



Existing Offsite Hydrology Report

February 2010

Prepared for

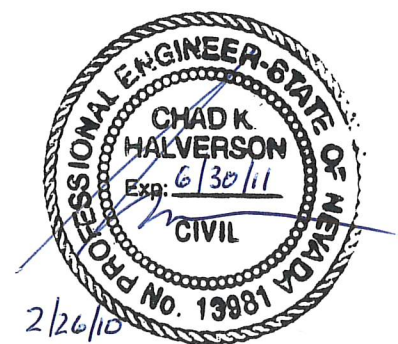


and



CH2MHILL

Prepared by



EXECUTIVE SUMMARY

This Existing Offsite Hydrology report is intended to document offsite hydrologic analysis, flow patterns, and offsite drainage design points for the Project NEON corridor. This document will be used as a basis for subsequent facility development and design reports as programming of project improvements continues. VTN has previously analyzed offsite hydrology for Project NEON, in association with Parsons Transportation Group, however these studies were based on the 2002 Clark County Regional Flood Control District (CCRFCDD) Master Plan Update (MPU). This report provides updates based on the 2008 MPU and incorporates drainage conditions from recently constructed City of Las Vegas flood control facilities, along with refinements to localized drainage basins near the project corridor.

Anticipated timeframes for full build-out for Project NEON extend beyond 20-years. Due to planned development of CCRFCDD Master Plan Facilities within this time frame, three hydrologic scenarios have been explored in order to understand the anticipated changes in flow patterns as project programming is developed.

Existing Conditions

Hydrology has been developed to reflect current offsite drainage impacts to the project corridor, based on CCRFCDD and City of Las Vegas facilities that are currently in place or are anticipated to be in place at the time of construction in 2012. In general, current offsite drainage facilities cannot fully convey offsite flows. This condition results in overland flows and inundation of properties in several areas of the project.

Existing Conditions with Sahara Ave Facility

Hydrology has been developed to assess changes to offsite drainage based on construction of the Sahara Ave. (FWSA) MPU facility from I-15 to Boulder Hwy. This facility is currently on the CCRFCDD 10-year plan and potentially results in significant improvements to the hydraulic capacity of drainage systems in the area.

Ultimate Conditions

Hydrology, based on full build-out proposed MPU facilities has also been analyzed to assess the ultimate condition offsite drainage conditions impacting the project corridor.

Field investigation to document existing facility conditions and suggested maintenance needs is not currently scoped for the project.

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1.0 INTRODUCTION AND PURPOSE

This Existing Offsite Hydrology report is intended to document offsite hydrologic analysis, flow patterns, and offsite drainage design points for the Project NEON Corridor. This document will be used as a basis for subsequent facility development and design reports as programming of project improvements continues. VTN has previously analyzed offsite hydrology for Project NEON, in association with Parsons Transportation Group, however these studies were based on the 2002 Clark County Regional Flood Control District (CCRFCD) Master Plan Update (MPU). This report provides updates based on the 2008 MPU and incorporates drainage conditions from recently constructed City of Las Vegas flood control facilities, along with refinements to localized drainage basins near the project corridor.

The Prime Consultant, CH2M Hill, has subcontracted drainage analysis and design to VTN Consulting.

1.1 Project Location and Description

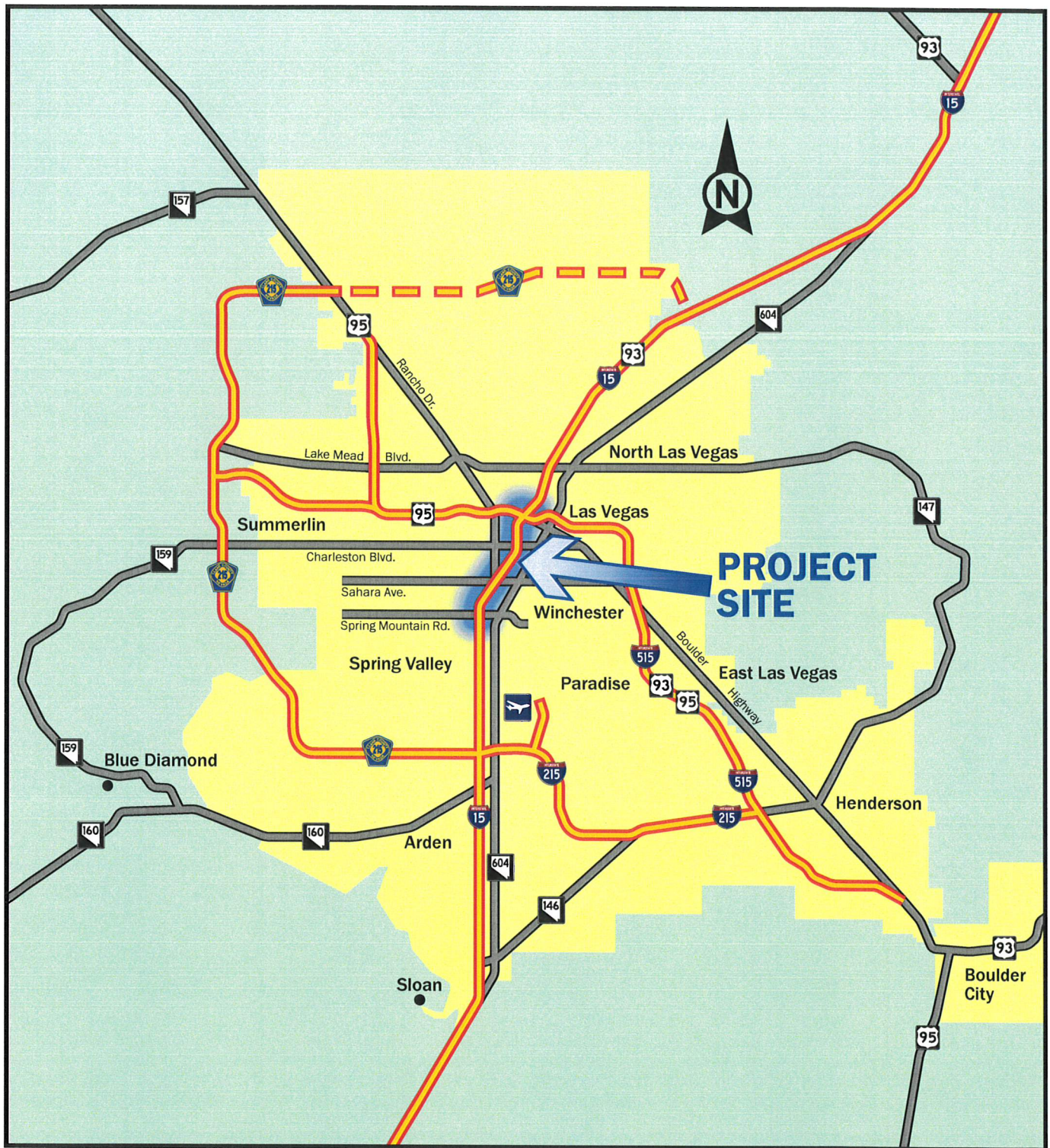
Project NEON is located in the City of Las Vegas, Nevada, within Township 20 South, Range 61 East, section 33, and Township 21 South, Range 61 East, Section 4.

Generally, the project is located along the I-15 corridor, between US-95 and Desert Inn Road. Improvements also include several local roads both east of and west of I-15 ([Refer to Figure 1.1 Vicinity Map](#)). Specific roadway improvements are described in the following section.

1.2 Overall Project Scope Summary

Project NEON is a multi phased program of freeway and local road improvements, generally consisting of the following:

- A High Occupancy Vehicle (HOV) direct connector ramp from the center of US 95, west of the Spaghetti Bowl, to the center of I-15, south of the Spaghetti Bowl.
- Widening of I-15 from the Spaghetti Bowl to south of Sahara Avenue with add/drop lanes at Oakey / Wyoming to accommodate the direct connector.



Vicinity Map



Project NEON

Figure 1.1
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- The connection of Martin Luther King Boulevard, located on the west side of I-15, and Industrial Road, located on the east side of I-15 to create a continuous north / south arterial. The Oakey / Wyoming grade separation over the Union Pacific Railroad.
- Reconfiguration of the I-15 / Charleston Boulevard Interchange.
- Reconfiguration of the I-15 / Sahara Avenue Interchange.
- Construction of Alta Ramps.
- Construction of collector distributor roads.

The current scope of services calls for development of 30% design plans for Phase I, with emphasis on establishing right-of-way setting.

1.3 Previous Studies

As part of the engineering services performed, VTN obtained and reviewed previous hydrologic and hydraulic reports and studies prepared for areas surrounding, tributary to, or adjacent to this segment of I-15. *Table 1.3* lists the reports and studies reviewed during the preparation of this report.

**TABLE 1.3
REFERENCE STUDIES**

Reference Studies		
1	2008 CCRFCD Flood Control Master Plan Update of the Las Vegas Valley, by PBS&J	September 2008
2	Preliminary Offsite Hydrology Report for Project NEON, By VTN Nevada <i>(based on 2002 MPU)</i>	April 2004
3	Offsite Hydrology Report for Project NEON, By VTN Nevada <i>(based on 2002 MPU)</i>	July 2004
4	Offsite Hydrology Update Memorandum, By VTN Nevada <i>(based on 2002 MPU)</i>	August 2005
5	City of Las Vegas City Wide Hydrology Analysis, by PBS&J	1997
6	I-15 Freeway Channel Pre-design Report, by Parsons Brinckerhoff	May 1999
7	Meadows Detention Basin Improvements & Las Vegas Springs Preserve Cienaga Grading-100% Design Report, by VTN Nevada	May 2001
8	Oakey Storm Sewer Conveyance System Corridor Study, by Carter-Burgess	Feb 2000
9	Martin Luther King Blvd. Widening Alta Dr. to Carey Ave. – Preliminary Design and Drainage Report, by VTN Nevada	Jan 2004
10	Spring Mountain Rd. Interchange and I-15 Median Widening, by Louis Berger and Associates	Nov 1996

1.4 FEMA

The Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM), Panel 32003C2170 E, revised September 27, 2002, shows the project is not located within a designated flood zone ([Refer to Appendix C.1, FEMA FIRM](#)).

2.0 CRITERIA

Several return frequencies will be considered for the design of drainage facilities within the project, depending on the type of drainage facility, location of the drainage facility, and jurisdiction of proposed improvements. *Table 2.0* provides a summary of various design storm frequencies.

**TABLE 2.0
SUMMARY OF DESIGN FLOW FREQUENCIES**

Jurisdiction	Design Condition	Design Return Frequency (years)
NDOT	NDOT Offsite Facility Design; Culverts, Channels, Bridges	50
NDOT	NDOT Maintain Existing Condition Drainage Patterns	100
NDOT	NDOT Onsite Drainage Design; I-15 Mainline, Ramps, CD Roads	25
CCRFC	CCRFC Regional Facility Design	100
CCRFC	CCRFC Local "Major" Event Facility Design (Local Streets)	100
CCRFC	CCRFC Local "Minor" Event Facility Design (Local Streets)	10

The hydrologic analysis presented in this study has been limited to the 100-year storm based on the following:

- The majority of existing offsite drainage facilities are CCRFC MPU facilities, designed for a 100-year return frequency.
- Proposed NEON improvements will widen the freeway footprint and potentially effect MPU facilities and 100-year flow patterns.
- Both I-15 and US-95 are elevated and isolated from direct effects of the 50 and 100-year storm flows. Design of 50-year offsite facilities, not associated with CCRFC facilities or maintenance of existing flow patterns, will be assessed during design.

- Analysis of NDOT 25-year onsite flows will be performed in conjunction with the project design, based on the roadway configuration.
- Analysis of local roadway onsite drainage (10-year and 100-year) will be performed in conjunction with project design, based on the roadway configuration.

3.0 OFFSITE DRAINAGE FACILITIES

Anticipated timeframes for full build-out of Project NEON extend beyond 20-years. Due to planned development of CCRFCD Master Plan Facilities within this time frame, three scenarios have been explored in order to understand the anticipated changes in flow patterns due to the future construction of these facilities as discussed below. [Refer to Figure 3.0 for the 2008 MPU Facility Map showing existing and proposed drainage facilities and Figure 4.1.3 Offsite Facility and Flow Exhibit.](#)

3.1 Existing Conditions

A meeting was held with the City of Las Vegas, CCRFCD and NDOT on October 21, 2008, to discuss issues related to Project NEON drainage design. The purpose of the meeting was to update project drainage design criteria originally developed in a meeting with CLV and NDOT on December 11, 2003. In this meeting, the status of several planned MPU facilities was discussed, and direction was given as to which of these facilities would be in place prior to the start of NEON construction in 2012. ([Refer to Appendix C.2 for Meeting Minutes](#)).

3.1.1 Freeway Channel (FW15 0000 to 0175)

The existing Freeway Channel (MPU Designation FW15 0000 to 0175) is the major CCRFCD facility existing in the project area. It begins on the west side of I-15 at Desert Inn Rd. and crosses under I-15 at Wall St. After crossing under, it continues north along the east side of I-15 and ultimately ties into the Washington Avenue Channel (LVWH) at US-95. There are several lateral systems branching out from the Freeway Channel including box culverts at Western Ave., Oakey Blvd., Waldman Ave., Charleston Blvd, Pinto Ln, Alta Dr., and Sahara Ave.

The 2008 MPU ultimately proposes to upsize the Freeway channel between Desert Inn Rd. and Sahara Ave (FW15 0301 to 0214); however, this is not on the current CCRFCD 2010-2019 Ten Year Construction Plan (TYCP) ([Refer to Appendix C.3 for CCRFCD 2010-2019 TYCP Excerpt](#)). No MPU improvements to the freeway channel facility are proposed north of Sahara Avenue.

Ultimately, the freeway channel will provide a 100-year level of protection to I-15 and the surrounding area. However, build out of proposed upstream MPU facilities is needed to achieve this.

The Existing Condition analysis models the Freeway Channel as in place without the FW15 0301 to 0214 upsizing.

3.1.2 Freeway Channel Bypass (FWUP 0000 to 0100)

The existing Freeway Channel Bypass Facility (MPU Designation FWUP 0000 to 0100) is located in Western Ave., beginning at Sahara Avenue and tying into the Freeway Channel at Wall St. It is intended to intercept flow in the corridor between I-15 and the UPRR from Sahara Ave. to Wall St. This system is impacted by large flows in the existing case and is currently over capacity. In the future, the MPU BHSA facility will intercept upstream flows that are currently tributary to this system.

The Existing Condition analysis models the Freeway Channel Bypass as in place.

3.1.3 Freeway Channel-Waldman Ave. (FWWL 0000)

The existing Waldman Ave. Lateral (MPU Designation FWWL 0000) is a box culvert that extends west from the I-15 Freeway Channel to Shadow Lane that intercepts flows traveling down Waldman Ave. This system utilizes a series of 20' modified county Type D drop inlets located on either side of Waldman Ave. from Charmast Lane to Shadow Lane.

The Waldman Ave. Lateral is modeled as in place.

3.1.4 West Charleston Drains (FWCH 0000 to 0060)

The existing West Charleston Drains (MPU Designation FWCH 0000 to 0060), along with CHRA 000 to 0014 and FWSH 000, currently extends west up Charleston Blvd. from the I-15 Freeway Channel to Shadow Lane and north up Shadow Lane to Goldring Ave.

The West Charleston Drains are modeled as in place.

3.1.5 Oakey Drain (FWOK 0000 to 0060)

The existing Oakey Drain (MPU Designation FWOK 0000 to 0060) is a box culvert that presently extends west from the I-15 Freeway Channel to Cahlan Dr. that intercepts flows conveyed down Oakey Blvd and ties to the Freeway Channel.

The Oakey Blvd. Lateral is proposed to be extended to the west to Barnard Dr. in the MPU (FWOK 0076 to 0100) and is currently on the CCRFCD TYCP. This proposed facility was not discussed at the October 21, 2009, City of Las Vegas drainage meeting; however, analysis shows the capacity of the Oakey Drain is limited by the hydraulics of the Freeway Channel in the Existing/Design Conditions, therefore the addition of this facility would not alter hydraulic results.

The Existing Condition analysis models the Oakey Drain (FWOK0000 to 0020) as in place.

3.1.6 Oakey Meadows Storm Drain System (MEOK 0000 to 0217)

The proposed Oakey Meadows System (MPU Designation MEOK 0000 to 0217) starts at Sahara Ave. and continues in a northeast direction to the Meadows Detention Basin (LCME). According to the CCRFCD TYCP, construction funding is in place for the first phase of the project, and sections MEOK 0070 to 0217 are included on the TYCP.

According to the 2008 MPU, this facility, when constructed, will convey over 2700 cfs to the LCME. Without this facility, nearly all of this flow would impact the NEON Project area.

The Charleston reach (MECN) will not be constructed at the same time as the Oakey Meadows System and is not currently on the TYCP. The City of Las

Vegas has directed VTN to assume the Oakey Meadows System will cut off the 100-year flow impacting the proposed Oakey alignment.

The Oakey System (MEOK) will be assumed in place for the Existing Conditions Hydrology Model, based on the October 21, 2009, City of Las Vegas drainage meeting.

3.1.7 Boulder Highway Sahara Ave. (BHSA 0175 to 0000)

The proposed Boulder Highway Sahara Avenue System (MPU designation BHSA 0175 to 0000) is proposed to collect flow at Sahara Avenue / I-15 and convey over 3000 cfs of the approximately 4500 cfs at this location to the east. The BHSA System is currently on the CCRFCD TYCP, but would require additional facilities be built west of I-15 to fully collect the intended flow. These facilities include the FWSA system in Sahara Ave. from I-15 west to Valley View Blvd, the FW15 system upgrade along I-15 from Sahara Ave. south to Desert Inn Rd., and the FWPS, PSDE, and FWVV systems extending west to Jones Blvd. and south to Twain Ave. It is not anticipated that this facility will be in place prior to commencement of NEON Phase I construction in 2012.

The Boulder Highway Sahara Ave. System (BSHA) will not be assumed in place for the Existing Conditions Hydrology Model, based on the October 21, 2009, City of Las Vegas drainage meeting.

3.1.8 Valley View Drain (FWVV 0000 to 0050)

The proposed Valley View Drain (MPU Designation FWVV 0000 to 0050) will collect flows impacting Valley View Blvd. between Sirius Ave and Twain Ave. and route them to the Freeway Channel. Due to the west to east slope in this area, some of the flows proposed to be collected by the FWVV System impact the Spring Mountain Rd. Interchange. Spring Mountain Rd. is a low point at I-15 and therefore, the majority of flow impacting it will cross under I-15 and be routed north by the UPRR to the project area. This facility is not included on the

CCRFC D TYCP and is not anticipated to be in place prior to commencement of NEON Phase I construction in 2012.

The Valley View Drain will not be assumed in place for the Existing Conditions Hydrology Model, based on the October 21, 2009, City of Las Vegas drainage meeting.

3.2 Existing Conditions with Sahara Ave. Facility

The Boulder Highway Sahara Ave. MPU facility (BHSA 0175 to 0000) is currently on the CCRFC D Ten Year Construction Program. It is unknown when this facility will be funded and constructed, however it is feasible that this facility will in be place at some point during an interim phase, prior to full build out of Project NEON. The Existing Conditions with Sahara Ave. facility model assumes this facility is in place, with all other facility assumptions from the Existing Design Conditions model being the same.

3.3 Ultimate Conditions

All existing and proposed facilities depicted in the 2008 MPU are assumed to be in place in the Ultimate Conditions Model.

3.4 Existing Facility Inventory

Field investigation to document existing facility conditions and suggested maintenance needs is not currently scoped for the project.

4.0 HYDROLOGY

Hydrologic analysis presented in this study is based on the 2008 CCRFCD MPU model. Three conditions have been analyzed, in conjunction with the three offsite drainage facility scenarios described in the previous section. [Refer to Appendix A.1 for an outline of hydrologic methodology.](#)

4.1 Existing Conditions

An Existing Condition model has been developed, based on existing facilities and those assumed to be in place prior to Project NEON. In addition, the following basin refinements to the MPU model have been made to more clearly define drainage patterns impacting the project ([See Figures 4.1.1, Existing Conditions Sub Basin Map, 4.1.2 Existing Conditions Flow Exhibit, and 4.1.3, Offsite Facility and Flow Exhibit](#)).

Table 4.1 provides a summary of hydrologic results at key design points throughout the project. PDF plots from the HEC-1 output files are on the data CD in [Appendix A.7](#).

4.1.1 Basin Refinements South of Sahara

Proposed I-15 improvements south of Sahara Ave. have the potential to impact the existing open channel along the west side of I-15 between Desert Inn Rd. and Sahara Ave. If these impacts result in capping the existing open channel or replacing it with a closed conduit facility, additional detail will be needed to determine inflow points to the existing channel. Based on field observations and analysis of existing topography, VTN has determined that six major inflow points occur between Desert Inn Rd. and Sahara Ave. These include: Desert Inn Rd., Sirius Ave., Meade Ave., Milo Way, Teddy Dr., and Sahara Ave. Additional refinement of the watershed tributary to this reach of the channel has been performed to provide flow rates at each of these points. ([See Appendix](#)

A.6 for Standard Form 4, Appendix A.2-2.2 for Land Use, Soils and Curve Numbers for Basin Refinements.)

4.1.2 Basin Refinements North of Alta

On the west side of I-15, the 2008 MPU currently accounts for the drainage area between Alta Dr. and US-95 with one subbasin, AL93-C. To more accurately determine the flow patterns in this area and their impact to I-15, additional subbasin refinement has been performed. This area has been divided into two subbasins, AL93-A and AL93-B. These subbasins are tributary to Alta Dr. and Discovery Dr., respectively. In addition to these basin refinements, two existing 48" RCP storm drains have been accounted for in the hydrology; one diverting flow from Pinto Ln. north to Alta Dr., and the other diverting flow from Alta Dr. north to Discovery Dr. Capacities for these storm drain pipes have been determined using Manning's Equation analysis. (See Appendix A.6 for Standard Form 4, Appendix A.2-2.2 for Land Use, Soils and Curve Numbers for Basin Refinements.)

TABLE 4.1
EXISTING CONDITIONS
FLOW SUMMARY

INTERSECTION	NODE	TRIB. AREA (sq mi)	MODEL	100-YEAR FLOW (cfs)
Spring Mtn Rd / I-15	CFW09	2.00	SWA3	1207
Highland Dr / I-15	DSPM	2.00	SWA3	947
Desert Inn / I-15	CCE3FD-C	1.22	SWA3	799
Sirius Ave / I-15	CRCPS06	2.22	SWA3	1652
Meade Ave / I-15	CCPS08	3.01	SWA3	2124
King's Way / I-15	CED10-C	3.69	SWA3	2550
Sahara Ave / I-15 - Flow from Sahara	CSA08	0.99	SWA3	867
Sahara Ave / I-15 - Flow from along I-15	CED10-C	3.69	SWA3	2550
Sahara Ave / I-15 - Total Flow	CCCSA08 ¹	4.68	SWA3	3284
Sahara Ave / I-15 - Facility Flow	CCCSA08	4.68	SWA3	2360
Sahara Ave / I-15 - Street Flow to East	DSAHARA2	4.68	SWA3	720
Sahara Ave / I-15 - Overland Flow to North	DSAHARA3	4.68	SWA3	204
Oakey Blvd / I-15 - Flow from Oakey	1COK11C	1.16	SWA3	928
Oakey Blvd / I-15 - Total Flow	COK11C ²	5.84	SWA3	3178
Oakey Blvd / I-15 - Facility Flow	DCOK11-C	5.84	SWA3	3080
Oakey Blvd / I-15 - Street Flow to East from	DOAKEY	5.84	SWA3	98
Oakey Blvd / I-15 - Total Street Flow to East	CDOAKEY	5.84	SWA3	296
Waldman Ave / I-15 - Flow from Waldman	CWAL2	0.45	SWA3	418
Waldman Ave / I-15 - Facility Flow	CCWAL2	6.29	SWA3	3361
Western Ave / Sahara Ave - Total Flow	CSA10-2	7.16	SWA3	1683
Western Ave / Upstream of Wall St - Street	DWESTERN ³	8.57	SWA4	1163
Western Ave / Upstream of Wall St - Facility	DCCH50	8.57	SWA4	520
Western Ave / Wall St - Total Flow	CCH50 ⁴	8.57	SWA4	1683
Wall / Western Confluence - Facility Flow	CCCH50	9.02	SWA4	3387
Charleston Blvd / I-15 - Flow from Charleston	CCH22	1.38	SWA3	1008
Charleston Blvd / I-15 - Total Flow	CCCH22	10.40	SWA4	3975
Charleston Blvd / I-15 - Facility Flow	DCCCH22	10.40	SWA4	3787
Charleston Blvd / I-15 - Street Flow to East	DCHARL	10.40	SWA4	188
Pinto Lane/ I-15 - Flow from Pinto Lane	AL96-C	0.18	SWA3	218
Pinto Lane/ I-15 - Flow North in 48" RCP	DPINTO	0.18	SWA3	90
Pinto Lane/ I-15 - Facility Flow	CAL96	10.58	SWA4	3810
Alta Dr / I-15 - Flow from Alta Drive	CDAL93B	0.28	SWA3	234
Alta Dr / I-15 - Flow North in 48" RCP	DDISC	0.28	SWA3	70
Alta Dr / I-15 - Total Flow	CAL93	10.87	SWA4	4035
Alta Dr / I-15 - Facility Flow	DCAL93	10.87	SWA4	3910
Alta Dr / I-15 - Street Flow to East	DALTA	10.87	SWA4	125
Discovery Dr / I-15 - Flow from LV Creek	CLC20-C	9.68	MEADOWS4	2894
Discovery Dr / I-15 Confluence - Facility	CCAL93	22.67	SWA5	5466

¹ Also includes flow from nodes DSAHARA2 and DSAHARA3. These flows are diverted out to keep track of facility vs overland flow.

² Doesn't include flow from node DSAHARA3 which travels under I-15 on south side of Oakey without combining with Freeway Channel flow.

³ At node DWESTERN, area of 8.57 and model of SWA4 yield a lesser flow (1007 cfs) than upstream (1163 cfs); therefore, upstream controls.

⁴ At node CCH50, area of 8.57 and model of SWA4 yield a lesser flow (1527 cfs) than upstream (1683 cfs); therefore, upstream controls.

4.2 **Existing Conditions with Sahara Ave. Facility**

The Sahara Avenue MPU facility is currently on the CCRFCD Ten Year Construction Program (Refer to Appendix C.3 for an excerpt from the 2010-2019 TYCP) It is unknown when this facility will be funded and constructed; however, it is feasible that this facility will be in place at some point during an interim phase, prior to full build out of Project NEON. Hydrologic modeling for this scenario follows the Existing Condition model, with Sahara Ave facility flow being diverted out. (Refer to Figure 4.1.3, Offsite Facility and Flow Exhibit and Figure 4.2.1 Existing Conditions with Sahara Ave. Facility Flow Exhibit)

This Sahara Ave. facility, when constructed, will intercept a portion of offsite flows south of Sahara and convey them east. A reduction of flows entering the Freeway Channel will allow it to operate within its hydraulic capacity and allow flows from offsite facilities west of I-15, north of Sahara to fully be intercepted.

However, additional facilities west of I-15 (specifically the FW15 upgrade, FWSA, FWPS, PSDE and FWVV) would be needed to fully intercept offsite flows impacting the Western Corridor and allow the Western RCB to convey offsite flows without overland inundation.

Table 4.2 provides a summary of hydrologic results at key design points throughout the project. PDF plots from the HEC-1 output files are on the data CD in Appendix A.7.

TABLE 4.2
EXISTING CONDITIONS WITH SAHARA AVE. SYSTEM
FLOW SUMMARY

INTERSECTION	NODE	TRIB. AREA (sq mi)	MODEL	100-YEAR FLOW (cfs)
Spring Mtn Rd / I-15	CFW09	2.00	SWB3	1207
Highland Dr / I-15	DSPM	2.00	SWB3	947
Desert Inn / I-15	CCE3FD-C	1.22	SWA3	799
Sirius Ave / I-15	CRCPS06	2.22	SWB3	1652
Meade Ave / I-15	CCPS08	3.01	SWB3	2124
King's Way / I-15	CED10-C	3.69	SWB3	2550
Sahara Ave / I-15 - Flow from Sahara	CSA08	0.99	SWB3	867
Sahara Ave / I-15 - Flow from along I-15	CED10-C	3.69	SWB3	2550
Sahara Ave / I-15 - Total Flow	CCCSA08	4.68	SWB3	3273
Sahara Ave / I-15 - Facility Flow to North	DCCSA08	4.68	SWB3	1450
Sahara Ave / I-15 - Facility Flow to East	DSAHARA	4.68	SWB3	1823
Sahara Ave / UPRR - Facility Flow to East	CSA10-2	5.16	SWB3	2140
Oakey Blvd / I-15 - Flow from Oakey	1COK11C	1.16	SWB3	928
Oakey Blvd / I-15 - Facility Flow	COK11C	5.84	SWB3	2320
Waldman Ave / I-15 - Flow from Waldman	CWAL2	0.45	SWB3	418
Waldman Ave / I-15 - Facility Flow	CCWAL2	6.29	SWB3	2606
Western Ave / Sahara Ave - Overland Flow to	RDSPM	2.00	SWB3	937
Western Ave / Upstream of Wall St - Street	DWESTERN	2.25	SWB3	584
Western Ave / Upstream of Wall St - Facility	DCCH50	2.25	SWB3	520
Western Ave / Upstream of Wall St - Total	CCH50	2.25	SWB3	1104
Wall / Western Confluence - Facility Flow	CCCH50 ¹	8.54	SWB4	2606
Charleston Blvd / I-15 - Flow from Charleston	CCH22	1.38	SWB3	1008
Charleston Blvd / I-15 - Facility Flow	CCCH22	9.92	SWB4	3120
Pinto Lane/ I-15 - Flow from Pinto Lane	AL96-C	0.18	SWB3	218
Pinto Lane/ I-15 - Flow North in 48" RCP	DPINTO	0.18	SWB3	90
Pinto Lane/ I-15 - Facility Flow	CAL96 ²	10.10	SWB4	3120
Alta Dr / I-15 - Flow from Alta Drive	CDAL93B	0.28	SWB3	234
Alta Dr / I-15 - Flow North in 48" RCP	DDISC	0.28	SWB3	70
Alta Dr / I-15 - Facility Flow	CAL93	10.39	SWB4	3300
Discovery Dr / I-15 - Flow from LV Creek	CLC20-C	9.68	MEADOWS4	2894
Discovery Dr / I-15 Confluence - Total	CCAL93	22.19	SWA5	4703

1 At node CCCH50, area of 8.57 and model of SWB4 yield a lesser flow (2496 cfs) than upstream (2606 cfs); therefore, upstream controls.

2 At node CCCH22, area of 9.92 and model of SWB4 yield a lesser flow (3086 cfs) than upstream (3120 cfs); therefore, upstream controls.

4.3 Ultimate Conditions

Ultimate Condition Hydrology, based on full build-out of proposed MPU facilities has also been analyzed to assess the ultimate condition offsite drainage facilities impacting the project corridor. (Refer to Figures 4.1.3, Offsite Facility and Flow Exhibit, 4.3.1, Ultimate Conditions Sub-Basin Map, and 4.3.2, Ultimate Conditions Flow Exhibit)

The MPU provides interception of flows west of I-15 and south of Sahara as needed to prevent flows from being directed to the Western Corridor.

Hydrology and facilities, as depicted on the 2008 MPU, will need to be considered as later phases of the project are developed. The ultimate MPU configuration directs additional flow to I-15, south of Sahara, and a proposed upsize of the I-15 Freeway channel, south of Sahara is proposed within an area of the overall Project NEON footprint.

Table 4.3 provides a summary of hydrologic results at key design points throughout the project. PDF plots from the HEC-1 output files are on the data CD in appendix A.7

TABLE 4.3
ULTIMATE CONDITIONS
FLOW SUMMARY

INTERSECTION	NODE	TRIB. AREA (Sq mi)	MODEL	100-YEAR FLOW (cfs)
Desert Inn / I-15	CCE3FD-C	0.54	SW3	433
Sirius Ave / I-15 Flow from Sirius Ave	CCPS06	4.88	SW3	3240
Sirius / I-15	CPS08	5.59	SW3	3674
Meade Ave / I-15	CCPS08	6.03	SW3	3968
Sahara Ave / I-15 Flow from along I-15	CED10-C	6.25	SW3	4104
Sahara Ave / I-15 Flow from Sahara Ave	CSA08	0.42	SW3	486
Sahara Ave / I-15	DCCSA08	6.67	SW3	1450
Sahara Ave / I-15 Flow to East from Sahara	CSA10-1	7.15	SW3	3232
Oakey Ave / I-15	COK11C	7.83	SW3	2295
Waldman Ave / I-15	CCWAL2	8.28	SW4	2448
Waldman Ave / I-15 Flow from Waldman	CWAL2	0.45	SW3	418
Western Ave/Wall	CH50	0.26	SW3	242
Wall / I-15	CCH50	8.54	SW4	2613
Charleston Ave / I-15	CCCH22	9.92	SW4	3344
Charleston Ave / I-15 Flow from Charleston	CCH22	1.38	SW3	1008
Pinto Ave / I-15	CAL96	10.10	SW4	3403
Alta Ave / I-15	CAL93	10.63	SW4	3728
Las Vegas Creek Channel	CLC20-C	9.63	MEADOWS4	2894
Washington Ave Channel / Las Vegas Creek	CCAL93	22.19	SW5	4978

5.0 HYDRAULIC ANALYSIS

Hydraulic analysis of several facilities has been performed in support of the Existing Condition Hydrologic analysis, as needed to more closely define drainage patterns.

5.1 Spring Mountain

In the Existing Condition, a higher 100-Year flow rate occurs in Spring Mountain Rd. at I-15 than will occur in the ultimate condition when there is a full build-out of CCRFCD master plan facilities. The proposed facility affecting Spring Mountain Rd. is the Valley View Drain, MPU designation FWVV. This facility starts as an 8'x6' RCB at Twain Ave. / Lindell Rd. and increases in size to a 12'x11' RCB at Desert Inn Rd. / Valley View Blvd.

Without the Valley View drain in place, a flow of 947 cfs continues under I-15 at Spring Mountain Rd. and is conveyed northward in the corridor between I-15 and the UPRR. This flow contributes to the existing condition flooding in Western Ave to the north. (Refer to Appendix B.1 for Spring Mountain Hydraulic Calculations).

5.2 Sahara Flow Split

The ultimate 100-year design flow for the Freeway Channel at Sahara is 1450 cfs, based on full build out of the 2008 MPU system, including construction of the Sahara Ave, system and proposed MPU systems southwest of Sahara/-15. In existing conditions, a peak 100-year flow of 3284 cfs impacts this area.

Hydraulic analysis, based on existing condition hydrology, has determined the maximum 100-year capacity of the Freeway Channel at Sahara is 2360 cfs. Existing upstream interception facilities in Sahara will not allow additional overland flows to enter the Freeway Channel in this condition; therefore, flows are conveyed overland. These flows combine with overland flows from Rancho Drive, south of Sahara, for a peak overland flow of 924 cfs at this location. An overland flow split analysis shows that 204 cfs will be conveyed north, along the west side of I-15, and the remaining 720 cfs will be conveyed

east of I-15 in Sahara and ultimately will contribute to flows in the Western Avenue Corridor. (Refer to Figure 4.1.3, Offsite Facility and Flow Exhibit).

Appendix B.2 includes methodology and calculations used in establishing the flow split at Sahara as well as the HEC-1 rating table.

5.3 Freeway Channel Hydraulics

Hydraulic analysis of the existing Freeway Channel was performed between a point approximately 1500 feet south of Sahara Ave, to approximately 500 feet north of Alta Drive using Water Surface Pressure Gradient for Windows (WSPGW). System geometry was taken from the record drawings for the I-15 Freeway Channel, by Parsons Brinkerhoff, December 17, 1999, I-15/US-95 Interchange, Stage 2, by GC Wallace, May 19, 1997, and I-15 Widening-Sahara to Charleston, by Louis Berger, December 14, 1999.

In the Existing Condition, the Freeway Channel is impacted by more flow than it has the capacity to convey. Flow intercepted at major intersections with I-15 is dependant on Freeway Channel hydraulics. To determine the existing capacity of the channel and the magnitude of bypass flow at each location, flow has been balanced at each junction in the model until the water surface elevation in the facility matches the elevation of the existing ground. Bypass flows are generally conveyed east at major intersections with I-15. Refer to Figure 4.1.3, Offsite Facility and Flow Exhibit. (Refer to Appendix B.3 for Freeway Channel Hydraulics methodology and calculations)

5.4 Rancho Drive South Overland Flows

In existing 100-year conditions 799 cfs is conveyed in the facility at Desert Inn in a concrete rectangular channel section that varies in width and height. South of W. Sirius Ave., the channel transitions to an earthen trapezoidal section with a base width of 10' and riprap sides sloping at 2:1. An additional 853 cfs is added to the system from Sirius Ave in this trapezoidal section, and another 472 cfs is combined at Meade Ave. South of Kings Way an approximately 97' section of riprap channel exists with a base width of 13' and sides sloping at 2:1 which then transitions to a rectangular concrete channel with a base width of 25' and a height of 6', and lastly 426 cfs is added into the system at Kings

Way into this concrete channel, for a combined peak 100-year flow of 2550 cfs.. This channel then transitions into (2)10'x8' RCBs, north of Kings Way. Hydraulic analysis of the Freeway Channel (discussed above) shows the maximum capacity of the RCBs is 2360 cfs.

Due to the capacity limitations of the Freeway Channel in existing conditions, a HEC-RAS analysis has been performed to assess the extent of overland flow west of Rancho Drive. (Refer to Figure 5.4.1, Rancho South Overland Flows and Appendix B.4 for Rancho South Overland Flows hydraulic methodology and calculations.)

This Freeway Channel, between Desert Inn and Sahara is assumed to remain in its current configuration in the Existing Condition with Sahara Ave facility scenario (without the proposed MPU upsizing of the FW15 0301 to 0214 facility), Therefore this overland flow condition will not be fully mitigated in this scenario.

In the ultimate MPU model, ultimate MPU facilities west of Rancho Drive convey additional flows the Freeway Channel alignment (up to 4104 cfs near Sahara), however the increased size of the proposed FW15 0301 to 0214 facility is anticipated to mitigate the overland flows.

5.5 Western Overland Flows

5.5.1 Existing Conditions

In existing 100-year conditions, 1,229 cfs is conveyed from south of Sahara, along the UPRR to the Western Avenue Corridor. In addition, 720 cfs is conveyed overland, via Sahara, based on the Sahara Ave. flow split analysis. These combine for a peak 100-year flow of 1683 cfs directed toward Western Avenue between I-15 and the UPRR. An existing RCB below Western Avenue, varying in size between 8'x4' and 12'x10' conveys 520 cfs of this flow to the I-15 Channel at Wall Street. In existing conditions, this system is under capacity to convey the entirety of the runoff tributary to the area, and the remaining 1163 cfs travels north, overland along the Western Corridor. HEC-RAS analyses of the

overland flow, coupled with weir calculations for flows overtopping the UPRR have been performed. (Refer to [Appendix B.5 for Western Overland Flows hydraulic methodology and calculations.](#))

Two existing case analysis of the overland conveyance have been performed: The first uses “historic” geometry, where buildings which have been in place until very recently are shown to exist in the vicinity of Wall Street, east of Western Avenue. The second uses “current” geometry, based on the current conditions where these buildings have recently been leveled.

Results of both analyses are similar between Sahara and Wall Street. Overland flows are conveyed north within both Western Avenue and the existing UPRR channel and include significant inundation of parcels between I-15 and the UPRR. Overtopping of the UPRR occurs between HEC-RAS river stations 16+00 and 7+00 (between to the I-15/Wall Street bridge and Charleston). Overland flows are progressively conveyed adjacent to the UPRR tracks through this area; however, significant overland inundation still occurs.

Comparison between the existing “historic” condition and the existing “current” condition reveals how removal of the existing buildings has affected flow patterns. Increased cross section conveyance in the “current” condition lowers water surface elevations up to 0.32’ between river stations 24+00 and 12+00. This result in a reduction of UPRR overtopping by approximately 175 cfs and a commensurate increase in flow directed north along the corridor. Between river stations 11+00 and 7+00, this increase in flows results in higher water surface elevations (up to 0.11’) and an increase of UPRR overtopping by approximately 129 cfs. (Refer to [Appendices B.5.1, Historic Case HEC-RAS Analysis, B.5.2, Historic Case UPRR Side Weir Calculations, B.5.3, Current Case HEC-RAS Analysis and B.5.4, Current Case UPRR Side Weir Calculations.](#))

The total effect of building removal in the “current” condition results in a total decrease of UPRR overtopping by 46 cfs, with a similar increase in flows

discharged to Charleston, east of the UPRR Bridge. (Refer to Figures 4.5.1, Historic Western Overland Flow Exhibit and 4.5.2, Current Western Overland Flow Exhibit) Appendix B.5 includes output from the HEC-RAS analyses, UPRR weir analyses, and a summary table comparing water surface elevation and flow patterns. (Refer to Figures 5.5.1, Historic Western Avenue Overland Flows, and 5.5.2, Current Western Avenue Overland Flows.)

TABLE 5.5
WESTERN CORRIDOR
HISTORIC -VS- CURRENT CONDITIONS
HYDRAULIC SUMMARY

STA.	Water Surface Elevation			UPPR Side Weir (cfs)			Western Conveyance (cfs)		
	Historic	Current	Difference	Historic	Current	Difference	Historic	Current	Difference
64+00	2058.58	2058.58	+0.00	0	0	+0	1163	1163	+0
62+00	2058.16	2058.16	+0.00	0	0	+0	1163	1163	+0
60+00	2057.54	2057.54	+0.00	0	0	+0	1163	1163	+0
58+00	2056.33	2056.33	+0.00	0	0	+0	1163	1163	+0
56+00	2055.14	2055.14	+0.00	0	0	+0	1163	1163	+0
54+00	2054.09	2054.09	+0.00	0	0	+0	1163	1163	+0
52+00	2053.23	2053.23	+0.00	0	0	+0	1163	1163	+0
50+00	2052.21	2052.21	+0.00	0	0	+0	1163	1163	+0
48+00	2051.08	2051.08	+0.00	0	0	+0	1163	1163	+0
46+00	2049.88	2049.88	+0.00	0	0	+0	1163	1163	+0
44+00	2049.12	2049.12	+0.00	0	0	+0	1163	1163	+0
42+00	2047.89	2047.89	+0.00	0	0	+0	1163	1163	+0
40+00	2046.89	2046.89	+0.00	0	0	+0	1163	1163	+0
38+00	2046.53	2046.53	+0.00	0	0	+0	1163	1163	+0
36+00	2046.16	2046.16	+0.00	0	0	+0	1163	1163	+0
34+00	2045.83	2045.83	+0.00	0	0	+0	1163	1163	+0
32+00	2045.17	2045.17	+0.00	0	0	+0	1163	1163	+0
30+00	2044.56	2044.56	+0.00	0	0	+0	1163	1163	+0
28+00	2043.93	2043.92	-0.01	0	0	+0	1163	1163	+0
26+00	2043.22	2043.42	+0.20	0	0	+0	1163	1163	+0
24+00	2043.23	2043.2	-0.03	0	0	+0	1163	1163	+0
22+00	2042.97	2042.91	-0.06	0	0	+0	1163	1163	+0
20+00	2042.62	2042.33	-0.29	0	0	+0	1163	1163	+0
18+00	2042.61	2042.34	-0.27	0	0	+0	1163	1163	+0
17+00	2042.60	2042.34	-0.26	0	0	+0	1163	1163	+0
16+00	2042.52	2042.31	-0.21	8	0	-8	1155	1163	+8
15+00	2042.40	2042.26	-0.14	51	23	-28	1104	1140	+36
14+00	2042.03	2042.01	-0.02	37	32	-5	1067	1108	+41
13+00	2041.78	2041.65	-0.13	65	34	-31	1002	1074	+72
12+00	2041.78	2041.46	-0.32	178	75	-103	824	999	+175
11+00	2041.23	2041.33	+0.10	113	147	+34	711	852	+141
10+00	2040.85	2040.94	+0.09	113	143	+30	598	709	+111
9+00	2040.36	2040.47	+0.11	79	112	+33	519	597	+78
8+00	2040.03	2040.11	+0.08	85	112	+27	434	485	+51
7+00	2039.41	2039.44	+0.03	17	22	+5	417	464	+47

Note: Refer to Figures 5.5.1, Historic Western Avenue Overland Flows, and 5.5.2, Current Western Avenue Overland Flows.

5.5.2 Existing Conditions with Sahara Ave. Facility

In the Existing Condition with Sahara Ave. facility scenario, offsite from flows west of I-15, south of Sahara, can potentially be intercepted and conveyed east within the Sahara facility. However interception facilities west of Sahara will be required that are not parts of the MPU system. With these interception facilities in place, flows impacting the Western Corridor can potentially be reduced and overland flows reduced or eliminated.

5.5.3 Ultimate Conditions

In the ultimate condition, storm water upstream of Sahara is intercepted and conveyed within proposed MPU drainage facilities. The existing I-15 Freeway Channel and Western RCB are capable of conveying offsite flows, and the overland flow condition along the Western Corridor will be alleviated.

6.0 CONCLUSION

The analysis of offsite hydrology and drainage patterns presented in this report provides 100-year storm flows and drainage patterns along the Project NEON corridor for three anticipated design conditions, and the following has been determined.

6.1 Existing Conditions

Hydrology for the Existing Conditions reflects flows anticipated for Phase I. Facilities in place, including the I-15 Freeway Channel and Western RCB, are not capable of fully conveying the 100-year storm, resulting in overland flow and inundation of existing local roads and properties. Design associated with the NEON project will need to maintain these conditions to avoid adverse impacts to surrounding properties.

6.2 Existing Conditions with Sahara Ave Facility

The Sahara Avenue MPU facility is currently on the CCRFCD Ten Year Construction Program. It is unknown when this facility will be funded and constructed; however, it is feasible that this will be in place at some point during an interim phase, prior to full build out of Project NEON. This facility, when constructed, will intercept a portion of offsite flows south of Sahara, and convey them east. A reduction of flows entering the I-15 Freeway Channel will allow this facility to operate within hydraulic capacity and allows flows from offsite facilities west of I-15, north of Sahara to be fully intercepted.

However, additional facilities west of I-15 would be needed to fully intercept offsite flows impacting the Western Corridor and allow the Western RCB to convey offsite flows without overland inundation.

6.3 Ultimate Conditions

Hydrology and construction timing for proposed 2008 MPU facilities will need to be coordinated with project NEON phasing. The ultimate MPU configuration directs additional flow to I-15, south of Sahara Ave, and a proposed upside of the Freeway Channel, south of Sahara Ave, is proposed within an area of the overall Project NEON footprint. In addition, the ultimate MPU also provides interception of flows west of I-15,

south of Sahara Ave., as needed to prevent flows from being directed to the Western Corridor. The overall NEON footprint proposes widening west into the Western Corridor, in addition to several above grade roadway structures.

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Existing Offsite Hydrology Report

SECTION 3

Figures



Existing Offsite Hydrology Report

FIGURE 3.0

MPU Facility Map

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BDMO 0000	E	BLUE DIAMOND CHANNEL MOHAWK Conc Chnl 10'W 6'D 0:1 SS	570	460	USACE	USACE	0.37	0.70
FLFA 0000	E	FLAMINGO - FASHION 12' X 5' RCB	2050	747	CFW17N	FLAM3A	0.72	0.28
0037	E	8' X 5' RCB	3060	526	FW14	FLAM3A	0.44	0.45
FLFL 0000	E	FLAMINGO WASH - FLAMINGO STORM DRAIN 54' RCP	1370	681	CFW4	FLAM3A	0.68	1.70
0026	E	57' RCP	1370	681	CFW4	FLAM3A	0.68	1.14
0051	E	51' RCP	1390	375	FW3	FLAM3A	0.37	0.96
0077	E	42' RCP	1160	375	FW3	FLAM3A	0.37	1.68
0101	E	45' RCP	1250					3.54
0123	E	39' RCP	790					0.83
0139	E	33' RCP	430					0.83
0147	E	27' RCP	1260					1.19
FLJO 0000	E	FLAMINGO DIVERSION - JONES BRANCH 12' X 6' RCB	3310	1100	USACE	USACE	1.46	1.00
0076	E	96' RCP	2640	780	CTD9	FLAM3A	0.79	1.00
FLLA 0000	E	FLAMINGO WASH - LATERAL (FLAMINGO/RAINBOW) Conc Chnl 20'W 6'D 0:1 SS	2180	1141	CLF32	FLAM3B	2.44	0.75
0041	E	2' 14' X 8' RCB	626	1141	CLF32	FLAM3B	2.44	0.06
0053	E	Conc Chnl 20'W 6'D 0:1 SS	1130	1141	CLF32	FLAM3B	2.44	0.75
0074	E	24' X 10' RCB	40	996	CLF31	FLAM3B	2.21	0.55
0075	E	Earth Chnl 20'W 6'D 0:1 SS	160	996	CLF31	FLAM3B	2.21	0.75
0076	E	114' RCP	1490	996	CLF31	FLAM3B	2.21	0.89
0104	E	114' RCP	5340	797	CLF29	FLAM3B	1.31	0.89
FLRO 0000	E	FLAMINGO WASH - ROCHELLE 60' CMP	4350	294	FW1	FLAM3A	0.29	1.30
FLTR 0000	E	FLAMINGO - TROPICANA DIVERSION CHANNEL Conc Chnl 26'W 19.5'D 0:1 SS	1480	3400	USACE	USACE	4.86	0.11
0014	E	26' X 18' RCBC @ Decatur Blvd	580	3400	USACE	USACE	4.86	0.11
0015	E	Conc Chnl 26'W 18'D 0:1 SS	205	3400	USACE	USACE	4.43	0.11
0020	E	Conc Chnl 13'W 18'D 2:1 SS	610	3400	USACE	USACE	4.43	0.11
0025	E	Conc Chnl 26'W 16.5'D 0:1 SS	500	3400	USACE	USACE	4.43	0.11
0044	E	26' X 16.5' RCBC @ Russell	160	3400	USACE	USACE	4.43	0.11
0046	E	Conc Chnl 13'W 16.5'D 2:1 SS	920	3400	USACE	USACE	4.43	0.11
0065	E	Conc Chnl 19.5'W 18'D 0:1 SS	740	3400	USACE	USACE	4.43	0.11
0076	E	19.5' X 18' RCBC @ Lindell	120	3300	USACE	USACE	4.06	0.11
0078	E	Conc Chnl 13'W 11.5'D 2:1 SS	2410	3300	USACE	USACE	4.06	1.25
0125	E	19.5' X 16.5' RCBC @ Snake	150	3150	USACE	USACE	4.06	1.25
0127	E	Conc Chnl 19.5'W 11.5'D 0:1 SS	2770	3150	USACE	USACE	2.61	1.25
0180	E	19.5 X 15' RCBC @ Torrey Pines Drive	120	2850	USACE	USACE	2.61	0.96
0181	E	Conc Chnl 13'W 11.5'D 2:1 SS	2530	2850	USACE	USACE	2.61	0.96
FLVV 0000	E	FLAMINGO - VALLEY VIEW 10' X 5' RCB	290	577 ^A	CFW6 ^A	FLAM3A	2.14	0.37
0001	P0	Add 1: 90' RCP	290	354 ^A	CFW6 ^A	FLAM3A	2.14	0.37
0006	E	54' & 60' RCP	1200	374 ^A	CFW6 ^A	FLAM3A	2.14	0.67
0007	P0	Add 1: 96' RCP	1200	557 ^A	CFW6 ^A	FLAM3A	2.14	0.67
FLWA 0672	E	FLAMINGO WASH Earth Chnl 25'W 4'D 2.5:1 SS (Replace w/ FLWA0673)	1230	3925	CFW18W	FLAM3B	5.82	0.80
0673	P1	Conc Chnl 25'W 7.5'D 2:1 SS (Replaces FLA0672)	1230	3925	CFW18W	FLAM3B	5.82	0.80
0695	E	5' 12' X 8' RCB	70	3925	CFW18W	FLAM3B	5.82	0.35
0696	E	5' 12' X 8' RCB	200	3925	CFW18W	FLAM3B	5.82	0.30
0699	E	2' 12' X 9' RCB	936	3925	CFW18W	FLAM3B	5.82	0.82
0719	E	2' 15' X 10' RCB	1440	3560	CFW17	FLAM3B	5.29	0.53
0748	E	Conc Chnl 30'W 10'D 0:1 SS	1220	2690	CFW17W	FLAM3B	4.35	0.64
0768	E	Conc Chnl 50'W 6'D 4:1 SS	150	2690	CFW17W	FLAM3B	4.35	0.64
0772	E	4' 8' X 6' RCB	90	2690	CFW17W	FLAM3B	4.35	2.30
0773	E	2' 11' X 7' RCB	1530	2690	CFW17W	FLAM3B	4.35	0.91
0798	E	4' 10' X 10' RCB (Imperial Palace Facility)	680	2690	CFW17W	FLAM3B	4.35	0.40
0810	E	4' 10' X 10' RCB	640	2690	CFW17W	FLAM3B	4.35	0.38
0820	E	8' 10' X 8' RCB	100	2589	CFW13	FLAM3B	4.19	0.38

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
FLWA 0823	E	FLAMINGO WASH 2' 16' X 10' RCB	2610	2589	CFW13	FLAM3B	4.19	0.83
0874	E	6' 10' X 8' RCB	560	2185	CFW12	FLAM3B	3.67	0.82
0884	E	Gabion Chnl 100'W 3.5'D 3:1 SS	320	1763	CFW11	FLAM3B	3.12	0.60
0891	E	7 Span Bridge 84'W 5.5'D @ UPRR	90	1763	CFW11	FLAM3B	3.12	1.30
0892	E	Earth Chnl 60'W 10'D 3:1 SS (Replace w/ FLWA0893)	140	1763	CFW11	FLAM3B	3.12	0.84
0893	P1	Gabion Chnl 20'W 7'D 2:1 SS (Replaces FLWA0892)	140	1763	CFW11	FLAM3B	3.12	0.84
0895	E	Earth Chnl 60'W 10'D 3:1 SS (Replace w/ FLWA0896)	560	1121	CFW11S	FLAM5A	13.54	0.84
0896	P1	Gabion Chnl 20'W 6'D 3:1 SS (Replaces FLWA0895)	560	1121	CFW11S	FLAM5A	13.54	0.84
0901	E	4' 12' X 10' RCBC @ Flamingo/Industrial Connector	180	1121	CFW11S	FLAM5A	13.54	0.60
0902	E	Earth/Conc Chnl 30'W 15'D 1:1 SS (Replace w/ FLWA0903)	1000	1121	CFW11S	FLAM5A	13.54	0.72
0903	P1	Conc Chnl 30'W 4'D 1:1 SS (Replaces FLWA0902)	1000	1121	CFW11S	FLAM5A	13.54	0.72
0923	E	3' 20' X 5' RCAC @ Valley	80	1121	CFW11S	FLAM5A	13.54	1.10
0924	E	Earth Chnl 60'W 14'D 1:1 SS (Replace w/ FLWA0925)	800	1121	CFW11S	FLAM5A	13.54	1.00
0925	P1	Gabion Chnl 20'W 6'D 2:1 SS (Replaces FLWA0924)	800	1121	CFW11S	FLAM5A	13.54	1.00
0940	E	Earth Chnl 60'W 14'D 1:1 SS (Replace w/ FLWA0941)	2700	938	CFW2	FLAM5A	12.91	1.00
0941	P1	Gabion Chnl 20'W 5'D 2:1 SS (Replaces FLWA0940)	2700	938	CFW2	FLAM5A	12.91	1.00
0990	E	7' 12' X 5' RCB	130	898	LWFLDB	FLAM4B	8.91	1.50
0991	E	3' 10' X 8' RCB	1970	898	LWFLDB	FLAM4B	8.91	1.00
1025	E	7' 10' X 5' RCB	100	898	LWFLDB	FLAM4B	8.91	1.10
1026	E	2' 24' X 9' RCAP	450	898	LWFLDB	FLAM4B	8.91	0.43
1033	E	3' 12' X 10' RCAP	680	898	LWFLDB	FLAM4B	8.91	0.43
1039	E	3' 12' X 10' RCBC @ Decatur	90	898	LWFLDB	FLAM4B	8.91	1.60
1048	P3	28,950 cfs PMF Spillway	28950		CLF33	FLAM4B	8.91	
1049	P3	2' 72' RCP Outlet	90	898	LWFLDB	FLAM4B	8.91	
1050	P3	222 ac-ft Lower Flamingo Detention Basin	2984		CLF33	FLAM4B	8.91	
1111	E	Riprap Chnl 40'W 5'D 2:1 SS	2470	1909	CLF20A	FLAM3A	7.86	1.35
1149	E	Conc Chnl 50'W 8'D 2:1 SS	150	1885	CLF20	FLAM3B	5.06	1.00
1151	E	4' 10' X 8' RCBC @ Jones	100	1885	CLF20	FLAM3B	5.06	1.70
1152	E	Earth Chnl 50'W 8'D 3:1 SS (Replace w/ FLWA1153)	2600	1885	CLF20	FLAM3B	5.06	0.44
1153	P1	Gabion Chnl 50'W 6'D 2:1 SS (Replaces FLWA1152)	2600	1885	CLF20	FLAM3B	5.06	0.44
1202	E	4' 10' X 8' RCBC @ Torrey Pines	90	1885	CLF20	FLAM3B	5.06	1.00
1203	E	Earth/Conc Chnl 40'W 10'D 2:1 SS (Replace w/ FLWA1204)	1640	1885	CLF20	FLAM3B	5.06	1.40
1204	P1	Conc Chnl 40'W 4'D 2:1 SS (Replaces FLWA1203)	1640	1885	CLF20	FLAM3B	5.06	1.40
FWVW 0025	P1	VALLEY VIEW DRAIN 10' X 10' RCB	2665	1006	CR4C1	SW3	1.74	0.30
0050	P1	8' X 6' RCB	7785	712	DFW5	SW3	1.34	1.50
NBSC 0000	E	TROPICANA WASH - NORTH BRANCH SCHIRLLS 60' RCP	1350	477	TW6	FLAM3A	0.43	0.80
TRBD 0000	E	BLUE DIAMOND CHANNEL Conc Chnl 10'W 10'D 2:1 SS	1700	4850	USACE	USACE	8.62	0.70
0014	E	23' X 10' RCBC @ Decatur	130	4850	USACE	USACE	8.62	0.70
0015	E	Conc Chnl 10'W 10'D 2:1 SS	3070	4750	USACE	USACE	8.37	0.90
0075	E	Conc Chnl 19.5'W 12'D 0:1 SS	400	4750	USACE	USACE	8.37	0.48
0083	E	2' 14' X 11' RCBC @ Sunset	120	4750	USACE	USACE	8.06	0.48
0084	E	Conc Chnl 19.5'W 12'D 0:1 SS	550	4750	USACE	USACE	8.06	0.48
0096	E	Conc Chnl 28'W 9'D 0:1 SS	760	4750	USACE	USACE	7.70	1.00
TRMC 0000	E	TROPICANA WASH - MCCARRAN AIRPORT Conc Chnl 10'W 4.5'D 2:1 SS (Replace w/ TRMC0001)	450	1222	CTW10S	FLAM3A	4.82	0.30
0001	P1	2' 12' X 7' RCB (Replaces TRMC0000)	450	1222	CTW10S	FLAM3A	4.82	0.30
0010	E	12' X 4' RCBC @ Harmon	80	603 ^A	CTW10S ^A	FLAM3A	4.82	0.50
0011	P1	Add 2: 12' X 4' RCBC @ Harmon	80	619 ^A	CTW10S ^A	FLAM3A	4.82	0.50
0012	E	Earth Chnl 18'W 5'D 2:1 SS (Replace w/ TRMC0013)	925	800	DTRMC	FLAM3A	4.32	0.45
0013	P1	Conc Chnl 20'W 6'D 0:1 SS (Replaces TRMC0012)	925	800	DTRMC	FLAM3A	4.32	0.45
0030	E	Earth Chnl 18'W 5'D 2:1 SS (Replace w/ TRMC0031)	1575	800	DTRMC	FLAM3A	4.32	0.45
0031	P1	Conc Chnl 20'W 6'D 0:1 SS (Replaces TRMC0030)	1575	800	DTRMC	FLAM3A	4.32	0.45
0033	P1	120 ac-ft Tropicana Wash - McCarran Airport Offline DB	2075		DTRSW	FLAM3A	4.32	
0060	E	5' 10' X 4' RCBC @ Tropicana Ave	120	2875	CMC11	FLAM3A	4.32	0.70
0062	P0	Add 1: 14' X 6' RCB	7100	932 ^A	CMC9 ^A	FLAM3A	3.24	0.50
0063	E	2' 8' X 6' RCB	7100	1205 ^A	CMC9 ^A	FLAM3A	3.24	0.50
0195	E	Conc Chnl 12'W 5'D 1.5:1 SS (Replace w/ TRMC0196)	1350	2137	CMC9	FLAM3A	3.24	0.60

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
TRMC		TROPICANA WASH - MCCARRAN AIRPORT						
0196	P0	Conc Chnl 12'W 8'D 1.5:1 SS (Replaces TRMC0195)	1350	2137	CMC9	FLAM3A	3.24	0.60
0215	E	Single Span Bridge 40'W 7'D @ Four Seasons	40	2137	CMC9	FLAM3A	3.24	0.90
0216	E	Conc Chnl 12'W 5'D 1.5:1 SS	930	2137	CMC9	FLAM3A	3.24	1.42
0233	E	2: 8' X 6' RCBC @ Dewey	40	1705 ^A	CMC9 ^A	FLAM3A	3.24	1.00
0234	P0	Add 2: 8' X 6' RCBC @ Dewey	40	432 ^A	CMC9 ^A	FLAM3A	3.24	1.00
0235	E	Conc Chnl 12'W 5'D 1.5:1 SS	1170	2137	CMC9	FLAM3A	3.24	0.80
0263	E	2: 10' X 6' RCB	1500	1793	CMC8	FLAM3A	2.72	1.28
0290	E	Riprap Chnl 30'W 2'D 4:1 SS	2440	283	MC8	FLAM3A	0.51	0.79
TRNB		TROPICANA WASH - NORTH BRANCH						
0000	E	Conc Chnl 17'W 5'D 0:1 SS	110	748	CTW8W	FLAM3A	1.78	1.19
0015	E	2: 15' X 4' RCBC @ Industrial	180	748	CTW8W	FLAM3A	1.78	0.20
0020	E	Conc Chnl 17'W 5'D 0:1 SS	170	748	CTW8W	FLAM3A	1.78	4.22
0030	E	Earth/Conc Chnl 15'W 8'D 2:1 SS (Replace w/ TRNB0031)	1190	748	CTW8W	FLAM3A	1.78	1.10
0031	P1	Conc Chnl 12'W 6'D 0:1 SS (Replaces TRNB0030)	1190	748	CTW8W	FLAM3A	1.78	1.10
0040	E	20' X 4.5' RCAP	1041	748	CTW8W	FLAM3A	1.78	1.00
0060	E	3: 9' X 5' RCB	115	673	TNDB	FLAM3A	1.50	1.00
0062	E	20' X Varies 5' - 9' RCAP	284	673	TNDB	FLAM3A	1.50	0.77
0067	P1	Gabion Chnl 12'W 5.5'D 2:1 SS	1180	673	TNDB	FLAM3A	1.50	1.32
0089	P1	9' X 6' RCB	274	673	TNDB	FLAM3A	1.50	1.00
0092	P3	90' RCP Outlet	152	673	TNDB	FLAM3A	1.50	1.00
0093	P3	14,000 cfs PMF Spillway		14000	CTW6	FLAM3A	1.50	
0094	P3	56 ac-ft Tropicana North Branch Detention Basin		1305	CTW6	FLAM3A	1.50	
0105	P3	Conc Chnl 30'W 5'D 0:1 SS	55	1305	CTW6	FLAM3A	1.50	1.18
0106	P3	2: 14' X 6' RCBC @ Schirlis	50	878	CTW7	FLAM3A	1.07	1.00
0107	P1	Conc Chnl 30'W 5'D 0:1 SS	220	878	CTW7	FLAM3A	1.07	1.18
0113	P1	Conc Chnl 26.5'W 7'D 0:1 SS	259	878	CTW7	FLAM3A	1.07	1.18
TRSW		TROPICANA WASH - SWENSEN AVENUE						
0000	P1	72" RCP	1925	222	TRMCDB	FLAM3A	4.32	0.50
0036	P1	72" RCP	2380	222	TRMCDB	FLAM3A	4.32	0.40
TRWA		TROPICANA WASH						
0033	E	Earth Chnl 100'W 8'D 3:1 SS (Replace w/ TRWA0034)	270	3208	CTW11	FLAM3B	6.93	1.21
0034	P1	Gabion Chnl 100'W 5'D 3:1 SS (Replaces TRWA0033)	270	3208	CTW11	FLAM3B	6.93	1.21
0039	E	6: 12' X 8' RCBC	40	3208	CTW11	FLAM3B	6.93	1.20
0040	E	Earth Chnl 100'W 8'D 3:1 SS (Replace w/ TRWA0041)	880	3208	CTW11	FLAM3B	6.93	1.21
0041	P1	Conc Chnl 50'W 6'D 2:1 SS (Replaces TRWA0040)	880	3208	CTW11	FLAM3B	6.93	1.21
0056	E	6: 12' X 4' RCB	900	2891	CTW10	FLAM3B	6.51	1.21
0074	E	10: 10' X 4' RCBC @ Paradise	120	2891	CTW10	FLAM3B	6.51	1.10
0075	E	3: 21' X 6' RCB	820	2891	CTW10	FLAM3B	6.51	0.70
0092	E	Grass Chnl 30'W 5'D 4:1 SS	210	2891	CTW10	FLAM3B	6.51	0.90
0096	E	2: 25' X 10' RCAC	30	2891	CTW10	FLAM3B	6.51	0.90
0097	E	Grass Chnl 30'W 5'D 4:1 SS	300	2891	CTW10	FLAM3B	6.51	0.90
0103	E	3: 16' X 7' RCAP	808	2891	CTW10	FLAM3B	6.51	0.44
0121	E	3: 10' X 6' RCB	1760	2891	CTW10	FLAM3B	6.51	1.27
0150	E	21' X 7' RCB	120	1796	CTW9	FLAM3B	1.69	1.27
0151	E	3: 8' X 7' RCB	100	1796	CTW9	FLAM3B	1.69	1.50
0152	E	2: 12' X 7' RCB	2730	1796	CTW9	FLAM3B	1.69	1.00
0192	E	3: 10' X 7' RCB	700	1796	CTW9	FLAM3B	1.69	0.75
0210	E	4: 10' X 6' RCB	200	1796	CTW9	FLAM3B	1.69	0.50
0218	E	3: 9.5' X 5.5' & 1: 10' X 5.5' RCB	1100	1796	CTW9	FLAM3B	1.69	0.45
0234	E	4: 8' X 7' RCB	1920	1796	CTW9	FLAM3B	1.69	0.86
0278	E	Conc Chnl 17'W 7'D 0:1 SS	310	1248	CTW3	FLAM3B	1.17	1.23
0284	E	Conc Chnl 19.5'W 7'D 0:1 SS	1700	1248	CTW3	FLAM3B	1.17	0.79
0310	E	Conc Chnl 15'W 6.5'D 0:1 SS	110	955	CTW2	FLAM3B	0.87	1.21
0314	E	15' X 6.5' RCB	3580	955	CTW2	FLAM3B	0.87	1.05
0382	E	10' X 6' RCB	400	557	CTW1	FLAM5A	175.32	1.02
0395	E	10' X 6' RCB	720	557	CTW1	FLAM5A	175.32	1.02
0404	E	Conc Chnl 10'W 6'D 0:1 SS	860	557	CTW1	FLAM5A	175.32	0.88
0422	E	10' X 6' RCB	1040	557	CTW1	FLAM5A	175.32	1.13
0433	E	Conc Chnl 10'W 6'D 0:1 SS	270	557	CTW1	FLAM5A	175.32	2.85
0439	E	10' X 7' RCBC @ UPRR	90	495	TRDB	FLAM5A	174.91	0.25

SECTION 4

FIGURES



Existing Offsite Hydrology Report

SECTION 4

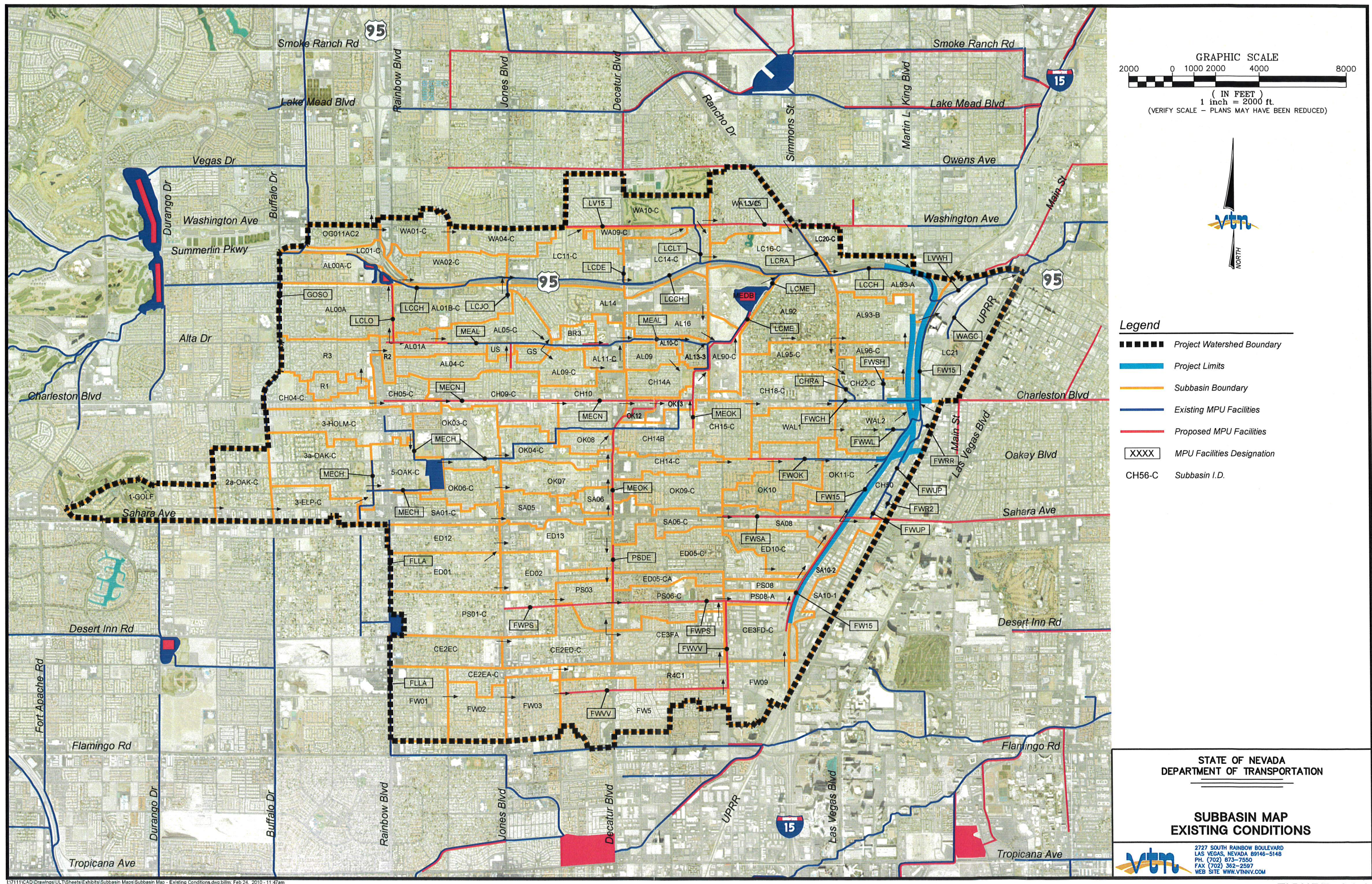
Figures



Existing Offsite Hydrology Report

FIGURE 4.1.1

Sub Basin Map Existing Conditions





Existing Offsite Hydrology Report

FIGURE 4.1.2

Flow Exhibit Existing Conditions

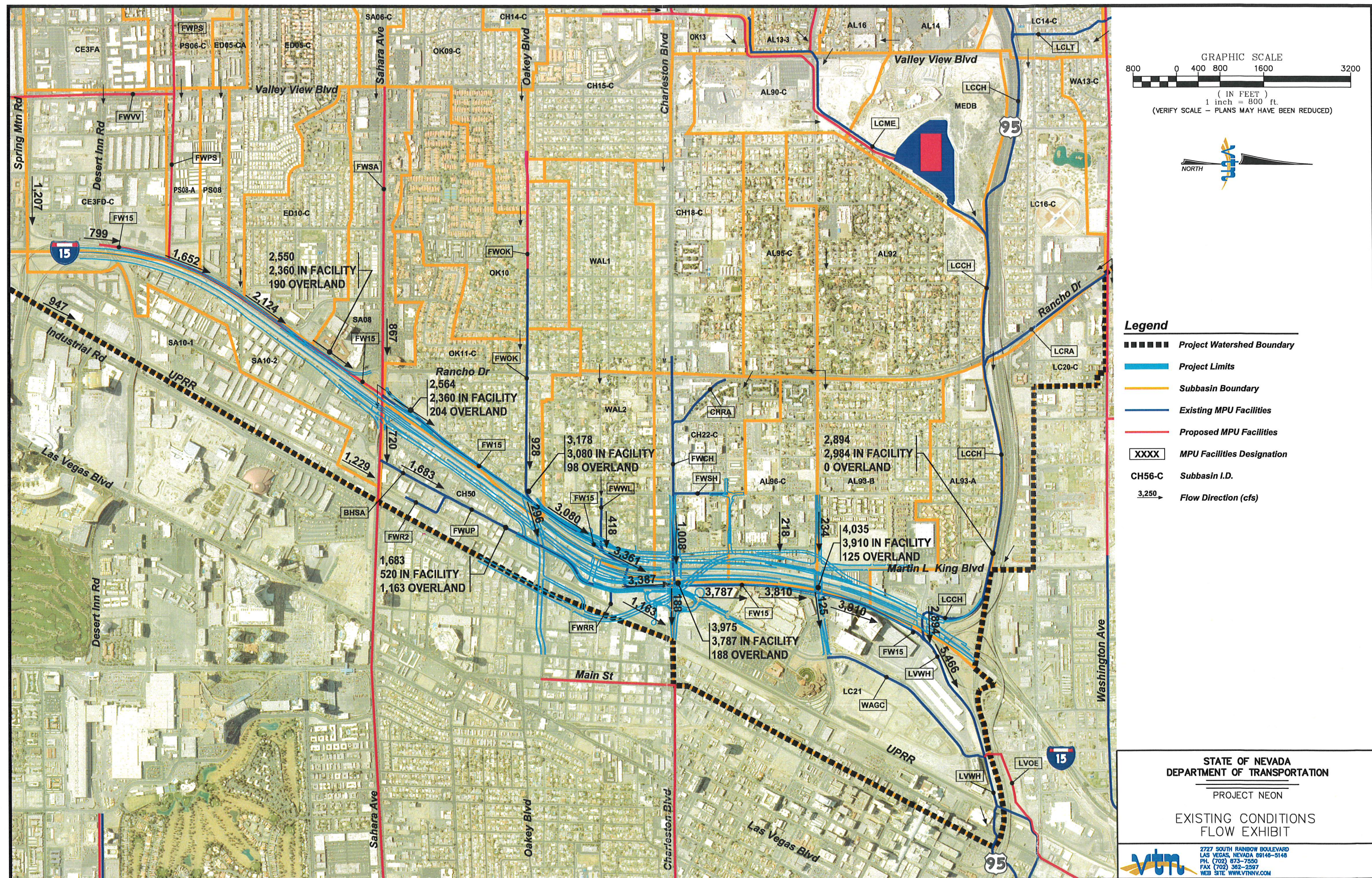


FIGURE 4.1.2



Existing Offsite Hydrology Report

FIGURE 4.1.3

Offsite Facility and Flow Exhibit



Existing Offsite Hydrology Report

SECTION 5

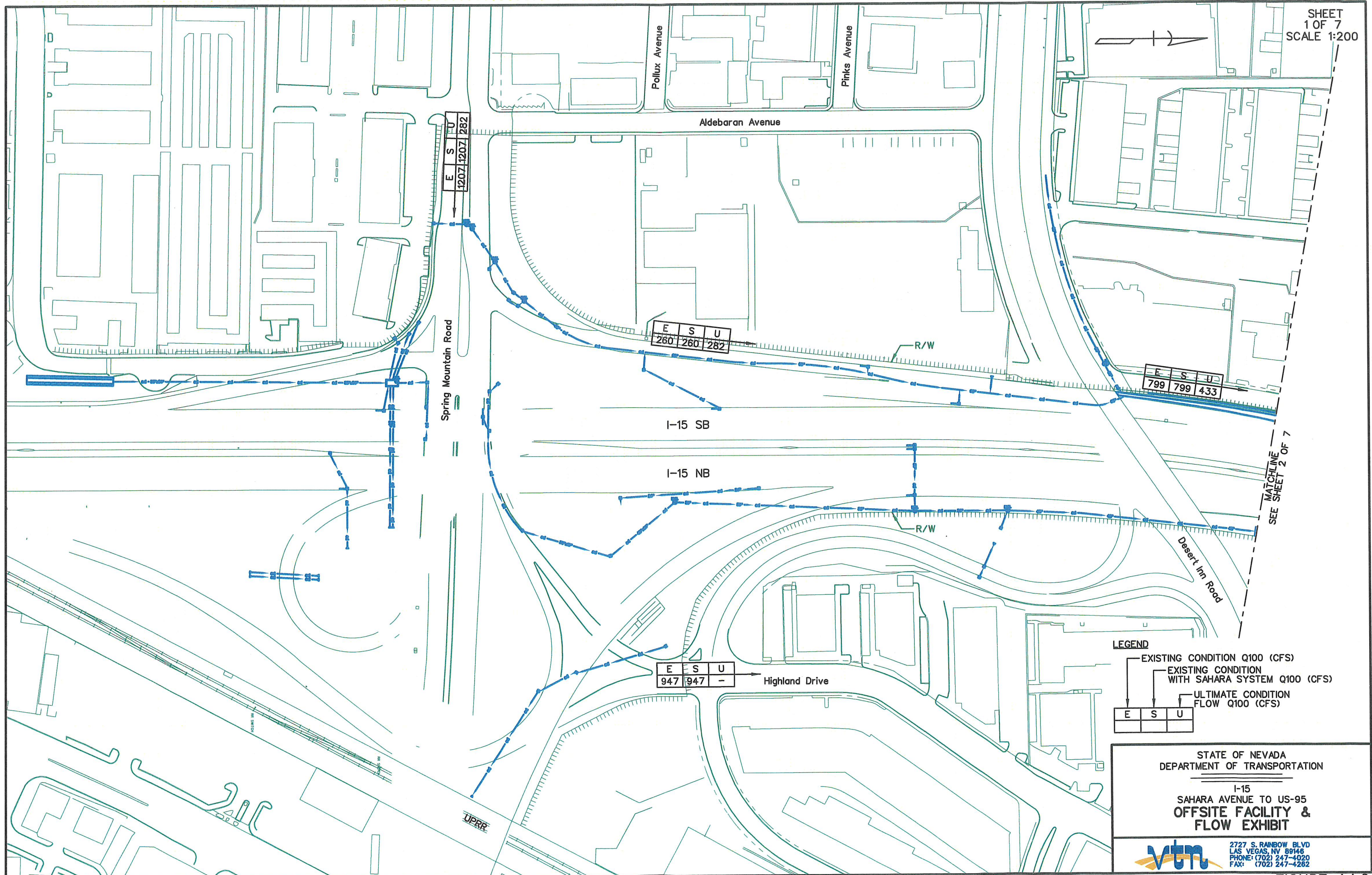
Figures

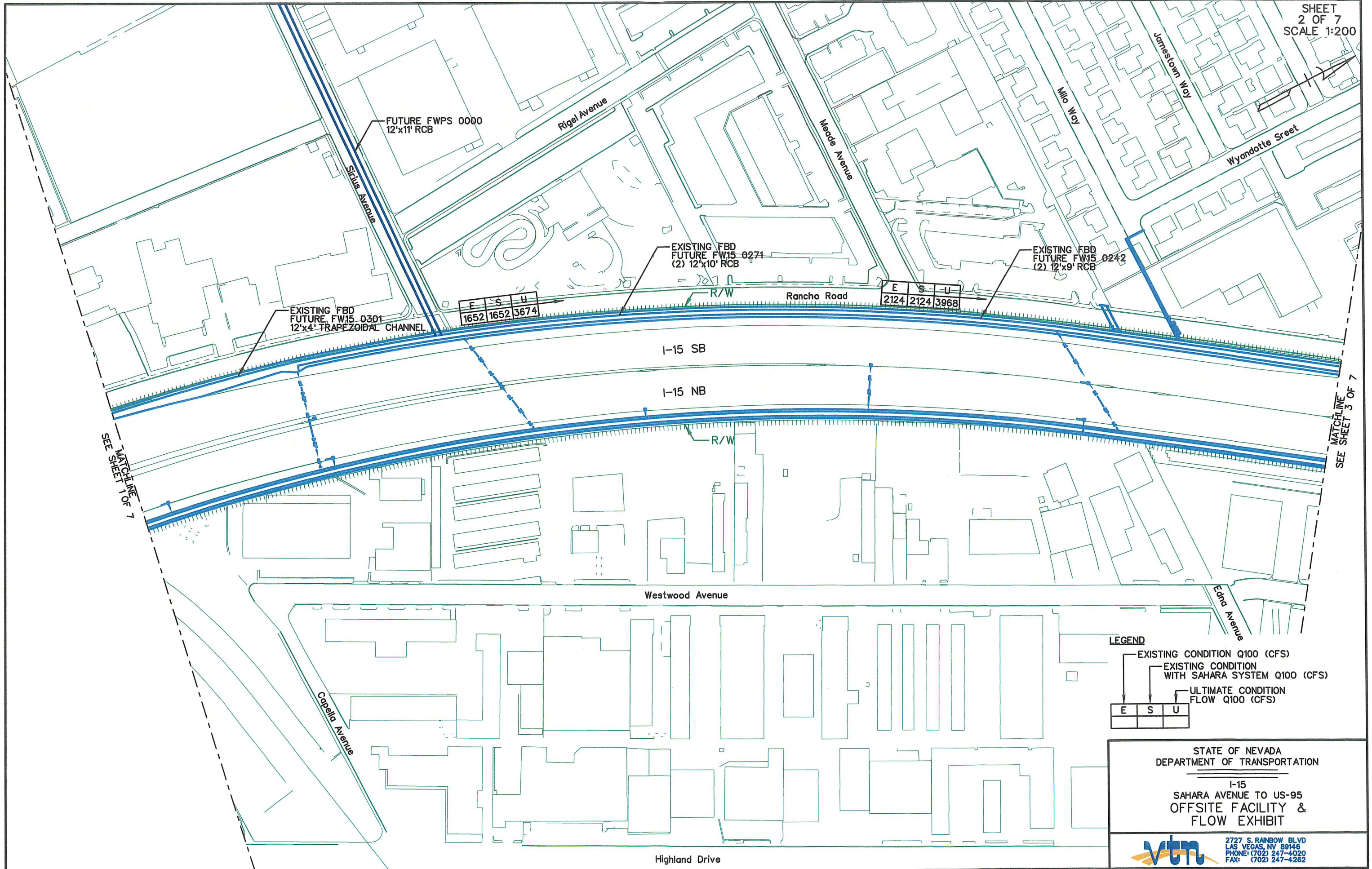


Existing Offsite Hydrology Report

FIGURE 5.4.1

Existing Rancho South Overland Flows





LEGEND

- EXISTING CONDITION Q100 (CFS)
- EXISTING CONDITION WITH SAHARA SYSTEM Q100 (CFS)
- ULTIMATE CONDITION FLOW Q100 (CFS)

E	S	U
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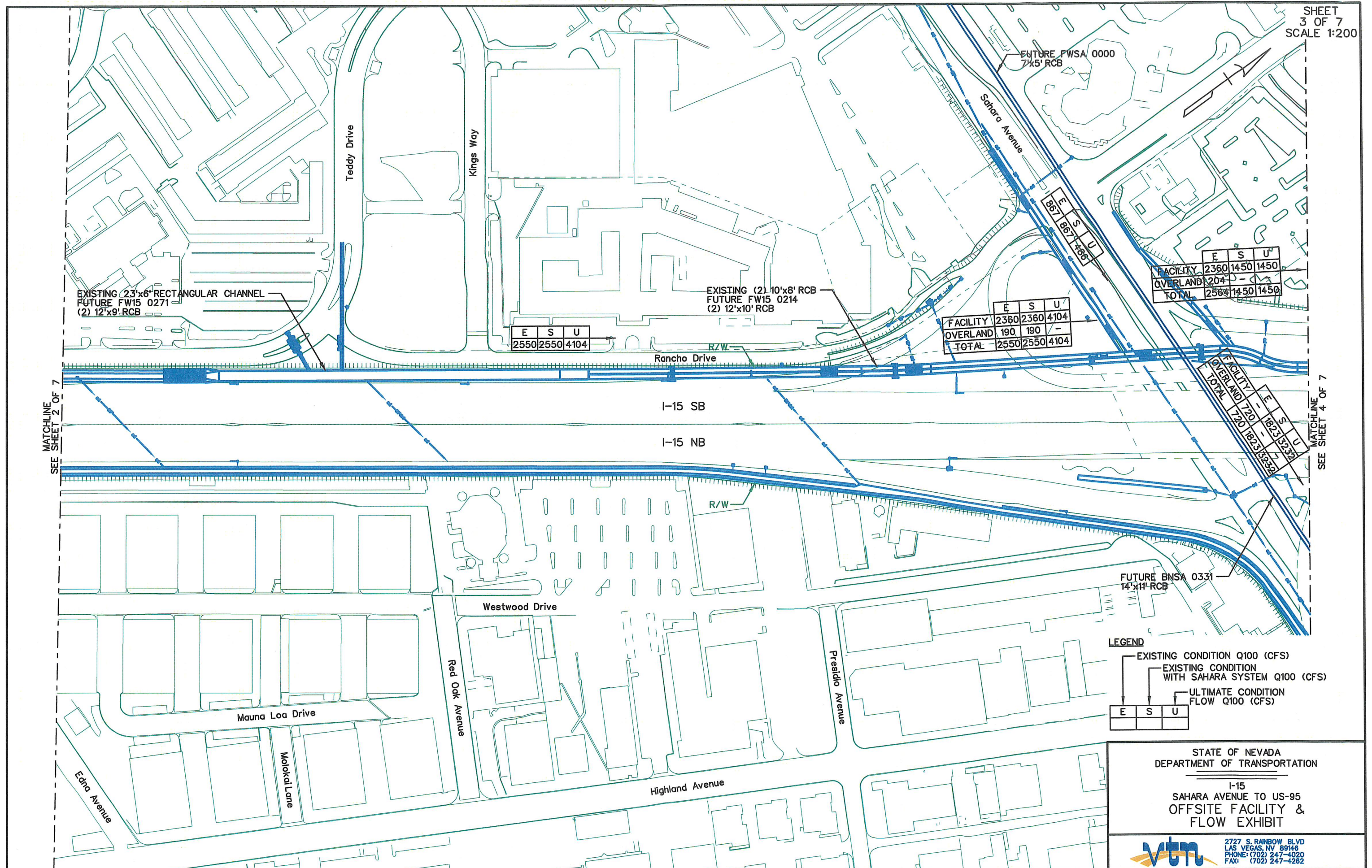
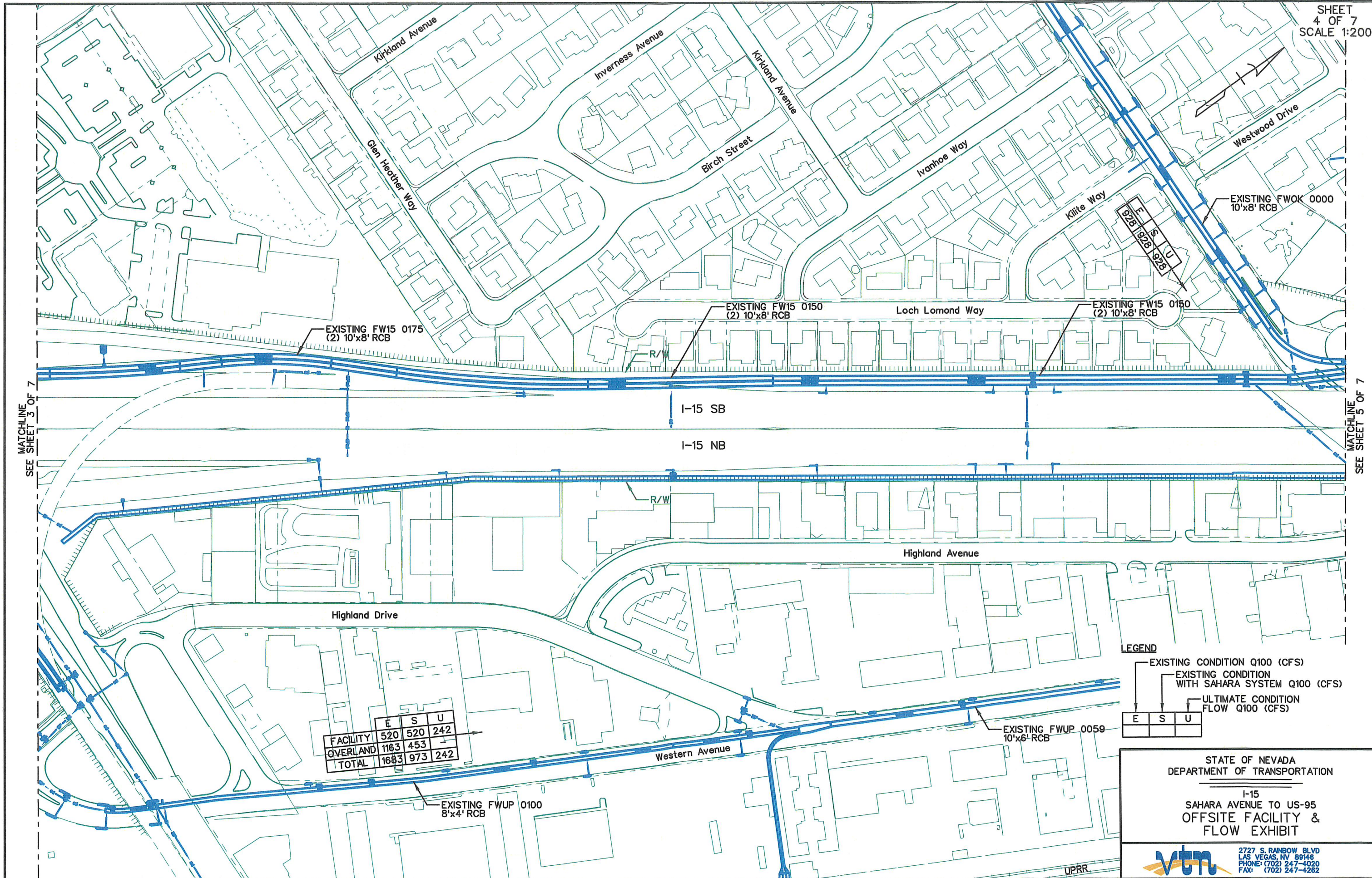


FIGURE 4.1.3



	E	S	U
FACILITY	520	520	242
OVERLAND	1163	453	-
TOTAL	1683	973	242

LEGEND

- EXISTING CONDITION Q100 (CFS)
- EXISTING CONDITION WITH SAHARA SYSTEM Q100 (CFS)
- ULTIMATE CONDITION FLOW Q100 (CFS)

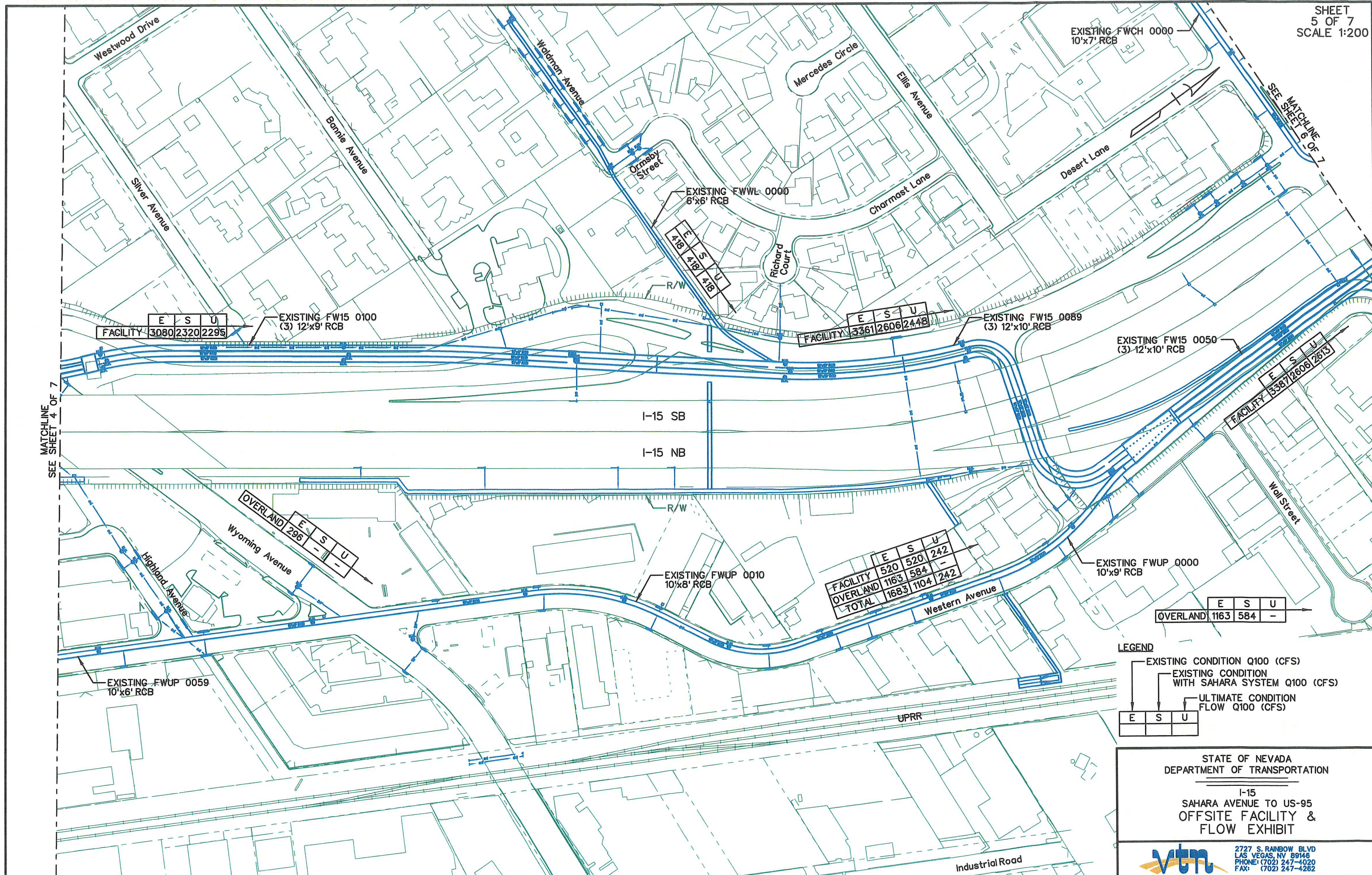
E	S	U
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FIGURE 4.1.3



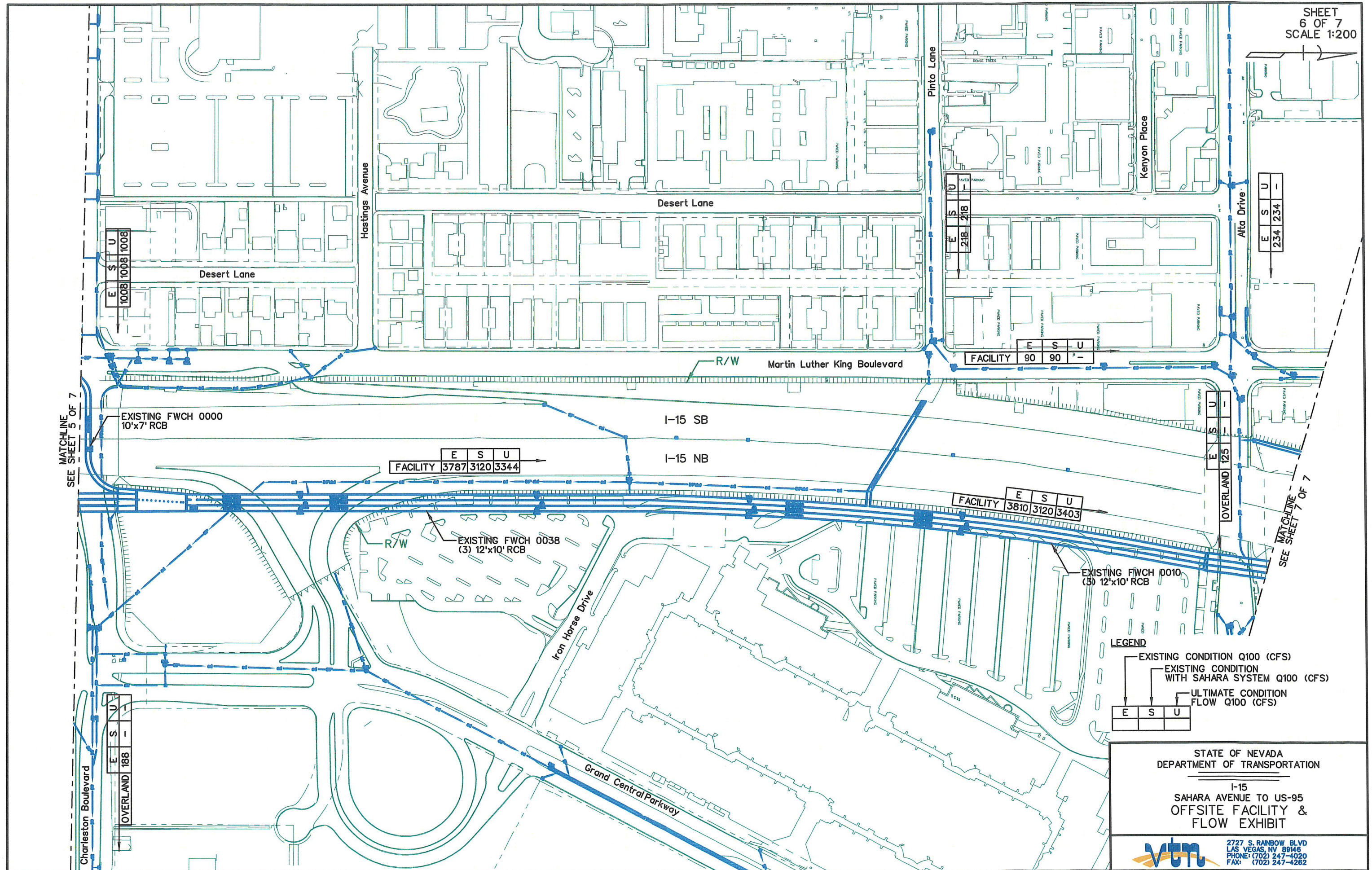
LEGEND

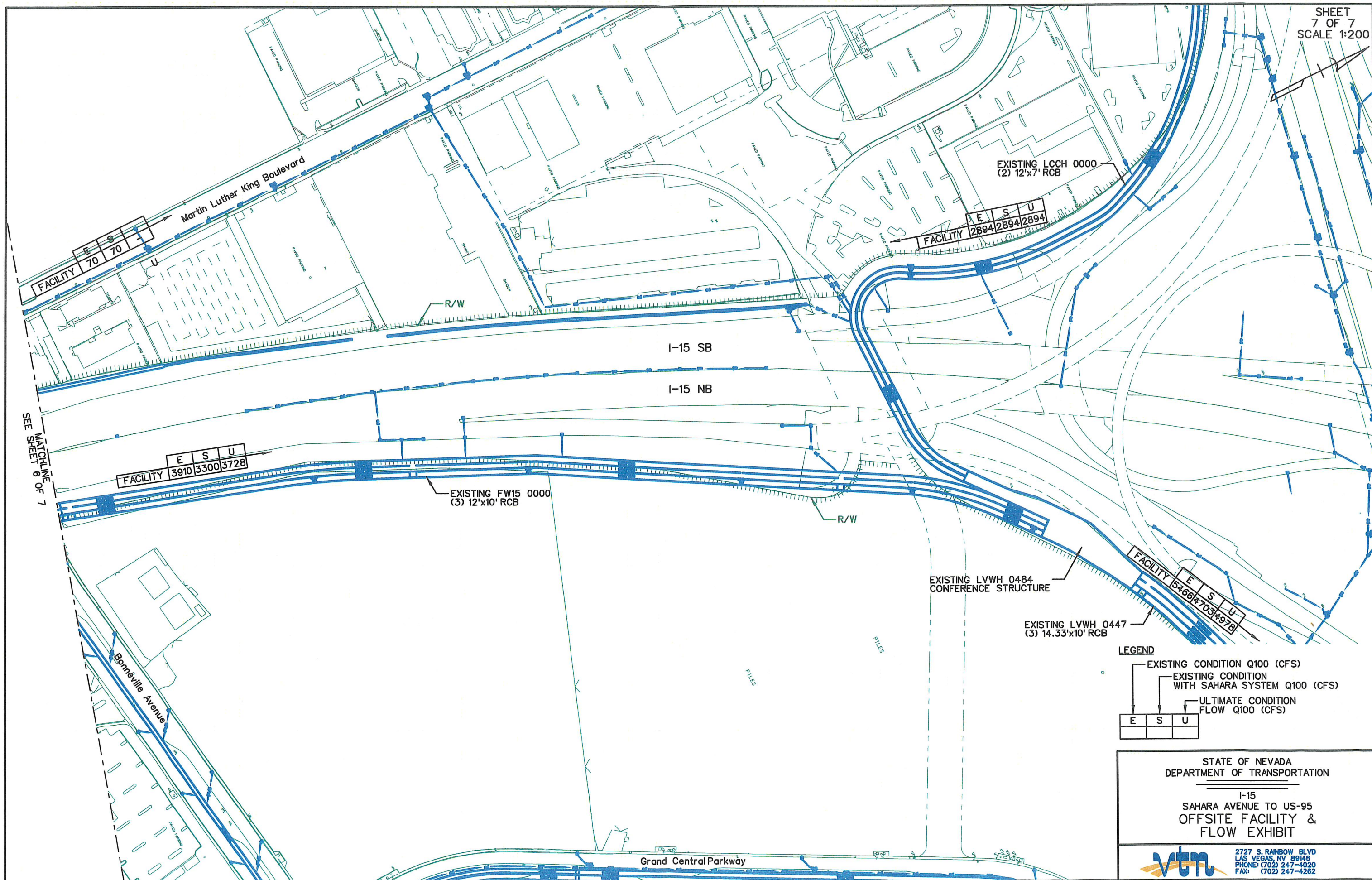
EXISTING CONDITION Q100 (CFS)		
EXISTING CONDITION WITH SAHARA SYSTEM Q100 (CFS)		
ULTIMATE CONDITION FLOW Q100 (CFS)		
E	S	U

