Request for Conditional Letter of Map Revision

Upper Las Vegas Wash Channel

Located
Between North Las Vegas Detention Basin & Craig Road
City of North Las Vegas
Nevada

Prepared for:

CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
600 South Grand Central Parkway, Suite 300
Las Vegas, NV 89155

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April 2005

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1.0 INTRODUCTION

PBS&J has prepared a request for a Conditional Letter of Map Revision (CLOMR) for the proposed Upper Las Vegas Wash Channel on behalf of the Clark County Regional Flood Control District (CCRFCD). The purpose of the study is to evaluate the removal of an existing Zone AE and Zone AO flood zone based on the construction of a proposed flood control facility (see Figure 1-Vicinity Map & Figure 3A).

The proposed facility generally follows the alignment of the existing Las Vegas Wash that runs southeasterly through the City of North Las Vegas. There are three primary flow sources to the proposed channel: 1. outfall of the North Las Vegas Detention Basin (NLVDB), 2. the watershed north of the I-215 Beltway and west of the NLVDB, and 3. various confluence structures and side drains. The proposed channel will convey flow within a rectangular channel and tie-in to the existing (7) 8'x8' RCB's beneath Craig Road, see Figure 5. Immediately downstream of Craig Road is the existing concrete lined King Charles Channel. The proposed rectangular channel is 42'W x 9'H at the upstream end and increasing in size to 56'W x 10'H at the downstream end. The Upper Las Vegas Wash channel was designed by VTN Nevada (VTN 2002). The proposed channel will consist of the following components:

1. Approximately 4 miles of rectangular concrete lined channel (Variable height and width)
2. Dual 10' x 9' RCB confluence structure at I-215
3. (2) 42' x 8' RCBs between Dorrell Lane and I-215
4. 42' x 8' RCB crossing at Dorrell Lane
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6. 46' x 9' RCB crossing at Centennial Parkway
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10. 50' x 8' RCB crossing at Tropical Parkway
11. 10' x 7' RCB confluence structure at Ann Road
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13. 56' x 9' RCB crossing at Washburn Ave
14. 56' x 8' RCB crossing at Losee Road
15. 56' x 7' RCB crossing at Lone Mountain Road
16. Approximately 20 side drains (RCP stubs) for future drainage connection

As described in the VTN Design Report (2002), the system allows for the adequate collection and conveyance of existing and future condition 100-year flows. Additional details on the proposed Upper Las Vegas Wash channel can be found in the approved design plans located in Appendix F.

2.0 PURPOSE AND SITE DESCRIPTION

2.1 PURPOSE

The Las Vegas Wash is the principal drainage feature of the Las Vegas Valley. The majority of the valley drains to the Las Vegas Wash and ultimately discharges to Lake Mead. The Las Vegas Wash originates in the upper northwest portion of Las Vegas and runs south-southeast through the eastern side of the valley. The subject facility is within the upper reach of the Las Vegas Wash. Currently there are four primary flood control facilities upstream of the proposed channel within the Las Vegas Wash: 1. North Las Vegas Detention Basin, 2. North Las Vegas Detention Basin Levee/Channel, 3. Upper Las Vegas Wash Detention Basin, and 4. Upper Las Vegas Wash Diversion Levee/Channel. The portion of the Las Vegas Wash between the NLVDB and Craig Road is predominantly unlined and partially graded. The Upper Las Vegas Wash is aligned mostly north-south and is adjacent to sparse residential and commercial developments. Under current conditions the Upper Las Vegas Wash does not have sufficient capacity and a 100-year event could cause significant flooding to the overbank areas. In recent years the City of North Las Vegas has experienced increased growth thus necessitating the need for flood control facilities, such as the one addressed in this report. Therefore, this CLOMR has been prepared to address the proposed facility for the purpose of showing that the 100-year flood can be contained in the proposed channel.

2.2 LOCATION

The project area is located in the northeastern part of the Las Vegas Valley within Sections 2-5, 8-11, and 14-17, Township 22 South, Range 60 East, Mount Diablo Base & Meridian, City of North Las Vegas, Clark County, Nevada. Specifically, the portion of the Las Vegas Wash between the North Las Vegas Detention Basin and Craig Road. Please refer to Figure 1 – Vicinity Map.

2.3 EXISTING FLOOD CONTROL FACILITIES

The 2002 Master Plan Update (MPU) serves as a planning tool for the implementation of existing and proposed flood control facilities within Clark County. The MPU shows the alignment of the proposed Upper Las Vegas Wash Channel (LVUP 0000 through LVUP0333), see Figures 2 & 2A. Refer to the tables immediately following Figures 2 & 2A that provide detailed information on each existing or proposed facility within the project reach.

2.4 FEMA FLOODZONE INFORMATION

Figure 3 is a reproduction of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps for Clark County & City of North Las Vegas, Nevada (Community No 32003C). It should be noted that the proposed facility and the affected flood zones are located entirely within the City of North Las Vegas. Currently, the 100-year flood event is contained in culvert at the intersection of the proposed facility with Lone Mountain Road and Craig Road. The following panels will be affected by the proposed project:

1. 1767E dated September 27, 2002
2. 1769E dated September 27, 2002
3. 1786E dated September 27, 2002
4. 1788E dated September 27, 2002
5. 2176E dated September 27, 2002, revised to reflect LOMR December 12, 2003

Figure 3 shows the Zone AE, AO and A flood zones in relation to the proposed facility. Note that this CLOMR request does not intend to remove the Zone A flood zone that ties-in to the Zone AE at Ann Road. Refer to Figure 3A that shows the DFIRM floodzone delineations for the subject area.

3.0 HYDROLOGY

3.1 EFFECTIVE VS. DESIGN FLOW

Three flow rates have been established for the Las Vegas Wash between the outlet of the NLVDB and Craig Road. The effective FIS discharge of 2,839 cfs was derived from the 1998 Upper Las Vegas Wash FIS Restudy by Northwest Hydraulics. A review of the Upper Las Vegas Wash FIS Restudy did not show any other flow rates for the area between NLVDB and Craig Road. The 2002 Clark County MPU shows a 100-year discharge ranging between 2,305 cfs at the upstream end of the proposed improvements to 5,158 cfs at Craig Road. The design discharge from VTN (2002) ranges from 2,691 cfs at the upstream end of the proposed improvements to 6,940 cfs at Craig Road. It should be noted that the hydrology developed for the design of the proposed channel is based on ultimate conditions, i.e., full build-out of the tributary watershed. The reference hydrology material from the FIS Restudy and VTN is presented in Appendix C.

3.2 REFERENCE HYDROLOGY

The hydrologic model utilized to calculate runoff is the HEC-1 Flood Hydrograph Package, Version 4.1, developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center. The methodology and calculations used to determine the hydrologic parameters in the HEC-1 modeling are included in Appendix C. The local parameters for computing runoff have been developed in accordance with the Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual.

The HEC-1 model submitted in this CLOMR is derived from a portion of the 2002 MPU. The model was updated by VTN to reflect current conditions and additional tributary area as described above. The total tributary area to the proposed channel is 13.6 square miles.

The HEC-1 model prepared by VTN (2002) is included in the Drainage Study Report, see Appendix C.

4.0 HYDRAULICS

4.1 COMPUTER MODELING

Hydraulic modeling of the proposed Upper Las Vegas Wash channel was performed in conformance with the local standards as specified in CCRFCD's Hydrologic Criteria and Drainage Design Manual using Water Surface Pressure Gradient (WSPG) software.

4.2 HYDRAULIC ANALYSIS

A momentum analysis was performed for each of the confluence structures located at Elkhorn Road, Centennial Parkway, Tropical Parkway and Ann Road. The momentum analysis calculations can be found in Appendix D.

The channel design was also analyzed for pulsating flow (roll waves and shock waves). The pulsating flow analysis can be found in Appendix D.

4.3 MODEL DESCRIPTION

The proposed channel was analyzed for three different hydraulic situations which correspond to the following WSPG input files (ULVW.dat, ULVW2.dat, and ULVW3.dat). The ULVW.dat model is for the expected condition with a Manning's n value of 0.015. The ULVW2.dat model uses a Manning's n value of 0.012. The ULVW3.dat model is a bulking analysis in which the center pier of each RCB was increased by 1-foot.

4.4 RESULTS

The models show that the proposed channel has sufficient conveyance capacity. A more detailed discussion of the channel design can be found in the reference drainage report in Appendix D. Also refer to Appendix D for the hardcopy output of the WSPG models and Appendix F (Data CD) for the digital version of the WSPG input/output files.

5.0 CONCLUSION

We believe that based on the data and supporting calculations contained within this Conditional Letter of Map Revision application, the flood zone revisions proposed in this report are warranted. Please refer to Figures 3 and 4, FEMA Flood Zone Map and Annotated FEMA Flood Zone Map.

6.0 REFERENCES

HCDDM — *Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual*. Prepared for: Clark County Regional Flood Control District. Adopted August 12, 1999.

HEC-1 — HEC-1 Flood Hydrograph Package Version 4.1. U.S. Army Corps of Engineers, Hydrologic Engineering Center, June 1998.

WSPG — Water Surface Pressure Gradient Version (F0515P), Los Angeles County Public Works & Civilsoft, 1989.

MPU 02 — *CCRFCD 2002 Master Plan Update for the Las Vegas Valley*. Prepared for Clark County Regional Flood Control District. Prepared by PBS&J, 2002.

VTN — *Upper Las Vegas Wash Channel 70% Design Report.* Prepared for the City of North Las Vegas. Prepared by VTN Nevada, dated May 2002.

VTN — *Upper Las Vegas Wash Channel 90% Design Report.* Prepared for the City of North Las Vegas. Prepared by VTN Nevada, dated October 2002.

APPENDIX A

FEMA MT-2 Forms

MT-2 FORM 1

FEDERAL EMERGENCY MANAGEMENT AGENCY

OVERVIEW & CONCURRENCE FORM

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

PAPERWORK BURDEN DISCLOSURE NOTICE

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

A. REQUESTED RESPONSE FROM FEMA

This request is for a (check one):

☒ CLOMR: A letter from FEMA commenting on whether a proposed project, if built as proposed, would justify a map revision, or proposed hydrology changes (See 44 CFR Ch. 1, Parts 60, 65 & 72).

☐ LOMR: A letter from FEMA officially revising the current NFIP map to show the changes to floodplains, regulatory floodway or flood elevations. (See Parts 60 & 65 of the NFIP Regulations.)

B. OVERVIEW

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

Community No.	Community Name	State	Map No.	Panel No.	Effective Date
Ex: 480301 480287	City of Katy Harris County	TX TX	480301 48201C	0005D 0220G	02/08/83 09/28/90
[illegible]07	City of North Las Vegas	NV	32003C	1767E	09/27/02
320007	City of North Las Vegas	NV	32003C	1769E	09/27/02
320007	City of N. Las Vegas	NV	32003C	1786E	9/27/02
320007	City of N. Las Vegas	NV	32003C	1788E	9/27/02
320007	City of N. Las Vegas	NV	32003C	2176E	12/11/03

2. Flooding Source: Las Vegas Wash

3. Project Name/Identifier: Request for Conditional Letter of Map Revision for Upper Las Vegas Wash Channel

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

5. Basis for Request and Type of Revision:

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

   ☒ Physical Change ☐ Improved Methodology/Data

   ☐ Regulatory Floodway Revision ☐ Other (Attach Description)

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

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

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

C. REVIEW FEE

Has the review fee for the appropriate request category been included? ☐ Yes Fee amount: $4,000

☒ No, Attach Explanation

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

D. SIGNATURE

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

Name: Brian K. Loffman, CFM	Company: PBS&J	
Mailing Address: 2270 Corporate Circle Suite 100 Henderson, NV 89074	Daytime Telephone No.: (702) 263-7275	Fax No.: (702) 263-7200
	E-Mail Address: bloffman@pbsj.com	
Signature of Requester (required):		Date: 4/25/05

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

Community Official's Name and Title: Lenny Badger, P.E., CFM, Flood Control Manager		Telephone No.: (702) 633-1223
Community Name: City of North Las Vegas	Community Official's Signature (required):	Date: 4/27/05

CERTIFICATION BY REGISTERED PROFESSIONAL ENGINEER AND/OR LAND SURVEYOR

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

Certifier's Name: Mathew S. Baird, P.E., CFM	License No.: NV 13684	Expiration Date: 12/31/06
Company Name: PBS&J	Telephone No.: (702) 263-7275	Fax No.: (702) 263-7200
Signature:		Date: 4/25/05

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

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



Seal (Optional)

4/25/05

MT-2 FORM 2

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE HYDROLOGY & HYDRAULICS FORM

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

PAPERWORK REDUCTION ACT

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

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

A. HYDROLOGY

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

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

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

Location	Drainage Area (Sq. Mi.)	FIS (cfs)	Revised (cfs)
City of North Las Vegas	13.6	2,833	6,940

Methodology for New Hydrologic Analysis (check all that apply)

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

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

4. Review/Approval of Analysis

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

5. Impacts of Sediment Transport on Hydrology

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

B. HYDRAULICS

1. Reach to be Revised

	Description	Cross Section	Water-Surface Elevations (ft.) Effective	Proposed/Revised
Downstream Limit	Craig Road	213+03.34	1921	1921
Upstream Limit	NLV Detention Basin Outfall	-1+71.70	2115	2114.8

2. Hydraulic Method Used

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

B. HYDRAULICS (CONTINUED)

3. Pre-Submittal Review of Hydraulic Models

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

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

4. Models Submitted

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

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

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

C. MAPPING REQUIREMENTS

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

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

D. COMMON REGULATORY REQUIREMENTS

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

For CLOMR requests, if either of the following is true, please submit evidence of compliance with Section 65.12 of the NFIP regulations:
- The proposed project encroaches upon a regulatory floodway and would result in increases above 0.00 foot.
- The proposed project encroaches upon a SFHA with BFEs established and would result in increases above 1.00 foot.

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

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

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

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

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

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

MT-2 FORM 3

Riverine Structures Form

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

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

PAPERWORK REDUCTION ACT

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

A. GENERAL

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

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

Description Of Structure

1. **Name of Structure: Upper Las Vegas Wash Channel**

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

   Location of Structure: Approximately 170' downstream of North Las Vegas Detention Basin to Craig Road

   Downstream Limit/Cross Section: 213+03.34

   Upstream Limit/Cross Section: -1+71.70

2. **Name of Structure: Dual 10' x 9' RCBs**

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

   Location of Structure: Elkhorn Road

   Downstream Limit/Cross Section: 10+03

   Upstream Limit/Cross Section: 6+14

3. **Name of Structure: 42' x 8' RCB**

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

   Location of Structure: Dorrell Lane & two locations upstream of Dorrell lane

   Downstream Limit/Cross Section: 23+35, 18+75 and 15+25 (respectively)

   Upstream Limit/Cross Section: 21+75, 18+25 and 14+75

NOTE: For more structures, attach additional pages as needed.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

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

PAPERWORK REDUCTION ACT

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

A. GENERAL

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

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

Description Of Structure

4. **Name of Structure: 42' x 8' RCB**

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

Location of Structure: Deer Springs Way

Downstream Limit/Cross Section: 38+71.99

Upstream Limit/Cross Section: 36+00

5. **Name of Structure: 46' x 9' RCBs**

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

Location of Structure: Centennial Parkway

Downstream Limit/Cross Section: 72+55.76

Upstream Limit/Cross Section: 69+90

6. **Name of Structure: 42' x 6' RCB Confluence Structure at Centennial Parkway**

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

Location of Structure: Centennial Parkway

Downstream Limit/Cross Section: 72+55.76

Upstream Limit/Cross Section: 68+05.69

NOTE: For more structures, attach additional pages as needed.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

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

PAPERWORK REDUCTION ACT

Public reporting burden for this form is estimated to average 7 hours per response. The burden estimate includes the time for reviewing instructions, searching existing data sources, gathering and maintaining the needed data, and completing, reviewing, and submitting the form. You are not required to respond to this collection of information unless a valid OMB control number appears in the upper right corner of this form. Send comments regarding the accuracy of the burden estimate and any suggestions for reducing this burden to: Information Collections Management, Federal Emergency Management Agency, 500 C Street, SW, Washington DC 20472, Paperwork Reduction Project (3067-0148). Submission of the form is required to obtain or retain benefits under the National Flood Insurance Program. **Please do not send your completed survey to the above address.**

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

A. GENERAL

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

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

Description Of Structure

7. **Name of Structure: 50' x 9.5' RCB**

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

Location of Structure: Between Azure Avenue and Tropical Parkway

Downstream Limit/Cross Section: 91+69

Upstream Limit/Cross Section: 91+19

8. **Name of Structure: 50' x 9.5' RCBs**

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

Location of Structure: Between Azure Avenue and Tropical Parkway

Downstream Limit/Cross Section: 95+87.75

Upstream Limit/Cross Section: 95+37.75

9. **Name of Structure: 50' x 8' RCB**

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

Location of Structure: Tropical Parkway

Downstream Limit/Cross Section: 100+94.72

Upstream Limit/Cross Section: 99+21.95

NOTE: For more structures, attach additional pages as needed.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. No. 3067-0148
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Flooding Source: Las Vegas Wash
Note: Fill out one form for each flooding source studied

A. GENERAL

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

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

Description Of Structure

10. **Name of Structure: 10' x 7' RCB**

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

Location of Structure: Confluence structure at Tropical Parkway

Downstream Limit/Cross Section: 100+94.72

Upstream Limit/Cross Section: 98+44.48

11. **Name of Structure: 50' x 9' RCB**

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

Location of Structure: Ann Road

Downstream Limit/Cross Section: 128+00.09

Upstream Limit/Cross Section: 125+10

12. **Name of Structure: 10' x 7' RCB confluence structure at Ann Road**

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

Location of Structure: Ann Road

Downstream Limit/Cross Section: 128+00.09

Upstream Limit/Cross Section: 124+79.65

NOTE: For more structures, attach additional pages as needed.

