.47	9750.03	1341.35
9751.44	1341.02	9752.44	1340.66	9753.85	1340.11	9756.68	1339.28	9756.68	1339.04
9756.68	1338.99	9756.68	1338.94	9758.92	1338.94	9760.33	1338.93	9761.33	1338.93
9762.33	1338.93	9763.75	1338.93	9765.16	1338.93	9768.77	1338.92	9774.42	1340.44
9783.64	1342.68	9788.64	1342.66	9792.25	1342.67	9809.28	1342.68	9811.51	1342.63
9812.93	1342.63	9814.34	1342.62	9814.34	1342.61	9820.75	1342.54	9824.35	1342.54
9827.18	1342.57	9830.79	1342.63	9833.02	1342.69	9841.62	1342.95	9844.45	1342.99
9845.87	1343	9850.87	1343	9865.87	1342.98	9905.27	1342.99	9919.49	1342.98
9928.09	1344.37	9928.09	1344.46	9929.5	1344.49	9939.5	1344.89	9940.82	1344.84
9943.11	1344.77	9948.11	1344.71	9954.51	1342.61	9956.75	1341.76	9958.73	1340.68
9959.58	1340.22	9963.18	1339.03	9972.4	1338.76	9978.23	1338.57	9993.23	1338.15
9998.23	1337.64	9999.65	1337.5110001.88		1337.6910004.71		1337.9210033.31		1337.98
10083.31	1338.0410084.48		1338.5110089.72		1340.6110093.32		1342.0510096.15		1343.52
10104.75	1347.3110105.75		1347.1710107.17		1346.8510116.07		1346.9810118.57		1347.01
10121.4	1347.0710123.63		1347.1610124.63		1347.1910127.46		1346.6310141.06		1343.62
10156.06	1344.1810157.48		1344.2610159.93		1344.5510161.08		1344.6910163.91		1345.03
10165.32	1345.0410167.56		1345.0510186.77		1345.2210191.24		1345.2110240.45		1345.01
10246.28	1344.9610247.69		1344.8510252.69		1344.68				

Manning's n Values num= 7

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9671.28	.018	9699.88	.05	9744.61	.018	9783.64	.05	9940.82	.028
10116.07	.08510159.93		.03						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.

9963.1810084.48		183.19	215.38	246.46	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9726.28	9813.451345.052		F
10160.7410252.691344.709			F

Blocked Obstructions num= 1

Sta L	Sta R	Elev
10189.9110252.691345.229		

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1341.85	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.20	Wt. n-Val.	0.028	0.028	0.028
W.S. Elev (ft)	1340.65	Reach Len. (ft)	183.19	215.38	246.46
Crit W.S. (ft)	1340.64	Flow Area (sq ft)	3.85	306.85	5.70
E.G. Slope (ft/ft)	0.008089	Area (sq ft)	33.24	306.85	5.70
Q Total (cfs)	2760.00	Flow (cfs)	16.12	2716.81	27.07
Top Width (ft)	153.83	Top Width (ft)	27.19	121.30	5.33
Vel Total (ft/s)	8.72	Avg. Vel. (ft/s)	4.19	8.85	4.75
Max Chl Dpth (ft)	3.14	Hydr. Depth (ft)	0.88	2.53	1.07
Conv. Total (cfs)	30687.0	Conv. (cfs)	179.2	30206.7	301.0
Length Wtd. (ft)	215.49	Wetted Per. (ft)	4.69	121.45	5.75
Min Ch El (ft)	1337.51	Shear (lb/sq ft)	0.41	1.28	0.50
Alpha	1.02	Stream Power (lb/ft s)	10252.69	0.00	0.00
Frctn Loss (ft)	1.81	Cum Volume (acre-ft)	2.98	64.18	1.73
C & E Loss (ft)	0.01	Cum SA (acres)	1.76	22.84	1.08

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1340.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.46	Wt. n-Val.	0.028	0.028	0.028
W.S. Elev (ft)	1339.57	Reach Len. (ft)	183.19	215.38	246.46
Crit W.S. (ft)	1339.38	Flow Area (sq ft)	0.44	175.76	1.39
E.G. Slope (ft/ft)	0.006492	Area (sq ft)	9.05	175.76	1.39
Q Total (cfs)	966.00	Flow (cfs)	0.75	961.54	3.71
Top Width (ft)	141.04	Top Width (ft)	17.10	121.30	2.64
Vel Total (ft/s)	5.44	Avg. Vel. (ft/s)	1.72	5.47	2.66
Max Chl Dpth (ft)	2.06	Hydr. Depth (ft)	0.27	1.45	0.53
Conv. Total (cfs)	11988.7	Conv. (cfs)	9.3	11933.4	46.0
Length Wtd. (ft)	215.43	Wetted Per. (ft)	1.71	121.45	2.84
Min Ch El (ft)	1337.51	Shear (lb/sq ft)	0.10	0.59	0.20
Alpha	1.01	Stream Power (lb/ft s)	10252.69	0.00	0.00
Frctn Loss (ft)	1.80	Cum Volume (acre-ft)	1.05	34.13	0.55
C & E Loss (ft)	0.02	Cum SA (acres)	1.03	21.83	0.64

Warning: Divided flow computed for this cross-section.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the

need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.301

INPUT
Description: Floodplain Redelineation Section 1.339

Original Model
Comment:
7069 at culvert entrance
Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9683.54	1347.41	9714.68	1346.73	9722.75	1346.57	9734.79	1346.29	9744.84	1346.09
9750.84	1345.94	9757.91	1345.79	9776.02	1345.37	9780.02	1345.29	9801.12	1344.79
9805.12	1344.69	9806.12	1344.69	9815.12	1344.48	9817.12	1344.46	9836.22	1344.03
9843.29	1343.92	9844.29	1343.92	9858.29	1343.81	9869.29	1343.8	9883.29	1343.7
9897.29	1343.55	9905.29	1343.47	9913.48	1343.45	9916.29	1343.45	9924.29	1343.36
9930.29	1342.73	9932.29	1341.94	9934.01	1340.94	9940.29	1337.26	9941.29	1336.43
10054.29	1336.43	10054.29	1336.24	10055.29	1336.18	10056.29	1336.12	10059.29	1335.76
10062.29	1335.57	10063.29	1335.46	10065.29	1335.35	10065.29	1336.53	10065.29	1337.71
10067.29	1337.81	10067.94	1337.87	10070.29	1338.12	10074.29	1339.76	10076.29	1340.48
10080.29	1345.42	10080.29	1345.81	10081.29	1345.84	10082.29	1345.84	10082.29	1345.85
10083.29	1345.85	10083.29	1345.82	10084.29	1345.78	10092.13	1345.73	10098.29	1345.69
10104.29	1345.62	10111.57	1345.56	10114.73	1345.36	10117.9	1345.15	10124.22	1344.87
10125.22	1344.86	10127.46	1344.69	10128.46	1344.66	10131.62	1344.48	10132.62	1344.43
10133.62	1344.41	10139.7	1344.21	10139.7	1344.19	10146.03	1343.98	10146.03	1343.97
10147.03	1343.96	10153.35	1343.79	10154.77	1343.75	10159.86	1343.61	10170.3	1343.29
10175.69	1343.17	10177.93	1343.12	10185.21	134	10195.65	1342.84	10199.77	1342.72
10208.31	1342.55	10218.75	1342.34	10228.24	1342.17	10230.24	1342.88	10237.23	1344.73
10237.52	1344.81	10242.91	1344.72	10242.91	1344.71	10243.91	1344.71	10249.29	1344.64
10249.29	1344.65	10250.29	1344.65	10254.41	1344.61	10255.83	1344.61	10257.83	1344.62
10257.83	1344.64	10265.11	1344.58	10266.11	1344.61	10267.11	1344.61	10268.11	1344.6
10269.11	1344.61	10273.58	1344.57	10276.58	1344.57	10277.58	1344.56	10278.58	1344.54
10283.97	1344.61	10317.21	1344.47	10319.44	1344.48	10321.68	1344.48	10334.05	1344.23
10334.05	1344.22	10335.46	1344.21	10345.9	1344.26	10353.18	1344.23	10369.95	1344.17

Manning's n Values num= 4

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9683.54	.05	9913.48	.028	10092.13	.085	10237.23	.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9934.01	10067.94	10.52	10.61	10.24	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9683.54	9924.29	1352.06	F
10080.29	10369.95	1349.6	F

Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10175.96	10187.44	1343.19	10208.46	10221.21	342.576	10248.61	10278.21	1344.67
10299.24	10320.27	1344.53	10338.71	10369.95	1344.212			

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1340.04	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.18	Wt. n-Val.		0.028	0.028
W.S. Elev (ft)	1338.85	Reach Len. (ft)	10.52	10.61	10.24
Crit W.S. (ft)	1338.85	Flow Area (sq ft)		314.51	2.67
E.G. Slope (ft/ft)	0.008680	Area (sq ft)		314.51	2.67
Q Total (cfs)	2760.00	Flow (cfs)		2750.41	9.59
Top Width (ft)	134.50	Top Width (ft)		130.37	4.13
Vel Total (ft/s)	8.70	Avg. Vel. (ft/s)		8.75	3.60
Max Chl Dpth (ft)	3.50	Hydr. Depth (ft)		2.41	0.64
Conv. Total (cfs)	29625.1	Conv. (cfs)		29522.2	103.0
Length Wtd. (ft)	10.61	Wetted Per. (ft)		133.69	4.29
Min Ch El (ft)	1335.35	Shear (lb/sq ft)		1.27	0.34
Alpha	1.01	Stream Power (lb/ft s)	10369.95	0.00	0.00
Frctn Loss (ft)	0.02	Cum Volume (acre-ft)	2.91	62.64	1.71
C & E Loss (ft)	0.42	Cum SA (acres)	1.70	22.21	1.06

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth,

the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical
answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1338.22	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.62	Wt. n-Val.		0.028		
W.S. Elev (ft)	1337.60	Reach Len. (ft)	10.52	10.61	10.24	
Crit W.S. (ft)	1337.60	Flow Area (sq ft)		153.28		
E.G. Slope (ft/ft)	0.011144	Area (sq ft)		153.28		
Q Total (cfs)	966.00	Flow (cfs)		966.00		
Top Width (ft)	125.58	Top Width (ft)		125.58		
Vel Total (ft/s)	6.30	Avg. Vel. (ft/s)		6.30		
Max Chl Dpth (ft)	2.25	Hydr. Depth (ft)		1.22		
Conv. Total (cfs)	9150.9	Conv. (cfs)		9150.9		
Length Wtd. (ft)	10.61	Wetted Per. (ft)		128.46		
Min Ch El (ft)	1335.35	Shear (lb/sq ft)		0.83		
Alpha	1.00	Stream Power (lb/ft s)	10369.95	0.00	0.00	
Frctn Loss (ft)	0.03	Cum Volume (acre-ft)	1.03	33.32	0.55	
C & E Loss (ft)	0.23	Cum SA (acres)	1.00	21.22	0.63	

Warning: The energy equation could not be balanced within the specified number of iterations. The program used
critical depth
for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This
may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth,
the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical
answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid,
energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.299

INPUT
Description: Floodplain Redelineation Section 1.298

Original Model
Comment:
6854 Top of vertical drop structu
Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9681.95	1347.98	9683.95	1347.95	9711.12	1347.56	9722.16	1347.45	9729.16	1347.36
9744.29	1347.24	9747.29	1347.21	9756.35	1347.13	9762.35	1347.01	9762.46	1347.01
9763.35	1346.98	9778.48	1346.66	9784.48	1346.53	9797.52	1346.24	9801.64	1346.17
9811.69	1345.94	9819.69	1345.77	9833.84	1345.47	9838.84	1345.35	9849.88	1345.12
9858.88	1345.05	9861.88	1345.02	9864.88	1344.99	9888.88	1344.81	9891.88	1344.78
9911.81	1344.74	9916.88	1344.73	9916.88	1344.72	9919.88	1344.68	9920.88	1344.67
9924.88	1344.29	9929.88	1343.48	9931.88	1343.23	9931.88	1343.11	9932.6	1342.98
9932.88	1342.93	9936.88	1340.58	9939.95	1333.4310049.95		1333.4310052.45		1333.36
10062.45	1333.3610063.88		1334.6210063.88		1334.8210063.88		1338.2610064.88		1338.7
10066.12	1338.6910069.88		1338.6710070.88		1339.1810071.88		1340.3310073.88		1345.8
10083.88	1345.7210086.54		1345.710097.88		1345.5810106.43		1345.5110109.43		1345.35
10112.59	1345.1810125.24		1344.6210125.24		1344.610127.24		1344.4910128.65		1344.42
10130.65	1344.3110132.89		1344.19 10134.3		1344.14 10137.3		1344.0410138.72		1343.98
10141.72	1343.8910143.13		1343.8410144.13		1343.810147.29		1343.7310149.53		1343.72
10152.69	1343.6310159.97		1343.5610165.07		1343.4110174.56		1343.1810194.48		1342.86
10207.13	1342.6610217.57		1342.4510221.69		1342.3810228.02		1342.2810236.26		1342.12
10240.39	1342.0610246.71		1341.9410246.71		1341.9210249.87		1341.92 10256.2		1343.31
10260.54	1344.33 10261.3		1344.5110264.46		1344.4810264.46		1344.4910265.46		1344.49
10273.71	1344.4410274.71		1344.4410274.71		1344.4310284.19		1344.52 10300		1344.46
10313.61	1344.5210315.61		1344.5310315.61		1344.5110316.61		1344.4910327.05		1344.31
10334.66	1344.2910341.94		1344.3210362.82		1344.22				

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9681.95	.018	9762.46	.05	9911.81	.02810086.54		.08510260.54		.03

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9936.8810066.12		517.59	532.96 522.53	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9681.95	9920.88	1352.06	F

10073.8810362.82 1349.6 F
Blocked Obstructions num= 5

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10172.611	10179.92	1343.235	10205.31	10211.66	1342.693	10245.32	10269.45	1344.468
10294.551	10310.42	1344.504	10332.34	10362.82	1344.294			

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1338.49	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.34	Wt. n-Val.		0.028		
W.S. Elev (ft)	1338.15	Reach Len. (ft)	517.59	532.96	522.53	
Crit W.S. (ft)	1335.92	Flow Area (sq ft)		590.07		
E.G. Slope (ft/ft)	0.001066	Area (sq ft)		590.07		
Q Total (cfs)	2760.00	Flow (cfs)		2760.00		
Top Width (ft)	125.96	Top Width (ft)		125.96		
Vel Total (ft/s)	4.68	Avg. Vel. (ft/s)		4.68		
Max Chl Dpth (ft)	4.79	Hydr. Depth (ft)		4.68		
Conv. Total (cfs)	84515.3	Conv. (cfs)		84515.3		
Length Wtd. (ft)	532.96	Wetted Per. (ft)		133.08		
Min Ch El (ft)	1333.36	Shear (lb/sq ft)		0.30		
Alpha	1.00	Stream Power (lb/ft s)	10362.82	0.00	0.00	
Frctn Loss (ft)		Cum Volume (acre-ft)	2.91	62.53	1.71	
C & E Loss (ft)		Cum SA (acres)	1.70	22.18	1.06	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1336.01	Element	Left OB	Channel	Right OB	
Vel Head (ft)	0.16	Wt. n-Val.		0.028		
W.S. Elev (ft)	1335.85	Reach Len. (ft)	517.59	532.96	522.53	
Crit W.S. (ft)	1334.67	Flow Area (sq ft)		300.75		
E.G. Slope (ft/ft)	0.001176	Area (sq ft)		300.75		
Q Total (cfs)	966.00	Flow (cfs)		966.00		
Top Width (ft)	124.97	Top Width (ft)		124.97		
Vel Total (ft/s)	3.21	Avg. Vel. (ft/s)		3.21		
Max Chl Dpth (ft)	2.49	Hydr. Depth (ft)		2.41		
Conv. Total (cfs)	28169.2	Conv. (cfs)		28169.2		
Length Wtd. (ft)	532.96	Wetted Per. (ft)		128.26		
Min Ch El (ft)	1333.36	Shear (lb/sq ft)		0.17		
Alpha	1.00	Stream Power (lb/ft s)	10362.82	0.00	0.00	
Frctn Loss (ft)		Cum Volume (acre-ft)	1.03	33.26	0.55	
C & E Loss (ft)		Cum SA (acres)	1.00	21.19	0.63	

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: Scatter_Wash
REACH: One RS: 1.251

INPUT
Description: 6603 SR 101L
9-10'x6' RCBC spaced at 1'
1-10'x9' RCBC
Distance from Upstream XS = 15
Deck/Roadway Width = 430
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 29

Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord	Sta Hi Cord	Lo Cord
9681.951	354.722	9733.548	1354.021	9853.398	1352.509
9930.381	1352.06	9930.905	1352.057	9943.174	1351.98
9943.582	1351.978	9955.764	1351.902	9956.252	1351.899
9968.182	1351.825	9968.791	1351.822	9981.101	1351.745
9982.722	1351.735	9993.141	1351.671	9993.442	1351.669
10005.74	1351.593	10006.2	1351.59	10018.44	1351.514
10018.71	351.512	10031.06	1351.436	10031.67	1351.432
10043.68	1351.357	10044.15	1351.354	10055.74	1351.282
10056.59	1351.277	10260.38	1350.004	10397.07	1349.469
10557.67	1349.035	10681.95	1349		

Upstream Bridge Cross Section Data
Station Elevation Data num= 103

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9681.95	1347.98	9683.95	1347.95	9711.12	1347.56	9722.16	1347.45	9729.16	1347.36
9744.29	1347.24	9747.29	1347.21	9756.35	1347.13	9762.35	1347.01	9762.46	1347.01
9763.35	1346.98	9778.48	1346.66	9784.48	1346.53	9797.52	1346.24	9801.64	1346.17
9811.69	1345.94	9819.69	1345.77	9833.84	1345.47	9838.84	1345.35	9849.88	1345.12
9858.88	1345.05	9861.88	1345.02	9864.88	1344.99	9888.88	1344.81	9891.88	1344.78
9911.81	1344.74	9916.88	1344.73	9916.88	1344.72	9919.88	1344.68	9920.88	1344.67
9924.88	1344.29	9929.88	1343.48	9931.88	1343.23	9931.88	1343.11	9932.6	1342.98
9932.88	1342.93	9936.88	1340.58	9939.95	1333.431	10049.95	1333.431	10052.45	1333.36

```
10062.45 1333.3610063.88 1334.6210063.88 1334.8210063.88 1338.2610064.88  1338.7
10066.12 1338.6910069.88 1338.6710070.88 1339.1810071.88 1340.3310073.88  1345.8
10083.88 1345.7210086.54  1345.710097.88 1345.5810106.43 1345.5110109.43 1345.35
10112.59 1345.1810125.24 1344.6210125.24  1344.610127.24 1344.4910128.65 1344.42
10130.65 1344.3110132.89 1344.19 10134.3 1344.14 10137.3 1344.0410138.72 1343.98
10141.72 1343.8910143.13 1343.8410144.13  1343.810147.29 1343.7310149.53 1343.72
10152.69 1343.6310159.97 1343.5610165.07 1343.4110174.56 1343.1810194.48 1342.86
10207.13 1342.6610217.57 1342.4510221.69 1342.3810228.02 1342.2810236.26 1342.12
10240.39 1342.0610246.71 1341.9410246.71 1341.9210249.87 1341.92 10256.2 1343.31
10260.54 1344.33 10261.3 1344.5110264.46 1344.4810264.46 1344.4910265.46 1344.49
10273.71 1344.4410274.71 1344.4410274.71 1344.4310284.19 1344.52   10300 1344.46
10313.61 1344.5210315.61 1344.5310315.61 1344.5110316.61 1344.4910327.05 1344.31
10334.66 1344.2910341.94 1344.3210362.82 1344.22

Manning's n Values         num=       5
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9681.95    .018 9762.46     .05 9911.81    .02810086.54    .08510260.54     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9936.8810066.12             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9681.95 9920.88 1352.06       F
10073.8810362.82  1349.6       F
Blocked Obstructions     num=       5
   Sta L   Sta R    Elev   Sta L   Sta R    Elev   Sta L   Sta R    Elev
10172.6110179.921343.23510205.3110211.661342.69310245.3210269.451344.468
10294.5510310.421344.50410332.3410362.821344.294

Downstream  Deck/Roadway Coordinates
    num=      33
     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord     Sta Hi Cord Lo Cord
 9524.161354.722         9575.7581354.021         9695.6081352.509
9918.5171350.997         9919.0441350.994          9919.151350.993
9919.3051350.992         9930.1251350.921         9931.5651350.911
9943.0251350.835         9944.0251350.829         9955.6351350.752
9956.6951350.745         9968.4551350.668         9969.1551350.663
9980.7041350.587         9981.785 1350.58         9993.2841350.504
9994.2241350.498         10005.92 1350.42         10006.981350.413
10018.441350.338          10019.51350.331         10031.091350.254
10032.181350.247         10043.751350.171         10044.351350.167
10045.38 1350.16         10056.431350.132         10102.591350.004
10239.281349.469         10399.881349.035         10524.16    1349

Downstream Bridge Cross Section Data
Station Elevation Data    num=     141
     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev     Sta     Elev
 9524.16 1346.56 9543.16 1346.67 9560.16  1346.7 9569.17 1346.75 9571.16 1346.76
 9580.16 1346.65 9581.16 1346.66 9585.16 1346.78 9593.16  1347.1 9594.16 1347.06
 9595.16 1346.95 9598.16 1346.34 9600.16 1346.17 9602.16 1346.07 9603.16 1346.04
 9605.16 1345.87 9612.16 1345.78 9613.16 1345.76 9614.16 1345.76 9624.16 1345.62
 9626.16 1345.58 9628.16 1345.55 9636.16 1345.39 9638.16 1345.19 9645.16 1344.92
 9647.16 1344.81 9655.16  1344.4 9656.16 1344.27 9666.16 1343.49 9669.16 1343.15
 9675.16 1342.46 9681.16 1341.98 9681.21 1341.97 9683.16 1341.82 9686.16 1341.79
 9690.16 1341.74 9694.16 1341.66 9698.16 1341.57 9706.16 1341.36 9708.22 1341.14
 9709.16 1341.05 9711.16 1340.88 9714.16 1340.82 9715.16 1340.81 9718.16 1340.76
 9721.16 1340.76 9726.16 1340.84 9729.16 1340.86 9732.16 1340.87 9740.16    1341
 9741.16 1340.95 9745.16 1340.65 9745.23 1340.65 9746.16 1340.68 9748.16 1340.83
 9766.24 1340.81 9844.22 1340.76 9851.22 1340.72 9852.22 1340.72 9855.22 1340.85
 9863.22 1342.81 9865.22 1343.19 9871.27 1343.14 9876.22  1343.1 9881.22 1343.02
 9889.22 1339.35 9896.22 1336.32 9900.28 1334.61 9901.22 1334.21 9905.291333.787
 9919.16 1332.4510029.16 1332.4510031.66  1332.410041.66  1332.410045.22 1334.07
10045.33 1334.1210050.22 1336.4410060.22 1340.7210064.22 1342.3910069.22 1342.66
10072.22 1343.0810074.34 1342.8910076.22 1342.7110086.22 1341.9310097.22 1340.74
10106.22 1339.6910111.22 1339.5810130.22 1339.3410138.22 1339.2810139.22 1339.28
10141.22 1339.2710158.22 1339.2510160.22 1339.2410162.22 1339.2510164.22 1339.11
10169.22 1338.8410172.22 1338.7410175.22 1338.6210178.22 1338.6210181.22 1338.58
10184.22 1338.5910187.22 1338.6310189.22 1338.6310193.22 1338.7810195.22 1338.89
10198.22 1339.0810201.22 1339.4810202.22 1339.7310204.46 1340.1410205.46 1340.24
10206.39 1340.2510251.46 1340.4910254.46 1340.5110287.46 1340.5710291.46 1340.55
10293.46 1340.6610297.46  1340.610301.46  1340.610310.46 1339.5610312.46  1339.3
10317.42 1338.8110319.46 1338.6110324.46 1338.6110325.46 1338.1110334.46 1338.51
10336.46 1338.5910339.46 1338.7410343.46 1338.5710354.46 1338.0710355.46 1338.57
10356.46 1338.5710358.43 1338.5610360.46 1338.5510362.46 1338.7110373.46 1339.78
10377.46 1340.1910379.46 1340.2510382.46  1340.310383.46 1340.3510417.46 1340.64
10430.46 1340.72

Manning's n Values         num=      12
     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9524.16    .018 9569.17     .05 9681.21     .03 9708.22     .05 9745.23    .018
 9766.24     .03 9871.27    .018 9905.29    .02810074.34     .0510206.39     .03
10317.42    .01810358.43     .03

Bank Sta: Left   Right    Coeff Contr.   Expan.
       9901.2210045.33             .3       .5
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9524.16 9878.281346.557       F
```

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10074.9510446.541343.016       F
Left Levee      Station= 9865.22      Elevation= 1343.19
Right Levee     Station=10072.22      Elevation= 1343.08
Blocked Obstructions     num=       2
   Sta L   Sta R    Elev   Sta L   Sta R    Elev
 10232.410295.421340.62610380.4410430.46 1340.72

Upstream Embankment side slope              =       0 horiz. to 1.0 vertical
Downstream Embankment side slope            =       0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow =     .98
Elevation at which weir flow begins         =
Energy head used in spillway design         =
Spillway height used in design              =
Weir crest shape                            = Broad Crested

Number of Culverts =  2

Culvert Name     Shape      Rise    Span
Culvert #1           Box       6      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                 15     430     .013     .013        0                    .4                 1
Number of Barrels =  9
Upstream   Elevation =  1333.43
Centerline Stations
    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.
 9944.95 9957.45 9969.95 9982.45 9994.9510007.4510019.9510032.4510044.95
Downstream Elevation =  1332.45
Centerline Stations
    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.    Sta.
 9924.16 9936.66 9949.16 9961.66 9974.16 9986.66 9999.1610011.6610024.16

Culvert Name     Shape      Rise    Span
Culvert #2           Box       9      10
FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG
Culvert Upstrm Dist  Length    Top n  Bottom n  Depth Blocked  Entrance Loss Coef   Exit Loss Coef
                 15     430     .013     .013        0                    .4                 1
Upstream   Elevation =  1333.96
           Centerline Station =  10057.45
Downstream Elevation =  1332.4
           Centerline Station =  10036.66

CULVERT OUTPUT  Profile #Q100 - Effective  Culv Group:  Culvert #1

  Q Culv Group (cfs)       2510.78    Culv Full Len (ft)
  # Barrels                      9    Culv Vel US (ft/s)          6.95
  Q Barrel (cfs)            278.98    Culv Vel DS (ft/s)          5.84
  E.G. US. (ft)            1338.49    Culv Inv El Up (ft)      1333.43
  W.S. US. (ft)            1338.15    Culv Inv El Dn (ft)      1332.45
  E.G. DS (ft)             1337.48    Culv Frctn Ls (ft)          0.44
  W.S. DS (ft)             1337.23    Culv Exit Loss (ft)         0.28
  Delta EG (ft)               1.01    Culv Entr Loss (ft)         0.30
  Delta WS (ft)               0.92    Q Weir (cfs)
  E.G. IC (ft)             1338.06    Weir Sta Lft (ft)
  E.G. OC (ft)             1338.49    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       1337.44    Weir Max Depth (ft)
  Culv WS Outlet (ft)      1337.23    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         3.26    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         2.89    Min El Weir Flow (ft)    1349.61


Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid, water
surface was used.

CULVERT OUTPUT  Profile #Q1- 35% Q100  Culv Group:  Culvert #1

  Q Culv Group (cfs)        889.30    Culv Full Len (ft)
  # Barrels                      9    Culv Vel US (ft/s)          4.70
  Q Barrel (cfs)             98.81    Culv Vel DS (ft/s)          3.30
  E.G. US. (ft)            1336.01    Culv Inv El Up (ft)      1333.43
  W.S. US. (ft)            1335.85    Culv Inv El Dn (ft)      1332.45
  E.G. DS (ft)             1335.53    Culv Frctn Ls (ft)          0.26
  W.S. DS (ft)             1335.44    Culv Exit Loss (ft)         0.09
  Delta EG (ft)               0.49    Culv Entr Loss (ft)         0.14
  Delta WS (ft)               0.40    Q Weir (cfs)
  E.G. IC (ft)             1335.70    Weir Sta Lft (ft)
  E.G. OC (ft)             1336.01    Weir Sta Rgt (ft)
  Culvert Control           Outlet    Weir Submerg
  Culv WS Inlet (ft)       1335.53    Weir Max Depth (ft)
  Culv WS Outlet (ft)      1335.44    Weir Avg Depth (ft)
  Culv Nml Depth (ft)         1.59    Weir Flow Area (sq ft)
  Culv Crt Depth (ft)         1.45    Min El Weir Flow (ft)    1349.61
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CULVERT OUTPUT Profile #Q100 - Effective Culv Group: Culvert #2

Q Culv Group (cfs)	249.22	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	7.77
Q Barrel (cfs)	249.22	Culv Vel DS (ft/s)	5.16
E.G. US. (ft)	1338.49	Culv Inv El Up (ft)	1333.96
W.S. US. (ft)	1338.15	Culv Inv El Dn (ft)	1332.40
E.G. DS (ft)	1337.48	Culv Frctn Ls (ft)	0.46
W.S. DS (ft)	1337.23	Culv Exit Loss (ft)	0.16
Delta EG (ft)	1.01	Culv Entr Loss (ft)	0.37
Delta WS (ft)	0.92	Q Weir (cfs)	
E.G. IC (ft)	1338.18	Weir Sta Lft (ft)	
E.G. OC (ft)	1338.48	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1337.17	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1337.23	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	2.55	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.68	Min El Weir Flow (ft)	1349.61

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT OUTPUT Profile #Q1- 35% Q100 Culv Group: Culvert #2

Q Culv Group (cfs)	76.70	Culv Full Len (ft)	
# Barrels	1	Culv Vel US (ft/s)	5.47
Q Barrel (cfs)	76.70	Culv Vel DS (ft/s)	2.52
E.G. US. (ft)	1336.01	Culv Inv El Up (ft)	1333.96
W.S. US. (ft)	1335.85	Culv Inv El Dn (ft)	1332.40
E.G. DS (ft)	1335.53	Culv Frctn Ls (ft)	0.28
W.S. DS (ft)	1335.44	Culv Exit Loss (ft)	0.01
Delta EG (ft)	0.49	Culv Entr Loss (ft)	0.19
Delta WS (ft)	0.40	Q Weir (cfs)	
E.G. IC (ft)	1335.84	Weir Sta Lft (ft)	
E.G. OC (ft)	1336.01	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1335.36	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1335.44	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	1.16	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	1.22	Min El Weir Flow (ft)	1349.61

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.198

INPUT
Description: Floodplain Redelineation Section 1.296

Original Model
Comment:
6843 Upstream of SR 101L culvert
Station Elevation Data num= 141

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9524.16	1346.56	9543.16	1346.67	9560.16	1346.7	9569.17	1346.75	9571.16	1346.76
9580.16	1346.65	9581.16	1346.66	9585.16	1346.78	9593.16	1347.1	9594.16	1347.06
9595.16	1346.95	9598.16	1346.34	9600.16	1346.17	9602.16	1346.07	9603.16	1346.04
9605.16	1345.87	9612.16	1345.78	9613.16	1345.76	9614.16	1345.76	9624.16	1345.62
9626.16	1345.58	9628.16	1345.55	9636.16	1345.39	9638.16	1345.19	9645.16	1344.92
9647.16	1344.81	9655.16	1344.4	9656.16	1344.27	9666.16	1343.49	9669.16	1343.15
9675.16	1342.46	9681.16	1341.98	9681.21	1341.97	9683.16	1341.82	9686.16	1341.79
9690.16	1341.74	9694.16	1341.66	9698.16	1341.57	9706.16	1341.36	9708.22	1341.14
9709.16	1341.05	9711.16	1340.88	9714.16	1340.82	9715.16	1340.81	9718.16	1340.76
9721.16	1340.76	9726.16	1340.84	9729.16	1340.86	9732.16	1340.87	9740.16	1341
9741.16	1340.95	9745.16	1340.65	9745.23	1340.65	9746.16	1340.68	9748.16	1340.83
9766.24	1340.81	9844.22	1340.76	9851.22	1340.72	9852.22	1340.72	9855.22	1340.85
9863.22	1342.81	9865.22	1343.19	9871.27	1343.14	9876.22	1343.1	9881.22	1343.02
9889.22	1339.35	9896.22	1336.32	9900.28	1334.61	9901.22	1334.21	9905.29	1333.787
9919.16	1332.45	10029.16	1332.45	10031.66	1332.41	10041.66	1332.41	10045.22	1334.07
10045.33	1334.12	10050.22	1336.44	10060.22	1340.72	10064.22	1342.39	10069.22	1342.66
10072.22	1343.08	10074.34	1342.89	10076.22	1342.71	10086.22	1341.93	10097.22	1340.74
10106.22	1339.69	10111.22	1339.58	10130.22	1339.34	10138.22	1339.28	10139.22	1339.28
10141.22	1339.27	10158.22	1339.25	10160.22	1339.24	10162.22	1339.25	10164.22	1339.11
10169.22	1338.84	10172.22	1338.74	10175.22	1338.62	10178.22	1338.62	10181.22	1338.58
10184.22	1338.59	10187.22	1338.63	10189.22	1338.63	10193.22	1338.78	10195.22	1338.89
10198.22	1339.08	10201.22	1339.48	10202.22	1339.73	10204.46	1340.14	10205.46	1340.24
10206.39	1340.25	10251.46	1340.49	10254.46	1340.51	10287.46	1340.57	10291.46	1340.55
10293.46	1340.66	10297.46	1340.61	10301.46	1340.61	10310.46	1339.56	10312.46	1339.3
10317.42	1338.81	10319.46	1338.61	10324.46	1338.61	10325.46	1338.11	10334.46	1338.51
10336.46	1338.59	10339.46	1338.74	10343.46	1338.57	10354.46	1338.07	10355.46	1338.57
10356.46	1338.57	10358.43	1338.56	10360.46	1338.55	10362.46	1338.71	10373.46	1339.78
10377.46	1340.19	10379.46	1340.25	10382.46	1340.31	10383.46	1340.35	10417.46	1340.64
10430.46	1340.72								

Manning's n Values num= 12

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9524.16	.018	9569.17	.05	9681.21	.03	9708.22	.05	9745.23	.018
9766.24	.03	9871.27	.018	9905.29	.02	810074.34	.05	10206.39	.03
10317.42	.01	810358.43	.03						

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
9901.22 10045.33 355.51 304.13 283.97 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9524.16	9878.28	1346.55	F
10074.95	10446.54	1343.01	F

Left Levee Station= 9865.22 Elevation= 1343.19
Right Levee Station=10072.22 Elevation= 1343.08

Blocked Obstructions num= 2

Sta L	Sta R	Elev	Sta L	Sta R	Elev
10232.41	10295.42	1340.62	10380.44	10430.46	1340.72

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1337.48	Element			
Vel Head (ft)	0.25	Wt. n-Val.	0.018	0.028	0.028
W.S. Elev (ft)	1337.23	Reach Len. (ft)	355.51	304.13	283.97
Crit W.S. (ft)	1334.83	Flow Area (sq ft)	10.77	670.76	10.26
E.G. Slope (ft/ft)	0.000735	Area (sq ft)	10.77	670.76	10.26
Q Total (cfs)	2760.00	Flow (cfs)	30.09	2711.58	18.32
Top Width (ft)	157.94	Top Width (ft)	7.10	144.11	6.73
Vel Total (ft/s)	3.99	Avg. Vel. (ft/s)	2.79	4.04	1.79
Max Chl Dpth (ft)	4.83	Hydr. Depth (ft)	1.52	4.65	1.52
Conv. Total (cfs)	101803.3	Conv. (cfs)	1110.0	100017.4	675.8
Length Wtd. (ft)	304.67	Wetted Per. (ft)	7.72	144.58	7.42
Min Ch El (ft)	1332.40	Shear (lb/sq ft)	0.06	0.21	0.06
Alpha	1.02	Stream Power (lb/ft s)	10430.46	9865.22	10072.22
Frctn Loss (ft)	0.51	Cum Volume (acre-ft)	2.91	61.47	1.71
C & E Loss (ft)	0.23	Cum SA (acres)	1.66	20.53	1.02

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1335.53	Element			
Vel Head (ft)	0.08	Wt. n-Val.	0.018	0.028	0.028
W.S. Elev (ft)	1335.44	Reach Len. (ft)	355.51	304.13	283.97
Crit W.S. (ft)	1333.67	Flow Area (sq ft)	1.80	413.46	1.85
E.G. Slope (ft/ft)	0.000465	Area (sq ft)	1.80	413.46	1.85
Q Total (cfs)	966.00	Flow (cfs)	2.19	962.31	1.50
Top Width (ft)	149.82	Top Width (ft)	2.92	144.11	2.79
Vel Total (ft/s)	2.32	Avg. Vel. (ft/s)	1.22	2.33	0.81
Max Chl Dpth (ft)	3.04	Hydr. Depth (ft)	0.62	2.87	0.66
Conv. Total (cfs)	44787.6	Conv. (cfs)	101.6	44616.4	69.6
Length Wtd. (ft)	304.43	Wetted Per. (ft)	3.17	144.58	3.09
Min Ch El (ft)	1332.40	Shear (lb/sq ft)	0.02	0.08	0.02
Alpha	1.01	Stream Power (lb/ft s)	10430.46	9865.22	10072.22
Frctn Loss (ft)	0.37	Cum Volume (acre-ft)	1.03	32.67	0.55
C & E Loss (ft)	0.12	Cum SA (acres)	0.98	19.54	0.62

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.141

INPUT
Description: Floodplain Redelineation Section 1.195

Original Model
Comment:
6310 Downstream of SR 101L culvert
Station Elevation Data num= 149

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9523.66	1340.1	9529.32	1340.05	9532.92	1340.06	9535.75	1339.69	9541.41	1339.17
9543.64	1339.07	9554.27	1338.65	9555.27	1338.65	9556.27	1338.65	9565.49	1338.65
9569.74	1338.62	9571.15	1338.73	9578.96	1339.68	9595.24	1339.77	9608.69	1339.85
9625.72	1339.97	9651.22	1340.06	9651.22	1340.07	9652.63	1340.06	9659.03	1340.35

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 9659.03 1340.37 9660.45 1340.38  9670.4 1340.27  9699.4 1339.96  9705.8 1339.93
 9710.04 1339.91 9712.28 1339.89 9715.89 1341.67 9715.89 1341.87 9732.91 1341.25
 9747.78 1340.82 9759.82 1340.43 9764.82 1340.29 9766.24 1340.07 9775.46 1339.97
 9810.17 1339.99 9826.45 1339.46 9827.86 1339.43 9831.47 1339.37 9834.39 1339.33
 9835.07 1339.32 9851.47 1339.52 9871.47 1338.98 9880.08    1339 9881.49 1338.98
 9884.32 1339.99 9887.92 1341.42 9891.53 1341.19 9895.77 1340.88 9897.19 1340.71
  9898.6 1340.56 9899.57 1340.07 9905.11 1337.37 9910.81 1334.44 9913.04 1332.97
 9914.04 1333.86 9914.04 1334.09  9923.3  1333.7 9946.25 1332.75 9950.49  1332.6
  9951.9 1332.54 9956.38 1332.36 9960.62 1332.51 9994.22 1333.64 9994.22  1333.6
 9997.82 1332.71 9999.24 1332.35 9999.24 1332.3710005.64 1333.7110035.64 1333.89
10040.64 1333.9110042.06  1333.810043.47 1333.6510049.86 1332.9810049.87 1333.14
10049.87 1333.6510053.23 1334.9810054.64 1335.5310058.48 1337.0410066.29 1340.49
10067.29 1341.3710076.51 1341.0710078.38 1340.9910080.11 1340.9210083.72 1340.34
10087.96 1339.4910100.17 1339.4210113.77 1339.37 10116.6 1339.35 10121.6 1339.37
 10121.6 1339.36 10125.2 1339.3210129.44 1339.2610133.05 1339.2410158.86 1338.97
10181.06 1338.7110184.67 1338.6310187.49 1338.61 10191.1  1338.610192.51  1338.6
10193.51 1338.5210194.93 1338.4910199.93 1338.2310214.93 1337.5810214.96 1337.57
10220.76 1337.1410221.76 1337.0710222.76 1336.6110222.76 1336.5710224.17 1336.59
10224.17 1336.6110239.17 1337.0210240.17    133710241.59 1336.9610250.19 1336.82
10253.79 1336.7510254.79 1337.0610254.79 1337.25 10258.4 1337.25 10258.8 1337.26
 10259.4 1337.2710267.21 1337.7910268.62 1337.8310281.66 1338.4410287.32 1338.51
10288.73 1338.5610289.73 1338.5610293.34 1338.5310298.34  1338.610301.17  1338.7
10336.97  1339.5 10342.8 1339.5110350.61 1339.5610355.61 1339.5310361.45 1339.57
10367.85 1339.5710369.26 1339.5710370.68 1339.5710371.68 1339.5710373.09 1339.57
10374.09 1339.5710376.92 1339.1710379.75 1338.8410384.75 1339.1610394.18 1339.47
10397.01  1339.810399.84  1340.210405.67 1340.2410410.67 1340.38

Manning's n Values         num=        9
     Sta   n Val     Sta    n Val     Sta   n Val     Sta   n Val     Sta   n Val
 9523.66     .03  9670.4     .03 9834.39     .06 9899.57    .018  9923.3    .028
10053.23    .01810078.38     .0310214.96    .018 10258.8     .03

Bank Sta: Left   Right    Lengths: Left Channel   Right     Coeff Contr.   Expan.
       9913.0410049.86           590.28  553.78  523.25             .1      .3
Ineffective Flow     num=       2
   Sta L   Sta R    Elev  Permanent
 9519.27  9887.91341.177       F
10068.6610422.961341.335       F
Left Levee       Station= 9887.92      Elevation= 1341.42
Right Levee      Station=10067.29      Elevation= 1341.37
Blocked Obstructions     num=       4
   Sta L   Sta R    Elev   Sta L   Sta R    Elev   Sta L   Sta R    Elev
 9713.91 9770.951341.046 9805.69 9825.741339.99110122.8310186.191339.364
10130.6710163.051339.275

CROSS SECTION OUTPUT  Profile #Q100 - Effective

  E.G. Elev (ft)           1336.75    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               1.01    Wt. n-Val.                0.018      0.027      0.027
  W.S. Elev (ft)           1335.74    Reach Len. (ft)          590.28     553.78     523.25
  Crit W.S. (ft)           1335.61    Flow Area (sq ft)          6.19     332.68       5.56
  E.G. Slope (ft/ft)      0.006758    Area (sq ft)               6.19     332.68       5.56
  Q Total (cfs)            2760.00    Flow (cfs)                45.36    2689.36      25.28
  Top Width (ft)            146.90    Top Width (ft)             4.76     136.82       5.32
  Vel Total (ft/s)            8.01    Avg. Vel. (ft/s)           7.33       8.08       4.54
  Max Chl Dpth (ft)           3.39    Hydr. Depth (ft)           1.30       2.43       1.05
  Conv. Total (cfs)        33572.6    Conv. (cfs)              551.8    32713.4      307.5
  Length Wtd. (ft)          553.82    Wetted Per. (ft)           5.52     137.85       6.38
  Min Ch El (ft)           1332.35    Shear (lb/sq ft)           0.47       1.02       0.37
  Alpha                       1.01    Stream Power (lb/ft s)  10410.67    9887.92   10067.29
  Frctn Loss (ft)             1.92    Cum Volume (acre-ft)       2.84      57.97       1.66
  C & E Loss (ft)             0.18    Cum SA (acres)             1.61      19.55       0.98


Warning: The velocity head has changed by more than 0.5 ft (0.15 m).  This may indicate the need for additional
cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater
than 1.4.
         This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section.  This
may indicate the
        need for additional cross sections.
Note:    Multiple critical depths were found at this location.  The critical depth with the lowest, valid,
energy was used.

CROSS SECTION OUTPUT  Profile #Q1- 35% Q100

  E.G. Elev (ft)           1335.04    Element                 Left OB    Channel   Right OB
  Vel Head (ft)               0.48    Wt. n-Val.                0.018      0.028      0.028
  W.S. Elev (ft)           1334.56    Reach Len. (ft)          590.28     553.78     523.25
  Crit W.S. (ft)           1334.46    Flow Area (sq ft)          1.91     170.49       1.05
  E.G. Slope (ft/ft)      0.007935    Area (sq ft)               1.91     170.49       1.05
  Q Total (cfs)             966.00    Flow (cfs)                10.59     953.01       2.40
  Top Width (ft)            141.58    Top Width (ft)             2.46     136.82       2.30
  Vel Total (ft/s)            5.57    Avg. Vel. (ft/s)           5.54       5.59       2.28
  Max Chl Dpth (ft)           2.21    Hydr. Depth (ft)           0.78       1.25       0.46
  Conv. Total (cfs)        10844.5    Conv. (cfs)              118.9    10698.7       27.0
  Length Wtd. (ft)          553.79    Wetted Per. (ft)           2.93     137.85       3.13
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Min Ch El (ft)	1332.35	Shear (lb/sq ft)	0.32	0.61	0.17
Alpha	1.01	Stream Power (lb/ft s)	10410.67	9887.92	10067.29
Frctn Loss (ft)	1.82	Cum Volume (acre-ft)	1.02	30.64	0.54
C & E Loss (ft)	0.10	Cum SA (acres)	0.96	18.56	0.60

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 1.036

INPUT
Description: Floodplain Redelineation Section 1.138

Original Model
Comment:
6007
Station Elevation Data num= 122

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
9497.45	1336.46	9528.75	1336.41	9565.43	1336.35	9598.08	1335.91	9602.55	1335.91
9613.73	1335.85	9615.97	1335.73	9627.15	1335.51	9629.38	1335.47	9632.55	1335.36
9642.84	1335.11	9643.84	1335.1	9652.79	1335.77	9654.2	1335.83	9679.7	1335.66
9681.11	1335.66	9744.62	1335.7	9758.93	1335.67	9761.76	1335.72	9776.08	1335.66
9782.79	1335.66	9821.7	1335.57	9825.3	1334.99	9826.3	1334.71	9827.72	1334.45
9835.78	1334.89	9837.61	1334.96	9838.02	1334.98	9840.25	1335.58	9853.25	1338.77
9859.96	1338.7	9865.79	1338.65	9867.21	1338.61	9868.21	1338.6	9876.27	1334.21
9880.39	1332.23	9881.8	1331.9	9881.8	1331.93	9885.69	1331.98	9887.03	1332
9901.93	1332.18	9952.02	1331.04	9960.08	1330.94	9975.73	1330.88	9998.09	1331.01
10009.28	1331.11	0040.58	1331.17	10058.69	1330.99	10060.7	1330.98	10061.7	1331.36
10063.18	1332.07	10068.41	1334.58	10078.26	1338.64	10079.68	1338.94	10079.68	1338.98
10081.09	1338.96	10090.94	1338.71	10095.41	1337.66	10097.78	1337.02	10100.8	1336.2
10102.21	1336.64	10105.37	1336.71	10106.79	1336.76	10108.2	1336.78	10113.59	1336.65
10117.19	1336.58	10117.19	1336.54	10118.19	1336.52	10121.8	1335.79	10133.88	1335.8
10134.88	1335.81	10142.5	1335.79	10168.9	1335.54	10180.6	1335.49	10191.78	1335.37
10214.63	1335.04	10219.1	1335.01	10220.17	1335.01	10225.43	1334.98	10240.66	1334.85
10247.37	1334.62	10249.6	1334.56	10251.84	1334.56	10252.1	1334.56	10253.84	1334.57
10253.84	1334.35	10254.84	1334.07	10263.38	1334.22	10271	1334.35	10278.61	1334.06
10286.23	1333.75	10287.23	1334.14	10287.23	1334.25	10288.64	1334.26	10291.81	1334.27
10292.6	1334.28	10292.81	1334.28	10298.64	1334.58	10304.02	1334.71	10306.26	1334.83
10309.42	1334.99	10333.59	1335.26	10339.91	1335.35	10347.53	1335.32	10379.31	1335.63
10389.16	1335.63	10391.39	1335.64	10392.39	1335.62	10392.39	1335.63	10394.39	1335.63
10395.81	1336.14	10395.81	1336.17	10395.81	1336.21	10396.81	1336.71	10397.81	1336.86
10398.81	1337.07	10398.81	1337.17	10407.35	1337.01	10416.29	1337	10417.29	1336.99
10419.53	1336.99	10421.77	1336.97						

Manning's n Values num= 8

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
9497.45	.05	9837.61	.018	9887.03	.028	10058.69	.018	10097.78	.05
10220.17	.03	10252.1	.018	10292.6	.03				

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
9881.8	10060.7	580.95	546.44	499.79	.1

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
9486.47	9860.24	1338.64	F
10085.11	10421.77	1338.79	F

Left Levee Station= 9853.25 Elevation= 1338.77
Right Levee Station=10079.69 Elevation= 1338.98
Blocked Obstructions num= 4

Sta L	Sta R	Elev	Sta L	Sta R	Elev	Sta L	Sta R	Elev
10196.29	10209.36	1335.33	10332.19	10381.27	1335.62	10510	399.74	10421.77	1337.15
10420.45	10421.77	1336.99							

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1334.65	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.40	Wt. n-Val.	0.018	0.028	0.018
W.S. Elev (ft)	1334.25	Reach Len. (ft)	580.95	546.44	499.79
Crit W.S. (ft)	1333.25	Flow Area (sq ft)	7.30	525.17	11.75
E.G. Slope (ft/ft)	0.002103	Area (sq ft)	7.30	525.17	11.75
Q Total (cfs)	2760.00	Flow (cfs)	31.07	2670.18	58.75
Top Width (ft)	191.51	Top Width (ft)	5.59	178.90	7.01
Vel Total (ft/s)	5.07	Avg. Vel. (ft/s)	4.26	5.08	5.00
Max Chl Dpth (ft)	3.37	Hydr. Depth (ft)	1.30	2.94	1.68
Conv. Total (cfs)	60180.6	Conv. (cfs)	677.4	58222.1	1281.0
Length Wtd. (ft)	546.01	Wetted Per. (ft)	6.12	178.92	7.74
Min Ch El (ft)	1330.88	Shear (lb/sq ft)	0.16	0.39	0.20
Alpha	1.00	Stream Power (lb/ft s)	10421.77	9853.25	10079.69

Frctn Loss (ft)	1.00	Cum Volume (acre-ft)	2.75	52.52	1.55
C & E Loss (ft)	0.04	Cum SA (acres)	1.54	17.54	0.90

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1333.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.16	Wt. n-Val.	0.018	0.028	0.018
W.S. Elev (ft)	1332.97	Reach Len. (ft)	580.95	546.44	499.79
Crit W.S. (ft)	1332.26	Flow Area (sq ft)	1.83	296.37	4.48
E.G. Slope (ft/ft)	0.001782	Area (sq ft)	1.83	296.37	4.48
Q Total (cfs)	966.00	Flow (cfs)	4.43	946.59	14.97
Top Width (ft)	186.19	Top Width (ft)	2.94	178.90	4.35
Vel Total (ft/s)	3.19	Avg. Vel. (ft/s)	2.42	3.19	3.34
Max Chl Dpth (ft)	2.09	Hydr. Depth (ft)	0.62	1.66	1.03
Conv. Total (cfs)	22883.4	Conv. (cfs)	105.0	22423.7	354.7
Length Wtd. (ft)	546.06	Wetted Per. (ft)	3.18	178.92	4.78
Min Ch El (ft)	1330.88	Shear (lb/sq ft)	0.06	0.18	0.10
Alpha	1.00	Stream Power (lb/ft s)	10421.77	9853.25	10079.69
Frctn Loss (ft)	0.83	Cum Volume (acre-ft)	0.99	27.67	0.50
C & E Loss (ft)	0.02	Cum SA (acres)	0.92	16.56	0.56

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.932

INPUT
Description:
Station Elevation Data num= 90

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1336.7	56.18	1337.2	66.1	1337.29	67.39	1337.3	68	1337.31
68.45	1337.31	68.6	1337.31	68.85	1337.32	69.57	1337.32	69.89	1337.32
84.3	1337.37	94.02	1335.53	96.59	1335.02	115.4	1335.19	116.91	1335.21
118.39	1335.78	122.68	1337.41	123.78	1335.5	124.15	1334.89	125.9	1334.51
134.29	1332.69	137.96	1332.55	139.1	1332.51	144.08	1333.48	144.35	1333.52
158.31	1337.41	163.15	1338.71	167.84	1338.66	167.93	1338.66	167.94	1338.66
169.89	1338.38	175.51	1338.07	177.85	1338.47	178.5	1338.58	180.13	1337.66
187.93	1333.03	191.49	1331.06	191.84	1331.26	215.27	1331.03	241.43	1331.19
280.81	1330.18	283.57	1329.88	291.56	1330.06	314.62	1330.77	318.7	1330.09
319.52	1329.95	320.15	1330.05	324.24	1330.73	327.04	1330.76	338.97	1330.94
345.41	1330.53	348.69	1330.29	353.88	1330.9	355.93	1331.12	359.21	1330.96
383.4	1330.24	412.69	1330.54	438.24	1330.28	443.71	1332.43	444.69	1332.73
446.18	1333.55	449.32	1335.35	453.57	1336.62	457.79	1337.97	467.03	1338.36
469.49	1338.49	473.15	1337.27	484.66	1333.49	496.58	1332.9	505.25	1332.85
512.17	1332.77	519.67	1332.96	537.16	1333.24	555.51	1333.23	582.29	1333.26
584.9	1333.25	594.43	1333.26	607.24	1333.27	644.53	1332.92	646.54	1332.93
654.05	1332.96	666.33	1332.52	673.12	1332.38	675.17	1332.37	675.91	1332.37
676.04	1332.29	676.65	1331.88	677.75	1331.89	692.42	1332.12	699.4	1332.01

Manning's n Values num= 5

Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val	Sta	n Val
0	.045	177.85	.047	191.84	.028	438.24	.047	457.79	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
191.49	438.24	228.06	212.07 198.46	.1	.3

Left Levee Station= 163.15 Elevation= 1338.71
Right Levee Station= 469.49 Elevation= 1338.49

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1333.61	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.26	Wt. n-Val.	0.047	0.028	0.047
W.S. Elev (ft)	1333.35	Reach Len. (ft)	228.06	212.07	198.46
Crit W.S. (ft)	1332.21	Flow Area (sq ft)	4.72	666.48	11.99
E.G. Slope (ft/ft)	0.001596	Area (sq ft)	4.72	666.48	11.99
Q Total (cfs)	2760.00	Flow (cfs)	5.98	2734.48	19.54
Top Width (ft)	258.41	Top Width (ft)	4.09	246.75	7.57
Vel Total (ft/s)	4.04	Avg. Vel. (ft/s)	1.27	4.10	1.63
Max Chl Dpth (ft)	3.47	Hydr. Depth (ft)	1.15	2.70	1.58
Conv. Total (cfs)	69090.5	Conv. (cfs)	149.8	68451.6	489.2
Length Wtd. (ft)	211.96	Wetted Per. (ft)	4.69	247.07	8.18
Min Ch El (ft)	1329.88	Shear (lb/sq ft)	0.10	0.27	0.15
Alpha	1.02	Stream Power (lb/ft s)	699.40	163.15	469.49
Frctn Loss (ft)	0.57	Cum Volume (acre-ft)	2.67	45.04	1.41
C & E Loss (ft)	0.00	Cum SA (acres)	1.48	14.87	0.82

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1332.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.10	Wt. n-Val.	0.047	0.028	0.047
W.S. Elev (ft)	1332.17	Reach Len. (ft)	228.06	212.07	198.46
Crit W.S. (ft)	1331.43	Flow Area (sq ft)	1.12	376.48	4.55
E.G. Slope (ft/ft)	0.001321	Area (sq ft)	1.12	376.48	4.55
Q Total (cfs)	966.00	Flow (cfs)	0.79	960.40	4.80
Top Width (ft)	253.57	Top Width (ft)	2.01	246.75	4.81
Vel Total (ft/s)	2.53	Avg. Vel. (ft/s)	0.71	2.55	1.06
Max Chl Dpth (ft)	2.29	Hydr. Depth (ft)	0.56	1.53	0.95
Conv. Total (cfs)	26576.0	Conv. (cfs)	21.8	26422.1	132.1
Length Wtd. (ft)	212.00	Wetted Per. (ft)	2.30	247.07	5.17
Min Ch El (ft)	1329.88	Shear (lb/sq ft)	0.04	0.13	0.07
Alpha	1.01	Stream Power (lb/ft s)	699.40	163.15	469.49
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	0.97	23.45	0.45
C & E Loss (ft)	0.00	Cum SA (acres)	0.89	13.89	0.51

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Manning's n values were composited to a single value in the main channel.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.892

INPUT
Description:
Station Elevation Data num= 160

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1354.35	4.27	1353.6	9.7	1352.64	20.77	1350.37	20.83	1350.36
20.9	1350.35	31.71	1348.97	39.59	1347.45	52.33	1345.02	64.9	1341.92
74.04	1339.44	78.32	1338.45	93.37	1335.39	105.64	1334.4	106.68	1334.28
107.16	1334.31	109.39	1334.8	117.16	1336.49	119.76	1336.38	122.27	1336.31
123.08	1336.53	125	1336.96	131.51	1335.89	135.25	1335.32	137.43	1334.21
140.61	1332.65	145.48	1332.45	150.42	1332.56	152.98	1332.46	154.98	1332.38
158.73	1331.91	162.63	1331.43	165.24	1330.96	166.33	1330.8	167.09	1330.72
175.19	1330.69	179.1	1330.7	198.53	1330.77	214.22	1330.82	219.68	1331.66
221.61	1331.94	232.04	1331.76	237.43	1331.64	251.64	1331.32	252.91	1331.21
260.29	1330.62	271.91	1330.13	278.19	1329.89	280.91	1329.79	284.48	1329.63
300.48	1329.7	323.07	1329.98	324.79	1328.98	326.21	1328.28	326.61	1328.24
328.76	1327.99	330.6	1328.09	333.83	1328.24	334.93	1328.61	339.76	1330.29
356.82	1330.07	368.62	1329.96	385.67	1329.9	421.02	1330.34	426.83	1331.86
426.84	1331.86	426.85	1331.86	426.87	1331.86	431.1	1333.25	432.56	1334.02
433.86	1334.58	435.35	1335.22	438.86	1336.12	442.82	1337.1	446.19	1337.22
455.26	1337.51	466.2	1334.06	466.56	1333.96	467.08	1333.74	468.23	1333.01
470.01	1332.01	470.87	1331.98	473.83	1331.5	476.52	1331.48	479.92	1331.35
482.01	1331.34	488.43	1331.39	490.96	1331.44	495.77	1331.49	497.79	1331.53
503.06	1331.58	505.82	1331.45	511.24	1331.1	513.63	1330.94	514.25	1330.87
514.67	1330.82	517.99	1330.97	519.66	1330.99	529.33	1331.09	538.33	1331.08
539.82	1331.18	541.86	1331.31	546.16	1331.57	549.45	1331.65	552.34	1331.71
556.45	1331.73	570.44	1331.98	576.59	1331.47	580.08	1331.46	584.41	1331.22
589.74	1331.21	602.44	1331.29	608.64	1331.28	615.22	1331.26	621.53	1331.38
627.6	1331.7	630.26	1331.75	635	1332.62	636.16	1332.87	637.07	1333.16
639.21	1333.52	639.68	1333.68	639.93	1333.76	640.31	1333.87	640.8	1333.96
641.56	1334.1	642.19	1334.16	642.65	1334.16	642.75	1334.17	643.86	1334.18
643.9	1334.18	645.05	1334.03	645.61	1333.9	646.41	1333.72	646.6	1333.66
647.49	1333.67	648.72	1333.68	653.15	1333.64	655.34	1333.64	657.66	1333.63
662.68	1333.64	663.01	1333.65	664.95	1333.66	665.31	1333.67	667.33	1333.67
667.74	1333.68	669.74	1333.69	670.24	1333.71	670.99	1333.74	672.7	1333.76
673.64	1333.79	675.03	1333.81	676.2	1333.85	677.86	1333.9	680.05	1333.94
680.65	1333.96	681.88	1333.98	682.37	1333.98	684.14	1333.97	684.86	1333.97

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	140.61	.044	421.02	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
140.61	421.02	210.24	211.09	216.73	.1	.3

Left Levee Station= 125 Elevation= 1336.96
Right Levee Station= 455.25 Elevation= 1337.55

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1333.03	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.29	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1332.74	Reach Len. (ft)	210.24	211.09	216.73
Crit W.S. (ft)	1331.85	Flow Area (sq ft)	0.01	631.15	10.75
E.G. Slope (ft/ft)	0.005589	Area (sq ft)	0.01	631.15	10.75
Q Total (cfs)	2760.00	Flow (cfs)	0.00	2729.84	30.16
Top Width (ft)	289.12	Top Width (ft)	0.18	280.41	8.53
Vel Total (ft/s)	4.30	Avg. Vel. (ft/s)	0.29	4.33	2.81
Max Chl Dpth (ft)	4.75	Hydr. Depth (ft)	0.05	2.25	1.26
Conv. Total (cfs)	36918.1	Conv. (cfs)	0.0	36514.7	403.4
Length Wtd. (ft)	211.17	Wetted Per. (ft)	0.21	281.48	8.87
Min Ch El (ft)	1327.99	Shear (lb/sq ft)	0.01	0.78	0.42
Alpha	1.01	Stream Power (lb/ft s)	684.86	125.00	455.25
Frctn Loss (ft)	1.44	Cum Volume (acre-ft)	2.66	41.88	1.36
C & E Loss (ft)	0.02	Cum SA (acres)	1.47	13.59	0.78

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1331.83	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.11	Wt. n-Val.		0.044	0.045
W.S. Elev (ft)	1331.72	Reach Len. (ft)	210.24	211.09	216.73
Crit W.S. (ft)	1330.95	Flow Area (sq ft)		358.67	3.62
E.G. Slope (ft/ft)	0.003839	Area (sq ft)		358.67	3.62
Q Total (cfs)	966.00	Flow (cfs)		960.36	5.64
Top Width (ft)	252.03	Top Width (ft)		246.77	5.26
Vel Total (ft/s)	2.67	Avg. Vel. (ft/s)		2.68	1.56
Max Chl Dpth (ft)	3.73	Hydr. Depth (ft)		1.45	0.69
Conv. Total (cfs)	15591.3	Conv. (cfs)		15500.2	91.1
Length Wtd. (ft)	211.13	Wetted Per. (ft)		247.77	5.44
Min Ch El (ft)	1327.99	Shear (lb/sq ft)		0.35	0.16
Alpha	1.00	Stream Power (lb/ft s)	684.86	125.00	455.25
Frctn Loss (ft)	1.74	Cum Volume (acre-ft)	0.97	21.66	0.43
C & E Loss (ft)	0.04	Cum SA (acres)	0.88	12.68	0.48

Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.852

INPUT
Description: COP MOD 60 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 115

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
315.67	1354.84	316.58	1354.8	316.84	1354.68	317.47	1354.38	318.36	1353.96
318.56	1353.87	318.85	1353.73	320.67	1352.87	320.98	1352.72	322.79	1351.87
324.33	1351.14	324.91	1350.87	325.79	1350.45	327.02	1349.87	328.44	1349.2
329.14	1348.87	329.31	1348.79	331.66	1347.87	332.44	1347.56	334.22	1346.87
334.71	1346.68	336.78	1345.87	337.26	1345.68	339.34	1344.87	340.44	1344.44
341.9	1343.87	343.93	1343.08	344.46	1342.87	345.7	1342.39	347.02	1341.87
347.36	1341.75	349.75	1340.87	351.66	1340.3	353.07	1339.87	355.42	1339.32
357.64	1338.87	360.54	1338.28	362.58	1337.87	364.28	1337.53	367.52	1336.87
372.14	1335.93	372.46	1335.87	372.59	1335.84	377.4	1334.87	380.56	1334.23
382.34	1333.87	386.31	1333.07	387.64	1332.87	391.41	1332.31	394.38	1331.87
398.02	1331.46	402.5	1330.87	413.01	1330.15	417.35	1329.87	430.86	1329.58
447.43	1329.32	470.79	1329.51	472.18	1329.5	472.58	1329.51	472.75	1329.44
474.04	1328.87	475.09	1328.4	477.23	1328.42	481.46	1328.52	482.64	1328.87
484.39	1329.39	486.31	1329.77	487.79	1329.87	491.2	1330.12	493.8	1330.12
497.33	1329.87	503.11	1329.09	505.58	1328.87	509.66	1328.56	511.76	1328.41
518.1	1328.37	536.71	1328.3	558.6	1328.19	571.23	1328.06	572.68	1328.06
582.76	1328.18	605.43	1328.24	616.16	1328.43	626.27	1328.8	628.18	1328.87
631.04	1329.48	632	1329.87	634.26	1330.78	634.48	1330.87	634.76	1330.98
636.91	1331.87	637.47	1332.1	639.34	1332.87	640.72	1333.44	641.76	1333.87

643.34	1334.52	644.19	1334.87	645.92	1335.58	646.49	1335.82	647.99	1335.78
658.46	1335.35	661.31	1334.87	664.97	1333.97	665.36	1333.87	667.4	1333.36
669.4	1332.87	669.67	1332.79	673.32	1331.87	674.22	1331.6	676.59	1330.87
694.66	1330.17	699.66	1329.98	702.06	1329.87	707.66	1328.88	707.91	1328.88

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
315.67	.045	417.35	.044	626.27	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
417.35	626.27	65.99	66.3	67.65	.1	.3

Right Levee Station= 646.49 Elevation= 1335.82

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1331.58	Element			
Vel Head (ft)	0.46	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1331.12	Reach Len. (ft)	65.99	66.30	67.65
Crit W.S. (ft)	1330.52	Flow Area (sq ft)	11.42	488.55	13.23
E.G. Slope (ft/ft)	0.008539	Area (sq ft)	11.42	488.55	13.23
Q Total (cfs)	2760.00	Flow (cfs)	26.95	2681.65	51.40
Top Width (ft)	234.47	Top Width (ft)	16.73	208.92	8.82
Vel Total (ft/s)	5.38	Avg. Vel. (ft/s)	2.36	5.49	3.89
Max Chl Dpth (ft)	3.06	Hydr. Depth (ft)	0.68	2.34	1.50
Conv. Total (cfs)	29867.6	Conv. (cfs)	291.7	29019.7	556.2
Length Wtd. (ft)	66.31	Wetted Per. (ft)	16.78	209.44	9.21
Min Ch El (ft)	1328.06	Shear (lb/sq ft)	0.36	1.24	0.77
Alpha	1.02	Stream Power (lb/ft s)	707.91	0.00	646.49
Frctn Loss (ft)	0.25	Cum Volume (acre-ft)	2.63	39.17	1.30
C & E Loss (ft)	0.08	Cum SA (acres)	1.43	12.41	0.74

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1330.05	Element			
Vel Head (ft)	0.48	Wt. n-Val.		0.044	0.045
W.S. Elev (ft)	1329.57	Reach Len. (ft)	65.99	66.30	67.65
Crit W.S. (ft)	1329.57	Flow Area (sq ft)		171.77	2.52
E.G. Slope (ft/ft)	0.029104	Area (sq ft)		171.77	2.52
Q Total (cfs)	966.00	Flow (cfs)		957.08	8.92
Top Width (ft)	185.14	Top Width (ft)		180.16	4.98
Vel Total (ft/s)	5.54	Avg. Vel. (ft/s)		5.57	3.54
Max Chl Dpth (ft)	1.51	Hydr. Depth (ft)		0.95	0.51
Conv. Total (cfs)	5662.4	Conv. (cfs)		5610.1	52.3
Length Wtd. (ft)	66.31	Wetted Per. (ft)		180.62	5.06
Min Ch El (ft)	1328.06	Shear (lb/sq ft)		1.73	0.90
Alpha	1.01	Stream Power (lb/ft s)	707.91	0.00	646.49
Frctn Loss (ft)	0.29	Cum Volume (acre-ft)	0.97	20.37	0.42
C & E Loss (ft)	0.12	Cum SA (acres)	0.88	11.65	0.46

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: Divided flow computed for this cross-section.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.840

INPUT
Description: COP MOD 59.4 Click here for details---------->

Original Model Comment:
- Updated per
topographic survey recieved September 2009
- Areas outside the
topographic survey were deleted
Station Elevation Data num= 101

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
222.28	1354.43	223.23	1354.5	232.84	1353.7	233.92	1353.79	243.87	1352.87
244.38	1352.91	252.76	1352.05	253.31	1351.87	254.41	1351.51	256.34	1350.87
258.94	1350.01	259.37	1349.87	260.13	1349.62	263.47	1348.87	265.44	1348.43
267.91	1347.87	270.67	1347.25	272.36	1346.87	275.44	1346.18	276.8	1345.87
280.18	1345.11	281.25	1344.87	284.09	1344.23	285.69	1343.87	288.5	1343.24
290.14	1342.87	294.4	1341.91	294.58	1341.87	294.68	1341.85	300.81	1340.87
301.34	1340.73	306.97	1339.87	307.55	1339.78	309.1	1339.55	312.11	1338.87
314.41	1338.36	316.58	1337.87	318.57	1337.42	321.04	1336.87	323.38	1336.35
325.51	1335.87	327.33	1335.46	329.97	1334.87	331.72	1334.48	334.43	1333.87
336.32	1333.45	338.9	1332.87	342.53	1332.06	343.36	1331.87	347.4	1330.96
347.83	1330.87	355.15	1329.88	355.22	1329.87	373.49	1328.87	379.05	1328.87
381.11	1328.87	383.94	1328.15	385.39	1327.87	411.64	1327.01	415.04	1326.91
418.47	1326.95	435.41	1327.27	445.49	1327.35	449.1	1327.34	458.9	1327.48
470.39	1327.65	487.98	1326.99	494.99	1326.87	495.72	1326.87	497.82	1326.87
500.6	1326.87	510.42	1326.87	538.5	1327.11	557.99	1327.6	565.02	1327.73
567.23	1327.87	568.59	1328.45	569.57	1328.87	571.05	1329.5	571.92	1329.87
573.7	1330.63	574.27	1330.87	576.31	1331.74	576.61	1331.87	577.47	1332.23
578.99	1332.87	579.62	1333.18	581.2	1333.87	582.59	1334.55	583.26	1334.87
595.63	1334.87	596.24	1334.87	596.91	1334.71	600.2	1333.87	601.64	1333.46
603.75	1332.87	605.8	1332.29	607.3	1331.87	610.69	1330.92	610.81	1330.88
610.85	1330.87								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
222.28	.045	373.49	.044	567.23	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
373.49	567.23	384.15	454.55	594.1	.1	.3

Right Levee Station= 583.26 Elevation= 1334.87

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1331.25	Element			
Vel Head (ft)	0.21	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1331.04	Reach Len. (ft)	384.15	454.55	594.10
Crit W.S. (ft)	1329.19	Flow Area (sq ft)	35.60	719.10	11.80
E.G. Slope (ft/ft)	0.002108	Area (sq ft)	35.60	719.10	11.80
Q Total (cfs)	2760.00	Flow (cfs)	65.59	2671.41	23.00
Top Width (ft)	227.64	Top Width (ft)	26.46	193.74	7.44
Vel Total (ft/s)	3.60	Avg. Vel. (ft/s)	1.84	3.71	1.95
Max Chl Dpth (ft)	4.17	Hydr. Depth (ft)	1.35	3.71	1.58
Conv. Total (cfs)	60112.5	Conv. (cfs)	1428.5	58183.1	500.9
Length Wtd. (ft)	454.72	Wetted Per. (ft)	26.57	193.90	8.09
Min Ch El (ft)	1326.87	Shear (lb/sq ft)	0.18	0.49	0.19
Alpha	1.04	Stream Power (lb/ft s)	610.85	0.00	583.26
Frctn Loss (ft)	0.82	Cum Volume (acre-ft)	2.60	38.25	1.28
C & E Loss (ft)	0.03	Cum SA (acres)	1.39	12.10	0.73

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1329.57	Element			
Vel Head (ft)	0.08	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1329.49	Reach Len. (ft)	384.15	454.55	594.10
Crit W.S. (ft)	1328.21	Flow Area (sq ft)	3.46	417.37	3.06
E.G. Slope (ft/ft)	0.001671	Area (sq ft)	3.46	417.37	3.06
Q Total (cfs)	966.00	Flow (cfs)	2.12	960.49	3.38
Top Width (ft)	208.77	Top Width (ft)	11.24	193.74	3.79
Vel Total (ft/s)	2.28	Avg. Vel. (ft/s)	0.61	2.30	1.11
Max Chl Dpth (ft)	2.62	Hydr. Depth (ft)	0.31	2.15	0.81
Conv. Total (cfs)	23632.2	Conv. (cfs)	52.0	23497.5	82.7
Length Wtd. (ft)	454.81	Wetted Per. (ft)	11.26	193.90	4.12
Min Ch El (ft)	1326.87	Shear (lb/sq ft)	0.03	0.22	0.08
Alpha	1.01	Stream Power (lb/ft s)	610.85	0.00	583.26
Frctn Loss (ft)	0.81	Cum Volume (acre-ft)	0.97	19.92	0.41
C & E Loss (ft)	0.01	Cum SA (acres)	0.88	11.37	0.45

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.754

INPUT
Description: COP MOD 54 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009

- Areas outside the
topographic survey were deletedeleted

Station Elevation Data num= 116

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
80.07	1350.12	80.72	1349.87	81.46	1349.59	83.35	1348.87	84.09	1348.59
85.98	1347.87	87.95	1347.12	88.6	1346.87	89.81	1346.41	91.23	1345.87
93.8	1344.89	93.86	1344.87	93.98	1344.82	96.49	1343.87	98.23	1343.21
99.12	1342.87	101.7	1341.89	101.74	1341.87	101.8	1341.85	105.89	1340.87
108.07	1340.44	110.97	1339.87	114.98	1339.08	116.05	1338.87	117.54	1338.58
121.14	1337.87	123.49	1337.41	126.22	1336.87	130.45	1336.04	131.3	1335.87
132.3	1335.67	136.38	1334.87	139.97	1334.16	141.45	1333.87	141.62	1333.84
146.52	1332.87	147.16	1332.75	151.58	1331.87	152.6	1331.67	156.65	1330.87
158.62	1330.48	158.9	1330.41	161.14	1329.87	167.23	1329.63	184.18	1328.87
211.95	1328.29	226.54	1327.93	226.8	1327.87	229.96	1327.21	234.93	1327.27
239.95	1327.38	243.08	1327.87	243.82	1327.98	263.73	1327.87	263.9	1327.87
268.65	1326.87	268.66	1326.87	268.74	1326.85	273.43	1325.87	275.34	1325.47
278.26	1324.87	283.41	1324.87	287.5	1324.87	289.35	1325.73	289.84	1325.87
291.64	1326.82	291.74	1326.87	301.66	1326.87	308.26	1326.87	309.83	1326.87
313.44	1326.59	315.44	1326.73	337.75	1326.87	370.96	1326.87	372.8	1326.92
372.98	1326.92	391.74	1326.98	397.39	1326.99	397.96	1326.99	401.59	1326.98
415.59	1326.87	434.63	1326.71	461.08	1326.87	461.25	1326.87	461.32	1326.88
463.06	1326.94	485.57	1327.77	487.96	1327.81	488.22	1327.87	492.63	1328.8
492.84	1328.87	493.57	1329.13	495.65	1329.87	496.15	1330.05	498.46	1330.87
500.38	1331.55	501.28	1331.87	501.8	1332.06	504.09	1332.87	505.64	1333.42
506.9	1333.87	508.77	1334.53	509.72	1334.87	510.47	1334.87	511.15	1334.87
530.85	1334.07	533.84	1333.95	535.35	1333.91	536.01	1333.87	549.57	1333.15
554.53	1332.87	558.15	1332.55	565.95	1331.87	574.55	1331.12	577.36	1330.87
583.87	1330.3								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
80.07	.045	167.23	.044	488.22	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
167.23	488.22	543.9	520.86	509.53	.1	.3

Right Levee Station= 509.72 Elevation= 1334.87

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1330.41	Element			
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1330.29	Reach Len. (ft)	543.90	520.86	509.53
Crit W.S. (ft)	1328.45	Flow Area (sq ft)	3.61	978.73	11.71
E.G. Slope (ft/ft)	0.001559	Area (sq ft)	3.61	978.73	11.71
Q Total (cfs)	2760.00	Flow (cfs)	2.81	2738.91	18.28
Top Width (ft)	337.39	Top Width (ft)	7.81	320.99	8.59
Vel Total (ft/s)	2.78	Avg. Vel. (ft/s)	0.78	2.80	1.56
Max Chl Dpth (ft)	5.41	Hydr. Depth (ft)	0.46	3.05	1.36
Conv. Total (cfs)	69895.4	Conv. (cfs)	71.1	69361.4	463.0
Length Wtd. (ft)	521.03	Wetted Per. (ft)	7.86	321.95	8.94
Min Ch El (ft)	1324.87	Shear (lb/sq ft)	0.04	0.30	0.13
Alpha	1.01	Stream Power (lb/ft s)	583.87	0.00	509.72
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	2.42	29.39	1.12
C & E Loss (ft)	0.01	Cum SA (acres)	1.24	9.41	0.62

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1328.75	Element			
Vel Head (ft)	0.06	Wt. n-Val.		0.044	0.045
W.S. Elev (ft)	1328.68	Reach Len. (ft)	543.90	520.86	509.53
Crit W.S. (ft)	1327.59	Flow Area (sq ft)		475.01	1.57
E.G. Slope (ft/ft)	0.001925	Area (sq ft)		475.01	1.57
Q Total (cfs)	966.00	Flow (cfs)		964.77	1.23
Top Width (ft)	298.94	Top Width (ft)		295.09	3.85
Vel Total (ft/s)	2.03	Avg. Vel. (ft/s)		2.03	0.78
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)		1.61	0.41
Conv. Total (cfs)	22014.6	Conv. (cfs)		21986.7	28.0
Length Wtd. (ft)	520.89	Wetted Per. (ft)		296.03	3.94
Min Ch El (ft)	1324.87	Shear (lb/sq ft)		0.19	0.05
Alpha	1.00	Stream Power (lb/ft s)	583.87	0.00	509.72
Frctn Loss (ft)	0.91	Cum Volume (acre-ft)	0.95	15.27	0.38
C & E Loss (ft)	0.00	Cum SA (acres)	0.83	8.81	0.40

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.655

INPUT

Description: COP MOD 49 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were d

Station Elevation Data num= 83

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
352.68	1328.87	353.79	1329.08	358.02	1329.87	358.8	1330.02	363.37	1330.87
363.51	1330.9	364.18	1331.02	369.16	1331.87	369.75	1331.97	375.03	1332.87
388.31	1332.87	397.19	1332.87	400.73	1332.01	401.32	1331.87	402.82	1331.51
405.45	1330.87	406.92	1330.52	409.62	1329.87	412.49	1329.19	413.83	1328.87
416.79	1328.17	418.04	1327.87	426.2	1327.12	429.71	1326.87	443.98	1326.11
448.55	1325.87	450.21	1325.78	463.59	1324.92	503.87	1325.55	525.23	1325.72
525.93	1325.87	526.28	1325.94	535.6	1326.45	545.68	1326.38	554.65	1326.29
592.23	1326.4	594.25	1325.87	595.19	1325.62	598.07	1324.87	599.33	1324.54
601.99	1324.79	626.23	1324.8	635.28	1324.87	637.71	1325.7	638.2	1325.87
639.02	1326.15	641.12	1326.87	643.9	1327.82	644.04	1327.87	644.14	1327.91
644.63	1328.07	646.6	1328.75	646.96	1328.87	648.97	1329.56	649.87	1329.87
651.97	1330.59	652.79	1330.87	653.55	1331.13	654.64	1331.5	655.71	1331.87
658.45	1332.81	658.56	1332.85	658.62	1332.87	661.93	1333.1	666.48	1333.14
669.39	1333.14	675.28	1332.87	676.16	1332.67	679.76	1331.87	680.25	1331.76
684.24	1330.87	688.31	1329.96	688.57	1329.9	688.72	1329.87	688.98	1329.82
689.6	1329.78	695.45	1329.23	698.8	1329.06	701.2	1328.87	705	1328.7
729.47	1327.87	731.66	1327.82	732.08	1327.82				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
352.68	.045	429.71	.044	641.12	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
429.71	641.12	622.35	536.53	466.49	.1	.3

Left Levee Station= 397.19 Elevation= 1332.87
Right Levee Station= 666.49 Elevation= 1333.14

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1329.49	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1329.31	Reach Len. (ft)	622.35	536.53	466.49
Crit W.S. (ft)	1327.42	Flow Area (sq ft)	27.21	765.47	8.66
E.G. Slope (ft/ft)	0.001961	Area (sq ft)	27.21	765.47	8.66
Q Total (cfs)	2760.00	Flow (cfs)	52.57	2693.52	13.92
Top Width (ft)	236.22	Top Width (ft)	17.71	211.41	7.11
Vel Total (ft/s)	3.44	Avg. Vel. (ft/s)	1.93	3.52	1.61
Max Chl Dpth (ft)	4.77	Hydr. Depth (ft)	1.54	3.62	1.22
Conv. Total (cfs)	62324.1	Conv. (cfs)	1187.0	60822.8	314.2
Length Wtd. (ft)	537.38	Wetted Per. (ft)	17.92	212.09	7.51
Min Ch El (ft)	1324.54	Shear (lb/sq ft)	0.19	0.44	0.14
Alpha	1.03	Stream Power (lb/ft s)	732.08	397.19	666.49
Frctn Loss (ft)	2.51	Cum Volume (acre-ft)	2.23	18.96	1.00
C & E Loss (ft)	0.07	Cum SA (acres)	1.08	6.23	0.53

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1327.84	Element			
Vel Head (ft)	0.07	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1327.77	Reach Len. (ft)	622.35	536.53	466.49
Crit W.S. (ft)	1326.53	Flow Area (sq ft)	4.99	440.30	1.18
E.G. Slope (ft/ft)	0.001578	Area (sq ft)	4.99	440.30	1.18
Q Total (cfs)	966.00	Flow (cfs)	3.96	961.17	0.87
Top Width (ft)	224.59	Top Width (ft)	10.55	211.41	2.63
Vel Total (ft/s)	2.16	Avg. Vel. (ft/s)	0.79	2.18	0.74
Max Chl Dpth (ft)	3.23	Hydr. Depth (ft)	0.47	2.08	0.45
Conv. Total (cfs)	24319.2	Conv. (cfs)	99.7	24197.5	22.0
Length Wtd. (ft)	536.66	Wetted Per. (ft)	10.59	212.09	2.77
Min Ch El (ft)	1324.54	Shear (lb/sq ft)	0.05	0.20	0.04
Alpha	1.01	Stream Power (lb/ft s)	732.08	397.19	666.49
Frctn Loss (ft)	2.23	Cum Volume (acre-ft)	0.92	9.80	0.37
C & E Loss (ft)	0.04	Cum SA (acres)	0.76	5.79	0.36

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.

This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.553

INPUT
Description: COP MOD 43.8 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were delet---------->

Station Elevation Data num= 132

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
208.39	1324.87	210.44	1325.36	212.83	1325.87	214.77	1326.33	217.01	1326.87
219.22	1327.4	221.2	1327.87	222.71	1328.23	225.39	1328.87	227.35	1329.34
229.57	1329.87	234.36	1330.27	239.52	1330.72	242.58	1330.75	245.11	1330.78
246.61	1330.43	249	1329.87	250.67	1329.48	253.26	1328.87	256.02	1328.22
257.52	1327.87	260.58	1327.15	260.66	1327.14	260.68	1327.14	261.94	1326.87
262.3	1326.79	266.7	1325.87	267.48	1325.7	270.24	1325.13	276.03	1325.04
276.07	1325.04	279.01	1325	283.63	1325.02	284.27	1324.91	285.79	1324.89
286.62	1324.87	286.85	1324.87	286.93	1324.87	286.96	1324.87	286.99	1324.87
289.95	1324.72	297.37	1324.41	301.35	1324.37	304.42	1324.22	304.61	1324.21
305.37	1324.21	308.64	1324.18	319.66	1324.17	322.6	1324.18	326.4	1324.14
332.7	1324.07	336.5	1324.03	340.71	1323.89	341.1	1323.88	341.66	1323.87
349.99	1323.87	352.48	1323.87	359.87	1323.81	361.49	1323.84	362.83	1323.84
364.14	1323.85	364.74	1323.87	367.2	1323.87	368.01	1323.87	368.73	1323.84
372.01	1323.78	375.45	1323.87	381.2	1323.87	383.33	1324.06	385.8	1324.18
390.16	1324.08	390.37	1324.08	398.28	1323.88	405.02	1323.87	411.21	1323.94
411.31	1323.94	412.06	1324.01	413.06	1324.11	413.08	1324.1	413.29	1324.1
426.62	1323.87	431.93	1324.3	438.1	1324.15	439.59	1324.2	440.51	1324.24
446.01	1324.51	451.22	1324.69	455.16	1324.79	458.23	1324.87	460.33	1324.93
460.52	1324.87	462.93	1324.87	463.82	1324.85	464.17	1324.87	471.55	1324.87
473.9	1324.87	477.93	1325.21	479.52	1325.74	479.6	1325.71	480.02	1325.87
481.38	1326.38	482.7	1326.87	484.68	1327.61	485.38	1327.87	487.22	1328.55
488.26	1328.87	488.65	1328.99	491.54	1329.87	493.35	1330.42	494.83	1330.87
495.64	1331.02	497.94	1330.87	499.02	1330.87	499.73	1330.76	499.79	1330.76
500.4	1330.75	503.43	1330.67	503.62	1330.65	504.81	1330.6	507.2	1330.49
508.27	1330.08	508.82	1329.87	509.01	1329.8	511.45	1328.87	513.02	1328.27
514.09	1327.87	514.77	1327.61	516.72	1326.87	517.83	1326.45	518.8	1326.08
519.36	1325.87	521.43	1325.08						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
208.39	.045	276.03	.044	473.9	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
276.03	473.9	57.48	58.17	59.31	.1	.3

Left Levee Station= 245.1 Elevation= 1330.78
Right Levee Station= 495.64 Elevation= 1331.02

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1326.91	Element			
Vel Head (ft)	0.87	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1326.04	Reach Len. (ft)	57.48	58.17	59.31
Crit W.S. (ft)	1326.04	Flow Area (sq ft)	7.49	359.01	5.08
E.G. Slope (ft/ft)	0.022575	Area (sq ft)	7.49	359.01	5.08
Q Total (cfs)	2760.00	Flow (cfs)	30.21	2708.91	20.87
Top Width (ft)	214.56	Top Width (ft)	10.13	197.87	6.57
Vel Total (ft/s)	7.43	Avg. Vel. (ft/s)	4.03	7.55	4.11
Max Chl Dpth (ft)	2.26	Hydr. Depth (ft)	0.74	1.81	0.77
Conv. Total (cfs)	18369.4	Conv. (cfs)	201.1	18029.4	138.9
Length Wtd. (ft)	58.16	Wetted Per. (ft)	10.22	197.97	6.73
Min Ch El (ft)	1323.78	Shear (lb/sq ft)	1.03	2.56	1.06
Alpha	1.02	Stream Power (lb/ft s)	521.43	245.10	495.64
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	1.98	12.04	0.93
C & E Loss (ft)	0.19	Cum SA (acres)	0.88	3.71	0.45

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1325.58	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.45	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1325.13	Reach Len. (ft)	57.48	58.17	59.31
Crit W.S. (ft)	1325.13	Flow Area (sq ft)	0.26	179.40	0.40
E.G. Slope (ft/ft)	0.028946	Area (sq ft)	0.26	179.40	0.40
Q Total (cfs)	966.00	Flow (cfs)	0.18	965.25	0.57
Top Width (ft)	206.69	Top Width (ft)	5.74	197.87	3.07
Vel Total (ft/s)	5.37	Avg. Vel. (ft/s)	0.71	5.38	1.44
Max Chl Dpth (ft)	1.35	Hydr. Depth (ft)	0.04	0.91	0.13
Conv. Total (cfs)	5677.8	Conv. (cfs)	1.1	5673.4	3.4
Length Wtd. (ft)	58.17	Wetted Per. (ft)	5.74	197.97	3.08
Min Ch El (ft)	1323.78	Shear (lb/sq ft)	0.08	1.64	0.23
Alpha	1.01	Stream Power (lb/ft s)	521.43	245.10	495.64
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.88	5.98	0.36
C & E Loss (ft)	0.10	Cum SA (acres)	0.64	3.27	0.33

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.542

INPUT
Description: COP MOD 43.3 Click here for details---------->

Original Model Comment:
- Updated per
topographic survey recieved September 2009
- Areas outside the
topographic survey were dele

Station Elevation Data num= 96

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
329.9	1325.49	331.91	1325.87	335.12	1326.46	337.29	1326.87	340.16	1327.4
342.67	1327.87	347.77	1328.82	348.05	1328.87	348.19	1328.9	348.46	1328.9
360.04	1329.72	362.9	1329.8	366.55	1329	367.11	1328.87	370.47	1328.11
371.56	1327.87	373.88	1327.35	375.99	1326.87	376.42	1326.77	380.42	1325.87
384.61	1324.93	384.86	1324.87	384.93	1324.85	403.84	1324.05	409.34	1323.87
411.24	1323.67	413.53	1323.43	418.88	1322.87	426.07	1322.12	428.43	1321.87
430.39	1321.66	432.29	1321.46	434.88	1320.87	439.8	1320.52	442.69	1320.15
453.68	1320.06	453.75	1320.06	453.77	1320.06	453.84	1320.06	453.97	1320.05
458.78	1319.87	462.61	1319.73	472	1319.41	483.12	1318.96	487.45	1318.98
503.87	1319.47	505.36	1319.51	511.53	1319.87	515.16	1319.87	529.54	1320.1
538.26	1320.04	540.87	1320.08	549.86	1320.21	557.64	1320.26	563.12	1320.31
571.59	1320.45	585.51	1320.61	593.03	1320.87	594.13	1320.73	595.16	1320.75
595.53	1320.87	598.5	1321.83	598.62	1321.87	598.95	1321.98	601.39	1322.87
602.67	1323.34	604.13	1323.87	605.96	1324.54	606.86	1324.87	608.97	1325.64
609.6	1325.87	610.4	1326.16	612.33	1326.87	614.38	1327.62	615.07	1327.87
617.59	1328.79	617.8	1328.87	618.14	1328.87	626.42	1328.87	631.26	1327.95
631.54	1327.87	631.86	1327.78	635.19	1326.87	638.24	1326.03	638.84	1325.87
641.49	1325.14	642.22	1324.87	643.93	1324.22	654.24	1324.16	710.79	1324.45
714.28	1324.52	818.23	1325.38	834.63	1325.71	850.43	1326.03	858.77	1326.19
876.61	1326.47								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
329.9	.045	442.69	.044	593.03	.045

Bank Sta: Left	Right	Lengths: Left Channel		Right	Coeff Contr.	Expan.
442.69	593.03	340.02	336.74	338.98	.1	.3

Left Levee Station= 362.89 Elevation= 1329.8
Right Levee Station= 617.8 Elevation= 1328.87

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1324.46	Element			
Vel Head (ft)	0.23	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1324.23	Reach Len. (ft)	340.02	336.74	338.98
Crit W.S. (ft)	1322.09	Flow Area (sq ft)	74.46	648.24	25.21
E.G. Slope (ft/ft)	0.001930	Area (sq ft)	74.46	648.24	25.21
Q Total (cfs)	2760.00	Flow (cfs)	154.77	2547.46	57.77
Top Width (ft)	205.61	Top Width (ft)	43.18	150.34	12.09
Vel Total (ft/s)	3.69	Avg. Vel. (ft/s)	2.08	3.93	2.29
Max Chl Dpth (ft)	5.27	Hydr. Depth (ft)	1.72	4.31	2.08
Conv. Total (cfs)	62819.7	Conv. (cfs)	3522.6	57982.1	1314.9
Length Wtd. (ft)	336.89	Wetted Per. (ft)	43.42	150.39	12.69
Min Ch El (ft)	1318.96	Shear (lb/sq ft)	0.21	0.52	0.24
Alpha	1.07	Stream Power (lb/ft s)	876.61	362.89	617.80
Frctn Loss (ft)	0.79	Cum Volume (acre-ft)	1.93	11.37	0.91
C & E Loss (ft)	0.00	Cum SA (acres)	0.85	3.48	0.44

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1322.27	Element			
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1322.15	Reach Len. (ft)	340.02	336.74	338.98
Crit W.S. (ft)	1321.01	Flow Area (sq ft)	17.23	335.32	5.97
E.G. Slope (ft/ft)	0.002313	Area (sq ft)	17.23	335.32	5.97
Q Total (cfs)	966.00	Flow (cfs)	27.55	929.60	8.85
Top Width (ft)	173.66	Top Width (ft)	16.93	150.34	6.39
Vel Total (ft/s)	2.69	Avg. Vel. (ft/s)	1.60	2.77	1.48
Max Chl Dpth (ft)	3.19	Hydr. Depth (ft)	1.02	2.23	0.93
Conv. Total (cfs)	20083.9	Conv. (cfs)	572.7	19327.2	184.0
Length Wtd. (ft)	336.80	Wetted Per. (ft)	17.06	150.39	6.63
Min Ch El (ft)	1318.96	Shear (lb/sq ft)	0.15	0.32	0.13
Alpha	1.03	Stream Power (lb/ft s)	876.61	362.89	617.80
Frctn Loss (ft)	0.98	Cum Volume (acre-ft)	0.87	5.64	0.35
C & E Loss (ft)	0.01	Cum SA (acres)	0.63	3.03	0.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.479

INPUT
Description: COP MOD 40.0 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 90

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
115.73	1322.87	118.91	1323.22	124.92	1323.87	127.99	1324.2	134.1	1324.87
136.9	1325.18	143.29	1325.87	144.35	1325.99	144.59	1326.01	152.51	1326.87
152.7	1326.87	157.43	1326.87	162.98	1326.85	164.27	1326.43	166	1325.87
167.81	1325.28	169.05	1324.87	170.64	1324.35	172.11	1323.87	174.4	1323.12
175.17	1322.87	177.74	1322.03	178.23	1321.87	178.98	1321.63	181.28	1320.87
182.84	1320.36	183.24	1320.22	183.26	1320.22	183.35	1320.22	191.13	1319.87
194.6	1319.71	213.41	1318.87	248.45	1318.11	250.27	1318.09	250.64	1318.05
252.48	1317.87	255.53	1317.57	256.77	1317.57	258.95	1317.52	264.18	1317.54
266.12	1317.52	267.41	1317.87	269.72	1318.49	291.99	1318.86	292.72	1318.87
292.76	1318.88	293.56	1319.08	296.79	1319.87	296.98	1319.92	300.62	1320.87
303.06	1321.53	304.31	1321.87	314.99	1321.98	327.77	1322.12	337.57	1322.24
370.02	1322.43	377.58	1322.04	378.3	1321.87	382.11	1320.96	382.46	1320.87
388.4	1320.87	390.22	1320.87	392.11	1321.34	394.21	1321.87	395.89	1322.29
398.2	1322.87	401.19	1323.62	402.18	1323.87	406.16	1324.87	406.17	1324.87
406.21	1324.88	406.28	1324.9	408.43	1325.47	410.06	1325.87	410.3	1325.93
414.17	1326.87	414.86	1327.04	418.27	1327.87	419.36	1328.13	424	1328.01
427.44	1328.01	429.88	1327.93	430.19	1327.87	432	1327.49	434.99	1326.87
438.9	1326.05	439.78	1325.87	441.36	1325.54	444.58	1324.87	446.84	1324.4

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val

115.73 .045 183.24 .044 390.22 .045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
183.24 390.22 45.31 45.37 46.62 .1 .3
Left Levee Station= 157.43 Elevation= 1326.87
Right Levee Station= 419.36 Elevation= 1328.13

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1323.67	Element			
Vel Head (ft)	0.24	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1323.43	Reach Len. (ft)	45.31	45.37	46.62
Crit W.S. (ft)	1321.38	Flow Area (sq ft)	15.60	675.51	13.04
E.G. Slope (ft/ft)	0.002900	Area (sq ft)	15.60	675.51	13.04
Q Total (cfs)	2760.00	Flow (cfs)	36.63	2696.61	26.76
Top Width (ft)	226.95	Top Width (ft)	9.77	206.98	10.19
Vel Total (ft/s)	3.92	Avg. Vel. (ft/s)	2.35	3.99	2.05
Max Chl Dpth (ft)	5.91	Hydr. Depth (ft)	1.60	3.26	1.28
Conv. Total (cfs)	51252.2	Conv. (cfs)	680.2	50075.0	497.0
Length Wtd. (ft)	45.38	Wetted Per. (ft)	10.28	207.71	10.51
Min Ch El (ft)	1317.52	Shear (lb/sq ft)	0.27	0.59	0.22
Alpha	1.02	Stream Power (lb/ft s)	446.84	157.43	419.36
Frctn Loss (ft)	0.09	Cum Volume (acre-ft)	1.58	6.25	0.76
C & E Loss (ft)	0.02	Cum SA (acres)	0.64	2.10	0.35

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1321.28	Element			
Vel Head (ft)	0.19	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1321.09	Reach Len. (ft)	45.31	45.37	46.62
Crit W.S. (ft)	1319.99	Flow Area (sq ft)	1.14	276.29	0.10
E.G. Slope (ft/ft)	0.003806	Area (sq ft)	1.14	276.29	0.10
Q Total (cfs)	966.00	Flow (cfs)	1.28	964.67	0.05
Top Width (ft)	130.39	Top Width (ft)	2.63	126.86	0.89
Vel Total (ft/s)	3.48	Avg. Vel. (ft/s)	1.13	3.49	0.46
Max Chl Dpth (ft)	3.57	Hydr. Depth (ft)	0.43	2.18	0.11
Conv. Total (cfs)	15657.7	Conv. (cfs)	20.8	15636.2	0.7
Length Wtd. (ft)	45.37	Wetted Per. (ft)	2.77	127.36	0.92
Min Ch El (ft)	1317.52	Shear (lb/sq ft)	0.10	0.52	0.03
Alpha	1.00	Stream Power (lb/ft s)	446.84	157.43	419.36
Frctn Loss (ft)	0.14	Cum Volume (acre-ft)	0.80	3.27	0.33
C & E Loss (ft)	0.02	Cum SA (acres)	0.55	1.96	0.30

Warning: Divided flow computed for this cross-section.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.470

INPUT
Description: COP MOD 39.6 Click here for details---------->

Original Model Comment:
added 100'
upstream of structure for freeboard chek (4.0') min required per FEMA/44CFR65.10

Station Elevation Data num= 60

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1321.87	154.97	1322.11	162.56	1322.25	163.9	1322.25	165.12	1322.24
171.99	1322.14	180.55	1323.08	210.62	1326.47	213.62	1327.47	221.62	1327.47
223.78	1326.75	230.57	1324.67	233.15	1323.73	242.67	1320.27	246.05	1320.15
268.05	1319.23	287.56	1318.75	297.04	1318.74	304.43	1318.54	316.75	1318.43
317.49	1318.24	322.55	1317.6	325.21	1317.84	326.3	1317.8	328.16	1317.69
329.09	1317.26	333.6	1317.19	335.18	1317.63	338.19	1318.52	360.6	1318.69
364.79	1318.73	369.08	1318.7	385.95	1319.09	392.92	1320.36	403.84	1322.06
404.9	1322.07	412.84	1322.18	419.94	1322.27	435.73	1319.53	436	1319.47
436.18	1319.47	450.21	1320.11	472.85	1325.97	480.61	1328.03	482.45	1328.04
488.41	1328.09	489.43	1328.05	491.04	1327.67	503.67	1324.75	503.95	1324.74
505.73	1324.78	505.95	1324.77	507.77	1324.77	518.56	1324.71	520.11	1324.7
521.74	1324.7	533.01	1324.58	534.8	1324.86	535.08	1324.9	604.57	1324.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	246.05	.044	450.21	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
246.05 450.21 98.12 96.9 98.07 .3 .5
Left Levee Station= 221.62 Elevation= 1327.47

Right Levee Station= 488.41 Elevation= 1328.09

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1323.55	Element			
Vel Head (ft)	0.17	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1323.39	Reach Len. (ft)	98.12	96.90	98.07
Crit W.S. (ft)	1320.98	Flow Area (sq ft)	24.11	811.42	20.75
E.G. Slope (ft/ft)	0.001523	Area (sq ft)	24.11	811.42	20.75
Q Total (cfs)	2760.00	Flow (cfs)	48.11	2675.53	36.36
Top Width (ft)	228.78	Top Width (ft)	11.96	204.16	12.66
Vel Total (ft/s)	3.22	Avg. Vel. (ft/s)	2.00	3.30	1.75
Max Chl Dpth (ft)	6.20	Hydr. Depth (ft)	2.02	3.97	1.64
Conv. Total (cfs)	70717.7	Conv. (cfs)	1232.7	68553.3	931.7
Length Wtd. (ft)	96.92	Wetted Per. (ft)	12.51	205.06	13.08
Min Ch El (ft)	1317.19	Shear (lb/sq ft)	0.18	0.38	0.15
Alpha	1.03	Stream Power (lb/ft s)	604.57	221.62	488.41
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	1.56	5.48	0.74
C & E Loss (ft)	0.36	Cum SA (acres)	0.63	1.88	0.34

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1321.12	Element			
Vel Head (ft)	0.12	Wt. n-Val.	0.045	0.044	0.045
W.S. Elev (ft)	1321.00	Reach Len. (ft)	98.12	96.90	98.07
Crit W.S. (ft)	1319.87	Flow Area (sq ft)	3.42	351.56	1.54
E.G. Slope (ft/ft)	0.002575	Area (sq ft)	3.42	351.56	1.54
Q Total (cfs)	966.00	Flow (cfs)	4.16	960.37	1.47
Top Width (ft)	182.81	Top Width (ft)	5.40	173.96	3.45
Vel Total (ft/s)	2.71	Avg. Vel. (ft/s)	1.22	2.73	0.96
Max Chl Dpth (ft)	3.81	Hydr. Depth (ft)	0.63	2.02	0.45
Conv. Total (cfs)	19036.4	Conv. (cfs)	81.9	18925.4	29.1
Length Wtd. (ft)	96.90	Wetted Per. (ft)	5.53	174.67	3.56
Min Ch El (ft)	1317.19	Shear (lb/sq ft)	0.10	0.32	0.07
Alpha	1.01	Stream Power (lb/ft s)	604.57	221.62	488.41
Frctn Loss (ft)	0.56	Cum Volume (acre-ft)	0.80	2.94	0.33
C & E Loss (ft)	0.21	Cum SA (acres)	0.55	1.81	0.29

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.452

INPUT
Description: COP MOD 38.6 Click here for details---------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 168

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
144.01	1323.87	146.96	1323.87	153.15	1324.2	162.18	1324.37	171.96	1324.87
175.57	1324.87	183.17	1324.87	190.83	1325.44	193.05	1325.47	202.26	1325.52
203.29	1325.49	213.76	1325.63	220.66	1326.17	223.59	1326.17	226.19	1326.17
228.59	1325.59	229.85	1325.47	232.96	1325.39	242.1	1325.23	248.37	1325.09
251.07	1325.1	256.58	1325.13	269.21	1324.87	278.86	1324.87	280.59	1324.74
284.43	1324.81	286.2	1324.87	286.36	1324.87	292.86	1324.87	297.34	1324.65
299.24	1324.64	299.47	1324.66	305.7	1324.09	305.73	1324.07	305.82	1324.06
306.09	1324.05	306.49	1324.03	307.32	1323.99	309.81	1323.87	309.87	1323.61
309.97	1323.22	310.06	1322.87	310.22	1322.2	310.25	1322.11	310.31	1321.87
310.45	1321.3	310.56	1320.87	310.73	1320.19	310.81	1319.87	310.97	1319.22
311.01	1319.05	311.05	1318.87	311.13	1318.64	311.38	1318.09	311.54	1318.1
313.24	1317.87	314.06	1317.87	314.88	1317.87	315.43	1317.87	317.09	1317.87
318.26	1317.87	320.15	1317.87	321.45	1317.87	322.75	1317.87	325.18	1317.87
325.83	1317.97	326.96	1317.97	328.75	1317.97	330.53	1317.97	332.23	1317.97

333.94	1317.97	335.23	1317.97	337.17	1317.97	339.1	1317.97	341.58	1317.97		
344.67	1317.9	346.68	1317.89	348.75	1317.87	348.78	1317.87	349	1317.87		
350.89	1317.87	351.42	1317.87	351.73	1317.87	352.07	1317.87	354.05	1317.87		
354.48	1317.87	354.89	1317.87	355.69	1317.87	357.31	1317.87	358.02	1317.87		
358.71	1317.87	360.39	1317.87	361.14	1317.87	361.87	1317.87	362.29	1317.87		
362.47	1317.78	362.52	1317.78	362.57	1317.77	362.75	1317.87	363.94	1317.87		
364.69	1317.87	367.83	1317.87	370.97	1317.87	371.67	1317.87	374.01	1317.87		
374.31	1317.85	375.68	1317.87	378.45	1317.87	378.77	1317.87	379.46	1317.87		
380.14	1317.87	380.77	1317.87	381.4	1317.87	382.12	1317.87	382.83	1317.87		
385.83	1317.87	386.86	1317.87	387.89	1317.87	389.36	1317.87	391.24	1317.87		
392.17	1317.87	394.96	1317.87	395.73	1317.87	396.54	1318.06	397.07	1318.81		
397.08	1318.87	397.11	1318.98	397.14	1319.09	397.35	1319.87	397.46	1320.3		
397.6	1320.87	397.72	1321.34	397.85	1321.87	398.05	1322.62	398.11	1322.87		
398.21	1323.29	398.36	1323.87	398.41	1324.06	398.67	1323.91	400.36	1324.12		
401.79	1324.07	403.3	1324.16	404.28	1324.22	404.39	1324.29	404.68	1324.24		
406.64	1324.24	411.71	1324.6	413.81	1324.87	417.62	1325.08	430.06	1325.87		
430.18	1325.88	430.79	1325.92	438.69	1326.37	439.2	1326.37	451.53	1326.18		
460.87	1326.03	461.18	1326.03	461.86	1326.02	475.69	1326.08	483.57	1326.13		
495.57	1326.26	497.38	1326.19	498.7	1326.16	498.91	1326.16	502.37	1326.28		
502.49	1326.25	504.94	1326.18	505.41	1326.17						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
144.01	.045	313.24	.044	396.54	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
313.24 396.54 3.82 3.82 3.88 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
144.01	314.76	1323.43	F
396.5	505.41	1323.39	F

Left Levee Station= 226.19 Elevation= 1326.17
Right Levee Station= 438.69 Elevation= 1326.37

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1322.86	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.35	Wt. n-Val.		0.044	
W.S. Elev (ft)	1321.51	Reach Len. (ft)	3.82	3.82	3.88
Crit W.S. (ft)	1321.18	Flow Area (sq ft)		295.77	
E.G. Slope (ft/ft)	0.013762	Area (sq ft)	8.40	301.44	2.57
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	87.36	Top Width (ft)	2.84	83.30	1.22
Vel Total (ft/s)	9.33	Avg. Vel. (ft/s)		9.33	
Max Chl Dpth (ft)	3.74	Hydr. Depth (ft)		3.62	
Conv. Total (cfs)	23526.8	Conv. (cfs)		23526.8	
Length Wtd. (ft)	3.82	Wetted Per. (ft)		81.82	
Min Ch El (ft)	1317.77	Shear (lb/sq ft)		3.11	
Alpha	1.00	Stream Power (lb/ft s)	505.41	226.19	438.69
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	1.52	4.24	0.72
C & E Loss (ft)	0.42	Cum SA (acres)	0.61	1.56	0.33

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1320.34	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.81	Wt. n-Val.		0.044	
W.S. Elev (ft)	1319.53	Reach Len. (ft)	3.82	3.82	3.88
Crit W.S. (ft)	1319.53	Flow Area (sq ft)		133.75	
E.G. Slope (ft/ft)	0.023754	Area (sq ft)	3.26	136.33	0.65
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	86.36	Top Width (ft)	2.35	83.30	0.72
Vel Total (ft/s)	7.22	Avg. Vel. (ft/s)		7.22	
Max Chl Dpth (ft)	1.76	Hydr. Depth (ft)		1.64	
Conv. Total (cfs)	6267.7	Conv. (cfs)		6267.7	
Length Wtd. (ft)	3.82	Wetted Per. (ft)		81.82	
Min Ch El (ft)	1317.77	Shear (lb/sq ft)		2.42	
Alpha	1.00	Stream Power (lb/ft s)	505.41	226.19	438.69
Frctn Loss (ft)	0.00	Cum Volume (acre-ft)	0.79	2.40	0.33
C & E Loss (ft)	0.28	Cum SA (acres)	0.54	1.52	0.29

Warning: The energy equation could not be balanced within the specified number of iterations. The program used critical depth
for the water surface and continued on with the calculations.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.