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LEGEND

EXISTING CONDITION Q100 (CFS)

EXISTING CONDITION WITH SAHARA SYSTEM Q100 (CFS)

ULTIMATE CONDITION FLOW Q100 (CFS)

E	S	U
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Existing Offsite Hydrology Report

FIGURE 4.2.1

**Existing Conditions with
Sahara Avenue Facilities
Flow Exhibit**

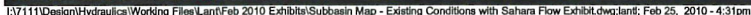


FIGURE 4.2.1



Existing Offsite Hydrology Report

FIGURE 4.3.1

Sub Basin Map Ultimate Conditions

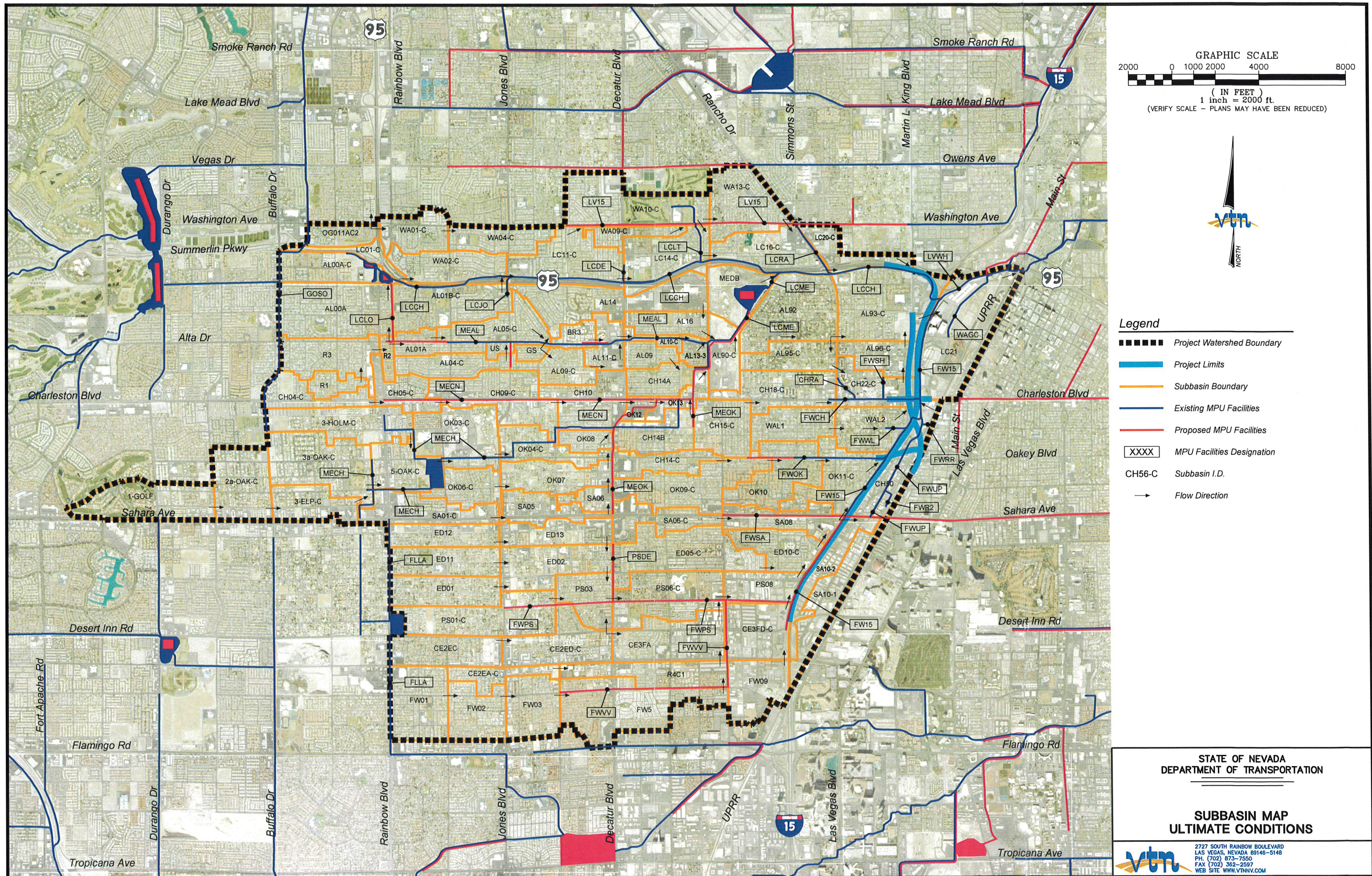


FIGURE 4.3.1

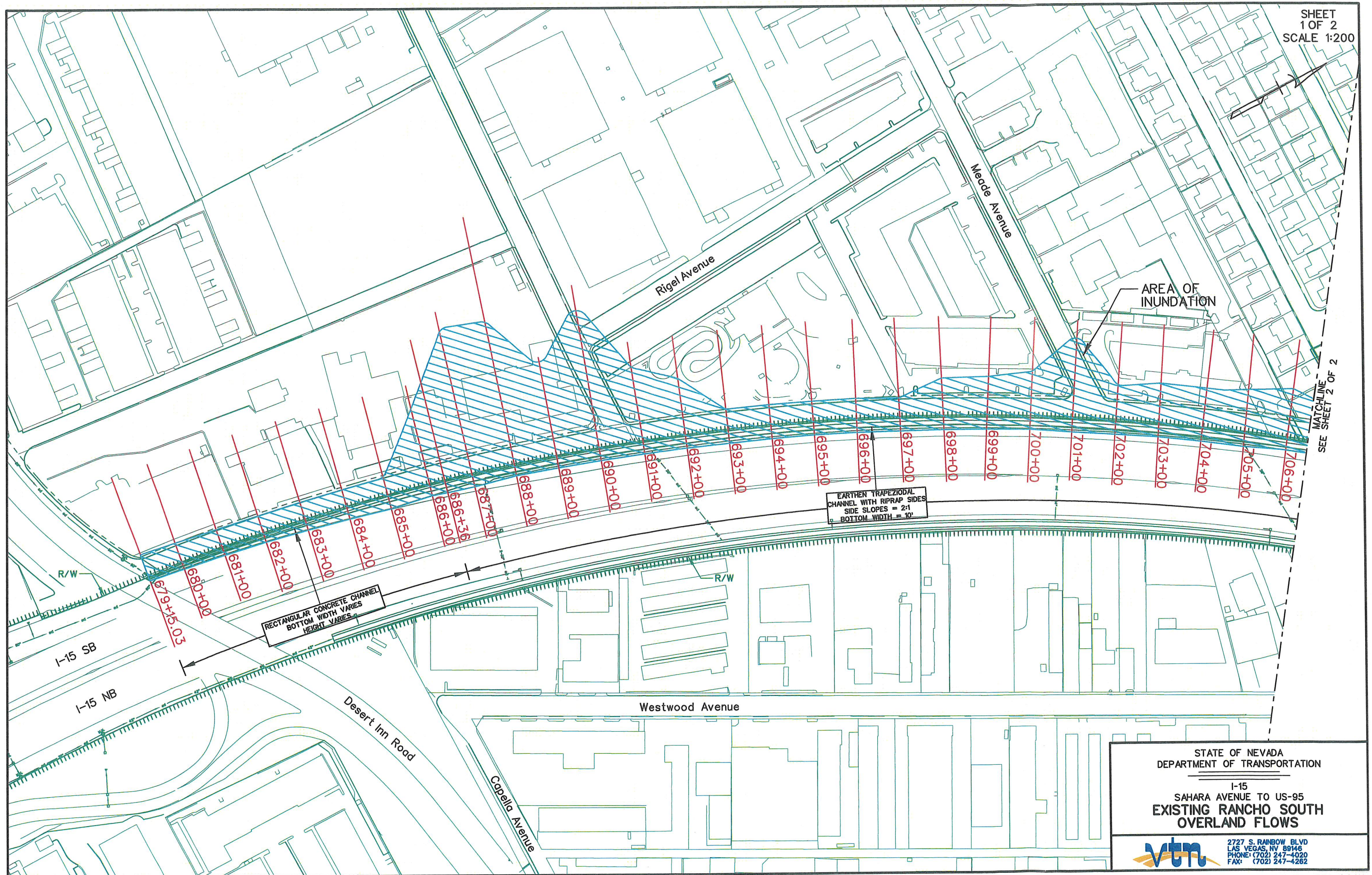


Existing Offsite Hydrology Report

FIGURE 4.3.2

Flow Exhibit Ultimate Conditions





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I-15
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EXISTING RANCHO SOUTH
OVERLAND FLOWS

vtn

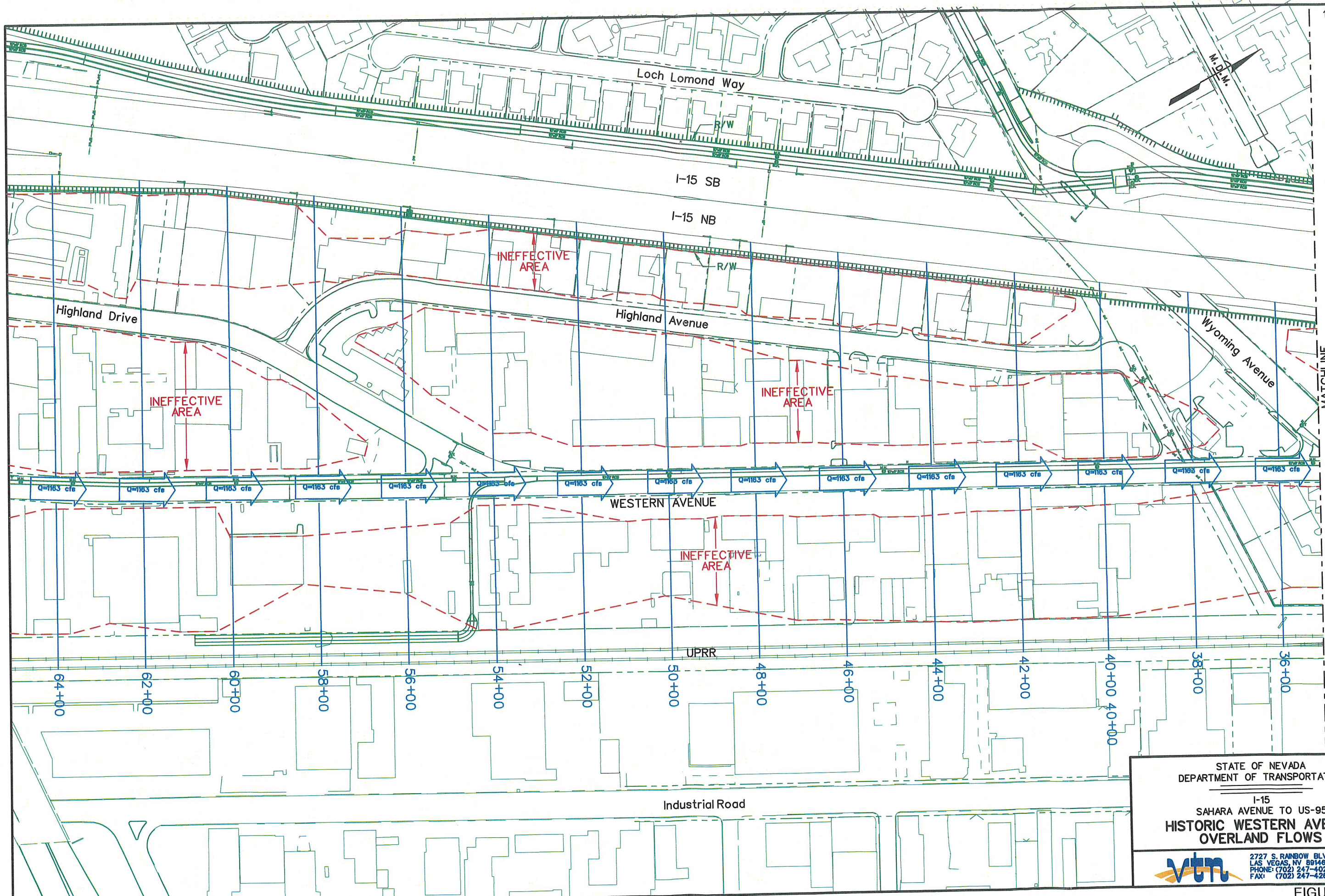
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Existing Offsite Hydrology Report

FIGURE 5.5.1

Historic Western Avenue Overland Flows



SEE SHEET 2 OF 2

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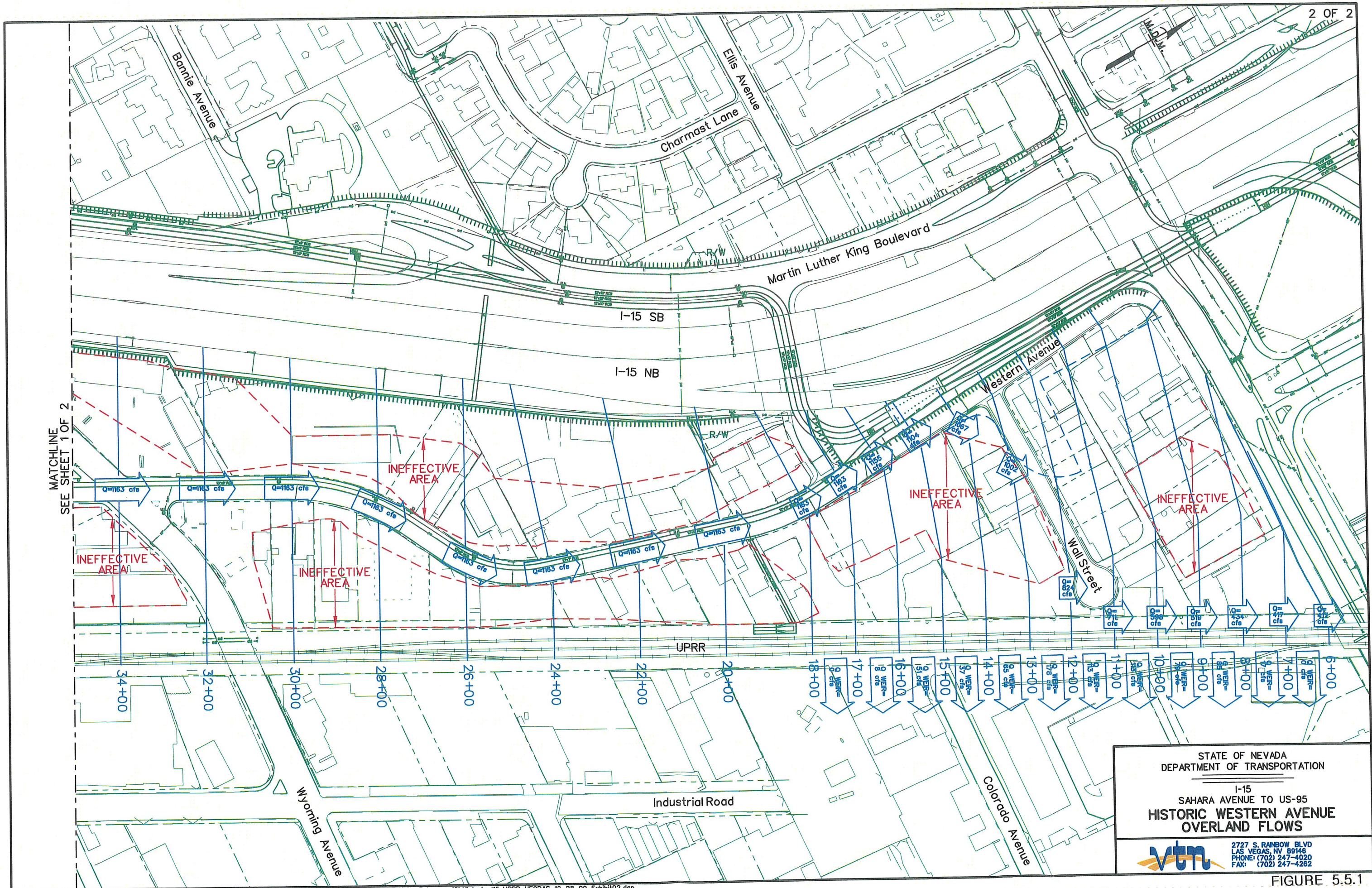
I-15
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**HISTORIC WESTERN AVENUE
OVERLAND FLOWS**



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FIGURE 5.5.1

MATCHLINE
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**HISTORIC WESTERN AVENUE
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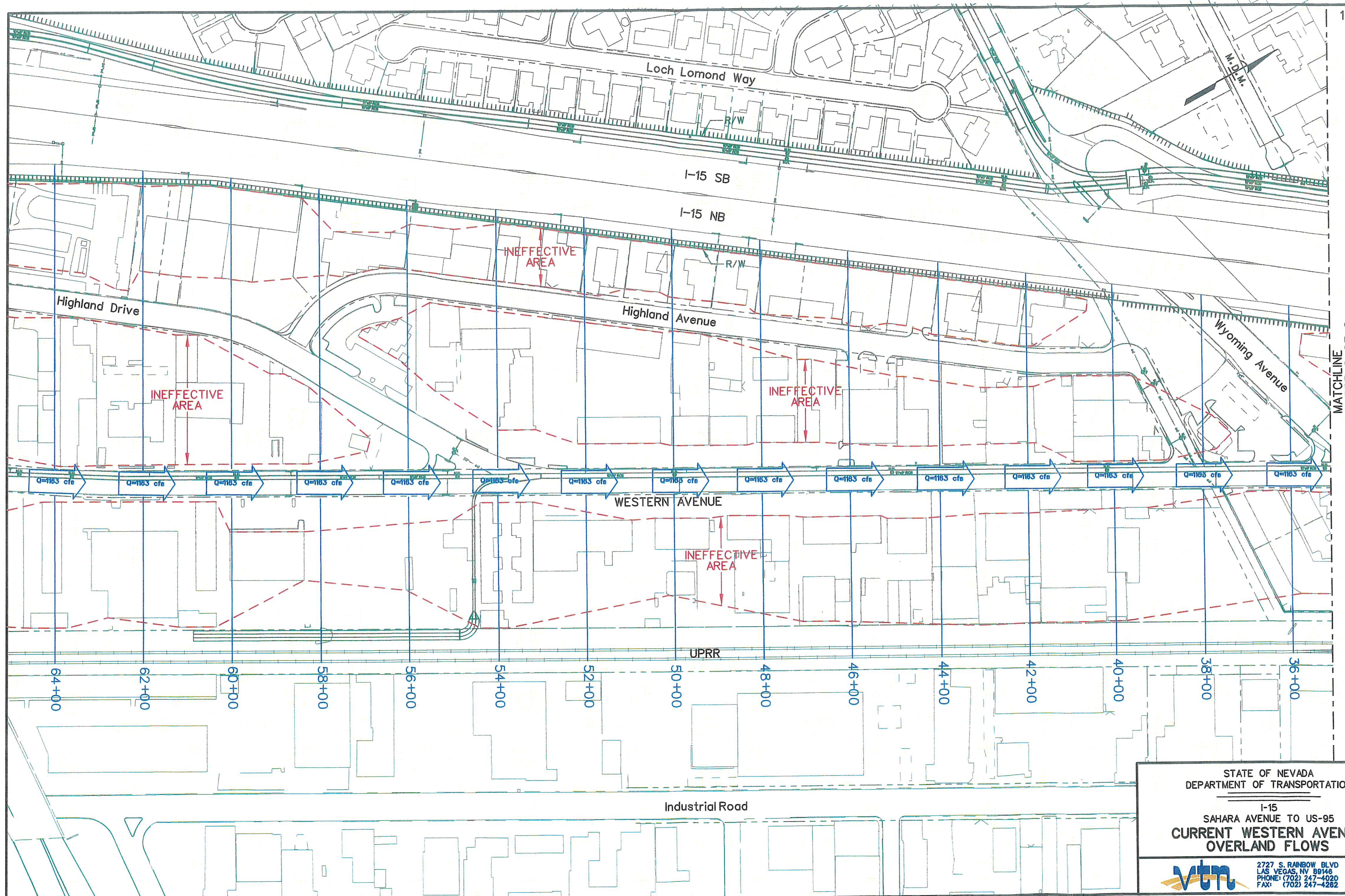
FIGURE 5.5.1



Existing Offsite Hydrology Report

FIGURE 5.5.2

Current Western Avenue Overland Flows

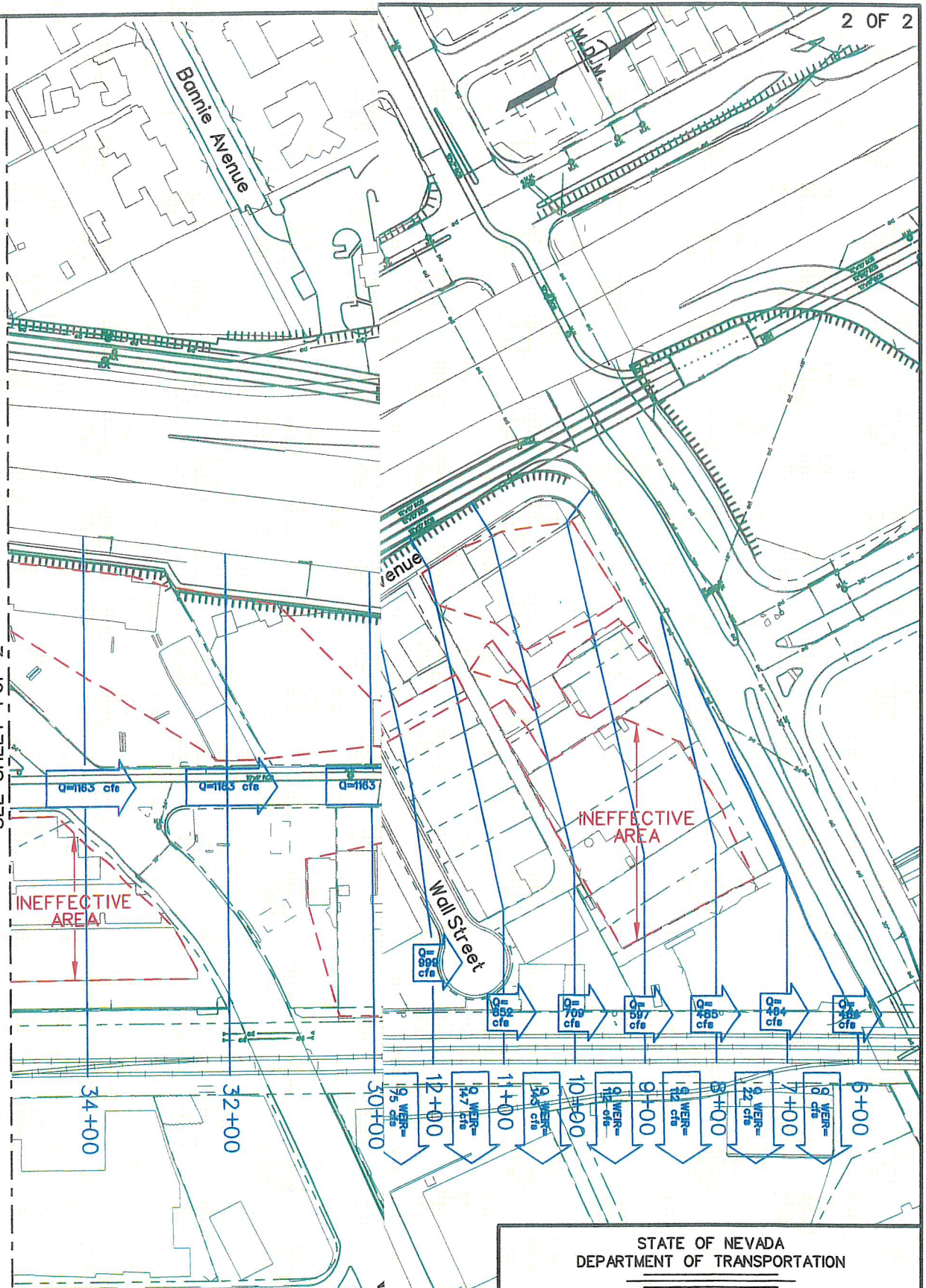


STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

I-15
SAHARA AVENUE TO US-95
**CURRENT WESTERN AVENUE
OVERLAND FLOWS**



2727 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 247-4020
FAX: (702) 247-4282

MATCHLINE
SEE SHEET 1 OF 2STATE OF NEVADA
DEPARTMENT OF TRANSPORTATIONI-15
SAHARA AVENUE TO US-95
CURRENT WESTERN AVENUE
OVERLAND FLOWS2727 S. RAINBOW BLVD
LAS VEGAS, NV 89146
PHONE: (702) 247-4020
FAX: (702) 247-4262



Existing Offsite Hydrology Report

APPENDIX A

Hydrologic Analysis



Existing Offsite Hydrology Report

A.1

Hydrologic Methodology

APPENDIX A.1 HYDROLOGIC METHODOLOGY

I Introduction

The hydrologic analysis is intended to provide the site-specific runoff/frequency relationship for the project area and is based on the 2008 MPU HEC-1 Hydrologic Model. HEC-1 utilizes the Soil Conservation Service (SCS) Unit Hydrograph Method to model subbasin storm hydrographs, and the Muskingum-Cunge method is used for channel routing. The model computes the hydrograph for each subbasin, and either combines or routes the computed hydrograph according to the flow paths and concentration points. Channel routing accounts for the time required for the hydrograph to travel from one design point to another. Modeling parameters listed below are per the 2008 MPU model except where noted.

II Physical Basin Characteristics

Several physical characteristics of a watershed are required for the SCS unit hydrograph method. This section describes the measurements of these parameters and drainage characteristics. The models created for this drainage study incorporate and/or modify the parameters established in previous studies.

A Basin Area

The watershed for a specific drainage basin is divided into subbasins to allow for the identification of the local drainage characteristics within the watershed. Basin area delineations are shown on Figures 4.1.1 – Sub Basin Map Existing Conditions, and 4.3.1 – Ultimate Conditions Sub-Basin Map. Refined basin areas, not defined in the 2008 MPU, are listed on Standard form 4 in Appendix A.6.

B Basin Slope

The watershed area tributary to design points along the project typically slopes to the east or northeast. Subbasin slope affects the runoff flow time through the subbasin. When a subbasin has an area greater than 1.0 mi^2 , the lag time for the storm hydrograph may be governed by the concentrated flow such as channel flow. When the subbasin area is less than 1.0 mi^2 , both overland flow time and channel flow time will be used to determine the lag time. Refined basin slopes, not defined in the 2008 MPU, are listed on Standard Form 4 in Appendix A.6.

C Basin Centroid

Subbasin centroid locations are used to determine the point precipitation for subbasins outside the McCarran Airport Rainfall Area. However, the watershed for this project was entirely within the McCarran Airport Rainfall Area. When subbasin areas exceed 1.0 mi^2 , the subbasin centroid is also used to calculate lag

times. All basins are within the McCarran Airport Rainfall Area (Refer to Appendix A.2, Rainfall Values and Appendix A-3, Precipitation Data).

D Channel Characteristics

Channel characteristics that are important to the hydrologic parameters of the watershed include: 1) the main channel length; 2) the length along the main channel to a point opposite each subbasin centroid; 3) the main channel slope; 4) the main channel width; and 5) the channel roughness. These channel characteristics are used to determine lag times and are used by the model to calculate channel routing characteristics.

E Lag Times

Lag times for each subbasin were calculated using the procedure outlined in the CCRFCD Hydrologic Criteria and Drainage Design Manual. The following lag time and time of concentration equations are used for drainage basins with areas less than 1.0 mi² :

$$TLAG = 0.6 T_c$$

$$T_c = T_i + T_t$$

$$T_i = \frac{1.8(1.1 - K)L_o^{1/2}}{S^{1/3}}$$

$$K = 0.0132 CN - 0.39$$

Where:

T_c = Time of concentration using the above equations

T_i = Initial or overland flow time (minutes)

T_t = Travel time through the subbasin in the channel

L_o = Overland flow length (500 ft. maximum for rural areas, 300 ft. maximum for urban areas)

K = Flow resistance coefficient

S = Average basin slope (percent)

Refined basin lag times, not defined in the 2008 MPU, are calculated on Standard Form 4 in Appendix A.6.

III Geology and Soil

For purposes of hydrologic analysis, infiltration losses are related to the SCS Soil Classifications. The SCS methodology divides soils into four hydrological groups: Group A, Group B, Group C, and Group D, which were developed based on infiltration rates. SCS Group A Soil has a high infiltration rate, such as for sands and gravels. SCS Group D Soil has a low infiltration rate, such as for clay soil or rock. The SCS Soil types within the study area, and their corresponding hydrologic soil groups, were identified from the Soil Survey of the Las Vegas Valley Area, Clark County, Nevada.

IV Land Use

The majority of the land tributary to Project Neon is developed. Developed land throughout the watershed consists of primarily single-family residential, multi-family residential, commercial, industrial, and open space. Existing vegetation in undeveloped areas is sparse, and consists predominantly of creosote bush, White Bursage, Alkali Sacaton, and Inland Saltgrass. The models included in this report assume that the watershed will be fully developed, as defined in the CCRFCD 2008 MPU.

IV Rainfall Analysis

A Point Precipitation Values

The hydrograph analysis was based on a six-hour precipitation value from the National Oceanic and Atmospheric Administration (NOAA) Atlas Volume 2, Precipitation Frequency Atlas of the Western United States, dated 1973, as referenced in the CCRFCD *Hydrologic Criteria and Drainage Design Manual*. The entire area tributary to Project Neon falls within the McCarran Airport Rainfall Area. For six-hour storm duration, the point precipitation for the various storm events was determined from Table 505 in the CCRFCD *Hydrologic Criteria and Drainage Design Manual* (Refer to Appendix A.3, Precipitation Data).

B Area Reduction

The point precipitation depths are related to rainfall intensity at an isolated point. A Depth Area Reduction Factor (DARF) is used to convert the point precipitation to an average depth of rainfall over the entire storm area. DARF ratios used for this study were obtained from Table 502 in the CCRFCD *Hydrologic Criteria and Drainage Design Manual* (Refer to Appendix A.4, Darf Values). Due to the number of diversions and the fact that tributary area is not carried with a diverted flow, care must be used to determine the correct DARF.

C Rainfall Pattern

The rainfall distributions for the Las Vegas Valley were determined using the percent of total depth tabulation from the USACE, Los Angeles District, 1988. Based on the CCRFCD *Hydrologic Criteria and Drainage Design Manual*, the storm distributions used for this study consist of the SDN3, SDN4 and SDN5. An SDN3 distribution is used when the total drainage basin area is less than 8 mi², an SDN4 distribution is used for drainage basins with areas between 8 and 12 mi², and an SDN5 distribution is used for drainage basin areas greater than 12 mi² (Refer to Appendix A.5, SDN Curves).

V Precipitation Losses

Precipitation losses consist of infiltration and interception/depression storage. Infiltration occurs throughout the storm event while interception on vegetation and in local depressions on the land surface occurs during the initial period of the storm. The

difference between the precipitation volume and the precipitation loss volume is the runoff volume from the land surface for a computational interval. The SCS curve number method is used to compute both types of precipitation losses. This method uses a curve number (CN) index to relate precipitation losses to soil types, land use, and vegetative cover conditions.

Where basin delineations vary from those defined in the MPU, VTN has utilized GIS data to overlay basin boundaries with soil types and land use. A CN value is defined for each sub area within a basin, and a composite CN value has been developed, based on an area weighted average. Refer to [Appendix A.2.2 for Land Use, Soils and Curve Numbers](#).

VI Unit Hydrograph Parameters

The unit hydrograph used in the HEC-1 model for this analysis is the SCS dimensionless unit hydrograph. Input for the unit hydrograph consists of a single parameter, the lag time between the center of mass of rainfall excess and the peak of the unit hydrograph. The input variables for this method consist of basin lag time, area in square miles, curve number, rainfall distribution, and precipitation values in inches.

VII Hydrograph Routing

Storm hydrographs generated by subbasins have to be conveyed downstream through a drainage network that may consist of channels, detention basins, basin conversions, etc. Channel routing methods are numerical simulations of flood wave movements along a drainage network. In this study, the Muskingum-Cunge routing procedures were used to model storm water movements in improved channel reaches and street sections. This method is recommended for flow modeling in uniform channels such as pipes and well-defined channels, as it translates the hydrograph downstream without significant attenuation of the peak discharge. The parameters used for this method are the shape of the channel cross-section, channel reach length, channel slope, and channel roughness.

VII Summary of HEC-1 Flood Hydrograph Program Input

The HEC-1 Flood Hydrograph Package Computer Model is used to simulate the surface runoff response of a basin or system of subbasins to precipitation. Each basin is described by a set of parameters, which specify the basin and storm characteristics. These basin parameters, as previously discussed, include precipitation, basin area, curve number, and lag time.

Hydrographs are computed for each subbasin within the drainage area. These hydrographs are then routed or combined according to the basin drainage network configuration. [Appendix A.7 includes PDF output files for each HEC-1 model](#). Based on tributary area at each node, the appropriate DARF values applied and the appropriate peak storm value is highlighted.



Existing Offsite Hydrology Report

A.2

Land Use, Soils and Curve Numbers



Existing Offsite Hydrology Report

A.2.1

2008 MPU Hydrologic Summary



2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

**FIGURE H-25
HYDROLOGIC SUMMARY**

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- Subbasin Boundary
- Drought Ordinance Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/Parallel Facilities
- Category B Remove & Replace/Parallel Facilities

Type Hydrologic Soil Groups

- A Low Runoff Potential
- B Moderately Low Runoff Potential
- C Moderately High Runoff Potential
- D High Runoff Potential/Rock Outcrops

Typical Land Use

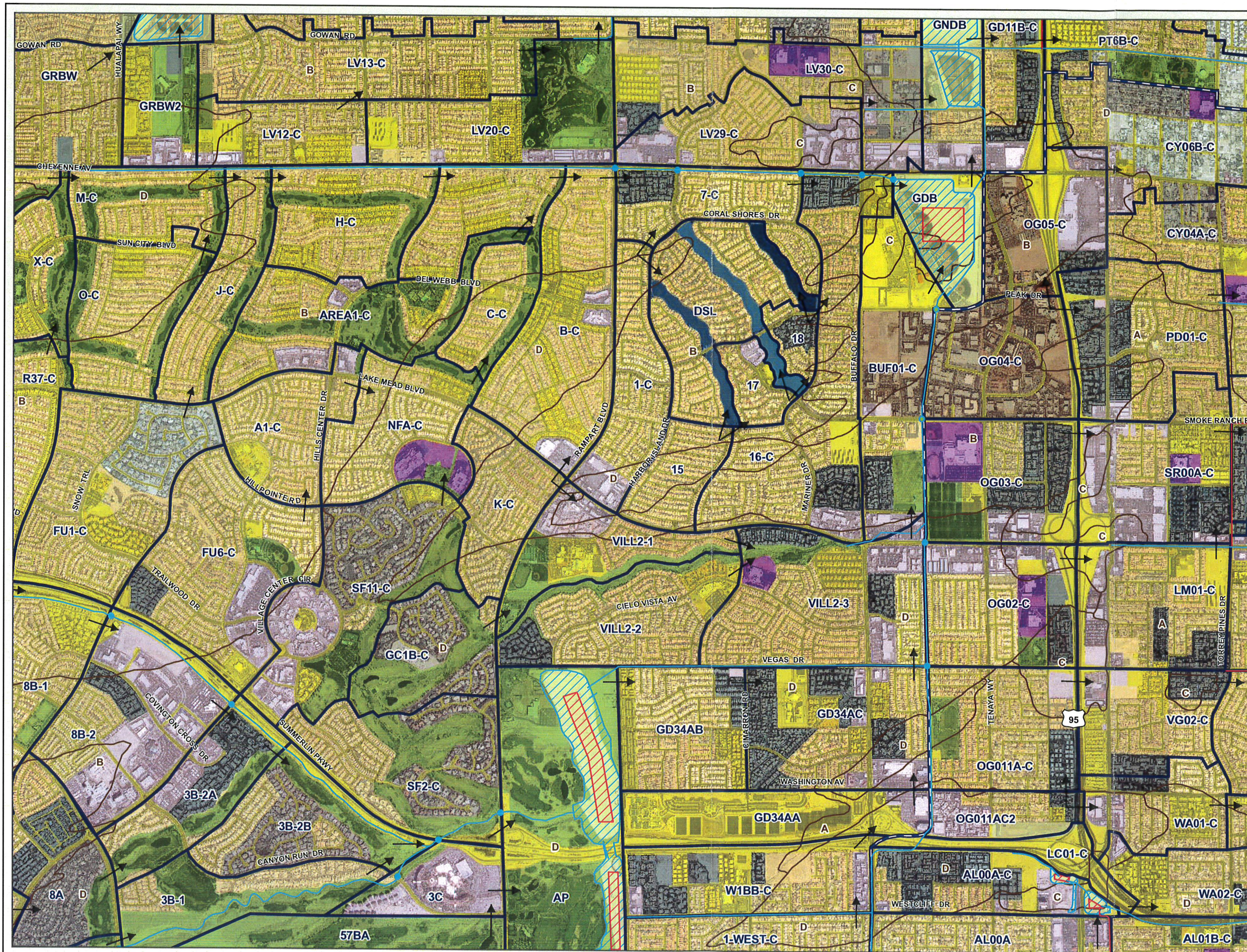
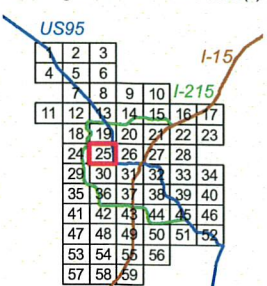
- 1 Undeveloped Land, Open Desert
- 2 Parks, Golf Courses
- 3 Rural
- 4 / 14* Low Density Residential
- 5 / 15* Medium Density Residential
- 6 / 16* High Density Residential
- 7 / 17* Public Facility, Residential
- 8 / 18* Very High Density Residential
- 9 / 19* Commercial, Retail, Casino, High Rise Condominiums
- 10 / 20* Light Industrial
- 11 / 21* Heavy Industrial
- 12 / 22* Schools
- 13 Lakes

* Drought Ordinance Applied

0 500 1,000 2,000 3,000
Feet

Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)





2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H-26
HYDROLOGIC SUMMARY

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- Subbasin Boundary
- Drought Ordinance Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/Parallel Facilities
- Category B Remove & Replace/Parallel Facilities

Type Hydrologic Soil Groups

- A Low Runoff Potential
- B Moderately Low Runoff Potential
- C Moderately High Runoff Potential
- D High Runoff Potential/Rock Outcrops

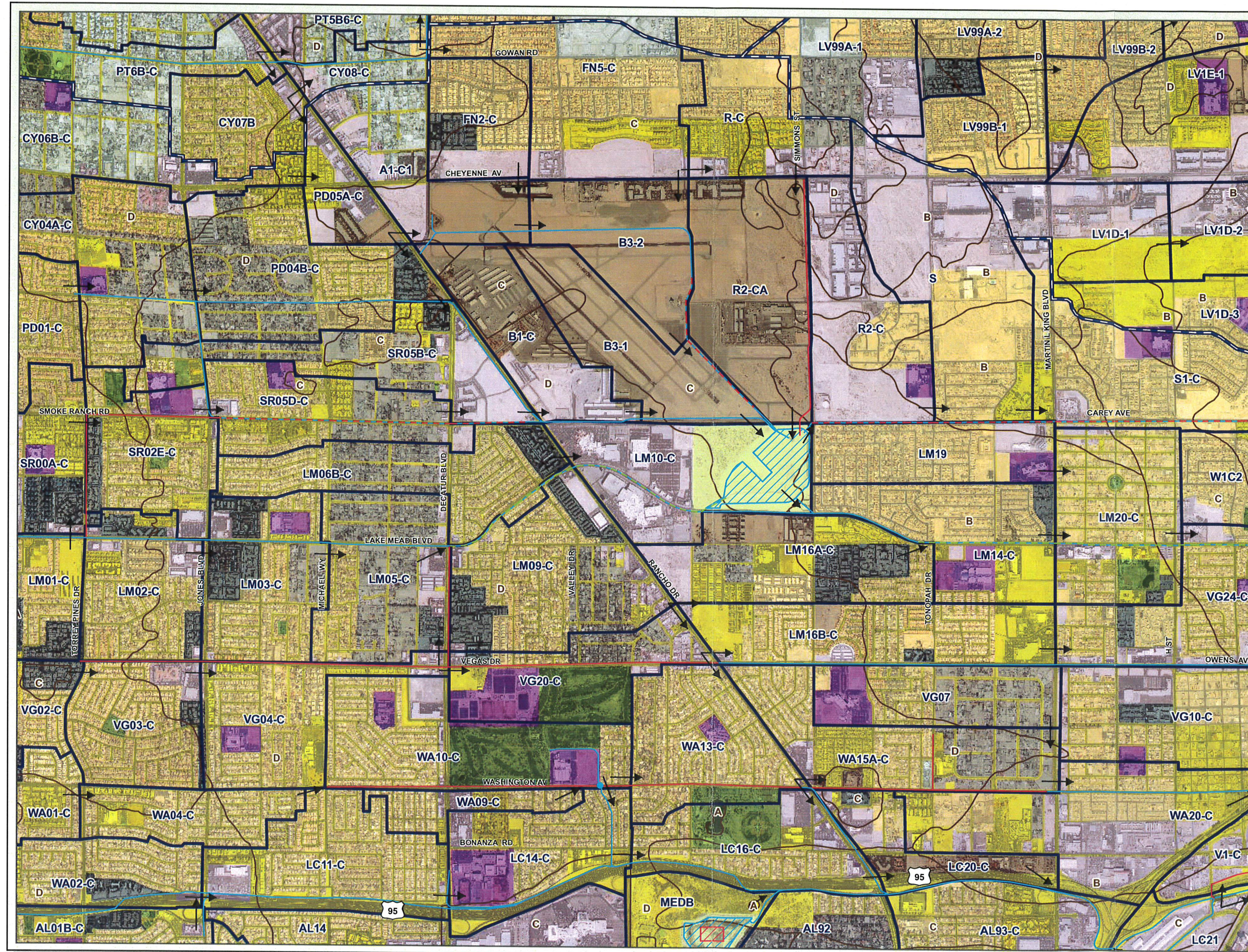
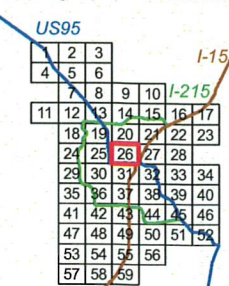
Typical Land Use

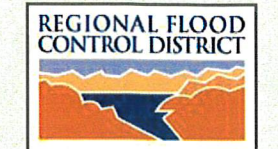
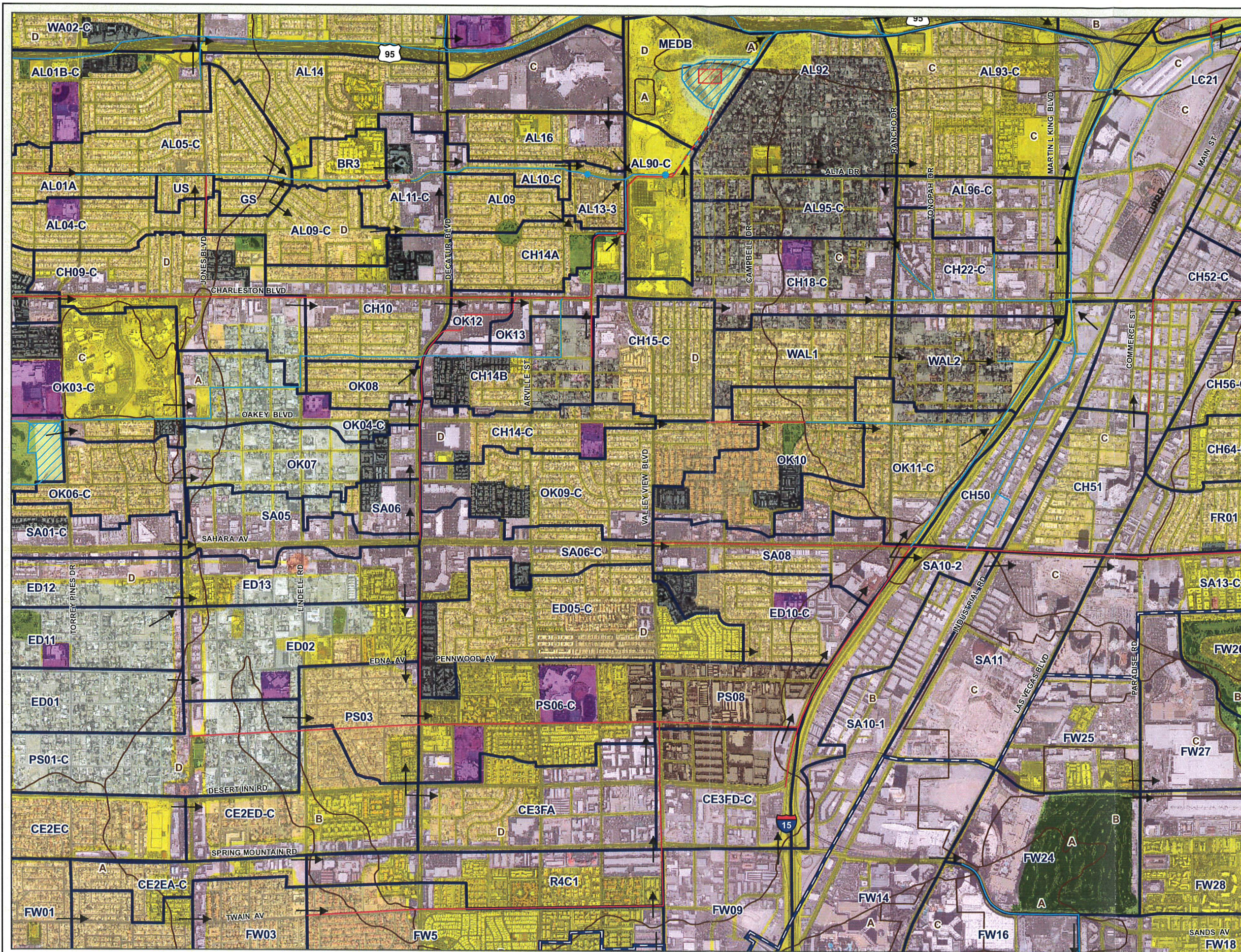
- 1 Undeveloped Land, Open Desert
- 2 Parks, Golf Courses
- 3 Rural
- 4 / 14* Low Density Residential
- 5 / 15* Medium Density Residential
- 6 / 16* High Density Residential
- 7 / 17* Public Facility, Residential
- 8 / 18* Very High Density Residential
- 9 / 19* Commercial, Retail, Casino, High Rise Condominiums
- 10 / 20* Light Industrial
- 11 / 21* Heavy Industrial
- 12 / 22* Schools
- 13 Lakes

* Drought Ordinance Applied

0 500 1,000 2,000 3,000
Feet
Scale: 1 inch = 2,000 feet

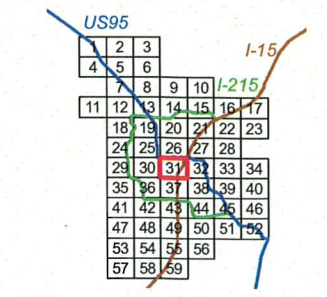
Refer to Figure G-2 for Aerial Source(s)

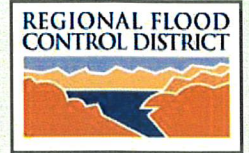




2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H-31
HYDROLOGIC SUMMARY

- LEGEND**
- Ultimate Development Boundary
 - Watershed Boundary
 - Subbasin Boundary
 - Drought Ordinance Boundary
 - Flow Arrows
- Flood Control Facilities**
- Existing Facilities
 - Category A Proposed Facilities
 - Category B Proposed Facilities
 - Category A Remove & Replace/Parallel Facilities
 - Category B Remove & Replace/Parallel Facilities
- Hydrologic Soil Groups**
- A Low Runoff Potential
 - B Moderately Low Runoff Potential
 - C Moderately High Runoff Potential
 - D High Runoff Potential/Rock Outcrops
- Typical Land Use**
- 1 Undeveloped Land, Open Desert
 - 2 Parks, Golf Courses
 - 3 Rural
 - 4 / 14* Low Density Residential
 - 5 / 15* Medium Density Residential
 - 6 / 16* High Density Residential
 - 7 / 17* Public Facility, Residential
 - 8 / 18* Very High Density Residential
 - 9 / 19* Commercial, Retail, Casino, High Rise Condominiums
 - 10 / 20* Light Industrial
 - 11 / 21* Heavy Industrial
 - 12 / 22* Schools
 - 13 Lakes
- * Drought Ordinance Applied





2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H- 36
HYDROLOGIC SUMMARY

LEGEND

- Ultimate Development Boundary
- Watershed Boundary
- Subbasin Boundary
- Drought Ordinance Boundary
- Flow Arrows

Flood Control Facilities

- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Category A Remove & Replace/Parallel Facilities
- Category B Remove & Replace/Parallel Facilities

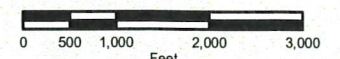
Type Hydrologic Soil Groups

- A Low Runoff Potential
- B Moderately Low Runoff Potential
- C Moderately High Runoff Potential
- D High Runoff Potential/Rock Outcrops

Typical Land Use

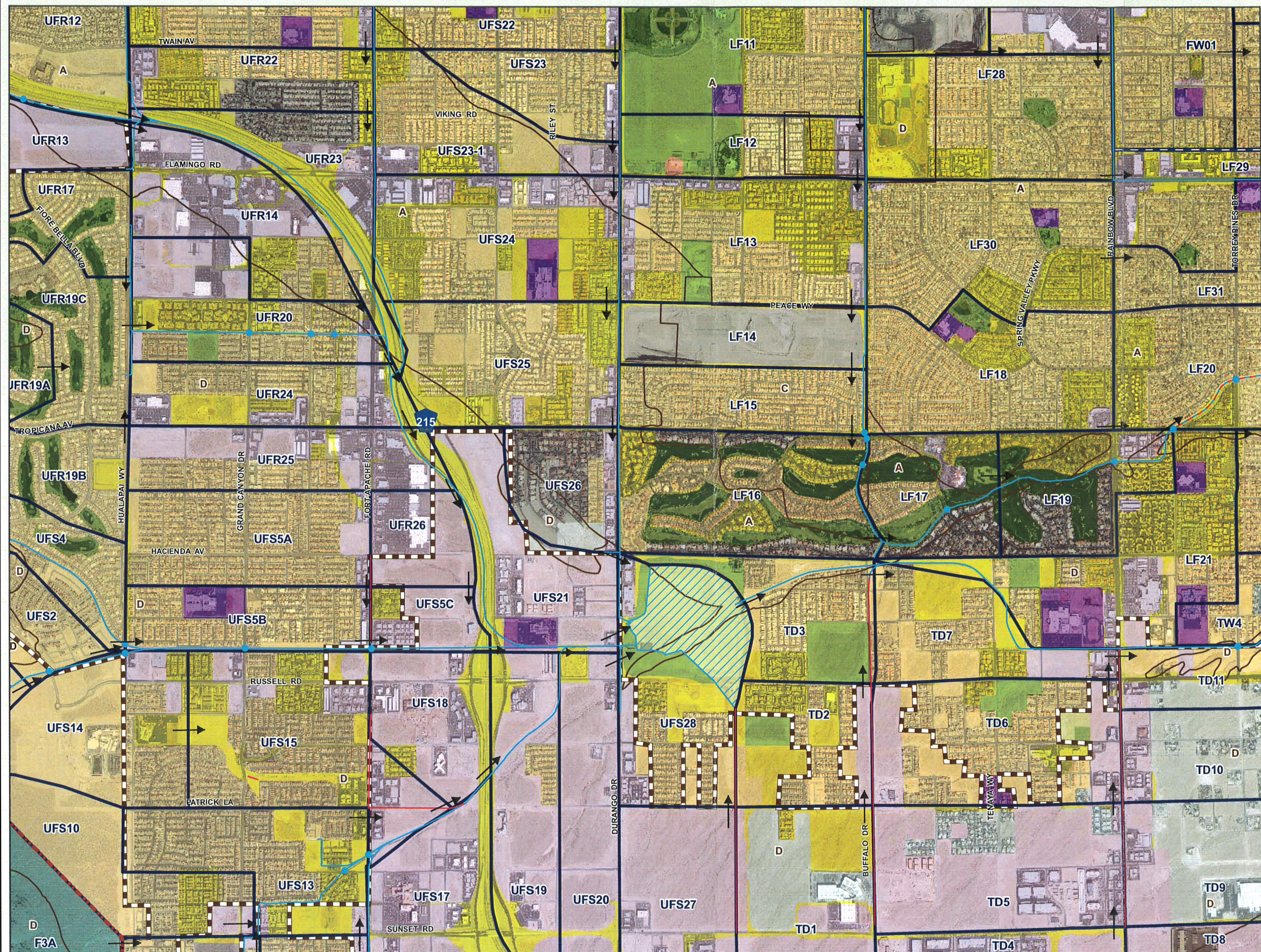
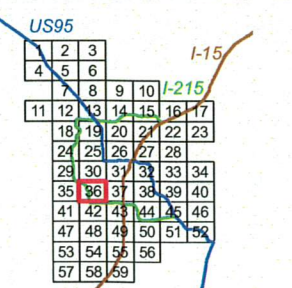
- 1 Undeveloped Land, Open Desert
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- 10 / 20* Light Industrial
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- 13 Lakes

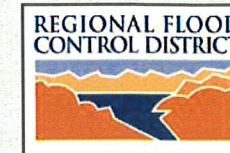
* Drought Ordinance Applied



Scale: 1 inch = 2,000 feet

Refer to Figure G-2 for Aerial Source(s)

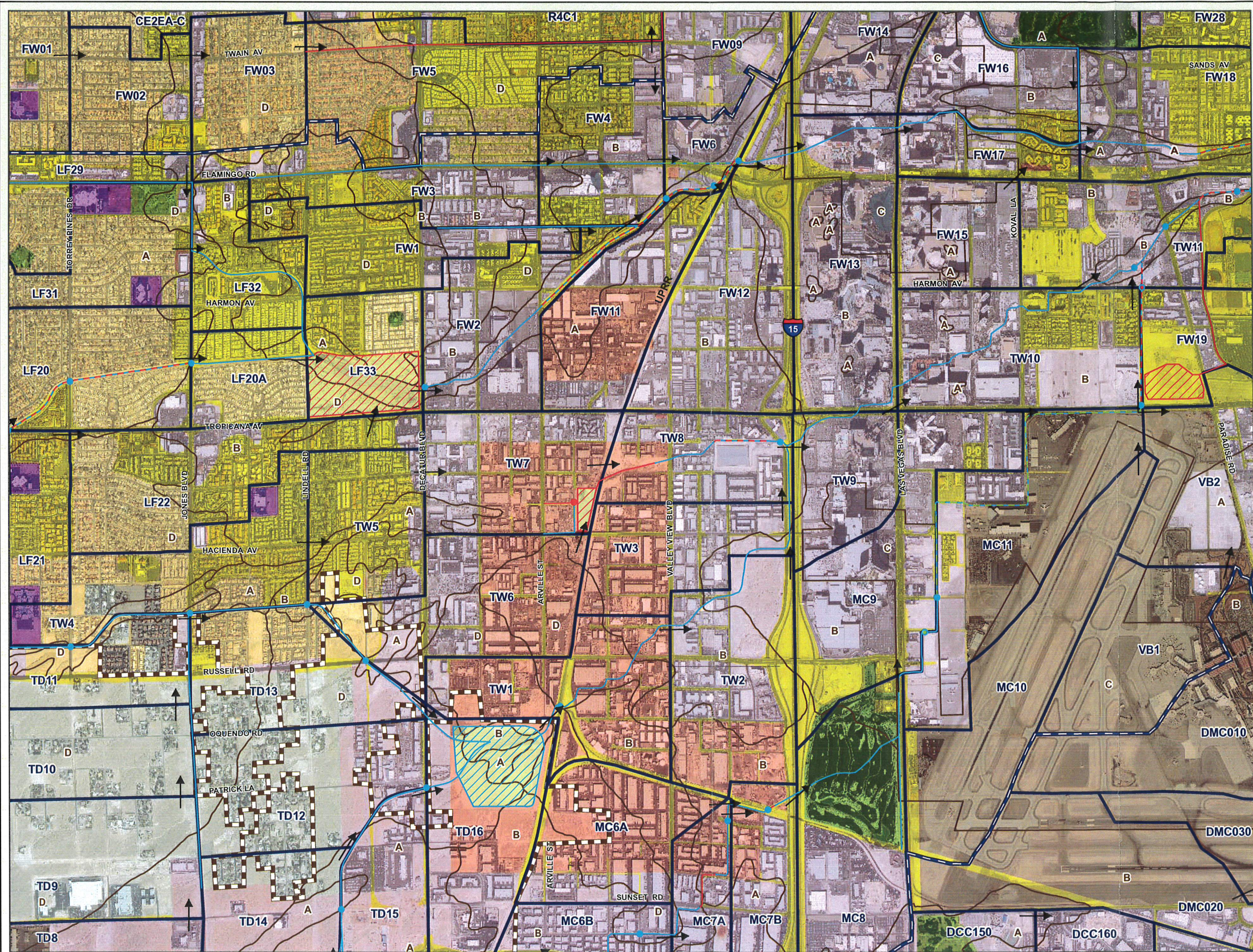
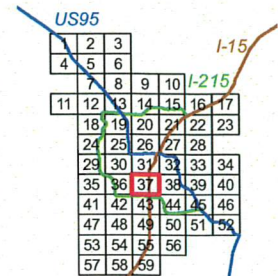




2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FIGURE H-37
HYDROLOGIC SUMMARY

- LEGEND**
- Ultimate Development Boundary
 - Watershed Boundary
 - Subbasin Boundary
 - Drought Ordinance Boundary
 - Flow Arrows
- Flood Control Facilities**
- Existing Facilities
 - Category A Proposed Facilities
 - Category B Proposed Facilities
 - Category A Remove & Replace/Parallel Facilities
 - Category B Remove & Replace/Parallel Facilities
- Type Hydrologic Soil Groups**
- A Low Runoff Potential
 - B Moderately Low Runoff Potential
 - C Moderately High Runoff Potential
 - D High Runoff Potential/Rock Outcrops

- Typical Land Use**
- 1 Undeveloped Land, Open Desert
 - 2 Parks, Golf Courses
 - 3 Rural
 - 4 / 14* Low Density Residential
 - 5 / 15* Medium Density Residential
 - 6 / 16* High Density Residential
 - 7 / 17* Public Facility, Residential
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 - 10 / 20* Light Industrial
 - 11 / 21* Heavy Industrial
 - 12 / 22* Schools
 - 13 Lakes
- * Drought Ordinance Applied
- Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)

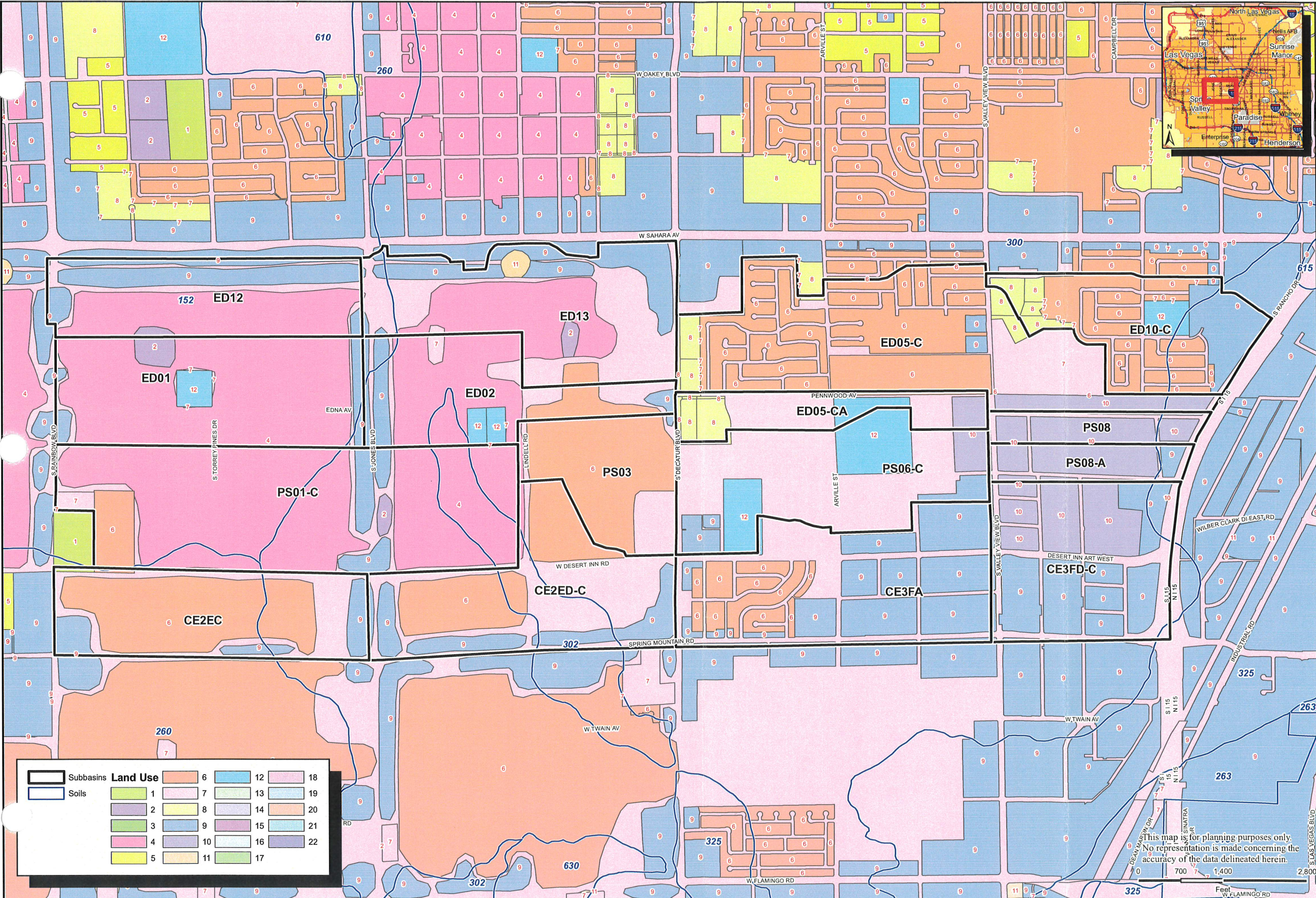




Existing Offsite Hydrology Report

A.2.2

Land Use, Soils and Curve Numbers for Basin Refinements



W.O.#: 7111-D
 DATE: 7-12-2008
 BY: JTG
 SCALE: 1" = 1,400'
 SHEET: 1



NEON DRAINAGE
LAND USE AND SOIL TYPE EXHIBIT

	Subbasins		Land Use 6		12		18
	Soils		1		13		19
			2		14		20
			3		15		21
			4		16		22
			5		17		

This map is for planning purposes only.
 No representation is made concerning
 the accuracy of the data delineated herein.



PROJECT NEC. /DROLOGY
COMPOSITE CURVE NUMBER BREAKDOWN - SOUTH OF SAHARA AVE
BASED ON 2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

WATERSHED	2008 MPU BASIN	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ. FT.)	SUBBASIN AREA (SQ. FT.)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
Central Watershed	CE2EC	1	152	86	1309	7379562	0.0%	0.0%	0.02	0.02	73.298
	CE2EC	6	152	86	12487	7379562	0.2%	0.2%	0.15	0.16	
	CE2EC	1	260	64	49464	7379562	0.7%	0.9%	0.43	0.59	
	CE2EC	4	260	64	389	7379562	0.0%	0.9%	0.00	0.59	
	CE2EC	6	260	86	3480899	7379562	47.2%	48.0%	31.13	31.72	
	CE2EC	7	260	63	903071	7379562	12.2%	60.3%	7.71	39.43	
	CE2EC	9	260	76	498561	7379562	6.8%	67.0%	5.13	44.57	
	CE2EC	4	300	87	4730	7379562	0.1%	67.1%	0.06	44.62	
	CE2EC	6	300	87	899315	7379562	12.2%	79.3%	10.60	55.23	
	CE2EC	7	300	86	1071220	7379562	14.5%	93.8%	12.48	67.71	
	CE2EC	9	300	90	458116	7379562	6.2%	100.0%	5.59	73.30	
	CE2ED-C	4	300	87	81268	8728287	0.9%	0.9%	0.81	0.81	
	CE2ED-C	6	300	87	2802724	8728287	32.1%	33.0%	27.94	28.75	
	CE2ED-C	7	300	86	2767156	8728287	31.7%	64.7%	27.26	56.01	
Central Watershed	CE2ED-C	9	300	90	1506361	8728287	17.3%	82.0%	15.53	71.54	86.223
	CE2ED-C	4	302	81	37746	8728287	0.4%	82.4%	0.35	71.89	
	CE2ED-C	6	302	82	236627	8728287	2.7%	85.1%	2.22	74.12	
	CE2ED-C	7	302	80	1018078	8728287	11.7%	96.8%	9.33	83.45	
	CE2ED-C	9	302	87	278327	8728287	3.2%	100.0%	2.77	86.22	
	CE3FA	6	300	87	1662203	9969368	16.7%	16.7%	14.51	14.51	
	CE3FA	7	300	86	3057321	9969368	30.7%	47.3%	26.37	40.88	
	CE3FA	9	300	90	5183521	9969368	52.0%	99.3%	46.80	87.67	
	CE3FA	12	300	96	66323	9969368	0.7%	100.0%	0.64	88.31	
	CE3FD-C	7	300	86	1693473	7824119	21.6%	21.6%	18.61	18.61	
	CE3FD-C	9	300	90	3363856	7824119	43.0%	64.6%	38.69	57.31	
	CE3FD-C	10	300	92	2335945	7824119	29.9%	94.5%	27.47	84.78	
	CE3FD-C	7	325	76	204804	7824119	2.6%	97.1%	1.99	86.76	
	CE3FD-C	9	325	84	228001	7824119	2.9%	100.0%	2.43	89.19	
Central Watershed	CE3FD-C	10	325	88	40	7824119	0.0%	100.0%	0.00	89.19	89.192
	ED01	2	152	76	300454	9095622	3.3%	3.3%	2.51	2.51	
	ED01	4	152	86	7706463	9095622	84.7%	88.0%	72.87	75.38	
	ED01	7	152	85	235482	9095622	2.6%	90.6%	2.20	77.58	
	ED01	9	152	90	390292	9095622	4.3%	94.9%	3.86	81.44	
	ED01	12	152	96	352344	9095622	3.9%	98.8%	3.72	85.16	
	ED01	4	300	87	5888	9095622	0.1%	98.8%	0.06	85.21	
	ED01	7	300	86	13279	9095622	0.1%	99.0%	0.13	85.34	
	ED01	9	300	90	91419	9095622	1.0%	100.0%	0.90	86.24	
	ED02	4	152	86	17235	6121611	0.3%	0.3%	0.24	0.24	
	ED02	7	152	85	69644	6121611	1.1%	1.4%	0.97	1.21	
	ED02	9	152	90	189025	6121611	3.1%	4.5%	2.78	3.99	
	ED02	4	300	87	2789765	6121611	45.6%	50.1%	39.65	43.64	
	ED02	6	300	87	670597	6121611	11.0%	61.0%	9.53	53.17	
Central Watershed	ED02	7	300	86	1064803	6121611	17.4%	78.4%	14.96	68.13	87.389
	ED02	9	300	90	565310	6121611	9.6%	88.0%	8.61	76.73	
	ED02	12	300	96	378629	6121611	6.2%	94.2%	5.94	82.67	
	ED02	4	302	81	355787	6121611	5.8%	100.0%	4.71	87.38	
	ED02	12	302	95	818	6121611	0.0%	100.0%	0.01	87.39	
	ED02	12	302	95	818	6121611	0.0%	100.0%	0.01	87.39	

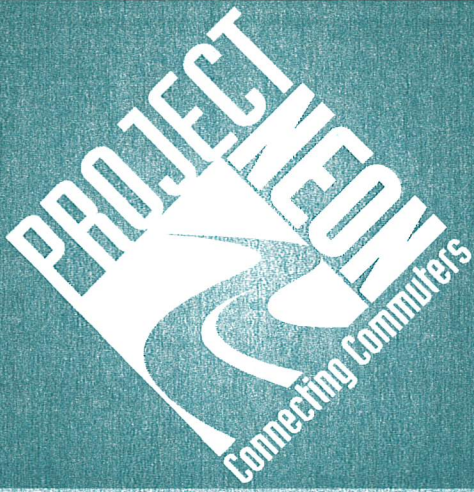
PROJECT NEC. / DROLOGY
COMPOSITE CURVE NUMBER BREAKDOWN - SOUTH OF SAHARA AVE
BASED ON 2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

WATERSHED	2008 MPU BASIN	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ. FT.)	SUBBASIN AREA (SQ. FT.)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
Central Watershed	ED05-C	6	300	87	7089005	12714375	55.8%	55.8%	48.51	48.51	86.890
	ED05-C	7	300	86	3656845	12714375	28.0%	83.7%	24.06	72.57	
	ED05-C	8	300	84	791969	12714375	6.2%	90.0%	5.23	77.80	
	ED05-C	9	300	90	252456	12714375	2.0%	91.9%	1.79	79.59	
	ED05-C	10	300	92	784008	12714375	6.2%	98.1%	5.67	85.26	
	ED05-C	7	325	76	32429	12714375	0.3%	98.4%	0.19	85.45	
	ED05-C	10	325	88	207662	12714375	1.6%	100.0%	1.44	86.89	
	ED05-CA	6	300	87	198765	3055782	6.5%	6.5%	5.66	5.66	
	ED05-CA	7	300	86	1563431	3055782	51.2%	57.7%	44.00	49.66	
	ED05-CA	8	300	84	648087	3055782	21.2%	78.9%	17.82	67.47	
Central Watershed	ED05-CA	9	300	90	1375	3055782	0.0%	78.9%	0.04	67.51	87.345
	ED05-CA	10	300	92	310193	3055782	10.2%	89.1%	9.34	76.85	
	ED05-CA	12	300	96	333931	3055782	10.9%	100.0%	10.49	87.34	
	ED10-C	6	300	87	2275688	6057296	37.6%	37.6%	32.69	32.69	
	ED10-C	7	300	86	762794	6057296	12.6%	50.2%	10.83	43.52	
	ED10-C	8	300	84	553379	6057296	9.1%	59.3%	7.67	51.19	
	ED10-C	9	300	90	149782	6057296	2.5%	61.8%	2.23	53.41	
	ED10-C	10	300	92	23348	6057296	0.4%	62.2%	0.35	53.77	
	ED10-C	12	300	96	359779	6057296	5.9%	68.1%	5.70	59.47	
	ED10-C	6	325	78	473913	6057296	7.8%	75.9%	6.10	65.57	
Central Watershed	ED10-C	7	325	76	244523	6057296	4.0%	80.0%	3.07	68.64	85.592
	ED10-C	9	325	84	1131252	6057296	18.7%	98.6%	15.69	84.33	
	ED10-C	10	325	88	23255	6057296	0.4%	99.0%	0.34	84.67	
	ED10-C	12	325	94	59603	6057296	1.0%	100.0%	0.92	85.59	
	ED12	2	152	76	94325	6638161	1.4%	1.4%	1.08	1.08	
	ED12	4	152	86	3385410	6638161	51.0%	52.4%	43.86	44.94	
	ED12	7	152	85	915288	6638161	13.8%	66.2%	11.72	56.66	
	ED12	9	152	90	2243138	6638161	33.8%	100.0%	30.41	87.07	
	ED13	4	152	86	8983	9172459	0.1%	0.1%	0.08	0.08	
	ED13	7	152	85	495821	9172459	5.4%	5.5%	4.59	4.68	
Central Watershed	ED13	9	152	90	140277	9172459	1.5%	7.0%	1.38	6.06	87.257
	ED13	2	300	78	142647	9172459	1.6%	8.6%	1.21	7.27	
	ED13	4	300	87	2885515	9172459	31.5%	40.0%	27.37	34.64	
	ED13	6	300	87	207006	9172459	2.3%	42.3%	1.96	36.60	
	ED13	7	300	86	3120650	9172459	34.0%	76.3%	29.26	65.86	
	ED13	8	300	84	3509	9172459	0.0%	76.4%	0.03	65.89	
	ED13	9	300	90	1997910	9172459	21.8%	98.1%	19.60	85.50	
	ED13	11	300	95	170141	9172459	1.9%	100.0%	1.76	87.26	

PROJECT NEC. HYDROLOGY
COMPOSITE CURVE NUMBER BREAKDOWN - SOUTH OF SAHARA AVE
BASED ON 2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

WATERSHED	2008 MPU BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ. FT)	SUBBASIN AREA (SQ. FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
Central Watershed	PS01-C	1	152	86	7093	14968104	0.0%	0.0%	0.04	0.04	
	PS01-C	4	152	86	5512906	14968104	36.8%	36.9%	31.67	31.72	
	PS01-C	6	152	86	841936	14968104	5.8%	42.5%	4.84	36.55	
	PS01-C	7	152	85	442655	14968104	3.0%	45.5%	2.51	39.07	
	PS01-C	9	152	90	8412	14968104	0.1%	45.5%	0.05	39.12	
	PS01-C	4	260	64	486031	14968104	3.2%	48.8%	2.08	41.20	
	PS01-C	6	260	66	1405	14968104	0.0%	48.8%	0.01	41.20	
	PS01-C	7	260	63	59496	14968104	0.4%	49.2%	0.25	41.45	
	PS01-C	2	300	78	138897	14968104	0.9%	50.1%	0.72	42.18	
	PS01-C	4	300	87	4557461	14968104	30.4%	80.5%	26.49	68.67	
	PS01-C	7	300	86	655283	14968104	4.4%	84.9%	3.76	72.43	
	PS01-C	9	300	90	860248	14968104	5.7%	90.7%	5.17	77.60	
Central Watershed	PS01-C	12	300	96	225	14968104	0.0%	90.7%	0.00	77.60	
	PS01-C	4	302	81	1366696	14968104	9.1%	99.8%	7.40	85.00	
	PS01-C	7	302	80	29306	14968104	0.2%	100.0%	0.16	85.16	
	PS01-C	12	302	95	55	14968104	0.0%	100.0%	0.00	85.16	85.157
	PS03	4	300	87	77454	4565273	1.7%	1.7%	1.48	1.48	
	PS03	6	300	87	3596330	4565273	78.8%	80.5%	68.53	70.01	
	PS03	7	300	86	86862	4565273	19.0%	99.5%	16.37	86.38	
	PS03	9	300	90	22627	4565273	0.5%	100.0%	0.45	86.82	86.825
	PS06-C	6	300	87	5133	8420299	0.1%	0.1%	0.05	0.05	
	PS06-C	7	300	86	5305284	8420299	63.0%	63.1%	54.19	54.24	
	PS06-C	8	300	84	52837	8420299	0.6%	63.7%	0.53	54.77	
	PS06-C	9	300	90	712422	8420299	8.5%	72.2%	7.61	62.38	
Central Watershed	PS06-C	10	300	92	392440	8420299	4.7%	76.8%	4.29	66.67	
	PS06-C	12	300	96	1952183	8420299	23.2%	100.0%	22.26	88.92	88.925
	PS08	7	300	86	257453	1875543	13.7%	13.7%	11.81	11.81	
	PS08	10	300	92	1237136	1875543	66.0%	79.7%	60.68	72.49	
	PS08	7	325	76	112103	1875543	6.0%	85.7%	4.54	77.03	
	PS08	9	325	84	22570	1875543	1.2%	86.9%	1.01	78.04	
	PS08	10	325	88	246280	1875543	13.1%	100.0%	11.56	89.60	89.599
	PS08-A	7	300	86	274112	2052763	13.4%	13.4%	11.48	11.48	
	PS08-A	9	300	90	26633	2052763	1.3%	14.7%	1.17	12.65	
	PS08-A	10	300	92	1454864	2052763	70.9%	85.5%	65.20	77.86	
	PS08-A	7	325	76	120709	2052763	5.9%	91.4%	4.47	82.32	
	PS08-A	9	325	84	174443	2052763	8.5%	99.9%	7.14	89.46	
	PS08-A	10	325	88	2003	2052763	0.1%	100.0%	0.09	89.55	89.548

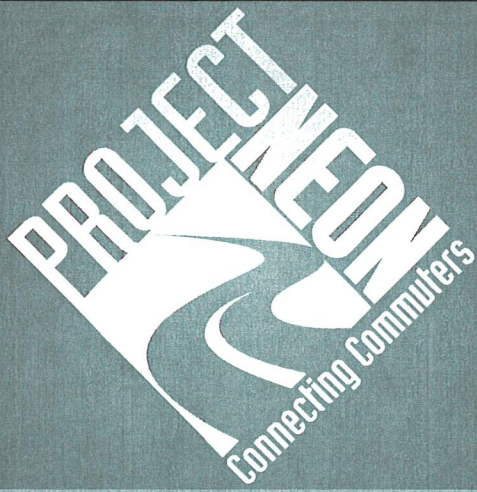
APPENDIX B



Existing Offsite Hydrology Report

APPENDIX B

Hydraulic Calculations



Existing Offsite Hydrology Report

B.1

Spring Mountain Hydraulic Calculations

APPENDIX B.1
SPRING MOUNTAIN
HYDRAULIC METHODOLOGY

In the Existing/Design Condition, a higher 100-Year flow rate occurs in Spring Mountain Rd. at I-15 than will occur in the ultimate condition when there is a full build-out of CCRFCD master plan facilities. The proposed facility affecting Spring Mountain Rd. is the Valley View Drain, MPU designation FWVV. This facility starts as an 8'x6' RCB at Twain Ave. / Lindell Rd. and increases in size to a 12'x11' RCB at Desert Inn Rd. / Valley View Blvd.

Three cross sections were taken on Spring Mountain Rd. at Aldearan and Valley View, using Clark County 5' topography and manning's equation was applied to determine the roadway capacity of each section. In addition, Clark County 5' topography and Spring Mountain/I-15 Construction Drawings were used to verify that flows will continue east, below I-15.

Spring Mountain Rd Capacity

Project Description

Worksheet	Spring Mt / Aldebaran ds
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	3.10 %
Discharge	1,000.00 cfs

Options

Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Mannings Coefficient	0.016
Water Surface Elevation	29.73 ft
Elevation Range	28.00 to 31.50
Flow Area	67.4 ft ²
Wetted Perimeter	77.96 ft
Top Width	77.88 ft
Actual Depth	1.73 ft
Critical Elevation	30.59 ft
Critical Slope	0.33 %
Velocity	14.84 ft/s
Velocity Head	3.42 ft
Specific Energy	33.15 ft
Froude Number	2.81
Flow Type	Supercritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	1+35	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	31.50
0+25	31.00
0+45	30.00
0+78	28.00
1+35	30.00

Spring Mountain Rd Capacity

Project Description

Worksheet	Spring Mt / Aldebaran us
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	1.20 %
Discharge	1,000.00 cfs

Options

Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Mannings Coefficient	0.016
Water Surface Elevation	34.30 ft
Elevation Range	33.00 to 35.00
Flow Area	117.8 ft ²
Wetted Perimeter	154.52 ft
Top Width	154.44 ft
Actual Depth	1.30 ft
Critical Elevation	34.65 ft
Critical Slope	0.37 %
Velocity	8.49 ft/s
Velocity Head	1.12 ft
Specific Energy	35.42 ft
Froude Number	1.71
Flow Type	Supercritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00	2+00	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
0+00	35.00
0+50	34.00
0+75	33.00
1+00	33.00
1+30	34.00
1+70	33.20
1+85	34.00
2+00	35.00

Spring Mountain Rd Capacity

Project Description

Worksheet	Spring Mt / Valley View
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	1.10 %
Discharge	1,000.00 cfs

Options

Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Mannings Coefficient	0.016
Water Surface Elevation	49.46 ft
Elevation Range	48.50 to 50.00
Flow Area	145.2 ft ²
Wetted Perimeter	244.09 ft
Top Width	244.08 ft
Actual Depth	0.96 ft
Critical Elevation	49.68 ft
Critical Slope	0.41 %
Velocity	6.89 ft/s
Velocity Head	0.74 ft
Specific Energy	50.19 ft
Froude Number	1.57
Flow Type	Supercritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
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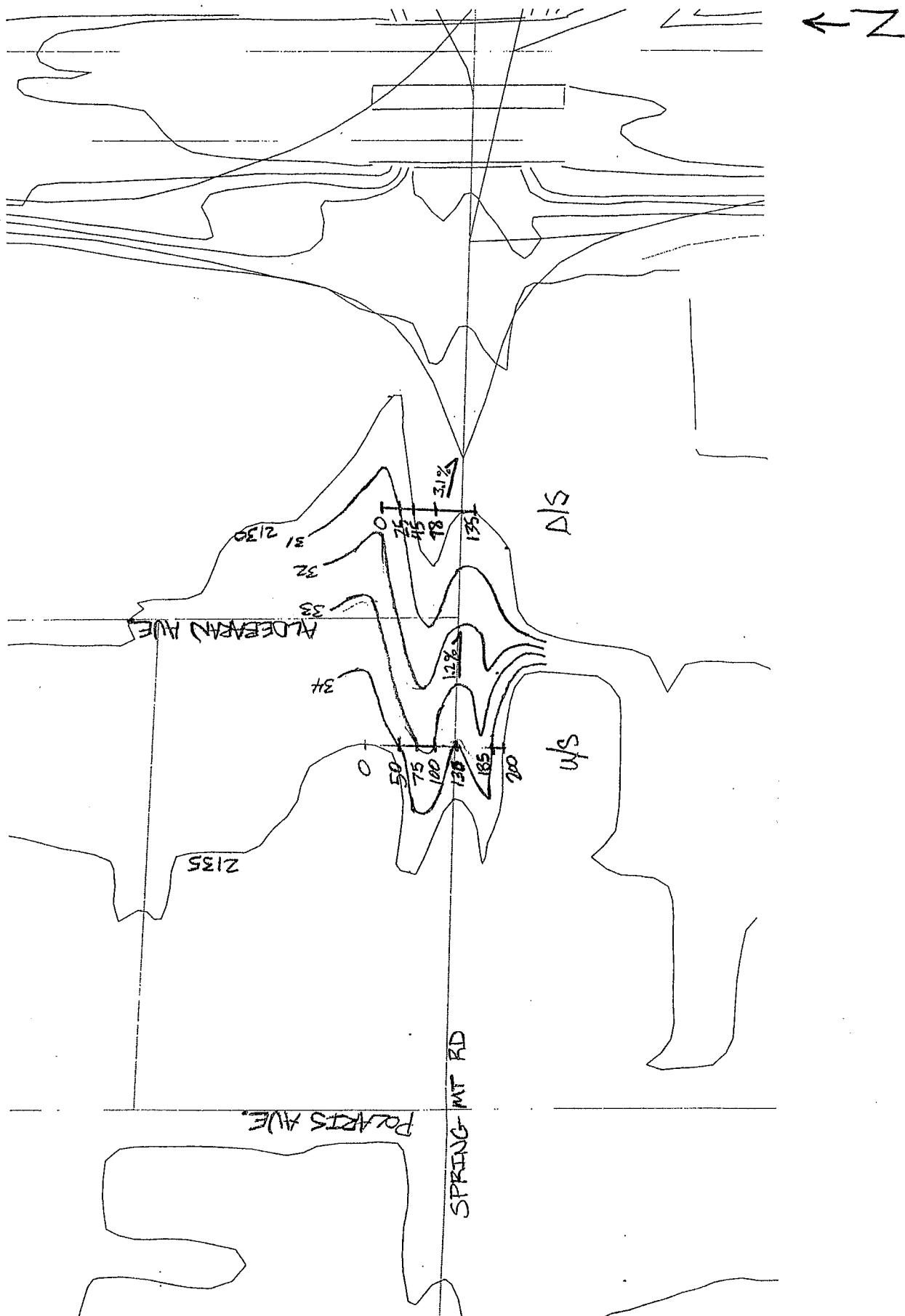
0+00	3+12	0.016
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Natural Channel Points

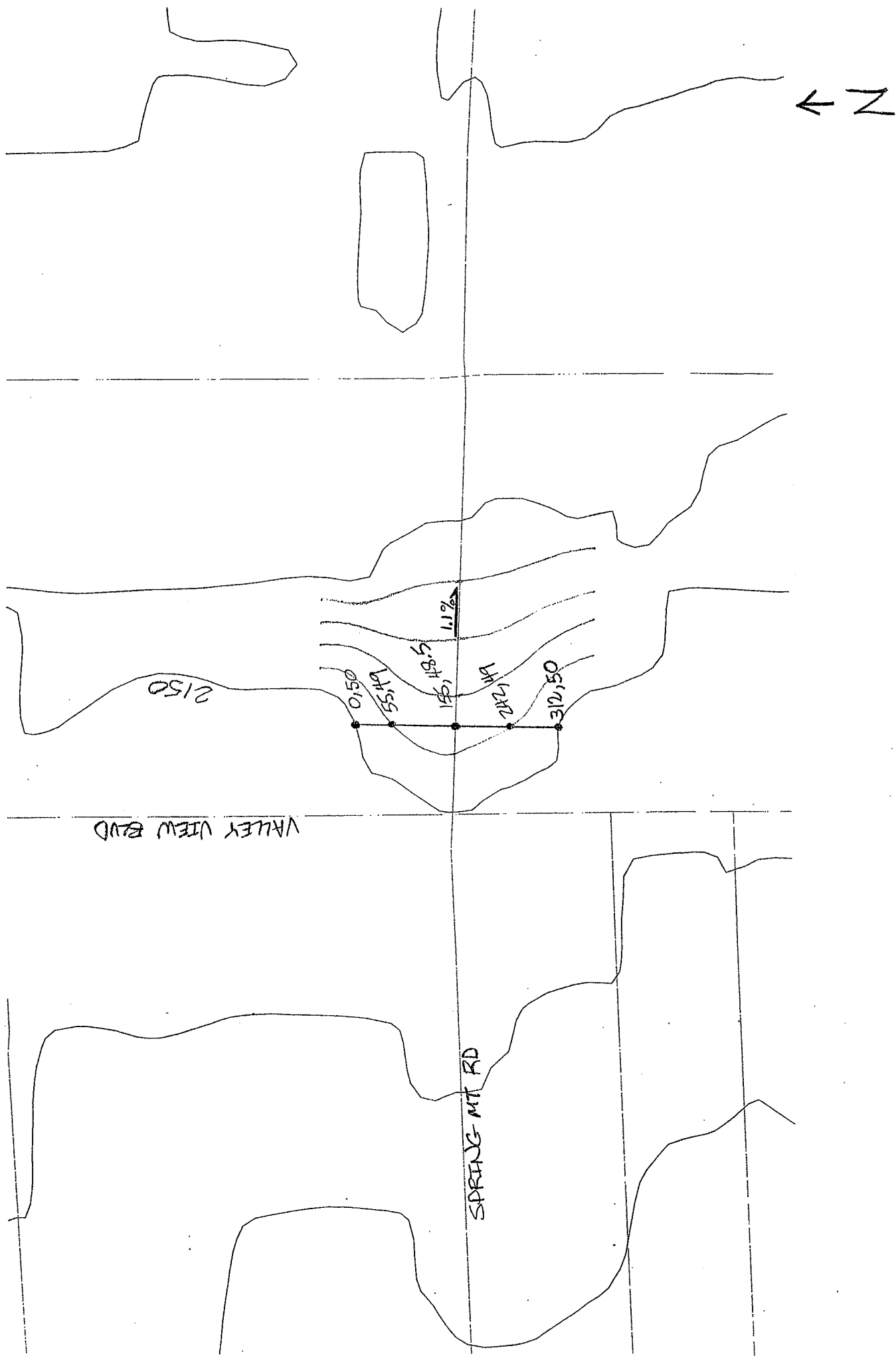
Station (ft)	Elevation (ft)
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0+00	50.00
0+55	49.00
1+55	48.50
2+42	49.00
3+12	50.00

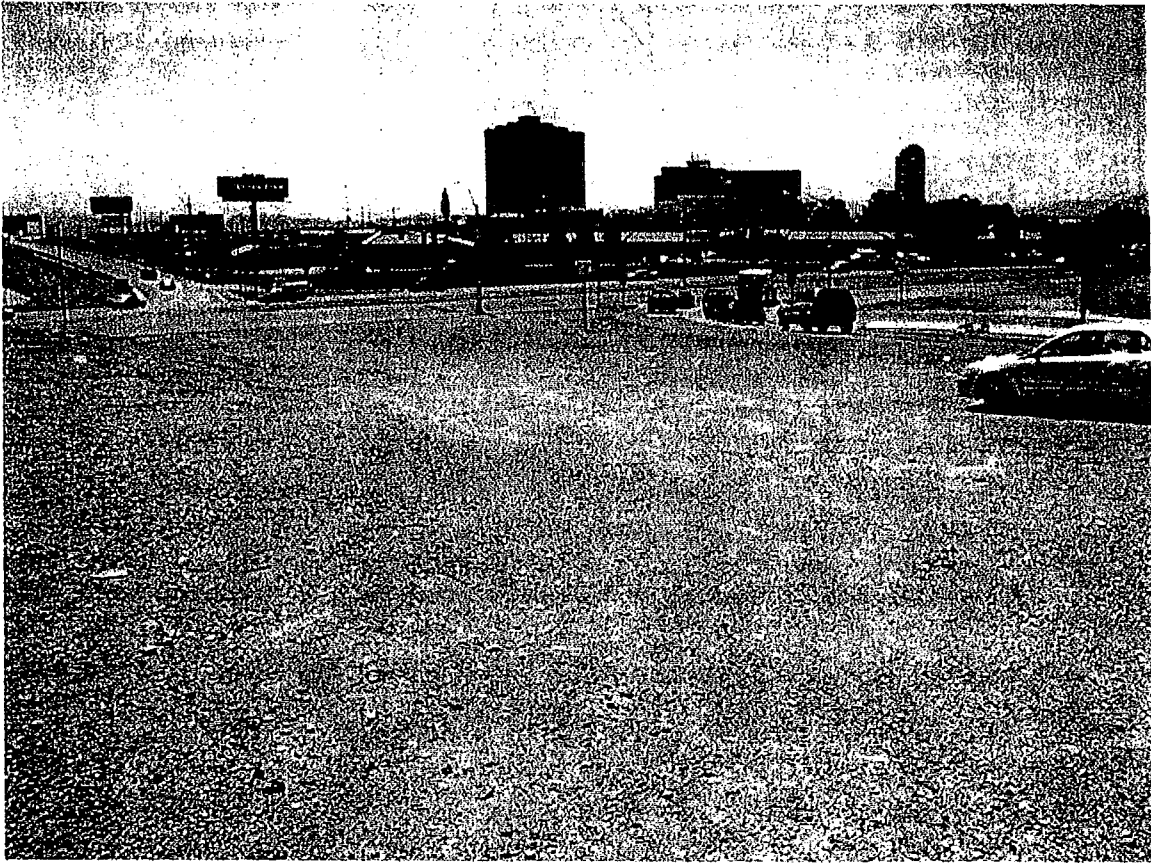
SPRING MT / ALDEBARAN



SPRING MT / VALLEY VIEW



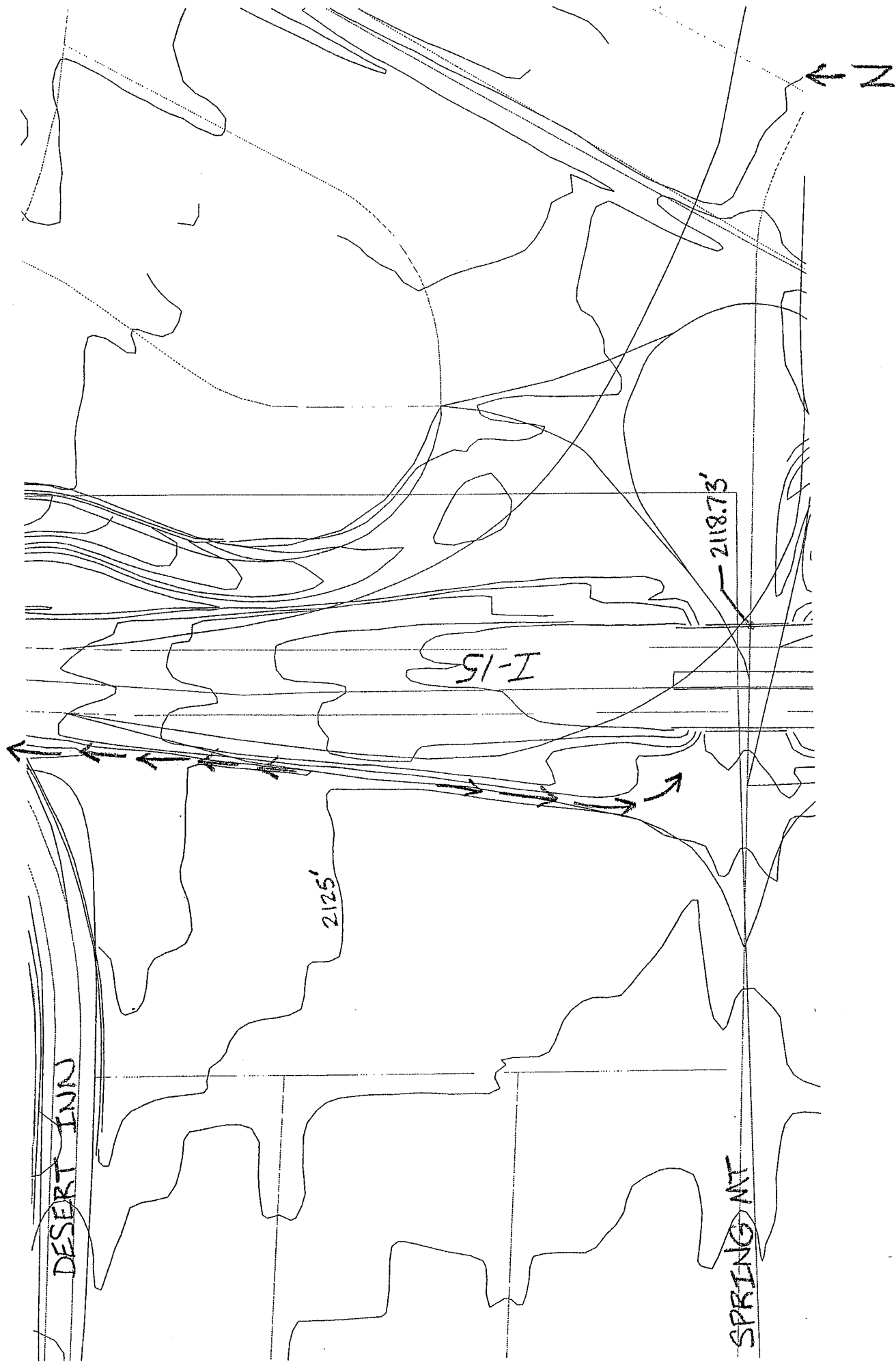
Spring Mountain Interchange Flow Analysis



Spring Mountain Rd / I-15 Interchange – Northwest quadrant of interchange, looking south

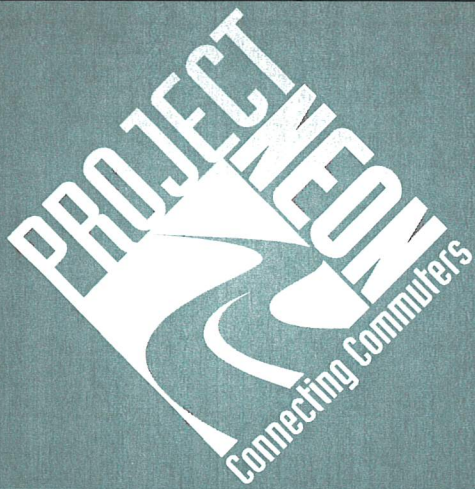
West of I-15, Spring Mountain Rd is lower than the adjacent ground on the north and south (as shown in the above figure). Review of Spring Mountain Rd / I-15 Interchange plans show that the centerline of the roadway at the east face of the bridge has an elevation of 2118.73'. The high point between Spring Mountain Rd and Desert Inn Rd to the north is as much as six feet higher than this (see included Spring Mountain / I-15 Interchange topography exhibit).