FEDERAL EMERGENCY MANAGEMENT AGENCY

RIVERINE STRUCTURES FORM

O.M.B. No. 3067-0148
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PAPERWORK REDUCTION ACT

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

A. GENERAL

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

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

Description Of Structure

13. **Name of Structure: 56' x 9' RCB**

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

Location of Structure: Washburn Avenue

Downstream Limit/Cross Section: 154+45

Upstream Limit/Cross Section: 152+95

14. **Name of Structure: 56' x 8' RCB**

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

Location of Structure: Losee Road

Downstream Limit/Cross Section: 175+19.48

Upstream Limit/Cross Section: 172+80

15. **Name of Structure: 56' x 7' RCB**

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

Location of Structure: Lone Mountain Road

Downstream Limit/Cross Section: 185+40

Upstream Limit/Cross Section: 183+95

NOTE: For more structures, attach additional pages as needed.

B. CHANNELIZATION

Flooding Source: Las Vegas Wash

Name of Structure: Upper Las Vegas Wash Channel

1. Accessory Structures

The channelization includes (check one):

- ☐ Levees [Attach Section E (Levee/Floodwall)]
- ☐ Superelevated sections
- ☐ Debris basin/detention basin
- ☒ Other (Describe): Concrete Lined Channel
- ☐ Drop structures
- ☐ Transitions in cross sectional geometry
- ☐ Energy dissipator

2. Drawing Checklist

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

3. Hydraulic Considerations

The channel was designed to carry 6,940 (cfs) and/or the 100-year flood.

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

☐ Subcritical flow ☐ Critical flow ☒ Supercritical flow ☐ Energy grade line

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

☐ Inlet to channel ☐ Outlet of channel ☐ At Drop Structures ☐ At Transitions
☐ Other locations (specify):

4. Sediment Transport Considerations

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

C. BRIDGE/CULVERT

Flooding Source: Las Vegas Wash

Name of Structure: Upper Las Vegas Wash Channel

1. This revision reflects (check one):

- ☒ New bridge/culvert not modeled in the FIS
- ☐ Modified bridge/culvert previously modeled in the FIS
- ☐ New analysis of bridge/culvert previously modeled in the FIS

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

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

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

4. Sediment Transport Considerations

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

D. DAM

Flooding Source:

ıe of Structure:

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

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

   ☐ Private organization Name of the agency or organization:

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

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

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

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

5. Does the Base Flood Elevation behind the dam or downstream of the dam change?

   ☐ Yes ☐ No If Yes, complete the Riverine Hydrology & Hydraulics Form (Form 2) and complete the table below.

Stillwater Elevation Behind the Dam

FREQUENCY (% annual chance)	FIS	REVISED
10-year (10%)		
50-year (2%)		
100-year (1%)		
500-year (0.2%)		
Normal Pool Elevation		

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

E. LEVEE/FLOODWALL

1. System Elements

a. This Levee/Floodwall analysis is based on (check one):

☐ upgrading of an existing levee/floodwall system
☐ a newly constructed levee/floodwall system
☐ reanalysis of an existing levee/floodwall system

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

☐ earthen embankment, dike, berm, etc.	Station	to
☐ structural floodwall	Station	to
☐ Other (describe):	Station	to

c. Structural Type (check one):

☐ monolithic cast-in place reinforced concrete
☐ reinforced concrete masonry block
☐ sheet piling
☐ Other (describe):

d. Has this levee/floodwall system been certified by a Federal agency to provide protection from the base flood?

☐ Yes ☐ No

If Yes, by which agency?

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

1. Plan of the levee embankment and floodwall structures. Sheet Numbers:
2. A profile of the levee/floodwall system showing the Base Flood Elevation (BFE), levee and/or wall crest and foundation, and closure locations for the total levee system. Sheet Numbers:
3. A profile of the BFE, closure opening outlet and inlet invert elevations, type and size of opening, and kind of closure. Sheet Numbers:
4. A layout detail for the embankment protection measures. Sheet Numbers:
5. Location, layout, and size and shape of the levee embankment features, foundation treatment, floodwall structure, closure structures, and pump stations. Sheet Numbers:

2. Freeboard

a. The minimum freeboard provided above the BFE is:

Riverine

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

Coastal

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

2. Freeboard (continued)

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

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

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

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

3. Closures

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

If opening exists, list all closures:

Channel Station	Left or Right Bank	Opening Type	Highest Elevation for Opening Invert	Type of Closure Device

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

Note: Geotechnical and geologic data

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

4. Embankment Protection

a. The maximum levee slope landside is:

b. The maximum levee slope floodside is:

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

d. Embankment material is protected by (describe what kind):

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

Reach	Sideslope	Flow Depth	Velocity	Curve or Straight	Stone Riprap			Depth of Toedown
					D_{100}	D_{50}	Thickness	
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								
Sta to								

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

4. Embankment Protection (continued)

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

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

Attach engineering analysis to support construction plans.

5. Embankment And Foundation Stability

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

☐ Overall height: Sta. ; height ft.

☐ Limiting foundation soil strength:

Sta. , depth to

strength ϕ = degrees, c = psf

slope: SS = (h) to (v)

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

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

c. Summary of stability analysis results:

Case	Loading Conditions	Critical Safety Factor	Criteria (Min.)
I	End of construction		1.3
II	Sudden drawdown		1.0
III	Critical flood stage		1.4
IV	Steady seepage at flood stage		1.4
VI	Earthquake (Case I)		1.0

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

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

If Yes, describe methodology used:

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

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

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

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

Attach engineering analysis to support construction plans.

E. LEVEE/FLOODWALL (CONTINUED)

Floodwall And Foundation Stability

a. Describe analysis submittal based on Code (check one):

☐ UBC (1988) or ☐ Other (specify):

b. Stability analysis submitted provides for:

☐ Overturning ☐ Sliding If not, explain:

c. Loading included in the analyses were:

☐ Lateral earth @ P_A = psf; P_p = psf

☐ Surcharge-Slope @ , ☐ surface psf

☐ Wind @ P_w = psf

☐ Seepage (Uplift); ☐ Earthquake @ P_{eq} = %g

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

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

d. Summary of Stability Analysis Results: Factors of Safety.

Itemize for each range in site layout dimension and loading condition limitation for each respective reach.

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

(Ref: FEMA 114 Sept 1986; USACE EM 1110-2-2502)

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

e. Foundation bearing strength for each soil type:

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

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

Attach engineering analysis to support construction plans.

E. LEVEE/FLOODWALL (CONTINUED)

7. Settlement

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

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

c. Settlement of the levee crest is determined to be primarily from :

☐ Foundation consolidation
☐ Embankment compression
☐ Other (Describe):

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

Attach engineering analysis to support construction plans.

8. Interior Drainage

a. Specify size of each interior watershed:

Draining to pressure conduit: acres
Draining to ponding area: acres

b. Relationships Established

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

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

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

e. Which flooding conditions were analyzed?

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

If No for any of the above, attach explanation.

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

If No, attach explanation.

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

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

E. LEVEE/FLOODWALL (CONTINUED)

8. Interior Drainage (continued)

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

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

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

Will the operation be automatic? ☐ Yes ☐ No

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

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

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

9. Other Design Criteria

a. The following items have been addressed as stated:

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

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

Attach supporting documentation

c. If the levee/floodwall is new or enlarged, will the structure adversely impact flood levels and/or flow velocities floodside of the structure?
☐ Yes ☐ No

Attach supporting documentation

d. Sediment Transport Considerations:

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

E. LEVEE/FLOODWALL (CONTINUED)

10. Operational Plan And Criteria

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

b. Does the operation plan incorporate all the provisions for closure devices as required in Paragraph 65.10(c)(1) of the NFIP regulations?
☐ Yes ☐ No

c. Does the operation plan incorporate all the provisions for interior drainage as required in Paragraph 65.10(c)(2) of the NFIP regulations?
☐ Yes ☐ No

If the answer is No to any of the above, please attach supporting documentation.

11. Maintenance Plan

a. Are the planned/installed works in full compliance with Part 65.10 of the NFIP Regulations? ☐ Yes ☐ No
If No, please attach supporting documentation.

12. Operations and Maintenance Plan

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

F. SEDIMENT TRANSPORT

Flooding Source:

Name of Structure:

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

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

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

Sediment transport rate (percent concentration by volume)

Method used to estimate sediment transport:

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

Method used to estimate scour and/or deposition:

Method used to revise hydraulic or hydrologic analysis (model) to account for sediment transport:
Please note that bulked flows are used to evaluate the performance of a structure during the base flood; however, FEMA does not map BFEs based on bulked flows.

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

EXPLANATIONS

Statement of Explanations

MT-2 Form 1

C. Clark County Regional Flood Control District will submit fee upon receiving an invoice from FEMA

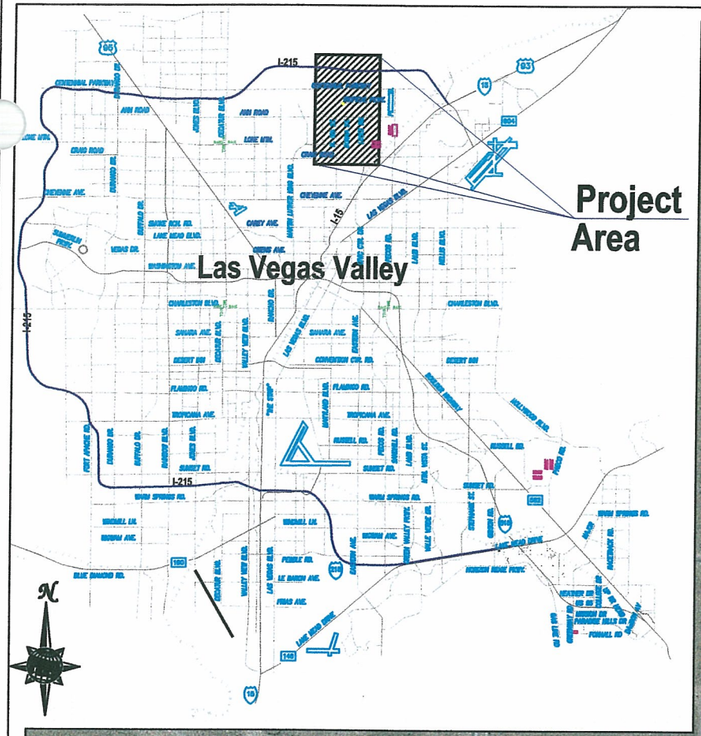
Statement of Explanations

MT-2 Form 2, A-5 & MT-2 Form 3, B-4

Sediment transport was not considered due to the supercritical flow regime of the proposed channel, the fact that the channel will be concrete lined and because the North Las Vegas Detention Basin will capture upstream sediment.

APPENDIX B

Figures



GRAPHIC SCALE

1500 0 750 1500 3000 6000

(IN FEET)

1 inch = 1500 ft.

FIGURE 1: VICINITY MAP

Upper Las Vegas Wash Channel CLOMR

Zone AE Flood Zone

Zone AO Flood Zone

Zone A Flood Zone

Upper Las Vegas Wash Facility Alignment

Note: Aerial Photo as of April 2004

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada 89074
Tele: 702-263-7275
Fax: 702-263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE 1

REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert
- Bridge
- Pipeline
- Lined Channel
- Unlined Channel
- Dike
- Natura Wash
- ID-Mile Separator

N
W E
S

0 1,000 2,000 3,000 4,000 5,000
Feet

SCALE: 1 inch = 3000 feet

US95 I-15 I-215

1	2			
3	4	5	6	
7	8	9	10	
11	12	13	14	
15	16	17	18	
19	20	21	22	
23	24	25	26	
27	28	29		

FLOOD CONTROL FACILITIES
FIGURE F-5

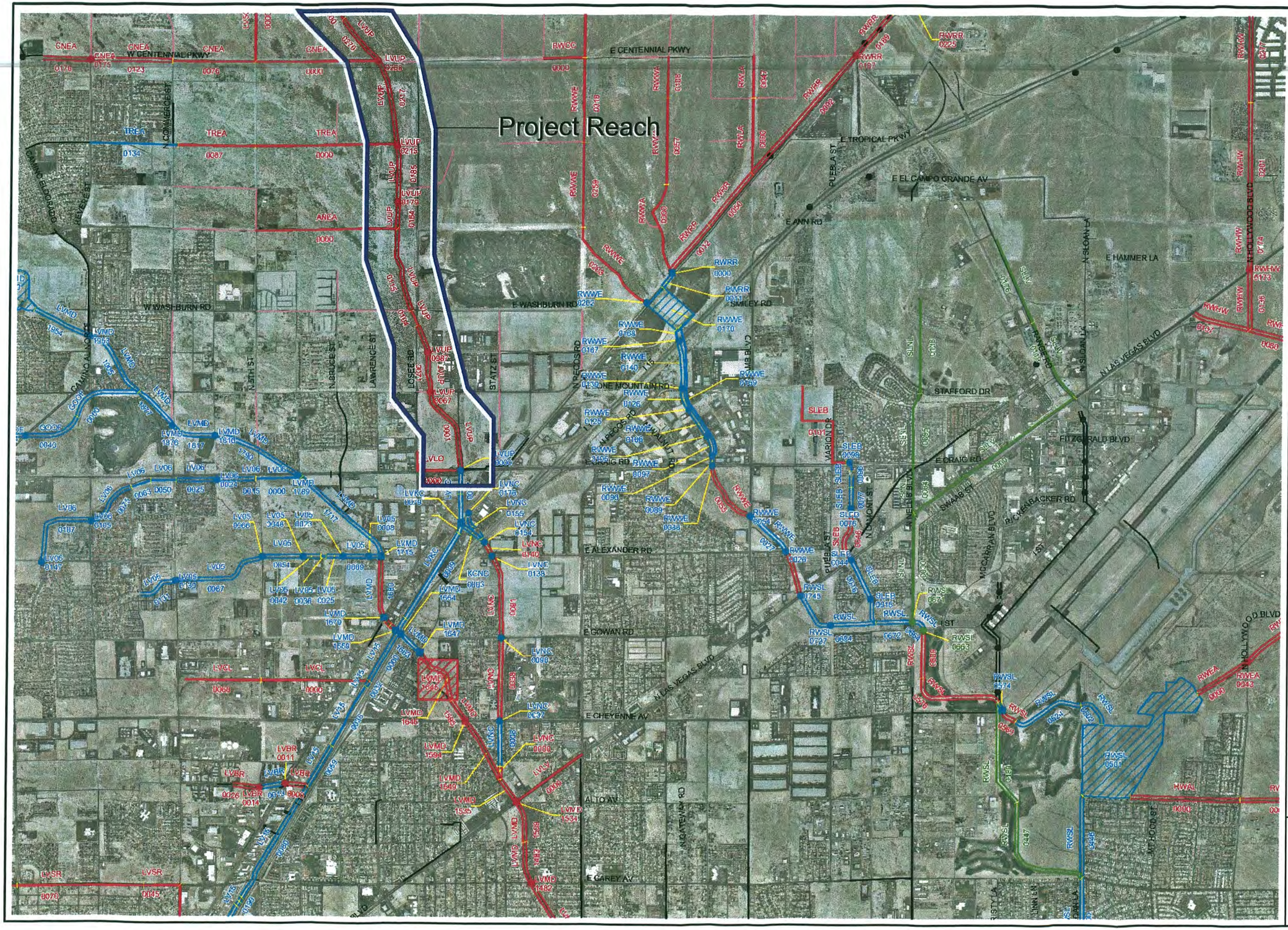
PBS&J

G.C. WALLACE, P.C.