Warning: The energy loss was greater than 1.0 ft (0.3 m). between the current and previous cross section. This may indicate the
need for additional cross sections.
Warning: During the standard step iterations, when the assumed water surface was set equal to critical depth, the calculated
water surface came back below critical depth. This indicates that there is not a valid subcritical answer. The program
defaulted to critical depth.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.451

INPUT
Description: COP MOD 38.5 Click here for details---------->

Original Model Comment:
US XSec for
43rd St. Culvert Click Here for Details ------------>

-
Updated per topographic survey recieved September 2009
- Areas
outside the topographic survey were deleted

Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1325.45	.99	1325.43	11.44	1325.36	17.17	1326.17	23.68	1326.17
24.9	1325.43	27.14	1325.4	30.71	1325.32	41.2	1325.14	45.84	1325.03
48.81	1325.05	52.98	1325.06	62.54	1324.87	77.23	1324.78	82.19	1324.87
83.91	1324.92	91.11	1324.87	94.92	1324.83	95.3	1324.82	95.34	1324.83
98.03	1324.58	103.47	1324.19	107.22	1324.87	108.2	1324.7	108.23	1324.57
108.4	1323.87	108.41	1323.84	108.43	1323.77	108.65	1322.87	108.78	1322.38
108.9	1321.87	108.93	1321.77	108.98	1321.58	109.09	1321.11	109.15	1320.87
109.33	1320.16	109.37	1320	109.4	1319.87	109.53	1319.37	109.65	1318.87
109.77	1318.47	109.95	1317.87	110.23	1316.95	111.45	1315.95	119.98	1315.95
145.63	1315.96	145.66	1315.94	145.71	1315.96	151.09	1316	190.76	1315.93
192.18	1316.72	192.19	1316.87	192.47	1316.99	192.65	1317.87	192.66	1317.95
192.72	1318.19	192.83	1318.71	192.87	1318.87	193.04	1319.53	193.12	1319.87
193.14	1319.95	193.38	1320.87	193.39	1320.93	193.63	1321.87	193.68	1322.08
193.88	1322.87	194.09	1323.67	194.12	1323.81	194.14	1323.87	194.15	1323.91
194.39	1324.87	196.62	1324.18	197.83	1324.33	200.47	1324.24	201.31	1324.29
201.85	1324.32	201.91	1324.36	202.07	1324.33	203.15	1324.34	209.48	1324.78
210.19	1324.87	215.88	1325.18	226.73	1325.87	227.42	1325.91	227.96	1325.95
229.41	1326.03								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	111.45	.013	190.76	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
111.45	190.76	94.79	93.97	94.02	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110.27	1323.35	F
191.6	229.41	1323.26	F

Left Levee Station= 23.68 Elevation= 1326.17
Right Levee Station= 229.4 Elevation= 1326.03

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1322.45	Element			
Vel Head (ft)	0.52	Wt. n-Val.	0.045	0.013	0.045
W.S. Elev (ft)	1321.93	Reach Len. (ft)	94.79	93.97	94.02
Crit W.S. (ft)	1319.30	Flow Area (sq ft)	6.48	472.97	4.84
E.G. Slope (ft/ft)	0.000238	Area (sq ft)	10.17	472.97	12.17
Q Total (cfs)	2760.00	Flow (cfs)	8.66	2744.09	7.25
Top Width (ft)	84.76	Top Width (ft)	2.56	79.31	2.88
Vel Total (ft/s)	5.70	Avg. Vel. (ft/s)	1.34	5.80	1.50
Max Chl Dpth (ft)	5.99	Hydr. Depth (ft)	5.49	5.96	5.76
Conv. Total (cfs)	178796.6	Conv. (cfs)	561.1	177766.1	469.4
Length Wtd. (ft)	93.97	Wetted Per. (ft)	1.53	79.32	0.96
Min Ch El (ft)	1315.93	Shear (lb/sq ft)	0.06	0.09	0.07
Alpha	1.03	Stream Power (lb/ft s)	229.41	23.68	229.40
Frctn Loss (ft)		Cum Volume (acre-ft)	1.52	4.20	0.72
C & E Loss (ft)		Cum SA (acres)	0.61	1.55	0.33

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1319.25	Element			

Vel Head (ft)	0.25	Wt. n-Val.	0.045	0.013	0.045
W.S. Elev (ft)	1319.00	Reach Len. (ft)	94.79	93.97	94.02
Crit W.S. (ft)	1317.62	Flow Area (sq ft)	3.03	241.10	2.38
E.G. Slope (ft/ft)	0.000276	Area (sq ft)	3.75	241.10	4.82
Q Total (cfs)	966.00	Flow (cfs)	2.63	960.98	2.40
Top Width (ft)	83.29	Top Width (ft)	1.83	79.31	2.14
Vel Total (ft/s)	3.92	Avg. Vel. (ft/s)	0.87	3.99	1.01
Max Chl Dpth (ft)	3.07	Hydr. Depth (ft)	2.57	3.04	2.84
Conv. Total (cfs)	58127.9	Conv. (cfs)	158.1	57825.6	144.2
Length Wtd. (ft)	93.97	Wetted Per. (ft)	1.53	79.32	0.96
Min Ch El (ft)	1315.93	Shear (lb/sq ft)	0.03	0.05	0.04
Alpha	1.03	Stream Power (lb/ft s)	229.41	23.68	229.40
Frctn Loss (ft)		Cum Volume (acre-ft)	0.79	2.39	0.33
C & E Loss (ft)		Cum SA (acres)	0.54	1.51	0.29

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CULVERT

RIVER: Scatter_Wash
REACH: One RS: .442

INPUT
Description: 43rd Ave Culvert added to CEM 7-8-09 Click Here--->

6-10'x7' RCB

- Upstream and Downstream Stations adjusted by -154' to align with US & DS Cross sections
Distance from Upstream XS = 9
Deck/Roadway Width = 75
Weir Coefficient = 2.6
Upstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-142.5	1323.39		-86.1	1323.97		-35.2	1324.55	
22.4	1325.12		75.6	1325.53		129.9	1325.79	
232.6	1325.88		282.3	1325.74		330.4	1325.65	
376.1	1325.38							

Upstream Bridge Cross Section Data
Station Elevation Data num= 86

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1325.45	.99	1325.43	11.44	1325.36	17.17	1326.17	23.68	1326.17
24.9	1325.43	27.14	1325.4	30.71	1325.32	41.2	1325.14	45.84	1325.03
48.81	1325.05	52.98	1325.06	62.54	1324.87	77.23	1324.78	82.19	1324.87
83.91	1324.92	91.11	1324.87	94.92	1324.83	95.3	1324.82	95.34	1324.83
98.03	1324.58	103.47	1324.19	107.22	1324.87	108.2	1324.7	108.23	1324.57
108.4	1323.87	108.41	1323.84	108.43	1323.77	108.65	1322.87	108.78	1322.38
108.9	1321.87	108.93	1321.77	108.98	1321.58	109.09	1321.11	109.15	1320.87
109.33	1320.16	109.37	1320	109.4	1319.87	109.53	1319.37	109.65	1318.87
109.77	1318.47	109.95	1317.87	110.23	1316.95	111.45	1315.95	119.98	1315.95
145.63	1315.96	145.66	1315.94	145.71	1315.96	151.09	1316	190.76	1315.93
192.18	1316.72	192.19	1316.87	192.47	1316.99	192.65	1317.87	192.66	1317.95
192.72	1318.19	192.83	1318.71	192.87	1318.87	193.04	1319.53	193.12	1319.87
193.14	1319.95	193.38	1320.87	193.39	1320.93	193.63	1321.87	193.68	1322.08
193.88	1322.87	194.09	1323.67	194.12	1323.81	194.14	1323.87	194.15	1323.91
194.39	1324.87	196.62	1324.18	197.83	1324.33	200.47	1324.24	201.31	1324.29
201.85	1324.32	201.91	1324.36	202.07	1324.33	203.15	1324.34	209.48	1324.78
210.19	1324.87	215.88	1325.18	226.73	1325.87	227.42	1325.91	227.96	1325.95
229.41	1326.03								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	111.45	.013	190.76	.045

Bank Sta: Left Right Coeff Contr. Expan.
111.45 190.76 .3 .5
Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	110.27	1323.35	F
191.6	229.41	1323.26	F

Left Levee Station= 23.68 Elevation= 1326.17
Right Levee Station= 229.4 Elevation= 1326.03

Downstream Deck/Roadway Coordinates
num= 10

Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord	Sta	Hi Cord	Lo Cord
-142.5	1323.39		-86.1	1323.97		-35.2	1324.55	
22.4	1325.12		75.6	1325.53		129.9	1325.79	
232.6	1325.88		282.3	1325.74		330.4	1325.65	
376.1	1325.38							

Downstream Bridge Cross Section Data

Station Elevation Data num= 72

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1323.89	6.42	1323.87	30.28	1323.8	31.93	1323.79	33.3	1323.75
38.8	1323.58	66.4	1323.84	67	1323.85	67.38	1323.85	69.58	1323.87
95.28	1324.06	98.66	1324.26	109.21	1324.87	113.75	1325.13	117.19	1325.33
120.65	1315.89	126.59	1315.87	126.95	1315.87	127.18	1315.87	133.97	1315.68
136.14	1315.68	136.75	1315.66	136.86	1315.68	138.85	1315.68	145.86	1315.68
147.79	1315.68	150.71	1315.69	151.69	1315.64	151.84	1315.69	159.67	1315.8
165.28	1315.87	166.76	1315.97	166.96	1315.98	167.15	1315.98	167.35	1315.98
167.55	1315.98	171.71	1315.87	174.95	1315.84	176.12	1315.87	183.72	1315.87
184.94	1315.87	185.07	1315.92	185.68	1316.87	185.81	1317.07	186.32	1317.87
186.68	1318.43	186.96	1318.87	187.44	1319.61	187.61	1319.87	187.68	1319.98
188.25	1320.87	188.72	1321.61	188.89	1321.87	189.47	1322.78	189.53	1322.87
189.59	1322.97	190.49	1323.87	191.89	1324.81	191.95	1324.85	192.01	1324.87
193.38	1324.98	195.02	1324.87	199.04	1324.6	202.13	1324.39	205.56	1324.16
209.94	1323.87	213.12	1323.87	213.44	1323.87	215.16	1324.04	224.04	1324.15
228.83	1324.15	229.41	1324.18						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	120.65	.056	185.07	.045

Bank Sta: Left Right Coeff Contr. Expan.
120.65 185.07 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	120.31	1323.37	F
190.5	229.41	1323.37	F

Left Levee Station= 117.19 Elevation= 1325.33
Right Levee Station= 193.38 Elevation= 1324.98

Upstream Embankment side slope = 0 horiz. to 1.0 vertical
Downstream Embankment side slope = 0 horiz. to 1.0 vertical
Maximum allowable submergence for weir flow = .98
Elevation at which weir flow begins =
Energy head used in spillway design =
Spillway height used in design =
Weir crest shape = Broad Crested

Number of Culverts = 1

Culvert Name	Shape	Rise	Span
43rd Ave RCB	Box	7	10

FHWA Chart # 8 - flared wingwalls
FHWA Scale # 1 - Wingwall flared 30 to 75 deg.
Solution Criteria = Highest U.S. EG

Culvert Upstrm Dist	Length	Top n	Bottom n	Depth Blocked	Entrance Loss Coef	Exit Loss Coef
9	76	.013	.013	0	.2	1

Number of Barrels = 6
Upstream Elevation = 1315.93
Centerline Stations

Sta.	Sta.	Sta.	Sta.	Sta.	Sta.
125.92	136.75	147.58	158.42	169.25	180.05

Downstream Elevation = 1315.92
Centerline Stations

Sta.	Sta.	Sta.	Sta.	Sta.	Sta.
125.92	136.75	147.58	158.42	169.25	180.05

CULVERT OUTPUT Profile #Q100 - Effective Culv Group: 43rd Ave RCB

Q Culv Group (cfs)	2760.00	Culv Full Len (ft)	
# Barrels	6	Culv Vel US (ft/s)	9.56
Q Barrel (cfs)	460.00	Culv Vel DS (ft/s)	11.40
E.G. US. (ft)	1322.45	Culv Inv El Up (ft)	1315.93
W.S. US. (ft)	1321.93	Culv Inv El Dn (ft)	1315.92
E.G. DS (ft)	1321.52	Culv Frctn Ls (ft)	0.19
W.S. DS (ft)	1319.79	Culv Exit Loss (ft)	0.45
Delta EG (ft)	0.93	Culv Entr Loss (ft)	0.28
Delta WS (ft)	2.13	Q Weir (cfs)	
E.G. IC (ft)	1322.44	Weir Sta Lft (ft)	
E.G. OC (ft)	1322.45	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1320.74	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1319.96	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	7.00	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	4.04	Min El Weir Flow (ft)	1325.34

Note: The normal depth exceeds the height of the culvert. The program assumes that the normal depth is equal to the height
of the culvert.

CULVERT OUTPUT Profile #Q1- 35% Q100 Culv Group: 43rd Ave RCB

Q Culv Group (cfs)	966.00	Culv Full Len (ft)	
# Barrels	6	Culv Vel US (ft/s)	6.18
Q Barrel (cfs)	161.00	Culv Vel DS (ft/s)	6.81
E.G. US. (ft)	1319.25	Culv Inv El Up (ft)	1315.93

W.S. US. (ft)	1319.00	Culv Inv El Dn (ft)	1315.92
E.G. DS (ft)	1318.84	Culv Frctn Ls (ft)	0.12
W.S. DS (ft)	1318.29	Culv Exit Loss (ft)	0.17
Delta EG (ft)	0.41	Culv Entr Loss (ft)	0.12
Delta WS (ft)	0.72	Q Weir (cfs)	
E.G. IC (ft)	1319.09	Weir Sta Lft (ft)	
E.G. OC (ft)	1319.25	Weir Sta Rgt (ft)	
Culvert Control	Outlet	Weir Submerg	
Culv WS Inlet (ft)	1318.54	Weir Max Depth (ft)	
Culv WS Outlet (ft)	1318.29	Weir Avg Depth (ft)	
Culv Nml Depth (ft)	6.22	Weir Flow Area (sq ft)	
Culv Crt Depth (ft)	2.00	Min El Weir Flow (ft)	1325.34

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.433

INPUT
Description: COP Mod 37.6 Click here for details----------->
DS Cross Section of 43rd Avenue Culvert

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted

Station Elevation Data num= 72

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1323.89	6.42	1323.87	30.28	1323.8	31.93	1323.79	33.3	1323.75
38.8	1323.58	66.4	1323.84	67	1323.85	67.38	1323.85	69.58	1323.87
95.28	1324.06	98.66	1324.26	109.21	1324.87	113.75	1325.13	117.19	1325.33
120.65	1315.89	126.59	1315.87	126.95	1315.87	127.18	1315.87	133.97	1315.68
136.14	1315.68	136.75	1315.66	136.86	1315.68	138.85	1315.68	145.86	1315.68
147.79	1315.68	150.71	1315.69	151.69	1315.64	151.84	1315.69	159.67	1315.8
165.28	1315.87	166.76	1315.97	166.96	1315.98	167.15	1315.98	167.35	1315.98
167.55	1315.98	171.71	1315.87	174.95	1315.84	176.12	1315.87	183.72	1315.87
184.94	1315.87	185.07	1315.92	185.68	1316.87	185.81	1317.07	186.32	1317.87
186.68	1318.43	186.96	1318.87	187.44	1319.61	187.61	1319.87	187.68	1319.98
188.25	1320.87	188.72	1321.61	188.89	1321.87	189.47	1322.78	189.53	1322.87
189.59	1322.97	190.49	1323.87	191.89	1324.81	191.95	1324.85	192.01	1324.87
193.38	1324.98	195.02	1324.87	199.04	1324.6	202.13	1324.39	205.56	1324.16
209.94	1323.87	213.12	1323.87	213.44	1323.87	215.16	1324.04	224.04	1324.15
228.83	1324.15	229.41	1324.18						

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	120.65	.056	185.07	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
120.65	185.07	32.72	29.86	29.91	.3	.5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
0	120.31	1323.37	F
190.5	229.41	1323.37	F

Left Levee Station= 117.19 Elevation= 1325.33
Right Levee Station= 193.38 Elevation= 1324.98

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1321.52	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.73	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1319.79	Reach Len. (ft)	32.72	29.86	29.91
Crit W.S. (ft)	1319.62	Flow Area (sq ft)	1.17	257.51	4.81
E.G. Slope (ft/ft)	0.025128	Area (sq ft)	2.79	257.51	4.81
Q Total (cfs)	2760.00	Flow (cfs)	6.85	2727.22	25.93
Top Width (ft)	68.34	Top Width (ft)	1.43	64.42	2.49
Vel Total (ft/s)	10.47	Avg. Vel. (ft/s)	5.86	10.59	5.39
Max Chl Dpth (ft)	4.15	Hydr. Depth (ft)	3.44	4.00	1.93
Conv. Total (cfs)	17411.4	Conv. (cfs)	43.2	17204.7	163.6
Length Wtd. (ft)	29.86	Wetted Per. (ft)	0.99	64.45	4.60
Min Ch El (ft)	1315.64	Shear (lb/sq ft)	1.86	6.27	1.64
Alpha	1.01	Stream Power (lb/ft s)	229.41	117.19	193.38
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	1.52	4.01	0.72
C & E Loss (ft)	0.36	Cum SA (acres)	0.61	1.40	0.32

Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1318.84	Element			
Vel Head (ft)	0.55	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1318.29	Reach Len. (ft)	32.72	29.86	29.91
Crit W.S. (ft)	1317.70	Flow Area (sq ft)	0.66	160.46	1.80
E.G. Slope (ft/ft)	0.015021	Area (sq ft)	1.05	160.46	1.80
Q Total (cfs)	966.00	Flow (cfs)	2.03	958.58	5.39
Top Width (ft)	66.82	Top Width (ft)	0.88	64.42	1.52
Vel Total (ft/s)	5.93	Avg. Vel. (ft/s)	3.08	5.97	3.00
Max Chl Dpth (ft)	2.65	Hydr. Depth (ft)	1.93	2.49	1.18
Conv. Total (cfs)	7881.9	Conv. (cfs)	16.5	7821.3	44.0
Length Wtd. (ft)	29.86	Wetted Per. (ft)	0.99	64.45	2.81
Min Ch El (ft)	1315.64	Shear (lb/sq ft)	0.62	2.33	0.60
Alpha	1.01	Stream Power (lb/ft s)	229.41	117.19	193.38
Frctn Loss (ft)	0.27	Cum Volume (acre-ft)	0.79	2.29	0.33
C & E Loss (ft)	0.14	Cum SA (acres)	0.54	1.36	0.29

Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, water surface was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.427

INPUT
Description: COP Model 36.9 Click Here for Details-------->

Original Model Comment:
- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted
- Added a blocked obstruction to avoid using scour hole for conveyance

Station Elevation Data num= 104

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
249.71	1322.34	253.08	1322.37	254.95	1322.38	266.38	1322.35	272.83	1322.33
287.48	1321.87	291.8	1321.73	305.93	1321.87	309.42	1321.9	310.34	1321.91
328.34	1322.08	339.06	1322.1	342.56	1322.14	347.96	1321.87	350.52	1321.87
351.43	1321.66	352.74	1321.39	353.56	1321.23	355.33	1320.87	356.14	1320.17
356.49	1319.87	356.75	1319.64	357.41	1319.07	357.56	1318.93	357.64	1318.87
358.5	1318.13	358.79	1317.87	359.95	1316.87	361.76	1316.23	362.23	1315.87
362.49	1315.75	365.05	1315.64	373.09	1314.87	380.76	1314.87	380.91	1314.87
385.1	1314.93	388.46	1314.94	394.68	1315.05	400.29	1315.07	406.53	1314.87
410.24	1314.77	412.45	1314.74	419.39	1314.69	422.69	1314.61	424.28	1314.58
430.87	1314.55	435.18	1314.64	436.86	1314.68	438.88	1314.72	441.83	1314.79
443.21	1314.82	444.01	1314.87	444.28	1314.8	445.15	1314.85	445.55	1314.87
445.68	1315.47	445.77	1315.87	445.82	1316.11	445.9	1316.44	445.96	1316.74
445.99	1316.87	446.14	1317.53	446.28	1317.87	446.45	1318.15	446.89	1318.87
446.98	1319.02	447.28	1319.52	447.49	1319.87	447.63	1320.1	447.64	1320.08
447.7	1319.97	447.84	1320.16	447.95	1320.08	448.07	1320.16	448.15	1320.21
448.75	1320.37	451.26	1320.87	459.11	1321.61	460.43	1321.77	460.92	1321.85
462.75	1321.87	474.32	1322.35	486.73	1322.87	488.52	1322.94	489.96	1322.97
507.07	1323.28	511.45	1323.27	518.31	1323.27	527.51	1323.43	537.12	1323.58
541.63	1323.59	541.74	1323.59	542.13	1323.6	544.92	1323.58	562.04	1323.85
562.46	1323.85	562.55	1323.86	562.59	1323.85	563.61	1323.82	580.46	1323.2
588.99	1322.87	590.5	1322.81	600.03	1322.76	603.17	1322.73		

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
249.71	.045	350.52	.056	451.26	.045

Bank Sta: Left Right Lengths: Left Channel Right Coeff Contr. Expan.
350.52 451.26 32.02 29.08 29.06 .3 .5

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
249.71	368.75	1323.37	F
451.75	603.17	1323.37	F

Left Levee Station= 342.56 Elevation= 1322.14
Right Levee Station= 562.04 Elevation= 1323.85

Blocked Obstructions num= 1

Sta L	Sta R	Elev
358.04	453.75	1315.18

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1320.62	Element			
Vel Head (ft)	1.00	Wt. n-Val.		0.056	
W.S. Elev (ft)	1319.62	Reach Len. (ft)	32.02	29.08	29.06
Crit W.S. (ft)	1318.57	Flow Area (sq ft)		344.09	
E.G. Slope (ft/ft)	0.013434	Area (sq ft)		382.11	
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	

Top Width (ft)	90.57	Top Width (ft)		90.57	
Vel Total (ft/s)	8.02	Avg. Vel. (ft/s)		8.02	
Max Chl Dpth (ft)	4.44	Hydr. Depth (ft)		4.38	
Conv. Total (cfs)	23812.8	Conv. (cfs)		23812.8	
Length Wtd. (ft)	29.08	Wetted Per. (ft)		81.69	
Min Ch El (ft)	1315.18	Shear (lb/sq ft)		3.53	
Alpha	1.00	Stream Power (lb/ft s)	603.17	342.56	562.04
Frctn Loss (ft)	0.45	Cum Volume (acre-ft)	1.52	3.79	0.71
C & E Loss (ft)	0.04	Cum SA (acres)	0.61	1.35	0.32

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1318.42	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.28	Wt. n-Val.		0.056	
W.S. Elev (ft)	1318.15	Reach Len. (ft)	32.02	29.08	29.06
Crit W.S. (ft)	1316.88	Flow Area (sq ft)		229.13	
E.G. Slope (ft/ft)	0.006203	Area (sq ft)		250.78	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	87.97	Top Width (ft)		87.97	
Vel Total (ft/s)	4.22	Avg. Vel. (ft/s)		4.22	
Max Chl Dpth (ft)	2.97	Hydr. Depth (ft)		2.95	
Conv. Total (cfs)	12264.8	Conv. (cfs)		12264.8	
Length Wtd. (ft)	29.08	Wetted Per. (ft)		79.97	
Min Ch El (ft)	1315.18	Shear (lb/sq ft)		1.11	
Alpha	1.00	Stream Power (lb/ft s)	603.17	342.56	562.04
Frctn Loss (ft)	0.19	Cum Volume (acre-ft)	0.79	2.14	0.32
C & E Loss (ft)	0.00	Cum SA (acres)	0.54	1.30	0.29

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.422

INPUT
Description: COP Model 36.6 Click Here for Details-------->

Original Model Comment:
Cross Section Updated

- Updated per topographic survey recieved September 2009
- Areas outside the topographic survey were deleted
-
Added Block obstruction to avoid using scour hole for conveyance

Station Elevation Data num= 101

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
273.83	1319.98	277.03	1319.87	278.73	1319.64	279.55	1319.53	281.88	1319.21
283.31	1319.02	284.44	1318.87	286.13	1318.64	286.9	1318.54	288.23	1318.36
290.14	1318.1	290.63	1318.03	293.57	1318.17	295.82	1318.28	298.12	1318.39
304.68	1318.69	305.88	1318.75	306.34	1318.76	308.42	1318.87	309.88	1318.94
310.59	1318.97	314.39	1319.15	316.91	1319.22	321.12	1319.43	322.88	1319.49
323.74	1319.52	324.06	1319.53	324.23	1319.52	327.97	1319.14	329.45	1318.95
330.12	1318.87	332.11	1318.59	332.98	1318.51	334.69	1318.3	337.53	1317.95
337.75	1317.92	338.17	1317.87	340.59	1317.57	341.17	1317.5	341.32	1317.47
341.85	1317.31	342.45	1317.19	343.14	1316.87	345.67	1316.87	350.13	1316.87
350.21	1316.86	350.24	1316.86	350.34	1316.87	353.56	1317.2	354.31	1317.19
354.83	1317.18	359.38	1316.87	368.14	1316.14	369.43	1315.87	370.19	1315.71
374.19	1315.2	376.72	1314.87	380.6	1314.83	392.25	1314.7	394.04	1314.66
399.7	1314.49	409.94	1314.33	418.02	1314.16	419.91	1314.11	426.89	1314.19
435.13	1314.69	436.92	1314.87	437.65	1315.13	439.73	1315.87	440.35	1316.09
442.12	1316.72	442.54	1316.87	443.21	1317.11	445.36	1317.87	445.97	1318.09
447.28	1318.65	447.79	1318.87	449.11	1319.44	449.98	1319.81	450.11	1319.87
452.21	1320.78	452.43	1320.87	452.5	1320.9	453.88	1321.5	460.98	1321.43
483.31	1321.42	492.67	1321.61	499.85	1321.74	505.25	1321.74	506.14	1321.72
513.72	1321.7	523.82	1321.87	530.77	1321.99	541.17	1322.15	549	1322.28
553.88	1322.35	556.73	1322.4	565.8	1322.15	566.2	1322.14	566.82	1322.12
573.42	1321.87								

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
273.83	.045	354.83	.056	443.21	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
354.83	443.21	64.37	58.05	57.96	.1	.3

Ineffective Flow num= 2

Sta L	Sta R	Elev	Permanent
273.83	357	1323.37	F

459 573.42 1323.37 F
Blocked Obstructions num= 1
Sta L Sta R Elev
370.11 446.74 1314.94

CROSS SECTION OUTPUT Profile #Q100 - Effective

E.G. Elev (ft)	1320.13	Element	Left OB	Channel	Right OB
Vel Head (ft)	1.13	Wt. n-Val.		0.056	0.045
W.S. Elev (ft)	1319.00	Reach Len. (ft)	64.37	58.05	57.96
Crit W.S. (ft)	1318.48	Flow Area (sq ft)		320.40	4.83
E.G. Slope (ft/ft)	0.018180	Area (sq ft)	49.89	324.50	4.83
Q Total (cfs)	2760.00	Flow (cfs)		2739.64	20.36
Top Width (ft)	146.71	Top Width (ft)	53.46	88.38	4.88
Vel Total (ft/s)	8.49	Avg. Vel. (ft/s)		8.55	4.22
Max Chl Dpth (ft)	4.06	Hydr. Depth (ft)		3.72	0.99
Conv. Total (cfs)	20469.5	Conv. (cfs)		20318.5	151.0
Length Wtd. (ft)	59.68	Wetted Per. (ft)		86.71	5.23
Min Ch El (ft)	1314.94	Shear (lb/sq ft)		4.19	1.05
Alpha	1.01	Stream Power (lb/ft s)	573.42	0.00	0.00
Frctn Loss (ft)	0.54	Cum Volume (acre-ft)	1.50	3.56	0.71
C & E Loss (ft)	0.24	Cum SA (acres)	0.59	1.29	0.32

Warning: Divided flow computed for this cross-section.
Warning: The velocity head has changed by more than 0.5 ft (0.15 m). This may indicate the need for additional cross sections.
Warning: The conveyance ratio (upstream conveyance divided by downstream conveyance) is less than 0.7 or greater than 1.4.
This may indicate the need for additional cross sections.
Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1318.23	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.27	Wt. n-Val.		0.056	0.045
W.S. Elev (ft)	1317.96	Reach Len. (ft)	64.37	58.05	57.96
Crit W.S. (ft)	1316.83	Flow Area (sq ft)		231.30	1.03
E.G. Slope (ft/ft)	0.006676	Area (sq ft)	14.18	233.17	1.03
Q Total (cfs)	966.00	Flow (cfs)		964.48	1.52
Top Width (ft)	108.21	Top Width (ft)	17.42	88.38	2.41
Vel Total (ft/s)	4.16	Avg. Vel. (ft/s)		4.17	1.47
Max Chl Dpth (ft)	3.02	Hydr. Depth (ft)		2.68	0.43
Conv. Total (cfs)	11823.2	Conv. (cfs)		11804.5	18.6
Length Wtd. (ft)	59.62	Wetted Per. (ft)		86.71	2.56
Min Ch El (ft)	1314.94	Shear (lb/sq ft)		1.11	0.17
Alpha	1.00	Stream Power (lb/ft s)	573.42	0.00	0.00
Frctn Loss (ft)	0.33	Cum Volume (acre-ft)	0.78	1.98	0.32
C & E Loss (ft)	0.04	Cum SA (acres)	0.53	1.25	0.28

Note: Multiple critical depths were found at this location. The critical depth with the lowest, valid, energy was used.

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.411

INPUT
Description: COP Model 36.2

Original Model Comment:
Left Overbank
Elevations based upon original topographygraphy
Station Elevation Data num= 73

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1321.87	127.2	1321.87	127.9	1321.87	129.4	1321.87	157.1	1321.87
162.1	1321.87	185.2	1321.87	208.2	1321.87	218.8	1321.87	224.6	1321.87
290.6	1322.57	305.3	1322.57	318	1322.67	323.3	1322.77	340	1321.87
366.33	1316.87	366.81	1316.86	367.78	1316.85	374.98	1316.63	384.86	1316.33
389.83	1316.19	390.56	1316.17	393.58	1316.16	408.76	1316.2	413.82	1316.22
418.68	1316.3	419.98	1316.29	433.71	1316.15	439.88	1316.08	442.19	1316.01
444.17	1315.97	449.82	1315.87	454.94	1315.78	457.3	1315.73	466.8	1315.84
467.88	1315.85	468.6	1315.87	469.96	1315.87	470.01	1315.86	479.32	1314.87
480.51	1314.74	485.08	1314.87	493.23	1314.87	494.09	1314.87	496.87	1315.39
503.25	1315.87	512.83	1315.92	522.88	1316.52	529.16	1316.59	544.45	1316.78
546.53	1316.78	557.81	1316.82	565.96	1316.87	568.93	1317.4	570.5	1317.68
571.57	1317.87	573.51	1318.21	576.28	1318.71	576.81	1318.8	577.19	1318.87
577.77	1318.97	583.66	1319.87	586.01	1319.94	589.49	1319.97	596.05	1320.29
599.76	1320.13	607.95	1320.28	624.4	1320.53	629.25	1320.62	632.21	1320.67
634.18	1320.7	635.24	1320.75	660.05	1320.48				

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	470.01	.056	503.25	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
470.01	503.25	351.76	311.27 307.63	.1	.3

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1319.34	Element			
Vel Head (ft)	0.33	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1319.01	Reach Len. (ft)	351.76	311.27	307.63
Crit W.S. (ft)		Flow Area (sq ft)	306.54	127.95	169.23
E.G. Slope (ft/ft)	0.005456	Area (sq ft)	306.54	127.95	169.23
Q Total (cfs)	2760.00	Flow (cfs)	1435.72	614.31	709.96
Top Width (ft)	223.02	Top Width (ft)	114.97	33.24	74.81
Vel Total (ft/s)	4.57	Avg. Vel. (ft/s)	4.68	4.80	4.20
Max Chl Dpth (ft)	4.27	Hydr. Depth (ft)	2.67	3.85	2.26
Conv. Total (cfs)	37367.1	Conv. (cfs)	19438.0	8317.1	9612.1
Length Wtd. (ft)	321.33	Wetted Per. (ft)	115.19	33.37	75.02
Min Ch El (ft)	1314.74	Shear (lb/sq ft)	0.91	1.31	0.77
Alpha	1.01	Stream Power (lb/ft s)	660.05	0.00	0.00
Frctn Loss (ft)	1.68	Cum Volume (acre-ft)	1.24	3.26	0.60
C & E Loss (ft)	0.04	Cum SA (acres)	0.46	1.21	0.26

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

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

			Left OB	Channel	Right OB
E.G. Elev (ft)	1317.86	Element			
Vel Head (ft)	0.14	Wt. n-Val.	0.045	0.056	0.045
W.S. Elev (ft)	1317.72	Reach Len. (ft)	351.76	311.27	307.63
Crit W.S. (ft)		Flow Area (sq ft)	162.05	84.90	77.12
E.G. Slope (ft/ft)	0.004773	Area (sq ft)	162.05	84.90	77.12
Q Total (cfs)	966.00	Flow (cfs)	483.79	290.05	192.16
Top Width (ft)	208.86	Top Width (ft)	108.15	33.24	67.47
Vel Total (ft/s)	2.98	Avg. Vel. (ft/s)	2.99	3.42	2.49
Max Chl Dpth (ft)	2.98	Hydr. Depth (ft)	1.50	2.55	1.14
Conv. Total (cfs)	13982.0	Conv. (cfs)	7002.5	4198.2	2781.3
Length Wtd. (ft)	321.05	Wetted Per. (ft)	108.25	33.37	67.56
Min Ch El (ft)	1314.74	Shear (lb/sq ft)	0.45	0.76	0.34
Alpha	1.04	Stream Power (lb/ft s)	660.05	0.00	0.00
Frctn Loss (ft)	1.57	Cum Volume (acre-ft)	0.65	1.77	0.27
C & E Loss (ft)	0.02	Cum SA (acres)	0.44	1.17	0.24

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

CROSS SECTION

RIVER: Scatter_Wash
REACH: One RS: 0.352

INPUT
Description: COP Model 32.5
Station Elevation Data num= 10

Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev	Sta	Elev
0	1321.67	56.7	1321.87	345	1321.87	375	1315.87	470	1313.87
500	1313.87	665	1315.87	690	1321.87	780	1321.87	1050	1321.87

Manning's n Values num= 3

Sta	n Val	Sta	n Val	Sta	n Val
0	.045	345	.056	690	.045

Bank Sta: Left	Right	Lengths: Left Channel	Right	Coeff Contr.	Expan.
345	690	0	0	.1	.3

CROSS SECTION OUTPUT Profile #Q100 - Effective

			Left OB	Channel	Right OB
E.G. Elev (ft)	1317.62	Element			
Vel Head (ft)	0.19	Wt. n-Val.		0.056	
W.S. Elev (ft)	1317.43	Reach Len. (ft)			
Crit W.S. (ft)	1316.17	Flow Area (sq ft)		783.42	
E.G. Slope (ft/ft)	0.005004	Area (sq ft)		783.42	
Q Total (cfs)	2760.00	Flow (cfs)		2760.00	
Top Width (ft)	304.30	Top Width (ft)		304.30	
Vel Total (ft/s)	3.52	Avg. Vel. (ft/s)		3.52	
Max Chl Dpth (ft)	3.56	Hydr. Depth (ft)		2.57	
Conv. Total (cfs)	39016.6	Conv. (cfs)		39016.6	
Length Wtd. (ft)		Wetted Per. (ft)		304.67	
Min Ch El (ft)	1313.87	Shear (lb/sq ft)		0.80	
Alpha	1.00	Stream Power (lb/ft s)	1050.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

CROSS SECTION OUTPUT Profile #Q1- 35% Q100

E.G. Elev (ft)	1316.27	Element	Left OB	Channel	Right OB
Vel Head (ft)	0.09	Wt. n-Val.		0.056	
W.S. Elev (ft)	1316.18	Reach Len. (ft)			
Crit W.S. (ft)	1315.34	Flow Area (sq ft)		410.72	
E.G. Slope (ft/ft)	0.005007	Area (sq ft)		410.72	
Q Total (cfs)	966.00	Flow (cfs)		966.00	
Top Width (ft)	292.85	Top Width (ft)		292.85	
Vel Total (ft/s)	2.35	Avg. Vel. (ft/s)		2.35	
Max Chl Dpth (ft)	2.31	Hydr. Depth (ft)		1.40	
Conv. Total (cfs)	13651.3	Conv. (cfs)		13651.3	
Length Wtd. (ft)		Wetted Per. (ft)		292.95	
Min Ch El (ft)	1313.87	Shear (lb/sq ft)		0.44	
Alpha	1.00	Stream Power (lb/ft s)	1050.00	0.00	0.00
Frctn Loss (ft)		Cum Volume (acre-ft)			
C & E Loss (ft)		Cum SA (acres)			

SUMMARY OF MANNING'S N VALUES

River:Scatter_Wash

Reach	River Sta.	n1	n2	n3	n4	n5	n6	n7	n8	n9	n10	n11	n12
One	1.342	.018	.05	.018	.05	.028	.085	.03					
One	1.301	.05	.028	.085	.03								
One	1.299	.018	.05	.028	.085	.03							
One	1.251	Culvert											
One	1.198	.018	.05	.03	.05	.018	.03	.018	.028	.05	.03	.018	.03
One	1.141	.03	.03	.06	.018	.028	.018	.03	.018	.03			
One	1.036	.05	.018	.028	.018	.05	.03	.018	.03				
One	0.932	.045	.047	.028	.047	.045							
One	0.892	.045	.044	.045									
One	0.852	.045	.044	.045									
One	0.840	.045	.044	.045									
One	0.754	.045	.044	.045									
One	0.655	.045	.044	.045									
One	0.553	.045	.044	.045									
One	0.542	.045	.044	.045									
One	0.479	.045	.044	.045									
One	0.470	.045	.044	.045									
One	0.452	.045	.044	.045									
One	0.451	.045	.013	.045									
One	.442	Culvert											
One	0.433	.045	.056	.045									
One	0.427	.045	.056	.045									
One	0.422	.045	.056	.045									
One	0.411	.045	.056	.045									
One	0.352	.045	.056	.045									

SUMMARY OF REACH LENGTHS

River: Scatter_Wash

Reach	River Sta.	Left	Channel	Right
One	1.342	183.19	215.38	246.46
One	1.301	10.52	10.61	10.24
One	1.299	517.59	532.96	522.53
One	1.251	Culvert		
One	1.198	355.51	304.13	283.97
One	1.141	590.28	553.78	523.25
One	1.036	580.95	546.44	499.79
One	0.932	228.06	212.07	198.46
One	0.892	210.24	211.09	216.73
One	0.852	65.99	66.3	67.65
One	0.840	384.15	454.55	594.1
One	0.754	543.9	520.86	509.53
One	0.655	622.35	536.53	466.49
One	0.553	57.48	58.17	59.31
One	0.542	340.02	336.74	338.98
One	0.479	45.31	45.37	46.62
One	0.470	98.12	96.9	98.07
One	0.452	3.82	3.82	3.88
One	0.451	94.79	93.97	94.02
One	.442	Culvert		
One	0.433	32.72	29.86	29.91
One	0.427	32.02	29.08	29.06
One	0.422	64.37	58.05	57.96
One	0.411	351.76	311.27	307.63
One	0.352	0	0	0

SUMMARY OF CONTRACTION AND EXPANSION COEFFICIENTS
River: Scatter_Wash

Reach	River Sta.	Contr.	Expan.
One	1.342	.1	.3
One	1.301	.3	.5
One	1.299	.3	.5
One	1.251	Culvert	
One	1.198	.3	.5
One	1.141	.1	.3
One	1.036	.1	.3
One	0.932	.1	.3
One	0.892	.1	.3
One	0.852	.1	.3
One	0.840	.1	.3
One	0.754	.1	.3
One	0.655	.1	.3
One	0.553	.1	.3
One	0.542	.1	.3
One	0.479	.1	.3
One	0.470	.3	.5
One	0.452	.3	.5
One	0.451	.3	.5
One	.442	Culvert	
One	0.433	.3	.5
One	0.427	.3	.5
One	0.422	.1	.3
One	0.411	.1	.3
One	0.352	.1	.3

HEC-RAS Plan: TS River: Scatter_Wash Reach: One

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)	
One	1.342	Q100 - Effective	2760.00	1337.51	1340.65	1340.64	1341.85	0.008089	8.85	316.40	153.83	0.98
One	1.342	Q1- 35% Q100	966.00	1337.51	1339.57	1339.38	1340.03	0.006492	5.47	177.59	141.04	0.80
One	1.301	Q100 - Effective	2760.00	1335.35	1338.85	1338.85	1340.04	0.008680	8.75	317.17	134.50	0.99
One	1.301	Q1- 35% Q100	966.00	1335.35	1337.60	1337.60	1338.22	0.011144	6.30	153.28	125.58	1.01
One	1.299	Q100 - Effective	2760.00	1333.36	1338.15	1335.92	1338.49	0.001066	4.68	590.07	125.96	0.38
One	1.299	Q1- 35% Q100	966.00	1333.36	1335.85	1334.67	1336.01	0.001176	3.21	300.75	124.97	0.36
One	1.251		Culvert									
One	1.198	Q100 - Effective	2760.00	1332.40	1337.23	1334.83	1337.48	0.000735	4.04	691.78	157.94	0.33
One	1.198	Q1- 35% Q100	966.00	1332.40	1335.44	1333.67	1335.53	0.000465	2.33	417.11	149.82	0.24
One	1.141	Q100 - Effective	2760.00	1332.35	1335.74	1335.61	1336.75	0.006758	8.08	344.44	146.90	0.91
One	1.141	Q1- 35% Q100	966.00	1332.35	1334.56	1334.46	1335.04	0.007935	5.59	173.46	141.58	0.88
One	1.036	Q100 - Effective	2760.00	1330.88	1334.25	1333.25	1334.65	0.002103	5.08	544.22	191.51	0.52
One	1.036	Q1- 35% Q100	966.00	1330.88	1332.97	1332.26	1333.13	0.001782	3.19	302.69	186.19	0.44
One	0.932	Q100 - Effective	2760.00	1329.88	1333.35	1332.21	1333.61	0.001596	4.10	683.19	258.41	0.44
One	0.932	Q1- 35% Q100	966.00	1329.88	1332.17	1331.43	1332.27	0.001321	2.55	382.14	253.57	0.36
One	0.892	Q100 - Effective	2760.00	1327.99	1332.74	1331.85	1333.03	0.005589	4.33	641.91	289.12	0.51
One	0.892	Q1- 35% Q100	966.00	1327.99	1331.72	1330.95	1331.83	0.003839	2.68	362.29	252.03	0.39
One	0.852	Q100 - Effective	2760.00	1328.06	1331.12	1330.52	1331.58	0.008539	5.49	513.20	234.47	0.63
One	0.852	Q1- 35% Q100	966.00	1328.06	1329.57	1329.57	1330.05	0.029104	5.57	174.29	185.14	1.01
One	0.840	Q100 - Effective	2760.00	1326.87	1331.04	1329.19	1331.25	0.002108	3.71	766.49	227.64	0.34
One	0.840	Q1- 35% Q100	966.00	1326.87	1329.49	1328.21	1329.57	0.001671	2.30	423.89	208.77	0.28
One	0.754	Q100 - Effective	2760.00	1324.87	1330.29	1328.45	1330.41	0.001559	2.80	994.05	337.39	0.28
One	0.754	Q1- 35% Q100	966.00	1324.87	1328.68	1327.59	1328.75	0.001925	2.03	476.58	298.94	0.28
One	0.655	Q100 - Effective	2760.00	1324.54	1329.31	1327.42	1329.49	0.001961	3.52	801.33	236.22	0.33
One	0.655	Q1- 35% Q100	966.00	1324.54	1327.77	1326.53	1327.84	0.001578	2.18	446.47	224.59	0.27
One	0.553	Q100 - Effective	2760.00	1323.78	1326.04	1326.04	1326.91	0.022575	7.55	371.58	214.56	0.99
One	0.553	Q1- 35% Q100	966.00	1323.78	1325.13	1325.13	1325.58	0.028946	5.38	180.05	206.69	1.00
One	0.542	Q100 - Effective	2760.00	1318.96	1324.23	1322.09	1324.46	0.001930	3.93	747.91	205.61	0.33

HEC-RAS Plan: TS River: Scatter_Wash Reach: One (Continued)

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)	
One	0.542	Q1- 35% Q100	966.00	1318.96	1322.15	1321.01	1322.27	0.002313	2.77	358.53	173.66	0.33
One	0.479	Q100 - Effective	2760.00	1317.52	1323.43	1321.38	1323.67	0.002900	3.99	704.15	226.95	0.39
One	0.479	Q1- 35% Q100	966.00	1317.52	1321.09	1319.99	1321.28	0.003806	3.49	277.53	130.39	0.42
One	0.470	Q100 - Effective	2760.00	1317.19	1323.39	1320.98	1323.55	0.001523	3.30	856.27	228.78	0.29
One	0.470	Q1- 35% Q100	966.00	1317.19	1321.00	1319.87	1321.12	0.002575	2.73	356.51	182.81	0.34
One	0.452	Q100 - Effective	2760.00	1317.77	1321.51	1321.18	1322.86	0.013762	9.33	295.77	87.36	0.86
One	0.452	Q1- 35% Q100	966.00	1317.77	1319.53	1319.53	1320.34	0.023754	7.22	133.75	86.36	1.00
One	0.451	Q100 - Effective	2760.00	1315.93	1321.93	1319.30	1322.45	0.000238	5.80	484.29	84.76	0.42
One	0.451	Q1- 35% Q100	966.00	1315.93	1319.00	1317.62	1319.25	0.000276	3.99	246.51	83.29	0.40
One	.442		Culvert									
One	0.433	Q100 - Effective	2760.00	1315.64	1319.79	1319.62	1321.52	0.025128	10.59	263.49	68.34	0.93
One	0.433	Q1- 35% Q100	966.00	1315.64	1318.29	1317.70	1318.84	0.015021	5.97	162.92	66.82	0.67
One	0.427	Q100 - Effective	2760.00	1315.18	1319.62	1318.57	1320.62	0.013434	8.02	344.09	90.57	0.68
One	0.427	Q1- 35% Q100	966.00	1315.18	1318.15	1316.88	1318.42	0.006203	4.22	229.13	87.97	0.43
One	0.422	Q100 - Effective	2760.00	1314.94	1319.00	1318.48	1320.13	0.018180	8.55	325.22	146.71	0.78
One	0.422	Q1- 35% Q100	966.00	1314.94	1317.96	1316.83	1318.23	0.006676	4.17	232.34	108.21	0.45
One	0.411	Q100 - Effective	2760.00	1314.74	1319.01		1319.34	0.005456	4.80	603.72	223.02	0.43
One	0.411	Q1- 35% Q100	966.00	1314.74	1317.72		1317.86	0.004773	3.42	324.07	208.86	0.38
One	0.352	Q100 - Effective	2760.00	1313.87	1317.43	1316.17	1317.62	0.005004	3.52	783.42	304.30	0.39
One	0.352	Q1- 35% Q100	966.00	1313.87	1316.18	1315.34	1316.27	0.005007	2.35	410.72	292.85	0.35

HEC-RAS Plan: TS River: Scatter_Wash Reach: One

Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
One	1.342	Q100 - Effective	1341.85	1340.65	1.20	1.81	0.01	16.12	2716.81	27.07	153.83
One	1.342	Q1- 35% Q100	1340.03	1339.57	0.46	1.80	0.02	0.75	961.54	3.71	141.04
One	1.301	Q100 - Effective	1340.04	1338.85	1.18	0.02	0.42		2750.41	9.59	134.50
One	1.301	Q1- 35% Q100	1338.22	1337.60	0.62	0.03	0.23		966.00		125.58
One	1.299	Q100 - Effective	1338.49	1338.15	0.34				2760.00		125.96
One	1.299	Q1- 35% Q100	1336.01	1335.85	0.16				966.00		124.97
One	1.251		Culvert								
One	1.198	Q100 - Effective	1337.48	1337.23	0.25	0.51	0.23	30.09	2711.58	18.32	157.94
One	1.198	Q1- 35% Q100	1335.53	1335.44	0.08	0.37	0.12	2.19	962.31	1.50	149.82
One	1.141	Q100 - Effective	1336.75	1335.74	1.01	1.92	0.18	45.36	2689.36	25.28	146.90
One	1.141	Q1- 35% Q100	1335.04	1334.56	0.48	1.82	0.10	10.59	953.01	2.40	141.58
One	1.036	Q100 - Effective	1334.65	1334.25	0.40	1.00	0.04	31.07	2670.18	58.75	191.51
One	1.036	Q1- 35% Q100	1333.13	1332.97	0.16	0.83	0.02	4.43	946.59	14.97	186.19
One	0.932	Q100 - Effective	1333.61	1333.35	0.26	0.57	0.00	5.98	2734.48	19.54	258.41
One	0.932	Q1- 35% Q100	1332.27	1332.17	0.10	0.45	0.00	0.79	960.40	4.80	253.57
One	0.892	Q100 - Effective	1333.03	1332.74	0.29	1.44	0.02	0.00	2729.84	30.16	289.12
One	0.892	Q1- 35% Q100	1331.83	1331.72	0.11	1.74	0.04		960.36	5.64	252.03
One	0.852	Q100 - Effective	1331.58	1331.12	0.46	0.25	0.08	26.95	2681.65	51.40	234.47
One	0.852	Q1- 35% Q100	1330.05	1329.57	0.48	0.29	0.12		957.08	8.92	185.14
One	0.840	Q100 - Effective	1331.25	1331.04	0.21	0.82	0.03	65.59	2671.41	23.00	227.64
One	0.840	Q1- 35% Q100	1329.57	1329.49	0.08	0.81	0.01	2.12	960.49	3.38	208.77
One	0.754	Q100 - Effective	1330.41	1330.29	0.12	0.91	0.01	2.81	2738.91	18.28	337.39
One	0.754	Q1- 35% Q100	1328.75	1328.68	0.06	0.91	0.00		964.77	1.23	298.94
One	0.655	Q100 - Effective	1329.49	1329.31	0.19	2.51	0.07	52.57	2693.52	13.92	236.22
One	0.655	Q1- 35% Q100	1327.84	1327.77	0.07	2.23	0.04	3.96	961.17	0.87	224.59
One	0.553	Q100 - Effective	1326.91	1326.04	0.87	0.27	0.19	30.21	2708.91	20.87	214.56
One	0.553	Q1- 35% Q100	1325.58	1325.13	0.45	0.33	0.10	0.18	965.25	0.57	206.69
One	0.542	Q100 - Effective	1324.46	1324.23	0.23	0.79	0.00	154.77	2547.46	57.77	205.61

HEC-RAS Plan: TS River: Scatter_Wash Reach: One (Continued)

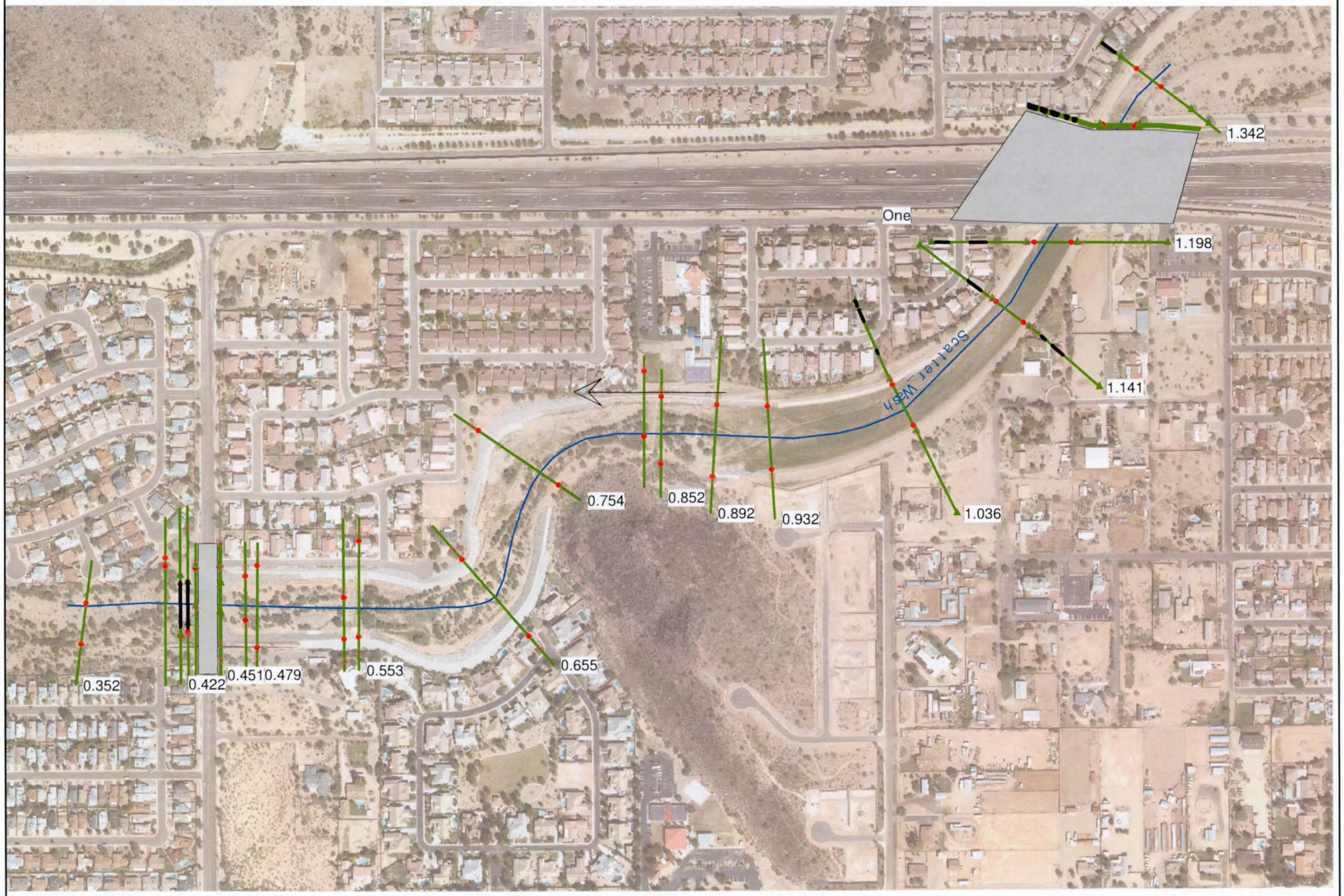
Reach	River Sta	Profile	E.G. Elev	W.S. Elev	Vel Head	Frctn Loss	C & E Loss	Q Left	Q Channel	Q Right	Top Width
			(ft)	(ft)	(ft)	(ft)	(ft)	(cfs)	(cfs)	(cfs)	(ft)
One	0.542	Q1- 35% Q100	1322.27	1322.15	0.12	0.98	0.01	27.55	929.60	8.85	173.66
One	0.479	Q100 - Effective	1323.67	1323.43	0.24	0.09	0.02	36.63	2696.61	26.76	226.95
One	0.479	Q1- 35% Q100	1321.28	1321.09	0.19	0.14	0.02	1.28	964.67	0.05	130.39
One	0.470	Q100 - Effective	1323.55	1323.39	0.17	0.33	0.36	48.11	2675.53	36.36	228.78
One	0.470	Q1- 35% Q100	1321.12	1321.00	0.12	0.56	0.21	4.16	960.37	1.47	182.81
One	0.452	Q100 - Effective	1322.86	1321.51	1.35	0.00	0.42		2760.00		87.36
One	0.452	Q1- 35% Q100	1320.34	1319.53	0.81	0.00	0.28		966.00		86.36
One	0.451	Q100 - Effective	1322.45	1321.93	0.52			8.66	2744.09	7.25	84.76
One	0.451	Q1- 35% Q100	1319.25	1319.00	0.25			2.63	960.98	2.40	83.29
One	.442		Culvert								
One	0.433	Q100 - Effective	1321.52	1319.79	1.73	0.54	0.36	6.85	2727.22	25.93	68.34
One	0.433	Q1- 35% Q100	1318.84	1318.29	0.55	0.27	0.14	2.03	958.58	5.39	66.82
One	0.427	Q100 - Effective	1320.62	1319.62	1.00	0.45	0.04		2760.00		90.57
One	0.427	Q1- 35% Q100	1318.42	1318.15	0.28	0.19	0.00		966.00		87.97
One	0.422	Q100 - Effective	1320.13	1319.00	1.13	0.54	0.24		2739.64	20.36	146.71
One	0.422	Q1- 35% Q100	1318.23	1317.96	0.27	0.33	0.04		964.48	1.52	108.21
One	0.411	Q100 - Effective	1319.34	1319.01	0.33	1.68	0.04	1435.72	614.31	709.96	223.02
One	0.411	Q1- 35% Q100	1317.86	1317.72	0.14	1.57	0.02	483.79	290.05	192.16	208.86
One	0.352	Q100 - Effective	1317.62	1317.43	0.19				2760.00		304.30
One	0.352	Q1- 35% Q100	1316.27	1316.18	0.09				966.00		292.85

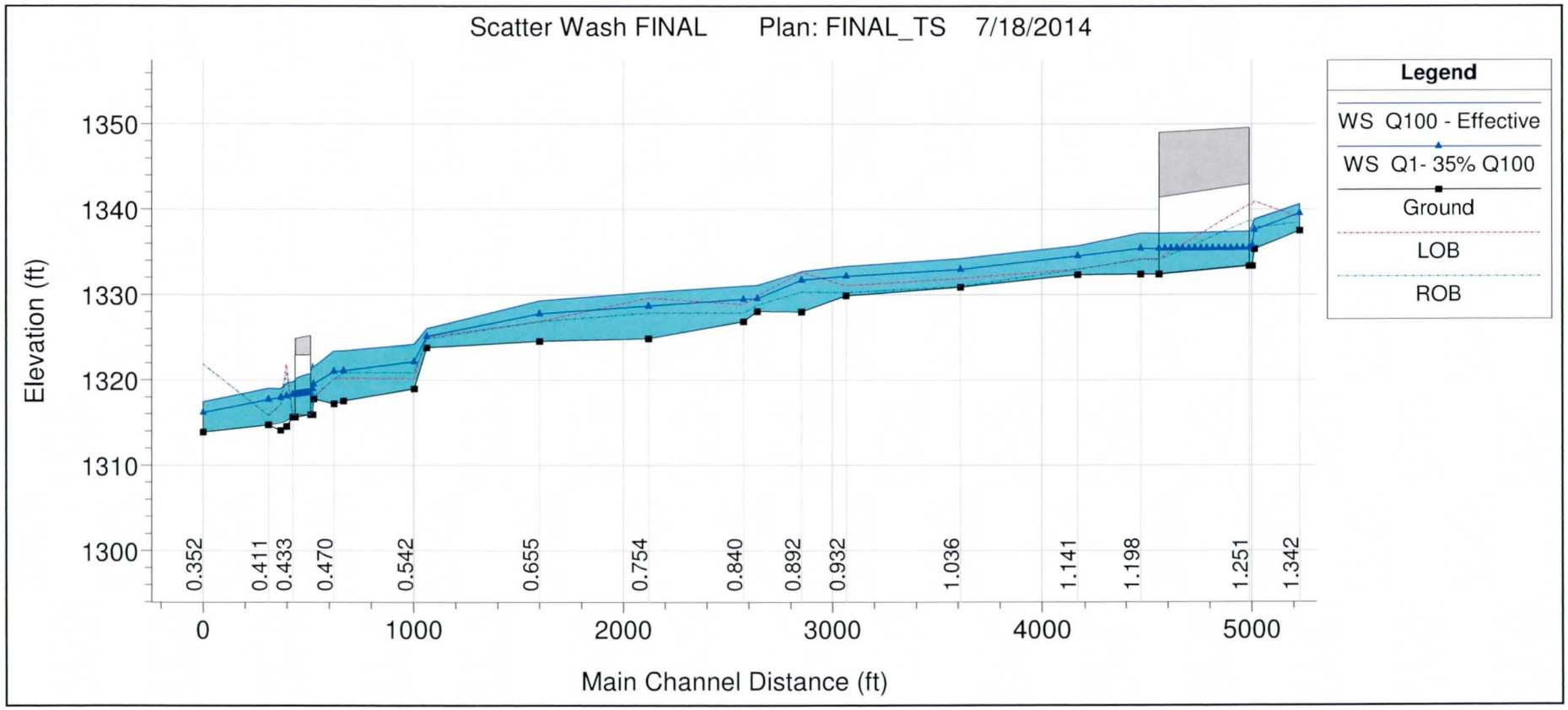
HEC-RAS Plan: TS River: Scatter_Wash Reach: One

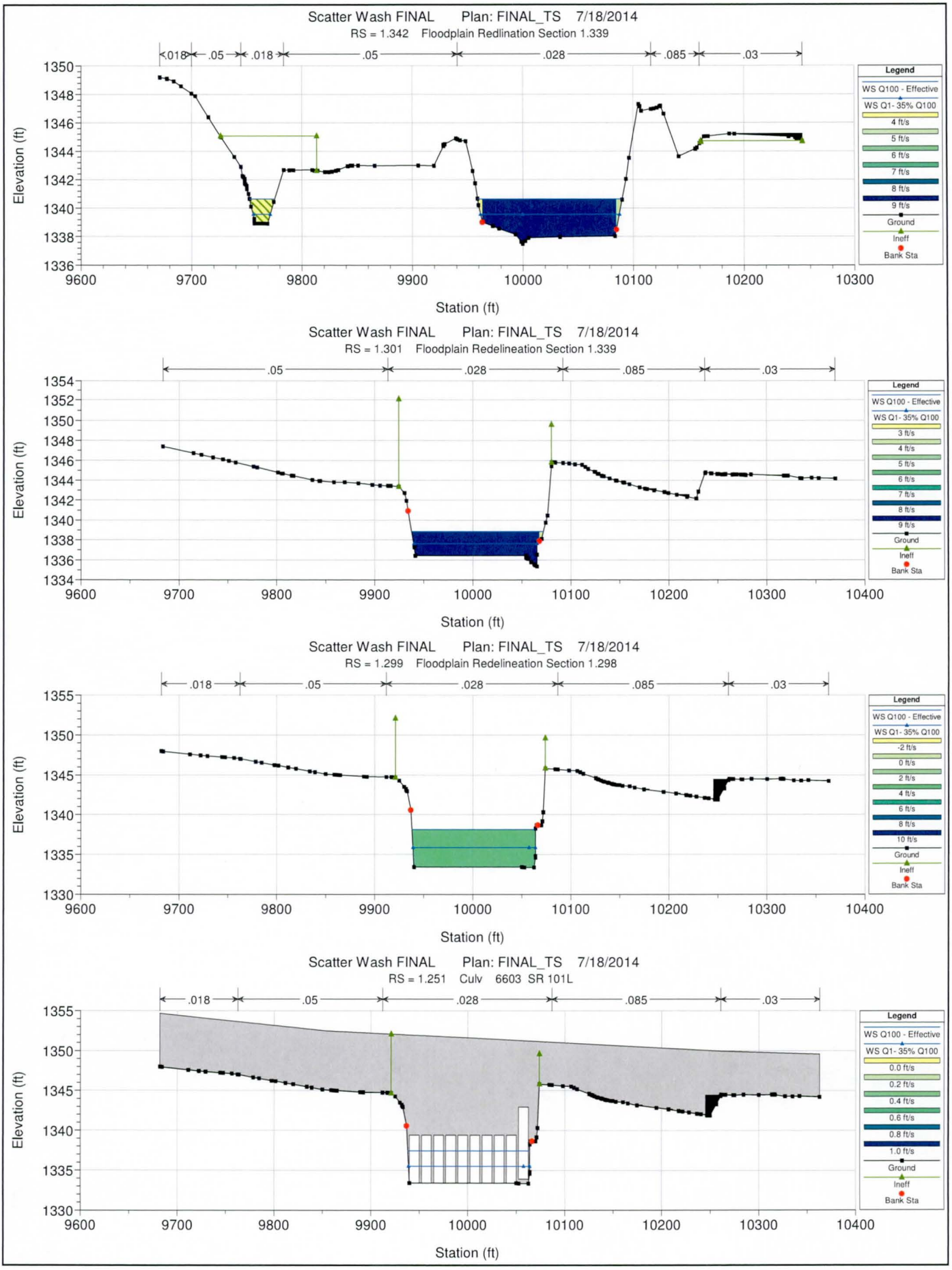
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl	Q Channel	Shear Chan	Shear Total	Shear LOB	Shear ROB
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(cfs)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
One	1.342	Q100 - Effective	2760	1337.51	1340.65	1340.64	1341.85	0.008089	8.9	316	154	0.98	2717	1.28	1.21	0.41	0.50
One	1.342	Q1- 35% Q100	966	1337.51	1339.57	1339.38	1340.03	0.006492	5.5	178	141	0.80	962	0.59	0.57	0.10	0.20
One	1.301	Q100 - Effective	2760	1335.35	1338.85	1338.85	1340.04	0.008680	8.7	317	135	0.99	2750	1.27	1.25		0.34
One	1.301	Q1- 35% Q100	966	1335.35	1337.60	1337.60	1338.22	0.011144	6.3	153	126	1.01	966	0.83	0.83		
One	1.299	Q100 - Effective	2760	1333.36	1338.15	1335.92	1338.49	0.001066	4.7	590	126	0.38	2760	0.30	0.30		
One	1.299	Q1- 35% Q100	966	1333.36	1335.85	1334.67	1336.01	0.001176	3.2	301	125	0.36	966	0.17	0.17		
One	1.251		Culvert														
One	1.198	Q100 - Effective	2760	1332.40	1337.23	1334.83	1337.48	0.000735	4.0	692	158	0.33	2712	0.21	0.20	0.06	0.06
One	1.198	Q1- 35% Q100	966	1332.40	1335.44	1333.67	1335.53	0.000465	2.3	417	150	0.24	962	0.08	0.08	0.02	0.02
One	1.141	Q100 - Effective	2760	1332.35	1335.74	1335.61	1336.75	0.006758	8.1	344	147	0.91	2689	1.02	0.97	0.47	0.37
One	1.141	Q1- 35% Q100	966	1332.35	1334.56	1334.46	1335.04	0.007935	5.6	173	142	0.88	953	0.61	0.60	0.32	0.17
One	1.036	Q100 - Effective	2760	1330.88	1334.25	1333.25	1334.65	0.002103	5.1	544	192	0.52	2670	0.39	0.37	0.16	0.20
One	1.036	Q1- 35% Q100	966	1330.88	1332.97	1332.26	1333.13	0.001782	3.2	303	186	0.44	947	0.18	0.18	0.06	0.10
One	0.932	Q100 - Effective	2760	1329.88	1333.35	1332.21	1333.61	0.001596	4.1	683	258	0.44	2734	0.27	0.26	0.10	0.15
One	0.932	Q1- 35% Q100	966	1329.88	1332.17	1331.43	1332.27	0.001321	2.6	382	254	0.36	960	0.13	0.12	0.04	0.07
One	0.892	Q100 - Effective	2760	1327.99	1332.74	1331.85	1333.03	0.005589	4.3	642	289	0.51	2730	0.78	0.77	0.01	0.42
One	0.892	Q1- 35% Q100	966	1327.99	1331.72	1330.95	1331.83	0.003839	2.7	362	252	0.39	960	0.35	0.34		0.16
One	0.852	Q100 - Effective	2760	1328.06	1331.12	1330.52	1331.58	0.008539	5.5	513	234	0.63	2682	1.24	1.16	0.36	0.77
One	0.852	Q1- 35% Q100	966	1328.06	1329.57	1329.57	1330.05	0.029104	5.6	174	185	1.01	957	1.73	1.71		0.90
One	0.840	Q100 - Effective	2760	1326.87	1331.04	1329.19	1331.25	0.002108	3.7	766	228	0.34	2671	0.49	0.44	0.18	0.19
One	0.840	Q1- 35% Q100	966	1326.87	1329.49	1328.21	1329.57	0.001671	2.3	424	209	0.28	960	0.22	0.21	0.03	0.08
One	0.754	Q100 - Effective	2760	1324.87	1330.29	1328.45	1330.41	0.001559	2.8	994	337	0.28	2739	0.30	0.29	0.04	0.13
One	0.754	Q1- 35% Q100	966	1324.87	1328.68	1327.59	1328.75	0.001925	2.0	477	299	0.28	965	0.19	0.19		0.05
One	0.655	Q100 - Effective	2760	1324.54	1329.31	1327.42	1329.49	0.001961	3.5	801	236	0.33	2694	0.44	0.41	0.19	0.14
One	0.655	Q1- 35% Q100	966	1324.54	1327.77	1326.53	1327.84	0.001578	2.2	446	225	0.27	961	0.20	0.20	0.05	0.04
One	0.553	Q100 - Effective	2760	1323.78	1326.04	1326.04	1326.91	0.022575	7.5	372	215	0.99	2709	2.56	2.44	1.03	1.06
One	0.553	Q1- 35% Q100	966	1323.78	1325.13	1325.13	1325.58	0.028946	5.4	180	207	1.00	965	1.64	1.57	0.08	0.23
One	0.542	Q100 - Effective	2760	1318.96	1324.23	1322.09	1324.46	0.001930	3.9	748	206	0.33	2547	0.52	0.44	0.21	0.24
One	0.542	Q1- 35% Q100	966	1318.96	1322.15	1321.01	1322.27	0.002313	2.8	359	174	0.33	930	0.32	0.30	0.15	0.13
One	0.479	Q100 - Effective	2760	1317.52	1323.43	1321.38	1323.67	0.002900	4.0	704	227	0.39	2697	0.59	0.56	0.27	0.22
One	0.479	Q1- 35% Q100	966	1317.52	1321.09	1319.99	1321.28	0.003806	3.5	278	130	0.42	965	0.52	0.50	0.10	0.03
One	0.470	Q100 - Effective	2760	1317.19	1323.39	1320.98	1323.55	0.001523	3.3	856	229	0.29	2676	0.38	0.35	0.18	0.15
One	0.470	Q1- 35% Q100	966	1317.19	1321.00	1319.87	1321.12	0.002575	2.7	357	183	0.34	960	0.32	0.31	0.10	0.07
One	0.452	Q100 - Effective	2760	1317.77	1321.51	1321.18	1322.86	0.013762	9.3	296	87	0.86	2760	3.11	3.11		
One	0.452	Q1- 35% Q100	966	1317.77	1319.53	1319.53	1320.34	0.023754	7.2	134	86	1.00	966	2.42	2.42		
One	0.451	Q100 - Effective	2760	1315.93	1321.93	1319.30	1322.45	0.000238	5.8	484	85	0.42	2744	0.09	0.09	0.06	0.07
One	0.451	Q1- 35% Q100	966	1315.93	1319.00	1317.62	1319.25	0.000276	4.0	247	83	0.40	961	0.05	0.05	0.03	0.04
One	.442		Culvert														
One	0.433	Q100 - Effective	2760	1315.64	1319.79	1319.62	1321.52	0.025128	10.6	263	68	0.93	2727	6.27	5.90	1.86	1.64
One	0.433	Q1- 35% Q100	966	1315.64	1318.29	1317.70	1318.84	0.015021	6.0	163	67	0.67	959	2.33	2.24	0.62	0.60

HEC-RAS Plan: TS River: Scatter_Wash Reach: One (Continued)

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	Q Channel	Shear Chan	Shear Total	Shear LOB	Shear ROB
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)		(cfs)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)	(lb/sq ft)
One	0.427	Q100 - Effective	2760	1315.18	1319.62	1318.57	1320.62	0.013434	8.0	344	91	0.68	2760	3.53	3.53		
One	0.427	Q1- 35% Q100	966	1315.18	1318.15	1316.88	1318.42	0.006203	4.2	229	88	0.43	966	1.11	1.11		
One	0.422	Q100 - Effective	2760	1314.94	1319.00	1318.48	1320.13	0.018180	8.6	325	147	0.78	2740	4.19	4.01		1.05
One	0.422	Q1- 35% Q100	966	1314.94	1317.96	1316.83	1318.23	0.006676	4.2	232	108	0.45	964	1.11	1.08		0.17
One	0.411	Q100 - Effective	2760	1314.74	1319.01		1319.34	0.005456	4.8	604	223	0.43	614	1.31	0.92	0.91	0.77
One	0.411	Q1- 35% Q100	966	1314.74	1317.72		1317.86	0.004773	3.4	324	209	0.38	290	0.76	0.46	0.45	0.34
One	0.352	Q100 - Effective	2760	1313.87	1317.43	1316.17	1317.62	0.005004	3.5	783	304	0.39	2760	0.80	0.80		
One	0.352	Q1- 35% Q100	966	1313.87	1316.18	1315.34	1316.27	0.005007	2.4	411	293	0.35	966	0.44	0.44		


One
1.342
1.198
1.141
1.036
0.754
0.852
0.892
0.932
0.655
0.553
0.352
0.422
0.451
0.479
Scatter_Wash


Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
Legend
WS Q100 - Effective
WS Q1- 35% Q100
Ground
LOB
ROB
Elevation (ft)
1350
1340
1330
1320
1310
1300
0.352
0.411
0.433
0.470
0.542
0.655
0.754
0.840
0.892
0.932
1.036
1.141
1.198
1.251
1.342
0
1000
2000
3000
4000
5000
Main Channel Distance (ft)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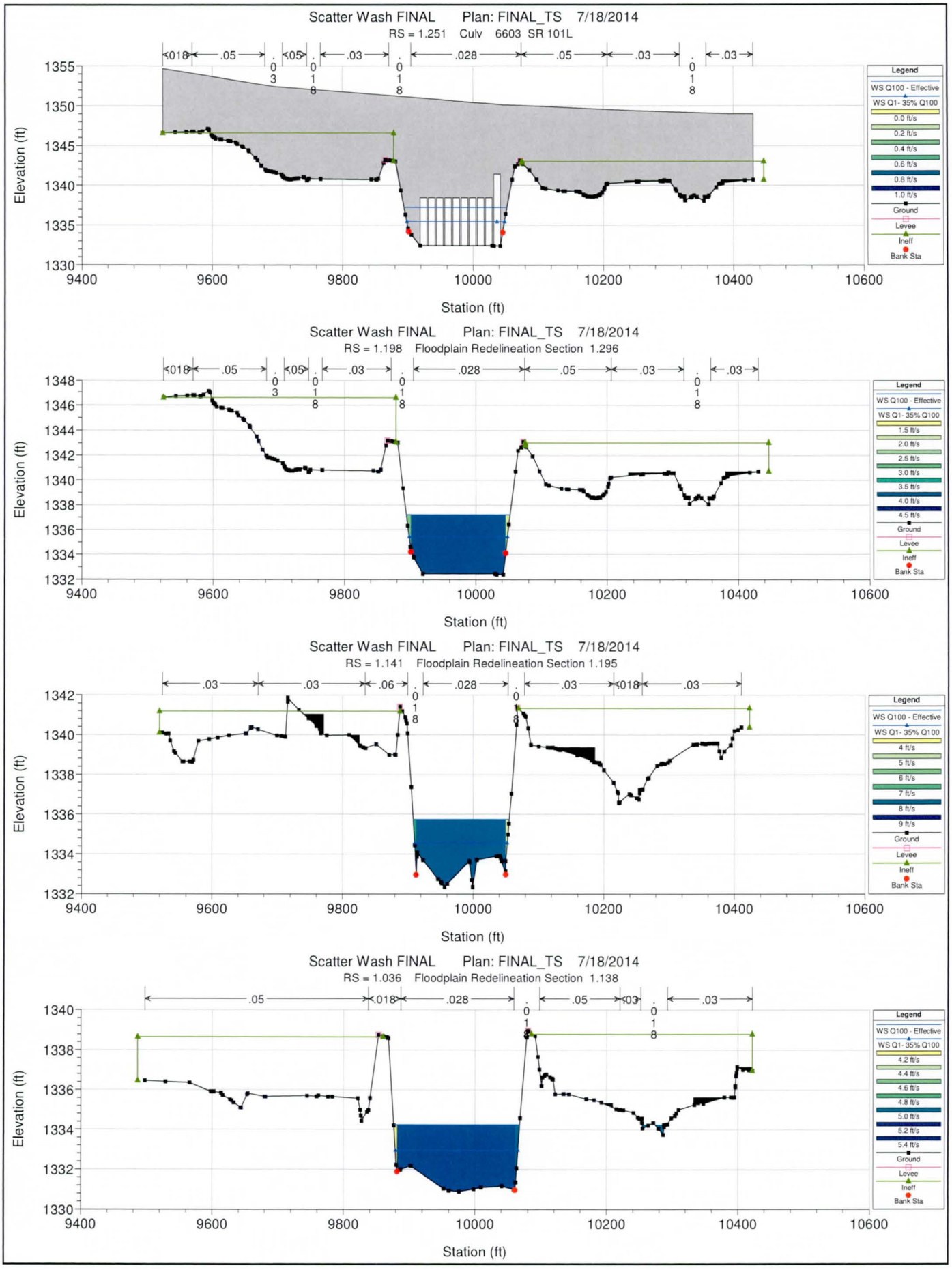
RS = 1.342 Floodplain Redlination Section 1.339
.018
.05
.018
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 1.301 Floodplain Redelineation Section 1.339
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
3 ft/s
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 1.299 Floodplain Redelineation Section 1.298
.018
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 1.251 Culv 6603 SR 101L
.018
.05
.028
.085
.03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Ineff
Bank Sta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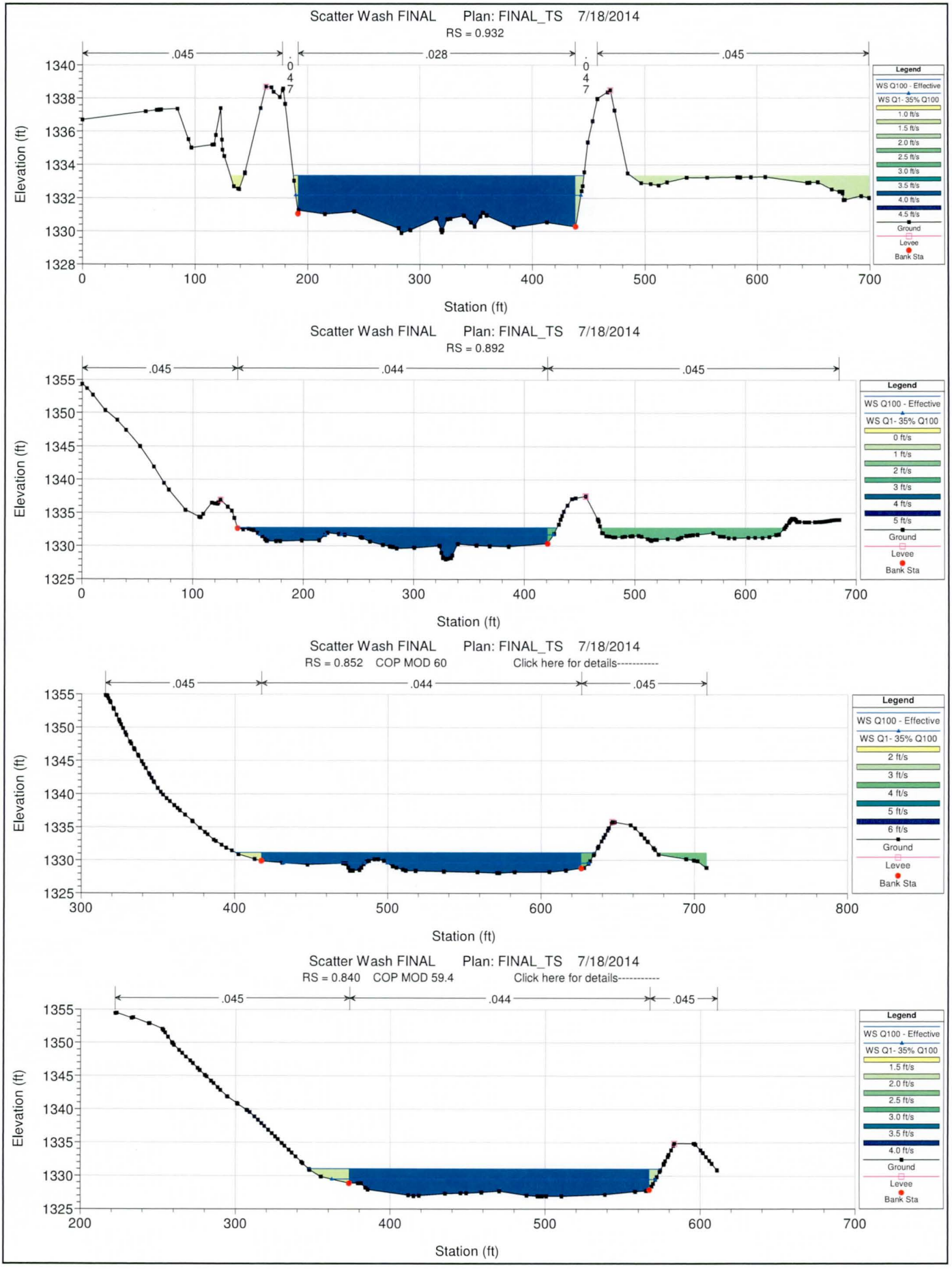
RS = 1.251 Culv 6603 SR 101L
.018 .05 .05 .03 .03 .028 .05 .03 .03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 1.198 Floodplain Redelineation Section 1.296
.018 .05 .05 .03 .03 .028 .05 .03 .03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 1.141 Floodplain Redelineation Section 1.195
.03 .03 .06 .028 .03 .018 .03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 1.036 Floodplain Redelineation Section 1.138
.05 .018 .028 .05 .03 .03
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
5.4 ft/s
Ground
Levee
Ineff
Bank Sta


Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 0.932
.045
.047
.028
.047
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
4.5 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 0.892
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0 ft/s
1 ft/s
2 ft/s
3 ft/s
4 ft/s
5 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 0.852 COP MOD 60
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
2 ft/s
3 ft/s
4 ft/s
5 ft/s
6 ft/s
Ground
Levee
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 0.840 COP MOD 59.4
Click here for details----------
.045
.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
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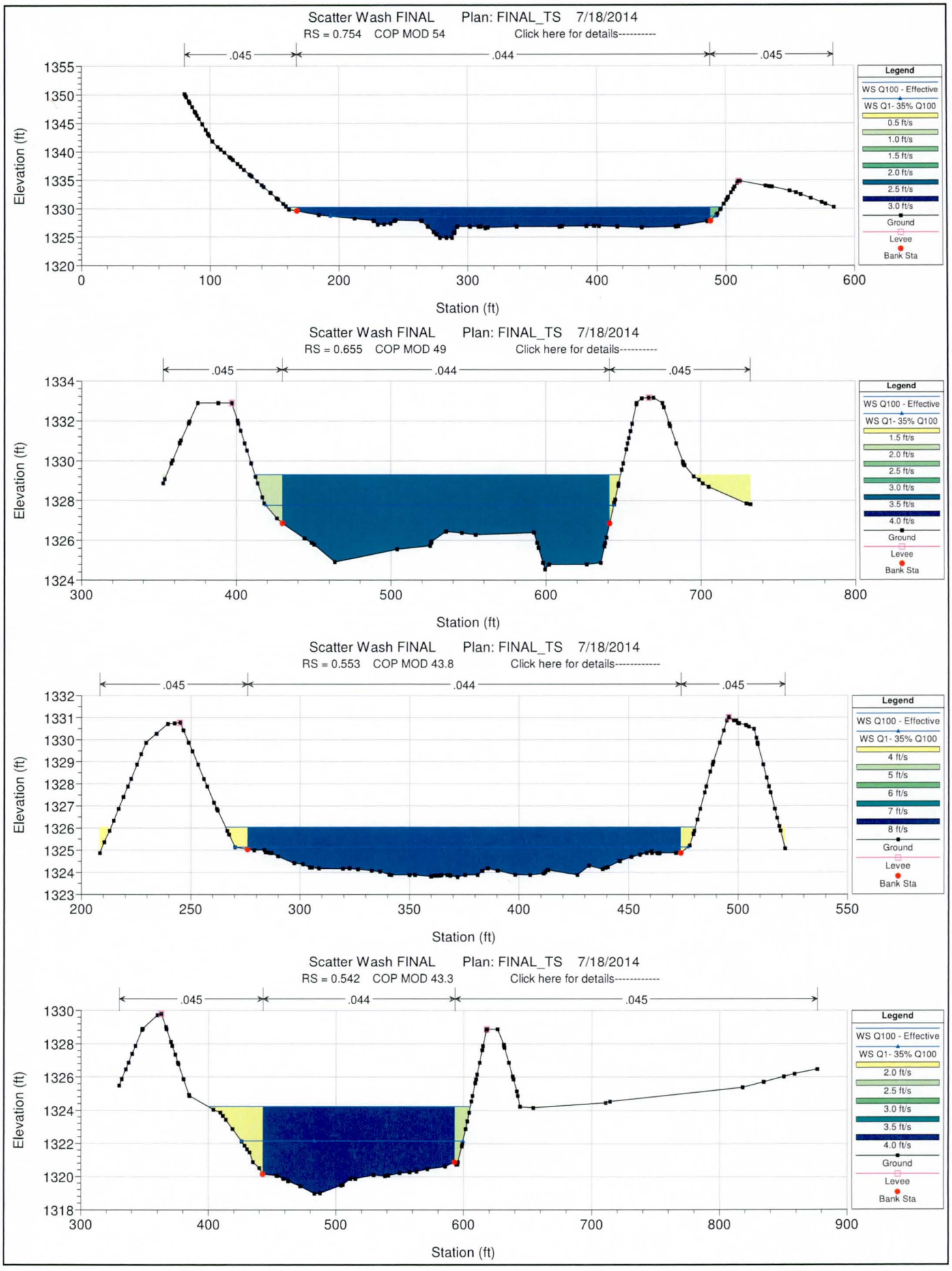
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta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WS Q1- 35% Q100
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1.0 ft/s
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
Ground
Levee
Bank Sta
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.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
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2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta
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.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
5 ft/s
6 ft/s
7 ft/s
8 ft/s
Ground
Levee
Bank Sta
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.045
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Station (ft)
Legend
WS Q100 - Effective
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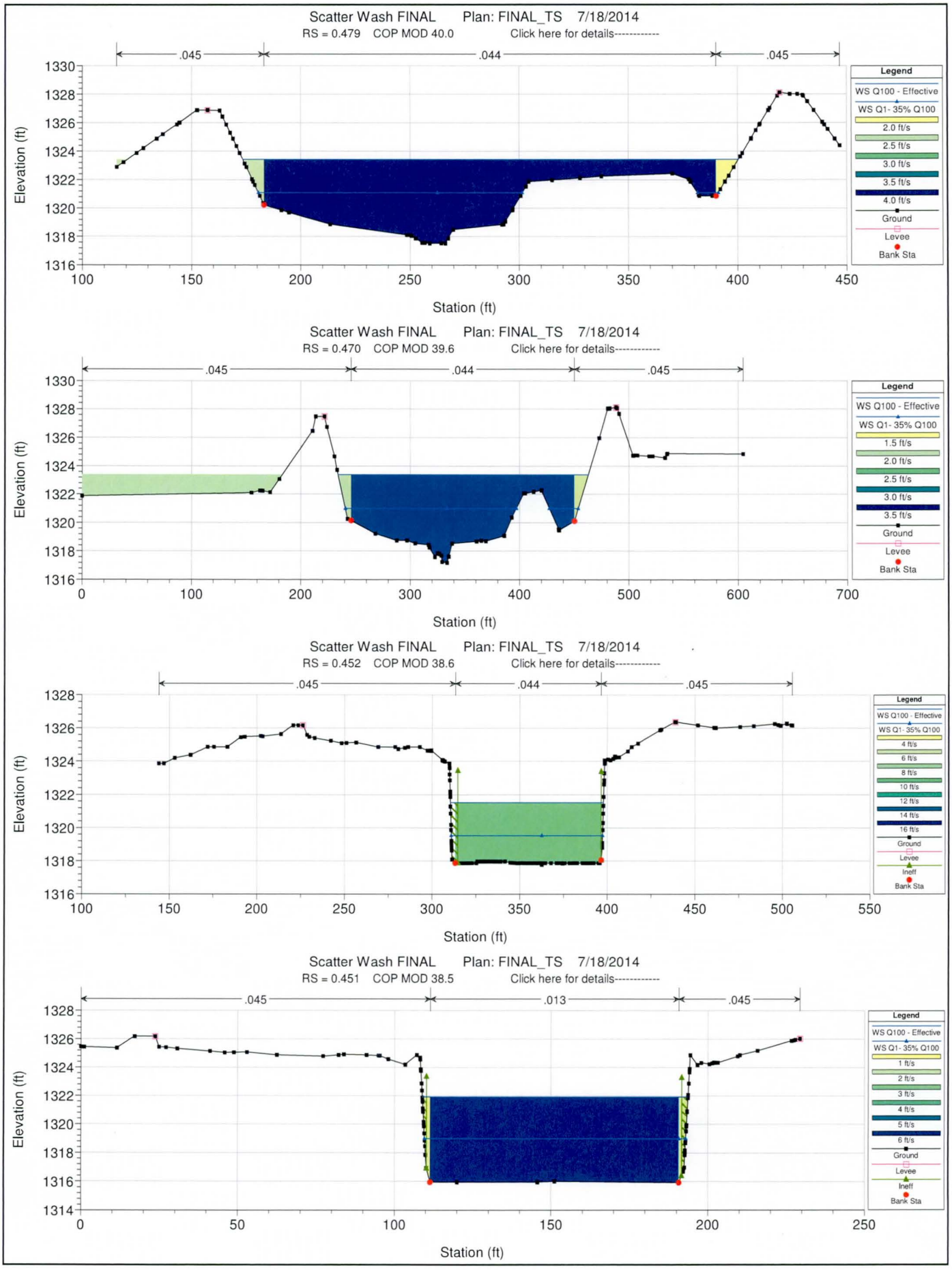
Ground
Levee
Bank Sta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Legend
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3.5 ft/s
4.0 ft/s
Ground
Levee
Bank Sta
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.044
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
1.5 ft/s
2.0 ft/s
2.5 ft/s
3.0 ft/s
3.5 ft/s
Ground
Levee
Bank Sta
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RS = 0.452 COP MOD 38.6 Click here for details----------
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.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4 ft/s
6 ft/s
8 ft/s
10 ft/s
12 ft/s
14 ft/s
16 ft/s
Ground
Levee
Ineff
Bank Sta
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.013
.045
Elevation (ft)
Station (ft)
Legend
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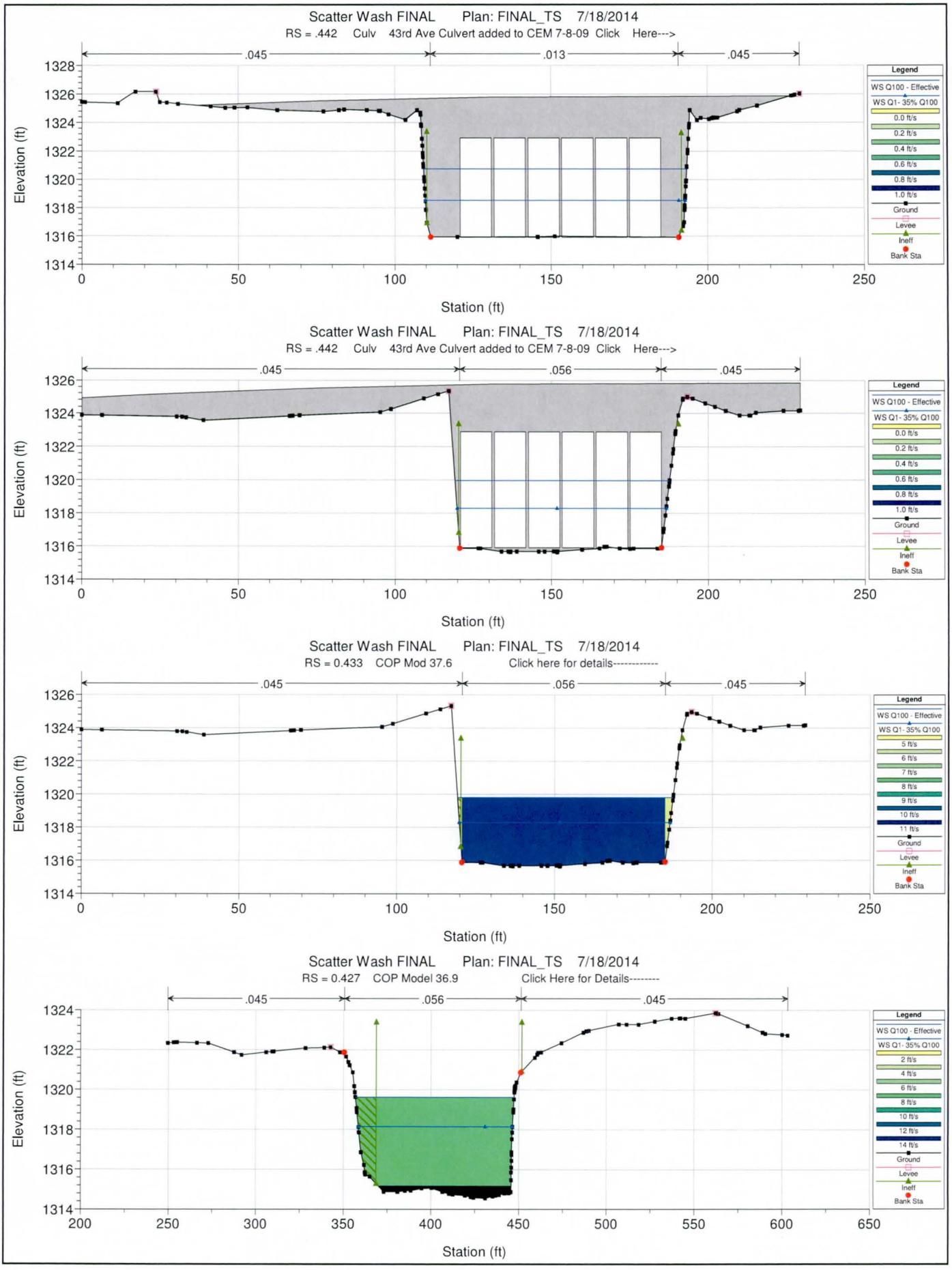
Levee
Ineff
Bank Sta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Station (ft)
Legend
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0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
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.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
0.0 ft/s
0.2 ft/s
0.4 ft/s
0.6 ft/s
0.8 ft/s
1.0 ft/s
Ground
Levee
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 0.433 COP Mod 37.6 Click here for details----------
.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
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6 ft/s
7 ft/s
8 ft/s
9 ft/s
10 ft/s
11 ft/s
Ground
Levee
Ineff
Bank Sta
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.056
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Elevation (ft)
Station (ft)
Legend
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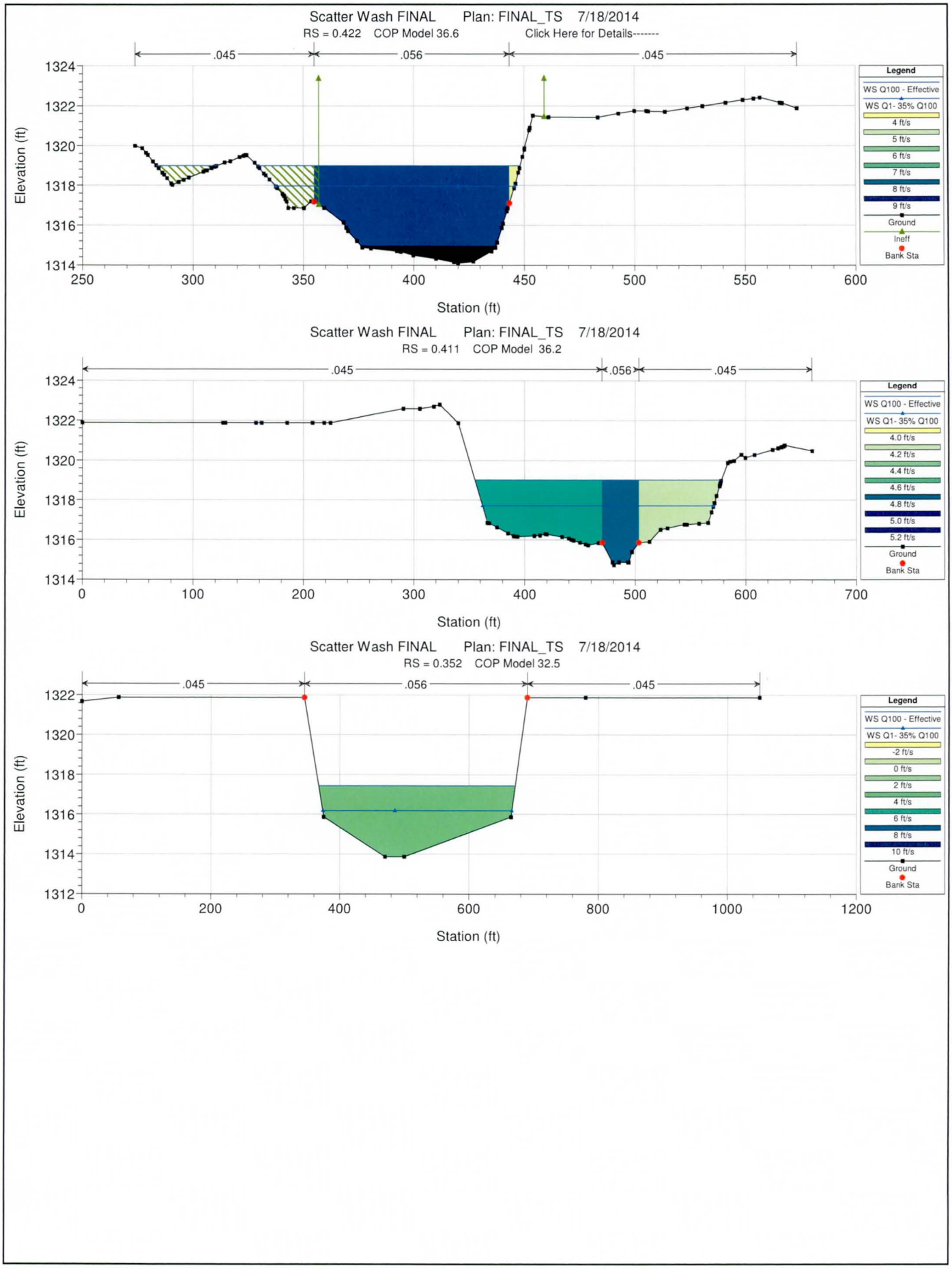
12 ft/s
14 ft/s
Ground
Levee
Ineff
Bank Sta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Station (ft)
Legend
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WS Q1- 35% Q100
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5 ft/s
6 ft/s
7 ft/s
8 ft/s
9 ft/s
Ground
Ineff
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
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.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
4.0 ft/s
4.2 ft/s
4.4 ft/s
4.6 ft/s
4.8 ft/s
5.0 ft/s
5.2 ft/s
Ground
Bank Sta
Scatter Wash FINAL Plan: FINAL_TS 7/18/2014
RS = 0.352 COP Model 32.5
.045
.056
.045
Elevation (ft)
Station (ft)
Legend
WS Q100 - Effective
WS Q1- 35% Q100
-2 ft/s
0 ft/s
2 ft/s
4 ft/s
6 ft/s
8 ft/s
10 ft/s
Ground
Bank Sta

APPENDIX H

GEOTECHNICAL INVESTIGATION AND ANALYSIS REPORT

Geotechnical Investigation and Analysis Report
Scatter Wash Levees
North Levee ID# 1901064146 and South Levee ID# 1901064147
Maricopa County, Arizona

Prepared for:

Flood Control District of Maricopa County
Phoenix, Arizona

Prepared by:

AMEC Environment & Infrastructure, Inc.
Phoenix, Arizona

Registered Professional Engineer (Civil)
CERTIFICATE NO.
55482
NAIDA
CAUSEVIC
DATE SIGNED
7-18-14
ARIZONA U.S.A.
Expires 12/31/2016

July 18, 2014

AMEC Job No. 37-2014-2002

July 18, 2014
AMEC Job No. 37-2014-2002

Flood Control District of Maricopa County
2801 W. Durango Street
Phoenix, AZ 85009

Attn: Frank E. Brown, PE

Re: Geotechnical Investigation and Analysis Report
Scatter Wash Levees
North Levee ID# 1901064146 and South Levee ID# 1901064147
Maricopa County, Arizona

Presented herein is the Geotechnical Investigation and Analysis Report for Scatter Wash Levees, North Levee ID# 1901064146 and South Levee ID# 1901064147, prepared by AMEC Environment & Infrastructure, Inc. This report includes a project description, discussions of the conditions and geotechnical profile encountered at the site, and the results of engineering analyses. The report is submitted in partial fulfillment of the Federal Emergency Management Agency (FEMA) certification of the Scatter Wash Levees.