SPRING MOUNTAIN / - INTERCHANGE



PROJECT NEON HYDROLOGY
COMPOSITE CURVE NUMBER BREAKDOWN - NORTH OF ALTA DRIVE
BASED ON 2008 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

WATERSHED	2008 MPU BASINID	LAND USE INDEX NUMBER	SOIL MAP UNIT #	SUBREGION CN	SUBREGION AREA (SQ FT)	SUBBASIN AREA (SQ FT)	PERCENT OF SUBBASIN	CUMULATIVE PERCENT	AREAL WEIGHTED CN	CUMULATIVE CN	COMPOSITE CN
Central Watershed	AL93-A	6	236	84	182589	6701920	2.7%	2.7%	2.29	2.29	91.139
	AL93-A	7	236	88	627515	6701920	9.4%	12.1%	8.24	10.53	
	AL93-A	9	236	94	64822	6701920	1.0%	13.1%	0.91	11.44	
	AL93-A	6	341	89	1420560	6701920	21.2%	34.3%	18.86	30.30	
	AL93-A	7	341	91	2741982	6701920	40.9%	75.2%	37.23	67.53	
	AL93-A	9	341	96	806774	6701920	12.0%	87.2%	11.56	79.09	
	AL93-A	6	390	89	316	6701920	0.0%	87.2%	0.00	79.09	
	AL93-A	7	390	91	316203	6701920	4.7%	91.9%	4.29	83.39	
	AL93-A	9	390	96	541158	6701920	8.1%	100.0%	7.75	91.14	
	AL93-B	6	341	89	400242	7912233	5.1%	5.1%	4.50	4.50	
	AL93-B	7	341	91	139497	7912233	1.8%	6.8%	1.60	6.11	
	AL93-B	9	341	96	302115	7912233	3.8%	10.6%	3.67	9.77	
Central Watershed	AL93-B	6	390	89	2463755	7912233	31.0%	41.7%	27.60	37.37	90.959
	AL93-B	7	390	91	3841637	7912233	48.6%	90.2%	44.18	81.56	
	AL93-B	9	390	96	774987	7912233	9.8%	100.0%	9.40	90.96	
	AL93-B										



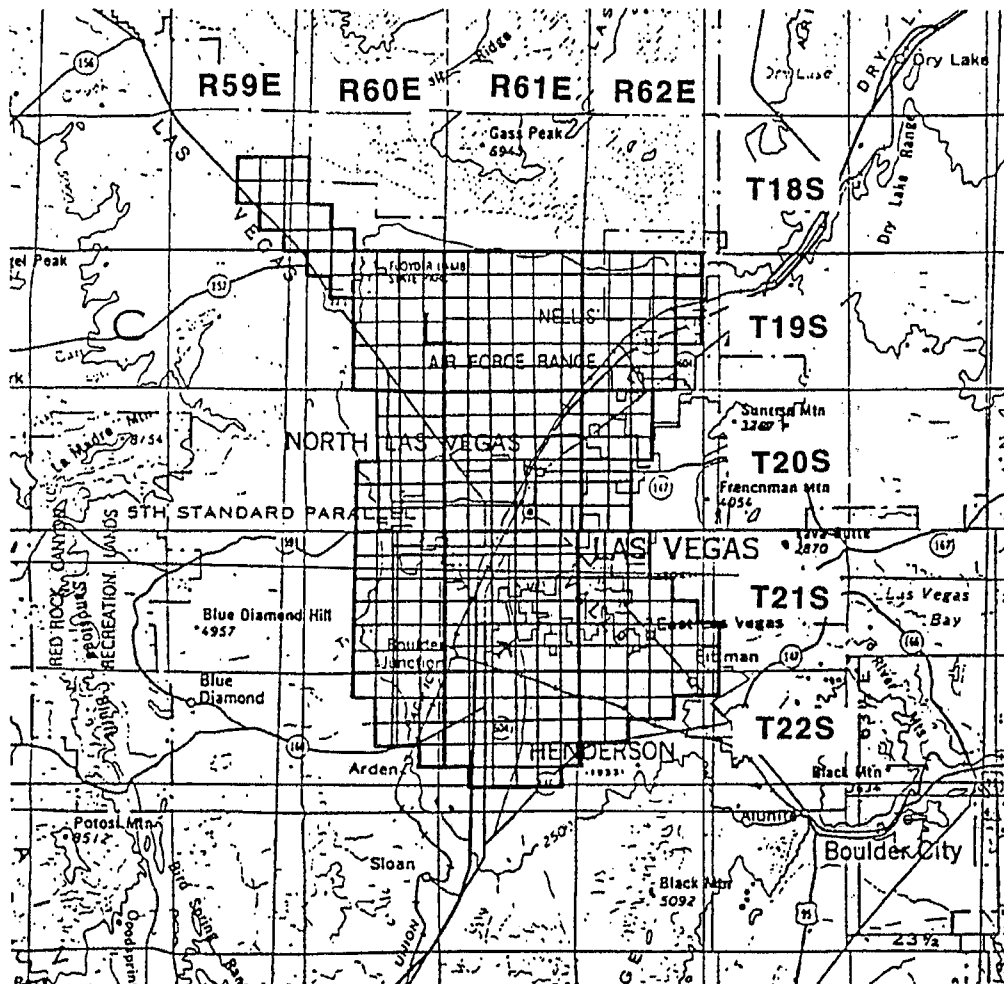
Existing Offsite Hydrology Report

A.3

Precipitation Data

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

18 South	59 East	13-15,22-26,36
18 South	60 East	30-32
19 South	60 East	1-6,8-16,21-28,33-36
19 South	61 East	ALL SECTIONS
19 South	62 East	2-11,14-23,27-34
20 South	60 East	1-3,10-15,21-28,33-36
20 South	61 East	ALL SECTIONS

TOWNSHIP RANGE SECTIONS

20 South	62 East	4-9,16-20,29-32
21 South	60 East	1-4,9-16,21-28,33-36
21 South	61 East	ALL SECTIONS
21 South	62 East	4-9,15-23, 25-36
22 South	60 East	1-4,10-15,24
22 South	61 East	1-24,26-29
22 South	62 East	1-10,17-18

Notes:

1. Refer to Table 505 and Figure 516 Depth-Duration-Frequency values in the McCarran Airport Rainfall Area.
2. Refer to Table 506 and Figure 517 for Time-Intensity-Frequency values on the McCarran Airport Rainfall Area.

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES)

TIME	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5 min.	0.15	0.27	0.35	0.46	0.54	0.63
10 min.	0.25	0.44	0.57	0.74	0.89	1.02
15 min.	0.33	0.57	0.74	0.97	1.15	1.32
30 min.	0.44	0.78	1.01	1.31	1.55	1.79
1 hour	0.52	0.89	1.15	1.50	1.78	2.06
2 hour	0.59	1.01	1.30	1.70	2.01	2.30
3 hour	0.64	1.08	1.39	1.82	2.15	2.48
6 hour	0.72	1.22	1.58	2.05	2.41	2.77
24 hour (TR-55)	1.20	1.60	1.80	2.40	2.70	2.96

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. The 24 hour values presented above are for use with TR-55 only.
3. Table 501 adjustments not required.

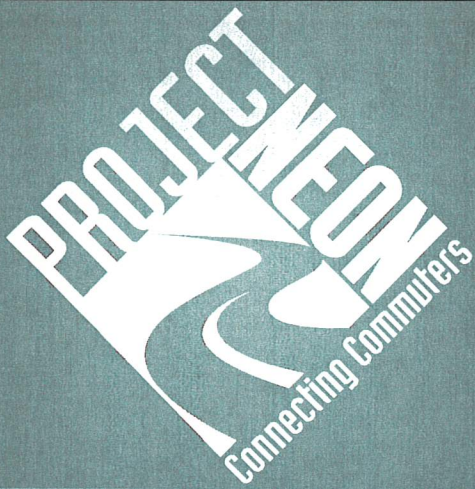
Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 505



Existing Offsite Hydrology Report

A.4

DARF Values

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

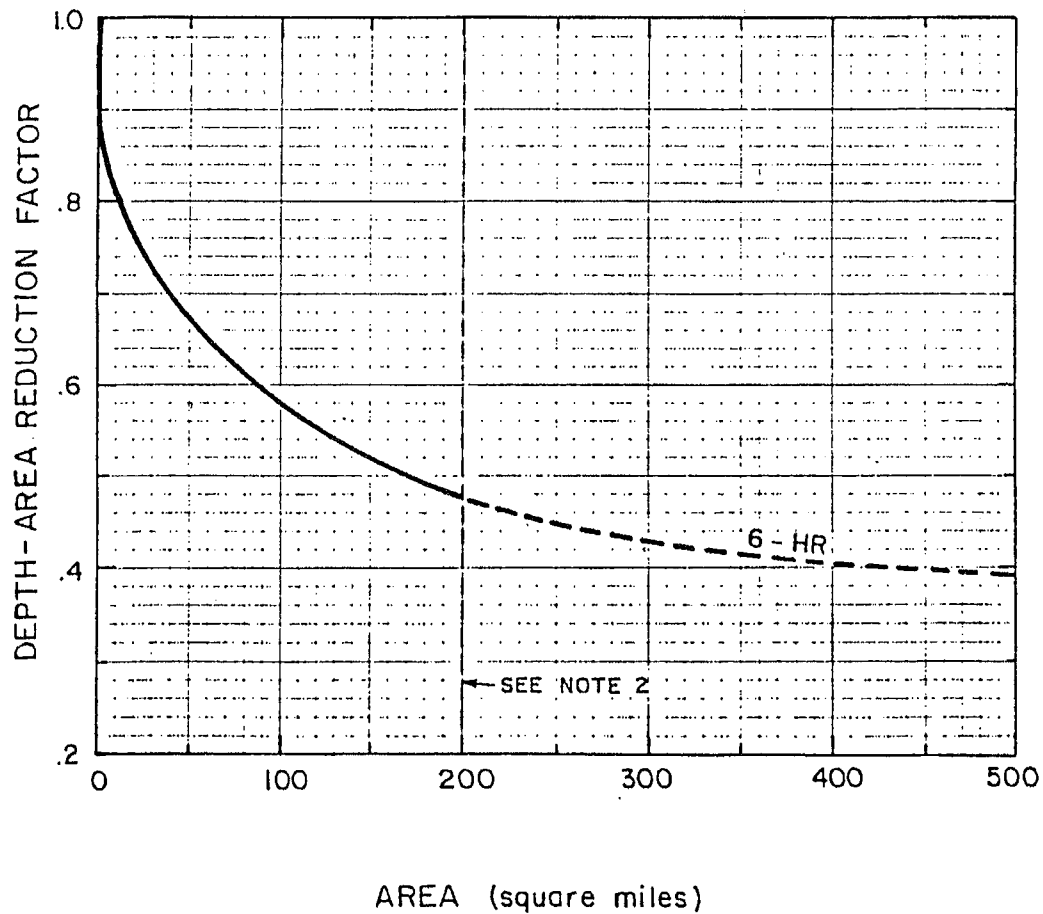
SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
0.0	1.00
0.5	0.98
1.0	0.97
2.0	0.93
4.0	0.91
6.0	0.90
8.0	0.88
10.0	0.86
20.0	0.79
30.0	0.74
50.0	0.68
100.0	0.60
150.0	0.55
200.0	0.51
300.0	0.46
400.0	0.42
500.0	0.39

- NOTES: 1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

<i>Revision</i>	<i>Date</i>

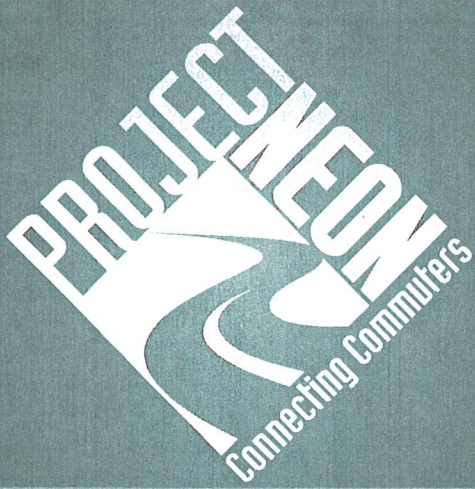
DEPTH-AREA REDUCTION CURVES



Note:

1. Refer to Table 502 for a tabulation of the 6-Hour Depth-Area reduction factors.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction factors for drainage areas greater than 200 miles.

Revision	Date



Existing Offsite Hydrology Report

A.5

SDN Curves

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

Percent of Total Storm Depth				Percent of Total Storm Depth			
Storm Time (In Minutes)	SDN3	SDN4	SDN5	Storm Time (In Minutes)	SDN3	SDN4	SDN5
0	0.0	0.0	0.0	185	32.2	37.6	43.0
5	2.0	2.0	2.0	190	35.2	41.5	47.7
10	5.7	5.8	5.9	195	40.9	46.2	51.4
15	7.0	7.5	8.0	200	49.9	53.0	56.1
20	8.7	9.9	11.0	205	59.0	61.0	63.0
25	10.8	12.6	14.4	210	71.0	71.0	71.0
30	12.4	13.7	15.0	215	74.4	73.2	72.0
35	13.0	14.5	16.0	220	78.1	75.6	73.1
40	13.0	14.9	16.8	225	81.2	78.2	75.2
45	13.0	15.1	17.1	230	81.9	79.9	77.9
50	13.0	15.5	18.0	235	83.5	81.3	79.0
55	13.0	15.6	18.2	240	85.1	82.3	79.5
60	13.0	15.9	18.7	245	85.6	83.0	80.4
65	13.3	16.2	19.0	250	86.0	83.5	81.0
70	14.0	16.9	19.7	255	86.8	84.4	82.0
75	14.2	17.2	20.2	260	87.6	85.1	82.6
80	14.8	17.9	21.0	265	88.8	86.4	84.0
85	15.8	18.9	22.0	270	91.0	88.5	85.9
90	17.2	20.1	23.0	275	92.6	90.8	88.9
95	18.1	21.1	24.1	280	93.7	92.4	91.0
100	19.0	22.0	25.0	285	95.0	94.4	93.8
105	19.7	22.8	25.9	290	97.0	96.8	96.6
110	19.9	23.2	26.5	295	97.6	97.3	97.0
115	20.0	24.0	28.0	300	98.2	97.8	97.4
120	20.1	24.6	29.0	305	98.5	98.2	97.9
125	20.4	25.2	30.0	310	98.7	98.4	98.1
130	21.4	26.0	30.5	315	98.9	98.6	98.3
135	22.9	26.9	30.9	320	99.0	98.8	98.5
140	24.1	27.6	31.0	325	99.3	99.1	98.9
145	24.9	28.3	31.7	330	99.3	99.2	99.0
150	25.1	28.6	32.1	335	99.4	99.3	99.2
155	25.6	29.2	32.7	340	99.5	99.4	99.3
160	27.0	30.2	33.3	345	99.8	99.7	99.6
165	27.8	31.2	34.6	350	99.8	99.8	99.7
170	28.1	32.1	36.1	355	99.9	99.9	99.9
175	28.3	33.2	38.1	360	100.0	100.0	100.0
180	29.5	35.2	40.8				

- Notes: 1. For drainage areas less than 8 square miles in size, use SDN 3.
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
 4. A graphical representation of these values is presented on Figure 515.

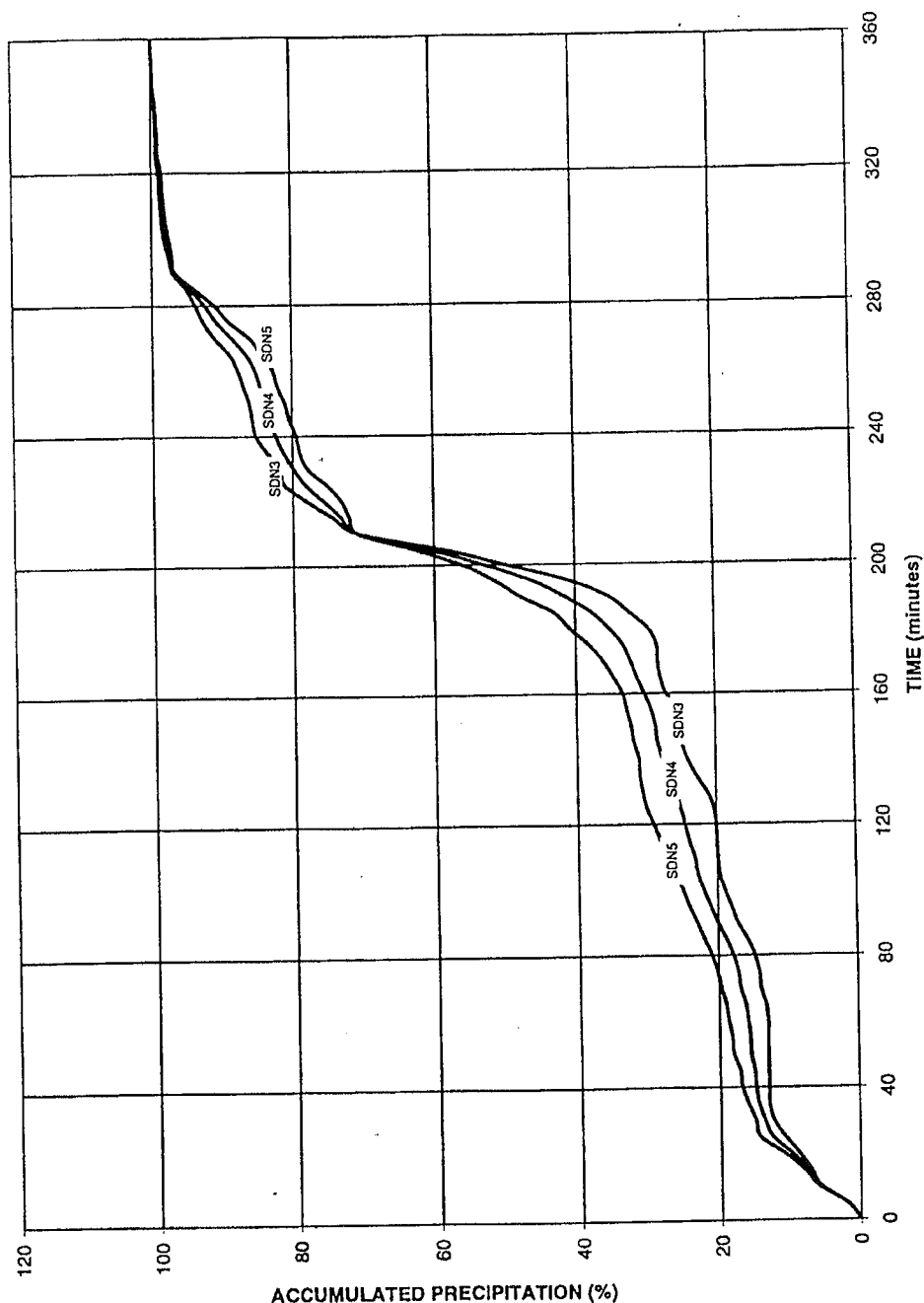
Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR DESIGN STORM DISTRIBUTIONS

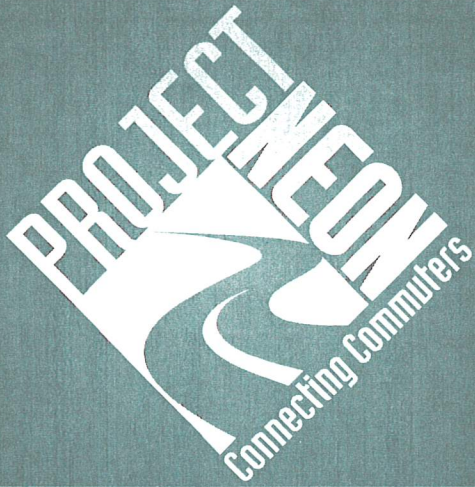


- Notes:
1. For drainage areas less than 8 square miles in size, use SDN 3.
 2. For drainage areas greater than or equal to 8 square miles and less than 12 square miles in size, use SDN 4.
 3. For drainage areas greater than or equal to 12 square miles, use SDN 5.
 4. Refer to Table 503 for a tabulation of storm distribution.

Revision	Date

REFERENCE:

FIGURE 515



Existing Offsite Hydrology Report

A.6

Standard Form 4 for Basin Refinements

Project NEON

BASIN AREAS AND 100 YR LAG TIMES FOR HEC-1 MODEL

VTN NEVADA
File: Lag Time.XLS

BY: MMB
DATE: 1/12/2009

SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc Check	Flag
DESIG: (1)	DEV./EX. (D or E) (2)	CN (3)	K (4)	AREA Mi^2 (5)	INITIAL LENGTH Feet (6)	SLOPE % (7)	Ti Min (8)	TRAVEL LENGTH Feet (9)	SLOPE % (10)	V1 VELOCITY FPS (10a)	V2 VELOCITY FPS (10b)	Tt Min (11)	Min (12)	Min (13)	Flag= 0.6Tc/60 Hours (14)
AL93-A	D	91.1	0.8125	0.240	100	1.00	5.2	5680	0.6	1.6	2.4	41.7	46.9	42.1	0.421
AL93-B	D	91.0	0.8112	0.284	100	1.00	5.2	5835	0.6	1.6	2.4	42.8	48.0	43.0	0.430
PS01-C	D	85.5	0.7386	0.537	100	1.00	6.5	8920	1.26	2.3	3.4	44.5	51.0	60.1	0.510
ED12	D	89.6	0.7927	0.238	100	1.00	5.5	5880	1.41	2.4	3.6	28.2	33.7	43.2	0.337
ED13	D	90.9	0.8099	0.329	100	1.00	5.2	6320	1.18	2.2	3.3	33.0	38.2	45.7	0.382
ED01	D	85.6	0.7399	0.326	100	1.00	6.5	6104	1.22	2.2	3.4	31.4	37.9	44.5	0.379
ED02	D	88.6	0.7795	0.220	100	1.00	5.8	6046	1.20	2.2	3.4	31.3	37.1	44.1	0.371
ED05-C	D	91.2	0.8138	0.456	100	1.00	5.2	9645	1.21	2.2	3.4	49.0	54.2	64.1	0.542
ED05-CA	D	92.2	0.8270	0.110	100	1.00	4.9	5883	1.04	2.1	3.1	32.8	37.7	43.2	0.377
PS06-C	D	91.5	0.8178	0.302	100	1.00	5.1	6077	1.10	2.1	3.2	32.9	38.0	44.3	0.380
ED10-C	D	90.8	0.8086	0.217	100	1.00	5.2	4891	1.48	2.5	3.7	23.0	28.3	37.7	0.283
PS08	D	92.1	0.8257	0.067	100	1.00	4.9	3810	1.50	2.5	3.7	18.1	23.0	31.7	0.230
PS03	D	90.4	0.8033	0.164	100	1.00	5.3	2920	1.00	2.0	3.1	17.3	22.6	26.8	0.226
PS08-A	D	92.7	0.8336	0.074	100	1.00	4.8	3494	1.50	2.5	3.7	16.7	21.5	30.0	0.215

NOTE:

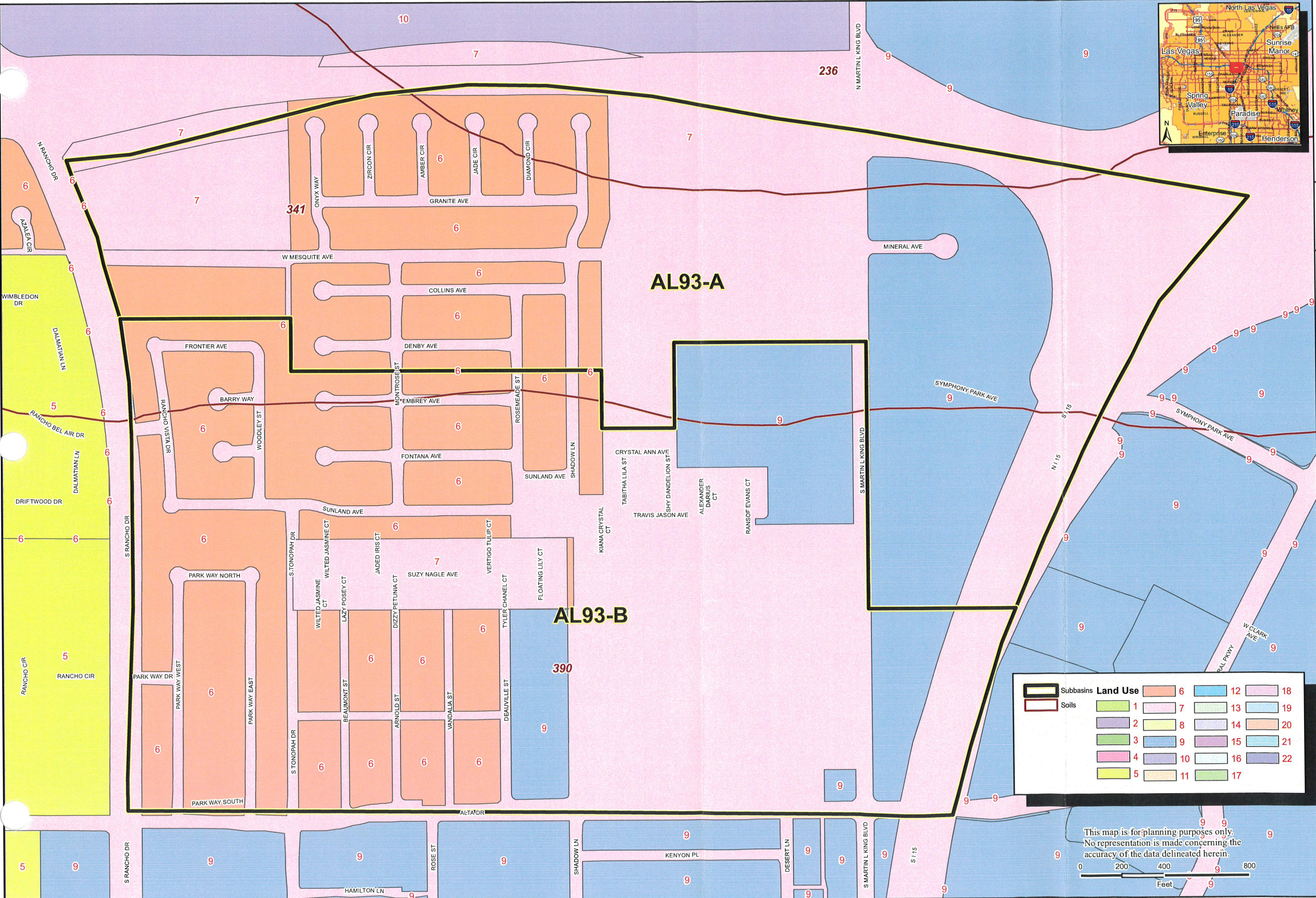
- Subbasin Name
- Developed or Undeveloped Subbasin
- Curve Number (See Subbasin CN Calculations)
- $K = 0.0132 (CN) - 0.39$
- Area
- Initial Length
- Initial Slope
- $Ti = 1.8 (1.1 - K) L^{1/2} / S^{1/3}$
- Travel Length
- Slope
- Slope V1 applies to the first 500 feet of travel distance;
Developed $V1 = 20.2 (S/100)^{1/2}$
- V2 applies to the remaining travel distance;
Developed $V2 = 30.6 (S/100)^{1/2}$
- $Tt = 500 / (V1 * 60) + (Travel Length - 500) / (V2 * 60)$
- $Tc = Ti + Tt$
- $Tc Check = L / 180 + 10$
- $Flag = 0.6 Tc / 60$



Existing Offsite Hydrology Report

A.7

HEC-1 Data CD



W.O.#: 7111-D
DATE 01-13-2101
BY: JTG
SCALE: 1" = 400'
SHEET: 1



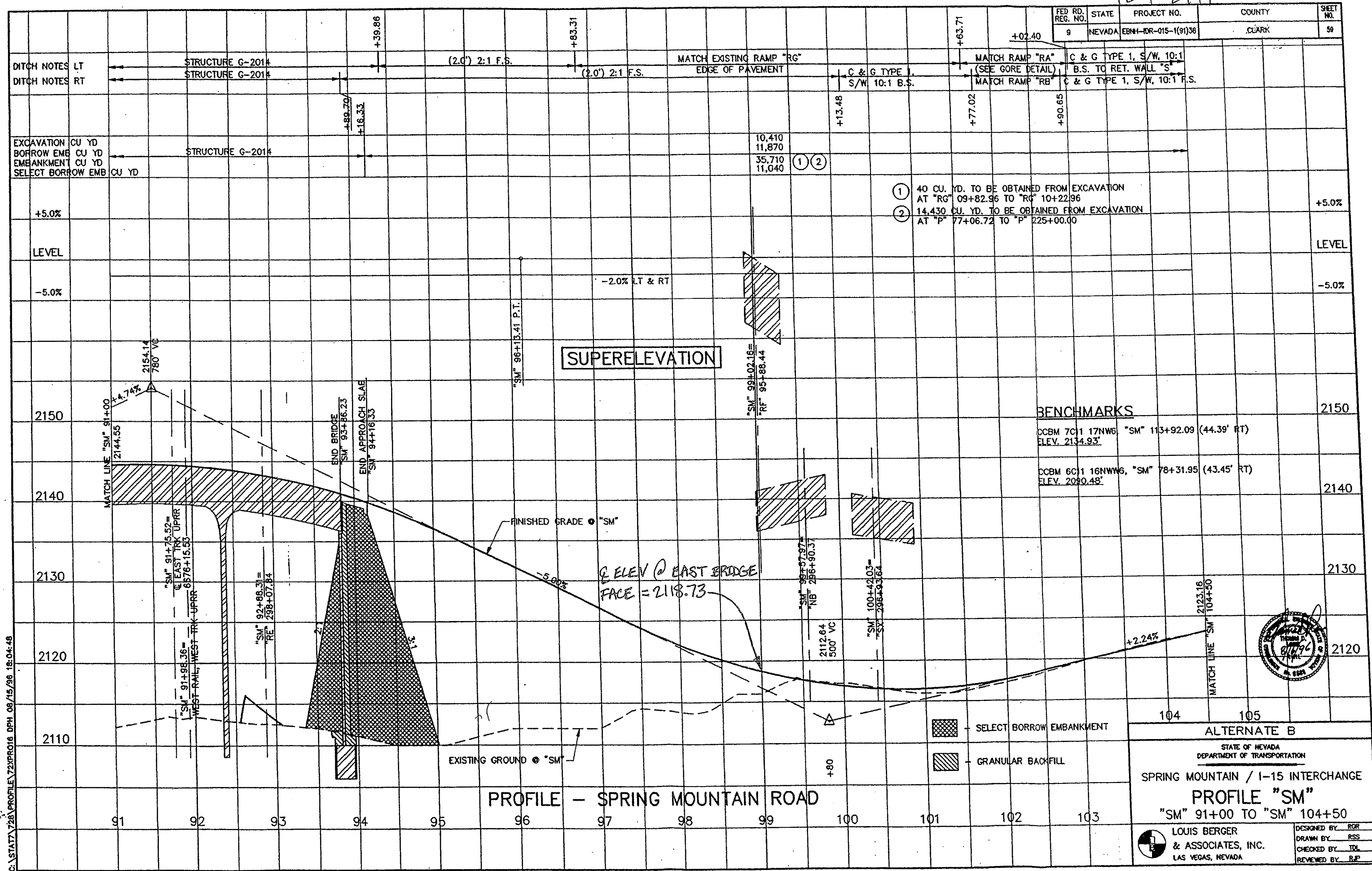
NEON DRAINAGE - New AL93 Subbasins
LAND USE AND SOIL TYPE EXHIBIT

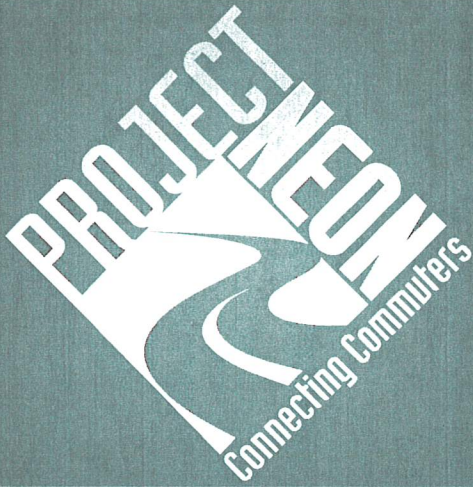
Subbasins	Land Use	6	12	18
Soils	1	7	13	19
	2	8	14	20
	3	9	15	21
	4	10	16	22
	5	11	17	

This map is for planning purposes only.
No representation is made concerning the
accuracy of the data delineated herein.



C:\STAT7\728\PROFILE\728PRO16.DPH 08/15/98 18:04:48





Existing Offsite Hydrology Report

B.2

Sahara Flow Split Calculations

APPENDIX B.2
SAHARA FLOW SPLIT
HYDRAULIC METHODOLOGY

In the Existing/Design Condition, flows in excess of the I-15 Freeway Channel capacity and flows from Sahara Ave. combine at Sahara Ave./I-15. These flows exceed the capacity of Sahara Ave. to convey flow to the east and therefore a flow split occurs to the north along I-15. Analysis of this flow split has been performed by balancing the water surface elevation from a Manning's Equation analysis of Sahara Ave. with the water surface elevation of a weir section to the north.

A flow split analysis was used to develop a flow split rating table for use in the HEC-1 analysis. The following table of values was used at node DCCSA08.

SAHARA FLOW SPLIT RATING TABLE

Rating Table		
Qin (cfs)	Qnorth (cfs)	Qeast (cfs)
0	0	0
200	60	140
400	100	300
600	141	459
800	179	621
1000	220	780
1500	330	1170
2000	430	1570

76.00

FLOW EAST*	FLOW NORTH	TOTAL FLOW
Sahara	I-15	Qtotal
1570	430	2000

* East flow from Manning's Equation Analysis

Rating Table		
Qin	Qnorth	Qeast
0	0	0
200	60	140
400	100	300
600	141	459
800	179	621
1000	220	780
1500	330	1170
2000	430	1570

$$Q_{weir} = C_r L H W_r^{1.5}$$
 $Q_{weir} = \text{Overtopping flow rate}$

Cr = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L = Length of the roadway crest

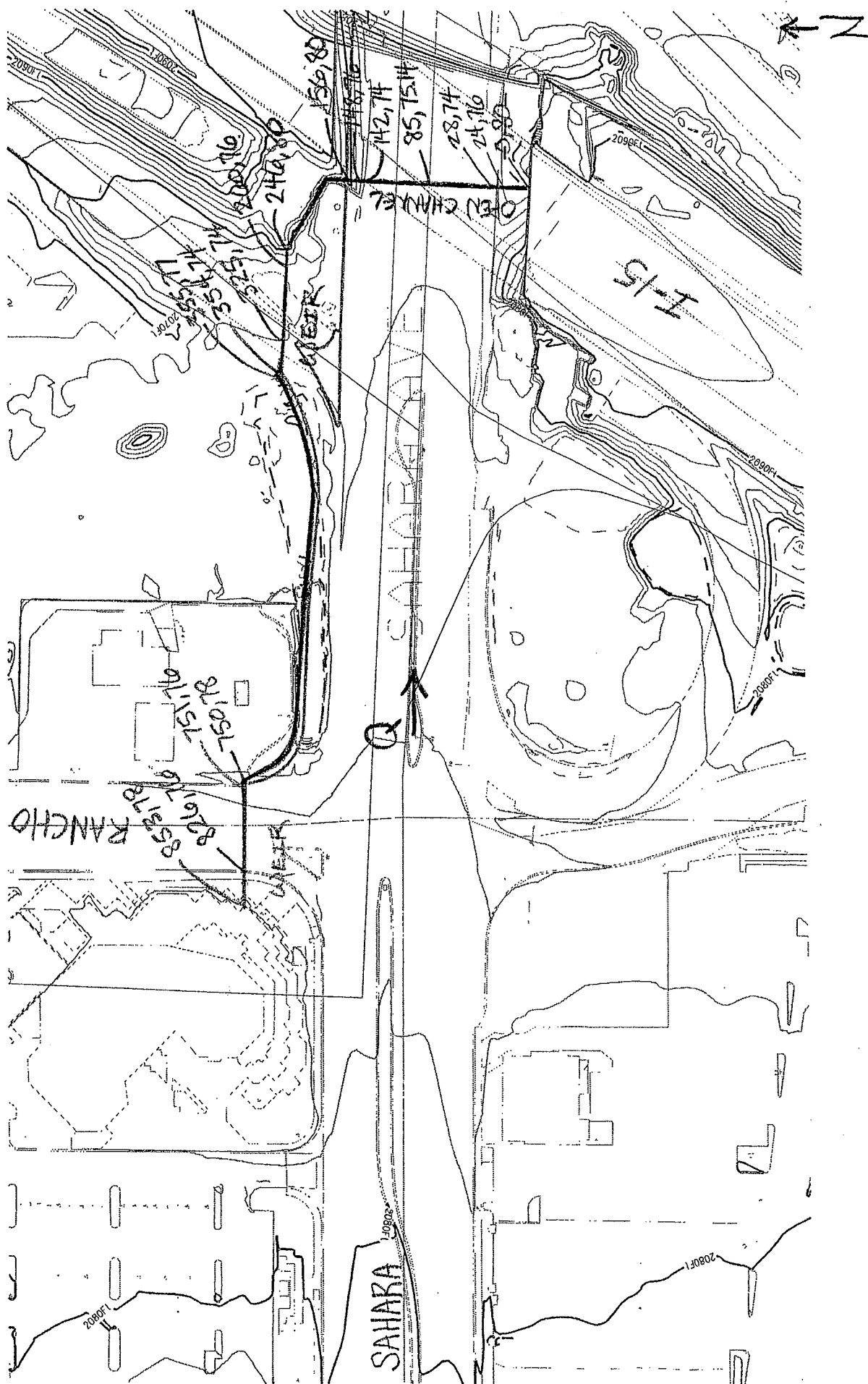
 $L_r = \text{Weir Crest Length}$

HWr = Upstream Depth (WSE-Crest Elevation)

[illegible]

	Flow Area (SF)	N/A	N/A	65.00	58.00	0.50	N/A	N/A	0.00	N/A
	Velocity (ft/s)	N/A	N/A	2.82	4.24	1.91	N/A	N/A	#DIV/0!	N/A
	HW _{T/Lr} <.15	#N/A	#N/A	2.820	2.980	2.700	#N/A	#N/A	2.890	#N/A
	HW _{T/Lr} >.15	#N/A	#N/A	2.900	3.000	2.900	#N/A	#N/A	3.060	#N/A

SAHARA/I-15 FLOW SPLIT



Sahara Flow Split

Project Description

Worksheet	Flow East
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data

Slope	0.60 %
Water Surface Elevation	76.00 ft

Options

Current Roughness Method	Improved Lotter's Method
Open Channel Weighting Method	Improved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Mannings Coefficient	0.016
Elevation Range	74.00 to 80.00
Discharge	1,570 cfs
Flow Area	173.6 ft ²
Wetted Perimeter	124.86 ft
Top Width	124.04 ft
Actual Depth	2.00 ft
Critical Elevation	76.32 ft
Critical Slope	0.31 %
Velocity	9.04 ft/s
Velocity Head	1.27 ft
Specific Energy	77.28 ft
Froude Number	1.35
Flow Type	Supercritical

Roughness Segments

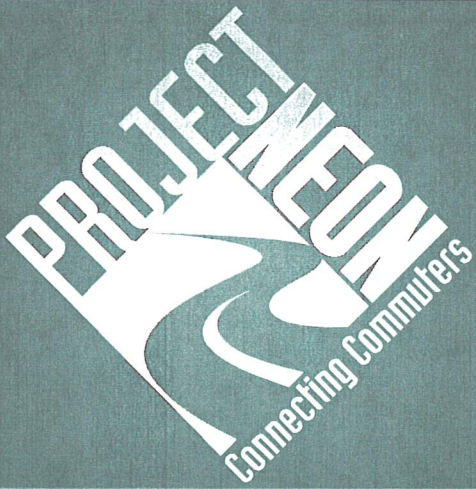
Start Station	End Station	Mannings Coefficient
---------------	-------------	----------------------

0+00	0+28	0.015
0+28	1+42	0.016
1+42	1+56	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
--------------	----------------

0+00	80.00
0+24	76.00
0+28	74.00
0+85	75.14
1+42	74.00
1+48	76.00
1+56	80.00



Existing Offsite Hydrology Report

B.3

I-15 Freeway Channel Hydraulics

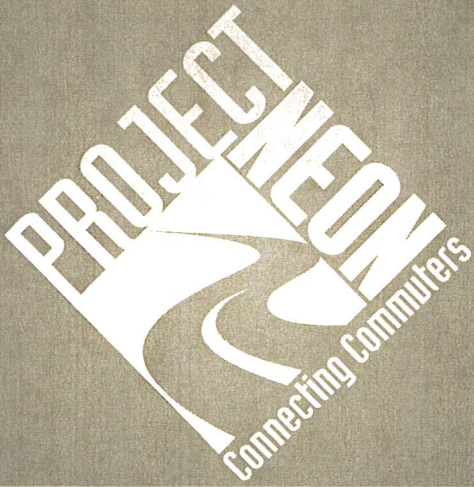
**APPENDIX B.3
FREEWAY CHANNEL
HYDRAULIC METHODOLOGY**

Hydraulic analysis of the existing Freeway Channel was performed between a point approximately 1500 feet south of Sahara Ave, to approximately 500 feet north of Alta Drive using Water Surface Pressure Gradient for Windows (WSPGW). This program uses regular or irregular cross sections entered into the program to compute uniform and non uniform steady flow water surface profiles and pressure gradients in open or closed conduits. This program uses Bernoulli's equation for the total energy at each section and Manning's equation for the friction loss between the sections in a reach. It is understood that NDOT discourages use of WSPG for analysis of smaller onsite storm drain systems, however this software is appropriate for analysis of this major system as it facilitates modeling of the various curves, confluences and system size changes that occur within the system.

System geometry was taken from the record drawings for the I-15 Freeway Channel, by Parsons Brinkerhoff, December 17, 1999, I-15/US-95 Interchange, Stage 2, by GC Wallace, May 19, 1997, and I-15 Widening-Sahara to Charleston, by Louis Berger, December 14, 1999.

FREEWAY CHANNEL HYDRAULIC CAPACITY SUMMARY

NEAREST CROSS STREET	WSPG MODEL STATION (FT)	MAX. FLOW DEPTH (FT)	ACTUAL FLOW DEPTH (FT)	TOTAL FLOW (CFS)	FACILITY CAPACITY (CFS)
PALACE STATION	9146.98	10.0	10.9	2550	2360
OAKLEY BLVD	4398.82	11.0	11.2	3178	3080
WALDMAN AVE	2779.02	17.0	16.0	3361	3361
WESTERN AVE	1787.34	14.4	14.9	3387	3387
CHARLESTON BLVD	920.01	13.5	13.9	3975	3787
PINTO LN	-774.52	12.7	11.4	3810	3810
ALTA DR	-1671.18	20.0	10.5	4035	3910



Existing Offsite Hydrology Report

B.3.1

Hydraulic Summary Table

Hydraulic Summary **Existing Freeway Channel** **Alta to Sahara**

* Starting at Downstream End, Looking Upstream

CROSS STREETS	DESCRIPTION	STATION (Metric)	ELEV (Metric)	RADIUS (Metric)	STATION (FT)	ELEV (FT)	DEPTH OF FLOW (FT)	H.G.L. (FT)	RADIUS (FT)	Delta (Degrees)
	SO	3500.000	616.162		-2303.724	2021.53	9.000	2030.528		
	(3)12'x9' RCB's - (2) 1' Piers									
	Angle Point	3321.370	616.466		-1717.668	2022.52	10.160	2032.685		10.543
	(3)12'x9' RCB's - (2) 1' Piers									
ALTA	JX (66" RCP)	3307.200	616.490		-1671.178	2022.60	10.451	2033.055		53.000
	(3)12'x9' RCB's - (2) 1' Piers									
	End RCB's	3276.370	616.542		-1570.030	2022.78	10.623	2033.399		
	(3)12'x10' RCB's - (2) 1' Piers									
	PT	3229.142	616.622		-1415.08	2023.04	10.767	2033.805		
	(3)12'x10' RCB's - (2) 1' Piers			2024.0					6640.42	5.527
PINTO	JX (8'X3' RCB)	3033.900	616.954		-774.52	2024.13	11.381	2035.508		
	(3)12'x10' RCB's - (2) 1' Piers			2024.0					6640.42	2.274
	PC	2953.557	617.091		-510.93	2024.58	11.665	2036.242		
	(3)12'x10' RCB's - (2) 1' Piers									
	Angle Point	2881.154	617.214		-273.39	2024.98	11.877	2036.857		2.263
	(3)12'x10' RCB's - (2) 1' Piers									
	End Precast RCB's, Begin RCB's	2690.000	617.539		353.76	2026.05	12.436	2038.483		
	(3)12'x10' RCB's - (2) 2' Piers									
	End Access Vent Structure, Begin Precast RCB's	2562.500	617.756		772.06	2026.76	12.805	2039.564		
	(3)12'x10' RCB's - (2) 1' Piers									
	End JX Structure, Begin Vent Structure	2552.404	617.773		805.19	2026.81	12.840	2039.654		
	(3)12'x10' RCB's - (2) 2' Piers									
CHARLESTON	End TS, Begin JX Structure (10'X9' RCB)	2517.405	617.832		920.01	2027.01	13.953	2040.961		
	(3)12'x10' RCB's - (2) 2' Piers									
	End Precast RCB's, Begin TS	2503.865	617.855		964.44	2027.08	13.975	2041.058		
	(3)12'x10' RCB's - (2) 2' Piers									
	Angle Point	2410.377	618.014		1271.15	2027.60	14.087	2041.692		1.132
	(3)12'x10' RCB's - (2) 2' Piers									

* Starting at Downstream End, Looking Upstream

CROSS STREETS	DESCRIPTION	STATION (Metric)	ELEV (Metric)	RADIUS (Metric)	STATION (FT)	ELEV (FT)	DEPTH OF FLOW (FT)	H.G.L. (FT)	RADIUS (FT)	Delta (Degrees)
	End JX Structure, Begin Precast RCB's	2293.397	618.213		1654.95	2028.26	14.224	2042.482		
WESTERN	End RCB's, Begin JX Structure (12'X9 RCB)	2253.043	618.282		1787.34	2028.48	14.868	2043.352		
	(3)12'x10' RCB's - (2) 1' Piers	2230.629	618.320		1860.88	2028.61	14.887	2043.496		
	PT			30.0					98.43	107.989
	(3)12'x10' RCB's - (2) 1' Piers	2174.086	618.416		2046.39	2028.92	15.250	2044.174		
	PC									
	(3)12'x10' RCB's - (2) 1' Piers	2114.195	618.518		2242.88	2029.26	15.319	2044.578		
	PT			21.5					70.54	86.096
	(3)12'x10' RCB's - (2) 1' Piers	2081.888	618.573		2348.87	2029.44	15.609	2045.048		
	PRC			450.0					1476.38	16.693
	(3)12'x10' RCB's - (2) 1' Piers	1950.781	618.796		2779.02	2030.17	15.953	2046.124		
WALDMAN	JX (6'X6' RCB)	1943.361	618.808		2803.36	2030.21	15.977	2046.187		
	(3)12'x10' RCB's - (2) 1' Piers			450.0					1476.38	0.945
	PC									
	(3)12'x10' RCB's - (2) 1' Piers	1880.000	618.917		3011.24	2030.57	15.972	2046.540		
	Grade Break									
	(3)12'x10' RCB's - (2) 1' Piers									
	End (3)12'x9' RCB's, Begin (3)12'x10' RCB's	1860.000	619.040		3076.85	2030.97	15.684	2046.655		
	(3)12'x9' RCB's - (2) 1' Piers									
	PT	1731.777	619.839		3497.53	2033.59	14.022	2047.615		
	(3)12'x9' RCB's - (2) 1' Piers			750.0					2460.63	2.971
	PC	1692.887	620.078		3625.12	2034.38	13.573	2047.950		
	(3)12'x9' RCB's - (2) 1' Piers									
	PT	1514.421	621.187		4210.64	2038.02	11.266	2049.281		
	(3)12'x9' RCB's - (2) 1' Piers			200.0					656.17	13.819
	PC, End JX Structure	1466.182	621.486		4368.91	2039.00	10.756	2049.752		
	(3)12'x9' RCB's - (2) 1' Piers									
OAKY	End Precast RCB's, Begin JX Structure (10'X8')	1457.063	621.543		4398.82	2039.18	11.168	2050.351		
	(2)10'x8' RCB's - (1) 2' Piers									
	Grade Break	1427.000	621.730		4497.46	2039.80	11.290	2051.087		
	(2)10'x8' RCB's - (1) 2' Piers									
	Angle Point	1404.207	621.832		4572.24	2040.13	11.458	2051.589		11.229

* Starting at Downstream End, Looking Upstream

CROSS STREETS	DESCRIPTION	STATION (Metric)	ELEV (Metric)	RADIUS (Metric)	STATION (FT)	ELEV (FT)	DEPTH OF FLOW (FT)	H.G.L. (FT)	RADIUS (FT)	Delta (Degrees)
	PT				8350.34	2066.86	11.665	2078.523		
	(2)10'x8' RCB's - (1) 1' Piers			1000.0					3280.96	2.779
	PC				8509.50	2068.05	11.654	2079.705		
	(2)10'x8' RCB's - (1) 1' Piers									
					9144.16	2072.81	11.120	2083.930		
	(2)10'x8' RCB's - (1) 1' Piers									
	GRADE BREAK - End TS				9146.98	2072.83	10.555	2083.386		
	(2)10'x8' RCB's - 25'x8' Channel									
	GRADE BREAK - Begin TS				9212.60	2076.21	9.842	2086.052		
	25'x8' Channel									
KING'S WAY	SH				10000.00	2082.68	4.900	2087.581		



Existing Offsite Hydrology Report

B.3.2

WSPG Output File

T1 PROJECT NEON

T2 WSPGW HYDRAULIC MODEL

T3 EXISTING FREEWAY CHANNEL ALIGNMENT FEB 2010

SO	-2303.72	2021.530	12			2030.530			
R	-1717.67	2022.520	12	.014					
JX	-1671.18	2022.600	12	15	.014	100.000	2022.600	53.00	.000
R	-1570.03	2022.780	12	.014					
R	-1415.08	2023.040	10	.014					
JX	-774.52	2024.130	10	9	.014	23.000	2024.130	90.00	5.53
R	-510.93	2024.580	10	.014				2.27	
R	-273.39	2024.980	10	.014					
R	353.76	2026.050	10	.014				.000	-2.263 0
R	772.06	2026.760	1	.014					
R	805.19	2026.810	10	.014					
JX	920.01	2027.010	11	5	.014	400.000	2027.010	.01	.000
WE	920.01	2027.010	11	.014					
R	964.44	2027.080	10	.014					
R	1271.15	2027.600	1	.014					
R	1654.94	2028.260	1	.014				.000	1.132 0
JX	1787.34	2028.480	14	.014	26.000		2028.480	.01	.000
R	1860.88	2028.610	10	.014					
R	2046.39	2028.920	10	.014				107.990	.000 0
R	2242.88	2029.250	10	.014					
R	2348.88	2029.440	10	.014				-86.090	
JX	2779.02	2030.170	10	7	.014	281.000	2030.230	30.00	16.690
R	2803.36	2030.210	10	.014				0.940	
R	3011.24	2030.570	10	.014					
R	3076.85	2030.970	10	.014					
R	3497.53	2033.590	12	.014					
R	3625.12	2034.380	12	.014				-2.970	.000 0
R	4210.64	2038.020	12	.014					
R	4368.91	2039.000	12	.014				-13.820	.000 0
JX	4398.82	2039.180	12	8	.014	720.000	2039.180	.01	.000
WE	4398.82	2039.180	12	.014					
R	4497.46	2039.800	13	.014					
R	4572.24	2040.130	13	.014					
R	4582.87	2040.200	13	.014				.000	11.229 0
R	5770.33	2048.280	3	.014					
R	6021.57	2049.940	3	.014					
R	6195.64	2051.100	3	.014					
R	6634.90	2054.000	3	.014				8.930	.000 0
R	6786.80	2055.010	3	.014					
R	7038.17	2056.670	3	.014				-14.190	.000 0
R	7080.05	2056.950	3	.014					
R	7134.51	2057.380	3	.014					
R	7434.75	2059.760	3	.014				6.040	.000 0
R	7486.75	2060.170	3	.014					
R	7512.36	2060.370	3	.014				7.440	.000 0
R	7575.32	2060.490	3	.014				18.300	.000 0
R	7660.00	2060.660	3	.014				-24.640	.000 0
R	7674.17	2060.850	3	.014				-4.120	.000 0
R	7834.65	2062.990	3	.014					
R	8350.34	2066.860	3	.014					
R	8509.50	2068.050	3	.014				2.780	.000 0
R	9144.16	2072.810	3	.014					
JX	9146.98	2072.830	3	.014	-190.000		2082.330	.01	.000
WE	9146.98	2072.830	3	.014					
TS	9212.60	2076.210	4	.014				.000	
R	10000.00	2082.680	4	.014					
SH	10000.00	2082.680	4				2087.370		

CD	1	3	2	2.000	10.000	40.000	.000	.000	.00
CD	2	3	2	2.000	9.000	40.000	.000	.000	.00
CD	3	3	1	1.000	8.000	21.000	.000	.000	.00
CD	4	2	0	.000	8.000	25.000	.000	.000	.00
CD	5	3	0	0.000	9.000	10.000	.000	.000	.00
CD	6	3	0	0.000	9.000	12.000	.000	.000	.00
CD	7	3	0	0.000	6.000	6.000	.000	.000	.00
CD	8	3	0	0.000	8.000	10.000	.000	.000	.00
CD	9	3	0	0.000	3.000	8.000	.000	.000	.00
CD	10	3	2	1.000	10.000	38.000	.000	.000	.00
CD	11	3	2	1.000	10.000	50.000	.000	.000	.00
CD	12	3	2	1.000	9.000	38.000	.000	.000	.00
CD	13	3	1	2.000	8.000	22.000	.000	.000	.00
CD	14	3	2	1.000	10.000	52.000	.000	.000	.00
CD	15	4	0	0.000	5.5000	.000	.000	.000	.00
Q				2550.000	.0				

Date: 2-12-2010 Time: 9:59:48

PROJECT NEON
WSPGW HYDRAULIC MODEL
EXISTING FREEWAY CHANNEL ALIGNMENT FEB 2010

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
2046.390	2028.920	15.250	2044.171	3361.00	9.34	1.35	2045.52	.00	6.47	38.00	10.000	38.000	.00	2 1.0
196.490	.0017					.0020	.40	15.25	.53	9.11	.014	.00	.00	BOX
2242.880	2029.250	15.319	2044.569	3361.00	9.34	1.35	2045.92	.00	6.47	38.00	10.000	38.000	.00	2 1.0
106.000	.0018					.0020	.22	.00	.53	8.88	.014	.00	.00	BOX
2348.880	2029.440	15.609	2045.049	3361.00	9.34	1.35	2046.40	.00	6.47	38.00	10.000	38.000	.00	2 1.0
JUNCT STR	.0017					.0017	.73	.00	.53		.014	.00	.00	BOX
2779.020	2030.170	15.953	2046.123	3080.00	8.56	1.14	2047.26	.00	6.10	38.00	10.000	38.000	.00	2 1.0
24.340	.0016					.0017	.04	.00	.49	8.58	.014	.00	.00	BOX
2803.360	2030.210	15.977	2046.187	3080.00	8.56	1.14	2047.32	.00	6.10	38.00	10.000	38.000	.00	2 1.0
207.880	.0017					.0017	.35	15.98	.49	8.40	.014	.00	.00	BOX
3011.240	2030.570	15.972	2046.542	3080.00	8.56	1.14	2047.68	.00	6.10	38.00	10.000	38.000	.00	2 1.0
65.610	.0061					.0017	.11	15.97	.49	5.21	.014	.00	.00	BOX
3076.850	2030.970	15.684	2046.654	3080.00	9.51	1.40	2048.06	.00	6.10	38.00	9.000	38.000	.00	2 1.0
420.680	.0062					.0023	.96	15.68	.57	5.17	.014	.00	.00	BOX
3497.530	2033.590	14.022	2047.611	3080.00	9.51	1.40	2049.01	.00	6.10	38.00	9.000	38.000	.00	2 1.0
127.590	.0062					.0023	.29	.00	.57	5.18	.014	.00	.00	BOX
3625.120	2034.380	13.573	2047.953	3080.00	9.51	1.40	2049.36	.00	6.10	38.00	9.000	38.000	.00	2 1.0
585.520	.0062					.0023	1.33	13.57	.57	5.17	.014	.00	.00	BOX

FILE: FWCH.WSW

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WATER SURFACE PROFILE LISTING

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Date: 2-12-2010 Time: 9:59:48

PROJECT NEON
WSPGW HYDRAULIC MODEL
EXISTING FREEWAY CHANNEL ALIGNMENT FEB 2010

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
4210.640	2038.020	11.266	2049.286	3080.00	9.51	1.40	2050.69	.00	6.10	38.00	9.000	38.000	.00	2 1.0
158.270	.0062					.0023	.36	.00	.57	5.18	.014	.00	.00	BOX
4368.910	2039.000	10.756	2049.756	3080.00	9.51	1.40	2051.16	.00	6.10	38.00	9.000	38.000	.00	2 1.0
JUNCT STR	.0060					.0013	.04	.00	.57		.014	.00	.00	BOX
4398.820	2039.180	11.168	2050.348	2360.00	7.28	.82	2051.17	.00	5.11	38.00	9.000	38.000	.00	2 1.0
WALL ENTRANCE														
4398.820	2039.180	11.254	2050.434	2360.00	14.75	3.38	2053.81	.00	7.56	22.00	8.000	22.000	.00	1 2.0
98.640	.0063					.0067	.66	11.25	.96	6.90	.014	.00	.00	BOX
4497.460	2039.800	11.290	2051.090	2360.00	14.75	3.38	2054.47	.00	7.56	22.00	8.000	22.000	.00	1 2.0
74.780	.0044					.0067	.50	11.29	.96	8.00	.014	.00	.00	BOX
4572.240	2040.130	11.458	2051.588	2360.00	14.75	3.38	2054.97	.00	7.56	22.00	8.000	22.000	.00	1 2.0
10.630	.0066					.0067	.07	11.46	.96	6.78	.014	.00	.00	BOX
4582.870	2040.200	11.584	2051.784	2360.00	14.75	3.38	2055.16	.00	7.56	21.00	8.000	21.000	.00	1 1.0
1187.460	.0068					.0067	7.91	11.58	.94	6.69	.014	.00	.00	BOX
5770.330	2048.280	11.412	2059.692	2360.00	14.75	3.38	2063.07	.00	7.56	21.00	8.000	21.000	.00	1 1.0
251.240	.0066					.0067	1.67	11.41	.94	6.76	.014	.00	.00	BOX
6021.570	2049.940	11.425	2061.365	2360.00	14.75	3.38	2064.74	.00	7.56	21.00	8.000	21.000	.00	1 1.0
174.070	.0067					.0067	1.16	11.42	.94	6.74	.014	.00	.00	BOX

Date: 2-12-2010 Time: 9:59:48

PROJECT NEON
WSPGW HYDRAULIC MODEL
EXISTING FREEWAY CHANNEL ALIGNMENT FEB 2010

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.--FT	Base Wt or I.D.	ZL	No Wth Prs/Pip		
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch		
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****		
6195.640	2051.100	11.424	2062.524	2360.00	14.75	3.38	2065.90	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
439.260	.0066					.0067	2.93	.00	.94	6.77	.014	.00	.00	BOX		
6634.900	2054.000	11.662	2065.662	2360.00	14.75	3.38	2069.04	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
151.900	.0066					.0067	1.01	11.66	.94	6.75	.014	.00	.00	BOX		
6786.800	2055.010	11.664	2066.674	2360.00	14.75	3.38	2070.05	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
251.370	.0066					.0067	1.67	.00	.94	6.77	.014	.00	.00	BOX		
7038.170	2056.670	11.946	2068.616	2360.00	14.75	3.38	2071.99	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
41.880	.0067					.0067	.28	11.95	.94	6.73	.014	.00	.00	BOX		
7080.050	2056.950	11.945	2068.895	2360.00	14.75	3.38	2072.27	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
54.460	.0079					.0067	.36	11.94	.94	6.31	.014	.00	.00	BOX		
7134.510	2057.380	11.877	2069.257	2360.00	14.75	3.38	2072.64	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
300.240	.0079					.0067	2.00	.00	.94	6.30	.014	.00	.00	BOX		
7434.750	2059.760	11.671	2071.431	2360.00	14.75	3.38	2074.81	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
52.000	.0079					.0067	.35	11.67	.94	6.32	.014	.00	.00	BOX		
7486.750	2060.170	11.608	2071.778	2360.00	14.75	3.38	2075.16	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
25.610	.0078					.0067	.17	.00	.94	6.34	.014	.00	.00	BOX		
7512.360	2060.370	11.772	2072.142	2360.00	14.75	3.38	2075.52	.00	7.56	21.00	8.000	21.000	.00	1 1.0		
-	-	-	-	-	-	-	-	-	-	-	-	-	-	-		
62.960	.0019					.0067	.42	.00	.94	8.00	.014	.00	.00	BOX		

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Program Package Serial Number: 1513
WATER SURFACE PROFILE LISTING

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PROJECT NEON
WSPGW HYDRAULIC MODEL
EXISTING FREEWAY CHANNEL ALIGNMENT FEB 2010

[illegible]

HYDRAULIC DROP

Date: 2-12-2010 Time: 9:59:48

PROJECT NEON

WSPGW HYDRAULIC MODEL

EXISTING FREEWAY CHANNEL ALIGNMENT FEB 2010

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt or I.D.	ZL	No Wth
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
9146.980	2072.830	10.927	2083.757	2550.00	15.18	3.58	2087.33	.00	7.71	21.00	8.000	21.000	.00	0 .0
TRANS STR	.0515					.0030	.19	10.93	.95		.014	.00	.00	BOX
9212.600	2076.210	9.842	2086.052	2550.00	10.36	1.67	2087.72	.00	6.86	25.00	8.000	25.000	.00	0 .0
18.974	.0082					.0010	.02	9.84	.58	4.68	.014	.00	.00	RECTANG
9231.573	2076.366	9.632	2085.998	2550.00	10.59	1.74	2087.74	.00	6.86	25.00	8.000	25.000	.00	0 .0
HYDRAULIC JUMP														
9231.573	2076.366	4.683	2081.049	2550.00	21.78	7.37	2088.41	.00	6.86	25.00	8.000	25.000	.00	0 .0
768.427	.0082					.0082	6.30	4.68	1.77	4.68	.014	.00	.00	RECTANG
10000.000	2082.680	4.690	2087.370	2550.00	21.75	7.34	2094.71	.00	6.86	25.00	8.000	25.000	.00	0 .0

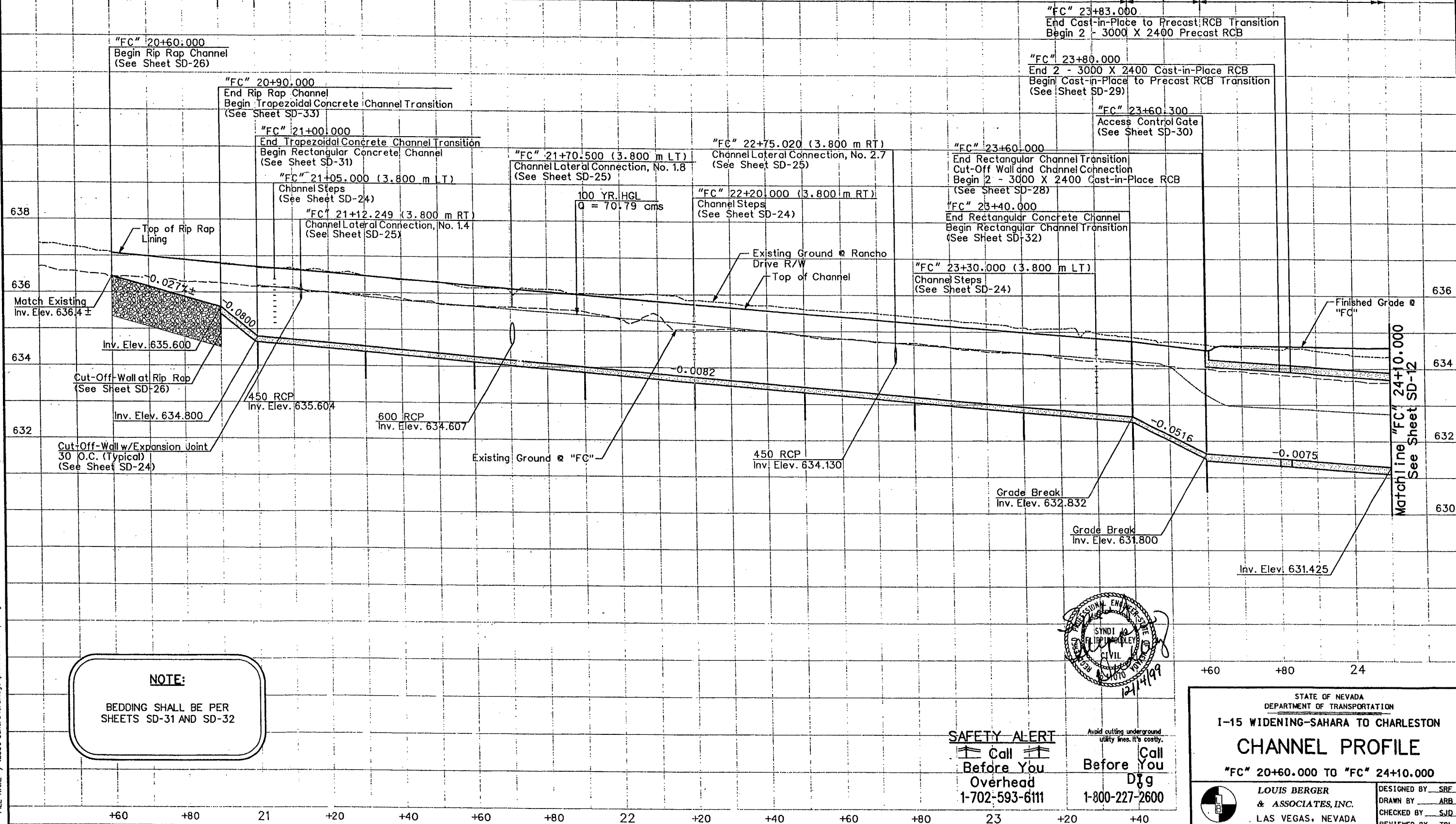


Existing Offsite Hydrology Report

B.3.3

Freeway Channel Record Drawings

Rip Rap Channel		1:2 SS Max. Bottom Width 4000 Top Width 1100		Trapezoidal Concrete Channel Transition		1:2 SS to Vertical Depth 1200 to 1800 Top Width 11000 to 7600		Rectangular Concrete Channel		Rectangular Concrete Channel Transition		 REV. NO. 9 NEVADA STPNHDEIM-015-1(108)40 ALL DIMENSIONS ARE IN MILLIMETERS UNLESS NOTED, ALL STATIONS ARE IN METERS 2-3000 X 2400 RCB	
								Depth 1800 Width 7600		Depth 1800 to 2740 Width 7600 to 6200			



BEDDING SHALL BE PER
SHEETS SD-31 AND SD-32

Call Before You Overhead
1-702-593-6111

Before You Dig
1-800-227-2600

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
~~CONTRACT FOR THE CONSTRUCTION OF HIGHWAYS~~
I-15 WIDENING-SAHARA TO CHARLESTON

CHANNEL PROFILE

"FC" 20+60.000 TO "FC" 24+10.000

LOUIS BERGER
& ASSOCIATES, INC.
LAS VEGAS, NEVADA

DESIGNED BY SRF
DRAWN BY ARB
CHECKED BY SJD
REVIEWED BY TDI

REFERENCE FILES: y:\833a-sahara\drainage\profiles\cbprofile.mst 11/03/99 11:57:00 am pst y:\833a-sahara\drainage\profiles\cbhatch.mst 11/05/99 11:00:00 am
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FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	STPNHDEIM-015-1(108)40	CLARK	SD-12

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED, ALL STATIONS ARE IN METERS

2-3000 X 2400 RCB

"FC" 24+16.409 (3.377 m RT)
Channel Lateral Connection, No. 2.1
(See Sheet SD-25)

"FC" 24+20.000 (2.910 m RT, 0.670 m LT)
Modified Type I Manhole
Rim Elev. = 634.6 ±
(See Sheet SD-28)

"FC" 25+06.000 (3.377 m RT)
Channel Lateral Connection, No. 2.13
(See Sheet SD-25)

"FC" 25+80.000 (2.910 m RT, 0.670 m LT)
Modified Type I Manhole
Rim Elev. = 633.5 ±
(See Sheet SD-28)

"FC" 25+87.931 (3.377 m RT)
Channel Lateral Connection, No. 2.12
(See Sheet SD-25)

"FC" 26+20.950 (3.377 m RT)
Channel Lateral Connection, No. 3.3
(See Sheet SD-25)

"FC" 26+56.147 (3.377 m RT)
Channel Lateral Connection, No. 3.21
(See Sheet SD-25)

"FC" 27+20.000 (2.820 m RT)
Modified Type I Manhole
Rim Elev. = 632.3 ±
(See Sheet SD-28)
Modified Type B D.I. (2.815 m RT)
Grote Elev. = 631.753
(See Sheet SD-25)

"FC" 27+45.442 (3.377 m LT)
3000 X 1800 Lateral Connection, No. 3.24
(See Sheet SD-24)

"FC" 27+28.000 (2.815 m LT)
Modified Type B D.I.
Grote Elev. = 631.670
(See Sheet SD-25)

Matchline "FC" 24+10.000
See Sheet SD-11

100 YR HGL
Q = 70.79 cms

450 RCP
Inv. Elev. 633.000
Inv. Elev. 631.425

1050 RCP
Inv. Elev. 631.510

Existing Ground • Rancho Drive
R/W

Finished Grade •
"FC"

Concrete Barrier
Rail

-0.0075

Existing Ground • "FC"

450 RCP
Inv. Elev. 631.492

450 RCP
Inv. Elev. 631.500

450 RCP
Inv. Elev. 630.520

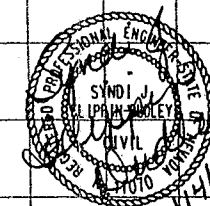
Inv. Elev. 629.160

Inv. Elev. 628.875

Matchline "FC" 27+50.000
See Sheet SD-13

NOTE:

BEDDING SHALL BE PER
SHEETS SD-31 AND SD-32



SAFETY ALERT
Call Before You Overhead
1-702-593-6111

Avoid cutting underground utility lines. It's costly.
Call Before You Dig
1-800-227-2600

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
I-15 WIDENING-SAHARA TO CHARLESTON
CHANNEL PROFILE
"FC" 24+10.000 TO "FC" 27+50.000

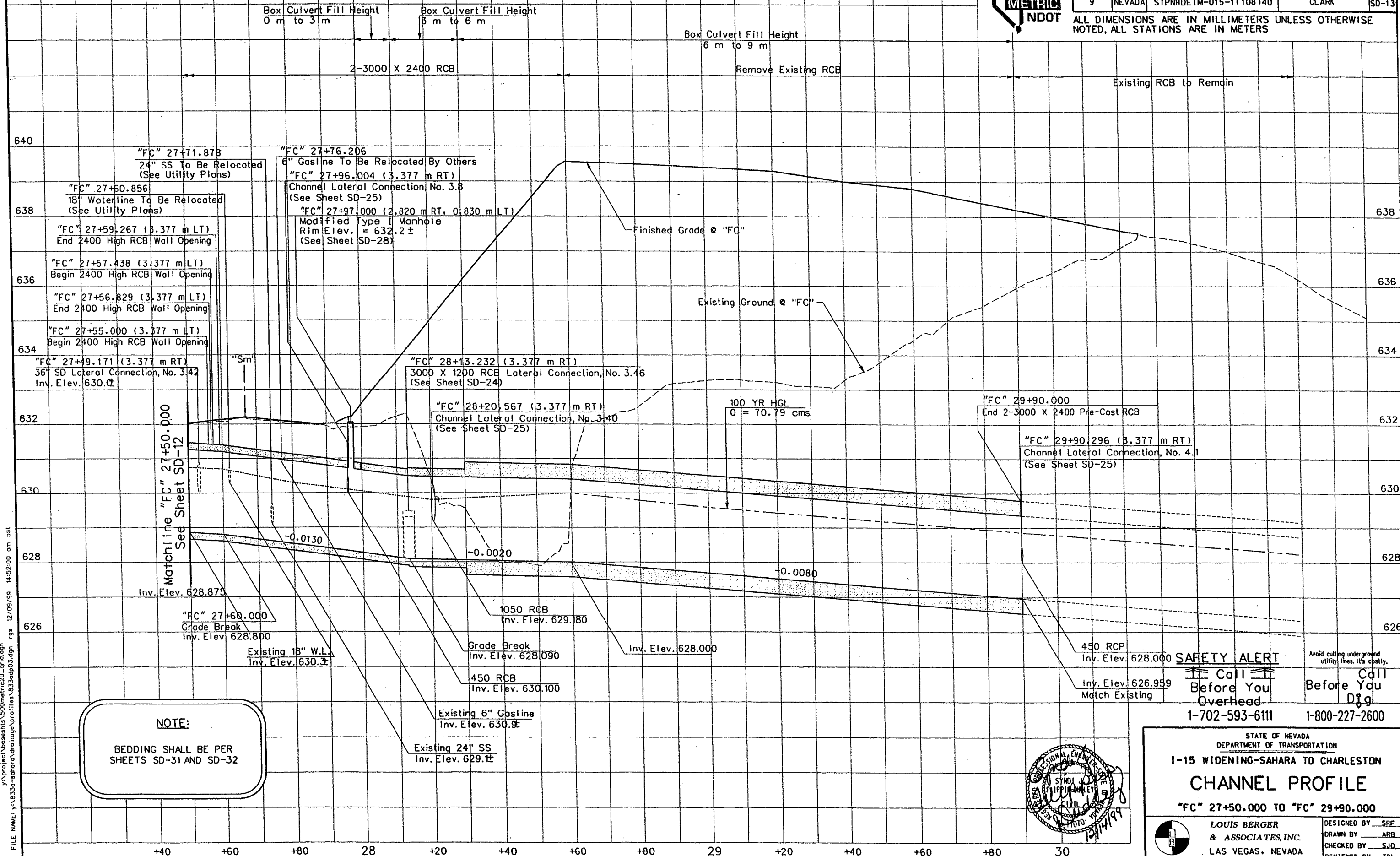
DESIGNED BY SRF
DRAWN BY ARB
CHECKED BY SJD
REVIEWED BY IDL
LOUIS BERGER
& ASSOCIATES, INC.
LAS VEGAS, NEVADA

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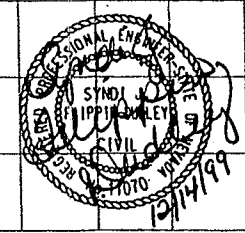


FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	STPNHDEIM-015-11108140	CLARK	SD-13

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE NOTED, ALL STATIONS ARE IN METERS



NOTE:
BEDDING SHALL BE PER
SHEETS SD-31 AND SD-32



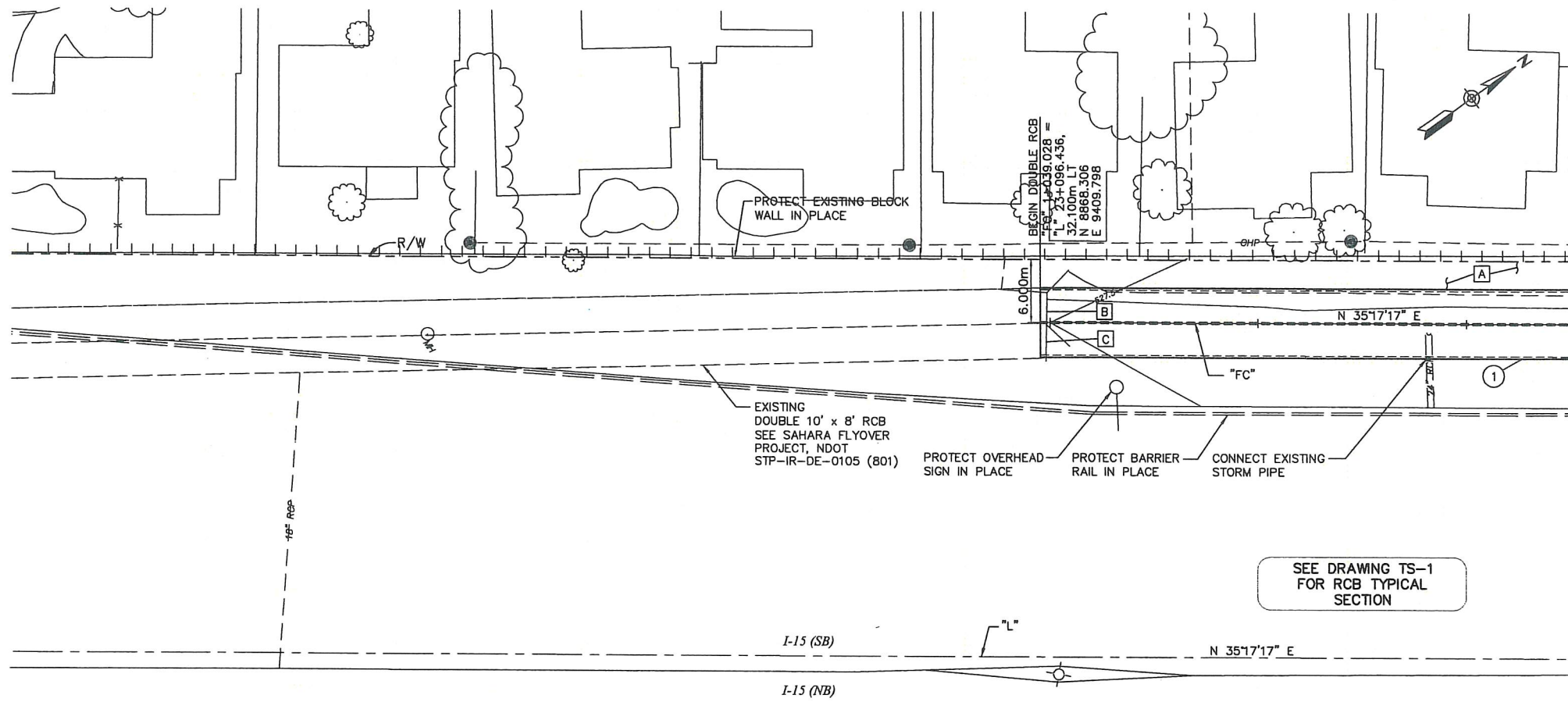
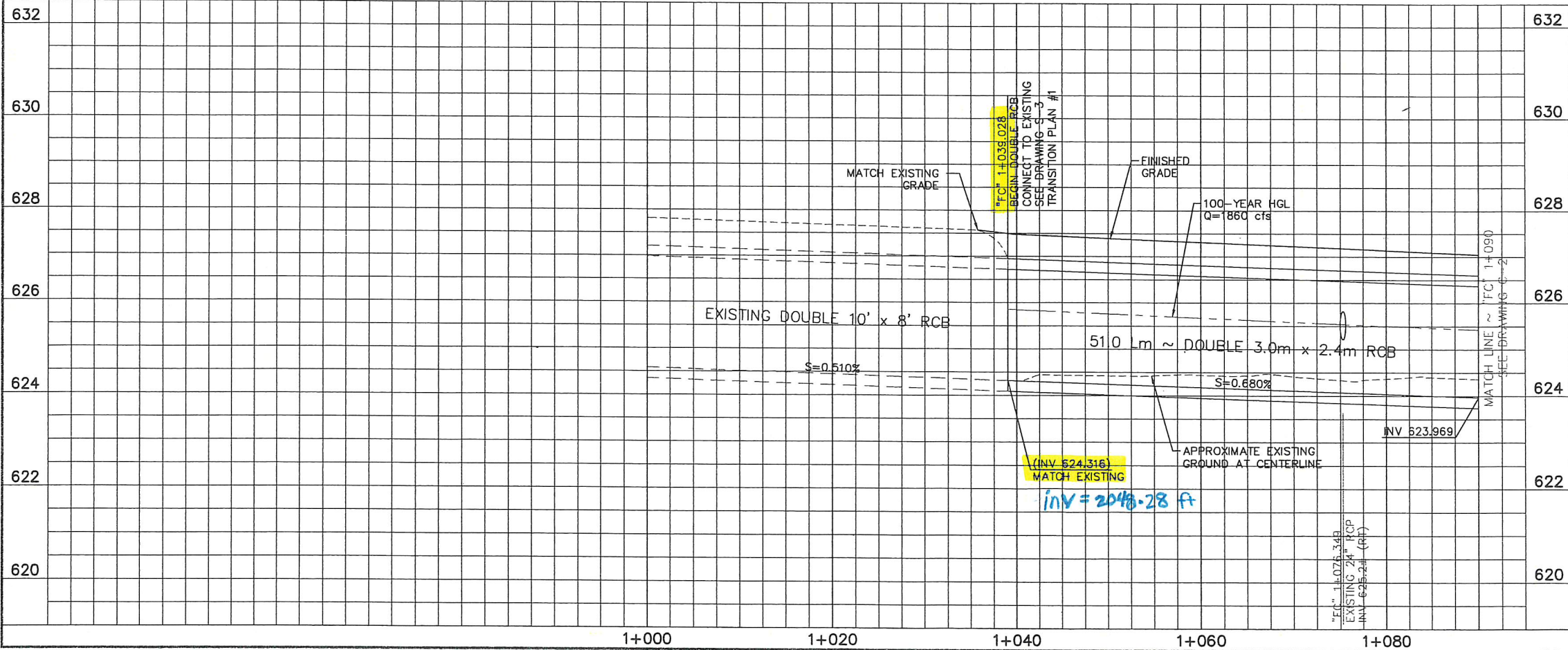
SAFETY ALERT
Call Before You Dig
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STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
1-15 WIDENING-SAHARA TO CHARLESTON
CHANNEL PROFILE
"FC" 27+50.000 TO "FC" 29+90.000

LOUIS BERGER
& ASSOCIATES, INC.
LAS VEGAS, NEVADA

DESIGNED BY SRF
DRAWN BY ARB
CHECKED BY SJD
REVIEWED BY TDL

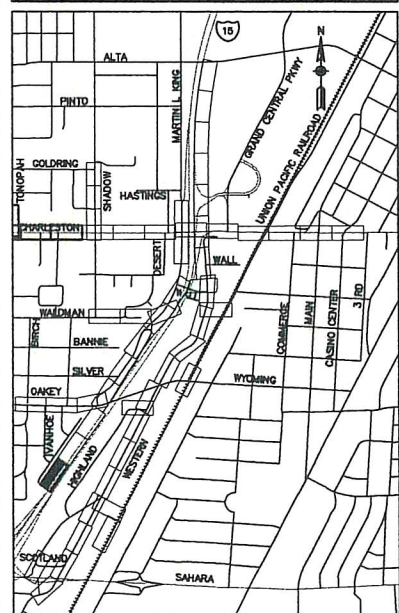
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- REMOVAL ITEMS**
- A REMOVE CONCRETE CHANNEL
 - B REMOVE HEADWALL
 - C REMOVE RCB PLUG
- CONSTRUCTION ITEMS**
- 1 "FC" 1+039.028 TO "FC" 1+090.000 CONSTRUCT DOUBLE 3.0m x 2.4m RCB

Call before you Dig.
1-800-277-2600
UNDERGROUND SERVICE (USA)

Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)



DEPARTMENT OF PUBLIC WORKS

I-15 FREEWAY CHANNEL
CONSTRUCTION PLAN AND PROFILE
"FC" 1+039.028 TO "FC" 1+090



DRAWING No. C-1
24

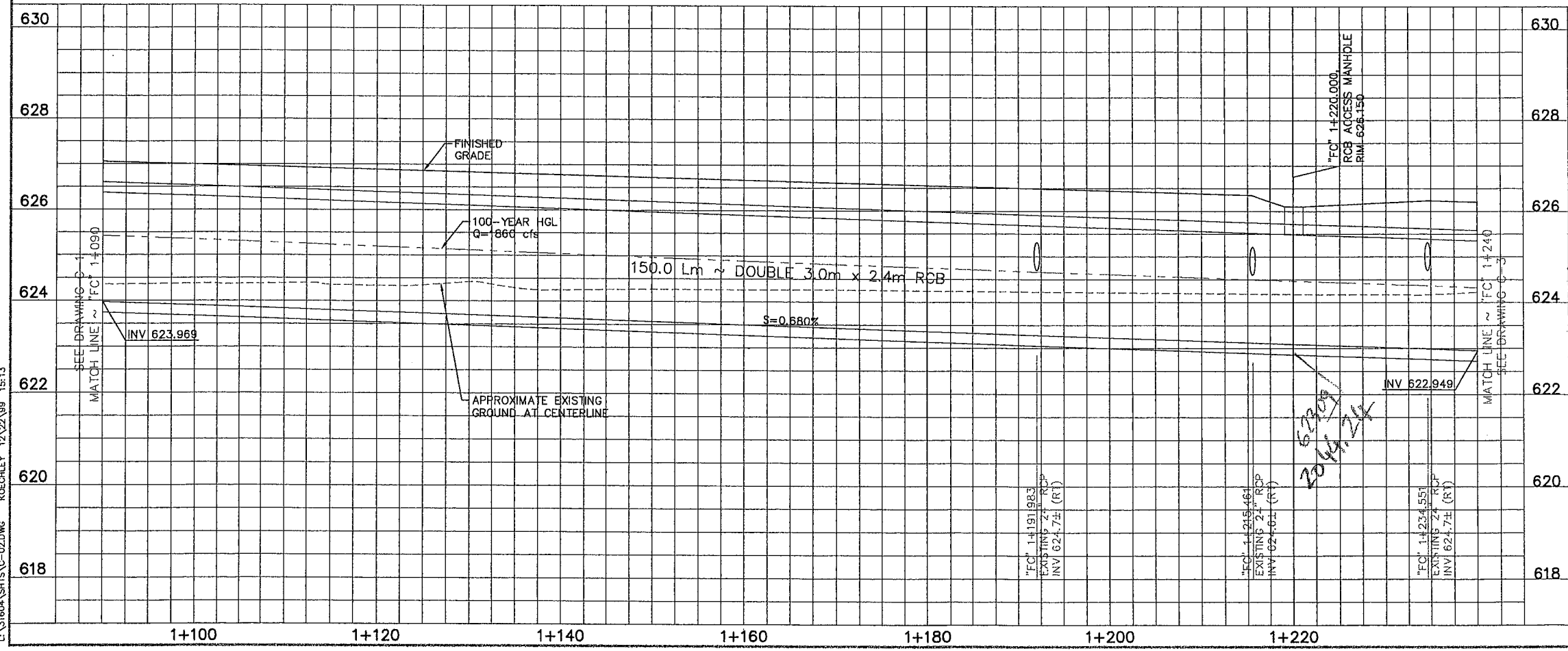
DATE	REVISIONS	PROJECT #	SCALE (V)	SCALE (H)	F.L.D. BK. #	DATE	DESIGN BY
		31604	1:50	1:250	N/A	17, 1999	BPP

PB PARSONS BRINCKERHOFF
Las Vegas, Nevada



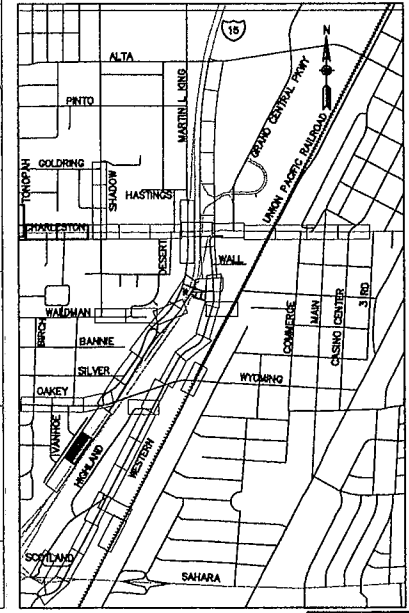
327-V254

L:\31604\SHS\TS-C-02.DWG KOECHLEY 12/22/99 15:13



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1-800-277-2600
UNDERGROUND SERVICE (USA)

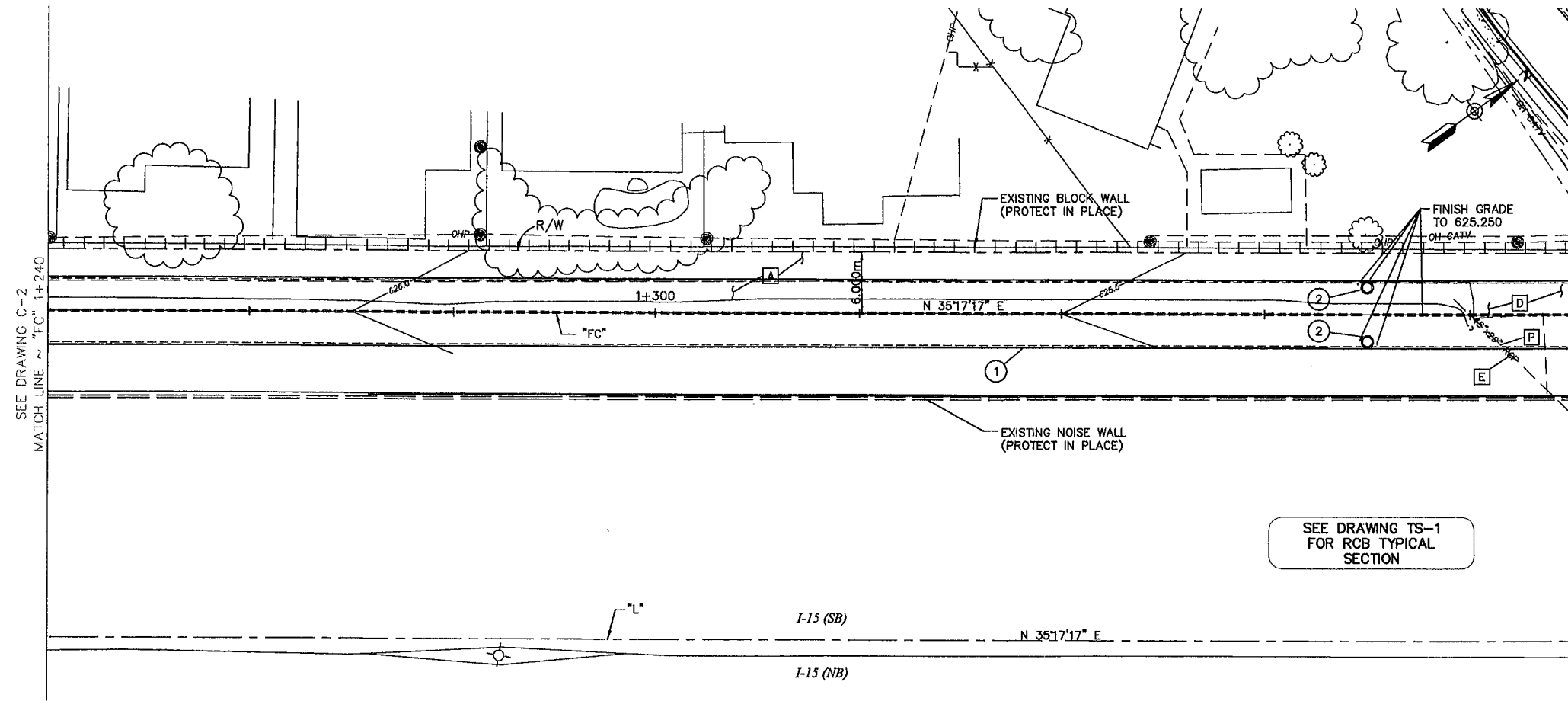
Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)



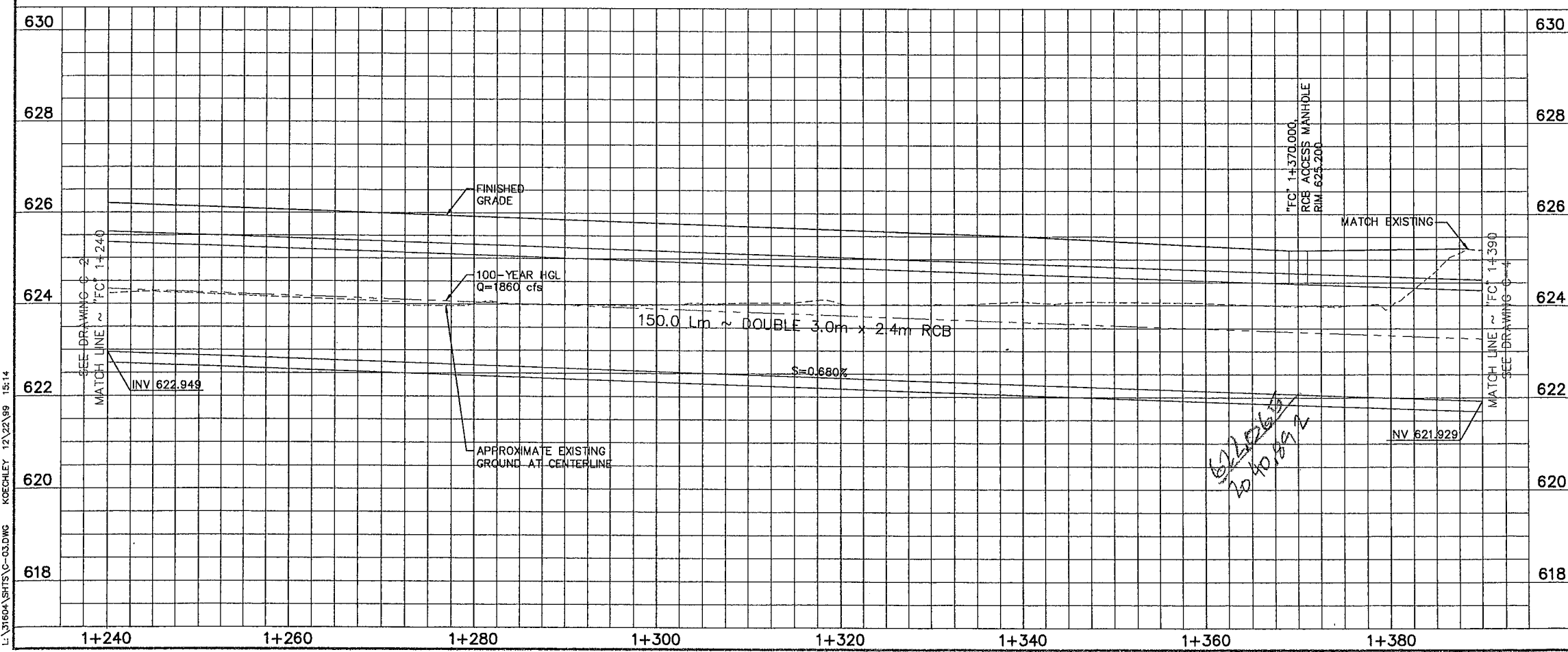
- REMOVAL ITEMS**
- A REMOVE CONCRETE CHANNEL
- CONSTRUCTION ITEMS**
- 1 "FC" 1+090.000 TO "FC" 1+240.000 CONSTRUCT DOUBLE 3.0m x 2.4m RCB
 - 2 "FC" 1+220.000, 2.650m LT CONSTRUCT RCB ACCESS MANHOLE SEE DRAWING S-19
 - "FC" 1+220.000, 2.650m RT

REVISIONS		PROJECT # 31604		DESIGN BY BPP	
DATE	REVISIONS	SCALE (V) 1:50	DATE DECEMBER 17, 1999	SCALE (H) 1:250	F.L.D. BK. # N/A
 DEPARTMENT OF PUBLIC WORKS I-15 FREEWAY CHANNEL CONSTRUCTION PLAN AND PROFILE "FC" 1+090 TO "FC" 1+240					

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BRINCKERHOFF
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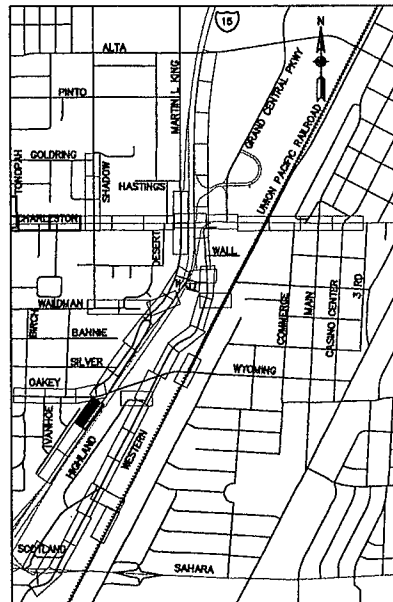


- REMOVAL ITEMS**
- [A] REMOVE CONCRETE CHANNEL
 - [D] REMOVE ACCESS RAMP
 - [E] PLUG STORM DRAIN PIPE
 - [P] REMOVE STORM DRAIN PIPE
- CONSTRUCTION ITEMS**
- ① "FC" 1+240.000 TO "FC" 1+390.000 CONSTRUCT DOUBLE 3m x 2.4m RCB
 - ② "FC" 1+370.000, 2.650m LT "FC" 1+370.000, 2.650m RT CONSTRUCT RCB ACCESS MANHOLE SEE DRAWING S-19

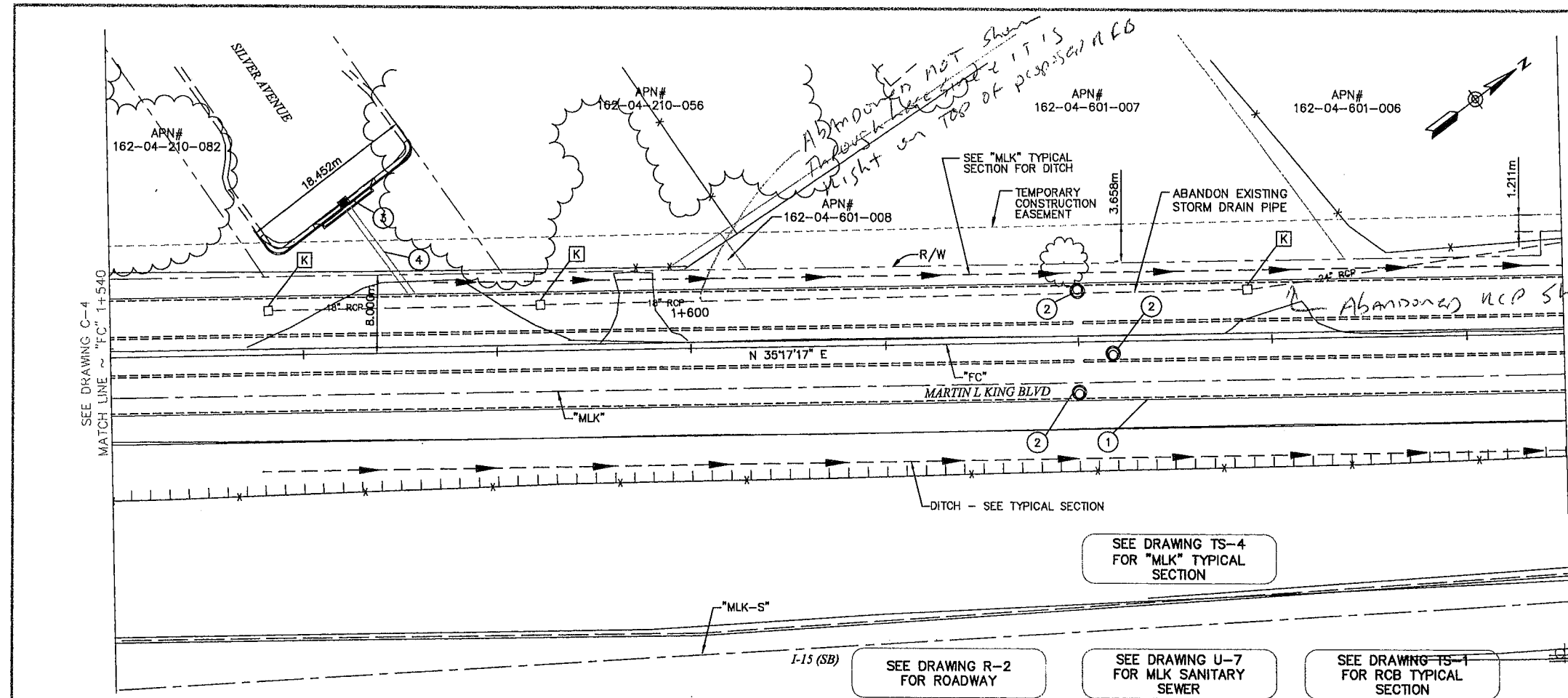


Call before you Dig.
1-800-277-2600
UNDERGROUND SERVICE (USA)

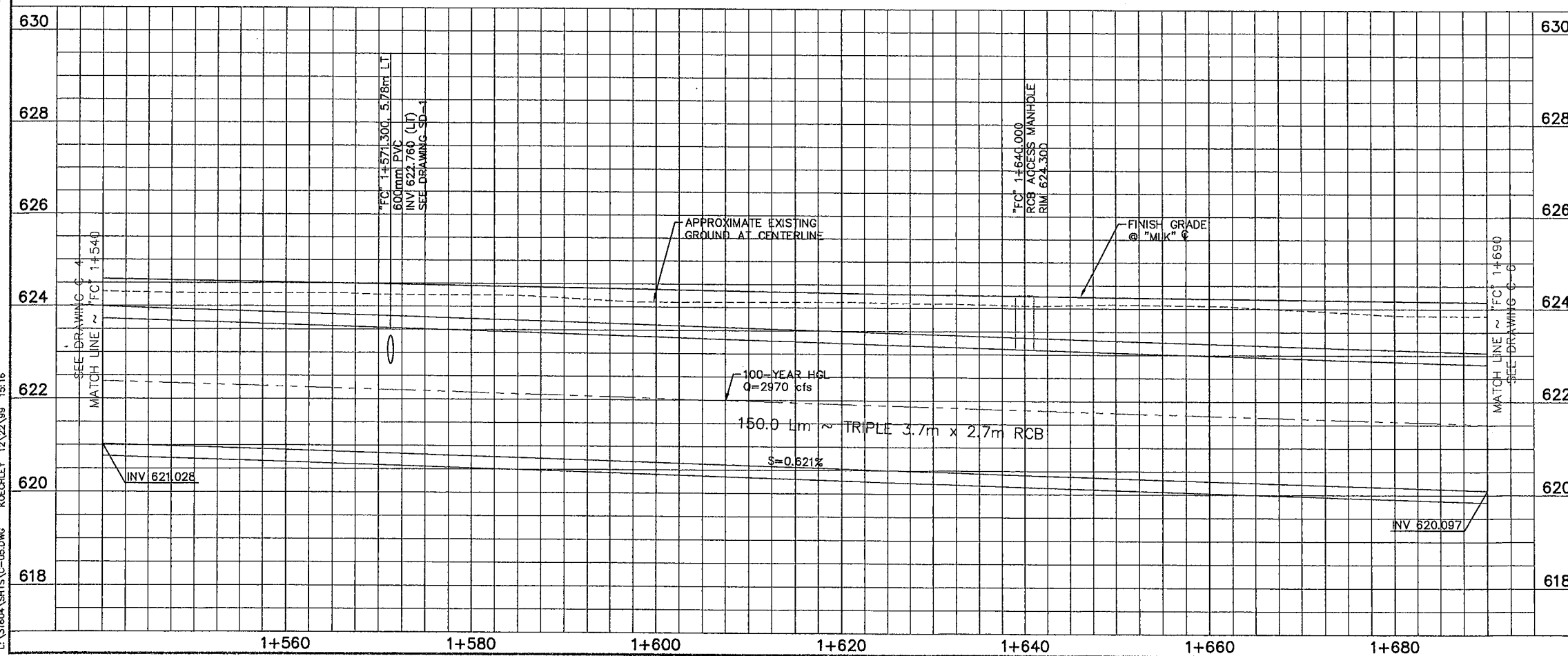
Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)



DATE		REVISIONS		PROJECT # 31804		DESIGN BY BPP	
SCALE (V) 1:50		DATE DECEMBER 17, 1999		SCALE (H) 1:250		F.L.D. BK. # N/A	
				DEPARTMENT OF PUBLIC WORKS I-15 FREEWAY CHANNEL CONSTRUCTION PLAN AND PROFILE "FC" 1+240 TO "FC" 1+390			
DRAWING No. C-3				26			
327-V254				241			

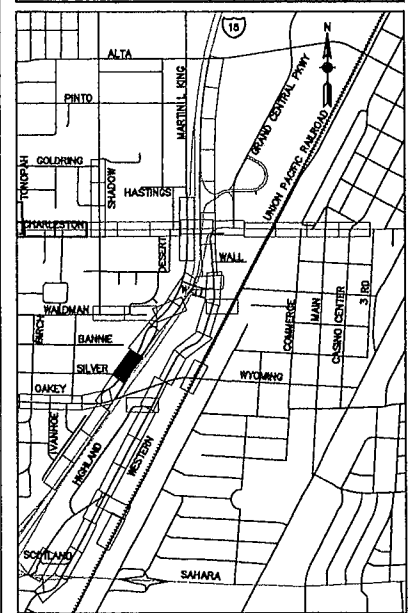


- REMOVAL ITEMS**
- [K] REMOVE DI
- CONSTRUCTION ITEMS**
- 1 "FC" 1+540.000 TO "FC" 1+690.000 CONSTRUCT TRIPLE 3.7m x 2.7m RCB SEE DRAWING S-2
 - 2 "FC" 1+640.000, 5.150m RT CONSTRUCT RCB ACCESS MH SEE DRAWING S-19
"FC" 1+640.000, 5.150m LT
"FC" 1+643.600, 1.250m RT
 - 3 "FC" 1+564.640, 15.19m LT CONSTRUCT 6.0m DI TYPE "D" MOD. SEE DRAWING S-7
 - 4 "FC" 1+564.910, 14.820m LT TO "FC" 1+571.500, 5.780m LT CONSTRUCT 600mm PVC



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OVERHEAD SERVICE (USA)



DATE: _____

REVISIONS: _____

PROJECT # 31604

SCALE (V) 1:50

DATE DECEMBER 17, 1999

DESIGN BY BPP

SCALE (H) 1:250

DATE: _____

DESIGN BY BPP

PR PARSONS BRINCKERHOFF

Las Vegas, Nevada

STATE OF NEVADA

DEPARTMENT OF PUBLIC WORKS

I-15 FREEWAY CHANNEL

CONSTRUCTION PLAN AND PROFILE

"FC" 1+540 TO "FC" 1+690

JOHN P. CLARK

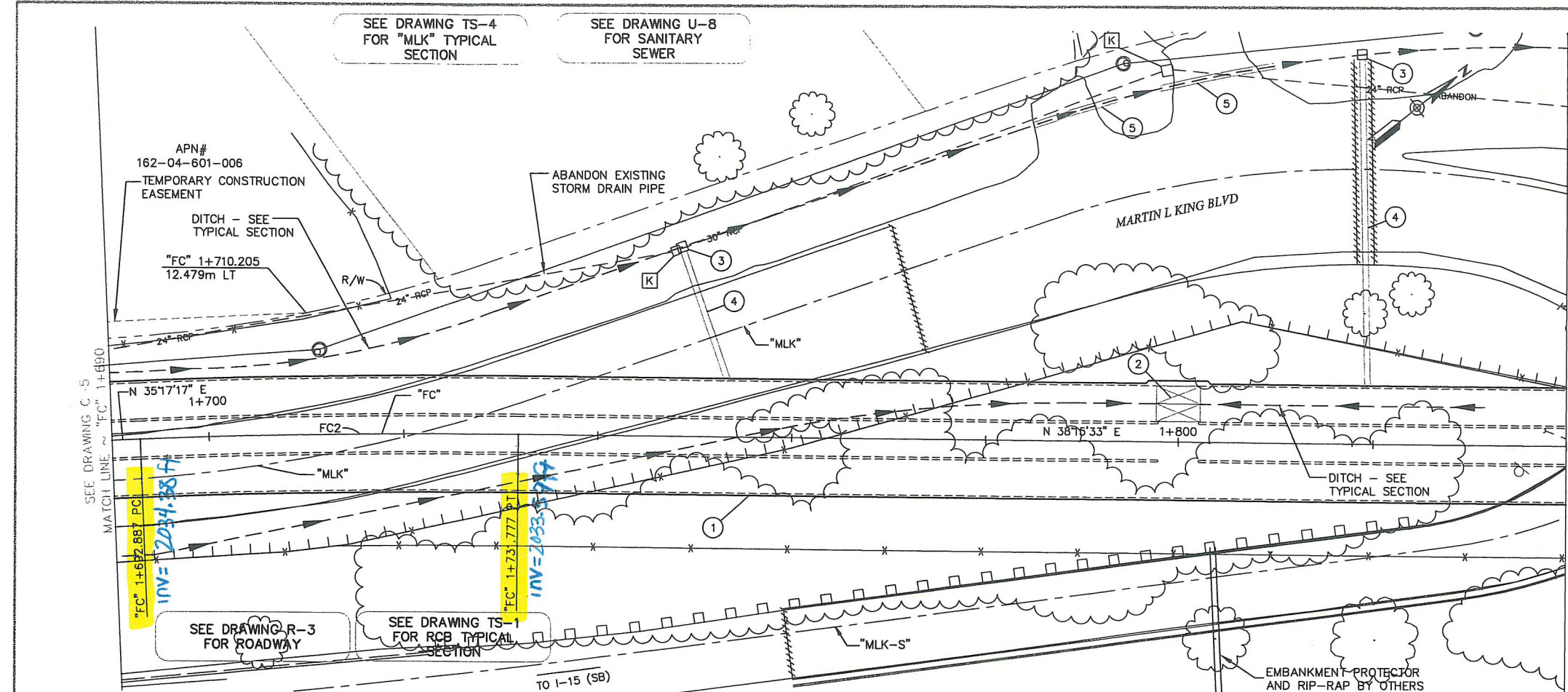
REGISTERED PROFESSIONAL ENGINEER

NO. 11081

DRAWING No. 28

C-5

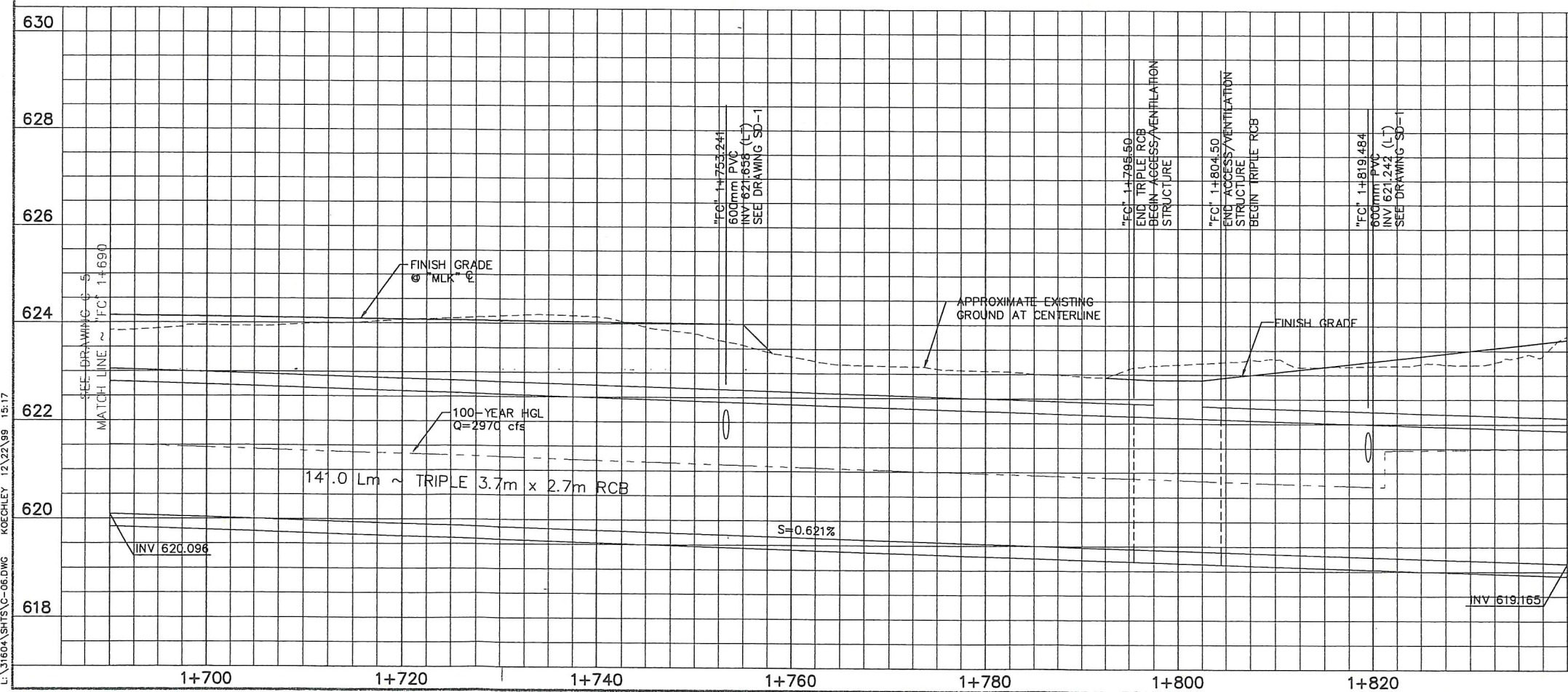
327-V254



- REMOVAL ITEMS**
- (K) REMOVE DI
- CONSTRUCTION ITEMS**
- "FC" 1+690.000 TO "FC" 1+840.000
CONSTRUCT TRIPLE 3.7m X 2.7m RCB
SEE DRAWING S-2
 - "FC" 1+800.000
CONSTRUCT ACCESS / VENTILATION STRUCTURE
SEE DRAWING S-17
 - "FC" 1+748.510, 19.400m LT
"FC" 1+818.660, 39.810m LT
CONSTRUCT NDOT TYPE 2-A INLET
 - "FC" 1+748.660, 18.920m LT TO "FC" 1+753.500, 5.780m LT
"FC" 1+818.670, 39.310m LT
"FC" 1+820.000, 5.780m LT
CONSTRUCT 600mm PVC
 - "FC" 1+784.810, 32.220m LT TO "FC" 1+793.410, 34.890m LT
"FC" 1+797.990, 36.090m LT TO "FC" 1+809.800, 38.540m LT
CONSTRUCT 600mm RCP CULVERT WITH HEADWALL
NDOT STD DWG R-2.1.4.