Project Reach

See Figure 2A for continuation

FIGURE 2



REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin
- Culvert
- Bridge
- Pipeline
- Lined Channel
- Unlined Channel
- Dike
- Natural Wash
- ID-Mile Separator

N W E S

0 1,000 2,000 3,000 4,000 6,000
Feet

SCALE: 1 inch = 3000 feet



FLOOD CONTROL FACILITIES
FIGURE F-9

PBS&J

G.C. WALLACE, INC.

FIGURE 2A

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANEA		**ANN ROAD CHANNEL EAST**						
0000	P1	8' X 6' RCB	4600	635	CNN142-C	CWEST3	1.07	0.97
CNEA		**CENTENNIAL PKWY CHANNEL EAST**						
0000	P3	4: 12' X 8' RCB	4000	1973	CNN138-C	CWEST3	2.44	0.20
0076	P3	2: 10' X 8' RCB	2707	1230	CNN093-C	CWEST3	1.45	0.55
0123	P3	Conc Chnl 15'W 6.5'D 0:1 SS	2550	1230	CNN093-C	CWEST3	1.45	1.04
0175	P3	15' X 6' RCBC @ Revere	115	948	CNN078-C	CWEST3	1.13	1.04
0176	P3	Conc Chnl 15'W 6.5'D 0:1 SS	1500	948	CNN078-C	CWEST3	1.13	0.86
GOOF		**GOWAN OUTFALL FACILITIES**						
0000	E	Conc Chnl 20'W 7'D 2:1 SS	2500	5252	CPT-2B-3	GW5SC	14.5	1.25
0040	E	Conc Chnl 20'W 7'D 2:1 SS	1900	5024	CPT2C-1*	GW4SC	11.61	0.60
0074	E	2: 16' X 7' RCBC @ Camino al Norte	131	5024	CPT2C-1*	GW4SC	11.61	1.30
0077	E	Conc Chnl 20'W 7'D 2:1 SS	3157	5024	CPT2C-1*	GW4SC	11.61	1.40
KCNC		**KING CHARLES - N CHANNEL**						
0000	E	Conc Chnl 13'W 6.3'D 0:1 SS	69	892	N	CWEST5	13.71	0.70
0001	E	Conc Chnl 16.5'W 8'D 0:1 SS	67	892	N	CWEST5	13.71	0.70
0003	E	Conc Chnl 10'W 7'D 2:1 SS	800	892	N	CWEST5	13.71	0.70
LV05		**TRIBUTARY TO WESTERN TRIBUTARY AT ALEXANDER RD**						
0000	E	Conc Chnl 30'W 10'D 0:1 SS	400	1310	CLV99B-6	CWEST3	1.43	0.47
0008	E	20' X 7' RCBC	100	1310	CLV99B-6	CWEST3	1.43	0.47
0009	E	Conc Chnl 20'W 11'D 0:1 SS	800	1310	CLV99B-6	CWEST3	1.43	0.47
0023	E	20' X 7' RCBC @ Bruce	125	1310	CLV99B-6	CWEST3	1.43	0.47
0025	E	Conc Chnl 16'W 10'D 0:1 SS	600	1310	CLV99B-6	CWEST3	1.43	0.78
0036	E	16' X 7' RCBC	300	1310	CLV99B-6	CWEST3	1.43	0.78
0042	E	Conc Chnl 18'W 10'D 0:1 SS	300	1310	CLV99B-6	CWEST3	1.43	0.78
0048	E	16' X 5.5' RCBC @ Donna	110	1072	CLV99B-4	CWEST3	1.17	0.78
0051	E	Conc Chnl 16'W 9'D 0:1 SS	1300	1072	CLV99B-4	CWEST3	1.17	1.20
0066	E	12' X 7' RCBC @ N. 5th Street	135	1072	CLV99B-4	CWEST3	1.17	1.20
0067	E	Conc Chnl 12'W 7'D 0:1 SS	2825	1072	CLV99B-4	CWEST3	1.17	1.80
0130	E	2: 14.5' X 4' RCBC @ Commerce	220	646	CLV99B-3	CWEST3	0.64	1.70
0131	E	Conc Chnl 28'W 3'D 3:1 SS	1300	646	CLV99B-3	CWEST3	0.64	0.76
LV06		**TRIBUTARY TO WESTERN TRIBUTARY AT CRAIG RD**						
0000	E	2: 9' X 6' RCB	1450	1259	CLV99A-4	CWEST3	1.73	1.00
0015	E	Conc Chnl 12'W 6'D 2:1 SS	1400	1259	CLV99A-4	CWEST3	1.73	0.71
0024	E	2: 10' X 6' RCBC	140	1259	CLV99A-4	CWEST3	1.73	2.36
0025	E	Conc Chnl 8'W 4.5'D 2:1 SS	1320	1123	CLV99A-3	CWEST3	1.31	1.54
0050	E	2: 8' X 6' RCB	729	1123	CLV99A-3	CWEST3	1.31	1.20
0063	E	2: 7' X 6' RCB	631	1123	CLV99A-3	CWEST3	1.31	1.17
0075	E	Conc Chnl 12'W 8'D 0:1 SS	1593	1123	CLV99A-3	CWEST3	1.31	0.74
0105	E	2: 8' X 6' RCBC @ Revere	105	1123	CLV99A-3	CWEST3	1.31	1.71
0107	E	Conc Chnl 12'W 6'D 2:1 SS	2600	1123	CLV99A-3	CWEST3	1.31	0.54
0147	E	12' X 6' RCBC @ Alexander	150	644	CLV99A-2	CWEST3	0.74	1.16
LV15		**FREEWAY CHANNEL**						
0000	E	Conc Chnl 20'W 10'D 1:1 SS	1800	5053	2CLV1E-3	CWEST4	11.31	0.18
0032	E	Conc Chnl 20'W 10'D 1:1 SS	200	4669	2CLV1D-5	CWEST4	10.41	0.18
0038	E	2: 15' X 12' RCB	2200	4669	2CLV1D-5	CWEST4	10.41	0.18
0059	E	Conc Chnl 20'W 10'D 1:1 SS	1600	4669	2CLV1D-5	CWEST4	10.41	0.18
0080	E	Conc Chnl 20'W 10'D 1:1 SS	4100	4346	CLV1D-4	CWEST4	9.81	0.18
0190	E	Conc Chnl 20'W 10'D 1:1 SS with Drop Structures	100	4185	CW1C2	NW4SC	9.04	0.18
0191	E	Conc Chnl 20'W 10'D 1:1 SS with Drop Structures	100	4185	CW1C2	NW4SC	9.04	0.18
0193	E	Conc Chnl 20'W 10'D 1:1 SS with Drop Structures	1300	4185	CW1C2	NW4SC	9.04	0.18
LV5C		**5TH STREET COLLECTOR**						
0000	P1	8' X 7' RCB	3900	726	CNN109-C	CWEST3	0.73	0.82
LVBR		**LAS VEGAS - BROOK**						
0000	P1	Conc Chnl 12'W 4.5'D 2:1 SS	700	994	CLV1D-5	CWEST3	0.8	2.90
0011	P1	8' X 7' RCBC @ N. 5th St.	100	994	CLV1D-5	CWEST3	0.8	2.90
0013	E	Conc Chnl 12'W 4.5'D 2:1 SS	850	994	CLV1D-5	CWEST3	0.8	2.60
0014	P1	8' X 7' RCBC @ Losee	100	994	CLV1D-5	CWEST3	0.8	2.60
0026	P1	Conc Chnl 12'W 4.5'D 2:1 SS	850	994	CLV1D-5	CWEST3	0.8	4.30
LVCL		**LAS VEGAS WASH - COLTON**						
0000	P1	108" RCP	3600	1078	CLV1E-3	CWEST3	0.9	1.50
0068	P1	96 RCP	2400	851	CLV1E-2	CWEST3	0.71	1.70
LVKC		**LAS VEGAS WASH - KING CHARLES CHANNEL**						
0000	E	Conc Chnl 35'W 10'D 0:1 SS	494	5158	CNN170-C*	CWEST4	11.48	0.40
0009	E	Conc Chnl 21.8'W 10'D 1.5:1 SS	3280	5158	CNN170-C*	CWEST4	11.48	0.40
0071	E	Conc Chnl 28'W 10.5'D 1.5:1 SS	341	5158	CNN170-C*	CWEST4	11.48	0.40
0078	E	Conc Chnl 52.6'W 8.6'D 0:1 SS	70	5158	CNN170-C*	CWEST4	11.48	0.40
0079	E	4 Span Bridge 52.6'W 9.5'D	61	5158	CNN170-C*	CWEST4	11.48	0.40
0080	E	Conc Chnl 15'W 10.5'D 2:1 SS	860	5158	CNN170-C*	CWEST4	11.48	0.40
0097	E	Conc Chnl 35'W 11'D 0:1 SS	747	5158	CNN170-C*	CWEST4	11.48	0.40

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVLO		**LAS VEGAS WASH - LOSEE**						
0000	P1	96" RCP	2600	345	NN174-C	CWEST3	0.33	0.38
LVLV		**LAS VEGAS BLVD DRAIN**						
0000	P1	2: 10' X 9' RCB	2600	1031	CLW075-4	CWEST3	1.03	0.10
LVMD		**LAS VEGAS WASH - MIDDLE**						
1421	E	Earth Chnl 60'W 8'D 1:1SS	3221	8782	CLW64-4	CCWEST5	77.37	0.60
1421	P2	Conc Chnl 64'W 10'D 0:1 SS	3221	8782	CLW64-4	CCWEST5	77.37	0.33
1482	E	5: 120" CMP @ Carey	120	8782	CLW64-4	CCWEST5	77.37	0.40
1482	P2	2 Span Bridge 64'W 8.5'D @ Carey	120	8782	CLW64-4	CCWEST5	77.37	0.39
1483	E	Earth Chnl 75'W 6'D 2:1SS	2693	8762	CLW64-4	CCWEST5	77.37	0.40
1483	P2	Conc Chnl 80'W 10'D 1.5:1 SS	1300	8782	CLW64-4	CCWEST5	77.37	0.36
1509	P2	Conc Chnl 80'W 10'D 1.5:1 SS	1400	8712	2CLW1A-4	CCWEST5	78.42	0.36
1534	E	5: 12' X 7' RCBC @ Las Vegas Blvd	120	8712	2CLW1A-4	CCWEST5	76.42	0.70
1534	P2	2 Span Bridge 95.5'W 6'D @ Las Vegas Blvd	120	8712	2CLW1A-4	CCWEST5	76.42	0.70
1535	E	Earth Chnl 80'W 6'D 3:1SS	730	8578	2CLW100	CCWEST5	74.73	0.90
1535	P2	Conc Chnl 80'W 10'D 1.5:1 SS	899	8578	2CLW100	CCWEST5	74.73	0.52
1549	E	Earth Chnl 70'W 8'-10'D 1:1 SS	2376	8226	CHYPEAK	CCWEST5	74.73	0.50
1549	P2	Conc Chnl 80'W 10'D 1.5:1 SS	2218	8226	CHYPEAK	CCWEST5	74.45	0.52
1594	E	5: 132" CMP @ Cheyenne	120	8226	CHYPEAK	CCWEST5	74.45	1.00
1594	P2	2 Span Bridge 90'W 5.5'D @ Cheyenne	120	8226	CHYPEAK	CCWEST5	74.45	0.39
1595	P2	Conc Chnl 90'W 7'D 0:1 SS	700	8226	CHYPEAK	CCWEST5	74.45	0.40
1643	P2	64,000 cfs PMF Spillway		64000	CHYPKIN	CCWEST5	74.45	
1644	P2	2: 34' X 7' RCB Outlet	221	8226	CHYPEAK	CCWEST5	74.45	0.15
1645	P2	440 ac-ft Cheyenne Peaking Basin		11703	CHYPKIN	CCWEST5	74.45	
1646	P2	Conc Chnl 70'W 8'D 0:1 SS	1771	11703	CHYPKIN	CCWEST5	74.45	0.15
1647	E	3 Span Bridge 95'W 8'-10'D 2:1 SS @ Civic Center	120	11675	3C99B-7	CCWEST5	74.13	0.70
1663	E	Conc Chnl 80'W 10'D 2:1 SS	700	11675	3C99B-7	CCWEST5	74.13	0.70
1664	E	3 Span Bridge 75'W 10'D 2:1 SS @ I-15	200	11675	3C99B-7	CCWEST5	74.13	0.70
1665	E	Conc Chnl 80'W 10'D 2:1 SS	214	7181	CLV99B-5	WEST5	50.09	0.70
1669	E	Free Span Bridge 55'W 12'D @ UPRR	80	7181	CLV99B-5	WEST5	50.09	0.70
1670	E	Earth Chnl 75'W 10'D 2:1 SS	185	7181	CLV99B-5	WEST5	50.09	0.70
1670	P2	Conc Chnl 85'W 10'D 2:1 SS	185	7181	CLV99B-5	WEST5	50.09	0.35
1673	E	Drop Structure 75'W 3'D 2:1 SS	185	7181	CLV99B-5	WEST5	50.09	
1673	P2	Drop Structure 80'W 10'D 2:1SS	10	7181	CLV99B-5	WEST5	50.09	
1674	E	Earth Chnl 80'W 10'D 2:1 SS	185	7181	CLV99B-5	WEST5	50.09	0.50
1674	P2	Conc Chnl 80'W 10'D 2:1 SS	185	7181	CLV99B-5	WEST5	50.09	0.49
1677	E	Earth Chnl 75'W 10'D 2:1 SS	100	7181	CLV99B-5	WEST5	50.09	0.50
1677	P2	Conc Chnl 80'W 10'D 2:1 SS	100	7181	CLV99B-5	WEST5	50.09	0.49
1679	E	4 Span Bridge 100'W 12'D 2:1 SS @ Losee	120	7181	CLV99B-5	WEST5	50.09	0.70
1680	E	Earth Chnl 75'W 10'D 3:1 SS	2008	7181	CLV99B-5	WEST5	50.09	0.50
1680	P2	Conc Chnl 80'W 10'D 2:1 SS	2008	7181	CLV99B-5	WEST5	50.09	0.36
1715	E	Energy Dissipator 70'W 18'D	10	7068	CNN134-C	WEST5	48.06	0.40
1718	E	Bridge 40'W 10.5'D @ Alexander	40	7068	CNN134-C	WEST5	48.06	0.36
1717	E	Conc Chnl 20'W 10'D 2:1 SS	3718	7068	CNN134-C	WEST5	48.06	1.00
1789	E	7 : 6' X 8' RCBC	100	7030	2C99A-4	WEST5	47.77	1.56
1790	E	Conc Chnl 18'W 10'D 2:1 SS	3200	6624	CNN118-C	WEST5	46.04	1.56
1816	E	6: 8' X 8' RCBC	100	6624	CNN118-C	WEST5	46.04	0.83
1817	E	Conc Chnl 32'W 13'D 0:1 SS	1200	6624	CNN118-C	WEST5	48.04	0.83
1876	E	3: 13' X 10.75' RCBC	125	6592	CNN104-C	WEST5	45.64	0.80
1877	E	Conc Chnl 30'W 10'D 1:1 SS	1800	6592	CNN104-C	WEST5	45.64	1.10
1905	E	Conc Chnl 12'W 10'D 1.65:1 SS	2500	3387	CNN086-C	WEST5	30.78	1.00
1953	E	3: 16' X 12' RCBC	100	3387	CNN086-C	WEST5	30.78	0.99
1954	E	Conc Chnl 30'W 5.5'D 2:1 SS	1979	3387	CNN086-C	WEST5	30.78	1.77
2048	E	68,000 cfs PMF Spillway		68000	LOWERIN	WEST5	30.21	
2049	E	4: 7' X 7' RCB Outlet	150	3333	LOWERDB	WEST5	30.21	
2050	E	600 ac-ft Lower Las Vegas Wash Detention Basin		7211	LOWERIN	WEST5	30.21	
LVNC		**LAS VEGAS WASH - N CHANNEL**						
0000	E	Earth Chnl 40'W 8'-10'D 2:1 SS	400	987	CLW100	CWEST5	13.99	0.70
0000	P1	Conc Chnl 12'W 5.5'D 2:1 SS	400	987	CLW100	CWEST5	13.99	0.70
0007	E	Drop Structure 18'W 2.8'D 3:1 SS	50	987	CLW100	CWEST5	13.99	0.70
0008	E	Conc Chnl 18'W 10'D 2:1 SS	1531	987	CLW100	CWEST5	13.99	0.70
0037	E	2: 132" CMP	120	987	CLW100	CWEST5	13.99	0.70
0038	P1	Conc Chnl 12'W 5.5'D 2:1 SS	2748	987	CLW100	CWEST5	13.99	0.70
0090	E	3 : 10' X 6' RCBC	120	987	CLW100	CWEST5	13.99	0.70
0091	P1	Conc Chnl 12'W 5.5'D 2:1 SS	2500	987	CLW100	CWEST5	13.99	0.70
0138	E	4: 6' X 4' RCBC	100	892	N	CWEST5	13.71	0.70
0140	P1	Conc Chnl 12'W 5.5'D 2:1 SS	500	892	N	CWEST5	13.71	0.70
0154	E	2 : 12' X 5.5' RCBC	100	892	N	CWEST5	13.71	0.70
0155	E	Earth Chnl 65'W 5'D 2:1 SS	1109	892	N	CWEST5	13.71	0.70
0176	E	36" CMP	100	36				1.00