Please do not hesitate to contact us if you have any questions concerning this report.

Respectfully submitted,

AMEC Environment & Infrastructure, Inc.

Naida Causevic, P.E.
Geotechnical Engineer

Reviewed by:

Tony Freiman, P.E.
Associate Geotechnical Engineer

AMEC Environment & Infrastructure, Inc.
4600 East Washington Street, Suite 600
Phoenix, Arizona 85034-1917
Tel (602) 733-6000
Fax (602) 733-6100
www.amec.com

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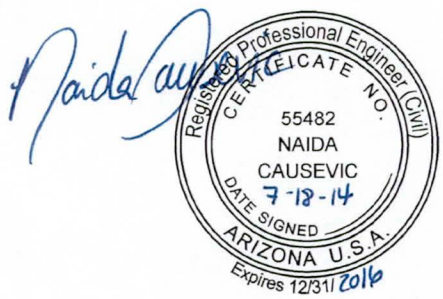
Appendix B – Laboratory Test Results
Appendix C – Engineering Analyses



1.0 INTRODUCTION

AMEC Environment and Infrastructure, Inc. (AMEC) presents herein the results of the geotechnical investigation and engineering analyses of the Scatter Wash Levees, North Levee and South Levee. This report includes the results of the field investigation, laboratory testing, and engineering analyses. All investigations and supporting engineering design were performed by AMEC.

The goals of this geotechnical investigation were to characterize the existing levee embankment and foundation soils and then use that information to complete seepage, stability and settlement analyses in accordance with the Federal Emergency Management Agency (FEMA) levee certification procedures, as outlined in Title 44, Code of Federal Regulations Section 65.10. The analyses were completed with substantial conformance to the procedures outlined in the U.S. Army Corps of Engineers (USACE) Engineering Design Manual (USACE, 2000). The purpose of the analyses is to provide the necessary information to complete Section E of FEMA's MT-2 Form 3.

2.0 PROJECT DESCRIPTION

The Scatter Wash Levees are operated and maintained by the Flood Control District of Maricopa County (District). They are located in Township 4 North, Range 2 East, Section 27, of the Gila and Salt River Baseline and Meridian; within the City of Phoenix just south of the Loop 101 Highway (L101) with a downstream limit approximately 0.4 miles upstream of 43rd Avenue (Figure 1). Along Scatter Wash, the levees occur from about River Mile 0.88 to River Mile 1.21.

The upstream longer portion of these levees, identified as ID #1901064146 (North Levee) & 1901064147 (South Levee), were built by the Arizona Department of Transportation (ADOT) in 1991 as part of the construction of the Outer L101 from 59th to 35th Avenue. The downstream shorter portion of these levees were constructed by the City of Phoenix for the city project ST-914085, which also installed two levee penetrations, on each levee bank. Both agencies, through intergovernmental agreements, turned over the constructed segments to the District for operation and maintenance. The levee crests have an all-weather gravel surface. Gates are present to restrict motorized access to only authorized personnel. The levee crests and channel bottom are also used for equestrian, bicycling and pedestrian recreational activities.

Currently Levee ID #1901064146 & 1901064147 are Provisionally Accredited by the FEMA and are shown as providing protection from the 1 percent annual-chance-flood on the most recent Flood Insurance Rate Map (FIRM Panel No. 04013C1270L). The Provisionally Accredited Levee (PAL) agreement between the District, the City of Phoenix and FEMA is due to expire on July 5, 2014. In order for Levees ID #1901064146 & 1901064147 to continue to be shown as providing flood protection on the FIRM Panels beyond the PAL expiration date, certification of the levees must be provided indicating that the levees meet the criteria of Title 44 of the Code of Federal Regulations, Section 65.10 (44 CFR 65.10).

Even though the City of Phoenix constructed a portion of the levees, the levees are entirely within incorporated City of Phoenix and the City was a signator on the provisionally Accredited

Levee Agreement, the District is responsible for levee certification, and maintaining that certification throughout the life of the levees.

3.0 INVESTIGATION

3.1 Subsurface Explorations

AMEC performed the subsurface exploration of the Scatter Wash Levees on April 10, 2014. Three test borings (B-1, B-3 and B-4) were advanced to depths between 11 and 17 feet below the crest of the levee. Test borings were advanced with a Diedrich D-50 truck-mounted drill rig equipped with a 6 5/8-inch outside-diameter hollow-stem auger, owned and operated by D&S Drilling, Inc. Standard penetration testing or open-end drive sampling was performed at maximum 5-foot intervals to depth. Completed borings were backfilled with portland cement grout in accordance with the applicable permit requirements. Due to access difficulties, one of the planned borings, B-2 was not drilled.

Encountered soils were visually inspected, labeled and classified in the field, and logged in general accordance with ASTM D2487, the Unified Soil Classification System. Field direction and borehole logging were performed by Joe Zaleski, EIT of AMEC. Logs of all the test borings are presented in Appendix A, which also includes a description of drilling and sampling procedures.

Locations of the borings are shown on the boring plan presented in Figure 1 of this report.

3.2 Laboratory Testing Program

Laboratory testing of selected soil samples recovered from the borings was performed to assist in characterizing the embankment soils and to assess their engineering properties. Tests included grain-size analysis, Atterberg limits (plasticity index), moisture content, density, shear strength, and hydraulic conductivity. Laboratory test results for the investigation are presented in Table B-1, Appendix B.

Two direct shear tests were performed on relatively undisturbed drive samples. The direct shear test results, adjusted to show the residual shear strength, are plotted on Figure B-1 in Appendix B. The lower bound for the data is an internal friction angle of 33 degrees and a cohesion intercept of 100 pounds per square foot (psf).

4.0 SITE CONDITIONS AND GEOTECHNICAL PROFILE

4.1 Site Conditions

The Scatter Wash Levee segments being evaluated extend from south of the L101 eastbound frontage road to a downstream limit approximately 0.4 miles upstream of 43rd Avenue. The levee embankments are generally 8 feet in height. Details of the levee embankment and channel lining are presented in Section 5.1. The levee crests have an all-weather gravel surface. Gates are present to restrict motorized access to only authorized personnel. The levee crests and channel are also used for equestrian, bicycling and pedestrian recreational activities.

The levee embankments and channel were inspected by AMEC as part of this project and were found to be well maintained and free of deep rooted vegetation.

A localized area of rodent activity was identified just beyond the landward toe of the north levee embankment. The burrows were probed to a depth of about 2 feet. A discussion of the evaluation of this condition and a discussion of the District's Plan for monitoring and mitigation are presented in Section 6.1.

4.2 Geologic Description

The Scatter Wash Levee site lies in the Hedgpeth Hills on the floor of the north-central portion of the Phoenix Basin in Maricopa County, Arizona. The northern portion of the basin is characterized by northwest- to southeast-trending small bedrock highs separated by small, shallow, alluvial-filled basins. The alluvial-filled basins trend northward and terminate to the north at the base of the New River Mountains and to the west at the Hieroglyphic Mountains. The immediate site area is characterized by a gentle, southwest-sloping alluvial basin floor that is intersected by northwest-trending mountain ranges and bedrock hills, which include the Hedgpeth Hills. The mountain ranges include the Hieroglyphic Mountains to the northwest, the Union Hills group to the northeast, and Deem Hills approximately 4 miles to the north.

The largest drainages within the north-central portion of the Phoenix Basin include New River, Skunk Creek and Cave Creek. Locally, Skunk Creek and Scatter Wash, a smaller drainage, bisect the southernmost portion of Hedgpeth Hills. These two drainages ultimately join downstream approximately 0.9 miles southwest of the project site.

The geologic units exposed in the site area include Quaternary- to Tertiary-period bedrock and basin-floor alluvium. The bedrock exposed in the Hedgpeth Hills includes Tertiary volcanic flows consisting of basalt and andesite. The alluvium includes Quaternary fluvial stream channel and floodplain deposits along the major drainage paths, smaller alluvial fan deposits issued from mountain fronts (bedrock highs), and localized colluvium adjacent to steeper bedrock slopes.

4.3 Levee Embankment Soil Conditions

The levee embankment soils typically consist of clayey sand, silty clayey sand, gravely clay, and mixtures thereof with occasional cobbles up to 9 inches in diameter and some gravel. The sand fraction is predominately fine to medium grained, and the fines (those passing the No. 200 sieve) average 40 percent and tend to decrease with depth. The levee embankment soils are typically moderately firm to very firm. The measured uncorrected Standard Penetration Test (SPT) blow counts varied from 15 to 47 with an average value of 24. The plasticity index varies from 5 to 12. The *in situ* dry density varies from 95 to 116 pounds per cubic foot (pcf) and averages 106 pcf. The in-place moisture content is 7 percent or less, with an average of 6.

4.4 Levee Foundation Soil Conditions

The levee foundation soils typically consist of sand with silt and clay, gravel with silt and clay, silty clayey sand with gravel, and mixtures thereof. The sand fraction is predominately medium to coarse grained, and the gravel fraction is predominantly fine grained. The coarse grained

sand and gravel content increased with depth. The fines passing the No. 200 sieve average 11 percent. The foundation soils are predominantly medium dense to very dense with moderately firm zones. The average uncorrected SPT blow count for these soils is greater than 50. The plasticity index varies from nonplastic to 10. The site soils generally were described as being slightly moist to moist. With depth, coarse sand and gravel content increased.

4.5 Reinforced Concrete Channel Lining

A 6-inch thick, measured normal to the slope, reinforced concrete channel lining was used to channelize the Scatter Wash south of L101, approximately ADOT Channel Station 183+60 to Station 197+80. A minimum concrete compressive strength of 3,000 pounds per square inch was required in the concrete mix design, which was reinforced with Grade 60, No 4, steel bars placed 10 to 12 inches on center. The reinforced concrete channel lining extends below the channel bottom a minimum of 8.5 feet from Channel Station 183+60 to 195+40 and a minimum of 10 feet from Channel Station 195+40 to 197+80.

From ADOT Station 181+23 to 186+60, 18-inch rip rap, about 42 inches wide, was placed on the riverside embankment instead of the reinforced concrete channel lining.

4.6 Groundwater and Soil Moisture Condition

No free groundwater was encountered during the current investigation. Groundwater will be influenced by the season and the volume of precipitation the area receives.

4.7 Site Seismicity

The project site is within the Sonoran Zone described in ADOT Report No. AZ92-344 (Euge and others 1992). The Sonoran Zone is not considered to be seismically active and is not in the vicinity of a seismically active area. The maximum credible earthquake for the project area is conservatively estimated at a magnitude of 6.5. For a 5 percent probability of exceedance in 50 years, the U.S. Geological Survey (USGS) website indicates a peak ground acceleration (PGA) value of 0.048g (USGS 2013). The PGA obtained from the website is based on 2008 USGS seismic hazard data.

5.0 GEOTECHNICAL ANALYSES

5.1 Description of the Levees

The north and south levees along the Scatter Wash are about 1,500 feet and 1,800 feet long, respectively, and generally consists of an 8-foot high embankment with a 6-inch thick reinforced concrete channel lining on the riverside. The embankment crest width is typically 10 feet. The landside embankment slope ratio is typically 3 horizontal to 1 vertical, and the riverside slope ratio is 2 horizontal to 1 vertical for the reinforced concrete channel lining portion, and 1.1 to 2.5 horizontal to 1 vertical for the riprap portion. The elevation of the levee ranges from 1337.6 to 1343.1 feet on the north side of the levee and 1337.0 to 1343.2 on the south side (North American Vertical Datum 1988).

5.2 Selection of Critical Cross Sections

Four representative levee cross sections were selected for analysis along the north and south banks of the Scatter Wash, two on the north levee and two on the south levee. Critical cross sections were chosen based on typical geometric attributes and levee embankment heights.

Cross sections at the following locations were selected as representative sections and analyzed for seepage, stability and settlement. The cross-sectional breakdown is as follows:

- Section No. 1 – North: Approximate ADOT Channel Station 183+00 (River Mile 0.932)
- Section No. 2 – North: Approximate ADOT Channel Station 189+00 (River Mile 1.036)
- Section No. 3 – South: Approximate ADOT Channel Station 183+00 (River Mile 0.920)
- Section No. 4 – South: Approximate ADOT Channel Station 193+00 (River Mile 1.141)

Figure 2 presents the Scatter Wash levees with the critical cross section locations.

5.3 Soil Engineering Parameters

The geotechnical parameters required for slope stability analysis include unit weights, shear strength for each material present in a cross section, and location of the phreatic surface within the cross section. The soil parameters used in the analyses were based on the results of direct shear testing completed by AMEC and on AMEC's experience with similar materials. AMEC elected to use a composite of the soil strength data from the laboratory testing, as presented in Figure B-1, Appendix B. The lower bound strength envelope of the soils can be characterized by a friction angle of 33 degrees and a cohesion intercept of 100 psf.

Conservative shear strength and hydraulic parameters used in the stability and seepage analysis are presented in Table 5.1.

Table 5.1 Soil Parameters Used in Analyses

Description	Moist Unit Weight,γ (pcf)	Effective Friction Angle,Φ' (deg)	Effective Cohesion, c' (psf)	Saturated Hydraulic Conductivity, K_{sat} (cm/s)
Embankment	110	33	100	1×10^{-5}
Foundation	115	34	0	1×10^{-3}

Notes: pcf = pounds per cubic foot, deg=degrees, psf = pounds per square foot, cm/s = centimeters per second

5.4 Seepage Analyses

Steady-state seepage analyses were completed to assess the development of a phreatic surface within the landside slope of the levee embankment resulting from the 1-percent flood condition in the Scatter Wash. Steady-state seepage analyses were completed using the two-dimensional finite element computer program SEEP/W (Geo-Slope International, 2012a) and saturated hydraulic conductivity values for the levee embankment and the foundation soils. SEEP/W is a computer code used to model the saturated and unsaturated flow of water within

porous materials. Analyses were completed using triangular and quadrilateral elements to develop the finite-element mesh, and solutions were obtained using four-point integration techniques.

The 1-percent flood condition for the steady-state seepage analysis for each section was obtained from the maximum modeled flood level based on the 100-year flood event. In general accordance with No. EM 1110-2-1913 (USACE 2000), in Appendix B, Section B-5, page B-12, a maximum exit gradient (i_{max} = 0.5) is used as an acceptance criterion for seepage exiting the toe of the levee. The critical sections were analyzed for seepage, where seepage is allowed to pass through the entire cross section of the levee. The assumed steady-state seepage condition is very conservative, as the ephemeral flows within Scatter Wash Channel are of too short a duration to develop saturation of the levee embankments.

Summarized in the table below are the seepage analysis results (Table 5.2). An additional seepage analysis was completed for Section No. 3 to assess the steady state seepage and exit gradient resulting from temporary interior drainage impounding on the landside of the levee, Case b. The ratio of the horizontal to vertical hydraulic conductivity was assumed to be 10 for all materials.

Table 5.2 Seepage Results

Critical Section	Exit Gradient i_{max} (ft/ft)
Scatter Wash Levee North	
Section No. 1	0.14
Section No. 2	0[1]
Scatter Wash Levee South	
Section No. 3	0.44
Section No. 3 (Case b)	0.06
Section No. 4	0[1]

Note: 1 = Final phreatic surface below ground surface – no exit gradient exists.
N/A = not applicable

The seepage analyses indicate that exit gradients at the toe of the critical sections of the levee are equal to or less than the maximum permitted exit gradient of i_{max} = 0.5 foot per foot referenced in USACE Design Manual No. EM-1110-2-1913. The results of the seepage analyses of the critical sections are included in Appendix C.

5.5 Slope Stability Analyses

Conventional static and pseudo static stability analyses of typical levee sections were performed using the computer program SLOPE/W (GeoSlope International, 2012b) and the phreatic surface imported from the SEEP/W seepage analysis, where appropriate. The comprehensive formulation of SLOPE/W and SEEP/W makes it possible to analyze both simple and complex slope stability problems using a variety of methods to calculate the factor of safety.

The slope stability analysis was performed in accordance with EM 1110-2-1913, Chapter 6, Section II (USACE 2000) using the SLOPE/W program, and the steady-state seepage condition was simulated using the SEEP/W program. Static stability analyses were completed for four cases:

- Case 1: End of Construction
    A. Landside – Static
    B. Riverside – Static
- Case 2: Sudden Drawdown Under 100-year Flood Stage
    B. Riverside – Static
- Case 3: Steady State Seepage under 100-Year Flood Stage
    A. Landside – Static
- Case 4: End of Construction
    A. Landside – Pseudo Static
    B. Riverside – Pseudo Static

Additional stability analyses, Case 5, were completed for Section No. 3 to assess the interior drainage on the landside of the levee for sudden drawdown and steady state seepage.

- Case 5: Assessment for Interior Drainage
    A. Sudden Drawdown Landside – Static
    B. Sudden Drawdown Riverside – Static
    C. Steady State Seepage Riverside - Static

Case 4 for the riverside and landside end-of-construction cases, assumed a PGA of 0.048 g (see Section 4.7), based on a 5 percent exceedance in 50 years. . The slopes for all cases were analyzed using the general limit equilibrium method that produces a circular failure surface. The minimum acceptable factors of safety for the existing levees from EM 1110-2-1913 (USACE 2000) were used as the acceptance criterion (see Table 5.3).

Table 5.3 Slope Stability Requirements[1]

Applicable Stability Conditions and Required Factors of Safety			
End of Construction (Static)	Sudden Drawdown[2]	Steady State Seepage	End of Construction (Pseudo Static)[3]
1.3	1.0-1.2	1.4	1.0

Notes: [1] EM 1110-2-1913, "Minimum Required Factors of Safety - Levee Slope Stability" (Table 6-1b)
[2] Sudden drawdown analyses. Factor of safety = 1.0 applies to stage levels prior to drawdown for conditions where these water levels are unlikely to persist for long periods preceding drawdown. Factor of safety. = 1.2 applies to stage level, likely to persist for long periods prior to drawdown.
[3] Based on Federal Highway Administration Geotechnical Engineering Circular No. 3 (2011), Chapter 7.3.1. A minimum allowable seismic (Pseudo Static) factor of safety is 1.0.

The analyses were performed on a two-dimensional representation of the levee's critical cross sections. Table 5.4 provides a summary of the slope stability factors of safety for each critical cross section. Analysis results for each of these cases are presented in Appendix C (Figures C-1 to C-32).

Table 5.4 Slope Stability Results Summary

Typical Section	Case 1 – End of Construction (Static)		Case 2 – Sudden Drawdown	Case 3 – Steady State Seepage	Case 4 – End of Construction (Pseudo Static)		Case 5 – Interior Drainage		
	A Land	B River	B River	A Land	A Land	B River	A Land	B River	C River
Scatter Wash Levee North									
Section No. 1	4.17	2.58	1.40	2.87	3.51	2.22	N/A	N/A	N/A
Section No. 2	5.86	2.43	1.38	5.86[1]	4.79	2.11	N/A	N/A	N/A
Scatter Wash Levee South									
Section No. 3	3.84	1.77	1.12	2.56	3.18	1.61	2.17	1.08	1.61
Section No. 4	5.60	2.21	1.34	5.60[1]	4.75	1.95	N/A	N/A	N/A
Required Factor of Safety	1.3		1.0 to 1.2	1.4	1		1.0 to 1.2 (Case 5A and 5B) 1.4 (Case 5C)		

Note: 1 = Final phreatic surface below ground surface
N/A = not applicable

The results of the stability analyses indicate the existing embankment meets or exceeds USACE stability requirements. The 100-year modeled flood level used in the stability analysis is expected to exist only for a short time. In general, the simple effective strength approach used in modeling sudden drawdown represents the worst-case scenario. This is because rapid

drawdown seldom occurs instantaneously and pore water pressures in the riverside levee material tend to dissipate readily during the drawdown process.

5.6 Settlement Analysis

Settlement analysis of the levees was performed using standard penetration test (SPT) results corrected for overburden pressure and field procedures; methods of estimating elastic settlement as presented by Schmertmann (1970) and Schmertmann et. al. (1978); and estimates of elastic modulus developed using correlations with SPT blow count and typical values for similar soils presented in Bowles (1982), American Association of State Highway and Transportation Officials (2012), and Kulhawy and Mayne (1990).

A majority of the SPT results obtained had refusal blow counts (i.e., 50 blows for less than a 6-inch interval). Levee load and geometry were used to estimate the settlement. Settlement estimates are presented in the following table.

Table 5.5 Results of Settlement Analysis

Description	Estimated Settlement (inches)
Estimated Settlement to Date (23 Years)	0.19
Estimated Settlement (100 Years)	0.20

Settlement is immediate and was essentially complete upon the construction of the levees (as indicated in Table 5.5). Moisture increases in supporting soils could result in further long-term settlement; however, it is likely that the soils have previously been wetted. Long-term settlement of the levee is not anticipated to be of significant magnitude, due to the favorable characteristics of the very dense site soils. The additional settlement is estimated to be less than 0.10 inches.

5.7 Subsidence

AMEC reviewed existing data regarding regional subsidence and earth fissures in the vicinity of the project based on subsidence maps produced by the Arizona Department of Water Resources (ADWR). The subsidence map obtained from the ADWR website for the Western Metropolitan Phoenix area is shown on Exhibit 1. Exhibit 1 indicates that no significant active subsidence is occurring within the project area.

6.0 RECOMMENDATIONS

6.1 Animal Burrows

Animal burrows were noted in proximity to the landside toe of the north levee embankment, between ADOT Channel Station 189+00 and 193+00. The burrows were about 2½ inches in diameter, indicating that they were most likely created by pocket gophers. Several of the burrows were probed, with a maximum depth of about 2 feet. Based on the area of burrows, covering an area of a few hundred square feet, AMEC believes that the Scatter Wash rodent population is currently small.

The District has a plan in place to treat and manage rodents in the vicinity of levees. For Scatter Wash Levee, the District should consistently monitor the rodent activity to prevent it from spreading to the levee itself.

7.0 FEMA LEVEE CERTIFICATION

Based on the findings of the geotechnical evaluation performed by AMEC, there is reasonable certainty that the evaluated portions of the Scatter Wash Levees meet or exceed the FEMA's 44 CFR 65.10 requirements for slope stability, seepage and ground subsidence/settlement.

8.0 REFERENCES

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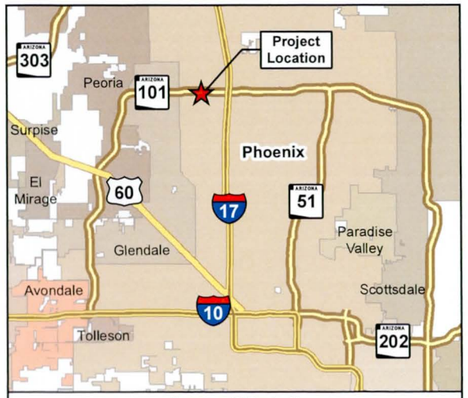
FIGURES



Area of Detail

Legend

B-1 Boring Location and Identification

B-2 Proposed Boring Location and Identification (not drilled)

Aerial Imagery: Flood Control District of Maricopa County, 2012

0 200 400 Feet

N

Scatter Wash Levees
North and South Banks
Maricopa County, Arizona

Boring Plan

FIGURE 1

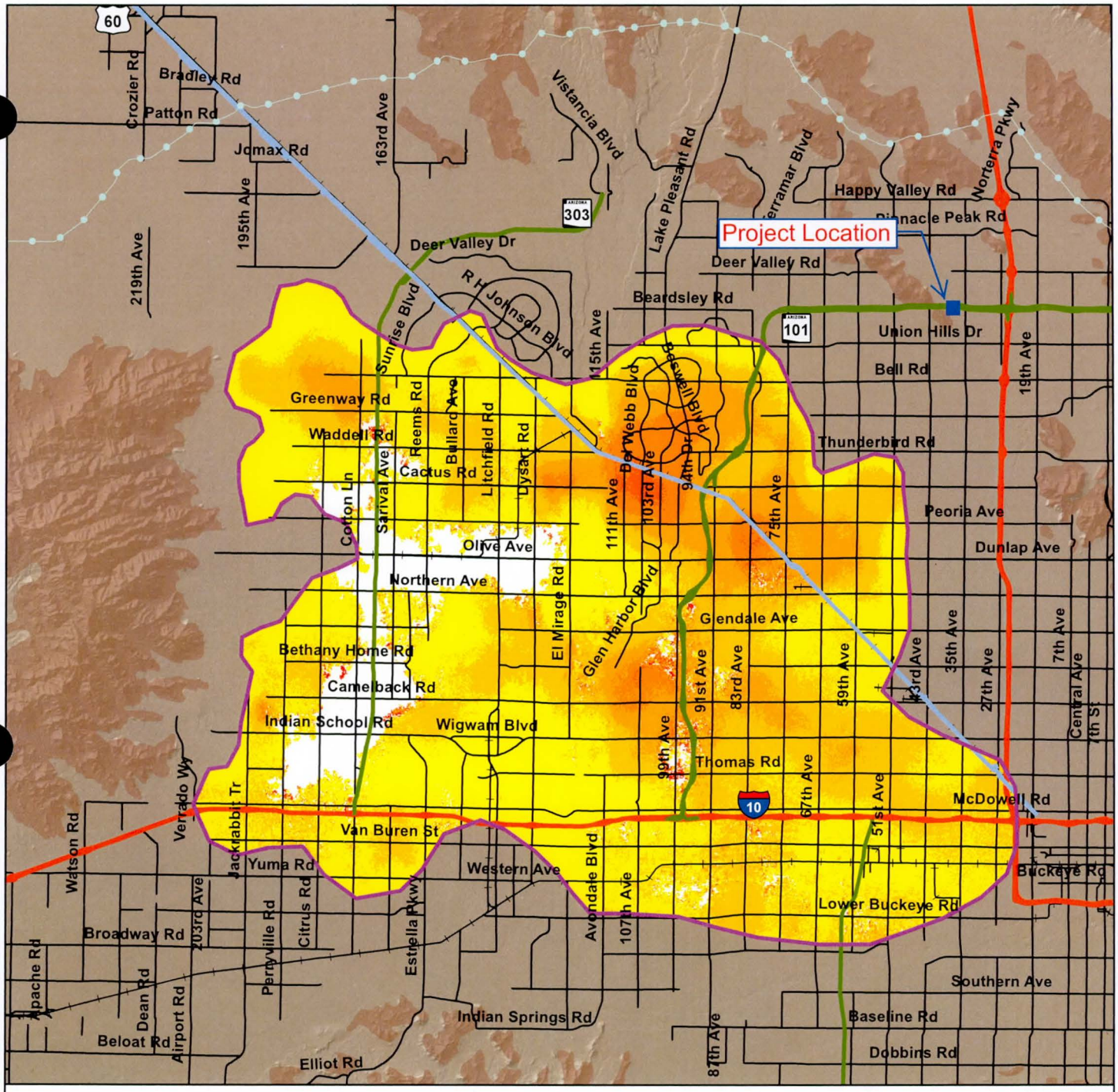
Job No.	3720142002
PM:	NC
Date:	6/30/2014
Scale:	1" = 200 feet

amec

The map shown here has been created with all due and reasonable care and is strictly for use with AMEC Project Number 3720142002. This map has not been certified by a licensed land surveyor, and any third party use of this map comes without warranties of any kind. AMEC assumes no liability, direct or indirect, whatsoever for any such third party or unintended use.

Path: X:\Projects\2014 Projects\3720142002 Scatter Wash Levee Certification\MXD\Boring_Plan.mxd

EXHIBITS



© MDA 2012 - 2014

Land Subsidence in Western Metropolitan Phoenix
Based on ADWR Radarsat-2 InSAR Data
Time Period of Analysis: 2.0 Years 04/03/2012 To 04/17/2014

04/03/2012 To 04/17/2014

Subsidence

- Decorrelation/No Data
- 2.5 To 3.0 cm
- 2.0 To 2.5 cm
- 1.5 To 2.0 cm
- 1.0 To 1.5 cm
- 0.5 To 1.0 cm
- 0 To 0.5 cm

- Subsidence Feature
- Hardrock
- CAP Canal

Highways and Interstates

- Interstate
- US
- State
- Roads

Note! Colors assigned representing differing amounts of subsidence apply to this map only. Color codes may vary for other maps

1:250,000

0 1.25 2.5 5 7.5 10 Miles

Decorrelation (white areas) are areas where the phase of the received satellite signal changed between satellite passes, causing the data to be unusable. This occurs in areas where the land surface has been disturbed (i.e. bodies of water, snow, agriculture areas, areas of development, etc).

ARIZONA DEPARTMENT OF WATER RESOURCES

Exhibit 1

APPENDIX A

GEOTECHNICAL INVESTIGATION

PROJECT Scatter Wash Levees
North and South Banks
Maricopa County, Arizona

JOB NO. 37-2014-2002 **DATE** 4/10/14

LOCATION See Boring Plan
RIG TYPE Diedrich D50
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1339' ±
DATUM

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil or Rock Unit Classification	REMARKS	VISUAL CLASSIFICATION
0				S	8-10-8			SC	slightly moist firm to very firm	**Embankment FILL** **CLAYEY SAND WITH GRAVEL,** occasional cobbles up to 8" in diameter, some well graded, subangular to subrounded gravel, predominantly fine grained, subangular to subrounded sand, low to medium plasticity, light brown
				S	14-24-23				slightly moist to moist below 2'6"	note: color change to light brown to brown below 2'6"
5				U	48			GC	slightly moist to moist very firm	**CLAYEY GRAVEL WITH SAND,** considerable predominantly fine to medium grained, subangular to subrounded sand, predominantly coarse grained, subangular to subrounded gravel, low to medium plasticity, light brown to brown
								GP-GM/ SP-SM	slightly moist very dense	**NATIVE** **SAND & GRAVEL WITH SILT,** predominantly coarse grained, subangular to subrounded gravel, predominantly medium grained, subrounded sand, nonplastic, light whitish-brown
10				S	42-32-23					
				S	50/2"					
										Auger refused at 11' Sampler refused at 11'2" Backfilled with portland cement grout to depth
15										
20										
25										

GROUNDWATER

	DEPTH(M)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE
A - Drill cuttings
Z - 2 1/2" O.D. 2" I.D. tube sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - 3" Shelby Tube
NR - No Recovery
SS - Sonic Sock

LOG OF TEST BORING NO. B-1

PROJECT Scatter Wash Levees
North and South Banks
Maricopa County, Arizona

JOB NO. 37-2014-2002 **DATE** 4/10/14

LOCATION See Boring Plan

RIG TYPE Diedrich D50
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1341' ±
DATUM

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil or Rock Unit Classification	REMARKS	VISUAL CLASSIFICATION
0				S	7-7-8			SC-SM	slightly moist moderately firm to hard	**Embankment FILL** **SILTY CLAYEY SAND,** occasional cobbles up to 8" in diameter, trace well graded, subangular to subrounded gravel, predominantly fine grained, subangular to subrounded sand, low plasticity, light brown note: decrease in cobbles below 2'6" note: sample at 5' likely refused on cobble
				U	34					
5				S	19-50/4"			SP-SM	slightly moist medium dense to very dense	**NATIVE** **SAND WITH SILT & GRAVEL,** considerable predominantly fine grained, subangular to subrounded gravel, predominantly medium to coarse grained, subangular to subrounded sand, nonplastic, light whitish-brown
10				S	9-11-20					
					100/3"					
				U	NR					
15				...						Auger refused at 12' Sampler refused at 12'3" Backfilled with portland cement grout to depth
20										
25										

GROUNDWATER

	DEPTH(M)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE
A - Drill cuttings
Z - 2 1/2" O.D. 2" I.D. tube sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - 3" Shelby Tube
NR - No Recovery
SS - Sonic Sock

LOG OF TEST BORING NO. B-3

PROJECT Scatter Wash Levees
North and South Banks
Maricopa County, Arizona

JOB NO. 37-2014-2002 **DATE** 4/10/14

LOCATION See Boring Plan
RIG TYPE Diedrich D50
BORING TYPE 6 5/8" Hollow Stem Auger
SURFACE ELEV. 1342' ±
DATUM

Depth in Feet	Drill Rate Min/ft.	Graphical Log	Sample	Sample Type	Blow Count	Dry Density lbs. per Cubic ft.	Moisture Content Percent of Dry Weight	Unified Soil or Rock Unit Classification	REMARKS	VISUAL CLASSIFICATION
0				S	9-11-9			SC	slightly moist to moist firm	**Embankment FILL** **CLAYEY SAND,** occasional cobbles up to 9" in diameter, trace predominantly coarse grained, subangular to subrounded gravel, predominantly fine to medium grained, subangular to subrounded sand, low to medium plasticity, light brown to brown note: increase in fine grained, subangular to subrounded gravel & decrease in cobbles below 2'
				S	11-10-8					
5				U	28					
								SC-SM	slightly moist moderately firm	**SILTY CLAYEY SAND WITH GRAVEL,** some fine grained, subangular to subrounded gravel, predominantly medium grained, subangular to subrounded sand, low plasticity, light brown
10				S	5-5-4					
								SP-SC/ GP-GC	slightly moist medium dense to very dense	**SAND & GRAVEL WITH CLAY,** predominantly coarse grained, subangular to subrounded gravel, predominantly medium to coarse grained, subangular to subrounded sand, low to medium plasticity, light brown
15				U	41					
					50/5"					
				S	NR					
										Auger refused at 17' Sampler refused at 17'5" Backfilled with portland cement grout to depth
20										
25										

GROUNDWATER

	DEPTH(M)	HOUR	DATE
▽		none	
▼			
▽			
▼			

SAMPLE TYPE
A - Drill cuttings
Z - 2 1/2" O.D. 2" I.D. tube sample
S - 2" O.D. 1.38" I.D. tube sample
U - 3" O.D. 2.42" I.D. tube sample
T - 3" Shelby Tube
NR - No Recovery
SS - Sonic Sock

LOG OF TEST BORING NO. B-4

APPENDIX B

LABORATORY TEST RESULTS

TABLE B-1
SUMMARY OF LABORATORY TEST RESULTS

Location **	Boring Number	Depth (ft)		USCS/Group Symbol	Percent Fines (minus 200)	Liquid Limit	Plasticity Index	Moisture Content (%)	In Place Dry Density (pcf)[1]	Hydraulic Conductivity (ASTM 5084) Method C (cm/sec)[2]	Direct Shear Performed (ASTM D3080)
		Begin	End								
North Levee - Station 186+00	B-1	4.5	5.5	GC	22	26	9	7.0	106.5		X
North Levee - Station 186+00	B-1	9.0	10.5	GP-GM	11	NV	NP				
North Levee - Station 193+00	B-3	2.5	3.5	SC-SM	41	22	5	3.3	115.9		
North Levee - Station 193+00	B-3	9.5	11.0	SP-SM	5.3	NV	NP				
South Levee - Station 195+00	B-4	4.5	5.5	SC	39	29	12	7.0	95.3	1.87E-05	X
South Levee - Station 195+00	B-4	9.5	11.0	SC-SM	15	25	7				
South Levee - Station 195+00	B-4	14.5	15.5	SP-SC	11	27	10				
				MEAN	20.6	18.4	6.1	5.8	105.9	-	-
				STDEV	14.2	12.8	4.7	2.1	10.3	-	-
				MAXIMUM	41	29	12	7	116	-	-
				MINIMUM	5	0	0	3	95	-	-
				COUNT	7	7	7	3	3	1	2

Note:
**Approximate location based on ADOT channel stationing
[1](pcf) = pounds per cubic foot
[2](cm/sec) = centimeters per second

amec

PROJECT: Scatter Wash Levee Certification
LOCATION:
MATERIAL: Native Soil
SAMPLE SOURCE: SEE BELOW

JOB NO: 37-2014-2002
WORK ORDER NO: 1
DATE ASSIGNED: 4/14/14

MECHANICAL SIEVE ANALYSIS
GROUP SYMBOL, USCS (ASTM D-2487)

				Silt or	SAND								GRAVEL									COBBLES	
				Clay	Fine			Medium			Coarse		Fine				Coarse						
Location & Depth	USCS	LL	PI	#200	#100	#50	#40	#30	#16	#10	#8	#4	1/4"	3/8"	1/2"	3/4"	1"	1 1/4"	1 1/2"	2"	3"	6"	Lab #

PERCENT PASSING BY WEIGHT

B-1 @ 4.5'-5.5'	GC	26	9	22	28	33	36	38	42	46	47	53	55	59	61	68	72	81	100	100	100	100	3
B-1 @ 9'-10.5'	GP-GM	NV	NP	11	15	19	22	26	34	41	42	51	54	59	63	66	71	100	100	100	100	100	4
B-3 @ 2.5'-3.5'	SC-SM	22	5	41	53	64	68	71	77	81	83	88	89	92	92	94	100	100	100	100	100	100	7
B-3 @ 9.5'-11.0'	SP-SM	NV	NP	5.3	8	13	18	24	38	47	51	67	74	83	89	95	100	100	100	100	100	100	9
B-4 @ 4.5'-5.5'	SC	29	12	39	51	61	65	69	77	83	85	90	91	94	96	100	100	100	100	100	100	100	13
B-4 @ 9.5'-11'	SC-SM	25	7	15	19	27	33	40	53	62	65	78	80	85	89	100	100	100	100	100	100	100	14
B-4 @ 14.5'-15.5'	SP-SC	27	10	11	14	18	20	22	30	39	43	57	61	67	70	75	85	85	100	100	100	100	15

AASHTO R18

REVIEWED BY _____

PROJECT:	Scatter Wash Levee Certification	**JOB NO:**	37-2014-2002
LOCATION:		**WORK ORDER NO:**	1
MATERIAL:	Native soil	**LAB NO:**	SEE BELOW
SAMPLE SOURCE:	SEE BORING	**DATE ASSIGNED:**	

DENSITY OF SOIL IN PLACE BY THE DRIVE-CYLINDER METHOD(ASTM D2937)

		MOISTURE						
LAB #	BORING	WET WT. (g)	DRY WT. (g)	MOISTURE CONTENT	NUMBER OF RINGS	WET WEIGHT & RINGS (g)	WEIGHT OF RINGS (g)	DRY DENSITY (pcf)
7	B-3 @2.5'-3.5'	341.1	330.1	3.3%	6	1,133.0	265.0	115.9

REVIEWED BY _____

PROJECT:	Scatter Wash Levee Certification	**JOB NO:**	37-2014-2002
LOCATION:		**WORK ORDER NO:**	2
MATERIAL:	Native soil	**LAB NO:**	13
SAMPLE SOURCE:	B-4 @ 4.5'-5.5'	**DATE SAMPLED:**	4/14/2014
SAMPLE PREP:	Remolded to 95.0 pcf at 7% moisture		

MEASUREMENT OF HYDRAULIC CONDUCTIVITY OF SATURATED POROUS MATERIALS USING A FLEXIBLE WALL PERMEAMETER (ASTM D5084-00) METHOD C

AVERAGE PERMEABILITY			1.87E-05 cm/sec	
INITIAL LENGTH OF SPECIMEN			6.34 cm	
INITIAL DIAMETER OF SPECIMEN			6.34 cm	
INITIAL WATER CONTENT			7.0 %	
INITIAL DRY UNIT WEIGHT			95.0 pcf	
INITIAL VOLUME			200.3 cu.cm	
PERMEANT LIQUID			Tap Water	
MAGNITUDE OF TOTAL BACK PRESSURE			50.0 psi	
EFFECTIVE CONSOLIDATION STRESS			5.0 psi	
RANGE OF HYDRAULIC GRADIENT USED	9.9	to	8.2	
FINAL LENGTH OF SPECIMEN			6.32 cm	
FINAL DIAMETER OF SPECIMEN			6.29 cm	
FINAL WATER CONTENT			26.0 %	
FINAL DRY UNIT WEIGHT			96.8 pcf	
FINAL VOLUME			196.5 cu.cm	
DEGREE OF SATURATION (BEFORE AND AFTER TEST)	25%	and		97%
SPECIFIC GRAVITY USED IN CALCULATIONS OF SATURATION			2.651	

TIME INTERVAL	K (cm/sec)	K (ft/yr)
0:31:16	1.83E-05	18.94
0:34:27	1.79E-05	18.55
0:37:51	1.99E-05	20.55
0:41:04	1.88E-05	19.46

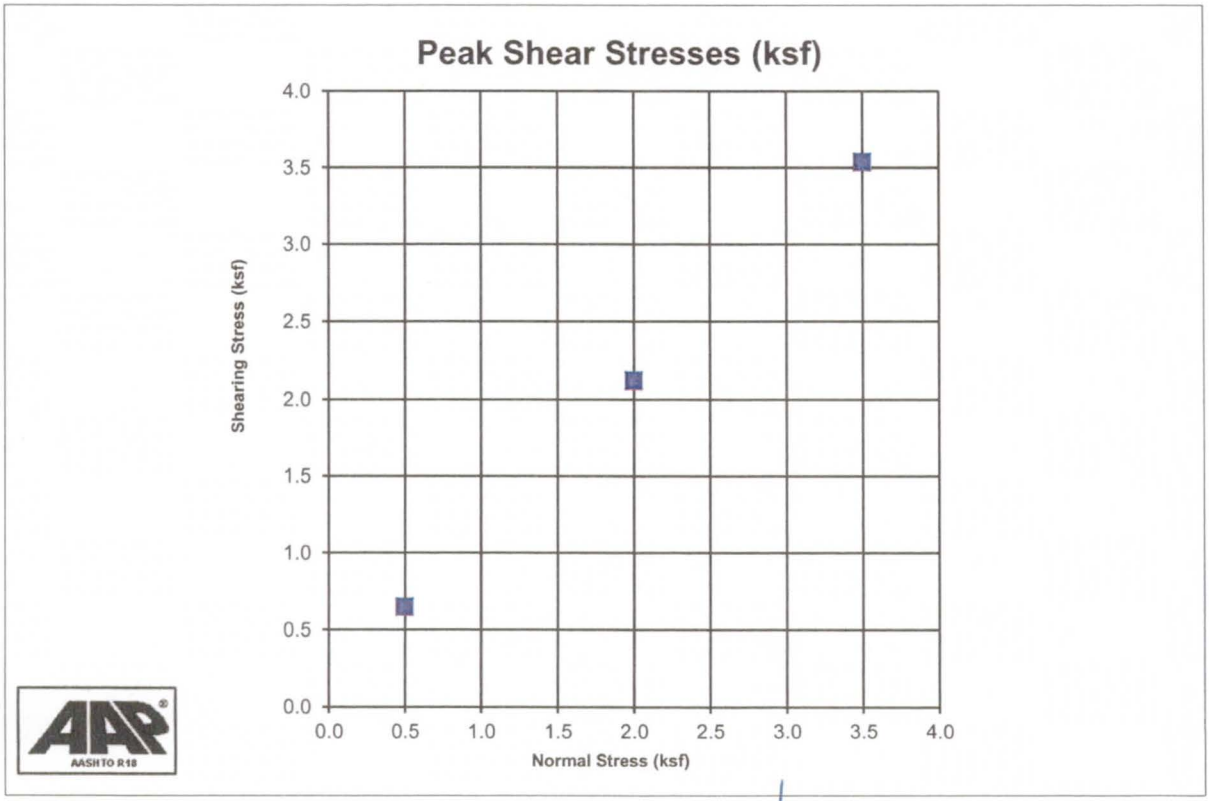
AASHTO R18

REVIEWED BY

PROJECT:	Scatter Wash Levee Certification	**JOB NO:**	37-2014-2002
LOCATION:		**WORK ORDER NO:**	1
MATERIAL:	Native soil	**LAB NO:**	3
SAMPLE SOURCE:	B-1 @ 4.5'-5.5'	**DATE ASSIGNED:**	4/14/2014
SAMPLE PREPARATION:	Saturate, N=0.5, 2 & 3.5ksf at 0.0053in/min		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00	1.00	1.00
Initial diameter of specimen (in.):	2.42	2.42	2.42
Final thickness before shear (in.):	0.987	0.969	0.883
Shearing device used:	Humboldt Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.0053	0.0053	0.0053
Direct shear point:	1	2	3
Dry mass of specimen (g):	127.9	130.1	128.0
Initial Moisture Content:	7.6%	6.4%	6.9%
Initial Wet Density (lb per cu.ft):	114.0	114.6	113.4
Initial Dry Density (lb per cu.ft):	105.9	107.7	106.0
Final Moisture Content:	23.0%	21.9%	20.2%
Final Wet Density (lb per cu.ft):	132.0	135.5	144.4
Final Dry Density (lb per cu.ft):	107.3	111.2	120.1
Normal Stress (ksf):	0.5	2.0	3.5
Maximum Shearing Stress (kips per sq. ft):	0.65	2.12	3.54
Vertical Deformation @ Max Shear (in):	-0.004	-0.045	-0.016
Horizontal Deformation @ Max Shear (in):	0.499	0.470	0.462

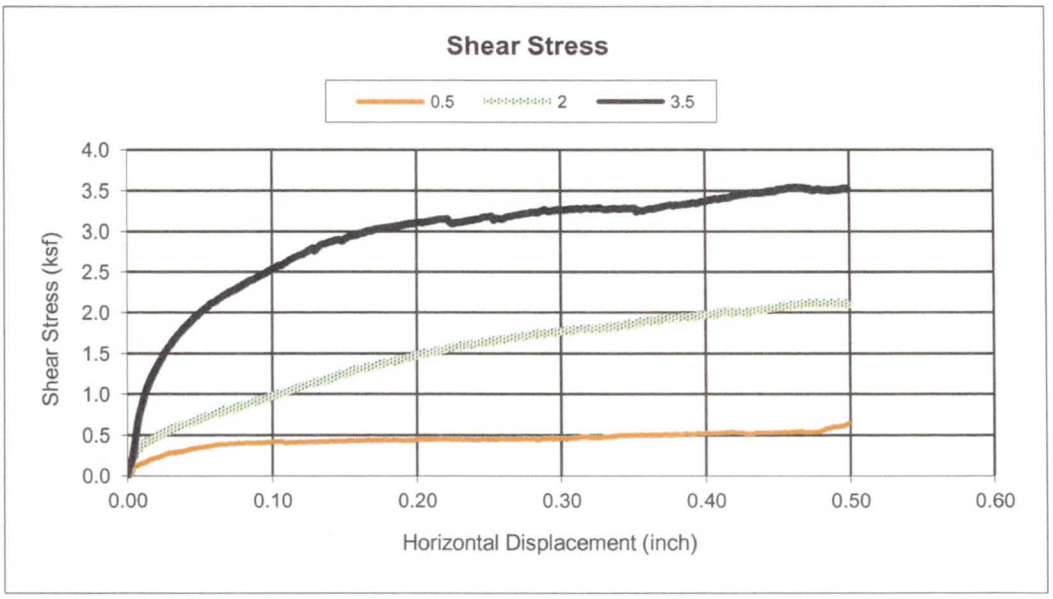


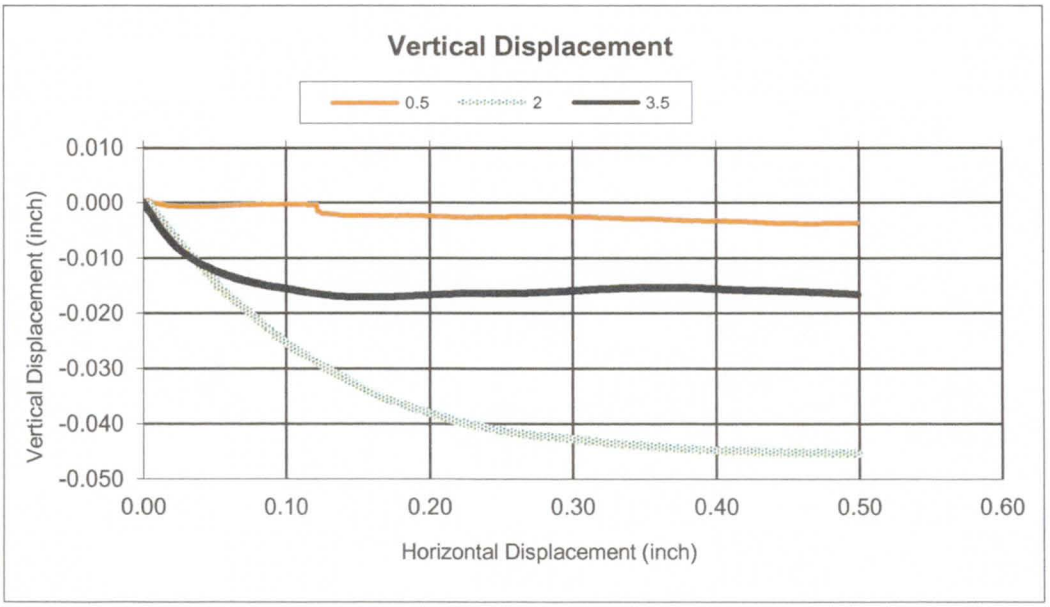
REVIEWED BY _____

PROJECT:	Scatter Wash Levee Certification	**JOB NO:**	37-2014-2002
LOCATION:		**WORK ORDER NO:**	1
MATERIAL:	Native soil	**LAB NO:**	3
SAMPLE SOURCE:	B-1 @ 4.5'-5.5'	**DATE ASSIGNED:**	4/14/2014
SAMPLE PREPARATION:	Saturate, N=0.5, 2 & 3.5ksf at 0.0053in/min		

NORMAL LOADS (ksf): 0.5 2 3.5

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

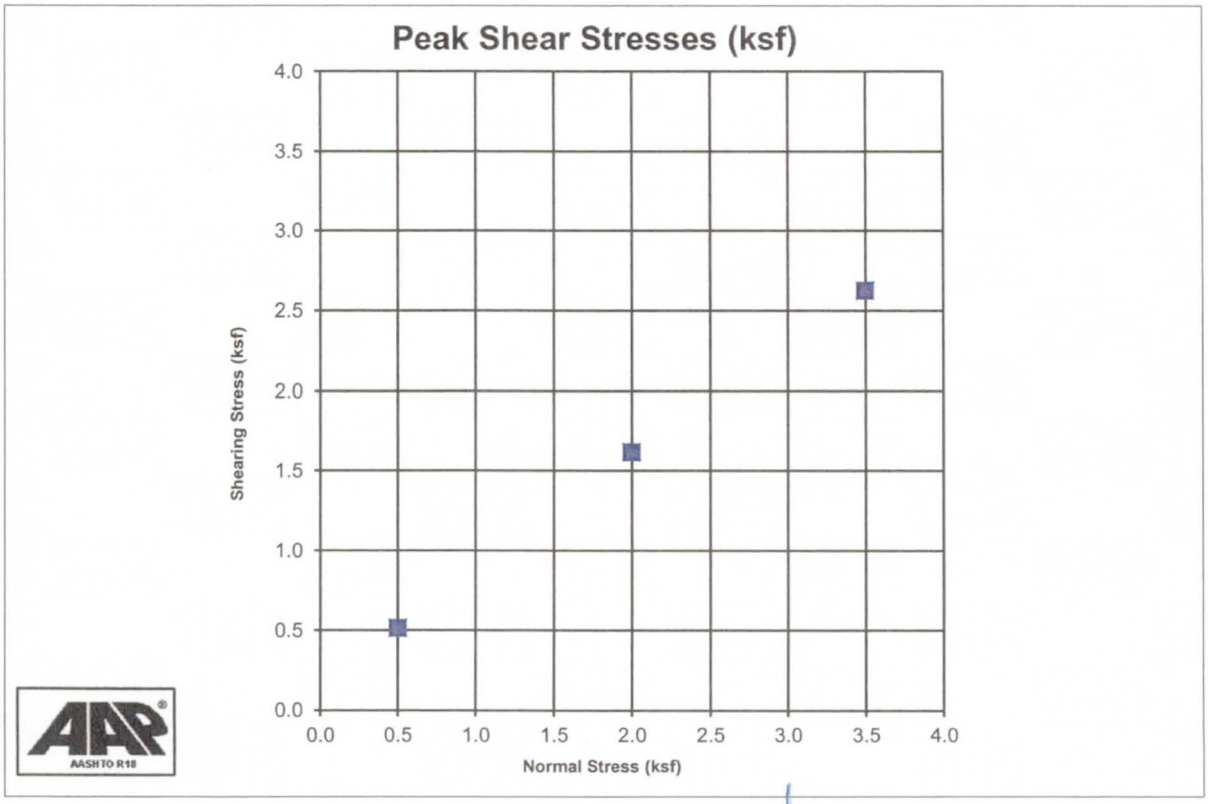




PROJECT:	Scatter Wash Levee Certification	**JOB NO:**	37-2014-2002
LOCATION:		**WORK ORDER NO:**	1
MATERIAL:	Native soil	**LAB NO:**	13
SAMPLE SOURCE:	B-4 @ 4.5'-5.5'	**DATE ASSIGNED:**	4/14/2014
SAMPLE PREPARATION:	Saturate, N=0.5, 2 & 3.5ksf at 0.0053in/min		

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)

Initial thickness of specimen (in.):	1.00	1.00	1.00
Initial diameter of specimen (in.):	2.42	2.42	2.42
Final thickness before shear (in.):	0.955	0.873	0.869
Shearing device used:	Humboldt Automated Shear Test System by Trautwein Soil Testing Equipment		
Rate of deformation (in/min):	0.0053	0.0053	0.0053
Direct shear point:	1	2	3
Dry mass of specimen (g):	113.6	114.6	116.9
Initial Moisture Content:	7.7%	7.0%	6.4%
Initial Wet Density (lb per cu.ft):	101.3	101.6	103.0
Initial Dry Density (lb per cu.ft):	94.1	94.9	96.8
Final Moisture Content:	27.8%	26.9%	27.2%
Final Wet Density (lb per cu.ft):	125.9	138.0	141.7
Final Dry Density (lb per cu.ft):	98.5	108.7	111.4
Normal Stress (ksf):	0.5	2.0	3.5
Maximum Shearing Stress (kips per sq. ft):	0.52	1.62	2.62
Vertical Deformation @ Max Shear (in):	-0.023	-0.032	-0.035
Horizontal Deformation @ Max Shear (in):	0.499	0.499	0.499

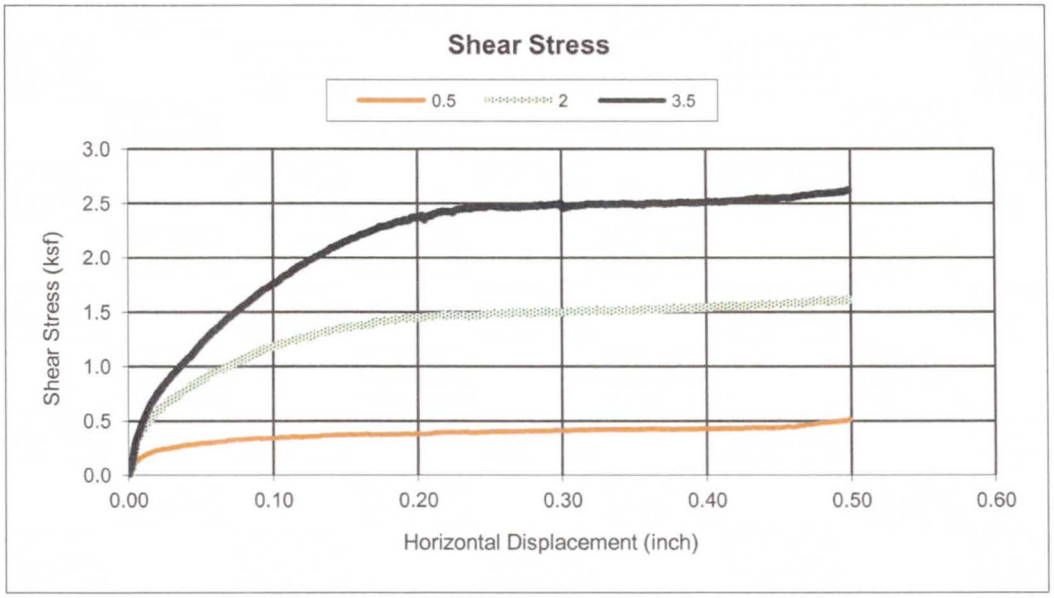


REVIEWED BY _____

PROJECT:	Scatter Wash Levee Certification	**JOB NO:**	37-2014-2002
LOCATION:		**WORK ORDER NO:**	1
MATERIAL:	Native soil	**LAB NO:**	13
SAMPLE SOURCE:	B-4 @ 4.5'-5.5'	**DATE ASSIGNED:**	4/14/2014
SAMPLE PREPARATION:	Saturate, N=0.5, 2 & 3.5ksf at 0.0053in/min		

NORMAL LOADS (ksf): 0.5 2 3.5

DIRECT SHEAR TEST OF SOILS UNDER CONSOLIDATED DRAINED CONDITIONS(ASTM D3080)



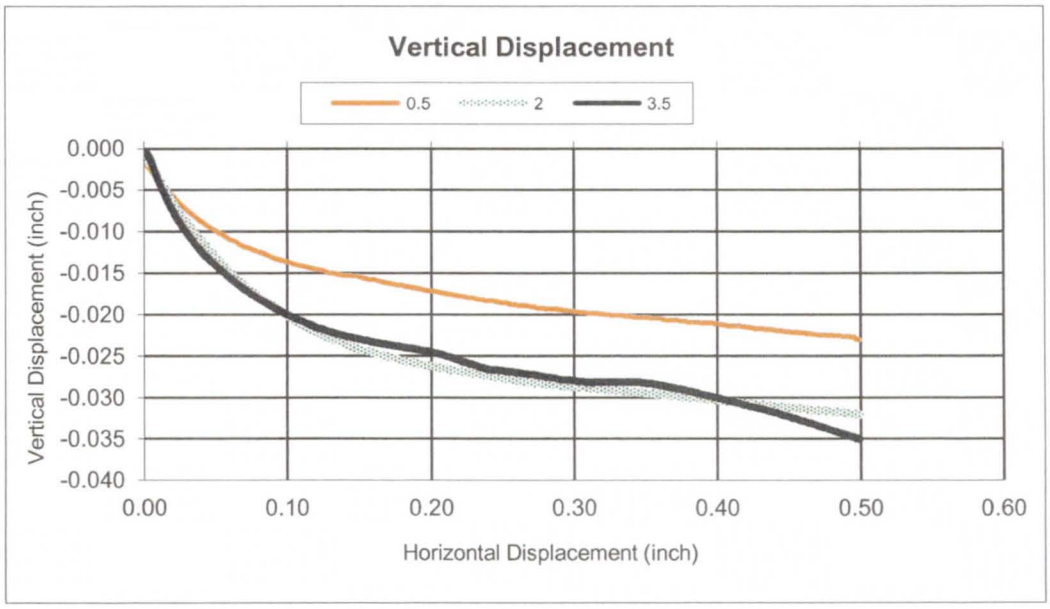
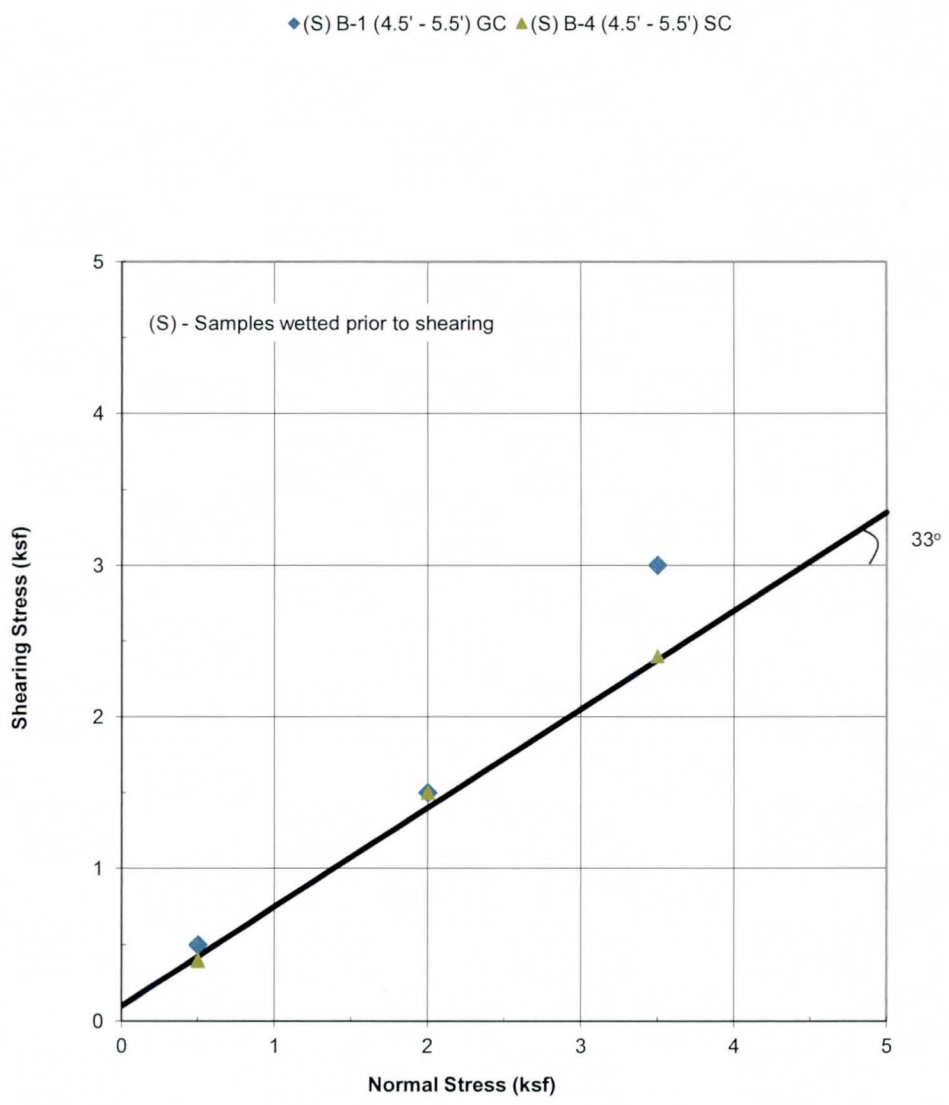


FIGURE B-1
Direct Shear Test Results
Embankment Soils



APPENDIX C

ENGINEERING ANALYSES

North Levee – Station 183+00

Figure C-1

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Steady State Seepage Analysis

Soil Type	Saturated Hydraulic Conductivity, Ksat (cm/s)	Ky/Kx Ratio
Embankment	1 E-5	0.1
Foundation	1 E-3	0.1

Exit Gradient = 0.14

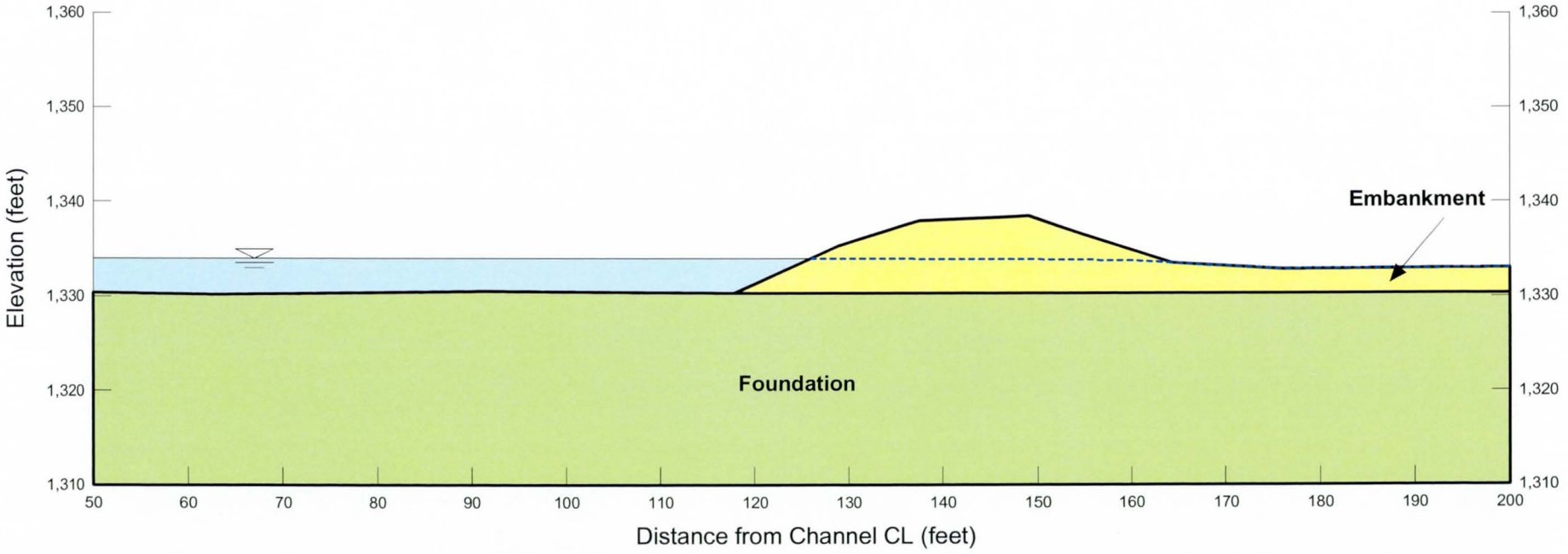


Figure C-2

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Case 1A - End of Construction
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 4.17

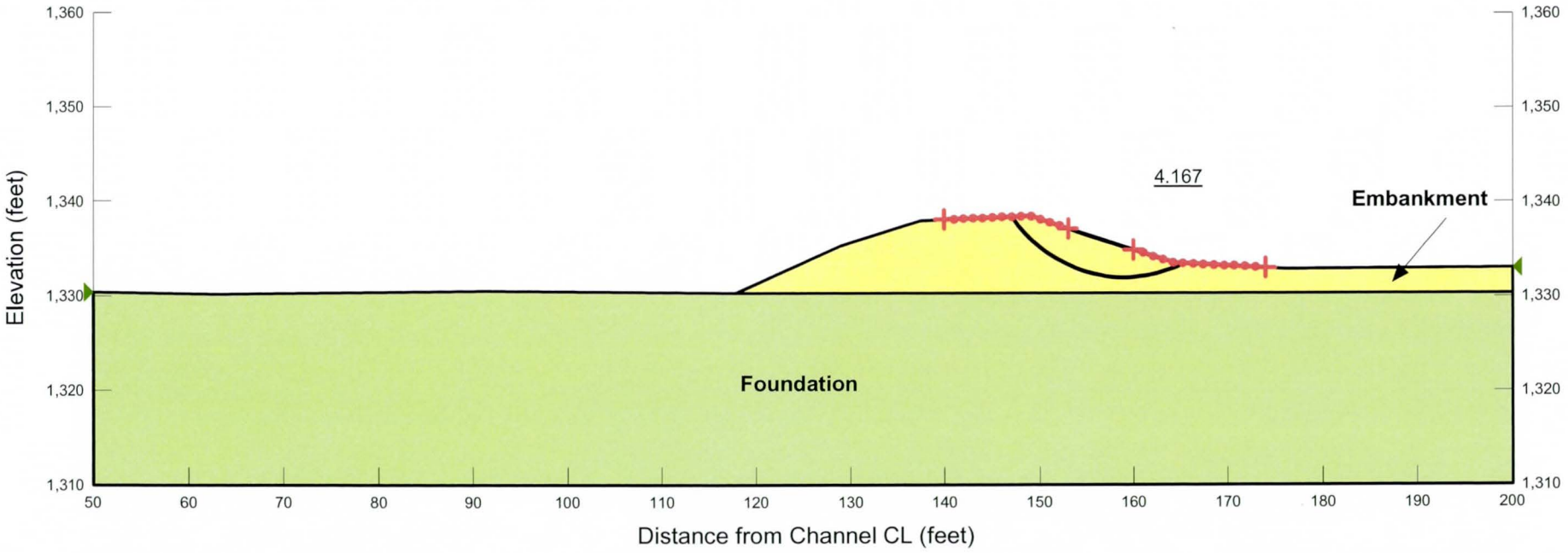


Figure C-3

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Case 1B - End of Construction
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.58

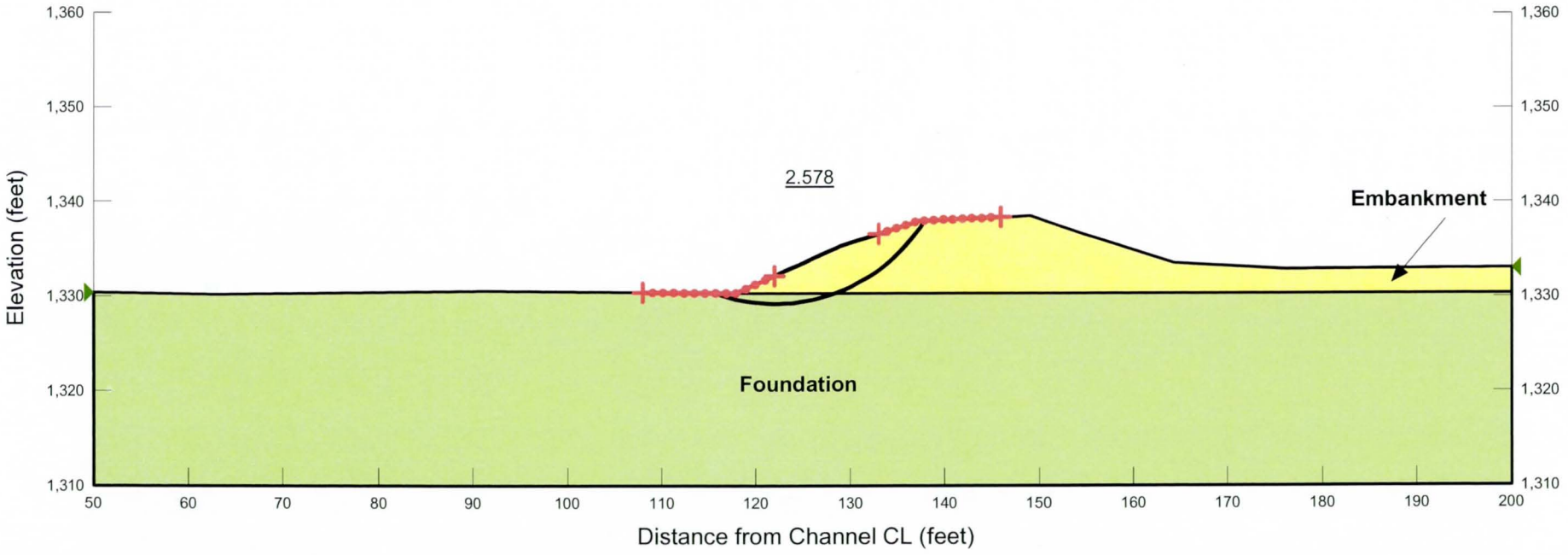


Figure C-4

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Case 2B - Sudden Drawdown
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.40

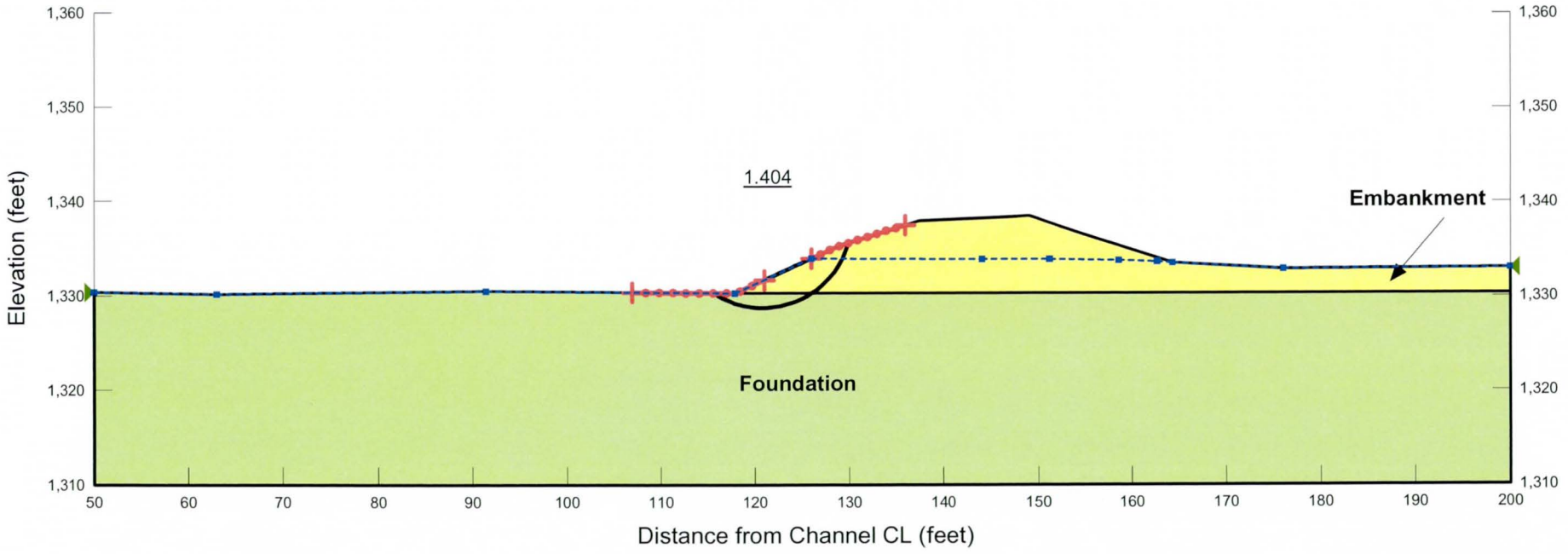


Figure C-5

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Case 3A - Steady State Seepage
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.87

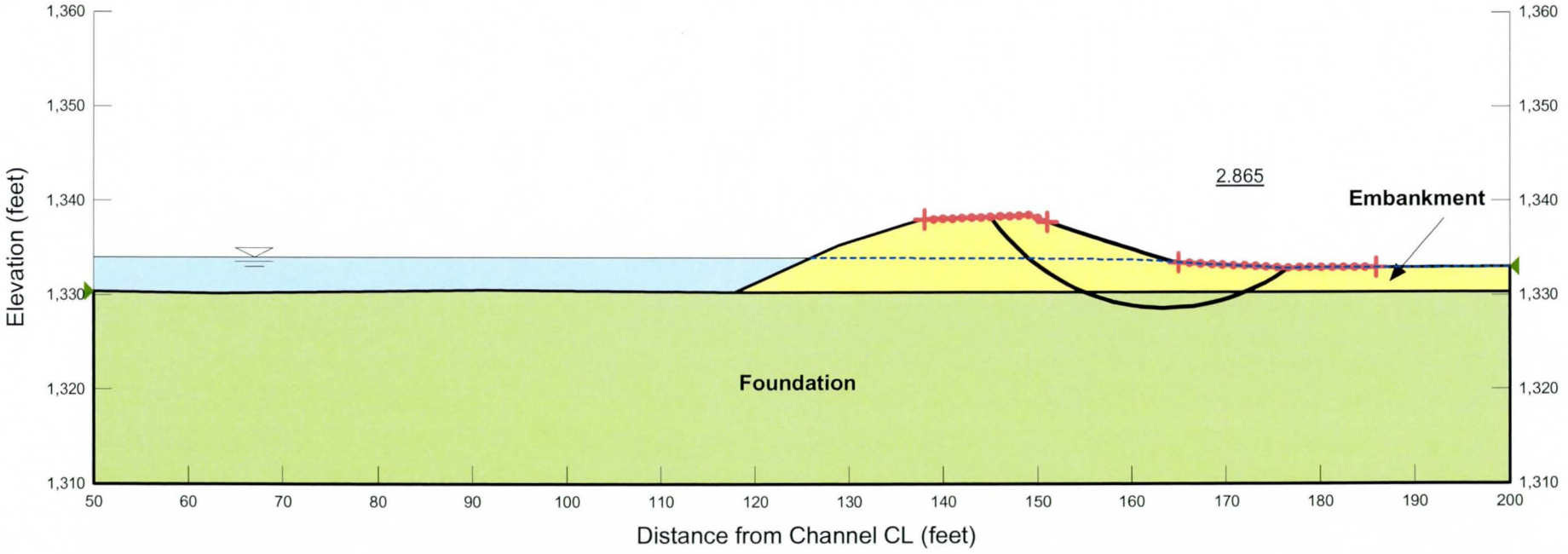


Figure C-6

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Case 4A - End of Construction
Landside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 3.51

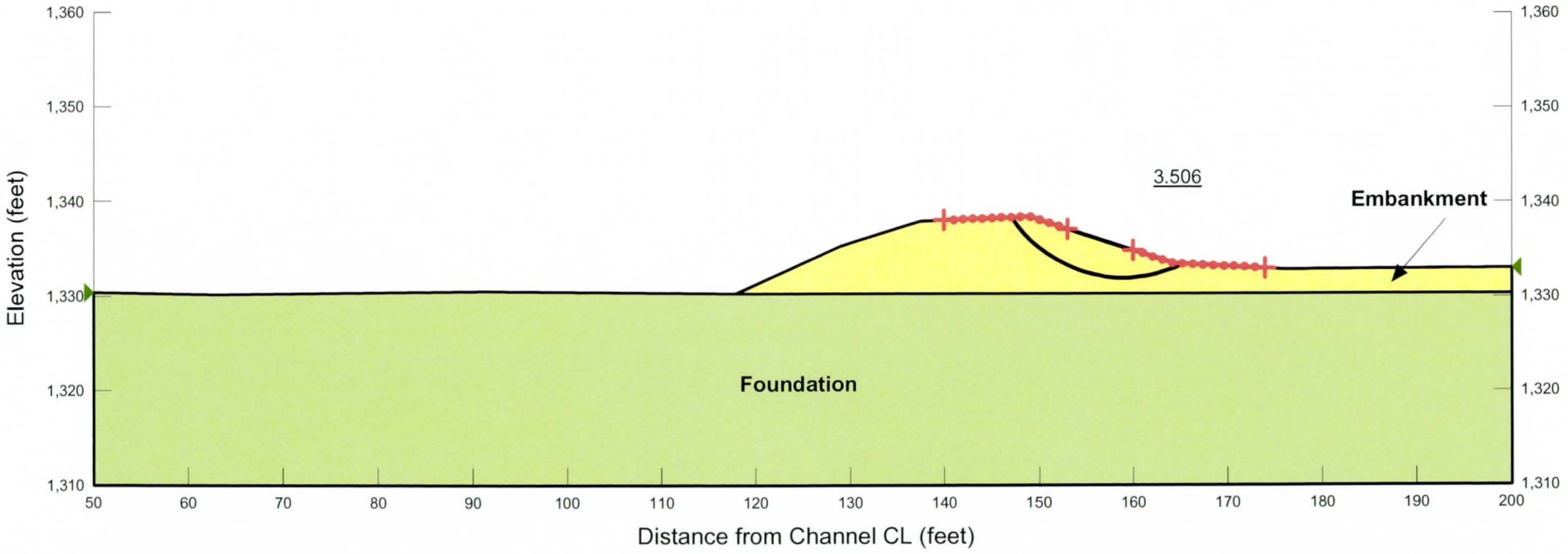


Figure C-7

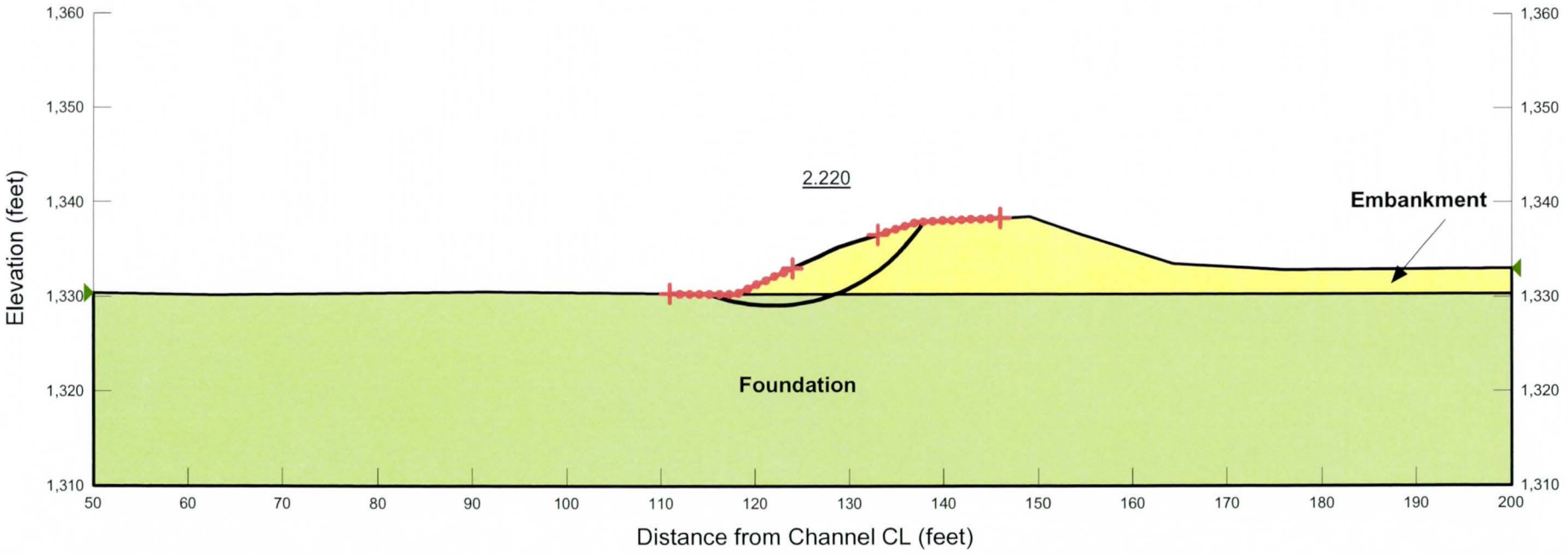
Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 183+00 (River Mile 0.932)

Case 4B - End of Construction
Riverside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.22



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North Levee – Station 189+00

Figure C-8

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Steady State Seepage Analysis

Soil Type	Saturated Hydraulic Conductivity, Ksat (cm/s)	Ky/Kx Ratio
Embankment	1 E-5	0.1
Foundation	1 E-3	0.1

Exit Gradient = 0

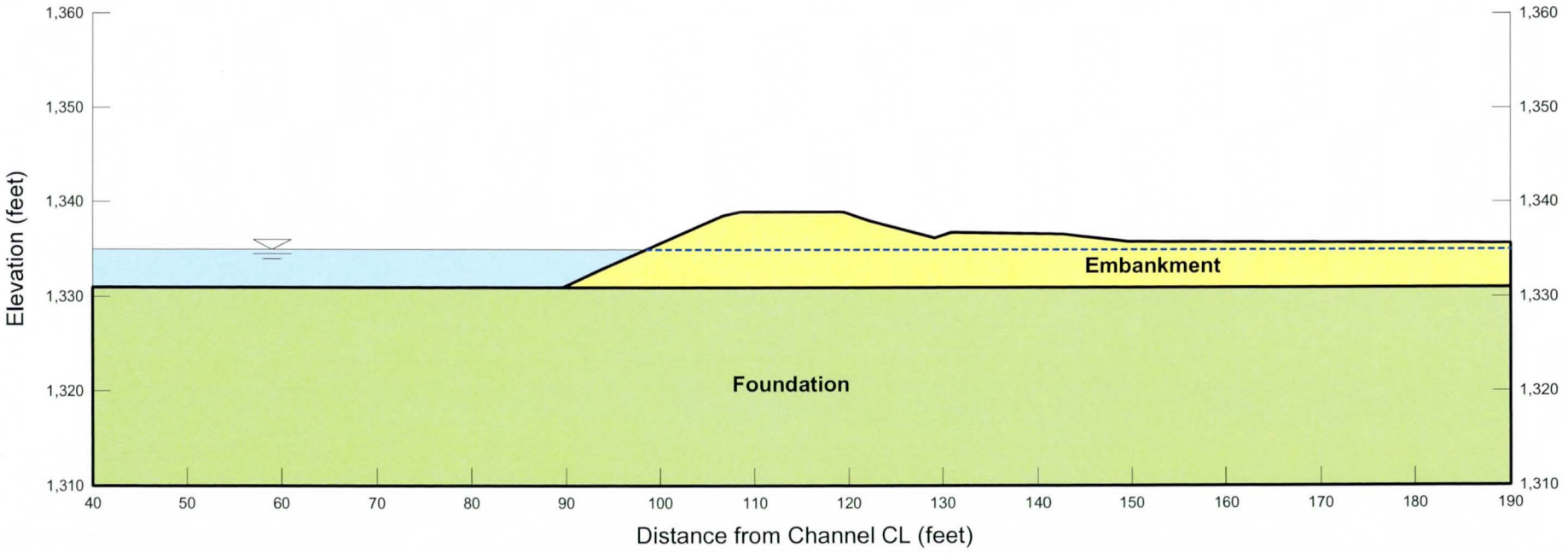


Figure C-9

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Case 1A - End of Construction
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 5.86

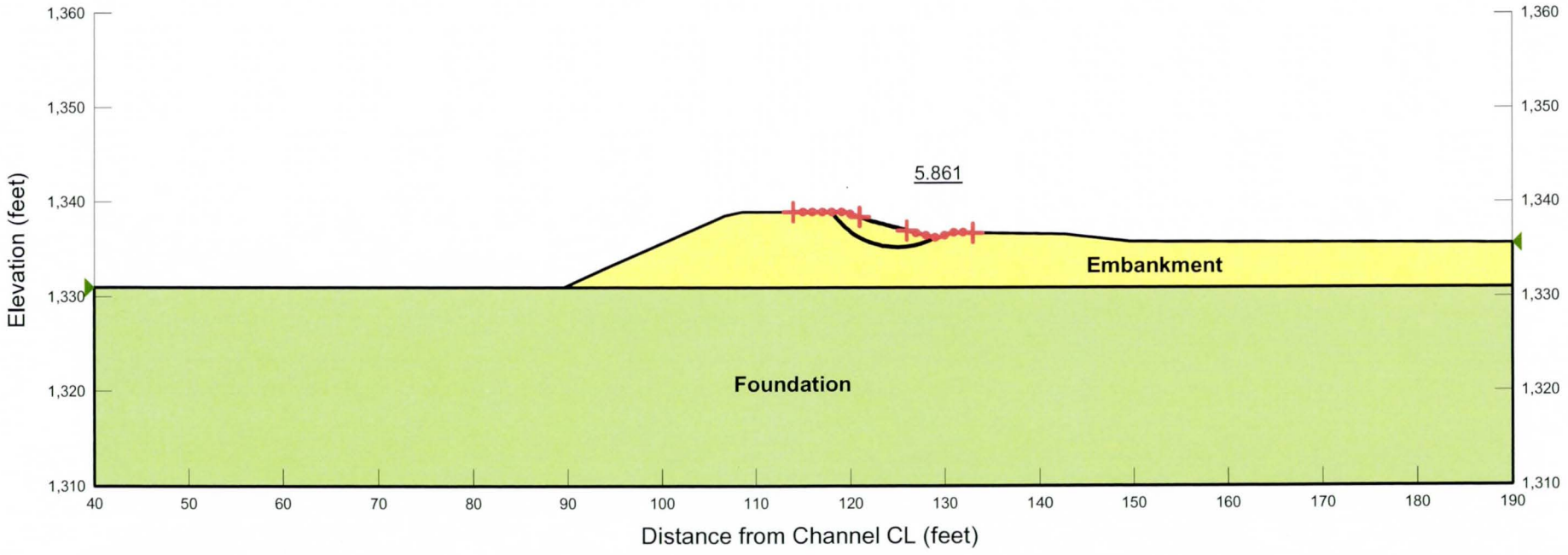


Figure C-10

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Case 1B - End of Construction
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.43

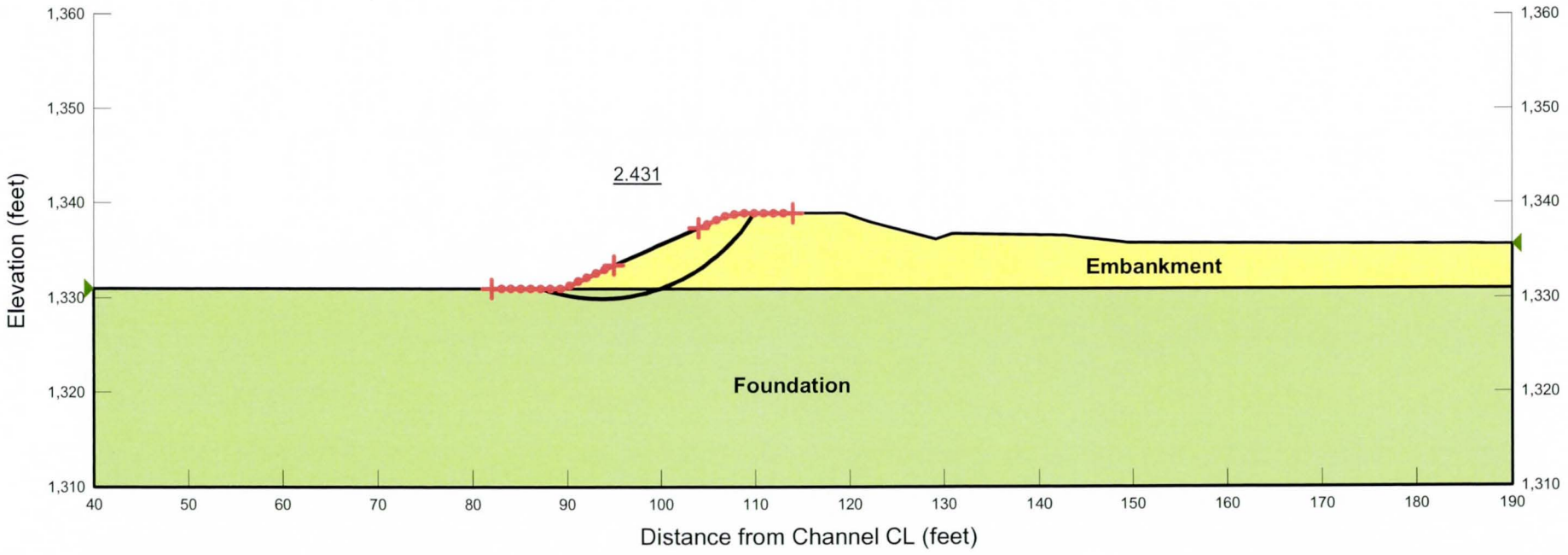


Figure C-11

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Case 2B - Sudden Drawdown
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.38

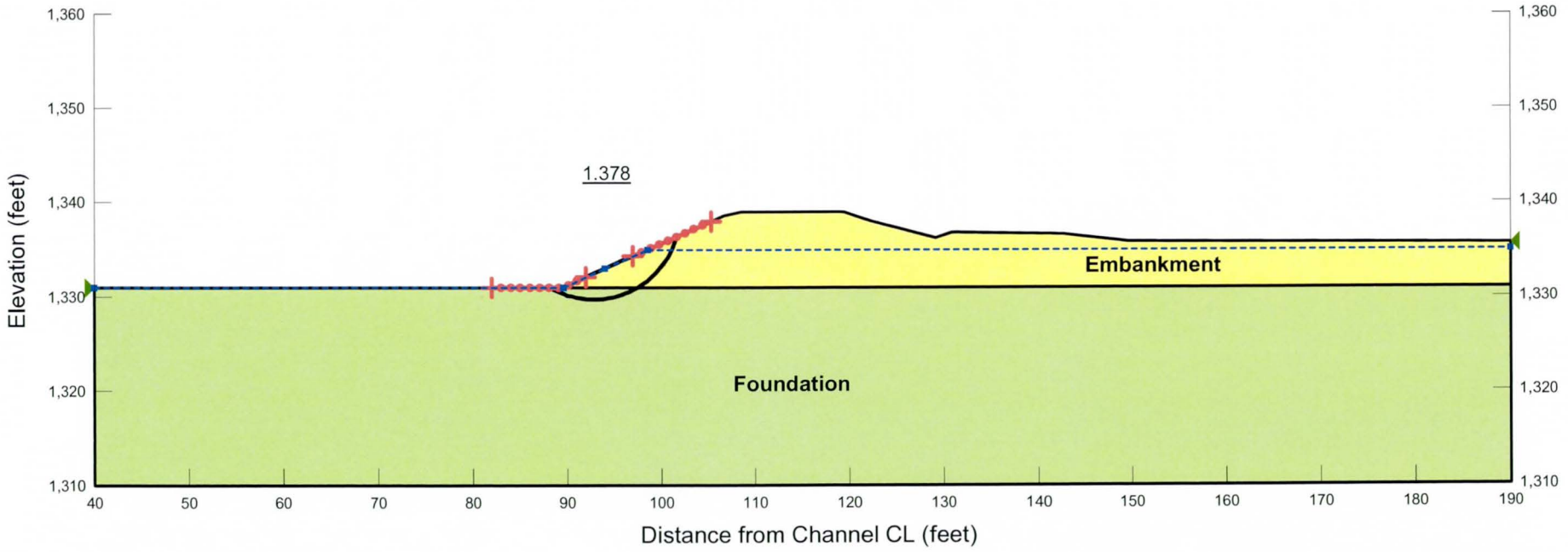


Figure C-12

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Case 3A - Steady State Seepage
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 5.86