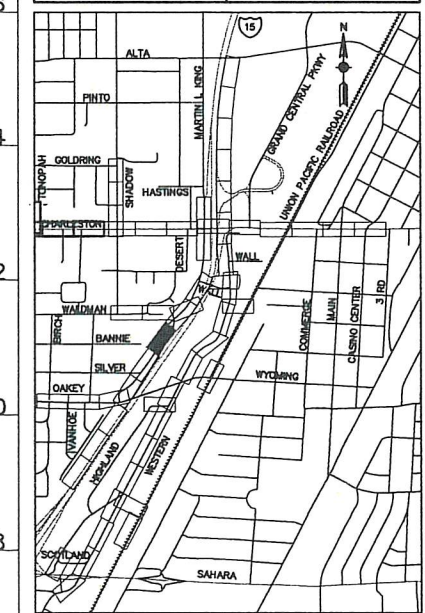
"FC" CURVE DATA

No.	Δ	R	L	T
FC2	2°58'16"	750.000m	38.891m	19.450m



Call before you Dig.
1-800-277-2600
UNDERGROUND SERVICE (USA)

Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)



DATE: _____

REVISIONS: _____

PROJECT # 31604

DESIGN BY BPP

DATE: DECEMBER 17, 1999

SCALE (V) 1:50

SCALE (H) 1:250

F.L.D. BK. # N/A

PARSONS BRINCKERHOFF
Las Vegas, Nevada

DEPARTMENT OF PUBLIC WORKS

I-15 FREEWAY CHANNEL

CONSTRUCTION PLAN AND PROFILE

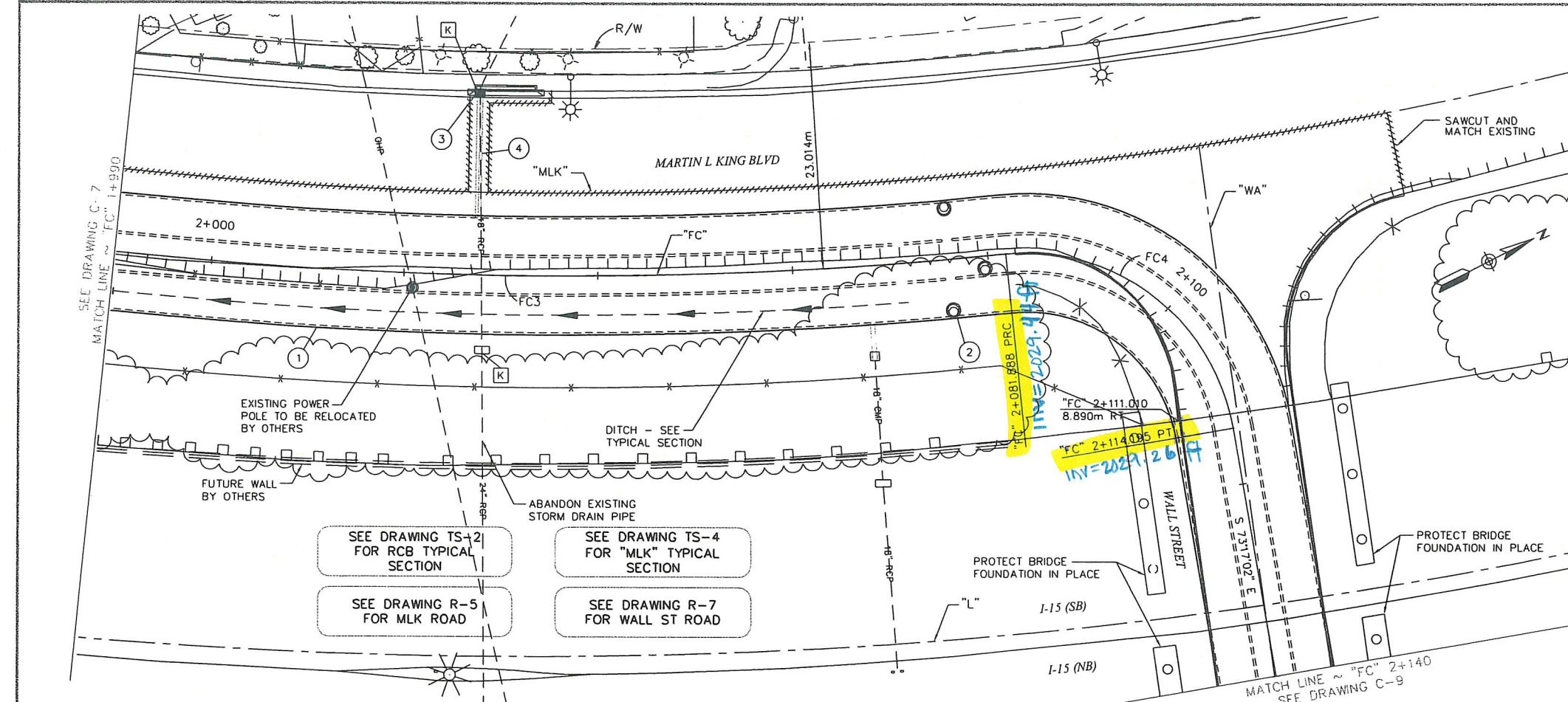
"FC" 1+690 TO "FC" 1+840

JOHN P. CLARK
REGISTERED PROFESSIONAL ENGINEER
STATE OF NEVADA
No. 11000

DRAWING No. 29

C-6

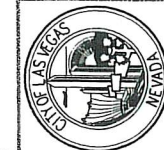
327-V254



- REMOVAL ITEMS**
- (K) REMOVE DI
- CONSTRUCTION ITEMS**
- "FC" 1+990.000 TO "FC" 2+140.000
CONSTRUCT TRIPLE 3.7m x 3.0m RCB
SEE DRAWINGS S-2 AND S-4
 - "FC" 2+076.000, 5.150m RT
"FC" 2+076.000, 5.150m LT
"FC" 2+079.600, 1.250m RT
CONSTRUCT RCB ACCESS MH
SEE DRAWING S-19
 - "FC" 2+027.50, 18.66m LT
CONSTRUCT 3.0m DI TYPE "D" MOD.
SEE DRAWING S-7
 - "FC" 2+027.50, 18.66m LT TO "FC" 2+027.52, 5.78m LT
CONSTRUCT 600mm PVC

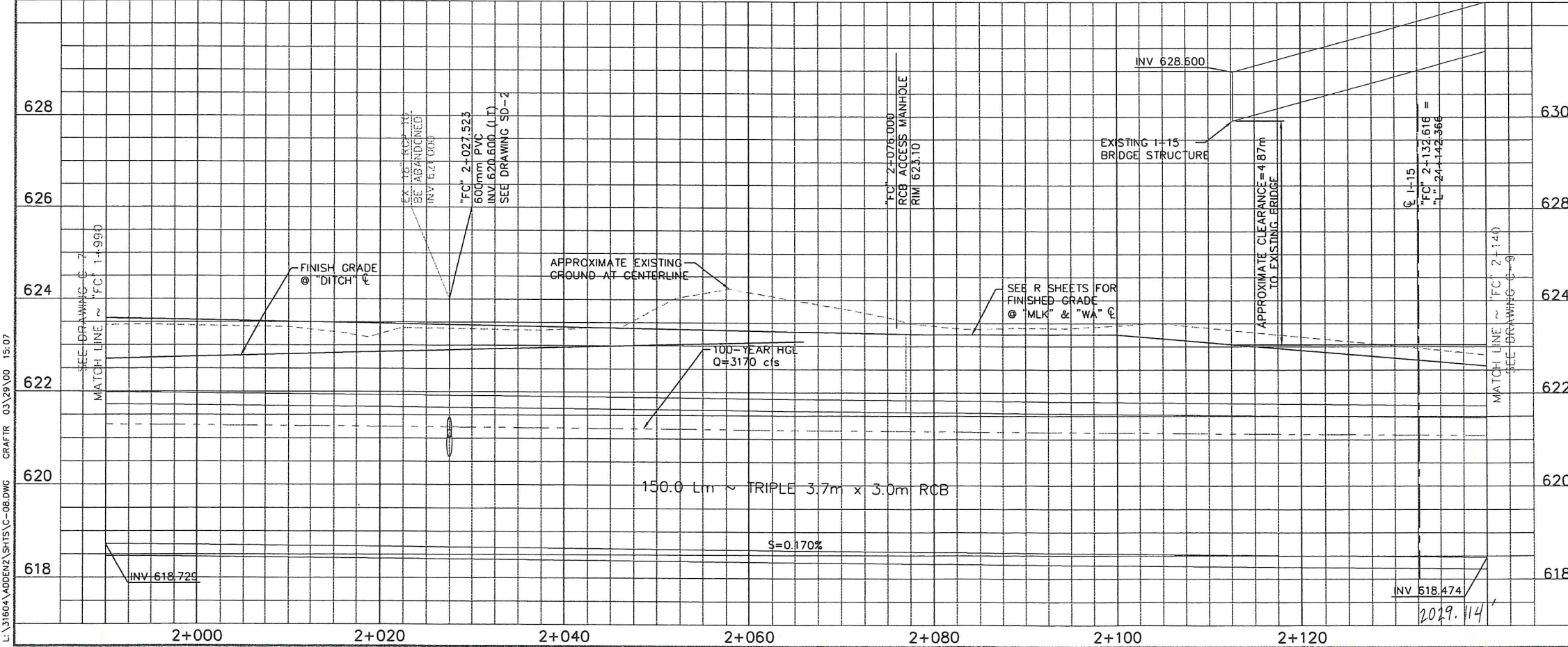
DATE	5/20/00
REVISIONS	
ADDITION 2	
PROJECT #	31604
DESIGN BY	BPP
DATE	DECEMBER 17, 1999
SCALE (H)	1:250
SCALE (V)	1:50
F.L.D. BK. #	N/A

PARSONS
PB BRINCKERHOFF
Los Vegas, Nevada



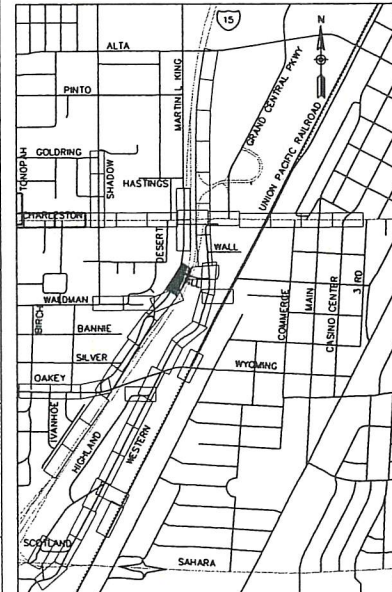
"FC" CURVE DATA

No.	Δ	R	L	T
FC3	17°38'16"	450.000m	138.527m	69.816m
FC4	86°05'41"	21.500m	32.307m	20.082m



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1-800-277-2600
UNDERGROUND SERVICE (USA)

Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)

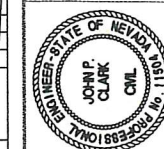


DEPARTMENT OF PUBLIC WORKS

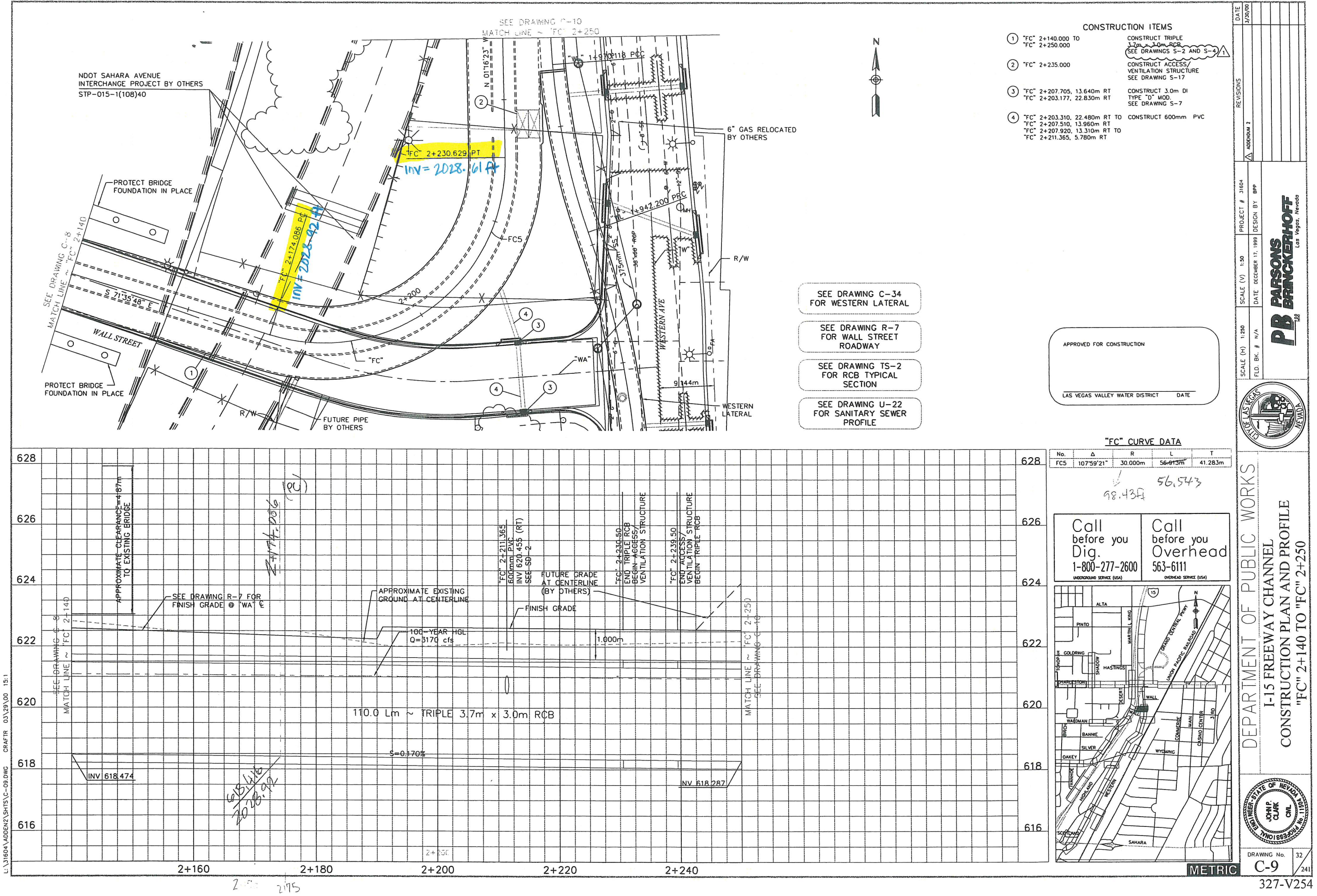
I-15 FREEWAY CHANNEL

CONSTRUCTION PLAN AND PROFILE

"FC" 1+990 TO "FC" 2+140



DRAWING No. 31
C-8
327-V254



- CONSTRUCTION ITEMS
- 1 "FC" 2+140.000 TO "FC" 2+250.000 CONSTRUCT TRIPLE 3.7m x 3.0m RCB SEE DRAWINGS S-2 AND S-3
 - 2 "FC" 2+235.000 CONSTRUCT ACCESS/ VENTILATION STRUCTURE SEE DRAWING S-17
 - 3 "FC" 2+207.705, 13.640m RT "FC" 2+203.177, 22.830m RT CONSTRUCT 3.0m DI TYPE "D" MOD. SEE DRAWING S-7
 - 4 "FC" 2+203.310, 22.480m RT TO "FC" 2+207.510, 13.960m RT "FC" 2+207.920, 13.310m RT TO "FC" 2+211.365, 5.780m RT CONSTRUCT 600mm PVC

SEE DRAWING C-34 FOR WESTERN LATERAL

SEE DRAWING R-7 FOR WALL STREET ROADWAY

SEE DRAWING TS-2 FOR RCB TYPICAL SECTION

SEE DRAWING U-22 FOR SANITARY SEWER PROFILE

APPROVED FOR CONSTRUCTION

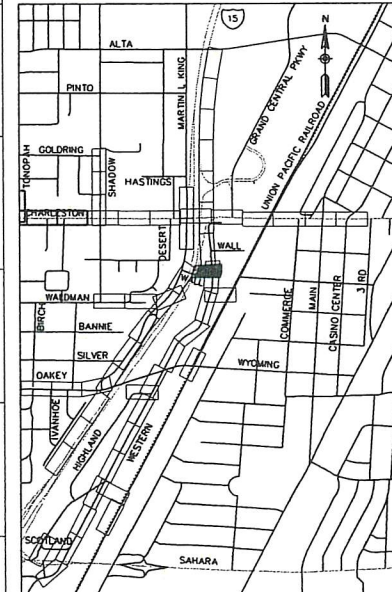
LAS VEGAS VALLEY WATER DISTRICT DATE

"FC" CURVE DATA

No.	Δ	R	L	T
FC5	107°59'21"	30.000m	56+913m	41.283m

Call before you Dig. 1-800-277-2600 (UNDERGROUND SERVICE (USA))

Call before you Overhead 563-6111 (OVERHEAD SERVICE (USA))



DATE 3/20/00

REVISIONS

PROJECT # 31604

SCALE (V) 1:50

DATE DECEMBER 17, 1999

DESIGN BY BPP

PB PARSONS BRINCKERHOFF
Las Vegas, Nevada

CITY OF LAS VEGAS

DEPARTMENT OF PUBLIC WORKS

I-15 FREEWAY CHANNEL

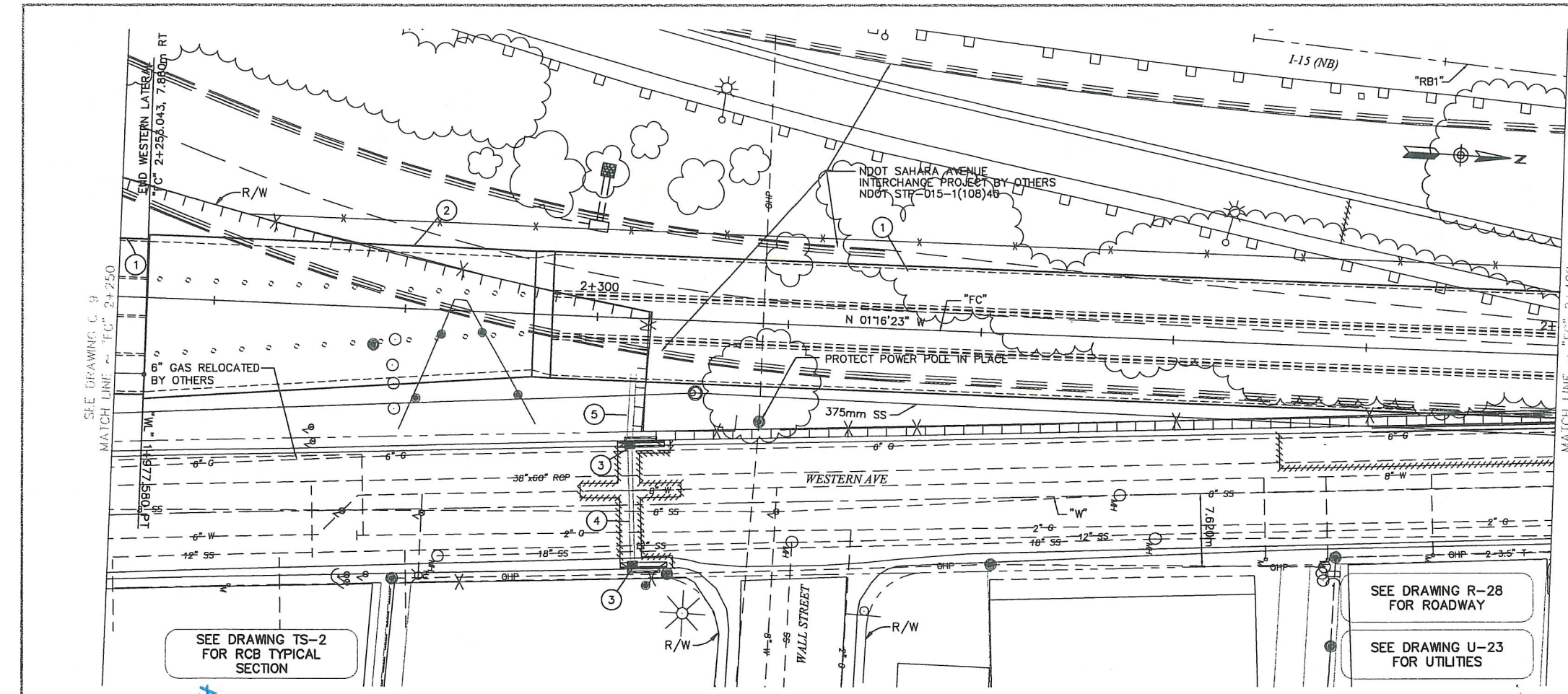
CONSTRUCTION PLAN AND PROFILE

"FC" 2+140 TO "FC" 2+250

DRAWING No. 32

C-9

327-V254



CONSTRUCTION ITEMS

① "FC" 2+250.000 TO "FC" 2+253.043 "FC" 2+253.043 TO "FC" 2+293.397 "FC" 2+400.000	CONSTRUCT TRIPLE 3.7m X 3.0m RCB SEE DRAWING S-2
② "FC" 2+253.043 TO "FC" 2+293.397	CONSTRUCT JUNCTION STRUCTURE No. 2 SEE DRAWING S-11
③ "FC" 2+303.873, 12.950m RT TO "FC" 2+304.644, 25.030m RT	CONSTRUCT 3.0m DI TYPE "D" MOD. SEE DRAWING S-7
④ "FC" 2+303.873, 12.950m RT TO "FC" 2+304.644, 25.030m RT	CONSTRUCT 450m PVC
⑤ "FC" 2+303.920, 11.280m RT TO "FC" 2+303.995, 5.780m RT	CONSTRUCT 600mm PVC

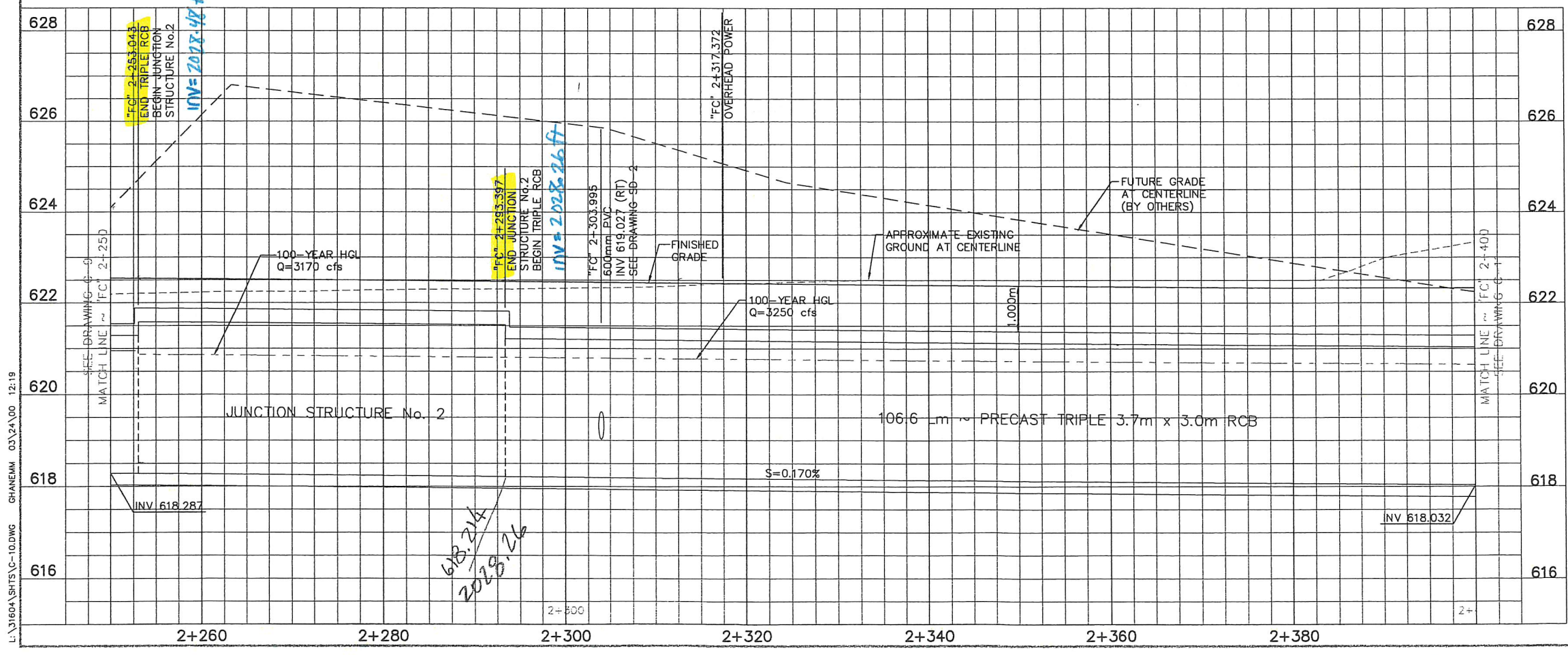
APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT DATE

SEE DRAWING TS-2 FOR RCB TYPICAL SECTION

SEE DRAWING R-28 FOR ROADWAY

SEE DRAWING U-23 FOR UTILITIES



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UNDERGROUND SERVICE (USA)

Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)

DEPARTMENT OF PUBLIC WORKS

I-15 FREEWAY CHANNEL
CONSTRUCTION PLAN AND PROFILE
"FC" 2+250 TO "FC" 2+400

DRAWING No. 33
C-10

327-V254

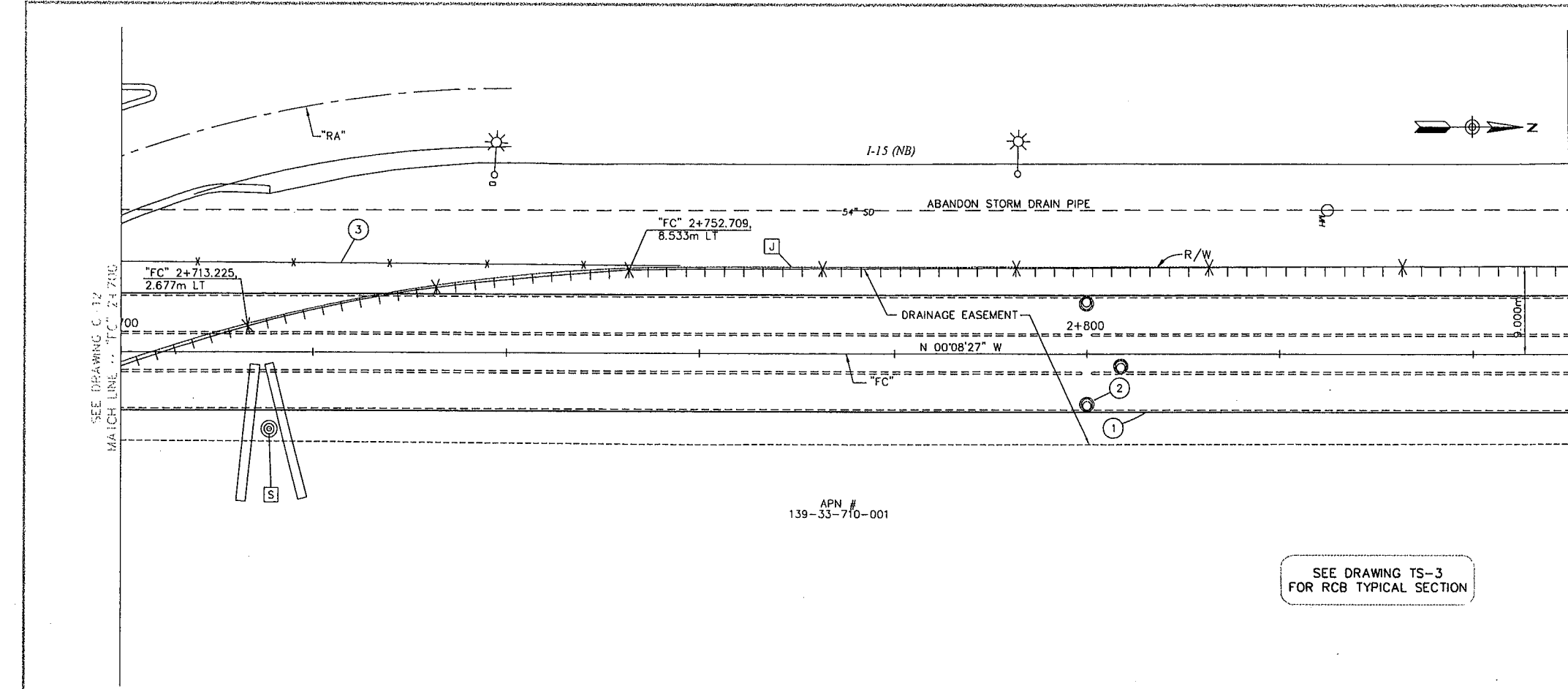
PARSONS
BRINCKERHOFF
Las Vegas, Nevada

SCALE (H) 1:250
SCALE (V) 1:50
DATE DECEMBER 17, 1995
DESIGN BY BPP

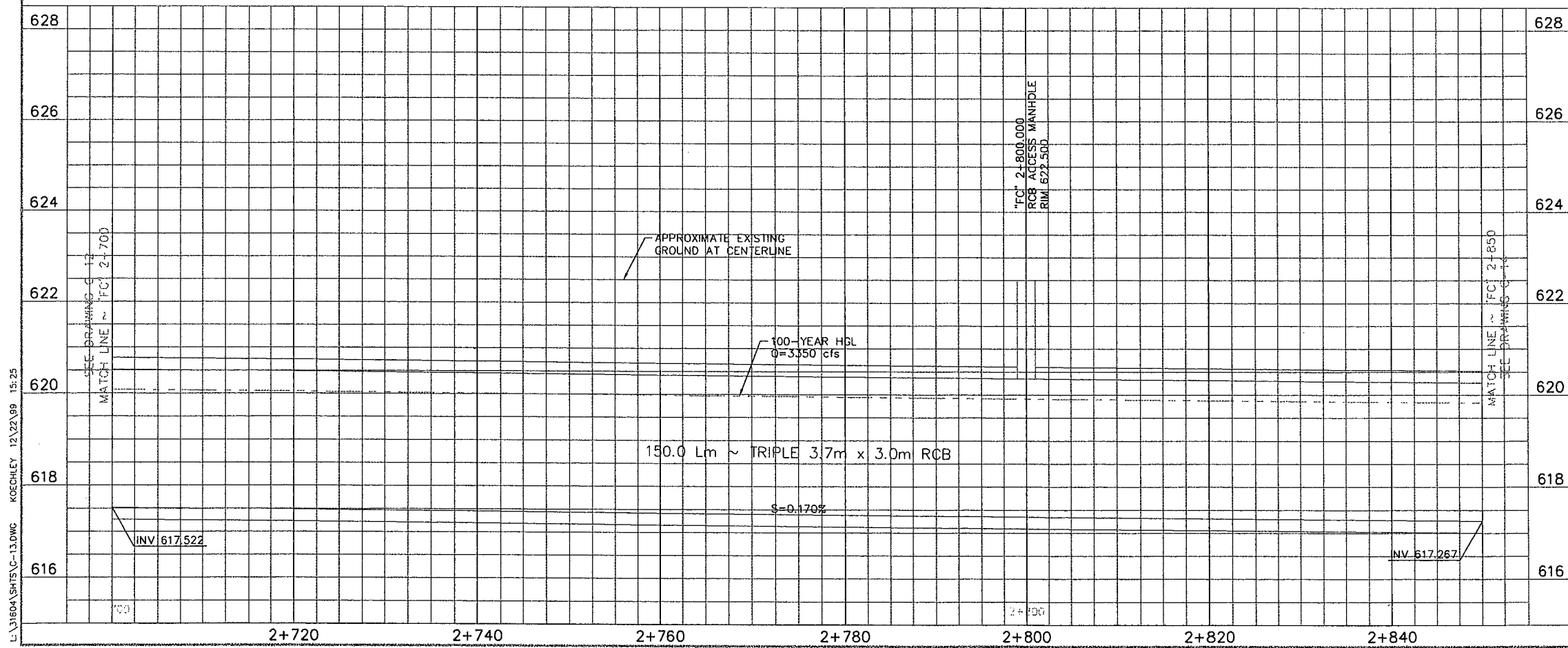
PROJECT # 31604

REVISIONS

DATE

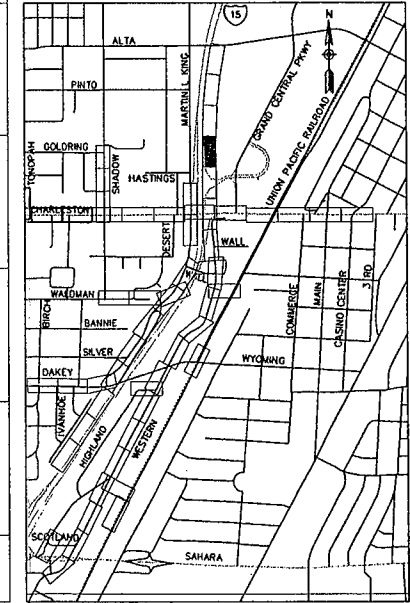


- REMOVAL ITEMS**
- [J] REMOVE AND RESTORE CHAIN LINK FENCE
 - [S] REMOVE BILLBOARD AND FOUNDATION
- CONSTRUCTION ITEMS**
- ① "FC" 2+700.000 TO "FC" 2+850.000 CONSTRUCT TRIPLE 3.7m x 3.0m RCB SEE DRAWING S-2
 - ② "FC" 2+800.000, 5.150m RT CONSTRUCT RCB ACCESS MH SEE DRAWING S-19
"FC" 2+800.000, 5.150m LT
"FC" 2+803.600, 1.250m RT
 - ③ "FC" 2+700.000, 9.292m LT TO "FC" 2+758.000, 9.010m LT CONSTRUCT TEMPORARY 1.8m CHAIN LINK FENCE



Call before you Dig.
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UNDERGROUND SERVICE (USA)

Call before you Overhead
563-6111
OVERHEAD SERVICE (USA)



DATE: _____

REVISIONS: _____

PROJECT # 31604 DESIGN BY BPP

SCALE (H) 1:250 SCALE (V) 1:50 DATE DECEMBER 17, 1998

F.L.D. BK. # N/A

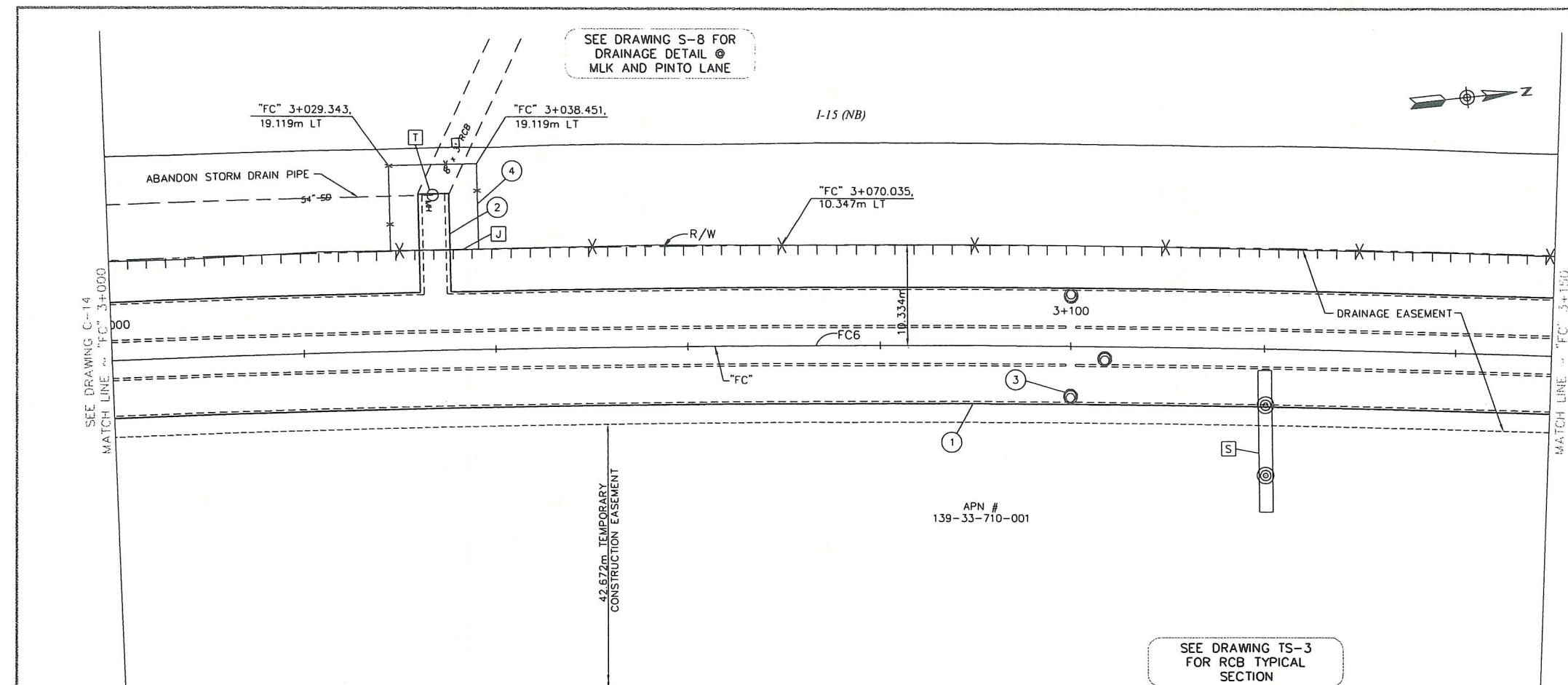
PARSONS BRINCKERHOFF
Los Vegas, Nevada

STATE OF NEVADA
DEPARTMENT OF PUBLIC WORKS

I-15 FREEWAY CHANNEL
CONSTRUCTION PLAN AND PROFILE
"FC" 2+700 TO "FC" 2+850

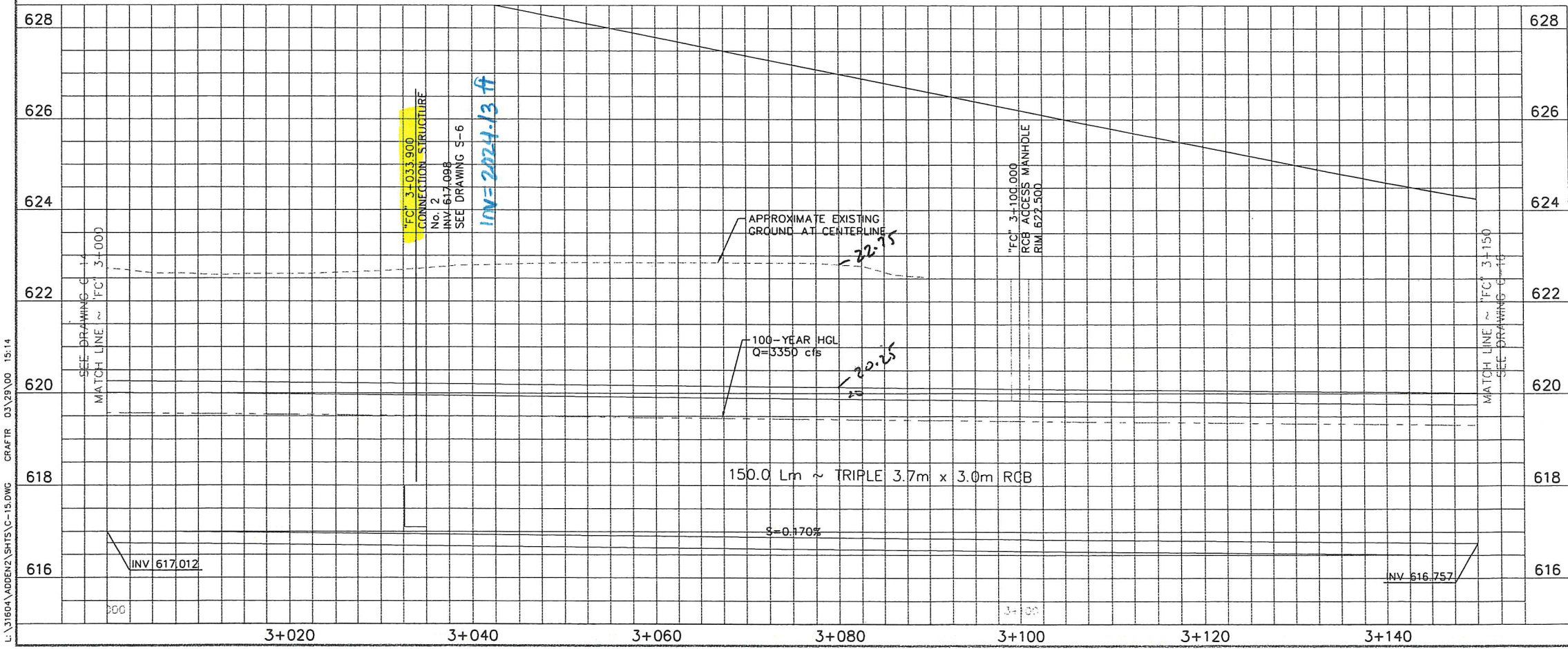
ENGINEER
JOHN P. CLARK
PROFESSIONAL ENGINEER
STATE OF NEVADA
No. 11110

DRAWING No. 36
C-13
327-V25



- REMOVAL ITEMS**
- U REMOVE AND RESTORE CHAIN LINK FENCE
 - S REMOVE BILLBOARD AND FOUNDATION
 - T REMOVE MH
- CONSTRUCTION ITEMS**
- 1 "FC" 3+000.000 TO "FC" 3+150.000
CONSTRUCT TRIPLE 3.7m x 3.0m RCB SEE DRAWING S-2
 - 2 "FC" 3+033.900, LT
CONSTRUCT CONNECTION STRUCTURE No. 2 SEE DRAWING S-6
 - 3 "FC" 3+100.000, 5.150m RT
"FC" 3+100.000, 5.150m LT
"FC" 3+103.600, 1.250m RT
CONSTRUCT RCB ACCESS MH SEE DRAWING S-19
 - 4 "FC" 3+029.323, 10.367m LT TO "FC" 3+038.476, 10.348m LT
CONSTRUCT TEMPORARY 1.8m CHAIN LINK FENCE

DATE	3/20/00
REVISIONS	
1	ADDENDUM 2
PROJECT #	J1604
DESIGN BY	BPP
SCALE (H)	1:250
SCALE (V)	1:50
DATE	DECEMBER 17, 1999
F.D. BK. #	N/A
PB PARSONS BRINCKERHOFF Las Vegas, Nevada	

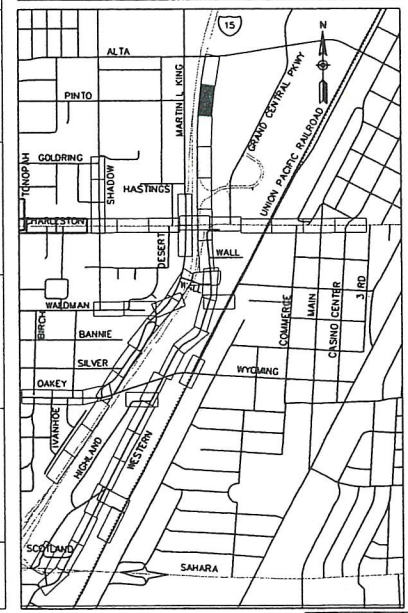


"FC" CURVE DATA

No.	Δ	R	L	T
FC6	07°48'05"	2024.000m	275.586m	138.006m

Call before you Dig.
1-800-277-2600
UNDERGROUND SERVICE (USA)

Call before you Overhead
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DEPARTMENT OF PUBLIC WORKS
I-15 FREEWAY CHANNEL
CONSTRUCTION PLAN AND PROFILE
"FC" 3+000 TO "FC" 3+150

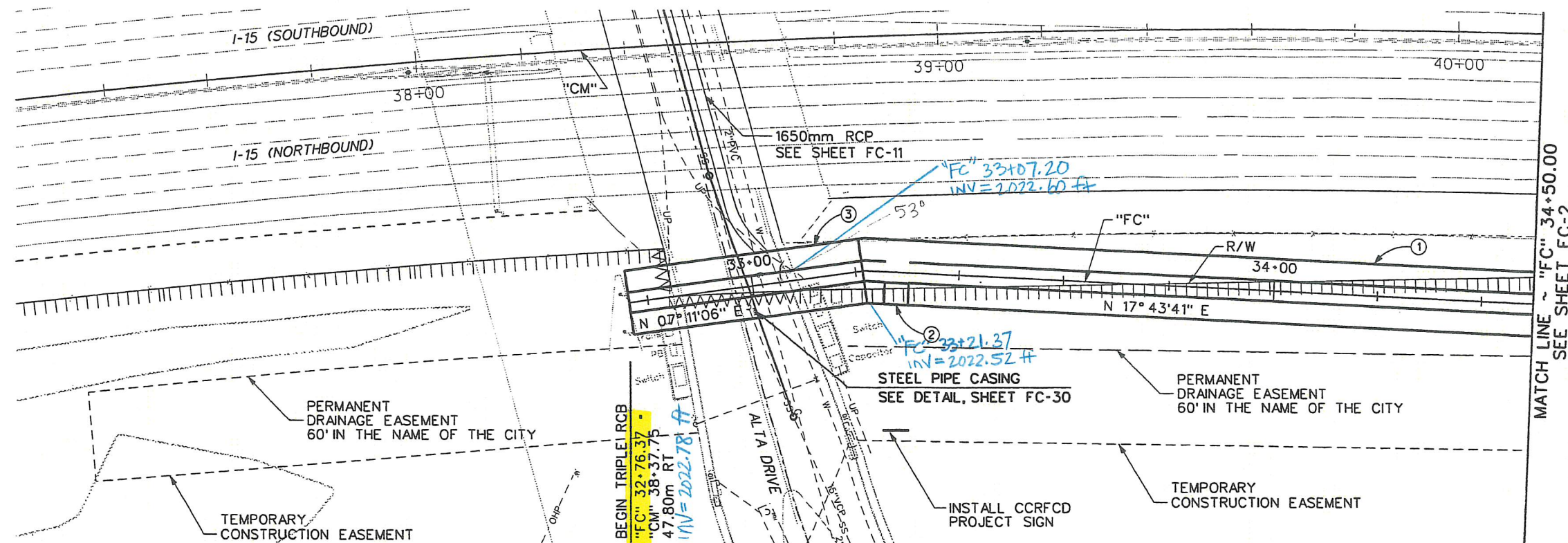


DRAWING No. 38
C-15
327-V254



FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	IDR-DPC-0009(3)	CLARK	FC-1

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN

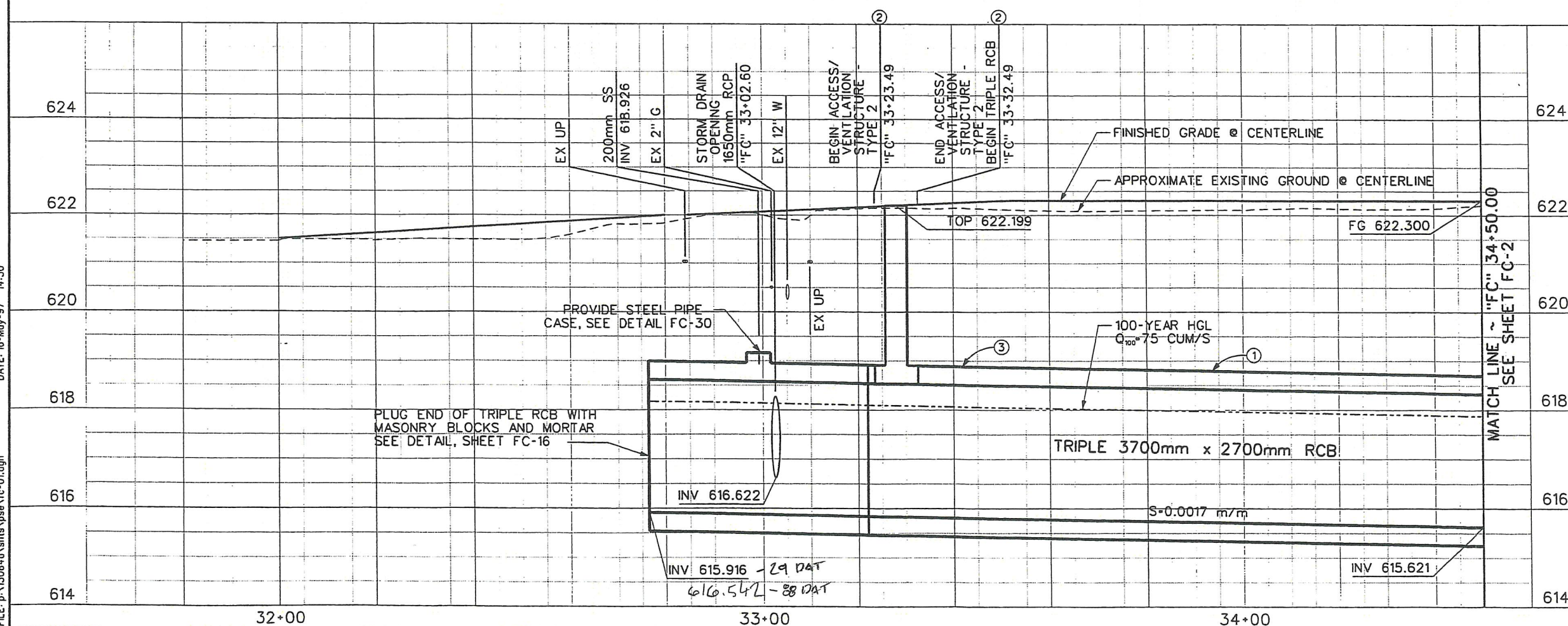


GENERAL NOTES

- THE CONTRACTOR SHALL NOTE THE NEVADA POWER UNDERGROUND ELECTRICAL POWER LINES IN ALTA DRIVE ARE ENERGIZED AND SHALL EXERCISE CAUTION WHEN EXCAVATING IN THE VICINITY OF THESE LINES.
- CONSTRUCT STORM PIPE OPENING AT LATERAL CONNECTIONS. SEE SHEET FC-20.
- CONSTRUCT BOX CULVERT STRUCTURAL SECTION PER OVERBURDEN AS SHOWN ON SHEET FC-16.

CONSTRUCTION NOTES

- "FC" 33+21.37 TO "FC" 34+50.00
CONSTRUCT TRIPLE 3700mm x 2700mm RCB (SEE SHEETS FC-15 THRU FC-17)
- "FC" 33+23.49 TO "FC" 33+32.49
CONSTRUCT ACCESS/VENTILATION STRUCTURE - TYPE 2 (SEE SHEETS FC-25 THRU FC-27)
- "FC" 32+76.37 TO "FC" 33+21.37
INSTALL 3700mm x 2700mm PRECAST CONCRETE BOX CULVERT.



REVISED 9/12/97

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
I-15 / US-95 STAGE 2

CCRFCD FACILITY
PLAN AND PROFILE
"FC" 32+76.37 TO 34+50.00

PB PARSONS
BRINCKERHOFF

DESIGN BY JDP
DRAWN BY BJC
CHECKED BY BJC
REVIEWED BY JDC

DATE: 16-May-97 14:30

FILE: p:\30600\site\pse\fc-01.dgn

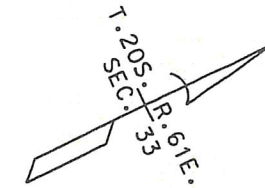
(29) + 0.626m (88)
+ 2.05ft

FILE: p:\13064\civil\pse\fc-02.dgn DATE: 16-May-97 14:31

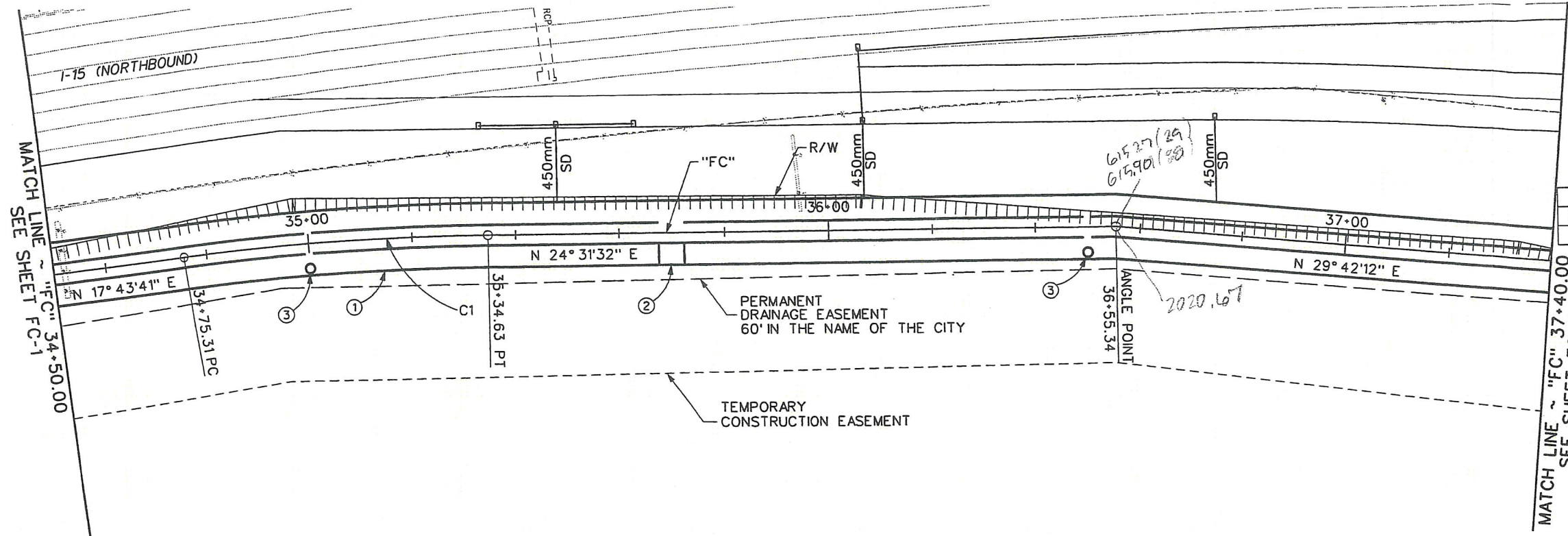


FED. RD. REG. NO.	STATE	PROJECT NO.	COUNTY	SHEET NO.
9	NEVADA	IDR-DPC-0009(3)	CLARK	FC-2

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN



CURVE DATA				
NO.	Δ	R	L	T
C1	6° 47' 51"	500.000m	59.319m	29.694m

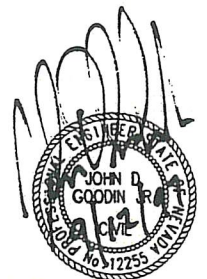
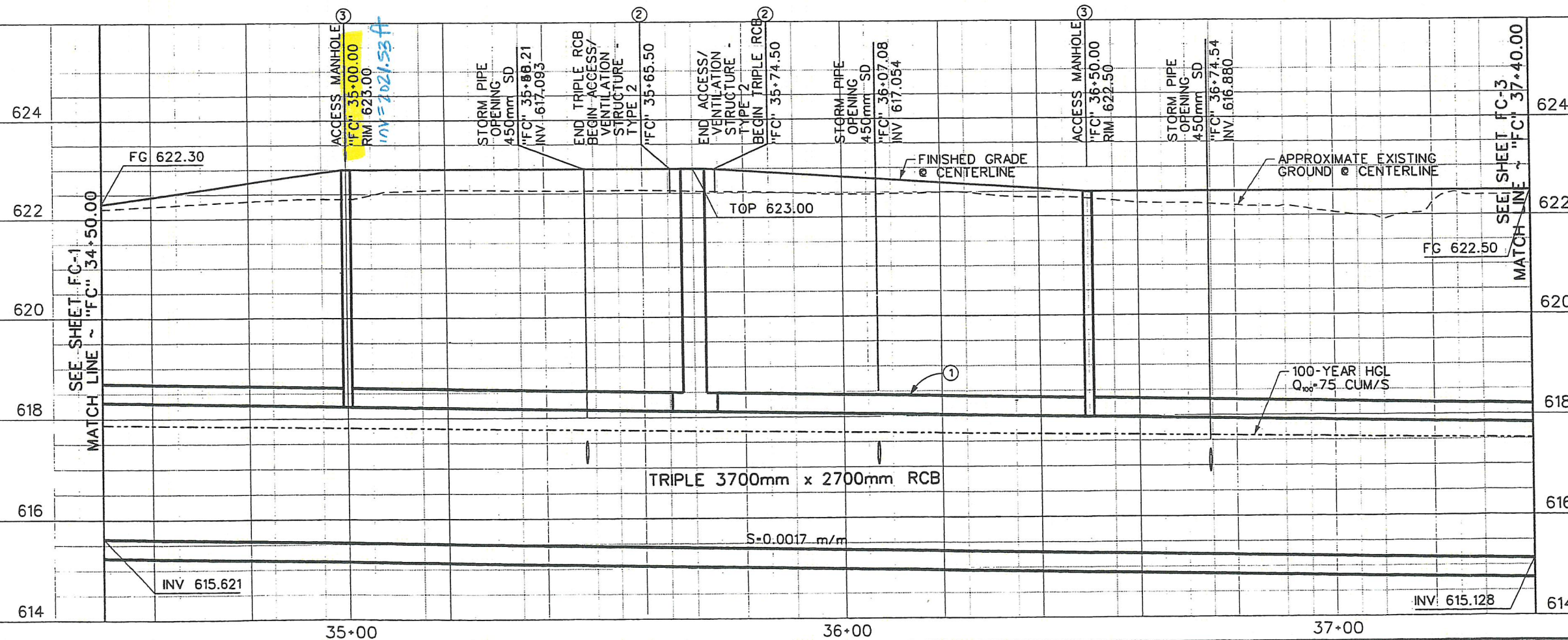


GENERAL NOTES

- CONSTRUCT STORM PIPE OPENING AT LATERAL CONNECTIONS. SEE SHEET FC-20.
- CONSTRUCT BOX CULVERT STRUCTURAL SECTION PER OVERBURDEN AS SHOWN ON FC-16.

CONSTRUCTION NOTES

- "FC" 34+50.00 TO "FC" 35+65.50
"FC" 35+74.50 TO "FC" 37+40.00
CONSTRUCT TRIPLE 3700mm x 2700mm RCB (SEE SHEETS FC-15 THRU FC-17)
- "FC" 35+65.50 TO "FC" 35+74.50
CONSTRUCT ACCESS/VENTILATION STRUCTURE - TYPE 2 (SEE SHEETS FC-25 THRU FC-27)
- "FC" 35+00.00 TO "FC" 36+50.00
INSTALL SPECIAL MANHOLE (RCB) (SEE SHEETS FC-28 THRU FC-29)

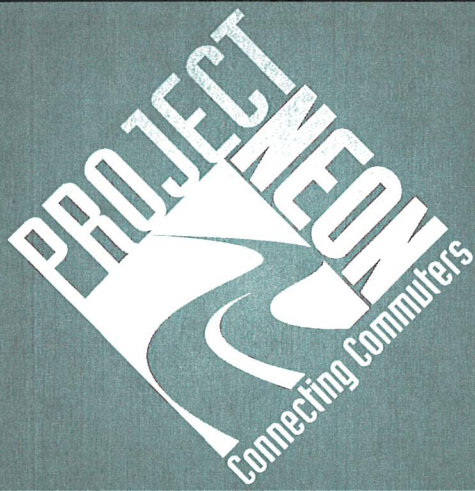


REVISED 9/12/97

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION
I-15 / US-95 STAGE 2

CCRFCD FACILITY
PLAN AND PROFILE
"FC" 34+50.00 TO 37+40.00

PB PARSONS BRINCKERHOFF
DESIGN BY: BPP
DRAWN BY: RTC
CHECKED BY: RB
REVIEWED BY: JDC



Existing Offsite Hydrology Report

B.4

Rancho South Overland Flows

APPENDIX B.4

RANCHO SHOUTH OVERLAND FLOWS

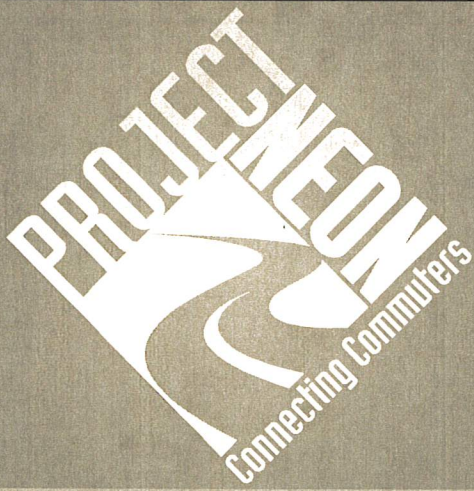
HYDRAULIC METHODOLOGY

I HEC-RAS

HEC-RAS Version 4.0.0 was used to model the existing Freeway Channel from Desert Inn to Sahara. This software is developed to analyze 1-dimensional open channel flows utilizing cross sectional data along the conveyance path. This hydraulic model provides a clear picture of existing overland flows on Ranch and properties to the west. Cross sections were taken perpendicular to the existing channel at 100' intervals using Microstation Inroads digital terrain model, as provided by NDOT.

II Manning's N

The existing channel consists of a rectangular concrete channel section with varying width and height, an earthen trapezoidal section with a 10' base and riprap sides sloping at 2:1, a rectangular concrete section with a 25' base and 6' height, and (2) 10' x 8' RCB's. A composite overland Manning's n was determined by dividing the terrain into three general categories; dirt, paved parking lot, and landscaped median. With the aide of an aerial photograph approximate lengths were determined for each corresponding terrain categories and a composite Manning's n was calculated. This Manning's n was incorporated into the HEC-RAS model. Cross sections that intersected a building or a wall were also modeled in HEC-RAS with a high wall that did not allow flow to overtop.



Existing Offsite Hydrology Report

B.4.1

Manning's n Calculations

**NEON - MANNING'S N CALCULATIONS
EXISTING FREEWAY CHANNEL
DESERT INN TO SAHARA**

Page: 1 of 4

Soil Description	Manning's N	679+15.03		680+00		681+00		682+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	190.43		190.43		190.43		112.17	
Pave Parking Lot	0.016	13.04		13.04		13.04		91.30	
Landscaped Median	0.030	0.00		0.00		0.00		0.00	
		0.024		0.024		0.024		0.021	

Soil Description	Manning's N	683+00		684+00		685+00		686+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	151.30		36.52		39.13		151.30	
Pave Parking Lot	0.016	52.17		159.13		156.52		44.35	
Landscaped Median	0.030	0.00		0.00		0.00		0.00	
		0.023		0.018		0.018		0.023	

Soil Description	Manning's N	687+00		688+00		689+00		690+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	73.04		73.04		106.96		117.39	
Pave Parking Lot	0.016	130.43		130.43		96.52		78.26	
Landscaped Median	0.030	0.00		0.00		0.00		0.00	
		0.019		0.019		0.021		0.021	

		691+00		692+00		693+00		694+00	
Soil Description	Manning's N	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
		203.48		203.48		203.48		203.48	
		0.00		0.00		0.00		0.00	
		0.00		0.00		0.00		0.00	
Dirt	0.025								
Pave Parking Lot	0.016								
Landscaped Median	0.030								
		0.025		0.025		0.025		0.025	

Soil Description	Manning's N	695+00		696+00		697+00		698+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	203.48		125.22		0.00		0.00	
Pave Parking Lot	0.016	0.00		78.26		65.22		65.22	
Landscaped Median	0.030	0.00		0.00		7.83		7.83	
		0.025		0.022		0.018		0.018	

Soil Description	Manning's N	699+00		700+00		701+00		702+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
		0.00		0.00		0.00		0.00	
		65.22		187.83		177.39		52.17	
		7.83		15.65		26.09		7.83	
Dirt	0.025								
Pave Parking Lot	0.016								
Landscaped Median	0.030								
			0.018		0.017		0.018		0.018

		703+00		704+00		705+00		706+00	
Soil Description	Manning's N	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	0.00		0.00		0.00		0.00	
Pave Parking Lot	0.016	52.17		57.39		117.39		203.48	
Landscaped Median	0.030	7.83		7.83		0.00		0.00	
		0.018		0.018		0.016		0.016	

Soil Description	Manning's N	707+00		708+00		709+00		710+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	0.00	0.016	0.00	0.016	0.00	0.016	0.00	0.016
Pave Parking Lot	0.016	52.17		73.04		125.00		65.22	
Landscaped Median	0.030	0.00		0.00		0.00		0.00	

Soil Description	Manning's N	711+00		712+00		713+00		714+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	0.00	0.018	0.00	0.016	0.00	0.017	0.00	0.018
Pave Parking Lot	0.016	65.22		130.43		195.65		44.35	
Landscaped Median	0.030	7.83		0.00		7.83		7.83	

Soil Description	Manning's N	715+00		716+00		717+00		718+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	0.00	0.017	0.00	0.017	0.00	0.017	73.04	0.019
Pave Parking Lot	0.016	122.61		75.65		195.65		130.43	
Landscaped Median	0.030	7.83		7.83		7.83		0.00	

Soil Description	Manning's N	719+00		720+00		721+00		722+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	203.48	0.025	203.48	0.025	0.00	0.016	0.00	0.018
Pave Parking Lot	0.016	0.00		0.00		203.48		65.22	
Landscaped Median	0.030	0.00		0.00		0.00		7.83	

Soil Description	Manning's N	723+00		724+00		725+00		726+00	
		Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	0.00		0.00		0.00		0.00	
Pave Parking Lot	0.016	65.22		65.22		65.22		65.22	
Landscaped Median	0.030	7.83		7.83		7.83		7.83	
		0.018		0.018		0.018		0.018	

Soil Description	Manning's N	727+00		728+00	
		Length (ft)	Composite n	Length (ft)	Composite n
Dirt	0.025	0.00		0.00	
Pave Parking Lot	0.016	65.22		65.22	
Landscaped Median	0.030	7.83		7.83	
		0.018		0.018	



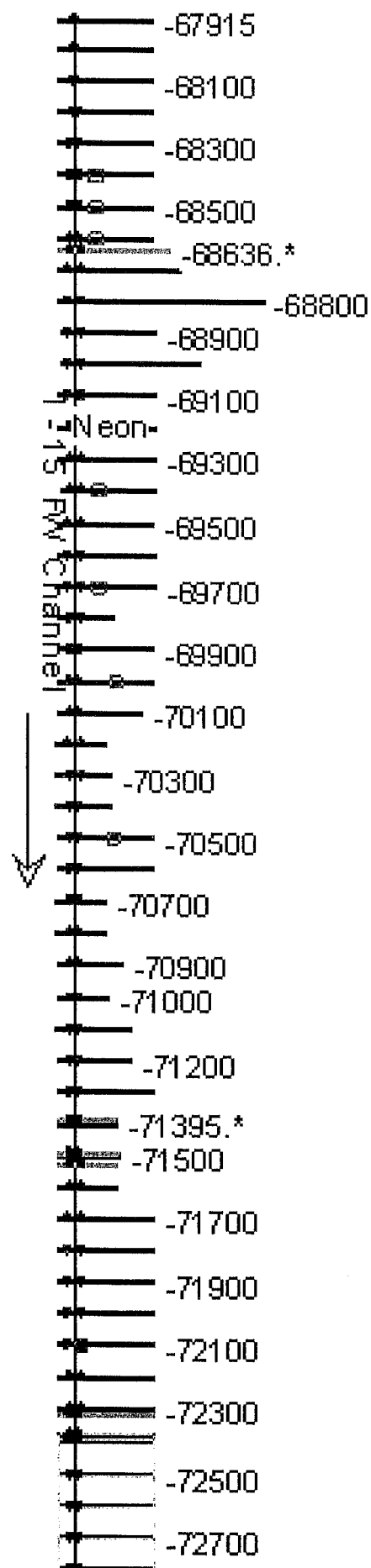
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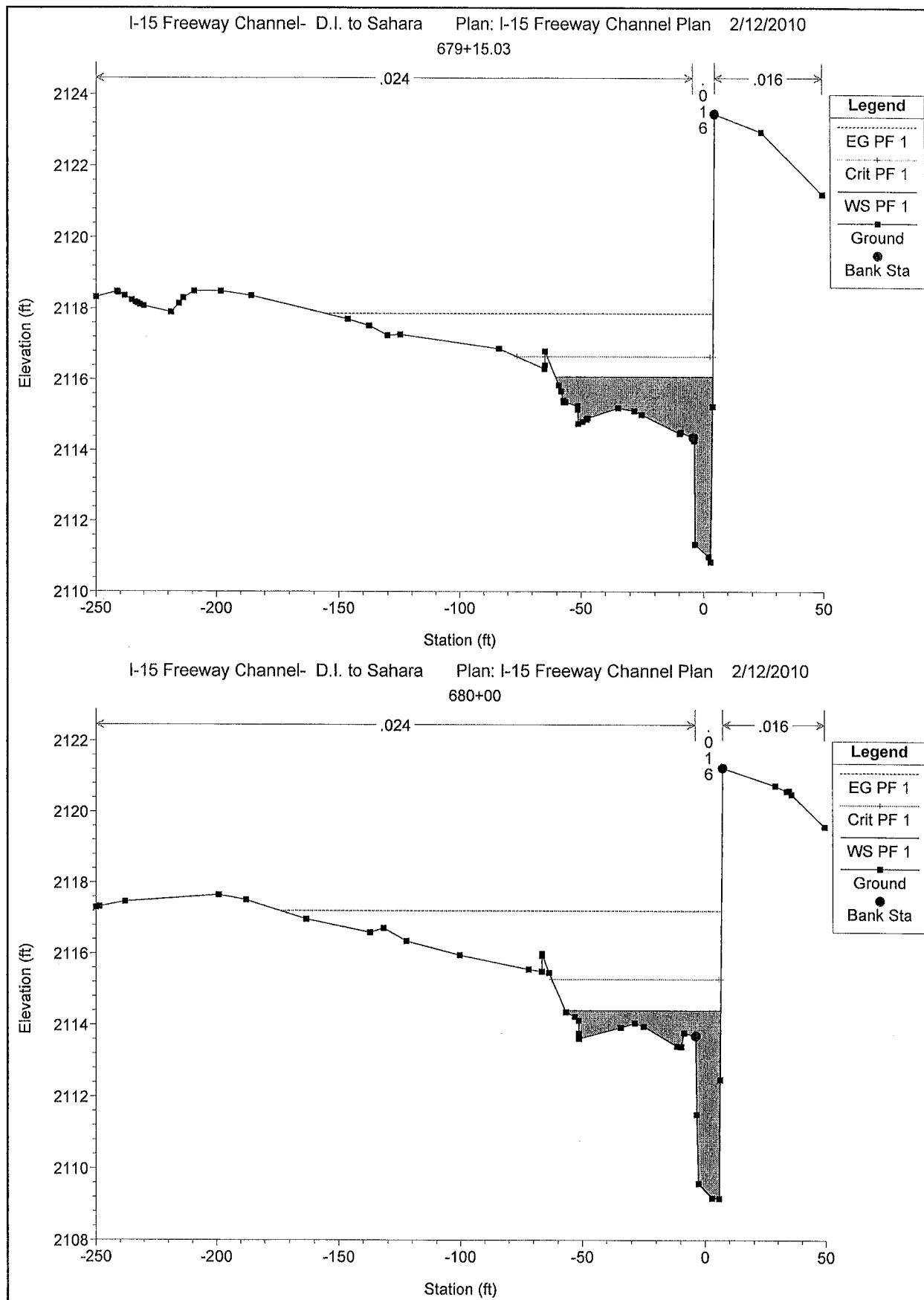
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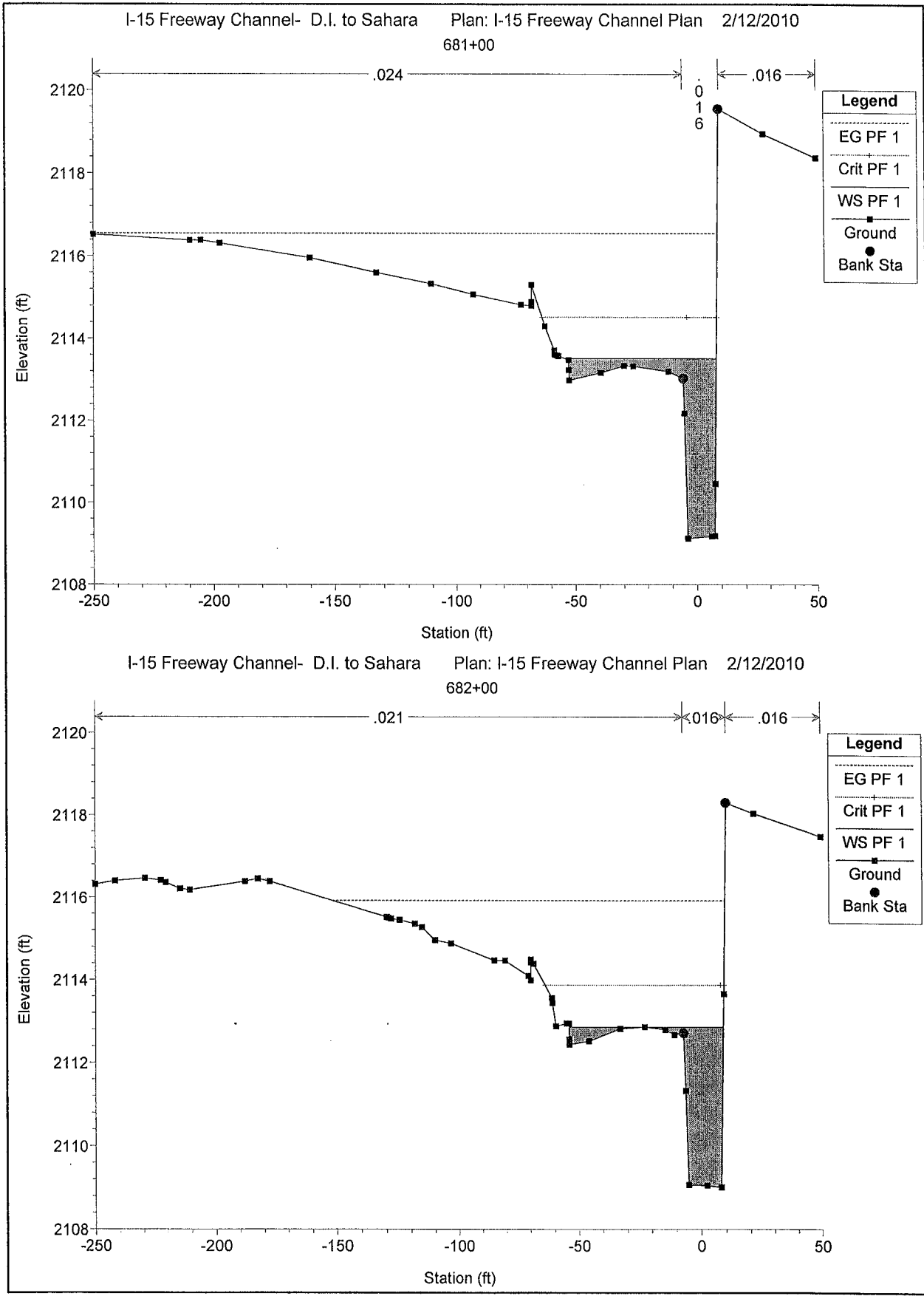
HEC-RAS Analysis

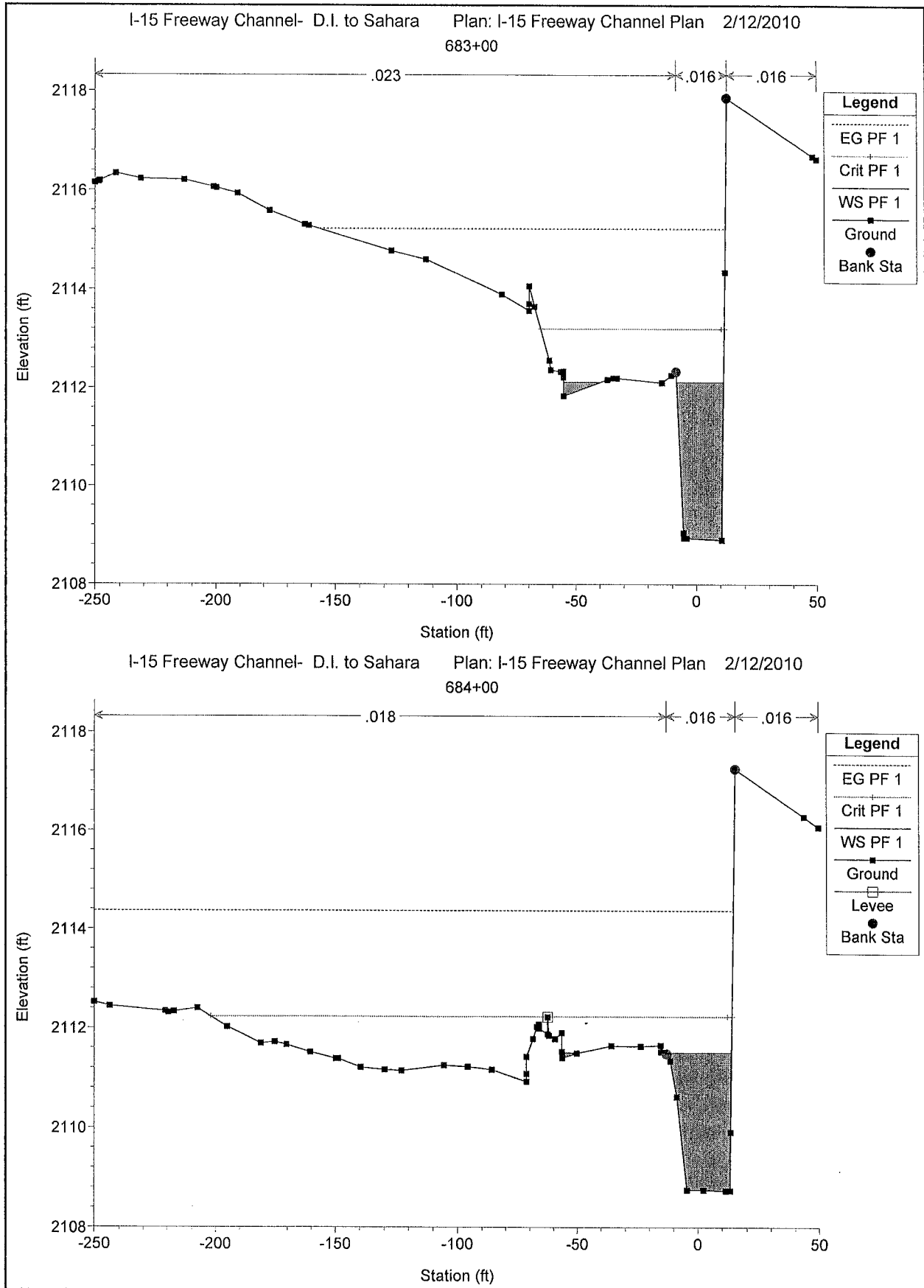
HEC-RAS Plan: 01 River: I-15 FW Channel Reach: Neon Profile: PF 1

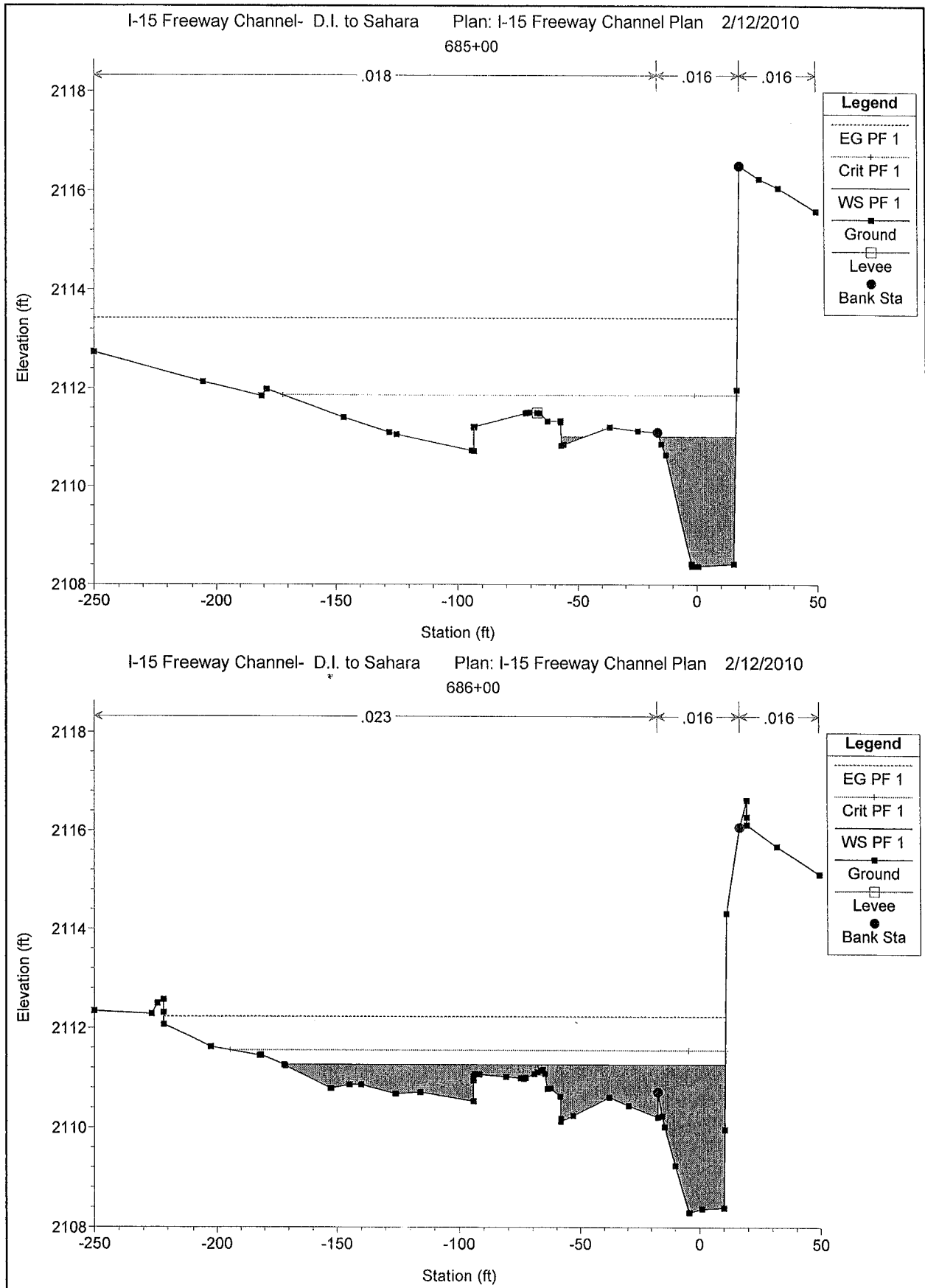
Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
Neon	-67915	PF 1	799.00	2110.84	2116.07	2116.65	2117.85	0.006423	13.24	97.78	64.31	1.11
Neon	-68000	PF 1	799.00	2109.16	2114.40	2115.28	2117.20	0.006396	14.36	79.06	63.27	1.17
Neon	-68100	PF 1	799.00	2109.13	2113.52	2114.52	2116.55	0.006154	14.27	68.81	62.44	1.26
Neon	-68200	PF 1	799.00	2109.01	2112.85	2113.87	2115.92	0.006433	14.16	62.47	60.83	1.34
Neon	-68300	PF 1	799.00	2108.90	2112.12	2113.20	2115.23	0.007222	14.18	58.33	37.24	1.47
Neon	-68400	PF 1	799.00	2108.73	2111.50	2112.23	2114.37	0.008445	13.58	59.19	35.47	1.61
Neon	-68500	PF 1	799.00	2108.37	2111.01	2111.86	2113.42	0.007836	12.47	64.85	42.18	1.56
Neon	-68600	PF 1	799.00	2108.30	2111.26	2111.55	2112.23	0.003316	9.01	148.67	182.89	1.03
Neon	-68636.*	PF 1	799.00	2108.26	2110.85	2111.18	2112.03	0.008588	10.14	122.33	207.11	1.32
Neon	-68700	PF 1	799.00	2108.18	2111.29	2110.71	2111.36	0.000541	3.03	398.12	366.18	0.35
Neon	-68800	PF 1	799.00	2106.99	2111.28		2111.32	0.000249	2.30	528.17	408.11	0.24
Neon	-68900	PF 1	1652.00	2106.60	2110.52	2110.52	2111.16	0.003600	8.50	289.95	233.84	0.91
Neon	-69000	PF 1	1652.00	2105.88	2110.58	2109.80	2110.70	0.000725	4.15	603.41	370.25	0.41
Neon	-69100	PF 1	1652.00	2105.27	2110.54		2110.64	0.000315	3.12	678.62	201.46	0.28
Neon	-69200	PF 1	1652.00	2103.55	2109.52	2109.52	2110.48	0.002709	9.33	240.10	141.53	0.82
Neon	-69300	PF 1	1652.00	2102.80	2108.57	2108.84	2110.07	0.004783	11.38	190.64	79.10	1.07
Neon	-69400	PF 1	1652.00	2101.60	2107.95	2108.34	2109.58	0.004432	11.70	189.34	78.80	1.03
Neon	-69500	PF 1	1652.00	2100.99	2107.25	2107.71	2109.08	0.005118	11.86	175.66	78.06	1.10
Neon	-69600	PF 1	1652.00	2100.44	2106.53	2107.18	2108.55	0.004989	12.43	168.29	78.76	1.09
Neon	-69700	PF 1	1652.00	2100.10	2105.99	2106.60	2108.04	0.005240	12.46	159.21	76.28	1.12
Neon	-69800	PF 1	1652.00	2099.25	2105.21	2105.93	2107.46	0.006049	13.16	165.33	119.32	1.20
Neon	-69900	PF 1	1652.00	2098.82	2104.46	2105.23	2108.81	0.006272	13.43	162.74	121.48	1.21
Neon	-70000	PF 1	1652.00	2098.59	2103.82	2104.50	2106.10	0.007389	13.45	162.49	133.29	1.30
Neon	-70100	PF 1	2124.00	2098.12	2104.62	2103.24	2104.78	0.000356	3.74	675.41	227.66	0.30
Neon	-70200	PF 1	2124.00	2097.81	2103.52	2103.52	2104.61	0.002888	9.49	269.06	111.87	0.85
Neon	-70300	PF 1	2124.00	2097.44	2102.62	2103.01	2104.19	0.004947	11.63	232.10	123.90	1.09
Neon	-70400	PF 1	2124.00	2097.16	2101.79	2102.30	2103.59	0.005992	12.44	217.67	123.08	1.20
Neon	-70500	PF 1	2124.00	2096.14	2101.25	2101.65	2103.02	0.005523	12.30	218.24	132.19	1.15
Neon	-70600	PF 1	2124.00	2094.72	2097.88	2099.32	2101.86	0.017706	15.57	132.72	78.34	1.89
Neon	-70700	PF 1	2124.00	2093.91	2099.50	2099.50	2100.62	0.003170	9.33	254.25	110.16	0.86
Neon	-70800	PF 1	2124.00	2092.64	2097.88	2098.48	2100.03	0.008050	13.18	188.79	110.50	1.35
Neon	-70900	PF 1	2124.00	2091.47	2096.40	2097.09	2099.06	0.011026	15.83	186.49	161.21	1.57
Neon	-71000	PF 1	2124.00	2091.26	2096.07	2096.60	2097.98	0.006209	12.68	203.42	112.36	1.22
Neon	-71100	PF 1	2124.00	2090.57	2094.18	2095.07	2097.02	0.016167	16.02	165.47	123.51	1.85
Neon	-71200	PF 1	2124.00	2090.40	2093.63	2094.28	2095.53	0.009446	11.67	192.41	129.86	1.40
Neon	-71300	PF 1	2124.00	2088.63	2093.44	2093.76	2094.52	0.005810	10.73	268.55	216.66	1.11
Neon	-71395.*	PF 1	2124.00	2087.27	2091.96	2092.40	2093.62	0.015674	8.99	208.71	144.99	0.92
Neon	-71400	PF 1	2124.00	2087.20	2092.04	2092.35	2093.50	0.012056	8.01	223.72	140.22	0.81
Neon	-71492.*	PF 1	2124.00	2085.31	2090.01	2090.53	2091.97	0.022243	11.77	190.19	147.86	1.12
Neon	-71500	PF 1	2124.00	2085.15	2090.52	2090.75	2091.72	0.002150	10.37	289.46	150.81	0.91
Neon	-71524.*	PF 1	2124.00	2084.48	2089.89	2090.38	2091.61	0.002758	11.88	251.52	148.30	1.02
Neon	-71600	PF 1	2124.00	2082.48	2087.78	2089.14	2091.18	0.004237	14.92	152.15	67.88	1.21
Neon	-71700	PF 1	2124.00	2081.59	2086.36	2088.35	2090.60	0.005828	16.58	131.51	48.29	1.42
Neon	-71800	PF 1	2124.00	2080.63	2084.94	2086.45	2089.86	0.007798	17.80	119.35	32.97	1.65
Neon	-71900	PF 1	2124.00	2079.77	2084.69	2085.90	2089.01	0.005924	16.68	127.30	29.91	1.43
Neon	-72000	PF 1	2124.00	2079.10	2083.83	2085.14	2088.38	0.006333	17.12	124.09	29.25	1.46
Neon	-72100	PF 1	2550.00	2077.67	2085.02	2085.02	2087.81	0.002847	13.40	190.33	33.86	1.00
Neon	-72200	PF 1	2550.00	2076.87	2082.28	2084.90	2087.19	0.005918	17.78	143.39	30.74	1.45
Neon	-72300	PF 1	2550.00	2076.17	2081.22	2083.94	2086.53	0.006681	18.49	137.92	31.18	1.55
Neon	-72315.*	PF 1	2550.00	2075.56	2082.85	2083.98	2085.73	0.002738	13.74	202.62	101.16	1.00
Neon	-72381.4	PF 1	2550.00	2073.03	2082.19	2083.44	2085.39	0.010673	14.50	188.48	86.58	0.79
Neon	-72400	PF 1	2550.00	2072.31	2078.71	2083.14	2084.88	0.011639	19.93	127.92	20.00	1.39
Neon	-72500	PF 1	2550.00	2071.56	2082.12	2082.12	2083.41	0.004023	9.87	298.94	103.93	0.46
Neon	-72600	PF 1	2550.00	2070.81	2080.89	2081.53	2082.84	0.006266	11.74	243.48	97.48	0.58
Neon	-72700	PF 1	2550.00	2070.06	2079.97	2080.98	2082.16	0.006918	12.36	231.28	86.40	0.62
Neon	-72800	PF 1	2550.00	2069.31	2079.50	2080.32	2081.44	0.005977	11.72	249.68	136.53	0.56