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVSR		**LAS VEGAS WASH - SMOKE RANCH**						
0020	E	60" RCP	1320	1451	CS1-C	NW3SC	1.59	3.03
0020	P1	10' X 6' RCB	1320	1451	CS1-C	NW3SC	1.59	3.03
0045	E	54" RCP	1320	1451	CS1-C	NW3SC	1.59	3.41
0045	P1	10' X 6' RCB	1320	1451	CS1-C	NW3SC	1.59	3.41
0070	E	66" RCP	4118	1126	CS	NW3SC	1.12	0.73
0070	P1	10' X 8' RCB	4118	1126	CS	NW3SC	1.12	0.73
0148	E	54" RCP	2587	1126	CS	NW3SC	1.12	0.58
0148	P1	11' X 8' RCB	2587	1126	CS	NW3SC	1.12	0.58
LVUP		**UPPER LAS VEGAS WASH**						
0000	E	7 : 8' X 8' RCBC	100	5158	CNN170-C	CWEST4	11.48	0.40
0001	P1	Conc Chnl 20'W 9.5'D 2:1 SS	3000	5158	CNN170-C	CWEST4	11.48	0.63
0067	P1	4: 10' X 10' RCBC @ Lone Mountain	200	5158	CNN170-C	CWEST4	11.48	0.71
0071	P1	Conc Chnl 20'W 9.5'D 2:1 SS	1300	5158	CNN170-C	CWEST4	11.48	0.47
0087	P1	4: 12' X 10' RCBC @ La Madre	100	5158	CNN170-C	CWEST4	11.48	0.50
0089	P1	Conc Chnl 20'W 9'D 2:1 SS	900	4838	CNN144-C	CWEST4	10.41	0.67
0104	P1	4: 10' X 10' RCBC @ Washburn	600	4838	CNN144-C	CWEST4	10.41	0.67
0115	P1	Conc Chnl 20'W 9'D 2:1 SS	2600	4645	C156-C	CWEST4	9.59	0.58
0184	P1	Conc Chnl 20'W 9'D 2:1 SS	800	4645	C156-C	CWEST4	9.59	0.50
0179	P1	4: 10' X 10' RCBC @ Ann	300	4281	CNN156-C	CWEST4	8.52	0.50
0185	P1	Conc Chnl 20'W 8.5'D 2:1 SS	1600	4281	CNN156-C	CWEST4	8.52	0.63
0215	P1	4: 10' X 9' RCBC @ Tropical	100	4236	2C141-C*	CWEST4	8.07	0.63
0217	P1	Conc Chnl 20'W 8.5'D 2:1 SS	2700	4236	CNN153-C	CWEST3	6.84	0.74
0268	P1	4: 10' X 9' RCBC @ Centennial	200	4236	CNN153-C	CWEST3	8.84	0.74
0270	P1	Conc Chnl 20'W 7.0'D 2:1 SS	1600	3227	CNN137-C	WEST5	75.57	0.94
0300	P1	4: 9' X 8' RCBC @ Bruce	500	3227	CNN137-C	WEST5	75.57	0.94
RWAL		**ALTO CONVEYANCE**						
0000	P1	Conc Chnl 12'W 7'D 2:1 SS	3600	2749	C318D2	RW3	3.39	1.81
0068	P1	Conc Chnl 12'W 6.5'D 2:1 SS	2700	2749	C318D2	RW3	3.39	2.78
RWCC		**RANGE WASH - CENTENNIAL COLLECTOR**						
0000	P1	8' X 7' RCB	1300	545	CNN178C	RW3	0.87	0.40
RWEA		**RANGE WASH - EAST TRIBUTARY**						
0000	P1	Conc Chnl 25'W 7'D 2:1 SS	1925	3857	C318A2	RW3SC	3.91	0.95
0043	E	Unknown Culvert	80	3857	C318A2	RW3SC	3.91	1.00
0043	P1	4: 10' X 8' RCBC @ Hollywood	80	3857	C318A2	RW3SC	3.91	0.95
0044	P1	Conc Chnl 25'W 6.5'D 2:1 SS	1700	3110	C317-4	RW3SC	2.66	0.95
RWHW		**RANGE WASH - HOLLYWOOD BRANCH**						
0080	P1	Conc Chnl 12'W 10'D 2:1 SS	1800	3151	C47A4	RW3SC	4.16	0.28
0136	P1	Gabion Chnl 12'W 10'D 2:1 SS	2000	2167	C312F2	SPDWY4	8.58	1.05
0137	P1	Gabion Chnl 12'W 8'D 2:1 SS	1900	1228	C312D3	RW3	1.09	0.53
0173	P1	12' X 10' RCBC @ Las Vegas Blvd	100	2187	C312F2	SPDWY4	8.58	1.05
0174	P1	Gabion Chnl 12'W 8.5'D 2:1 SS	1300	2187	C312F2	SPDWY4	8.58	1.43
0201	P1	Gabion Chnl 12'W 9.5'D 2:1 SS	4000	1905	C312E4	SPDWY4	8.15	1.13
0277	P1	Gabion Chnl 12'W 6'D 2:1 SS	3500	97	CSPDWY	SPDWY3	6.06	1.71
RWLA		**RANGE WASH - LAMB**						
0000	P1	10' X 6' RCB	2500	915	CNN209C	RW3	0.82	1.09
0047	P1	7' X 6' RCB	1300	625	NN224-C	RW3	0.51	1.32
RWRR		**RANGE WASH - RAILROAD CHANNEL**						
0000	E	Conc Chnl 12'W 7.5'D 2:1 SS	600	2492	CCNN217C	RW3SC	0.19	2.00
0011	E	2 Span Bridge 21'W 12'D @ UPRR	40	2492	CCNN217C	RW3SC	3.00	1.46
0012	P1	Rip Rap Chnl 12'W 9'D 2:1 SS	2000	1588	CCNN214C	RW3SC	1.00	0.85
0050	P1	Rip Rap Chnl 12'W 8.5'D 2:1 SS	2200	1397	CCNN209C	RW3SC	1.02	0.82
0092	P1	Rip Rap Chnl 12'W 5.5'D 2:1 SS	5000	561	CNN226-C	RW3SC	0.00	0.90
0187	P1	6' X 6' RCBC @ Centennial	100	271	CNN230C	RW3SC	0.00	0.90
0189	P1	Rip Rap Chnl 12'W 4'D 2:1 SS	1700	271	CNN230C	RW3SC	0.00	1.18
0221	P1	42" RCP	200	71	BELT	RW3	3.20	1.18
RWSL		**RANGE WASH - SLOAN**						
0380	E	Conc Chnl 38'W 8'D 3:1 SS	2640	1046	C318D1	CONFDB	20.76	0.36
0446	E	Conc Chnl 20'W 6'D 2:1 SS	2650	1009	CONFDB	RW5SC	20.23	0.38
0447	E	Earth Chnl 25'W 9'D 2:1 SS	4050	1691	SLOAN	RW4SC	10.93	0.42
0447	P0	Rip Rap Chnl 25'W 8'D 2:1 SS	4050	1891	SLOAN	RW4SC	10.93	0.42
0489	E	Earth Chnl 12'W 9'D 2:1 SS	3200	1691	SLOAN	RW4SC	10.93	0.42
0489	P0	Rip Rap Chnl 12'W 10'D 2:1 SS	3200	1891	SLOAN	RW4SC	10.93	0.42
0499	E	72,000 cfs PMF Spillway		72000	CCOND	RW5SC	20.23	
0500	E	2: 8' X 7' RCB Outlet	126	1009	CONFDB	RW5SC	20.23	
0501	E	1,025 ac-ft Confluence Detention Basin		8166	CCOND	RW5SC	20.23	
0502	E	Grass Chnl 60'W 6'D 3:1 SS	1100	4540	D2C47B3*	RW4SC	10.93	0.37
0524	E	Grass Chnl 60'W 6'D 3:1 SS	2400	4540	D2C47B3	RW4SC	10.93	0.37
0560	E	Rip Rap Chnl 50'W 6'D 0:1 SS	580	4540	D2C47B3	RW4SC	10.93	0.37
0560	P1	Conc Chnl 55'W 6.5'D 2:1 SS	580	4540	D2C47B3	RW4SC	10.93	0.37

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
RWSL		**RANGE WASH - SLOAN -- continued**						
0574	E	2 Span Bridge 24'W	50	4540	D2C47B3	RW4SC	10.93	0.38
0575	E	Diversion Structure	15	6232	2C47B3	RW4SC	10.93	
0576	E	Earth Chnl 16'W 9'D 2:1 SS	4450	6232	2C47B3	RW4SC	10.93	0.38
0576	P1	Conc Chnl 40'W 8.5'D 2:1 SS	3010	6232	2C47B3	RW4SC	10.93	0.38
0609	P1	Conc Chnl 30'W 9.5'D 2:1 SS	1440	6232	2C47B3	RW4SC	10.93	0.38
0663	E	3: 10' X 8' RCBC @ Tyndall Street	60	6232	2C47B3	RW4SC	10.93	0.38
0663	P0	Add 4: 10' X 9' RCBC	60	3152	2C47B3	RW4SC	10.93	0.38
0664	E	Conc Chnl 16'W 9'D 1.5:1 SS	520	5444	CCSLNL	RW4SC	8.62	0.56
0671	E	3: 10' X 7' RCBC @ Nellis	100	5444	CCSLNL	RW4SC	8.62	0.56
0671	P0	Add 3: 12' X 7' RCBC	100	2266	CCSLNL	RW4SC	8.62	0.56
0672	E	Conc Chnl 14'W 8'D 1.5:1 SS	1200	2943	CC47C-4	RW3SC	3.94	0.56
0694	E	Conc Chnl 10'W 8'D 1.5:1 SS	1500	1722	C47C4	RW3SC	2.39	0.56
0727	E	3: 10' X 8' RCBC	100	1620	C307E3	RW3SC	2.24	0.56
0728	E	Conc Chnl 12'W 8.5'D 1.5:1 SS	1500	1620	C307E3	RW3SC	2.24	0.56
0745	E	7: 10' X 7' RCBC @ Las Vegas Blvd	200	1620	C307E3	RW3SC	2.24	0.56
RWWA		**RANGE WASH - WALNUT**						
0000	P1	10' X 8' RCB	3000	1030	CNN217-C	RW3	1.13	1.17
0057	P1	8' X 7' RCB	2750	854	CNN213-C	RW3	0.88	1.00
0108	P1	7' X 6' RCB	1300	523	CNN197-C	RW3	0.48	1.15
RWWE		**RANGE WASH - WEST TRIBUTARY**						
0000	P2	Conc Chnl 12'W 7'D 2:1 SS	1500	1477	C307B2	RW3SC	2.01	0.31
0026	E	4: 12' X 10' RCBC @ Alexander	100	1477	C307B2	RW3SC	2.01	0.40
0027	E	Conc Chnl 32'W 8'D 2:1 SS	1650	1477	C307B2	RW3SC	2.01	0.79
0054	E	3: 9' X 8' RCBC	60	884	C307E1	RW3SC	1.26	0.76
0055	P2	Conc Chnl 12'W 5'D 2:1 SS	2200	884	C307E1	RW3SC	1.26	0.76
0088	E	2: 8' X 4' RCBC @Craig	60	228	VANDDB	RW3SC	5.10	0.91
0089	E	Conc Chnl 8'W 4'D 1.5:1 SS	325	228	VANDDB	RW3SC	5.10	0.91
0096	E	2: 8' X 4' RCBC	60	228	VANDDB	RW3SC	5.10	0.91
0097	E	Conc Chnl 8'W 4'D 1.5:1 SS	680	228	VANDDB	RW3SC	5.10	0.91
0105	E	2: 8' X 4' RCBC	60	228	VANDDB	RW3SC	5.10	0.91
0106	E	Conc Chnl 8'W 4'D 1.5:1 SS	1040	228	VANDDB	RW3SC	5.10	0.91
0125	E	2: 9' X 3' RCBC	60	228	VANDDB	RW3SC	5.10	0.91
0126	E	Conc Chnl 8'W 4'D 1.5:1 SS	740	228	VANDDB	RW3SC	5.10	0.91
0139	E	8' X 6' RCBC @ Lone Mountain	100	228	VANDDB	RW3SC	5.10	0.91
0140	E	Conc Chnl 12'W 3'D 2:1 SS	1500	228	VANDDB	RW3SC	5.10	0.91
0167	E	3: 12' X 10' RCB Culverts @ I-15	200	228	VANDDB	RW3SC	5.10	0.91
0168	E	5' X 2.75' RCB Outlet	115	228	VANDDB	RW3SC	5.10	0.30
0169	E	36" RCP Outlet	4300	30	VANDDB	RW3SC	5.10	0.28
0170	E	342 ac-ft Vandenberg Detention Basin		3906	VANDIN	RW3SC	5.10	
0202	E	12' X 8' RCBC @ UPRR	60	1399	CNN202C	RW3SC	2.29