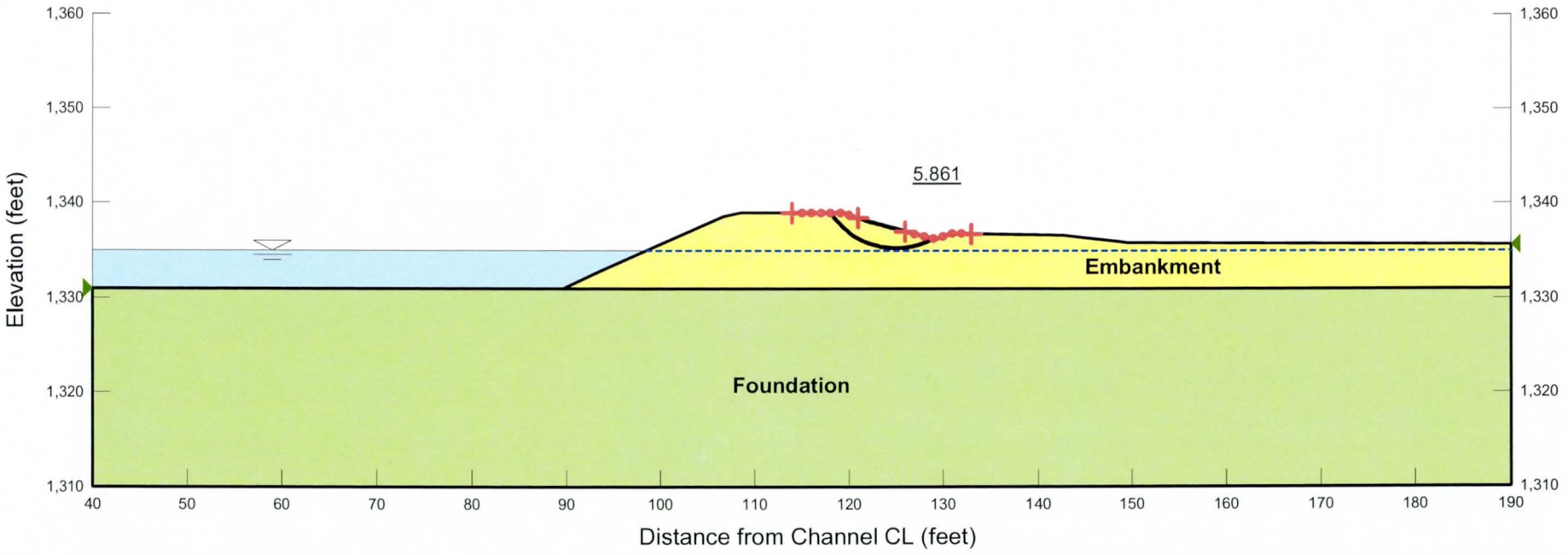


Figure C-13

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Case 4A - End of Construction
Landside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 4.79

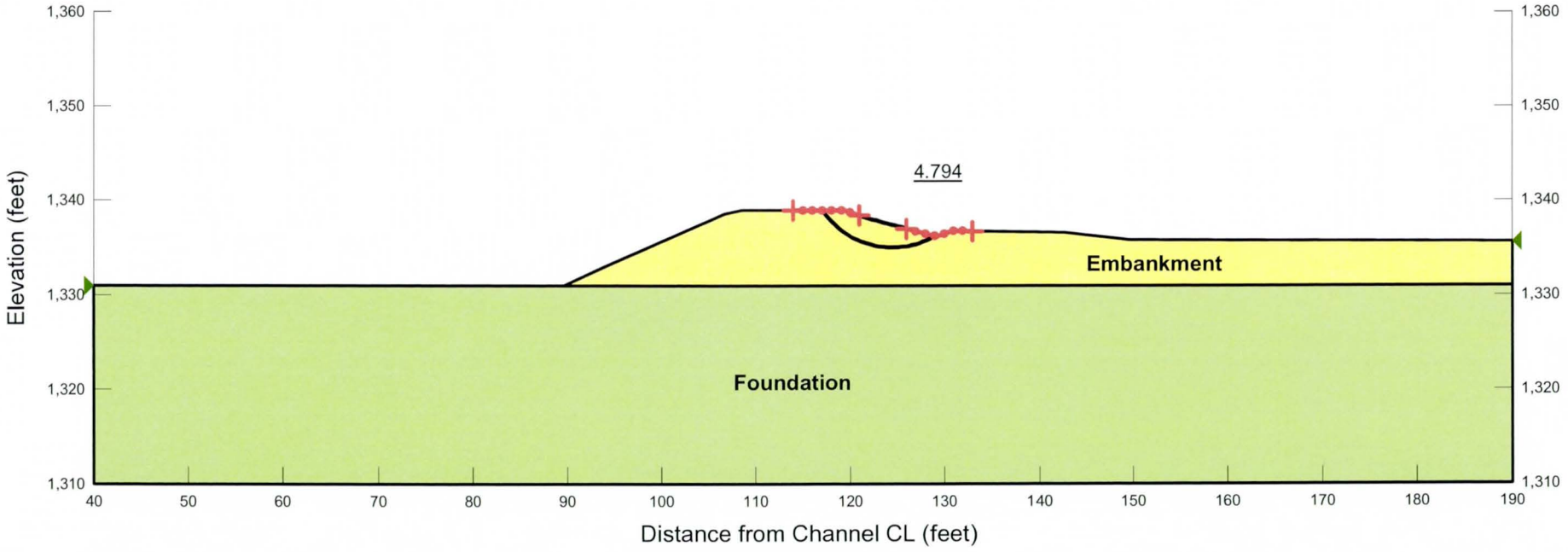


Figure C-14

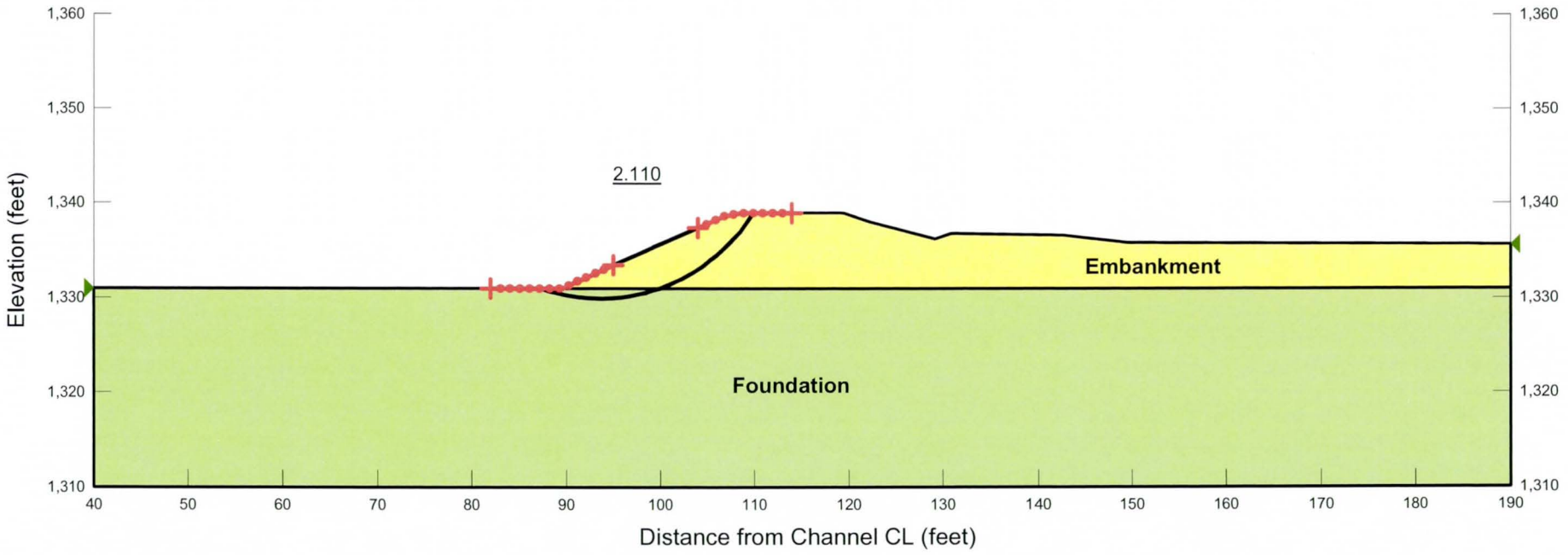
Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

North Levee Station 189+00 (River Mile 1.034)

Case 4B - End of Construction
Riverside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.11



South Levee – Station 183+00

Figure C-15

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Steady State Seepage Analysis

Soil Type	Saturated Hydraulic Conductivity, Ksat (cm/s)	Ky/Kx Ratio
Embankment	1 E-5	0.1
Foundation	1 E-3	0.1

Exit Gradient = 0.44

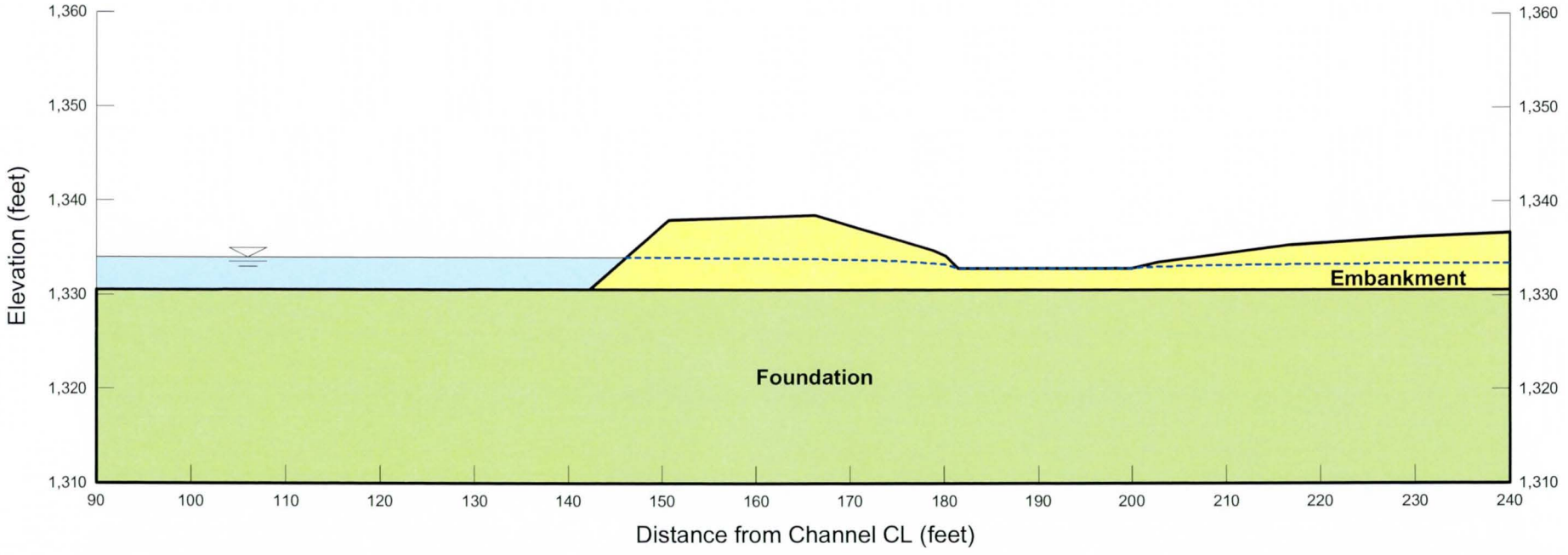


Figure C-16

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Steady State Seepage Analysis
Interior Drainage Assessment

Soil Type	Saturated Hydraulic Conductivity, Ksat (cm/s)	Ky/Kx Ratio
Embankment	1 E-5	0.1
Foundation	1 E-3	0.1

Exit Gradient = 0.06

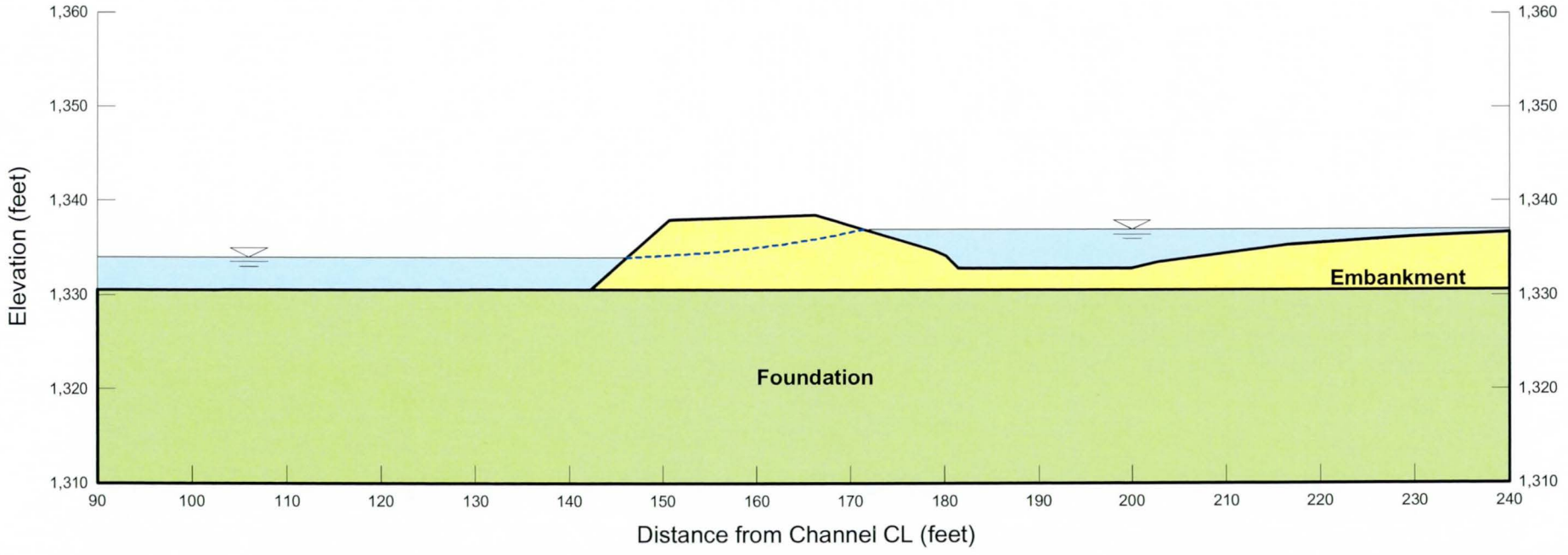


Figure C-17

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 1A - End of Construction
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 3.84

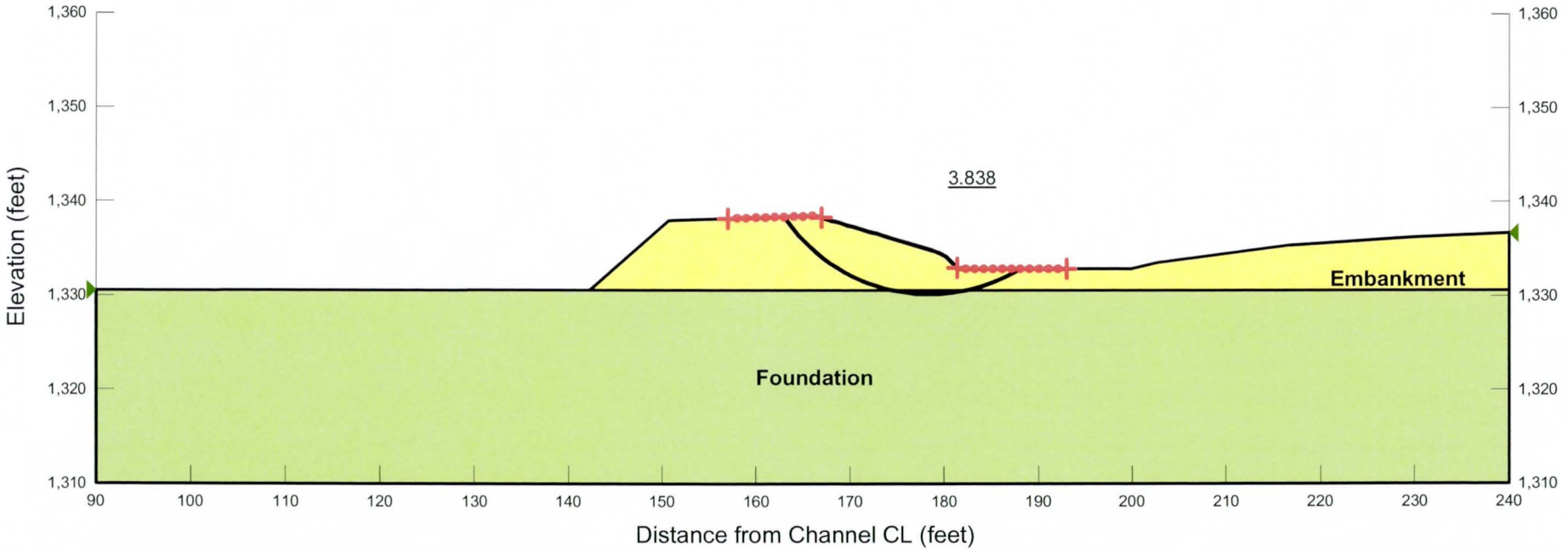


Figure C-18

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 1B - End of Construction
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.77

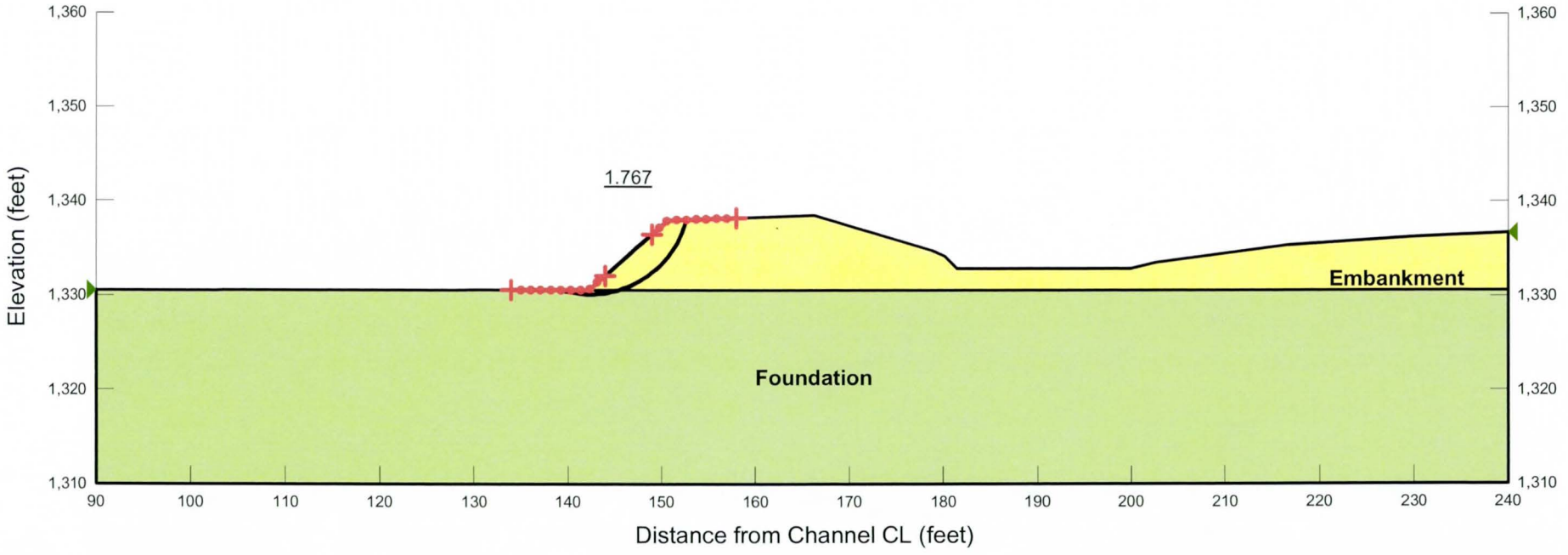


Figure C-19

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 2B - Sudden Drawdown
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.12

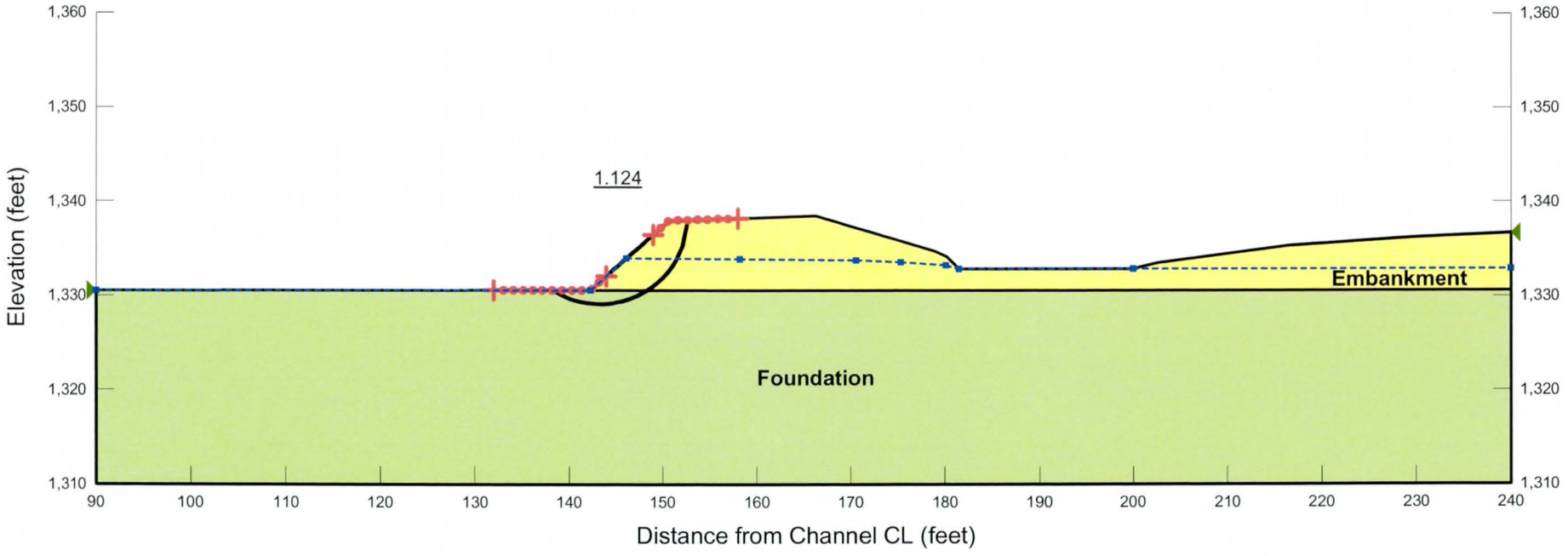


Figure C-20

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 3A - Steady State Seepage
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.56

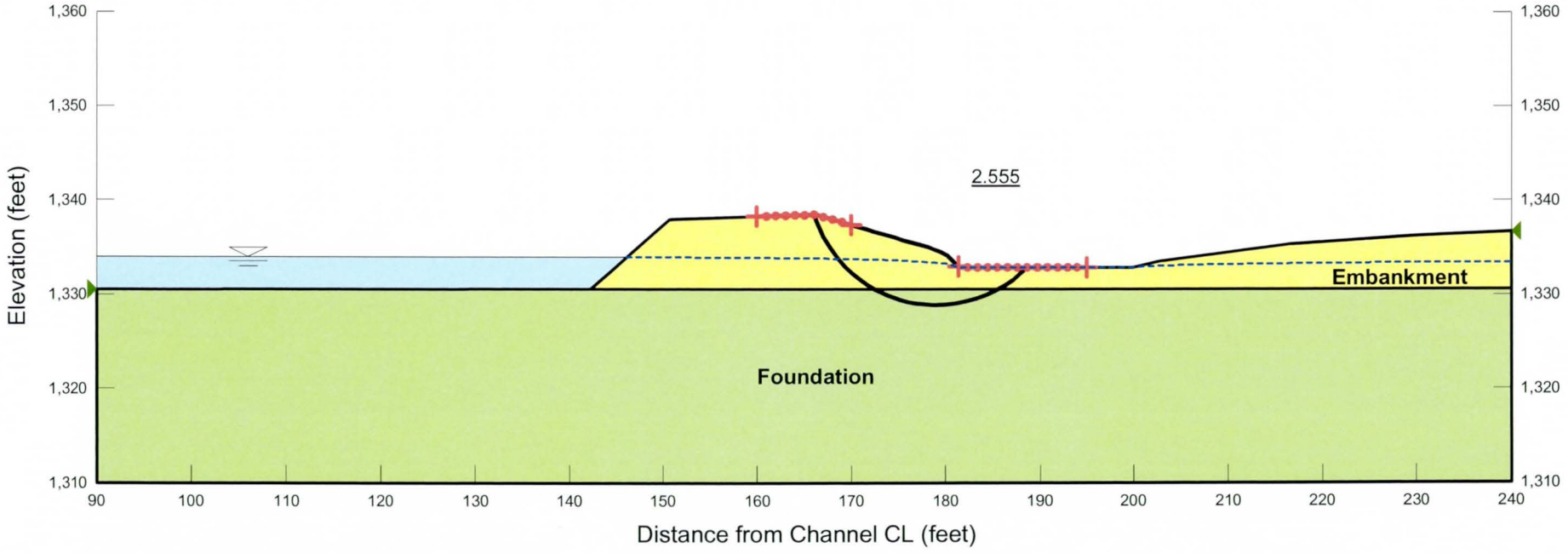


Figure C-21

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 4A - End of Construction
Landside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 3.18

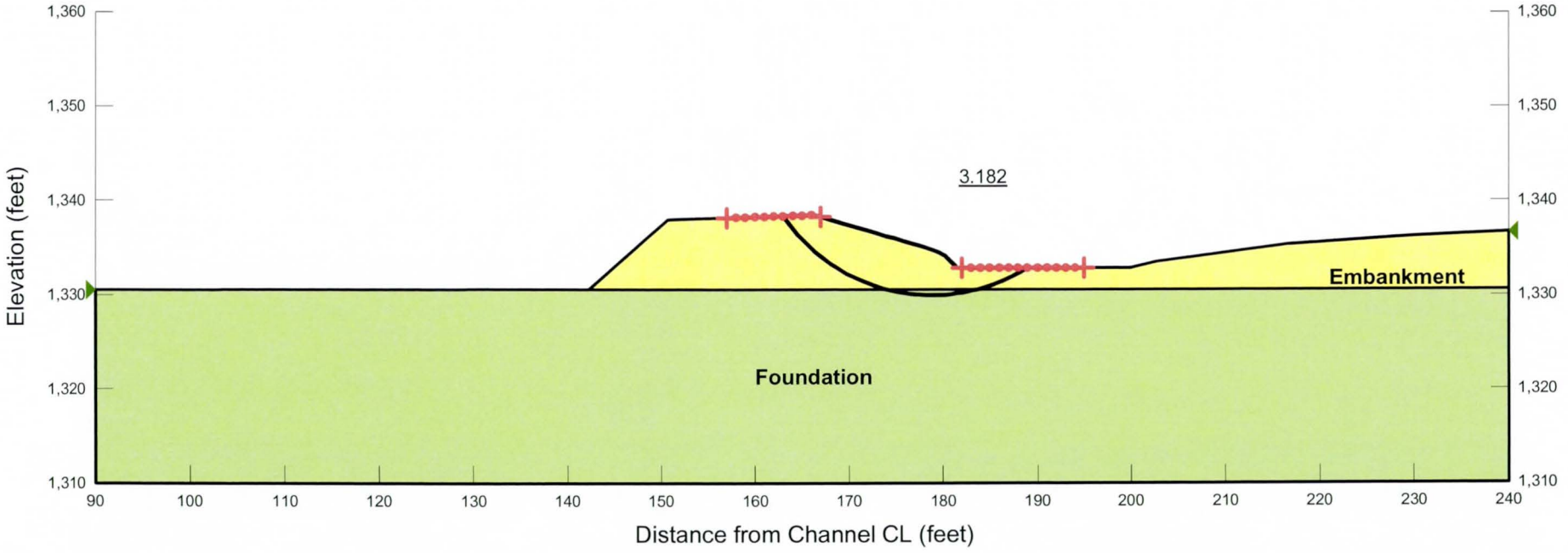


Figure C-22

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 4B - End of Construction
Riverside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.61

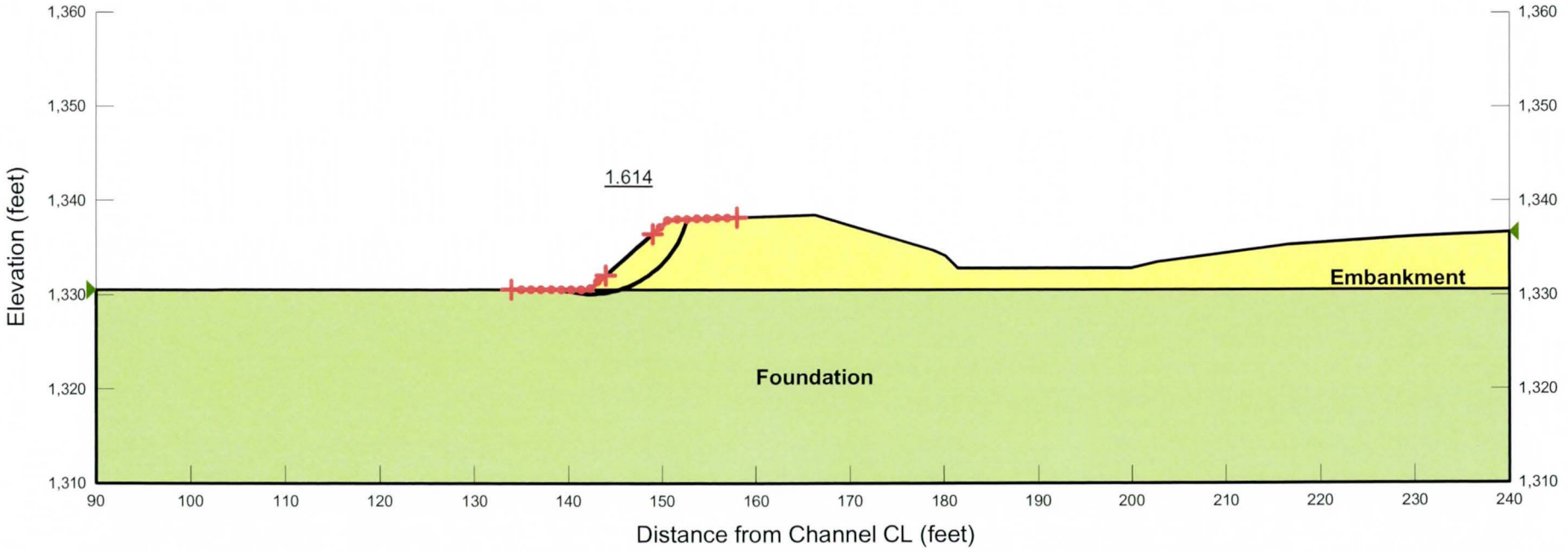


Figure C-23

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 5A - Sudden Drawdown under Interior Drainage
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.17

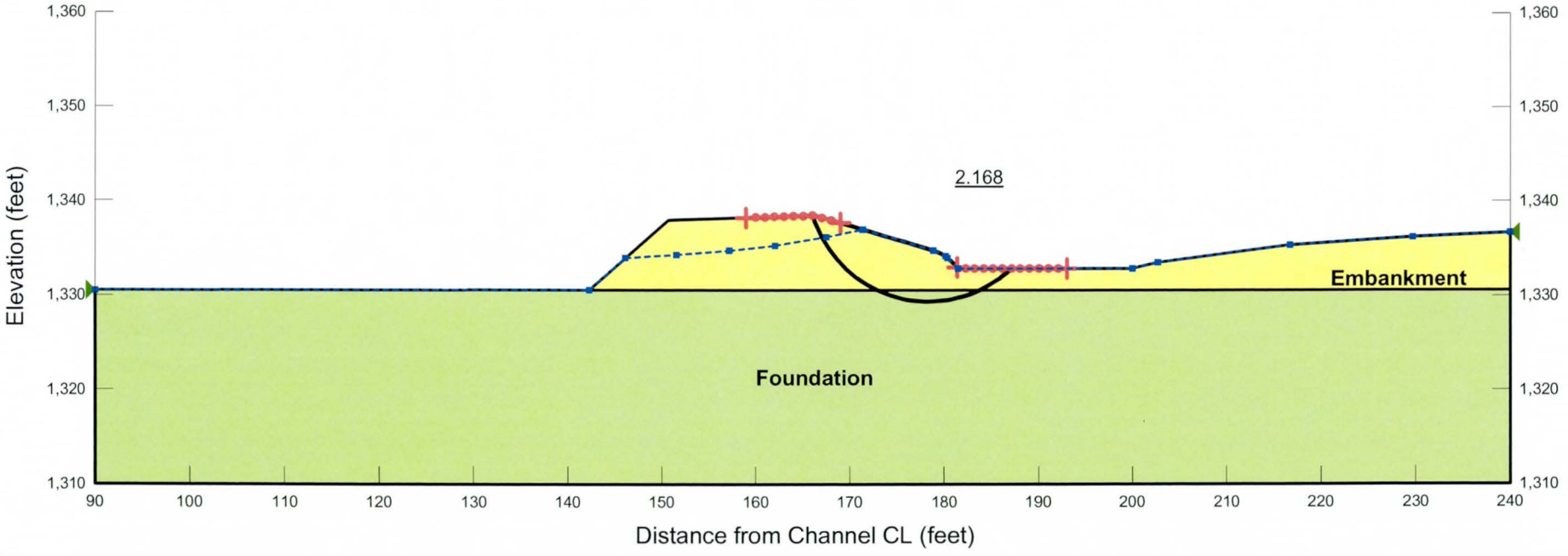


Figure C-24

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 5B - Sudden Drawdown under Interior Drainage
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.08

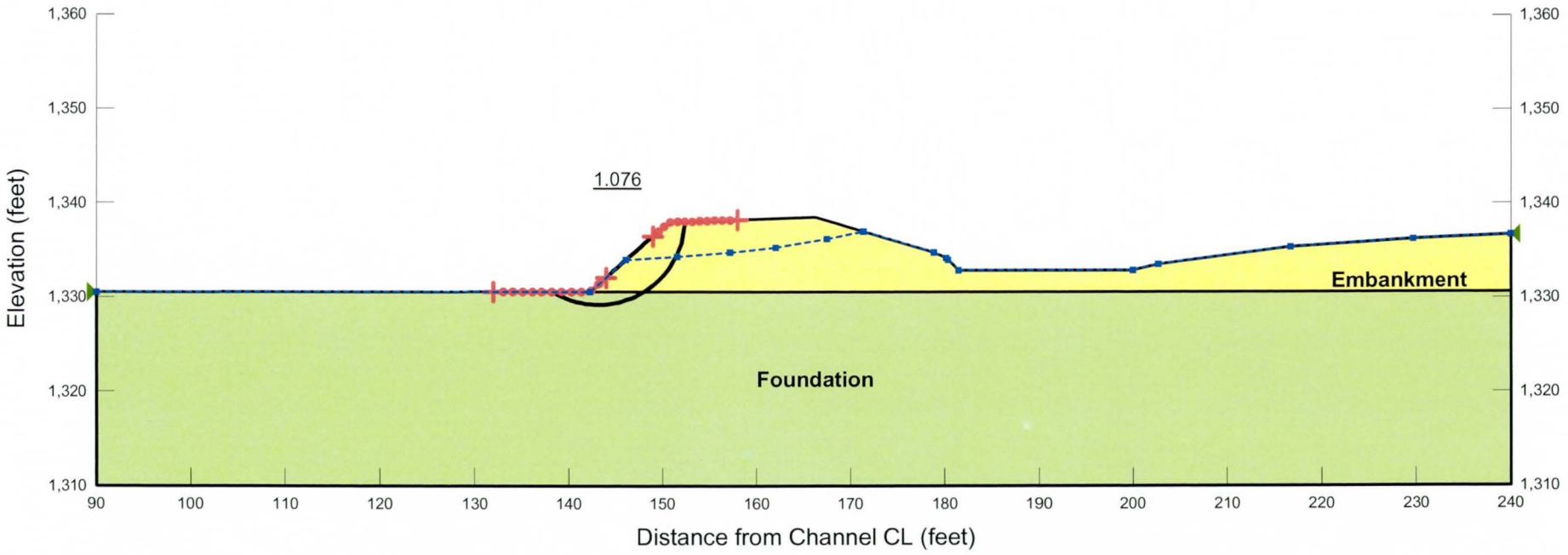


Figure C-25

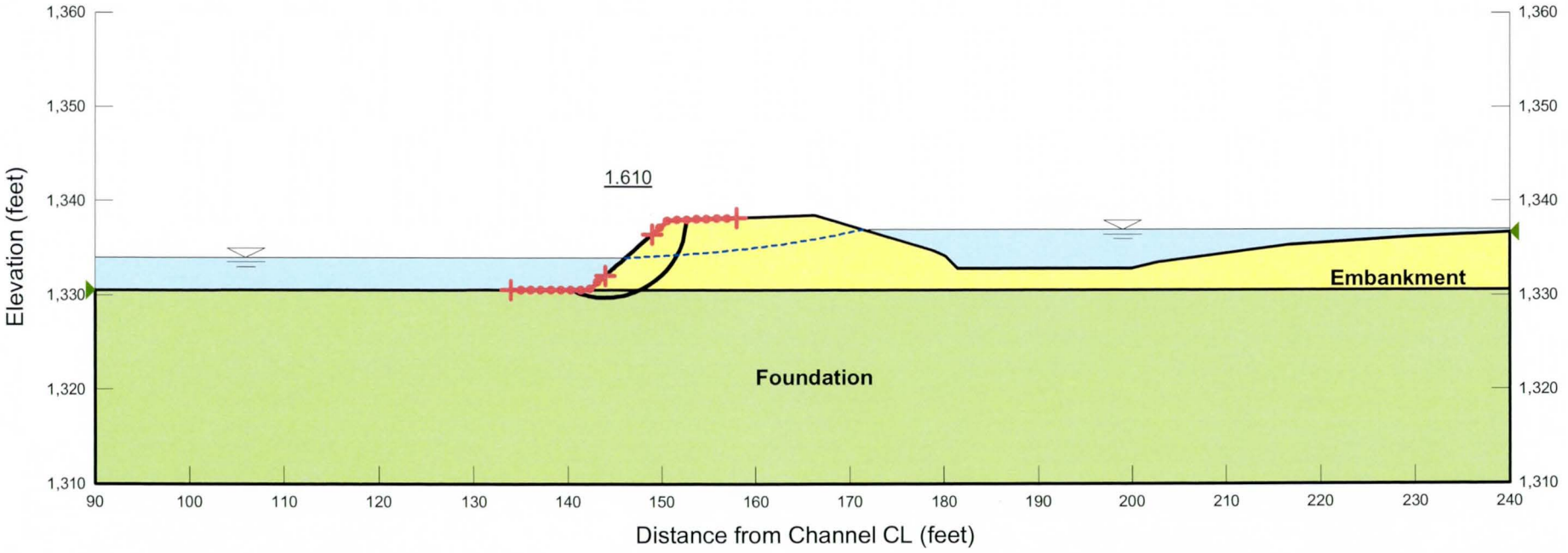
Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 183+00 (River Mile 0.92)

Case 5C - Steady State Seepage under Interior Drainage
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.61



South Levee – Station 193+00

Figure C-26

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Steady State Seepage Analysis

Soil Type	Saturated Hydraulic Conductivity, Ksat (cm/s)	Ky/Kx Ratio
Embankment	1 E-5	0.1
Foundation	1 E-3	0.1

Exit Gradient = 0

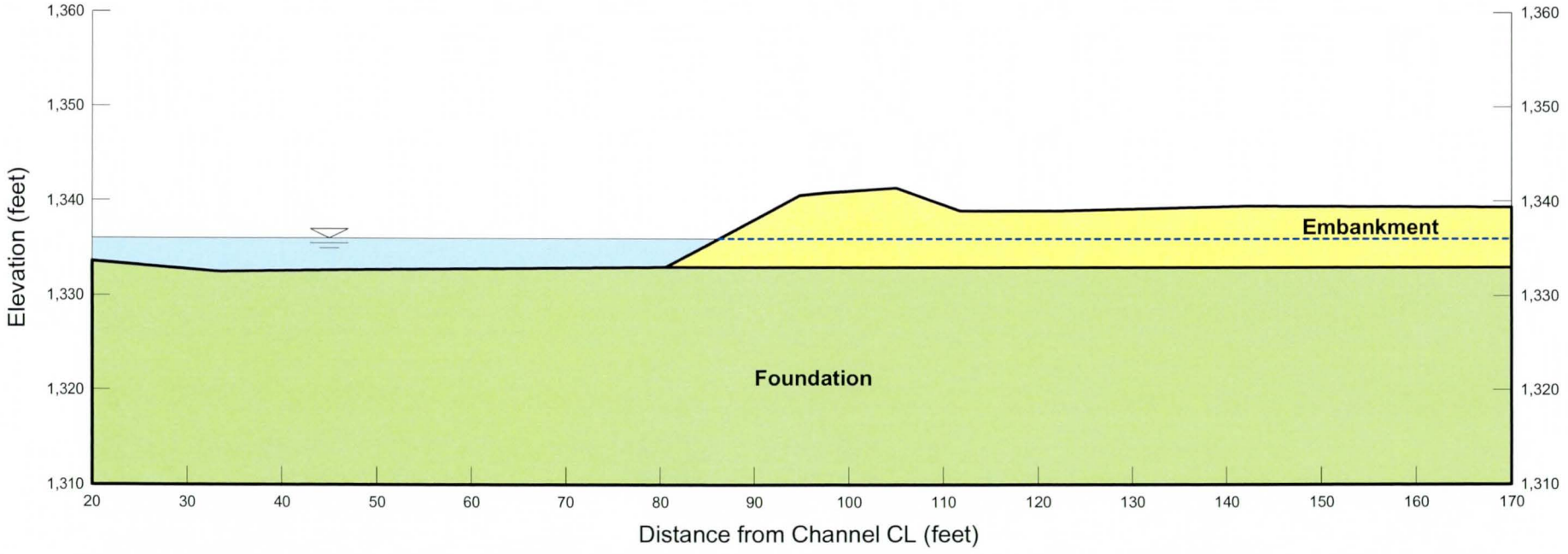


Figure C-27

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Case 1A - End of Construction
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 5.60

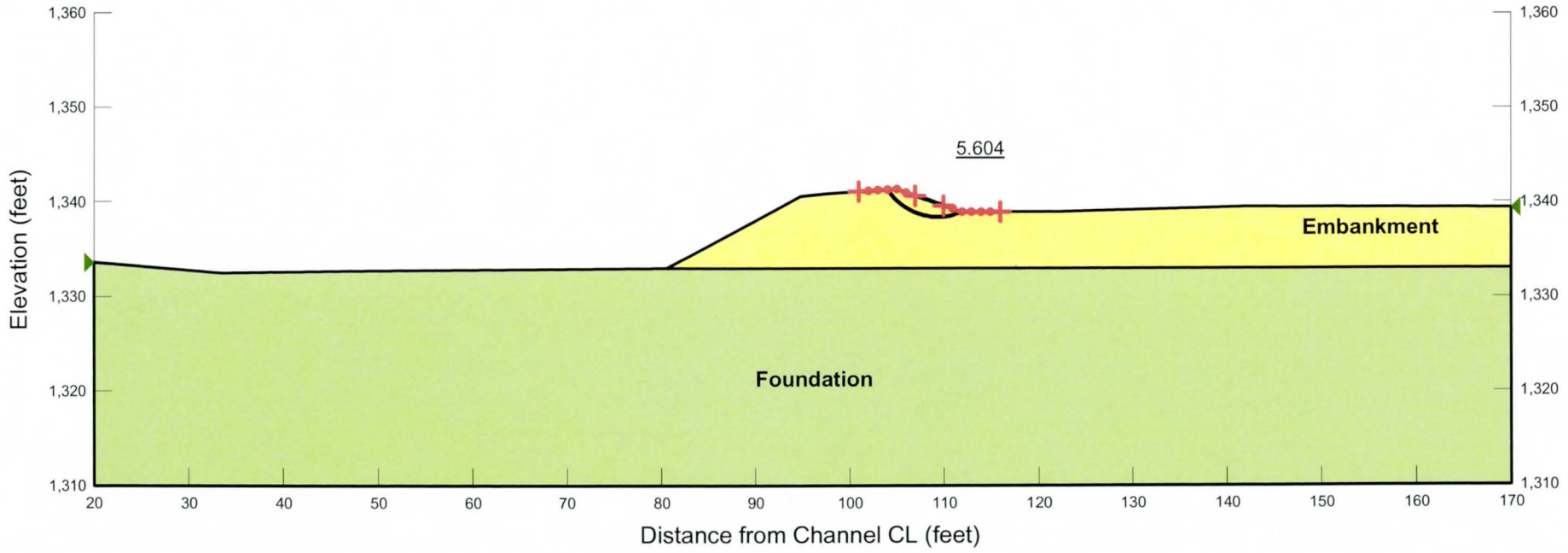


Figure C-28

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Case 1B - End of Construction
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 2.21

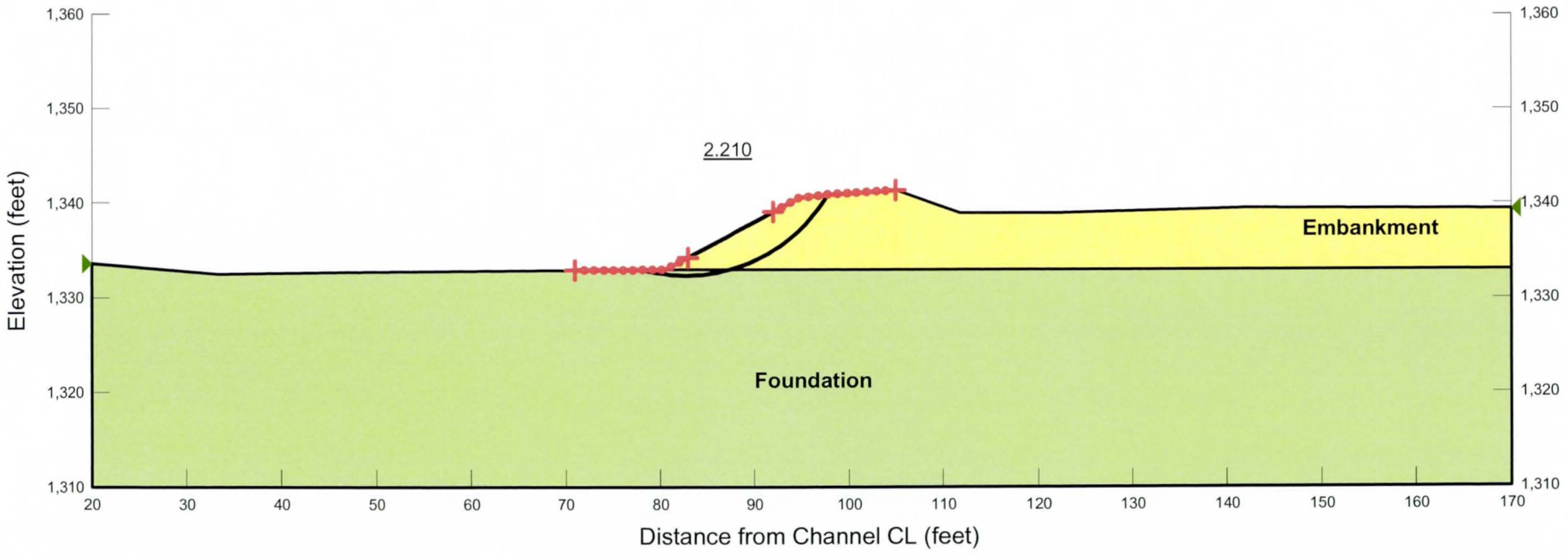


Figure C-29

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Case 2B - Sudden Drawdown
Riverside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.34

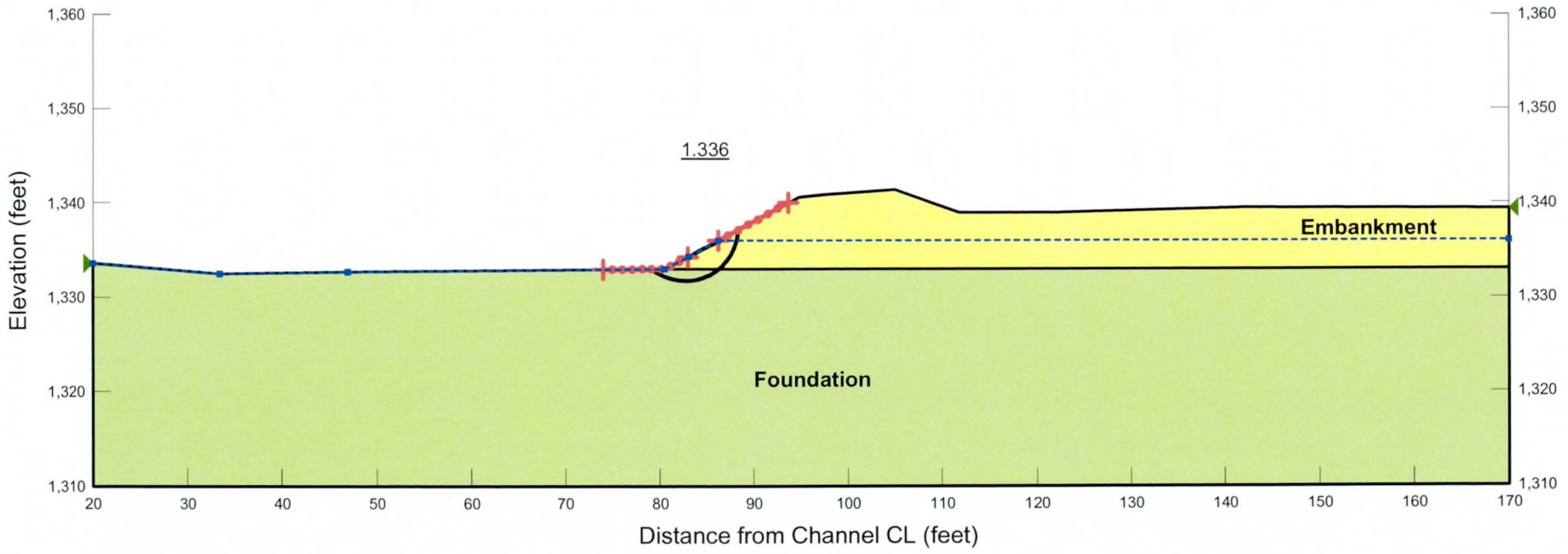


Figure C-30

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Case 3A - Steady State Seepage
Landside - Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 5.60

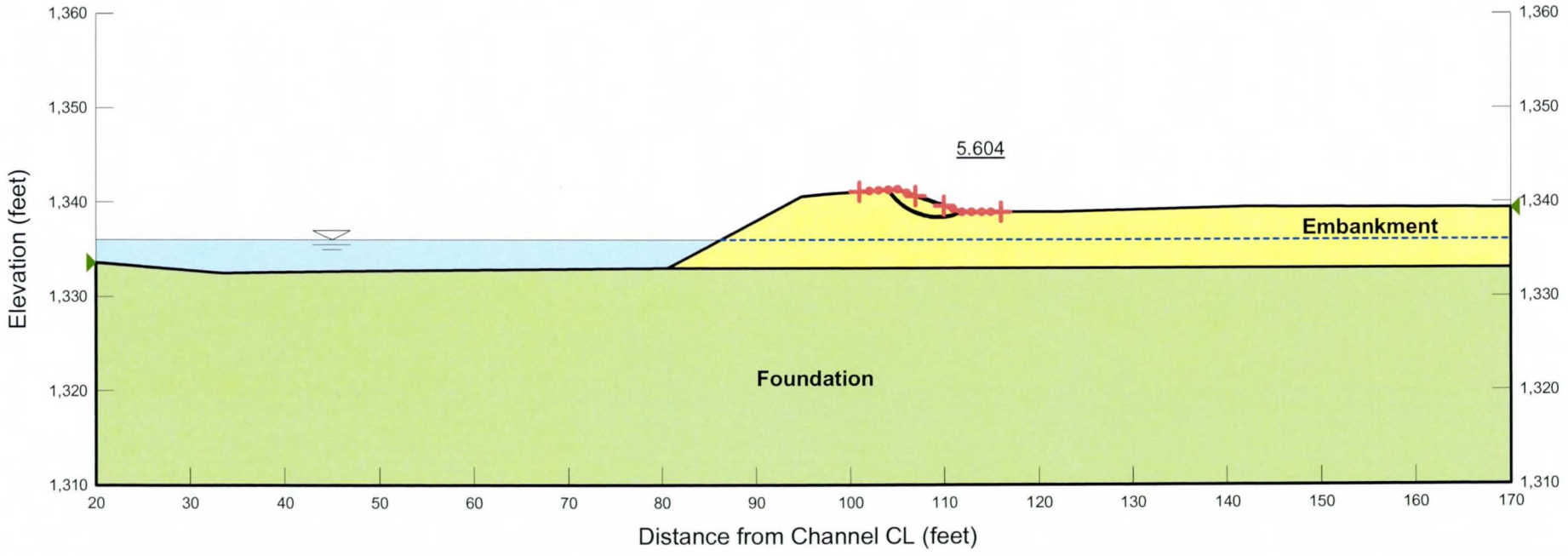


Figure C-31

Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Case 4A - End of Construction
Landside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 4.75

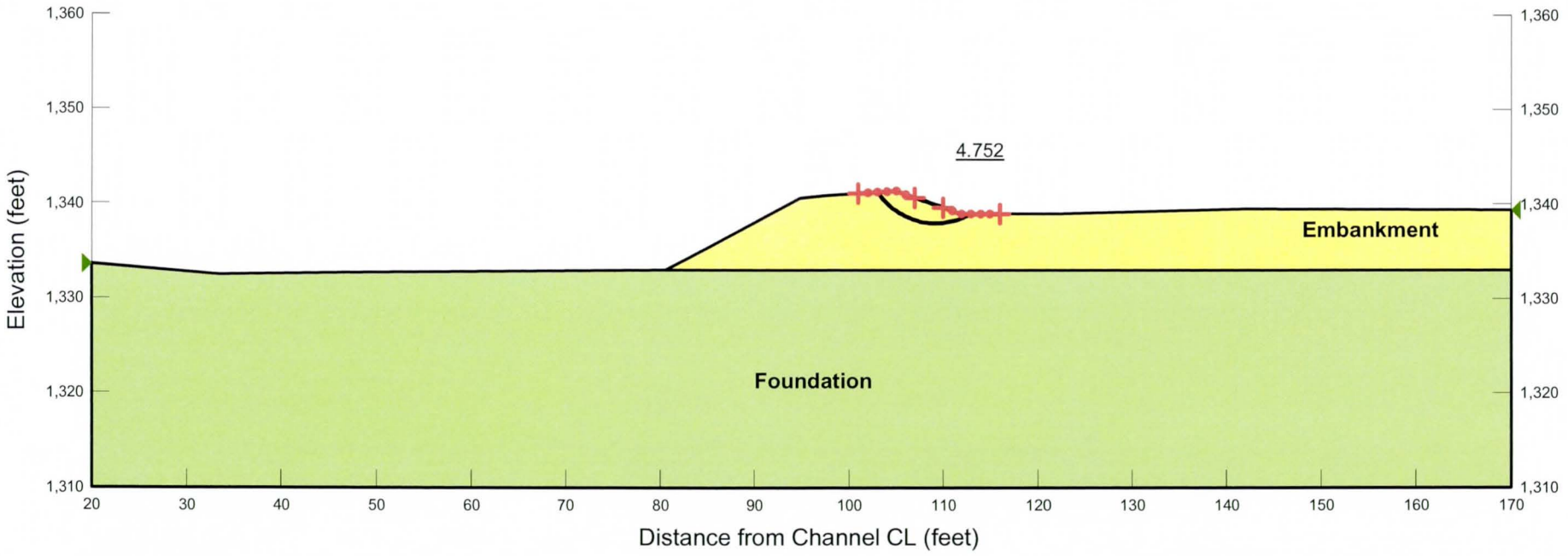


Figure C-32

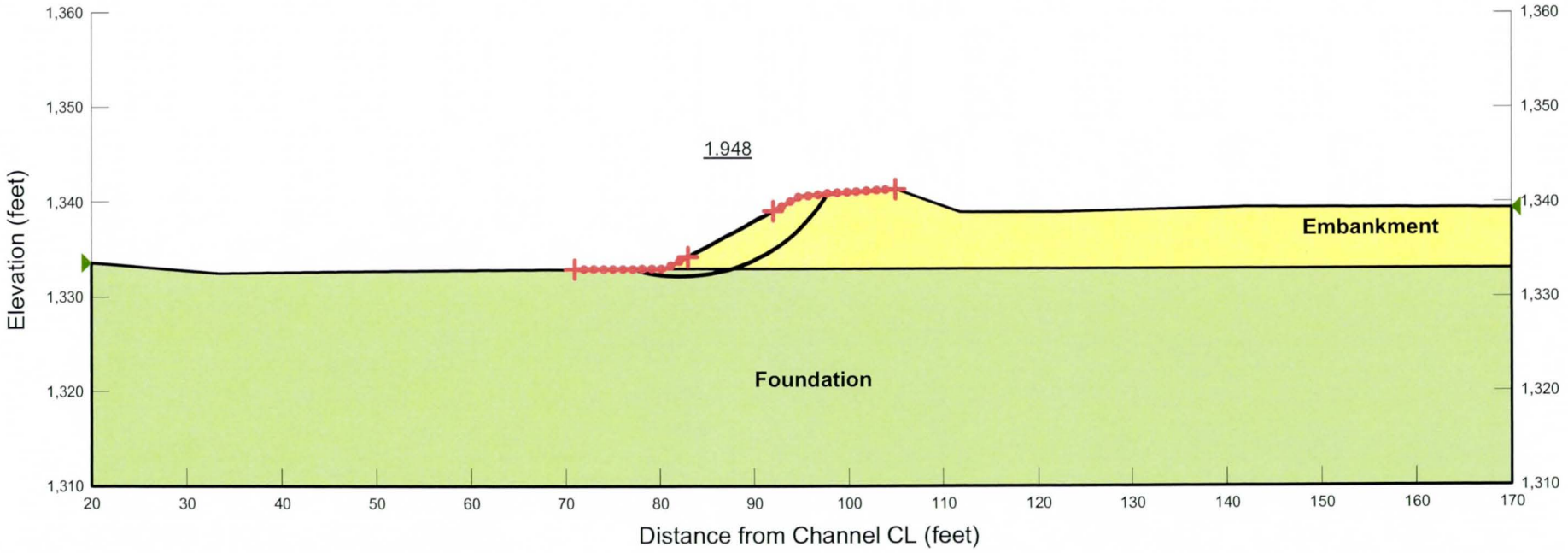
Levee Certification for Scatter Wash
North and South Banks
Scatter Wash Levees ID #1901064146 & 1901064147
AMEC Project No. 37-2014-2002

South Levee Station 193+00 (River Mile 1.139)

Case 4B - End of Construction
Riverside - Pseudo Static

Soil Type	Unit Weight (pcf)	Cohesion (psf)	Phi (degree)
Embankment	110	100	33
Foundation	115	0	34

Factor of Safety = 1.95



APPENDIX I

INTERIOR DRAINAGE ANALYSIS

RATIONAL METHOD HYDROLOGY

ID	Sub Basin Data							Sub Basin Hydrology Summary					
	Area (acres)	Length (ft)	USGE	DSGE	Slope (ft/mi)	Kb		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Major Basin ID: 01													
N1-D1	8.8	1,457	1,341.70	1,330.60	40.2	0.034	Q (cfs)	9.4	13.6	17.0	23.7	30.2	42.3
							C	0.48	0.48	0.48	0.53	0.58	0.70
							CA (ac)	4.24	4.24	4.24	4.69	5.13	6.19
							Tc (min)	15	13	12	11	10	9
							i (in/hr)	2.21	3.21	4.00	5.05	5.88	6.83
S1-D1	3.3	572	1,346.90	1,339.10	72.0	0.037	Q (cfs)	4.9	7.0	8.6	11.9	14.9	17.3
							C	0.48	0.48	0.48	0.53	0.58	0.60
							CA (ac)	1.59	1.59	1.59	1.76	1.93	1.99
							Tc (min)	7	6	6	5	5	5
							i (in/hr)	3.11	4.41	5.40	6.75	7.73	8.68
SO.PEN	56.1	5,610	1,357.30	1,332.80	23.1	0.039	Q (cfs)	34.6	52.2	66.3	93.9	119.5	146.2
							C	0.56	0.56	0.56	0.62	0.67	0.71
							CA (ac)	31.42	31.42	31.42	34.78	37.59	39.83
							Tc (min)	48	41	37	34	32	30
							i (in/hr)	1.10	1.66	2.11	2.70	3.18	3.67
S3-D1	29.6	2,137	1,342.50	1,332.80	24.0	0.051	Q (cfs)	21.6	32.7	41.6	58.9	75.7	94.9
							C	0.50	0.50	0.50	0.55	0.60	0.65
							CA (ac)	14.79	14.79	14.79	16.26	17.74	19.22
							Tc (min)	30	26	23	21	20	19
							i (in/hr)	1.46	2.21	2.81	3.62	4.27	4.94
S2-D1	10.5	1,511	1,345.90	1,336.70	32.1	0.034	Q (cfs)	15.0	21.5	27.0	37.9	45.9	53.4
							C	0.67	0.67	0.67	0.74	0.77	0.78
							CA (ac)	7.06	7.06	7.06	7.79	8.11	8.21
							Tc (min)	16	14	13	12	11	10
							i (in/hr)	2.12	3.05	3.83	4.86	5.66	6.51
DRYSID	14.9	1,838	1,342.50	1,333.10	27.0	0.033	Q (cfs)	14.0	20.1	25.0	35.3	45.3	54.1
							C	0.48	0.48	0.48	0.53	0.58	0.60
							CA (ac)	7.15	7.15	7.15	7.90	8.64	8.94

* Non default value

ID	Sub Basin Data							Sub Basin Hydrology Summary					
	Area (acres)	Length (ft)	USGE	DSGE	Slope (ft/mi)	Kb		2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Major Basin ID: 01													
							Tc (min)	19	17	15	14	13	12
							i (in/hr)	1.96	2.81	3.50	4.47	5.24	6.05
S3-O1	13.6	468	1,348.90	1,346.40	28.2	0.033	Q (cfs)	13.9	19.9	24.5	34.4	42.9	51.2
							C	0.35	0.35	0.35	0.39	0.42	0.44
							CA (ac)	4.77	4.77	4.77	5.32	5.73	6.00
							Tc (min)	8	7	7	6	6	5
							i (in/hr)	2.91	4.17	5.14	6.47	7.48	8.54
S3-SP1	24.1	2,296	1,352.70	1,342.40	23.7	0.031	Q (cfs)	32.4	47.3	59.2	83.0	104.7	111.6
							C	0.75	0.75	0.75	0.83	0.90	0.83
							CA (ac)	18.11	18.11	18.11	20.04	21.73	20.04
							Tc (min)	22	19	18	16	15	15
							i (in/hr)	1.79	2.61	3.27	4.14	4.82	5.57
N1-O1	6.7	1,173	1,339.80	1,333.80	27.0	0.035	Q (cfs)	7.0	10.2	12.8	17.8	22.7	31.5
							C	0.48	0.48	0.48	0.53	0.58	0.70
							CA (ac)	3.23	3.23	3.23	3.56	3.90	4.70
							Tc (min)	15	13	12	11	10	10
							i (in/hr)	2.17	3.16	3.95	4.99	5.81	6.71
VH-CH	8.5	1,660	1,418.10	1,334.70	265.3	0.056	Q (cfs)	11.6	16.7	20.9	28.9	36.4	45.9
							C	0.53	0.53	0.53	0.58	0.63	0.69
							CA (ac)	4.48	4.48	4.48	4.90	5.32	5.83
							Tc (min)	11	9	8	8	7	7
							i (in/hr)	2.58	3.72	4.66	5.89	6.85	7.87
S3-SP2	20.9	2,109	1,357.30	1,350.00	18.3	0.032	Q (cfs)	17.3	25.4	31.8	44.7	57.1	79.1
							C	0.48	0.48	0.48	0.53	0.58	0.70
							CA (ac)	10.01	10.01	10.01	11.06	12.10	14.60
							Tc (min)	24	20	19	17	16	15
							i (in/hr)	1.73	2.54	3.18	4.04	4.72	5.42

Sub Basin	Land Use Code	Area (acres)	Area (%)	Kb	Runoff Coefficient C					
					2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
Major Basin ID: 01										
DRYSID	130	14.90	100.0	0.033	0.48	0.48	0.48	0.53	0.58	0.60
		14.900	**100.0**							
N1-D1	140	8.84	100.0	0.034	0.48	0.48	0.48	0.53	0.58	0.70*
		8.840	**100.0**							
N1-O1	140	6.72	100.0	0.035	0.48	0.48	0.48	0.53	0.58	0.70*
		6.720	**100.0**							
S1-D1	130	3.32	100.0	0.037	0.48	0.48	0.48	0.53	0.58	0.60
		3.320	**100.0**							
S2-D1	130	5.27	50.0	0.034	0.48	0.48	0.48	0.53	0.58	0.60
	220	3.16	30.0	0.034	0.85	0.85	0.85	0.94	0.95	0.95
	530	2.11	20.0	0.034	0.85	0.85	0.85	0.94	0.95	0.95
		10.540	**100.0**							
S3-D1	130	14.79	50.0	0.031	0.48	0.48	0.48	0.53	0.58	0.60
	140	7.39	25.0	0.031	0.48	0.48	0.48	0.53	0.58	0.70*
	730	7.39	25.0	0.113	0.55	0.55	0.55	0.61	0.66	0.69
		29.570	**100.0**							
S3-O1	520	2.73	20.0	0.033	0.75	0.75	0.75	0.83	0.90	0.94
	710	10.91	80.0	0.033	0.25	0.25	0.25	0.28	0.30	0.31
		13.640	**100.0**							
S3-SP1	160	21.73	90.0	0.031	0.75	0.75	0.75	0.83	0.90	0.82*
	520	2.41	10.0	0.031	0.75	0.75	0.75	0.83	0.90	0.94
		24.140	**100.0**							
S3-SP2	140	20.86	100.0	0.032	0.48	0.48	0.48	0.53	0.58	0.70*
		20.860	**100.0**							
SO.PEN	130	22.48	40.1	0.029	0.48	0.48	0.48	0.53	0.58	0.60
	140	13.31	23.7	0.029	0.48	0.48	0.48	0.53	0.58	0.70*
	160	6.84	12.2	0.029	0.75	0.75	0.75	0.83	0.90	0.94
	220	3.16	5.6	0.029	0.85	0.85	0.85	0.94	0.95	0.95
	520	0.76	1.4	0.029	0.75	0.75	0.75	0.83	0.90	0.94
	530	2.11	3.8	0.029	0.85	0.85	0.85	0.94	0.95	0.95
	730	7.39	13.2	0.106	0.55	0.55	0.55	0.61	0.66	0.69
		56.050	**100.0**							
VH-CH	140	3.00	35.5	0.034	0.48	0.48	0.48	0.53	0.58	0.70*
	730	5.45	64.5	0.067	0.55	0.55	0.55	0.61	0.66	0.69
		8.450	**100.0**							

ID	Method	Duration	2 Year	5 Year	10 Year	25 Year	50 Year	100 Year
DEFAULT	NOAA14	5 MIN	0.287	0.388	0.465	0.566	0.644	0.723
	NOAA14	10 MIN	0.438	0.590	0.708	0.861	0.980	1.101
	NOAA14	15 MIN	0.543	0.731	0.877	1.067	1.215	1.365
	NOAA14	30 MIN	0.731	0.985	1.181	1.437	1.636	1.838
	NOAA14	1 HOUR	0.904	1.219	1.462	1.779	2.025	2.275
	NOAA14	2 HOUR	1.040	1.384	1.648	2.002	2.273	2.550
	NOAA14	3 HOUR	1.072	1.411	1.678	2.041	2.324	2.614
	NOAA14	6 HOUR	1.245	1.587	1.859	2.235	2.526	2.829
	NOAA14	12 HOUR	1.412	1.783	2.074	2.463	2.765	3.074
	NOAA14	24 HOUR	1.607	2.068	2.433	2.938	3.339	3.758

DDMSW INPUT

Client:	FCDMC	Sheet	1	of 1
Project:	Scatter Wash	Date:	7/16/2014	
Design:	DDMSW Inputs			
Prepared By:	afc	Checked By:	RKB	

NAME	Land Use Area(ac)	Land Use %	Land Use Code	C100	Length (ft)	US ELE	DS ELE	
N1-D1	8.84	100	140	0.7	1,457	1341.7	1,330.6	
S1-D1	3.32	100	130	0.6	572	1,346.9	1,339.1	
S3-D1	14.79	50	130	0.6	2,137	1,342.5	1,332.8	
	7.39	25	140	0.7				
	7.39	25	730	0.7				
S2-D1	2.11	20	530	0.95	1,511	1,345.9	1,336.7	
	3.16	30	220	0.95				
	5.27	50	130	0.6				
S3-O1	10.91	80	710	0.31	468	1348.9	1,346.4	
	2.73	20	520	0.95				
NC-1	8.96	100			998	1350.5	1,343.9	non contributing
NC-2	16.85	100			1,626	1352.8	1,347.9	non contributing
S3-SP1	21.73	90	160	0.82	2,296	1,352.7	1,342.4	
	2.41	10	520	0.95				
N1-O1	6.72	100	140	0.7	1,173	1339.8	1333.8	
VH-Ch	5.45	64	730	0.69	1,660	1418.1	1334.7	
	3.00	36	140	0.7				
S3-SP2	20.86	100	140	0.7	2109	1357.3	1350.0	
South Peneteration Pond S3	56.05			0.70	5610	1357.3	1332.8	

NOAA Atlas 14, Volume 1, Version 5
Location name: Phoenix, Arizona, US*
Latitude: 33.6662°, Longitude: -112.1350°
Elevation: 1351ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

Sanja Perica, Sarah Dietz, Sarah Heim, Lillian Hiner, Kazungu Maitaria, Deborah Martin, Sandra Pavlovic, Ishani Roy, Carl Trypaluk, Dale Unruh, Fenglin Yan, Michael Yekta, Tan Zhao, Geoffrey Bonnin, Daniel Brewer, Li-Chuan Chen, Tye Parzybok, John Yarchoan

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval(years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	0.221 (0.182-0.272)	0.287 (0.239-0.355)	0.388 (0.317-0.478)	0.465 (0.378-0.571)	0.566 (0.454-0.694)	0.644 (0.511-0.786)	0.723 (0.564-0.878)	0.803 (0.616-0.973)	0.909 (0.681-1.10)	0.991 (0.726-1.21)
10-min	0.336 (0.277-0.414)	0.438 (0.363-0.541)	0.590 (0.483-0.727)	0.708 (0.576-0.869)	0.861 (0.691-1.06)	0.981 (0.779-1.20)	1.10 (0.860-1.34)	1.22 (0.938-1.48)	1.38 (1.04-1.68)	1.51 (1.11-1.84)
15-min	0.416 (0.344-0.513)	0.542 (0.451-0.670)	0.731 (0.599-0.901)	0.877 (0.713-1.08)	1.07 (0.857-1.31)	1.22 (0.965-1.48)	1.37 (1.07-1.66)	1.52 (1.16-1.84)	1.71 (1.28-2.08)	1.87 (1.37-2.28)
30-min	0.561 (0.463-0.691)	0.730 (0.606-0.903)	0.985 (0.806-1.21)	1.18 (0.961-1.45)	1.44 (1.15-1.76)	1.64 (1.30-2.00)	1.84 (1.44-2.23)	2.04 (1.57-2.47)	2.31 (1.73-2.80)	2.52 (1.85-3.07)
60-min	0.694 (0.573-0.855)	0.904 (0.751-1.12)	1.22 (0.998-1.50)	1.46 (1.19-1.80)	1.78 (1.43-2.18)	2.03 (1.61-2.47)	2.28 (1.78-2.76)	2.53 (1.94-3.06)	2.86 (2.14-3.47)	3.12 (2.28-3.80)
2-hr	0.808 (0.675-0.983)	1.04 (0.867-1.28)	1.39 (1.15-1.68)	1.65 (1.35-2.00)	2.00 (1.62-2.41)	2.27 (1.81-2.73)	2.55 (2.00-3.05)	2.83 (2.18-3.38)	3.20 (2.41-3.83)	3.49 (2.58-4.20)
3-hr	0.841 (0.700-1.03)	1.07 (0.897-1.32)	1.41 (1.17-1.73)	1.68 (1.38-2.04)	2.04 (1.66-2.47)	2.33 (1.86-2.79)	2.62 (2.06-3.15)	2.93 (2.27-3.52)	3.37 (2.54-4.04)	3.71 (2.72-4.45)
6-hr	0.988 (0.846-1.18)	1.25 (1.07-1.49)	1.59 (1.35-1.89)	1.86 (1.57-2.20)	2.24 (1.86-2.62)	2.53 (2.07-2.95)	2.83 (2.28-3.30)	3.14 (2.49-3.66)	3.56 (2.75-4.16)	3.89 (2.94-4.55)
12-hr	1.13 (0.969-1.33)	1.41 (1.22-1.67)	1.79 (1.53-2.10)	2.08 (1.76-2.44)	2.47 (2.07-2.90)	2.77 (2.29-3.23)	3.08 (2.51-3.60)	3.39 (2.74-3.97)	3.81 (3.00-4.48)	4.13 (3.19-4.88)
24-hr	1.27 (1.09-1.49)	1.61 (1.38-1.89)	2.07 (1.77-2.43)	2.44 (2.08-2.85)	2.95 (2.49-3.42)	3.35 (2.80-3.89)	3.77 (3.12-4.38)	4.20 (3.44-4.87)	4.80 (3.87-5.58)	5.28 (4.20-6.16)
2-day	1.33 (1.14-1.54)	1.69 (1.45-1.96)	2.20 (1.88-2.55)	2.61 (2.21-3.01)	3.17 (2.68-3.65)	3.61 (3.02-4.16)	4.08 (3.38-4.71)	4.56 (3.73-5.27)	5.22 (4.22-6.08)	5.75 (4.56-6.73)
3-day	1.39 (1.21-1.61)	1.78 (1.54-2.06)	2.33 (2.01-2.70)	2.78 (2.39-3.20)	3.41 (2.90-3.92)	3.91 (3.31-4.50)	4.44 (3.72-5.12)	5.00 (4.15-5.77)	5.78 (4.73-6.69)	6.41 (5.18-7.46)
4-day	1.46 (1.27-1.69)	1.87 (1.63-2.16)	2.47 (2.14-2.85)	2.95 (2.56-3.40)	3.64 (3.13-4.19)	4.20 (3.59-4.83)	4.80 (4.07-5.52)	5.43 (4.56-6.26)	6.34 (5.25-7.31)	7.07 (5.79-8.19)
7-day	1.64 (1.42-1.90)	2.10 (1.82-2.43)	2.77 (2.40-3.21)	3.32 (2.86-3.84)	4.10 (3.51-4.72)	4.72 (4.02-5.45)	5.39 (4.55-6.22)	6.11 (5.11-7.06)	7.12 (5.88-8.25)	7.95 (6.49-9.24)
10-day	1.79 (1.55-2.06)	2.29 (1.99-2.64)	3.02 (2.62-3.48)	3.61 (3.12-4.16)	4.44 (3.82-5.10)	5.11 (4.37-5.87)	5.83 (4.94-6.69)	6.58 (5.54-7.57)	7.64 (6.35-8.81)	8.50 (6.98-9.83)
20-day	2.19 (1.91-2.50)	2.82 (2.46-3.22)	3.72 (3.25-4.24)	4.40 (3.83-5.02)	5.33 (4.62-6.08)	6.04 (5.22-6.89)	6.78 (5.81-7.73)	7.53 (6.42-8.60)	8.54 (7.22-9.79)	9.32 (7.81-10.7)
30-day	2.57 (2.23-2.95)	3.30 (2.87-3.80)	4.36 (3.78-5.00)	5.16 (4.46-5.91)	6.24 (5.36-7.15)	7.07 (6.06-8.10)	7.93 (6.76-9.08)	8.80 (7.46-10.1)	9.97 (8.38-11.5)	10.9 (9.07-12.5)
45-day	3.00 (2.63-3.42)	3.87 (3.38-4.41)	5.09 (4.45-5.81)	6.01 (5.23-6.84)	7.22 (6.26-8.22)	8.13 (7.03-9.27)	9.06 (7.79-10.3)	9.99 (8.55-11.4)	11.2 (9.53-12.9)	12.2 (10.3-14.0)
60-day	3.32 (2.92-3.78)	4.29 (3.77-4.87)	5.64 (4.95-6.40)	6.63 (5.79-7.52)	7.92 (6.90-8.98)	8.89 (7.71-10.1)	9.85 (8.51-11.2)	10.8 (9.29-12.3)	12.1 (10.3-13.8)	13.0 (11.0-14.9)

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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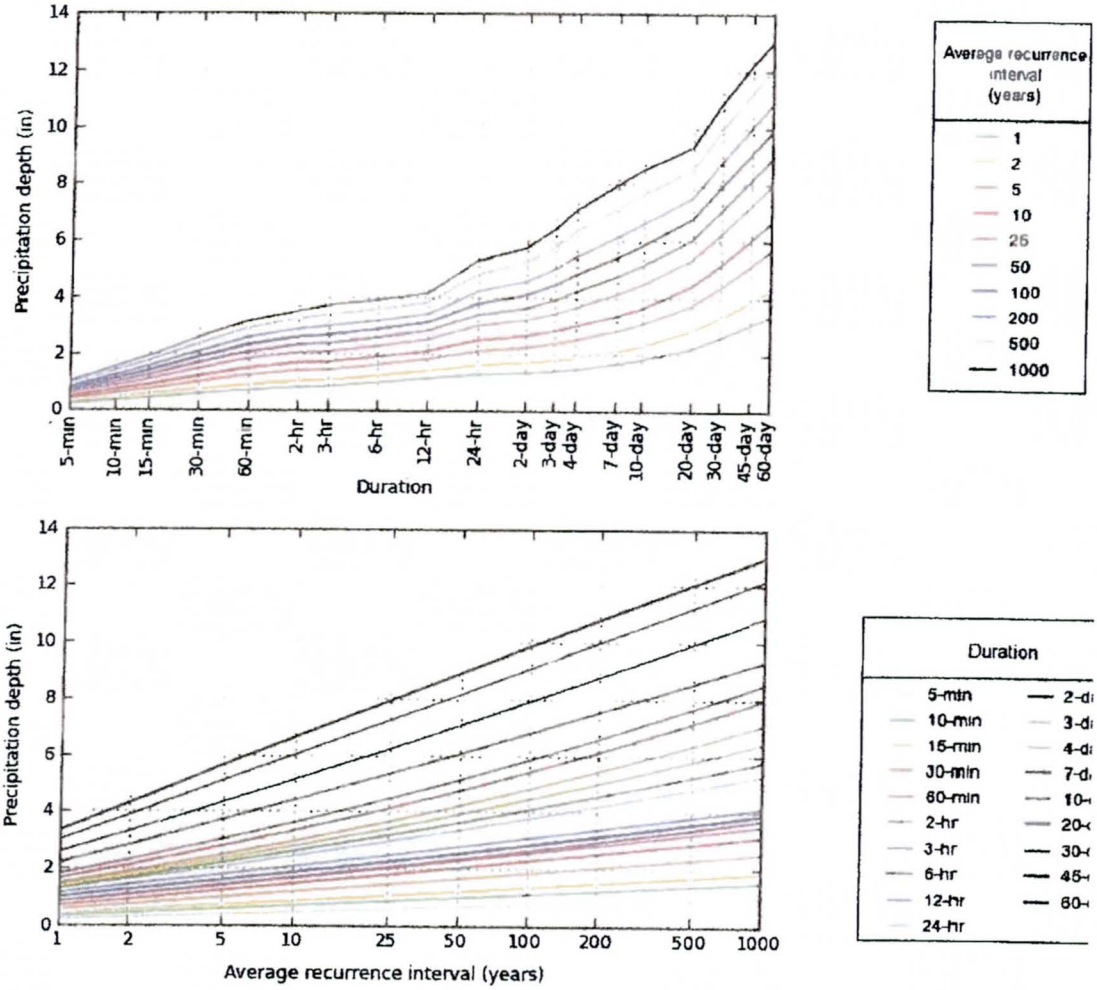
PF graphical

PDS-based depth-duration-frequency (DDF) curves
Latitude: 33.6662°, Longitude: -112.1350°



NOAA Atlas 14, Volume 1, Version 5

Created (GMT): Wed Apr 9 02:13:22 2014

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Maps & aerials

Small scale terrain

AVAILABLE RETENTION VOLUME CALCULATIONS

Client:	FCDMC	Sheet	1	of 1
Project:	Scatter Wash	Date:	7/17/2014	
Design:	Volume Estimate			
Prepared By:	afc	Checked By:		

Pond Name	Pond Location	Water Surface Elevation	Available Volume
		ft	acre-ft
N1-O1	Within subdivision in subbasin N1-O1	1333.5	0.98
N1-D1*	North of North Levee Outlet	1331.8	1.28
S1-D1	Northernmost pond that overflows to S2	1338.9	0.23
S2-D1	North of S3 and captures overflow from S1	1337.2	0.07
S3-D1**	South of South Levee Outlet	1335.9	2.90

* Note: for N1-D1 basin statistics are reported with respect to the weir elevation (1331.8).

* Note: for S3-D1 basin statistics are reported with respect to the weir elevation (1335.9).

Proposed Retention Basin Sizing

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/14/2014	
Design:	N1-O1 Volume Estimate			
Prepared By:	RR	Checked By:	BJS	

Choose Volume Calculation ("Area" or "Cone"): *cone*

Cone Approximation: Volume = $1/3h[(A_2+A_1)+(A_2*A_1)^{1/2}]$

Ave. End Area: Volume = [(A1 + A2)/2]*E

Retention Basin Requirements

SE = 1.4

Retention Basin:

Elevation (ft)		Elevation Increment (ft)	Area (sf)	(ac)	Incremental Volume (ac-f)	(cf)	Total Volume (ac-ft)	(cf)
SE = 1330.25		0.0	206.9	0.00	0.00	0.00	0.00	0.0
SE = 1330.50	SE = 0.25	0.3	1,601.5	0.04	0.005	198.67	0.00	198.7
SE = 1330.75	SE = 0.50	0.3	3,572.4	0.08	0.014	630.48	0.02	829.2
SE = 1331.00	SE = 0.75	0.3	5,210.3	0.12	0.025	1091.42	0.04	1,920.6
SE = 1331.25	SE = 1.00	0.3	7,562.6	0.2	0.04	1587.51	0.08	SV = 3508.080
SE = 1331.50	SE = 1.25	0.3	9,143.8	0.2	0.05	2085.18	0.13	SV = 5593.255
SE = 1331.75	SE = 1.50	0.3	11,703.5	0.3	0.06	2599.34	0.19	SV = 8192.595
SE = 1332.00	SE = 1.75	0.3	15,437.9	0.4	0.08	3381.92	0.27	SV = 11574.514
SE = 1332.25	SE = 2.00	0.3	17,987.0	0.4	0.10	4174.06	0.36	SV = 15748.571
SE = 1332.50	SE = 2.25	0.3	19,912.3	0.5	0.11	4735.37	0.47	SV = 20483.944
SE = 1333.00	SE = 2.75	0.5	22,258.1	0.5	0.24	10537.16	0.71	SV = 31021.103
SE = 1333.50	SE = 3.3	0.5	24,526.5	0.6	0.27	11691.56	0.98	SV = 42712.668

Proposed Retention Basin Sizing

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	7/17/2014	
Design:	N1-D1 Volume Estimate			
Prepared By:	afc	Checked By:		

Choose Volume Calculation ("Area" or "Cone"): *cone*

Cone Approximation: Volume = $1/3h[(A_2+A_1)+(A_2*A_1)^{1/2}]$

Ave. End Area: Volume = [(A1 + A2)/2]*E

Retention Basin Requirements

SE = 1.1

Retention Basin:

Elevation (ft)		Elevation Increment (ft)	Area (sf)	Area (ac)	Incremental Volume (ac-f)	Incremental Volume (cf)	Total Volume (ac-ft)	Total Volume (cf)
SE = 1327.83		0.0	170.8	0.00	0.00	0.00	0.00	0.0
SE = 1327.87	SE = 0.04	0.0	515.4	0.01	0.000	14.09	0.00	14.1
SE = 1327.94	SE = 0.11	0.1	1,536.1	0.04	0.001	63.73	0.00	77.8
SE = 1327.95	SE = 0.12	0.0	1,992.3	0.05	0.000	21.11	0.00	98.9
SE = 1328.07	SE = 0.25	0.1	5,572.5	0.1	0.01	454.03	0.01	SV = 552.959
SE = 1328.31	SE = 0.49	0.2	9,171.2	0.2	0.04	1751.40	0.05	SV = 2304.360
SE = 1328.64	SE = 0.81	0.3	11,697.9	0.3	0.08	3351.68	0.13	SV = 5656.039
SE = 1328.94	SE = 1.11	0.3	13,013.7	0.3	0.09	3729.69	0.22	SV = 9385.731
SE = 1329.90	SE = 2.07	1.0	14,881.0	0.3	0.31	13421.28	0.52	SV = 22807.015
SE = 1330.43	SE = 2.60	0.5	15,734.3	0.4	0.19	8081.39	0.71	SV = 30888.407
SE = 1330.93	SE = 3.10	0.5	17,609.9	0.4	0.19	8348.30	0.90	SV = 39236.707
SE = 1331.11	SE = 3.3	0.2	18,703.0	0.4	0.07	3195.05	0.97	SV = 42431.756
SE = 1331.63	SE = 3.8	0.5	23,048.1	0.5	0.25	10877.31	1.22	SV = 53309.068
SE = 1331.65	SE = 3.8	0.0	23,429.9	0.5	0.01	441.54	1.23	SV = 53750.604
SE = 1331.69	SE = 3.9	0.0	24,064.0	0.6	0.02	1021.09	1.26	SV = 54771.692
SE = 1331.74	SE = 3.9	0.0	24,707.1	0.6	0.03	1121.70	1.28	SV = 55893.394
SE = 1332.10	SE = 4.3	0.4	24,708.1	0.6	0.21	9018.27	1.49	SV = 64911.661

Overflow Condition

Proposed Retention Basin Sizing

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/8/2014	
Design:	S1-D1 Volume Estimate			
Prepared By:	RR	Checked By:		

Choose Volume Calculation ("Area" or "Cone"): *cone*

Cone Approximation: Volume = $1/3h[(A_2+A_1)+(A_2 \cdot A_1)^{1/2}]$

Ave. End Area: Volume = [(A1 + A2)/2]*E

Retention Basin Requirements

SE = 0.3

Retention Basin:

Elevation (ft)		Elevation Increment (ft)	Area (sf)	(ac)	Incremental Volume (ac-f)	(cf)	Total Volume (ac-ft)	(cf)
SE = 1337.69		0.0	263.1	0.01	0.00	0.00	0.00	0.0
SE = 1337.71	SE = 0.02	0.0	851.9	0.02	0.000	10.06	0.00	10.1
SE = 1337.73	SE = 0.04	0.0	1,881.6	0.04	0.001	30.66	0.00	40.7
SE = 1337.77	SE = 0.08	0.0	3,529.3	0.08	0.002	90.53	0.00	131.3
SE = 1337.79	SE = 0.10	0.0	4,349.8	0.1	0.00	90.45	0.01	SV = 221.699
SE = 1337.81	SE = 0.12	0.0	4,779.8	0.1	0.00	73.01	0.01	SV = 294.710
SE = 1337.86	SE = 0.17	0.1	5,660.2	0.1	0.01	271.12	0.01	SV = 565.828
SE = 1337.87	SE = 0.18	0.0	5,804.1	0.1	0.00	63.05	0.01	SV = 628.880
SE = 1338.41	SE = 0.72	0.5	9,991.8	0.2	0.10	4198.41	0.11	SV = 4827.292
SE = 1338.52	SE = 0.83	0.1	10,492.6	0.2	0.03	1116.29	0.14	SV = 5943.581
SE = 1338.87	SE = 1.18	0.4	12,167.3	0.3	0.09	3995.84	0.23	SV = 9939.421

Proposed Retention Basin Sizing

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	6/20/2014	
Design:	S2-D1 Volume Estimate			
Prepared By:	RR	Checked By:		

Choose Volume Calculation ("Area" or "Cone"): *cone*

Cone Approximation: Volume = $1/3h[(A_2+A_1)+(A_2*A_1)^{1/2}]$

Ave. End Area: Volume = [(A1 + A2)/2]*E

Retention Basin Requirements

SE = 0.3

Retention Basin:

Elevation (ft)		Elevation Increment (ft)	Area (sf)	(ac)	Incremental Volume (ac-f)	(cf)	Total Volume (ac-ft)	(cf)
SE = 1336.31		0.0	167.9	0.004	0.00	0.00	SV = 0.00	0.0
SE = 1336.34	SE = 0.03	0.0	321.6	0.007	0.000	6.74	SV = 0.00	6.7
SE = 1336.42	SE = 0.10	0.0	824.2	0.019	0.00	5.62	SV = 0.00	SV = 49.648
SE = 1336.43	SE = 0.12	0.0	933.3	0.021	0.00	15.81	SV = 0.00	SV = 65.455
SE = 1336.56	SE = 0.25	0.1	1,851.6	0.043	0.00	173.55	SV = 0.01	SV = 239.003
SE = 1336.64	SE = 0.3	0.1	2,546.7	0.058	0.00	173.01	SV = 0.01	SV = 412.010
SE = 1336.67	SE = 0.4	0.0	2,867.8	0.066	0.00	91.99	SV = 0.01	SV = 504.003
SE = 1336.76	SE = 0.4	0.1	3,716.5	0.085	0.01	282.33	SV = 0.02	SV = 786.337
SE = 1336.81	SE = 0.5	0.1	4,316.3	0.099	0.01	220.69	SV = 0.02	SV = 1007.032
SE = 1336.9	SE = 0.5	0.0	4,793.2	0.110	0.00	191.21	SV = 0.03	SV = 1198.244
SE = 1337.0	SE = 0.7	0.1	5,990.5	0.138	0.02	677.97	SV = 0.04	SV = 1876.217
SE = 1337.2	SE = 0.8	0.2	7,293.4	0.167	0.03	1114.05	SV = 0.07	SV = 2990.270

Proposed Retention Basin Sizing

Freeboard = 0 ft

Blue = These Cells are for Entering Data and are linked to "**Bsn. given Vol. calc. WS**"
Green = Indicates Calculations Performed by Spreadsheet

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	6/20/2014	
Design:	S3-D1 Volume Estimate			
Prepared By:	RR	Checked By:		

Choose Volume Calculation ("Area" or "Cone"): *cone*

Proposed Side Slope: 4 X:1

Cone Approximation: Volume = $1/3h[(A_2+A_1)+(A_2 \cdot A_1)^{1/2}]$
Ave. End Area: Volume = [(A1 + A2)/2]*E

Retention Basin Requirements

SE = 1.5

Retention Basin:

Elevation (ft)		Elevation Increment (ft)	Area (sf)	Area (ac)	Incremental Volume (ac-f)	Incremental Volume (cf)	Total Volume (ac-ft)	Total Volume (cf)
SE = 1331.00		0.0	0.0	0.00	0.00	0.00	0.00	0.0
SE = 1333.00	SE = 0.00	2.0	4,037.0	0.09	0.062	2691.33	0.06	2,691.3
SE = 1333.50	SE = 0.50	0.5	13,814.0	0.32	0.097	4219.79	0.16	6,911.1
SE = 1334.00	SE = 1.00	0.5	21,124.0	0.48	0.199	8670.06	0.36	15,581.2
SE = 1334.50	SE = 1.50	0.5	28,204.0	0.65	0.282	12289.44	0.64	27,870.6
SE = 1335.00	SE = 2.00	0.5	43,925.0	1.01	0.411	17887.74	1.05	SV = 45758.363
SE = 1335.50	SE = 2.50	0.5	90,009.0	2.07	0.753	32802.00	1.80	SV = 78560.367
SE = 1335.90	SE = 2.90	0.4	152,167.0	3.49	1.100	47894.35	2.90	SV = 126454.716
SE = 1336.00	SE = 3.00	0.1	170,319.0	3.91	0.370	16115.78	3.27	SV = 142570.494
SE = 1336.10	SE = 3.10	0.1	179,851.0	4.13	0.402	17506.34	3.67	SV = 160076.832
SE = 1336.30	SE = 3.30	0.2	198,198.0	4.55	0.868	37790.05	4.54	SV = 197866.883
SE = 1336.50	SE = 3.50	0.2	214,315.0	4.92	0.947	41240.80	5.49	SV = 239107.684

Overflow Condition

6/28/2014

FLOW ATTENUATION CALCULATIONS

Client:	FCDMC	Sheet	1	of 1
Project:	Scatter Wash	Date:	7/16/2014	
Design:	Volume @ North Culvert Summary			
Prepared By:	afc	Checked By:	RAS	

NAME	AREA (ac)	C100	Available Volume	100 yr, 2-hr Volume	Rainfall Volume Plus Upstream Overflow Volume	Overflow Volume
			acre-ft	acre-ft	acre-ft	acre-ft
N1-O1	6.72	0.7	0.98	1.00		0.02
N1-D1	8.84	0.7	0.9	1.32	1.34	0.44
				Total Volume at North Culvert		1.34
				Volume Capacity Before Downstream Flow		1.28
				Total Overflow Volume Escaping Downstream		0.06

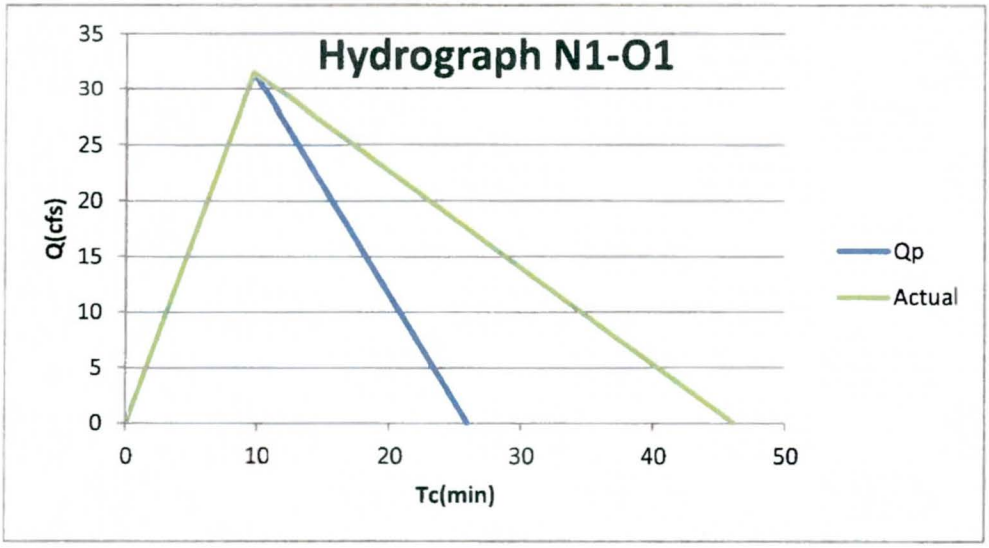
Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/14/2014	
Design:	Attenuated Flow Summary			
Prepared By:	RR	Checked By:		RJS

Basin	Peak Flow without Upstream Flow	Peak Flow with Upstream Flow	Attenuated Flow
	cfs	cfs	cfs
N1-O1	31.5	-	5.0
N1-D1	42.3	47.3	23.7
S1-D1	17.3	-	12.6
S2-D1	53.4	66.0	66.0

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/14/2014	
Design:	N1-O1 Attenuation			
Prepared By:	RR	Checked By:		RJS

Name	Area
N1-O1	6.72

Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	24,475	0.56
9.7	31.5		
25.899	0		



Attenuation

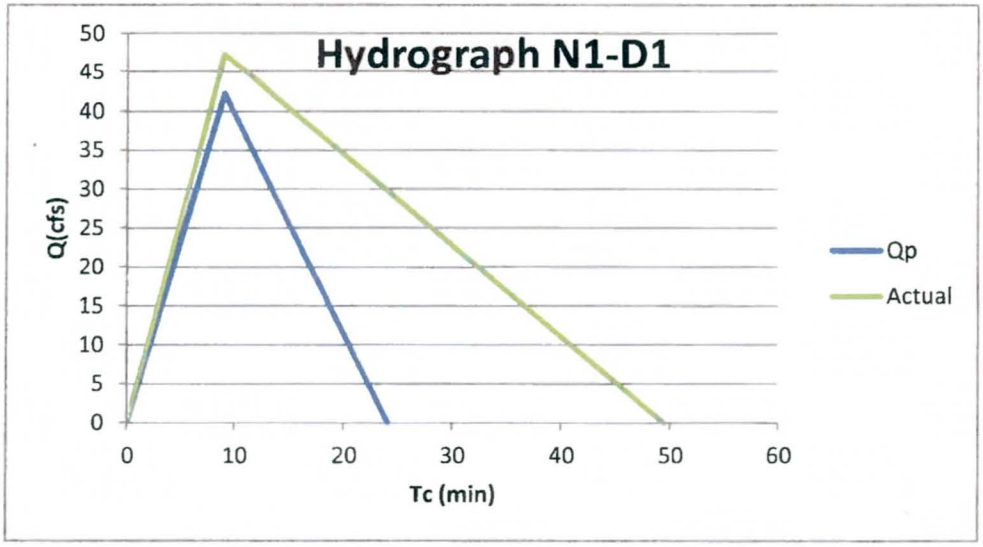
Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	43,560	1.00
9.7	31.5		
46.09524	0		

Va	VLeg1	Va	Qp	Qa	ta-tc	V	V	ta
acre-ft	cf	cf	cfs	cfs	min	cf	cf	min
0.98	9166.5	42688.8	31.5	5.0	30.602	33522	33522	40.302

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/14/2014	
Design:	N1-D1 Overflow Attenuation			
Prepared By:	RR	Checked By:		RJS

Name	Area
N1-D1	8.84

Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	30,494	0.70
9	42.3		
24.03	0		



Attenuation (including N1-O1 Overflow)

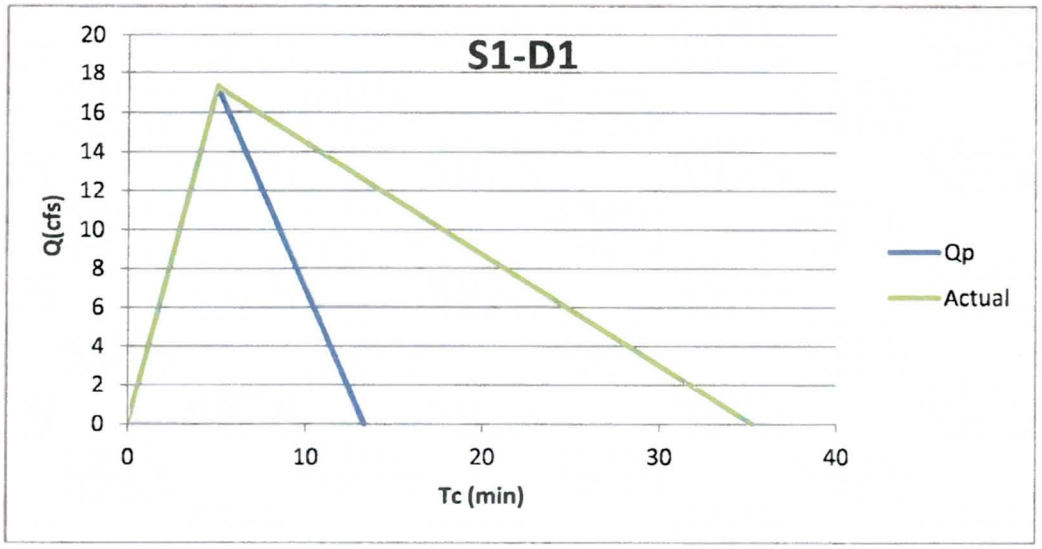
Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	70,132	1.61
9	47.31404		
49.4086	0		

Va	VLeg1	Va	Qp	Qa	ta-tc	V	V	ta
acre-ft	cf	cf	cfs	cfs	min	cf	cf	min
1.28	12774.79	55756.8	47.3140351	23.7	20.179	42982	42982	29.179

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/14/2014	
Design:	S1-D1 Attenuation			
Prepared By:	RR	Checked By:		RJS

Name	Area
S1-D1	3.32

Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	6,929	0.16
5	17.3		
13.35	0		



Attenuation

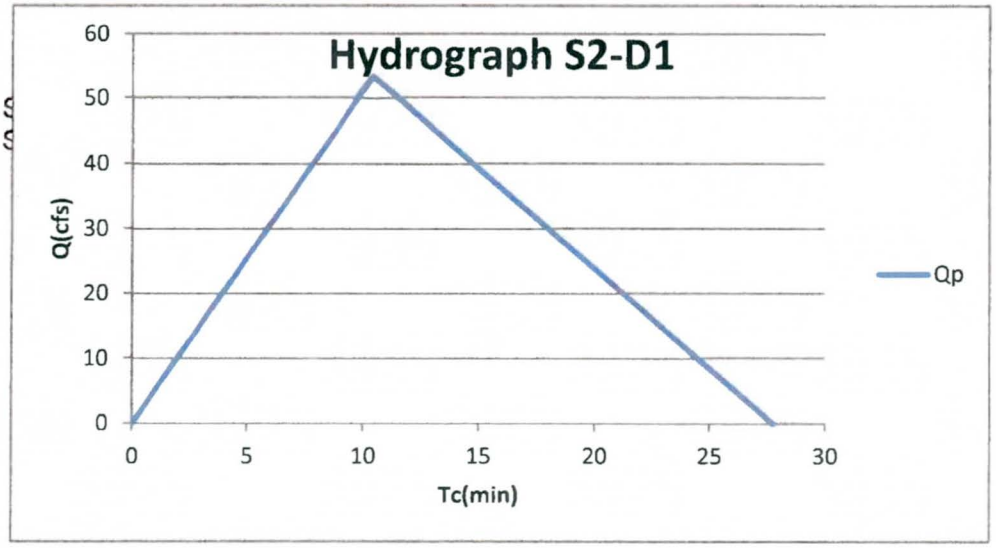
Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	18,295	0.42
5	17.3		
35.25087	0		

Va	VLeg1	Va	Qp	Qa	ta-tc	V	V	ta
acre-ft	cf	cf	cfs	cfs	min	cf	cf	min
0.23	2595	10018.8	17.3	12.6	8.287	7424	7424	13.287

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	5/20/2014	
Design:	S2-D1 Attenuation			
Prepared By:	RR	Checked By:		

Name	Area	Q S1-D1
S2-D1	10.53	**12.6**

Tc	Qp	Vtot
0	0	44,484
10.4	53.4	
27.768	0	



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Attenuation

Tc	Qp	Vtot	Vtoot (ac-ft)
0	0	75,359	1.73
10.4	53.4		
47.04045	0		

Va	VLeg1	Va	Qp	Qa	ta-tc	V	V	ta
acre-ft	cf	cf	cfs	cfs	min	cf	cf	min
0.07	16660.8	3049.2	53.4	38.24298	10.4	28592.61	-13611.6	20.8

NO ATTENUATION

WEIR CACLULATION AT POND N1D2

Hydraulic Analysis Report

Project Data

Project Title: Scatter Wash

Designer: Ronald Record

Project Date: Tuesday, May 06, 2014

Project Units: U.S. Customary Units

Notes:

Weir Analysis: N1-D1

Notes:

Input Parameters

Weir Type: Rectangular

Coefficient: 2.5000

Length: 40.0000 ft

Flow: 23.7000 cfs

Result Parameters

Head: 0.383 ft + 1331.75 = 1332.1

SPLIT FLOW ANALYSIS

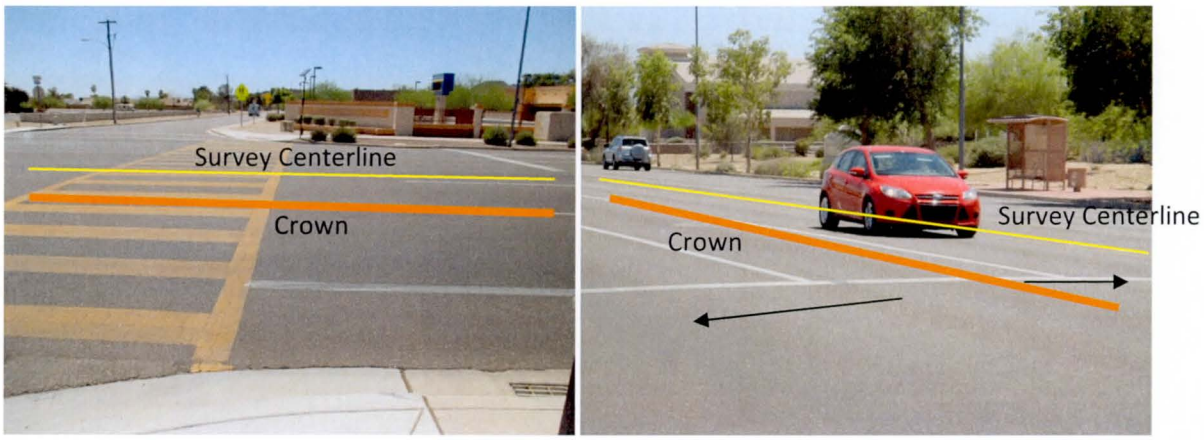
Assumptions for Flow Splits
Scatter Wash Levee Certification Project

All weir analysis done in Hydraulic Toolbox
All channel analysis done in FlowMaster
All cross sections were cut from field survey data collected specifically for this project as documented in Appendix C

35th Ave

- The weir capacity was calculated using the flow depth from the section to the east of 35th Ave. (below are photos taken on N and S sides of Behrend Dr. Facing E at 35th Ave.)