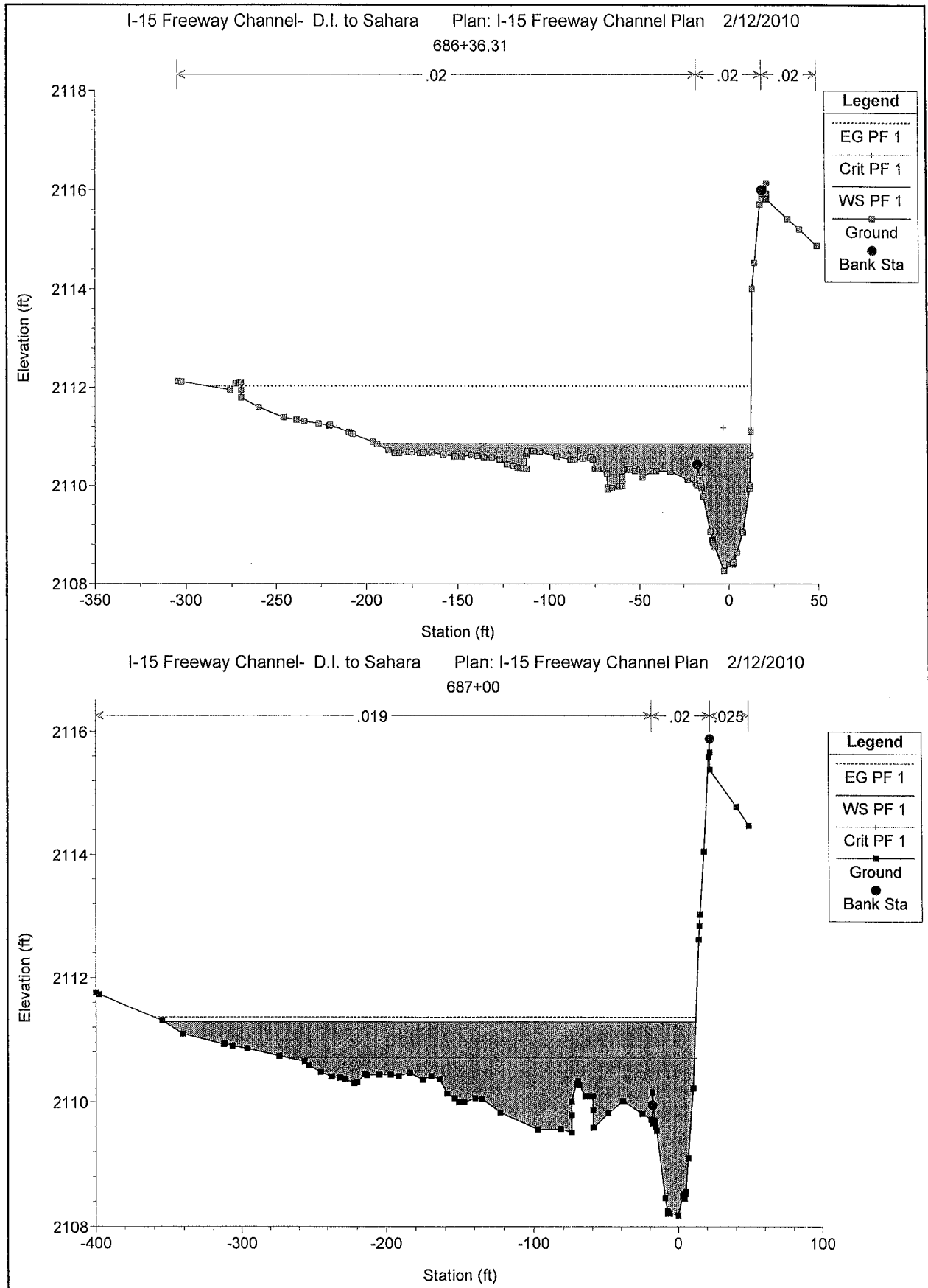


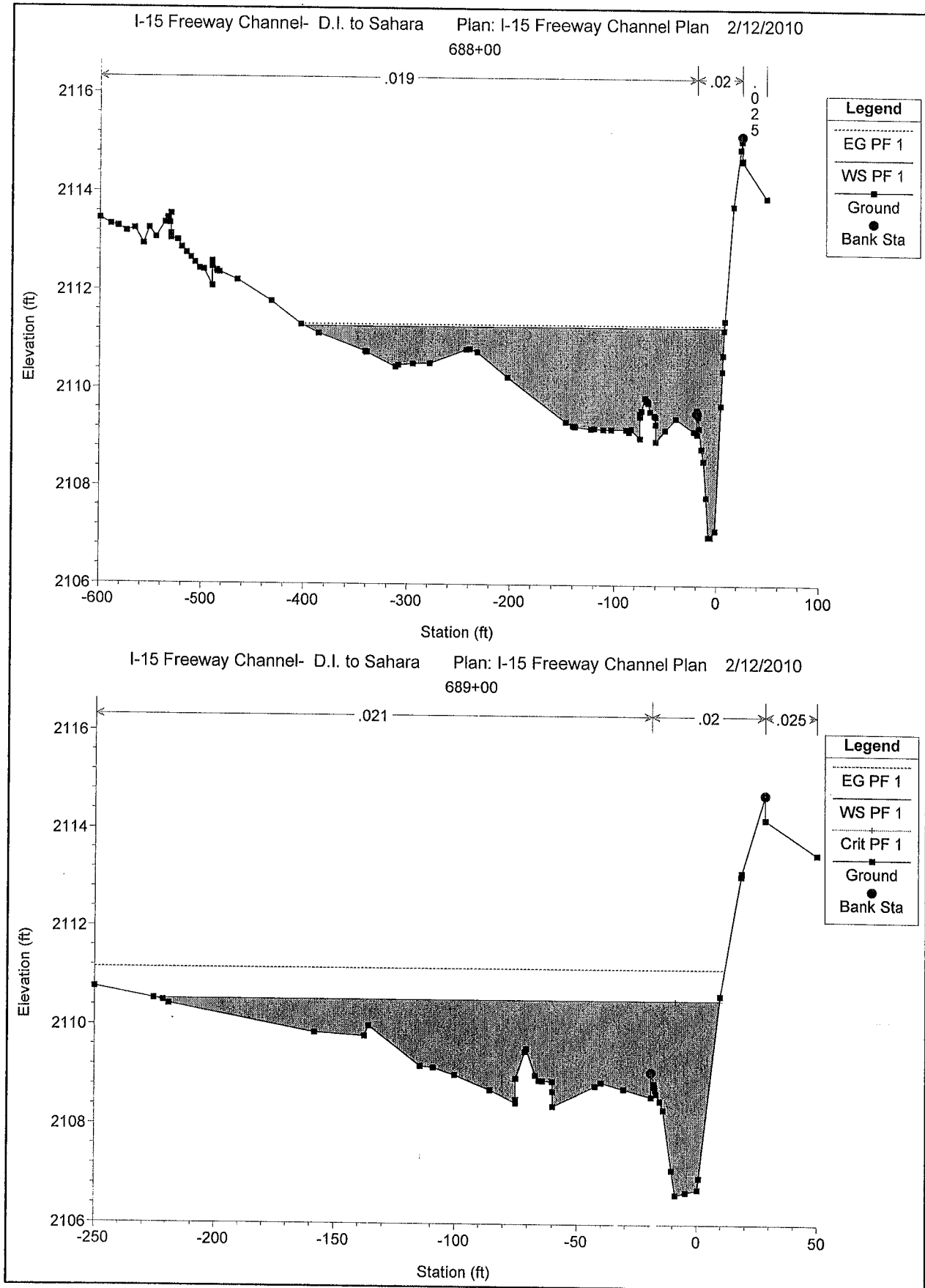




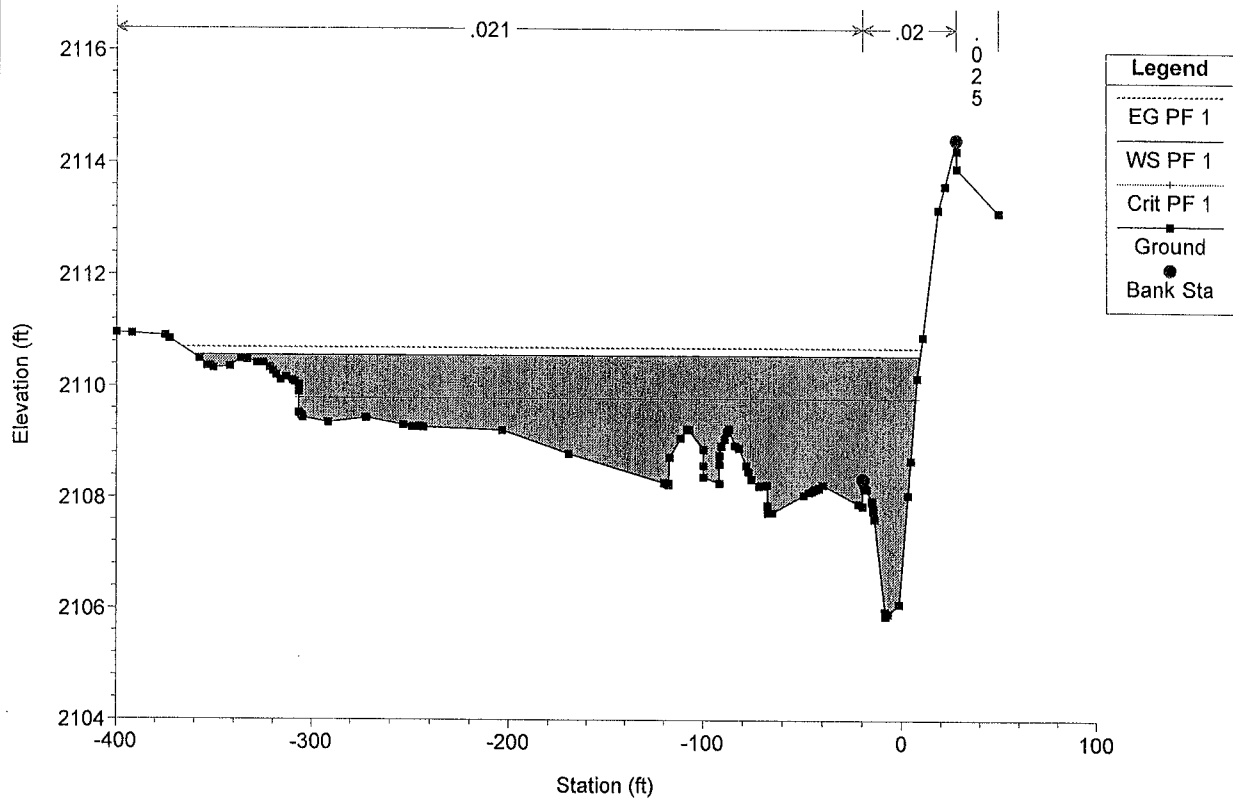




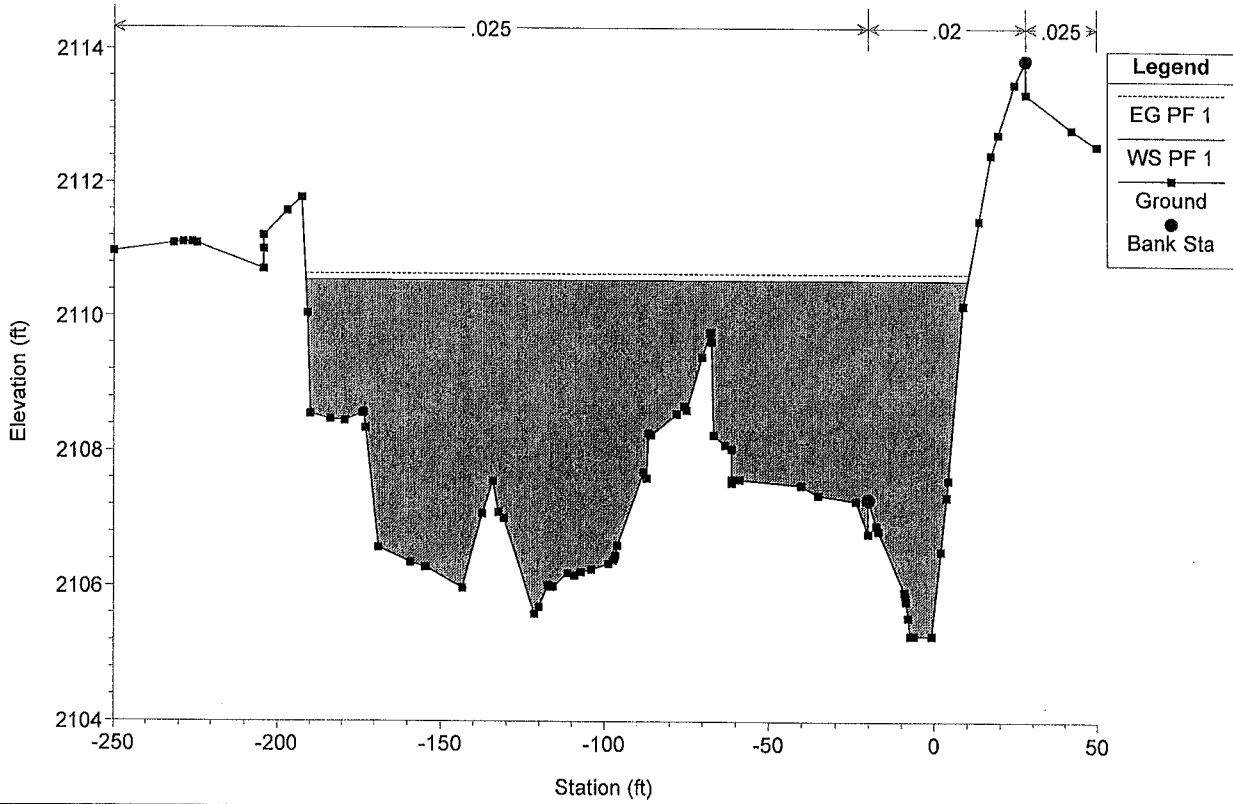


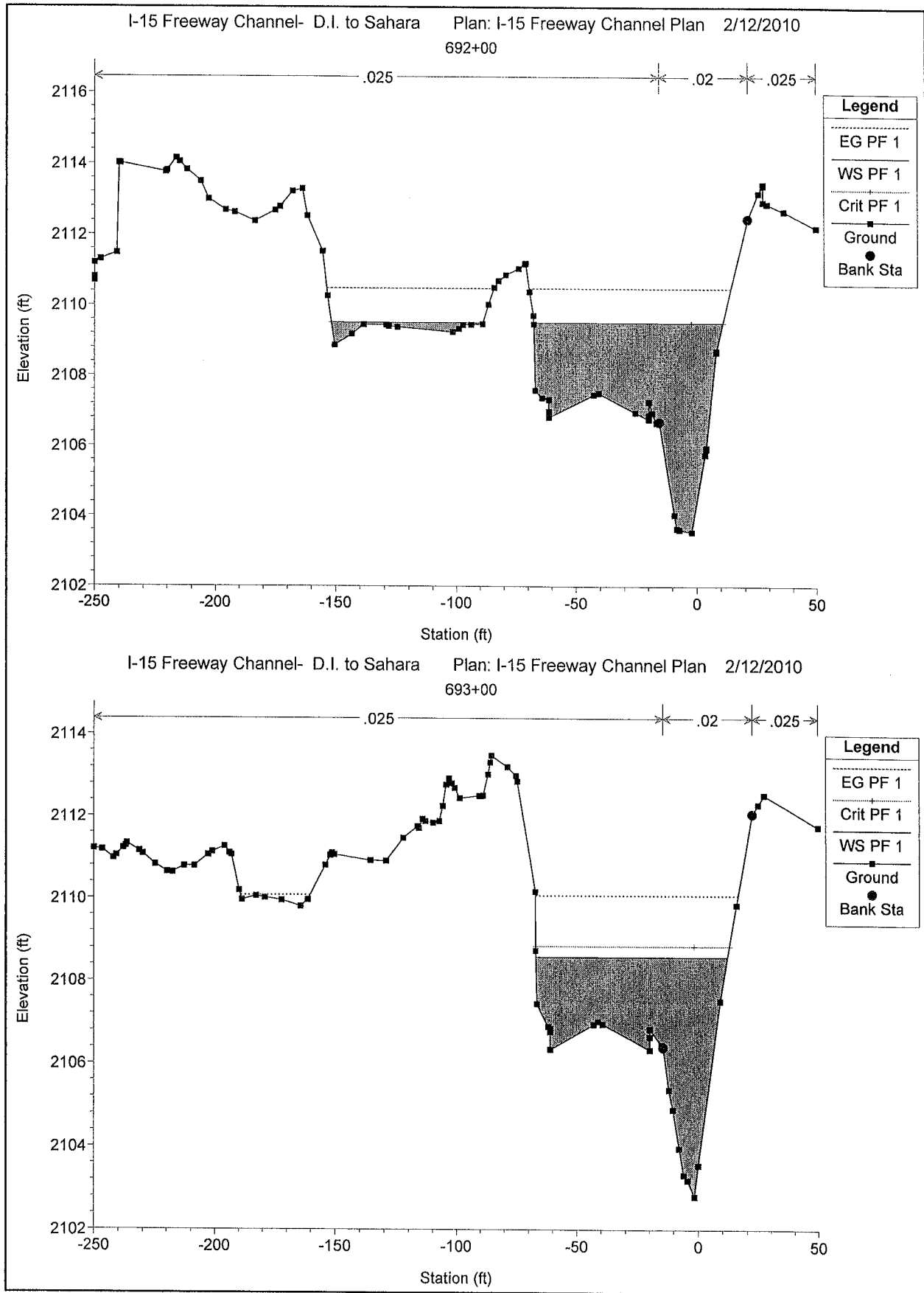


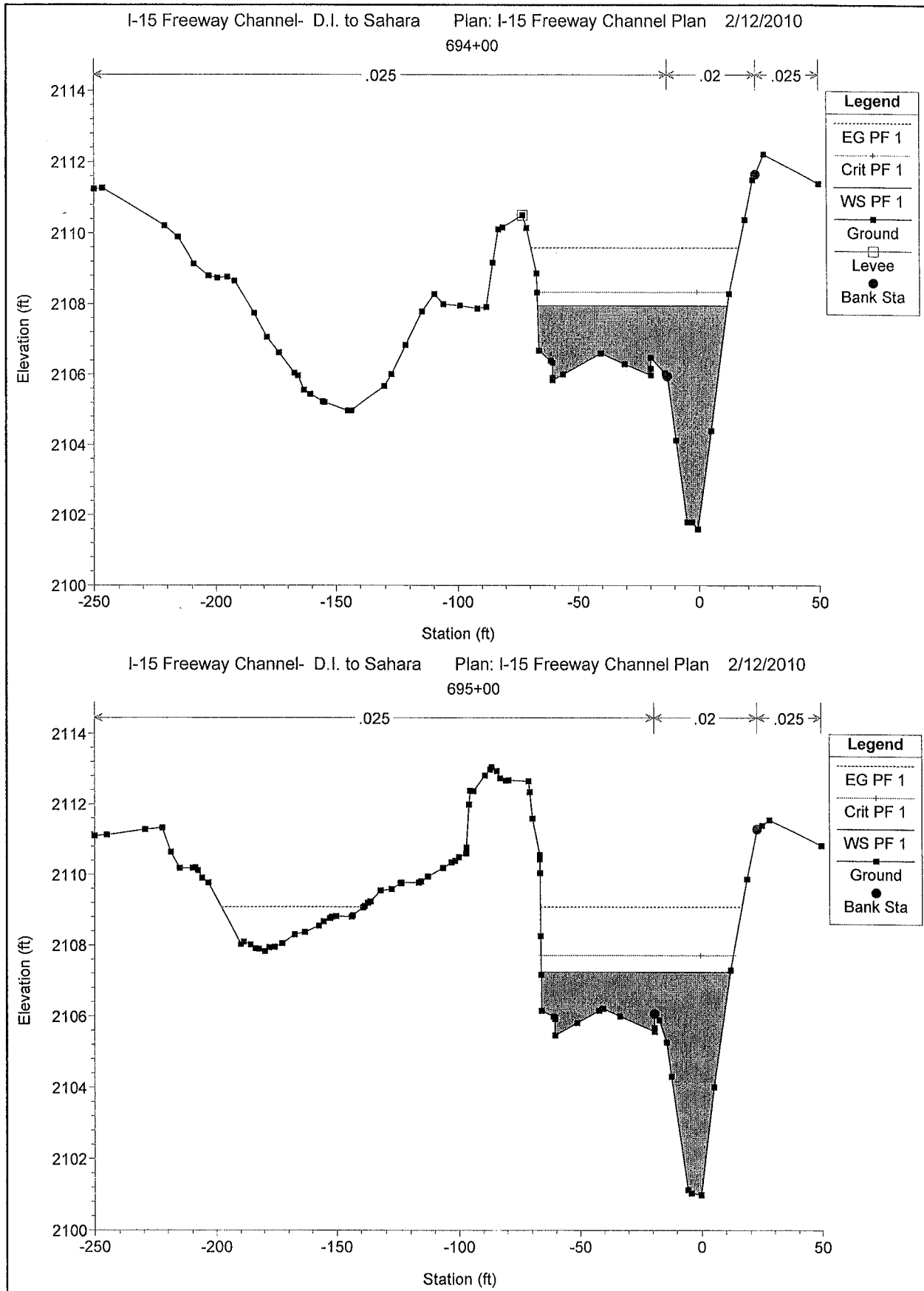
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690+00

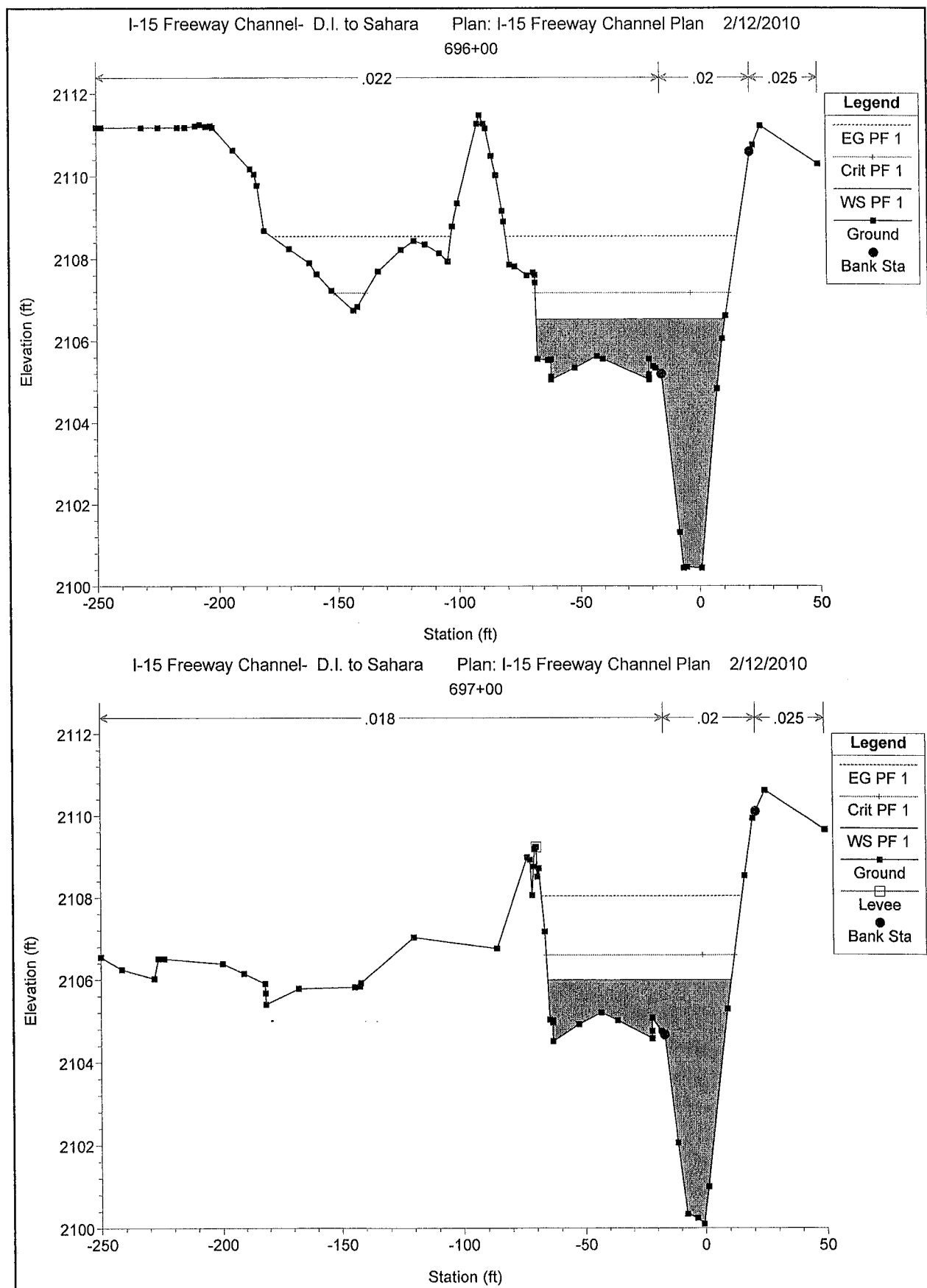


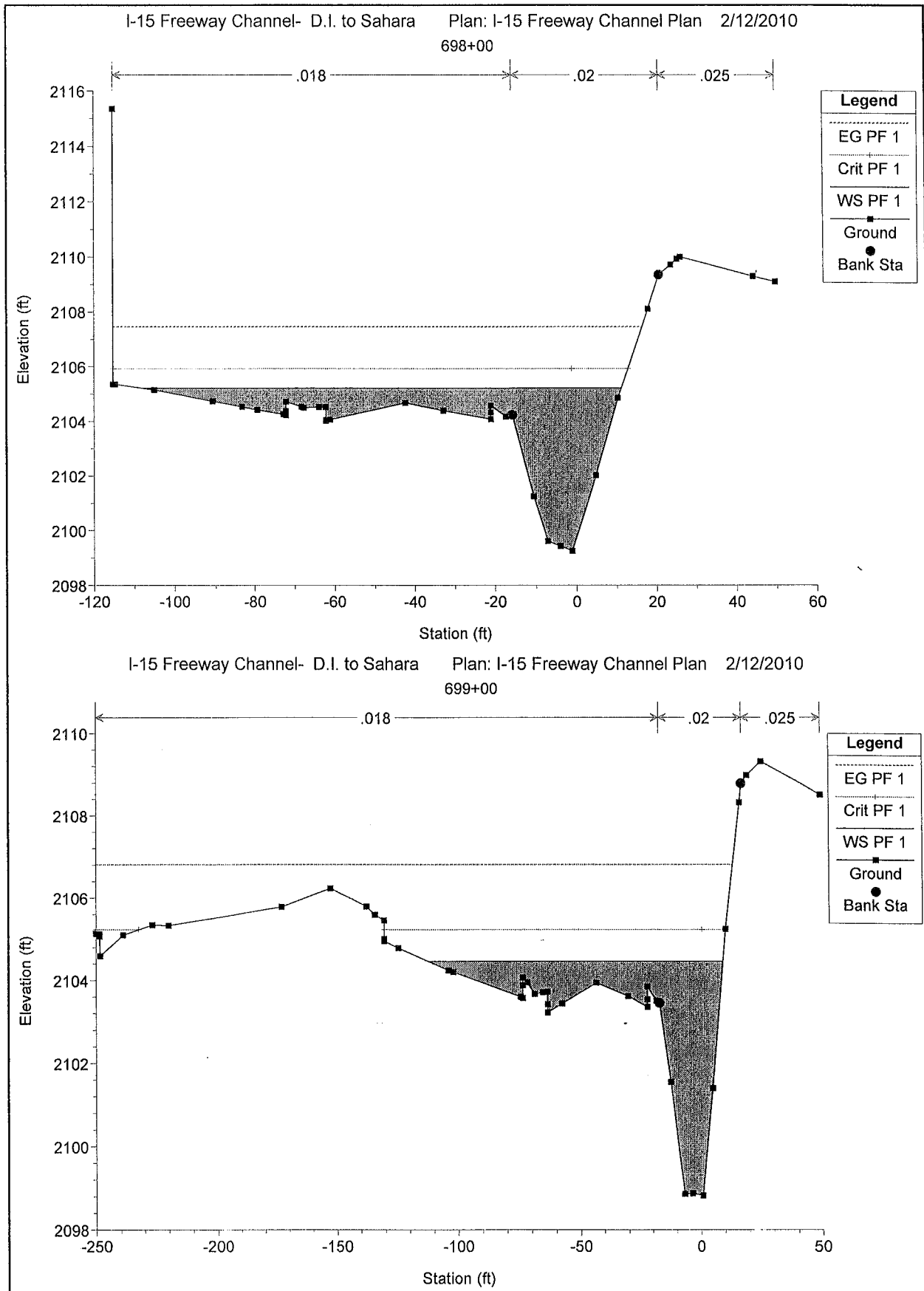
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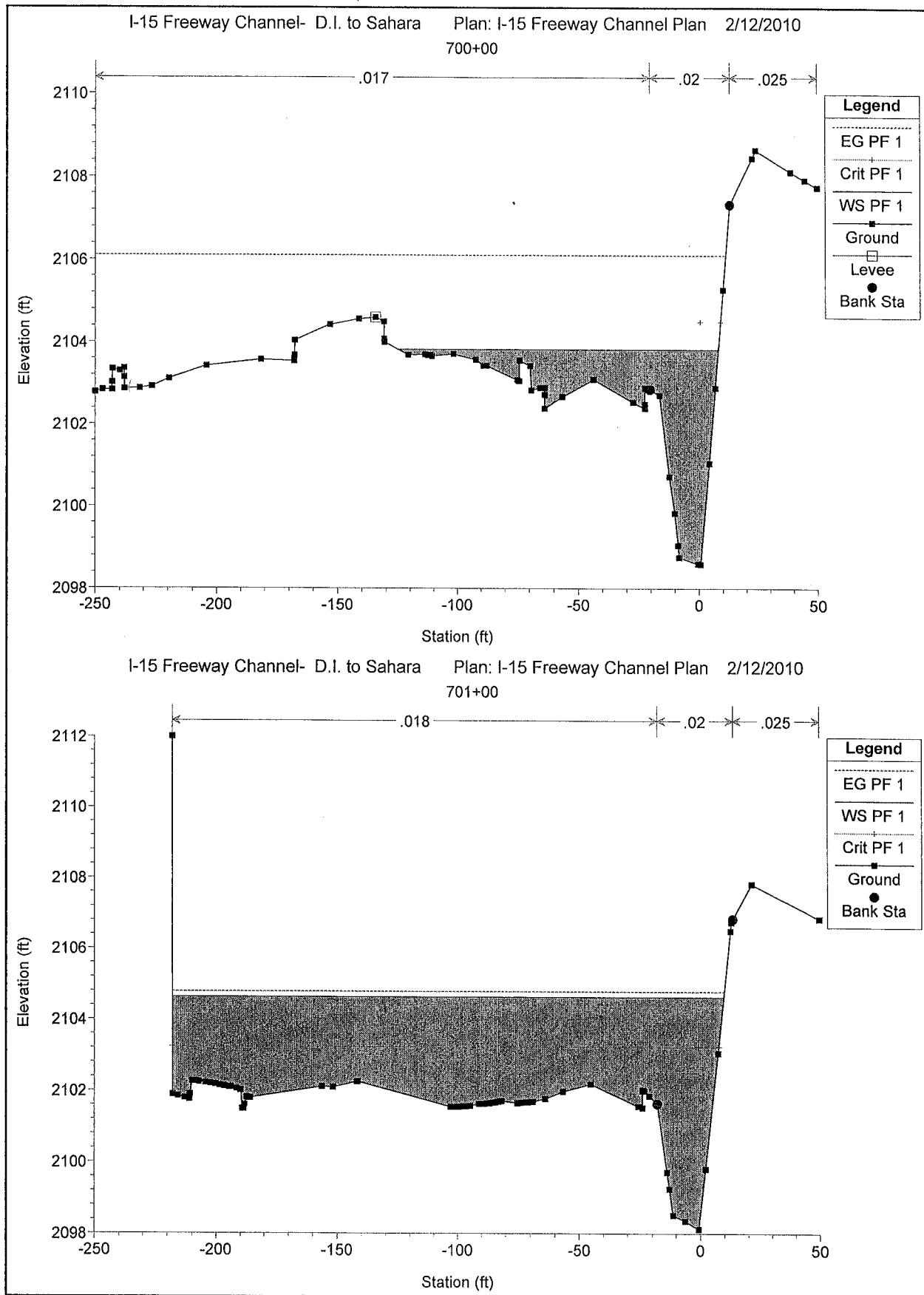




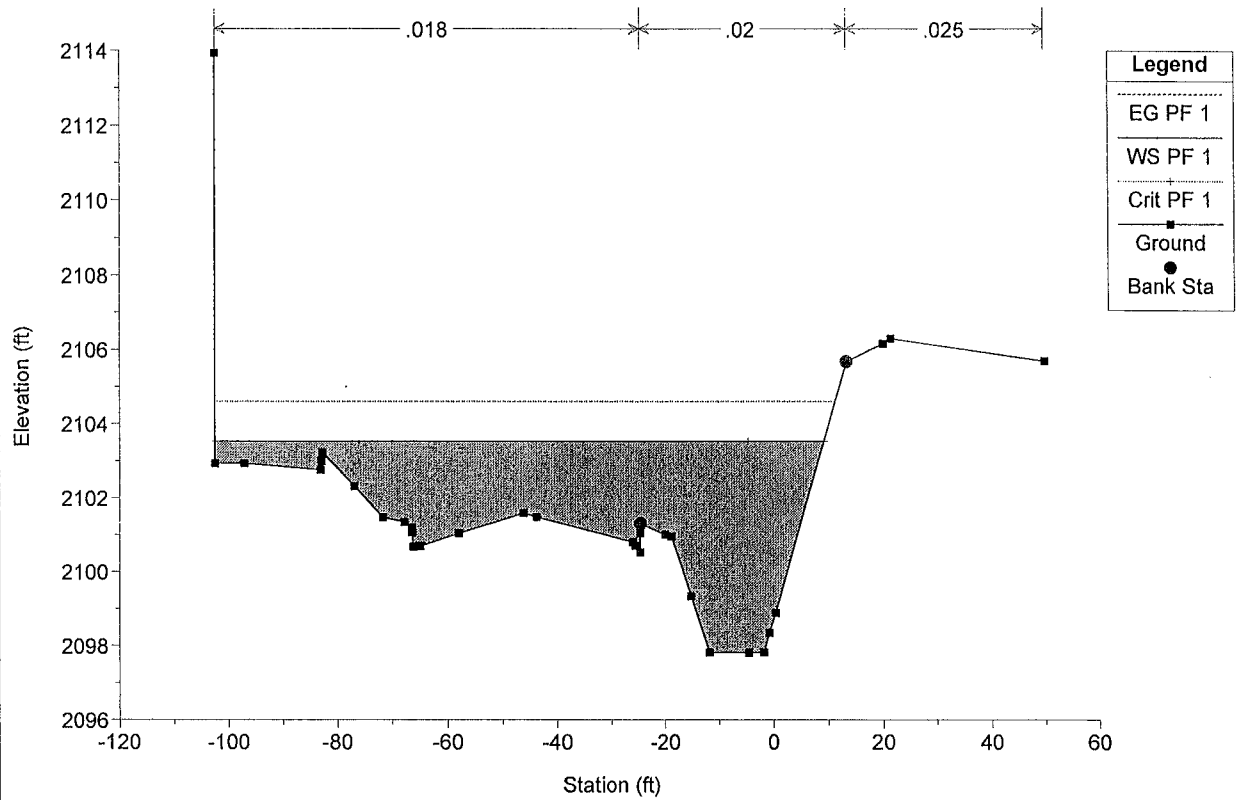




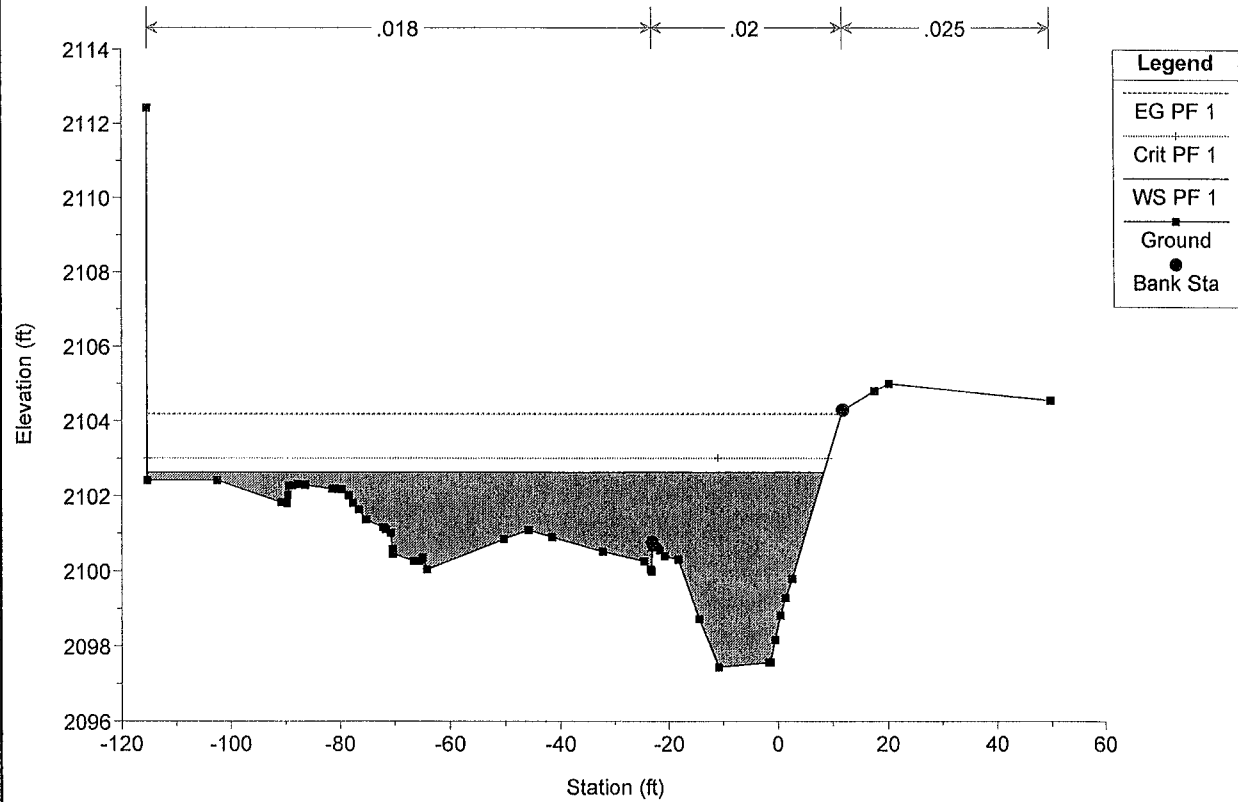


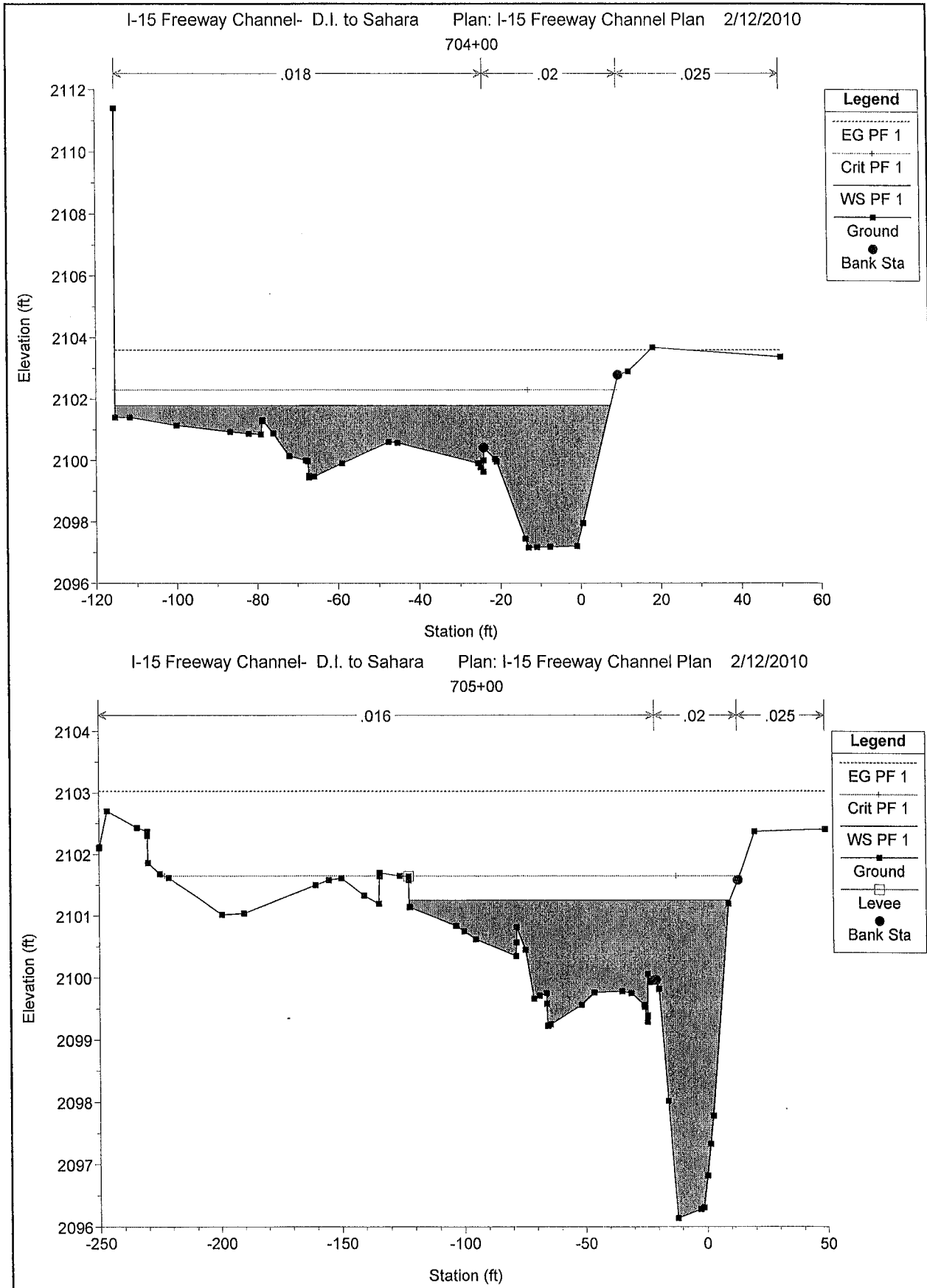


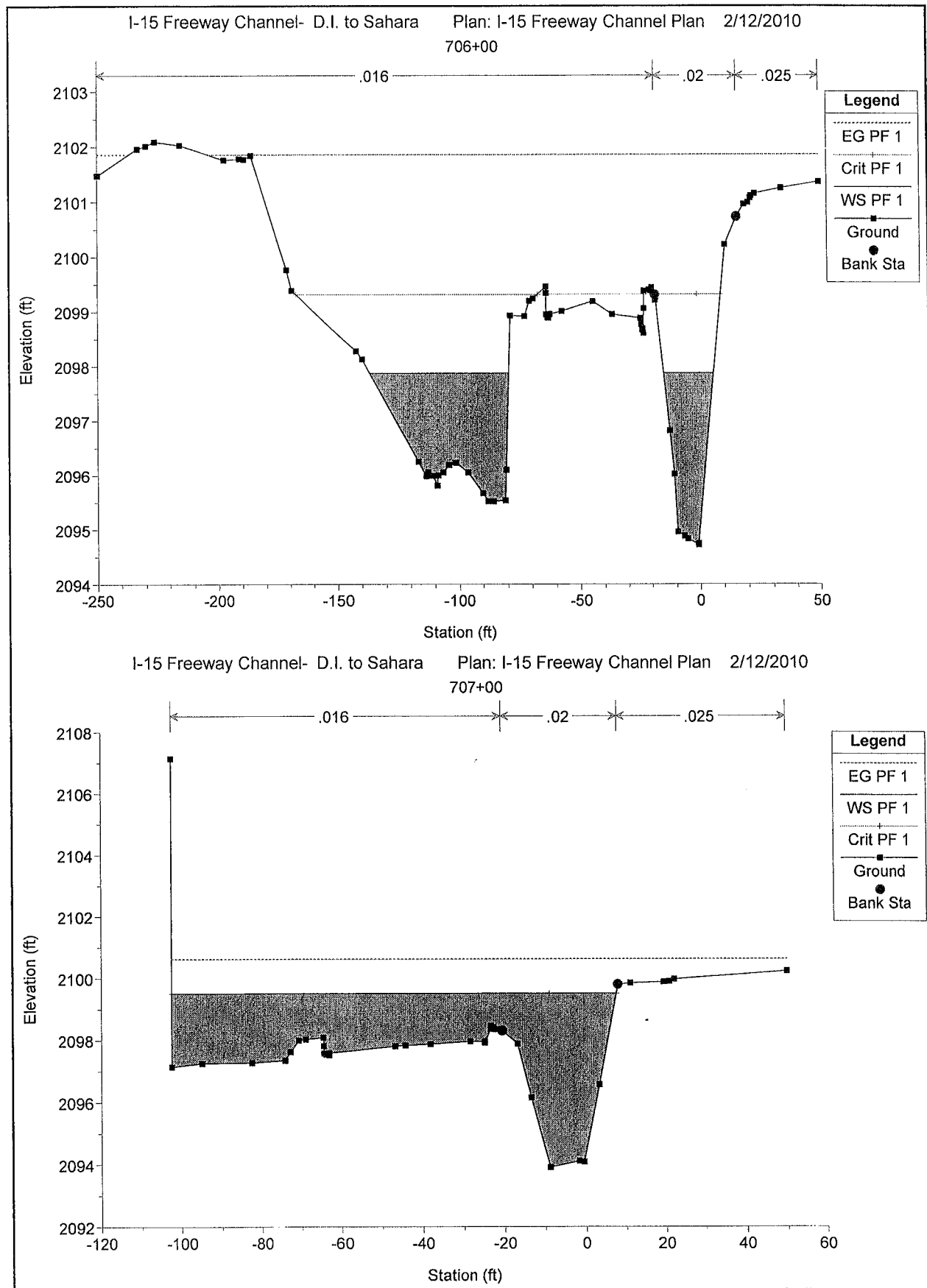
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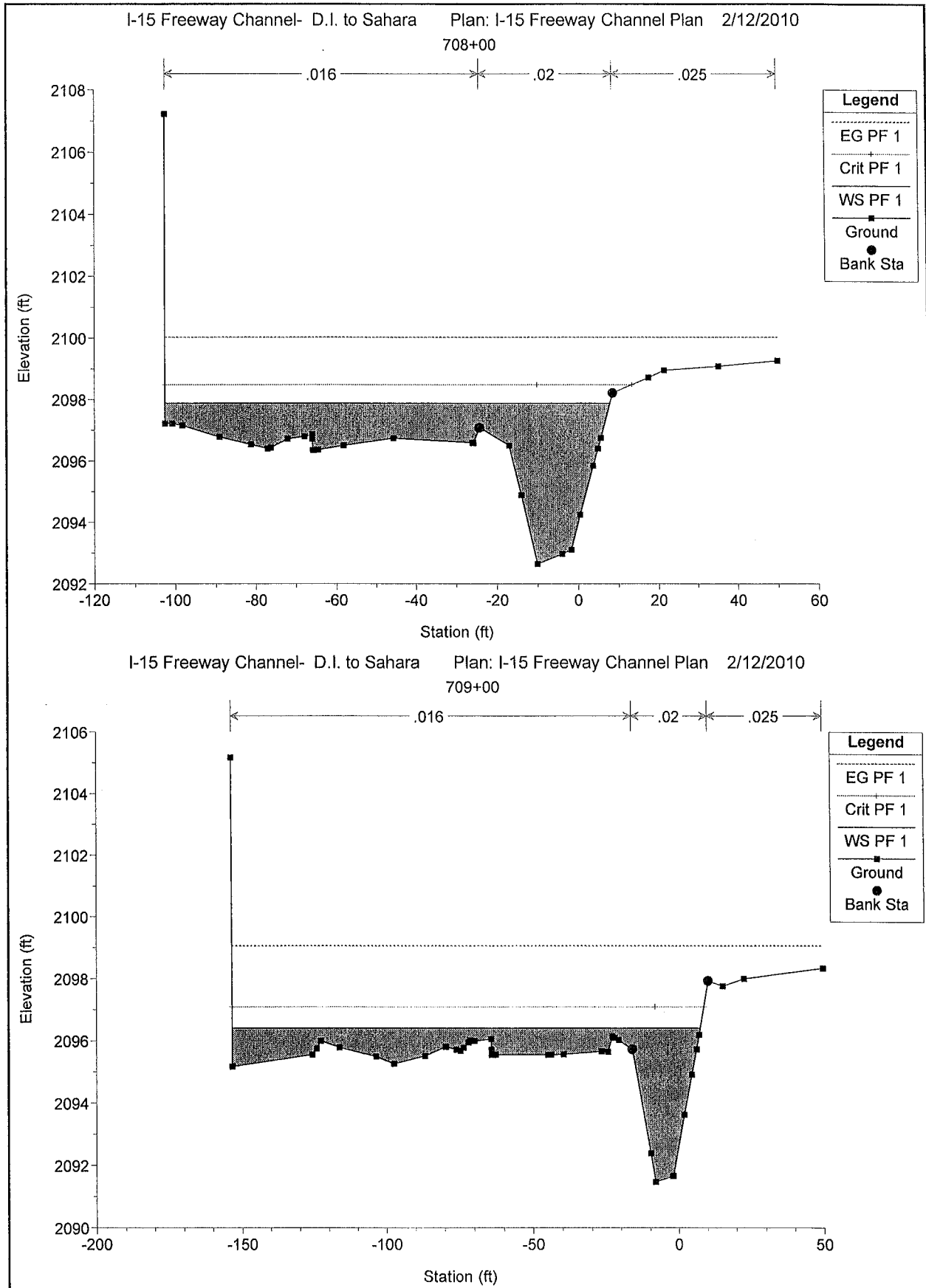


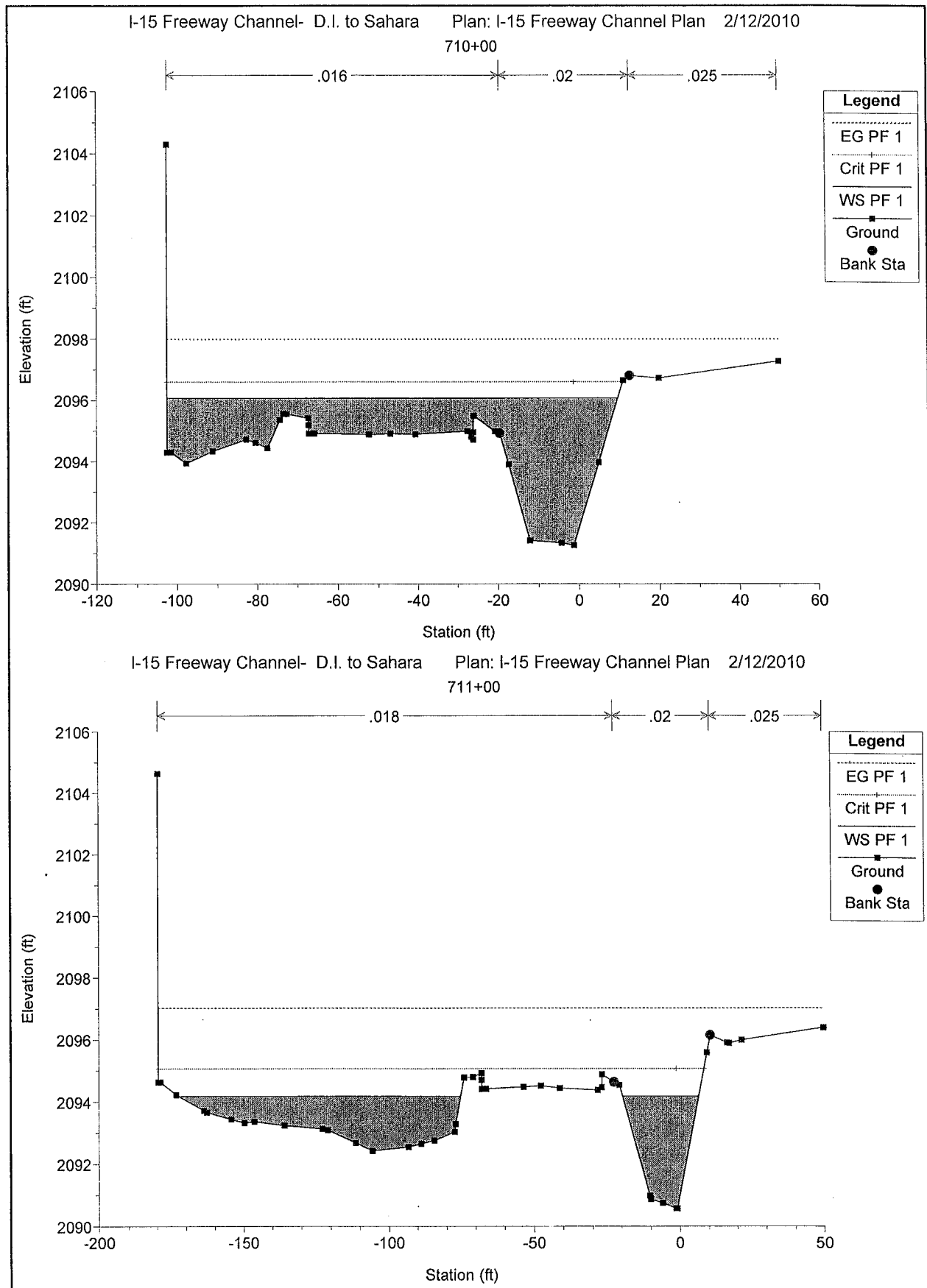
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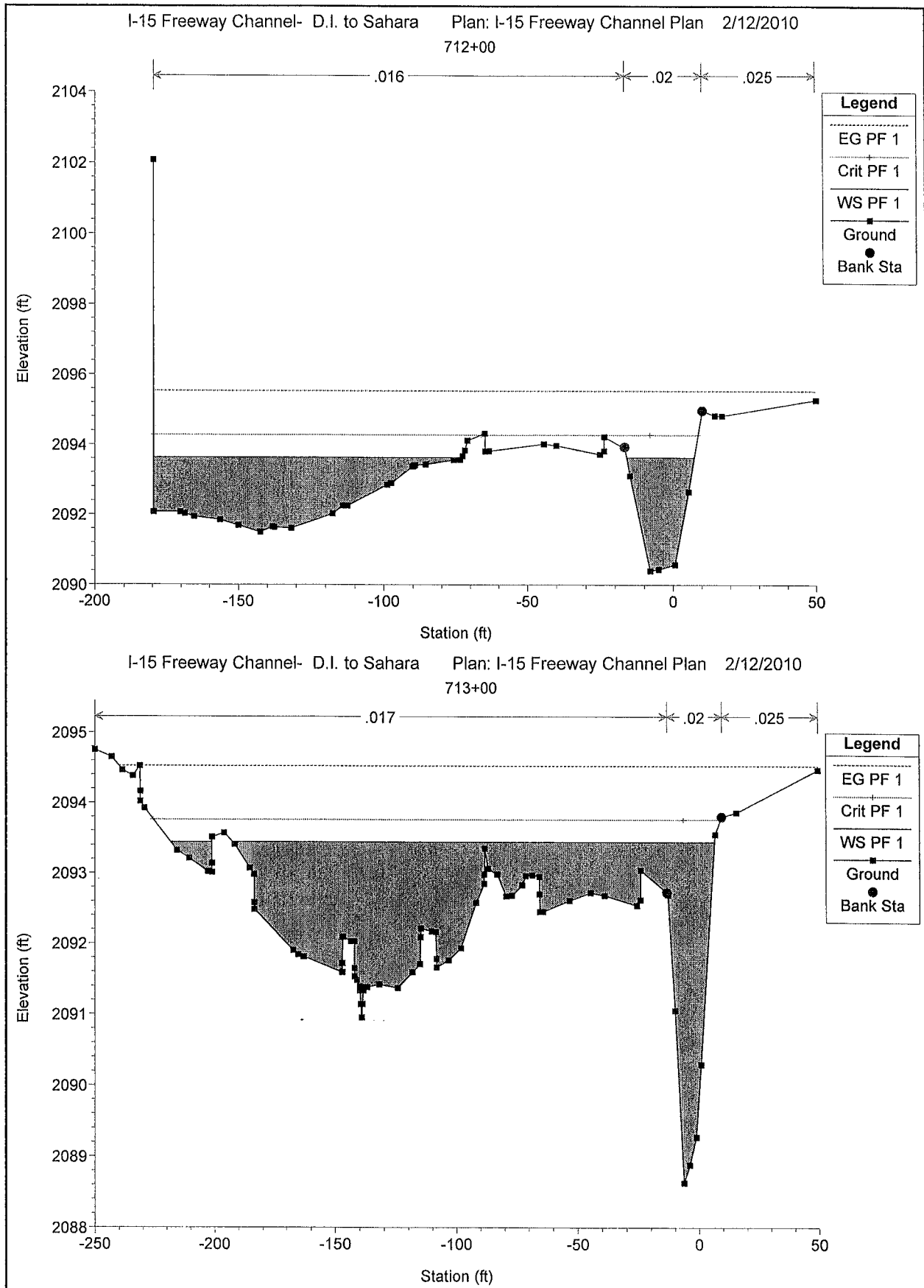


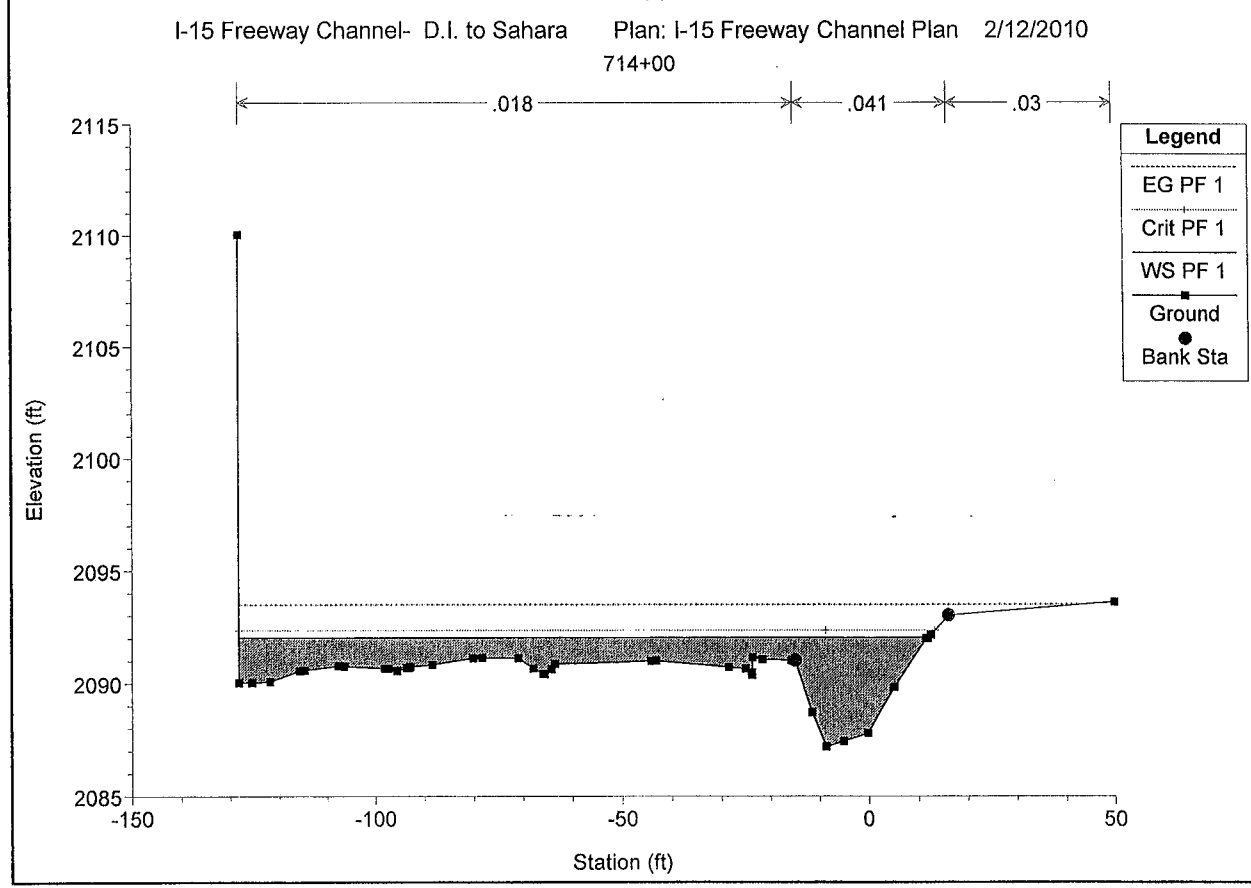
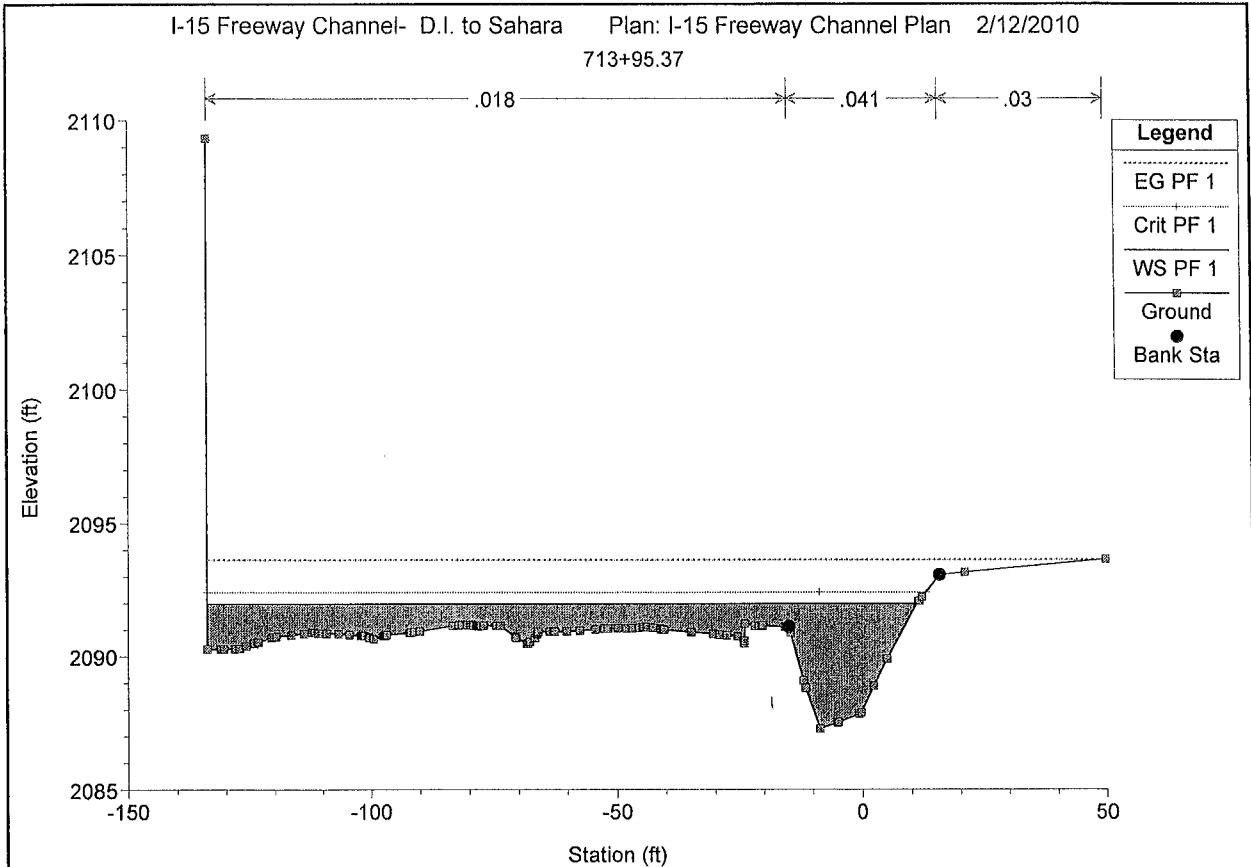




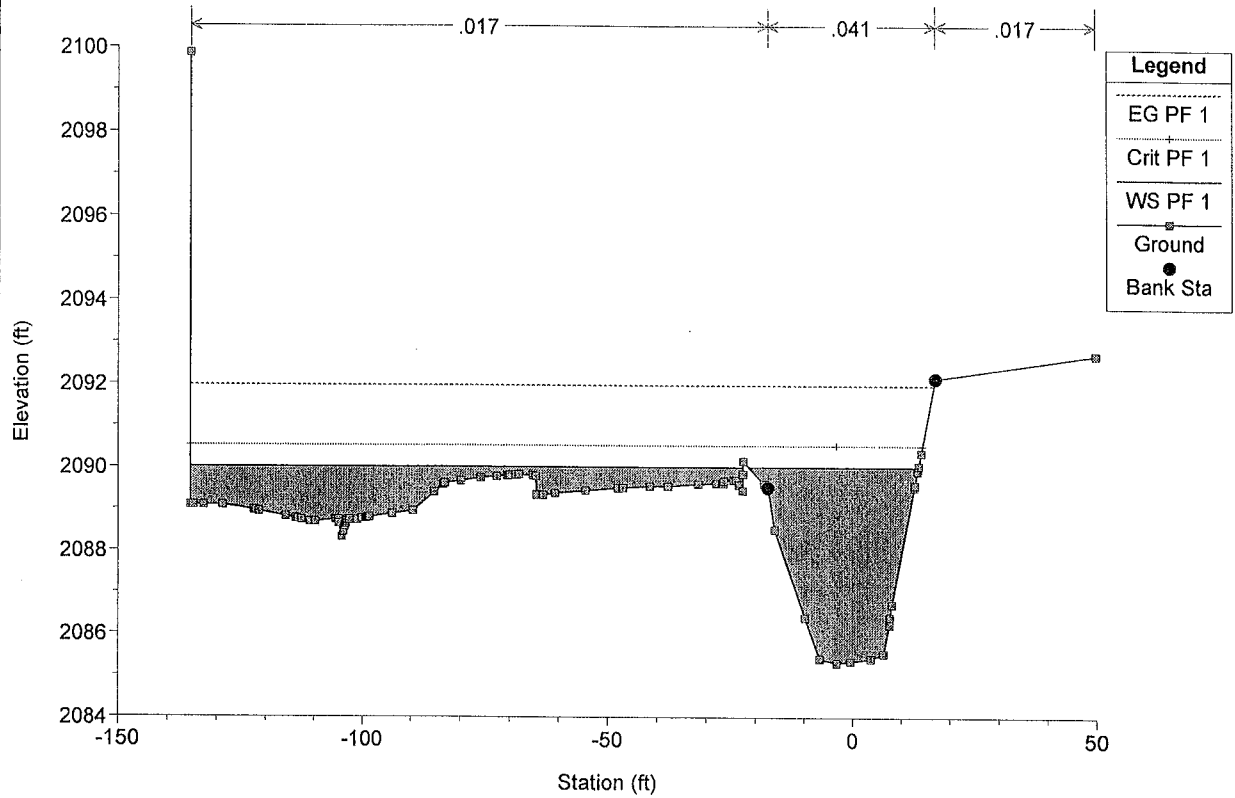




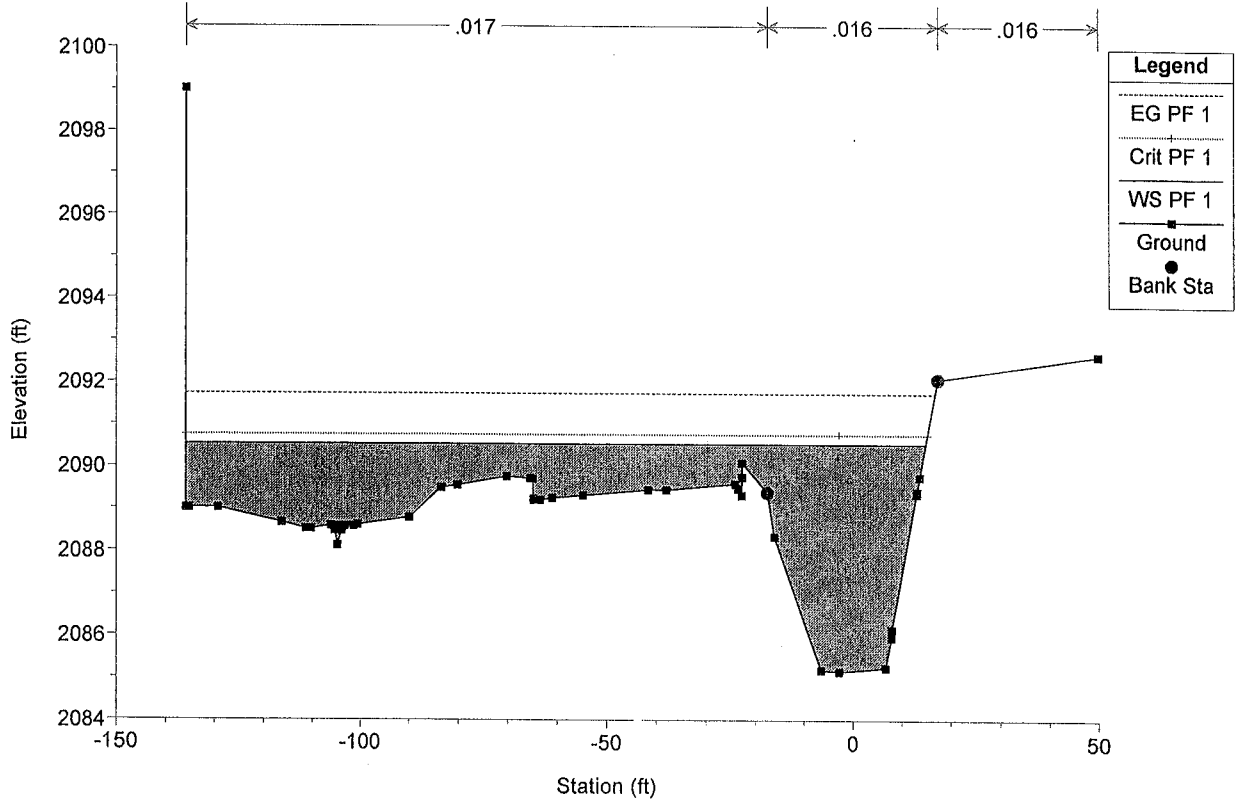


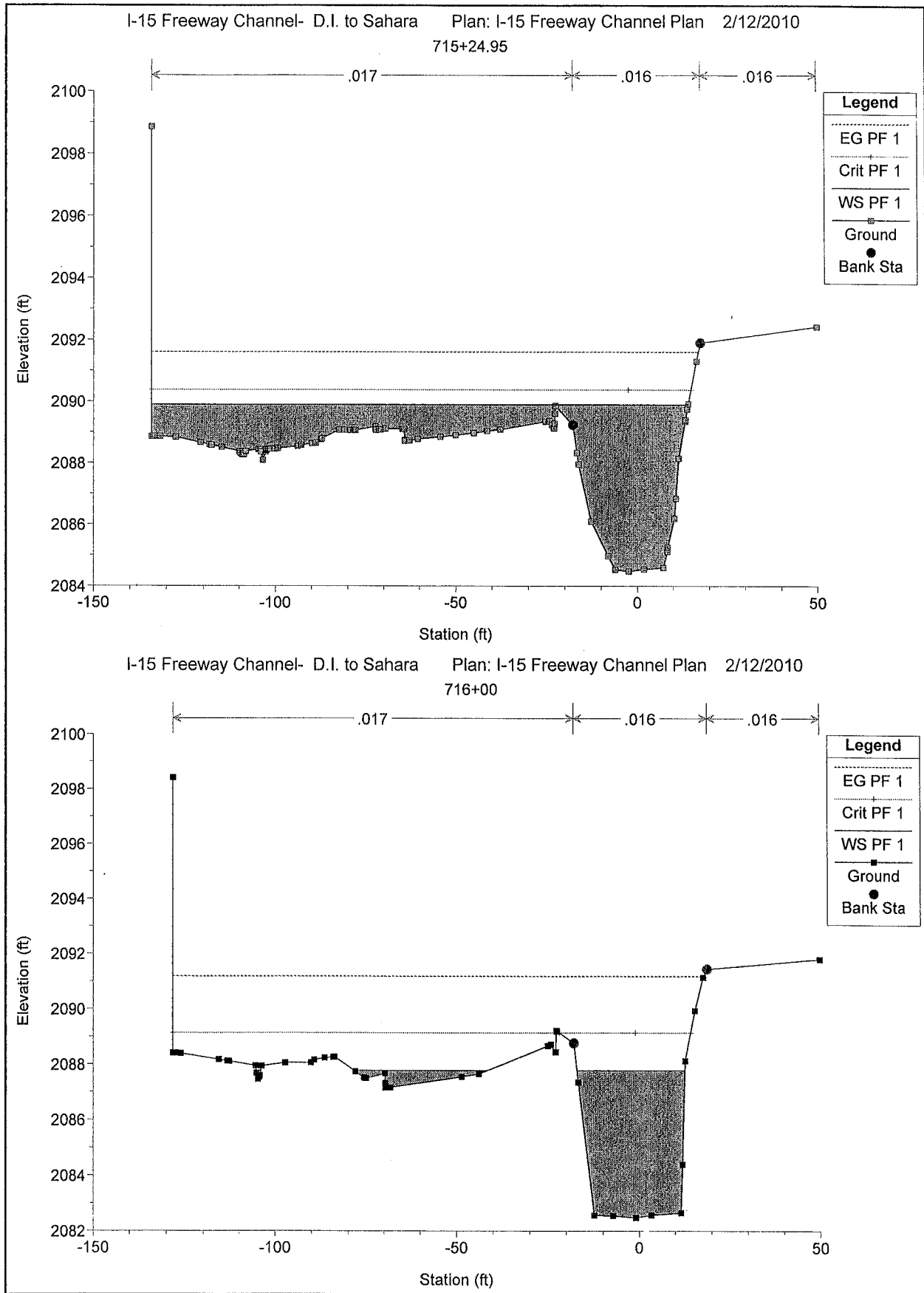


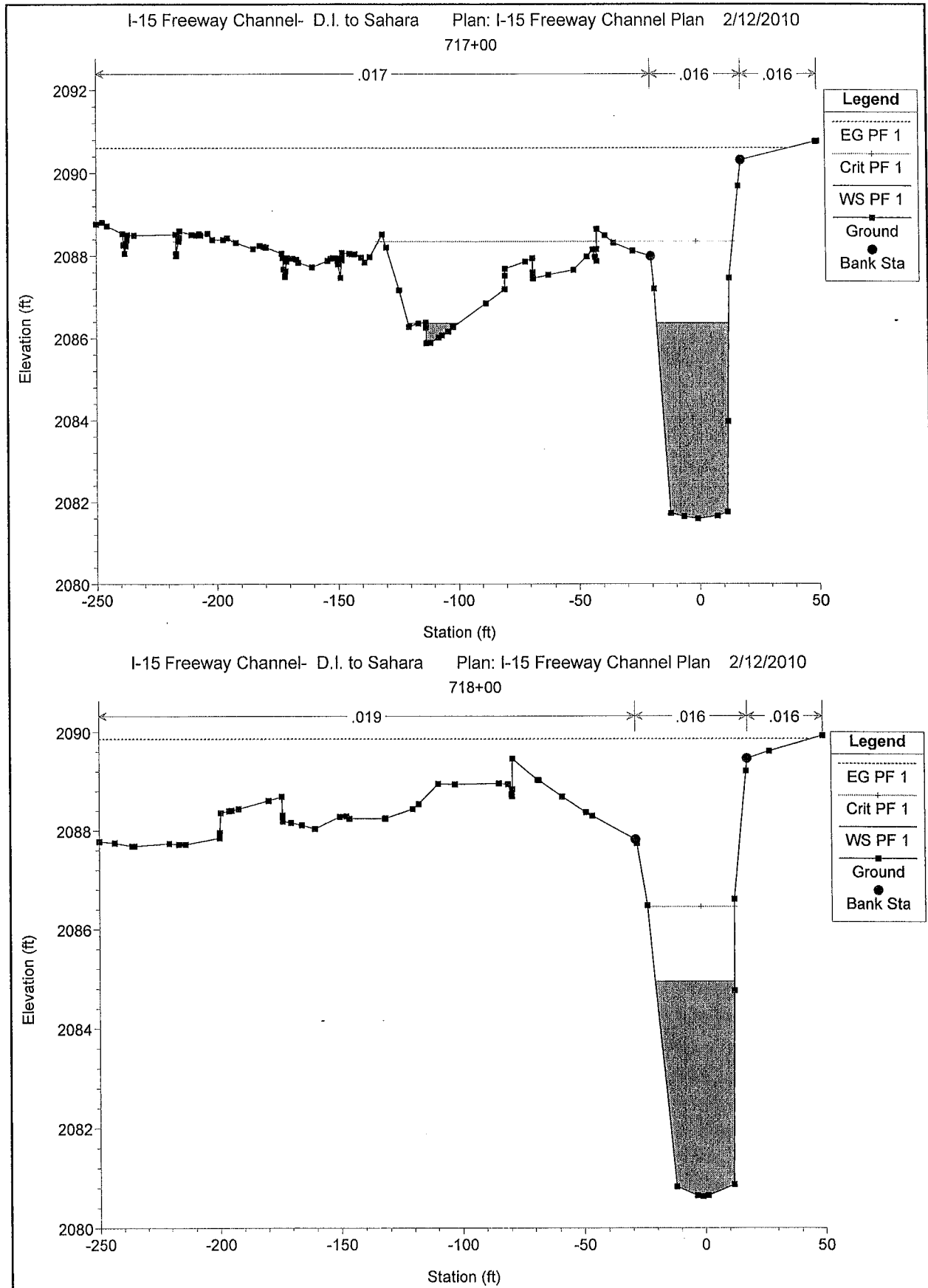
I-15 Freeway Channel- D.I. to Sahara Plan: I-15 Freeway Channel Plan 2/12/2010
714+92.31

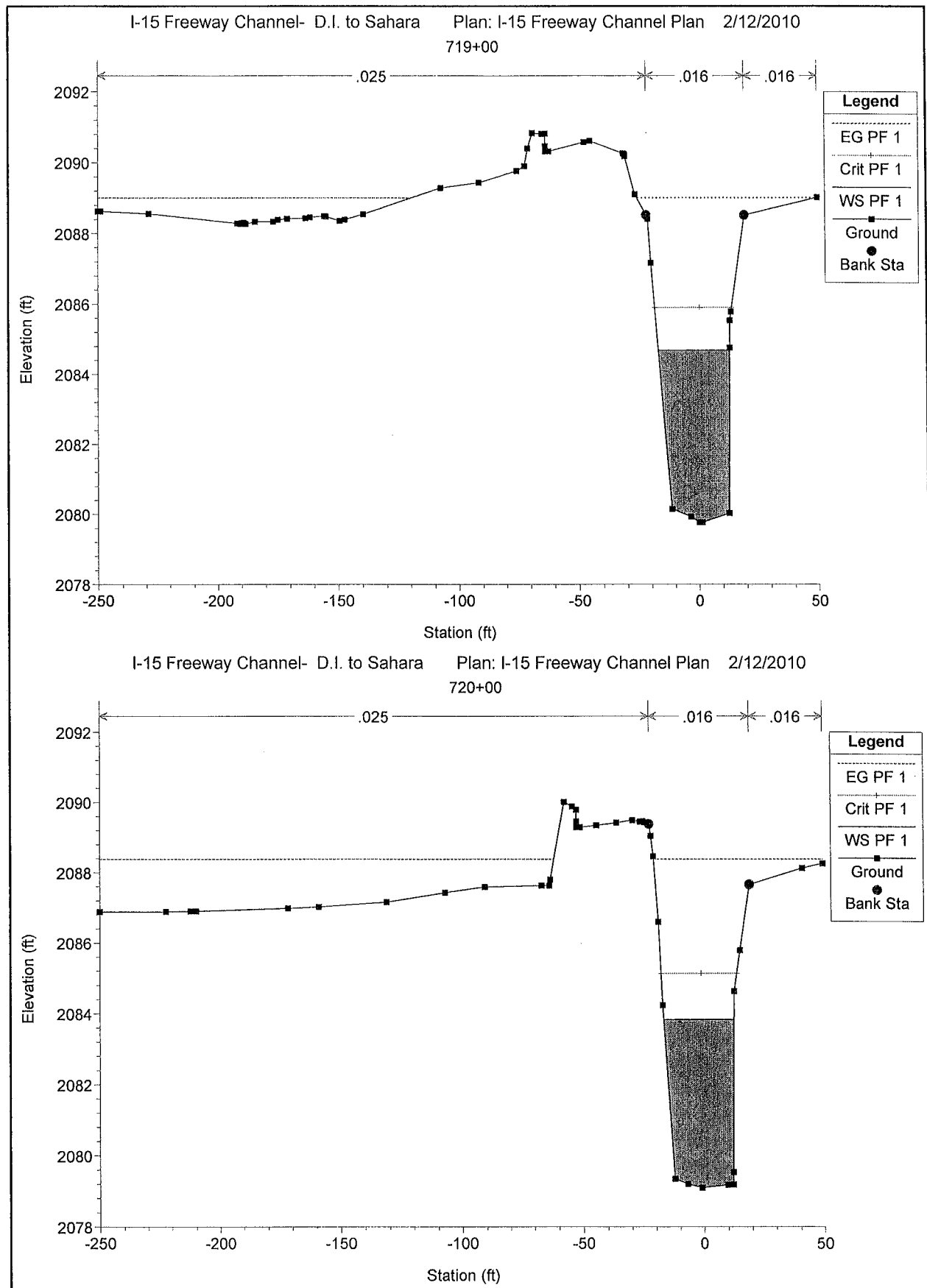


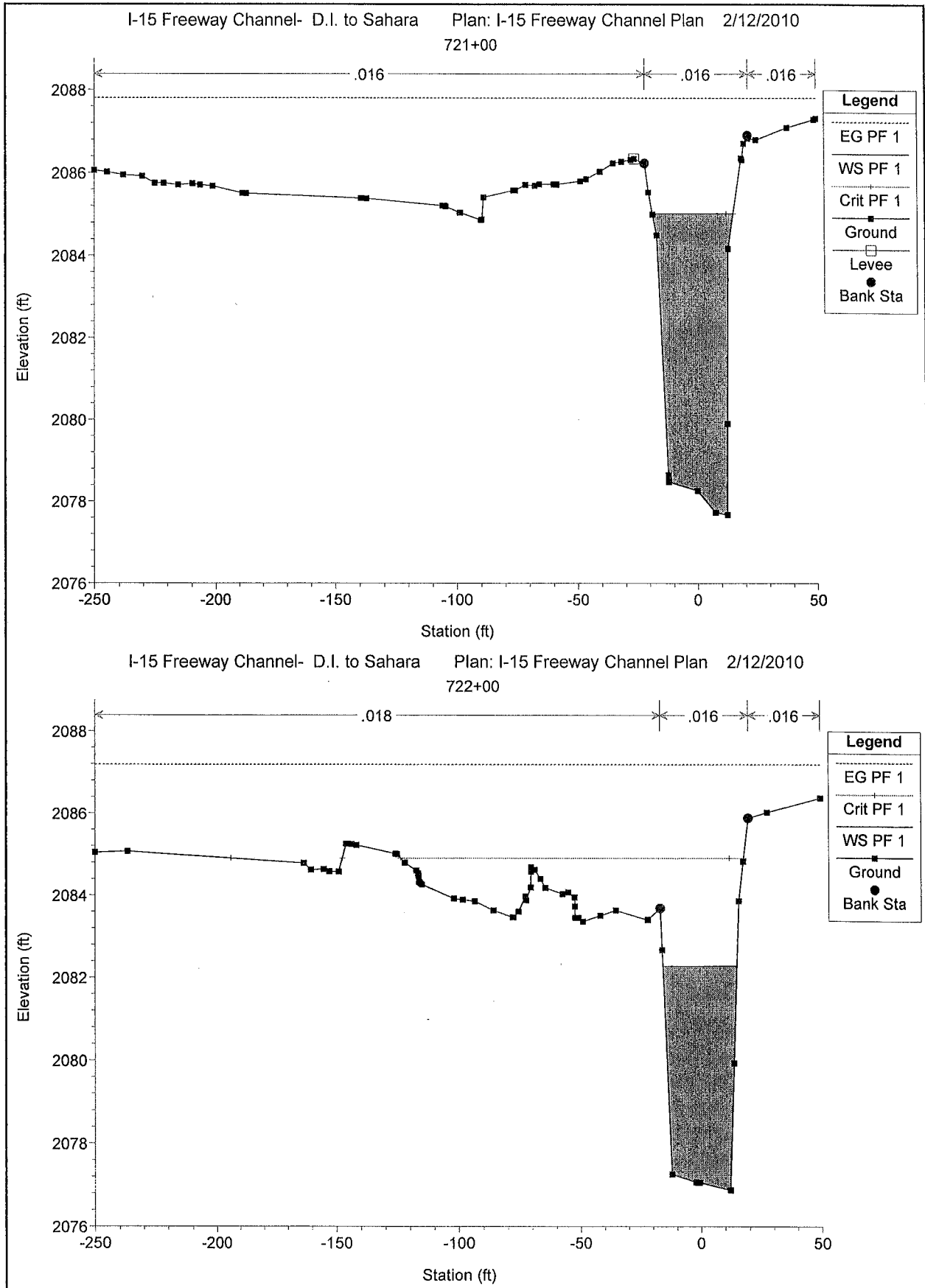
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715+00

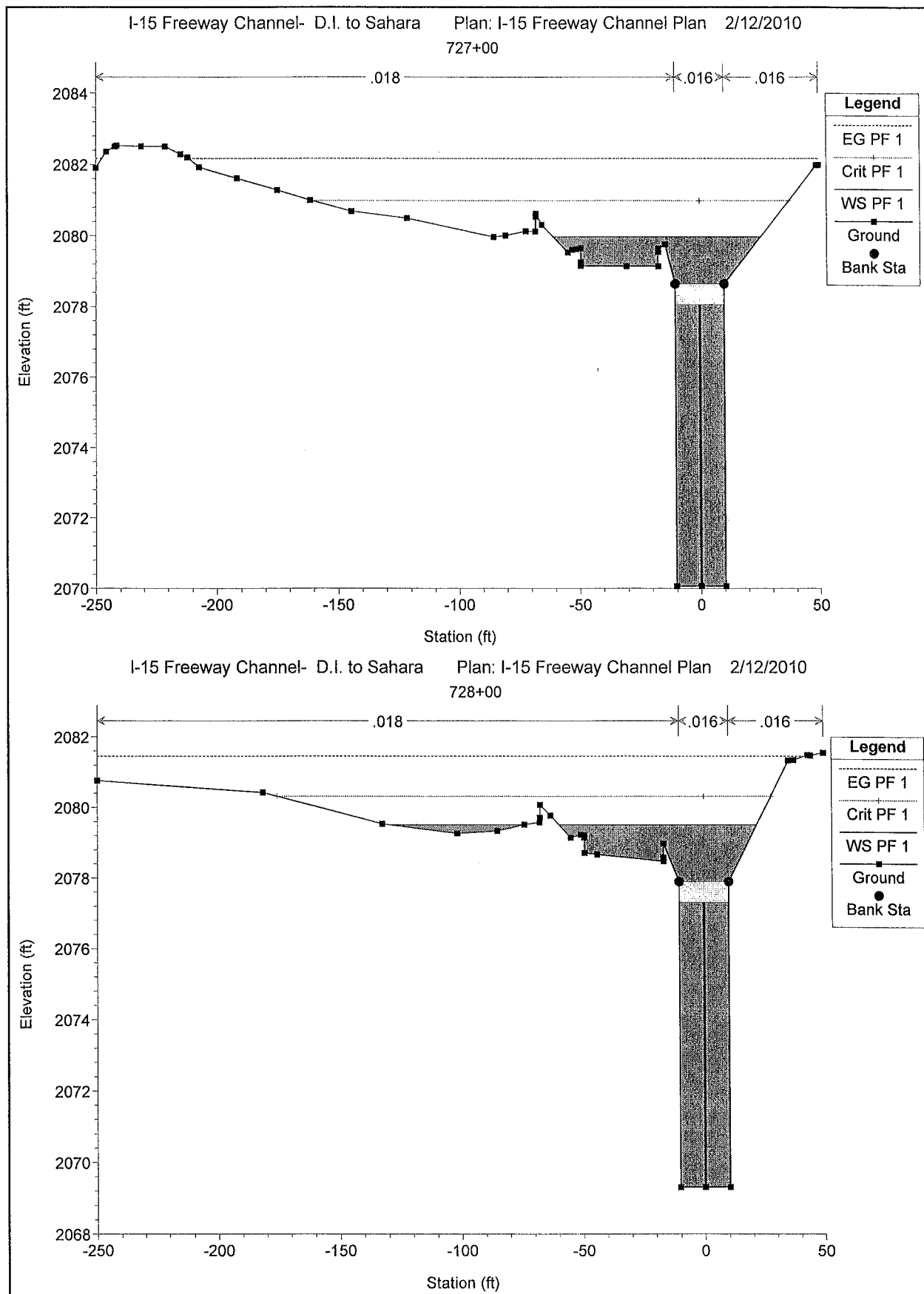


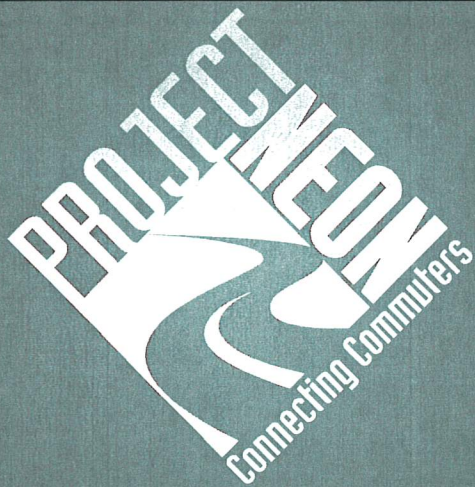












Existing Offsite Hydrology Report

B.5

Western Overland Flows

APPENDIX B.5 WESTERN OVERLAND FLOWS HYDRAULIC METHODOLOGY

I HEC-RAS

Cross sections along the Western corridor were taken, generally perpendicular to the UPRR railroad to the east. Cross section elevations were taken at key locations, such as the top of the UPRR tracks, top/toe of the existing open channel along the UPRR, building corners, top of curb, curb flow line, street centerline and at the toe/top of the existing I-15 embankment. Elevations have been derived from the Microstation Inroads digital terrain model, as provided by NDOT.

The topography along the cross sections does not exhibit a single main channel with overbanks. Two principal conveyance paths exist: Western Avenue and the UPRR Channel. In addition, multiple buildings, parking lots, storage areas and a mixture of fence types are present throughout the area. Between these features are open areas that would allow the water surface between Western Avenue and the UPRR channel to balance. In order to model the loss of conveyance due to existing structures, and facilitate the balance of water surface elevation, "islands" surrounding groups of buildings and walls have been defined as "ineffective flow areas". In the HEC-RAS model, the ineffective flow areas allow the water surface to balance across each cross section, but do not convey flow downstream.

Cross section geometry had been taken at 200-foot intervals between Sahara and Wall Street, and 100-foot intervals between Wall Street and Charleston, to facilitate analysis of weir overtopping of the UPRR.

Due to the complexity of topography within the Western corridor, and modeling limitations of HEC-RAS, results of this analysis will be used for a comparative analysis to assess impacts to hydraulics, but may not be accurate in determining specific water surface elevations with respect to existing building finish floors etc.

II Weir Analysis

Results of the HEC-RAS model indicate a water surface elevation higher than the existing UPRR tracks between Wall Street and Charleston. This overtopping progressively reduces flows conveyed along the Western Corridor.

To determine weir overtopping, calculation spreadsheets have been developed, based on procedures outlined in FHWA HDS5, Hydraulic Design of Highway Culverts, September 2001, using the following:

$$Q_o = C_d L H W_r^{1.5}$$

Where:

Q_o = the overtopping discharge rate

C_d = the overtopping discharge coefficient

L = the length of the weir crest

HW_r = the upstream depth, measured from the weir crest to the water surface elevation.

The overtopping discharge coefficient is determined as follows:

$$C_d = K_t C_r$$

Where:

K_t = the submergence factor.

Based on the elevated railroad berm, the weir is not submerged and K_t has a factor of 1. Therefore:

$$C_d = C_r$$

FHWA HDS5, Figure III-11 provides graphs showing the relationship between HW_r/L_r and C_d . Four conditions are indicated:

C_r for $HW_r/L_r > 0.15$ with a gravel crest

C_r for $HW_r/L_r > 0.15$ with a paved crest

C_r for $HW_r/L_r \leq 0.15$ with a gravel crest

C_r for $HW_r/L_r \leq 0.15$ with a paved crest

Where:

L_r = the width of the weir crest.

Point values from each of these conditions have been taken and incorporated into the spreadsheet. A lookup table within the spreadsheet finds the appropriate value of C_r , based on HW_r/L_r and a toggle that defines if the weir crest is paved or gravel. (A gravel crest is used for the UPRR weir).

The UPRR track elevations are at a very mild slope to the north. The weir calculations take an average of the crest elevation from the upstream and downstream limits of the weir for each section. Weir length is centered between the HEC-RAS cross sections (for example HEC-RAS station 17+00 uses a weir length between 17+50 and 16+50).

Water surface elevation at each HEC-RAS cross section was balanced with its adjacent weir to determine the quantity of runoff conveyed along Western versus the quantity of overtopping across the UPRR. At each station, the HEC-RAS flow data was reduced based on the weir calculations, resulting in a progressive

reduction of flow along Western. This process was iterative until all HEC-RAS flows were balanced with weir flows, and all HEC-RAS water surface elevations were balanced with their adjacent weir flows. Elevations are balanced within 0.01' and flows are within 1 cfs.