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
CNEA		**CENTENNIAL PKWY CHANNEL EAST**						
0000	P3	4: 12' X 6' RCB	4000	1973	CNN138-C	CWEST3	2.44	0.20
0076	P3	2: 10' X 6' RCB	2707	1230	CNN093-C	CWEST3	1.45	0.55
0123	P3	Conc Chnl 15'W 6.5'D 0:1 SS	2550	1230	CNN093-C	CWEST3	1.45	1.04
0175	P3	15' X 6' RCBC @ Revere	115	948	CNN078-C	CWEST3	1.13	1.04
0176	P3	Conc Chnl 15'W 6.5'D 0:1 SS	1500	948	CNN078-C	CWEST3	1.13	0.86
EKEA		**ELKHORN ROAD CHANNEL EAST**						
0000	P2	2: 10' X 9' RCB	600	2305	CELK06G	CWEST3	3.55	0.96
0008	P2	2: 10' X 10' RCB	282	2305	CELK06G	CWEST3	3.55	0.96
0013	P2	2: 10' X 10' RCB	786	2305	CELK06G	CWEST3	3.55	1.00
0028	P2	Conc Chnl 21'W 9'D 0:1 SS	2378	2305	CELK06G	CWEST3	3.55	0.96
0073	P2	Conc Chnl 40'W 7.5'D 0:1 SS	2428	2150	CELK06F	CWEST3	3.27	2.00
0119	P2	40' X 7.5' RCBC	280	2017	CELK06E	CWEST3	3.01	2.00
0124	P2	Conc Chnl 40'W 7.5'D 0:1 SS	2440	2017	CELK06E	CWEST3	3.01	0.80
FMEA		**FARM ROAD CHANNEL EAST**						
0000	P0	Conc Chnl 12'W 4.5'D 2:1 SS	3500	1017	CELK06C	CWEST3	1.40	2.10
0076	P0	Conc Chnl 12'W 5'D 2:1 SS	2640	805	CELK06B	CWEST3	1.11	0.80
GTEA		**GRAND TETON DRIVE CHANNEL EAST**						
0000	P0	Conc Chnl 12'W 5.5'D 2:1 SS	7483	1307	CGT03E	CWEST3	2.89	1.03
LSLE		**LOSEE NORTH CHANNEL - EAST BRANCH**						
0000	P0	Rip Rap Chnl 100'W 5'D 3:1 SS	7900	2810	305A	WEST3	6.49	0.95
0001	P0	Rip Rap Levee 12'	7900	2810	305A	WEST3	6.49	0.95
LSLW		**LOSEE NORTH CHANNEL - WEST BRANCH**						
0000	P0	Rip Rap Chnl 50'W 4'D 3:1 SS	10800	1440	305	WEST3	2.60	2.08
0001	P0	Rip Rap Levee 10.5'	10800	1440	305	WEST3	2.60	2.10
LV5C		**5TH STREET COLLECTOR**						
0000	P1	8' X 7' RCB	3900	726	CNN109-C	CWEST3	0.73	0.82
LVLS		**UPPER LAS VEGAS WASH - LOSEE NORTH**						
0000	P0	Gabion Chnl 75'W 4.5'D 3:1 SS	5400	3430	C213D	CWEST4	10.04	2.80
0102	P0	Gabion Chnl 75'W 4.5'D 3:1 SS	5000	3427	C213E	CWEST4	9.59	2.90
LVRW		**RANGE WASH - LAS VEGAS WASH DIVERS**						
0000	E	Unlined Chnl 120'W 4'D 3:1 SS	2500	11343	C306A	WEST5	57.21	2.50
0001	E	Unlined Chnl 120'W 4'D 3:1 SS	500	10441	C213C	WEST5	45.97	2.50
0056	E	Unlined Levee 15'	12200	10441	C213C	WEST5	45.97	0.80
0057	E	Unlined Chnl 120'W 3:1 SS	12200	10441	C213C	WEST5	45.97	0.82
0292	E	Unlined Chnl 120'W 3:1 SS	15600	10200	C309	WEST5	43.02	1.00
0293	E	Unlined Levee 15'	15600	10200	C309	WEST5	43.02	1.00

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVUP		**UPPER LAS VEGAS WASH**						
0185	P1	Conc Chnl 20'W 8.5'D 2:1 SS	1600	4281	CNN156-C	CWEST4	8.52	0.63
0215	P1	4: 10' X 9' RCBC @ Tropical	100	4236	2C141-C*	CWEST4	8.07	0.63
0217	P1	Conc Chnl 20'W 8.5'D 2:1 SS	2700	4236	CNN153-C	CWEST3	6.84	0.74
0268	P1	4: 10' X 9' RCBC @ Centennial	200	4236	CNN153-C	CWEST3	6.84	0.74
0270	P1	Conc Chnl 20'W 7.0'D 2:1 SS	1600	3227	CNN137-C	WEST5	75.57	0.94
0300	P1	4: 9' X 8' RCBC @ Bruce	500	3227	CNN137-C	WEST5	75.57	0.94
0309	P1	Conc Chnl 20'W 7.5'D 2:1 SS	1150	3227	CNN137-C	WEST5	75.57	0.63
0331	P1	4: 10' X 8' RCBC @ Deer Springs	100	3227	CNN137-C	WEST5	75.57	0.63
0333	P1	Conc Chnl 20'W 6.5'D 2:1 SS	2350	3227	2CELK06G	WEST5	75.14	1.51
0370	P1	2: 10' X 7' RCB	700	3227	2CELK06G	WEST5	75.14	2.20
0400	P1	2: 10' X 7' RCB	1000	3155	NLVDB	WEST5	71.59	2.20
0403	E	114,660 cfs PMF Spillway		114660	NLVIN	WEST5	71.59	
0404	E	4: 84" RCP Outlet, 1 blocked	100	3155	NLVDB	WEST5	71.59	
0405	E	1,435 ac-ft North Las Vegas Detention Basin		11466	NLVIN	WEST5	71.59	
0406	P1	Upgrade to 1,650 ac-ft North Las Vegas Detention Basin		11466	NLVIN	WEST5	71.59	
0446	E	Floodway	24000	4259	ULWDB	SPRING5	199.03	1.04
RWBE		**RANGE WASH - BELTWAY EAST**						
0000	P1	Rip Rap Chnl 12'W 6.5'D 2:1 SS	5300	638	C306D2	RW3	0.83	0.40
RWBW		**BELTWAY CONVEYANCE**						
0000	P1	9' X 8' RCBC	300	881	C306B5	RW3	1.20	1.00
0001	P1	Rip Rap Chnl 12'W 8'D 2:1 SS	2100	881	C306B5	RW3	1.20	0.26
RWCC		**RANGE WASH - CENTENNIAL COLLECTOR**						
0000	P1	8' X 7' RCB	1300	545	CNN178C	RW3	0.87	0.40
RWHW		**RANGE WASH - HOLLYWOOD BRANCH**						
0201	P1	Gabion Chnl 12'W 9.5'D 2:1 SS	4000	1905	C312E4	SPDWY4	8.15	1.13
0277	P1	Gabion Chnl 12'W 6'D 2:1 SS	3500	97	CSPDWY	SPDWY3	6.06	1.71
0338	P0	36" RCP	670	58	SPDWY1OT	RW3	1.10	1.67
0343	P0	Gabion Chnl 12'W 7'D 2:1 SS	1000	937	C312H	SPDWY3	4.96	0.50
0355	P0	24" RCP Outlet	100	58	SPDWY1OT	RW3	1.10	
0356	E	73 ac-ft Speedway #1 Retention Basin		1114	SPDWY1IN	RW3	1.10	
0357	P0	Upgrade to 83 ac-ft Speedway #1 Detention Basin		1114	SPWDY1IN	RW3	1.10	
0362	P0	2: 10' X 6' RCBC @ I-15	400	937	C312H	SPDWY3	4.96	0.50
0369	P0	Gabion Chnl 12'W 6'D 2:1 SS	2400	937	C312H	SPDWY3	4.96	1.67
0411	E	140 ac-ft Speedway #2 Retention Basin		1724	SPDWY2IN	RW5	19.28	
0412	P0	Upgrade to 155 ac-ft Speedway #2 Detention Basin		1724	SPDWY2IN	RW5	19.28	
0459	P0	72" RCP	2800	477	SNORTH	RW5	14.64	2.67
0498	P0	44,540 cfs PMF Spillway		44540	SPWDYNO	RW5	14.64	
0499	P0	60" RCP Outlet	100.00	477	SNORTH	RW5	14.64	
0500	P1	700 ac-ft Speedway North Detention Basin		4454	SPDWYNO	RW5	14.64	
0516	P0	Conc Chnl 12'W 5'D 2:1 SS	1800	1277	44B-4	RW3	2.38	3.41
0563	P0	Rip Rap Chnl 20'W 9'D 2:1 SS	4000	1277	44B-4	RW3	2.38	0.20

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
RWLA		**RANGE WASH - LAMB**						
0000	P1	10' X 6' RCB	2500	915	CNN209C	RW3	0.82	1.09
0047	P1	7' X 6' RCB	1300	625	NN224-C	RW3	0.51	1.32
RWRR		**RANGE WASH - RAILROAD CHANNEL**						
0050	P1	Rip Rap Chnl 12'W 8.5'D 2:1 SS	2200	1397	CCNN209C	RW3SC	1.02	0.82
0092	P1	Rip Rap Chnl 12'W 5.5'D 2:1 SS	5000	561	CNN226-C	RW3SC	0.00	0.90
0187	P1	6' X 6' RCBC @ Centennial	100	271	CNN230C	RW3SC	0.00	0.90
0189	P1	Rip Rap Chnl 12'W 4'D 2:1 SS	1700	271	CNN230C	RW3SC	0.00	1.18
0221	P1	42" RCP	200	71	BELT	RW3	3.20	1.18
0223	P1	18,180 cfs PMF Spillway		18180	C306D-3	RW3	3.20	
0224	P1	24" RCP Outlet	100	71	BELT	RW3	3.20	
0225	P1	180 ac-ft Beltway Detention Basin		1818	C306D-3	RW3	3.20	
0244	P1	Rip Rap Chnl 12'W 6'D 2:1 SS	900	755	C309-1	RW3	1.45	1.09
0261	P1	Rip Rap Chnl 12'W 6.5'D 2:1 SS	3500	755	C309-1	RW3	1.45	1.00
RWWA		**RANGE WASH - WALNUT**						
0057	P1	8' X 7' RCB	2750	854	CNN213-C	RW3	0.88	1.00
0108	P1	7' X 6' RCB	1300	523	CNN197-C	RW3	0.48	1.15
RWWE		**RANGE WASH - WEST TRIBUTARY**						
0259	P1	10' X 7' RCB	2700	1184	CNN183C	RW3SC	2.03	1.09
0318	P1	10' X 7' RCB	2700	1151	CNN181C	RW3SC	1.77	1.04
0397	P1	6' X 6' RCB	4800	461	CNN194C	RW3SC	0.47	1.42
0464	P1	16,590 cfs PMF Spillway		16590	VNORTH	RW3	2.64	
0465	P1	24" RCP Outlet	100	68	VNORTH	RW3	2.64	
0466	P1	140 ac-ft Vandenberg North Detention Basin		1659	VNORTH	RW3	2.64	
0467	P1	8' X 8' RCBC	300	944	C306B4	RW3	1.43	1.00
0468	P1	Rip Rap Chnl 15'W 8.5'D 2:1 SS	2100	944	C306B4	RW3	1.43	0.19
0517	P1	Rip Rap Chnl 12'W 7.5'D 2:1 SS	2650	621	C306A1	RW3	0.86	0.19
TREA		**TROPICAL ROAD CHANNEL EAST**						
0000	P1	10' X 7' RCB	4600	923	CNN141-C	CWEST3	1.23	0.81
0087	P1	8' X 7' RCB	2500	681	CNN111-C	CWEST3	0.84	0.80
0134	E	72" RCP	2700	506	CNN095-C	CWEST3	0.57	2.10
UPEB		**UPPER LAS VEGAS WASH - EAST BRANCH**						
0161	P0	Rip Rap Chnl 100'W 5'D 3:1 SS	10600	2790	102B	VSHEEP3	5.64	0.94
0162	P0	Rip Rap Levee 12'	10600	2790	102B	VSHEEP3	5.64	0.94

**The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.*

***As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.*

REGIONAL FLOOD CONTROL DISTRICT

2002 LAS VEGAS VALLEY
FLOOD CONTROL MASTER PLAN UPDATE
FACILITY INVENTORY
FIGURE F-5

LEGEND

Street Name Designator AA BB
Parent Stream Name
Stream Name
ID / River Mile 00 00
Distance above confluence
With parent stream
Miles in tenths

Existing Facility ..... E
Proposed or Modified Facility ..... P
Contingency Level
Category B P0
Master Plan P1
Preliminary Design P2
Design P3

Bottom Width ..... W
Depth ..... D
Side Slope, H:V ..... SS

Construction Features

Cast in Place Concrete Pipe ..... CIPCP
Corrugated Metal Arch Pipe Culvert ..... CMAP
Corrugated Metal Pipe Culvert ..... CMP
High Density Polyethylene ..... HDPE
Helical Elliptical Reinforced Concrete Pipe ..... HERCP
Reinforced Concrete Arch Pipe ..... RCAC
Reinforced Concrete Box ..... RCB
Reinforced Concrete Box Culvert ..... RCBC
Reinforced Concrete Pipe ..... RCP
Reinforced Concrete Pipe Culvert ..... RCPC
Storm Sewer Pipe ..... SSP

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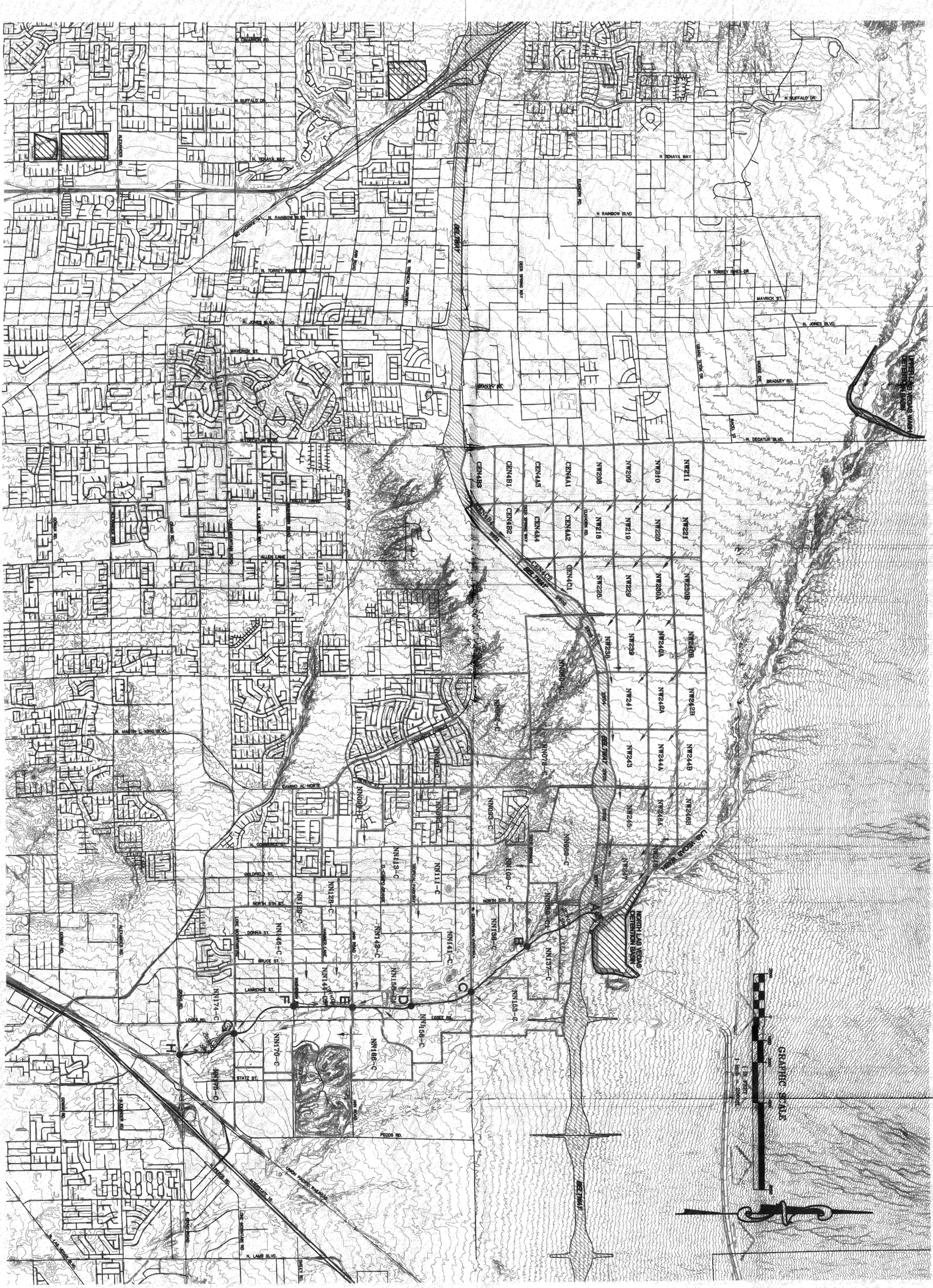
I:\CAD\PUBWRK\5840\EXHIBITS\DRAINAGE MAP.dwg