- Flow depth at the 100-year flow of 79.1 cfs was calculated to equal 1350.37 ft.
- To calculate the weir capacity, 5 survey points were averaged to get a weir elevation equal to 1349.56.
- After site visit on 6/19/14, it was found that the centerline of the roadway was not the crown of the road. The crown was shifted approximately 13' to the east. In order to recalculate a weir elevation, a 2% slope over the 13' shift was applied adding 0.26 ft making the weir elevation 1349.82. (below are photos taken at 35th Ave and Behrend facing W on the left and SW on the right to show the crown shift)

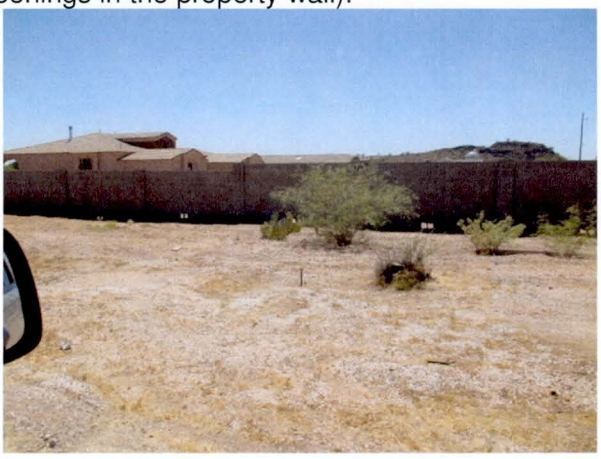


- Using a weir coefficient of 2.5 and a weir length of 70ft, the weir capacity of the crown of 35th Ave is **71.4 cfs**.

- The rest of the 79.1 cfs (7.7 cfs) would flow to the south.
- **Based on the analysis described above, AMEC assumed a 90-10 split where 90% of the flow from S3-SP2 would continue to the west down Behrend Dr.**
- Consideration was given to accounting for the capacity of the storm drain in 35th Avenue in reducing the peak flows and related volumes. AMEC assumed that, per City of Phoenix Criteria, the storm drain was designed for the 2-year flow and that the system would be surcharged and unable to receive flow for discharges greater than the 2-year flow during the regulatory 100-year event. The volume removed during the rising and receding limbs of the hydrograph (up to the 2-year flow) is negligible and the capacity of the storm drain was ignored.

37th Ave

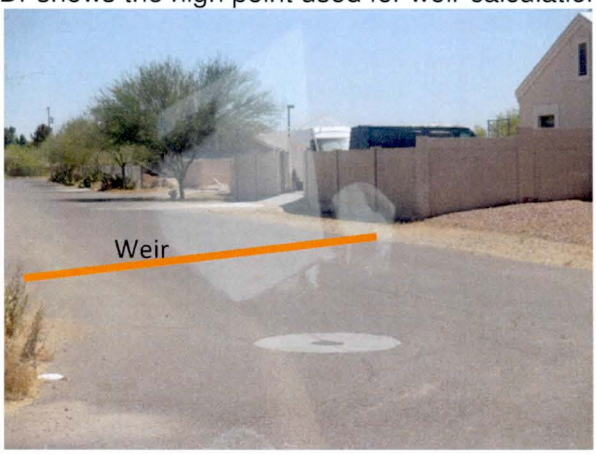
- The total flow reaching this intersection is the sum of the 90% split from S3-SP2 (71.2 cfs) and the runoff from S3-SP1 (111.6 cfs) which is equal to 182.8 cfs.
- At an elevation of 1342.26, the capacity of Behrend Dr to the west is 33% of the total flow whereas the large open area on the west side of 37th Ave can carry 66% of the flow to the south (59 cfs, 125 cfs)
- Since the slope from east to west is larger (0.6%) compared to the slope form north to south (0.4%) **AMEC assumed a 50%-50% split in flow to be conservative**
- Runoff that flows south could escape the open area on the SW side of the intersection through openings in the wall however the prevailing flow direction is southwesterly and any flow that escapes would not return to the roadway (photo below is facing W on 37th Ave to show the openings in the property wall).



- Final flow continuing to west is **91.4 cfs.**

37th Dr

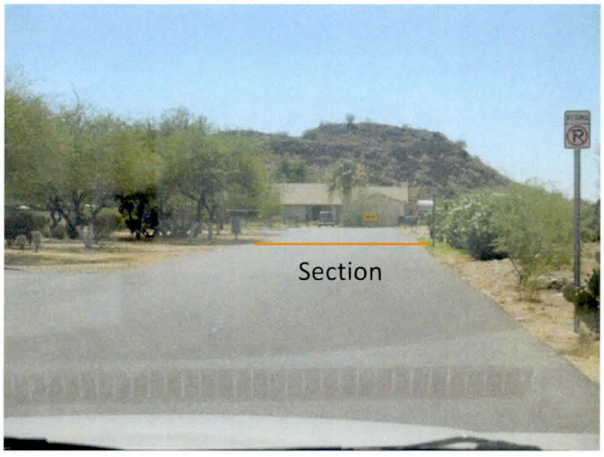
- The high point just to the south of the intersection of Behrend Dr and 37th Dr led to the necessity to calculate a lateral weir discharge for a split at this roadway. (photo below looking S at 37th Dr shows the high point used for weir calculations)



- A cross section was cut at the centerline of 37th Dr and capped to the south at the top of the weir to calculate an expected depth if that was the only place the water could flow.
- The average weir elevation was calculated to equal 1339.19. This resulted in a calculated depth of 0.14 ft.
- The calculated depth was then used at the lateral weir with a weir coefficient of 2.5 resulting in a discharge which was approximately 7% of the total flow.
- 10% was assumed to travel south resulting in **90% of total flow continuing west.**
- Final flow continuing to the west is **82.3 cfs.**

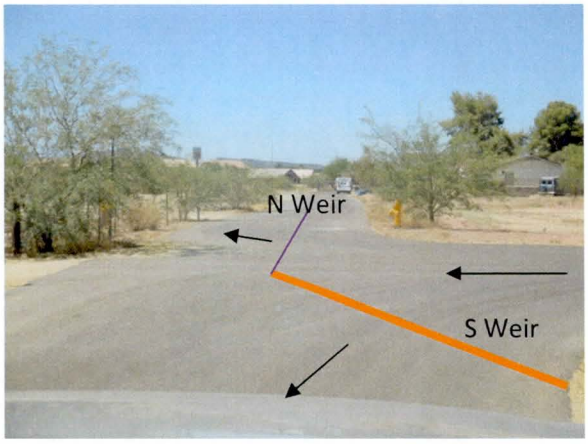
38th Ave

- The survey data provided to the east of 38th Ave was analyzed as a channel cross section. The section was truncated using vertical walls at the ends since no more survey data exists outside of that range. (photo below facing W on Behrend Dr shows approximate section location)
-



- At the flow of 82.3 cfs above, the resulting water surface was at an elevation of 1337.84 ft.

- To determine the flow that splits south, a weir section was analyzed using the center of the intersection of Behrend and 38th Ave (1337.6 ft) and an interpolated value between the curb return to the SE (average of 1337.27 and 1337.56) resulting in an average weir elevation of 1337.51. The resulting head entered into Hydraulic Toolbox was equal to the water surface elevation of 1337.84 minus the average weir elevation of 1337.51 which is equal to 0.33 ft.



- A 2.2 weir coefficient was used for the south weir.
- 12.5 cfs is the resulting discharge over the weir to the South.
- To determine the flow that splits northwest, an average weir elevation was cut down the centerline of 38th Ave starting from the intersection center point to the northernmost survey data point available to calculate a comparison value to the above 13.1 cfs. The weir average elevation was averaged out to be equal to 1337.63 ft which is equal to a 0.21 ft head.
- A 3.0 Weir coefficient was used for the north weir.
- Using these values, the resulting discharge at an elevation of 1337.84 ft is equal to 28.9 cfs.
- **Therefore 70% of the analyzed flow would travel to the S3 pond while 30% would travel to the South.** (28.9/[28.9+12.5]=70%)

Final Estimated equivalent area that can contribute to Ponding Area S3 from S3-SP2

0.90 * 0.50 * 0.90 * 0.70 or 0.284 = 28.4% of the area of 20.86 acres = **5.92 acres.**

Final Estimated area that can contribute to Ponding Area S3 from S3-SP1

0.50 * 0.90 * 0.70 or 0.3.15 = 31.5% of the area of 24.14 acres = **7.60 acres.**

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	7/16/2014	
Design:	DDMSW Composite Input to South Levee Penetration			
Prepared By:	afc	Checked By:		RLS

NAME	Basin Area	Contributing Area % [1]	Contributing Area	Cumulative Contributing Area	Land Use Area [2]		Land Use	C
					%	ac		
S3-SP2	20.86	28.4%	5.92	5.92	100	5.92	140	0.70
S3-SP1	24.14	31.5%	7.60	13.53	90	6.84	160	0.82
S3-SP1					10	0.76	520	0.95
S3-D1	29.57	100.0%	29.57	43.10	50	14.79	130	0.60
S3-D1					25	7.39	140	0.70
S3-D1					25	7.39	730	0.70
S2-D1	10.53	100.0%	10.53	53.63	20	2.11	530	0.95
S2-D1					30	3.16	220	0.95
S2-D1					50	5.27	130	0.60
S1-D1	3.32	73.0%	2.42	56.05	100	2.42	130	0.60
Totals / Composite	88.42		56.05			56.05		0.70

Notes:
1. Contributing area determined by applying a ratio to the Basin Area based on flow split or attenuated flow. See attached flow spit calculations.
2. Land use area for development of weighted C value.

Worksheet for 35th Ave West

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	79.10	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1352.00
0+01	1350.02
0+19	1350.11
0+23	1350.03
0+24	1349.37
0+25	1349.53
0+44	1349.99
0+61	1349.47
0+62	1349.28
0+63	1350.03
0+77	1350.26
1+04	1350.89
1+05	1353.00

+ 1.09 = 1350.37 = Normal Depth CWSEL

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1352.00)	(1+05, 1353.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for 35th Ave West

Results

Normal Depth		1.09	ft
Elevation Range	1349.28 to 1353.00 ft		
Flow Area		35.75	ft²
Wetted Perimeter		81.52	ft
Hydraulic Radius		0.44	ft
Top Width		80.81	ft
Normal Depth		1.09	ft
Critical Depth		0.94	ft
Critical Slope		0.01920	ft/ft
Velocity		2.21	ft/s
Velocity Head		0.08	ft
Specific Energy		1.16	ft
Froude Number		0.59	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.09	ft
Critical Depth	0.94	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.01920	ft/ft

Cross Section for 35th Ave West

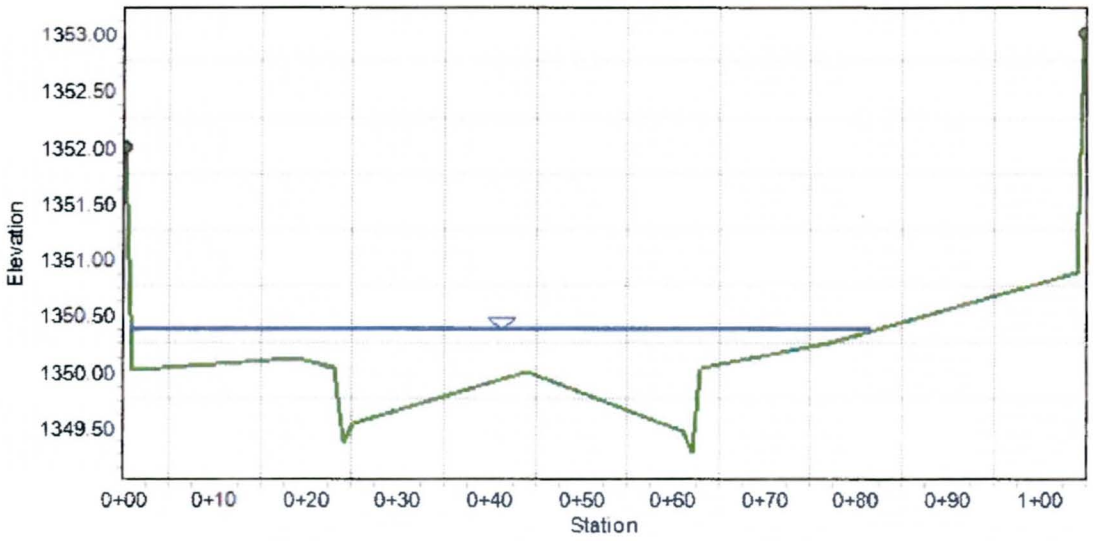
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	1.09	ft
Discharge	79.10	ft³/s

Cross Section Image



Hydraulic Analysis Report

Project Data

Project Title: Scatter Wash

Designer: Alex Coronel

Project Date: Wednesday, July 16, 2014

Project Units: U.S. Customary Units

Notes:

Weir Analysis: 35th Ave

Notes:

Input Parameters

Weir Type: Rectangular

Coefficient: 2.5000

Length: 70.0000 ft

Head: 0.5500 ft (1350.37 - 1349.82)

Result Parameters

Flow: 71.381 cfs

Worksheet for 37th Ave South

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Flow Total = Qs35P1 + Qoverflow @ 35th Ave
= 111.6 cfs + 71.2 cfs
= 182.8 cfs

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	1.35	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1343.00
0+01	1340.98
0+23	1340.91
0+40	1341.21
0+45	1341.76
0+53	1341.84
0+63	1341.27
0+64	1341.76
0+69	1341.85
0+86	1341.89
0+87	1344.00

+ 1.35' = 1342.26

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 1343.00)	(0+87, 1344.00)	0.050

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Discharge	124.92	ft³/s
Elevation Range	1340.91 to 1344.00 ft	

= Flow South @ EL = 1342.26

Worksheet for 37th Ave South

Results

Flow Area		74.02	ft²
Wetted Perimeter		87.00	ft
Hydraulic Radius		0.85	ft
Top Width		85.81	ft
Normal Depth		1.35	ft
Critical Depth		0.77	ft
Critical Slope		0.04465	ft/ft
Velocity		1.69	ft/s
Velocity Head		0.04	ft
Specific Energy		1.39	ft
Froude Number		0.32	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	1.35	ft
Critical Depth	0.77	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.04465	ft/ft

Cross Section for 37th Ave South

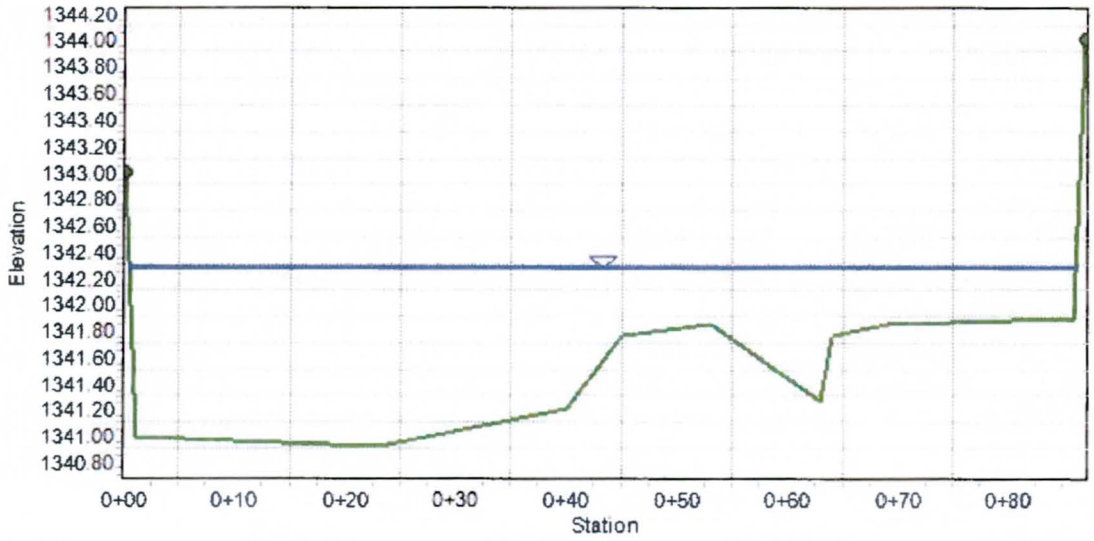
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	1.35	ft
Discharge	124.92	ft^3/s

Cross Section Image



Worksheet for 37th Ave West

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.83	ft

Section Definitions

Station (ft)	Elevation (ft)
0+00	1344.00
0+01	1342.00
0+04	1341.89
0+19	1341.98
0+23	1341.93
0+24	1341.43
0+40	1341.98
0+56	1341.47
0+57	1341.53
0+58	1341.94
0+62	1342.01
0+88	1342.34
0+89	1344.00

+0.83' = 1342.26

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00, 1344.00)	(0+89, 1344.00)	0.030

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Worksheet for 37th Ave West

Results

Discharge		59.14	ft³/s = Flow West
Elevation Range	1341.43 to 1344.00 ft		
Flow Area		29.96	ft²
Wetted Perimeter		81.21	ft
Hydraulic Radius		0.37	ft
Top Width		80.83	ft
Normal Depth		0.83	ft
Critical Depth		0.69	ft
Critical Slope		0.02014	ft/ft
Velocity		1.97	ft/s
Velocity Head		0.06	ft
Specific Energy		0.89	ft
Froude Number		0.57	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.83	ft
Critical Depth	0.69	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.02014	ft/ft

Cross Section for 37th Ave West

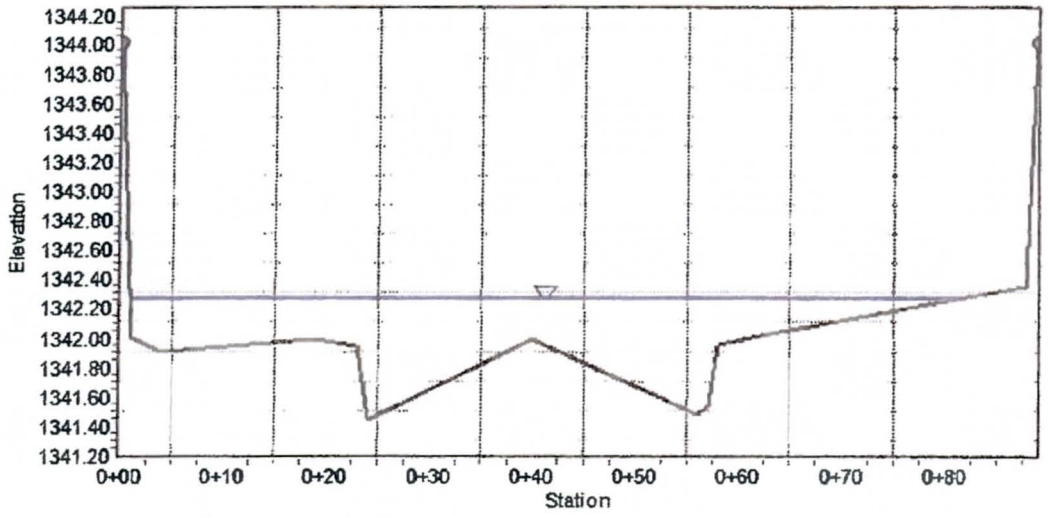
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.83	ft
Discharge	59.14	ft³/s

Cross Section Image



Worksheet for 37th Dr Center

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	69.80	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	1338.88
0+25	1338.95
0+47	1338.97
0+72	1339.23
0+94	1338.99
1+11	1338.64
1+25	1339.14
1+37	1339.35
1+50	1339.28
1+69	1339.31

Roughness Segment Definitions

Start Station & Elevation	End Station & Elevation	Roughness Coefficient
(0+00, 1338.88)	(1+69, 1339.31)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.52	ft
Elevation Range	1338.64 to 1339.35 ft	
Flow Area	22.81	ft²

Worksheet for 37th Dr Center

Results

Wetted Perimeter		112.35	ft
Hydraulic Radius		0.20	ft
Top Width		112.06	ft
Normal Depth		0.52	ft
Critical Depth		0.55	ft
Critical Slope		0.00410	ft/ft
Velocity		3.06	ft/s
Velocity Head		0.15	ft
Specific Energy		0.66	ft
Froude Number		1.20	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.52	ft
Critical Depth	0.55	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00410	ft/ft

Cross Section for 37th Dr Center

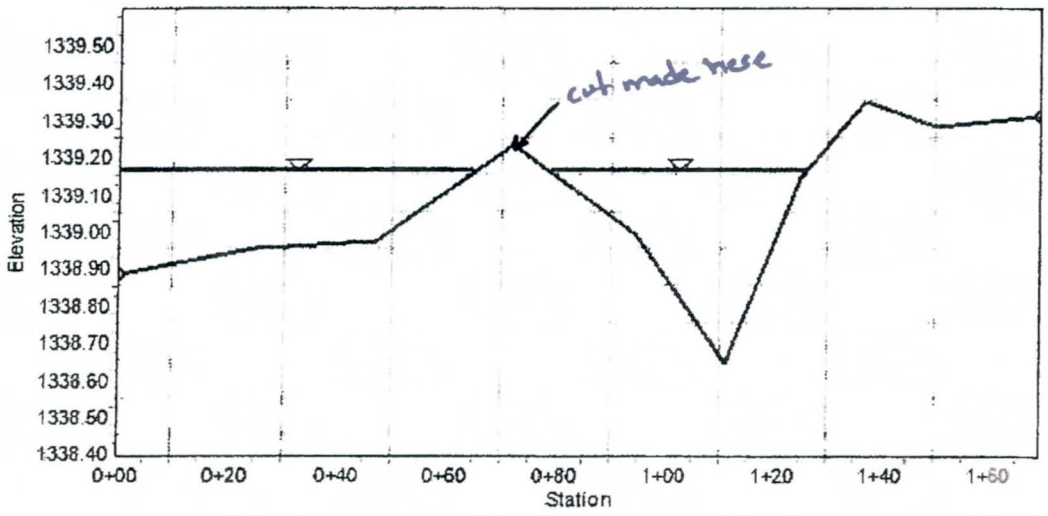
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.52	ft
Discharge	69.80	ft³/s

Cross Section Image



Worksheet for 37th Dr Center-Cut

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	91.40	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+47	1341.00
0+72	1339.23
0+94	1338.99
1+11	1338.64
1+25	1339.14
1+37	1339.35
1+50	1339.28
1+69	1339.31

+0.73 = 1339.37 - Water Surface EL.

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+47, 1341.00)	(1+69, 1339.31)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.73	ft
Elevation Range	1338.64 to 1341.00 ft	
Flow Area	25.48	ft²
Wetted Perimeter	99.03	ft
Hydraulic Radius	0.26	ft

Worksheet for 37th Dr Center-Cut

Results

Top Width		98.95	ft
Normal Depth		0.73	ft
Critical Depth		0.77	ft
Critical Slope		0.00370	ft/ft
Velocity		3.59	ft/s
Velocity Head		0.20	ft
Specific Energy		0.93	ft
Froude Number		1.25	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.73	ft
Critical Depth	0.77	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00370	ft/ft

Cross Section for 37th Dr Center-Cut

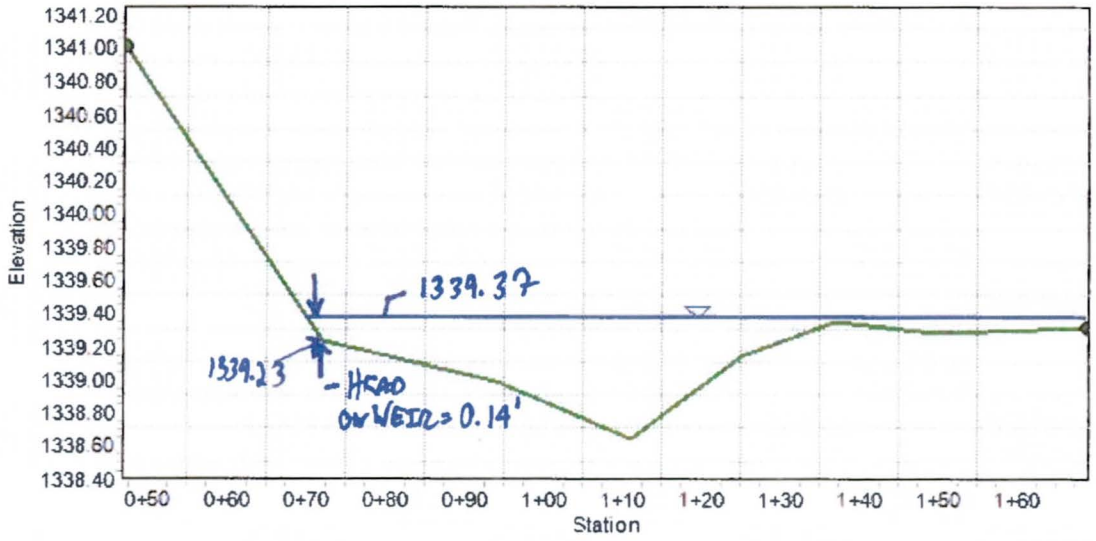
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.73	ft
Discharge	91.40	ft³/s

Cross Section Image



Hydraulic Analysis Report

Project Data

Project Title: Scatter Wash

Designer: Alex Coronel

Project Date: Wednesday, July 16, 2014

Project Units: U.S. Customary Units

Notes:

Weir Analysis: 37th Dr

Notes:

Input Parameters

Weir Type: Rectangular

Coefficient: 2.5000

Length: 50.0000 ft

Head: 0.1400 ft

Result Parameters

Flow: 6.548 cfs

Worksheet for 38th Ave West

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Discharge	82.30	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+01	1340.00
0+02	1337.44
0+10	1337.47
0+22	1337.79
0+23	1337.56
0+38	1337.49
0+42	1337.69
0+67	1337.29
0+68	1340.00

+0.55' = 1337.84

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+01, 1340.00)	(0+68, 1340.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.55	ft
Elevation Range	1337.29 to 1340.00 ft	
Flow Area	20.37	ft²
Wetted Perimeter	66.06	ft

Worksheet for 38th Ave West

Results

Hydraulic Radius		0.31	ft
Top Width		65.36	ft
Normal Depth		0.55	ft
Critical Depth		0.61	ft
Critical Slope		0.00350	ft/ft
Velocity		4.04	ft/s
Velocity Head		0.25	ft
Specific Energy		0.80	ft
Froude Number		1.28	
Flow Type	Supercritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.55	ft
Critical Depth	0.61	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00350	ft/ft

Cross Section for 38th Ave West

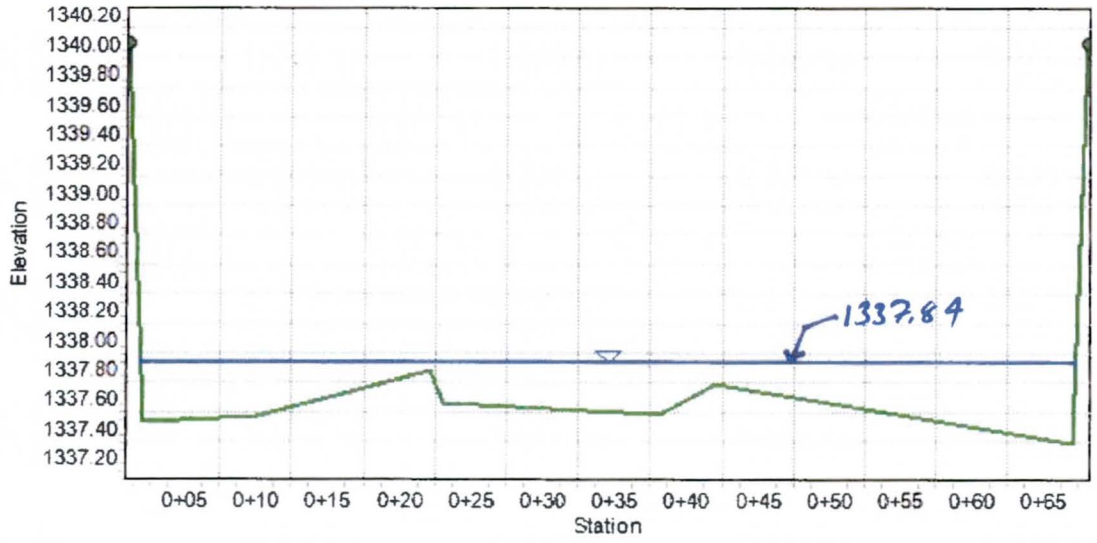
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00600	ft/ft
Normal Depth	0.55	ft
Discharge	82.30	ft³/s

Cross Section Image



Hydraulic Analysis Report

Project Data

Project Title: Scatter Wash

Designer: Ronny Record

Project Date: June 20, 2014

Project Units: U.S. Customary Units

Notes:

Weir Analysis: 38th Ave-S

Notes:

Input Parameters

Weir Type: Broad-crested

Coefficient: 2.2000

Length: 30.0000 (ft)

Head: 0.330 (ft) (1337.84 - 1337.51)

Result Parameters

Flow: 12.512 (cfs)

Weir Analysis: 38th Ave-N

Notes:

Input Parameters

Weir Type: Broad-crested

Coefficient: 3.0000

Length: 100.0000 (ft)

Head: 0.2100 (ft) (1337.84 - 1337.63)

Result Parameters

Flow: 28.870 (cfs)

RESERVOIR ROUTING

Client:	Flood Control District of Maricopa County
Project:	Scatter Wash Hydraulic and Geotechnical Certification for Levees
Design:	Reservoir Routing Calculation at South Levee Penetration - 100 year CWSEL in Scatter Wash
Prepared By:	AFC

Note: Method per **Section 8.8 Flood Routing** of the Drainage Design Manual for Maricopa County, Volume II, Hydraulics, 1996 Edition

Sheet	1 of 1
Date:	7/17/2014
Checked By:	

amec

Volume Calculation Method: conic 'Conic' or 'Area'

INFLOW Hydrograph Time, hrs	INFLOW Hydrograph Inflow, cfs	Elevation Δh ft	Outflow Rating Curve Discharge O (cfs)	Surface Area A_1, A_2, A_N (ac)	$(A_1 + A_2)/2$ or $1/3h*[(A_2+A_1)+(A_2*A_1)^{1/2}]$	Difference in Elevation Δ ft	Interval Storage ac-ft	Storage ac-ft
0.00	0.0	1331.00	0.00 (O_j)	0.00			0	0
0.08	24.4	1333.00	0.00 (O_{j+1})	0.09	0.09	2.00	0.06	0.06
0.17	48.7	1333.50	20.00 (O_j)	0.32	0.58	0.50	0.10	0.16
0.25	73.1	1334.00	33.00 (O_{j+1})	0.48	1.19	0.50	0.20	0.36
0.33	97.5	1334.50	42.00	0.65	1.69	0.50	0.28	0.64
0.42	121.8	1335.00	49.00	1.01	2.47	0.50	0.41	1.05
0.50	146.2	1335.50	54.00	2.07	4.53	0.50	0.75	1.80
0.58	132.3	1336.00	65.10	3.91	8.82	0.50	1.47	3.27
0.67	118.5	1336.30	118.00	4.55	12.68	0.30	1.27	4.54
0.75	104.6							
0.83	90.8							
0.92	76.9							
1.00	63.1							
1.08	49.2							
1.17	35.4							
1.25	21.5							
1.33	7.6							
1.42	-6.2							

Discharge in Green Cells is sum of flow through pipe and flow over wier at 39th Avenue.

Table 8.5 - Storage-Outfall Relationship for Detention Resevoir

S Storage ft³		Y O Rating Curve Discharge (cfs)	X Storage - Outflow {2S/Δ t)+O} (cfs)
0		0.00	0
2,689		0.00	18
6,908		20.00	66
15,527		33.00	137
27,786		42.00	227
45,720		49.00	354
78,578		54.00	578
142,647		65.10	1,016
197,872		118.00	1,437

For a given time interval, Dt, the outflow that occurrs between successive water surface elevations is a function of the change in storage with the change in time:

Oa = f(dS/dt) + Oj

Oa = actual outflow over time interval

Oj = outflow at given water surface elevation

Oa = f(Dt)

Oj = f(WSEL)

Table 8.6 - Routing of Flow Through the Detention Basin; Page 8-50 of FCDMC HydrauliCS Manual

$\{(2S_{j+1}/\Delta_t) + O_{j+1}\} = (I_j + I_{j+1}) + \{(2S_j/\Delta_t) - O_j\}$ (8.3)

INFLOW Hydrograph Time, hrs	Incremental Inflow, cfs	Cumulative Inflow $I_j + I_{j+1}$ cfs	$(2S_j/\Delta_t) - O_j$ Net Inflow, cfs	"X" $(2S_{j+1}/\Delta_t) + O_{j+1}$ cfs	"Y" - from graph O_{j+1} Outflow, cfs
0.00	0.0 (I_j)	0	0.0	0.0	0
0.08	24.4 (I_{j+1})	24.4	24.4	24.4	0
0.17	48.7	73.1	45.5	97.5	26
0.25	73.1	121.8	95.3	167.3	36
0.33	97.5	170.6	177.9	265.9	44
0.42	121.8	219.3	297.2	397.2	50
0.50	146.2	268.0	459.2	565.2	53
0.58	132.3	278.5	621.7	737.7	58
0.67	118.5	250.8	750.6	872.6	61
0.75	104.6	223.1	845.7	973.7	64
0.83	90.8	195.4	905.1	1041.1	68
0.92	76.9	167.7	928.8	1072.8	72
1.00	63.1	140.0	926.8	1068.8	71
1.08	49.2	112.3	903.1	1039.1	68
1.17	35.4	84.6	857.6	987.6	65
1.25	21.5	56.9	790.5	914.5	62
1.33	7.6	29.1	699.6	819.6	60
1.42	-6.2	1.4	587.1	701.1	57
			479.1	587.1	54

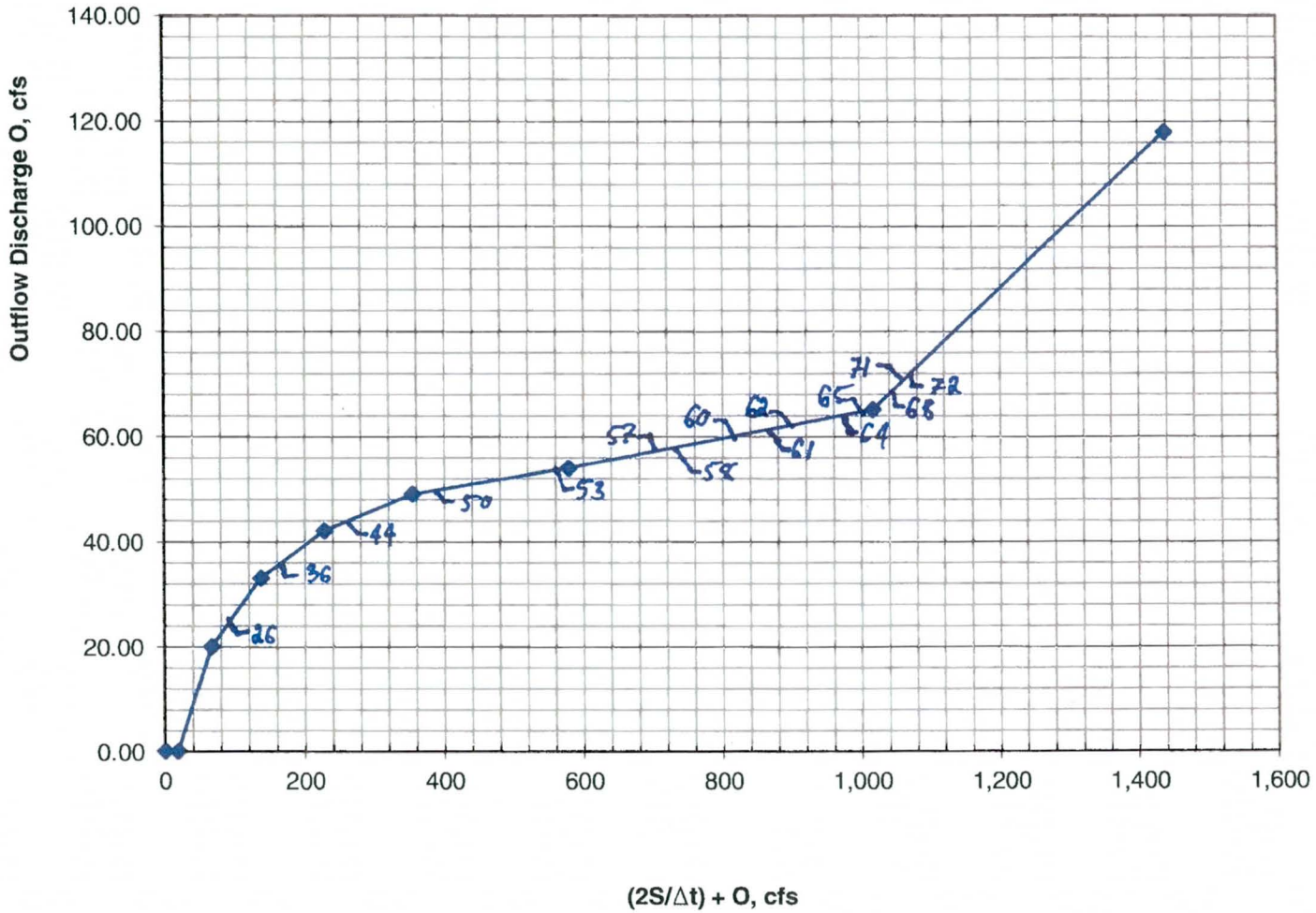
Read from Graph: Given "X", Pick "Y"

Peak Outflow cfs	Stage Stage, ft
72	1336.0

Notes:

1) Stage - Discharge from HY-8, assuming 100-year Water Surface Elevation in Scatter Wash
2) Stage - Storage calculated from project topography.

Storage-Outflow Function, - 100yr CWSEL in Scatter Wash



DISCRETIZED HYDROGRAPH AT SOUTH LEVEE PENETRATION

Green = Indicates Calculations Performed by Spreadsheet
Blue =Indicates User Input Required

Individual Inflow Hydrograph Estimated Given a Time of Concentration and a Peak Flow:

This assumes that the peak ocurrs at a point in time which represents ***29/80*** of the storm duration

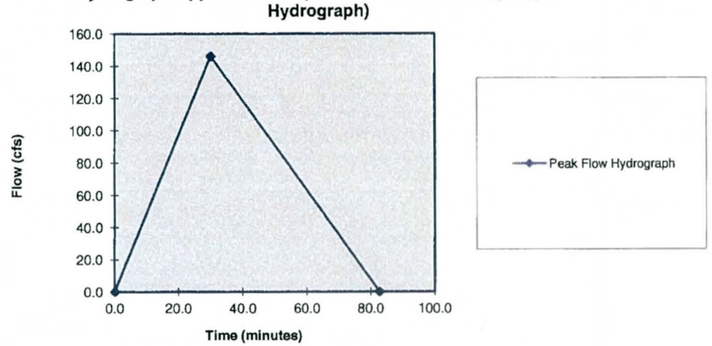
	Input	
Start Time:	0	minutes
DDMSW Peak Flow Rate	**146.2**	cfs
DDMSW Calculated Time to Peak	**30**	minutes
% Area Under Rising Leg of Hydrograph:	36%	

*Assume 1/3 area under rising side of hydrograph and 2/3 area uner falling side

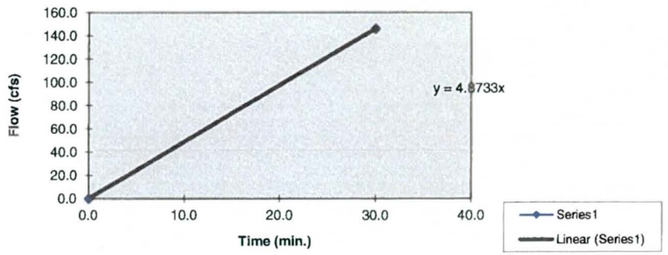
X Time (min)	Y Peak Flow (cfs)	Area Under Rising Side of Hydrograph (square units)	Area Under Falling Side of Hydrograph (square units)
0.0	0.0		
30.0	146.2	2,193.0	3,856.7
82.76	0.0		

Volume At Peak:	131,580	cubic ft	3.0	acre ft
Volume After Peak:	231,399	cubic ft	5.3	acre ft
Total Volume:	*362,979*	cubic ft	8.33	acre ft

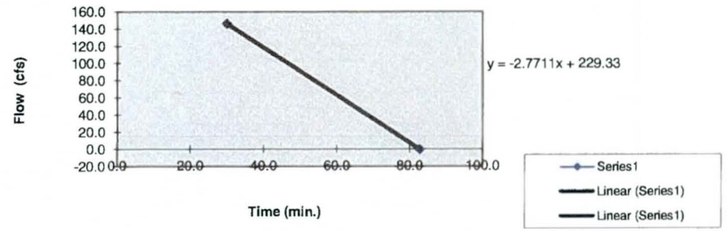
Hydrograph Approximation (Assume % Under Rising Leg of Hydrograph)



Line Graph for Rising Hydrograph



Line Graph for Falling Hydrograph



Equation of Rising Line		
m =	4.873	slope of line
b =	0	Y-intercept

Y = ***4.873*** ***X*** ***+*** ***0***

Equation of Falling Line		
m =	-2.771	slope of line
b =	229.3333333	Y-intercept

Y = ***-2.771*** ***X*** ***+*** ***229.3333***

Discritezed Hydrograph time (min)	Flow Rate cfs
0	**0**
5	24.4
10	48.7
15	73.1
20	97.5
25	121.8
30	146.2
35	132.3
40	118.5
45	104.6
50	90.8
55	76.9
60	63.1
65	49.2
70	35.4
75	21.5
80	7.6
85	-6.2
90	-20.1

Client:	Flood Control District of Maricopa County
Project:	Scatter Wash Hydraulic and Geotechnical Certification for Levees
Design:	Reservoir Routing Calculation at South Levee Penetration - No Flow in Scatter Wash
Prepared By:	AFC

Note: Method per **Section 8.8 Flood Routing** of the Drainage Design Manual for Maricopa County, Volume II, Hydraulics, 1996 Edition

Sheet	1 of 1
Date:	7/17/2014
Checked By:	

amec

Volume Calculation Method: conic 'Conic' or 'Area'

INFLOW Hydrograph Time, hrs	INFLOW Hydrograph Inflow, cfs	Elevation Δh ft	Outflow Rating Curve Discharge O (cfs)	Surface Area A_1, A_2, A_N (ac)	$(A_1 + A_2)/2$ or $1/3h*[(A_2+A_1)+(A_2*A_1)^{1/2}]$	Difference in Elevation Δ ft	Interval Storage ac-ft	Storage ac-ft
0.00	0.0	1331.00	0.00 (O_j)	0.00			0	0
0.08	24.4	1333.00	21.00 (O_{j+1})	0.09	0.09	2.00	0.06	0.06
0.17	48.7	1333.50	30.00 (O_j)	0.32	0.58	0.50	0.10	0.16
0.25	73.1	1334.00	38.00 (O_{j+1})	0.48	1.19	0.50	0.20	0.36
0.33	97.5	1334.50	44.00	0.65	1.69	0.50	0.28	0.64
0.42	121.8	1335.00	49.00	1.01	2.47	0.50	0.41	1.05
0.50	146.2	1335.50	54.00	2.07	4.53	0.50	0.75	1.80
0.58	132.3	1336.00	65.10	3.91	8.82	0.50	1.47	3.27
0.67	118.5	1336.30	119.00	4.55	12.68	0.30	1.27	4.54
0.75	104.6							
0.83	90.8							
0.92	76.9							
1.00	63.1							
1.08	49.2							
1.17	35.4							
1.25	21.5							
1.33	7.6							
1.42	-6.2							

Discharge in Green Cells is sum of flow through pipe and flow over wier at 39th Avenue.

Table 8.5 - Storage-Outfall Relationship for Detention Resevoir

		Y	X
S Storage ft³		O Rating Curve Discharge (cfs)	Storage - Outflow {2S/Δt)+O} (cfs)
0		0.00	0
2,689		21.00	39
6,908		30.00	76
15,527		38.00	142
27,786		44.00	229
45,720		49.00	354
78,578		54.00	578
142,647		65.10	1,016
197,872		119.00	1,438

For a given time interval, Dt, the outflow that occurrs between successive water surface elevations is a function of the change in storage with the change in time:

Oa = f(dS/dt) + Oj

Oa = actual outflow over time interval

Oj = outflow at given water surface elevation

Oa = f(Dt)

Oj = f(WSEL)

Table 8.6 - Routing of Flow Through the Detention Basin; Page 8-50 of FCDMC HydrauliCS Manual

$\{(2S_{j+1}/\Delta_t) + O_{j+1}\} = (I_j + I_{j+1}) + \{(2S_j/\Delta_t) - O_j\}$ (8.3)

INFLOW Hydrograph Time, hrs	Incremental Inflow, cfs	Cumulative Inflow $I_j + I_{j+1}$ cfs	$(2S_j/\Delta_t) - O_j$ Net Inflow, cfs	"X" $(2S_{j+1}/\Delta_t) + O_{j+1}$ cfs	"Y" - from graph O_{j+1} Outflow, cfs
0.00	0.0 (I_j)	0	0.0	0.0	0
0.08	24.4 (I_{j+1})	24.4	0.4	24.4	12
0.17	48.7	73.1	15.5	73.5	29
0.25	73.1	121.8	61.3	137.3	38
0.33	97.5	170.6	143.9	231.9	44
0.42	121.8	219.3	265.2	363.2	49
0.50	146.2	268.0	427.2	533.2	53
0.58	132.3	278.5	591.7	705.7	57
0.67	118.5	250.8	720.6	842.6	61
0.75	104.6	223.1	817.7	943.7	63
0.83	90.8	195.4	883.1	1013.1	65
0.92	76.9	167.7	912.8	1050.8	69
1.00	63.1	140.0	912.8	1052.8	70
1.08	49.2	112.3	893.1	1025.1	66
1.17	35.4	84.6	847.6	977.6	65
1.25	21.5	56.9	778.5	904.5	63
1.33	7.6	29.1	687.6	807.6	60
1.42	-6.2	1.4	577.1	689.1	56
			469.1	577.1	54

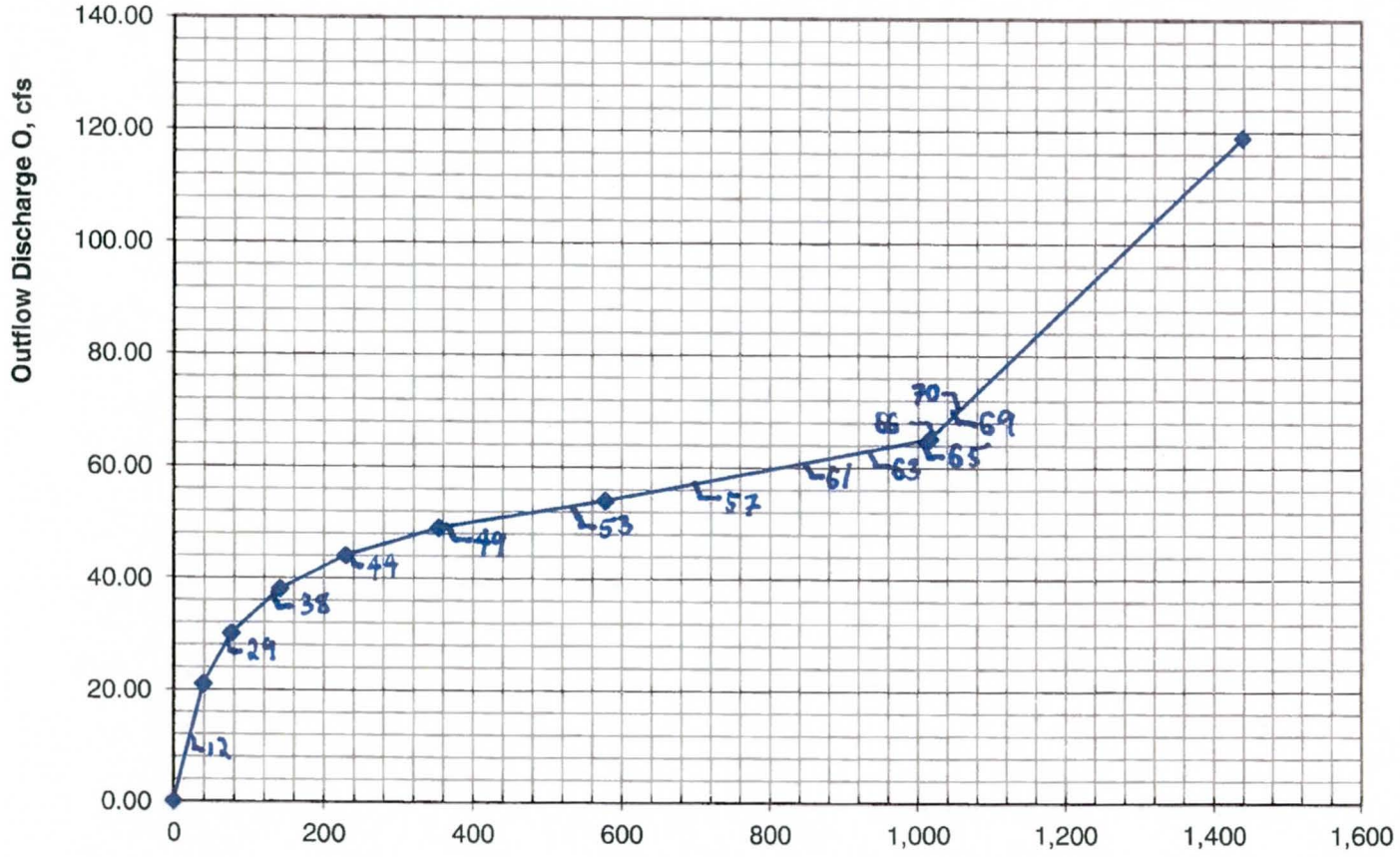
Peak Outflow cfs	Stage Stage, ft
70	1336.0

Notes:

1) Stage - Discharge from HY-8, assuming no-flow in Scatter Wash

2) Stage - Storage calculated from project topography.

Storage-Outflow Function, -- No Flow in Scatter Wash



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CULVERT CALCULATIONS (HY-8 FILES)

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: North Culvert

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1329.88	0.00	0.00	0.00	1
1332.14	10.00	10.00	0.00	1
1336.08	20.00	20.00	0.00	1
1336.89	30.00	21.45	8.44	10
1336.96	40.00	21.56	18.32	5
1337.00	47.00	21.63	25.24	4
1337.07	60.00	21.74	38.17	4
1337.11	70.00	21.82	47.97	3
1337.15	80.00	21.89	57.98	3
1337.19	90.00	21.95	67.98	3
1337.23	100.00	22.01	77.96	3
1336.79	21.27	21.27	0.00	Overtopping

Rating Curve Plot for Crossing: North Culvert

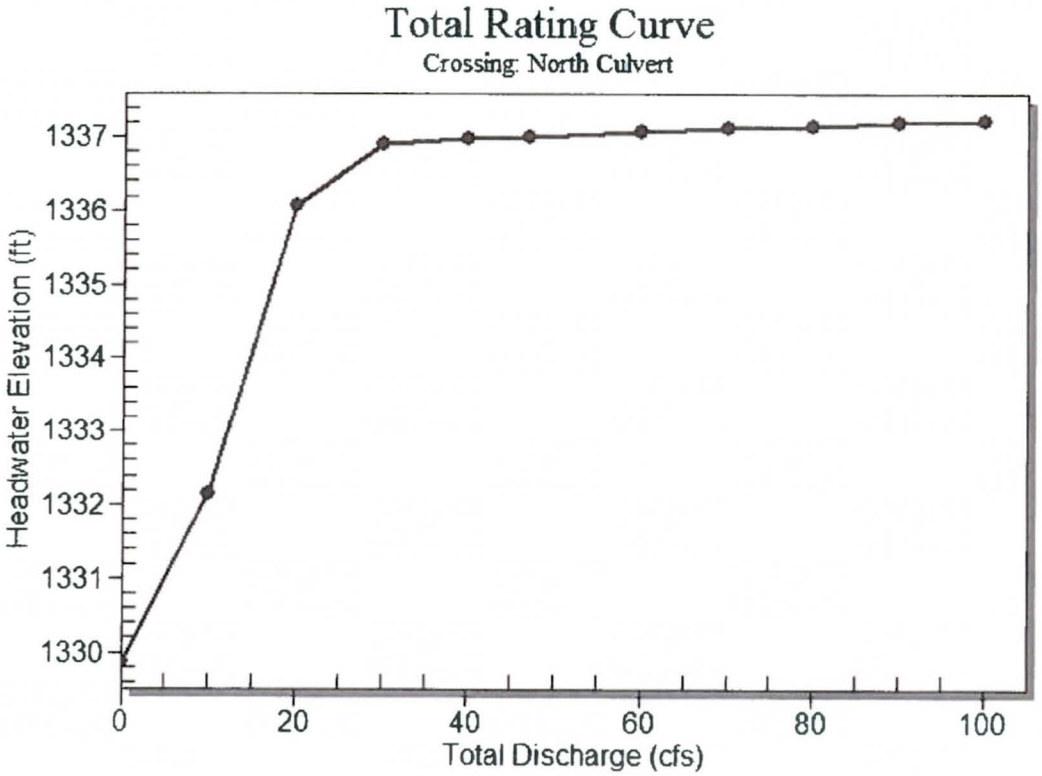


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1329.88	0.000	0.0*	0-NF	0.000	0.000	0.000	0.000	0.000	0.000
10.00	10.00	1332.14	2.263	0.0*	5-S2n	1.058	1.215	1.058	0.000	7.500	0.000
20.00	20.00	1336.08	6.197	5.261	6-FFc	1.500	1.500	1.500	0.000	11.318	0.000
30.00	21.45	1336.89	7.012	5.888	6-FFc	1.500	1.500	1.500	0.000	12.136	0.000
40.00	21.56	1336.96	7.081	5.940	6-FFc	1.500	1.500	1.500	0.000	12.201	0.000
47.00	21.63	1337.00	7.120	5.971	6-FFc	1.500	1.500	1.500	0.000	12.240	0.000
60.00	21.74	1337.07	7.186	6.021	6-FFc	1.500	1.500	1.500	0.000	12.303	0.000
70.00	21.82	1337.11	7.230	6.055	6-FFc	1.500	1.500	1.500	0.000	12.345	0.000
80.00	21.89	1337.15	7.272	6.087	6-FFc	1.500	1.500	1.500	0.000	12.385	0.000
90.00	21.95	1337.19	7.312	6.117	6-FFc	1.500	1.500	1.500	0.000	12.422	0.000
100.00	22.01	1337.23	7.349	6.146	6-FFc	1.500	1.500	1.500	0.000	12.457	0.000

* theoretical depth is impractical. Depth reported is corrected.

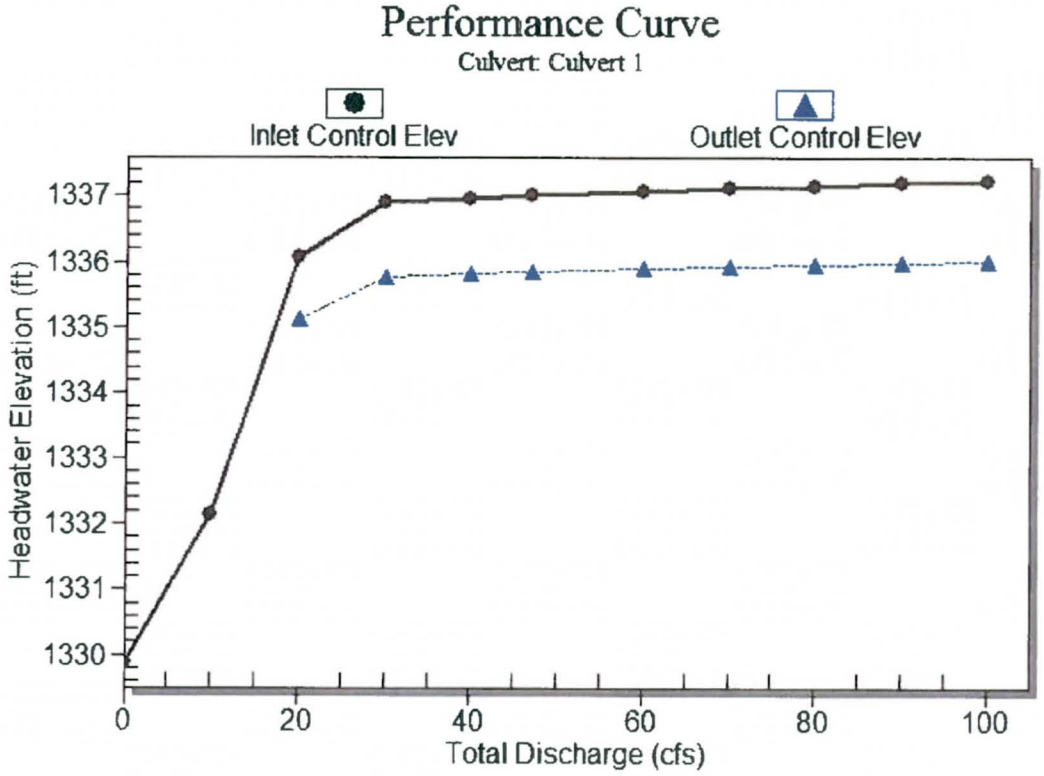
****

Inlet Elevation (invert): 1329.88 ft, Outlet Elevation (invert): 1329.46 ft

Culvert Length: 39.00 ft, Culvert Slope: 0.0108

****

Culvert Performance Curve Plot: Culvert 1



HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: South Culverts - SW 100 CWSE

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1333.20	0.00	0.00	0.00	1
1333.23	7.00	7.00	0.00	1
1333.35	14.00	14.00	0.00	1
1333.53	21.00	21.00	0.00	1
1333.78	28.00	28.00	0.00	1
1334.11	35.00	35.00	0.00	1
1334.51	42.00	42.00	0.00	1
1334.77	45.90	45.90	0.00	1
1335.74	56.00	56.00	0.00	1
1336.52	63.00	62.44	0.47	28
1336.59	70.00	63.02	6.85	6
1336.50	62.32	62.32	0.00	Overtopping

Rating Curve Plot for Crossing: South Culverts - SW 100 CWSE

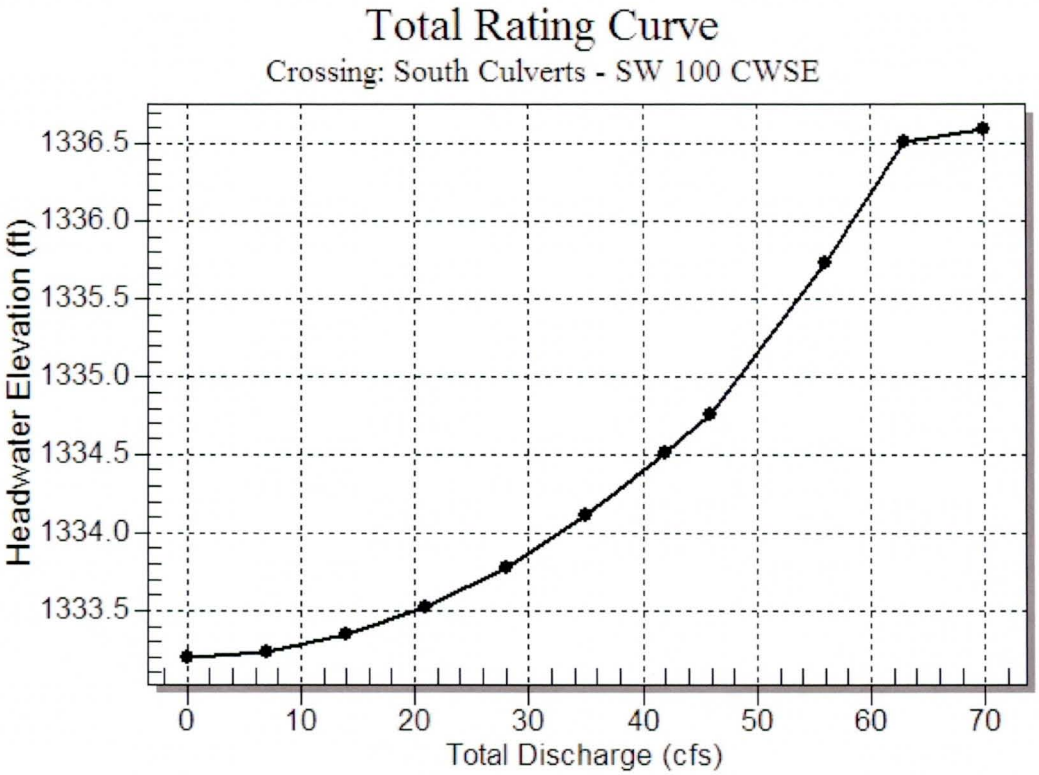


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1333.20	0.000	1.910	0-NF	0.000	0.000	0.000	3.200	0.000	0.000
7.00	7.00	1333.23	0.884	1.941	1-S1f	0.373	0.649	2.000	3.200	1.114	0.000
14.00	14.00	1333.35	1.338	2.055	4-FFf	0.528	0.935	2.000	3.200	2.228	0.000
21.00	21.00	1333.53	1.727	2.237	4-FFf	0.656	1.158	2.000	3.200	3.342	0.000
28.00	28.00	1333.78	2.109	2.492	4-FFf	0.767	1.344	2.000	3.200	4.456	0.000
35.00	35.00	1334.11	2.545	2.820	4-FFf	0.868	1.502	2.000	3.200	5.570	0.000
42.00	42.00	1334.51	3.072	3.220	4-FFf	0.964	1.634	2.000	3.200	6.685	0.000
45.90	45.90	1334.77	3.411	3.475	4-FFf	1.017	1.692	2.000	3.200	7.305	0.000
56.00	56.00	1335.74	4.449	4.240	4-FFf	1.149	1.841	1.149	3.200	15.001	0.000
63.00	62.44	1336.52	5.225	4.807	4-FFf	1.234	1.936	1.234	3.200	15.333	0.000
70.00	63.02	1336.59	5.300	4.861	4-FFf	1.242	1.944	1.242	3.200	15.358	0.000

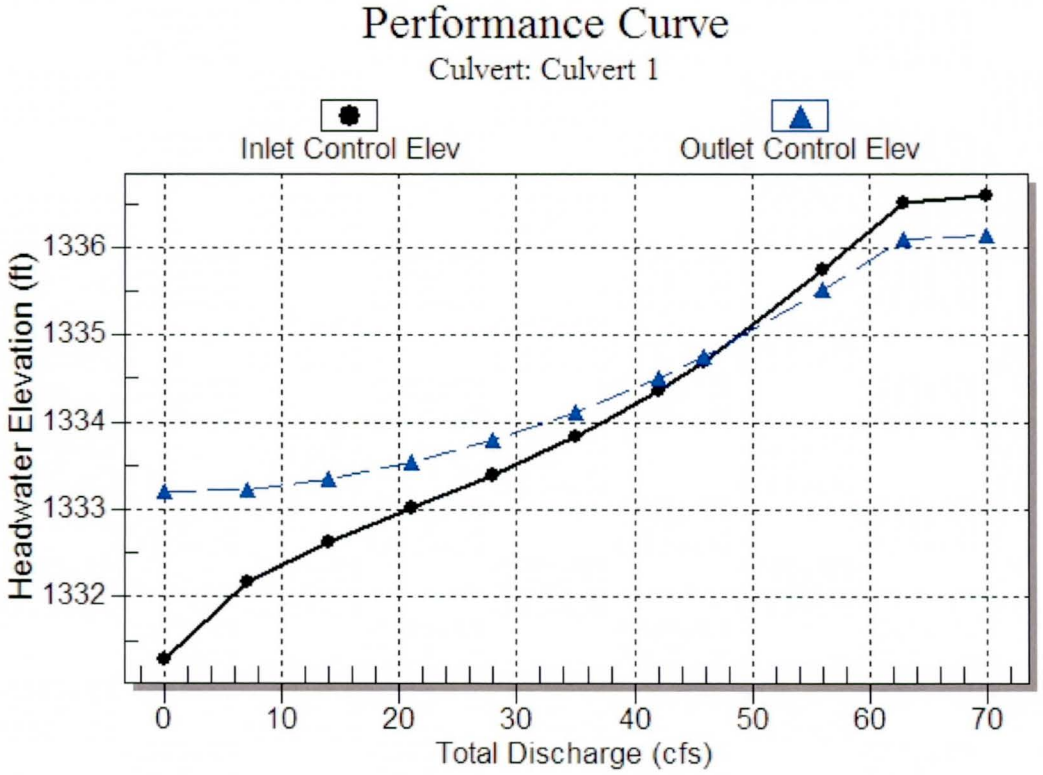
****

Inlet Elevation (invert): 1331.29 ft, Outlet Elevation (invert): 1330.07 ft

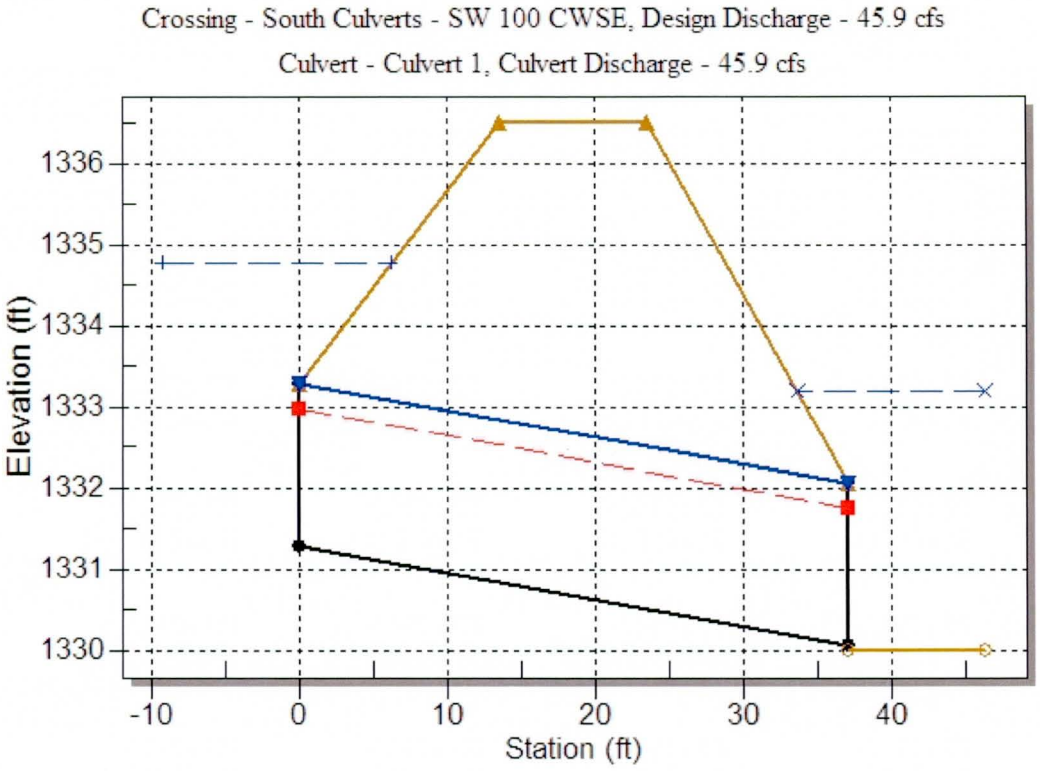
Culvert Length: 37.02 ft, Culvert Slope: 0.0330

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1331.29 ft

Outlet Station: 37.00 ft

Outlet Elevation: 1330.07 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: South Culverts - SW 100 CWSE)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	1333.20	3.20
7.00	1333.20	3.20
14.00	1333.20	3.20
21.00	1333.20	3.20
28.00	1333.20	3.20
35.00	1333.20	3.20
42.00	1333.20	3.20
45.90	1333.20	3.20
56.00	1333.20	3.20
63.00	1333.20	3.20
70.00	1333.20	3.20

Tailwater Channel Data - South Culverts - SW 100 CWSE

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1333.20 ft

Roadway Data for Crossing: South Culverts - SW 100 CWSE

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 1336.50 ft

Roadway Surface: Gravel

Roadway Top Width: 10.00 ft

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: South Culverts - SW Dry

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1331.29	0.00	0.00	0.00	1
1332.17	7.00	7.00	0.00	1
1332.63	14.00	14.00	0.00	1
1333.02	21.00	21.00	0.00	1
1333.40	28.00	28.00	0.00	1
1333.84	35.00	35.00	0.00	1
1334.36	42.00	42.00	0.00	1
1335.00	49.00	49.00	0.00	1
1335.74	56.00	56.00	0.00	1
1336.52	63.00	62.44	0.47	28
1336.59	70.00	63.02	6.85	6
1336.50	62.32	62.32	0.00	Overtopping

Rating Curve Plot for Crossing: South Culverts - SW Dry

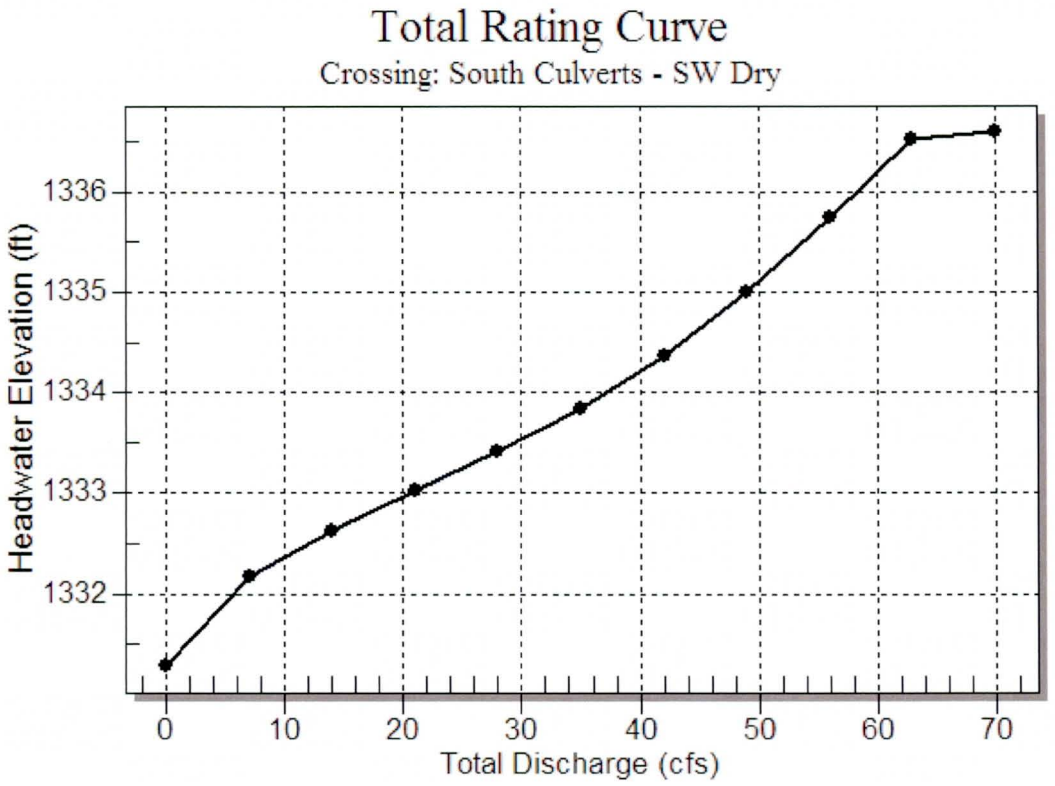


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1331.29	0.000	0.000	0-NF	0.000	0.000	0.000	0.500	0.000	0.000
7.00	7.00	1332.17	0.884	0.884	1-S2n	0.373	0.649	0.378	0.500	8.401	0.000
14.00	14.00	1332.63	1.338	0.000	1-S2n	0.528	0.935	0.579	0.500	9.265	0.000
21.00	21.00	1333.02	1.727	0.000	1-S2n	0.656	1.158	0.732	0.500	10.058	0.000
28.00	28.00	1333.40	2.109	0.000	5-S2n	0.767	1.344	0.873	0.500	10.616	0.000
35.00	35.00	1333.84	2.545	0.000	5-S2n	0.868	1.502	1.000	0.500	11.148	0.000
42.00	42.00	1334.36	3.072	0.000	5-S2n	0.964	1.634	1.122	0.500	11.579	0.000
49.00	49.00	1335.00	3.705	0.000	5-S2n	1.058	1.737	1.232	0.500	12.054	0.000
56.00	56.00	1335.74	4.449	0.000	5-S2n	1.149	1.841	1.347	0.500	12.459	0.000
63.00	62.44	1336.52	5.225	0.000	5-S2n	1.234	1.936	1.427	0.500	13.011	0.000
70.00	63.02	1336.59	5.300	0.000	5-S2n	1.242	1.944	1.434	0.500	13.054	0.000

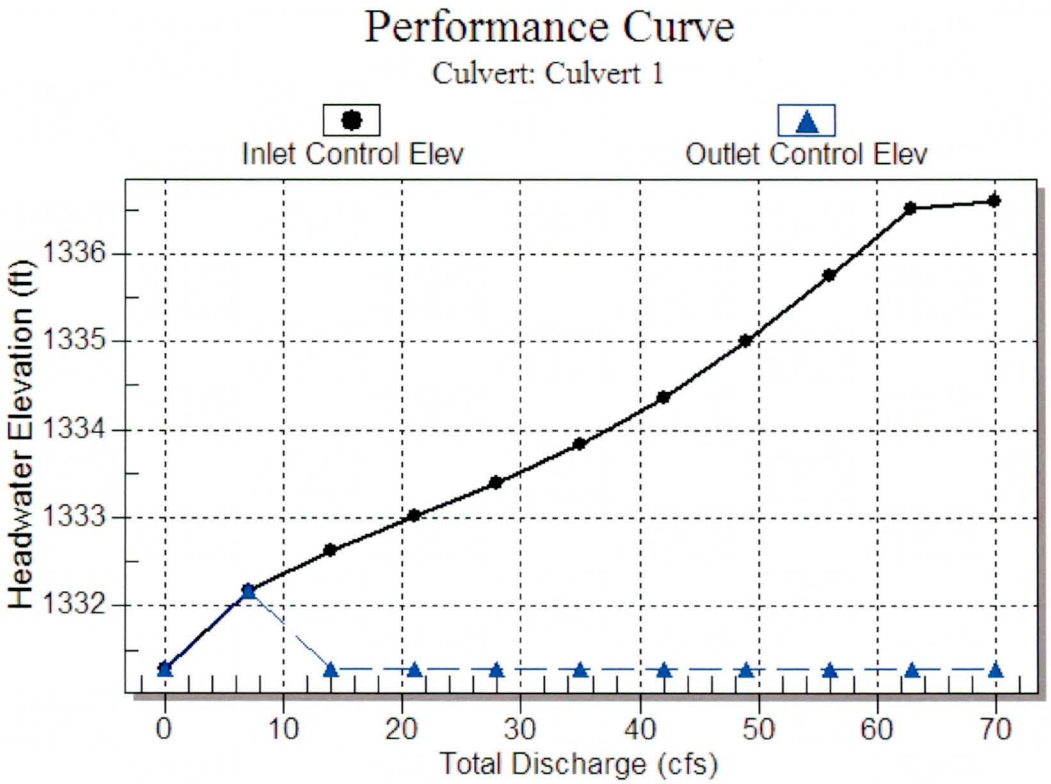
****

Inlet Elevation (invert): 1331.29 ft, Outlet Elevation (invert): 1330.07 ft

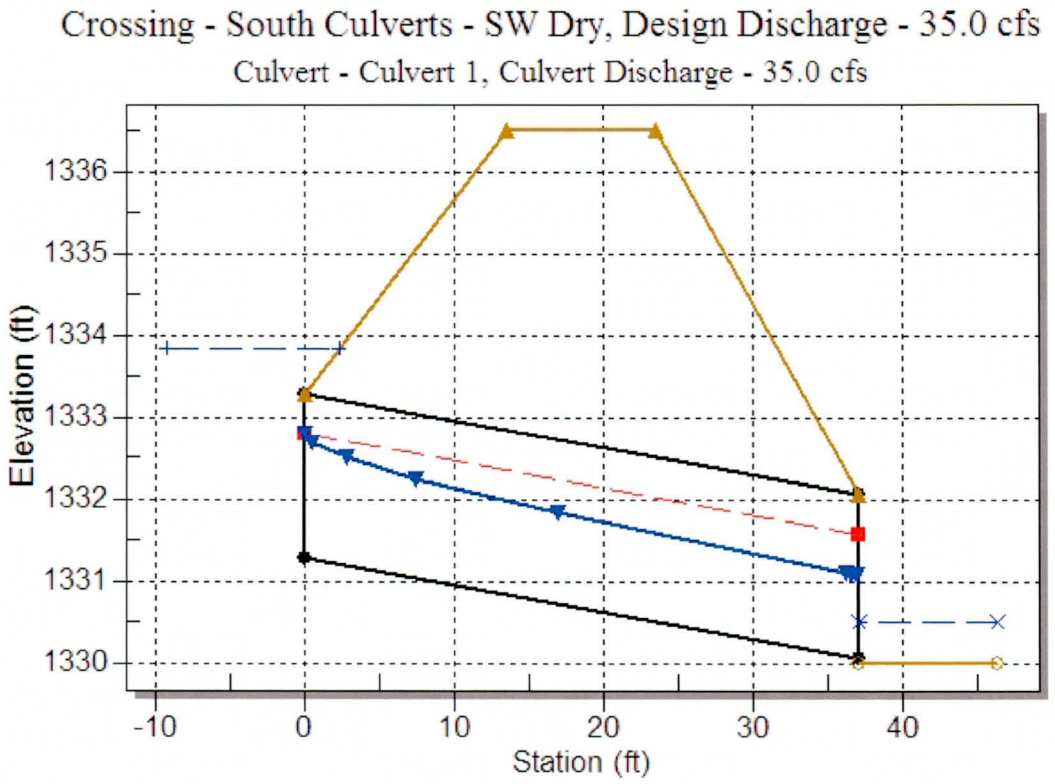
Culvert Length: 37.02 ft, Culvert Slope: 0.0330

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1331.29 ft

Outlet Station: 37.00 ft

Outlet Elevation: 1330.07 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: South Culverts - SW Dry)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	1330.50	0.50
7.00	1330.50	0.50
14.00	1330.50	0.50
21.00	1330.50	0.50
28.00	1330.50	0.50
35.00	1330.50	0.50
42.00	1330.50	0.50
49.00	1330.50	0.50
56.00	1330.50	0.50
63.00	1330.50	0.50
70.00	1330.50	0.50

Tailwater Channel Data - South Culverts - SW Dry

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1330.50 ft

Roadway Data for Crossing: South Culverts - SW Dry

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 1336.50 ft

Roadway Surface: Gravel

Roadway Top Width: 10.00 ft

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: South Culverts - SW Dry

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1331.29	0.00	0.00	0.00	1
1332.17	7.00	7.00	0.00	1
1332.63	14.00	14.00	0.00	1
1333.02	21.00	21.00	0.00	1
1333.40	28.00	28.00	0.00	1
1333.84	35.00	35.00	0.00	1
1334.36	42.00	42.00	0.00	1
1335.00	49.00	49.00	0.00	1
1335.74	56.00	56.00	0.00	1
1336.52	63.00	62.44	0.47	28
1336.59	70.00	63.02	6.85	6
1336.50	62.32	62.32	0.00	Overtopping

Rating Curve Plot for Crossing: South Culverts - SW Dry

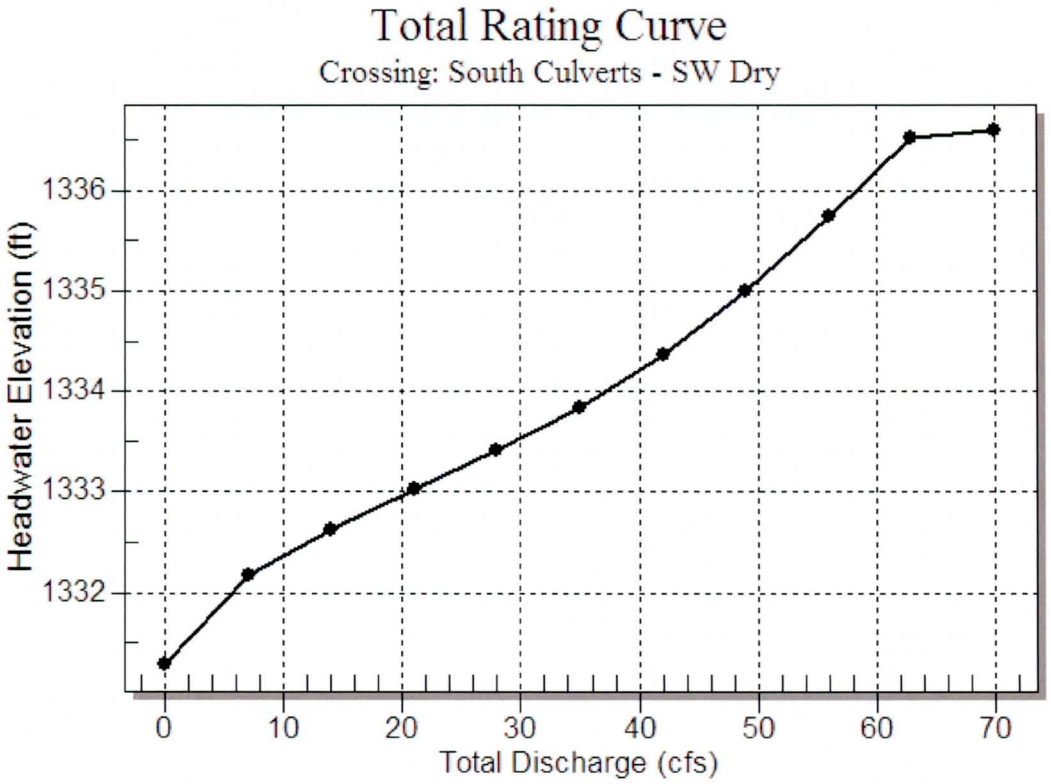


Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1331.29	0.000	0.000	0-NF	0.000	0.000	0.000	0.500	0.000	0.000
7.00	7.00	1332.17	0.884	0.884	1-S2n	0.373	0.649	0.378	0.500	8.401	0.000
14.00	14.00	1332.63	1.338	0.000	1-S2n	0.528	0.935	0.579	0.500	9.265	0.000
21.00	21.00	1333.02	1.727	0.000	1-S2n	0.656	1.158	0.732	0.500	10.058	0.000
28.00	28.00	1333.40	2.109	0.000	5-S2n	0.767	1.344	0.873	0.500	10.616	0.000
35.00	35.00	1333.84	2.545	0.000	5-S2n	0.868	1.502	1.000	0.500	11.148	0.000
42.00	42.00	1334.36	3.072	0.000	5-S2n	0.964	1.634	1.122	0.500	11.579	0.000
49.00	49.00	1335.00	3.705	0.000	5-S2n	1.058	1.737	1.232	0.500	12.054	0.000
56.00	56.00	1335.74	4.449	0.000	5-S2n	1.149	1.841	1.347	0.500	12.459	0.000
63.00	62.44	1336.52	5.225	0.000	5-S2n	1.234	1.936	1.427	0.500	13.011	0.000
70.00	63.02	1336.59	5.300	0.000	5-S2n	1.242	1.944	1.434	0.500	13.054	0.000

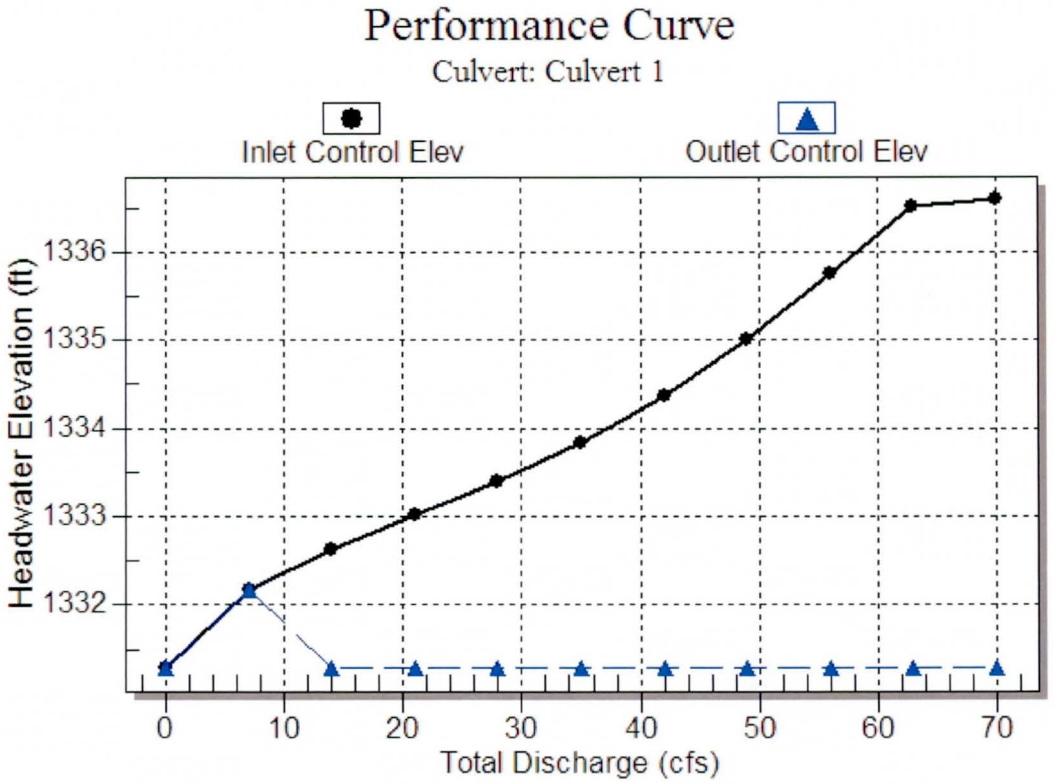
****

Inlet Elevation (invert): 1331.29 ft, Outlet Elevation (invert): 1330.07 ft

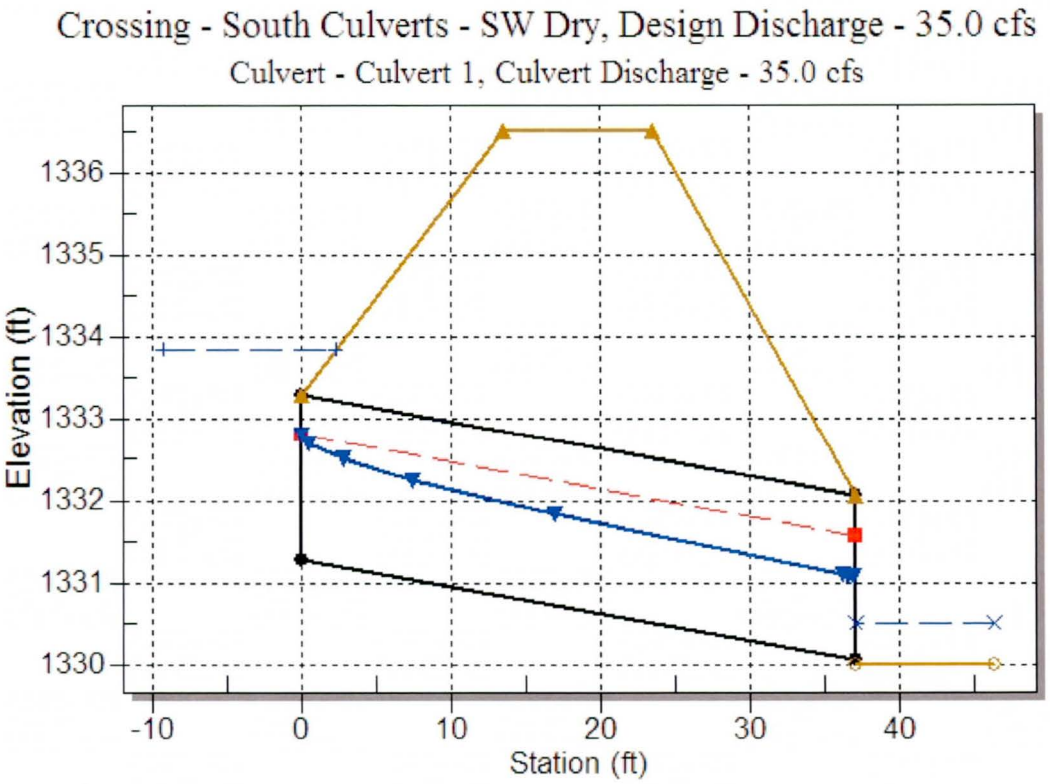
Culvert Length: 37.02 ft, Culvert Slope: 0.0330

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1331.29 ft

Outlet Station: 37.00 ft

Outlet Elevation: 1330.07 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: South Culverts - SW Dry)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	1330.50	0.50
7.00	1330.50	0.50
14.00	1330.50	0.50
21.00	1330.50	0.50
28.00	1330.50	0.50
35.00	1330.50	0.50
42.00	1330.50	0.50
49.00	1330.50	0.50
56.00	1330.50	0.50
63.00	1330.50	0.50
70.00	1330.50	0.50

Tailwater Channel Data - South Culverts - SW Dry

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1330.50 ft

Roadway Data for Crossing: South Culverts - SW Dry

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 1336.50 ft

Roadway Surface: Gravel

Roadway Top Width: 10.00 ft

HY-8 Culvert Analysis Report

Table 1 - Summary of Culvert Flows at Crossing: South Culverts - SW Dry

Headwater Elevation (ft)	Total Discharge (cfs)	Culvert 1 Discharge (cfs)	Roadway Discharge (cfs)	Iterations
1331.29	0.00	0.00	0.00	1
1332.17	7.00	7.00	0.00	1
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1333.40	28.00	28.00	0.00	1
1333.84	35.00	35.00	0.00	1
1334.36	42.00	42.00	0.00	1
1335.00	49.00	49.00	0.00	1
1335.74	56.00	56.00	0.00	1
1336.52	63.00	62.44	0.47	28
1336.59	70.00	63.02	6.85	6
1336.50	62.32	62.32	0.00	Overtopping

Rating Curve Plot for Crossing: South Culverts - SW Dry

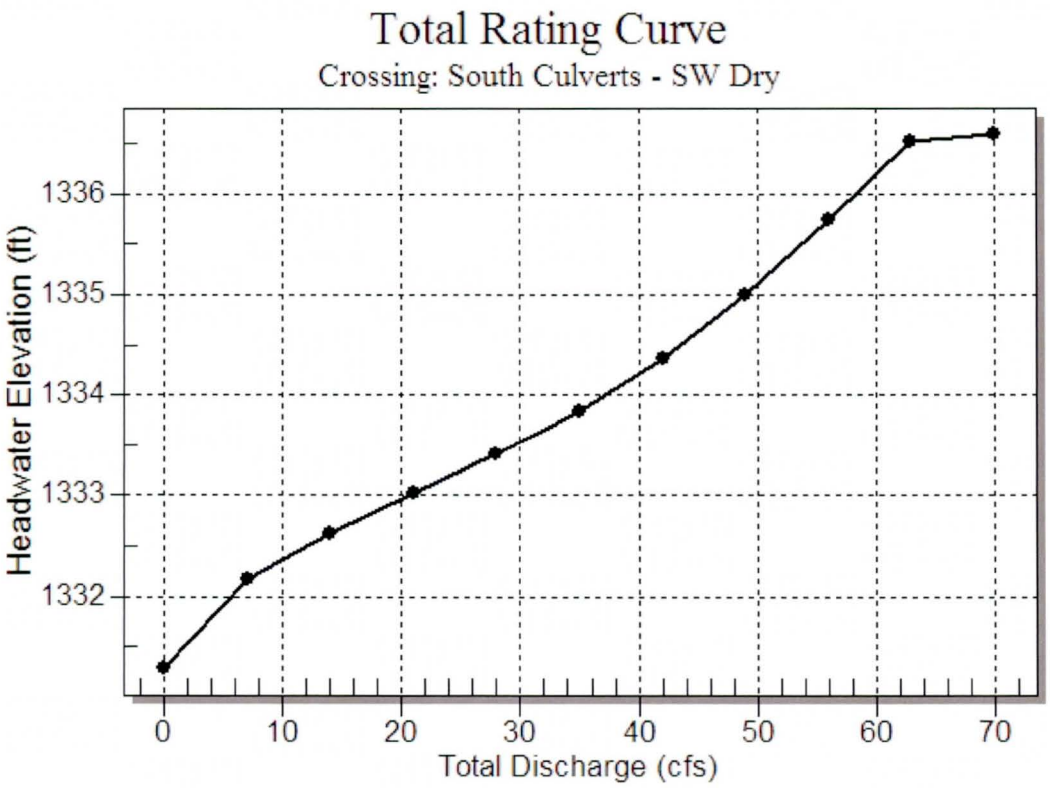

Table 2 - Culvert Summary Table: Culvert 1

Total Discharge (cfs)	Culvert Discharge (cfs)	Headwater Elevation (ft)	Inlet Control Depth (ft)	Outlet Control Depth (ft)	Flow Type	Normal Depth (ft)	Critical Depth (ft)	Outlet Depth (ft)	Tailwater Depth (ft)	Outlet Velocity (ft/s)	Tailwater Velocity (ft/s)
0.00	0.00	1331.29	0.000	0.000	0-NF	0.000	0.000	0.000	0.500	0.000	0.000
7.00	7.00	1332.17	0.884	0.884	1-S2n	0.373	0.649	0.378	0.500	8.401	0.000
14.00	14.00	1332.63	1.338	0.000	1-S2n	0.528	0.935	0.579	0.500	9.265	0.000
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28.00	28.00	1333.40	2.109	0.000	5-S2n	0.767	1.344	0.873	0.500	10.616	0.000
35.00	35.00	1333.84	2.545	0.000	5-S2n	0.868	1.502	1.000	0.500	11.148	0.000
42.00	42.00	1334.36	3.072	0.000	5-S2n	0.964	1.634	1.122	0.500	11.579	0.000
49.00	49.00	1335.00	3.705	0.000	5-S2n	1.058	1.737	1.232	0.500	12.054	0.000
56.00	56.00	1335.74	4.449	0.000	5-S2n	1.149	1.841	1.347	0.500	12.459	0.000
63.00	62.44	1336.52	5.225	0.000	5-S2n	1.234	1.936	1.427	0.500	13.011	0.000
70.00	63.02	1336.59	5.300	0.000	5-S2n	1.242	1.944	1.434	0.500	13.054	0.000

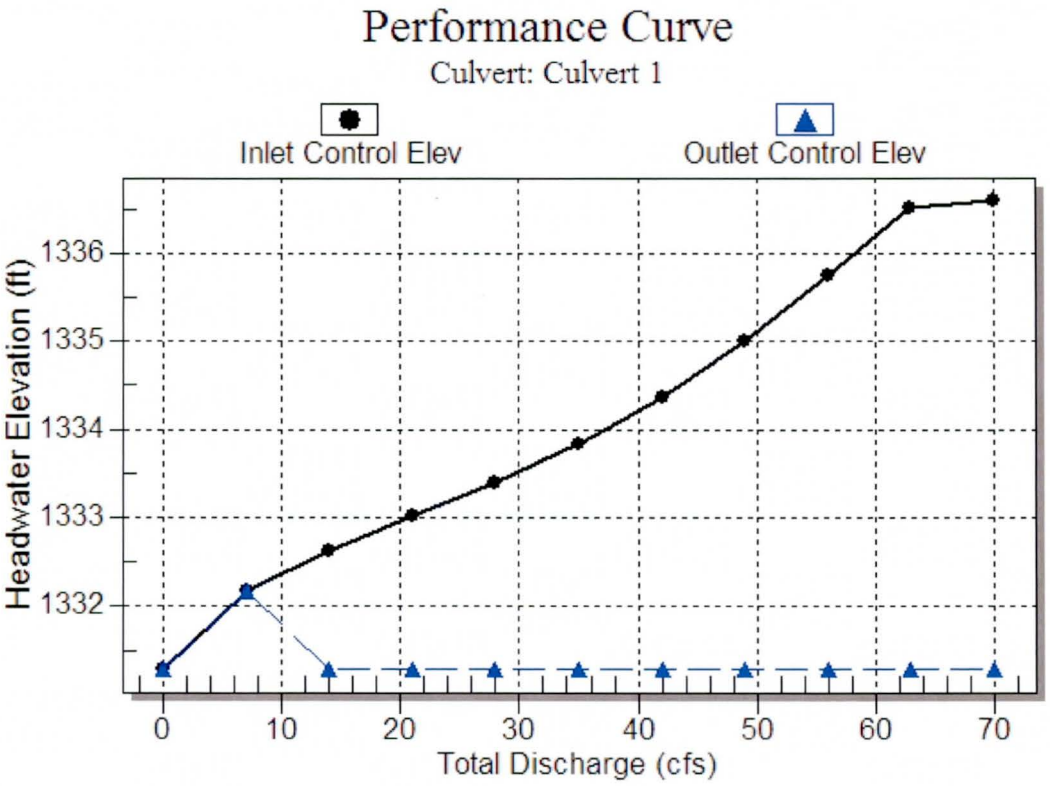
****

Inlet Elevation (invert): 1331.29 ft, Outlet Elevation (invert): 1330.07 ft

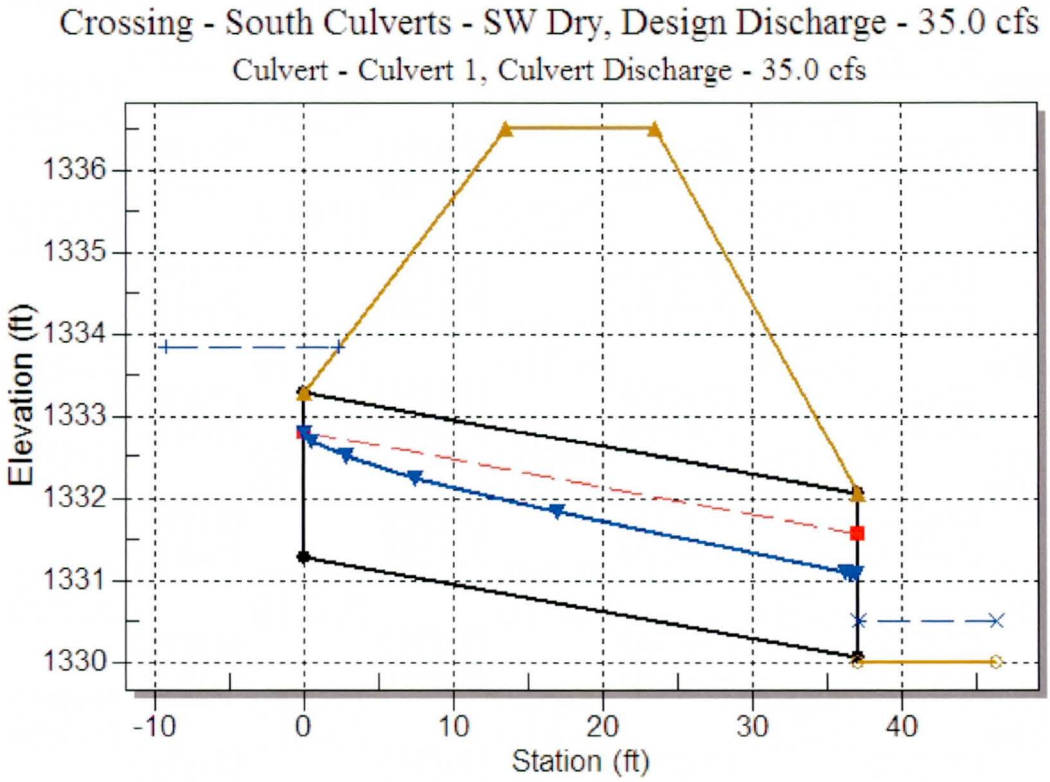
Culvert Length: 37.02 ft, Culvert Slope: 0.0330

****

Culvert Performance Curve Plot: Culvert 1



Water Surface Profile Plot for Culvert: Culvert 1



Site Data - Culvert 1

Site Data Option: Culvert Invert Data

Inlet Station: 0.00 ft

Inlet Elevation: 1331.29 ft

Outlet Station: 37.00 ft

Outlet Elevation: 1330.07 ft

Number of Barrels: 2

Culvert Data Summary - Culvert 1

Barrel Shape: Circular

Barrel Diameter: 2.00 ft

Barrel Material: Concrete

Embedment: 0.00 in

Barrel Manning's n: 0.0120

Inlet Type: Conventional

Inlet Edge Condition: Square Edge with Headwall

Inlet Depression: None

Table 3 - Downstream Channel Rating Curve (Crossing: South Culverts - SW Dry)

Flow (cfs)	Water Surface Elev (ft)	Depth (ft)
0.00	1330.50	0.50
7.00	1330.50	0.50
14.00	1330.50	0.50
21.00	1330.50	0.50
28.00	1330.50	0.50
35.00	1330.50	0.50
42.00	1330.50	0.50
49.00	1330.50	0.50
56.00	1330.50	0.50
63.00	1330.50	0.50
70.00	1330.50	0.50

Tailwater Channel Data - South Culverts - SW Dry

Tailwater Channel Option: Enter Constant Tailwater Elevation

Constant Tailwater Elevation: 1330.50 ft

Roadway Data for Crossing: South Culverts - SW Dry

Roadway Profile Shape: Constant Roadway Elevation

Crest Length: 100.00 ft

Crest Elevation: 1336.50 ft

Roadway Surface: Gravel

Roadway Top Width: 10.00 ft

WIER FLOW CALCULATION AT 39TH AVENUE

Hydraulic Analysis Report

Project Data

Project Title: Scatter Wash

Designer:

Project Date: June 20, 2014, 2014

Project Units: U.S. Customary Units

Notes:

Weir Analysis: 39th Ave

Notes: Weir Elevation = 1335.90 = (1336.09+1335.84+1335.78)/3

Input Parameters

Weir Type: Broad-crested

Coefficient: 2.5000

Length: 90.0000 (ft)

Head: 0.1000 (ft)

Result Parameters

Flow: 7.115 (cfs) @ 1336

Weir Analysis: 39th Ave

Notes: Weir Elevation = 1335.90 = (1336.09+1335.84+1335.78)/3

Input Parameters

Weir Type: Broad-crested

Coefficient: 2.5000

Length: 90.0000 (ft)

Head: 0.2000 (ft)

Result Parameters

Flow: 20.125 (cfs)

Weir Analysis: 39th Ave

Notes: Weir Elevation = 1335.90 = (1336.09+1335.84+1335.78)/3

Input Parameters

Weir Type: Broad-crested

Coefficient: 2.5000

Length: 90.0000 (ft)

Head: 0.3000 (ft)

Result Parameters

Flow: 36.971 (cfs)

Weir Analysis: 39th Ave

Notes: Weir Elevation = 1335.90 = (1336.09+1335.84+1335.78)/3

Input Parameters

Weir Type: Broad-crested

Coefficient: 2.5000

Length: 90.0000 (ft)

Head: 0.4000 (ft) @ 1336.3

Result Parameters

Flow: 56.921 (cfs)

Weir Analysis: 39th Ave

Notes: Weir Elevation = 1335.90 = (1336.09+1335.84+1335.78)/3

Input Parameters

Weir Type: Broad-crested

Coefficient: 2.5000

Length: 90.0000 (ft)

Head: 0.5000 (ft) @ 1336.4

Result Parameters

Flow: 79.550 (cfs)

POND DRAIN TIME CALCULATIONS

Client:	FCDMC	Sheet	1	of
Project:	Scatter Wash	Date:	6/28/2014	
Design:	Drain Time Calculations			
Prepared By:	AFC	Checked By:		

Pond Location	Overflow Weir Elevation	Volume at Top/Overflow Elevation	Pipe Invert Elevation	Storage Volume at Pipe Invert Elevation	Volume to be Drained		Average Head on Outlet Pipe	Discharge Rate at Average Head	Drain Time	Drain Time
	feet	acre-ft	feet	acre-ft	acre-ft	cubic feet	feet	cfs	seconds	hours
N1-D1	1331.8	1.32	1329.88	0.52	0.80	34848.0	1.0	5	6969.60	1.9
S3-D1	1335.9	2.90	1331.29	0.00	2.90	126454.7	2.3	31	4079.18	1.1

CRITICAL BASIN STATISTICS

Client:	FCDMC	Sheet	1	of 1
Project:	Scatter Wash	Date:	7/17/2014	
Design:	Basin Statitstics			
Prepared By:	afc	Checked By:		RLS

Pond Name	Pond Location	Surface Area	Stored Volume	Water Surface Elevation	Maximum Depth***	Approximate Average Depth	Approximate Pond Drain Time***
		acre	acre-ft	ft	ft	ft	hrs
N1-D1*	North of North Levee Outlet	0.57	1.49	1332.1	4.3	2.63	1.9
S1-D1	Northernmost pond that overflows to S2	0.28	0.23	1338.9	1.2	0.82	not calculated
S2-D1	North of S3 and captures overflow from S1	0.17	0.07	1337.2	0.8	0.41	not calculated
S3-D1**	South of South Levee Outlet	3.91	3.27	1336.0	4.7	0.84	1.1

* Note: for N1-D1 basin statistics are reported with respect to the overflow elevation obtained from weir flow calculations. See report section 2.6.2.5.