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
COMPARISON BETWEEN
HISTORIC CASE AND CURRENT CASE HYDRAULICS**

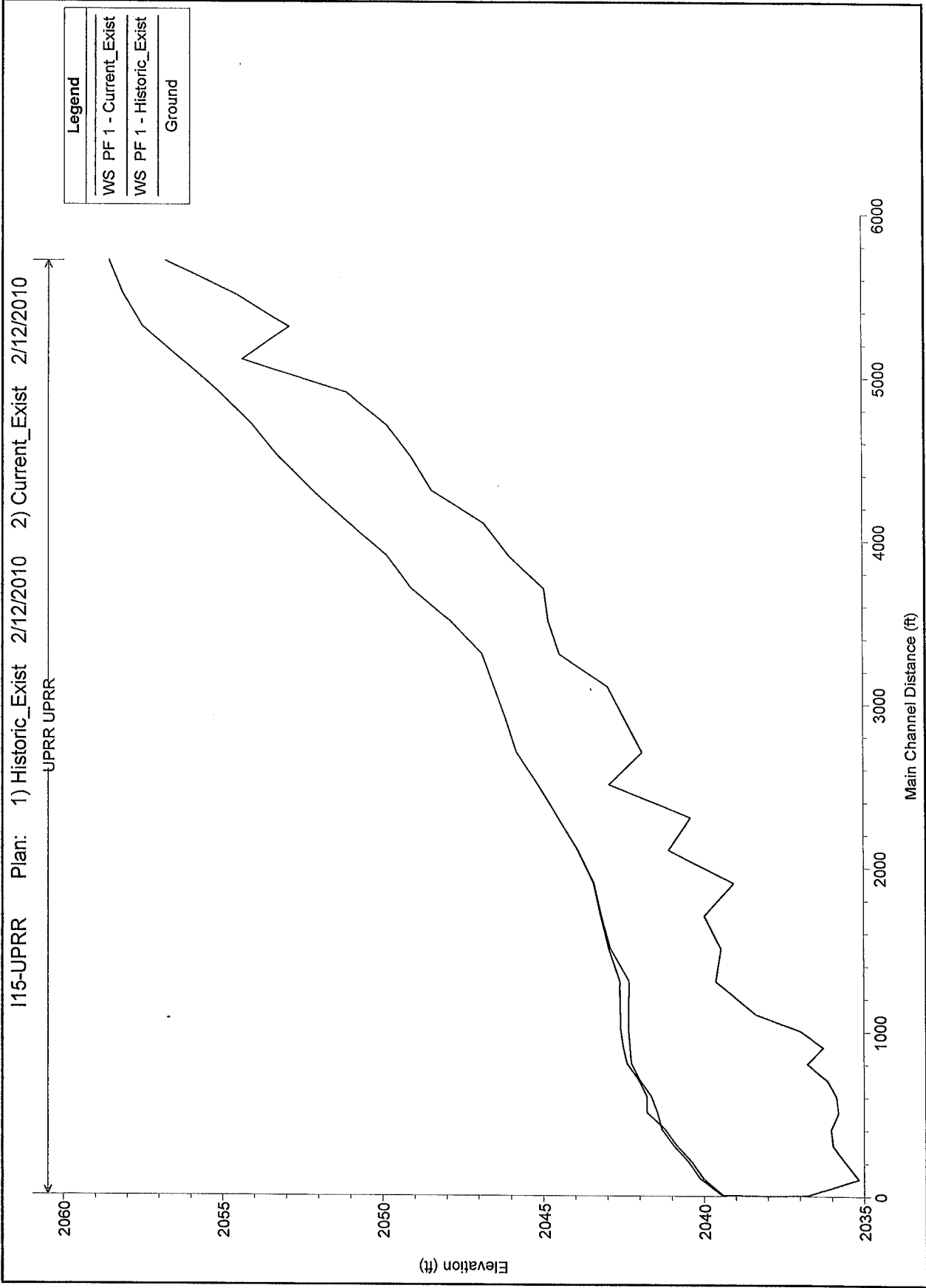
STA.	Water Surface Elevation			UPPR Side Wier (cfs)			Western Conveyance (cfs)		
	Historic	Current	Difference	Historic	Current	Difference	Historic	Current	Difference
64+00	2058.58	2058.58	+0.00	0	0	+0	1163	1163	+0
62+00	2058.16	2058.16	+0.00	0	0	+0	1163	1163	+0
60+00	2057.54	2057.54	+0.00	0	0	+0	1163	1163	+0
58+00	2056.33	2056.33	+0.00	0	0	+0	1163	1163	+0
56+00	2055.14	2055.14	+0.00	0	0	+0	1163	1163	+0
54+00	2054.09	2054.09	+0.00	0	0	+0	1163	1163	+0
52+00	2053.23	2053.23	+0.00	0	0	+0	1163	1163	+0
50+00	2052.21	2052.21	+0.00	0	0	+0	1163	1163	+0
48+00	2051.08	2051.08	+0.00	0	0	+0	1163	1163	+0
46+00	2049.88	2049.88	+0.00	0	0	+0	1163	1163	+0
44+00	2049.12	2049.12	+0.00	0	0	+0	1163	1163	+0
42+00	2047.89	2047.89	+0.00	0	0	+0	1163	1163	+0
40+00	2046.89	2046.89	+0.00	0	0	+0	1163	1163	+0
38+00	2046.53	2046.53	+0.00	0	0	+0	1163	1163	+0
36+00	2046.16	2046.16	+0.00	0	0	+0	1163	1163	+0
34+00	2045.83	2045.83	+0.00	0	0	+0	1163	1163	+0
32+00	2045.17	2045.17	+0.00	0	0	+0	1163	1163	+0
30+00	2044.56	2044.56	+0.00	0	0	+0	1163	1163	+0
28+00	2043.93	2043.92	-0.01	0	0	+0	1163	1163	+0
26+00	2043.22	2043.42	+0.20	0	0	+0	1163	1163	+0
24+00	2043.23	2043.2	-0.03	0	0	+0	1163	1163	+0
22+00	2042.97	2042.91	-0.06	0	0	+0	1163	1163	+0
20+00	2042.62	2042.33	-0.29	0	0	+0	1163	1163	+0
18+00	2042.61	2042.34	-0.27	0	0	+0	1163	1163	+0
17+00	2042.60	2042.34	-0.26	0	0	+0	1163	1163	+0
16+00	2042.52	2042.31	-0.21	8	0	-8	1155	1163	+8
15+00	2042.40	2042.26	-0.14	51	23	-28	1104	1140	+36
14+00	2042.03	2042.01	-0.02	37	32	-5	1067	1108	+41
13+00	2041.78	2041.65	-0.13	65	34	-31	1002	1074	+72
12+00	2041.78	2041.46	-0.32	178	75	-103	824	999	+175
11+00	2041.23	2041.33	+0.10	113	147	+34	711	852	+141
10+00	2040.85	2040.94	+0.09	113	143	+30	598	709	+111
9+00	2040.36	2040.47	+0.11	79	112	+33	519	597	+78
8+00	2040.03	2040.11	+0.08	85	112	+27	434	485	+51
7+00	2039.41	2039.44	+0.03	17	22	+5	417	464	+47
Total				746	700	-46			

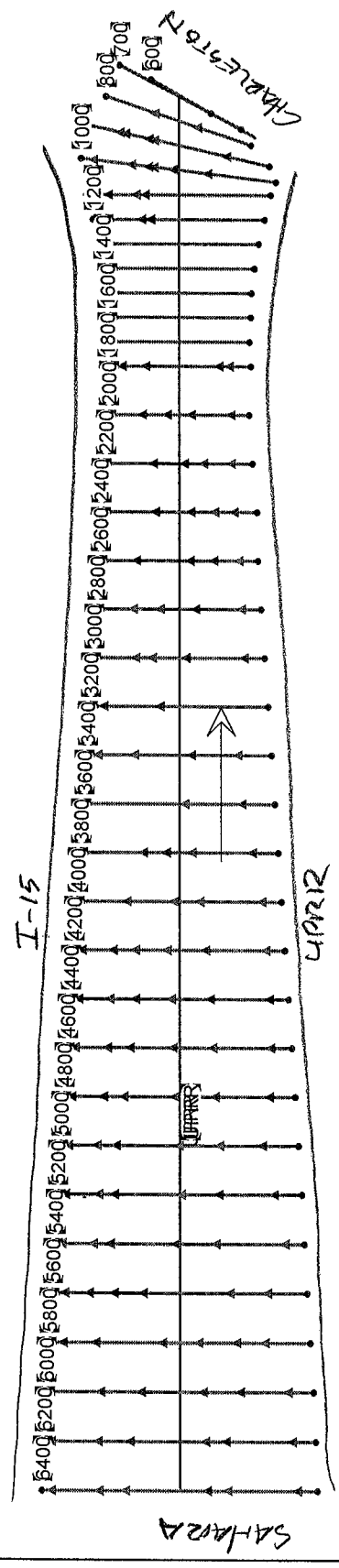
HEC-RAS River: UPRR Reach: UPRR Profile: PF 1

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
UPRR	6400	PF 1	Historic_Exist	1163.00	2056.80	2058.58	2059.99	2071.93	0.200400	29.32	39.67	33.89	4.78
UPRR	6400	PF 1	Current_Exist	1163.00	2056.80	2058.58	2059.99	2071.93	0.200400	29.32	39.67	33.89	4.78
UPRR	6200	PF 1	Historic_Exist	1163.00	2054.63	2058.16	2058.51	2059.38	0.019075	8.88	131.00	186.53	1.47
UPRR	6200	PF 1	Current_Exist	1163.00	2054.63	2058.16	2058.51	2059.38	0.019075	8.88	131.00	186.53	1.47
UPRR	6000	PF 1	Historic_Exist	1163.00	2052.93	2057.54	2057.03	2057.86	0.003602	4.51	257.74	251.90	0.66
UPRR	6000	PF 1	Current_Exist	1163.00	2052.93	2057.54	2057.03	2057.86	0.003602	4.51	257.74	251.90	0.66
UPRR	5800	PF 1	Historic_Exist	1163.00	2054.41	2056.33	2056.33	2056.73	0.009825	5.09	228.31	470.10	1.00
UPRR	5800	PF 1	Current_Exist	1163.00	2054.41	2056.33	2056.33	2056.73	0.009825	5.09	228.31	470.10	1.00
UPRR	5600	PF 1	Historic_Exist	1163.00	2051.15	2055.14	2054.71	2055.31	0.002863	3.36	345.97	472.33	0.57
UPRR	5600	PF 1	Current_Exist	1163.00	2051.15	2055.14	2054.71	2055.31	0.002863	3.36	345.97	472.33	0.57
UPRR	5400	PF 1	Historic_Exist	1163.00	2049.89	2054.09		2054.51	0.005589	5.23	222.54	457.13	0.81
UPRR	5400	PF 1	Current_Exist	1163.00	2049.89	2054.09		2054.51	0.005589	5.23	222.54	457.13	0.81
UPRR	5200	PF 1	Historic_Exist	1163.00	2049.10	2053.23		2053.55	0.003951	4.51	257.64	419.05	0.69
UPRR	5200	PF 1	Current_Exist	1163.00	2049.10	2053.23		2053.55	0.003951	4.51	257.64	419.05	0.69
UPRR	5000	PF 1	Historic_Exist	1163.00	2048.48	2052.21		2052.58	0.006277	4.74	245.33	456.57	0.83
UPRR	5000	PF 1	Current_Exist	1163.00	2048.48	2052.21		2052.58	0.006277	4.74	245.33	456.57	0.83
UPRR	4800	PF 1	Historic_Exist	1163.00	2046.84	2051.08	2050.82	2051.37	0.005455	4.35	267.34	484.98	0.77
UPRR	4800	PF 1	Current_Exist	1163.00	2046.84	2051.08	2050.82	2051.37	0.005455	4.35	267.34	484.98	0.77
UPRR	4600	PF 1	Historic_Exist	1163.00	2046.05	2049.88		2050.22	0.006021	4.71	246.71	543.31	0.82
UPRR	4600	PF 1	Current_Exist	1163.00	2046.05	2049.88		2050.22	0.006023	4.72	246.66	543.00	0.82
UPRR	4400	PF 1	Historic_Exist	1163.00	2044.97	2049.12		2049.32	0.003213	3.58	324.94	682.68	0.60
UPRR	4400	PF 1	Current_Exist	1163.00	2044.97	2049.12		2049.32	0.003211	3.58	325.01	682.68	0.60
UPRR	4200	PF 1	Historic_Exist	1163.00	2044.84	2047.89	2047.84	2048.32	0.008381	5.26	220.98	423.03	0.95
UPRR	4200	PF 1	Current_Exist	1163.00	2044.84	2047.89	2047.84	2048.32	0.008384	5.26	220.95	423.01	0.95
UPRR	4000	PF 1	Historic_Exist	1163.00	2044.49	2046.89		2047.18	0.003868	4.31	269.62	660.98	0.68
UPRR	4000	PF 1	Current_Exist	1163.00	2044.49	2046.89		2047.18	0.003868	4.31	269.62	660.98	0.68
UPRR	3800	PF 1	Historic_Exist	1163.00	2042.98	2046.53		2046.69	0.001454	3.26	356.41	510.35	0.44
UPRR	3800	PF 1	Current_Exist	1163.00	2042.98	2046.53		2046.69	0.001454	3.26	356.41	510.35	0.44
UPRR	3600	PF 1	Historic_Exist	1163.00	2042.45	2046.16		2046.29	0.002748	2.88	403.66	600.13	0.54
UPRR	3600	PF 1	Current_Exist	1163.00	2042.45	2046.16		2046.29	0.002748	2.88	403.66	600.13	0.54
UPRR	3400	PF 1	Historic_Exist	1163.00	2041.91	2045.83		2045.94	0.001168	2.62	444.45	400.77	0.38
UPRR	3400	PF 1	Current_Exist	1163.00	2041.91	2045.83		2045.94	0.001168	2.62	444.45	400.77	0.38
UPRR	3200	PF 1	Historic_Exist	1163.00	2042.94	2045.17	2044.99	2045.48	0.005575	4.43	262.58	477.85	0.78
UPRR	3200	PF 1	Current_Exist	1163.00	2042.94	2045.17	2045.00	2045.48	0.005575	4.43	262.58	477.85	0.78
UPRR	3000	PF 1	Historic_Exist	1163.00	2040.40	2044.56		2044.73	0.002445	3.31	350.87	444.87	0.53
UPRR	3000	PF 1	Current_Exist	1163.00	2040.40	2044.56		2044.73	0.002445	3.31	350.87	444.87	0.53
UPRR	2800	PF 1	Historic_Exist	1163.00	2041.09	2043.93		2044.16	0.003308	3.87	300.38	406.26	0.62
UPRR	2800	PF 1	Current_Exist	1163.00	2041.09	2043.92		2044.16	0.003323	3.88	299.84	404.36	0.62
UPRR	2600	PF 1	Historic_Exist	1163.00	2039.06	2043.44		2043.63	0.002075	3.50	332.09	539.15	0.51
UPRR	2600	PF 1	Current_Exist	1163.00	2039.06	2043.42		2043.62	0.002143	3.54	328.82	538.20	0.51
UPRR	2400	PF 1	Historic_Exist	1163.00	2039.98	2043.23		2043.32	0.001000	2.50	465.66	526.41	0.35
UPRR	2400	PF 1	Current_Exist	1163.00	2039.98	2043.20		2043.30	0.001063	2.54	457.02	526.22	0.36
UPRR	2200	PF 1	Historic_Exist	1163.00	2039.46	2042.97		2043.09	0.001311	2.81	414.07	517.99	0.40
UPRR	2200	PF 1	Current_Exist	1163.00	2039.46	2042.91		2043.05	0.001492	2.92	398.14	517.76	0.43
UPRR	2000	PF 1	Historic_Exist	1163.00	2039.62	2042.62		2042.78	0.001811	3.20	363.62	518.12	0.47
UPRR	2000	PF 1	Current_Exist	1163.00	2039.62	2042.33		2042.58	0.003734	4.01	289.80	511.99	0.66
UPRR	1800	PF 1	Historic_Exist	1163.00	2038.36	2042.61		2042.64	0.000235	1.53	760.79	504.62	0.18
UPRR	1800	PF 1	Current_Exist	1163.00	2038.36	2042.34		2042.38	0.000273	1.57	740.57	495.96	0.19
UPRR	1700	PF 1	Historic_Exist	1163.00	2036.98	2042.60		2042.62	0.000163	1.28	909.93	575.99	0.15
UPRR	1700	PF 1	Current_Exist	1163.00	2036.98	2042.34		2042.36	0.000120	1.04	1122.54	555.06	0.13
UPRR	1600	PF 1	Historic_Exist	1154.00	2036.26	2042.52		2042.59	0.000646	2.09	551.26	532.04	0.29
UPRR	1600	PF 1	Current_Exist	1163.00	2036.26	2042.31		2042.34	0.000313	1.44	807.74	502.74	0.20
UPRR	1500	PF 1	Historic_Exist	1004.00	2036.76	2042.40		2042.50	0.001201	2.53	396.75	555.07	0.38
UPRR	1500	PF 1	Current_Exist	1140.00	2036.76	2042.26		2042.30	0.000444	1.52	748.03	554.77	0.23
UPRR	1400	PF 1	Historic_Exist	1067.00	2036.14	2042.03		2042.28	0.003829	4.03	264.77	532.05	0.66
UPRR	1400	PF 1	Current_Exist	1108.00	2036.14	2042.01		2042.18	0.005889	3.34	331.89	526.97	0.74

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

Reach	River Sta	Profile	Plan	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
UPRR	1300	PF 1	Historic_Exist	1002.00	2035.86	2041.79		2041.93	0.002738	3.03	330.60	623.23	0.54
UPRR	1300	PF 1	Current_Exist	1074.00	2035.86	2041.65		2041.75	0.002969	2.53	424.34	611.49	0.54
UPRR	1200	PF 1	Historic_Exist	824.00	2035.80	2041.78		2041.81	0.000353	1.37	601.26	691.85	0.21
UPRR	1200	PF 1	Current_Exist	999.00	2035.80	2041.46		2041.53	0.001489	2.10	475.44	540.34	0.39
UPRR	1100	PF 1	Historic_Exist	711.00	2036.04	2041.23	2041.04	2041.68	0.006615	5.42	131.24	389.80	0.87
UPRR	1100	PF 1	Current_Exist	852.00	2036.04	2041.33		2041.39	0.001283	2.05	416.31	439.97	0.37
UPRR	1000	PF 1	Historic_Exist	598.00	2035.97	2040.85		2041.05	0.004636	3.54	168.92	204.67	0.69
UPRR	1000	PF 1	Current_Exist	709.00	2035.97	2040.94		2041.16	0.004836	3.76	188.38	214.90	0.71
UPRR	900	PF 1	Historic_Exist	519.00	2035.57	2040.36		2040.58	0.004619	3.73	139.03	154.88	0.69
UPRR	900	PF 1	Current_Exist	597.00	2035.57	2040.47		2040.70	0.004401	3.82	156.48	162.65	0.69
UPRR	800	PF 1	Historic_Exist	434.00	2035.17	2040.02		2040.19	0.003060	3.30	131.71	129.43	0.58
UPRR	800	PF 1	Current_Exist	485.00	2035.17	2040.11		2040.29	0.003526	3.34	145.27	155.94	0.61
UPRR	700	PF 1	Historic_Exist	417.00	2036.76	2039.42	2039.42	2039.62	0.014534	3.61	115.62	323.29	1.06
UPRR	700	PF 1	Current_Exist	464.00	2036.76	2039.44	2039.44	2039.66	0.014473	3.73	124.52	330.48	1.07
UPRR	600	PF 1	Historic_Exist	417.00	2038.26	2038.02	2038.30	2038.77	0.015374		59.92	114.43	0.00
UPRR	600	PF 1	Current_Exist	464.00	2038.26	2038.07	2038.39	2038.83	0.015114		66.38	124.51	0.00





ome schematic data outside default extents (see View/Set Schematic Plot Extents...)
 one of the XS's are Geo-Referenced (Geo-Ref user entered XS) (Geo-Ref interpolated XS) (Non Geo-Ref user entered XS) (Non Geo-Ref interpolated XS)



Existing Offsite Hydrology Report

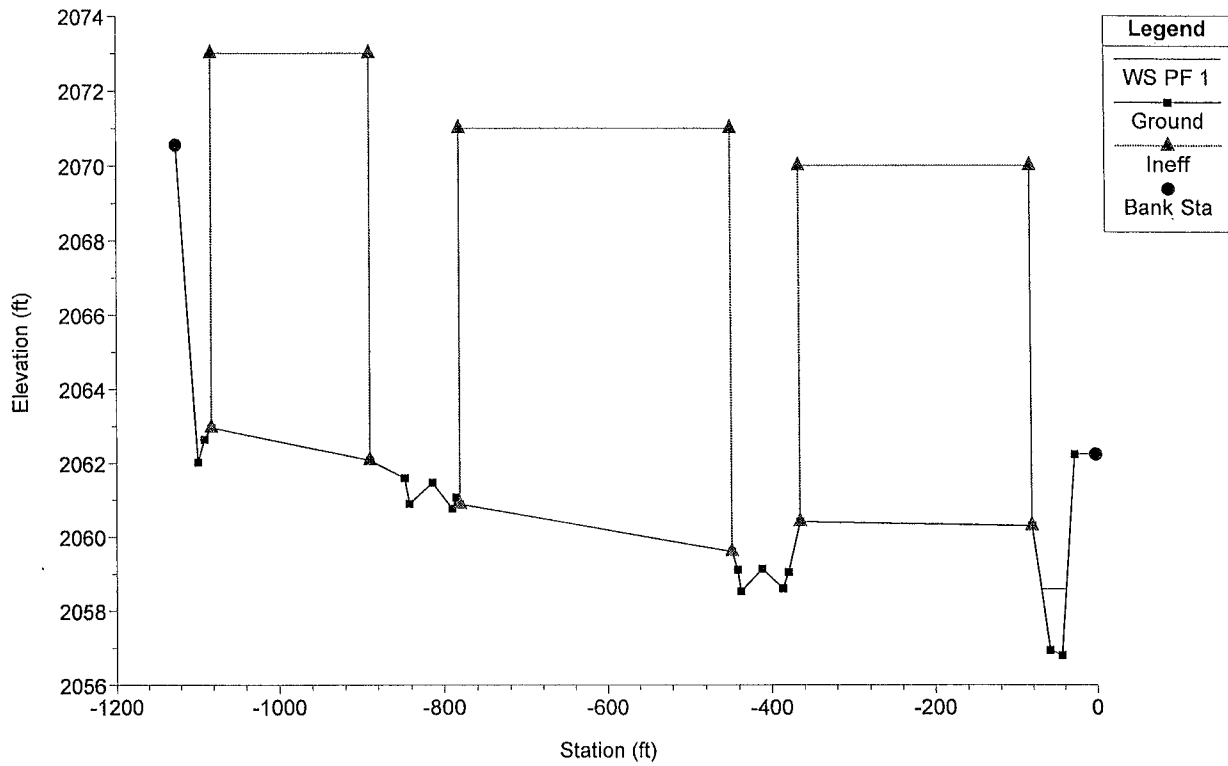
B.5.1

Historical Case HEC-RAS Analysis

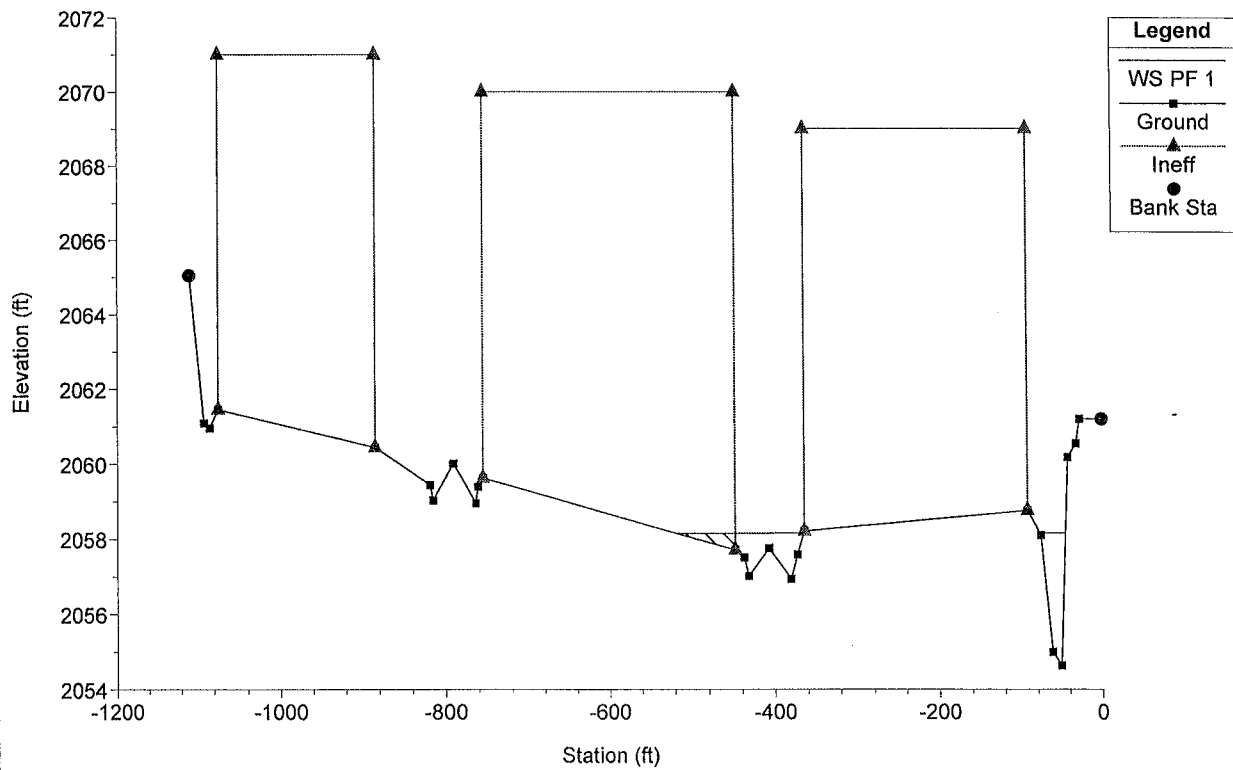
HEC-RAS Plan: Historic_Exist River: UPRR Reach: UPRR Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
UPRR	6400	PF 1	1163.00	2056.80	2058.58	2059.99	2071.93	0.200400	29.32	39.67	33.89	4.78
UPRR	6200	PF 1	1163.00	2054.63	2058.16	2058.51	2059.38	0.019075	8.88	131.00	186.53	1.47
UPRR	6000	PF 1	1163.00	2052.93	2057.54	2057.03	2057.86	0.003602	4.51	257.74	251.90	0.66
UPRR	5800	PF 1	1163.00	2054.41	2056.33	2056.33	2056.73	0.009825	5.09	228.31	470.10	1.00
UPRR	5600	PF 1	1163.00	2051.15	2055.14	2054.71	2055.31	0.002863	3.36	345.97	472.33	0.57
UPRR	5400	PF 1	1163.00	2049.89	2054.09		2054.51	0.005589	5.23	222.54	457.13	0.81
UPRR	5200	PF 1	1163.00	2049.10	2053.23		2053.55	0.003951	4.51	257.64	419.05	0.69
UPRR	5000	PF 1	1163.00	2048.48	2052.21		2052.56	0.006277	4.74	245.33	456.57	0.83
UPRR	4800	PF 1	1163.00	2046.84	2051.08	2050.82	2051.37	0.005455	4.35	267.34	484.98	0.77
UPRR	4600	PF 1	1163.00	2046.05	2049.88		2050.22	0.006021	4.71	246.71	543.31	0.82
UPRR	4400	PF 1	1163.00	2044.97	2049.12		2049.32	0.003213	3.58	324.94	682.68	0.60
UPRR	4200	PF 1	1163.00	2044.84	2047.89	2047.84	2048.32	0.008381	5.26	220.98	423.03	0.95
UPRR	4000	PF 1	1163.00	2044.49	2046.89		2047.18	0.003868	4.31	269.62	660.98	0.68
UPRR	3800	PF 1	1163.00	2042.98	2046.53		2046.69	0.001454	3.26	356.41	510.35	0.44
UPRR	3600	PF 1	1163.00	2042.45	2046.16		2046.29	0.002748	2.88	403.66	600.13	0.54
UPRR	3400	PF 1	1163.00	2041.91	2045.83		2045.94	0.001168	2.62	444.45	400.77	0.38
UPRR	3200	PF 1	1163.00	2042.94	2045.17	2044.99	2045.48	0.005575	4.43	262.58	477.85	0.78
UPRR	3000	PF 1	1163.00	2040.40	2044.56		2044.73	0.002445	3.31	350.87	444.87	0.53
UPRR	2800	PF 1	1163.00	2041.09	2043.93		2044.16	0.003308	3.87	300.38	406.26	0.62
UPRR	2600	PF 1	1163.00	2039.06	2043.44		2043.63	0.002075	3.50	332.09	539.15	0.51
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UPRR	1700	PF 1	1163.00	2036.98	2042.60		2042.62	0.000163	1.28	909.93	575.99	0.15
UPRR	1600	PF 1	1154.00	2036.26	2042.52		2042.59	0.000646	2.09	551.26	532.04	0.29
UPRR	1500	PF 1	1004.00	2036.76	2042.40		2042.50	0.001201	2.53	396.75	555.07	0.38
UPRR	1400	PF 1	1067.00	2036.14	2042.03		2042.28	0.003829	4.03	264.77	532.05	0.66
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UPRR	1100	PF 1	711.00	2036.04	2041.23	2041.04	2041.68	0.006615	5.42	131.24	389.80	0.87
UPRR	1000	PF 1	598.00	2035.97	2040.85		2041.05	0.004636	3.54	168.92	204.67	0.69
UPRR	900	PF 1	519.00	2035.57	2040.36		2040.58	0.004619	3.73	139.03	154.88	0.69
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UPRR	700	PF 1	417.00	2036.76	2039.42	2039.42	2039.62	0.014534	3.61	115.62	323.29	1.06
UPRR	600	PF 1	417.00	2038.26	2038.02	2038.30	2038.77	0.015374		59.92	114.43	0.00

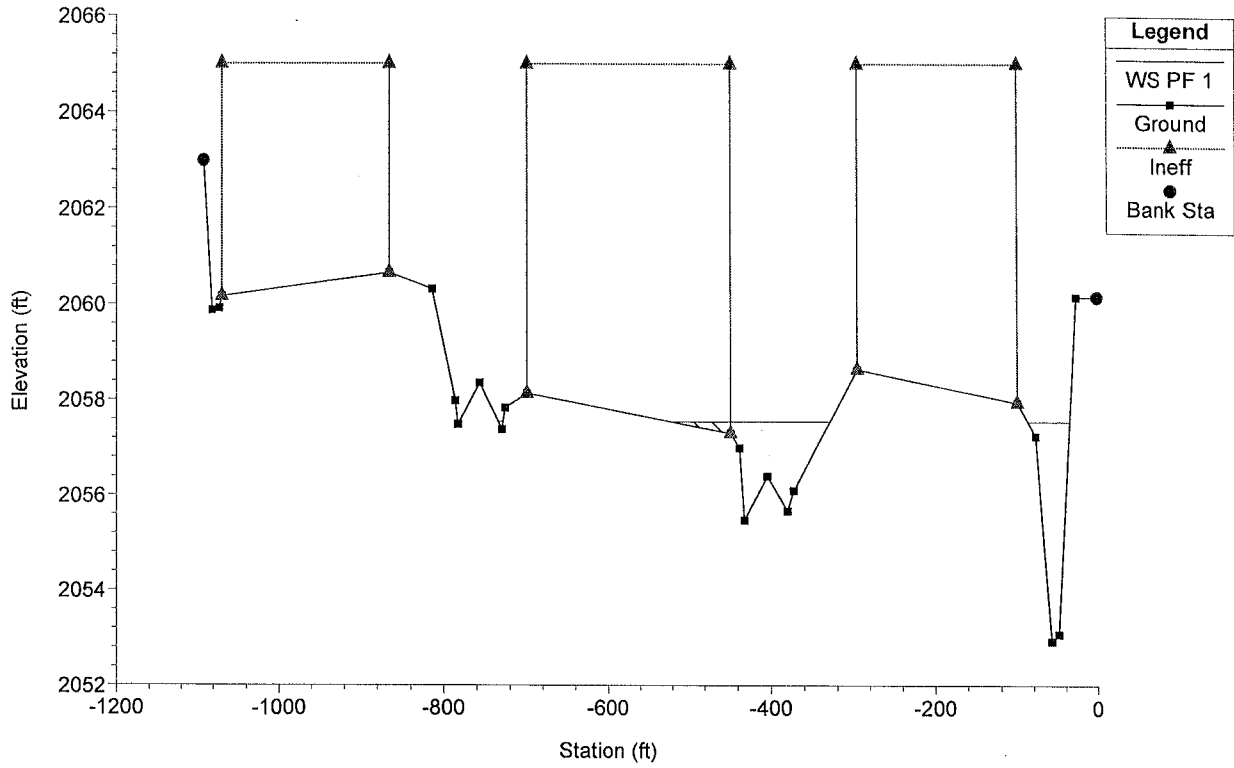
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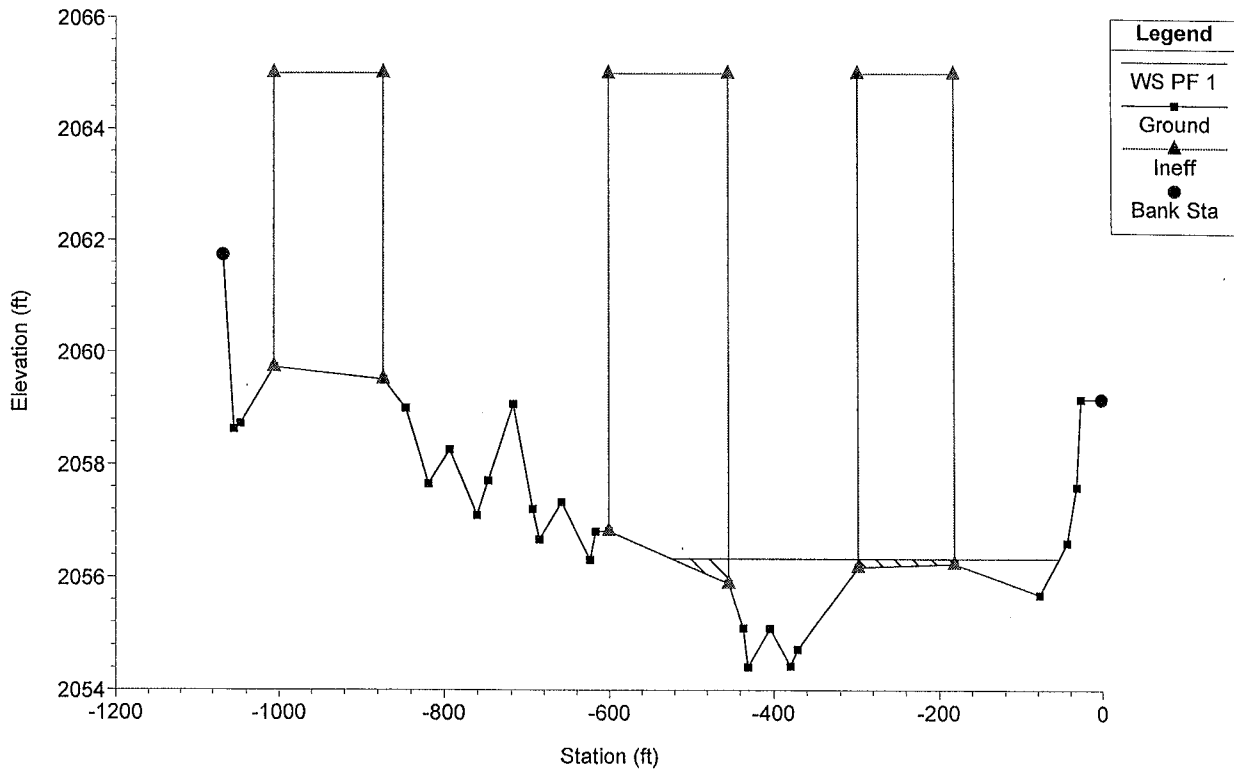
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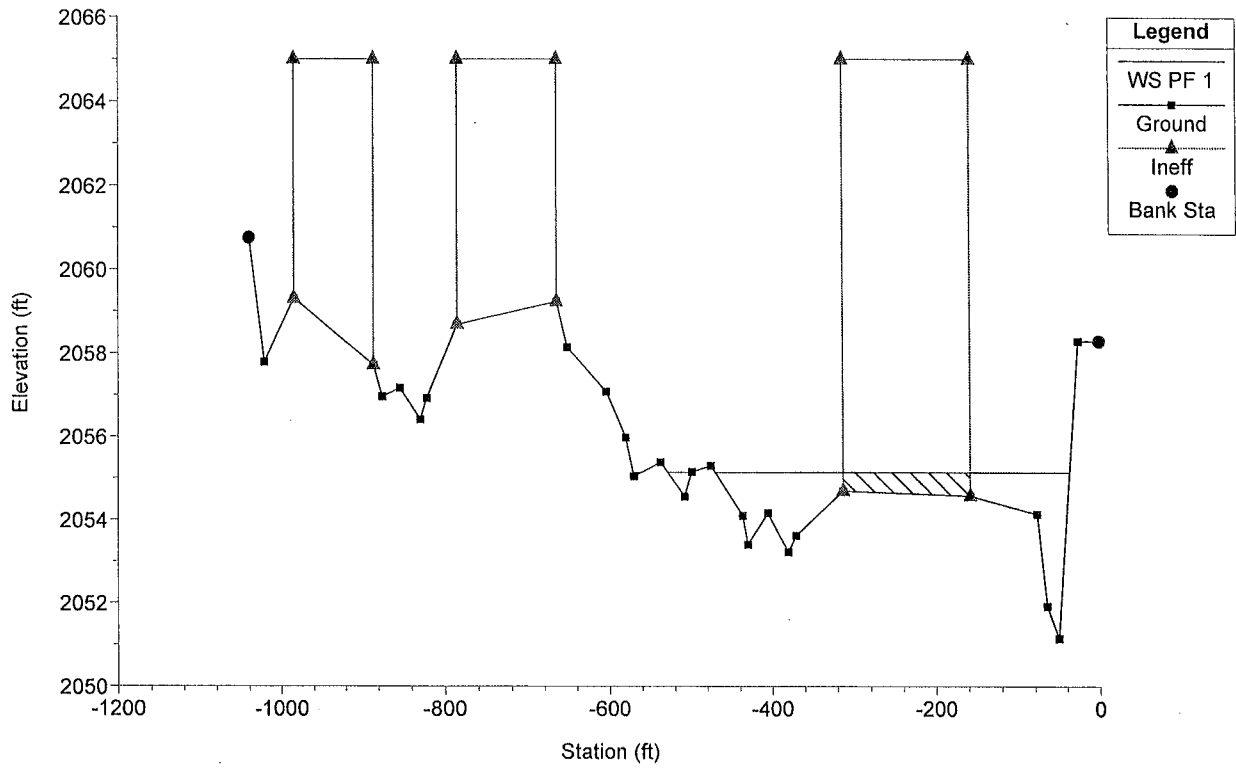
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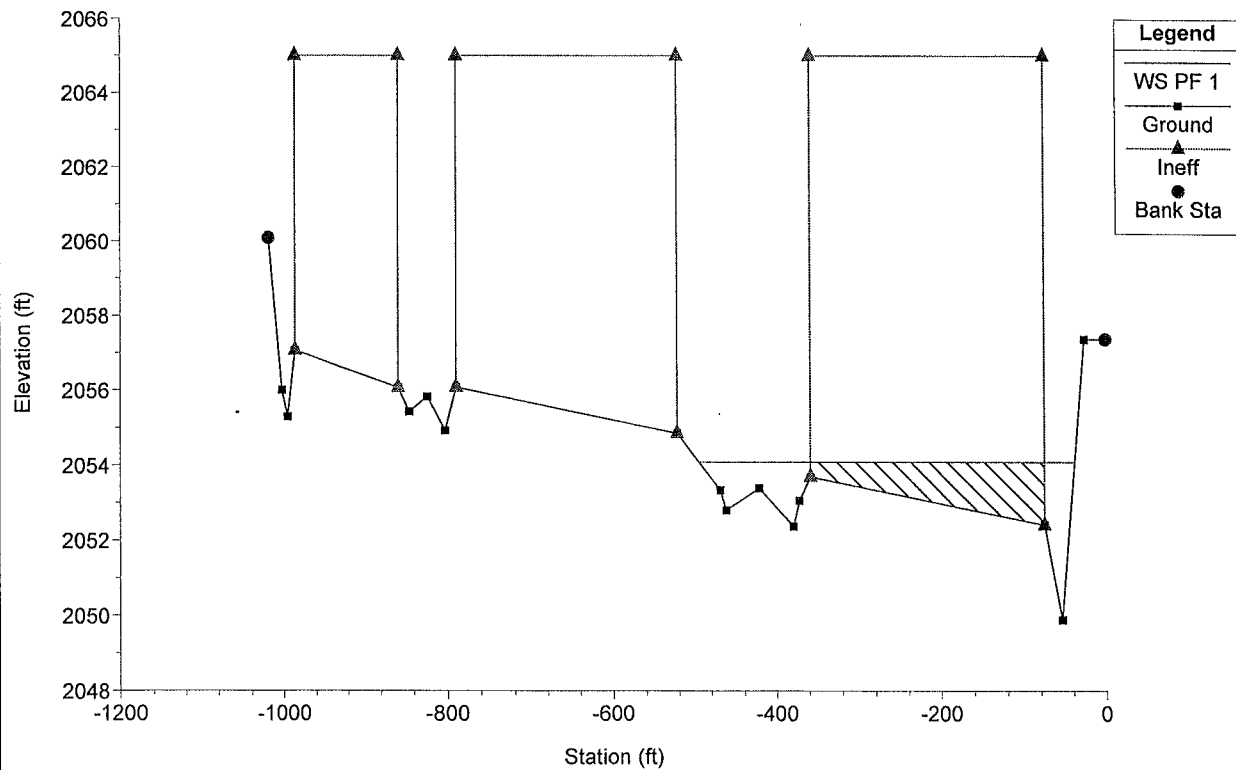
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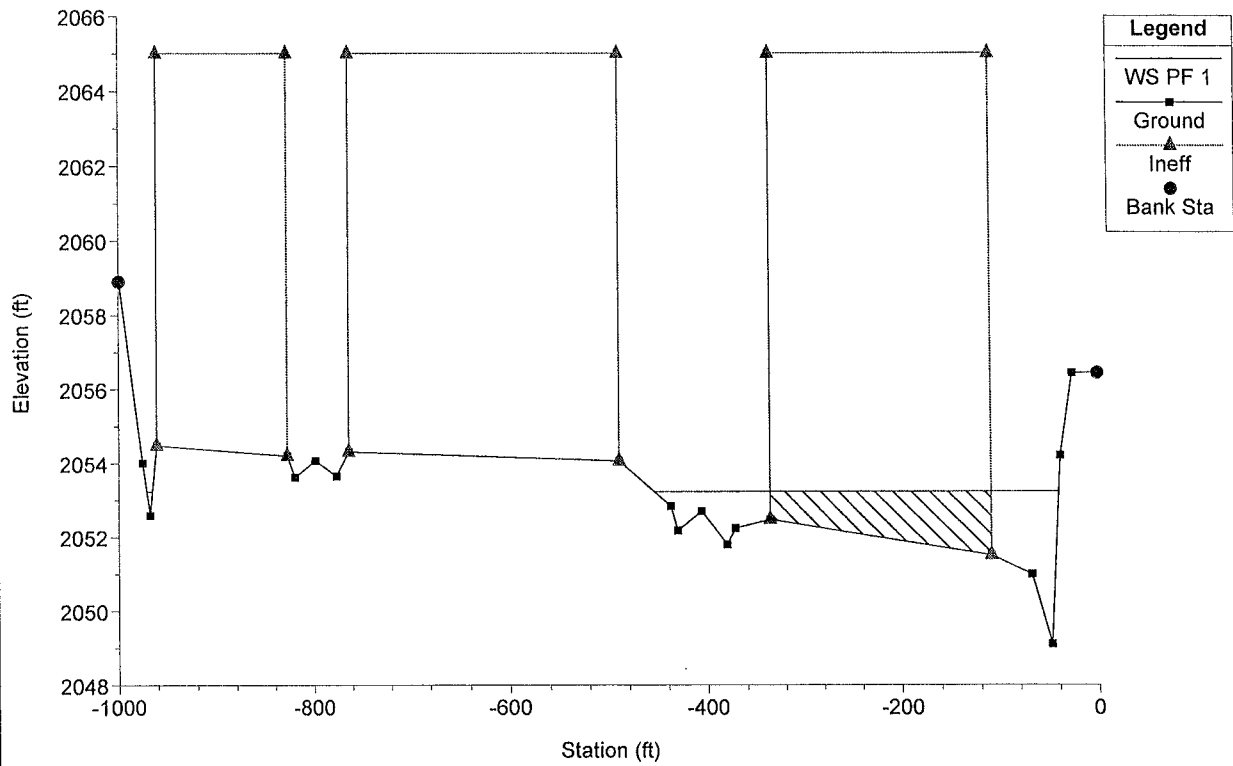
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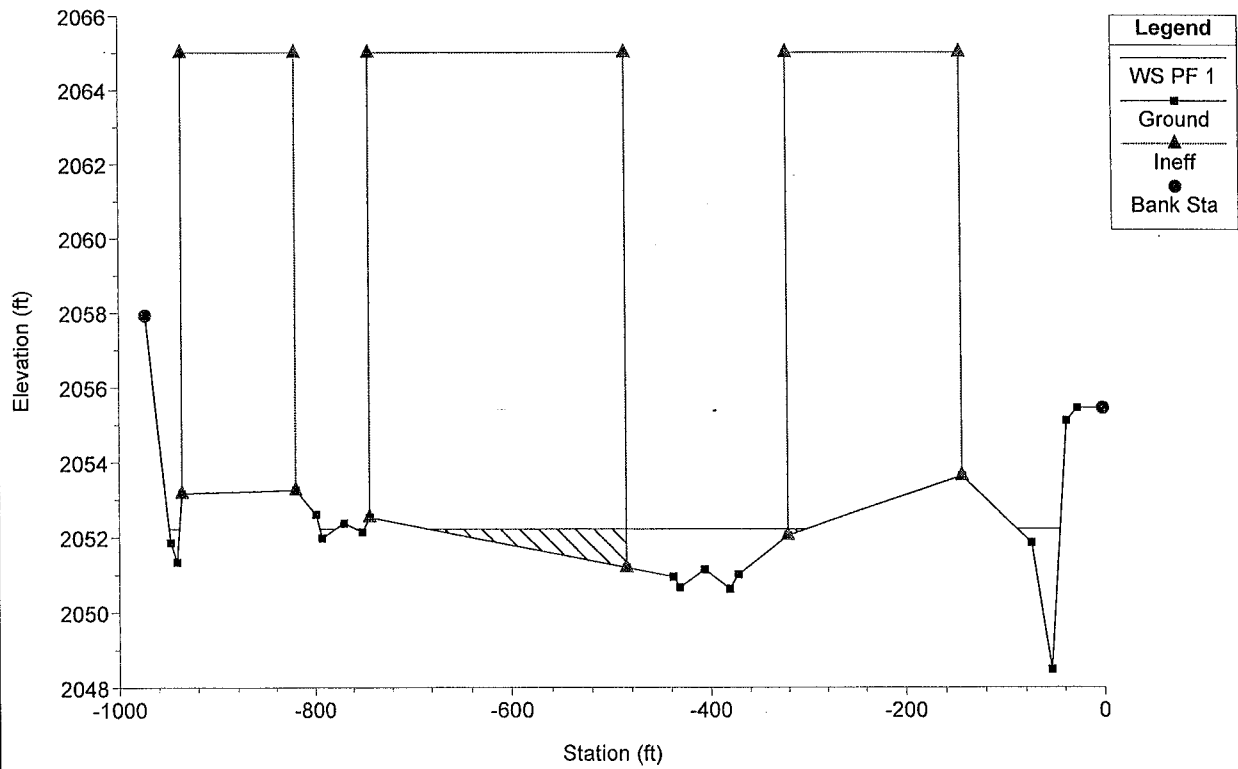
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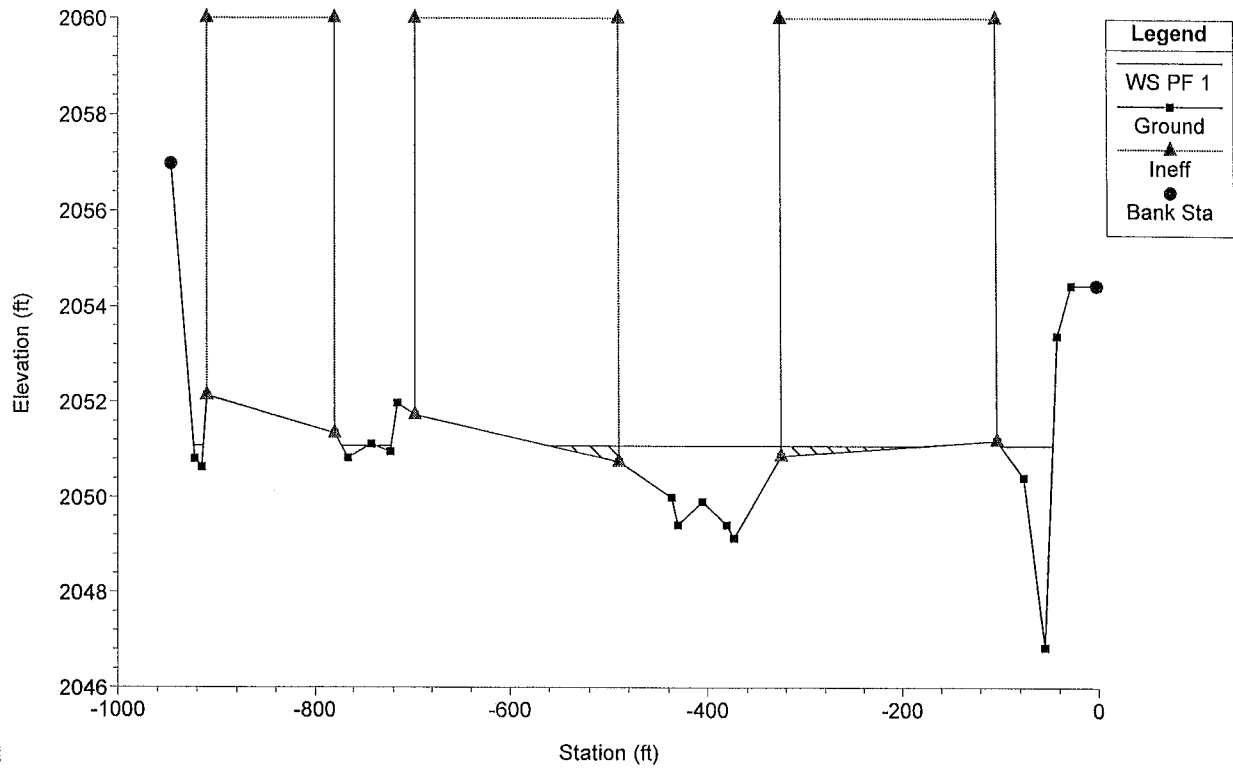
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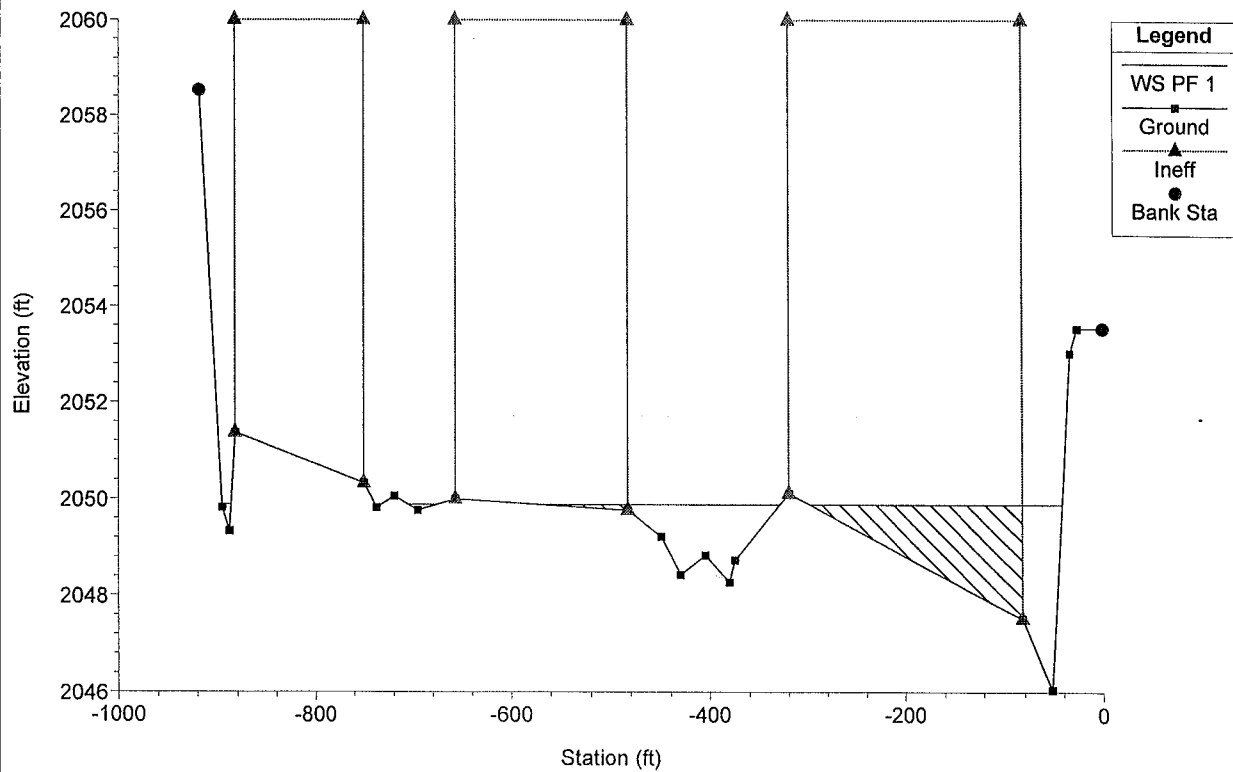
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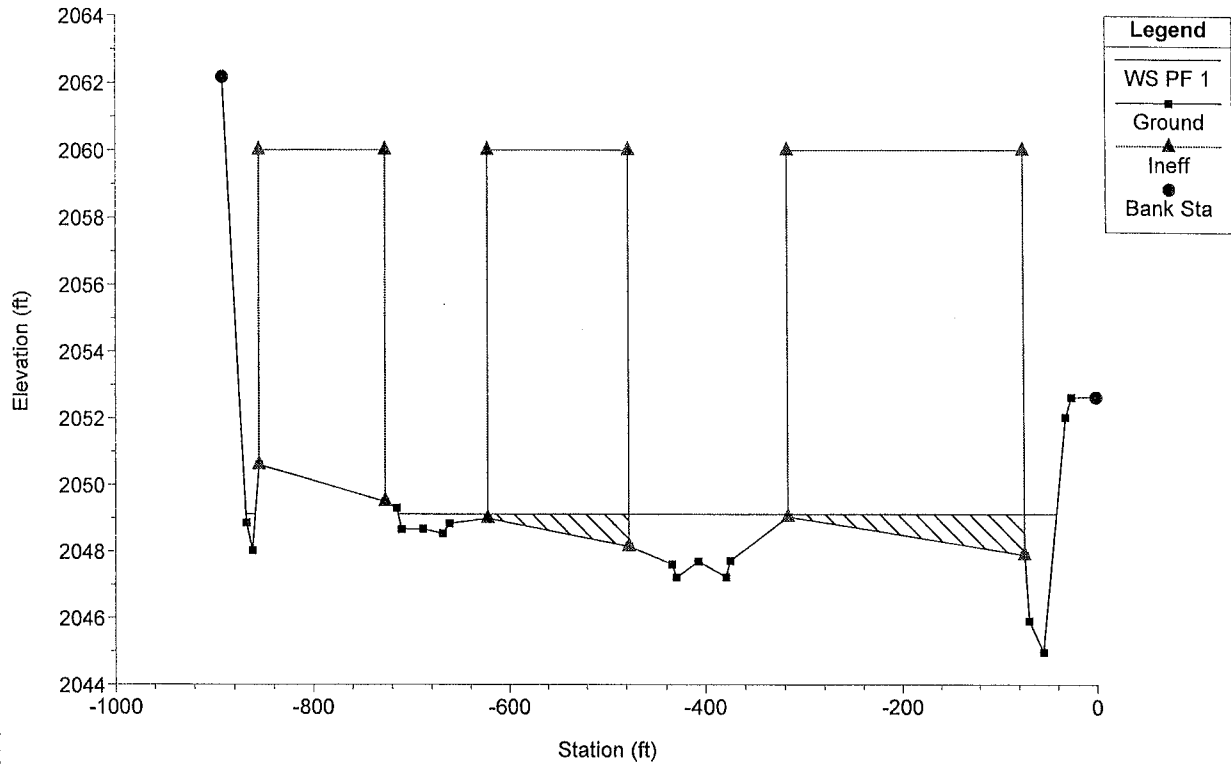
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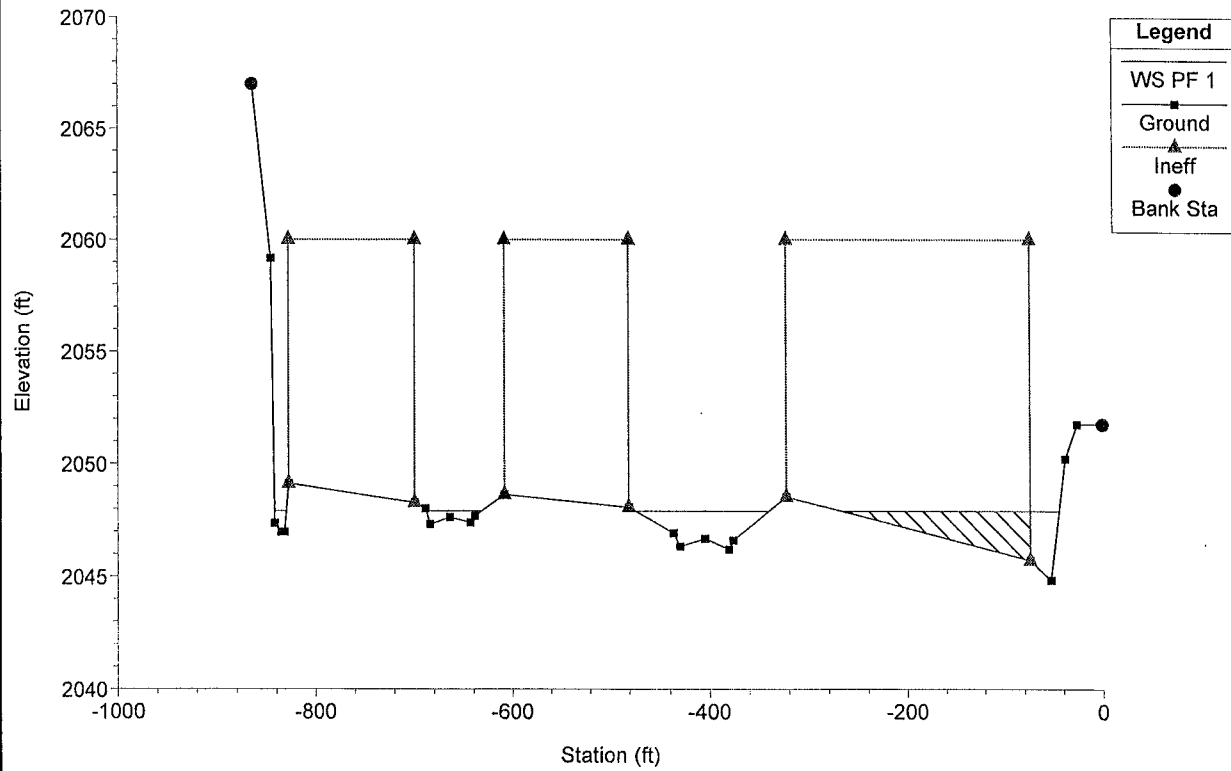
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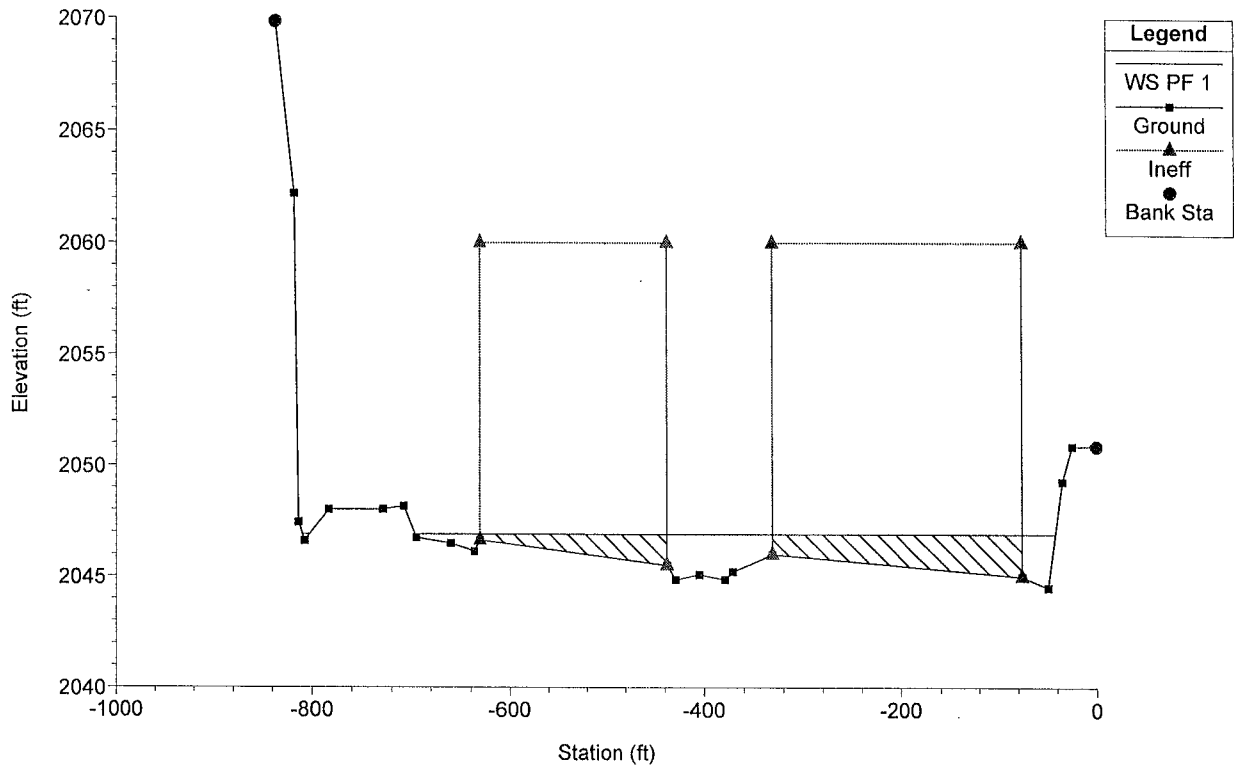
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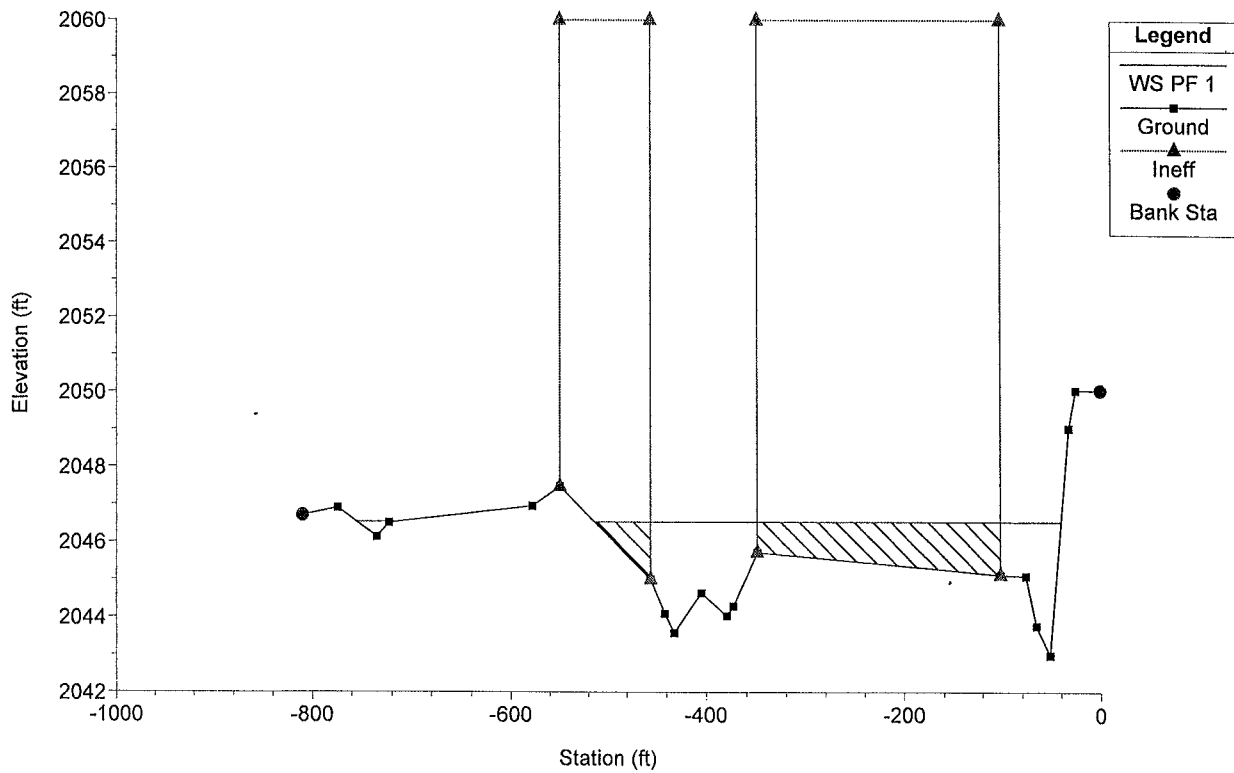
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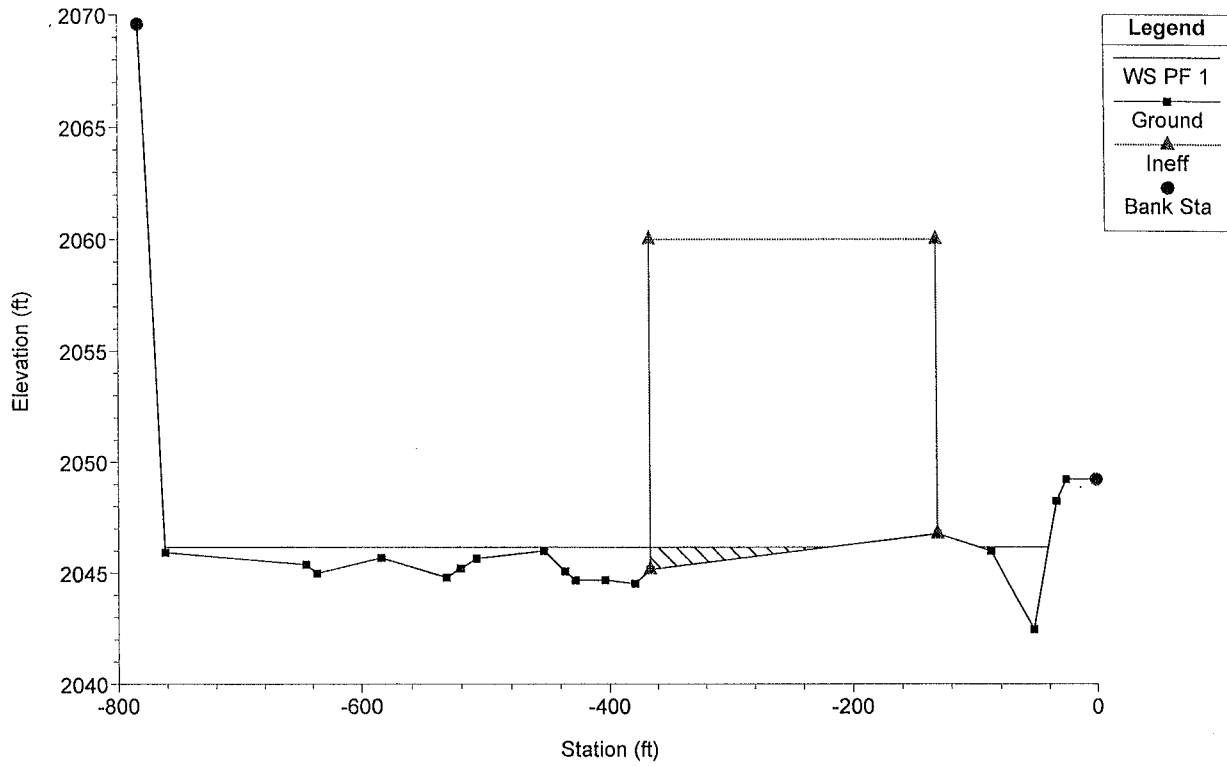
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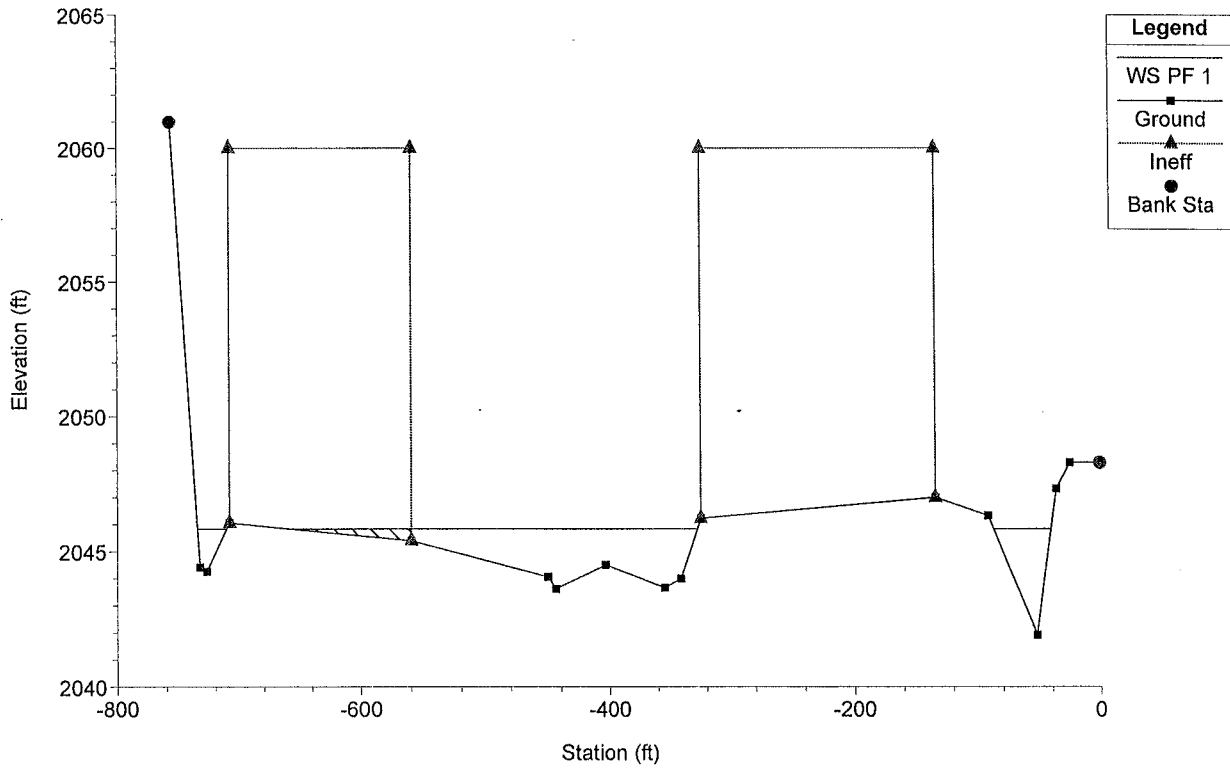
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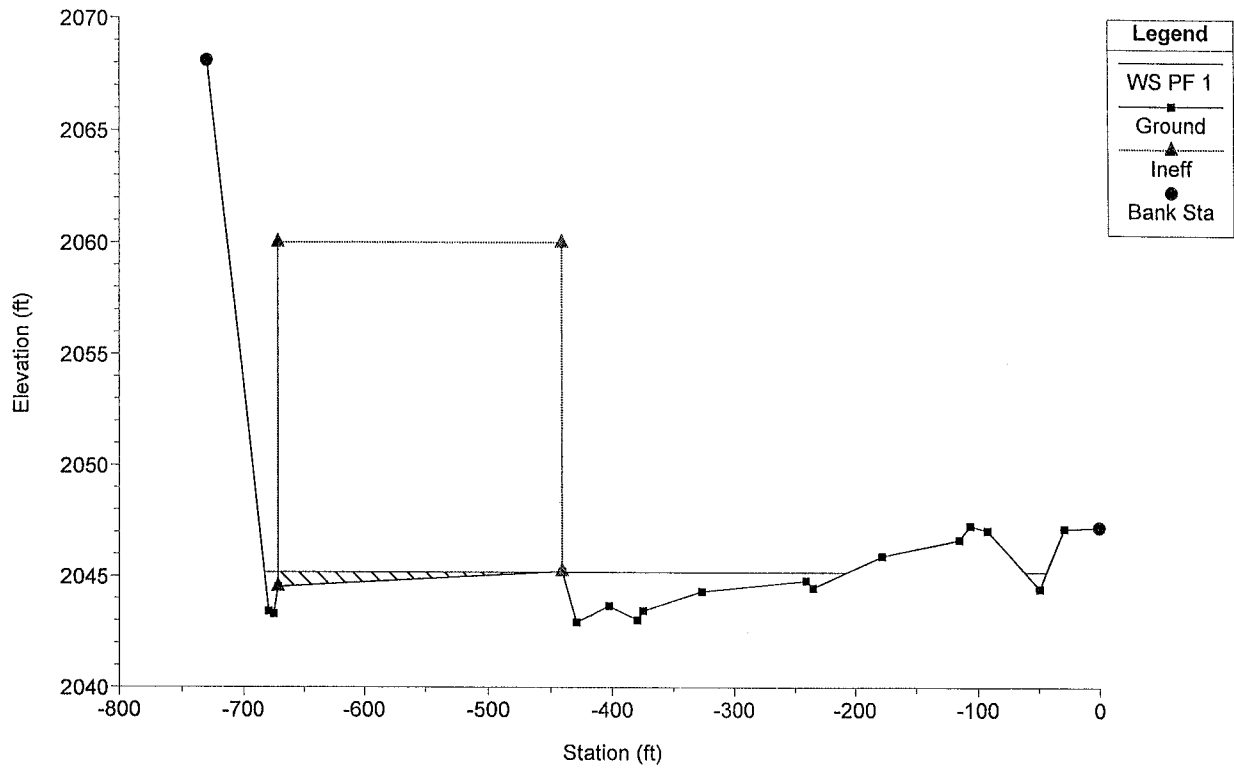
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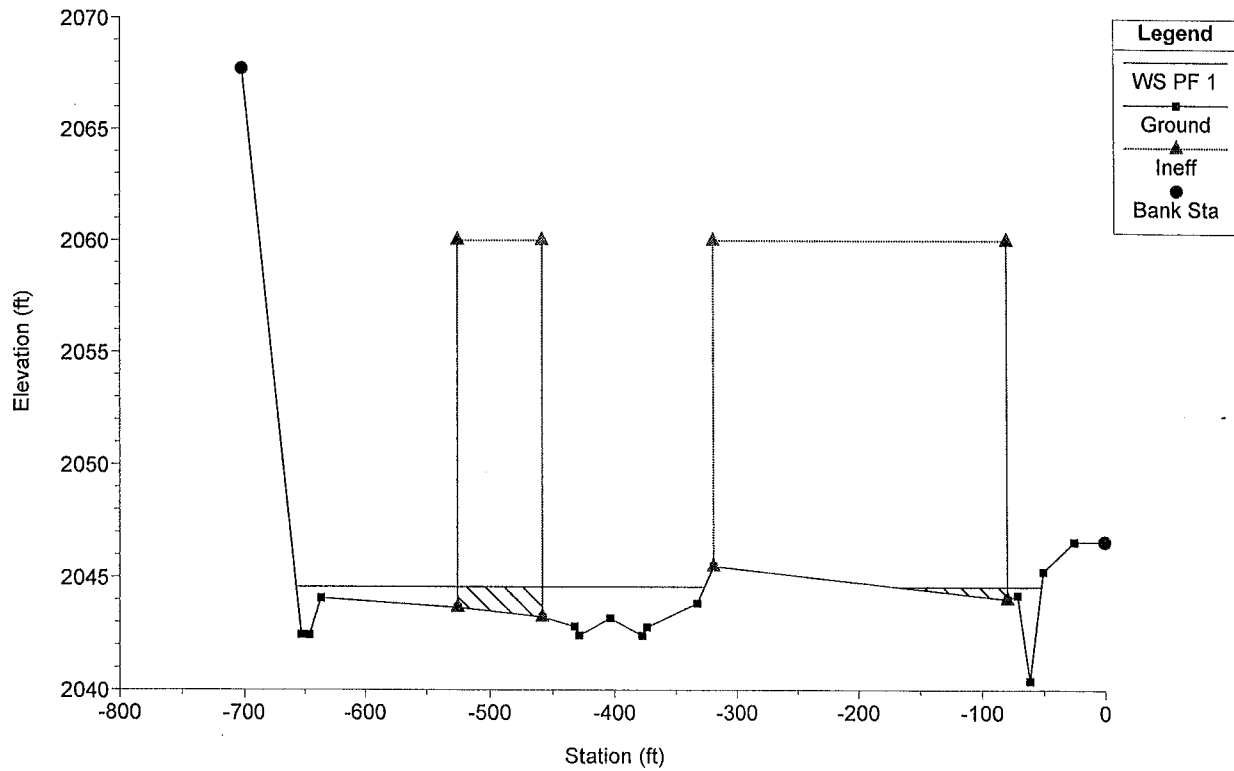
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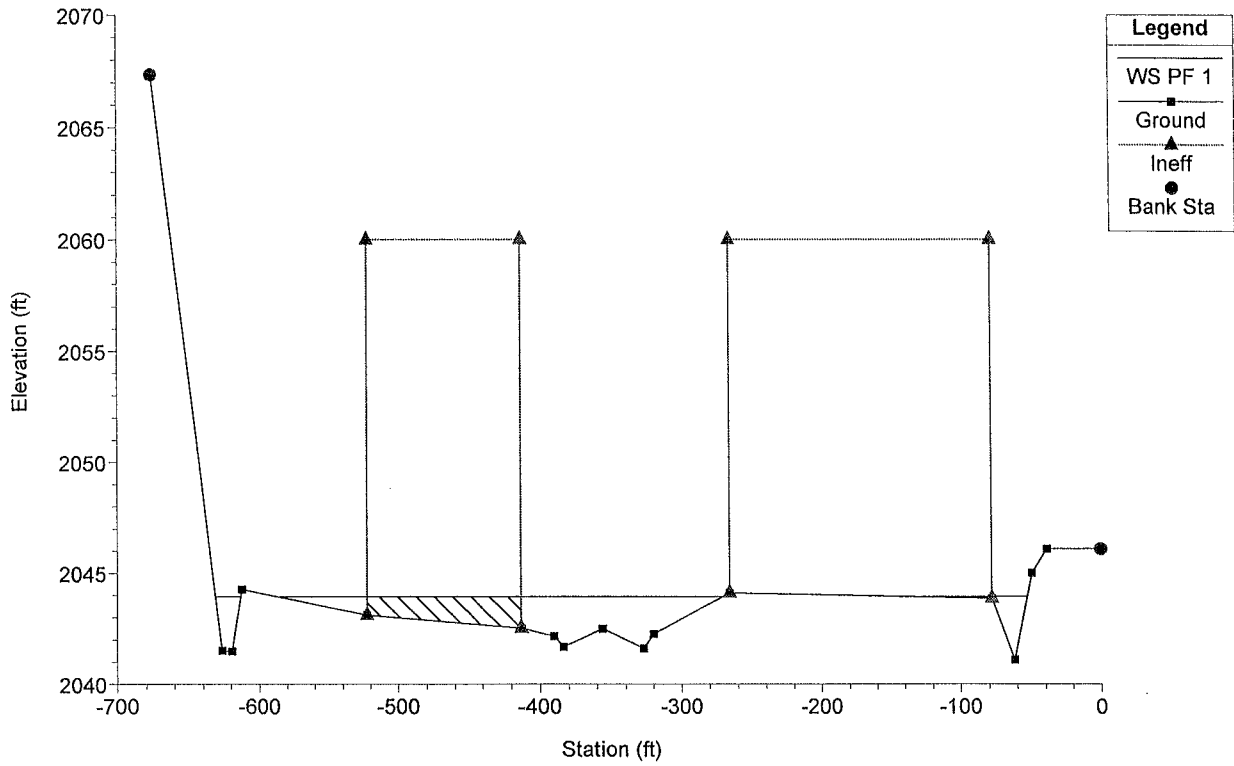
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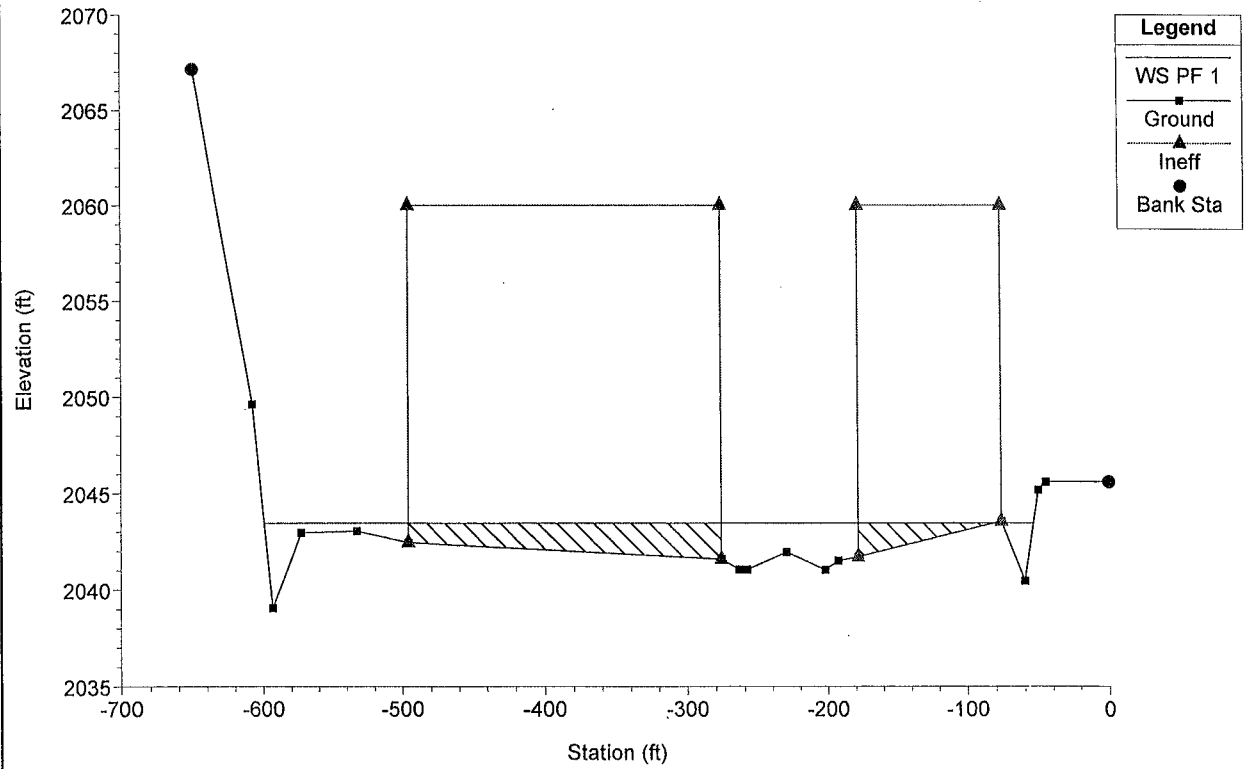
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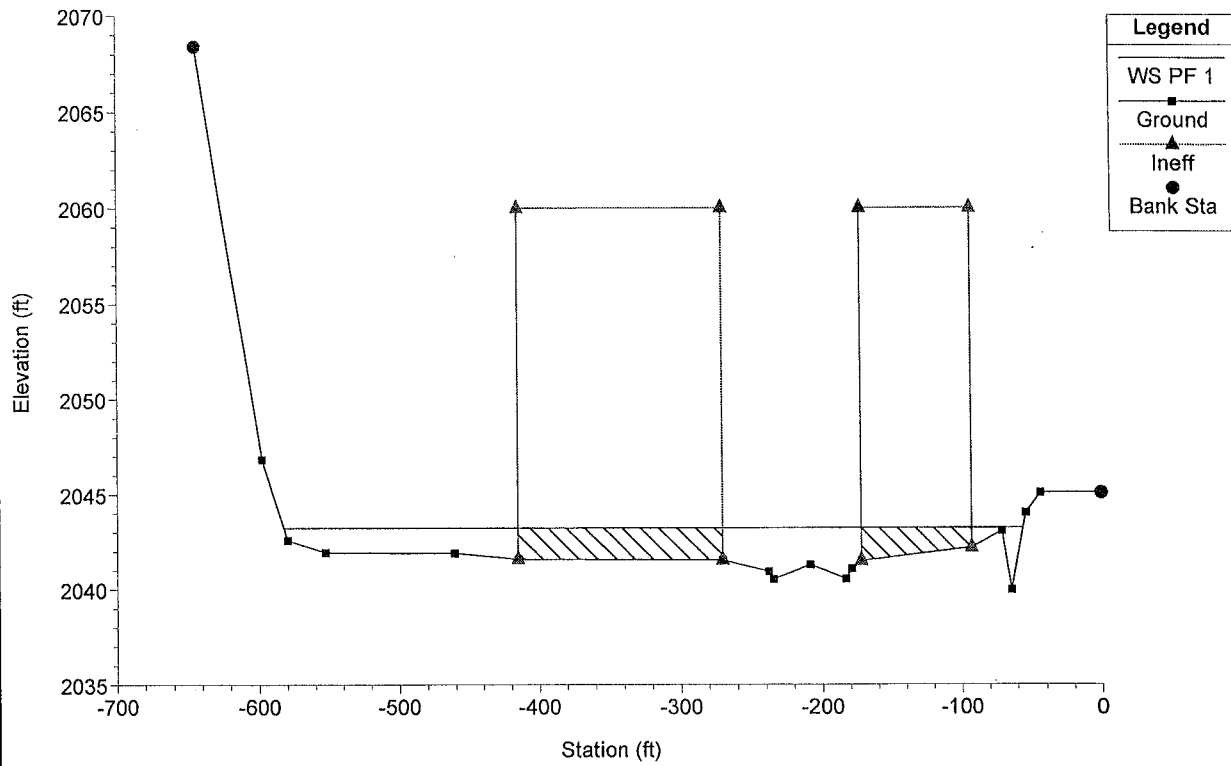
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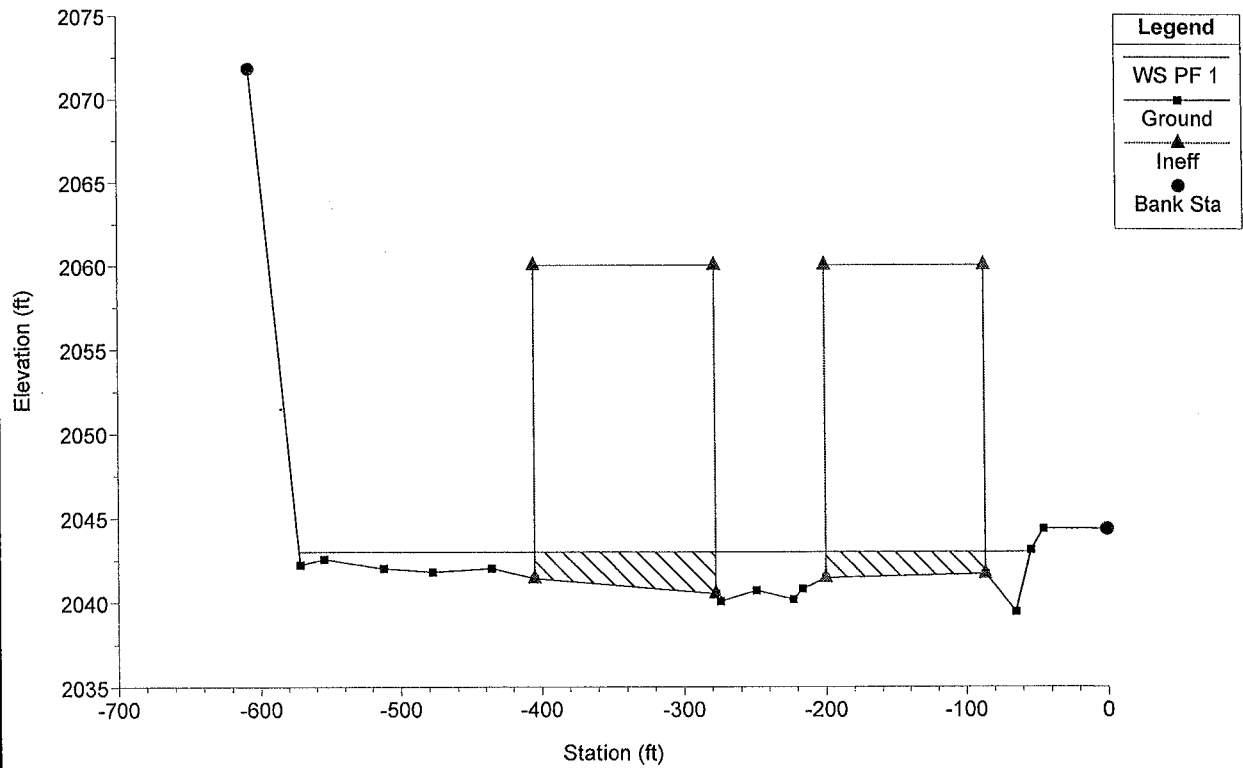
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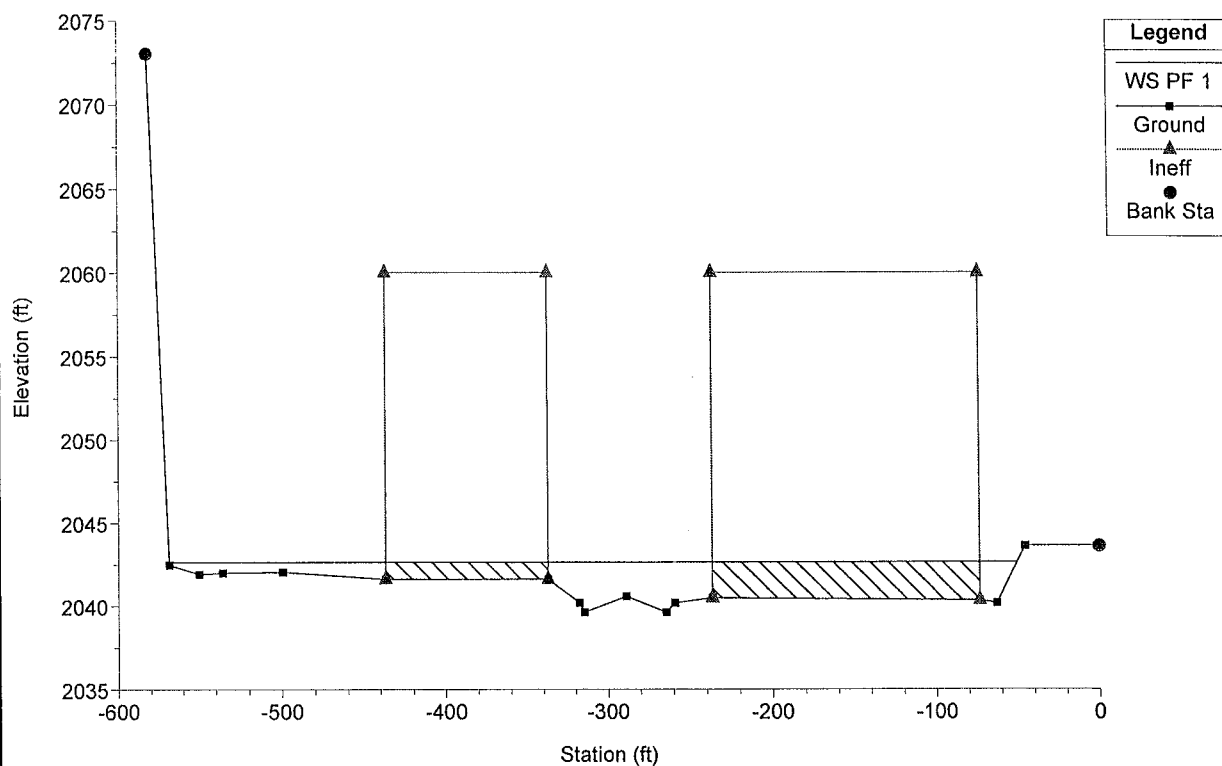
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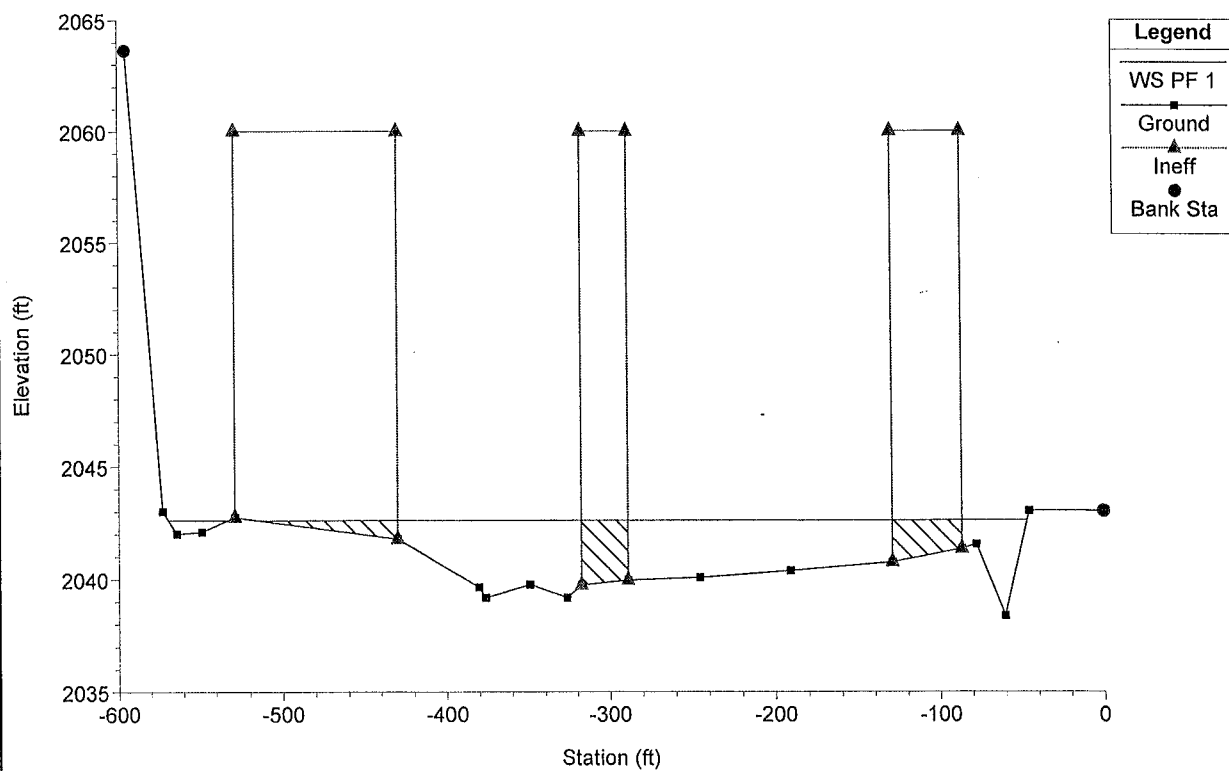
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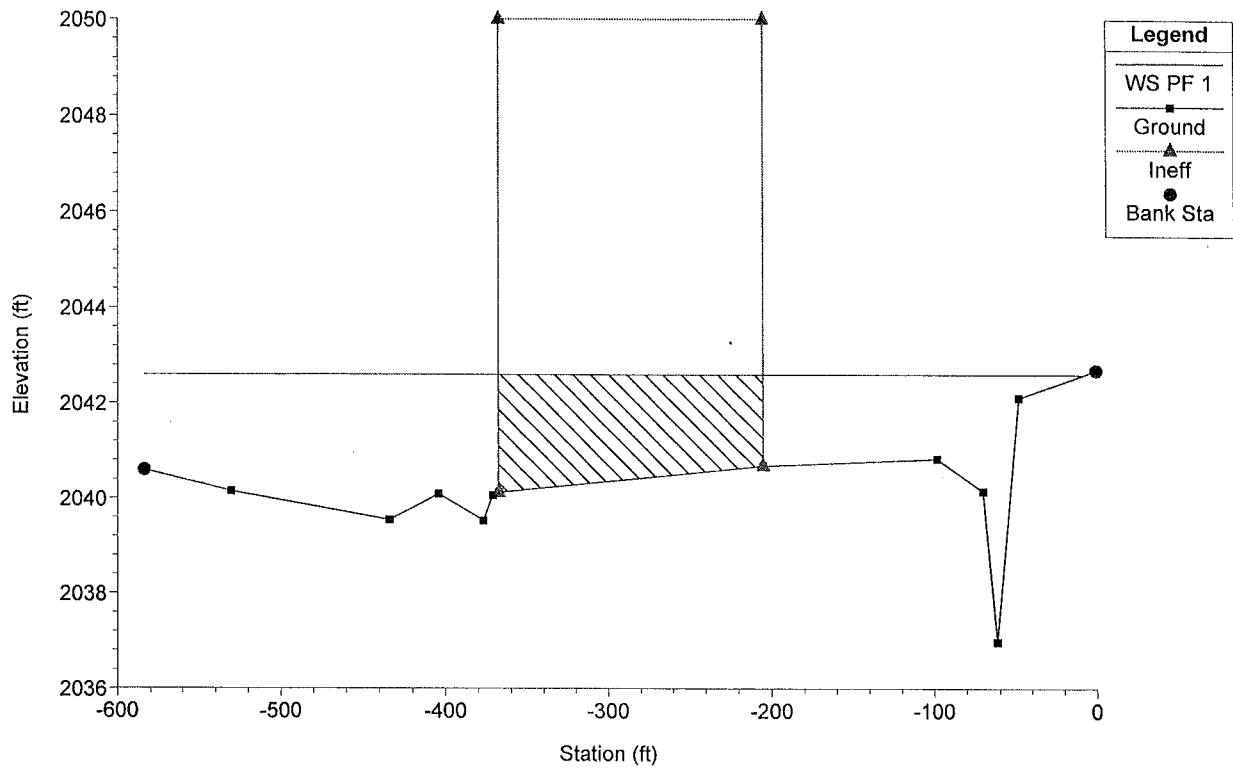
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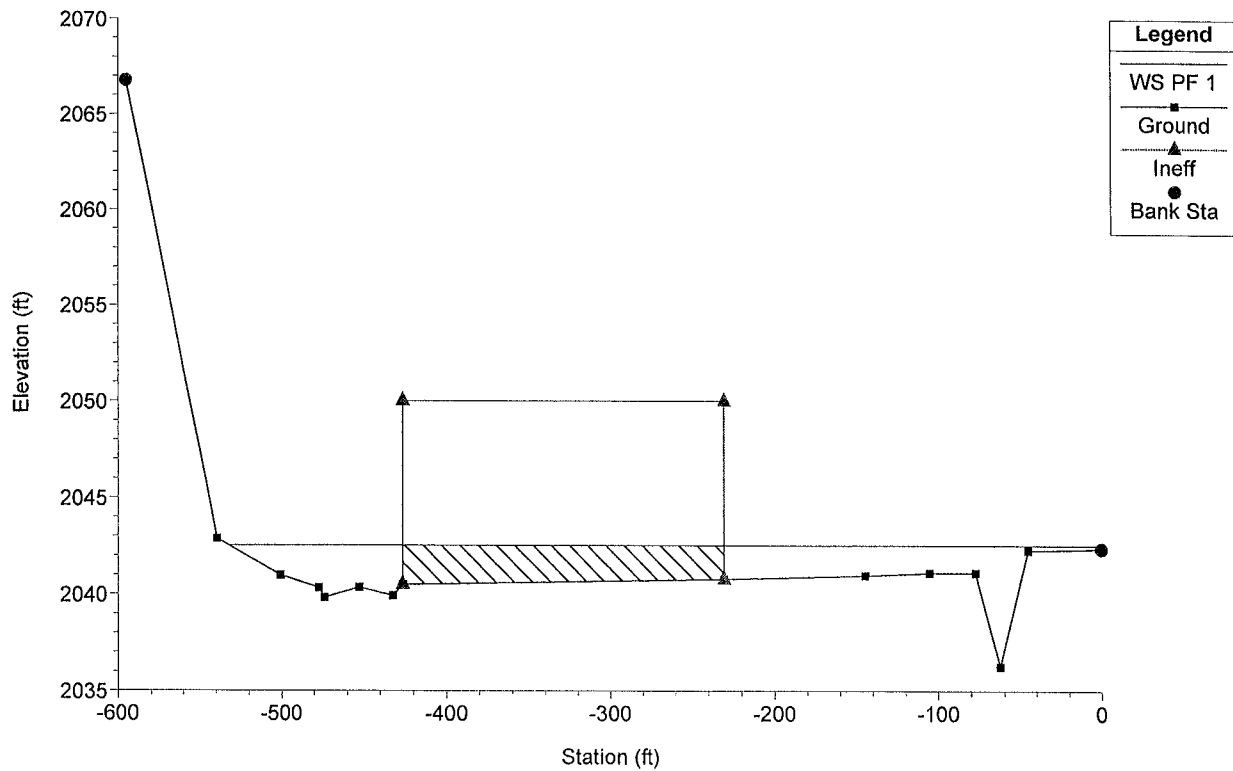
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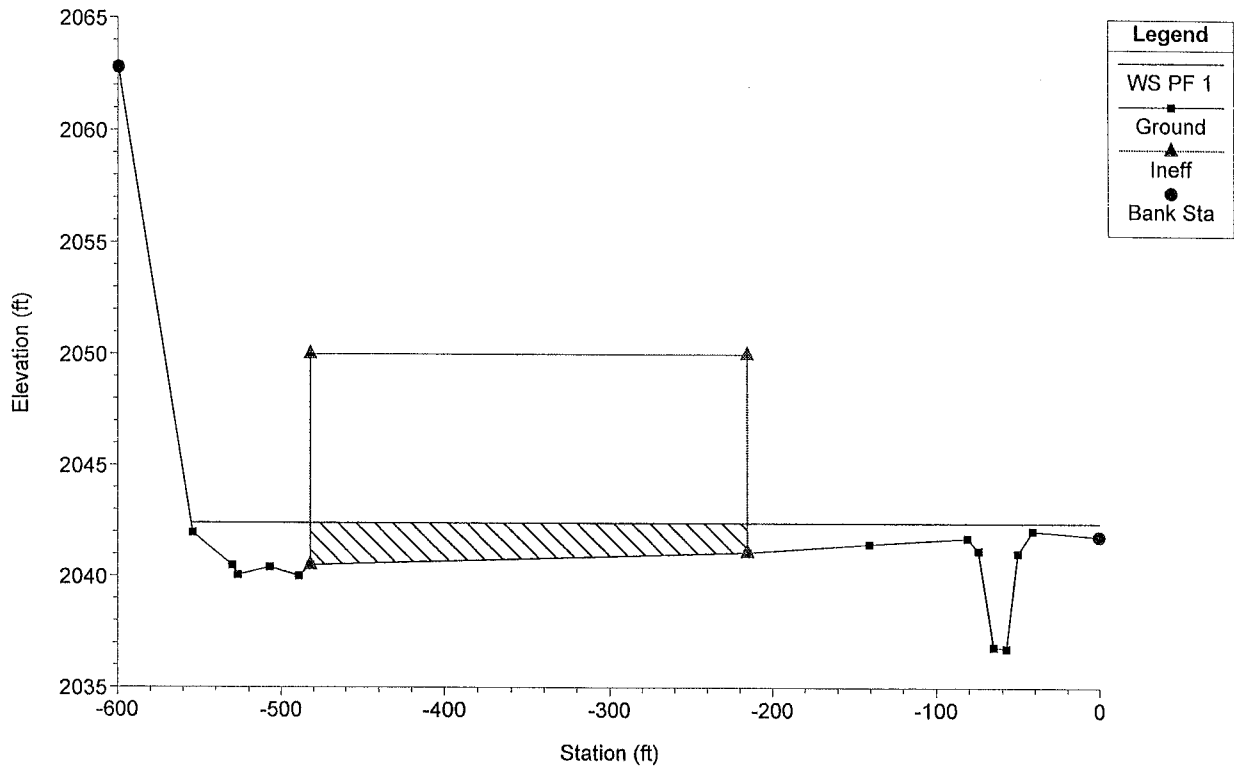
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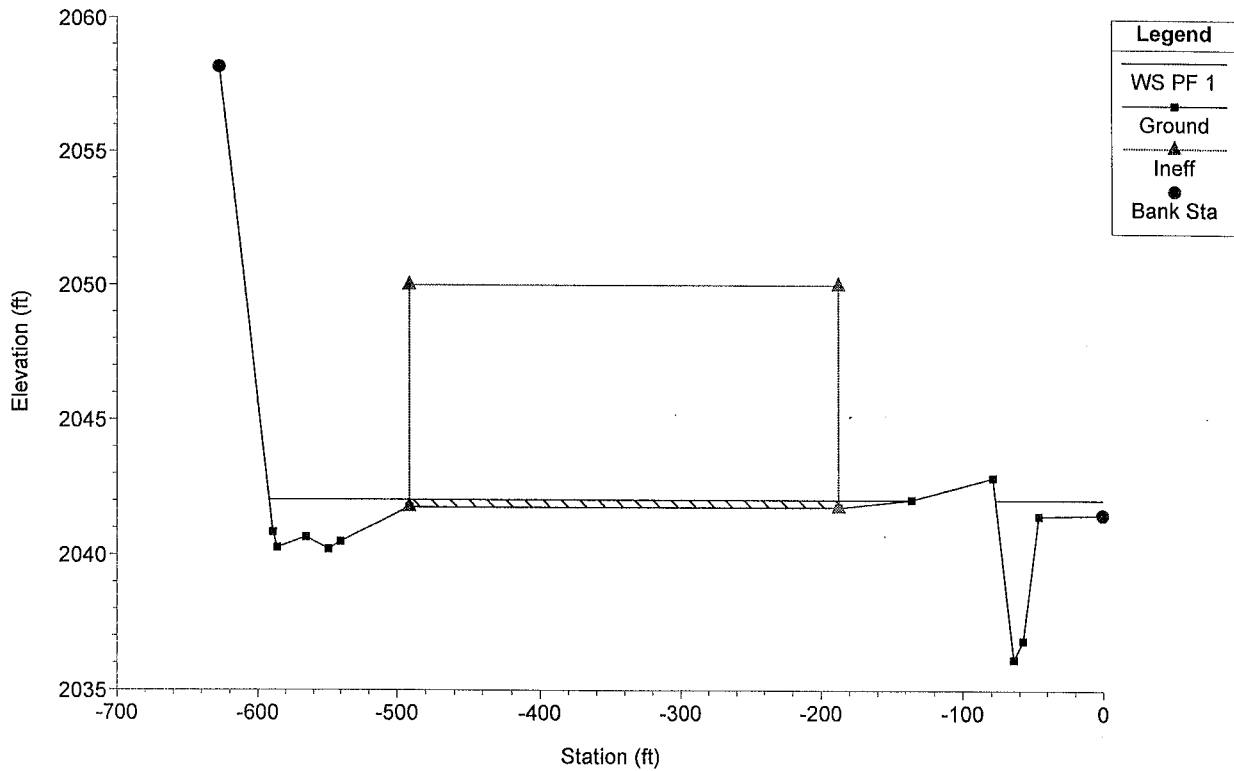
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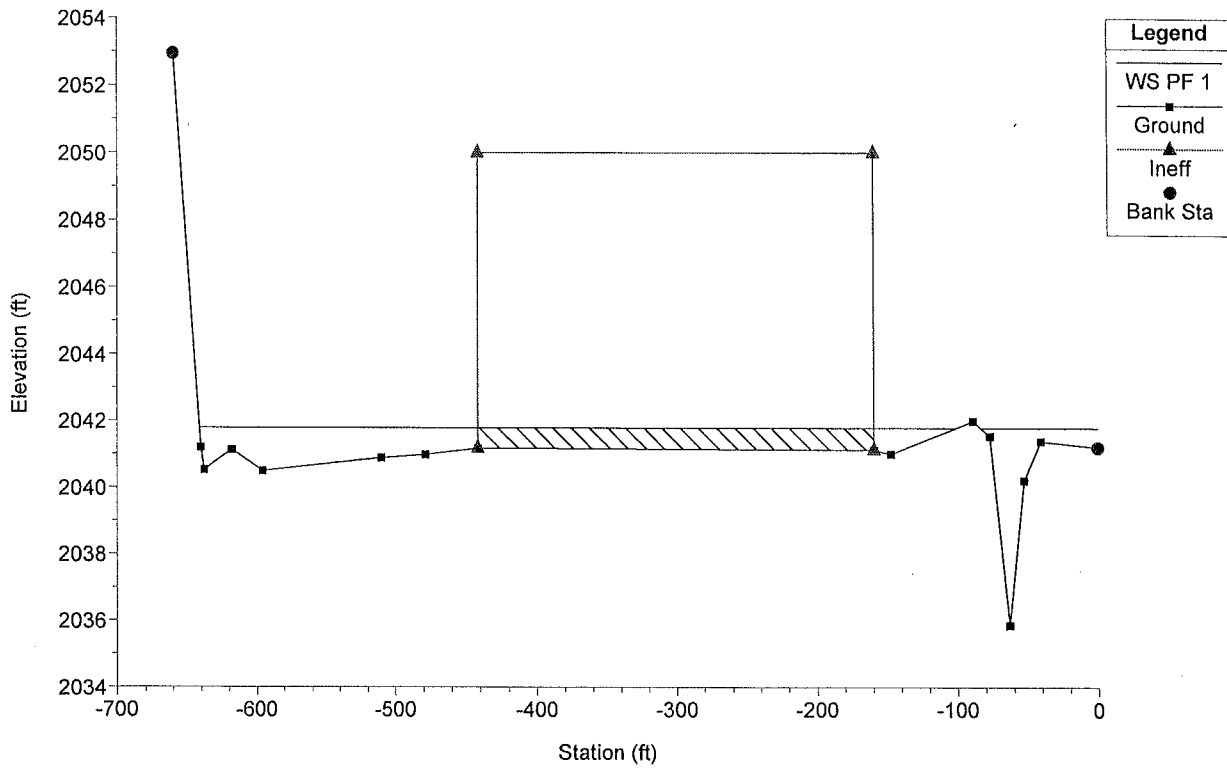
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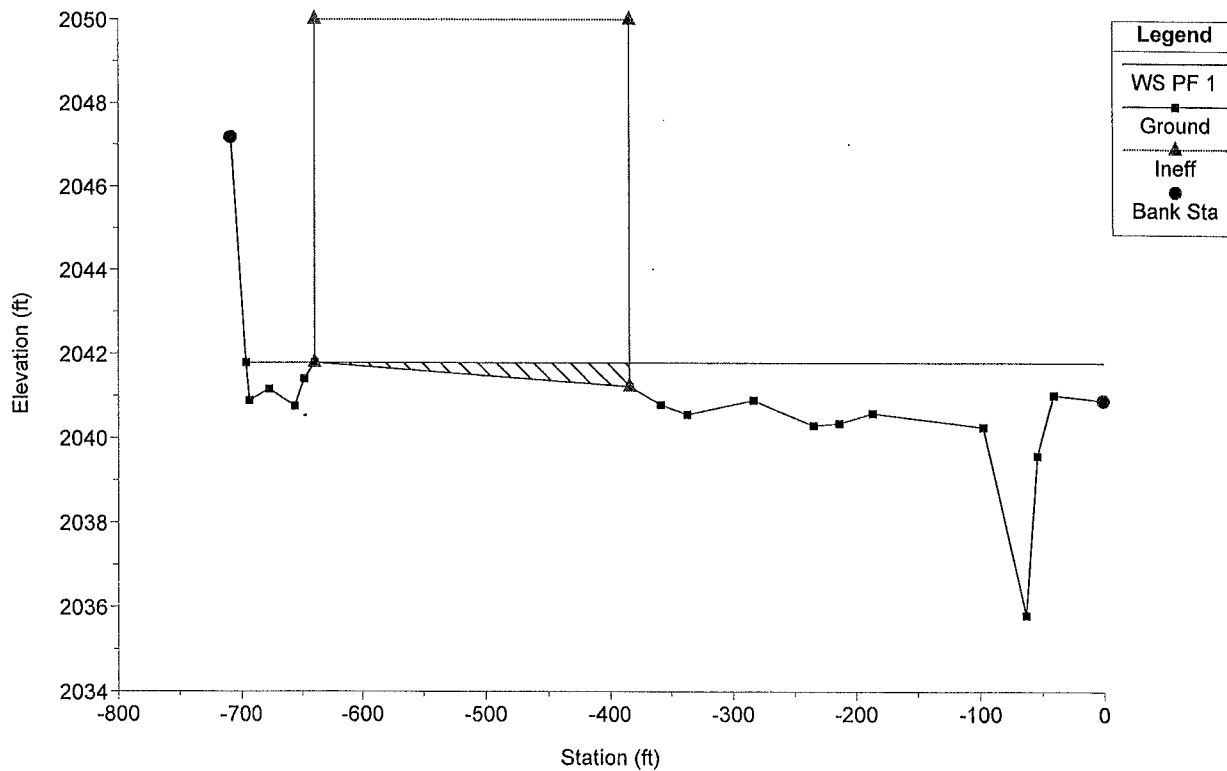
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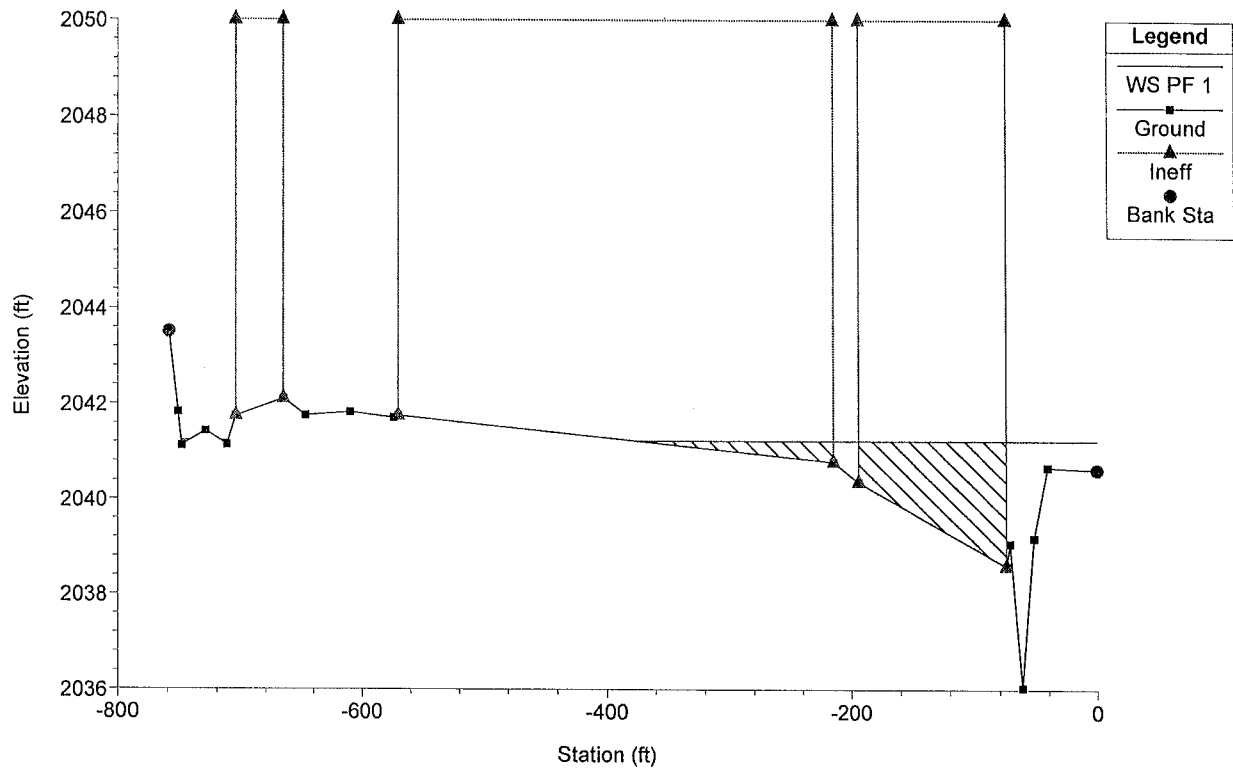
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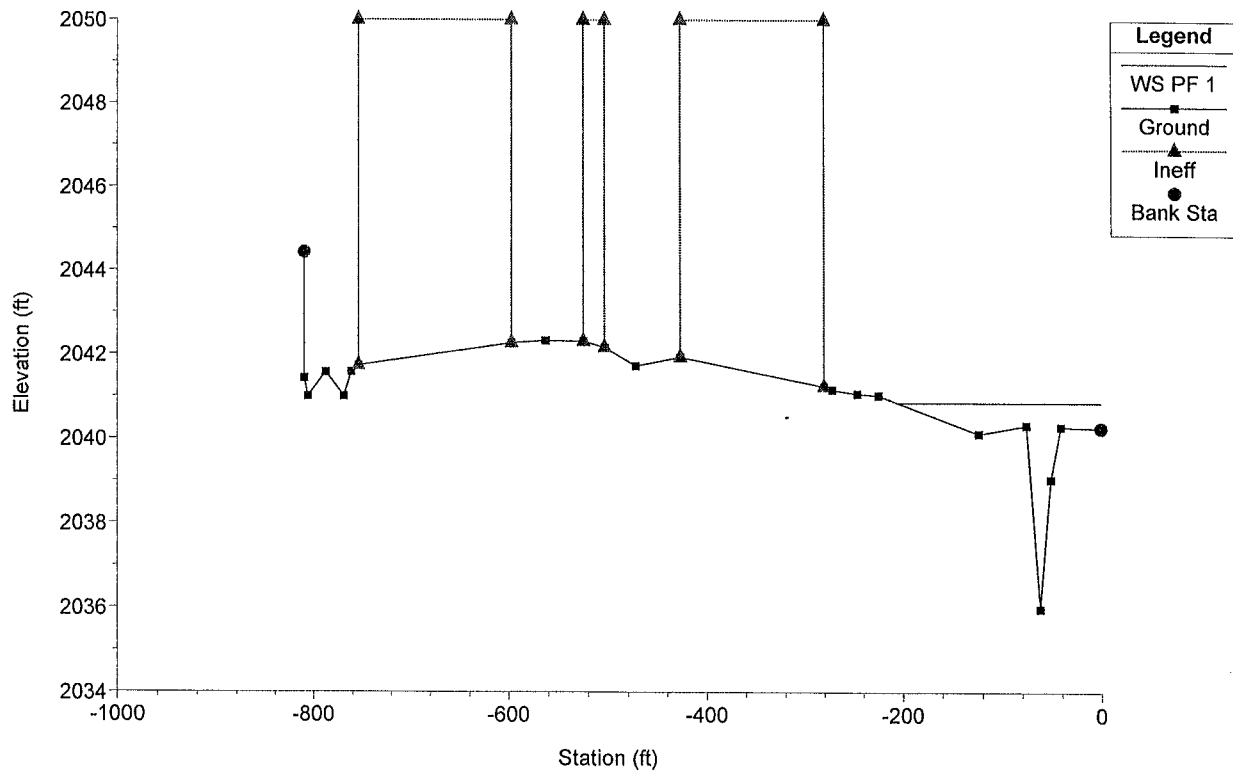
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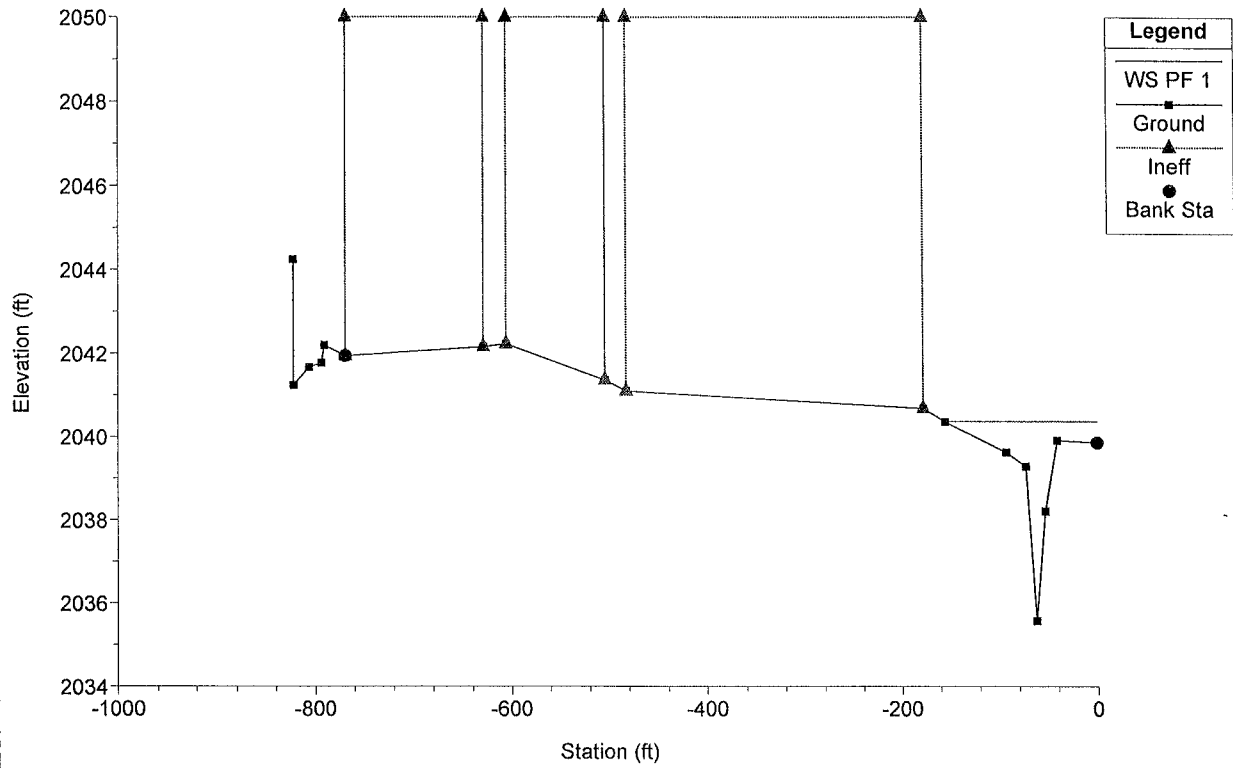
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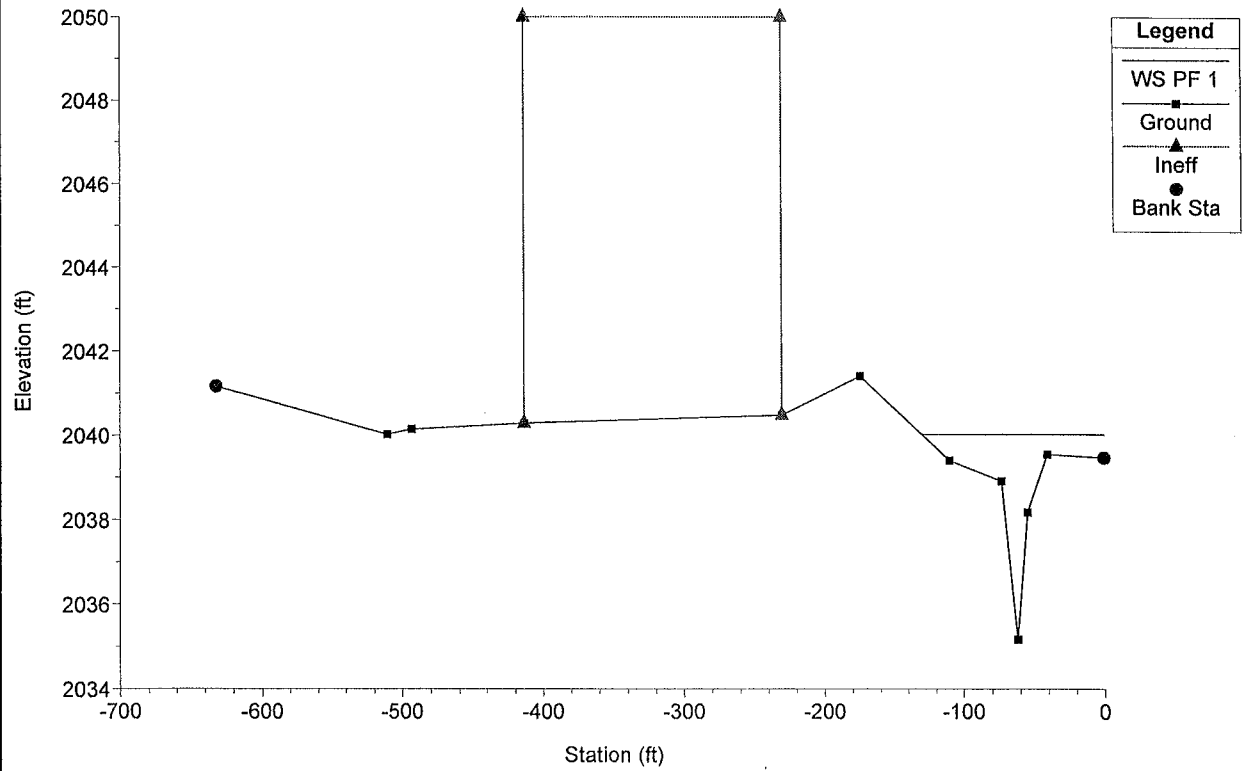
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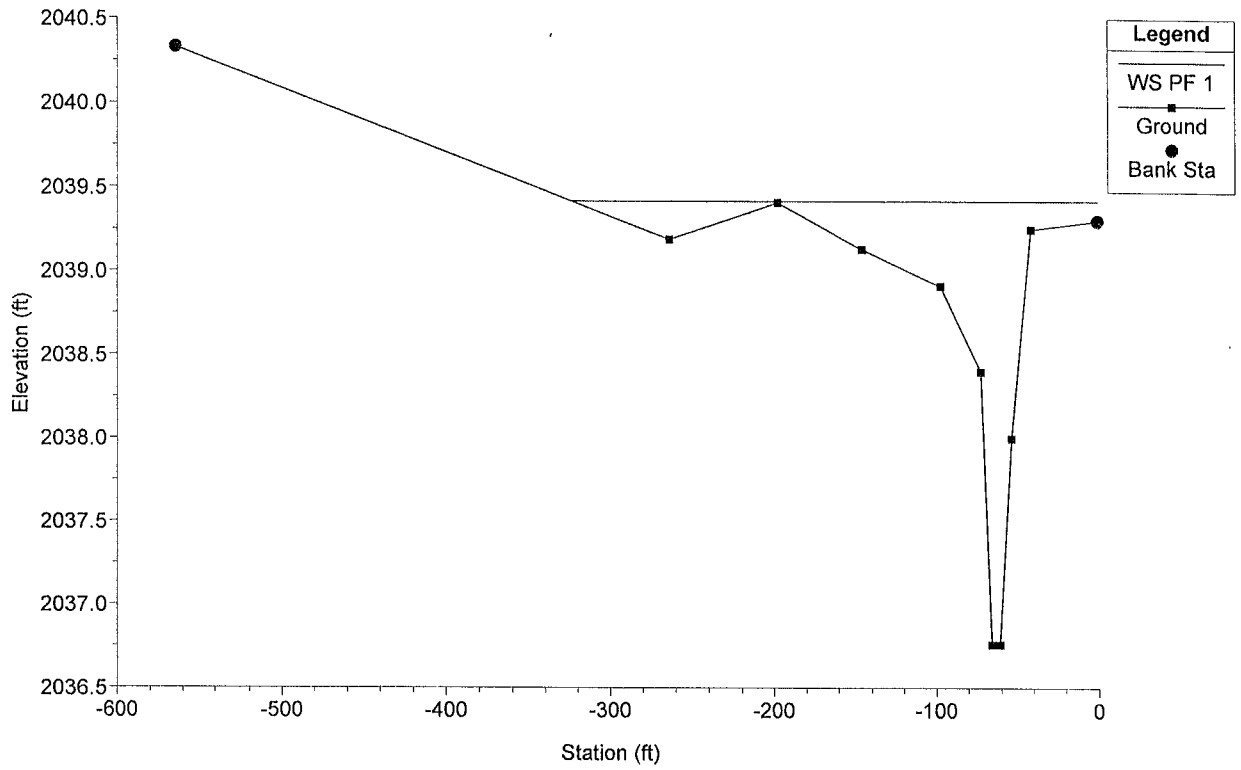
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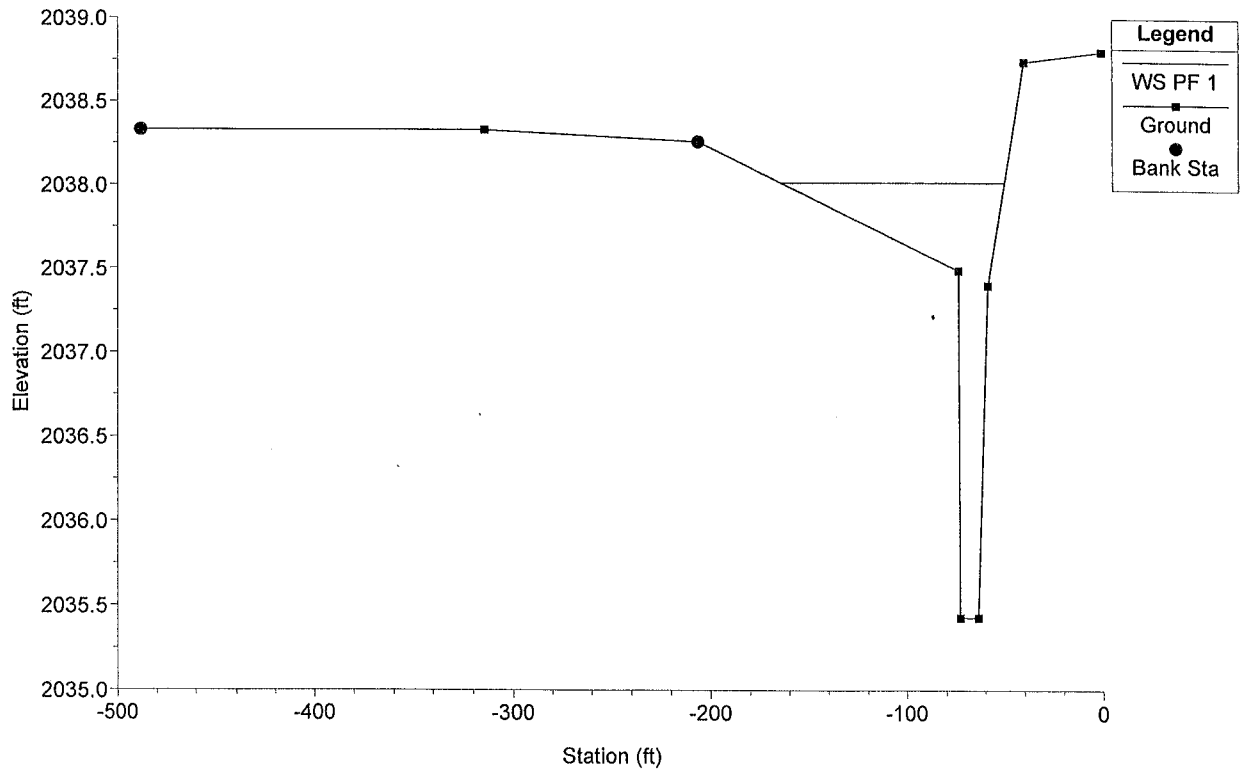
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Existing Offsite Hydrology Report