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

SHEET NO. 1 OF 1 SHEETS

(DRAWING TITLE) **DRAINAGE MAP**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

FLOOD CONTROL IMPROVEMENTS

(LOCATION)

VTN nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

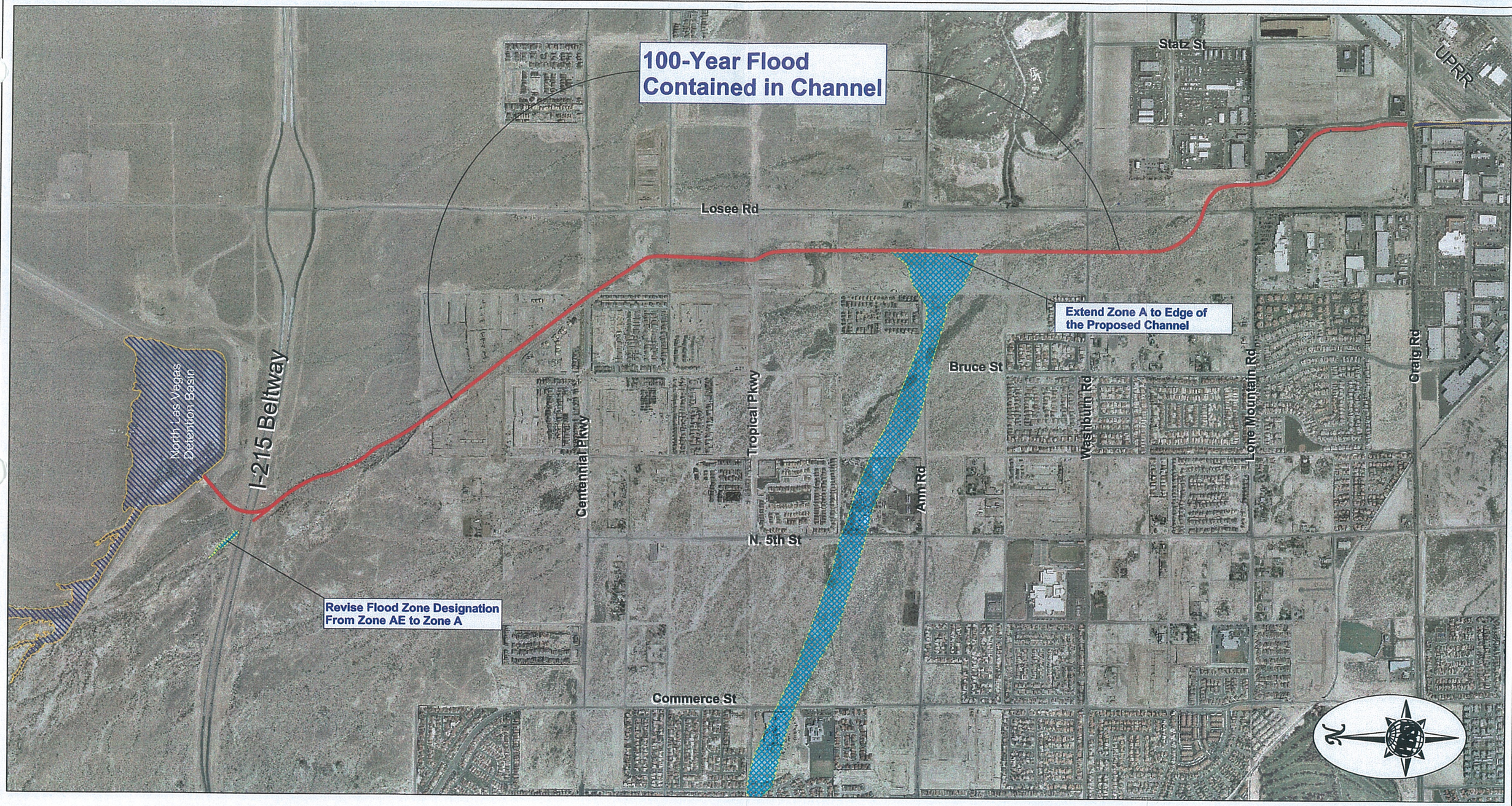
PRELIMINARY

SCALE:	1"=2000'
DESIGN:	N/A
DRAWN:	DJB
CHECKED:	HT
APPROVED:	KDG
DATE:	10/29/2001

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			

FIGURE 4



GRAPHIC SCALE

1500 0 750 1500 3000 6000

(IN FEET)

1 inch = 1500 ft.

FIGURE 4A: PROPOSED FLOOD ZONE DELINEATION MAP

Upper Las Vegas Wash Channel CLOMR

Zone AE Flood Zone

Zone A Flood Zone

Upper Las Vegas Wash Facility Alignment/100-Year Flood Zone

Note: Aerial Photo as of April 2004

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada 89074
Tele: 702-263-7275
Fax: 702-263-7200
ENGINEERING · PLANNING · SURVEYING · CONSTRUCTION SERVICES

FIGURE 4A

North Las Vegas Detention Basin
(1,435 ac-ft)

Limit of Study

I-215 Beltway

Existing (2) 10' x 9' RCB's
(2) 10' x 9' RCB's
(2) 12' x 9' RCB's
42' x 8' RCB
42' x 8' RCB
42' x 8' RCB
42' x 8' RCB
42' x 6' RCB
46' x 9' RCB
50' x 9.5' RCB
50' x 8' RCB
10' x 7' RCB
10' x 7' RCB
56' x 9' RCB
56' x 9' RCB
56' x 8' RCB
56' x 7' RCB
Existing (7) 8' x 8' RCB's
King Charles Channel
35'Wx11'D Rect Channel

Dorrell Lane
Deer Springs
Rome Blvd
Centennial Pkwy
Azure Ave
Tropical Pkwy
El Campo Grande Ave
Ann Rd
Hammer Ln
Washburn Rd
Lone Mountain Rd
Craig Rd

Lawrence St
Commerce St
N. 5th St
Losee Rd
Bruce St
Statz St
Berg St
Pecos Rd
UPRR
Interstate 15

Aerial Photo as of April 2004
Clark County GIS 5' Contour Data as of 1996
Vertical Datum: NAVD88

I hereby certify that the information used to prepare this CLOMR is in substantial conformance with the proposed channel improvement plans located in Appendix E.

Matthew S. Baird, NV 13684 — Date 4/25/05

LEGEND

- 5' Contour
- Proposed Upper Las Vegas Facility Alignment/Flood Zone
- Channel/WSPG Station
- Zone AO Flood Zone
- Zone AE Flood Zone
- Zone A Flood Zone
- Shaded Zone X Flood Zone

GRAPHIC SCALE
800 0 400 800 1600 3200
(IN FEET)
1 inch = 800 ft.

Upper Las Vegas Wash Channel CLOMR
Overall Workmap

Project No. 511606

April 2005

PBSJ
2270 Corporate Circle
Suite 100
Henderson, Nevada 89074
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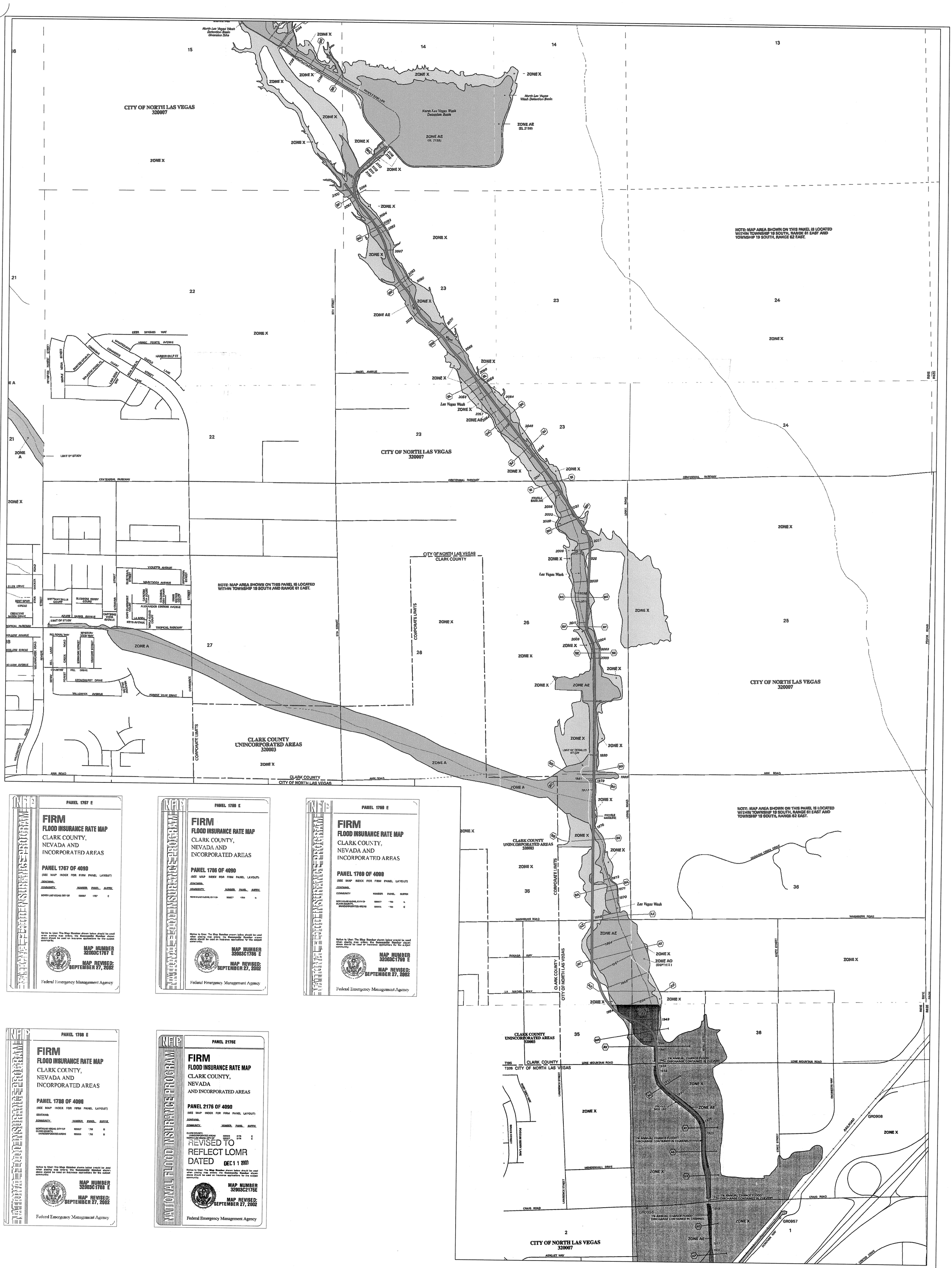
Engineering • Planning • Surveying • Construction Services

FIGURE 5



PANEL 1767 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1767 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1767	E

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

MAP NUMBER 32003C1767 E
MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 1768 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1768 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1768	E

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

MAP NUMBER 32003C1768 E
MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 1769 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1769 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1769	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1769	E

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

MAP NUMBER 32003C1769 E
MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 1768 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1768 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1768	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1768	E

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

MAP NUMBER 32003C1768 E
MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 2176E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2176 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLARK COUNTY, UNINCORPORATED AREAS	320003	2176	E
NORTH LAS VEGAS, CITY OF	320007	2176	E

REVISED TO REFLECT LOMR DATED DEC 11 2003

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

MAP NUMBER 32003C2176E
MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

N

Proposed Facility

GRAPHIC SCALE
800 0 400 800 1600 3200
(IN FEET)
1 inch = 800ft.

FIGURE 3
FEMA Flood Zone Map
Upper Las Vegas Wash Channel CLOMR

PBS&J
2270 Corporate Circle
Suite 100 Henderson,
Nevada 89014
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING • PLANNING • SURVEYING • CONSTRUCTION SERVICES

FIGURE 3

Area proposed to be revised from Zone AE to Zone A

Extend Zone A to Channel

CITY OF NORTH LAS VEGAS 320007

CLARK COUNTY UNINCORPORATED AREAS 320003

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 19 SOUTH, RANGE 61 EAST AND TOWNSHIP 19 SOUTH, RANGE 62 EAST.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 19 SOUTH AND RANGE 61 EAST.

NOTE: MAP AREA SHOWN ON THIS PANEL IS LOCATED WITHIN TOWNSHIP 19 SOUTH, RANGE 61 EAST AND TOWNSHIP 19 SOUTH, RANGE 62 EAST.

PANEL 1767 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1767 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1767	E

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

MAP NUMBER 32003C1767 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 1768 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1768 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1768	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1768	E

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

MAP NUMBER 32003C1768 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 1769 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1769 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1769	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1769	E

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

MAP NUMBER 32003C1769 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 1768 E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 1768 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
NORTH LAS VEGAS, CITY OF	320007	1768	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1768	E

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

MAP NUMBER 32003C1768 E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

PANEL 2176E

FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 2176 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLARK COUNTY, UNINCORPORATED AREAS	320003	2176	E
NORTH LAS VEGAS, CITY OF	320007	2176	E

REVISED TO REFLECT LOMR DATED DEC 11 2003

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

MAP NUMBER 32003C2176E

MAP REVISED: SEPTEMBER 27, 2002

Federal Emergency Management Agency

Zone AE & AO within box to be removed and shown as contained in channel. Also, current Zone AE to be shown as Shaded Zone X

Proposed Facility/100-Year Flood Zone

GRAPHIC SCALE

800 0 400 800 1600 3200

(IN FEET)

1 inch = 800ft.