** Note: for S3-D1 basin statistics are reported with respect to the elevation obtained from the reservoir routing analysis. See report section 2.6.2.6.

*** Note: Pond Drain Time calculations are made with respect to weir overlow elevations (1331.75 for N1D1 and 1335.9 for S3-D1).

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
STANDARD OPERATING PROCEDURES (SOP'S), DEFICIENCY LEVELS, MAINTENANCE STANDARDS, AND STANDARD DRAWINGS

Operations & Maintenance Division

Standard Operating Procedures (SOP's), Deficiency Levels, Maintenance Standards, and Standard Drawings.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

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..... Wrought Iron Fence 3 of 8 13
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..... Wrought Iron Fence 5 of 8 15
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FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #1

Subject: Chain of Command

PURPOSE: Define reporting responsibility within the Flood Control District (FCD) and the Operations and Maintenance Division (O&M)

PROCEDURE A: Organization Structure

1. The FCD is a municipal corporation and political subdivision of the State of Arizona, an entity that reports to and is governed by a Board of Directors, the members of which are also elected officials serving as the Board of Supervisors for Maricopa County.

2. A separate Flood Control Advisory Board (FCAB), comprised of appointed private citizens, (one citizen appointed by each Board of Director member), serve the Flood Control District of Maricopa County (FCDMC), officials as both an advisory and consulting group.

3. The FCD Chief Engineer and General Manager directs the District's operations. The reporting responsibility of this office is to the County Manager.

4. Under the Chief Engineer and General Manager there is the following organizational structure:

    A. The Chief Engineer and General Manager directs the operations of six divisions:
        1. Administration
        2. Operations & Maintenance
        3. Engineering
        4. FMS
        5. Real Estate
        6. Planning & Projects Management

    B. Within the Operations and Maintenance (O&M) Division there are five (5) branches, which report to the O&M Division Manager.
        1. Ecology
        2. Work Control
        3. Maintenance
        4. Administration
        5. Shop

A schematic organizational chart is attached (Attachment A) that depicts both the authorized position title and vertical/horizontal relationship definitions.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #1

Subject: Chain of Command

PROCEDURE B: Personnel Responsibility

1. Each employee's responsibilities is to be made in accordance with the vertical chain of command as presented herein.

    A. Daily assignments and project goals will be given by the immediate supervisor.

    B. In the event that an assignment is given by another supervisor of equal or higher level, the assignment shall be undertaken with the priority given by the assignor, notifying the employee's immediate supervisor as soon as possible of the situation.

    C. The employee's position responsibilities may necessitate directing employee activity for personnel not his subordinate(s); such direction may be deemed necessary by an emergency or work conditions.

2. When such assignments are made, it is the responsibility of the assignor to make known the reason for such direction to the assignee's immediate supervisor as soon as possible.

3. Each employee is to discharge, to the best of his ability, the responsibility of his position, and report to his immediate supervisor.

    A. Questions regarding position duties shall be directed to the immediate supervisor.

    B. Any deviations from the established chain of command initiated by the employee, shall be reported to the employee's immediate supervisor at the first available opportunity, along with an explanation of the reason(s) for such action.

4. No one is authorized to bypass the chain of command, which is shown on attachment.

Attachment: A: Schematic Organizational Chart

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #2

SUBJECT: Preparation Time For Maintenance Personnel

PURPOSE: To Minimize Congestion In the Maintenance Yard(s) During The Work Day.

PROCEDURE A: Assignments

1. Each Team Leader, Work Crew Leader, Maintenance Technician, and any Equipment Operators working independently, will report to his/her Supervisor at the beginning of each workday.

2. Work Crew Leaders are to obtain their supplies at the beginning of the workday **prior** to departing. They are not to return to the Durango Complex with their crews unless:

    A. Their assigned tasks require that they do. This can include educational training, special work assignments, etc.

3. Work Crew Leaders are to fuel their vehicles at the end of the workday.

4. Team Leaders and Equipment Operators are to obtain the tools and materials needed for the following day at the end of the workday. Equipment Operators are to fuel and prepare their vehicles/equipment at the end of the workday.

5. All materials, supplies, and tools needed are to be coordinated through either the shop personnel or the Work Control Center. In order to ensure that the needed items are available, as much lead-time as possible should be given when making your request.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #3

SUBJECT: Daily Vehicle Inspections

PURPOSE: To ensure vehicle is in a safe operating condition.

PROCEDURE A: Vehicles weighing one ton or less

1. The assigned operator of any motor vehicle shall perform the following daily checks prior to departing the FCD yard or storage area:

A. Walk around the vehicle and check for:
   1. Fluid leaks
   2. Body damage
   3. Inspect tires for proper inflation or damage

B. Check under the hood for the following:
   1. All fluid levels and add as necessary.
   2. Inspect all belts, hoses, and battery cables.

C. Verify proper operation of the following:
   1. Headlights
   2. Tail lights
   3. Brake lights
   4. Turn signals and emergency flashers
   5. Windshield wiper
   6. Rotating beacon, if so equipped
   7. Shoulder harness/seat belts

PROCEDURE B: Other vehicles and/or equipment

1. The operator of any other type of vehicle shall perform pre-operational checks and inspections required for the specific vehicle and operating license.

2. A Driver's Vehicle Inspection Report is to be completed by the operator **DAILY**. The last recorded operator will be held responsible for any damage or deficiencies not noted on this report.

3. Upon completion of the inspections listed above, the operator will mark on the Daily Inspection Report that the inspection has been performed.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #4

SUBJECT: Daily Team Activities Report

PURPOSE: To record data from job assignments to include labor, material and equipment usage.

PROCEDURE: Employee Responsibility

1. Each General Maintenance Worker, Maintenance Specialist, Ecology Technician, Crew Leader, Shop Personnel, and all Equipment Operators (EO, HEO, and HEOSr.) will be responsible for completing a Daily Team Activities Report detailing his/her crews activities.

2. The responsible person will ensure that all recorded information is correct, neat and legible.

3. Record all information in the spaces provided such as Date, Team, Weather, Work Order Number, Personnel, and the hours worked for each Work Order. It is important to be accurate as to the hours charged. The correct starting and stopping time for each work order should also be noted.

4. Any time that is spent away from the job site should be noted on the report.

5. Personnel that are on personal leave, jury duty, military duty, or FML will have their time recorded under the Off-Duty Hour" sections.

6. List all materials used for each work order.

7. Mark appropriate box after completing equipment check. (See SOP #2)

8. For each Work Order, list the equipment number, the start and stop hours or miles, the total hours or miles used, and the operator initials. Rental equipment is charged by the day, regardless of the type of equipment unless otherwise directed.

9. The individual completing the form will legibly sign and date the report.

10. When applying chemicals, the same daily report is to be used.

11. Daily Reports are to be completed and turned in **prior** to the end of the workday.

Updated 09-24-07

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #5

SUBJECT: Work Orders

PURPOSE: To standardize the work order process

PROCEDURE: Work request

1. All Work Orders are to be initiated in the Work Control Center.

2. The Operations and Maintenance Division Manager shall approve all Work Orders which can also include the following:

    A. Requests from other agencies or department outside the Flood Control District.
    B. Jobs considered Capital Improvement Projects.
    C. Any proposed modifications to the structure.
    D. Projects of a significant nature that are not categorized as routine maintenance.

3. Work Orders are to be used for all work:
    A. Tasks that can be completed in one (1) hour or less that a crew happens upon during their normal workday will utilize a standard work order (swo-….)
    B. Citizen concern work orders will utilize the current year and the 1000 series (05-1…).
    C. Regular work orders will utilize the current year and the 2000 series (05-2…).
    D. Work orders generated by maintenance inspections will utilize the current year and the 4000 series (05-4…).
    E. Work orders that are considered special in nature will utilize the current year and the 5000 series (05-5…).
    F. Work orders that are generated for other departments both internally and externally will utilize the current year and the 6000 series (05-6…).
    G. Work orders generated by the annual inspections will utilize the current year and the 7000 series (05-7…).
    H. Work orders generated for Ecology will utilize the current year and the 8000 series (05-8…).

4. Team Leaders, Crew Leaders, or the responsible parties are to ensure that any support personnel correctly charge their time, materials, and equipment to the work order on their Daily Reports.

5. Team Leaders, Crew Leaders, or the responsible parties are to ensure that upon completion, the Work Order is signed and that the start and completion dates are accurate.

6. Crews are not to "hold" Work Orders. If it is apparent that the work orders will not be completed as scheduled, they should be returned to the Work Center for reassignment.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #6

SUBJECT: On the Job Training---for the Operations and Maintenance Division

PURPOSE: To Train Employees for Proficiency, Increased Productivity and Diversified Assignments

PROCEDURE A: Define job responsibilities, required skills, and their application regarding various job classifications within Flood Control District

1. Objectives of O.J.T.
    A. Improve proficiency, productivity and aptitude of the employee.
    B. Cross-trained employees are versatile and more easily deployed.
    C. Provide for employee development/improvement of skills and familiarity of related equipment.

2. Position Description
    A. Describe job requirements as per necessary skills, objectives, responsibilities, methodology and authority.
    B. Explain procedures to accomplish job objectives, describing the performance requirements in detail. Refer to any applicable Standard Operating Procedures. (SOP's)
    C. Review employee's previous understanding and skills developed applicable to the position being trained for.

3. On the Job Training for Individuals, Routine Positions
    A. Prepare for Training: collect and prepare materials, tools and equipment necessary to conduct training.
    B. Demonstrate method to employee.
    C. Demonstrate job procedures and skills necessary to employee.
    D. Observe the employee repeat the above demonstration.
    E. Review the employee's performance and discuss any inadequacies in their performance.
    F. Document any increased ability/understanding regarding job training received.

4. On the Job Training for Individuals: Flood Control Operation
    A. Each FCD (O&M) employee authorized to operate a FCD or Maricopa County vehicle and/or equipment shall obtain a "Maricopa County Vehicle Use Permit" (MCVUP) card. An appropriate Arizona Commercial Drivers License (CDL) is needed prior to operating any vehicle, over 1 ton, and shall be carried with the employee while on duty.

SUBJECT: On the Job Training---for the Operations and Maintenance Division

B. There are two levels of Operator training:

1. The first type of training is classroom instruction for light motor vehicles (cars to 1 ton trucks) which is a course in Defensive Driving, given by the County and must be completed by each employee driving any FCD vehicle.

2. A combination of classroom and field training /observation of the employee by the MCDOT Safety Office Equipment Instructor (Risk Management Department). Each type of heavy duty motor vehicle or equipment requires a separate training/education period. Successful completion of training by employee is documented by endorsement on their Maricopa County Vehicle Permit Card.

3. In the case of heavy-duty vehicles, (trucks greater than 1 ton and larger or any off-road construction equipment), the training is provided by the MCDOT Safety Office Equipment Instructor, or a designed deputy. Training must be successfully completed and documented on their Maricopa County Vehicle Permit in order for the employee to be authorized to operate the specific type of equipment they may be assigned.

****** Heavy Equipment Includes: Motor Graders, Dozers, Scrapers, Large Front End Loaders, etc. that require more experience to operate efficiently are restricted to licensed Operators only. Alternate Operators are seldom needed on this type of equipment.

- An arrangement for this type of training is to be approved by the O&M Division Manager.
- During this type of second level training the Operator's Handbook for the applicable equipment will be made available for the employee/trainee to read and understand.
- The Equipment Instructor shall review the employee's understanding of the Handbook and when the employee is considered knowledgeable, a field demonstration and practice on the equipment will be given to the employee.
- The Equipment Instructor will provide for a follow –up review of the employee's ability/understanding to operate the equipment on a periodical basis, or as required for personnel on alternate (underfill) status as an operator.
- Concern for the safety of the operator and those working around him prohibit OJT personnel from operating any equipment without authorization by their immediate supervisor.
- An Equipment Training Form (copy attached) must be completed by an employee before any equipment training is given by the MCDOT Equipment Instructor.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #7

SUBJECT: Check out procedures for FCD tools and/or equipment.

PURPOSE: To establish control and ensure proper care, repair and accountability of tools and/or equipment in the O&M Division.

PROCEDURE:

1. Team Leader/Work Crew Leader or designated person will request tools/equipment from Resource Coordinator.

2. The Resource Coordinator will check out each tool(s) or piece of equipment, maintain an accurate updated log and check each tool(s) or piece of equipment back into the shop.

3. Person returning checked out tool(s) or equipment will return it clean and operable. If any damage is sustained, ensure shop personnel are made aware of the damage.

4. Person returning checked out tool(s) or equipment will notify shop personnel if any tool or equipment is not operating properly or if any damage has occurred.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #8

SUBJECT: Controlled burning operations

PURPOSE: To establish a safe and efficient means to control burn vegetation.

PROCEDURE:

1. Personnel or crews requesting to burn will notify the O&M Administrative Coordinator. The O&M office will then make necessary telephone calls requesting permission to burn and notify the requestors by radio before or by 0800 hours.

2. Personnel must have the appropriate burning permit in their possession when burning. They will comply with all conditions set forth on the permit.

3. Personal will not burn within 10' of fences, gates, or appurtenant structures. Debris from burning will be disposed of (i.e. by raking) and the area burned will be returned to as close to natural as possible.

4. When controlled burning in Pinal County, follow the burn permit stipulations. A water truck or backhoe must be on site for all controlled burning operations.

5. Discontinue all burning operations when wind conditions create a hazard.

6. Notify the O&M Administrative Coordinator when burning operations have ceased for the day.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #9

SUBJECT: Inspections and Documentation

PURPOSE: Document the Procedure for Tracking MFR Measures

PROCEDURE:

1. Annual Inspections:
The Work Control Center will conduct annual inspections of all of the Districts flood control facilities on an annual basis. The annual inspection will be documented in report form and reviewed by the O&M Division Manager. The report will include a statement concerning whether or not the structure will operate as designed. The inspection report will be filed away as a hard copy and an electronic form will also be documented and saved in the FCD share drive. Applicable copies of the inspection report will be mailed to the projects sponsoring agency, the U.S. Army Corps of Engineers or the Natural Resources Conservation Service.

In addition, projects built by the U.S. Army Corps of Engineers require a semi-annual inspection and report.

The annual inspection team, for dams and FRS's, consists of a Public Works Inspector, Dam Safety Engineer, and two additional trained employees. The projects sponsoring agency, and the Arizona Department of Water Resources Dam Safety Section will be also be invited to attend the inspection.

2. Maintenance Inspections:
The Maintenance Inspections also occur on an annual basis. This inspection precedes the Annual inspection by six to eight weeks. The Work Control Center staff conducts the maintenance inspections. The inspection staff will provide a detailed report noting any maintenance deficiencies, continuous monitored concerns, and any dam safety anomalies observed during the inspection. From this report, work orders will be generated, some deferred and assigned accordingly. The maintenance inspection report will be filed away as a hard copy and an electronic form will also be documented and saved in the FCD share drive. Each work order will be assigned a priority rating. (See Attachment X)

Managing for Results (MFR) Measure:

All priority #**1-work orders** generated from the maintenance inspections shall be completed before the start of the scheduled annual inspections. When this condition is met, the structure has been maintained to District and sponsoring agencies standards.

See attached priorities and inspection schedule.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #9

SUBJECT: Inspections and Documentation

Deficiency Levels and Maintenance Standards (Priorities)

(During Inspections and Routine Maintenance)

SUBJECT: Index

PURPOSE: List titles of deficiency levels and maintenance standards

Function & Integrity-Priority #1

Standard No.	Title	Revision Date	Reviewer
#7	Dams	2005	CFK
#9	Flap Gates	2005	CFK
#11	Inlet & Outlet Structures	2005	CFK
#12	Inverts-Channels & Storm Drains	2005	CFK
#13	Levees	2005	CFK
#14	Outlet Towers	2005	CFK
#15	Trash Racks	2005	CFK
#16	Reservoirs-Dams	2005	CFK
#19	Channel & Storm Drain Walls	2005	CFK

Security & Liability-Priority #2

Standard No.	Title	Revision Date	Reviewer
#1	Access Gates	2005	CFK
#3	Retention Basins	2005	CFK
#4	Buildings	2005	CFK
#5	Bridges & Catwalks	2005	CFK
#6	Catch Basins	2005	CFK
#10	Handrails	2005	CFK

Aesthetics-Priority #3

Standard No.	Title	Revision Date	Reviewer
#2	Access Roads	2005	CFK
#8	Fencing	2005	CFK
#17	Right-of-Way Vacant	2005	CFK
#18	Signs & Staff Gages	2005	CFK
#20	Trails	2005	CFK

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

MONTH	DATE	DAM	FEDERAL AGENCY	DISTRICT RESPONSIBLE ENGINEER	FY 04-05 INSPECTING ENGINEER
November 2004	8th – 11th	Buckeye FRS No. 1	NRCS	B. Howey	M. Greenslade
		Buckeye FRS No. 2	NRCS	B. Howey	L. Lambert
		Buckeye FRS No. 3	NRCS	B. Howey	L. Lambert
	15th – 16th	Saddleback FRS	NRCS	B. Howey	B. Howey
		Harquahala FRS	NRCS	B. Howey	B. Howey
December 2004	6th – 9th	Guadalupe FRS	NRCS	L. Lambert	M. Greenslade
		Spookhill FRS	NRCS	M. Greenslade	M. Greenslade
		Apache Junction FRS	NRCS	M. Greenslade	M. Greenslade
		Signal Butte FRS	NRCS	M. Greenslade	M. Greenslade
January 2005	10th – 13th	White Tanks FRS No. 3	NRCS	L. Lambert	L. Lambert
		White Tanks FRS No. 4	NRCS	L. Lambert	L. Lambert
February 2005	7th – 10th	Powerline FRS	NRCS	L. Lambert	B. Howey
		Vineyard FRS	NRCS	L. Lambert	B. Howey
		Rittenhouse FRS	NRCS	L. Lambert	B. Howey
	14th – 15th	McMicken Dam	USACE	M. Greenslade	M. Greenslade
March 2005	7th – 10th	Adobe Dam	USACE	L. Lambert	L. Lambert
		Dreamy Draw Dam	USACE	L. Lambert	L. Lambert
		Cave Buttes Dam	USACE	B. Howey	L. Lambert
		New River Dam	USACE	M. Greenslade	L. Lambert
April 2005	4th	Sunnycove FRS	NRCS	M. Greenslade	B. Howey
		Sunset FRS	NRCS	M. Greenslade	B. Howey
		Casandro Wash Dam	NRCS	M. Greenslade	B. Howey

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Structure Name	Inspection Date
Adobe Dam	October 2004
Dreamy Draw Dam Semi-Annual	October 2004
Cave Buttes Dam Semi-Annual	October 2004
New River Dam Semi-Annual	October 2004
ACDC & Cave Creek Arm Semi-Annual	October 2004
Skunk Creek @I-17 Semi-Annual	October 2004
New River Channel (COE sponsored area) Semi-Annual	October 2004
Buckeye FRS #1	November 2004
Buckeye FRS #2	November 2004
Buckeye FRS #3	November 2004
Saddleback FRS	November 2004
Harquahala FRS	November 2004
Guadalupe FRS	December 2004
Spook Hill FRS	December 2004
Apache Jct. FRS	December 2004
Signal Butte FRS	December 2004
White Tanks FRS #3	January 2005
White Tanks FRS #4	January 2005
Harquahala Floodway	January 2005
Saddleback Floodway	January 2005
Centennial Wash Levee	January 2005
Powerline FRS	February 2005
Vineyard FRS	February 2005
Rittenhouse FRS	February 2005
McMicken Dam	February 2005
Adobe Dam	March 2005
Dreamy Draw Dam	March 2005
Cave Buttes Dam	March 2005
New River Dam	March 2005
ACDC & Cave Creek Arm	March 2005
Sunnycove FRS	April 2005
Sunset FRS	April 2005
Cassandro Wash Dam	April 2005
Skunk Creek @ I-17	April 2005
New River Channel	April 2005
Camelback Ranch Levee	April 2005
Agua Fria River	April 2005
Holly Acres	May 2005
Perryville Riprap	May 2005
Colter Channel	May 2005
RID Overchute	May 2005
Indian School Rd. Drain	May 2005
Dysart Drain	May 2005

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Structure Name	Inspection Date
El Mirage Drain	May 2005
EMF	June 2005
Spook Hill Floodway	June 2005
Signal Butte Floodway	June 2005
Bulldog Floodway	June 2005
Pass Mountain Diversion Channel	June 2005
Sun City Drains	July 2005
Sun City West Drains	July 2005
East Fork Cave Creek	July 2005
10th Street Basins #1 & #2	July 2005
Paradise Valley Basin	July 2005
Scatter Wash	July 2005
Rittenhouse Road Drain	August 2005
Sossaman Road Drain	August 2005
Guadalupe Road Drain	August 2005
Indian Bend Wash Project	August 2005
Rio Salado	September 2005
Old Cross Cut Canal	September 2005
48th Street Drain	September 2005
Adobe Dam Semi-Annual Inspection	October 2005
Dreamy Draw Dam Semi-Annual Inspection	October 2005
Cave Buttes Dam Semi-Annual Inspection	October 2005
New River Dam Semi-Annual Inspection	October 2005
ACDC & Cave Creek Arm	October 2005
Skunk Creek @ I-17	October 2005
New River Channel (COE sponsored area)	October 2005

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #10

SUBJECT: Employee Work Clothes and Safety Equipment

PURPOSE: To Issue Correct Clothing and Safety Equipment and Define Responsibility for Their Usage

PROCEDURE A: Clothing

1. Outer work clothes are provided both as a benefit to employees and for a public relations measure that identifies each employee to the general public.
2. Once an order for clothes has been placed, it takes three (3) to four (4) weeks to receive the first issue. During this time, the employee shall provide his /her own clothing at the employee's expense.
3. Each employee will be issued the following:
   A. Ten (10) shirts – Shirts may be long or short sleeve, (employee's choice).
   B. Ten (10) pairs of pants
   C. Two (2) jackets
4. The O&M Shop Personnel assigned, North Yard, and East Yard Field Supervisor shall maintain records of clothing sizes.
5. The O&M Division will provide cleaning services for the issued clothing. Soiled clothing will be picked up on pre-arranged days according to each of the three work areas. During weeks in which holidays occur, changes in pickup will be posted. It is the responsibility of each employee to bring and pick up his/her clothing each laundry day.
6. Each employee will be expected to take care of his/her work clothes. Normal wear and usage is expected. However, repair or replacement of issued clothing as a result of abuse (as determined by the O&M Division Manager) will be at the employee's expense.
7. The O&M Shop Personnel assigned shall be contacted if any problems or questions arise.

PROCEDURE B: Personal Protective Equipment

1. Basic safety is the responsibility of each employee. Each employee can call upon their immediate Supervisor for necessary equipment, procedures, and /or personnel to create a safe work environment.
2. Safety equipment shall be utilized in all designated areas and/or for hazardous activities
3. O&M Shop Personnel will provide the following items for employee use:
   A. First Aid Kit (installed in vehicles)
   B. Eye Protection
   C. Wet Weather Boots, Ponchos, slickers
   D. Gloves
   E. Dust/Fumes/Mist Respirator
   F. Hard Hat
   G. Ear Plugs
   H. Safety Vest

4. Employees needing to wear prescription safety glasses will be provided with them in accordance with District policy.
5. The use of District provided clothing and safety equipment is a mandatory condition of employment.
6. It is the responsibility of the Field Supervisor to ensure personal protective equipment is the appropriate type of PPE designated for the task, is made available, and is used at his/her job site.
7. All employees required to use Personal Protective Equipment must be trained in the proper wearing, usage, maintenance, limitations, care and disposal of Personal Protective Equipment: 1. Before use of PPE, 2. If any changes occur in the workplace rendering previous training obsolete, or if any changes in the types of PPE to be used render previous training obsolete, the employees must be retrained.
8. Employee's that are required to wear respirators must be in a respiratory protection program in compliance with 29 CFR 1910.134. This includes a medical evaluation, Cardio-pulmonary baseline function test, fit testing of respirators and training for employee on the respirators in use.

PROCEDURE C: Protective Footwear

1. Field Supervisors, Crew Leaders, Equipment Operators (3 titles), Maintenance Specialist, General Maintenance Workers, and all other personnel in similar field positions are required to wear steel-toed safety boots. These shall be at least a "3/4 boot" covering and supporting the employee's ankles. Toe guards will be worn at all times when operating jackhammers and pneumatic tampers.

2. Employees will be reimbursed for the cost of their boots (up to $120.00) on an annual basis or as determined by District Policy. For specific details, employees should consult with their supervisor.

PROCEDURE D: Equipment Responsibility

1. Each employee shall list and sign for all District provided clothing and safety equipment on the form provided by the Resource Coordinator.

2. Upon employment termination, the employee shall return all District provided clothing and safety equipment. If any times are missing or not accounted for, their value will be deducted from the final paycheck.

Updated 12-4-07

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Operations and Maintenance Division

Standard Operating Procedure #11

SUBJECT: Material Safety Data Sheet

PURPOSE: To establish a standard procedure for properly obtaining, reviewing and filing MSDSs

REQUIREMENTS:

1. All hazardous materials purchased by FCD employees must have a current MSDS filed with:
   A. Ecology Branch
   B. O&M Public Works Supervisor – Shop

      1) Buying a NEW product:
         A) Obtain a MSDS at the time of purchase.
         B) If the seller does not have a MSDS, DO NOT buy the product, use an already approved product ONLY. Provide the Ecology Branch with the following information in order for a formal request for a MSDS may be made:
            - Product Name
            - Name and address of Distributor
            - Manufacturers name

         C). The ecology Branch will notify the O&M Division Manager when the MSDS has been obtained and the purchase may be made.

   C. Before using a new hazardous material, provide the Ecology Branch with the following information: (Note: use the New Hazardous Material Product form, See next page this S.O.P.)

      1. Copy of MSDS
      2. Name of product
      3. Use(s) of product
      4. Where the product will be used (location(s))
      5. Where the product will be stored
      6. Job Title(s) of employee(s) that will be using the product

2. All employees using a hazardous material will have the proper MSDS on the job site. If a supervisor does not have a specific MSDS for a hazardous substance that is brought into the work area he will prohibit the use of the product on his job site until a proper MSDS is available on the site.

REFERENCES: Hazard Communication Plan for Maricopa County Division of Public Works, 10/03/88

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #12

SUBJECT: Heat Stress Guidelines

PURPOSE: **HEAT STRESS GUIDELINES**

A Heat Stress Index developed for the National Weather Service (NWS) is a new service provided in the Maricopa County area. The Index is compiled from information about heat-related deaths. The atmospheric conditions believed to have contributed to these deaths are temperature, humidity, sky condition and the general prevailing air mass. Based on this information a "Heat Advisory, High Heat Watch or Warning" could be issued by the NWS. Prior data shows that only about 4% of calendar days would be affected by these conditions.

Causal Factors:

1. Each division should determine work operations that place employees in areas at risk of being affected by heat stress and provide annual training to help them understand their responsibilities to withstand working in the heat.
2. Employees should seek a physician's advice about their medical history and current medications that may predispose them to heat related illness.

Control:

1. Each division should determine acclimation criteria for current employees, new employees, inmates, hosts, temporary help, and employees returning from extended leave.
2. Encourage workers to wear lightweight, loose fitting, light-colored clothing or issued work clothes.
3. The Agricultural Health and Safety Center, the National Weather Service, the US Air Force and the University of Minnesota Extension Service recommend natural fibers, such as cotton.

Fluid Replacement:

1. Chilled water/fluids should be consumed in small, frequent amounts, 8 oz. to 16 oz., each 30 minutes. Workers should be cautioned against drinking too much water, which could increase fluid loss.
2. FCD shop personnel will provide enough ice to chill the water in available water coolers.
3. Encourage employees to seek a physician's advice about individual appropriate electrolyte replacement.
4. Each work crew exposed to extreme heat working conditions should have a minimum of 2.5 gallons of water available, per person per day, plus 5 gallons of rescue water.
5. There should be a minimum of 2.5 gallons of usable water and 2.5 gallons of rescue water available for single persons on field vehicles.
6. When a crew uses all drinking water except the 5-gallon rescue water, they should stop work and replenish their drinking water supply.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY

Operations and Maintenance Division

Standard Operating Procedure #12

SUBJECT: Heat Stress Guidelines

Administration Controls:

1. Training - Employees shall be informed of these guidelines and requirements.
2. On days when the heat index is in the "Severe" category, employees shall alternate work and rest periods. Rest periods shall be taken in a shaded area (15 minutes or more in every hour).
3. If an employee is suspected of suffering from heat stress/stroke call "911" and also inform "61 Flood Control."
4. No employee suspected of being ill from heat stroke should be sent home or left unattended unless released by a qualified medical professional.
5. On days when the heat index is in the "Severe" category, employees in areas identified as at risk of being affected by heat stress/stroke should not be allowed to work alone.

Reduced Work Days:

1. On days of extreme heat (heat index in the "Extreme" category) work crews shall discontinue work at 1 pm and return to their reporting facility.
2. The supervisor will provide specific work instructions.
3. The department will coordinate training or other work activities.

Attachments:
OSHA Facts Sheet 95-16
http://climate.geog.udel.edu/~jdwatts/index_web/

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #13

SUBJECT: Reporting Vehicle Accidents

PURPOSE: Describe content and method of reporting facts for vehicular accidents

PROCEDURE A: Method of Reporting:

1. An accident is defined as an incident that rearranges ANY part of the vehicle, its accessories (either inside or outside the vehicle or contents within the vehicle). Employees must report any accident/injury to his/her supervisor. Any accident not reported or covered up may result in severe disciplinary action.

2. An Accident Report Form is defined as the Risk Management Department triplicate form No. 7500-005 R12-81.

   A. Copies of the Accident Report form can be found inside each FCDMC vehicle. The FCD Shop supervisor is responsible for maintaining forms in each vehicle.
   B. The form is to be completed by your immediate supervisor, after investigation of the accident, and consultation with the employee.

PROCEDURE B: When an accident occurs on FCD facilities:

1. Notify immediate supervisor or use vehicle radio and call "61 Flood Control." Refer to the "Radio Usage Procedures" SOP #17 for additional information concerning use of the radio to report accidents.

2. In serious accidents, do not move the vehicle unless instructed to do so by an FCD supervisor, police or emergency workers.

3. An investigation of the accident will be conducted by the supervisor and the Accident Report form is to be completed by the supervisor that same day.

PROCEDURE C: When an accident occurs on a public highway or any other private or public area:

1. Use vehicle radio if operational and call "61 Flood Control" providing the following information:
   A. Code 961 for an accident without injuries
   B. Code 962 for an accident involving injuries.
   C. Location of the accident:
      1) Federal highway; (interstate) give highway number and the number of the nearest mile marker if possible, or approximate distance and direction from the nearest crossroad.
      2) State highway; give highway name/number and distance to the nearest crossroad.

3) County highway; give road name/number and distance to nearest crossroad.
4) City street; give the street and nearest the crossroad or an adjacent street number.
   a) Give the number of vehicles involved.
   b) Give the ownership of involved vehicle(s), (Federal, State, County, or private).
   c) Provide the accident circumstances, for example
      - Are traffic lanes blocked?
      - Are power lines down?
      - Any spilled fuel or other fire hazard present?
      - Description of traffic conditions, heavy or light.
      - Description of weather conditions.
      - Other conditions or circumstances that conventional rescue/law enforcement response.

2. In serious accidents, do not move the vehicle unless instructed to do so by a police officer.
3. Do not discuss the accident with anyone except a police officer or an FCD supervisor.
4. The office will contact emergency and/or law enforcement authorities, as the situation warrants. Supervisors are responsible for contacting MCDOT-Safety when their employees are involved in any accident, regardless of the extent of damage.
5. Employees may be required to submit to a physical examination that will include a drug and alcohol test. Supervisors are required to follow the Maricopa County Substance Abuse Policy.
6. The supervisor will conduct an investigation of the accident and review the events surrounding the accident with the employee on the day the accident occurred. Supervisors are to submit a completed accident report form to the office in a timely manner in order to meet the 24-hour requirement for reporting accidents to Risk Management.
7. The supervisor and employee will be required to attend the next Accident Review Board to review the circumstances of the incident.
8. Any accident involving contract laborers must be reported to Staff Mark.
9. It is imperative that the Division Manager or his designee be promptly notified in the event of **any** accident involving the District.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #14

Subject: Hazardous Materials Incidents

PURPOSE:

1) To establish Standard Operations Procedures for Emergency Response to any Hazardous Materials Incident within Maricopa County Flood Control District.
2) To provide safety procedures for Maricopa County Flood Control District employees to follow when internal or external hazardous material incidents occur.

The Flood Control District of Maricopa County shall utilize the following Standard Operating Procedures for Emergency Response of Hazardous Materials to ensure proper emergency response procedures and the safety of all employees is observed when a response to a hazardous chemical/incident may be required within the Flood Control District.

DEFINITIONS:

1) **EXTERNAL INCIDENT:**
A hazardous material incident that occurs on county properties or right-of-way, away from any existing county facility.
   A. Where the County is directly involved, caused or is part of a traffic accident involving a hazardous material.
   B. When a report or request for assistance in the clean up of an incident created by a private citizen, involving known or unknown substances or notice of illegal dumping of chemicals.

2) **INTERNAL INCIDENT:**
Hazardous material incidents, (spills, or hazardous release of any gas, liquid or vapor involving a hazardous material) that occur within any Maricopa County facility, to include but not limited to the Department of Transportation Procurement facility, Facilities Management facility, Equipment Services facility, Vector Control storage area, or the Medical Examiners offices.

3) **HAZARDOUS MATERIAL:**
Any material that can significantly contribute to an increase in serious, irreversible or incapacitating illness; pose substantial present or potential hazard to human health or the environment when improperly treated, stored, transported or disposed of, or otherwise managed; or material that has a characteristic of ignitability, corrosivity, reactivity, or toxicity.

4) **LIFE THREATENING:**
Any hazardous material that is a threat to human life or health when released into the environment.

5) NON-LIFE THREATENING:
Any hazardous material that is hazardous in nature but is NOT an immediate threat to human life, i.e., oil or diesel fuels.

6) BIOODBORNE PATHOGENS:
Pathogenic microorganisms that are present in human blood and can cause disease in humans, to include but are not limited to hepatitis B virus (HBV) and human immunodeficiency virus.

7) OTHER POTENTIALLY INFECTIOUS MATERIALS (OPIM):
The following human body fluids: semen, vaginal secretions, cerebrospinal fluid, pleural fluid, any body fluid that is visibly contaminated with blood, and ALL body fluids in situations where it is difficult or impossible to differentiate between body fluids.

8) CONTAMINATED:
The presence or the reasonably anticipated presence of blood or "Other Potentially Infectious Materials" on any item or surface.

9) CONTAMINATED SHARPS:
Any contaminated object that can penetrate the skin including, but not limited to, needles, scalpels, broken glass, broken glass tubing, broken glass vials.

10) DECONTAMINATION:
The use of physical or chemical means to remove, inactivate, or destroy Bloodborne Pathogens on a surface or item to the point where they are no longer capable of transmitting infectious particles and the surface or item is rendered safe for handling, use or disposal.

11) PPE:
Personal Protective Equipment

12) REGULATED WASTE:
Liquid or semi-liquid blood or Other Potentially Infectious Materials; contaminated items that would release blood or OPIM in a liquid state or semi- liquid state if compressed; items that are caked with dried blood or OPIM and are capable of releasing these materials during handling; contaminated sharps; and pathological and microbiological wastes containing blood or OPIM.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure # 14

HAZARDOUS MATERIALS "EXTERNAL or INTERNAL" INCIDENTS

1. **External Safety Procedures for spills on Maricopa County properties, right of way and facilities.**

   A. When the County is directly involved, caused, or is part of a traffic accident involving a hazardous material.

   B. When a report or request for assistance in the clean up of an incident created by a private citizen, involving known or unknown substances, or notice of Illegal dumping of chemicals.

2. **EMERGENCY NOTIFICATION:**

   Notify the immediate supervisor if a hazardous material incident occurs.

   A. Report what type material is leaking and where, as well as the size of the spill and rate of flow.
   B. The supervisor will use the Material Safety Data Sheet (MSDS) OR Department of Transportation Emergency Response Guidebook to determine if the material is life threatening or non-life threatening.
   C. The supervisor will determine whether or not the immediate employees can contain the spill or if an Emergency Response Team is needed.
   D. The supervisor will immediately notify the appropriate agencies (only when Life threatening, or in the event of a chemical reaction or fatality), "**61**" Office, Emergency Services by dialing "**9-9-1-1**" or "**9-1-1**", and the Safety Division at **(602) 506-7179**. Advise that there is a hazardous material spill and give the following information:

      - Name of the person calling and department.
      - What hazardous material has been spilled?
      - Source of the hazardous material (i.e., vehicle, container, etc.).
      - Where the spill is located.
      - When the spill occurred (time).
      - What has been done to control or contain the spill?

3. **CONTAIN THE SPILL.**

   ATTENTION! Employees are to contain <u>only</u> if determined by supervisor to be safe. In ALL OTHER circumstances, employees must have Emergency Response Team contain the spill.

Use the Material Data Safety Sheet (MSDS) or Department of Transportation Emergency Response Guidebook to identify proper protective equipment and to understand what hazards are associated with the hazardous material and what to do to contain the spill.

4. CONTAINMENT PROCEDURES:

- When determined by the supervisor (SAFE) stop the source of the leak. Close the valves, pumps, or whatever may be allowing the material to spill.
- Cover drains or other possible escape routes to waterways.
- Patch holes with patch kits, valve pluggers, or whatever is available for safe patching.
- Contain the spill by the best method that may be available by:
    1. Building a dike to keep spilled liquid from getting into water.
    2. Channeling the spill to a place where it will not spread, by diking or pumping, or opening a trench to a secure spot.
    3. Placing an empty container under the leak.
    4. Use absorbent materials to soak up the spill.

5. SPILL OF A PETROLEUM PRODUCT (i.e., gas, oil, hydraulic fluid) of less than 1 gallon: Following procedures must be followed

- Place a piece of plastic on the ground, away from the spill and with a SHOVEL scrape up the spill contents and place it on the plastic.
- Contact the **Safety Division Hazardous Materials Consultant** for further guidance. **(602) 506-7179** or **(602) 723-7057.**

PREVENTION:

1. TO PREVENT SPILLS:

- Make sure containers are intact and are stored to prevent spills or external damage.
- Ensure containers are marked correctly and are segregated with compatible materials only.
- Always remember hazardous spills can cause a fire, explosion, or release of toxic substances into the air or water that can affect not just you, but others in the surrounding area.
- Inspect vehicles and equipment for possible leaks or damaged hoses that contain hazardous material.
- Always carry MSDS's of all hazardous materials carried on vehicles to include proper safety equipment.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure # 14

HAZARDOUS MATERIALS "ILLEGAL DUMP " INCIDENTS

In the event of locating or uncovering a container or containers where possible hazardous chemicals may be present on Maricopa County Properties and Right Of Way, the following procedures must be followed:

1. If operating equipment/machinery and a container is uncovered by the equipment/machinery, stop operation of the machinery/equipment and notify the immediate supervisor with the following information:

    - Location
    - Type of container (i.e., 55 gallon or 5 gallon drum, metal, plastic, tanker)
    - If liquid is present describe the color of the liquid
    - Indicate if any odor or reaction has occurred

2. Supervisor will contact emergency services immediately. If a reaction or fatality has occurred call "**9-9-1-1**" or "**9-1-1**". If there is no reaction or fatality associated with the container, **contact the Safety Division Hazardous Materials Consultant at (602) 506-7179.**

3. All equipment/machinery in contact with the container or liquid will be marked off and secured until an appropriate Hazardous Materials Responder identifies the contents.

HAZARDOUS MATERIALS "BIOHAZARD " INCIDENTS

In the event of locating or uncovering any possible contaminated sharps or possible bloodborne pathogen or other potentially infectious materials that may be present on Maricopa County Properties and Right Of Way, the following procedures must be followed:

1. **Contaminated Sharps collection and disposal**

    When determined by the crew lead/supervisor to be safe, collect and dispose of the contaminated sharps items as regulated waste.

    To collect contaminated sharps the following process must be used:

    - Identify the contaminated sharps items to be collected and disposed of.
    - Wearing puncture resistant gloves, and using mechanical means such as safety tongs, shovel and dust pan, pick up the contaminated sharps item and place in the appropriate sharps container provided.
    - Do not touch the item with bare hands during collection and/or disposal.

- Under no circumstances shall any sharps item be bent, broken, recapped, or removed during collection for disposal by any Maricopa county employee.
- The appropriate sharps container for placement of the sharps shall be marked/labeled as bio-hazardous in orange or red-orange coloring and lettering and symbols in contrasting color, and shall be puncture resistant and leak proof.
- Sharps collection containers shall remain closed and secured after each use.
- Sharps collection containers shall be disposed of when full, by delivering or having it collected by, a pre-determined county bio-hazardous waste contractor approved for regulated waste disposal.

2. **Bloodborne Pathogens and Other Potentially Infectious Materials, decontamination, collection and disposal**

When determined by the crew lead/supervisor to be safe, decontaminate, collect and/or dispose of the BBP/OPIM as follows:

Determine location and amount of BBP/OPIM exposure.

- If larger than 55 gallon drum for waste disposal, employee shall immediately stop the process and notify the supervisor.
- If larger than 55 gallon drum for waste disposal, supervisor shall notify a predetermined contractor to decontaminate, collect and dispose of BBP/OPIM.

If exposure to BBP/OPIM is less than 55 gallon drum for waste disposal, it must be decontaminated, collected and disposed of by Flood Control employee for Maricopa County by using the following procedures:

- Employees must first decontaminate the area or item by using a 1:10 solution of bleach.
- Employees must use PPE recommended by bleach Manufacturer / Material Safety Data Sheet Information. The following PPE must be worn when decontaminating and BBP/OPIM area or item:
  - Safety glasses or goggles
  - Chemical gloves
- Bleach solution shall be diluted by using 1part bleach to 10 parts water and should be immediately applied to the exposed area or item.
- Bleach solution shall remain on area or item for <u>at least</u> 10 minutes to allow for decontamination process to complete.
- After decontamination process is complete:
  - Small decontaminated surface areas shall be wiped down with clean towels with disposal of towels being placed in red bio-hazardous waste bags and placed in secondary leak proof container with lid for disposal drop off to or collection by the predetermined bio-hazardous waste disposal contractor.

- Decontaminated items shall be placed in red bio-hazardous waste bags and placed in secondary leak proof container with lid for disposal drop off to or collection by the predetermined bio-hazardous waste disposal contractor.
- All human and animal waste shall be decontaminated, bagged or contained in a closed, leak proof container and disposed of in normal waste disposal.

SAFETY ALWAYS! At no time will a Maricopa County employee handle or attempt to move containers abandoned or uncovered. Report illegal dumpsites to the Safety Division with a good location and marking. If and when possible, obtain as much information about the container at a distance with little or no risk to all.

For further information and training in spill containment and illegal dumpsites, contact the **Maricopa County Risk Management Safety Division, Hazardous Materials Consultant at (602) 506-7179.**

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #15

SUBJECT: Tailgate Safety Talks

PURPOSE: To Promote Better Safety Habits For District Employees

PROCEDURE:

1. On the first day of each workweek, all Team Leaders and Work Crew Leaders will give a (10) ten-minute safety talk at the work site. The talks will be given following the subjects outlined in the most current Tailgate Safety Manual. However, Team Leaders and Crew Leaders should also address any additional concerns or job related safety hazards at this time.

2. Employees are encouraged to speak up about safety hazards. The Team Leader will direct group participation and comments on near accidents that happened in the past as related to the work at hand.

3. Always demonstrate the proper use of safety equipment by having an employee show its use and work application.

4. For the benefit of all personnel, demonstrate the use of tools that will be utilized on the job site.

5. Any questions or concerns that the Team Leader cannot address should be directed to the O&M Supervisor.

6. All employees are required to **legibly** sign the Safety Meeting Attendance Sheet.

MARICOPA COUNTY FLOOD CONTROL DISTRICT

Operations and Maintenance Division

Standard Operating Procedure #16

SUBJECT: Radio Call-In

PURPOSE: To provide a standard call-in procedure for O&M personnel operating independently in the field.

Procedure:

1. The Public Works Area Supervisors or Team Leader shall indicate those personnel who will be operating independently by placing an asterisk (*) next to their name on the weekly work schedule.

2. O&M personnel operating independently will call the Administrative Coordinator (210) or one of the Work Control Staff (230, 231, or 232) at 10:00 a.m., 12:00 p.m., and 2:00 p.m.

3. The Administrative Coordinator shall notify the respective Supervisor by radio if contact is not established with any person reported to be operating independently by 10:30 a.m., 12:30 p.m., or 2:30 p.m. for follow-up.

MARICOPA COUNTY FLOOD CONTROL DISTRICT
Operations and Maintenance Division

Standard Operating Procedure #17

SUBJECT: Radio Use

PURPOSE: Communication

Procedure: Radio Communications

1. Radios are installed in all Flood Control District vehicles, for use in daily work requirements. These units are configured with Flood Control District (FCD), MCDOT, Equipment Services, and Emergency Services.

• Flood Control District	6-1 Flood Control
• MCDOT	6-1 Office
• Equipment Services	6-1 Shop
• Emergency Services	E.S. Base

2. The radio system consists of repeaters located on mountaintops throughout the County. The Smart Zone system is a wide area "trunked" radio system. Trunking is the automatic sharing of a small number of communication channels between a large numbers of users. It Distributes message traffic among the available channels for efficiency and reduces waiting time For an open channel.

   A normal trunked system consists of one site (typically located on a mountain top, tall tower, or a tall building) used to provide communications to a specific geographic area. The Smart Zone System utilizes four different mountain top sites to provide coverage to a major portion of Maricopa County. Smart Zone uses site locations at Thompson Peak, White Tanks, Yarnell, and Oatman.

Radio Communication Procedure

1. Radios are installed in all Flood Control District vehicles for use in daily work requirements or official business only.
2. Radios should be checked prior to departing the yard each morning to ensure proper operation.
3. The radio is to be left on and monitored throughout the workday.
4. When transmitting, use your normal voice. Do not shout or yell.
5. Speak clearly and be brief.
6. Never use profane, obscene, vulgar, or abusive language on the radio.
7. Know what you plan to say and the call number of which you are calling before you key the mike.
8. Make certain the airway is clear before you begin transmitting.
9. Identify yourself first by call number and then request the desired party by their call number.
10. Make certain to clear the airway when you have finished with your transmission. (Only the person who **initiated** the call is to clear the net.)

MARICOPA COUNTY FLOOD CONTROL DISTRICT
Operations and Maintenance Division

Standard Operating Procedure #17

SUBJECT: Radio Use

11. In the event of an emergency, contact the Operations and Maintenance Division #210, the Shop #250, or an Operations and Maintenance Supervisor.

12. During an emergency situation, DO NOT use the net for routine business and DO NOT break in to offer advice or opinion! In an emergency situation, the radio is to be used only by the individual at the scene of the emergency and the person directing emergency response personnel (firemen, police, ambulance, etc...).

Standard Operating Procedure #18

SUBJECT: Flood Emergency Operations

PURPOSE: To Define Duties and Responsibilities for O&M Personnel during Flood Emergency Conditions

Procedure A:

1. Each employee will be assigned to one of the defined observation teams to serve as "Flood Water Personnel." Each team will have specific observation points assigned, for which the employee will observe and report data as observed.

    A. The assignment listing is provided on the "Flood Emergency Staff List."

    B. The observation points are established by the Alert Branch.

    C. The specific duties to be performed at each observation point will be found in the "Flood Watch Assignment Book" and in the "Site Specific Packet."

        - The "Flood Watch Assignment Book" contains both photographs of the site and data gages, which are to be documented and monitored.

        - The "Site Specific Packet" contains detailed instructions to be followed for each observation point and a listing of both primary and secondary sites.

    D. The SWS personnel may define additional task (s) for any observation point at the time of team activation which shall be completed in addition to those listed in the "Flood Watch Assignment Book."

    E. All personnel shall evaluate their personnel safety consideration when undertaking both defined and special assignments.

2. Flood Watch Personnel (FWP) will be assigned a FCD vehicle equipped with the following items:

   A. Mobile 2-way radio
   B. Rotating warning light
   C. Most FCD vehicles are also equipped with a commercial radio for use in monitoring local emergency frequency available to the general public.
   D. For off highway locations, a four-wheel drive vehicle will be assigned.

Standard Operating Procedure #18

SUBJECT: Flood Emergency Operations

3. Each observation team will be assigned a Flood Watch Box. The Public Works Supervisor Shop is responsible for storing and maintaining such boxes. Each flood watch box measures about eighteen (18) inches in dimension, is locked with the "3E59" key, and shall contain the following:

   A. Flashlight
   B. Spot Flood Lamp
   C. Flares (8)
   D. Pig Tail Adaptor
   E. Soft Rope
   F. Safety Vests (2)
   G. Vinyl Poncho (2)
   H. Surveillance Reports
   I. Call Numbers
   J. Accident Reports
   K. Pens (2)
   L. Highway Map
   M. Light Bulb (Replace)
   N. Rags
   O. Life Preserver
   Reminder Pickup
   P. Traffic Cones (4)
   Q. Barricades (2)
   R. Team #3 Only
   Crank For Gated Outlets

4. FWP are charged with the responsibility of knowing and understanding the contents of the flood watch boxes including how to travel to the assigned area prior to any flood event.

5. FWP shall return items to the Flood watch Box after use in a neat and clean state.

   A. A photo book of each observation point is maintained by the O&M Division Manager for

use in becoming familiar with the applicable site and general area. FWP are required to visit their assigned area for orientation/training purposes.

B. FWP shall update themselves periodically with the current assignment of their respective observation team.

6. Rain gear and personal clothing suitable for working outdoors during stormy periods are the responsibility of the FWP, although the FCD Senior Resource Coordinator/staff can provide additional rain gear; however.

Standard Operating Procedure #18

SUBJECT: Flood Emergency Operations

7. Personnel will maintain FCD radio contact at all times beginning with a preliminary radio check to "61 Flood Control" prior to departing the Flood Control District complex.

A. Refer to "Radio Usage Procedures" SOP #17 for additional instruction.

B. Upon arrival at assigned observation point, FWP will observe, record, and report by radio the following data:

- Team number
- Observation point
- Stream flow characteristics:

a. Stream and/or staff gage reading(s) to be measured in feet or elevation depending on the structure.
b. Stream gage condition, (rising, falling, or steady).
c. Estimated velocity, feet per second.
d. Weather conditions (raining or not; light or hard).

C. The need for extended conversations should be made by cellular phone, if practical. REMEMBER, THE PUBLIC AND THE NEWS MEDIA ARE MONITORING YOUR RADIO TRANSMISSION.

D. Prior to departing from your assigned observation area, check in with "61 Flood Control" to notify the FCD that you are leaving and to receive any special instructions and clearance.

8. Any unusual or changing conditions having a significant potential to be life threatening or

dangerous to the general public will be reported immediately.

9. When the FCD vehicle is so equipped, the local AM radio station shall be monitored for general public broadcasts that may conflict with observed conditions. Should conflicting information be heard it shall be reported to "61 Flood Control."

10. In severe situations, personnel will be required to go on twelve-hour shifts, generally from 0600 to 1800 hours. Personnel will report to FCD Headquarters or Civil Defense Headquarters, 2035 N. 52nd Street, Phoenix, as directed by the Chief, Operations and Maintenance Division, at the beginning of the shift.

Standard Operating Procedure #18

SUBJECT: Flood Emergency Operations

11. If a life-threatening situation occurs in your vicinity and you can assist without endangering yourself, do so, but use good judgment and keep safety in mind at all times.

12. FWP must understand and be experienced with the hazards of driving in rainy/foggy/snowing weather. Typical hazards can include:

    A. Downed power/utility lines.
    B. Flooded dip crossings.
    C. General public vehicle accidents.

13. Flooded steams or dip crossings and impounded water behind structures at road crossings where a potential hazard exists for public traffic will be reported by radio to the MCDOT ("61-Office") so that traffic control devices can be installed.

14. Do not divulge any information or give opinions to the news media or the general public; refer them to FCD Public Information office @ (602) 506-2983.

15. Maintain adequate vehicle fuel reserve during your shift and fill the fuel tank at the end of your shift.

16. Arrange for restocking of the flood watch box if any supplies or equipment replacement is needed.

FLOOD WATCH ASSIGNMENT AND RESPONIBILITES

O&M Field Supervisor

- To assign areas that have been repaired or reconstructed to senior operators for transport on rotating schedule. Review and evaluate all assigned reports.
- Flood Watch Team Leaders will inspect drainage of various locations and structures that have been repaired or reconstructed and will complete a report on performance of repair work and note and prioritized any deficiencies.

Standard Operating Procedure #18

SUBJECT: Flood Emergency Operations

Team Leaders

These field supervisors will update flood emergency staff list at least three times a year; all areas will be fully manned at all times. Each area is assigned a monitoring crew and the supervisor will make certain any emergency equipment is ready for use. Members of each team must be familiar with their areas. Storm surveillance and any work request forms must be properly completed, and each report checked to verify that all areas have been reported. Before each team departs, the supervisor is to verify that all members are present or substituted and the proper paper work is in their possession.

Work Control Center Supervisor/Staff

The Work Control Center will assist the field observers in obtaining equipment, materials, and other resources for emergency repairs to District structures and will keep accurate logs of incoming calls. In addition, the WCC will monitor the various team locations movements as they make observations and inspections during the emergency.

All flood watch vehicles will be manned by two or more staff members:

Utility trucks	2 or more
Crew cabs	3 or more

All other vehicles must have supervisor approval to be used.

This memo in no way supersedes the FCD procedures and policies that must be met during storm

surveillance.

Attachment A: Flood Emergency Staff List

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Operations Division

Standard Operating Procedure #19

SUBJECT: O&M Mosquito Treatment

PURPOSE: To Outline Responsibilities for Mosquito Control for Flood Control Structures

Procedure: Notify the Ecology Team Leader of any actual or potential mosquito breeding concerns. **FCD Ecology 506-4105.**

a) Give the following information:

A. Location of the concern i.e. City, Zip Code, major cross streets, breeding source.
B. Notify Vector Control if the concern is located in an area which is not a Flood Control maintained structure or right-of-way (Vector Control **506-6616).**
C. Action will be confirmed by Vector Control to Flood Control office.

2. Refer to the Districts Mosquito Management Program

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operation and Maintenance Division

Standard Operating Procedure #20

Subject: Standard Operating Procedure (SOP) for Pesticide Licensing and Chemical Usage

Purpose: The Operations & Maintenance Division requires a license for specific positions. When a licensing requirement exists the following SOP will apply:

Procedure:

1. The O&M Division Manager will decide whether a pesticide license is required per job classification on an "as needed" basis.

2. If a pesticide license is required for a specific job, O&M will pay all registration, testing, and certification fees. All pesticide technical training manuals needed to study for the pesticide license test will be provided by the Ecology Branch of O&M. Time involved in testing for the pesticide license shall be paid for by the Flood Control District.

3. The Ecology Field Supervisor will oversee all personnel with Certified Pesticide Licenses.

4. An employee must pass two (2) separate tests in order to receive their pesticide certification. A passing score of seventy-five percent (75%) is required on each test. The two tests consist of:

    - B0- CORE Materials- Laws and Regulations
    - B3- Right-of-Way and/or Weed Certification

    If any one of the two tests is failed, a retake will be rescheduled for that particular test. All testing and rescheduling will be coordinated through the Qualifying Party Licensee in the Ecology Branch of O&M.

5. The Ecology Field Supervisor shall coordinate all training, testing, paying of fees, and distribution of up-to-date technical training manuals.

6. The Pesticide Certification License, if required, must be obtained during the original probation period.

7. To retain the Pesticide Certification License, each qualified employee shall take six (6) Continuing Educational Units (CEU's) within the twelve (12) months prior to the renewal date of their license (Arizona State Statute, Section 32-2319). A CEU is one (1) hour. At least one (1) hour of the six CEU's must be directly related to the pesticide classification that the applicator is certified in. Per the Ecology Technician job description, members of the Ecology Branch are required to obtain twelve (12) CEU's per twelve-month period.

Updated 10-15-07

8. All CEU training fees and license renewal fees shall be paid by the O&M Division.

9. All training, seminars, etc. shall be given by an instructor who is certified and registered with the SPCC.

10. The Ecology Field Supervisor is responsible for coordinating CEU training classes and seminars.

11. CHEMICAL USAGE: A pesticide applicator WILL NOT handle or apply any pesticide or herbicide until:
    (a) They have in their possession a Material Safety Data Sheet (MSDS) for the chemical they intend to use and a specimen label.
    (b) They have demonstrated to their Field Supervisor that they are familiar with the MSDS and label information included on the product packet. This includes knowledge of environmental dangers, exposure and toxicity, first aid treatment, and basic knowledge of the chemicals properties; e.g., aquatic or non-aquatic use, systemic or contact penetration, mixture rate, re-entry time into treated area, etc.
    (c) All chemicals will be stored, transported, marked with identification, and applied in accordance with all SPCC, State, Federal, Occupational Safety and Health Organization (OSHA), and Environmental Protection Agency (EPA) laws and bylaws.
    (d) All equipment used for spraying will be working properly and calibrated in accordance with the equipment Operational Manual.

12. Qualifying Party members of the Ecology Branch will issue chemicals to applicators in the various yards.

13. The Ecology Field Supervisor shall be responsible for monitoring chemical inventory and usage. The Operations Shop will be responsible for equipment maintenance.

14. The Ecology Branch will apply spot spraying that requires over two and a half gallons of herbicides.

Updated 10-15-07

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #21

SUBJECT: Removal of Unwanted or Nuisance Vegetation

PURPOSE: To standardize the removal of unwanted, deep-rooted, or nuisance vegetation on FCD structures and right-of-way.

PROCEDURE: Deep Rooted Vegetation

1. The following species have been determined to be deep-rooted and will not be acceptable on all FCD dams, dikes, levees, and earthen slopes:

    a) Desert Broom
    b) Ironwood Trees
    c) Mesquite Trees
    d) Palo Verde Trees
    e) Salt Cedar

    Deep-rooted vegetation is defined as trees and shrubs having a woody structure penetrating below a 3' ft. depth.

    Plants will be stump cut flush with the soil surface and a suitable herbicide will be applied to the stump immediately.

    All trees will be kept a minimum of 20' ft. from the toe of the dams, levees, and dikes.

    Any tree branches or foliage canopy that reduce the roadway clearance to less than 14' ft. above the road surface or which reduce the width to less than 12' feet, must be trimmed or removed.

2. Deep rooted trees must not be allowed on embankments because they limit access and visibility, and can pose potential hazards by toppling in windstorms, fill cracking by root invasion, or openings of seepage paths by root decay. Any vegetation with an extensive root system or prevents a clear view of the embankment or abutment areas should be removed.

3. **Maintenance of unlined floodways**. To ensure that the integrity of the structure is preserved and that the floodway will function as designed.

    a) Unwanted vegetation will be removed or destroyed within the flow line of the floodway, collection ditches, or side inlet basins. Remove any trash or debris that may impede flows. If grasses are established, maintain to a height of 6" inches.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #22

SUBJECT: Planting Technique for Landscape Replacements

PURPOSE: To establish a standard procedure for plant replacement in A) irrigated and B) non-irrigated landscapes.

A) PLANTING PROCEDURES FOR IRRIGATED LANDSCAPES:

MATERIALS NEEDED:

1. 1, 5 or 15 gallon replacement plants
2. Organic mulch (1.5 or 3 ft\3 size bags)
3. Stakes and staking materials
4. Utility knife and extra blades
4. 6' x 6' plastic sheeting or tarp

PLANTING PROCEDURE:

1. Plants to be replaced will be flagged in the field. Distribute replacement plants next to their flagged counterparts.

2. Strip any existing decomposed granite from a 3-4 foot diameter area, centered around the base of the flagged plant. Stockpile DG on one side of the planting area.

3. Cut the flagged plant off close to its base, discard.

4. Carefully probe the soil to locate irrigation tubing. Ideally, the tubing should be located within 4" of the ground surface. Carefully lift the ring-shaped irrigation tubing (or spaghetti tubing) from the soil and place it on one side of the planting site, DO NOT disconnect any portion of the tubing. It may be necessary to gently anchor the tubing to prevent it form interfering with the planting process.

5. Remove the remaining stump and root-ball of the flagged plant, discard and proceed to excavate hole. Place all excavated material on 6' x 6' plastic sheeting or tarp. Size the hole as indicated below:

    1. For 1 gallon size transplant-(2 to3x diameter of container)
    2. For 5 gallon size transplant-(2 to3x diameter of container)
    3. For 15 gallon size transplant-(2 to3x diameter of container)

6. On plastic sheeting or tarp, thoroughly mix the excavated soil with the following:

   a. Backfill hole with native soil and old root-ball soil mix. Add additional fill as needed to bring to grade.

7. Reposition ring-shaped irrigation tubing (or spaghetti tubing) no deeper than 4" and no less than 1" below the ground surface. It may be necessary to increase the diameter of the excavated hole to accommodate the irrigation tubing.

8. Just prior to planting, lay each plant on its side and carefully cut the bottom off of the container using the utility knife. Avoid putting any pressure on the container, this pressure could cause the container to deform, and the root-ball to break. Plants with damaged root-balls do not generally survive. Gently remove the bottom of the container.

9. Do not pick up the plants by their stems, instead handle the plant by the sides of the container, while supporting the bottom of the root-ball with hands and gently place plant into the hole. Slit one side of the container with the utility knife, remove and discard the container pieces.

10. Shovel the remaining backfill material around the plant root-ball, gently by thoroughly compacting the soil around the root-ball as you go. (Large boxed plants-fill hole with water and add backfill to remove air pockets.)

11. Water the plant using a quick coupler and a hose.

12. If appropriate, replace the stockpiled decomposed granite around the base of the plant, creating a smooth even surface.

13. Stake trees only if necessary.

B) PLANTING PROCEDURE FOR NON-IRRIGATED LANDSCAPES:

MATERIALS NEEDED:

5 gal replacement plants and/or 15 gal replacement plants

1. Osmocote fertilizer (14-14-14)
2. Clean gravel approximate size 1" x 1"
3. Utility knife - extra blades
4. 1 2-cup measuring cup
5. 1 Wheelbarrow
6. Water truck (use only "clean" water)

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #22

SUBJECT: Planting Technique for Landscape Replacements

PLANTING PROCEDURE:

1. Plants to be replaced will be flagged in the field. Distribute replacement plants next to their flagged counterparts.

2. Remove flagged plants and discard, then proceed to excavate hole. Size hole as indicated below:

   - For 5 gallon size transplants-(2 to 3x diameter /depth of container
   - For 15 gallon size transplants-(2 to 3x diameter /depth of container

3. Remove all rocks larger than 1" x 1" from excavated material.

4. Fill holes with clean water and allow to drain.

5. Remove approximately 2' ft. to 3" ft. of soil from excavated material and set aside for berm construction (see step #10).

6. Thoroughly mix remaining excavated material with the following amendments:

For 5 gallon transplants	**For 15 gallon transplants**
1.5 cups of Osmocate fertilizer	2.5 (1.5 ft\3 bag of organic mulch.
3 cups of Osmocote fertilizer	Or: 1 (3ft/3) bag
Or: 0.5 (3ft\3) bag	

7. Fill the hole as necessary (approximately 1/3 of the total volume) with the mixed backfill and gently compact, so that the top of the replacement root-ball is flush with the finished grade .

8. Just prior to planting, lay each plant on its side and carefully cut the bottom off of the container using the utility knife, Avoid putting undo pressure on the container, this pressure could cause the container to deform, and the root-ball to break. Plants with damaged root-balls do not generally survive. Gently remove the bottom of the container.

9. Do not pick up the plants by their stems, instead handle the plant by the sides of the container. While supporting the bottom of the root-ball with hands and gently place plant into the center of the hole. Slit one side of the container with the utility knife, remove and discard the container pieces.

10. Shovel the remaining mixed backfill material around the plant root-ball, gently but thoroughly compacting the soil around the root-ball as you go.

SUBJECT: Planting Technique for Landscape Replacements

11. Form tree well 3' feet in diameter for each plant. For plants positioned on embankments, form berm around the downslope perimeter of each well only. For plants positioned off-slope, form berm completely around the tree well. Berm will be approximately 5" high by 6" wide (at the base). Compact berm thoroughly.

12. Fill tree well with gravel uniformly to a 4" depth. Gravel should be hand-placed around the base of the plant.

13. Gently fill tree wells completely with water using FCD water truck. Allow water to completely drain; and fill a second time. Do not blast water at the base of the plant.

14. Stake trees only if necessary.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #23

SUBJECT: Protected Vegetation

PURPOSE: To identify desirable plant species that should be preserved during vegetation clearing operations.

The following species are considered desirable to provide wildlife habitat. These species are not considered to obstruct flows. However, no stands will be left which will block or divert flows. Removal of these species will be done **only** under special direction from the Environmental Branch and only with a written work order.

Common Name	Scientific Name
Willow	Salix nigra
Cottonwood	Populus fremontii
Cat-tails	Typha Species

Updated 11-5-07

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #24

SUBJECT: Staking of Landscape Trees

Purpose: To establish a uniform standard for proper tree support that minimizes tree damage from improper or unnecessary staking and guying techniques.

Materials: Stakes (Lodgepoles): treated for water and insect resistance
2" diameter x 6', 8', or 10' length.
Wire: Galvanized & Annealed 12 gauge wire
Rubber Hose: 1/2" I.D. (Inner Diameter) Garden Hose, Wirecutters,.
Pole Pounder, Flat Head Screwdriver (optional), Gloves

Principals of Staking:

1. While staking is often necessary to provide support for newly planted trees, not all trees may require it. Rule of thumb: If the tree can support itself, don't stake it. Regular flexing and motion caused by the wind produces plant hormones responsible for increasing trunk caliper. A young tree standing alone with its top free to move becomes a stronger tree better able to withstand the elements.

2. Staking effects tree growth. Compared to unstaked trees, staked trees are taller, somewhat weaker trees with smaller root systems and less trunk taper (the caliper of the trunk does not vary from base to the top as it would normally). Containerized nursery trees that have been tied to a center pole exhibit lack of trunk taper- their trunk caliper is often the same from tree base to the top of the center pole.

3. The staking technique utilized can enhance or deter a tree's future performance in the landscape. Most problems seen in trees 1-4 years after installation can be directly related to improper staking &/or restaking techniques:

a) Lodgepoles driven through rootballs
b) Guy wires pulled rigidly tight, not allowing the tree any movement necessary for trunk development. Loose yet secure guys are needed to yield strong trunks capable of self support and removal of stakes.
c) Trunk girdling by guy wires too small or not removed
d) Failure to return to tree site to remove stakes.
e) Failure to quickly restake trees that have fallen down or are leaning, allowing them to remain in that position for extended periods of time.
f) Improper placement of stake or guy wire in tree canopy resulting in rubbing abrasions to the tree.

4. The tree should remain staked for the shortest amount of time. Staking reduces trunk movement and bending, the natural stresses that promote trunk taper and caliper development. The faster the tree can be self-supporting and have the stakes removed, the better it is for the tree.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #24

SUBJECT: Staking of Landscape Trees

Staking Precedent:

1. Trees that have fallen down or are leaning will be restaked immediately.

2. A newly planted tree will be supported (if required) by the staking procedure outlined here. Nursery stakes left on after planting or center pole staking is an unacceptable manner of staking.

Staking Procedure:

1. Place stakes at an equal distance on both sides of the tree (a minimum of 6" outside the rootball), forming a straight line with the trunk. Position the stakes to minimize damage to the tree. If possible, stakes should be placed at right angles to prevailing winds. Be consistent with directional orientation of the lodgepoles throughout the staked area. Do not orientate E-W first tree, then N-S the second tree.

2. With a pole pounder, drive stakes through plant pit (not through the rootball) and into the undisturbed ground below pit (min. 4"). Desired stake height after driving would have the top of the stake positioned just below or near the lowest tree branch. This may not always be possible with smaller tree sizes, such as 5 gal. containers. In that instance, if staking is required, position the stake height to allow for tree growth.

3. Determine the proper height to place the top guy wire along the trunk to yield maximum support for the tree. Where possible, position top guy wire loop above the first scaffold branch. Wrap 1 /2" I.D. rubber hose pre-threaded with single strand wire inside around the trunk to form a circle. Twist wire to close and secure the loop. This loop should be independent of the side wire, allowing for reuse. Make sure the loop is not too small and maintains at least a 4" minimum I.D. for smaller trees. Larger trees will require a bigger loop to allow the trunk freedom of movement. Secure the loop to the stakes with double strand wire making sure not to have the wires so tight that movement is not allowed. This can be achieved by running a strand of wire from the stake through the notched opening of the loop to pass under the wire (already inside the loop) and back to the stake. Fasten wires to the stake by wrapping the wire around the stake several times and twisting close. The additional wire wrapped around the stake provides the added length required for future loosening. Install the lower loop in the same manner, positioning it halfway between the top guy and the ground. Staple guy wires to lodgepoles by utilizing a staple gun loaded with 1/2" staples. This will help prevent the guy wires from slipping down the lodgepole.

SUBJECT: Staking of Landscape Trees

4. Check back later in the year to make sure:
   a. The tree has not outgrown the ring.
   b. The wire and stakes are in good condition and not broken.
   c. The tree still needs to be staked-if not remove staking

.

5. Double trunk and Multi-trunk trees require additional leaders to be staked and loop wires to be joined but otherwise follow the general principals above.

Figures Accompanying Text:

Figure 1: Staking Detail
Figure 2: Tree Guying Detail
Figure 3: Hose Loop Detail

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #25

SUBJECT: Core Drain Marker Post's

PURPOSE: To identify and locate core drains on FCD structures.

PROCEDURE A:

Install a 3"x 5'6" standard sign post, 18" in the ground at toe area of downstream slope.

PROCEDURE B:

For Tile or PVC core drains install post 12" in front of drain offset in either direction by 12" from center of drain with intent to protect the drain from heavy equipment.

PROCEDURE C:

For (various size) rock core drains at toe area of structures, install post at center point of rock at the end of rock furthest from the structure.

PROCEDURE D:

Install all marker posts straight and parallel to the structure, so delineator can be installed on each side of post, facing traffic from both directions paralleling the structure.

PROCEDURE E:

Install a "1-Ball Red" Delineator on each side of post, and flush to the top of the post. Red has been designated as the color to identify core drains.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #26

SUBJECT: Subsidence Monument Marker Posts

PURPOSE: To establish a uniform subsidence marker post to identify subsidence markers that are located either on the crest or toe of the structures.

PROCEDURE A.

Install a 3" x 5'6" standard channel post, 18" in the ground on shoulder of crest and downstream side of structure within 4" of monument, with the intent to protect monument from damage during grader work and other heavy equipment operation.

PROCEDURE B.

Install post's straight and parallel to the structure on the shoulder of crest and downstream slope, so that delineators can be installed on each side of post to face traffic in each direction, paralleling the structure.

PROCEDURE C.

Use a 1-ball yellow delineator on each side of the marker post.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #27

SUBJECT: Stationing Procedures for Pertinent Structure Reference

PURPOSE: To Identify Locations for Reference and Maintenance Functions and Repairs

PROCEDURE A.

1. Stationing is required every 500' ft. on FCD structures, preferably to be installed on the crest of a dam, levee, or dike if applicable.

2. All Principal Spillways and vegetative/irrigation gated outlets need stationing to be identified on the headwalls and at gated lifting units located on crest.

3. All other pertinent structures; side inlets, drop inlets, drains, etc. associated with FCD structures need stationing installed either on concrete surfaces or sign placards.

4. Linear stationing located on shoulders of crest and upstream or downstream ROW needs to be installed on a 2" x 5' channel post installed 18" into the ground. A 6" x 6" placard need to be installed flush to top of the sign post and facing traffic parallel to the structure. Snap off or bend down any excess thread of installation bolts on each placard. Install correct stationing numbers with 2" black numbers centered on white face of placard. Check the "As-builts" of the structure for correct stationing reference.

PROCEDURE B.

In the event changes in sequence of stationing on structures with more than one reach, stationing numbers may not correspond between reaches, follow the procedure below.

At the point where stationing sequence changes-install:
(2) two 6"x 6" placards on both sides of the sign post, one directly under the other (4 in total). Indicate on the top placard the different stationing numbers and on bottom placards, the end of reach and the opposite side begin the next reach.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #28

SUBJECT: To insure that the integrity of the structure is preserved and that the Floodway will function as designed.

PURPOSE: Procedures for the maintenance of unlined floodways

PROCEDURE A.

1. Nuisance or high unwanted vegetation.

   Remove and or destroy any woody vegetation within the flow area of the floodway, of the floodway, collection ditches, or side inlet basins. Also, remove trash/debris that will impede flows in these areas. If grasses are established, maintain to the height to six inches.

2. Sediment/silt deposits.

   Remove accumulated deposits of loose material to obtain designed grades and cross sections Loose deposited materials shall not be used for repairs within the floodway unless tested and meets the earth fill criteria in the construction specifications. Depending on the amount of accumulation in the invert, a sediment survey may be required. Ensure any 404 permits are in order to perform the job. The lead operator shall keep a copy the 404 with him at all times.

3. Erosion/deep rills. Contact the Work Control Center for job assessment.

   A sample of the stockpiled material that will be used for the repair of the erosion/rills will be submitted for a proctor test through coordination by the Work Control Center. Once the proctor test is completed, repairs of eroded areas may begin by replacing displaced material with approved proctored material. Moisture conditioned material will be placed in lifts not to exceed 6" inches. Each lift will have a compaction test required to meet 95% density or in accordance with the project's specified requirements. If the compaction lift does not meet the 95% criteria, the tested lift will be removed, reprocessed and re-installed accordingly and re-tested. 5 ea. nuclear compaction tests to1ea. sand cone test will be the normal. A daily field report(s) will be submitted by the consultant once the job scope is completed along with the density results report. Compaction equipment to be used will be approved through coordination with the Work Control Center as the job plan dictates.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #29

SUBJECT: To insure that the integrity of the structure is preserved.

PURPOSE: Procedures for the repair of rodent or animal holes.

PROCEDURE A.

Procedure: Rodent Control

1) Gophers can damage the structure by burrowing deep holes with more than one outlet. These can be identified by fresh mounds of soil.
2) Ground squirrels can also damage structures even with insignificant numbers and must be treated accordingly.
3) After rodent activity has been treated and controlled, holes are to be excavated, filled and compacted with proper density.

Procedure: Rodent & Animal Hole Repair

1) Excavate hole to bottom of cavity and remove all loose material.
2) Compact bottom area of cavity after applying adequate moisture to achieve 95% compaction.
3) The removed clean material may be used again and blended with other suitable material as needed.
4) Mix material and add enough water for optimum density.
5) Fill in cavity with no more than a six inch compacted lift of material to achieve 95% density using a hand tamper or pneumatic "Pogo" type compactor.
6) *See standard drawing #4 for compaction procedures.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #30

SUBJECT: Dust Abatement

PURPOSE: The District possesses an Earthmoving Block permit that includes all District structures. The Block permit includes a dust control plan employees are to follow to reduce fugitive dust. The purpose of this SOP is to better define the planning and implementation of the dust control plan before, during and after conducting any dust generating activity.

PROCEDURE A: Employee Responsibility.

General Dust Control Plan for Routine O&M Work

Activities	**Primary Control Measures**	**Contingency Control Measures**
Grading/Excavation/Trenching/ Backfilling	Watering by Truck / Prewet work zone	• Dust suppressant application • Increase frequency and intensity of water during high wind conditions. • Temporarily cease work. • Automatic sprinkler or spray bar.
Unpaved Haul Roads or Equipment Paths	• Watering by Truck / Prewet work zone. • Limit vehicle access/reduce vehicle speed (Signs must be posted) • Gravel Pad / Stabilized entrance	• Dust suppressant application • Increase frequency and intensity of water during high wind conditions. • Temporarily cease work. • Vacuum/Wet broom any track out daily
Access Points	Same measures as haul roads above.	Same measures as haul roads above.
Material Handling	Watering by Truck / Prewet work zone	• Increase frequency and intensity of water during high wind conditions. • Temporarily cease work.

Hauling	• Watering by Truck / Prewet work zone • Freeboard of not less than 3" on haul trucks. • Cover haul trucks with tarp or other enclosure.	• Increase frequency and intensity of water during high wind conditions. • Temporarily cease work.
Clearing Vegetation /weed control including disking and mowing operations.	• Watering by Truck / Prewet work zone	• Increase frequency and intensity of water during high wind conditions. • Temporarily cease work. • Automatic sprinkler or spray bar. • Hand Cut vegetation

General Guidance and Definitions

Opacity
Rule 310, Section 301-Opacity Limitations for Dust Generating Operations requires generated dust to be less than 20% opacity. As a general rule of thumb, if at any time you can see dust being generated by equipment operations, it is already at least 10% opacity. (Maricopa County Guidance for Dust Control Permit)

Effective Watering

1) Wet the area to depth of cuts or equipment penetration 15 to 30 minutes prior to the start of work. (Dust Devil Academy)
2) Apply water at the end of the day to soak the nest day's work area overnight. (Dust Devil Academy)
3) During grading, apply water in sufficient quantity to maintain a moist surface using a water truck. (Dust Devil Academy)
4) Water must be applied continuously in front of or in conjunction with a scraper/grader/dozer. (Maricopa County Guidance for Dust Control Permit)

Track out

1) Gravel Pad is a stabilized construction entrance, designed to remove mud and dirt from tires of vehicles leaving the construction site. Use between one and three inch diameter washed well graded gravel or crushed rock. The gravel should be 30 feet wide by 50 feet long, and a minimum of 6 inches deep.
2) Grizzly (rails pipes or grates) used to dislodge mud, dirt and debris from tires and undercarriage of vehicles prior to leaving the work site.
3) Paving from the point of the intersection with a paved public roadway at least 100 feet back onto the site, with a width of at least 20 feet.
4) Clean up of track out, carryout and spillage is required immediately.

Chemical Stabilizers (Dust Palliative)

1) All chemical stabilizers used must be in compliance with all applicable environmental laws.
2) Surfactant, or surface-active agent, makes water more effective. Water becomes "wetter" by lowering its surface tension. Drops of water spread out and contact surfaces more effectively. (Maricopa County Guidance for Dust Control Permit)
3) Crusting agents are binding agents used for long-term surface stabilization. (Maricopa County Guidance for Dust Control Permit)
4) Foaming Agents are primarily high foaming surfactants and may contain wetting and binding agents. (Maricopa County Guidance for Dust Control Permit)

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Daily Recordkeeping Log For Rule 310

Maricopa County's Rule 310 (Fugitive Dust Sources) requires that you keep a daily log recording the actual implementation of control measures identified in your Dust Control Plan. Write "yes" or "no" for each question, in the table below. If you write "no", for any question, please explain.

Contractor:_____ **Project Location:**_____

Name Of Person Completing Recordkeeping Log: _____ **Earthmoving Permit Number:**_____

	Monday Yes / No	Tuesday Yes / No	Wednesday Yes / No	Thursday Yes / No	Friday Yes / No	Saturday Yes / No	Sunday Yes / No
Controlling excessive dust on unpaved parking lots?							
Controlling dust on haul roads and access roads?							
Controlling dust on inactive portions of construction site?							
Maintaining at least 3" freeboard on haul trucks and covering haul trucks that leave the site?							
Covering loads contained in haul trucks?							
Preventing dirt from spilling onto paved public roadways?							
Using a trackout control device?							
Using water to control dust on active portions of site?							

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Daily Log For Overall Site Operations

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Standard Operating Procedure #31

SUBJECT: Claims/Concerns from the public

PURPOSE: To provide guidance for handling concerns, inquiries, and/or claims from the public

GENERAL:

1. The primary rule to remember when dealing with the public is to conduct business in a calm, professional manner—no matter what the emotional state of the person making the inquiry or concern may be.

2. The second rule to remember is that under no circumstances should the individual making the claim or concern be passed from one person or agency to another.

PROCEDURES: In general:

1. All phone inquiries will be referred to the Work Control Center Supervisor.
2. All web based inquiries will be checked on a daily basis by the Work Control Center Supervisor.
3. Upon receipt of a concern, if the Work Control Center Supervisor is not available to receive the call immediately, the person receiving the call will complete the name and telephone number portion of the Citizen Inquiry Form (see attachment) as well as a brief explanation of the inquiry. This information captures the basic data necessary to take action. It is the recipient's responsibility to defuse the situation and obtain sufficient information to determine who should receive the inquiry, claim or concern.

FOLLOW-UP: After receipt of inquiry:

1. The Work Control Center Supervisor will record a detailed report of the concern or complaint by speaking with the Citizen who prompted the inquiry.
2. A Work Control Center Inspector will investigate the inquiry visually on-site. They will then report their findings to the Work Control Center Supervisor.
3. The Work Control Center Supervisor will generate a Work Order based on the findings reported by the Inspector.
4. The Maintenance Supervisor will forward the Work Order to the appropriate crew to ensure completion of the job. The crew will have 21 days to complete the task.
5. Once all work has been completed, the Work Control Center Supervisor will call the Citizen to confirm the completion of the work requested.

NOTE:
The Work Control Center Supervisor is authorized to delegate these responsibilities to the appropriate person as he/she sees fit, to ensure a timely and accurate level of customer service and satisfaction.

DEFICIENCY and MAINTENANCE STANDARDS
Operations and Maintenance Division

SUBJECT: INDEX

PURPOSE: List Titles of Deficiency Levels and Maintenance Standards

Number	Title
1.	Access Gates
2.	Access Roads
3.	Retention Basins
4.	Buildings
5.	Bridges & Catwalks
6.	Catch Basins
7.	Dams
8.	Fencing
9.	Flap Gates
10.	Handrails
11.	Inlet/Outlet Structures
12.	Inverts-Channels & Storm Drains
13.	Levees
14.	Outlet Towers
15.	Trash Grates
16.	Reservoirs/Dams
17.	Right-of-Way Vacant
18.	General Sign & Staff Gage
19.	Channels & Storm Drain Walls
20.	Trails

DEFICIENCY LEVELS and MAINTENANCE STANDARDS
Operations and Maintenance Division

#1. ACCESS GATES

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Damaged or missing members.**	
	a. Missing gates, panels, or locks	a. Replace with standard panel and appropriate locks (3E-59 or 3E-56)
	b. Broken or missing gate hinges	b. Replace or repair as needed
	c. Members bent or out of alignment causing the gate not to function properly.	c. Repair members and align accordingly
	d. Large space or opening under gate panel	d. Standard calls for 4" inches of clearing
	e. Large voids or erosion around gate post/braces	e. Fill in holes flush & compact to grade with natural fill
B. Chainlink & Wire gates	**1. Rusty surfaces**	
	a. Rusty surfaces that affect the integrity of the existing gate fabric or wire.	a. Remove damaging rust and either repaint or replace damaged gate fabric or wire.
	b. Holes in chain link gate fabric of more than 6" wide and 12" long	b. Repair or replace damaged section as needed
	c. Chain link gate fabric stretched or bent out more than 6" inches	c. If possible refurbish stretched out chain link fabric or replace sections as needed.
	d. Gates out of adjustment more than 2" inches	d. Adjust gates to within ½" inch.
	e. Loose or sagging smooth or barbed wire more than a 2" inch sag	e. Re-stretch wire to remove sag in wire fence.
	f. Missing strands of wire.	f. Re-install missing strands to match up to existing fence.
C. Pipe Gate	**1. Surface paint.**	
	a. 25% of overall surface of pipe gate needing re-painting	a. Remove any peeling paint, primer and re-paint as needed.
	b. Rusty surface	b. Remove rust, primer and paint.

DEFICIENCY LEVELS AND MAINTENANCE STANDARD
Operations and Maintenance Division

#2. ACCESS ROADS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Unsightly condition visible to public (paralleling residences, streets, bridge crossings, etc….).**	
	a. Trash/debris, or litter along an access road.	a. Remove trash & debris.
	b. Unwanted or high vegetation.	b. Cut, remove, or chemical spray and follow up if needed for control.
	c. Large rocks or debris.	c. Remove rocks/debris.
	2. Health hazard	
	a. Animal droppings	a. Remove and dispose of accordingly.
	b. Garbage, dead animals causing unpleasant odors or attracting insects	b. Remove and dispose of accordingly.
	2. Restricted roadway	
	a. Any storm debris, or trash that reduces the driving width to less than 10' ft.	a. Clear debris /trash from roadway for access.
	3. Shoulder erosion	
	a. Erosion within 1' ft. of the roadway more than 8" inches wide and 12" deep	a. Repair with natural fill and compact as needed.
B. Asphaltic Concrete	**1. Vegetation concerns**	
	a. Unwanted or high vegetation	a. Cut, remove and chemical spray if needed
	2.Cracks	
	a. Cracks wider than a ¼" inch.	b. Repair cracks with a suitable fill material.
	3. Potholes	
	a.. Potholes no larger than 6" inch in diameter	c. Repair & compact potholes with SS1 oil and coldpatch mix.
	4. Depressions or settlement.	
	a. Depressions on the surface deeper than 4" inches.	a. Clean area and fill and compact with SS1 oil & coldpatch material as to re-establish surface area to flush conditions with existing road.
C. Concrete & Grouted riprap ramps	**1. Cracks**	
	a. Cracks wider than ½" inch	a. Fill with a suitable filler material.

#2. ACCESS ROADS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
Graded earth/unimproved roads	**1. Ruts**	
	a. Ruts that are more than 4" inches deep and 8" inches wide.	a. Utilize motor grader rippers to remove ruts and holes, moisture condition properly and re-grade surface to uniform condition. If needed import suitable fill material to re-establish road. Ensure proper dust control methods.
	2. High vegetation	
	a. High weeds growing in the road exceeding 6" inches tall.	a. Cut and remove nuisance vegetation as needed from roadway.

DEFICIENCY LEVELS AND MAINTENANCE STANDARDS
Operations & Maintenance Division
#3. RETENTION BASINS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. Earthen	**1. Vegetation**	
	a. High or unwanted vegetation taller than 2' ft.	a. Mower operations or hand cut to manage high vegetation to acceptable standard of 6" inches.
	b. Deep-rooted vegetation (Palo Verde, Mesquite, Ironwood, and Salt Cedar trees). Remove or destroy all woody vegetation within the sediment basin.	b. Any volunteer growth that is not part of the original project landscape will be cut, stump treated and removed if needed. All herbicide treatment should be environmentally friendly (consult with Ecology Branch).
	c. Citizen concerns regarding unpleasant odors from stagnant water or annoying insects or other pests.	c. Treat area for insects and schedule follow up treatments as needed. Remove any stagnant water by pumping out with water truck or portable pump.
	d. Dead animals.	d. Remove and dispose of dead animal accordingly.
	b. Trash & debris.	b. Remove trash/debris and dispose of accordingly.
	2. Pollutants	
	a. Oil, gas, or other contaminants.	a. Contact Bob Stevens FCDMC @ 602-506-4073 & Hazardous Material Emergency 602-506-7179 for instructions and dispose of accordingly.
	3. Sediment	
	a. Accumulated silt/sediment in basin invert that adversely affects the integrity of the structure.	a. Remove silt/sediment to restore basin to original or baseline conditions.
B. Concrete Lined Basin	**1. Sediment**	**Concrete lined basins are generally self-cleaning, although excess sediment should be removed for the inspection of the concrete works.**
	a. Accumulated sediment/silt on the concrete apron.	a. Remove & dispose of accordingly.
	2. Stagnant water	
	b. Citizen concerns regarding unpleasant odors from stagnant water or annoying insects or other pests.	b. Treat area for insects and schedule follow up treatments as needed. Remove any stagnant water by pumping out with water truck or portable pump.
	3. Cracks	
	a. Cracks wider than a ¼"	a. Cracks should be cleaned out and sealed with a suitable filler material.

DEFICIENCY LEVELS AND MAINTENANCE STANDARDS
Operations and Maintenance Division

#4. BUILDINGS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Paint peeling, chipping or blistering.**	
	a. For buildings visible to the public, deterioration of the paint or protective coating that has affected 10% of a surface area.	a. Resurface with uniform protective coating.
	2. Obscene graffiti	
	a. Obscene graffiti	a. Remove or paint over
	3. Holes, splits, and cracks	
	a. Holes, splits or cracks that allow moisture to penetrate to the interior.	a. Fill with a suitable filler material to prevent moisture access.
	4. Insects (pests)	
	a. Insect infestation such as wasps, bees, cockroaches, etc.	a. Treat with proper pesticide and schedule follow up treatments as needed.
	b. Presence of rats or mice	b. Treat for rodents and schedule follow up treatments as needed.
B. Metal exterior surface	**1. Damage to metal works.**	
	a. Bent in or out surface more than 3" inches within a diameter of 24" inches.	a. Refurbish so as to establish surface deformation of less than 1/2" inch
	b. Rust that is affecting more than 10% of a surface area	b. Remove rust and refurbish with uniform protective coating.
C. Concrete surface	**1. Loose or missing concrete**	
	a. Loose or missing concrete more than 1/2" deep	a. Clean damaged area and patch in place with suitable patch material (dry patch, rockite, concrete, etc…)
D. Doors	**1. Damage**	
	a. Door hardware that is broken, missing, bent, or defective that prevent the door form opening, closing, or locking properly	a. Replace, or repair damaged parts, service as needed so that door will properly secure.
E. Roof leaks	**1. Leaks**	
	a. Leaks which allow moisture to penetrate to the interior	a. Repair, refurbish or replace roof parts as needed to prevent moisture from penetrating to the interior.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#5. BRIDGES & CATWALKS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Settlement or movement on piers or abutments**	
	a. Settlement or movement that could lead to or cause failure.	a. Repair any voids or sinkholes caused by subsidence by either filling with an approved slurry mix and or excavation and fill & compact to proper grade, so piers or abutments are on stable footings.
	b. Erosion around the abutments and piers that could cause subsidence	b. Repair any voids caused erosion by either filling with an approved slurry mix and or excavation and fill & compact to proper grade, so piers or abutments are on stable footings.
	2. Safety hazard	
	a. Holes or obstacles that could be dangerous to vehicles or personnel	a. Fill in and compact any holes with native fill and remove any obstacles that could be dangerous to vehicles or personnel
	3. Trash & debris	
	a. Trash or debris that would obstruct or limit the use of the catwalk or bridge decking	a. Clear/remove any debris from catwalk or bridge.
	4. Loose or damaged handrails	
	a. Loose guard rails or handrails	a. Repair loose or damaged members or replace as needed.
	5. Graffiti	
	a. Obscenities	a. Repaint or remove as needed.
B. Metal	**1. Structural damage**	
	a. Bent or deformed structural members that are bent out of shape more than 2" inches	a. Refurbish, repair or replace structural members to acceptable standard of ½"
	b. Broken or missing members	b. Repair or replace as needed
	c. Deterioration of the paint that has affected an area of more than 25%	c. Apply uniform protective coating applied to address deterioration.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#5 BRIDGES & CATWALKS

C. Wooden	**1. Deteriorated paint or protective coating**	
	a. Peeling, scaling or chipping that has affected 30% or more of the surface area.	a. Remove deterioration concern by scraping or sanding surface and applying a protective new coating of paint.
	2. Structural damage	
	a. Cracks or splitting of wood surface.	a. Refurbish by filling in cracks with suitable fill material or replacing wood as needed.
	b. Damage from dry rot.	b. If applicable treat dry wood with a suitable protective coating or replace in kind.
	c. Termite or insect infestation.	c. Treat with appropriate pesticide and continue follow up treatments as needed.
	d. Broken or missing members.	d. If applicable, refurbish the wood surface or replace as needed.
	e. Exposed nails.	e. Drive the nails back into the wood surface so heads of the nails are flush with surface.
D. Concrete	**1. Structural damage.**	
	a. Chipped out pieces or sections of concrete.	a. Patch areas of concrete surface to meet existing surface conditions.
	b. Exposure of reinforcing steel.	b. Remove any rust from exposed steel if applicable. Prepare the surface by cleaning thoroughly and patch the areas of concern to meet the existing conditions.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#6. CATCH BASINS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Trash & Debris**	
	a. Trash & debris located at the inlet of the catch basin opening.	a. Remove obstructions so flows are not restricted.
	b. Unwanted vegetation restricting the catch basin inlet.	b. Remove unwanted vegetation from inlet.
	2. Settlement or movement	
	a. Settlement or movement of walls or invert that has a difference or separation more than ½" inch.	a. Stabilize condition to no more than ¼" inch difference or separation. This could involve repairing voids and or erosion sheet flow damage.
	3. Fire Hazard	
	a. Presence of chemicals, such as gasoline or oil	a. Contact Bob Stevens FCDMC @ 602-506-4073 & Hazardous Material Emergency 602-506-7179 for instructions and dispose of accordingly.
	4. Vegetation	
	a. Vegetation growth in the joints that is more than 6" tall	a. Cut and remove vegetation from joints and if applicable treat with proper herbicide.
B. Steps	**1. Defective or missing steps**	
	a. Defective or missing step(s) that are broken or missing.	a. Repair or replace so that step(s) are structurally adequate.
C. Catch basins with metal grates	**1. Safety hazard**	
	a. Safety hazard where grate opening is wider than design	a. Restore to design condition.
	b. High or lower than design elevation	b. Correct to elevation difference of no more than ¼" inch than surrounding area
	2. Settlement or movement	
	a. Separation of more than ½" between apron & frame	a. Stabilize condition to no more than ¼" inch.
	3. Trash & debris	
	a. Trash/debris that is restricting more than 20% of the grate surface	a. Remove obstructions so that flows are not restricted

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#6. CATCH BASINS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
C. Catch basin with metal grates	**1. Safety hazard**	
	a. Grate with opening wider than design.	a. Restore to original design.
	b. Higher or lower than the surrounding surface grade.	b. Elevation restored to a difference of no more than ¼" than surrounding grade.
	2. Settlement or movement	
	a. Separation of more than ½" between frame and apron.	a. Reset frame & apron to allow no more than ¼" separation.
	3. Trash & debris	
	a. Trash & debris that is restricting more than 20% of the grate surface.	a. Remove trash and debris to allow for proper drainage.
	4. Damaged or missing	
	a. Broken member of the grate.	a. Repair or replace as needed.
	b. Missing grate	b. Re-install or replace as needed.

DEFIENIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#7. DAMS (FRS's)

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. Concrete Spillways & Aprons	**1. Cracks.**	
	a. Cracks wider than 1/4" inch	a. Clean properly & fill in with a suitable filler material.
	2. Erosion, spalling, or chipping.	
	a. Damage that is more than 2" inches deep & 2 sq. ft. which exposes reinforcing steel	a. Remove any rust from exposed steel, clean properly, and patch damaged area.
	b. Chipping or spalling along expansion joint edges which is more than 2" inches deep and 5' ft. long	b. Clean and repair damaged area to flush with existing concrete
	3. Missing or deteriorated joint sealer.	
	a. Missing joint filler material which allows passage of water or earth material.	a. Remove damaged material, clean out joint & replace with new joint filler material. If needed, install backer-rod to fill wide gaps then seal as needed.
	b. Vegetation in joints	b. Remove unwanted vegetation from joints and treat with proper herbicide if applicable.
	4. Settlement or movement.	
	a. Subsidence that has settled or uplifted concrete more than 2" inches	a. Repair any hollow areas exposed underneath concrete structure to stabilize the spillway/apron if possible. If needed, cut out and remove uplifted sections and replace damaged concrete.
	5. Trash & debris.	
	a. Trash/debris on spillway or apron.	a. Remove trash/debris or sediment and sweep clean.
	6. Deep-rooted vegetation	
	a. Deep-rooted vegetation located in emergency spillway.	a. Cut & stump treat as need. Remove any large root systems. Fill & compact holes accordingly.

DEFIENIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#7. DAMS (FRS's)

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
B. Pipes	**1. Obstructions.**	
	a. Blockage which reduces discharge from pipe.	a. Remove blockage to ensure proper unrestricted flows. This concern can be accumulated sediment, organic debris, rock or other foreign matter.
	b. Loose or leaking pipes which allows water to escape around the outside of the pipe	b. Secure loose pipe in place to control or prevent water leakage
C. Piezometers	**1. Damaged or vandalized.**	
	a. Bent or damaged to prevent from obtaining accurate measurements.	a. Notify Dam Safety Branch. Repair or replace piezometer as per instructions from Dam Safety.
	b. Vandalized protective metal covers.	b. Notify Dam Safety Branch. Replace or re-secure as needed.
D. Principal Spillway	**1. Structural integrity.**	
	a. Cracks in the concrete works or deterioration.	a. Clean & seal any cracks wider than ¼" inch with suitable fill material.
	b. Walls, floor, or ceiling chipped or spalled	b. Repair with patch work to restore to original surface.
	c. Cracks that allow seepage to penetrate causing rust, deterioration, etc.	c. Remove any visible rust and prepare surface for patch or crack seal with a suitable fill material.
	2. Conduit	
	a. Blockage from accumulated sediment or organic debris.	a. Remove and clean conduit so as not restrict any flows.
	b. Cracks that allow seepage to penetrate the conduit causing rust, deterioration, etc.	b. Remove any visible rust and prepare surface for patch or crack seal with a suitable fill material.
E. Stilling Basin	**1. Structural integrity.**	
	a. Cracks that allow seepage to penetrate causing rust, deterioration, etc.	a. Remove any visible rust and prepare surface for patch or crack seal with a suitable fill material.
	b. Damaged dissipaters.	b. Repair with patch work to restore to original surface.
	c. Stagnant water causing breeding grounds for mosquito's or other pests.	c. Pump out stagnant water; remove accumulated sediment, trash and organic debris. Sweep clean so concrete works can be inspected.

DEFIENIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#7. DAMS (FRS's)

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
F. Crest of dam	**1. Structural integrity**	
	a. Access road damaged or needing additional plating.	a. Re-grade access road and install additional safe all-weather access plating. Fill in vehicle ruts and small depressions.
	b. Stationing, survey monuments, project signs, damaged or missing.	b. Refurbish or replace missing signs according to as-builts and identify with SOP.
	c. Transverse, longitudinal cracks, depressions, holes or other questionable findings.	c. Provide proper stationing and describe the concern with accurate measurements. Take photographs and log the concern and return to the Work Control Center.
	d. Unwanted vegetation.	d. Cut & remove weeds taller than 18" inches and chemically spray with appropriate herbicide.
	e. Rodent activity.	e. Document stationing reference and where activity is prevalent (upstream shoulder, downstream shoulder). This concern will be assigned to the Ecology Branch for treatment.
G. Slopes of dam	**1. Structural integrity**	
	a. Inadequate slope protection.	a. Install slope protection to match existing slope (riprap, gravel mulch, etc…).
	b. Slope protection displacement or movement (depressions, slides, sloughing, etc…).	b. Provide proper stationing and describe the concern with accurate measurements. Take photographs and log the concern and return to the Work Control Center.
	c. Rodent activity.	c. Document stationing reference and where activity is prevalent (shoulder, mid-slope, toe). This concern will be assigned to the Ecology Branch for treatment.

DEFIENIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#7. DAMS (FRS's)

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
G. Slopes of dam. (continued)	**1. Structural integrity**	
	d. Deep erosion or rilling on slopes	d. Provide proper stationing and describe the concern with accurate measurements. Take photographs and log the concern and return to the Work Control Center. Dam Safety must approve repair. If erosion/rill is deeper than 2' ft. deep, a proctor test must be taken. Compaction lifts will not be more than 6" high and compaction tests will be administered on every lift and a 95% result or better must be obtained to continue each lift. Unless otherwise specified 5 nuclear compaction tests to 1 sand cone test will be the normal.
H. Low flow channel	**1. Structural integrity.**	
	a. Inadequate slope protection on channel slopes.	a. Install slope protection to match existing slope (riprap, gravel mulch, etc…).
	b. Slope protection displacement or movement (depressions, slides, sloughing, etc…).	b. Provide proper stationing and describe the concern with accurate measurements. Take photographs and log the concern and return to the Work Control Center.
	c. Rodent activity.	c. Document stationing reference and where activity is prevalent (shoulder, mid-slope, toe). This concern will be assigned to the Ecology Branch for treatment.
	d. Deep erosion or rilling on slopes of channel.	d. Provide proper stationing and describe the concern with accurate measurements. Take photographs and log the concern and return to the Work Control Center. If erosion/rill is deeper than 2' ft. deep, a proctor test must be taken. Compaction lifts will not be more than 6" high and compaction tests will be administered on every lift and a 95% result or better must be obtained to continue each lift. Unless otherwise specified nuclear compaction tests will be suffice.

DEFIENIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#7. DAMS (FRS's)

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
H. Low flow channel (continued)	**1. Structural integrity**	
	e. Deep-rooted vegetation and or high vegetation.	e. Cut, stump treat, and remove deep-rooted vegetation so as not to allow trees to impede flows. If high vegetation becomes an issue, either mower or disking is encouraged for control.
	f. Sediment/silt plugs.	f. Remove plugs and re-store invert back to baseline condition.
	g. Trash/debris in low flow.	g. Remove and dispose of accordingly.
I. Other	**1. Approach channel to principal spillway.**	
	a. Obstructions	a. Remove accumulated sediment, debris, trash, deep-rooted vegetation so as not to disrupt flows into the inlet structure.
	2. Principal spillway trash racks.	
	a. Obstructions	a. Remove any obstructions from the trash rack that could cause water flow restrictions.
	b. Rust or deterioration	b. Remove rust as needed as provide protective coating to protect metal works surface.
	3. Outlet channel.	
	a. Blockage.	a. Remove any obstructions that could cause water flow restrictions.
	b. Deep-rooted vegetation	b. Cut, stump treat, and remove deep-rooted vegetation so as not to allow trees to impede flows.
	c. Sediment/silt plugs.	c. Remove plugs and re-store invert back to baseline condition.

DEFIENIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#7. DAMS (FRS's)

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
I. Other (cont'd)	**1. Structural integrity**	
	d. Deep erosion or rilling on slopes of outlet channel.	d. Provide proper stationing and describe the concern with accurate measurements. Take photographs and log the concern and return to the Work Control Center. If erosion/rill is deeper than 2' ft. deep, a proctor test must be taken. Compaction lifts will not be more than 6" high and compaction tests will be administered on every lift and a 95% result or better must be obtained to continue each lift. Unless otherwise specified nuclear compaction tests will be suffice.
	3.Transverse or longitudinal cracks	
	a. Transverse or longitudinal cracks located on the crest or toe of the levees.	a. Record the station of the crack. Give location; crest, upstream shoulder, downstream shoulder, mid-slope, or toe of levee. Take measurements to include; diameter size, and depth of crack. Include photograph, inspector, date, and structure.
	4. Other	
	a. Report any other dam safety related concerns (sink holes, depressions, slides, or other anomalies).	a. Record the station of the concern. Give location; crest, upstream shoulder, downstream shoulder, mid-slope, or toe of levee. Take measurements to include; diameter size, and depth of depression. Include photograph, inspector, date, and structure.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#8. FENCING

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Missing or broken parts.**	
	a. Any defects in the fence line that permits easy access into a District right-of-way.	a. Repair or replace damaged fencing.
	2. Erosion	
	a. Erosion more than 4" deep x 18" wide which allows for an opening underneath the fence line.	a. Fill & compact the depression under the fencing.
B. Wire Fences	**1. Damaged parts or members**	
	a. Posts that are out of plumb.	a. Straighten out the post.
	b. Top railing bent out of shape more than 3" inches.	b. Repair or replace as needed.
	c. Fabric material stretched out of shape by more than 6" inches.	c. Attempt to re-stretch fabric in place or replace.
	d. Missing or loose tension wires.	d. Re-stretch tension wire accordingly.
	e. Missing or loose barbed wire causing a sagging affect.	e. Re-stretch wire if possible, if not replace as needed.
	f. Deterioration or rust occurring on posts, hinges, panels, etc.	f. Refurbish by removing rust, apply protective coating if applicable, and re-paint. If not applicable, replace as needed.
C. Wooden Fences	**1. Loose, damaged, or missing members.**	
	a. Loose or missing members that cause the fence to lean or sag more than 3" inches.	a. Refurbish by re-nailing, stapling, or replacing loose members. Adjust fence as needed to proper alignment.
	b. Damage from weather.	b. Refurbish or replace as needed.
	c. Damage from termites.	c. If possible treat wooden fence and or replace sections or members as needed.
D. Masonry fences	**1. Cracks, movement, or subsidence.**	
	a. Surface cracks wider than ½" across the full height of the fence.	a. Attempt to seal any cracks wider than 1/8" inch. Fill cracks with suitable fill material.
	b. Fence is leaning and out of alignment.	b. Replace sections of panels as needed.
D. Masonry fences	**2. Loose or missing masonry**	
	a. Loose or missing masonry.	a. Re-mortar the loose masonry or replace any missing masonry.
	b. Spalled or chipped sections of masonry. Holes in the masonry.	b. Repair damaged pieces if possible. Patch holes as needed.

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Operations and Maintenance Division

#9. FLAP GATES

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
General		
	1. Loose anchor bolts	
	a. Loose anchor bolts	a. Refasten bolts securely in place
	b. Missing, broken or bent frame or parts that prevent the gate form functioning properly	b. Repair or replace damaged parts & ensure the frame is structurally sound & functioning properly
	c. Flap gate "frozen" and not able to open & close freely	c. Service and lubricate to function properly
	2. Trash/debris	
	a. Trash/debris that prevents the flap gate from opening or closing	a. Remove as needed to function as designed.
	3. Painted flap gates	
	a. Paint is peeling off the flap gate.	a. Clean, remove any rust and re-apply a protective coating.
	4. Graffiti	
	a. Graffiti present on the flap gate metal works.	a. Remove or paint over to match in kind.

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Operations and Maintenance Division

#10. HANDRAILS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Loose, damaged or missing members**	
	a. Loose, damaged, broke, or missing members	a. Tighten, repair or replace as needed so that handrail is structurally sound
	b. Surface defects, sharp edges, metal burrs, or splinters that could cause injury	b. Remove sharp edges, burrs, or splinters so surface is free of these hazards.
	2. Deteriorated paint or protective coating	
	a. Peeling or chipping paint that has affected 25% of surface	a. Recoat and or paint to acceptable conditions
B. Metal		
	1. Rusty surfaces	
	a. Rusty surface that affected more than 10% of the surface	a. Surface should be uniformly coated
C. Wooden	**1. Damaged member**	
	a. Cracking or splitting of a wooden member which causes sagging of the handrail more than 2" inches	a. Structurally adequate member in place with alignment to within 1/2" inch

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#11. INLET & OUTLET STRUCTURES:

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Trash & debris**	
	a. Trash & debris that obstructs the inlet or outlet more than ¼ the height or diameter of the structure.	a. Inlet/outlet clear & free of restriction so as not to restrict flows.
	2. Rodents/animals	
	a. Holes or diggings caused by burrowing animals.	a. Area adjacent to structure free of holes and burrowing animals by initial treatment and follow up for control.
	3. Erosion	
	a. Erosion around the wingwalls or headwalls that create voids leading to the result of undermining or unwanted settlement.	a. Fill & compact voids or holes with proper moisture conditioned material. Lifts should not exceed 6" inches and density results at 95%.
	4. Settlement or movement.	
	a. Settlement or movements that have dropped or uplifted the structure facing or base more than 3" inches.	a. Structure should be re-installed firmly and bedded in place.
	5. Vegetation	
	a. Vegetation 18" tall closer than 2 feet apart located on the apron or within 5' ft. of the structure.	a. Remove vegetation as needed. If applicable, apply proper herbicide to control unwanted vegetation growth.
B. Concrete	**1. Structural damage**	
	a. Parts of the structure that is cracked, chipped, broken off, or spalled more than 2" deep & 6" in diameter.	a. Remove any damaged pieces or sections; clean thoroughly, patch, replace, or repair as needed.
	2. Graffiti	
	a. Obscenities	a. Re-paint areas of surface affected to match in kind the surroundings.
C. Rock or masonry	**1. Structural damage**	
	a. Any missing and loose rock or block sections of the structure.	a. Remove any damaged pieces or sections; clean thoroughly, patch, replace, or repair as needed.
D. Metal	**1. Worn or deteriorated**	
	a. Eroded, rusted, or worn conditions that affect the structural integrity of the inlet/outlet.	a. Repair, refurbish, or replace as needed.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#12. CHANNEL & STORM DRAIN INVERTS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Trash, litter, & debris.**	
	a. Trash & debris restricting the intake into a storm drain.	a. Remove any obstructions from inlets and dispose of accordingly.
	b. Debris/trash which impedes flows in a channel invert.	b. Remove any obstructions from the invert and dispose of accordingly.
	c. Citizen concerns involving foul odors or unsightliness.	c. Remove trash, litter, or debris from premises that are causing concern.
	d. Mud or sediment deposits which restrict 10% or more of the structure.	d. Remove accumulated sediment and dispose of accordingly.
	d. Vegetation in excess of 2" inches high protruding through cracks or expansion joints.	d. Cut & remove protruding vegetation and chemically treat if applicable.
	e. Ponded water complaints of foul odors or insects.	e. Pump out water with water truck or portable pump. If not practical, treat for vector concerns and schedule follow up treatments as needed.
	f. Dead animals.	f. Remove dead animal and dispose of accordingly.
	g. Pollution-any hazardous materials.	g. Contact Bob Stevens FCDMC @ 602-506-4073 & Hazardous Material Emergency 602-506-7179 for instructions and dispose of accordingly.
B. Improved channels	**1. Deterioration concerns.**	
	a. Reinforcement exposed.	a. Remove exposed rust, refurbish, and or repair by patching areas of exposed reinforcement.
	2. Cracks.	
	a. Cracks wider than 3/8" wide x 6" inches deep	a. Cracks in the invert and slopes should be cleaned out and sealed with a suitable filler material.
	b. Cracks wider than ¼" wide that go completely through the concrete less than 6" inches thick.	b. Cracks in the invert and slopes should be cleaned out and sealed with a suitable filler material.
	3. Settlement or movement.	
	a. Movement or settlement that has displaced the invert facing more than 4" from grade elevation.	a. Attempt to restore securely bedded within ¼" of grade. If not, remove either by saw cutting or jack hammer methods. Repair damaged section.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#12. CHANNEL & STORM DRAIN INVERTS

TYPE	DEFICIENCY NOTED	MAINTENACE STANDARD
C. Grouted riprap	**1. Missing riprap or dislodged riprap.**	
	a. Missing grouted riprap	a. Clean out area where rock is missing; re-install missing or dislodged riprap with proper grout application. Ensure to use a concrete glue to assist in repair.
D. Unimproved channel invert.	**1. Obstructions.**	
	a. Deep-rooted vegetation (Palo Verde, Mesquite, Ironwood, and Salt Cedar trees). Remove or destroy all woody vegetation within the sediment basin.	a. Any volunteer growth that is not part of the original project landscape will be cut, stump treated and removed if needed. All herbicide treatment should be environmentally friendly (consult with Ecology Branch).
	b. Vegetation or debris which restricts more than 10% of channel capacity.	b. Remove restrictions and dispose of accordingly.
E. Asphaltic concrete	**1. Erosion concerns**	
	a. Sheet flow erosion causing damage to the asphalt structure.	a. Repair erosion by filling and compacting with proper moisture conditioned material. If needed, re-grade shoulder to drain properly.
	b. Settlement or movement causing damage to asphalt structure.	b. Cut out damaged section of asphalt and replace accordingly by using SS1 oil and cold patch or hot mix asphalt.
F. Concrete low flow	**1. Vegetation.**	
	a. High vegetation growing in joints.	a. Remove vegetation so joints are free of vegetation and root growth. Chemically treat if applicable.
	b. Damage from flows to the curbing which does not confine flows as designed.	b. Repair or replace damaged curbing to contain designed flows.
G. Low flow channel	**1. Trash, debris or silt.**	
	a. Trash, debris or silt plugs that cause flows to divert out of defined low flow.	a. Remove restrictions so that flows stay within defined area.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#13. LEVEES

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General right-of-way	**1. Trash & Debris**	
	a. Trash, litter, and debris creating an unsightly condition.	a. Remove & dispose of accordingly.
	2. Fencing damage	
	a. Nuisance vegetation taller than 18" inches.	a. Cut vegetation and chemically spray treatment if applicable.
	b. Cut or damaged fencing or gates.	b. Repair or replace damaged fencing or gates to set standards.
	c. Damaged signs or stationing.	c. Re-furbish or replace as needed any damaged signs.
	3. Rodents	
	a. Rodents/animals creating holes or burrows on the crest or embankments.	a. Treat with proper rodenticides and schedule follow up treatments as needed.
B. Concrete/soil cement structures	**1. Structural damage.**	
	a. Cracks 1/8" inch or wider on the concrete which can expose reinforcement.	a. Clean out and fill in cracks with suitable fill material.
	b. Erosion, spalling, or deterioration which affects the structural integrity.	b. Repair erosion from runoff/sheetflow. Repair areas where spalling or deterioration has occurred.
	c. Broken or missing protective facing which could allow water or rust to become a concern to the structure.	c. Repair or patch as needed to stabilize concerns.
	2. Graffiti	
	a. Obscene material /writings	a. Remove or re-paint as needed to match to existing conditions.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#13. LEVEES

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
Earthen levee	**1.Structural Damage**	
	a. Erosion from sheet runoff causing deep rills on crest or slopes of levee.	a. If erosion/rill is deeper than 2' ft. deep, a proctor test must be taken. Install moisture conditioned material in lifts not to exceed more than 6" high and compaction tests will be administered on every lift and a 95% result or better must be obtained to continue each lift. Unless otherwise specified nuclear compaction tests will be suffice.
	b. Plating material on the access road on the crest of the levee is displaced or missing. Plating missing on the access ramps.	b. Re-grade to design elevation with motor grader by bringing back into place any displaced material from the shoulder. If needed, re-install ABC material on the crest as needed to re-establish safe all-weather access.
	c. Slope protection missing or displaced.	c. Re-install gravel mulch, loose riprap, or grouted riprap as needed.
	2. Deep-rooted vegetation	
	a. Deep-rooted vegetation located on the crest or slopes.	a. Cut & stump treat as need. Remove any large root systems. Fill & compact holes accordingly.
	3.Transverse or longitudinal cracks	
	a. Transverse or longitudinal cracks located on the crest or toe of the levees.	a. Record the station of the crack. Give location; crest, upstream shoulder, downstream shoulder, mid-slope, or toe of levee. Take measurements to include; diameter size, and depth of crack. Include photograph, inspector, date, and structure.
	4. Other	
	a. Report any other dam safety related concerns (sink holes, depressions, slides, or other anomalies).	a. Record the station of the concern. Give location; crest, upstream shoulder, downstream shoulder, mid-slope, or toe of levee. Take measurements to include; diameter size, and depth of depression. Include photograph, inspector, date, and structure.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#14. OUTLET TOWERS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Trash & Debris**	
	a. Trash or debris that is restricting inflows.	a. Remove & dispose of accordingly.
	2. Subsidence	
	a. Any depressions, holes and or other questionable conditions in the immediate area.	a. Dam Safety Branch will investigate these concerns and recommend repair method. If hole or depression is deeper than 2' ft. deep, it will be excavated; material proctored, filled in lifts not to exceed 6" inches, and compacted to 95%.
	3. Graffiti	
	a. Obscene material or writings.	a. Remove obscenities and repaint to match existing structural conditions.
	4. Vegetation	
	a. Vegetation higher than 2' ft. tall which can create vector issues and sediment accumulation.	a. Implement either mower operations or hand cut vegetation to acceptable standards.
B. Concrete	**1. Structural damage**	
	a. Concrete surfaces which have been damaged due to deterioration or vandalism.	a. Patch or repair areas on the tower surface to match existing structural conditions.
C. Metal surfaces	**1. Structural damage**	
	a. Surface caved in or bent.	a. Repair areas on the metal surface to match existing structural conditions.
	2. Deterioration	
	a. Rusted or oxidized surface.	b. Remove rust or oxidation and match surface to existing conditions.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#15. TRASH RACKS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Loose, bent, broken or missing members**	
	a. Frame or bar members bent out of shape or alignment.	a. Repair or replace frame to original design.
	b. Any missing or broken parts of the grate.	b. Repair or replace as needed.
	c. Breakaway pin missing.	c. Re-install breakaway pin to secure the grate.
	d. Trash or debris resulting in flow restrictions.	d. Remove blockage so as to flows are not impeded.
	2. Deteriorated paint or protective coating.	
	a. Paint or protective coating that is peeling, rusting or oxidized.	a. Remove damaged surface paint, coating, or rust and refurbish as needed.

DEFICIENCY LEVELS and MAINTENANCE STANDARDS
Operations and Maintenance Division

#16. DAM RESERVOIRS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Pollution**	
	a. Oil, gas, or other contaminants.	a. Contact Bob Stevens FCDMC @ 602-506-4073 & Hazardous Material Emergency 602-506-7179 for instructions and dispose of accordingly.
	b. Citizen concern for the removal of dead animals.	b. Remove and properly disposal of dead animal.
	2. Safety or health hazard.	
	a. Rodents or insects causing a heath hazard to District personnel or the Public.	a. Treat area with proper pesticide to ensure control of the nuisance.
	3. Ponded water	
	a. Obstruction or sediment plugs creating ponds.	a. Remove obstructions and or plugs so water can flow accordingly.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#17. FCDMC EXCESS LAND RIGHT-OF-WAY

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. GENERAL	**1. Illegal dumping**	
	a. Illegal dumping of trash & debris.	a. Pick up and dispose of properly all illegal discarded material.
	2. Health or safety concens	
	a. Dead animals, garbage attracting insects or other pests.	a. Pick up and dispose of dead animal(s), garbage to rectify health hazard.
	3. High vegetation.	
	a. High vegetation taller than 18".	a. Depending of size of lot, either hand cut or arrange for mower operations. If applicable treat with proper herbicide for weed control.
	4. Damaged signs	
	a. Missing or vandalized signs.	a. Re-install or refurbish damaged signs as needed.
	5. Fencing	
	a. Cut or damaged fencing or gates.	a. Repair damaged fencing or gates to ensure District property is in compliance to PM-10 compliance.
	6. Dust	
	a. Fugitive dust concerns.	a. Options are to water down area of concern, or apply approved soil stabilizer, and or install plating material to conform to PM-10 standards.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#18. GENERAL SIGNS & STAFF GAGES

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Illegible information**	
	a. Faded lettering, peeling, or chipping which has caused the sign to be illegible.	a. Refurbish or replace sign as needed.
	b. Graffiti or vandalism which covers up the sign so that it can't be read.	b. Refurbish or replace sign as needed.
	c. High or dense vegetation that restricts the sign from being read.	c. Thin out or remove vegetation that is restricting the sign.
	d. Sign or stationing is missing.	d. Reinstall missing signs as per specifications.
	2. Deteriorated paint or protective coating.	
	a. Protective coating/paint is peeling or rusting.	a. Remove any rust that may be present, apply proper primer, and repaint.
	3. Loose, bent, broken or split sign support channel or posts.	
	a. Loose bolts or anchors which cause signs to move, tilt, or fall over.	a. Sign & mounting supports should be tightened and secured in place.
	b. Bent, broken, or split so that the sign information is illegible.	b. Refurbish or replace sign as needed.
B. Staff gage metal tubing	**1. Staff gage is out of level or alignment.**	
	a. Staff gage is out of level more than ½" inch.	**a.** Attempt to re-level staff gage metal tube. If unsuccessful, reinstall the staff gage so that it is level & plumb according to standard drawing #6.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#19. CHANNEL & STORM DRAIN WALLS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. Concrete	**1. Structural Damage**	
	a. Cracks wider than ¼" inch.	a. Clean out the crack and apply suitable filler material.
	b. Spalling or chipping that is greater than 2" deep or which exposes reinforcement.	b. Remove any rust that may be present, clean damaged portion thoroughly, and patch accordingly with an approved product (dry patch product, rock-ite, etc.). Ensure the usage of a concrete glue to assist in adhering to the wall.
	c. Chipping or spalling along an expansion joint or edge which is more than 1" deep.	c. Properly clean & remove damaged section along expansion joint. Patch damaged area to restore to original condition.
	d. Missing expansion material or separation at the joint which permits passage of filler or backfill material.	d. Clean out the joint and replace missing expansion material (if needed, add "backer-rod" to fill any large gaps).
	2. Voids behind walls.	
	a. Voids behind concrete walls.	a. Excavate the void to the termination point. If the void is less than 4' feet deep; remove any loose material, add moisture to the void by wetting the cavity, install moisture conditioned material in lifts not to exceed 6" and compact to 95% density. If voids are deeper than 4' feet deep, contact Engineering and they will recommend a repair method.
	3. Vegetation	
	a. Vegetation in the expansion joints.	a. Cut and remove vegetation, if applicable, apply proper herbicide to control vegetation.
	4. Grouted riprap	
	a. Loose or missing riprap.	a. Clean out areas where riprap is missing, re-install rock and grout in place. Ensure to use a concrete glue in the mix.
	5. Weep holes	
	a. Animal guards missing.	a. Re-install missing animal guards.
	b. Blockage	b. Remove any restrictive material and clean out as needed.

DEFICIENCY LEVELS and MAINTENANCE STANDARD
Operations and Maintenance Division

#20. TRAILS

TYPE	DEFICIENCY NOTED	MAINTENANCE STANDARD
A. General	**1. Restricted access or safety hazard**	
	a. Debris, rock, or slide material which reduces the width of the trail by 25%.	a. Remove restrictions so as to allow the usage of the trail.
	b. Trees or branches that reduce the trail vertical clearance to less than 14' feet above the road surface.	b. Cut, trim or remove branches to meet standard.
	c. Rock slides from steep walls that block the trail	c. If needed, close the trail with barricades. Use proper equipment for the removal & disposal of fallen rock. Re-open the trail once hazard has been removed.
B. Earthen	**1. Erosion**	
	a. Ruts, depressions or holes in the trails which can create a safety hazard.	a. If the ruts are numerous, arrange for equipment to remove the ruts and restore trail to original condition. If the ruts are few and can be done by hand, rake out the ruts and install native fill as needed for restoration.
	2. Vegetation	
	a. Weeds or brush higher than 18" inches.	b. Either hand cut to acceptable standard (4" inches or less), or mow high vegetation. If applicable spray with appropriate herbicide for weed control.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

FCDMC STANDARD DRAWINGS

The standard drawings are a tool to be used by the various FCDMC branches for the purpose of having uniformity in the construction and installation of these commonly used items on FCD property. These drawings give details to FCD field personnel, contractors, and others for the specifications, and materials needed for their proper installation. These standard drawings can also be used in conjunction with the Standard Operating Procedures. Below is a listing of the various standard drawings:

Standard Drawing #1: Gates-Smooth or Barbed Wire.

Standard Drawing #2: Fence- Smooth or Barbed Wire.

Standard Drawing #3: Grouted Riprap Side Inlet Chute.

Standard Drawing #4: Embankment Backfilling.

Standard Drawing #5: Retaining Walls.

Standard Drawing #6: Staff Gages.

Standard Drawing #7: FCDMC Signs Right-of-Way

Standard Drawing #8: Wrought Iron Fence

Standard Drawing #9: Subsidence Markers

Standard Drawing #10: Core Drain Markers

Standard Drawing #11: Standard Break-Away Fence

Standard Drawing #12: Standard Break-Away Pipe Rail Fence

Standard Drawing #13: Sediment Gage

Standard Drawing #14: Removable Bollard

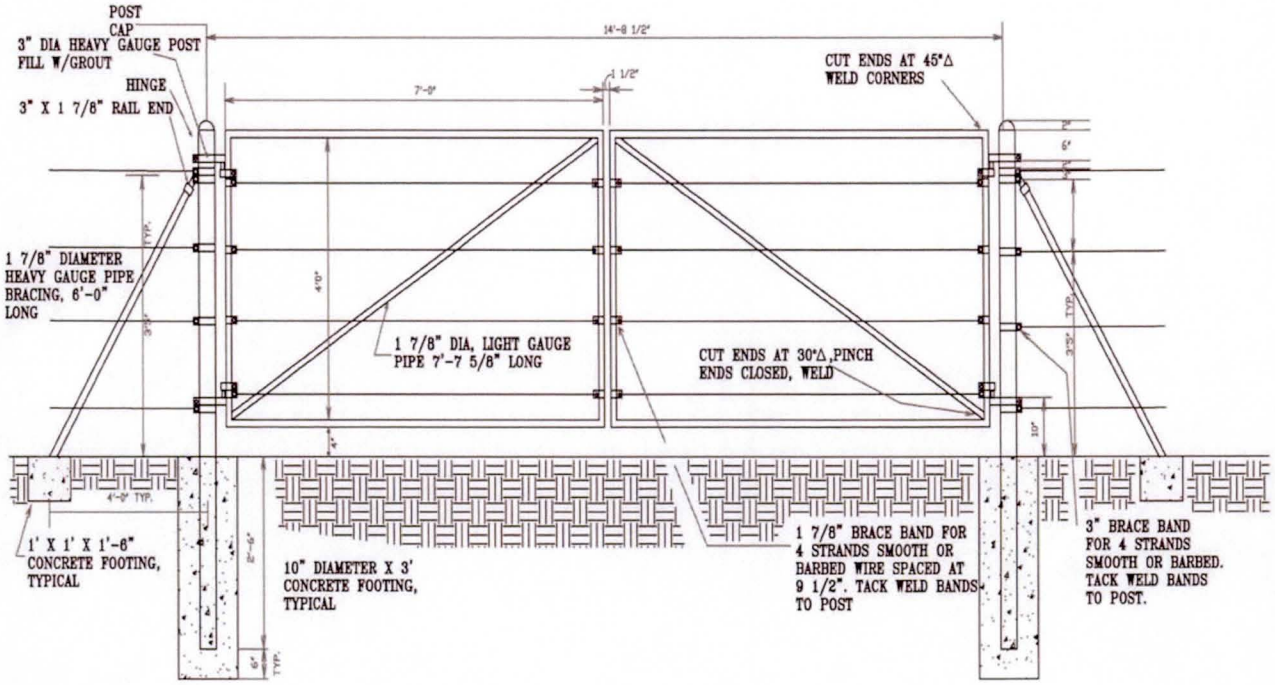
Standard Drawing #15: Observation Bridge at Adobe Dam

Standard Drawing #16: Line and Fence Posts

Standard Drawing #17: Equestrian Gate

Standard Drawing #18: Stationing Placard

Standard Drawing #19: Weldable Anchors

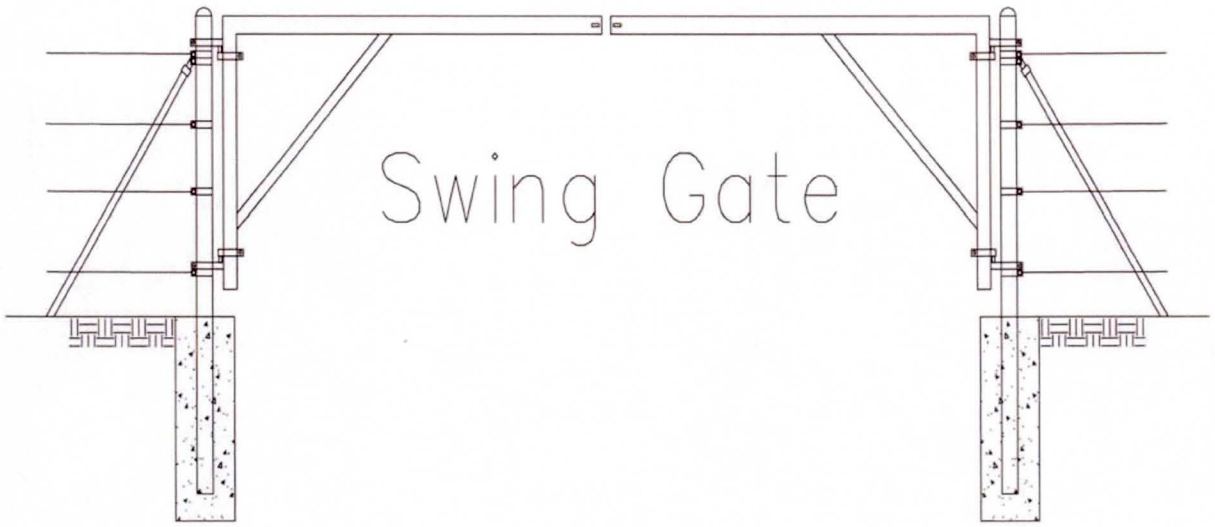


SD#1 Gates- Smooth of Barbed Wire

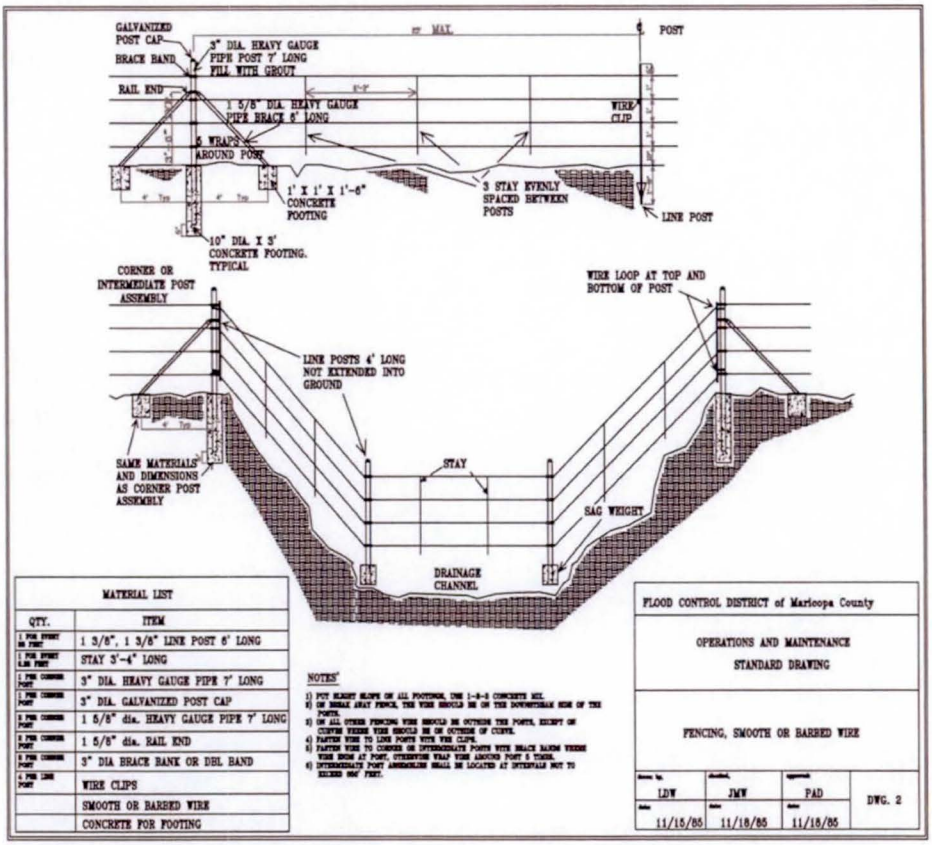
MATERIALS LIST	
QTY ITEM	
2 3" HEAVY GAUGE POSTS, 7' LONG	
2 POST CAPS	
4 1 7/8" LIGHT GAUGE PIPE 4' LONG	
4 1 7/8" LIGHT GAUGE PIPE 7' LONG	
2 1 7/8" LIGHT GAUGE PIPE 7'-7 5/8" LONG	
2 1 7/8" HEAVY GAUGE PIPE 6'-0" LONG	
4 HINGES 3" X 1 7/8"	
16 BRACE BAND 1 7/8"	
8 BRACE BAND 3"	
BARBED OR SMOOTH WIRE	
1 GALVANIZED CHIN ABOUT 19" LONG	
1 PADLOCK # 3E59	
2 RAIL ENDS 3" X 1 7/8"	
16 CARRIAGE BOLTS 5/16" X 2"	

NOTES
1. PUT SLIGHT SLOPE ON TOP OF FOOTINGS.
2. GATE DIAGONAL BAR IS ABOUT 7'- 7 5/8" MUST BE FIELD CUT TO FIT.
1, 2, 3, CONCRETE MIX 1 PART CEMENT 2 PARTS SAND 3 PARTS AGGREGATE ADD WATER TO ACHIEVE WORKABILITY, NO MORE THAN 6" SLUMP.

……..Materials List



……..Swing Gate



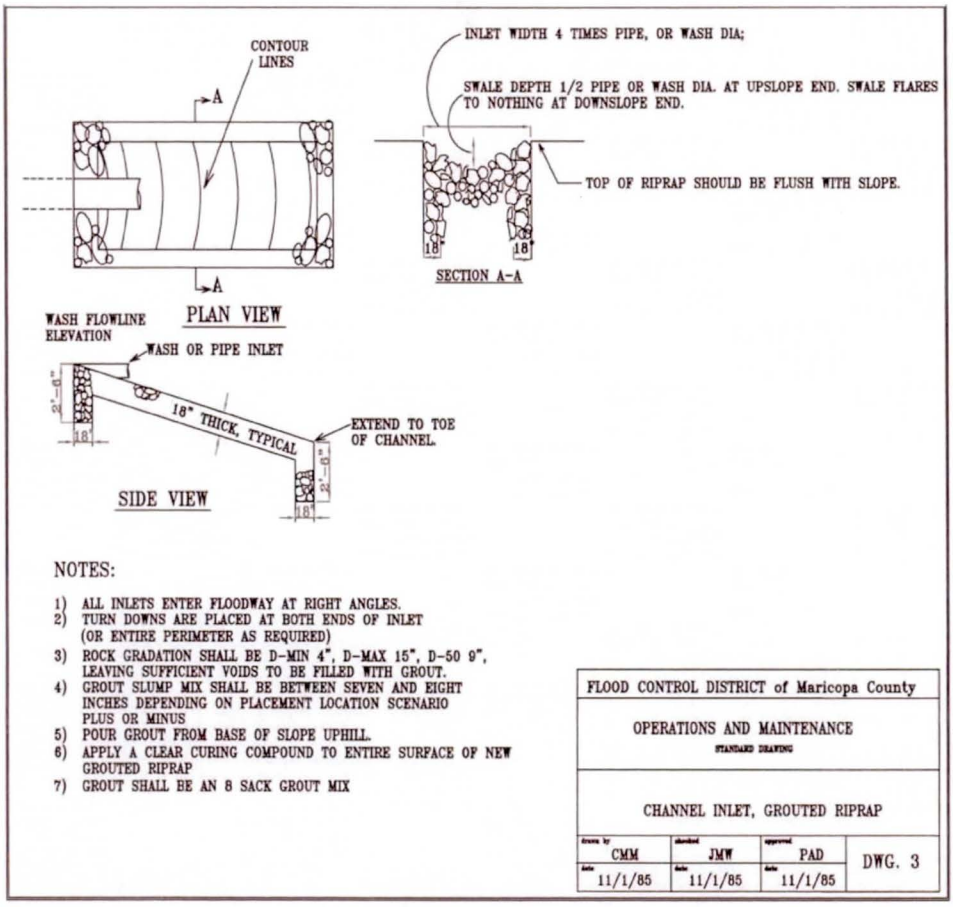
MATERIAL LIST	
QTY.	ITEM
1 PER SPAN 20 FEET	1 3/8", 1 3/8" LINE POST 6' LONG
1 PER SPAN 6.25 FEET	STAY 3'-4" LONG
1 PER CORNER POST	3" DIA. HEAVY GAUGE PIPE 7' LONG
1 PER CORNER POST	3" DIA. GALVANIZED POST CAP
2 PER CORNER POST	1 5/8" dia. HEAVY GAUGE PIPE 7' LONG
2 PER CORNER POST	1 5/8" dia. RAIL END
2 PER CORNER POST	3" DIA BRACE BANK OR DBL BAND
1 PER LINE POST	WIRE CLIPS
	SMOOTH OR BARBED WIRE
	CONCRETE FOR FOOTING

NOTES:

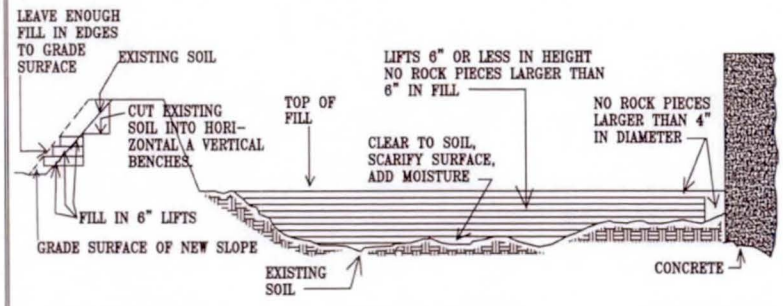
1) FOR HEIGHT SLOPE OF ALL FOOTINGS, USE 1-0-3 CONCRETE MIX.
2) ON BARBS AWAY FENCE, THE WIRE SHOULD BE ON THE DOWNSTREAM SIDE OF THE POSTS.
3) ON ALL OTHER FENCING WIRE SHOULD BE OUTSIDE THE POSTS, EXCEPT ON CURVES WHERE WIRE SHOULD BE ON OUTSIDE OF CURVE.
4) FASTEN WIRE TO LINE POSTS WITH WIRE CLIPS.
5) FASTEN WIRE TO CORNER OR INTERMEDIATE POSTS WITH BRACE BANDS WHERE WIRE ENDS AT POST, OTHERWISE WRAP WIRE AROUND POST 6 TIMES.
6) INTERMEDIATE POST ASSEMBLIES SHALL BE LOCATED AT INTERVALS NOT TO EXCEED 660' TEST.

FLOOD CONTROL DISTRICT of Maricopa County			
OPERATIONS AND MAINTENANCE STANDARD DRAWING			
FENCING, SMOOTH OR BARBED WIRE			
drawn by: LDW	checked: JMW	approved: PAD	DWG. 2
date: 11/15/85	date: 11/18/85	date: 11/18/85	

SD#2 Fencing, Smooth or Barbed Wire



SD#3 Grouted Riprap Side Inlet Chute



PLACING FILL AGAINST EXISTING EMBANKMENTS
1.) BENCH HILLSIDE INTO HORI-ZONTAL A VERTICAL CUTS.
2.) FILL IN 6" LIFTS, LEAVING ENOUGH MATERIAL ON EDGES TO GRADE SLOPE SURFACE.

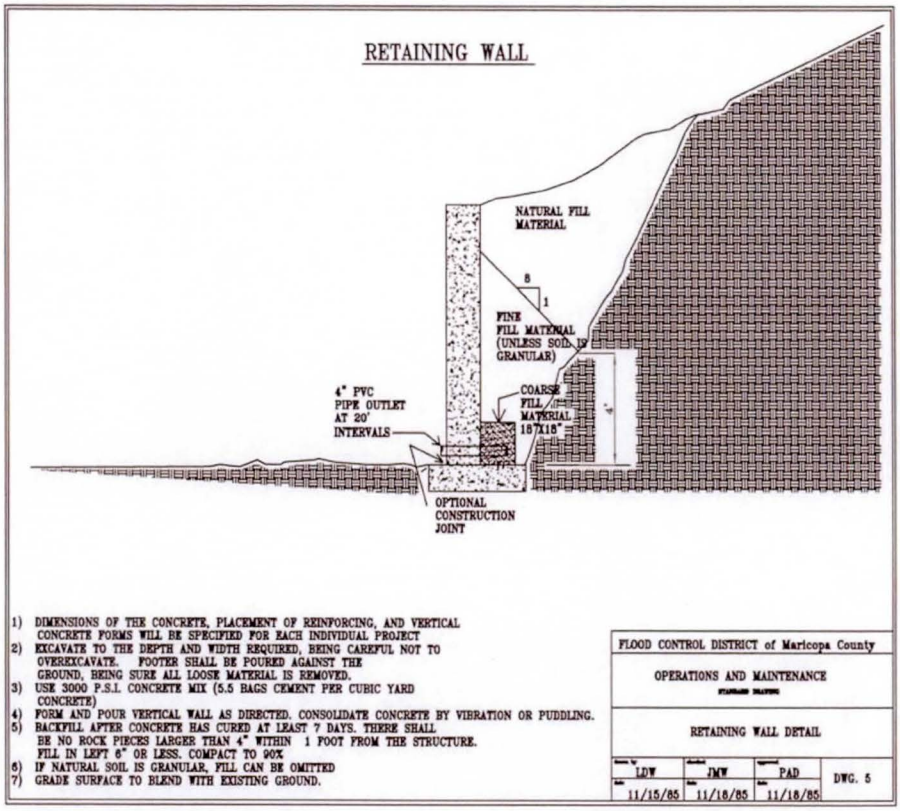
PLACING FILL IN DEPRESSION
1.) CLEAR AREA OF TOPSOIL A VEGET-ATION
2.) SCARIFY TO 6" DEPTH ADD MOISTURE
3.) FILL IN 6" LIFTS

PLACING FILL AROUND STRUCTURES
1.) DON'T FILL AROUND FRESH CONCRETE, ALLOW IT TO CURE AT LEAST 7 DAYS BEFORE FILLING.
2.) WITHIN 1' OF STRUCTURE OR SURFACE NO ROCK SHALL EXCEED 4" IN DIAMETER.

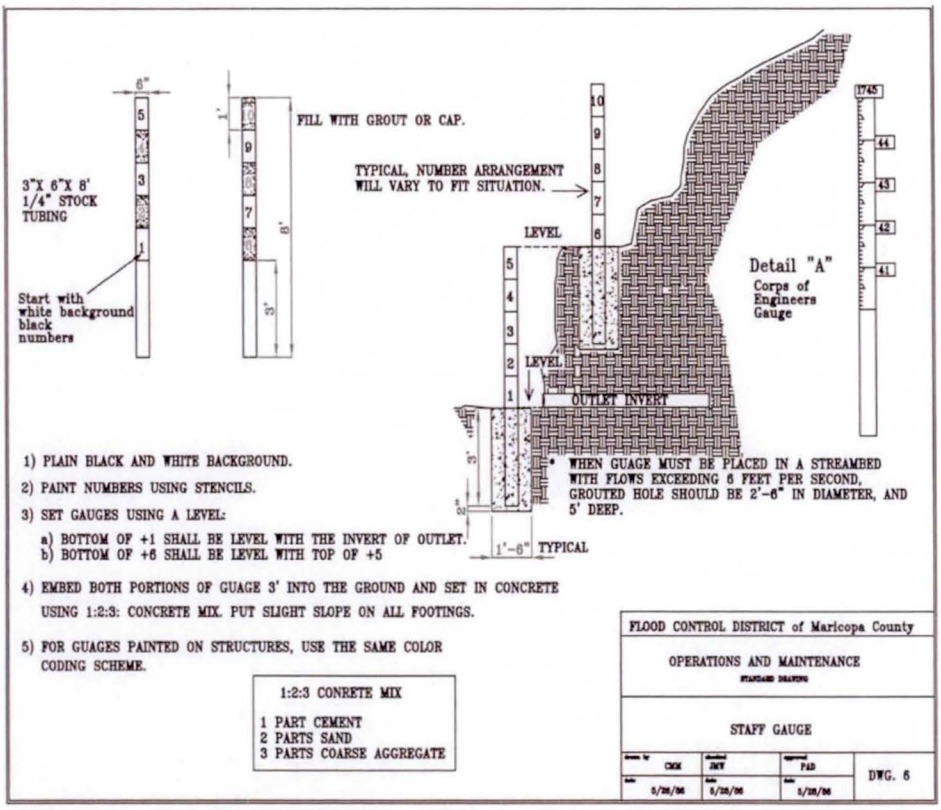
GENERAL NOTES
1.) PLACE BACKFILL IN LIFTS OF HEIGHT WHICH CAN BE EFFECTIVELY COMPACTED, IN NO CASE LARGER THAN 6"
2.) IF MATERIAL IS ROCKY, MIX WITH FINER MATERIAL TO FILL VOIDS.
3.) TO ACHIEVE COMPACTION; SOIL SHOULD HAVE OPTIMUM MOISTURE, (SOIL CAN BE FORMED INTO A BALL WHICH WILL FALL APART UPON HITTING THE GROUND WHEN DROPED FROM A HEIGHT OF 3'.)
4.) COMPACT WITH NECESSARY EQUIPMENT.
5.) SURFACE SHOULD BE PRESENTABLE AND BLEND WITH EXISTING AREA. GRADE SURFACE TO DRAIN.

FLOOD CONTROL DISTRICT of Maricopa County			
OPERATIONS AND MAINTENANCE STANDARD DRAWING			
BACKFILLING; EMBANKMENTS, DEPRESSIONS AND STRUCTURES			
drawn by LDW	checked JMW	approved PAD	DWG.4
date 8/1/85	date 11/18/85	date 11/18/85	

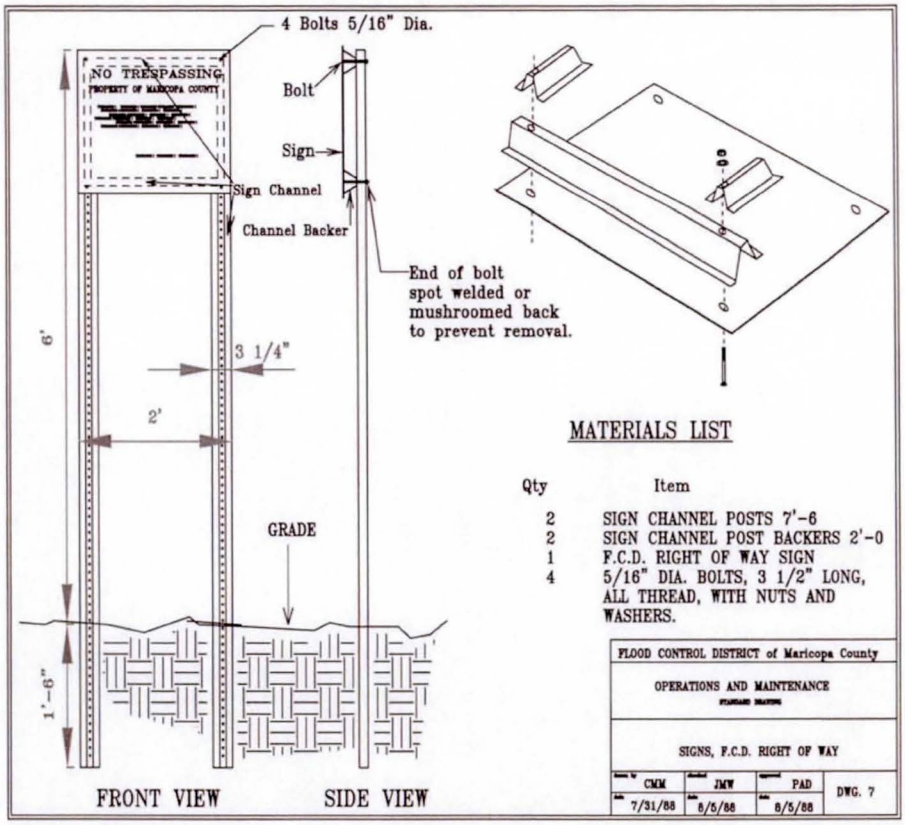
SD#4 Embankment Backfilling



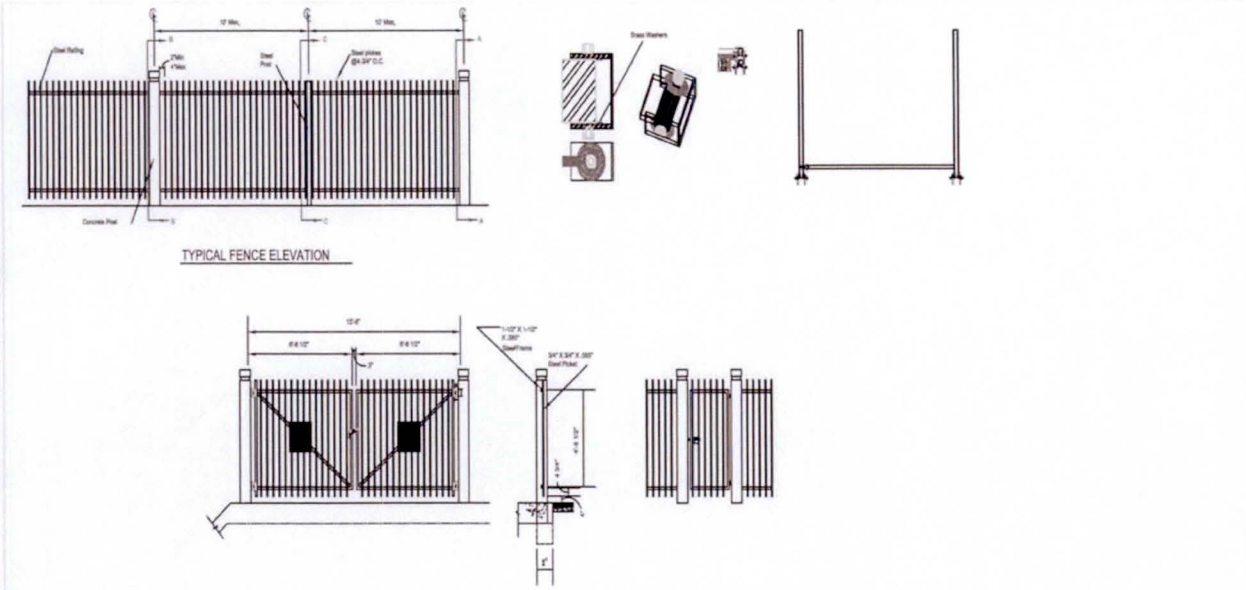
SD#5 Retaining Walls

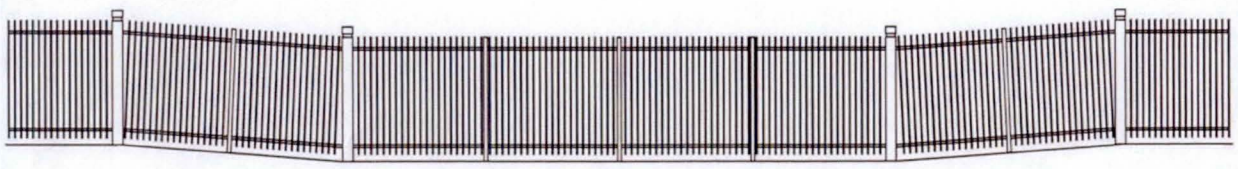


SD#6 Staff Gages

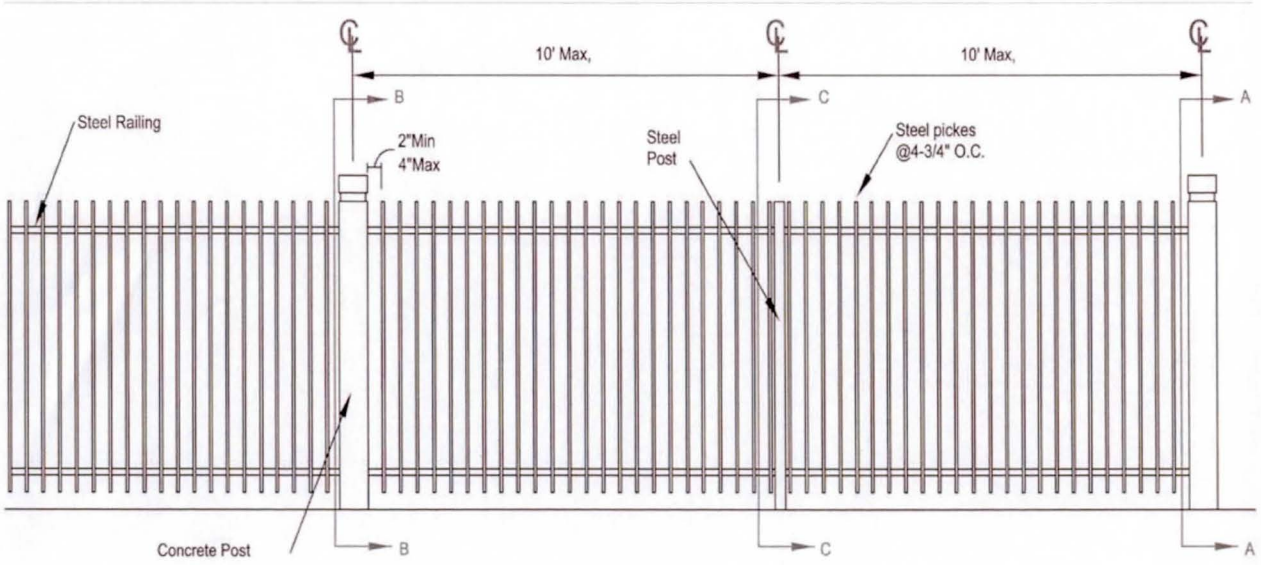


SD#7 FCDMC Signs Right-Of-Way



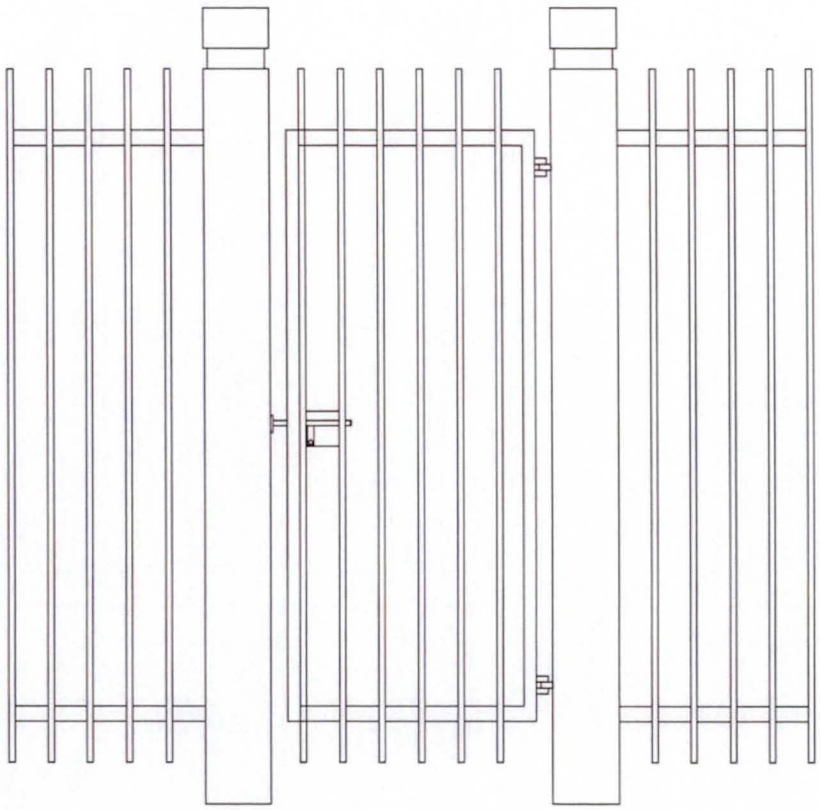


SD#8 Wrought Iron Fence 1 0f 8

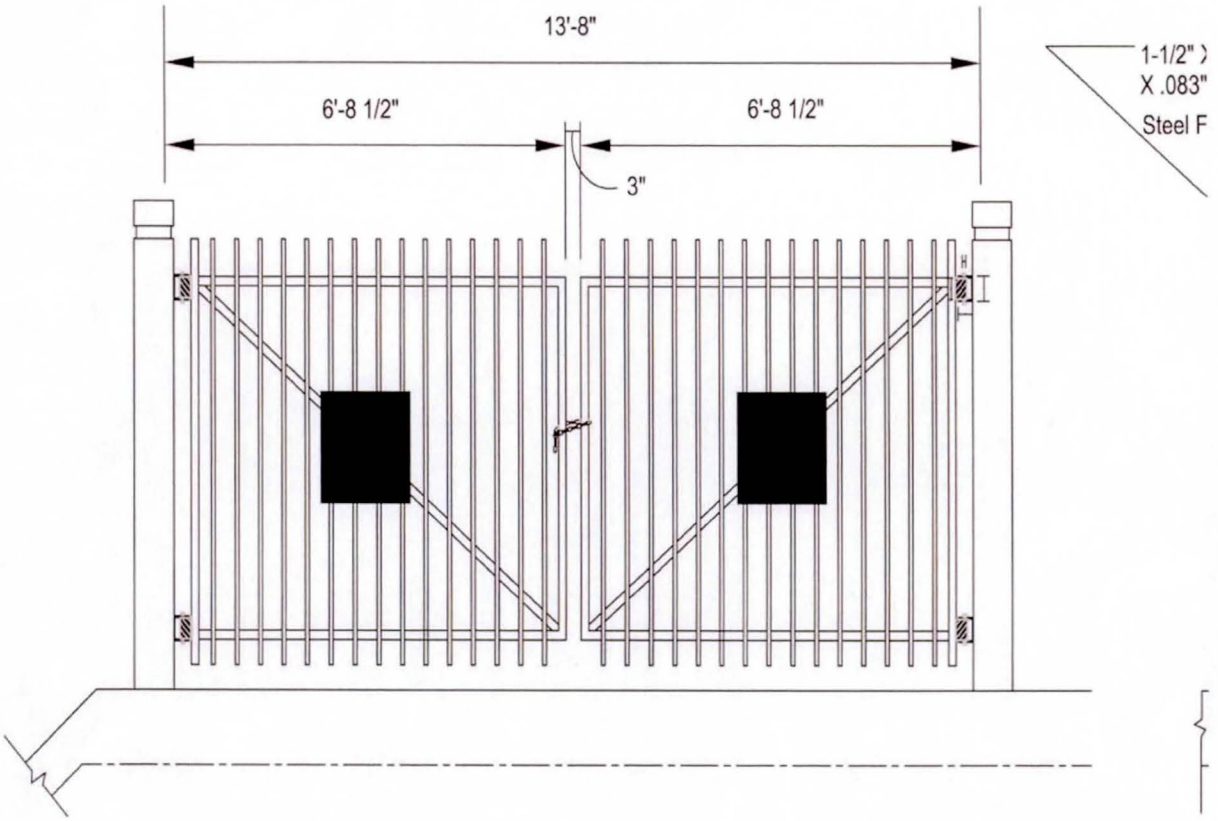


TYPICAL FENCE ELEVATION

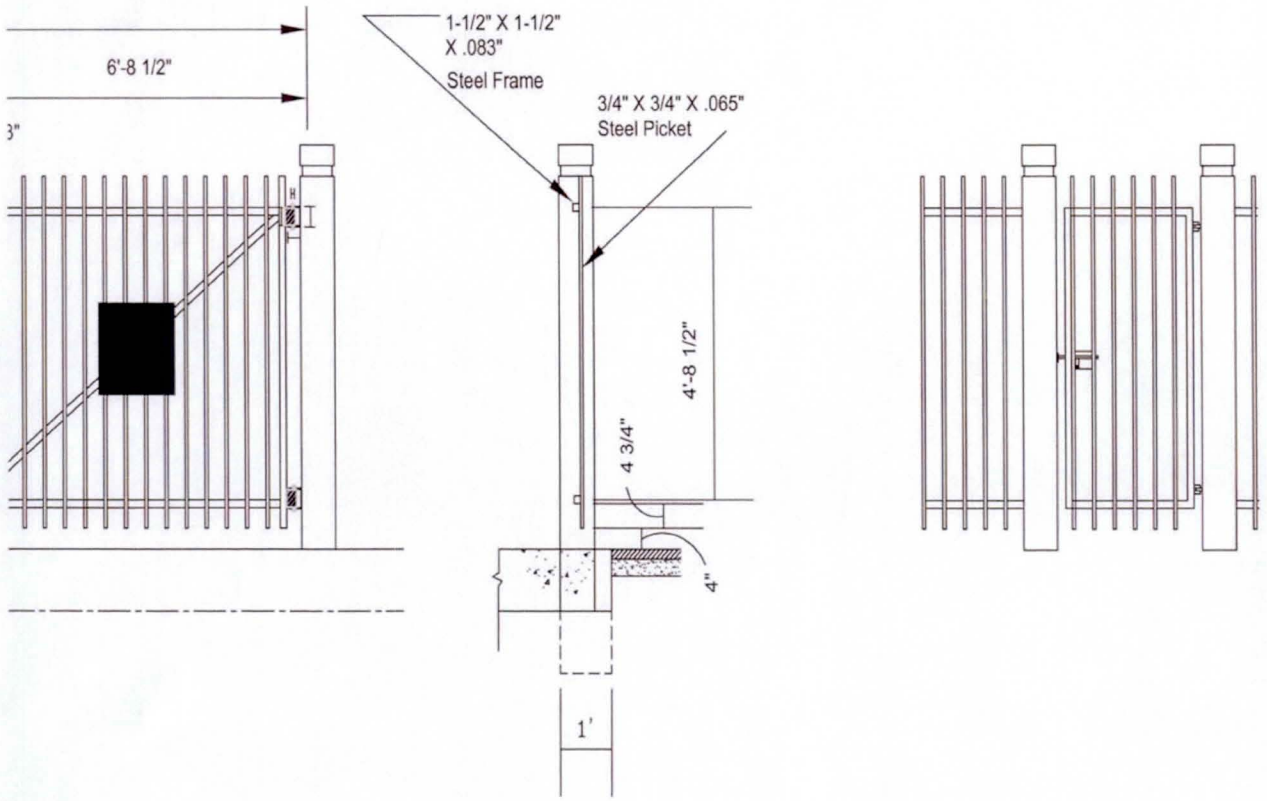
..... Wrought Iron Fence 2 of 8



..... Wrought Iron Fence 3 of 8



..... Wrought Iron Fence 4 of 8



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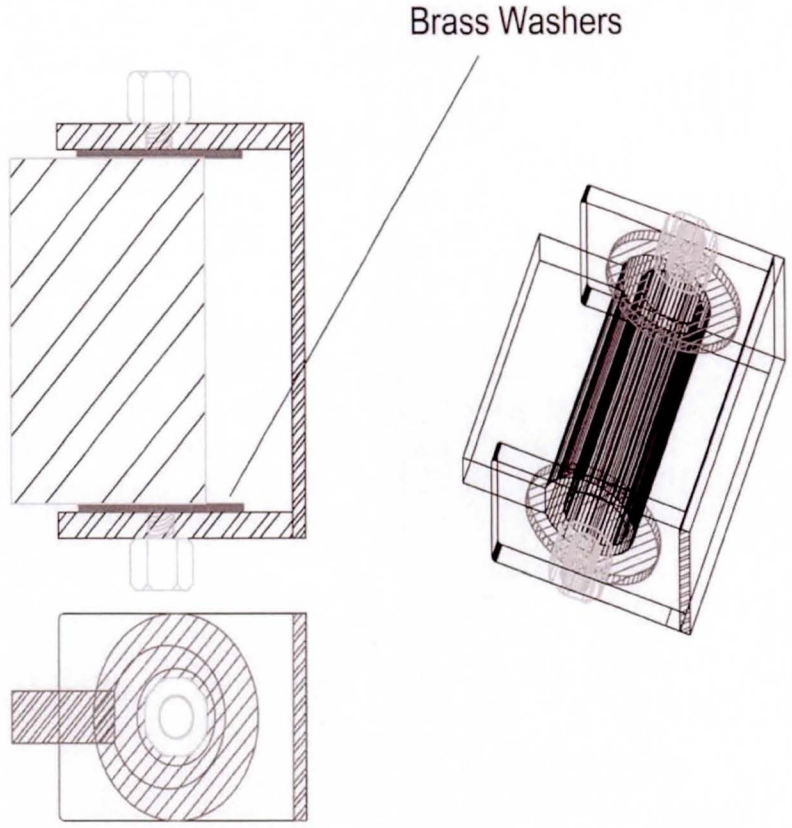

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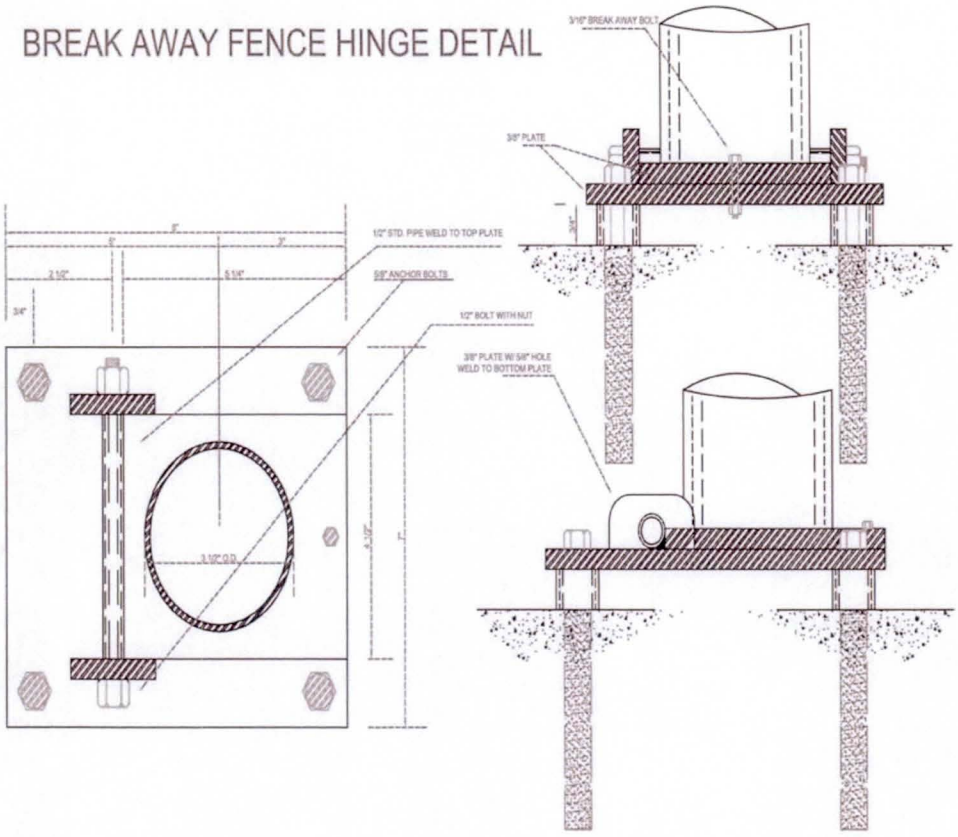

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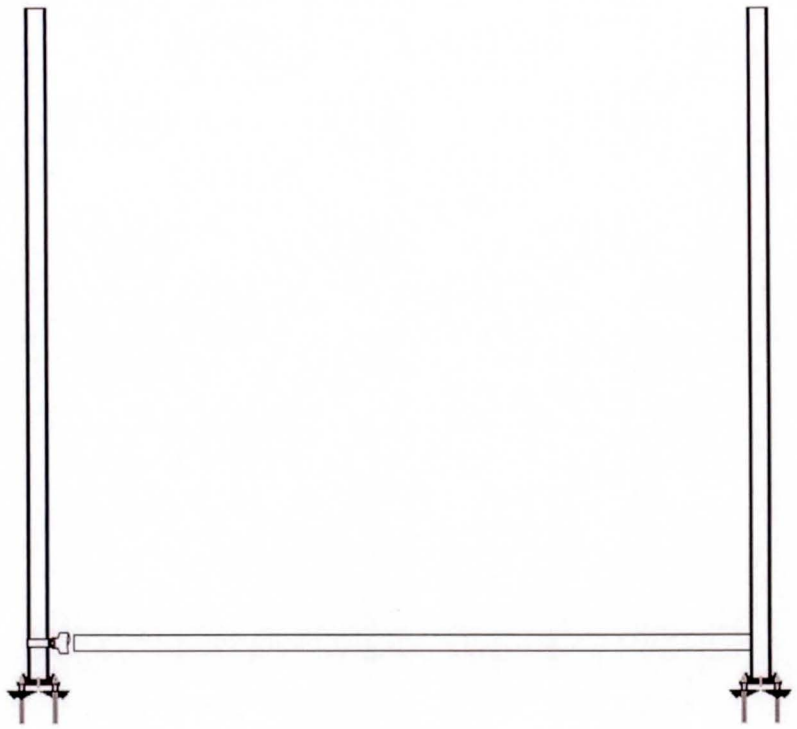

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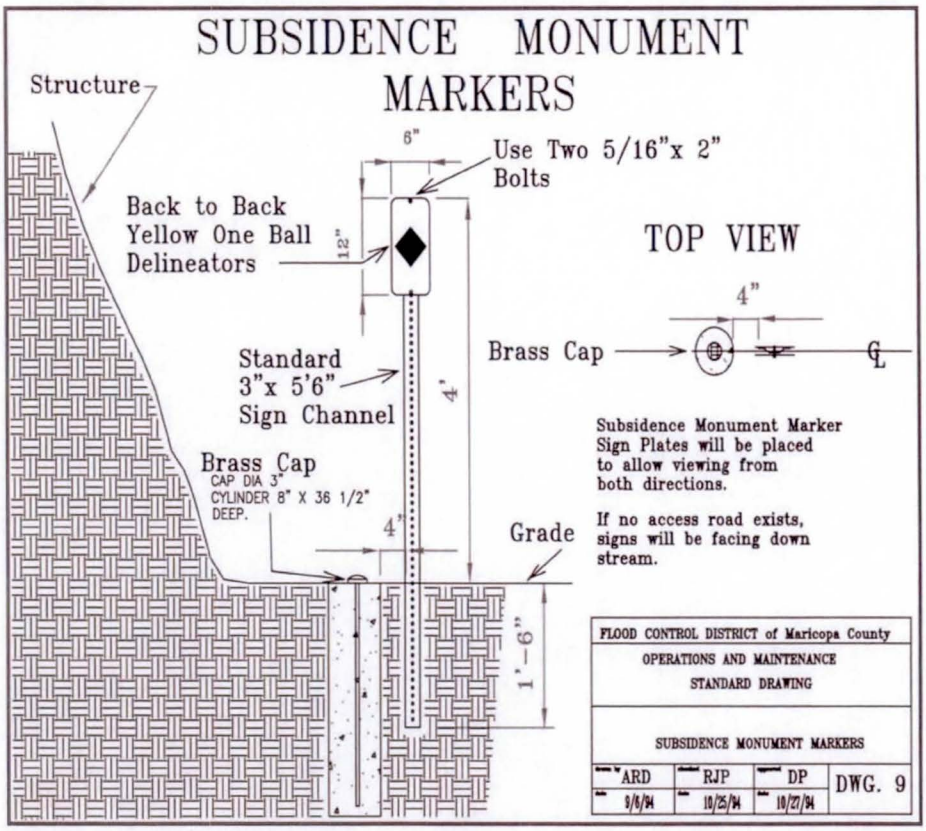
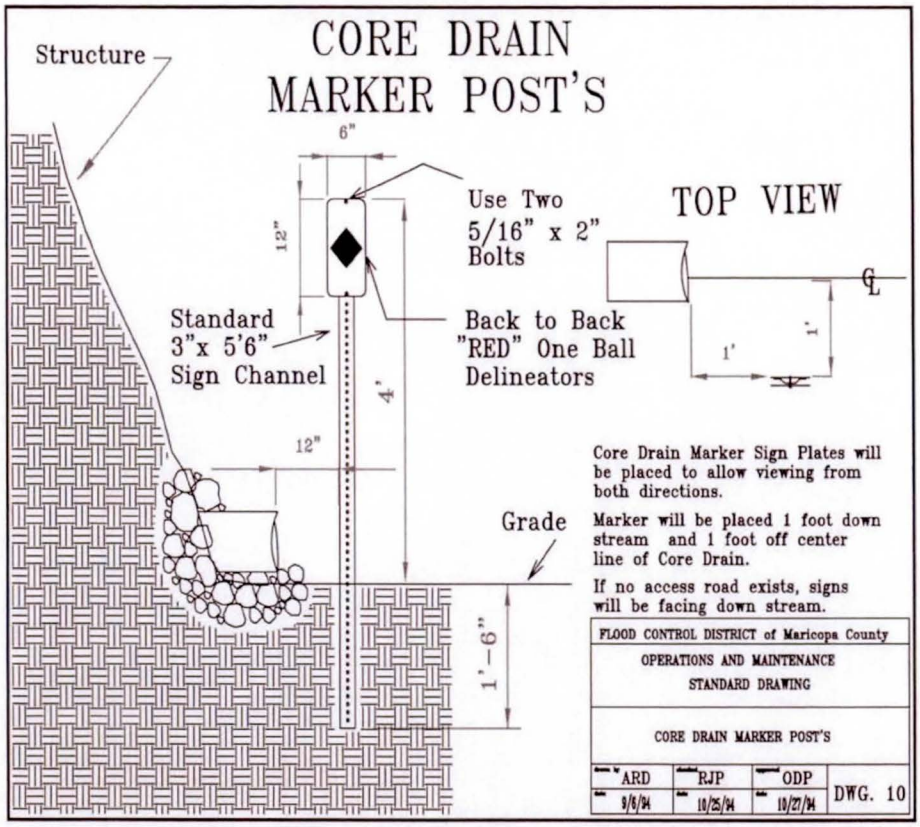
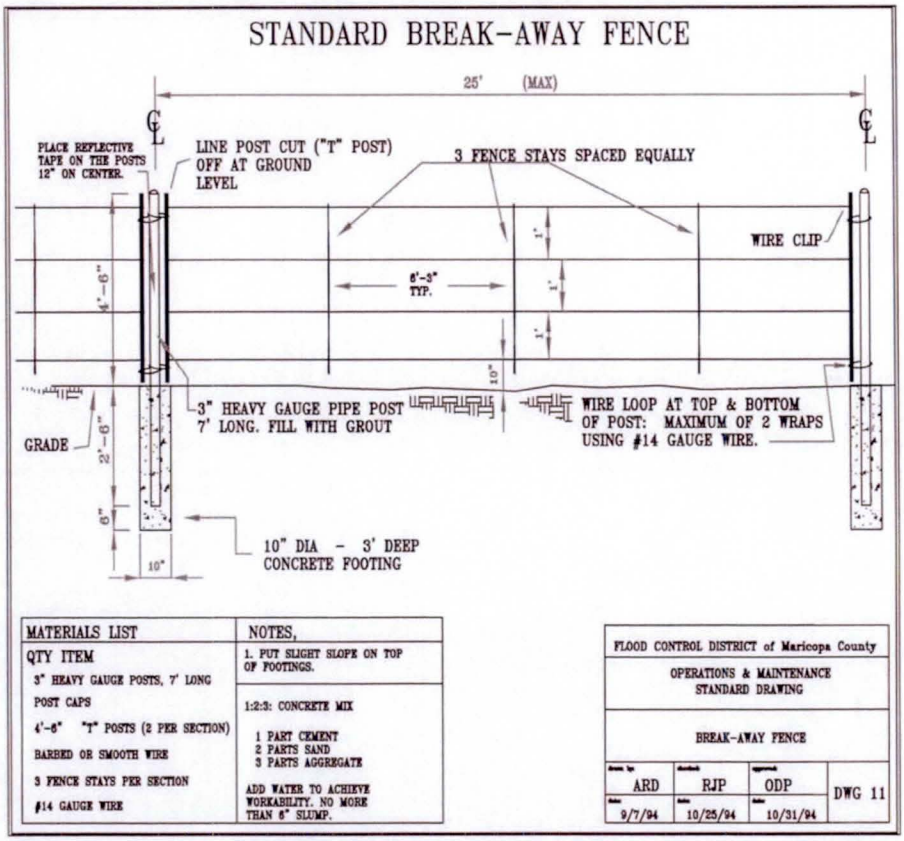


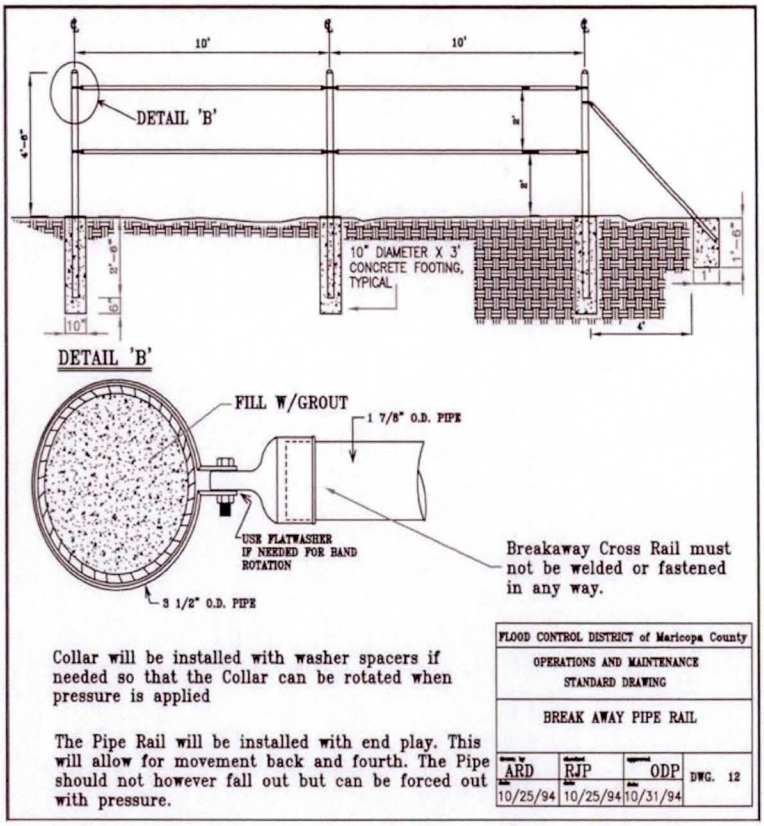
SD#9 Subsidence Markers



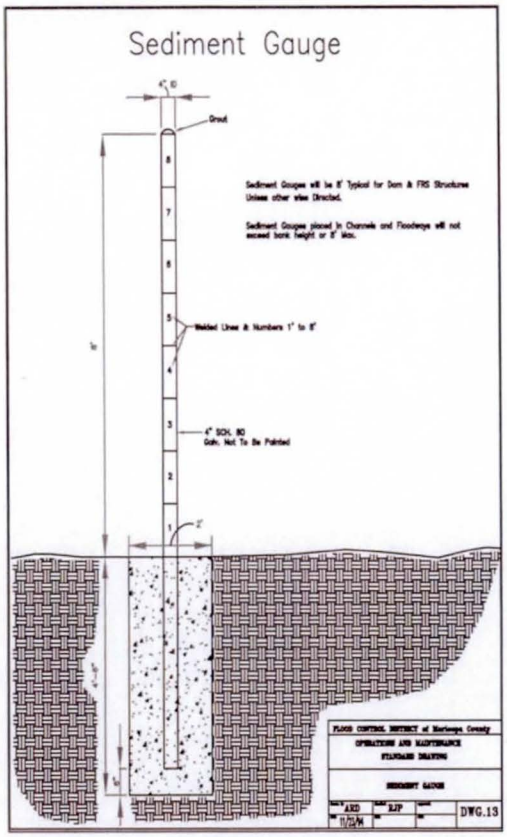
SD#10 Core Drain Markers



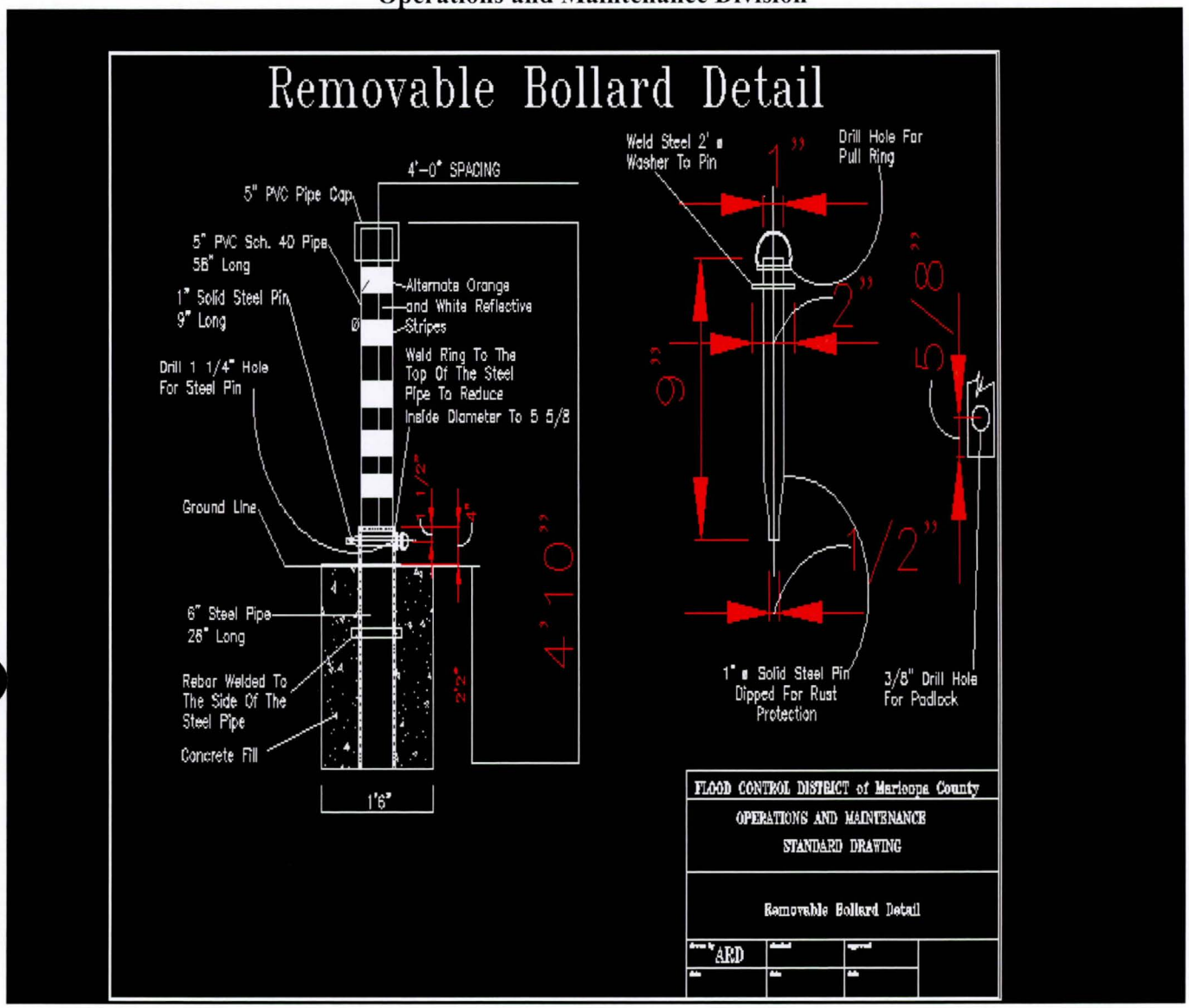
SD#11 Standard Break-Away Fence



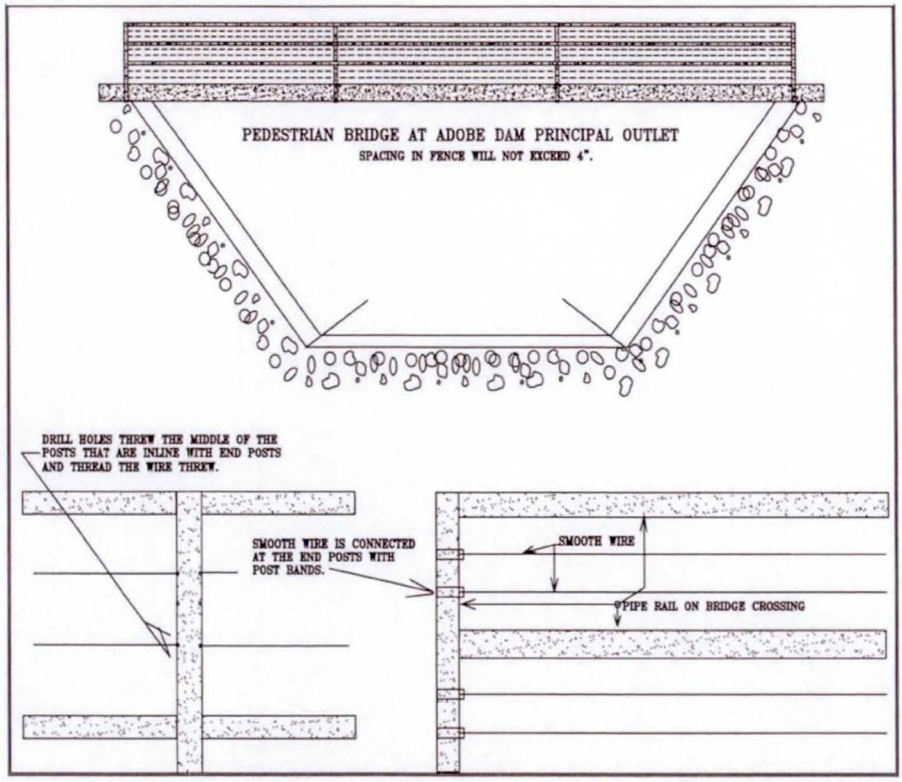
SD#12 Standard Break-Away Pipe Rail Fence



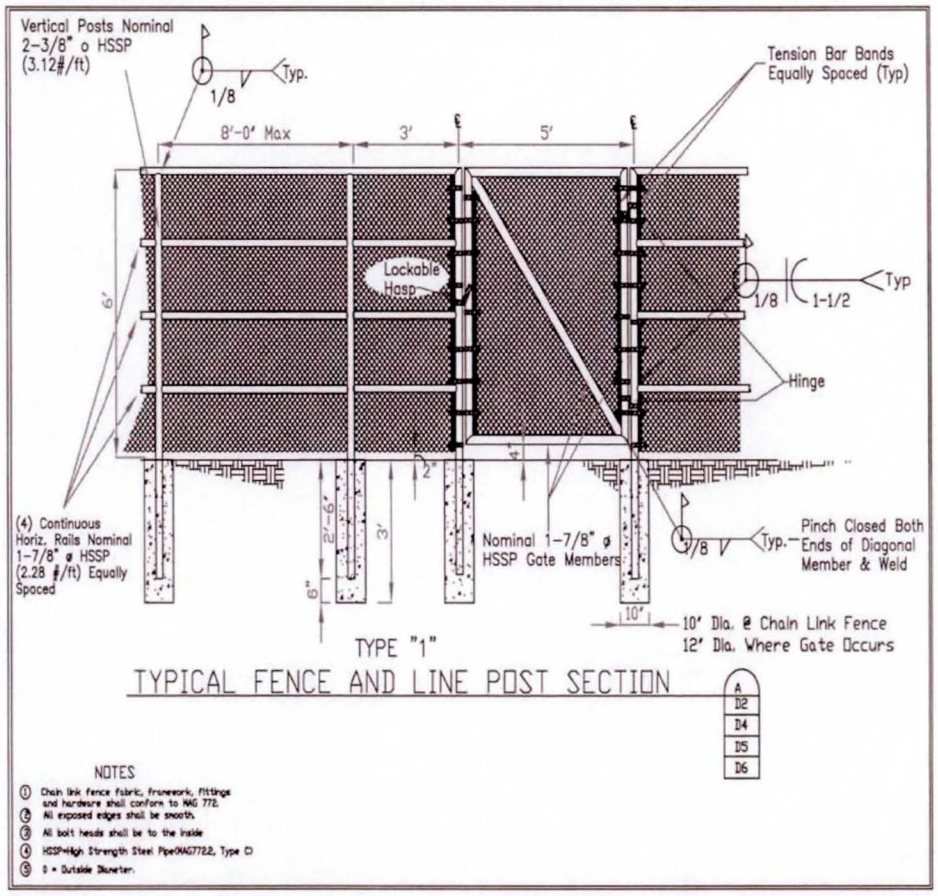
SD#13 Sediment Gage



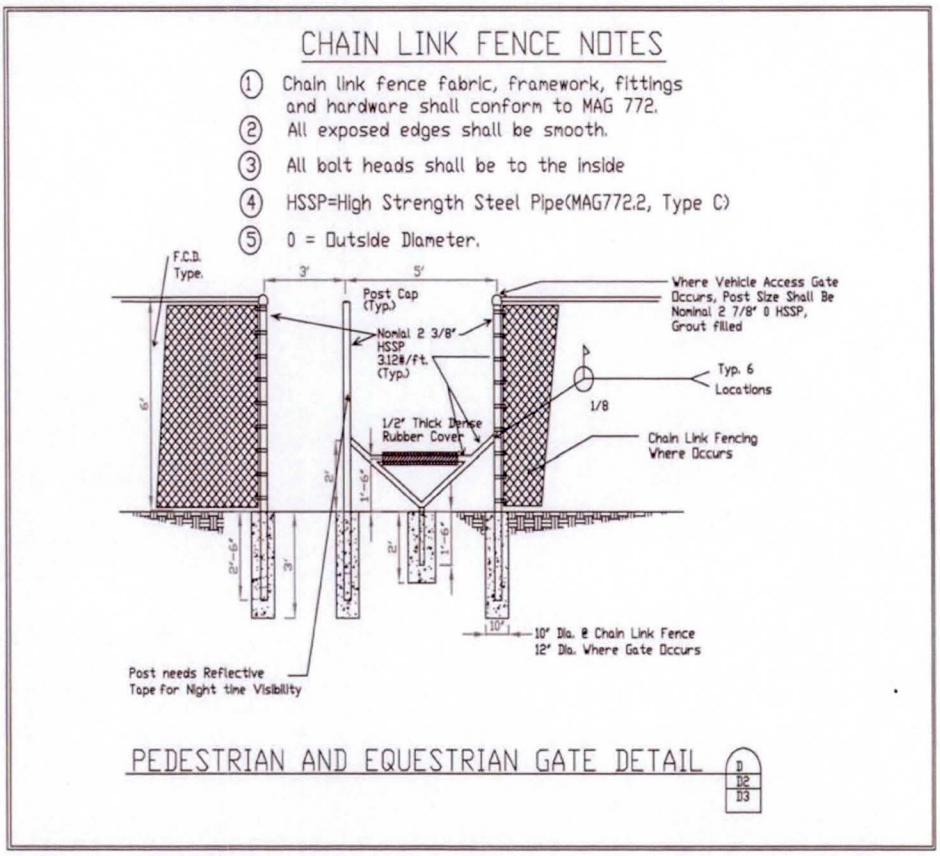
SD#14 Removable Bollard



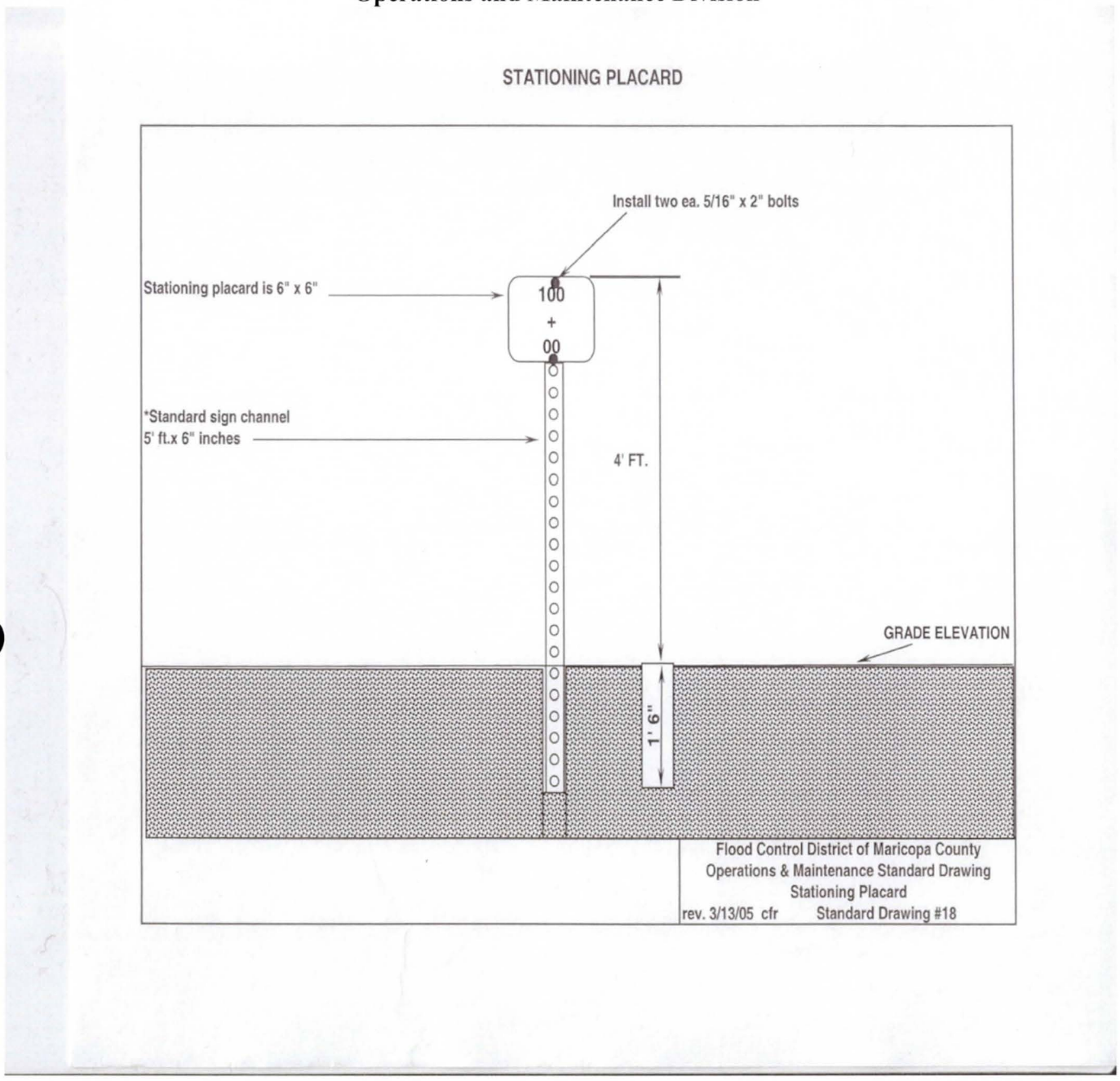
SD#15 Observation Bridge at Adobe Dam



SD#16 Line and Fence Posts



SD#17 Equestrian Gate



SD#18 Stationing Placard

6

2.3. Weldable Anchors

Occasionally anchors may be located on steel ground supports such as tunnel arches, steel tubbing or on soldier piles. The eyebolt is attached to a small steel plate, which is then welded to the structure. (Alternately an eyebolt can be screwed directly into a ¼-20 hole drilled and tapped in the steel member.)

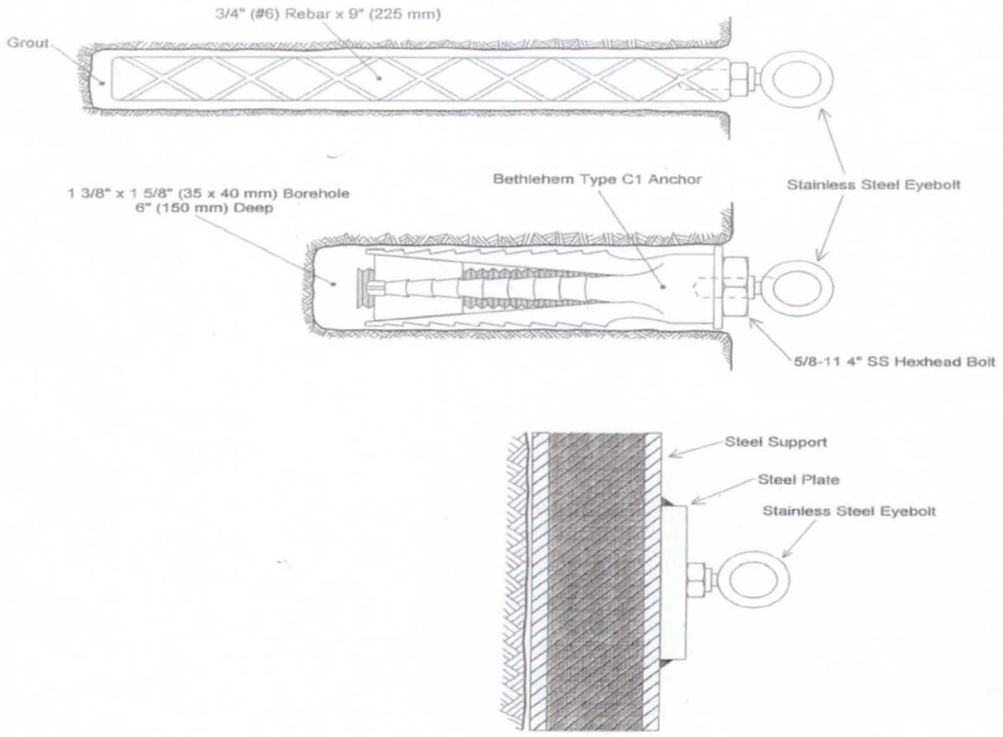


Figure 3 - Three Anchor Types

SD#19 Weldable Anchors

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

FCD Grouted Riprap Placement Notes

1. Riprap bed shall be installed @ 1.67 feet thick. Turndowns shall be installed around the perimeter of the riprap apron at a depth of 2.5 feet.