B.5.2

Historical Case UPRR Side Weir Calculations



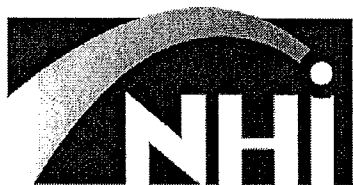
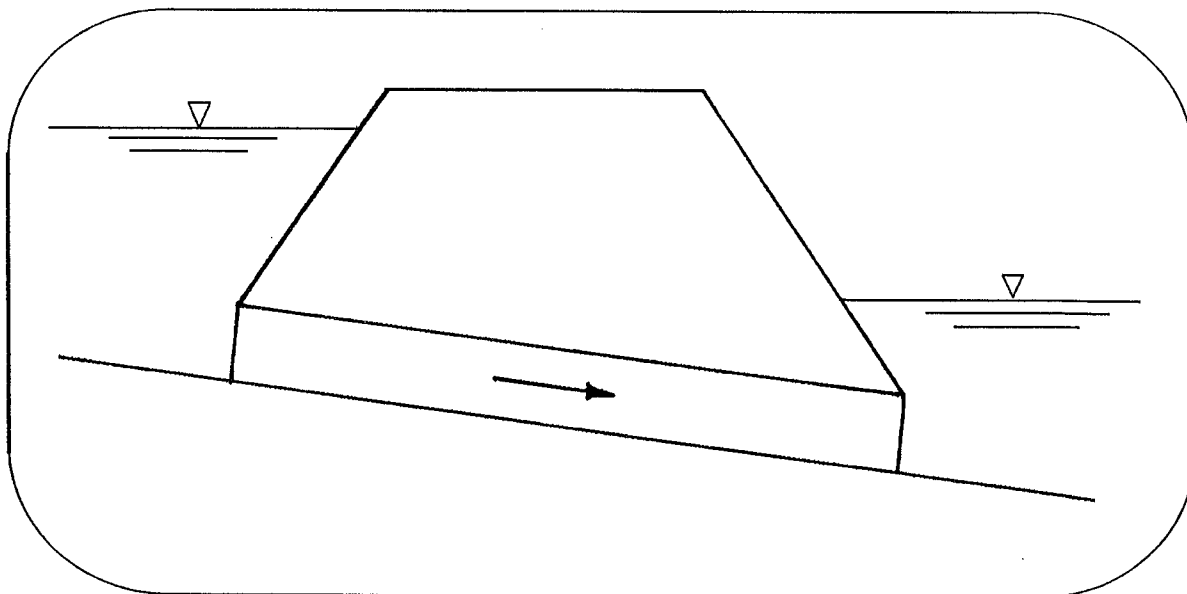
U.S. Department
of Transportation

**Federal Highway
Administration**

Publication No. FHWA-NHI-01-020
September 2001

Hydraulic Design Series Number 5

HYDRAULIC DESIGN OF HIGHWAY CULVERTS



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This approximate method works best when the barrel flows full over at least part of its length (Figure III-9-B). When the barrel is partly full over its entire length (Figure III-9-C), the method becomes increasingly inaccurate as the headwater falls further below the top of the barrel at the inlet. Adequate results are obtained down to a headwater of $0.75D$. For lower headwaters, backwater calculations are required to obtain accurate headwater elevations.

The outlet control nomographs in Appendix D provide solutions for Equation (5) for entrance, friction, and exit losses in full barrel flow. Using the approximate backwater method, the losses (H) obtained from the nomographs can be applied for the partly full flow conditions shown in Figures III-7 and III-9. The losses are added to the elevation of the extended full flow hydraulic grade line at the barrel outlet in order to obtain the headwater elevation. The extended hydraulic grade line is set at the higher of $(d_c + D)/2$ or the tailwater elevation at the culvert outlet. Again, the approximation works best when the barrel flows full over at least part of its length.

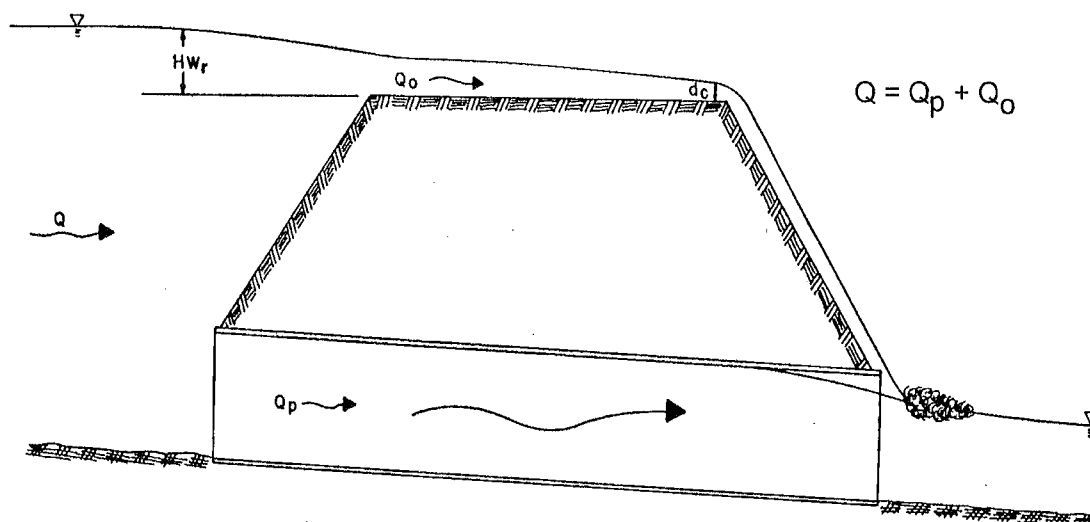


Figure III-10--Roadway Overtopping

3. Roadway Overtopping. Overtopping will begin when the headwater rises to the elevation of the roadway (Figure III-10). The overtopping will usually occur at the low point of a sag vertical curve on the roadway. The flow will be similar to flow over a broad crested weir. Flow coefficients for flow overtopping roadway embankments are found in HDS No. 1, Hydraulics of Bridge Waterways (21), as well as in the documentation of HY-7, the Bridge Waterways Analysis Model (22). Curves from reference (22) are shown in Figure III-11. Figure III-11-A is for deep overtopping, Figure III-11-B is for shallow overtopping, and Figure III-11-C is a correction factor for downstream submergence. Equation (8) defines the flow across the roadway.

$$Q_o = C_d L HW_r^{1.5} \quad (8)$$

- Q_o is the overtopping flow rate in m^3/s (ft^3/s)
- C_d is the overtopping discharge coefficient (*for use in SI units, see note)
- L is the length of the roadway crest, m (ft)
- HW_r is the upstream depth, measured from the roadway crest to the water surface upstream of the weir drawdown, m (ft)

*Note: C_d determined from Figure III-11 and other English unit research must be corrected by a factor of 0.552 [C_d (SI) = 0.552 (C_d English)]

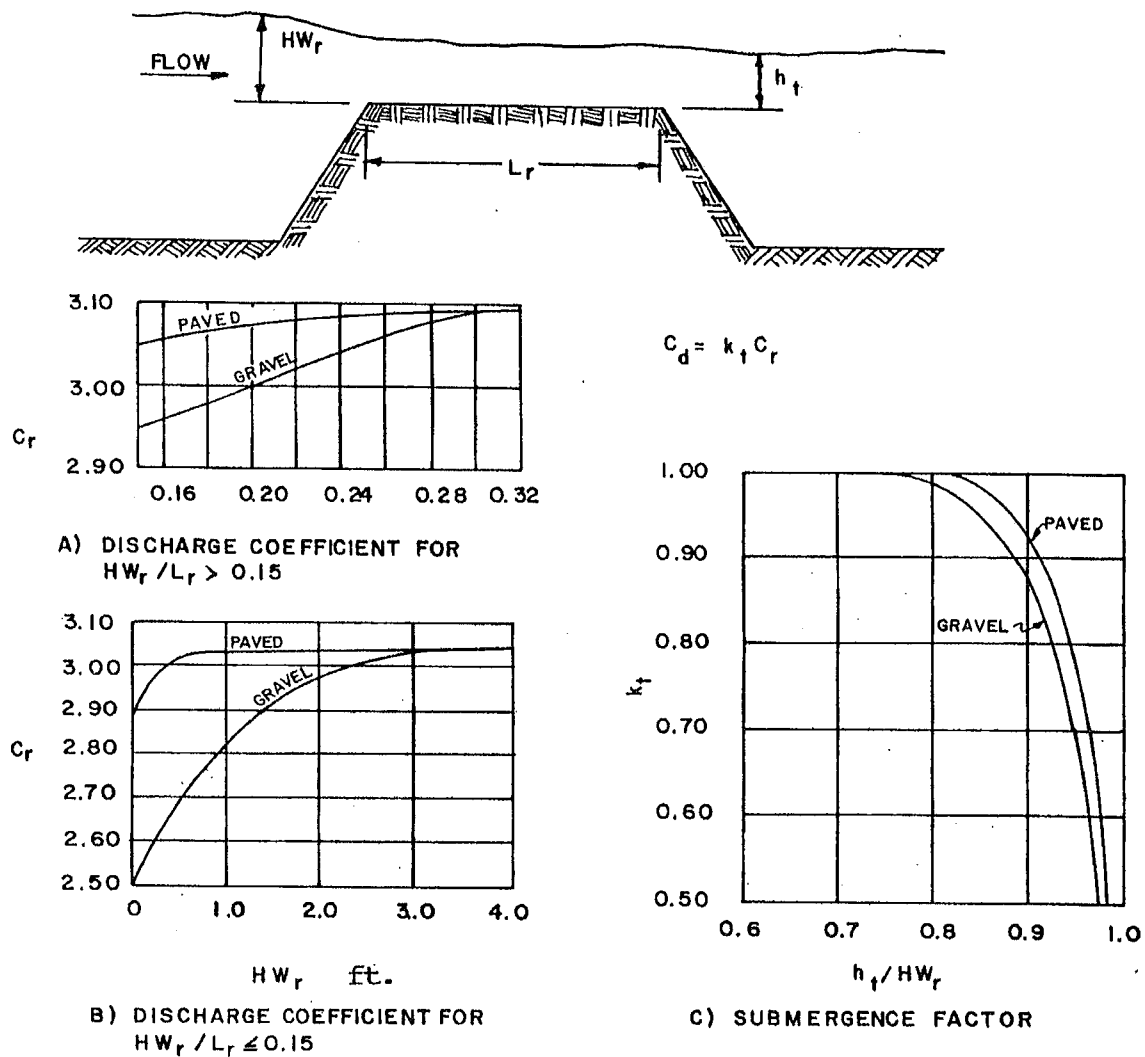
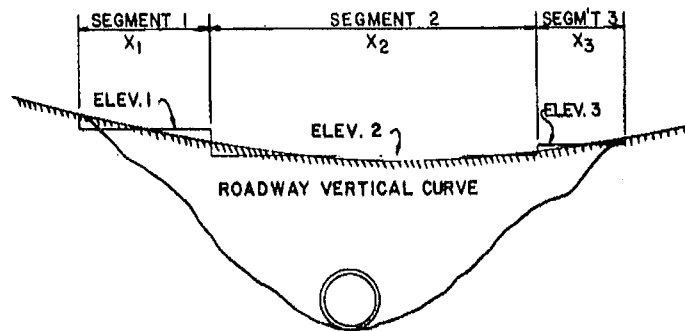


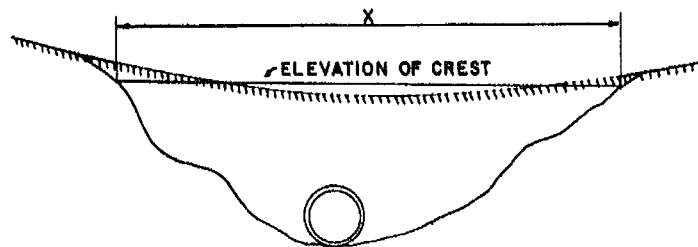
Figure III-11--English Discharge Coefficients for Roadway Overtopping

The length and elevation of the roadway crest are difficult to determine when the crest is defined by a roadway sag vertical curve. The sag vertical curve can be broken into a series of horizontal segments as shown in Figure III-12-A. Using Equation (8), the flow over each segment is calculated for a given headwater. Then, the incremental flows for each segment are added together, resulting in the total flow across the roadway.

Representing the sag vertical curve by a single horizontal line (one segment) is often adequate for culvert design (Figure III-12-B). The length of the weir can be taken as the horizontal length of this segment or it can be based on the roadway profile and an acceptable variation above and below the horizontal line. In effect, this method utilizes an average depth of the upstream pool above the roadway crest for the flow calculation.



A.METHOD 1 - SUBDIVISION INTO SEGMENTS



B.METHOD 2 - USE OF A SINGLE SEGMENT

Figure III-12--Weir Crest Length Determinations for Roadway Overtopping

It is a simple matter to calculate the flow across the roadway for a given upstream water surface elevation using Equation (8). The problem is that the roadway overflow plus the culvert flow must equal the total design flow. A trial and error process is necessary to determine the amount of the total flow passing through the culvert and the amount flowing across the roadway. Performance curves may also be superimposed for the culvert flow and the road overflow to yield an overall solution as is discussed later in this chapter.

4. Outlet Velocity. Culvert outlet velocities should be calculated to determine the need for erosion protection at the culvert exit. Culverts usually result in outlet velocities which are higher than the natural stream velocities. These outlet velocities may require flow readjustment or energy dissipation to prevent downstream erosion.

In inlet control, backwater (also called drawdown) calculations may be necessary to determine the outlet velocity. These calculations begin at the culvert entrance and proceed downstream to the exit. The flow velocity is obtained from the flow and the cross-sectional area at the exit (Equation (2)).

An approximation may be used to avoid backwater calculations in determining the outlet velocity for culverts operating in inlet control. The water surface profile converges toward normal depth as calculations proceed down the culvert barrel. Therefore, if the culvert is of adequate length, normal depth will exist at the culvert outlet. Even in short culverts, normal depth can be assumed and used to define the area of flow at the outlet and obtain the outlet velocity (Figure

In outlet control, the cross sectional area of the flow is defined by the geometry of the outlet and either critical depth, tailwater depth, or the height of the conduit (Figure III-14).

Critical depth is used when the tailwater is less than critical depth and the tailwater depth is used when tailwater is greater than critical depth but below the top of the barrel. The total barrel area is used when the tailwater exceeds the top of the barrel.

B. Performance Curves

Performance curves are representations of flow rate versus headwater depth or elevation for a given flow control device, such as a weir, an orifice, or a culvert. A weir constricts open channel flow so that the flow passes through critical depth just upstream of the weir. An orifice is a flow control device, fully submerged on the upstream side, through which the flow passes. Performance curves and equations for these two basic types of flow control devices are shown in Figure III-15.

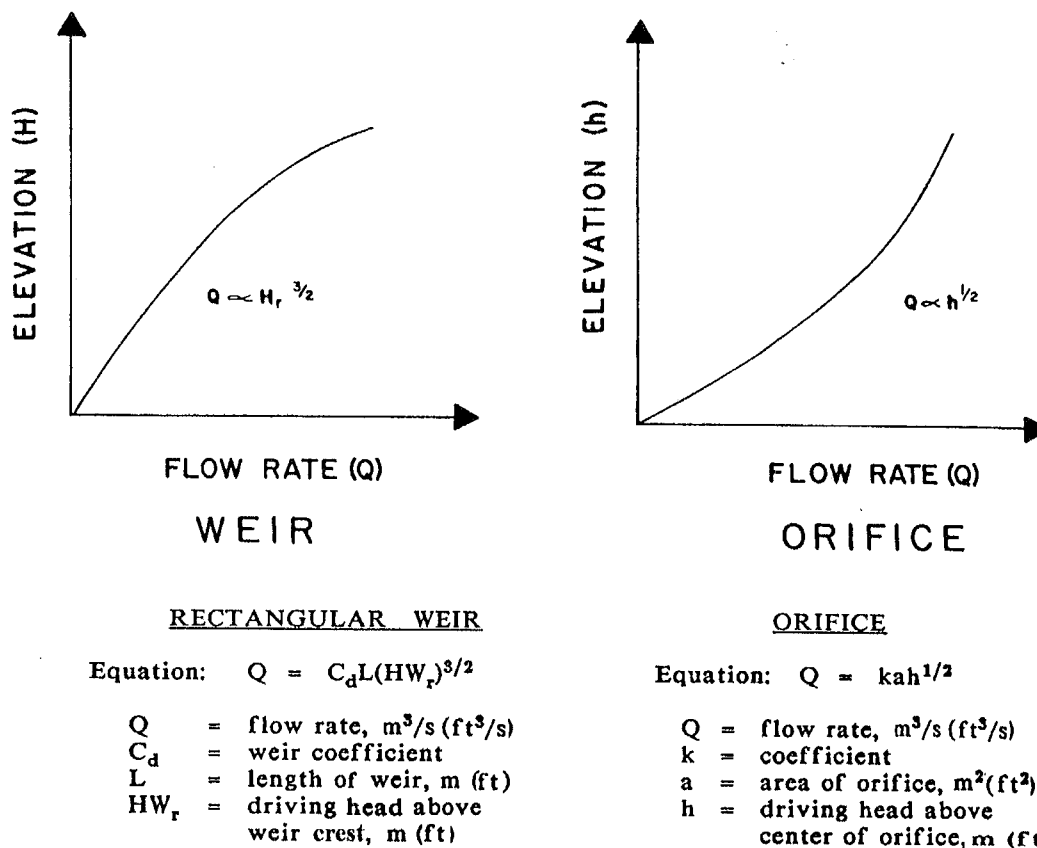


Figure III-15--Performance Curves and Equations for Weirs and Orifices

When a tailwater exists, the control device may be submerged so that more than one flow-versus-elevation relationship exists. Then, the performance curve is dependent on the variation

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Subject **NEON-WESTERN OVERLAND FLOWS**Date **2/9/2010**By **CRJ****TYPICAL SIDE WIER GEOMETRY**

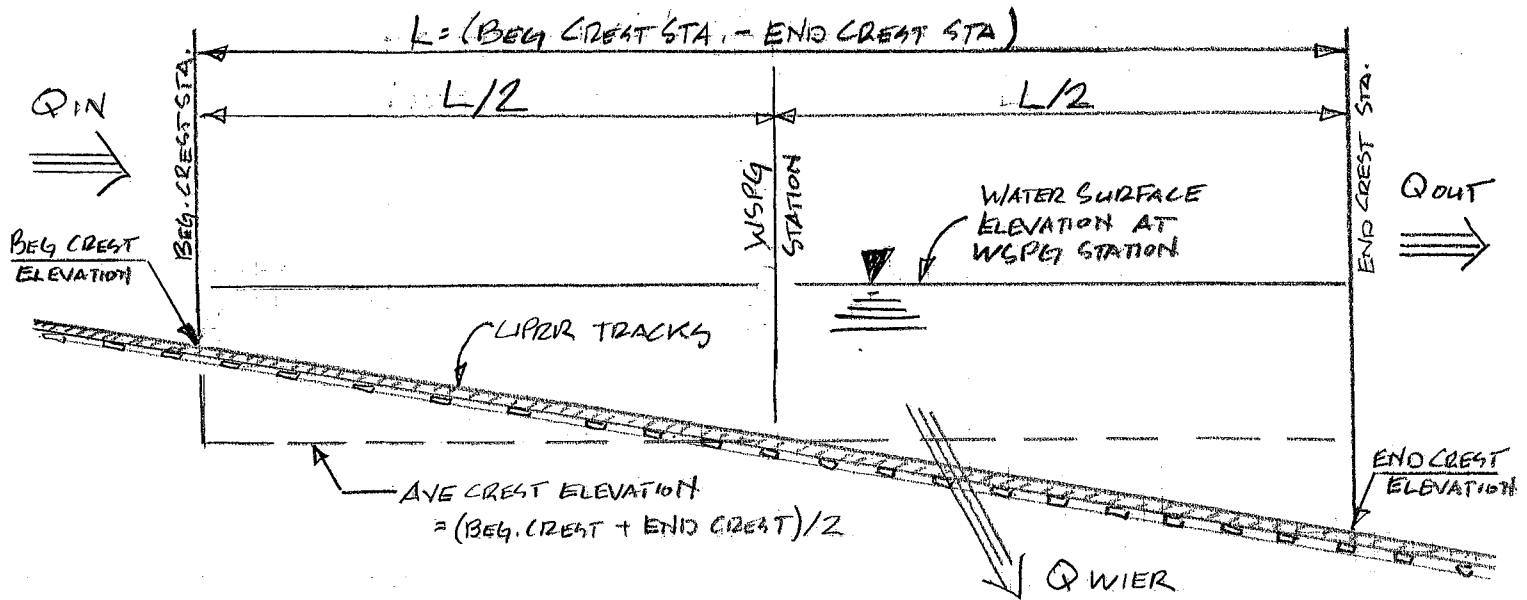
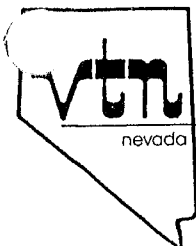
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Revised

By

**TYPICAL SIDE WIER GEOMETRY**

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**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
WIER SPLIT SUMMARY TABLE**

STA.	HEC-RAS WSE	SIDE WIER	Q OVERLAND
18+00	2042.61	0	1163
17+00	2042.60	0	1163
16+00	2042.52	8	1155
15+00	2042.40	51	1104
14+00	2042.03	37	1067
13+00	2041.78	65	1002
12+00	2041.78	178	824
11+00	2041.23	113	711
10+00	2040.85	113	598
9+00	2040.36	79	519
8+00	2040.03	85	434
7+00	2039.41	17	417

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 18+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.61
Enter 1 for gravel, 0 for paved	1
Beg Sta	18+50
Beg Crest	2043.355
End Sta	17+50
End Crest	2043.05
Ave Crest	2043.203
L	1+00
L_r	40
H_{Wr}	-0.591
H_{Wr}/L_r	-0.01
C_r	#N/A
Q_o	0.00

Q Sta 19+00	1163.00
Wier Out	0.00
Q Sta 18+00	1163.00

$H_{Wr}/L_r < .15$ #N/A

$H_{Wr}/L_r > .15$ #N/A

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 17+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.60
Enter 1 for gravel, 0 for paved	1
Beg Sta	17+50
Beg Crest	2043.05
End Sta	16+50
End Crest	2042.64
Ave Crest	2042.845
L	1+00
L_r	40
H_{Wr}	-0.245
H_{Wr}/L_r	-0.01
C_r	#N/A
Q_o	0.00

Q Sta 18+00	1163.00
Wier Out	0.00
Q Sta 17+00	1163.00

$H_{Wr}/L_r < .15$ #N/A

$H_{Wr}/L_r > .15$ #N/A

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 16+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.52
Enter 1 for gravel, 0 for paved	1
Beg Sta	16+50
Beg Crest	2042.64
End Sta	15+50
End Crest	2042.2
Ave Crest	2042.420
L	1+00
L_r	40
H_{Wr}	0.102
H_{Wr}/L_r	0.00
C_r	2.540
Q_o	8.27

Q Sta 17+00	1163.00
Wier Out	8.27
Q Sta 16+00	1154.73

$H_{Wr}/L_r < .15$	2.540
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 15+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.40
Enter 1 for gravel, 0 for paved	1
Beg Sta	15+50
Beg Crest	2042.2
End Sta	14+50
End Crest	2041.93
Ave Crest	2042.065
L	1+00
L_r	40
H_{Wr}	0.335
H_{Wr}/L_r	0.01
C_r	2.633
Q_o	50.97

Q Sta 16+00	1154.73
Wier Out	50.97
Q Sta 15+00	1103.76

$H_{Wr}/L_r < .15$	2.633
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 14+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.03
Enter 1 for gravel, 0 for paved	1
Beg Sta	14+50
Beg Crest	2041.93
End Sta	13+50
End Crest	2041.59
Ave Crest	2041.760
L	1+00
L_r	40
H_{Wr}	0.271
H_{Wr}/L_r	0.01
C_r	2.605
Q_o	36.72

Q Sta 15+00	1103.76
Wier Out	36.72
Q Sta 14+00	1067.04

$H_{Wr}/L_r < .15$	2.605
$H_{Wr}/L_r > .15$	2.900

**DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 13+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2041.78
Enter 1 for gravel, 0 for paved	1
Beg Sta	13+50
Beg Crest	2041.59
End Sta	12+50
End Crest	2041.19
Ave Crest	2041.390
L	1+00
L_r	40
H_{Wr}	0.392
H_{Wr}/L_r	0.01
C_r	2.648
Q_o	65.06

Q Sta 14+00	1067.04
Wier Out	65.06
Q Sta 13+00	1001.99

$H_{Wr}/L_r < .15$	2.648
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 12+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2041.78
Enter 1 for gravel, 0 for paved	1
Beg Sta	12+50
Beg Crest	2041.19
End Sta	11+50
End Crest	2040.87
Ave Crest	2041.030
L	1+00
L_r	40
H_{Wr}	0.747
H_{Wr}/L_r	0.02
C_r	2.759
Q_o	178.31

Q Sta 13+00	1001.99
Wier Out	178.31
Q Sta 12+00	823.68

$H_{Wr}/L_r < .15$	2.759
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 11+00**

$$Q_o = C_r L H W_r^{1.5}$$

Q_o=Overtopping flow rate

C_d = Ovetopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{W_r} = Upstream Depth (WSE-Crest Elevation)

WSE	2041.23
Enter 1 for gravel, 0 for paved	1
Beg Sta	11+50
Beg Crest	2040.87
End Sta	10+50
End Crest	2040.47
Ave Crest	2040.670
L	1+00
L _r	40
H _{W_r}	0.556
H _{W_r} /L _r	0.01
C _r	2.724
Q _o	113.03

Q Sta 12+00	823.68
Wier Out	113.03
Q Sta 11+00	710.64

H _{W_r} /L _r <.15	2.724
H _{W_r} /L _r >.15	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 10+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2040.85
Enter 1 for gravel, 0 for paved	1
Beg Sta	10+50
Beg Crest	2040.47
End Sta	9+50
End Crest	2040.12
Ave Crest	2040.295
L	1+00
L_r	40
H_{Wr}	0.555
H_{Wr}/L_r	0.01
C_r	2.724
Q_o	112.65

Q Sta 11+00	710.64
Wier Out	112.65
Q Sta 10+00	597.99

$H_{Wr}/L_r < .15$	2.724
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 9+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2040.36
Enter 1 for gravel, 0 for paved	1
Beg Sta	9+50
Beg Crest	2040.12
End Sta	8+50
End Crest	2039.72
Ave Crest	2039.920
L	1+00
L_r	40
H_{Wr}	0.442
H_{Wr}/L_r	0.01
C_r	2.676
Q_o	78.66

Q Sta 10+00	597.99
Wier Out	78.66
Q Sta 9+00	519.33

$H_{Wr}/L_r < .15$	2.676
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 8+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2040.03
Enter 1 for gravel, 0 for paved	1
Beg Sta	8+50
Beg Crest	2039.72
End Sta	7+50
End Crest	2039.4
Ave Crest	2039.560
L	1+00
L_r	40
H_{Wr}	0.465
H_{Wr}/L_r	0.01
C_r	2.684
Q_o	85.24

Q Sta 9+00	519.33
Wier Out	85.24
Q Sta 8+00	434.09

$H_{Wr}/L_r < .15$	2.684
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
HISTORIC CASE GEOMETRY
STATION 7+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2039.41
Enter 1 for gravel, 0 for paved	1
Beg Sta	7+50
Beg Crest	2039.4
End Sta	6+50
End Crest	2039.09
Ave Crest	2039.245
L	1+00
L_r	40
H_{Wr}	0.165
H_{Wr}/L_r	0.00
C_r	2.564
Q_o	17.20

Q Sta 8+00	434.09
Wier Out	17.20
Q Sta 7+00	416.90

$H_{Wr}/L_r < .15$	2.564
$H_{Wr}/L_r > .15$	2.900



Existing Offsite Hydrology Report

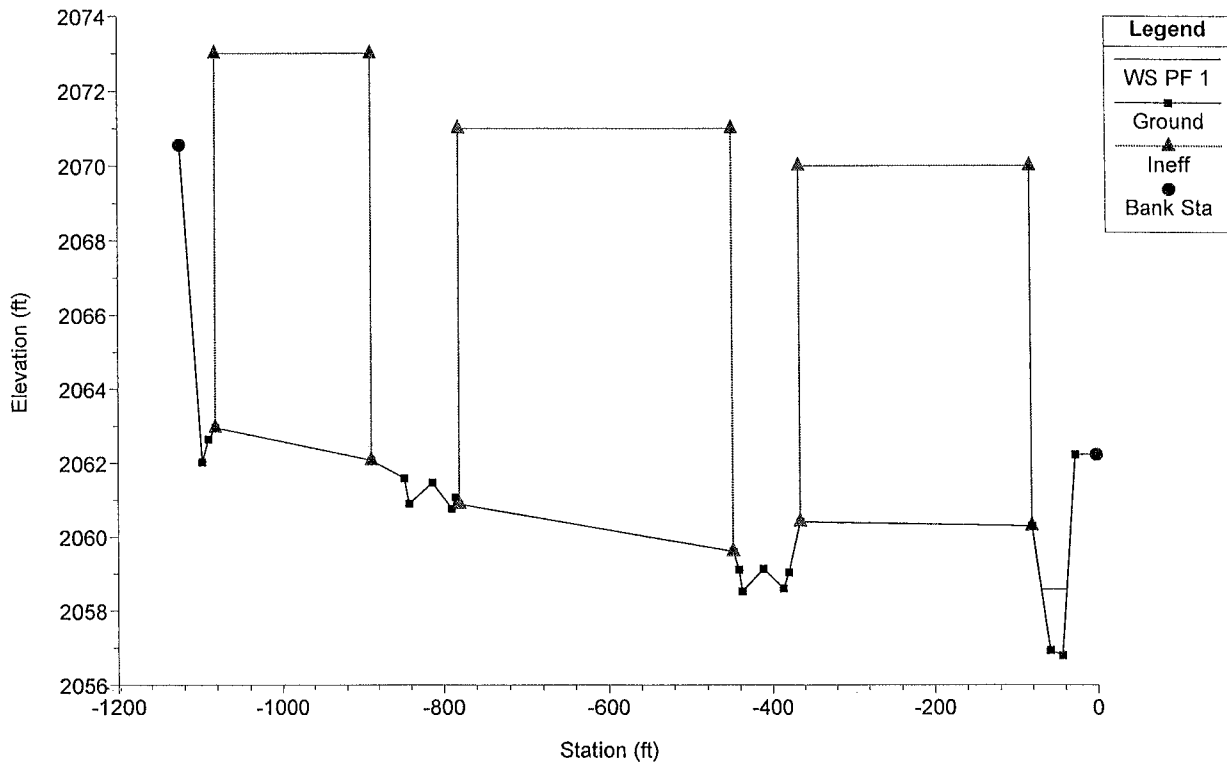
B.5.3

Current Case HEC-RAS Analysis

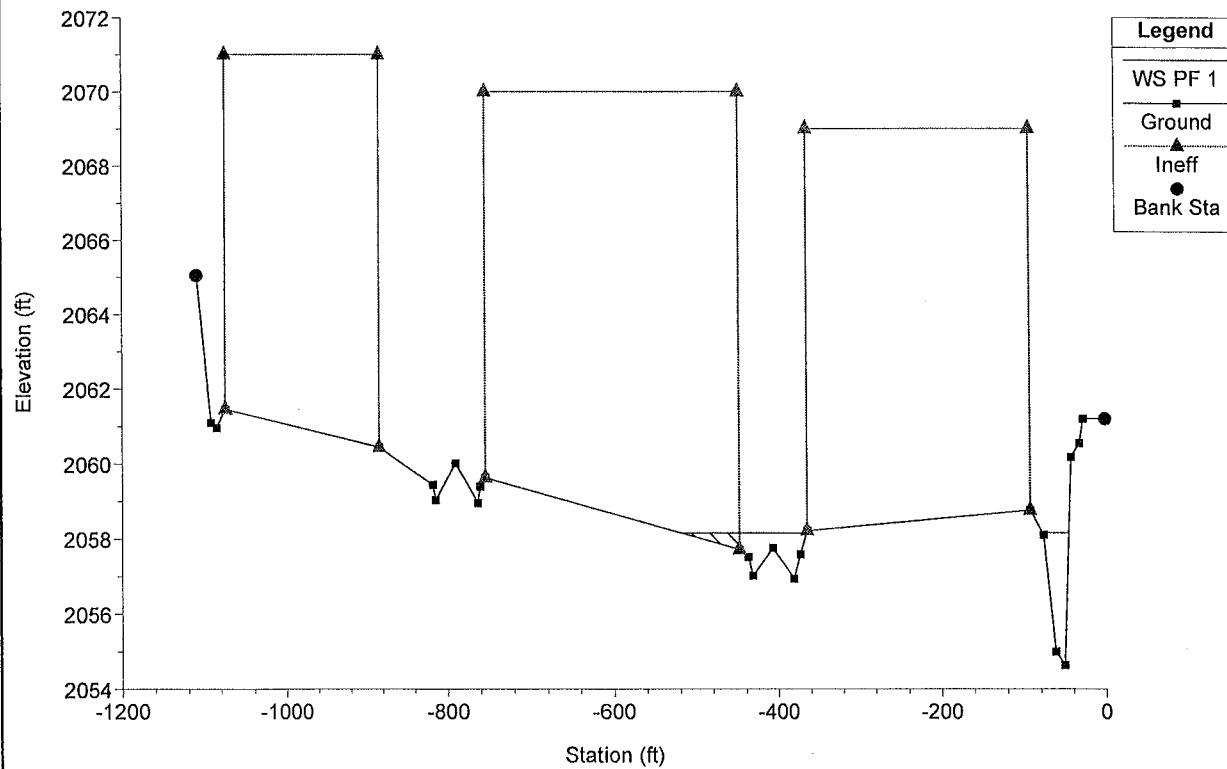
HEC-RAS Plan: Current_Exist River: UPRR Reach: UPRR Profile: PF 1

Reach	River Sta	Profile	Q Total (cfs)	Min Ch El (ft)	W.S. Elev (ft)	Crit W.S. (ft)	E.G. Elev (ft)	E.G. Slope (ft/ft)	Vel Chnl (ft/s)	Flow Area (sq ft)	Top Width (ft)	Froude # Chl
UPRR	6400	PF 1	1163.00	2056.80	2058.58	2059.99	2071.93	0.200400	29.32	39.67	33.89	4.78
UPRR	6200	PF 1	1163.00	2054.63	2058.16	2058.51	2059.38	0.019075	8.88	131.00	186.53	1.47
UPRR	6000	PF 1	1163.00	2052.93	2057.54	2057.03	2057.86	0.003602	4.51	257.74	251.90	0.66
UPRR	5800	PF 1	1163.00	2054.41	2056.33	2056.33	2056.73	0.009825	5.09	228.31	470.10	1.00
UPRR	5600	PF 1	1163.00	2051.15	2055.14	2054.71	2055.31	0.002863	3.36	345.97	472.33	0.57
UPRR	5400	PF 1	1163.00	2049.89	2054.09		2054.51	0.005589	5.23	222.54	457.13	0.81
UPRR	5200	PF 1	1163.00	2049.10	2053.23		2053.55	0.003951	4.51	257.64	419.05	0.69
UPRR	5000	PF 1	1163.00	2048.48	2052.21		2052.56	0.006277	4.74	245.33	456.57	0.83
UPRR	4800	PF 1	1163.00	2046.84	2051.08	2050.82	2051.37	0.005455	4.35	267.34	484.98	0.77
UPRR	4600	PF 1	1163.00	2046.05	2049.88		2050.22	0.006023	4.72	246.66	543.00	0.82
UPRR	4400	PF 1	1163.00	2044.97	2049.12		2049.32	0.003211	3.58	325.01	682.68	0.60
UPRR	4200	PF 1	1163.00	2044.84	2047.89	2047.84	2048.32	0.008384	5.26	220.85	423.01	0.95
UPRR	4000	PF 1	1163.00	2044.49	2046.89		2047.18	0.003868	4.31	269.62	660.98	0.68
UPRR	3800	PF 1	1163.00	2042.98	2046.53		2046.69	0.001454	3.26	356.41	510.35	0.44
UPRR	3600	PF 1	1163.00	2042.45	2046.16		2046.29	0.002748	2.88	403.66	600.13	0.54
UPRR	3400	PF 1	1163.00	2041.91	2045.83		2045.94	0.001168	2.62	444.45	400.77	0.38
UPRR	3200	PF 1	1163.00	2042.94	2045.17	2045.00	2045.48	0.005575	4.43	262.58	477.85	0.78
UPRR	3000	PF 1	1163.00	2040.40	2044.56		2044.73	0.002445	3.31	350.87	444.87	0.53
UPRR	2800	PF 1	1163.00	2041.09	2043.92		2044.16	0.003323	3.88	299.84	404.36	0.62
UPRR	2600	PF 1	1163.00	2039.06	2043.42		2043.62	0.002143	3.54	328.82	538.20	0.51
UPRR	2400	PF 1	1163.00	2039.98	2043.20		2043.30	0.001063	2.54	457.02	526.22	0.36
UPRR	2200	PF 1	1163.00	2039.46	2042.91		2043.05	0.001492	2.92	398.14	517.76	0.43
UPRR	2000	PF 1	1163.00	2039.62	2042.33		2042.58	0.003734	4.01	289.80	511.99	0.66
UPRR	1800	PF 1	1163.00	2038.36	2042.34		2042.38	0.000273	1.57	740.57	465.96	0.19
UPRR	1700	PF 1	1163.00	2036.98	2042.34		2042.36	0.000120	1.04	1122.54	555.06	0.13
UPRR	1600	PF 1	1163.00	2036.26	2042.31		2042.34	0.000313	1.44	807.74	502.74	0.20
UPRR	1500	PF 1	1140.00	2036.76	2042.26		2042.30	0.000444	1.52	748.03	554.77	0.23
UPRR	1400	PF 1	1108.00	2036.14	2042.01		2042.18	0.005889	3.34	331.89	526.97	0.74
UPRR	1300	PF 1	1074.00	2035.86	2041.65		2041.75	0.002969	2.53	424.34	611.49	0.54
UPRR	1200	PF 1	999.00	2035.80	2041.46		2041.53	0.001489	2.10	475.44	540.34	0.39
UPRR	1100	PF 1	852.00	2036.04	2041.33		2041.39	0.001283	2.05	416.31	439.97	0.37
UPRR	1000	PF 1	709.00	2035.97	2040.94		2041.16	0.004836	3.76	188.38	214.90	0.71
UPRR	900	PF 1	597.00	2035.57	2040.47		2040.70	0.004401	3.82	156.48	162.65	0.69
UPRR	800	PF 1	485.00	2035.17	2040.11		2040.29	0.003526	3.34	145.27	155.94	0.61
UPRR	700	PF 1	464.00	2036.76	2039.44	2039.44	2039.66	0.014473	3.73	124.52	330.48	1.07
UPRR	600	PF 1	464.00	2038.26	2038.07	2038.39	2038.83	0.015114		66.38	124.51	0.00

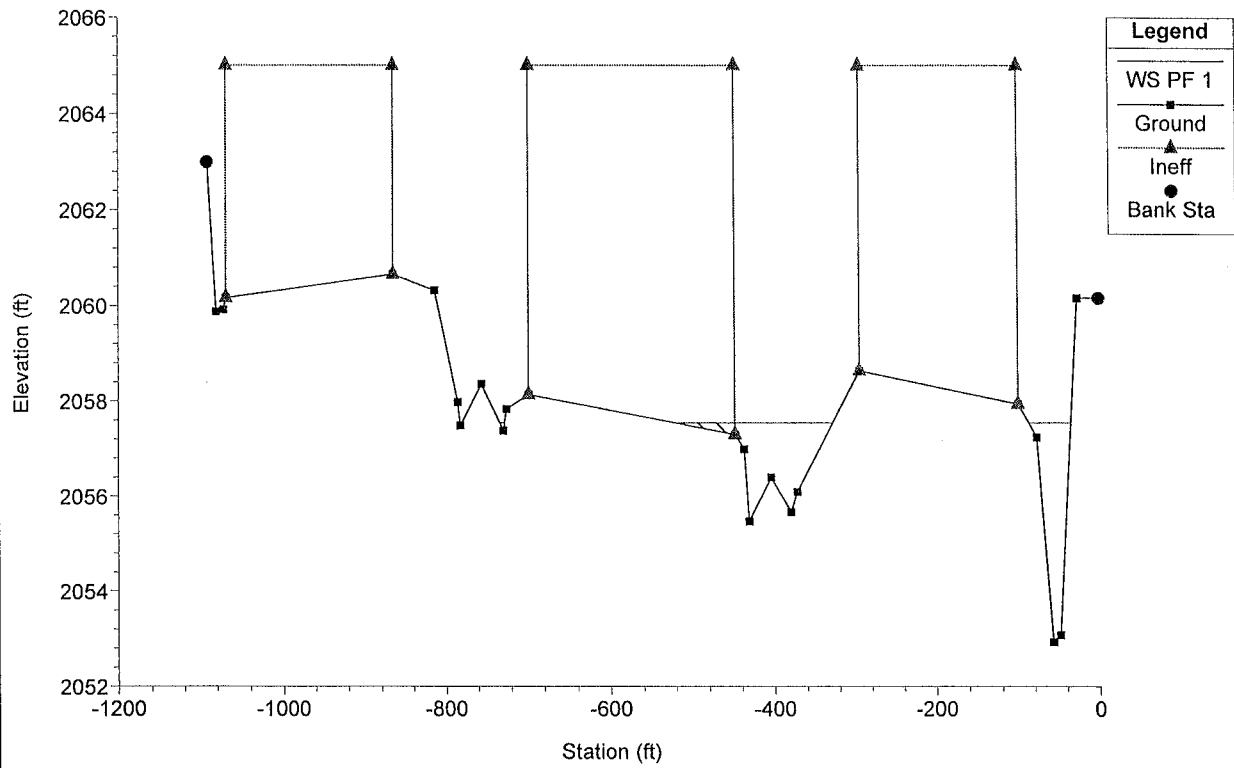
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64+00



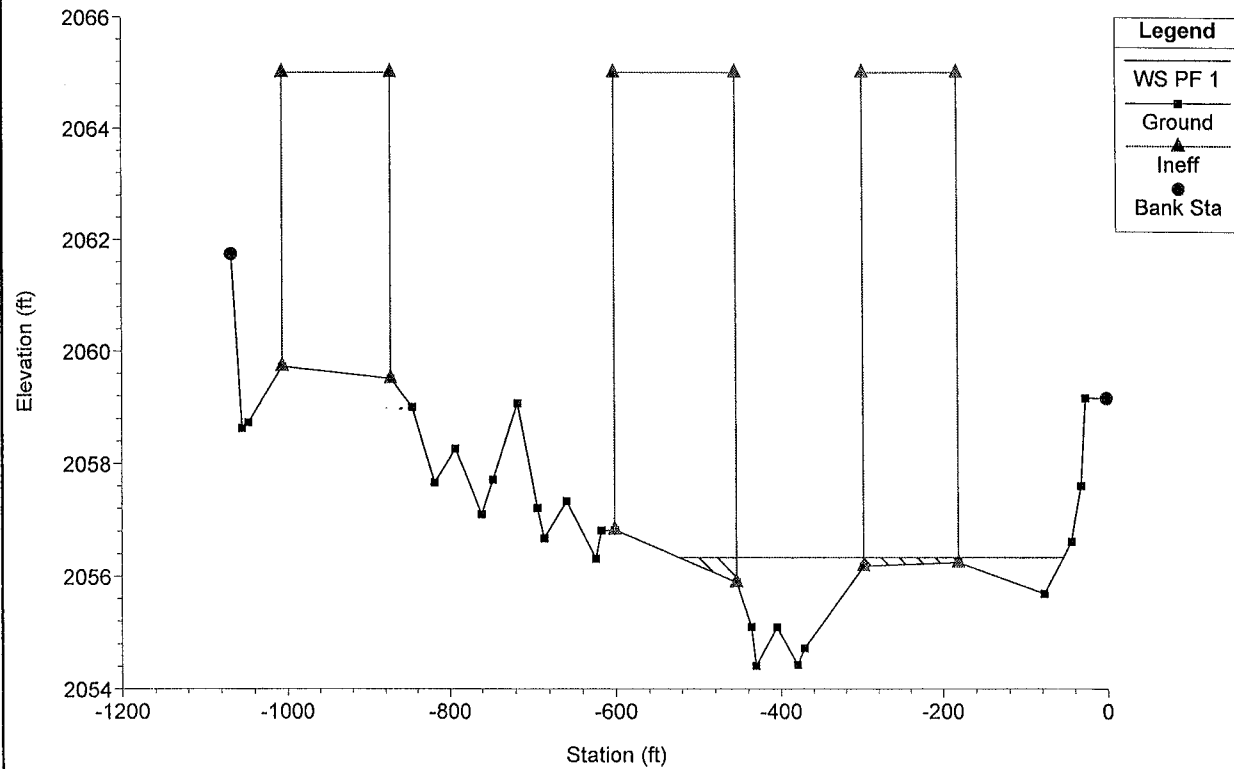
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62+00



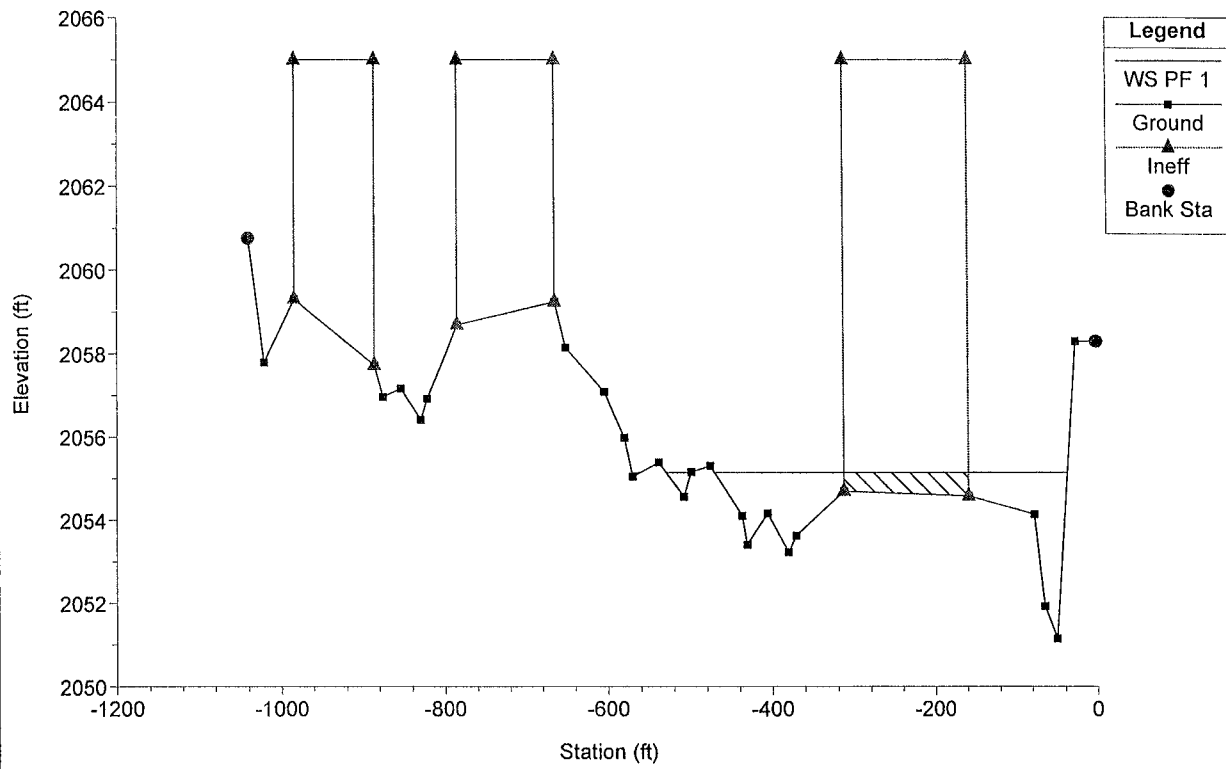
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60+00



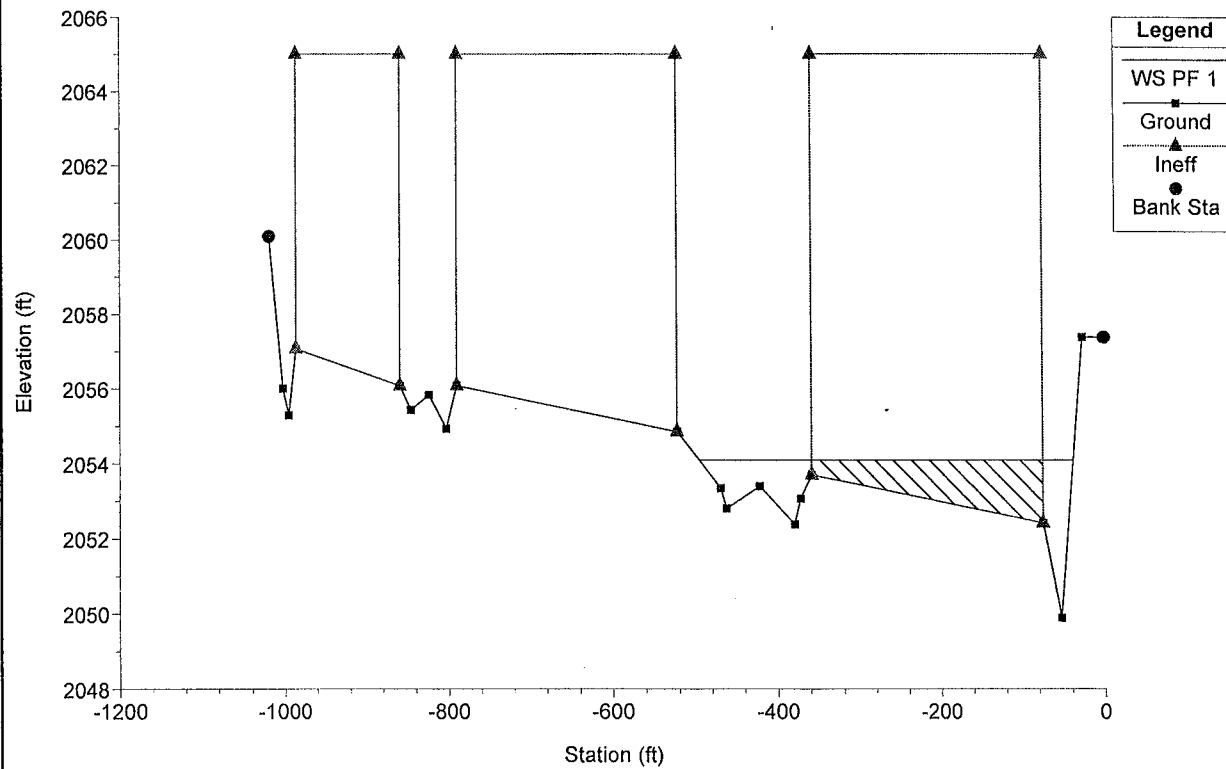
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58+00



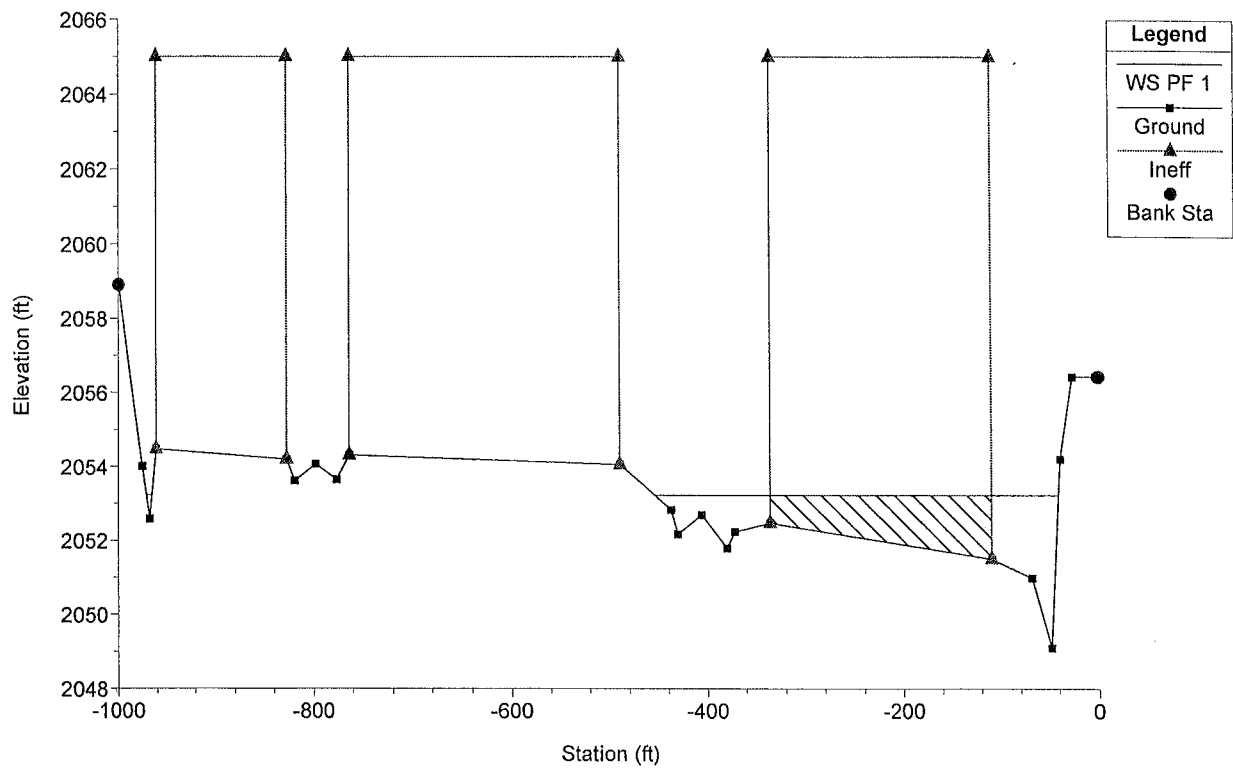
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56+00



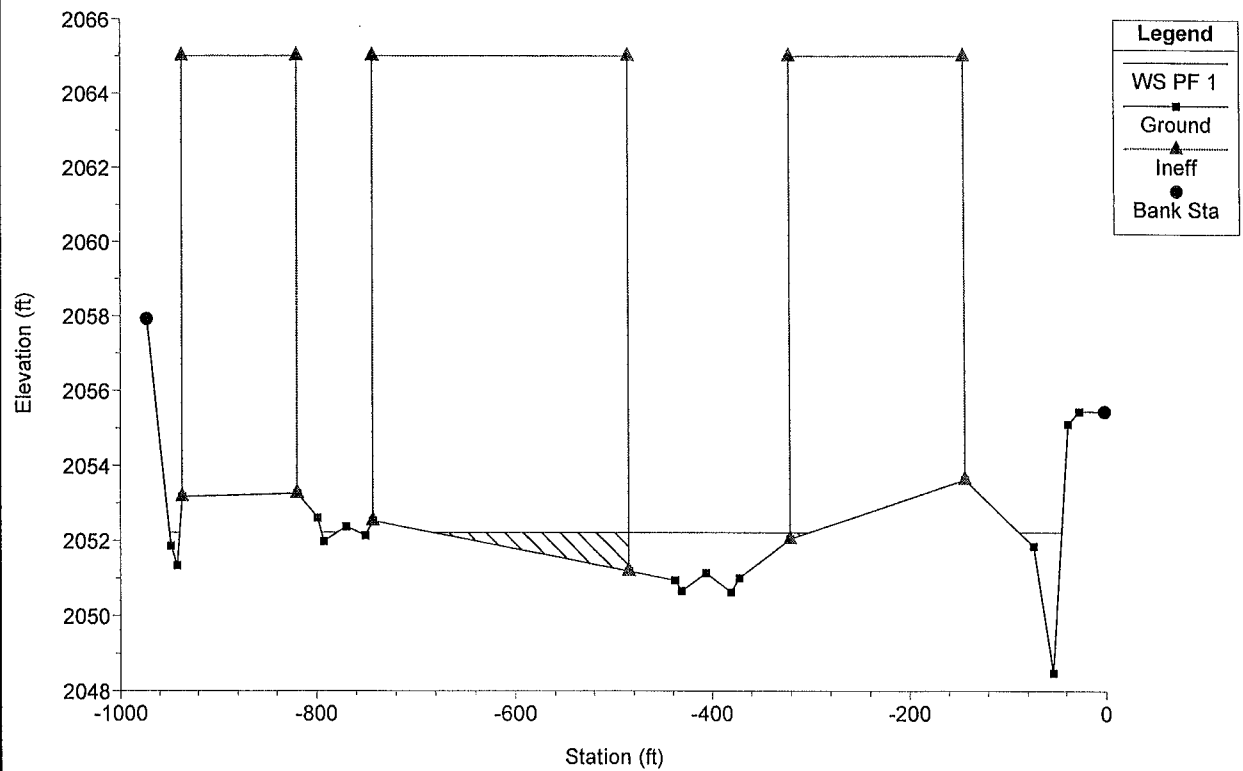
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54+00



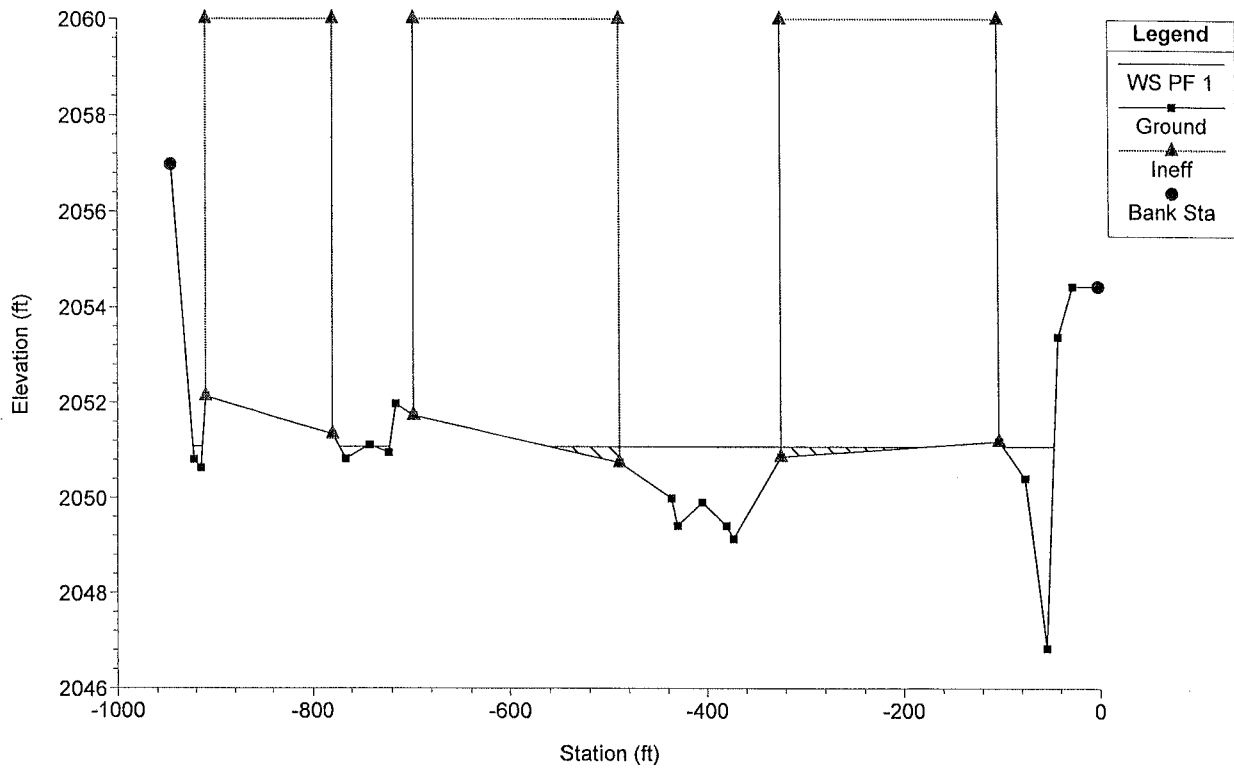
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52+00



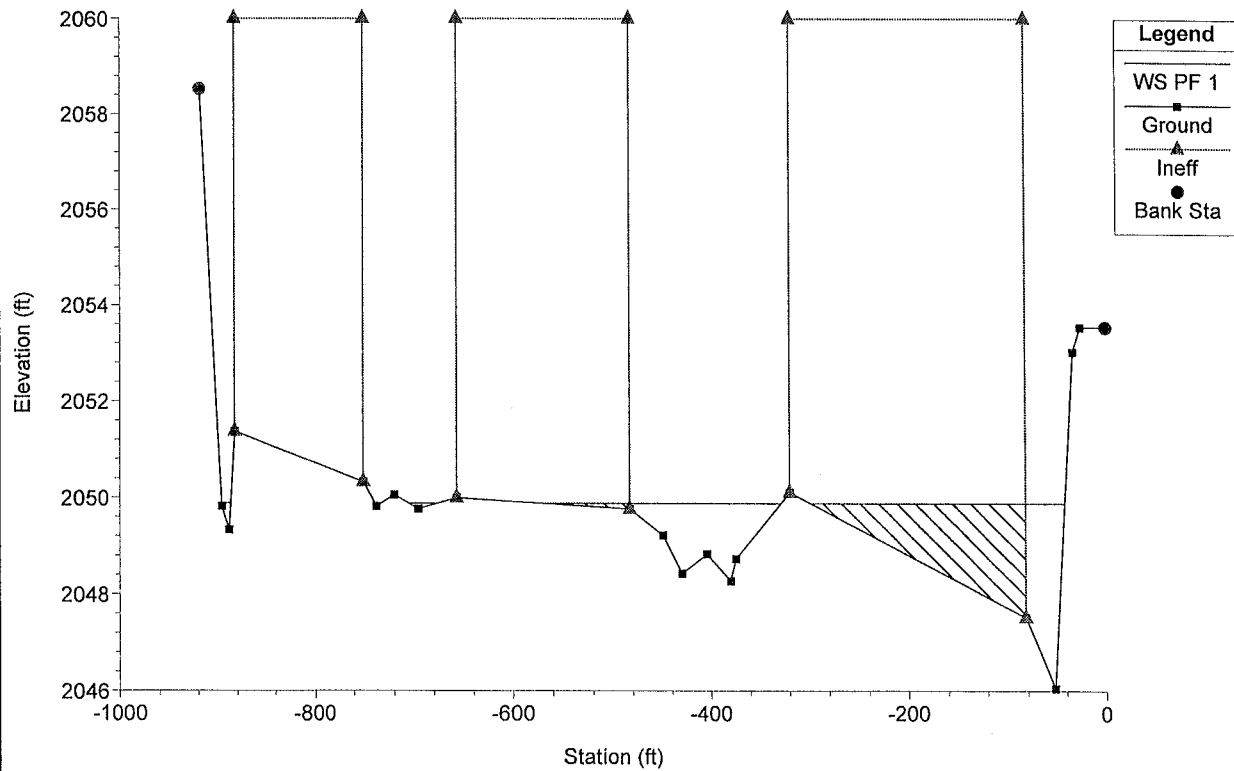
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50+00



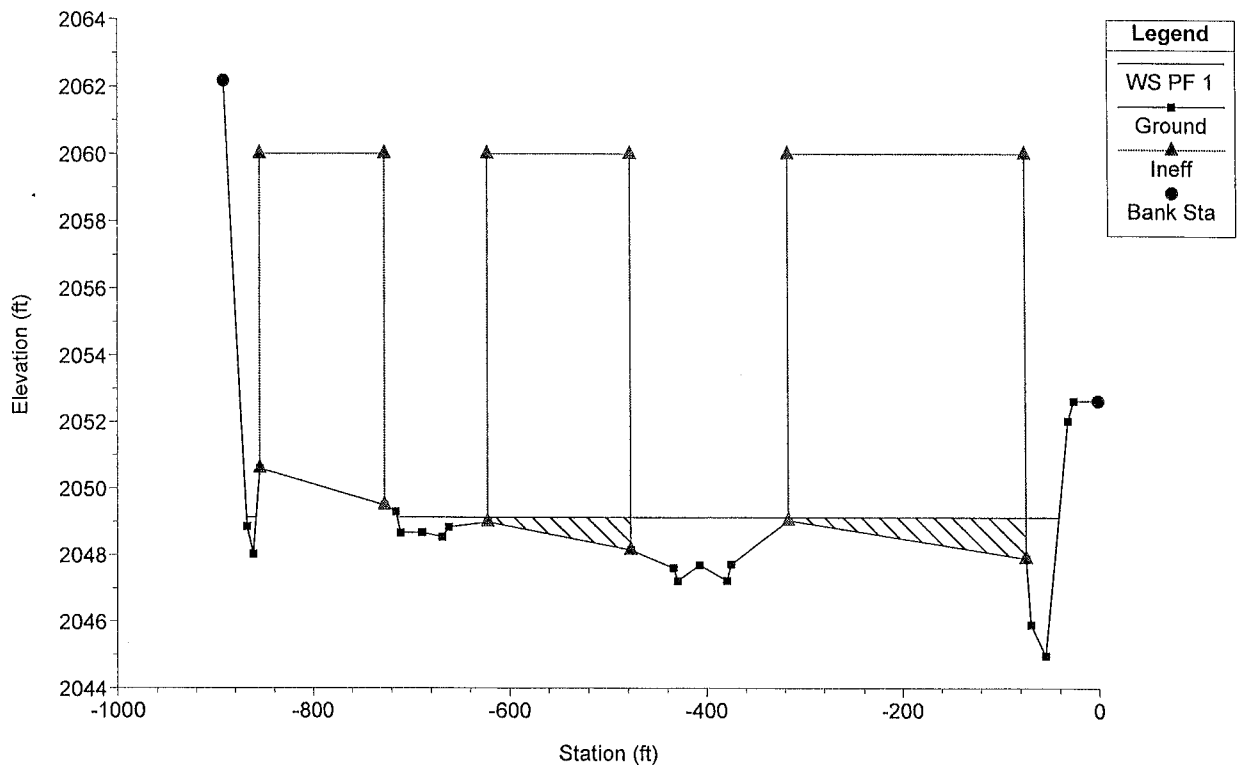
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48+00



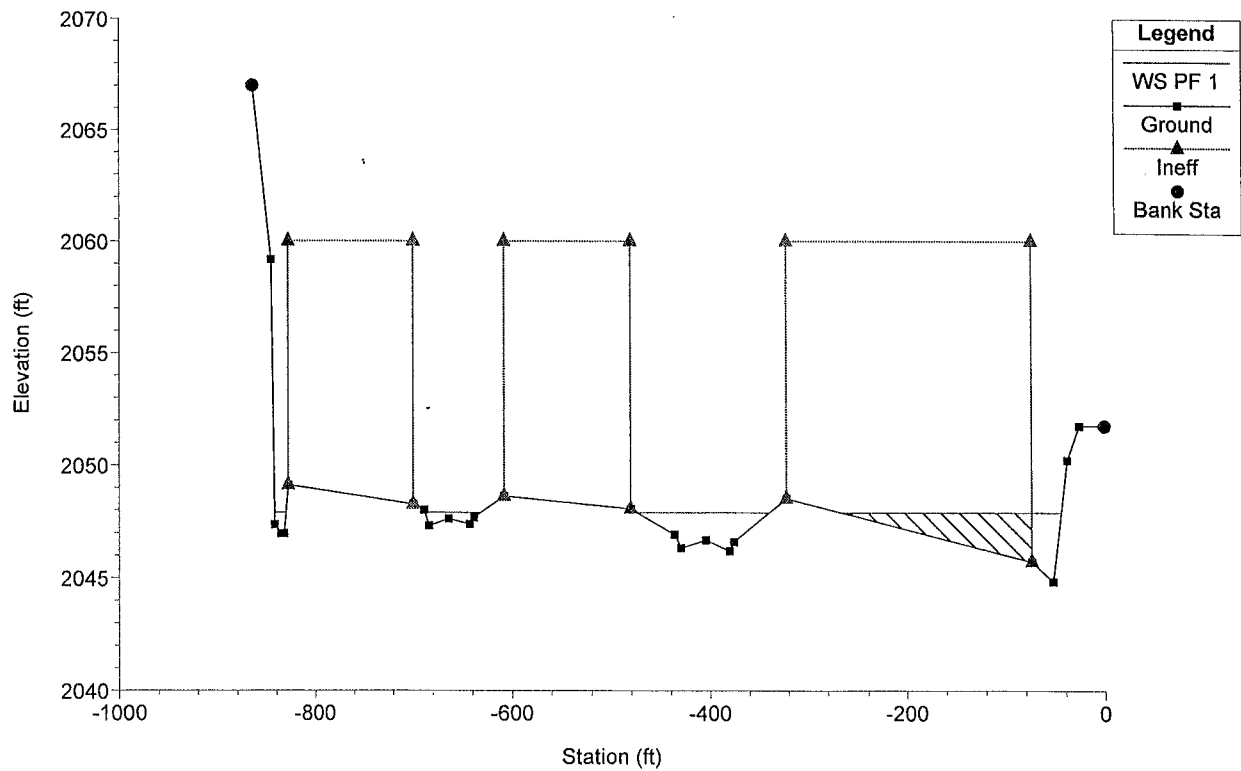
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46+00



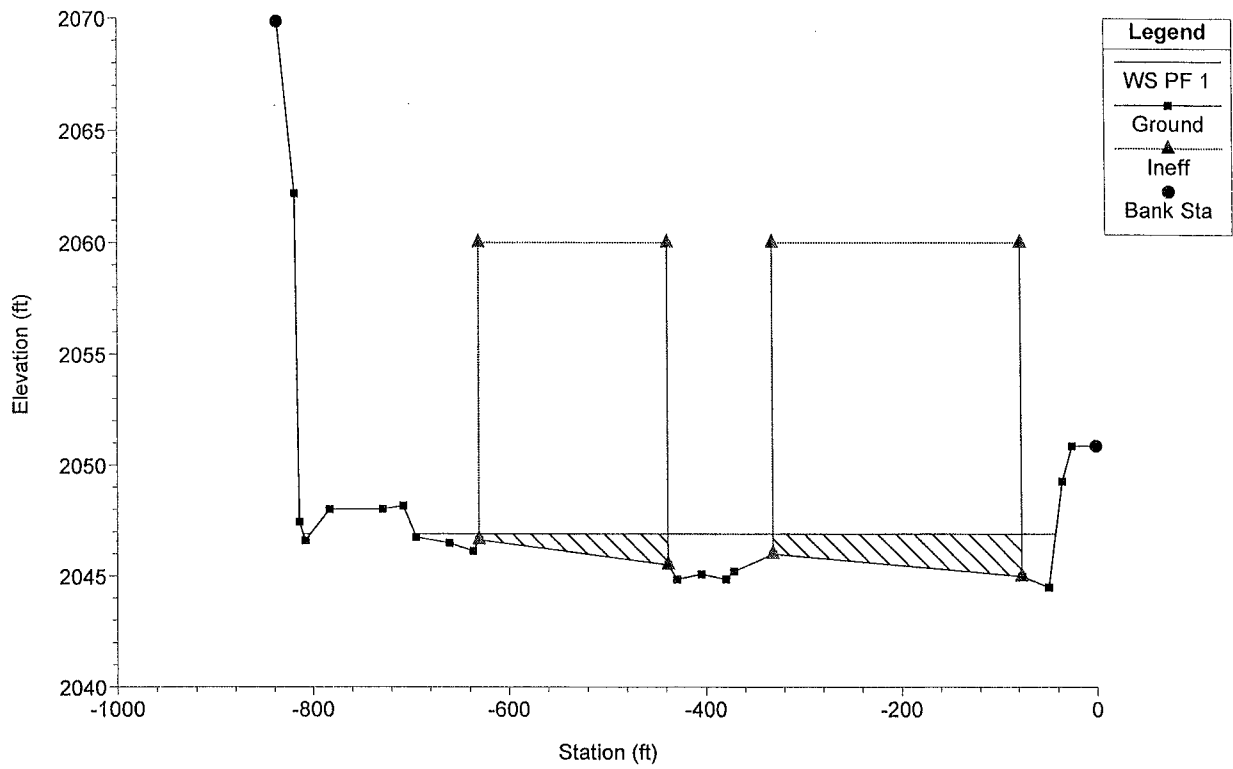
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44+00