FIGURE 4

Annotated FEMA Flood Zone Map

Upper Las Vegas Wash Channel CLOMR

PBS&J
2270 Corporate Circle
Suite 100 Henderson,
Nevada 89014
Telephone: 702/263-7275
Fax: 702/263-7200
ENGINEERING • PLANNING • SURVEYING • CONSTRUCTION SERVICES

FIGURE 4

APPENDIX C

Reference Hydrology

MOMENTUM ANALYSIS

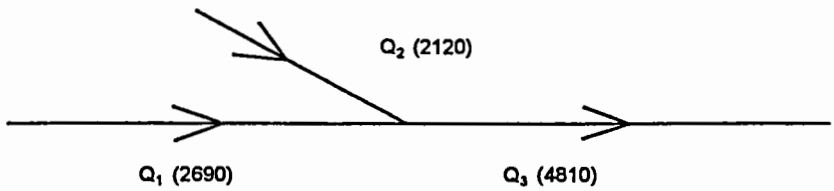
- *Elkhorn Road*
- *Centennial Parkway*
- *Tropical Parkway*
- *Ann Road*

Confluence Momentum Analysis

EKEA/NLVDB Confluence

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

EKEA/NLVDB
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 1)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	2,690	b_1 (ft)	26.00	y_1 (ft)	5.791	F_1	1.31	θ (deg)	0
Q_2 (cfs)	2,120	b_2 (ft)	21.67	y_2 (ft)	5.600	F_2	1.30	cos θ	1.0000
Q_3 (cfs)	4,810	b_3 (ft)	49.47	y_3 (ft)	5.164	F_3	1.46	L (ft)	100.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2 g}}=6.65 \qquad 0.85y_{c3}=5.65$$

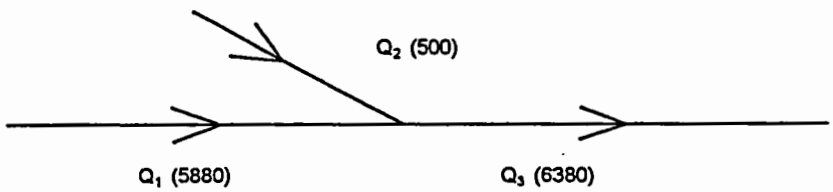
MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	1492.5	$y_3=$ 5.164 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	1150.2	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	2812.6
$\frac{b_1y_1^2}{2}=$	436.0	$\frac{b_3y_3^2}{2}=$	659.6
$\frac{(b_3-b_1)}{2}y_1^2=$	393.5		
$\sum M_{1-2}$	3472.2	$\sum M_{1-2}$	3472.2

* THE TERM r (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

Centennial Parkway Confluence

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

CENTENNIAL PARKWAY
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 1)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	5,880	b_1 (ft)	46.00	y_1 (ft)	5.178	F_1	1.91	θ (deg)	0
Q_2 (cfs)	500	b_2 (ft)	42.00	y_2 (ft)	0.980	F_2	2.16	$\cos\theta$	1.0000
Q_3 (cfs)	6,380	b_3 (ft)	90.00	y_3 (ft)	2.498	F_3	3.16	L (ft)	180.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

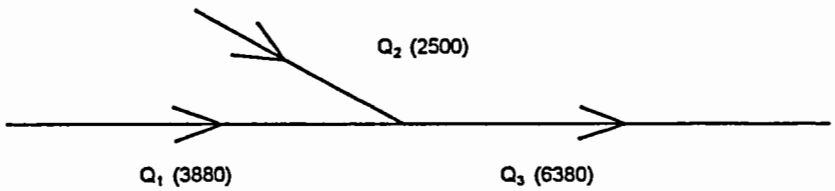
$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2 g}}=5.38 \qquad 0.85y_{c3}=4.58$$

MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	4507.9	$y_3=$ 2.498 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	188.6	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	5622.2
$\frac{b_1y_1^2}{2}=$	616.7	$\frac{b_3y_3^2}{2}=$	280.9
$\frac{(b_3-b_1)}{2}y_1^2=$	589.9		
$\sum M_{1-2}$	5903.1	$\sum M_{1-2}$	5903.1

* THE TERM *r* (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

CENTENNIAL PARKWAY
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 2)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	3,880	b_1 (ft)	46.00	y_1 (ft)	3.742	F_1	2.05	θ (deg)	0
Q_2 (cfs)	2,500	b_2 (ft)	42.00	y_2 (ft)	3.242	F_2	1.80	$\cos\theta$	1.0000
Q_3 (cfs)	6,380	b_3 (ft)	90.00	y_3 (ft)	3.275	F_3	2.11	L (ft)	180.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2 g}}=5.38 \qquad 0.85y_{c3}=4.58$$

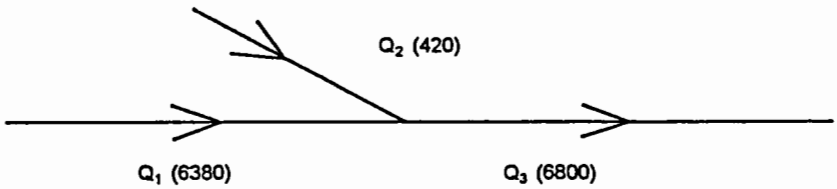
MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	2716.1	$y_3=$ 3.275 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	1425.5	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	4289.1
$\frac{b_1y_1^2}{2}=$	322.1	$\frac{b_3y_3^2}{2}=$	482.6
$\frac{(b_3-b_1)}{2}y_1^2=$	308.1		
$\sum M_{1-2}$	4771.7	$\sum M_{1-2}$	4771.7

* THE TERM r (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

Tropical Parkway Confluence

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

TROPICAL PARKWAY
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 1)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	6,380	b_1 (ft)	50.00	y_1 (ft)	4.428	F_1	2.41	θ (deg)	0
Q_2 (cfs)	420	b_2 (ft)	10.00	y_2 (ft)	2.594	F_2	1.77	$\cos\theta$	1.0000
Q_3 (cfs)	6,800	b_3 (ft)	62.00	y_3 (ft)	3.810	F_3	2.60	L (ft)	125.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

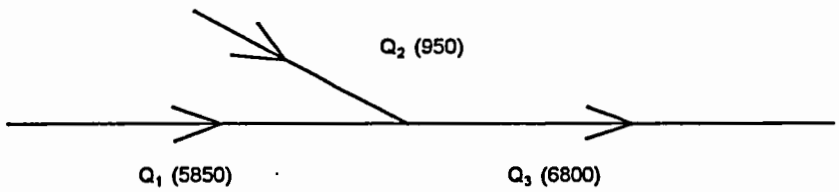
$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2g}}=7.20 \qquad 0.85y_{c3}=6.12$$

MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	5709.6	$y_3=$ 3.810 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	211.2	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	6078.5
$\frac{b_1y_1^2}{2}=$	490.2	$\frac{b_3y_3^2}{2}=$	450.1
$\frac{(b_3-b_1)}{2}y_1^2=$	117.6		
$\sum M_{1-2}$	6528.6	$\sum M_{1-2}$	6528.6

* THE TERM r (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

TROPICAL PARKWAY
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 2)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	5,850	b_1 (ft)	50.00	y_1 (ft)	4.084	F_1	2.50	θ (deg)	0
Q_2 (cfs)	950	b_2 (ft)	10.00	y_2 (ft)	4.786	F_2	1.60	$\cos\theta$	1.0000
Q_3 (cfs)	6,800	b_3 (ft)	62.00	y_3 (ft)	3.983	F_3	2.43	L (ft)	125.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2g}}=7.20 \qquad 0.85y_{c3}=6.12$$

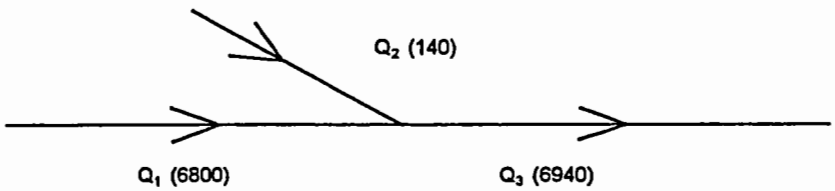
MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	5204.8	y_3 = 3.983 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	585.6	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	5815.7
$\frac{b_1y_1^2}{2}=$	417.0	$\frac{b_3y_3^2}{2}=$	491.7
$\frac{(b_3-b_1)}{2}y_1^2=$	100.1		
$\sum M_{1-2}$	6307.4	$\sum M_{1-2}$	6307.4

* THE TERM r (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

Ann Road Confluence

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

ANN ROAD
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 1)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	6,800	b_1 (ft)	50.00	y_1 (ft)	6.850	F_1	1.34	θ (deg)	0
Q_2 (cfs)	140	b_2 (ft)	10.00	y_2 (ft)	1.611	F_2	1.21	$\cos\theta$	1.0000
Q_3 (cfs)	6,940	b_3 (ft)	62.00	y_3 (ft)	4.875	F_3	1.83	L (ft)	125.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

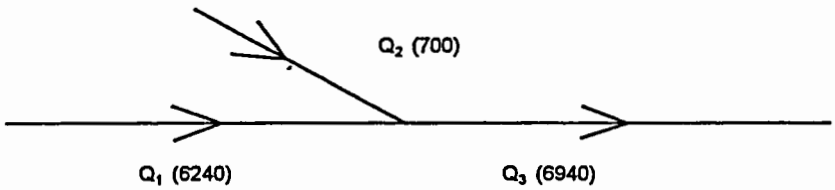
$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2g}}=7.30 \qquad 0.85y_{c3}=6.21$$

MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	4192.8	y_3 = 4.875 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	37.8	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	4948.3
$\frac{b_1y_1^2}{2}=$	1173.1	$\frac{b_3y_3^2}{2}=$	736.9
$\frac{(b_3-b_1)}{2}y_1^2=$	281.5		
$\sum M_{1-2}$	5685.2	$\sum M_{1-2}$	5685.2

* THE TERM r (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

W.O.#: 5840
Calculated by: J.G.
Checked by:
Date:

ANN ROAD
CONFLUENCE MOMENTUM ANALYSIS
(FLOW COMBINATION 2)



GIVEN DATA

DISCHARGES		CHANNEL WIDTHS		FLOW DEPTHS		FROUDE NO.		ANGLE & LENGTH	
Q_1 (cfs)	6,240	b_1 (ft)	50.00	y_1 (ft)	6.258	F_1	1.40	θ (deg)	0
Q_2 (cfs)	700	b_2 (ft)	10.00	y_2 (ft)	4.991	F_2	1.11	$\cos\theta$	1.0000
Q_3 (cfs)	6,940	b_3 (ft)	62.00	y_3 (ft)	5.376	F_3	1.58	L (ft)	125.00

MOMENTUM EQUATION*

$$\frac{Q_1^2}{gA_1}+\frac{Q_2^2}{gA_2}COS\theta+\frac{b_1y_1^2}{2}+\frac{(b_3-b_1)}{2}y_1^2=\frac{Q_3^2}{gA_3}+\frac{b_3y_3^2}{2}$$

$$y_{c3}=\sqrt[3]{\frac{Q_3^2}{b_3^2 g}}=7.30 \qquad 0.85y_{c3}=6.21$$

MOMENTUM UPSTREAM*	(ft^3)	MOMENTUM DOWNSTREAM*	(ft^3)
$\frac{Q_1^2}{gA_1}=\frac{Q_1^2}{32.2(b_1y_1)}=$	3864.6	$y_3=$ 5.376 ft	
$\frac{Q_2^2}{gA_2}COS\theta=\frac{Q_2^2}{32.2(b_2y_2)}COS\theta=$	304.9	$\frac{Q_3^2}{gA_3}=\frac{Q_3^2}{32.2(b_3y_3)}=$	4487.7
$\frac{b_1y_1^2}{2}=$	979.1	$\frac{b_3y_3^2}{2}=$	895.9
$\frac{(b_3-b_1)}{2}y_1^2=$	235.0		
$\sum M_{1-2}$	5383.6	$\sum M_{1-2}$	5383.6

* THE TERM *r* (SPECIFIC WEIGHT OF WATER) HAS BEEN OMITTED FROM ALL TERMS OF THIS EQUATION AND THE FOLLOWING COMPUTATIONS.

APPENDIX E
Design Plans

1998 UPPER LAS VEGAS WASH FIS RESTUDY

Northwest Hydraulics.

rev. 4.21.98

Flood Insurance Study
Clark County, Nevada
With NLVDB Diversion Dike

1.0 INTRODUCTION

1.1 Purpose of Study

Community Name: City of North Las Vegas; City of Las Vegas; Unincorporated Areas of Clark County
County: Clark County
State: Nevada

1.2 Authority and Acknowledgments

Study Contractor: Northwest Hydraulic Consultants, Inc.
*Subcontracto*r: Kenney Aerial Mapping (Mapping and Surveying)
Completion Date: April, 1998

Provider of Base Map: Kenney Aerial Mapping, Inc

Base Map Compilation Source: Kenney Aerial Mapping, Inc.
Base Map Compilation Scale: 1:4800
Base Map Compilation Date: August, 1996

Coordinate System: State Plane
Projection: State Plane
Datum: NGVD 1929

Has base map source been modified? Yes

If so, how and where: Corporate limits, section lines, and streets were added to base map drawing files from information provided by the City of Las Vegas and the City of North Las Vegas from community GIS mapping.

Any restrictions on the release of base map data?

No

If yes, what restrictions apply?

1.3 Coordination

Initial Consultation and Coordination Officer's (CCO) meeting date:

Wednesday, September 7, 1994

List of attendees and agencies represented at the initial CCO meeting:

Leslie K. Sakumoto, P.E. - FEMA Project Officer
Randy Tarr - City of North Las Vegas
Kevin Eubanks - Clark County Regional Flood Control District
Tom Chiatovich - City of Las Vegas
Bob Murnane - City of North Las Vegas
Phu Simpson - Clark County
Bob MacArthur, Northwest Hydraulic Consultants
Ed Wallace, Northwest Hydraulic Consultants

Intermediate CCO meeting data and attendees (if applicable):

Not applicable.

List of contacts made for the purpose of acquiring information:

Flooding sources requiring detailed study were discussed at the initial community meeting on September 7, 1994 involving representatives from FEMA, Clark County Regional Flood Control District, Clark County, City of North Las Vegas, and City of Las Vegas. Additional contacts were made with each of these agencies during the course of the study to obtain information. Additional contacts for the purpose of obtaining information were made with the US Geological Survey, Desert Research Institute, and FEMA's LMMP contractor, Ensign & Buckley Consulting Engineers.

The study contract was executed on September 25, 1995, and the first site visit and informational meetings were held on September 27 and 28, 1995. Separate meetings were held with the flood control district and each of the three communities in the study area to research available hydrologic and hydraulic reports, design documents for flood control facilities, as-built plans for bridges and other infrastructure, and available topographic mapping and aerial photography. A second site visit for the purpose of geomorphic reconnaissance was conducted on December 6 and 7, 1995. A meeting was held with Clark County Regional Flood Control District at this time to discuss available information for the West Range Wash Diversion Dike, North Las Vegas

Detention Basin and Diversion Dike, and Upper Las Vegas Detention Basin and Interception Berm; key hydrologic studies and precipitation analysis by the Corps of Engineers and NOAA; and existing sedimentation analyses for the diversion facilities.

The review of information provided by FEMA and the communities revealed gaps in the information regarding the design of the flood control facilities in the project area, including the two detention basins and three diversion dikes in the upper portion of the study area. A second site visit and meetings with Clark County Regional Flood Control District and the City of North Las Vegas were conducted on April 17 and 18, 1996. Additional information was obtained at these meetings, including review of microfiche files for the King Charles Channel, N Channel, and two bridges across Upper Las Vegas Wash. Blueline plans for these facilities were provided by the City of North Las Vegas on May 29, 1996.

Following the site review and initial hydraulic analysis, the study contractor requested additional information from the City of North Las Vegas regarding the status of the Sunrise Memorial Park development project and the control of debris in the Upper Las Vegas Wash channel. The City of North Las Vegas provided additional information in a letter dated June 21, 1996, advising the study contractor to consider the planned channel improvements at Sunrise Memorial Park in the hydraulic analysis, and that debris in the Upper Las Vegas Wash is scheduled for annual cleanup.

On August 13, 1996 the study contractor conducted a meeting with FEMA's project officer to discuss the results of preliminary hydrologic and hydraulic analysis. At this meeting, concerns were raised regarding the adequacy of available information in assessing the performance of the three diversion structures in the upper portion of the study area. The study contractor submitted preliminary hydrology and hydraulic information to FEMA on August 29, 1996 relating to these structures. In a September 12 conference call with representatives of FEMA, the study contractor was directed to assume that the Upper Las Vegas Wash Interception Berm would perform adequately in containing the base flood. It was agreed in this meeting that adequate information was not available to assess the performance of the West Range Wash Diversion Dike or the North Las Vegas Detention Basin Diversion Dike.

FEMA requested additional information from the Clark County Regional Flood Control District in a letter dated September 5, 1996, and subsequently notified the District on November 17, 1996 that work on the study had been suspended pending review of additional information on the West Range Wash Diversion Dike. FEMA's Technical Evaluation Contractor (TEC) also began research into review documentation for the North Las Vegas Detention Basin Diversion Dike. FEMA issued a Letter of Map Revision for the West Range Wash Diversion Dike

on January 28, 1997, but FEMA's research (concluded in April 1997) failed to reveal adequate information regarding performance of the North Las Vegas Diversion Dike if subjected to current estimates of the 100-year discharge.

The study contractor summarized the changes in estimated 100-year discharges and concerns regarding performance of the North Las Vegas Diversion Dike in an April 28, 1997 letter to FEMA, and FEMA advised the Clark County Regional Flood Control District of the situation in a May 5, 1997 letter. The Clark County Regional Flood Control District advised FEMA in a June 26, 1997 letter that the District agreed that the impacts of sediment on the structure, and the stability of the structure if overtopped warranted further consideration. The District undertook an independent evaluation of the diversion dike, and provided a report summarizing the results dated February 25, 1998.