2. Riprap shall be obtained from any source approved by Flood Control District of Maricopa County (FCD), and shall be reasonable well graded between four and fifthteen inches, with not less than 40% nor more than 70% six inches in size.

3. Riprap shall be placed to produce a surface in which the tops of the individual riprap do not vary more than plus two inches from true grade. Double decking of thin flat riprap will not be permitted.

4. Grout shall fully penetrate to base of Riprap. Contractor shall use a pencil vibrator to ensure full grout penetration.

5. Grout shall be composted of cement, sand, and water mixed in the proportions as directed. The estimated cement content requirement per cubic yard of grout shall be eight sack mix-per Mag Specification 220.5. The water content of the mix shall not exceed eight and a half gallons per sack of cement. Slump of grout mix shall be between seven and eight inches depending on placement location scenario plus or minus.

6. Placement and brooming of the grouted surface shall be such that the outer layer of rocks projects 1/3 to 1/4 their diameter above the grouted surface. After the top course has stiffened, the entire surface shall be re-broomed to eliminate runs in the top course and to fill voids caused by sloughing of the layers of grout.

7. Representative of FCD required to be onsite during grouting operations. Contractor shall contact FCD 48 Hours prior to grouting

8. Contractor shall clean surface of riprap stone projecting above grout to match any existing riprap. Surface shall be cleaned by air-water blasting or other approved method. Cleaning shall remove all grout, cement paste, and discolorations caused by grout, without damaging the grout to remain in place.

9. The grout shall be permitted to set of a minimum of one hour before air-water blasting is commenced. The air-water blasting shall be at right angles to the surface of the stone.

10. Contractor shall apply a clear curing compound to entire surface of new grouted riprap.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

FCD Gated Outlet Positioning

Buckeye 1-2-3-

The irrigation gates should remain wide open at all times. They provide water to the vegetation along the washes downstream from the structure. Buckeye 1-Sta.#710+00 & 817+00/Buckeye 2-Sta.#239+00/Buckeye 3-Sta.#155+00 & 88+00.

Casandro Wash Dam

The gated outlet should remain closed at all times unless otherwise directed by the FCD Operations Center. Sta. #14+23

Guadalupe FRS

The gate will be closed at all times until floodwaters accumulate within the structure and the silt has settled from the water. Then subject to notification of Salt River Project and their concurrence, the gate should be opened and the floodwaters drained from the structure. Sta.#09+33.

Harquahala FRS

Irrigation outlet sta.# 583+75 (New Tank Outlet) is to remain in the open position. Irrigation outlet sta. #746+00 is to remain closed. The gated outlet at the Principal Outlet Sta. #1045+08 should remain in the closed position.

McMicken Dam

The irrigation outlet gates are to remain in the closed position, due to FCD Dam Safety concerns. The drains shall be used only to drain low pockets of water after flow through the outlet structure has ceased. The drains shall be closed at all other times. The Maricopa Water District needs to be notified before water is released into their canal. The water district has the right to open and close these gates at their discretion. They are supposed to notify the Flood Control District of Maricopa County when they change the position of these gates, but are not well known for this practice. Sta.# 387+14 & 398+24.

Powerline FRS

The gated outlet will be used only to drain the impoundment area after flow through the outlet structure has ceased otherwise it should remain in the closed position. Sta. #141+50

Rittenhouse FRS

The irrigation outlets provide water into the cattle tanks downstream from the structure, leave the gates about ½ open. In the event of heavy rainfall and the tanks are full, they should be closed. However, sta.#69+50 is currently in the closed position due to a Dam Safety concern with a possible transverse crack near the operating wheel & 154+60 is still in the ½ open position.

Saddleback FRS

The two gated outlets supply water to vegetation and cattle tanks downstream, and are to remain open at all times. However at sta.#60+50, the vegetative outlet is closed due to a Dam Safety concern with a possible transverse crack near the operating wheel & sta. 256+00 is still in the open position.

Signal Butte FRS.

The irrigation outlet has two design purposes. One is to act as a means of totally evacuating the reservoir and borrow area. The other is to supply additional water to downstream vegetation. This gate is to remain closed except under controlled circumstances. Due to the development of this area, some kind of warning to the public downstream may be required before the gate is to be opened. Sta. #229+00

Spook Hill FRS

The low stage slide gate should remain in the closed position at all times, unless otherwise directed by the FCD Operations Center. Sta. #299+00

Sunset & Sunnycove FRS

These structures each have one manually operated gate. These gates are to remain closed until floodwaters have accumulated within the structures and the silt has had time to settle out. At this time the gates are to be opened and the impoundment areas completely drained. Sunset FRS Sta.#00+00/Sunnycove FRS Sta.#08+00.

White Tanks-FRS #3

The gated outlets are to remain closed, unless otherwise directed by the FCD Operations Center. The Beardsley Water District needs to be notified before water is released into their canal. The water district has the right to open and close the gate at their discretion. They are supposed to notify the Flood Control District of Maricopa County when they change the position of this gate. Located at Sta. #29+00, 46+00 and 63+80.

White Tanks-FRS #4

The gated outlets are to remain closed, unless otherwise directed by the FCD Operations Center. Due to development, some kind of warning may be required to the public downstream if the gate is opened. In any case the gate and outlet should be under responsible supervision at all times, when it is opened. Sta. #17+32 & 58+50

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Type of Structure and Maintenance

Adobe Dam:

Type of structure: Zoned earth-filled dam. 11,220 lf with approx. 81.31 acres of earthen embankment.
Typical maintenance: Ant treatment, bank improvements, concrete repair, debris removal, erosion repair, fence installation, floodway maintenance, fence repair, floodway storm maintenance, gate installation, grounds maintenance, graffiti removal, grouted riprap repair, mosquito abatement, operational and annual inspections, principal outlet maintenance, asphalt road repair, earth road or ramp maintenance, rodent erosion repair, rodent treatment, structure additions (drop inlets, chutes, etc.), sediment removal, staff gages, sign installation and maintenance, storm surveillance, vegetation removal, and vandalized fencing; gates, plants, signs, trash, vehicle damage.

Agua Fria River:

Type of structure: Compacted earth with soil cement levee's. (65.45 acres of earthen embankment & 32.72 acres of soil cement)
The Agua Fria River Channelization, carries water from the ACDC, Skunk Creek, Adobe Dam, and New River and empties into the Gila river.
Total length of the four reaches of FCD responsibilities: 31,680 lf (6 miles)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, grader work on maintenance roads, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle,.

Alma School Drain:

Type of structure: 3,640 lf of concrete lined channel and 1,250 lf of unlined channel.
Combination storm drain, irrigation waste ditch, and flood control channel.
Typical maintenance- Concrete repair, debris removal, erosion repair, graffiti removal, grader road work, sediment removal, staff gages, sign maintenance, floodway maintenance, fence repair, weed control, vegetation removal, rodent treatment, vandalism-fencing, gates, signs, trash.

Apache Jct. FRS & Fldwy:

Type of structure: Earth-fill dam (8,450 lf) (1,537 lf concrete rectangular channel floodway). 28.3 acres of earthen embankment.
Catches water from the Usery Mtns. and transports it to Signal Butte FRS.
Typical maintenance- Debris removal, erosion repair, fence repair, floodway maintenance, graffiti removal, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

ACDC:

Type of structure: Partly earth lined channel in Glendale and concrete box channel in Phoenix.
Reach-1 = 10,560 lf of earthen channel. 17.3 miles in length, divided into four reaches. (91,344 lf)
Reach-2 =32,736 lf concrete channel.
Reach-3 =21,120 lf concrete channel. Reach-4 =26,928 lf concrete channel.
Typical maintenance: Bank improvements, granite erosion repair, debris removal, erosion repair, fence repair, graffiti removal, mower operations, plant maintenance, asphalt road maintenance, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, irrigation, plant replacement, vandalism-fencing, gates, irrigation, plants, signs, trash, vehicle, sweeper operations.

Buckeye FRS #1:

Type of structure: Compacted earth filled dam. 7.14 miles in length (37,680 lf) 147.33 acres of earthen embankment
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Buckeye FRS #2:

Type of structure: Compacted earth filled dam. 2.37 miles in length (12,155 lf) 30.4 acres of earthen embankment
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Buckeye FRS #3:

Type of structure: Compacted earth filled dam. 3 miles in length (16,847 lf) 56.59 acres of earthen embankment
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Camelback Ranch Levee's:

Type of structure: Compacted soil cement levee's. 10,977.8 lf or 2.07 miles in length.
Typical maintenance: Debris removal, fence repair, graffiti removal, rodent treatment, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Casandro Dam:

Type of structure: Homogenous dam. 2,300 lf in length (0.43 miles) 1.3 acres of earthen embankment
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Cave Buttes Dam:

Type of structure: Zoned earth filled dam. 2,275 lf (.43 miles) 25.51 acres of earthen embankment
Typical maintenance: Bank improvements, debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Cave Creek @ ACDC:

Type of structure: Concrete lined channel: 2.25 miles (11,880 lf)
Typical maintenance: Debris removal, erosion repair, granite erosion repair, floodway maintenance, fence repair, graffiti removal, irrigation maintenance, mower operations, plant maintenance, plant replacement, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, irrigation, plants, signs, trash, vehicle removal, sweeper
operations.

Centennial Levee:

Typical of structure: Compacted earthen embankment with floodway: 4.53 miles (23,918 lf) in length. (33.7 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, mower operations, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Colter Channel:

Type of structure: Unlined channel of compacted earth. 19,008 lf (3.6 miles) in length. (22.5 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, fence repair, floodway maintenance, graffiti removal, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
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Dreamy Draw Dam:

Type of structure: Zoned compacted earth-fill dam. 455 lf in length. (2.87 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, fence repair, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash.

Dysart Drain:

Type of structure: Concrete lined channel, shot-creted along the top edge. 21,648 lf (4.1 miles) in length.-3.93 miles of dirt road.
Typical maintenance: Currently the only maintenance being performed is the inlet end of the drain off of Olive Ave to Falcon Dunes Golf Course. This is a concrete lined channel. IGA is not in place.
Debris removal, floodway maintenance, fence repair, sediment removal, sign maintenance, weed control, vandalism-fencing gates, trash.

East Fork Cave Creek:

Type of structure: Earth compacted unlined channel. 6,336 lf (1.2 miles) (9.76 acres of earthen embankment)
Typical maintenance: Debris removal, granite erosion repair, erosion repair, floodway maintenance, fence repair, graffiti removal, irrigation maintenance, mower operations, plant maintenance, plant replacement, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, irrigation, plants, signs, trash.

Paradise Valley Community College Basin #4:

Type of structure: 16.5 acre basin area.
Typical maintenance-Debris removal, erosion repair, sediment removal, vegetation removal, weed control.

El Mirage Drain:

Type of structure: Lined concrete channel. 8,448 lf (1.6 miles)
Typical maintenance: Concrete repair, debris removal, floodway maintenance, graffiti removal, sediment removal, staff gages, fence repair, rodent treatment, sign maintenance, vegetation removal, weed control, vandalism-fencing, signs, trash, vehicle.

East Maricopa Floodway-Reaches 1-6:

Type of structure:

Reach 1-23,760 lf (4.55 miles) compacted earth with sections of riprap. (23.15 acres of earthen embankment)
Reach 2-23,971 lf (4.54 miles) compacted earth with sections of riprap. (29.76 acres of earthen embankment)
Reach 3-23,443 lf (4.44 miles) compacted earthen channel. (35.8 acres of earthen embankment)
Reach 4-25,872 lf (4.9 miles) compacted earthen channel. (31.8 acres of earthen embankment)

Reach 5-16,363 lf (3.1 miles) compacted earthen channel in a golf course greenbelt. (25.05 acres of earthen embankment)

Reach 6-13,200 lf (2.5 miles) compacted earthen channel incorporated with desert landscaping. (11.97 acres of earthen embankment)

Typical maintenance: Bank improvements, granite erosion repair, debris removal, erosion repair, floodway maintenance, graffiti removal, fence repair, irrigation maintenance, mower operations, plant maintenance, plant replacement, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, irrigation, plants, signs, trash, vehicle, yard maintenance.

48th St. Drain:

Type of structure: Concrete lined trapezoidal channel. 9,450 lf (1.8 miles)

Typical maintenance: Debris removal, erosion repair, floodway maintenance, graffiti removal, fence repair, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Guadalupe Dam:

Type of structure: Homogenous earth-fill dam. 10.36 acres of earthen embankment.

East Dam-4,597 lf North Dam #1-450 lf North Dam #2-950 lf

Typical maintenance: Debris removal from outlet tower, principal outlet maintenance, sediment removal from outlet tower, staff gages, check and maintain manhole outlet system.

Guadalupe Road Box Channel:

Type of structure: Concrete trapezoidal channel. 4,752 lf (0.90 miles).

Typical maintenance: Debris removal, floodway maintenance, fence repair, graffiti removal, sediment removal, staff gages, sign maintenance, vandalism-fencing, gates, signs, trash.

Harquahala FRS:

Type of structure: Compacted earth-fill dam. 62,308 lf (11.80 miles) (393.31 acres of earthen embankment)

Typical maintenance: Bank improvements, debris removal, erosion repair, floodway maintenance, fence repair, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Holly Acres:

Type of structure: Compacted earthen levee with riprap, gabions, soil cement protection.
6,600 lf (1.25 miles) (1.37 acres of earthen embankment)

Typical maintenance: Debris removal, fence repair, rodent erosion & hole repair, rodent treatment, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash.

Indian Bend Wash Outlet Channel:

Type of structure: Unlined trapezoidal channel. 10,032 lf (1.9 miles)-2.4 acres of earthen embankment.

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, mower operations, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Indian Bend Wash Inlet:

The inlet takes in flood waters from McCormick Ranch, conveys them across Indian Bend Road and discharges them into the IBW Greenbelt
Floodway.

IGA gives City of Scottsdale maintenance responsibilities.

Indian Bend Wash Greenbelt:

Type of structure:

Unlined trapezoidal channel-23,232 lf (4.7 miles), developed under the direction of the City of Scottsdale and the U.S. Army Corps of Engineers for park, recreation and private enterprise. IGA gives City of Scottsdale maintenance responsibilities.

Indian Bend Wash Collector & Side Drains:

Type of structure: Unlined trapezoidal channel & reinforced concrete (covered).

7,392 lf (1.4 miles) open channel. 9,504 lf (1.8 miles) covered channel.

McDonald Rd. side channel-2,112 lf- 2 each reinforced concrete pipes.

Chaparral Rd. side channel-3,168 lf-1 each reinforced concrete pipe.

Camelback Rd. side channel-5,280 lf-1 each reinforced concrete pipe.

Typical maintenance: Debris removal, graffiti removal, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-inlet grates, signs, trash.

Indian Bend Wash Interceptor:

Flood flows entering the Arizona Canal from the north are directed to the interceptor Channel at Pima Road and conveyed to the Inlet Channel. 6,864 lf (1.3 miles)

IGA gives City of Scottsdale maintenance responsibilities.

Indian School Road Drain:

Type of structure: Shot-crete Channel- 9,200 lf (1.7 miles)

Typical maintenance: Debris removal, graffiti removal, fence repair, sediment removal, vandalism-gates, signs, trash, vehicle, weed control.

McMicken Dam & Floodway:

Type of structure: Compacted earth-fill dam. 53,700 lf (10.17 miles) (151.93 acres of earthen embankment)

Type of structure: Compacted earthen floodway. 30,624 lf (5.8 miles) (39.4 acres of earthen embankment)

Typical maintenance: Bank improvements, debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

New River Dam:

Type of structure: Zoned earth-fill dam. Main dam-2,327 lf (44.41 acres of earthen embankment)
Dike #1-7,475 lf Dike #2-256 lf

Typical maintenance:

Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

New River Channelization-Bethany Home Road alignment to Olive Ave.

Type of structure: Compacted earth with soil cement slopes.-13,200 lf (2.5 miles) (23.12 acres of soil cement embankment)

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

New River Channelization-Olive Ave to Grand Ave.

Type of structure: Compacted earth with soil cement slopes.-13,200 lf (2.5 miles) (16.27 acres of soil cement embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, irrigation maintenance, mower operations, plant maintenance, plant replacement, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, irrigation, plants, signs, trash, vehicle, mitigation maintenance.

New River Channelization-Thunderbird Ave to Greenway Road.

Type of structures: Compacted earth-fill with soil cement levees.
Length of west levee-2,357 lf Length of east levee-1,007 lf
Typical maintenance: Debris removal, fence repair, graffiti removal, vandalism-fencing, gates, signs, trash.

Old Cross Cut Canal:

Type of structure: Covered channel from Indian School Road to McDowell. (City of Phoenix maintenance)
Type of structure: Concrete lined open channel from McDowell Road to the Salt River. 7,920 lf (1.5 miles)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, sediment removal, sign maintenance, staff gages, vegetation removal, weed control, vandalism-fencing, gates, signs, trash.

Pass Mountain Diversion Channel:

Type of structure: Earthen embankment-earth channel. 6,635 lf (diversion) & 2,800 lf (outlet)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Powerline FRS-

Type of structure: Compacted earth-fill dam.-15,070 lf (2.85 miles) (65.69 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Powerline Floodway:

Type of structure: Concrete lined floodway-38,174 lf (7.23 miles)
Type of structure: Unlined floodway-8,025 lf (1.52 miles)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Rio Salado: (HoHokam Road bridge east)

Type of structure: Soil cement, riprap armored slope protection channel. (Approx. 7 miles in length)
Typical maintenance: Debris removal, disking operations, floodway maintenance, mosquito abatement, sign maintenance, vegetation removal, weed control, vandalism-fencing gates, signs, trash.

Rittenhouse FRS:

Type of structure: Compacted earth-fill dam. 22,000 lf (4.16 miles) (45.45 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Rittenhouse Road Channel:

Type of structure: Unlined channel with gravel mulch slopes.-22,154 lf (4.19 miles) (74.03 acres of earthen embankment)
Typical maintenance: Bank improvements, debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash.

Saddleback FRS & Diversion Channel:

Type of structure: Compacted earth-fill dam.-27,269 lf (5.16 miles) 68.84 acres of earthen embankment (FRS)
Type of structure: Unlined compacted channel.-24,974 lf (4.73 miles) 24.86 acres of earthen embankment (diversion)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Perryville Bank Stabilization:

Type of structure: 2,300 lf (0.43 miles)

Compacted earth-fill levee, provides protection along the north bank of the Gila River near Perryville to prevent further erosion of the river bank and the resultant loss of land and improvements.

Typical maintenance: Debris removal, vegetation removal, weed control, vandalism-signs, trash.

Signal Butte FRS & Floodway:

Type of structure:

Earth-fill dam-7,038 lf (1.33 miles) (20.75 acres of earthen embankment)

Earthen trapezoidal channel-8,440 lf

Concrete rectangular channel-5,966 lf

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates signs, trash, vehicle.

Skunk Creek at I-17:

Type of structure: Earth-fill levees-8,900 lf (1.68 miles) (8.2 acres of earthen embankment)

North levee-7,627 lf South levee-4,927 lf

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Sossaman Road Drain:

Type of structure:

Concrete lined channel-5,140 lf

Unlined channel-5,808 lf (7.2 acres of earthen embankment)

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Spookhill FRS & Outlet:

Type of structure:

Compacted earth-fill dam.-21,014 lf (3.98 miles) (60.3 acres of earthen embankment)

Outlet channel-19.49 acres of earthen embankment

Sediment basin-1.62 acres of earthen embankment

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Sunnycove Dam:

Type of structure: Zoned compacted earth-fill dam. 714 lf in length (12.12 acres of earthen embankment)

Typical maintenance: Debris removal, erosion repair, fence repair, graffiti removal, mower operations, principal outlet maintenance, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Sunset Dam:

Typical maintenance: Debris removal, erosion repair, fence repair, graffiti removal, mower operations, principal outlet maintenance, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

Sunset & Sunnycove Pipeline:

Type of structure:

Collects and conveys runoff from both Sunset and Sunnycove Dams through a 30" pipe and discharges these flows into a natural wash that empties into the Hassayampa River. 9 manholes-7,624 lf in length.

Typical maintenance-Storm drain maintenance, stationing, sediment removal,

Sun City Drains:

Type of structure: Shot-crete channel-22,785 lf.(4.31 miles) Unlined channel-1,700 lf.

These drains carry street runoff from Sun City into the Agua Fria River.

Typical maintenance: Debris removal, erosion repair, floodway maintenance, graffiti removal, sediment removal, sign maintenance, vegetation removal, weed control, vandalism-signs, trash.

Sun City West Drains:

Type of structure: Shot-crete channel-35,376 lf (6.7 miles) Storm drain pipe-848 lf
These drainage channels carry Sun City West runoff into the Agua Fria River.
Typical maintenance: Debris removal, erosion repair, floodway maintenance, graffiti removal, sediment removal, sign maintenance, vegetation removal, weed control, vandalism-signs, trash.

Vineyard FRS:

Type of structure: Compacted earth-fill dam-37,900 lf (7.17 miles) (78.3 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & animal hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

White Tanks #3

Type of structure: Compacted earth-fill dam-7,667 lf (1.45 miles) (26.4 acres of earthen embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

White Tanks #4:

Type of structure: Compacted earth-fill dam-6,839 lf (1.29 miles) (16.08 earthen embankment)
Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti removal, mower operations, principal outlet maintenance, grader road work, rodent erosion & hole repair, rodent treatment, sediment removal, staff gages, sign maintenance, vegetation removal, weed control, vandalism-fencing, gates, signs, trash, vehicle.

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East Valley Drains:

1. Apache Paradise Unit One-	1.29 acres
2. Newman Park-	1.72
3. Valley View-	3.48
4. Cherokee Mobile Estates	1.41
5. Crisway Estates Unit Two	0.17
Crisway Estates Unit Three	0.22
6. Superstition View	
7. Knolls Estates	1.33
8. Knolls Mobile Estates	0.2
9. University Basins	11.1
10. Cherokee Mobile Estates	2.48
11. Desert Vista Estates	
	22.11 Acres

Typical maintenance: Debris removal, erosion repair, floodway maintenance, fence repair, graffiti repair, mower operations, rodent erosion & hole repair, rodent treatment, sediment removal, vandalism-fencing, signs, trash.

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Maintenance Definitions

Programmed Major Maintenance:

Definition; Includes those maintenance tasks whose cycle exceeds one year (multiple year expenditures).

Examples; Asphalt roads, parking lots, bike paths, walkways, painting.

Projects; Adobe Dam, ACDC, New River Dam, Skunk Creek @ I-17, Cave Buttes Dam, Dreamy Draw, IBW Collector-side channels, Durango FCD complex.

Maint. Scheduled chip or slurry seal projects, larger scaled painting projects.

Applicable Codes: BM-building maintenance, CR-concrete repair, OM-other maintenance, RA-road asphalt, TT-travel time.

Preventive Maintenance:

Definition; Is the planned, periodic inspection, adjustment, cleaning. Lubrication, parts replacement, and minor repair of equipment and systems for which specialized training is not normally required. This activity consists of many check point activities on items that, if disabled, would interfere with an essential operation of the installation, endanger life or property, or involve high cost or long lead time for replacement. PM is the cornerstone of any good maintenance program. A weak or nonexistent PM program could result in much emergency work and costly repairs.

Examples; Principal inlet & outlet structures, flap gates, levees, outlet towers, inverts-channel & storm drains, access gates, buildings, ladders & safety cages, handrails, retention basins, catch basins, bridges & catwalks, fencing, access roads, trails, etc.

Projects; All FCD structures on the annual and operational inspection schedules.

Maint. PM performed as mentioned in the above definition.

a. Function & integrity of structure
b. Security & liability
c. Ascetics

Applicable Codes: AI-annual inspections, AR-algae removal, AT-ant treatment, BC-bank improvements, BM-building maintenance, BS-bee support, CR-concrete repair, CT-chemical truck, DG-granite erosion repair, DR-debris removal, DSP-dam safety program, EC-equip. cleanup, EI-equip. inspection, ER-erosion repair, FM-floodway maintenance, FP-filter pad, IM-irrigation maint., MW-mower operations, OI-operational insp., OM-other maintenance, PO-principal outlet, RE-rodent erosion, RH-rodent hole repair, RT-rodent treatment, SAG-staff gage, SD-sediment removal, SM-sign maintenance, TT-travel time, VR-vegetation removal, WC-weed control,

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Extraordinary Maintenance:

Definition; Is maintenance that is performed on as-needed basis. Includes; repairs, rehab., improvements.

Examples; Slope protection, access and maintenance roads/ramps, landscaping work.

Projects; All FCD structures on the annual and operational inspection schedules.

Maint. Bank improvements: Revegetation, gravel mulch installation, drainage chutes-grouted rip-rap, concrete, drop inlets, plating, slope protection, and landscaping concerns.

Applicable Codes: AR-algae removal, BL-blue stake, CT-chemical truck, FI-fence installation, FM-floodway maint., FR-fence repair, FS-fldwy. storm maint., GI-gate installation, GR-graffiti removal, GUT-grouted riprap repair, MI- mitigation, OM-other maint., RR-riprap repair, RT-rodent treatment,
RV-revegetation, SE-seeding operations, SI-sign installation, SO-sweeper operations.

Critical Maintenance:

Definition; Those activities which if deferred, carries a significant risk of consequential damage and significantly higher costs of risk impairment of health safety or reliability or functionality, thus impacting the program.

Examples; Principal outlet maintenance of dams or floodways, rodent activities, discovery of transverse or longitudinal cracks during inspections, large scale erosion concerns, sink holes or other irregularities.

Projects; All FCD structures on the annual and operational inspection schedules.

Maint. Erosion repair, preventive maintenance, rodent treatment and hole repair, cracks and sink hole repair as per DSP recommendations or monitor as directed.

Applicable Codes: AI-annual inspections, CT-chemical truck, ER-erosion repair, DR-debris removal, FM-floodway maintenance, FS-fldwy. storm maint., KB-Africanized bees, MA-mosquito abatement, MW-mower operations, OI-operational inspections, OM-other maintenance, PO-principal outlet maint., RH-rodent hole repair, RT-rodent treatment, SD-sediment removal, TT-travel time, RV-revegetation, VF-vandalized fencing, VG-vandalized gates, VT-vandalized trash, WC-weed control.

Breakdown Maintenance: (Run to failure)

Definition; Refers to repairing a non-critical component after it has been consciously allowed to "run to failure." These components are those that are considered essential for the delivery of services, impacts safety to personnel, or impacts the overall mission and purpose of a facility.

Examples; Maintenance & access roads.

Projects; All FCD structures on the annual and operational inspection schedules.

Maint. Replating of access, maintenance roads and ramps.

Applicable Codes: OM-other maintenance, RA-road asphalt, RD-dirt road, TT-travel time.

Replacement Maintenance:

Definition; Work undertaken to bring a component or system into compliance with new codes or safety regulations or to replace an item that is unacceptable, inefficient, obsolete, or for which spare parts can no longer be obtained. Such work is considered maintenance work if it is required for the continued operation of the facility.

Examples; Gated outlet designs, trash racks on outlet towers.

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Projects; White Tanks #3 & #4, McMicken Dam, Powerline FRS, Vineyard FRS, Rittenhouse FRS, Buckeye #1 & #2,

Maint. Manual gated operations on designs for the White Tank 3-4 need modified (400 plus turns). McMicken Dam has same concern as White Tanks structures. Trash rack openings on the Pinal Co. structures are too large and need modified accordingly. This issue also applies to Buckeye #1 & #2. An environmental impact concern is also the shaft stems on the gated outlets that leak and contaminate the immediate ground.

Applicable Codes: DSP-dam safety program, OM-other maintenance, PO-principal outlet, TT-travel time.

Reliability Centered Maintenance:

Definition; Is a maintenance philosophy that incorporates the most logical and cost effective-mix of breakdown maintenance, pm, predictive testing and inspection, and proactive maintenance.

Examples; Prioritizing the work load, keeping logs and reliable records, a skilled reliable work force.

Projects; All FCD structures on the annual and operational inspection schedules.

Maint. This would include the quarterly operational and annual inspections performed to address maintenance issues through understanding the type of maintenance needed, priority, work load and efficiency.

Applicable Codes: DSP-dam safety program, JT-on the job training, OM-other maintenance, TR-training, TT-travel time.

Deferred Maintenance:

Definition; Is maintenance that was not performed when it should have been or was scheduled to be and which, therefore, is put off or delayed for future consideration.

Examples; Major erosion concerns, bank protection; revegetation, gravel mulch, riprap installation, etc...

Projects; All FCD structures on the annual and operational inspection schedules. Currently; Harquahala FRS for gravel mulch installation, Spookhill FRS erosion concerns.

Maint. Because of total maintenance costs to the Division gravel mulch installation is done in sections. Currently there is not a 404 permit in place, which prevents work from being performed in low and high flow areas, inflow and outlet channels, impoundment's, maintenance roads, and many other water conveying structures.

Applicable Codes: BM-building maintenance, CT-chemical truck, DG-granite erosion repair, DR-debris removal, ER-erosion repair, FM-floodway maintenance, MW-mower operations, OM-other maintenance, PM-plant maintenance, RV-revegetation, SA-structure addition, SD-sediment removal, TT-travel time, VR-vegetation removal.

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Predictive Maintenance:

Definition;	Refers to testing and inspection activities that involve the use of sophisticated means to identify maintenance requirements.
Examples;	Ultrasonic testing, infrared photography, nuclear compaction tests, etc....
Projects;	All FCD structures on the annual and operational inspection schedules.
Maint.	Erosion compaction tests, soils test (lab work), conduit- still photography or video, air quality monitoring devices in confined entry spaces, laser level work.

Applicable Codes: ER-erosion repair, DSP-dam safety program, OM-other maintenance, PO-principal outlet.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
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ADWR-Rules and Regulations Pertaining to Dam Safety Procedures:

General maintenance and ordinary repairs which do not require prior approval of the Director of Arizona Department of Water Resources. Those activities which do not impair or adversely effect the safety of the dam. These activities include:

1. Removal of brush or tall weeds.
2. Cutting of trees and removal of slash from the embankment or spillway. Small stumps may be removed provided no excavation into the embankment occurs.
3. Rodent control or extermination by trapping or other methods. Minor rodent damage may be repaired provided it does not involve excavation into the embankment that exceeds 2' ft. deep and replacement materials are compacted as they are placed.
4. Repair of erosion gullies less than 2' ft. deep on the embankment or in the spillway.
5. Surface grading of the top of the dam embankment or spillway to eliminate potholes and provide proper drainage provided that the freeboard is not reduced.
6. Placement of additional riprap and bedding on the upstream slope, or in the spillway in areas which have sustained minor damage. Restoration of the original riprap protection where the damage has not yet resulted in erosion and weakening of the dam.
7. Painting, caulking, or lubricating metal surfaces.
8. Patching or caulking spalled or cracked concrete to prevent deterioration.
9. Removing debris, rock, or earth from the outlet conduits or spillway channels and basins.
10. Patching to prevent deterioration within the outlet works.
11. Replacement of worn or damaged parts of outlet valves or control to restore them to original or equivalent conditions.
12. Repair replacement of fences intended to keep traffic or livestock off the dam or spillway.

General maintenance and ordinary repair which may impair or adversely effect safety such as excavation into or near the toe of the dam, construction of new appurtenant structures for the dam, and repair of damage which has already significantly weakened the dam must be done in accordance with A.A.C. R12-15-1207. The determination of whether general maintenance and ordinary repair will impair or adversely effect safety shall be made by the Director.

Emergency actions not impairing or adversely effecting the safety of the dam may be taken before guidance can be provided by an engineer, and do not require prior approval of the Director. Emergency actions shall not excuse an owner(s) responsibility to promptly undertake a permanent solution as required for the dam(s) safety. Emergency actions include:

1. Stockpiling materials such as riprap, earthfill, sand, and plastic sheeting.
2. Lowering the reservoir level by making releases through the outlet or a gated spillway, by pumping, or by siphoning. Where large releases are to be made, the Director shall be notified no later than 12 hours after the release began.
3. Armoring eroded areas by placing sandbags, riprap, plastic sheeting, or other available material.
4. Plugging leakage entrances on the upstream slope.
5. Increasing freeboard by placing sandbags or temporary earth fill on the dam.

6. Diverting floodwaters to prevent them from entering the reservoir basin.
7. Constructing training berms to control floodwaters.
8. Placing sandbag ring dikes or reverse filter materials around boils at the downstream toe to prevent back pressure.
9. Removing obstructions from outlet or spillway flow areas.

Emergency actions impairing or adversely effecting the safety of the dam require prior approval by the Director. Lowering the water level by excavating the spillway or embankment is prohibited unless failure is imminent.

For all high and significant hazard potential dams, the Emergency Action Plan shall be implemented in conjunction with any appropriate emergency actions at the dam.

The owner or the owner(s) engineer shall notify the director immediately of any emergency condition that exists and any emergency action taken.

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

FCDMC STRUCTURE NOTIFICATION ELEVATIONS FOR 2005

Structure	Gage ID#	ALERT Alarm Level	O&M Notification Level	Emergency Management Notification	Emergency Spillway Height	Top of Structure
Adobe Dam	5539	6.4	10.0	26.0	40.0	65.6
Apache Jct. FRS	6673	5.0	6.0	11.0	16.3	27.2
Buckeye FRS #1	5203	6.0	7.0	13.0	22.3	30.5
Buckeye FRS #2	5208	8.0	10.0	13.0	16.7	22.5
Buckeye FRS #3	6813	8.0	10.0	13.0	17.0	25.0
Cave Buttes Dam	4904	10.0	20.0	65.0	97.0	119.0
Casandro Dam	7093	5.0	7.0	10.0	21.0	40.5
Dreamy Draw Dam	4803	5.0	8.0	17.0	36.7	50.5
Guadalupe FRS	6503	4.0	5.0	10.0	24.5	32.0
Harquahala FRS	5128	15.0	21.0	27.0	35.6	46.7
McMicken Dam	5448	5.0	6.0	13.0	21.1	28.1
McMicken Dam South	5443	2.0	2.0	?	n/a	n/a
New River Dam	5614	5.8	15.0	45.0	67.0	97.3
Powerline FRS	6683	6.0	9.0	14.0	20.9	26.7
Rittenhouse FRS	6703	5.0	7.0	13.0	19.5	24.2
Saddleback FRS	5113	4.0	5.0	8.0	n/a	16.1
Signal Butte FRS	6628	7.0	10.0	20.0	27.0	35.6
Spookhill FRS	4563	5.0	6.0	11.0	16.0	25.0
Sunnycove FRS	5248	10.0	14.0	24.0	42.2	50.4
Sunset FRS	5233	3.0	4.0	10.0	19.5	28.5
Vineyard FRS	6688	4.0	5.0	8.0	11.8	16.5
White Tanks #3	5418	6.0	7.0	13.0	19.6	25.4
White Tanks #4	6823	2.0	4.0	6.0	8.0	13.0

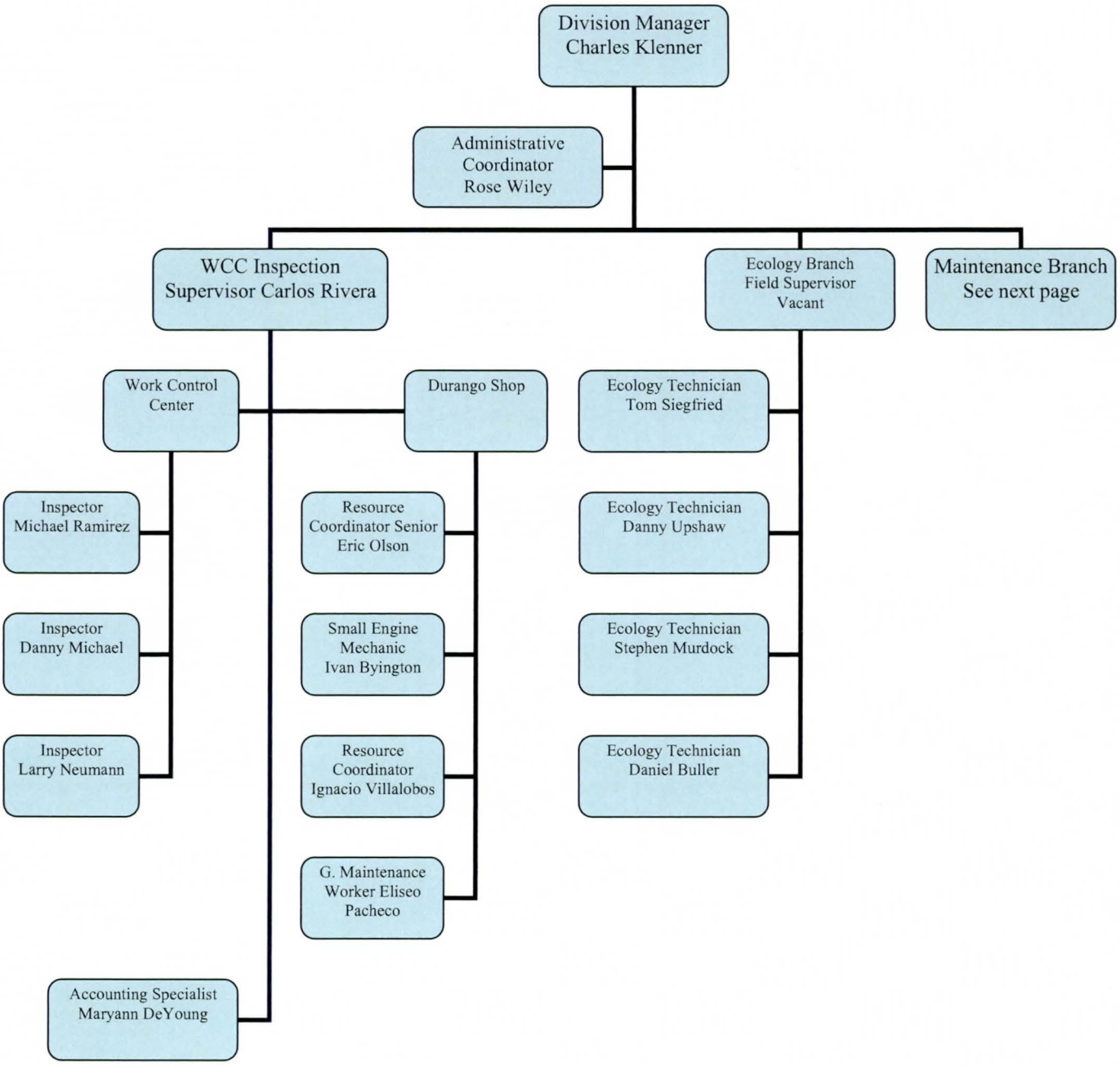
FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

FCD STRUCTURE NUMERICAL LISTING FOR 2005

005	FCD Main Building	208	Buckeye 2	399	New River Mitigation Area (CHICKEN RANCH)
006	FCD Shop	209	Buckeye 3	400	New River Channelization
035	Town of Guadalupe	210	EL Mirage Rd. Drain	400	Reach #1 Camelback Ranch Levee's
075	Bell Rd./Dysart Yd. Detention Basin	218	Indian School Rd. Drain	401	Agua Fria River Flow
100	Dysart Rd.-Agua Fria Drain	300	Spook Hill FRS	450	Orangewood Basin
101	48th St. Drain	301	Signal Butte Floodway	460	Reach #7 East Fork Cave Creek
102	Alma School Drain	302	Pass Mountain Diversion	460	Reach #4 P.V.C.C.
103	Old Cross Cut Canal	303	Apache Jct. FRS & Floodway	470	Reach #1 Colter Channel
104	Broadway Rd. Bank Stabilization	304	Signal Butte FRS	470	Reach #2 RID Overchute
105	Salt-Gila Clearing & Channelization	305	Bulldog Floodway	480	Rittenhouse Rd. Drain
106	Holly Acres	306	Knoll Drain	580	10th St. Wash
107	Channel @ Sky Harbor	307	West Valley Drains	590	Scatter Wash
108	Sossaman Rd. Drain	308	Guadalupe Rd. Box-Channel	620	Maryvale ADMP
109	Agua Fria River	309	East Mesa Drains		
110	Agua Fria River (ADOT Agreement)	310	Powerline FRS		
111	IBW Outlet	311	Powerline Floodway		
112	IBW Inlet	320	Vineyard Rd. FRS		
113	IBW Greenbelt	321	Rittenhouse FRS		
114	IBW Interceptor & Side Drains	330	Harquahala FRS		
115	Price Drain	331	Saddleback FRS		
116	Champion Storm Drain	332	Saddleback Floodway		
117	Laveen Basin	333	Centennial Levee		
118	ACDC	334	Harquahala Floodway		
119	Cave Creek Wash @ ACDC	337	Sun City Drains		
121	East Maricopa Floodway	338	Sun City West Drains		
124	Rio Salado (Hohokam to 19th Ave)	339	Thunderbird Rd. Bridge Protection		
125	Salt River Channel (Hohokam-East)	340	Sunset FRS		
127	Perryville Bank Stabilization	341	Sunnycove FRS		
128	Salt/Gila Pilot Channel	342	Sunset-Sunnycove Pipeline		
200	White Tanks #3	343	Casandro Wash Dam		
201	White Tanks #4	344	Wittman Wash		
202	McMicken Dam	350	Cave Buttes Dam		
203	Dreamy Draw Dam	360	Adobe dam		
204	McMicken Dam Outlet Channel	361	Skunk Creek Channel @ I-17		
205	Guadalupe Dam	362	Skunk Creek Channelization		
206	Lower Queen Creek	370	New River Dam		
207	Buckeye 1	371	New River ADMS		

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
Operations and Maintenance Division

Attachment: A: Schematic Organizational Chart



FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
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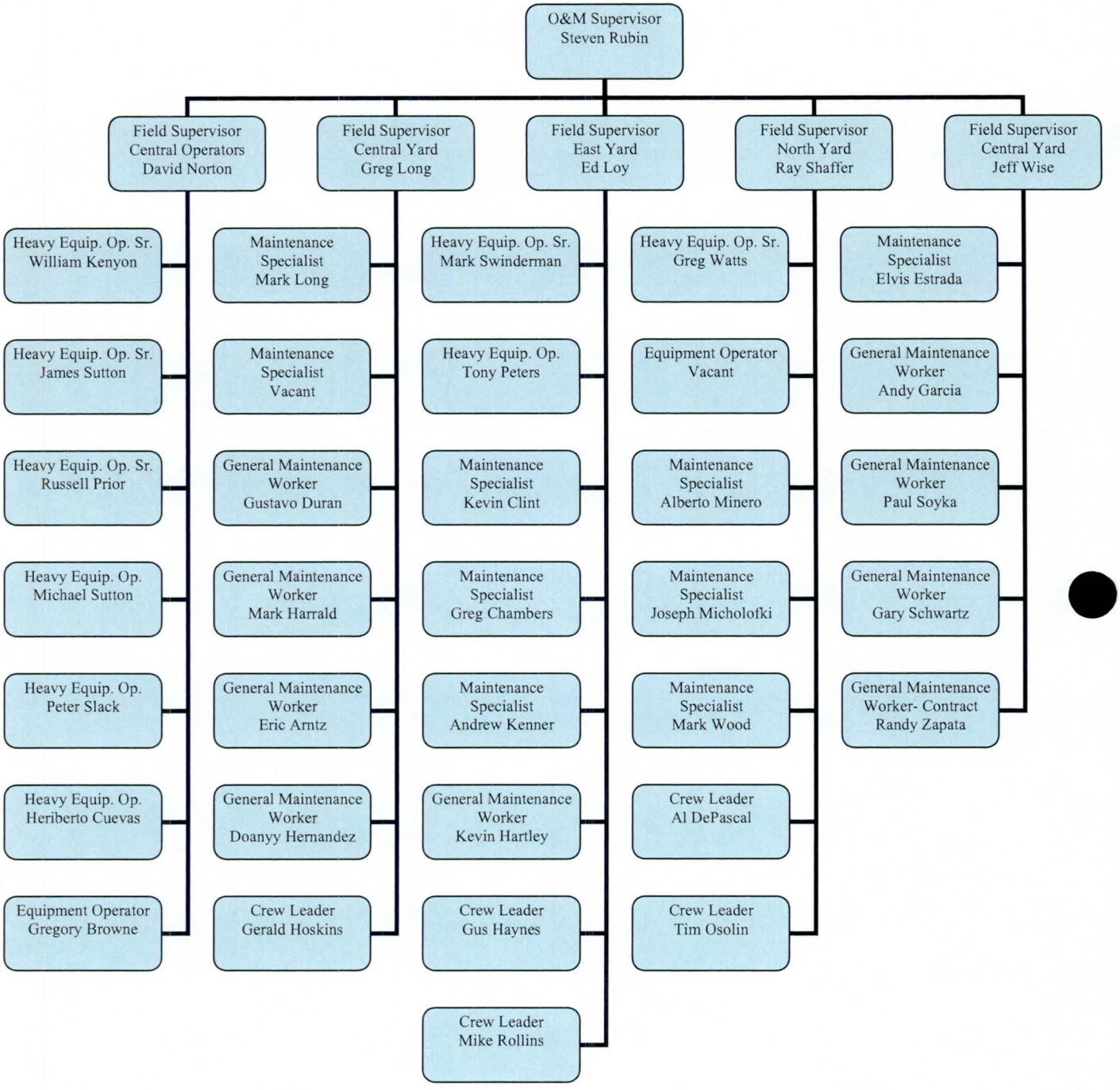


Update 02-09-09

FLOOD CONTROL DISTRICT OF MARICOPA COUNTY
2004 Maintenance Inspection Report Pass Mountain Diversion Channel

O&M Div. Mgr._____
Maint. Mgr_____

ignore this page - not a scatter wash inspection report.
F. Brown July 2014

Pass Mountain Diversion Channel
Buckhorn-Mesa Watershed

Inspection Date: 7-20-04

Date of Last Inspection: 9-6-03

Inspectors: Mike Ramirez / Earl Pearcy

Existing Weather Conditions: Sunny & Hot

Recent Rainfall: Yes ☐ No ☑

Yes	No	
		The perimeter project fencing and gates.
☐	☑	Existence of physical damage, unsecured, and in need of repairs.
☐	☑	Vandalism
☐	☑	Horse gates need attention
☐	☑	Breakaway fencing concerns
☑	☐	Other
		See Comments: #1, 4 &5
		Condition of the existing levees.
☐	☑	The crest of the levee stable; need for re-grading or additional plating
☐	☑	Embankment slopes stable
☑	☐	Erosion/rilling present
☐	☑	Maintenance concerns with associated side inlet chutes
☐	☑	Rodent/animal activity
☑	☐	Vegetative drains; properly marked, restricted, vandalized, etc.
☑	☐	Other
		See Comments: #6 & 7
		The diversion channel bottom low flow from sta. #45+00 downstream to sta. #82+62
☐	☑	Accumulated sediment or restrictions
☐	☑	Low flow channel needs re-graded
☐	☑	Other
		See Comment: # 3 & 6
		Drop structure #1 located at sta. #82+62 downstream to sta. #84+62.
☐	☑	Displaced loose riprap concerns
☐	☑	Grouted riprap concerns; cracking, voids, deterioration, etc.
☐	☑	Accumulated sediment
☐	☑	Other
		See Comments: Good Condition
		Drop structure #2 located at sta. #100+00 downstream to sta. 101+23.
☐	☑	Displaced loose riprap concerns
☐	☑	Grouted riprap concerns; cracking, voids, deterioration, etc.
☐	☑	Accumulated sediment
☑	☐	Other
		See Comments: # 6

ANNUAL INSPECTIONS

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2013 Inspector(s): Erik Arntz-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

1. (1,400 lf)Concrete slope lined channel and associated features:	N/A	No	Yes	Mon.	Rep.
a. Erosion concerns?		✓			
b. Access roads/ramps in need of maintenance? **Vegetation growth on maintenance roads needs to be removed or cut back for access. All weather plating needs to be place on the crest of the levees.**			✓		✓
c. Concrete slopes stable?			✓		
d. Scaling or spalling evident?		✓			
e. Cracking evident? **Nonstructural temperature cracking is evident.**			✓	✓	
f. Exposed reinforcement?		✓			
g. Loss of joint material?		✓			
h. Adverse vegetation?		✓			
i. Sediment accumulation? **Sediment accumulations in the invert cause ponding and an undefined low flow channel. Grading of the channel is recommended to establish a low flow to properly drain nuisance flows.**			✓		✓
j. Drainage issues? **See comment 1.i.**			✓		✓
k. Project stationing/signs concerns? **The stationing needs to be relocated or painted on the concrete to allow unrestricted access across the crest of the levees.**			✓		✓
l. Side inlets, flap gate concerns? **The inlets throughout the FCD maintained need to be cleaned out and put on an inspection cycle.**			✓		✓
m. Subsidence concerns along sloped walls?		✓			
n. Aesthetic concerns with landscaped areas?		✓			
o. Invert of channel needs mowed? **See comment 1.i.**			✓		✓
p. Vandalism?		✓			
q. Illegal discharge noted into the channel?		✓			
r. Safety hazards or liability concerns?		✓			
s. Flow restrictions or possible blockage noted?		✓			
t. Fencing or gate concerns? **The equestrian gates are not FCD standard and significantly restrict the type of equipment into the structure. City of Phoenix and the FCDMC need to coordinate on replacing these gates with an FCD standard.**			✓		✓
u. Associated drop structures at sta. #357+45 & 374+51? **Vegetation growth within the riprap needs to be removed and treated.**			✓		✓
v. City of Phoenix IGA landscape concerns?		✓			
w. Other: **The development south of the left levee has a hardened drain that appears to direct flows directly at the levee. Research is needed to be determined if this was permitted.**			✓		

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2013 Inspector(s): Erik Arntz-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REP

Instrumentation:	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			

INSPECTION COMMENTS: From 40th Ave. to 43rd Ave. alignment, the City of Phoenix is responsible for landscape maintenance to include the levees and the invert of the Scatter Wash project.

Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2013 Inspector(s): Erik Arntz-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

Photo No.: 1
Date: 7/3/2013
Description: Culvert at the 101.

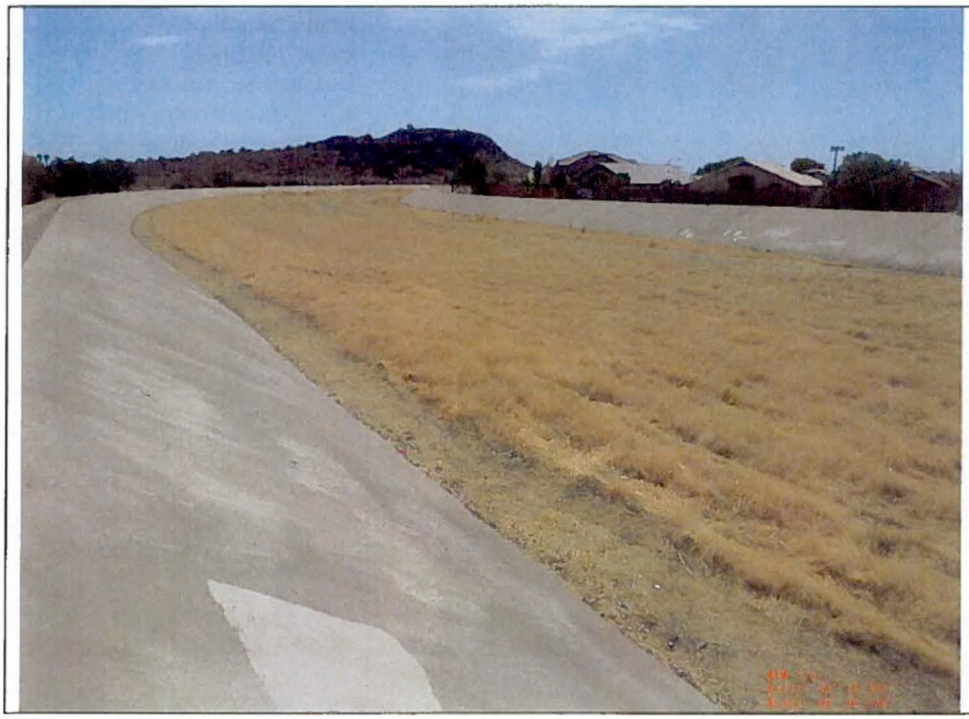


Photo No.: 2
Date: 7/3/2013
Description: View looking downstream from the 101 culvert. Note the lack of a low flow channel.

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2013 Inspector(s): Erik Arntz-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REP

Photo No.: 3
Date: 7/3/2013
Description: Flap gates at Sta. # 378+55.

Photo No.: 4
Date: 7/3/2013
Description: Inlet at Sta. #377+00 upstream side, note there is sediment accumulation inside the pipe.

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2013 Inspector(s): Erik Arntz-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

Photo No.: 5
Date: 7/3/2013
Description: Drop structure at Sta. # 374+50

Photo No.: 6
Date: 7/3/2013
Description: Drop structure at Sta. # 357+45

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2013 Inspector(s): Erik Arntz-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REP

Photo No.: 7
Date: 7/3/2013
Description: City of Phoenix responsible area

Photo No.: 8
Date: 7/3/2013
Description: Development draining against the levee. View is atop the levee crest.

ANNUAL INSPECTION REPORT

Inspection Date: 7/5/2011 Inspector(s): Erik Arntz-FCDMC Carlos Rivera-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

1. (1,400 lf)Concrete slope lined channel and associated features:	N/A	No	Yes	Mon.	Rep.
a. Erosion concerns? **Minor rilling on back slopes**			✓	✓	
b. Access roads/ramps in need of maintenance? **Additional plating needed on access roads**			✓		✓
c. Concrete slopes stable?			✓		
d. Scaling or spalling evident?		✓			
e. Cracking evident? **Normal temperature and shrinkage cracks, non-structural**			✓	✓	
f. Exposed reinforcement?		✓			
g. Loss of joint material?		✓			
h. Adverse vegetation? **Some deep-rooted vegetation noted in the invert of the channel**			✓		✓
i. Sediment accumulation?		✓			
j. Drainage issues? **A low flow channel needs to be established to allow proper drainage**			✓		✓
k. Project stationing/signs concerns?		✓			
l. Side inlets, flap gate concerns? **3 unmarked flap gates discovered in City of Phoenix section of the structure.**			✓		✓
m. Subsidence concerns along sloped walls?		✓			
n. Aesthetic concerns with landscaped areas?		✓			
o. Invert of channel needs mowed? **Channel invert is being prepped for mowing operations**			✓		✓
p. Vandalism? **Possible ATV traffic at Sta. # 365+00**			✓	✓	
q. Illegal discharge noted into the channel?		✓			
r. Safety hazards or liability concerns?		✓			
s. Flow restrictions or possible blockage noted?		✓			
t. Fencing or gate concerns?		✓			
u. Associated drop structures at sta. #357+45 & 374+51?		✓			
v. City of Phoenix IGA landscape concerns?		✓			

ANNUAL INSPECTION REPORT

Inspection Date: 7/5/2011 Inspector(s): Erik Arntz-FCDMC Carlos Rivera-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

Instrumentation:	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			

INSPECTION COMMENTS: From 40th Ave. to 43rd Ave. alignment, the City of Phoenix is responsible for landscape maintenance to include the levees and the invert of the Scatter Wash project.

Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner

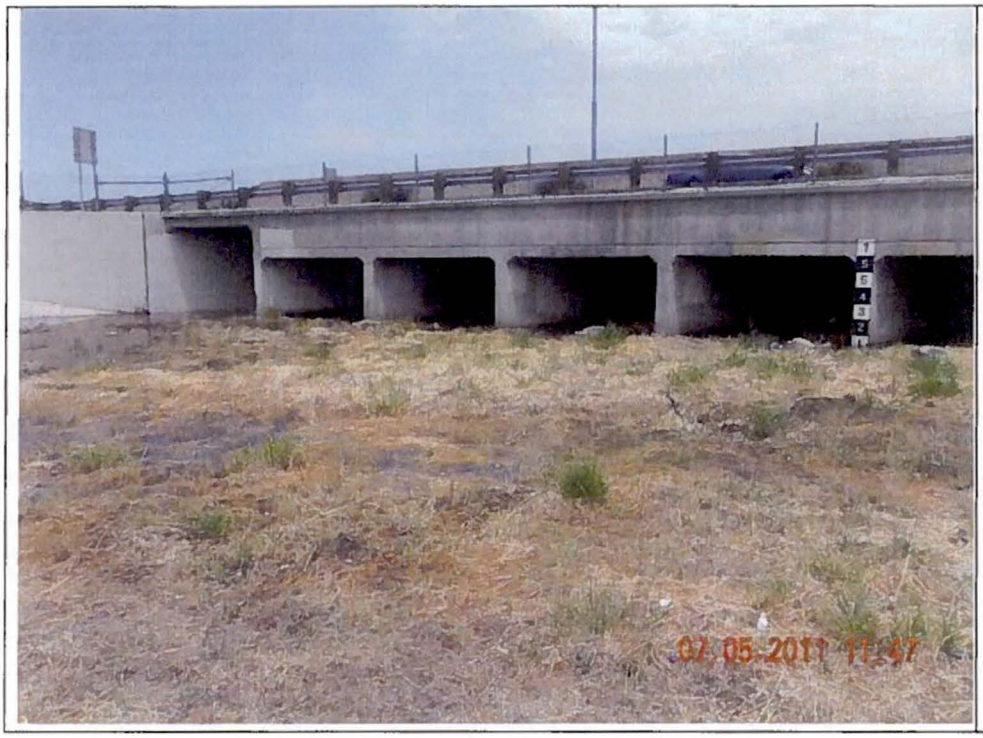


Photo No.: 1
Date: 7/5/2011
Description:
Culvert at free way with staff gauge, note the standing water

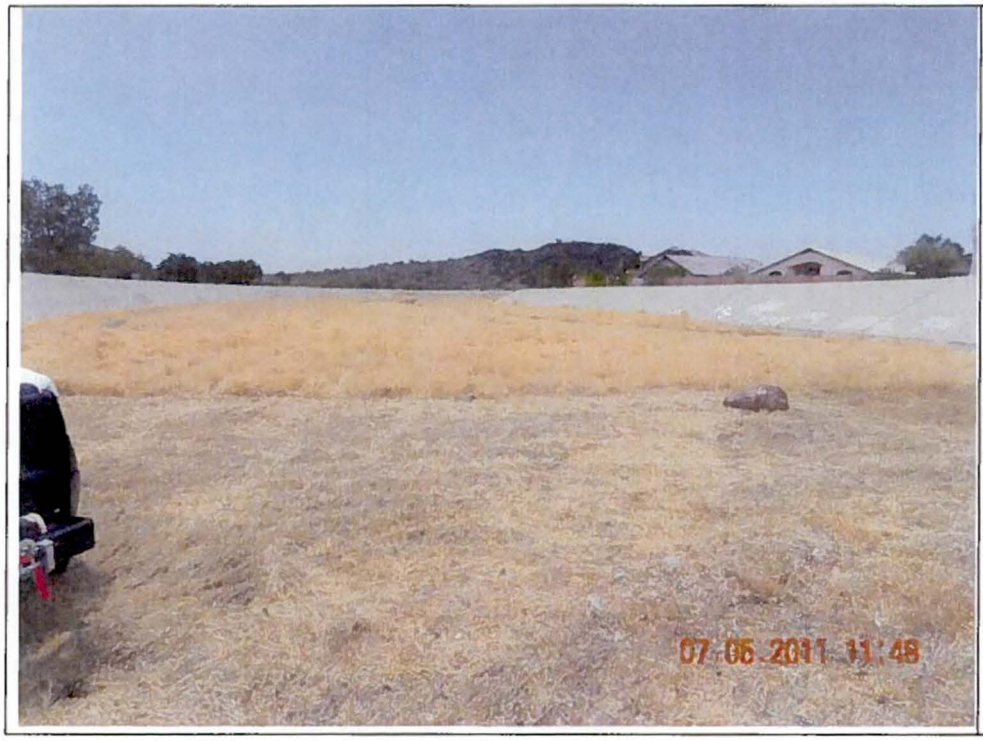


Photo No.: 2
Date: 7/5/2011
Description:
Looking downstream from culvert on freeway.

Photo No.: 3
Date: 7/5/2011
Description:
Looking upstream at the end of the concrete liner on the south side

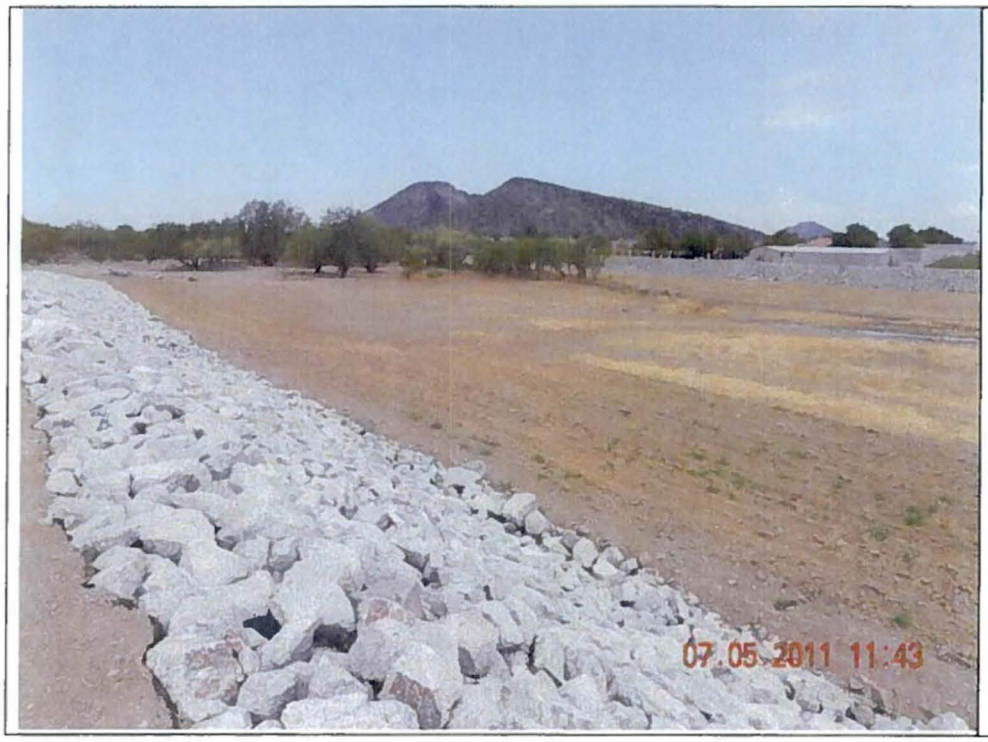


Photo No.: 4
Date: 7/5/2011
Description:
Looking downstream at the refurbished levee and the edge of county maintenance responsibilities at the trees.

Photo No.: 5
Date: 7/5/2011
Description:
Sta. # 374+51 drop structure

Photo No.: 6
Date: 7/5/2011
Description:
Sta. # 357+45 drop structure

ANNUAL INSPECTION REPORT

Inspection Date: 7/6/2010	Structure: Scatter Wash	N/A	NO	YES	MONITOR	REPAIR
Inspector(s): C.F. Rivera-FCDMC, Charles F. Klenner-FCDMC	PCN #590.01.10					

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

1. (1,400 lf)Concrete slope lined channel and associated features:	N/A	No	Yes	Mon.	Rep.
a. Erosion concerns? **Minor rilling occurring on the backslopes of the levees**			✓	✓	
b. Access roads/ramps in need of maintenance? **Plating material needs to be installed on the crest of the levees for all-weather access when resources allow.**			✓	✓	
c. Concrete slopes stable?			✓		
d. Scaling or spalling evident?		✓			
e. Cracking evident? **Temperature and shrinkage cracks, non-structural.**			✓	✓	
f. Exposed reinforcement?		✓			
g. Loss of joint material?		✓			
h. Adverse vegetation?		✓			
i. Sediment accumulation?		✓			
j. Drainage issues?		✓			
k. Project stationing/signs concerns?		✓			
l. Side inlets, flap gate concerns?		✓			
m. Subsidence concerns along sloped walls?		✓			
n. Aesthetic concerns with landscaped areas?		✓			
o. Invert of channel needs mowed? **Dead vegetation present. Scheduled for mowing.**		✓			
p. Vandalism? **Illegal dumping occurring behind the south levee.**			✓		✓
q. Illegal discharge noted into the channel?		✓			
r. Safety hazards or liability concerns? ***See comment 1.v. below.**			✓	✓	
s. Flow restrictions or possible blockage noted?		✓			
t. Fencing or gate concerns? ***See comment 1.p. above.**			✓		✓
u. Associated drop structures at sta. #357+45 & 374+51? **Drop structures appeared stable.**		✓			
v. City of Phoenix IGA landscape concerns? **The City of Phoenix has allowed trees to grow very dense within the invert of the channel they maintain. The tree canopies present a public safety hazard for trail users as well as a serious fire concern. Deep-rooted vegetation has been allowed in the embankments of the channel the City maintains which effects the integrity of the slope. Rodent activity is abundant throughout the City's area of responsibility.**			✓	✓	

ANNUAL INSPECTION REPORT

Inspection Date: 7/6/2010 Inspector(s): C.F. Rivera-FCDMC, Charles F. Klenner-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

Instrumentation:	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			

INSPECTION COMMENTS: From 40th Ave. to 43rd Ave. alignment, the City of Phoenix is responsible for landscape maintenance to include the levees and the invert of the Scatter Wash project. During the inspection of the project on 7/6/2010, it should be noted that the invert of the channel is choked out with very dense and dry vegetation (Palo Verde and Mesquite trees). The maintenance standards are different between the Flood Control District and the City of Phoenix in allowing vegetation growth as currently present in the invert of the channel as well as uncontrolled growth on the slopes of the levees. This situation also will present a concern with certifying levees to meet FEMA guidelines in the future. The area is also a public safety hazard with potential for a dangerous fire that could impact homeowners that are living adjacent to the levee structures. The dense vegetation in the invert possibly could impact the channel capacity and a hydraulic analysis needs to be performed to verify.

Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner

Grade control structure 357+45.

Grade control structure 374+50

FCDMC section of maintenance responsibility.

ANNUAL INSPECTION REPORT

Inspection Date: 7/6/09	Structure: Scatter Wash	N/A	NO	YES	MONITOR	REPAIR
Inspector(s): C.F. Rivera-FCDMC	PCN #590.01.10					

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

1. (1,400 lf)Concrete slope lined channel and associated features:	N/A	No	Yes	Mon.	Rep.
a. Erosion concerns? **Minor rilling occurring on the backslopes of the levees**			✓	✓	
b. Access roads/ramps in need of maintenance? **Plating material needs to be installed on the crest of the levees for all-weather access when resources allow.**			✓	✓	
c. Concrete slopes stable?			✓		
d. Scaling or spalling evident?		✓			
e. Cracking evident? **Temperature and shrinkage cracks, non-structural.**			✓	✓	
f. Exposed reinforcement?		✓			
g. Loss of joint material?		✓			
h. Adverse vegetation?		✓			
i. Sediment accumulation?		✓			
j. Drainage issues?		✓			
k. Project stationing/signs concerns?		✓			
l. Side inlets, flap gate concerns?		✓			
m. Subsidence concerns along sloped walls?		✓			
n. Aesthetic concerns with landscaped areas?		✓			
o. Invert of channel needs mowed? **Dead vegetation present.**			✓	✓	
p. Vandalism? **Access gates have been damaged.**			✓		✓
q. Illegal discharge noted into the channel?		✓			
r. Safety hazards or liability concerns? ***See comment 1.v. below.**			✓	✓	
s. Flow restrictions or possible blockage noted?		✓			
t. Fencing or gate concerns? ***See comment 1.p. above.**			✓		✓
u. Associated drop structures at sta. #357+45 & 374+51?		✓			
v. City of Phoenix IGA landscape concerns? **The City of Phoenix has allowed trees to grow very dense in the invert the channel they maintain. The tree canopies present a public safety hazard for trail users as well as a serious fire concern. Deep-rooted vegetation has been allowed in the embankments of the channel the City maintains which effects the integrity of the slope. Rodent activity is abundant throughout the City's area of responsibility.**			✓	✓	

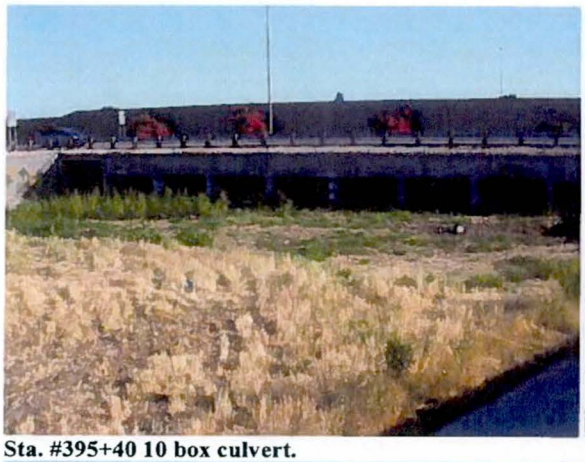
ANNUAL INSPECTION REPORT

Inspection Date: 7/6/09 Inspector(s): C.F. Rivera-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

Instrumentation:	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			

INSPECTION COMMENTS: From 40th Ave. to 43rd Ave. alignment, the City of Phoenix is responsible for landscape maintenance to include the levees and the invert of the Scatter Wash project. During the inspection of the project on 7/7/09, it should be noted that the invert of the channel is choked out with very dense and dry vegetation (Palo Verde and Mesquite trees). The maintenance standards are different between the Flood Control District and the City of Phoenix in allowing vegetation growth as currently present in the invert of the channel as well as uncontrolled growth on the slopes of the levees. This situation also will present a concern with certifying levees to meet FEMA guidelines in the future. The area is also a public safety hazard with potential for a dangerous fire that could impact homeowners that are living adjacent to the levee structures. The dense vegetation in the invert possibly could impact the channel capacity and a hydraulic analysis needs to be performed to verify.

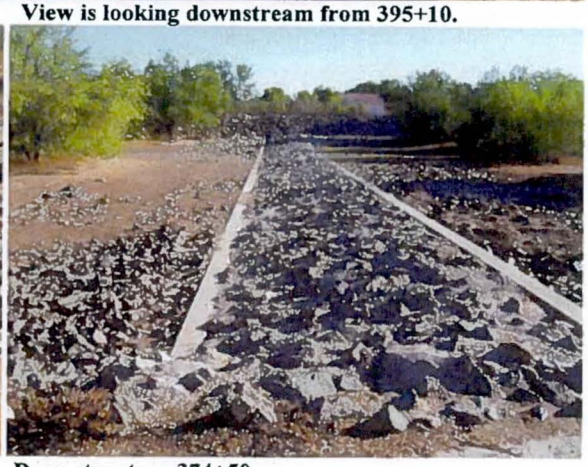
Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner



Sta. #395+40 10 box culvert.

View is looking downstream from 395+10.

24" flap gates sta. #378+55

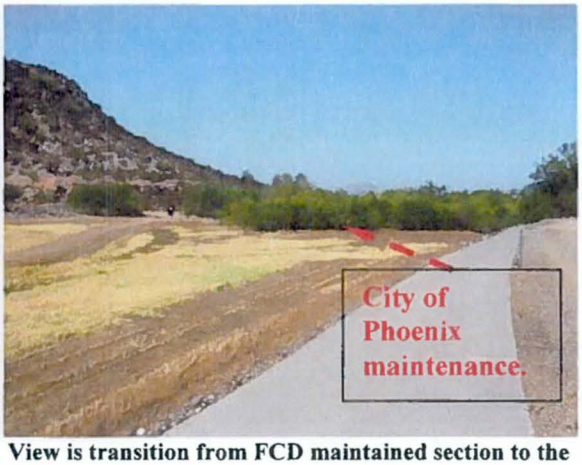


Drop structure 374+50.

Drop structure 375+45.

View is looking upstream from 43rd Ave. Bridge crossing

Damaged gate on north levee access.



View is transition from FCD maintained section to the City of Phoenix area of responsibility.

ANNUAL INSPECTION REPORT

Inspection Date: 7/8/08 Inspector(s): C.F. Rivera-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

1. (1,400 lf)Concrete slope lined channel and associated features:	N/A	No	Yes	Mon.	Rep.
a. Erosion concerns?		✓			
b. Access roads/ramps in need of maintenance? **Roads will need plating material for all-weather access.**			✓	✓	
c. Concrete slopes stable? **Minor surface cracking, non-structural.**			✓	✓	
d. Scaling or spalling evident?		✓			
e. Cracking evident? ***See comment 1.c above.**			✓	✓	
f. Exposed reinforcement?		✓			
g. Loss of joint material?		✓			
h. Adverse vegetation? **Channel invert was recently mowed by FCD crews.**		✓			
i. Sediment accumulation?		✓			
j. Drainage issues?		✓			
k. Project stationing/signs concerns?		✓			
l. Side inlets, flap gate concerns?		✓			
m. Subsidence concerns along sloped walls?		✓			
n. Aesthetic concerns with landscaped areas?		✓			
o. Invert of channel needs mowed? ***See comment 1.h above**		✓			
p. Vandalism?		✓			
q. Illegal discharge noted into the channel?		✓			
r. Safety hazards or liability concerns? ***See inspection comments on page 2.**			✓	✓	
s. Flow restrictions or possible blockage noted? ***See inspection comments on page 2.**			✓	✓	
t. Fencing or gate concerns?		✓			
u. Associated drop structures at sta. #357+45 & 374+51?		✓			
v. City of Phoenix IGA landscape concerns? ***See inspection comments on page 2.**			✓	✓	

ANNUAL INSPECTION REPORT

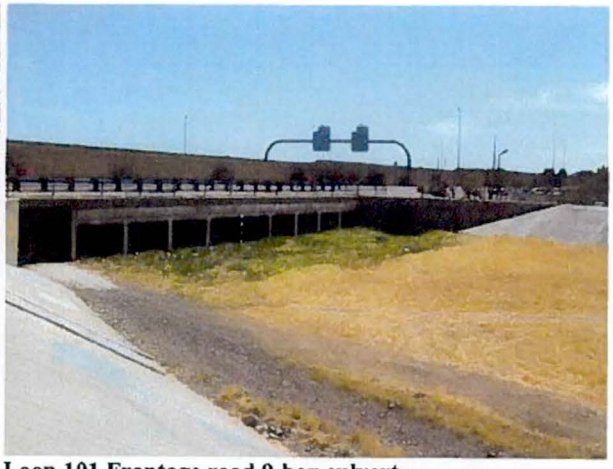
Inspection Date: 7/8/08 Inspector(s): C.F. Rivera-FCDMC	Structure: Scatter Wash PCN #590.01.10	N/A	NO	YES	MONITOR	REPAIR

Instrumentation: Staff Gages	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			

INSPECTION COMMENTS: From 40th Ave. to 43rd Ave. alignment, the City of Phoenix is responsible for landscape maintenance to include the levees and the invert of the Scatter Wash project. During the inspection of the project on 7/8/08, it should be noted that the invert of the channel is choked out with very dense and dry vegetation (Palo Verde and Mesquite trees). The maintenance standards are different between the Flood Control District and the City of Phoenix in allowing vegetation growth as currently present in the invert of the channel as well as uncontrolled growth on the slopes of the levees. This situation also will present a concern with certifying levees to meet FEMA guidelines in the future. The area is also a public safety hazard with potential for a dangerous fire that could impact homeowners that are living adjacent to the levee structures. The dense vegetation in the invert possibly could impact the channel capacity and a hydraulic analysis needs to be performed to verify.

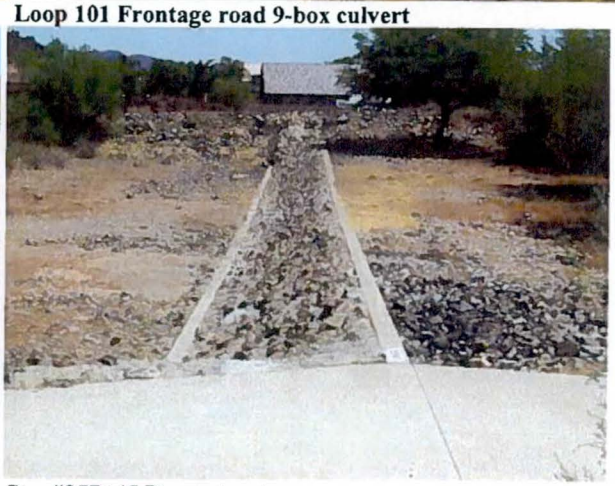
Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner

Twin pipe side inlets sta. #378+55.



Loop 101 Frontage road 9-box culvert

Sta. # 374+51 Drop structure.



Sta. #357+45 Drop structure

View is looking upstream of the Scatter Wash project.

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2007 Structure: Scatter Wash Inspector(s): Daniel Michael, FCDMC Location: #590	N/A	NO	YES	MONITOR	REPAIR

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

Concrete lined channel: 1400' lf	**N/A**	**No**	**Yes**	**Mon.**	**Rep.**
a. Erosion concerns?		✓			
b. Access roads in need of maintenance? **Access roads are in need of dust palliative protection.**			✓	✓	
c. Concrete slopes stable? **Slopes showed only minor surface cracking, non-structural.**			✓	✓	
d. Scaling or spalling evident? **None observed**		✓			
e. Cracking evident? ***See comment c. above**			✓	✓	
f. Exposed reinforcement? **None observed**		✓			
g. Loss of joint material? **None significant**		✓			
h. Leakage evident? **None observed**		✓			
i. Adverse vegetation? **Current maintenance activities addressed this concern.**			✓		✓
j. Sediment accumulation? **Unknown, would require a silt survey.**		?			
k. Drainage issues? **None significant**		✓			
l. Project stationing issues? **None significant**		✓			
m. Side inlets, flap gate concerns? **Rocks blocking flap gate operation**			✓		✓
n. Subsidence concerns along sloped walls?		✓			
o. Aesthetic concerns with landscaped areas? **IGA with City of Phoenix**		✓			
p. Invert of channel needs cleaned and swept? **N/A**	✓				
q. Vandalism? **None significant**		✓			
r. Illegal discharge noted into the channel? **None observed**		✓			
s. Safety hazards or liability concerns? **City of Phoenix's responsibility in the unlined sectior of the channel is overgrown with trees/brush. The other concern is with deep-rooted vegetation on the embankments of the levees.**			✓	✓	
t. Flow restrictions or possible blockage noted? ***See comment s. above**			✓	✓	
u. Fencing or gate concerns? **None observed**		✓			
v. Signs and stationing concerns? **None observed**		✓			
w. Access ramps stable? **Ramps appear stable**			✓		
x. Other**? N/A**		✓			

ANNUAL INSPECTION REPORT

Inspection Date: 7/3/2007 Inspector(s): Daniel Michael, FCDMC	Structure: Scatter Wash Location: #590	N/A	NO	YES	MONITOR	REPAIR

Instrumentation: Staff Gages	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			
c. Last monitoring report?	✓				

Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner

Rocks inhibiting flap gate operation at 378+55

Drop structure during maintenance activities

Drop structure before maintenance activities

Sediment accumulation at 43rd Ave. upstream side.

ANNUAL INSPECTION REPORT

Inspection Date: 8/8/06 **Structure: Scatter Wash** **Inspector(s):** **Location: #590** **C.F. Klenner-FCDMC, C.F. Rivera-FCDMC**	N/A	NO	YES	MONITOR	REPAIR

INSPECTION OBSERVATIONS: Watershed and relationship to other structures: This structure carries released water from the Adobe Dam Outlet Channel and also ADOT storm drain channel that parallels Loop 101. Local Sponsor(s): City of Phoenix & Flood Control District of Maricopa County. Functional Description: This structure carries released waters from Adobe Dam & ADOT storm channels into Skunk Creek.

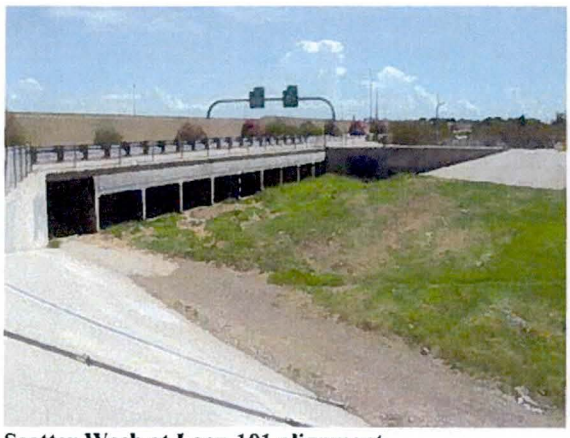
Concrete lined channel: 1400' lf	**N/A**	**No**	**Yes**	**Mon.**	**Rep.**
a. Erosion concerns?		✓			
b. Access roads in need of maintenance?		✓			
c. Concrete slopes stable? **Slopes showed only minor surface cracking, non-structural.**			✓	✓	
d. Scaling or spalling evident?		✓			
e. Cracking evident? ***See comment c. above**			✓	✓	
f. Exposed reinforcement?		✓			
g. Loss of joint material?		✓			
h. Leakage evident?		✓			
i. Adverse vegetation? **FCD mower was cutting high vegetation as inspection was being conducted.**			✓		✓
j. Sediment accumulation? **Unknown, would require a silt survey.**		?			
k. Drainage issues?		✓			
l. Project stationing issues?		✓			
m. Side inlets, flap gate concerns?		✓			
n. Subsidence concerns along sloped walls?		✓			
o. Aesthetic concerns with landscaped areas? **IGA with City of Phoenix**		✓			
p. Invert of channel needs cleaned and swept?	✓				
q. Vandalism?		✓			
r. Illegal discharge noted into the channel?		✓			
s. Safety hazards or liability concerns? **City of Phoenix's responsibility in the unlined sectio of the channel is overgrown with trees/brush. The other concern is with deep-rooted vegetation on the embankments of the levees.**			✓	✓	
t. Flow restrictions or possible blockage noted? ***See comment s. above**			✓	✓	
u. Fencing or gate concerns?		✓			
v. Signs and stationing concerns?		✓			
w. Access ramps stable?			✓		
x. Other?		✓			

ANNUAL INSPECTION REPORT

Inspection Date:	Structure: Scatter Wash	N/A	NO	YES	MONITOR	REPAIR
Inspector(s):	Location: #590					

Instrumentation: Staff Gages	N/A	No	Yes	Mon.	Rep.
a. List type(s) of instrumentation? **Staff Gages**					
b. Any repair or replacement required?		✓			
c. Last monitoring report?	✓				

Flood Control District of Maricopa County Operations & Division Manger-Charles F. Klenner



Scatter Wash at Loop 101 alignment.

Side inlet drain sta. #395+40

View of FCD maintained channel

View of existing grade control structure.

2005 ANNUAL INSPECTION SCATTER WASH

1. **Inspection Team:**

The annual inspection of the Scatter Wash was conducted on ~~June 6, 2004.~~ July 3, 2005. The inspection team consisted of:

Carlos F. Rivera	Operations and Maintenance Supervisor-FCDMC
~~Steven Rubin~~	~~Public Works Inspector/Coordinator-FCDMC~~ DB per Steve Rubin
~~Ray Shaffer~~	~~Team Leader-FCDMC~~ DB

2. **Project Conditions:**

The weather was clear and hot with a high temperature reported at Phoenix Sky Harbor International Airport of 107°.

3. **Highest recorded flow:**

The highest recorded flow between July 2003 & July 2004 was recorded on April 2, 2004 @ 1.70 with 763 cfs.

4. **Inspection Observations:**

Loop 101 alignment; downstream to the 40th Avenue alignment
The maintenance roads located on both sides of the levees were in stable condition. The concrete slopes of the floodway were in good condition with minor surface cracking evident. The channel invert was overgrown with dead vegetation that needs to be mowed. The invert also had numerous small trees growing that will need to be cut and removed. The twin pipe flap gates located at sta. #378+55 side drain need to be secured with breakaway bolts. High vegetation (dead) also needs cut in the grouted riprap area immediately downstream of the Loop 101.

40th Avenue to 43rd Avenue
Lands and Property Acquisition FCDMC has informed the O&M Division that we have no legal rights to perform any maintenance in this area. The aesthetic feature of this project is its natural habitat, providing shelter for wildlife to flourish. The maintenance roads on the levee are in fair condition. The loose riprap bank protection is in fair condition, although deep-rooted vegetation on the earthen embankments could possibly lead to serious problems. The channel invert is maintained by the City of Phoenix and contains a variety of desert vegetation and trees. The side inlets that empty into the channel bottom appear to be in good condition. The grouted riprap drop structures appear to be in good condition. There are signs of scattered rodent activity throughout. The City of Phoenix should thin out some of the dense vegetation located in the invert of the channel. Un-maintained, this area could have an impact on flows and result in blockages at

43rd Ave. Bridge crossing. The City of Phoenix should also consider the dense vegetation as a public safety hazard, which currently is allowing unauthorized residency and other unsanitary living conditions. The dense vegetation also will influence standing water that can lead to mosquito breeding habitat.

5. **Conclusion:**
The overall structure (FCDMC maintained) is in fair condition and should operate as designed. The City of Phoenix portion of the structure has serious concerns with dense vegetation.

6. **Required Action:**
Continue the scheduled maintenance and inspections of the channel. The areas of concern located between 40th and 43rd Avenues shall be addressed to the City of Phoenix.

Charles F. Klenner
Operations and Maintenance Division Manager

2004 ANNUAL INSPECTION SCATTER WASH

1. Inspection Team:

The annual inspection of the Scatter Wash was conducted on June 6, 2004. The inspection team consisted of:

Carlos F. Rivera	Operations and Maintenance Supervisor-FCDMC
Steven Rubin	Public Works Inspector/Coordinator-FCDMC
Ray Shaffer	Team Leader-FCDMC

2. Project Conditions:

The weather was clear and hot with a high temperature reported at Phoenix Sky Harbor International Airport of 107°.

3. Highest recorded flow:

The highest recorded flow between July 2003 & July 2004 was recorded on April 2, 2004 @ 1.70 with 763 cfs.

4. Inspection Observations:

Loop 101 alignment; downstream to the 40th Avenue alignment
The maintenance roads located on both sides of the levees were in stable condition. The concrete slopes of the floodway were in good condition with minor surface cracking evident. The channel invert was overgrown with dead vegetation that needs to be mowed. The invert also had numerous small trees growing that will need to be cut and removed. The twin pipe flap gates located at sta. #378+55 side drain need to be secured with breakaway bolts. High vegetation (dead) also needs cut in the grouted riprap area immediately downstream of the Loop 101.

40th Avenue to 43rd Avenue
Lands and Property Acquisition FCDMC has informed the O&M Division that we have no legal rights to perform any maintenance in this area. The aesthetic feature of this project is its natural habitat, providing shelter for wildlife to flourish. The maintenance roads on the levee are in fair condition. The loose riprap bank protection is in fair condition, although deep-rooted vegetation on the earthen embankments could possibly lead to serious problems. The channel invert is maintained by the City of Phoenix and contains a variety of desert vegetation and trees. The side inlets that empty into the channel bottom appear to be in good condition. The grouted riprap drop structures appear to be in good condition. There are signs of scattered rodent activity throughout. The City of Phoenix should thin out some of the dense vegetation located in the invert of the channel. Un-maintained, this area could have an impact on flows and result in blockages at

43rd Ave. Bridge crossing. The City of Phoenix should also consider the dense vegetation as a public safety hazard, which currently is allowing unauthorized residency and other unsanitary living conditions. The dense vegetation also will influence standing water that can lead to mosquito breeding habitat.

5. **Conclusion:**
The overall structure (FCDMC maintained) is in fair condition and should operate as designed. The City of Phoenix portion of the structure has serious concerns with dense vegetation.

6. **Required Action:**
Continue the scheduled maintenance and inspections of the channel. The areas of concern located between 40th and 43rd Avenues shall be addressed to the City of Phoenix.

Charles F. Klenner
Operations and Maintenance Division Manager

2003 ANNUAL INSPECTION SCATTER WASH

1. Inspection Team:

The annual inspection of the Scatter Wash was conducted on June 17, 2003. The inspection team consisted of:

Charles Klenner	Operations and Maintenance Division Manager-FCD
Steven Rubin	PW Inspector/Coordinator-FCD

2. Project Conditions:

The weather was clear and hot with a high temperature reported at Phoenix Sky Harbor International Airport of 108°.

3. Inspection Observations:

101 Loop southwest to 40th Avenue

The maintenance roads on the Levee were in good condition. The concrete slopes were in good condition with some minor cracking. The channel bottom was clear of obstructive debris. The channel bottom will need mowing in the near future and some deep-rooted vegetation cut and treated. There are signs of scattered rodent holes.

40th Avenue to 43rd Avenue

Lands and Property Acquisition FCDMC has informed the O&M Division that we have no legal rights to perform any maintenance in this area. The aesthetic feature of this project is its natural habitat, providing shelter for wildlife to flourish. The maintenance roads on the Levee are in fair condition. The Riprap bank protection is in fair condition. The channel bottom is maintained by the City of Phoenix and contains a variety of desert vegetation and trees. The side inlets that empty into the channel bottom appear to be in good condition. The Riprap drop structures appear to be in good condition. There are signs of scattered rodent holes.

4. Conclusion:

The overall structure is in fair condition and should operate as designed.

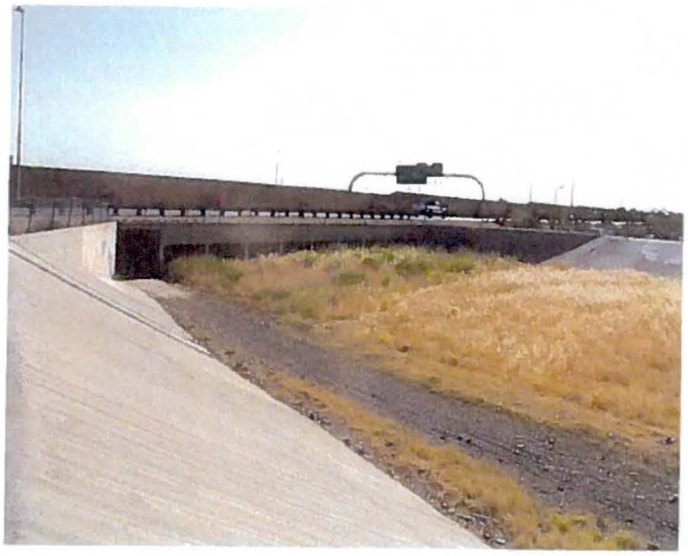
5. Required Action:

Continue the periodic inspections of the channel and the scheduled maintenance program. The areas between 40th and 43rd avenues shall continue to be maintained by the City of Phoenix.

Charles F. Klenner
Operations and Maintenance Division Manager

Carlos F. Rivera
Work Control Center Supervisor

Kevin D. Dubose
Maintenance Manager



Facing North just south of 101 loop clear vegetation

East bank twin flap gates clear vegetation 378+55

395+40 clear grate of vegetation

East Bank inlet, clear debris and vegetation 378+55

Between 40th and 43rd Avenues natural habitat

Between 40th Avenue and 43rd Avenue natural habitat

2002 ANNUAL INSPECTION REPORT
Scatter Wash

1. **Inspection Team:**
The annual inspection of the Scatter Wash project was conducted on July 10, 2002. The inspection team consisted of:

Kevin DuBose	Maintenance Manager
Ernie Hamer	Public Works Inspector, FCDMC

2. **Project Conditions:**
The weather was clear and hot. The high temperature reported at Sky Harbor International Airport was 112°.

3. **Flows:**
The highest flow recorded since the last inspection was .70 ft. in height and 166 cfs on 8/9/01.

4. **Inspection Observataions: (101 Loop southwest to 40th Avenue)**

A. **Levees:**
The crest maintenance roads were in good condition, free of erosion and debris. The concrete slopes of the channel were in good condition with some minor cracking.

B. **Channel Invert:**
The channel bottom was clear and free of obstructive vegetation and debris. Some areas need mowing and scattered small trees need to be cut and stump treated.

5. **Inspection Observations: (40th Avenue west to 43rd Avenue):**

A. Lands & Property Acquisition FCDMC have informed the O&M Division, that we have no legal rights to perform any maintenance in this area.

B. The aesthetic feature of this project is its natural habitat, providing shelter for wildlife to flourish.

C. **Levee:**
The maintenance roads on the levees were in fair condition. The riprap bank protection is stable and in fair condition.

D. **Channel:**
The channel bottom that is maintained by the City of Phoenix contains a variety of desert vegetation and trees. There is an abundance of dead trees, organic debris, and trash in the channel primarily due to the lack of periodic maintenance. The side inlet pipes that empty into the channel appear to be in good condition although the City of Phoenix should

D. **Channel:**
remove any blockages and check the operations of the flap gates. The existing drop structures appear to be in good condition.

6. **Conclusion:**
The overall condition of this structure is fair and should function as designed. Let it be noted that at the inlet end of SR 101 (ADOT maintenance) there is dense vegetation that has not been removed, and also, at the City of Phoenix responsibility, the existing trees and additional growth of natural vegetation could affect the capacity flow of the channel design.

7. **Required Action:**
The Flood Control District will conduct quarterly operational inspections and monitor the project during major storm events. The Flood Control District will not perform maintenance to the flood control features of the project from 40th Ave. to 43rd Ave., until a new IGA is created and or unless otherwise directed. FCD will perform routine maintenance in the area south of Loop 101 to 40th Ave. in the near future.

Charles Klenner
Operation and Maintenance Division Manager

Kevin DuBose
Maintenance Manager

2001 ANNUAL INSPECTION REPORT
Scatter Wash

1. **Inspection Team:**
The annual inspection of the Scatter Wash project was conducted on July 2, 2001. The inspection team consisted of:

Carlos Rivera Public Works Inspector, FCDMC

2. **Project Conditions:**
The weather was partly cloudy and humid. The high temperature reported at Sky Harbor International Airport was 112°.

3. **Flows:**
The highest flow recorded since the last inspection was 1.33 ft. in height and 491 cfs on 10/27/2000.

4. **Inspection Observataions: (101 Loop southwest to 40th Avenue)**

A. **Levees:**
The crest maintenance roads were in good condition, free of erosion and debris. The concrete slopes of the channel were in good condition with some minor cracking.

B. **Channel Invert:**
The channel bottom was clear and free of obstructive vegetation and debris. It should be noted that this structure had just been recently mowed (see attached photo's).

5. **Inspection Observations: (40th Avenue west to 43rd Avenue):**

A. Lands & Property Acquisition FCDMC, have informed the O&M Division, that we have no legal rights to perform any maintenance in this area.

B. The aesthetic feature of this project is its natural habitat, providing shelter for wildlife to flourish.

C. **Levee:**
The maintenance roads on the levees were in fair condition. The riprap bank protection is stable and in fair condition.

D. **Channel:**
The channel bottom that is maintained by the City of Phoenix contains a variety of desert vegetation and trees. The side inlet pipes that empty into the channel appear to be in good condition although the City of Phoenix should remove any blockages and check the operations of the flap gates. The existing drop structures appear to be in good condition.

5. **Conclusion:**
The overall condition of this structure is fair and should function as designed. Let it be noted that at the inlet end of SR 101 (ADOT maintenance) there is dense vegetation that has not been removed, and also, at the City of Phoenix responsibility, the existing trees and additional growth of natural vegetation could affect the capacity flow of the channel design.

6. **Required Action:**
The Flood Control District will conduct quarterly operational inspections and monitor the project during major storm events. The Flood Control District will not perform maintenance to the flood control features of the project from 40th Ave. to 43rd Ave., until a new IGA is created and or unless otherwise directed.

Charles Klenner
Operation and Maintenance Division Manager

Michael Meng
FCDMC

Kevin DuBose
FCDMC

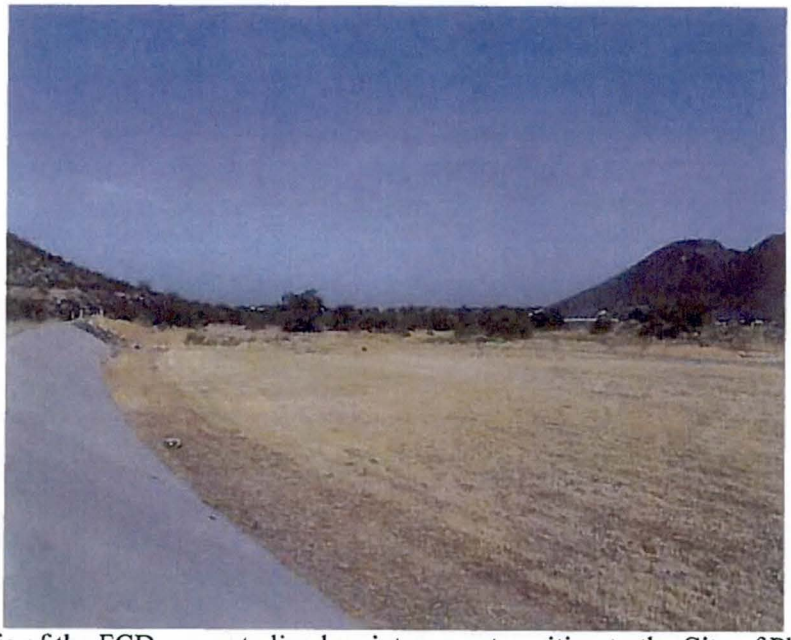
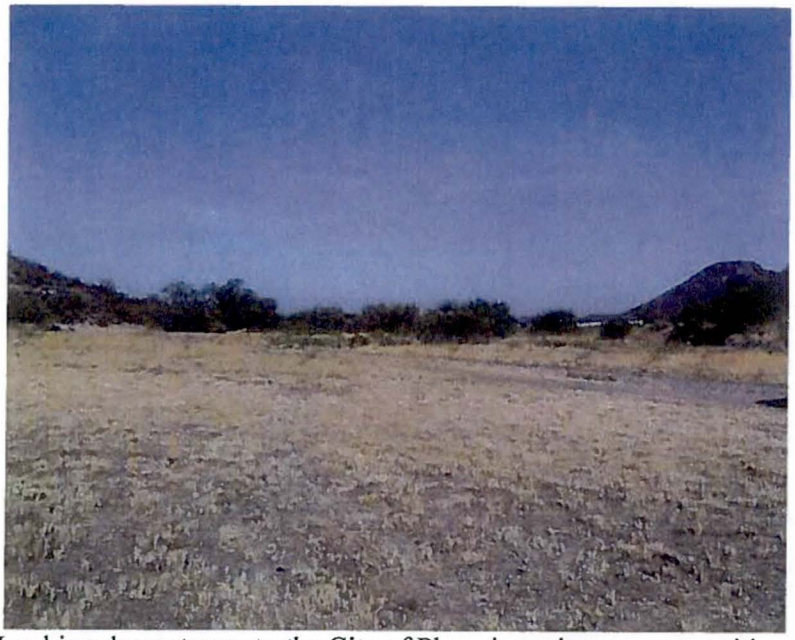
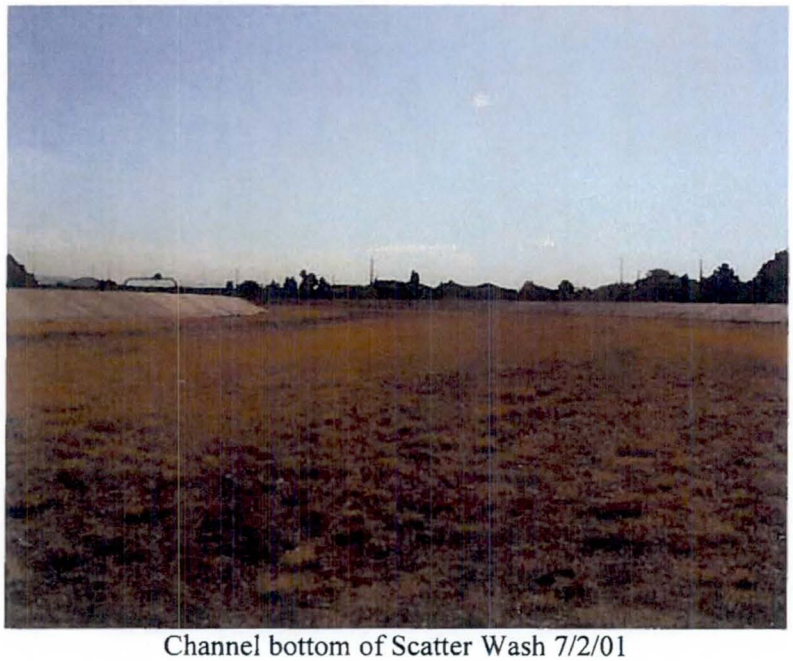


Photo is of the FCD concrete lined maintenance transition to the City of Phoenix maintenance. *Channel bottom recently mowed.



Looking downstream to the City of Phoenix maintenance transition.

Recently mowed channel at Scatter Wash 7/2/01



Channel bottom of Scatter Wash 7/2/01