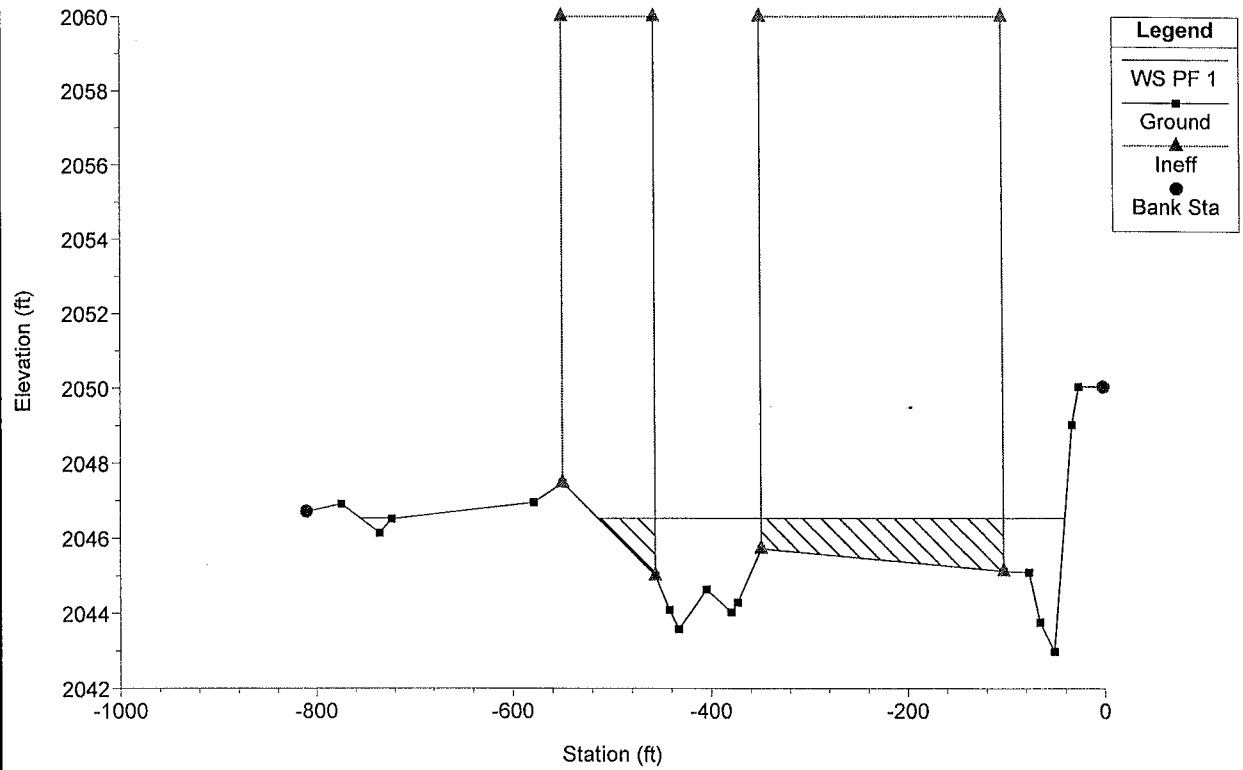
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42+00



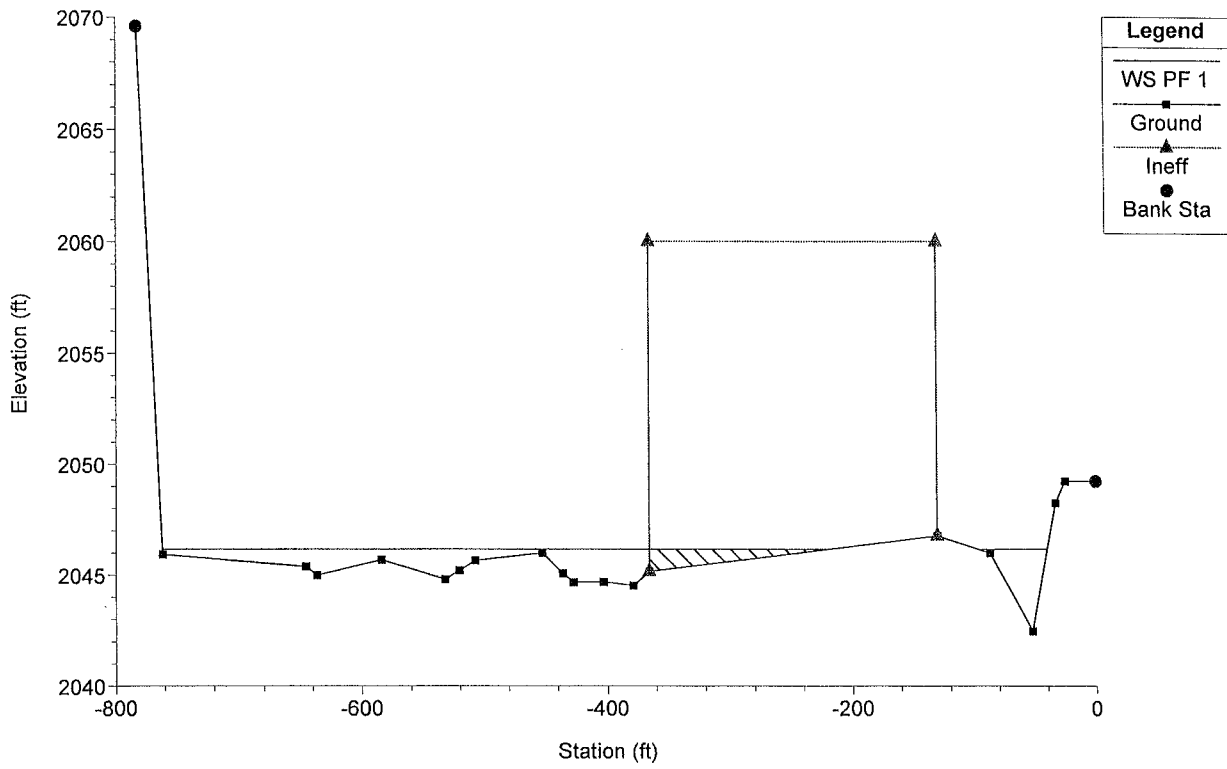
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40+00



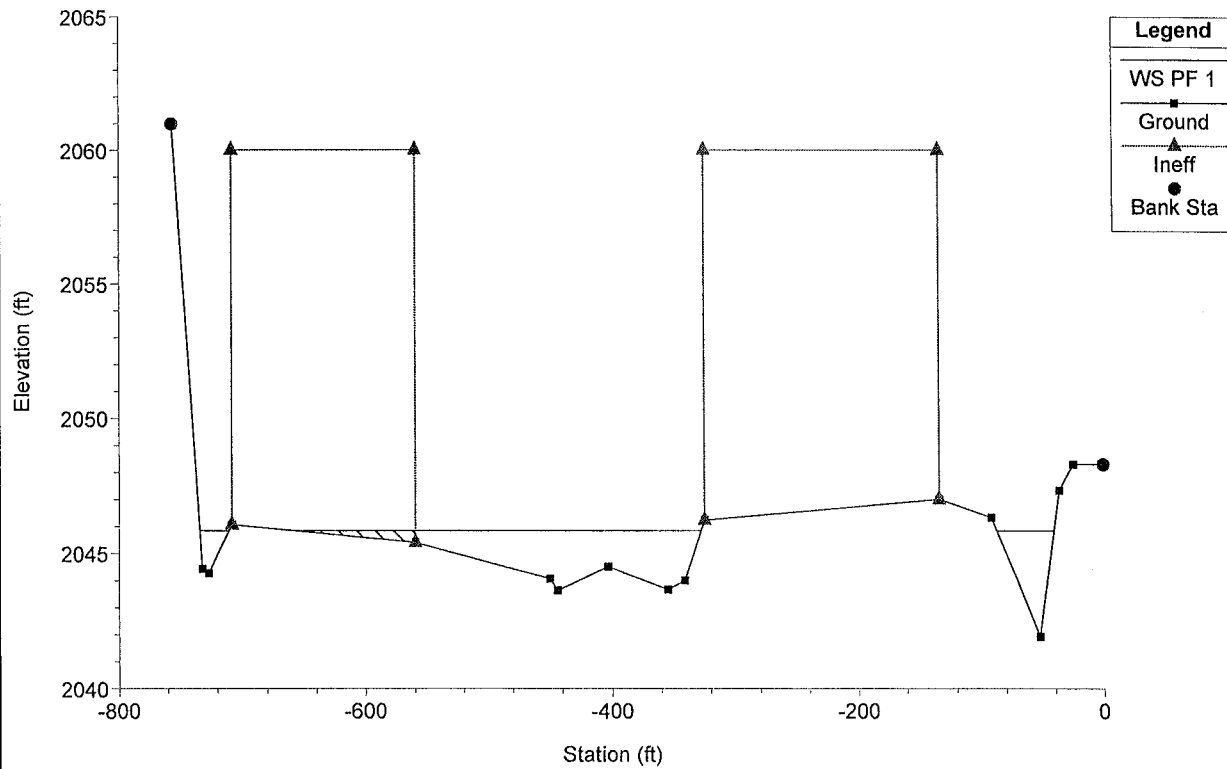
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38+00



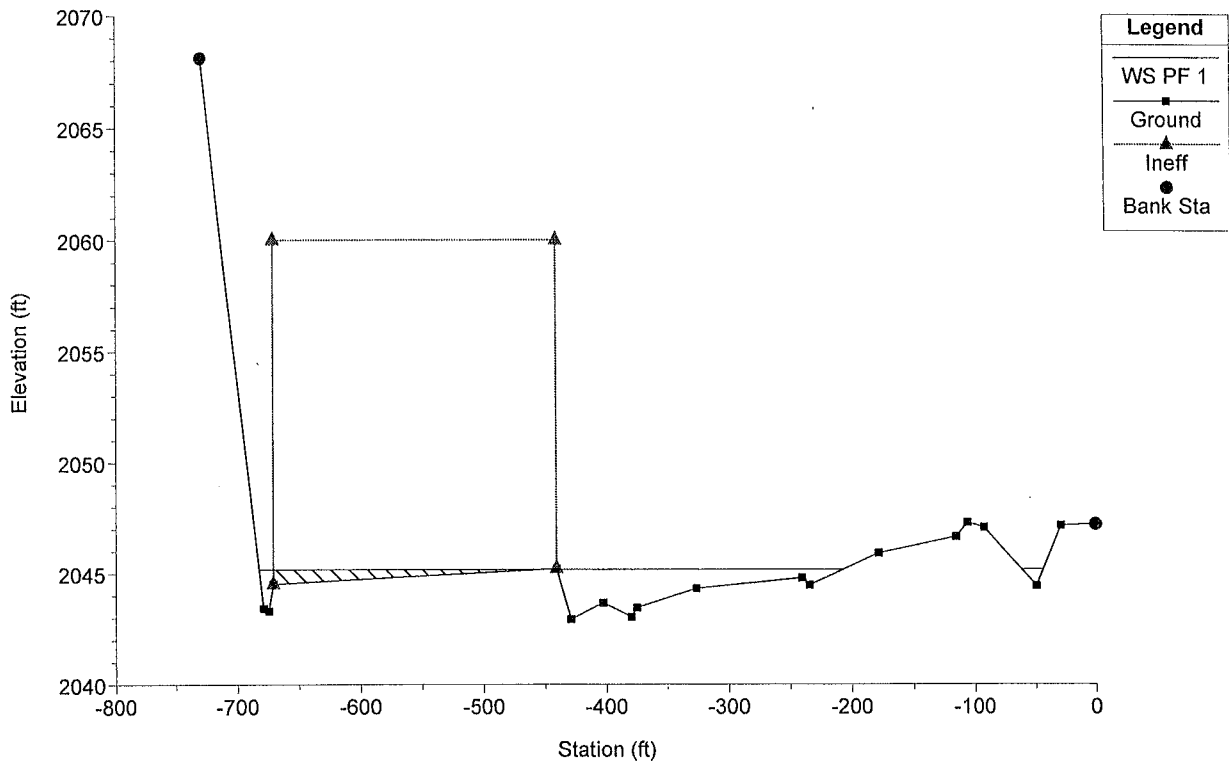
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36+00



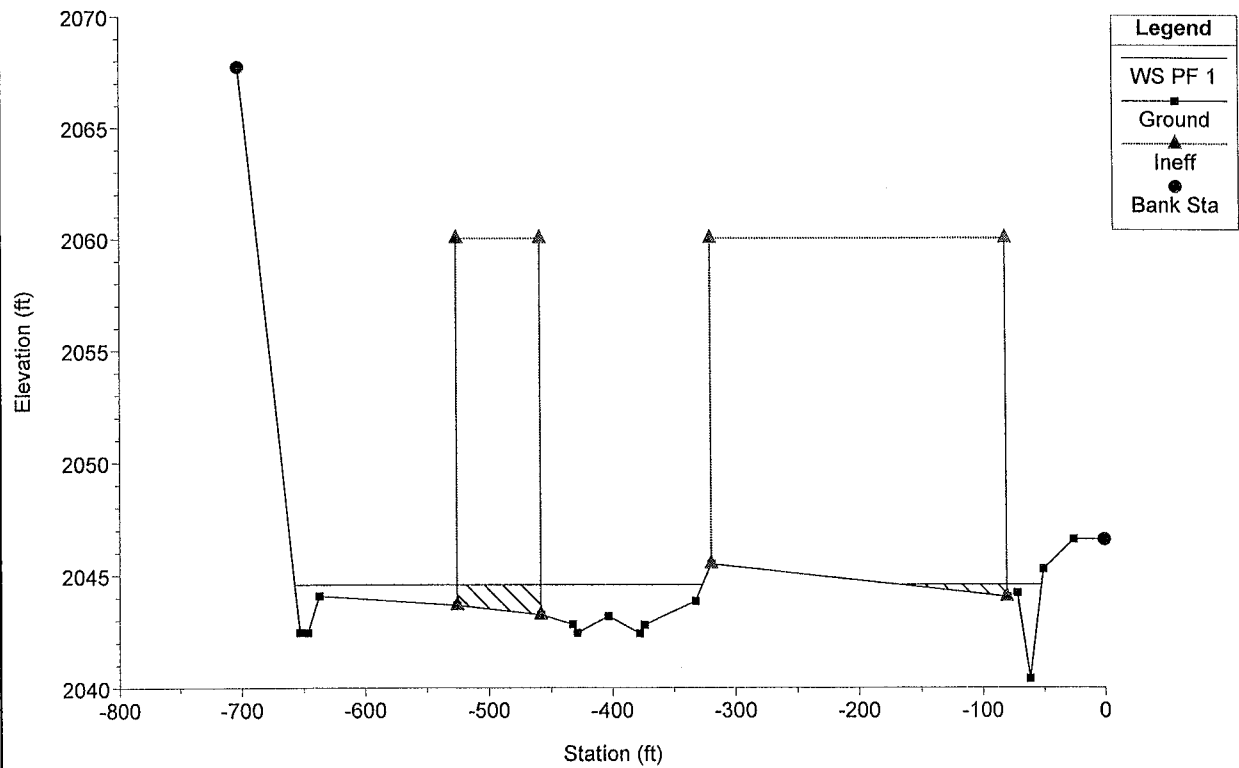
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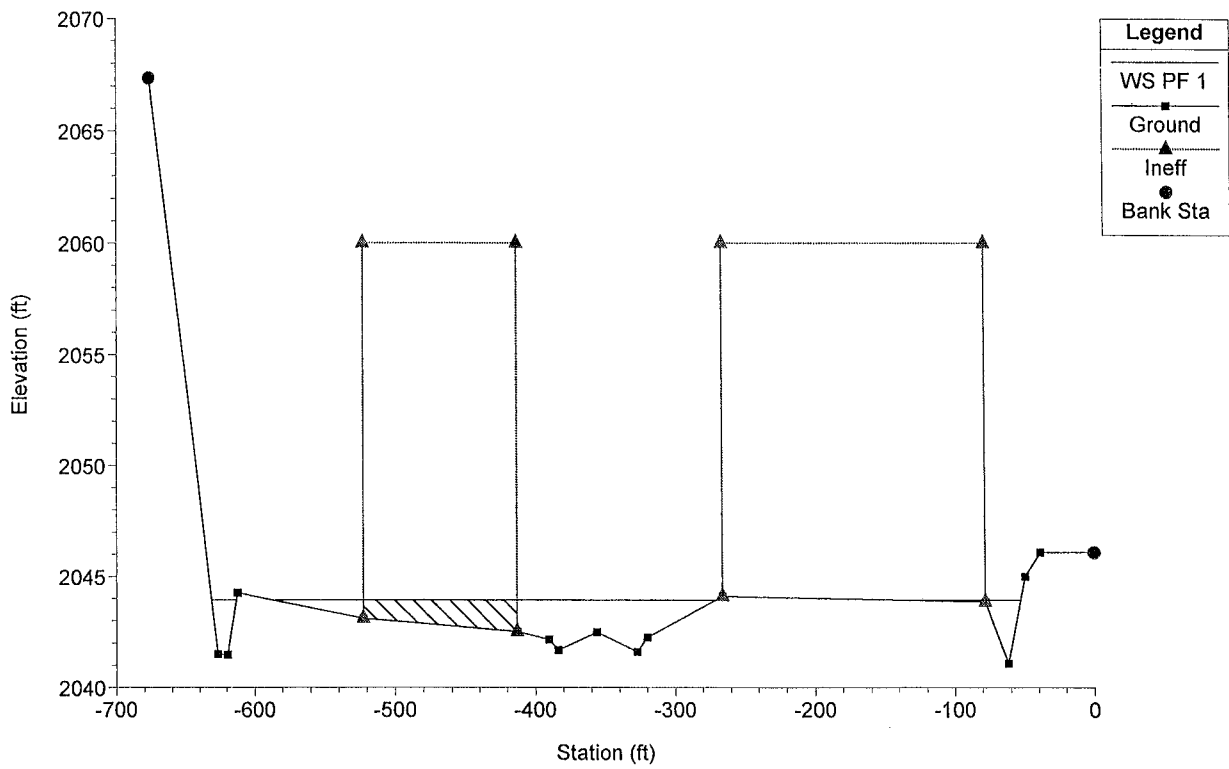
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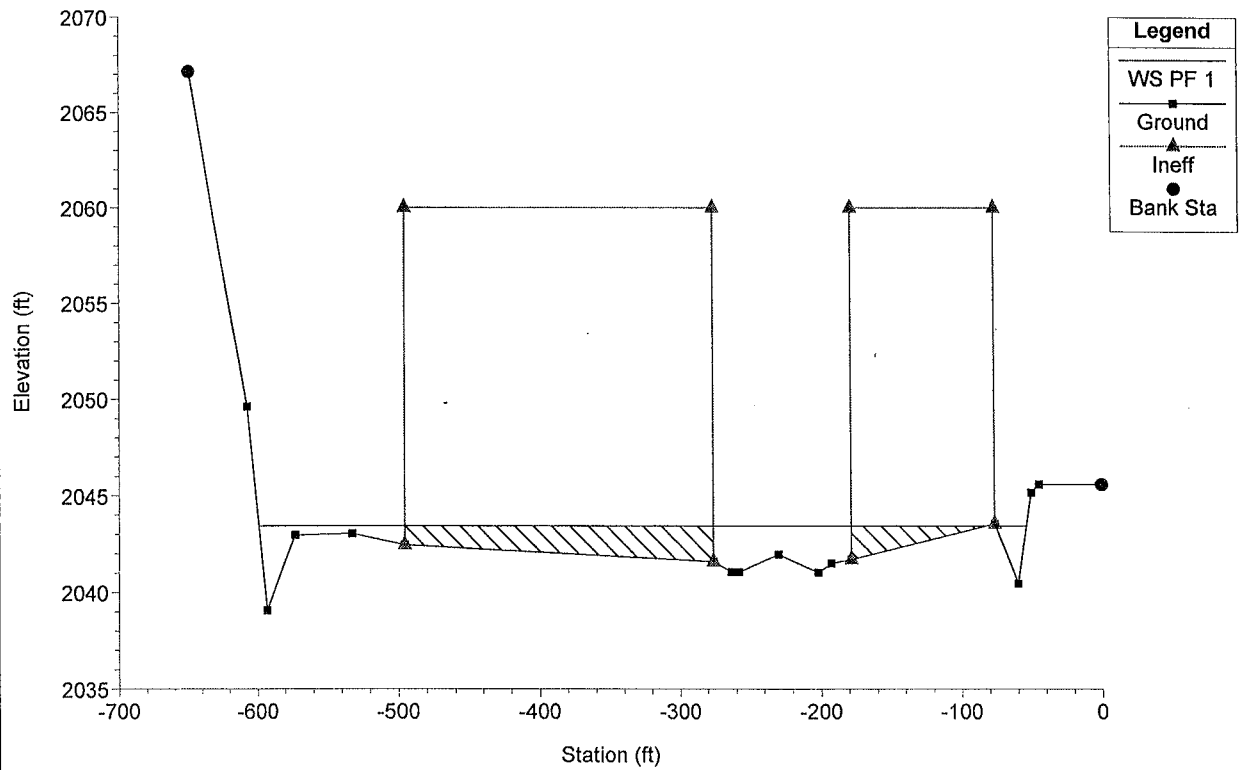
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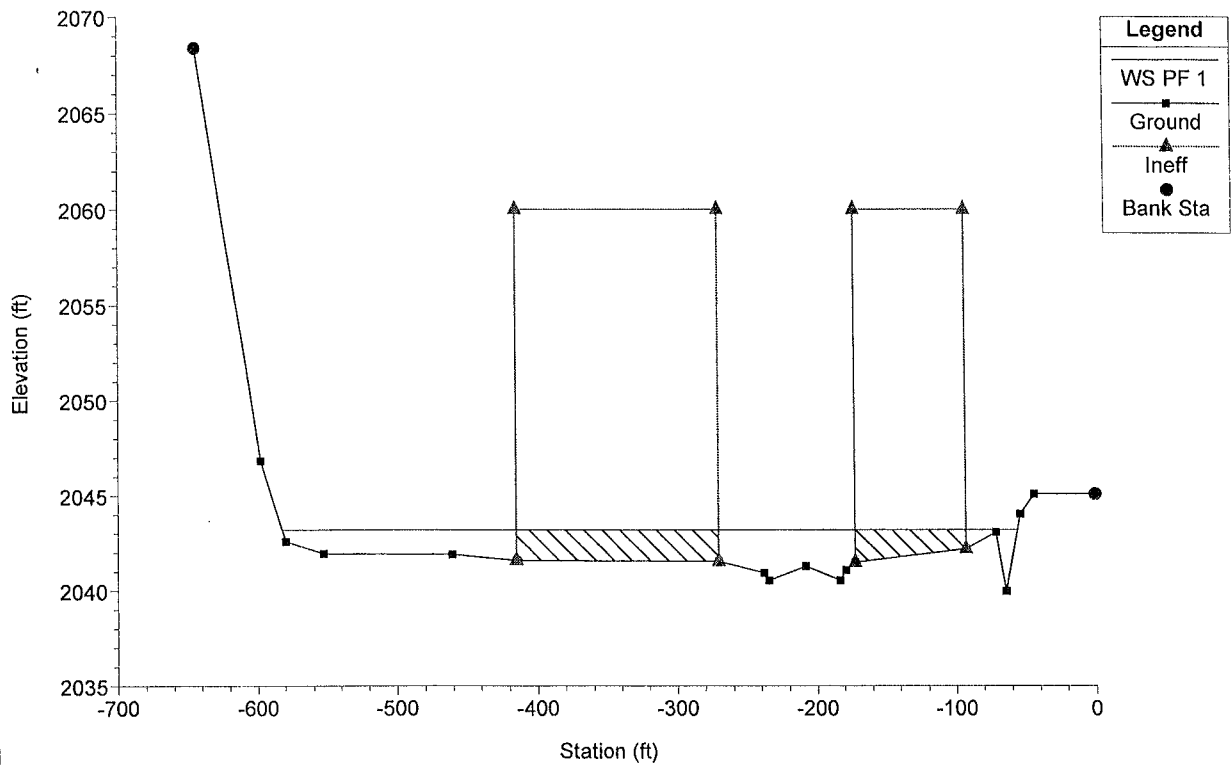
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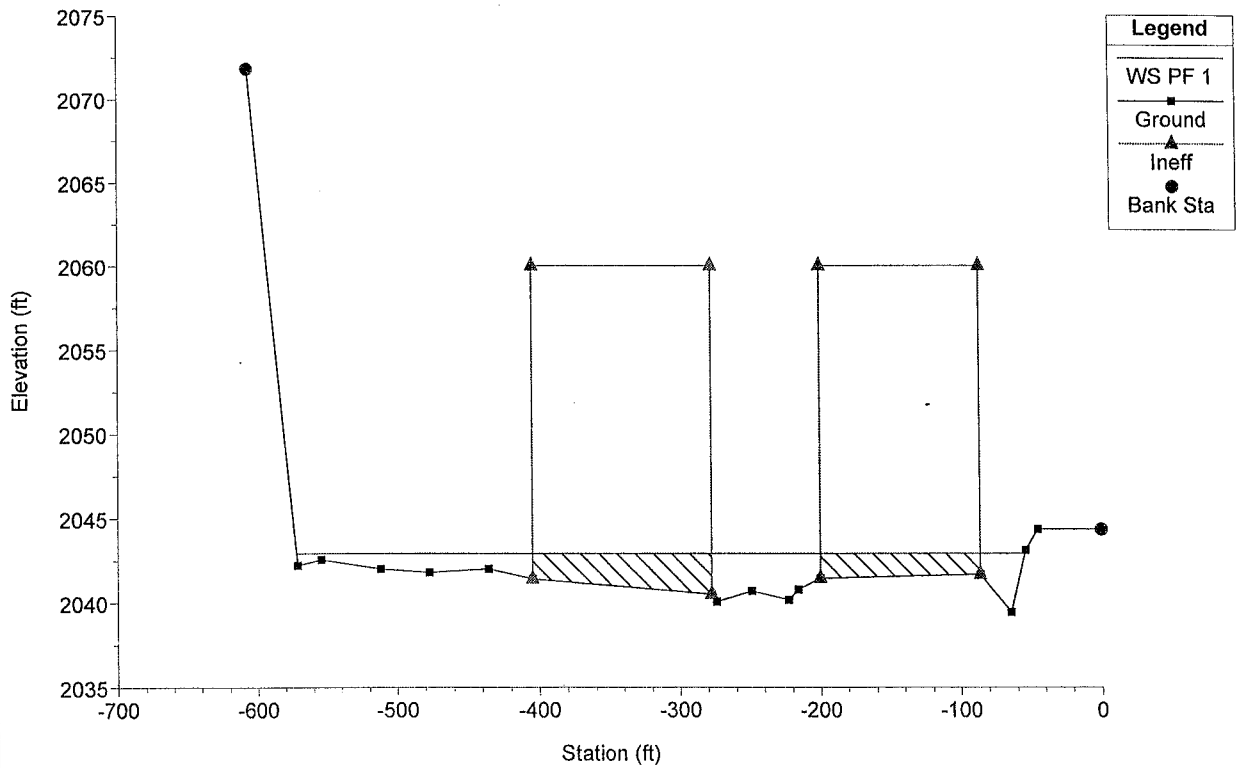
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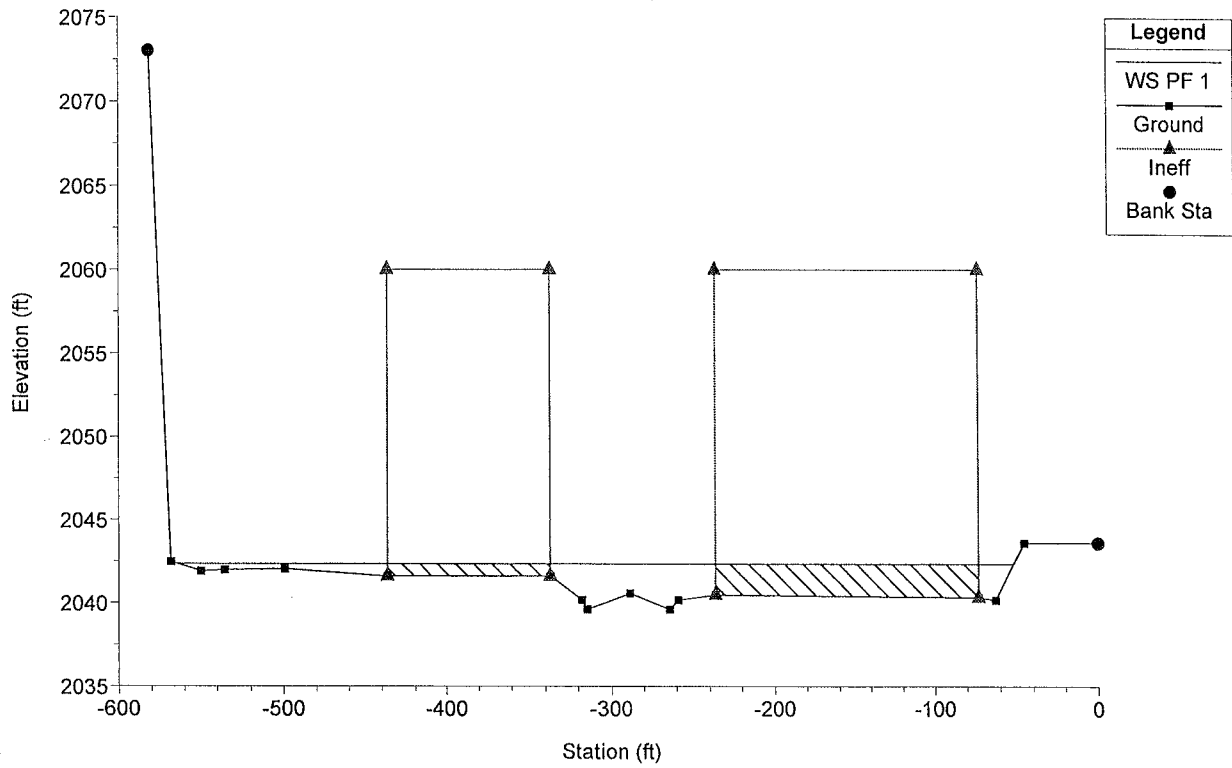
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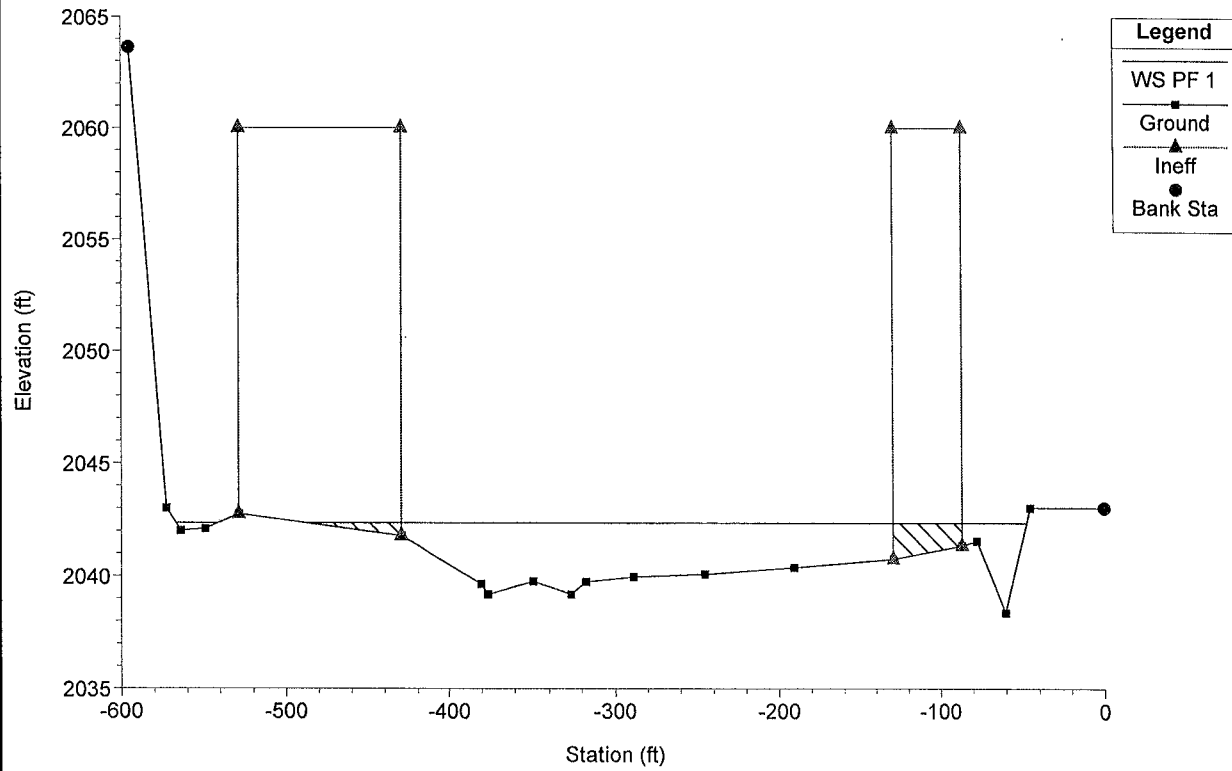
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22+00



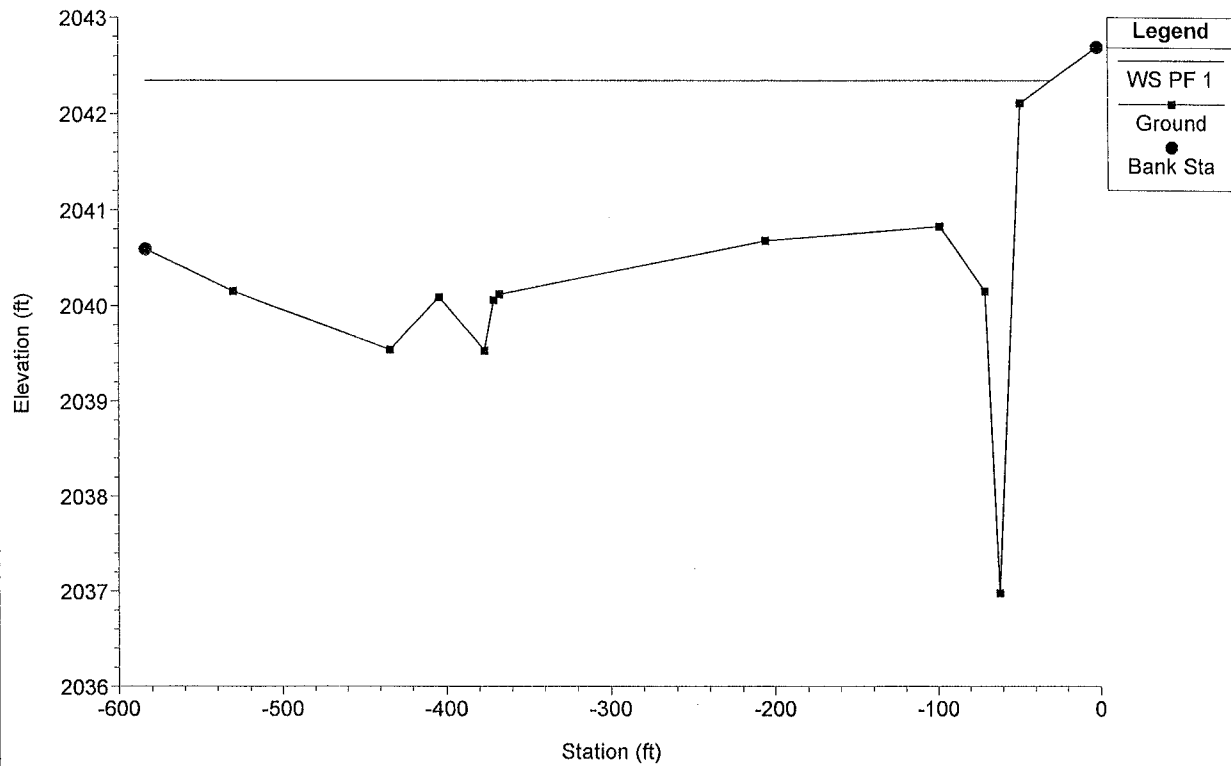
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20+00



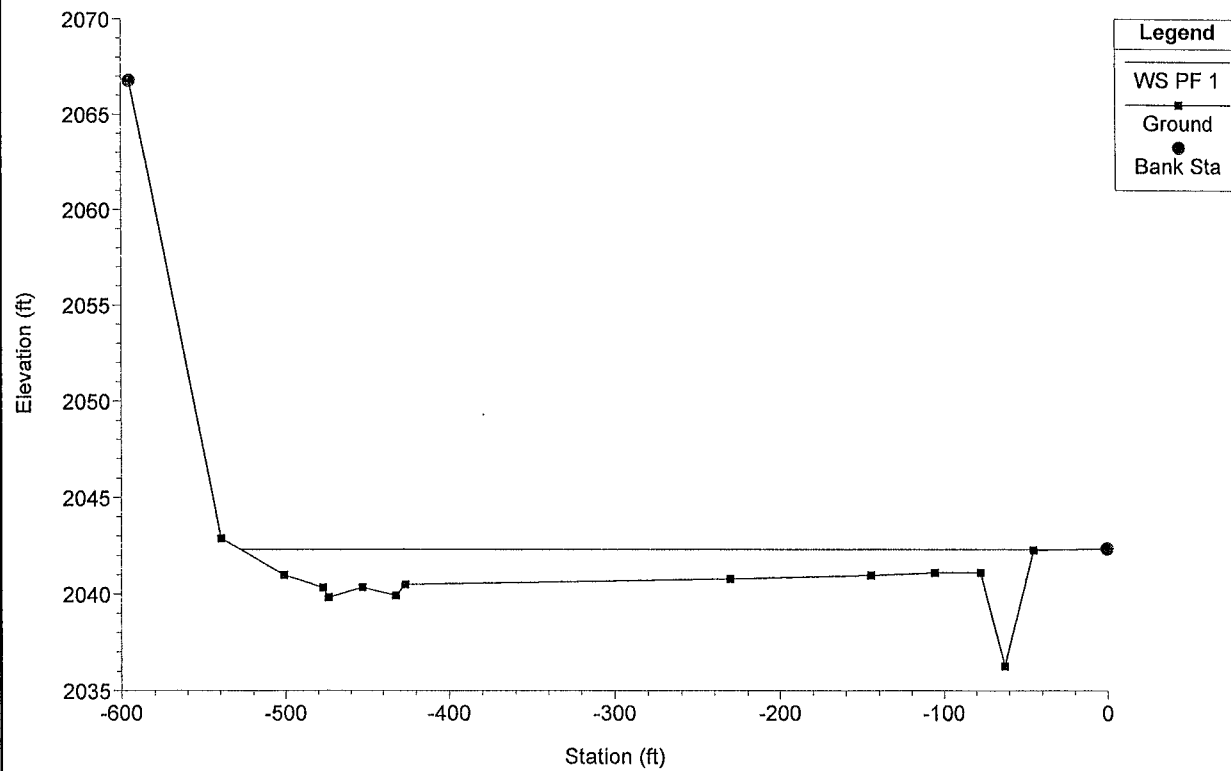
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18+00



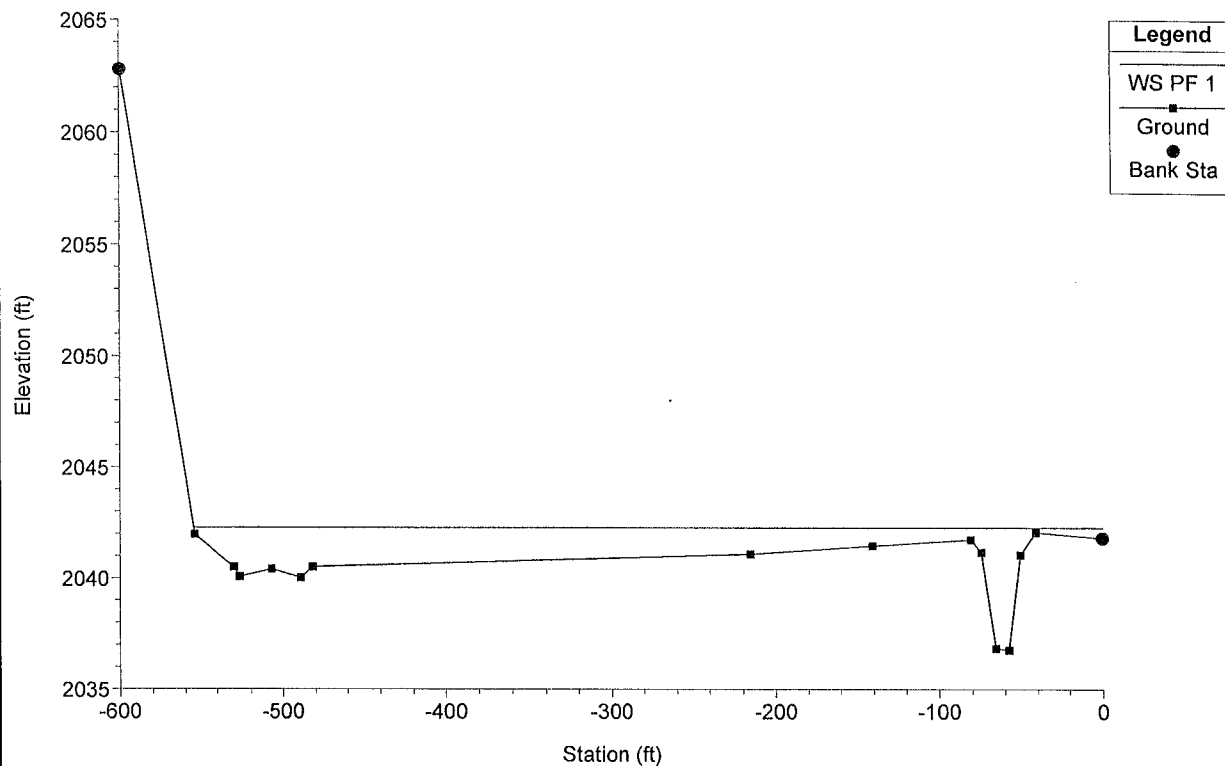
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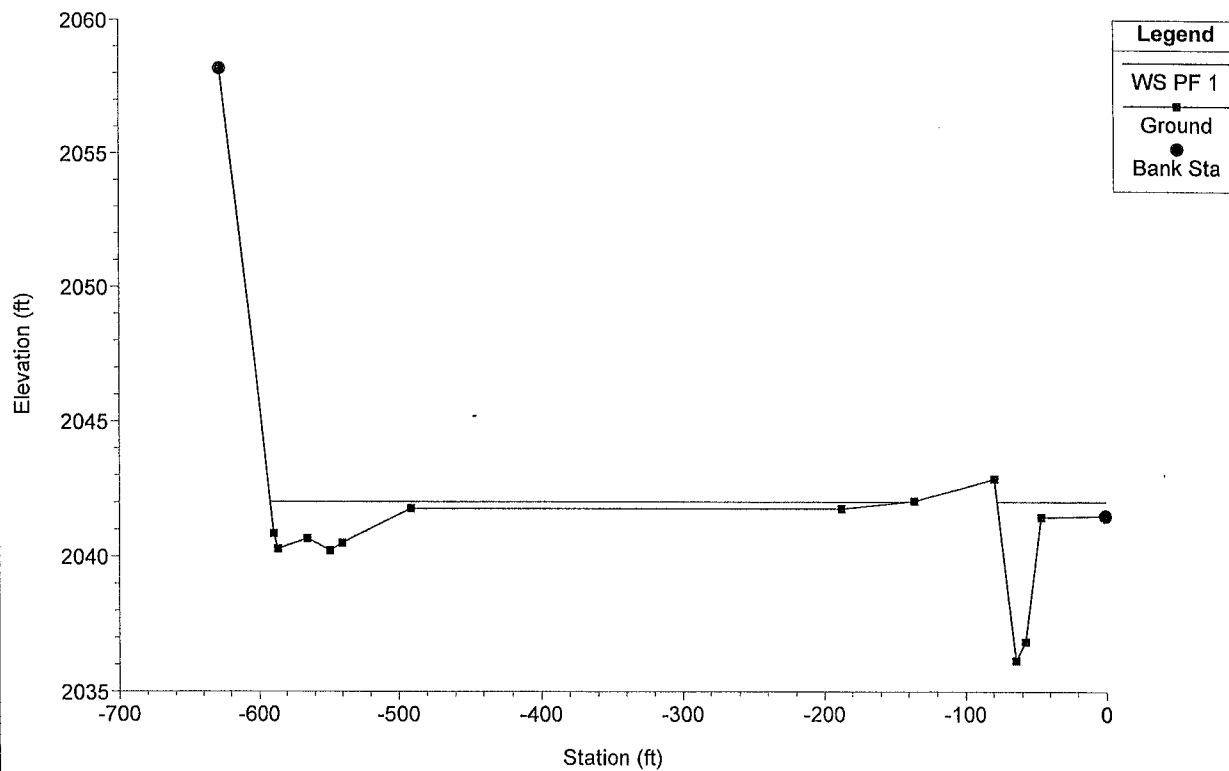
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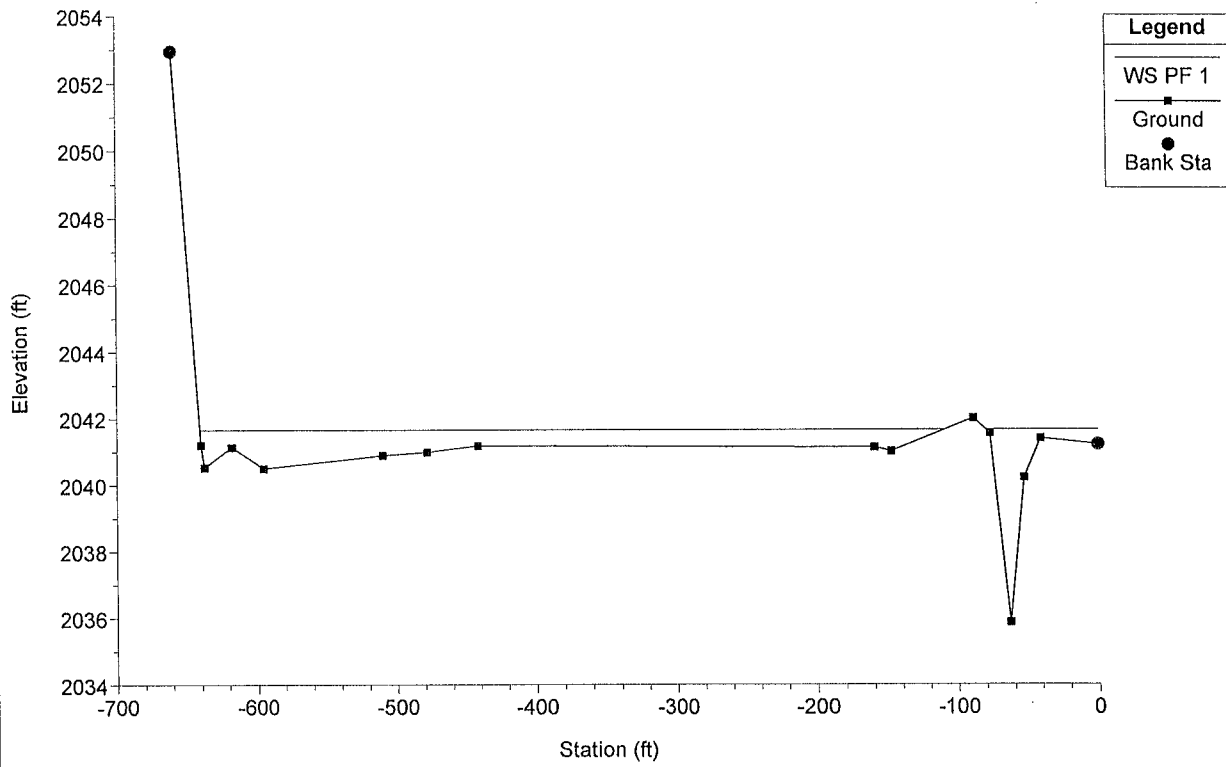
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15+00



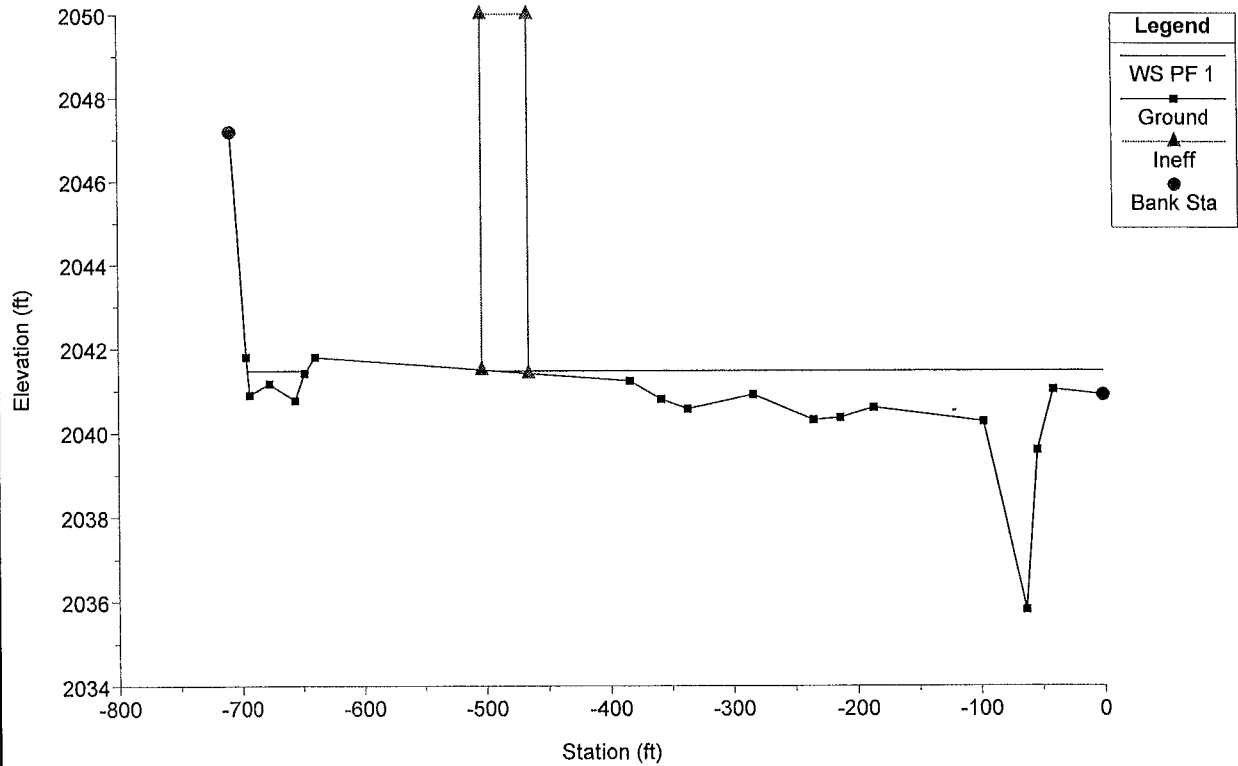
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14+00



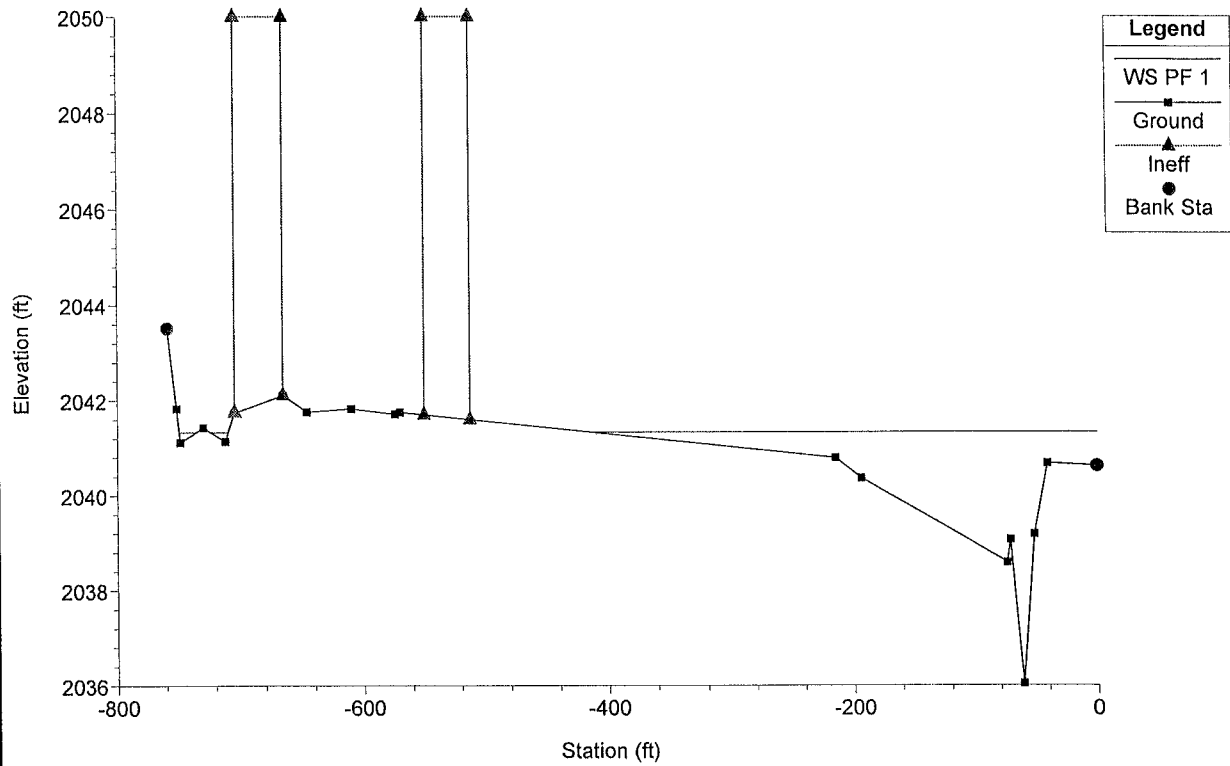
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13+00



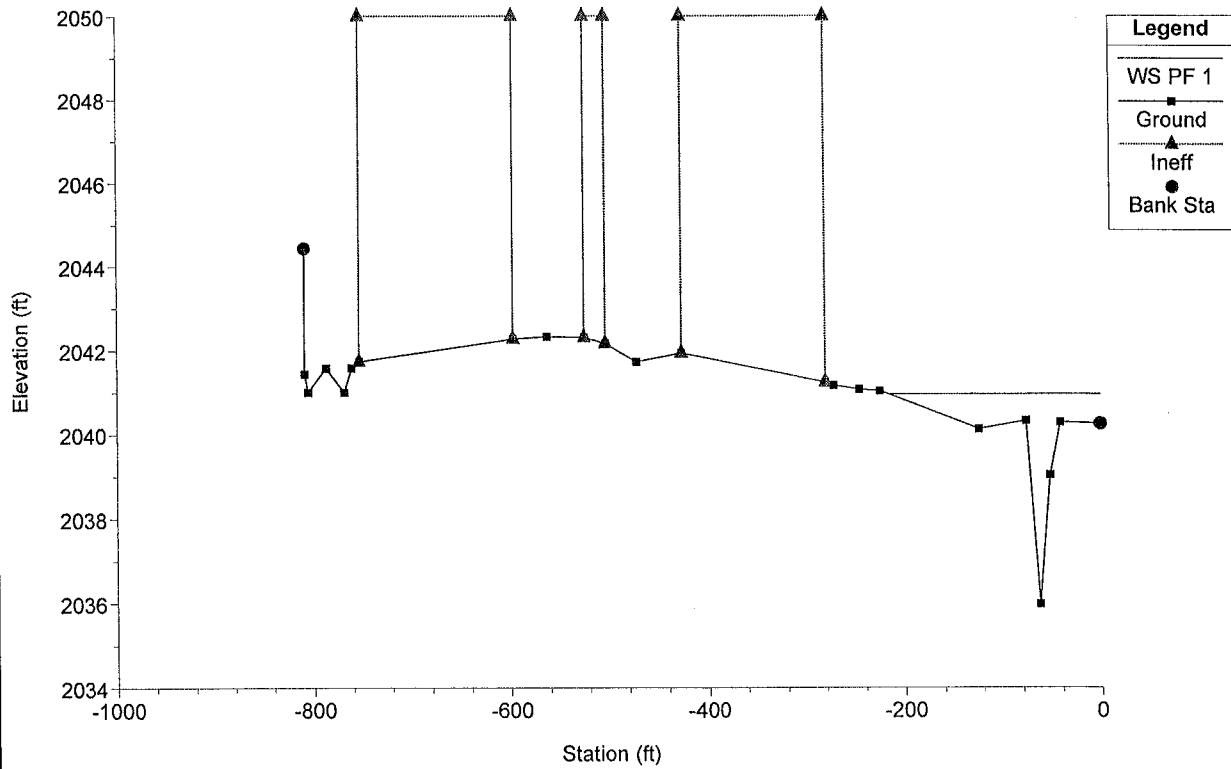
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12+00



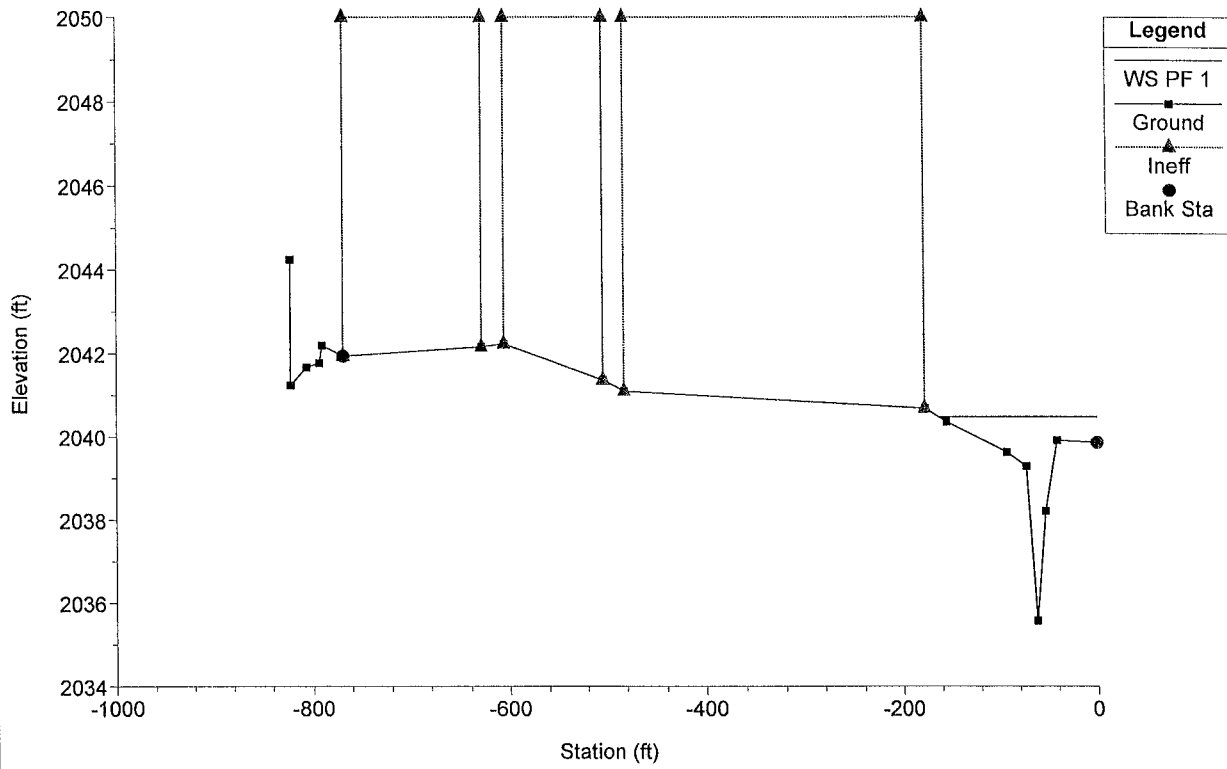
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11+00



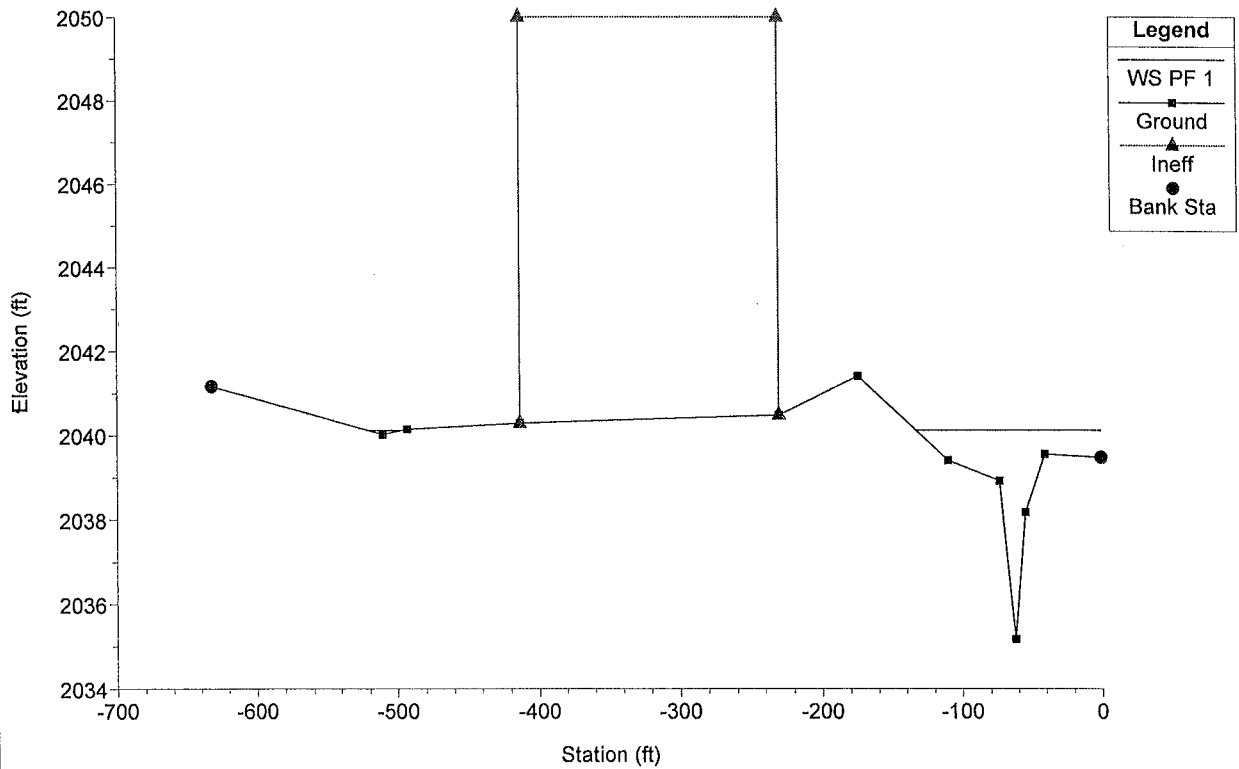
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10+00



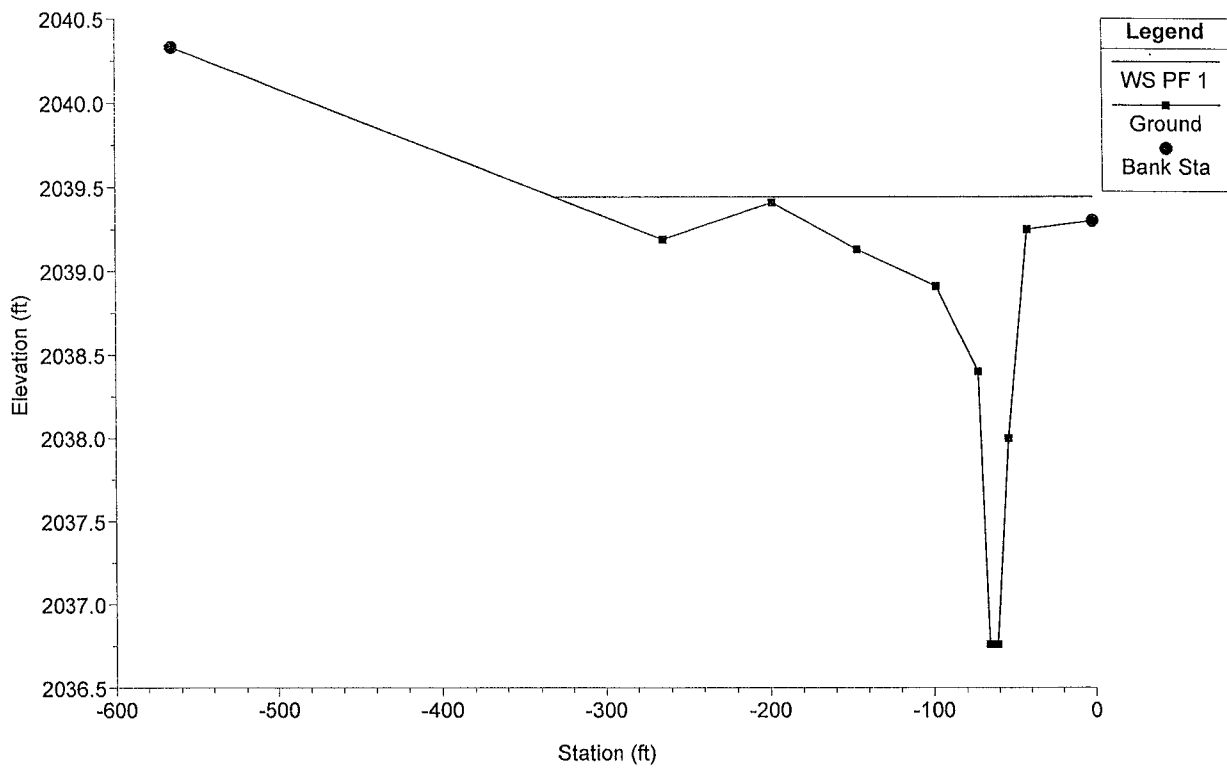
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9+00



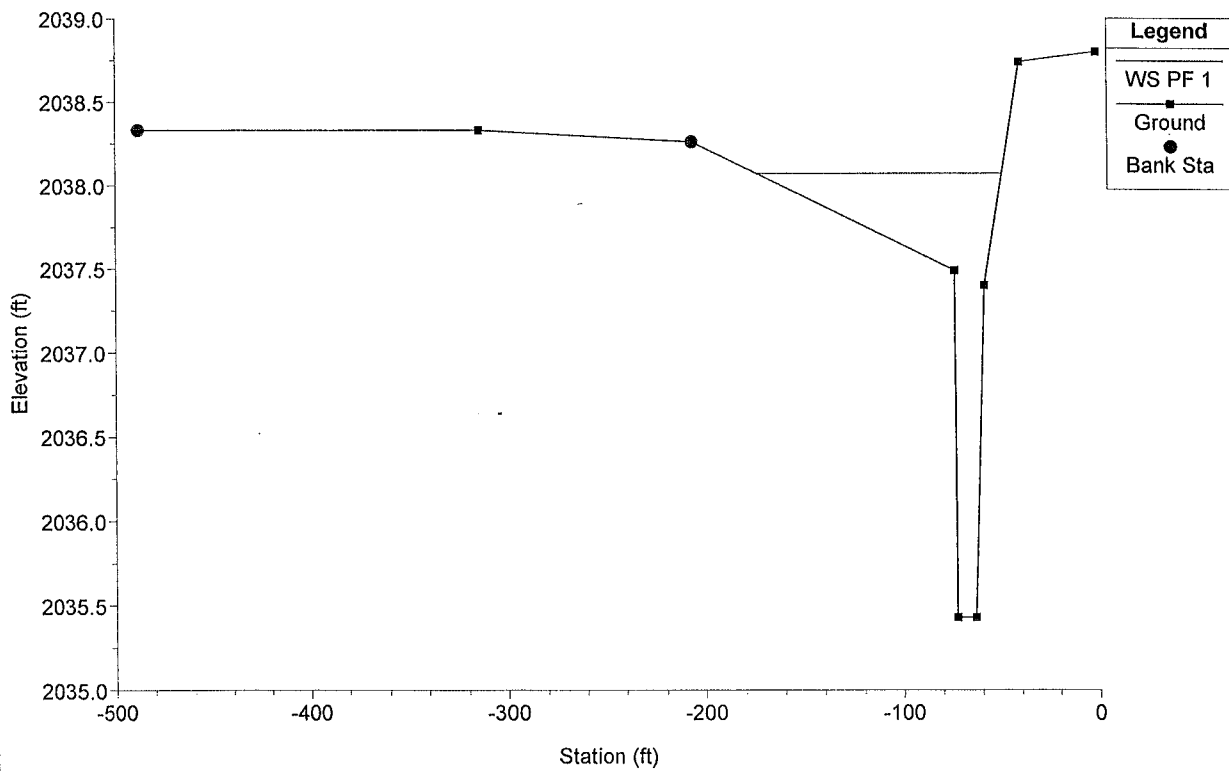
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8+00



I15-UPRR Plan: Current_Existing 2/12/2010
7+00



I15-UPRR Plan: Current_Existing 2/12/2010
6+00





Existing Offsite Hydrology Report

B.5.4

Current Case UPRR Side Weir Calculations

NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
WIER SPLIT SUMMARY TABLE

STA.	HEC-RAS WSE	SIDE WIER	Q OVERLAND
18+00	2042.34	0	1163
17+00	2042.34	0	1163
16+00	2042.31	0	1163
15+00	2042.26	23	1140
14+00	2042.01	32	1108
13+00	2041.65	34	1074
12+00	2041.46	75	999
11+00	2041.33	147	852
10+00	2040.94	143	709
9+00	2040.47	112	597
8+00	2040.11	112	485
7+00	2039.44	22	464

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 18+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.34
Enter 1 for gravel, 0 for paved	1
Beg Sta	18+50
Beg Crest	2043.355
End Sta	17+50
End Crest	2043.05
Ave Crest	2043.203
L	1+00
L_r	40
H_{Wr}	-0.859
H_{Wr}/L_r	-0.02
C_r	#N/A
Q_o	0.00

Q Sta 19+00	1163.00
Wier Out	0.00
Q Sta 18+00	1163.00

$H_{Wr}/L_r < .15$ #N/A

$H_{Wr}/L_r > .15$ #N/A

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 17+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.34
Enter 1 for gravel, 0 for paved	1
Beg Sta	17+50
Beg Crest	2043.05
End Sta	16+50
End Crest	2042.64
Ave Crest	2042.845
L	1+00
L_r	40
H_{Wr}	-0.502
H_{Wr}/L_r	-0.01
C_r	#N/A
Q_o	0.00

Q Sta 18+00	1163.00
Wier Out	0.00
Q Sta 17+00	1163.00

$H_{Wr}/L_r < .15$ #N/A

$H_{Wr}/L_r > .15$ #N/A

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 16+00**

$$Q_o = C_r L H_{W_r}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{W_r} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.31
Enter 1 for gravel, 0 for paved	1
Beg Sta	16+50
Beg Crest	2042.64
End Sta	15+50
End Crest	2042.2
Ave Crest	2042.420
L	1+00
L_r	40
H_{W_r}	-0.111
H_{W_r}/L_r	0.00
C_r	#N/A
Q_o	0.00

Q Sta 17+00	1163.00
Wier Out	0.00
Q Sta 16+00	1163.00

$H_{W_r}/L_r < .15$ #N/A

$H_{W_r}/L_r > .15$ #N/A

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 15+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.26
Enter 1 for gravel, 0 for paved	1
Beg Sta	15+50
Beg Crest	2042.2
End Sta	14+50
End Crest	2041.93
Ave Crest	2042.065
L	1+00
L_r	40
H_{Wr}	0.198
H_{Wr}/L_r	0.00
C_r	2.575
Q_o	22.76

Q Sta 16+00	1163.00
Wier Out	22.76
Q Sta 15+00	1140.24

$H_{Wr}/L_r < .15$	2.575
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 14+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2042.01
Enter 1 for gravel, 0 for paved	1
Beg Sta	14+50
Beg Crest	2041.93
End Sta	13+50
End Crest	2041.59
Ave Crest	2041.760
L	1+00
L_r	40
H_{Wr}	0.248
H_{Wr}/L_r	0.01
C_r	2.596
Q_o	32.09

Q Sta 15+00	1140.24
Wier Out	32.09
Q Sta 14+00	1108.15

$H_{Wr}/L_r < .15$	2.596
$H_{Wr}/L_r > .15$	2.900

**DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 13+00**

$$Q_o = C_r L H_{W_r}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{W_r} = Upstream Depth (WSE-Crest Elevation)

WSE	2041.65
Enter 1 for gravel, 0 for paved	1
Beg Sta	13+50
Beg Crest	2041.59
End Sta	12+50
End Crest	2041.19
Ave Crest	2041.390
L	1+00
L_r	40
H_{W_r}	0.260
H_{W_r}/L_r	0.01
C_r	2.600
Q_o	34.42

Q Sta 14+00	1108.15
Wier Out	34.42
Q Sta 13+00	1073.73

$H_{W_r}/L_r < .15$	2.600
$H_{W_r}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 12+00**

$Q_o = C_r L H_{Wr}^{1.5}$
 Q_o = Overtopping flow rate
 C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)
 L_r = Width of the wier crest
 L = Weir Crest Length
 H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2041.46
Enter 1 for gravel, 0 for paved	1
Beg Sta	12+50
Beg Crest	2041.19
End Sta	11+50
End Crest	2040.87
Ave Crest	2041.030
L	1+00
Lr	40
HWr	0.429
HWr/Lr	0.01
Cr	2.668
Qo	75.00

Q Sta 13+00	1073.73
Wier Out	75.00
Q Sta 12+00	998.73

$H_{Wr}/L_r < .15$ 2.668
 $H_{Wr}/L_r > .15$ 2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 11+00**

$$Q_o = C_r L H_{Wr}^{1.5}$$

Q_o = Overtopping flow rate

C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)

L_r = Width of the wier crest

L = Weir Crest Length

H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2041.33
Enter 1 for gravel, 0 for paved	1
Beg Sta	11+50
Beg Crest	2040.87
End Sta	10+50
End Crest	2040.47
Ave Crest	2040.670
L	1+00
L_r	40
H_{Wr}	0.657
H_{Wr}/L_r	0.02
C_r	2.752
Q_o	146.53

Q Sta 12+00	998.73
Wier Out	146.53
Q Sta 11+00	852.20

$H_{Wr}/L_r < .15$	2.752
$H_{Wr}/L_r > .15$	2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 10+00**

$Q_o = Cr L HWr^{1.5}$
 Q_o = Overtopping flow rate
 Cd = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)
 L_r = Width of the wier crest
 L = Weir Crest Length
 HW_r = Upstream Depth (WSE-Crest Elevation)

WSE	2040.94
Enter 1 for gravel, 0 for paved	1
Beg Sta	10+50
Beg Crest	2040.47
End Sta	9+50
End Crest	2040.12
Ave Crest	2040.295
L	1+00
Lr	40
HWr	0.647
HWr/Lr	0.02
Cr	2.751
Qo	143.27

Q Sta 11+00	852.20
Wier Out	143.27
Q Sta 10+00	708.92

$HW_r/L_r < .15$ 2.751
 $HW_r/L_r > .15$ 2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 9+00**

$Q_o = C_r L H_{Wr}^{1.5}$
 Q_o = Overtopping flow rate
 C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)
 L_r = Width of the wier crest
 L = Weir Crest Length
 H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2040.47
Enter 1 for gravel, 0 for paved	1
Beg Sta	9+50
Beg Crest	2040.12
End Sta	8+50
End Crest	2039.72
Ave Crest	2039.920
L	1+00
Lr	40
HWr	0.552
HWr/Lr	0.01
Cr	2.724
Qo	111.66

Q Sta 10+00	708.92
Wier Out	111.66
Q Sta 9+00	597.26

$H_{Wr}/L_r < .15$ 2.724
 $H_{Wr}/L_r > .15$ 2.900

**NEON/UPRR WIER
DESIGN CONDITION FLOWS
CURRENT CASE GEOMETRY
STATION 7+00**

$Q_o = C_r L H_{Wr}^{1.5}$
 Q_o = Overtopping flow rate
 C_d = Overtopping Discharge Coefficient (per HDS No. 5, Sept 1985)
 L_r = Width of the wier crest
 L = Weir Crest Length
 H_{Wr} = Upstream Depth (WSE-Crest Elevation)

WSE	2039.44
Enter 1 for gravel, 0 for paved	1
Beg Sta	7+50
Beg Crest	2039.4
End Sta	6+50
End Crest	2039.09
Ave Crest	2039.245
L	1+00
Lr	40
HWr	0.192
HWr/Lr	0.00
Cr	2.575
Qo	21.60

Q Sta 8+00	485.18
Wier Out	21.60
Q Sta 7+00	463.57

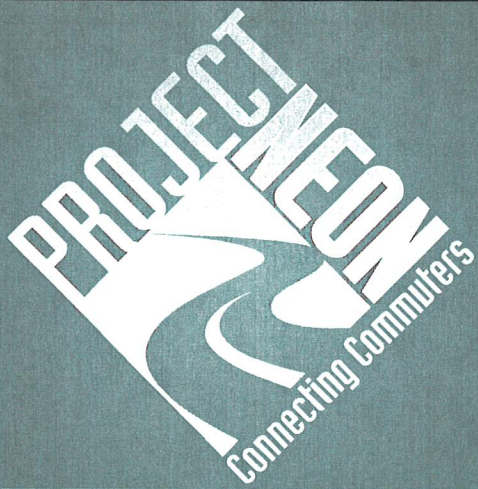
$H_{Wr}/L_r < .15$ 2.575
 $H_{Wr}/L_r > .15$ 2.900



Existing Offsite Hydrology Report

APPENDIX C

Supplemental Documentation



Existing Offsite Hydrology Report

C.1

FEMA FIRM



Existing Offsite Hydrology Report

C.2

Meeting Minutes

*Drainage Coordination Meeting
with City of Las Vegas
10/21/08*



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

DRAINAGE MEETING MEMO
Nevada Department of Transportation
Project Neon

VTN Nevada
WO#: 7111-D
WBS#: 4.A1.T4.DR.01

To: Paul Frost, P.E., NDOT Chief Hydraulic Engineer
Matt Nussbaumer, P.E., NDOT Principal Hydraulic Engineer

From: Lant Leavitt, P.E., Project Manager

Subj: Drainage Meeting for Project Neon held at 9:00 a.m. on Tuesday, October 21, 2008, at
City of Las Vegas Engineering Planning Department Conference Room 2D.

Primary Meeting Attendees:

Randy Fultz, P.E., CLV
Rob Welch, P.E., CLV
Joe Damiani, P.E., CCRFCD
Todd Myers, P.E., CCRFCD

Paul Frost, P.E., NDOT
Ken Gilbreth, P.E., VTN
Lant Leavitt, P.E., VTN

A meeting was arranged with the City of Las Vegas, Clark County Flood Control District and NDOT to discuss issues related to Project Neon drainage design. The purpose of the meeting was to update project drainage design criteria originally developed in a meeting with CLV and NDOT on December 11, 2003.

Meeting Minutes:

The City prefers the use of the 2008 MPU as a backbone for hydrology models for this project. "Design Conditions" hydrology models will be developed based on the 2008 MPU to determine what the existing hydrologic conditions will be at the start of Project Neon. The Design Conditions models will use the same land use and similar subbasin delineation assumptions as the 2008 MPU, but will route flows differently in the vicinity of proposed facilities that will not be complete prior to Project Neon. For example, if a proposed MPU facility will direct flow north in the future (after Project Neon), but the existing flow pattern is to the east, the Design Conditions model will route the flow to the east. The status of the timing of the following drainage facilities was decided in the meeting:

- The Oakey System (MPU designation MEOK) is scheduled to be constructed prior to Project Neon including any modifications to the Meadows Detention Basin inflow channel and associated appurtenances that are necessary for capturing 100-year flows. The Charleston reach (MECN) will not be constructed at the same time as the Oakey

System and is not currently on the 10-year plan. However, the intent of the Oakey System is to cut off the 100-year flow impacting the proposed Oakey alignment.

The Oakey System (MEOK) will be assumed in place for the Design Conditions Hydrology Model.

- The Las Vegas Creek Channel – Lorenzi facility (LCLO) and the Meadows Alta facilities (MEAL) will be constructed prior to Project Neon.

The Lorenzi facility (LCLO) and Meadows Alta facilities (MEAL) will be assumed in place for the Design Conditions Hydrology Model.

- The Sahara System (FWSA/BHSA) is on the 10-year plan and may be constructed prior to Project Neon depending on phasing and timing of the projects. VTN will update the offsite hydrologic modeling to account for both scenarios.

The Sahara System (FWSA/BHSA) will be modeled both in place and not in place for the Design Conditions Hydrology Model.

- The Palmyra/Sirius Drain (FWSS), Palmyra/Sirius Drain - Decatur Lateral (PSDE), and the Valley View Drain (FWVV) discharge to the Sahara System. They are not currently on the 10-year plan.

The Palmyra/Sirius Drain (FWSS), Palmyra/Sirius Drain - Decatur Lateral (PSDE), and Valley View Drain (FWVV) will *not* be assumed in place for the Design Conditions Hydrology Model.

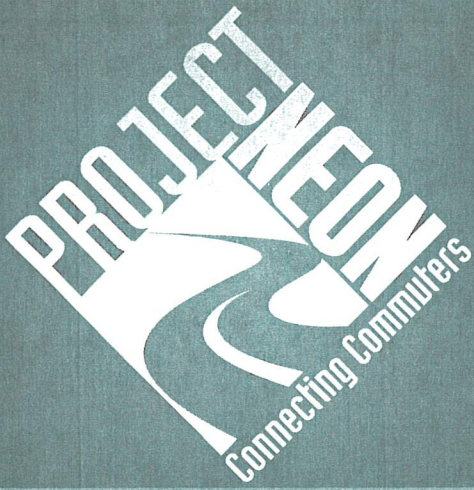
Distribution:

Attendees

John Taylor, P.E., CH2M Hill

Chad Anson, P.E., CA Group

File: 7111/Meetings - Drainage/Meeting Minutes



Existing Offsite Hydrology Report

C.3

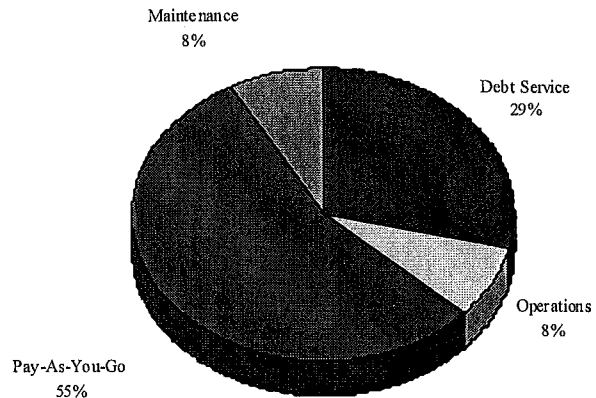
**CCRFC D 2010–2019
TYCP Excerpt**

REGIONAL FLOOD CONTROL DISTRICT

Capital Improvement Program

The District staff maintains a listing of projects proposed for funding in the next ten-year period. The 10-Year Construction Program (TYCP) is updated annually and is approved by the Board after review by the Technical and Citizens Advisory Committees. In addition to the TYCP, the District's Chief Engineer with assistance, cooperation and approval of the Technical Advisory Committee, prepares a list of projects proposed for funding during the upcoming fiscal year. The fiscal year project list, after approval by the Board, constitutes the Capital Improvement Program for the District in the ensuing fiscal year. The fiscal year project list and the updated TYCP presented in this document were approved on June 11, 2009, for Fiscal Year 2010. Board approval of the TYCP and the fiscal year project list does not authorize funding of any project and does not commit the District to expend any funds.

Typical Annual Expenditures



The TYCP consumes all revenues that the District receives that are not allocated to Operations (Fund 2860), Debt Service (Fund 3300), or the Maintenance Work Program (Fund 2870). A pie chart representing the typical annual expenditures for a fiscal year is depicted above. The TYCP revenues are derived from the $\frac{1}{4}$ % Sales Tax and interest revenues commonly known as the Pay-As-You-Go Program. Sales Tax funds the District's Pay-As-You-Go Program in Fund 4430 and is used to retire debt issued for flood control projects accounted for in Fund 4440. These two funds are used to separate debt funding from Pay-As-You-Go funding in order to accurately account for debt proceeds. Since May 1987, the date the first $\frac{1}{4}$ % Sales Tax Revenues were received and projected through the end of June 2009, the District has received over \$1,074,289,770 in Sales Tax Revenues. Additionally, the District has issued \$80,000,000, \$150,000,000, \$200,000,000, and \$50,570,000 in General Obligation Bonds, secured by Sales Tax Revenue, which were sold in November 1991, September 1998, February 2006, and August 2008, respectively, to expedite projects. The District has funded over \$1,153,774,809 in projects through June 2009.

The TYCP is an estimate of when funding will be requested. Available revenues for the TYCP are estimated to be \$943,173,864, which includes estimated future debt issues of \$700,000,000, which will be distributed in \$150 million increments over Years 1 and 2, and \$200 million increments over Years 7 and 8. Programming of future debt is not a guarantee that the debt will be issued. The District will evaluate whether to issue the debt based on economic conditions and progress in project development. Sales Tax growth for Year 1 is based on a zero growth rate, a 1 percent growth rate for year 2, a 2 percent growth rate for Year 3, a 3 percent growth rate for

REGIONAL FLOOD CONTROL DISTRICT

Las Vegas (continued)

Oakey Drain, Birch Street to Cahlan Drive

Oakey – Meadows Storm Drain, Phase I

Owens Avenue System (Rancho Drive to I-15)

Peak Drive, Rainbow Boulevard to Torrey Pines Drive, Local Drainage Project

Peak Drive System (Jones Boulevard to Michael Way)

Rampart Storm Drain

Project in conjunction with the Regional Transportation Commission of Southern Nevada (RTC)

Rancho Detention Basin, Phase II

Rancho Road System: Durango Drive US-95 Interchange

Rancho Road System – El Campo Grande Storm Drain

Washington Avenue System

Las Vegas Creek from Las Vegas Wash beneath Sandhill Road to Washington Avenue then along Washington Avenue to Sagman Street; Sagman Street to Bonanza Road; Bonanza Road to Veterans Memorial Drive; Veterans Memorial Drive to UPRR; and UPRR to Alta Drive (southeast quadrant of the Spaghetti Bowl).

Washington Avenue System (Martin Luther King Boulevard to I-15) and Freeway Channel North (Washington Avenue to Vegas Drive)

District funding since 1987 for the projects plus design efforts on future projects totals approximately \$391,999,988.

The projects proposed on the TYCP in hydrographic basin order with Priority Value (PV) include the following:

Central – Freeway Channel – Owens Avenue to Miller Avenue, Phase I

LV15 0093 through 0230 – The Board received a presentation and set a priority for funding this project at their December 2008 meeting. This project increases the capacity of an existing concrete channel parallel to and west of I-15 extending from Owens Avenue to Miller Avenue in order to receive additional flow from the Owens Avenue System. City of North Las Vegas is the Lead Entity for this project. Construction by

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Las Vegas (continued)

NDOT is underway. Construction funding is programmed in FY 09/10. The TYCP includes approximately \$4.6 million for this project.

Central – Freeway Channel – Owens Avenue to Miller Avenue, Phase II (PV = 87.0)
LVCS 0000 through 0015 – This project is an underground storm drain beneath Losee Road from Owens to Lake Mead Boulevard ranging in size from 10' x 5' to 12' x 5' reinforced concrete box delivering flow to the I-15 Freeway system. City of North Las Vegas is the Lead Entity for this project. Design is underway. Construction funding is programmed in FY 10/11. The TYCP includes approximately \$7.5 million for this project.

Central – Simmons – Cheyenne Avenue to Carey Avenue (PV = 90.5)
LAAS 0000 through 0103 – This project is an 84" reinforced concrete pipe beneath Simmons Street extending from Carey-Lake Mead Detention Basin at the North Las Vegas Air Terminal north to Cheyenne Avenue. The project will be constructed with the Simmons – Alexander Road to Craig Road project. It will be a cost share project with the Regional Transportation Commission of Southern Nevada (RTC). City of North Las Vegas is the Lead Entity for this project. Design is underway. Construction funding is programmed in FY 13/14. The TYCP includes approximately \$6.6 million for this project.

Central – Owens Avenue System – Rancho Drive to Shadow Mountain (PV = 88.3)
LVOW 0241 and 0351 – This project is a reinforced concrete box storm drain in Owens Avenue between Rancho Drive and Shadow Mountain. Design is underway. Construction funding is programmed in FY 10/11. The TYCP includes approximately \$11.1 million for this project.

Central – Owens Avenue System – Shadow Mountain Torrey Pines Drive (PV = 77.5)
LVOW 0360 and 0460 – This project is a reinforced concrete box storm drain in Owens Avenue between Shadow Mountain and Torrey Pines Drive. Design is programmed in FY 13/14 and construction funding is programmed in FY 15/16. The TYCP includes approximately \$11.7 million for this project.

Central – Las Vegas Wash – Charleston Boulevard to Stewart Avenue (PV = 79.0)
LVMD 1071 – This project consists of an open concrete channel extending from Charleston Boulevard to Stewart Avenue. Design is programmed in FY 14/15 and construction funding is programmed in FY 17/18. The TYCP includes approximately \$8.2 million for this project.

Central – Oakey Drain – Cahlan Drive to Barnard Drive (PV = 84.5) FWOK 0076 through 0100 – This project consists of a 6' x 6' reinforced concrete box storm drain beneath Oakey Drive from Cahlan Drive to Barnard Drive. Design is
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programmed in FY 11/12 and construction is programmed in FY 14/15. The TYCP includes approximately \$4.2 million for this project.

Central – Oakey–Meadows Storm Drain (PV = 84.0)

MEOK 0070 through 0217 – This project is a reinforced concrete box storm drain following a stair-step path to the northeast from Sahara Avenue at Edmond Street to Valley View Boulevard and Alta Drive. This project has been divided into three phases. Design is underway. Phase one construction funding is underway. Construction funding is programmed in FY 10/11 for phase two (MEOK 0070 through 0166) and phase three (MEOK 0191 through 0217). The TYCP includes approximately \$21.4 million for this project.

Central – Las Vegas Creek Channel Parallel System

LCCH 0051 through 0512 & 0518 through 0543 – This project is a storm drain system in US-95 extending from Martin Luther King Drive to Rainbow Boulevard. This project is complete having been constructed with NDOT's widening project. The Board approved Resolution Number 05-1 to reimburse NDOT for these costs. Construction reimbursement is programmed in FY 11/12 consistent with the resolution. The TYCP includes approximately \$5.6 million for this project.

Central – Boulder Highway Sahara Avenue – Mojave Road to Boulder Highway (PV = 81.0)

BHSA 0000 – This project is a 14' by 12' RCBC beneath Sahara Avenue from Boulder Highway to Mojave Road. Design is programmed in FY 12/13 and construction funding is programmed in FY 15/16. The TYCP includes approximately \$5.8 million for this project.

Central – Boulder Highway Sahara Avenue – Eastern Avenue to Mojave Road (PV = 81.0)

BHSA 0026 – This project is a 12' by 12' RCBC beneath Sahara Avenue from Mojave Road to Eastern Avenue. Design is programmed in FY 13/14 and construction funding is programmed in FY 16/17. The TYCP includes approximately \$19.2 million for this project.

Central – Sahara Avenue – Eastern Lateral (PV = 81.0)

SAEA 0000 – This project consists of a 10' x 8' RCBC storm drain beneath Eastern Avenue delivering flow to the Boulder Highway Sahara Avenue system. Design is programmed in FY 13/14 and construction funding is programmed in FY 16/17. The TYCP includes approximately \$4.8 million for this project.

Central – Boulder Highway Sahara Avenue – Maryland Parkway to Eastern Avenue (PV = 81.0)

BHSA 0075 – This project is a 12' x 10' RCBC beneath Sahara Avenue from Eastern Avenue to Maryland Parkway. Design is programmed in FY 14/15 and construction

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funding is programmed in FY 16/17. The TYCP includes approximately \$23.3 million for this project.

Central – Boulder Highway Sahara Avenue – Las Vegas Boulevard to Maryland Parkway (PV = 81.0)

BHSA 0175 – This project is a 14' x 13' RCBC beneath Sahara Avenue from Maryland Parkway to Las Vegas Boulevard. Design is programmed in FY 15/16 and construction funding is programmed in FY 18/19. The TYCP includes approximately \$37.0 million for this project.

Central – Boulder Highway Sahara Avenue – Industrial Road to Las Vegas Boulevard (PV = 81.0)

BHSA 0289 – This project is a 14' x 12' RCBC beneath Sahara Avenue from Las Vegas Boulevard to Industrial Road. Design is programmed in FY 15/16 and construction funding is programmed in FY 18/19. The TYCP includes approximately \$13.0 million for this project.

Central – Boulder Highway Sahara Avenue – I-15 to Industrial Road (PV = 81.0)

BHSA 0331 – This project is a 12' x 12' RCBC beneath Sahara Avenue from Industrial Road to Interstate 15. Design is programmed in FY 16/17. The TYCP includes approximately \$0.70 million for this project.

Central – Flamingo Boulder Highway North, Sahara Avenue to Flamingo Wash (PV = 89.3)

FLBN 0001 through 0033 – This project is storm drain beneath Boulder Highway ranging in size from 2 - 10' x 6' RCBC to 3 - 14' x 12' RCBC extending from Sahara Avenue to Flamingo Wash. Design is underway. Construction funding is programmed in FY 10/11. The TYCP includes approximately \$12.5 million for this project.

Gowan North – Angel Park North – Detention Basin (PV = 85.0)

APNO 0001 – This project consists of expansion of the existing Angel Park North Detention Basin from 1,400 acre feet to 1,512 acre feet. Design is programmed in FY 10/11 and construction funding is programmed in FY 11/12. The TYCP includes approximately \$4.0 million for this project.

Gowan North – Simmons – Confluence (PV = 89.5)

GOOF 0196 – This project consists of a confluence structure to transition flow from the Simmons storm drain into the Gowan North Channel. Design is underway. Construction funding is programmed in FY 10/11. The TYCP includes approximately \$5.5 million for this project.

Gowan North – Simmons – Alexander Road to Craig Road (PV = 70.0)

GOOF 0199 and 0224 – This project consists of a multi-cell reinforced concrete box storm drain beneath Simmons Street from Alexander Road to the Gowan Outfall

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Channel. City of North Las Vegas is the Lead Entity for this project. Design is programmed in FY 16/17. The TYCP includes approximately \$0.20 million for this project.

Gowan North – Gowan Outfall – Lone Mountain Branch, Rancho Drive to Decatur Boulevard (PV = 87.0)

GOLO 0152 through 0275 – This project is a storm drain in Lone Mountain Road from Rancho Drive discharging to the existing Gowan Outfall near Woodview Street. This project has three phases. Design is underway for all Phases. This is the third and final phase from Rancho Drive to Decatur Boulevard. Construction funding for phase three is programmed in FY 15/16. The TYCP includes approximately \$25.8 million for this project.

Upper Northern LV Wash – Ann Road – Rancho Road System – Fort Apache to Grand Canyon (PV = 73.0)

RCHB 0275 – This project is a 7' x 6' RCBC storm drain beneath Elkhorn Road from Fort Apache Road to Grand Canyon Drive. Design is programmed in FY 12/13 and construction funding is programmed in FY 15/16. The TYCP includes approximately \$6.2 million for this project.

Upper Northern LV Wash – Ann Road – Rancho Road System – Grand Canyon to Hualapai Way (PV = 73.0)

RCHB 0295 – This project is a 7' x 6' RCBC storm drain beneath Elkhorn Road from Grand Canyon Drive to Hualapai Way. Design is programmed in FY 14/15 and construction funding is programmed in FY 16/17. The TYCP includes approximately \$6.6 million for this project.

Upper Northern LV Wash – Ann Road – Rancho Road System – Beltway to Echelon Point (PV = 83.0)

RCHB 0227 – This project is an 11' x 8' RCBC along CC 215 and Fort Apache Road to Echelon Point. Design is programmed in FY 10/11 and construction funding is programmed in FY 11/12. The TYCP includes approximately \$4.8 million for this project.

Upper Northern LV Wash – Ann Road – Rancho Road System – Echelon Point to Elkhorn Road (PV = 83.5)

RCHB 0250 – This project is an 11' x 8' RCBC along Fort Apache Road from Echelon Point to Elkhorn Road. Design is programmed in FY 10/11 and construction funding is programmed in FY 12/13. The TYCP includes approximately \$8.6 million for this project.

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Upper Northern LV Wash – Ann Road Channel West – Rainbow Boulevard (PV = 82.5)

ANRB 0000 – This project is a 10' x 7' RCBC beneath Rainbow Boulevard delivering flow to the Ann Road storm drain system. Design is programmed in FY 10/11 and construction funding is programmed in FY 11/12. The TYCP includes approximately \$3.0 million for this project.

Upper Northern LV Wash – Upper Western Tributary – Centennial Parkway Channel West – U.S. 95 Facilities (PV = 82.5)

CN95 0000 through 0167 – This project is an RCBC and open channel system adjacent to US-95 from Deer Springs Way to Grand Teton Drive. Design is programmed in FY 13/14 and construction funding is programmed in FY 15/16. The TYCP includes approximately \$36.7 million for this project.

Upper Northern LV Wash – Upper Western Tributary – Floyd Lamb Park N & S Environmental Enhancement Area and Racel Street Collector

BRDB 0000 through 0033 & RACO 0000 and 0064 & TSDB 0002 through 0012 – The Board received a presentation and set a priority for funding this project at their February 2009 meeting. The project consists of two (2) environmental enhancement areas along with associated drainage collection facilities to collect the storm water flows along Racel Street. The South Environmental Enhancement Area (SEEA) consists of a 165 acre feet detention basin and the North Environmental Enhancement Area (NEEA) consists of a 50 acre feet detention basin. The associated drainage collection facilities will collect storm water flows along Racel Street and convey them to the SEEA. Construction funding is programmed in FY 09/10. The TYCP includes approximately \$30.6 million for this project.

Upper Northern LV Wash – Upper Western Tributary – Las Vegas Wash – Grand Teton, Mountain Spa Drive to Buffalo Drive (PV = 80.5)

LVMD 2632 through 2661 – This project is a reinforced concrete box storm drain in Grand Teton Drive extending from Mountain Spa/Vista Ranch channel confluence to Buffalo Drive. Design is underway. Construction funding is programmed in FY 15/16. The TYCP includes approximately \$10.7 million for this project.

Upper Northern LV Wash – Upper Western Tributary – Las Vegas Wash – Grand Teton, Buffalo Drive to Durango Drive (PV = 80.5)

LVMD 2711 through 2763 – This project is a reinforced concrete box storm drain in Grand Teton Drive extending from Buffalo Drive to Durango Drive. Design is underway. Construction funding is programmed in FY 16/17. The TYCP includes approximately \$7.7 million for this project.

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Upper Northern LV Wash – Upper Western Tributary – Floyd Lamb Park South Environmental Enhancement Area Collector (PV = 67.5)

BRDB 0043 through 0157 – This is a collector stormdrain beneath Brent Lane from the Floyd Lamb Park South Environmental Enhancement Area to El Capitan Way then north to Log Cabin Way. Design is programmed in FY 14/15 and construction funding is programmed in FY 16/17. The TYCP includes approximately \$18.3 million for this project.

The funding programmed for the Upper Northern Las Vegas Wash, Central Basin and Gowan Planning Areas in Las Vegas totals approximately \$365.9 million on the TYCP.