To avoid delay in the completion of the study, the study contractor was directed by FEMA to complete hydraulic analysis of independent study cases with and without the North Las Vegas Detention Basin Diversion Dike.

The study contractor conducted a meeting with FEMA on December 11, 1997 and received information regarding a November 20 , 1997 LOMR issued in the study area between Lone Mountain Road and Craig Road. The study contractor conducted a site visit on December 13, 1997 to verify the conditions in the area of the LOMR and the remainder of the study area.

The study contractor met with the FEMA project officer on March 19,1998 to review the results of revised hydraulic analysis including the two cases with and without the North Las Vegas Detention Basin Diversion Dike, and the changes associated with the LOMR.

2.0 AREA STUDIED

2.1 Scope of Study

Note areas excluded from study, as well as areas of extraterritorial jurisdiction:

The study area includes the areas potentially subject to flooding from Upper Las Vegas Wash upstream of Interstate 15, including portions of the City of North Las Vegas, the City of Las Vegas, and unincorporated areas of Clark County. The study area's upstream (northwest) end is the upper end of the Upper Las Vegas Wash Interception Berm in Section 4, Range 60 East, Township 19 South in the City of Las Vegas. It extends from this point eastward to the North Las Vegas Detention Basin in the City of North Las Vegas in Section 14, Range 61 East, Township 19 South, thence southward through portions of Clark County and the City of North Las Vegas to Interstate 15 near Gowan Road in Section 11, Range

61 East, Township 20 South. The study area excludes the areas southeast of Interstate 15; northwest of the North Las Vegas Detention Basin along the West Range Wash Diversion Channel; and north of the Upper Las Vegas Wash and Upper Las Vegas Wash Interception Berm channels.

List the flooding sources studied in detail (detailed study streams should be listed in the same order as they appear in profiles). If they are also partially studied by approximate methods, provide the limits of detailed study:

The flooding source studied in detail is the portion of Las Vegas Wash generally known as Upper Las Vegas Wash, located northwest of Interstate 15, including the following channel segments as referred to in the Clark County Regional Flood Control District August 1991 Master Plan Update of the Las Vegas Valley (Reference 1):

Upper Las Vegas Wash - King Charles Channel
Upper Las Vegas Wash
"N" Channel Diversion

List the flooding sources studied by approximate methods:

None

If applicable, discuss streams on which study was terminated where the 100-year floodplain permanently narrowed to less than 200 feet wide or for which detailed study was ended where the drainage area was less than 1 square mile:

None

2.2 Community Description

Provide a general description of the community's location within the county and state:

Clark County is located in the southern tip of Nevada. The greater Las Vegas metropolitan area, including the City of Las Vegas, City of North Las Vegas, and development within the unincorporated areas of Clark County, is located in the central part of Clark County, approximately 20 miles west of Lake Mead. The study area is located in the northern portion of the Las Vegas metropolitan area.

List surrounding communities and their locations with respect to the subject community:

Surrounding communities include the town of East Las Vegas, approximately 10 miles southeast; the City of Henderson, approximately 15 miles southeast; and Boulder City, approximately 25 miles southeast.

List other nearby large cities and their locations:

Las Vegas is located approximately 250 miles northeast of Los Angeles, California; 360 miles southwest of Salt Lake City, Utah; and 340 miles southeast of Reno, Nevada.

Briefly describe the community. This description may include patterns of residential and commercial development; the extent and nature of floodplain development; natural features that affect flood hazards in the community; and sufficient description of climatic, physiographic, and land use features to support the discussion of flood problems that follows (Section 2.3).

The topographic features of Clark County are generally typical of the Basin and Range physiographic province, with north-south trending ranges. Las Vegas Valley cuts diagonally across the county, following a line of geologic deformation indicated by bending of the north-south trending ranges. Major ranges in the area include the Spring Mountain Range to the west, and the Sheep Mountain Range and Las Vegas Range to the north. The elevations of Las Vegas Valley are between approximately 3000 feet and 1800 feet (National Geodetic Vertical Datum, NGVD), and elevations of peaks in the surrounding ranges reach up to nearly 12,000 feet in the Spring Mountain Range and 10,000 feet in the Sheep Mountain Range. A series of large, coalescing alluvial fans are located along the margins of the upper portion of the valley at the base of the ranges. Much of the upper Las Vegas Valley floor is comprised of fine-grained lacustrine sediments. Marginal areas of the upper valley, and the lower Las Vegas Valley are covered by alluvial deposits. (References 2, 3).

The climate is arid to semi-arid, characterized by infrequent rainfall, low humidity, and wide extremes in daily temperatures. Annual precipitation in the area is strongly correlated to elevation, but intense cloudburst storms are possible in all areas of the Las Vegas Valley and surrounding ranges. The Las Vegas Valley receives an average annual rainfall of approximately 4 inches, and the higher elevations in the county receive up to 20 inches. Precipitation varies greatly in any location from year to year due to local cloudburst events. The average annual temperature is approximately 66^0 F, with average daily maximums in the high 70's and average daily minimums in the mid 50's. Daily maximum temperatures usually exceed 100^0 F in the summer in the lower valley, and daily minimum temperatures drop below 20^0 F in the mountain ranges in the winter.

Vegetation is strongly zoned by elevation, with little or no vegetation on the

playas, and sparse vegetation in the lower valleys. Species in the lower valleys are generally phreatophytes. Creosote bush, saltbrush, and rabbitbrush are common on the alluvial slopes, and Joshua trees, Spanish bayonet, small cacti, and blackrush grow on the middle portions of the fans. Above approximately 4,500 feet there are wooded areas of pinion and juniper (Reference 3).

The developed area of Clark County is concentrated in the Las Vegas Valley. Growth has been extremely rapid over the past 60 to 70 years, increasing from less than 5,000 in 1920 to approximately 600,000 in 1986. The current population is approximately 1.1 million. A large portion of the population is located in unincorporated areas of Las Vegas Valley. The developed area is located primarily in the lower portions of Las Vegas Valley, and is subject to runoff concentrated in the lower valley from a large surrounding geographic area. Development in the study area along Upper Las Vegas Wash, King Charles Channel, and "N" Channel includes low density residential, commercial, and industrial development. Extensive additional development, especially commercial and industrial development in North Las Vegas, is planned in the near future. This development is planned within the area formerly mapped within the 100-year flood hazard zone by FEMA in 1995 (Reference 4).

In addition to the permanent population, a large visitor population is present in the Las Vegas Valley throughout the year. The visitor population is generated primarily by the gaming and entertainment industries, which are a prime element in the County's economy.

2.3 Principal Flood Problems

Include the discharges and recurrence intervals of major floods:

Reports of flooding in the Las Vegas area date back almost 100 years. The U.S. Soil Conservation Service reviewed historical flooding in a report entitled History of Flooding, Clark County, Nevada 1905-1975 (Reference 5). This report documented 184 flood events that resulted in damages to private property and public facilities. Since 1960, the Las Vegas area has experienced at least seven floods that caused damages in excess of one million dollars, and the loss of over 22 lives in nine separate flash flood events (Reference 6).
The largest recorded flood on Las Vegas Wash occurred on July 3, 1976, when 12,000 cfs was measured at the USGS gaging station located upstream of Las Vegas Boulevard north of Las Vegas. The next largest events occurred on May 31, 1973 (1,640 cfs) , and September 25, 1967 (1,170 cfs). Although recurrence intervals for these events have previously been estimated by others (Reference 4), the construction of flood control facilities in the upper portion of the study area have altered flood flow paths and added flood storage to the extent that these estimates have little bearing on current recurrence intervals and flood discharges.

Give the location (city and state) of all stream gages for studied streams:

USGS Gages 09419648 (Las Vegas Wash above Detention Basin near North Las Vegas) and 09419650 (Las Vegas Wash at North Las Vegas) were discontinued in 1993 an 1978, respectively. There are no known active gaging stations on the studied streams.

Note any factors that aggravate flood problems:

Although flooding may occur in the study area in any season, the most severe floods are typically associated with intense cloudburst type storms that occur between July and September. This high intensity precipitation on steep mountain slopes and armored desert surfaces produces rapid, high rates of runoff. Runoff is concentrated in the lower valley where the largest population exists. There is a high potential for the public to underestimate the potential for flooding and to be unaware of floods until it is too late to avoid damages or injury. Factors that contribute to these problems include the arid nature of the area, rapid rates of runoff, localized nature of cloudburst precipitation that can result in flooding many miles away from the center of the cloudburst, and the popularity of the area with tourists.

Provide photos of flooding, flood control structures, etc. (with location of photo noted):

Principal flood control facilities in the study area include the King Charles Channel (Photo 1); "N" Channel Diversion (Photo 2); North Las Vegas Detention Basin (Photo 3); North Las Vegas Detention Basin Diversion Dike (Photo 4); Upper Las Vegas Wash Detention Basin (Photo 5); and Upper Las Vegas Wash Interception Berm (Photo 6). The West Range Wash Diversion Dike (Photo 7) is not included in the study area, but diverts flow from the West Range Wash into the North Las Vegas Detention Basin.

2.4 Flood Protection Measures

Describe all flood protection structures and floodplain management measures used to reduce potential flood damage:

The Clark County Regional Flood Control District first adopted a Flood Control Master Plan in 1986. Periodic Master Plan Updates are used to account for changes in land use, construction of new facilities, and improved data. Master planned facilities constructed in the study area include the Upper Las Vegas Wash

Detention Basin and Interception Berm (1992); North Las Vegas Detention Basin and Diversion Dike (1984); King Charles Channel (Phase 1 1987; Phase 2 1990); "N" Channel Diversion (Phase 1 1987; Phase 2 1990); and the Upper Las Vegas Wash channel constructed as part of improvement plans for 142 acres between Lone Mountain Road and Craig Road (1997).

The Upper Las Vegas Wash Interception Berm is designed to intercept flows at the upper end of the study area and divert them into the Upper Las Vegas Wash Detention Basin. This basin has a low level outlet as well as a roller compacted concrete spillway. Outflows from the upper basin are confined in an incised wash channel. A diversion dike intercepts flows in this incised channel and diverts them to the North Las Vegas Detention Basin. The West Range Wash Diversion Dike runs across the face of a large alluvial fan to the east of this basin, and also diverts flows into the basin. The North Las Vegas Detention Basin has both low level and spillway outlets that discharge into the wash channel. Flows are conveyed in the natural wash channel until reaching Lone Mountain Road, where they are intercepted by a constructed channel approach to the bridge at Lone Mountain Road. A constructed channel with earth bottom (with gabion grade controls) and riprapped banks carries flows to the Craig Road bridge, where flows enter the concrete lined King Charles Channel. Flows are carried in this lined channel under the Union Pacific Railroad bridge. Downstream of the bridge, a portion of the flows are diverted into the concrete lined "N" Channel Diversion to a culvert crossing of I-15. The flows remaining in the main channel (King Charles Channel) are conveyed in a concrete lined channel parallel to the Interstate to the confluence of the channel with the "A" Channel. The Western Tributary Channel also enters this confluence from the west.

Mention all dams, including those affecting the communities that lie outside the community:

Dams in the study area include those listed above for the North Las Vegas Detention Basin and the Upper Las Vegas Detention Basin.

Mention dams within the community used for purposes other than flood control:

None.

If levees are mentioned, state whether the levees meet or fail to meet the FEMA 3-foot freeboard requirement.

The berm along the south side of the Upper Las Vegas Wash Interception Berm meets the FEMA freeboard requirements. The Diversion Dike at the upper end of the North Las Vegas Detention Basin would not meet this criterion. However, for

the purpose of this study case, it has been assumed to remain in place during a 100-year event.

3.0 ENGINEERING METHODS *(Note any digital methodologies used)*

3.1 Hydrologic Analyses

Describe the hydrologic analyses for all flooding sources studied in detail:

Previous hydrologic analyses conducted by the US Army Corps of Engineers (1988), James M. Montgomery (1991), Boyle Engineering Corporation (1991), and Black & Veatch (1993) were reviewed during the study (References 7,8,9,10). The previous studies considered numerous separate storm centerings to identify the storm configurations that produced the highest peak flows at various locations in the basin. These studies utilized HEC-1 models (Reference 11) to estimate peak flows for various recurrence intervals. These models were calibrated to the Corps of Engineers regional analysis curve. The conclusions of the previous studies with respect to critical storm centerings were reviewed and accepted for this study:

- the "Spring Mountain Storm" produces the highest uncontrolled peak inflows to the Upper Las Vegas Wash Interception Berm and Detention Basin;

- the "Interbasin Storm" produces the highest 100-year peak inflow to the North Las Vegas Wash Detention Basin; and

- an unnamed storm in the West Range Wash tributary area produces the highest peak inflows to the West Range Wash Diversion Dike (although the West Range Wash Diversion Dike is not a part of the study area, flows were modeled for the purpose of reviewing the potential impact of the structure's performance on flows in Las Vegas Wash downstream, and for determining flood elevations in the North Las Vegas Detention Basin).

The previously developed HEC-1 models were modified to reflect the presence and current outlet work configurations of the existing flood control facilities. In addition, the models were expanded to represent 10- and 50- year rainfall events for the Interbasin Storm, and 500-year events for the Spring Mountain, Interbasin, and West Range Wash storms.

No changes were made to the previously defined runoff and channel routing parameters (including basin areas, curve numbers, loss rates, channel geometry, channel routing parameters, or rainfall amounts). Review of the existing models indicated that these values were all consistent with the Clark County Regional

Flood Control District Hydrologic Criteria and Drainage Design Manual (Reference 12).

Changes were made in the existing HEC-1 models to reflect as-built stage -storage and stage-discharge relationships for the Upper Las Vegas Wash Detention Basin (Reference 9), and to reflect the stage-discharge relationship for the modified three-pipe outlet structure at the North Las Vegas Detention Basin, including the upstream barrier wall.

Rainfall amounts for the 500-year Spring Mountain Storm, not previously modeled, were determined by extrapolation of the 10-, 50-, and 100-year rainfall amounts in previous models (Reference 7). Rainfall amounts for the 10- and 50-year Interbasin Storm events, not previously modeled, are based on the precipitation amounts for the Lower Central Valley storm (Reference 7) and the NOAA Atlas 2 (Reference 13) for Nevada, adjusted to reflect appropriate depth-area reduction factors from the Hydrologic Criteria and Drainage Design Manual. Rainfall amounts for the 500-year Interbasin Storm event were determined by extrapolation of the 10-, 50-, and 100-year rainfall amounts. Rainfall amounts for the 500-year West Range Wash storm event were determined by extrapolating rainfall amounts from the previous models for the 10-, 50-, and 100-year events.

The analyses produce results similar to the previously adopted FIS discharges for the 10- through 100-year peak discharges. The revised hydrologic analyses produce an increase of approximately 80% over the previously adopted FIS peak discharge for the 500-year event. This change is due to a loss of flow control at the detention basin that was not addressed in previous models.

Peak discharges determined using HEC-1 were applied in the computation of water surface profiles for the portion of the study area upstream of the outflow from the North Las Vegas Detention Basin. Downstream of this point, the 500-year peak discharge exceeded channel capacity, and flows were lost from the main channel at several points. Peak discharges were computed in this area using the HEC-1 results for the computation node downstream of the North Las Vegas Detention Basin at the upstream end of this reach, and the results of the hydraulic analyses described in Section 3.2 to determine flow splits and losses from the main channel. Where significant flows were lost from the main channel, they were subtracted from the total flow downstream. Where flows were determined to re-enter the channel, they were added to the remaining flows in the main channel.

In a summary of discharges table, provide a summary of drainage area-peak discharge relationships for the streams studied by detailed methods. Discharges and drainage areas for each stream should be listed in descending order. Streams should be listed in the same order as flood profiles:

Summary of Peak Discharges (in cfs) for Las Vegas Wash

Location	Storm Area, sq.mi. [a]	Storm Return Period 10-year	50-year	100-year	500-year
King Charles Channel below N Channel Diversion	54.4 [b]	1,025	1,746	2,266	4694 [d]
N Channel					
I-15 to Donovan Road	NA	256	436	567	2025 [d]
Donovan Road to King Charles		256	436	567	1173 [d]
Downstream of North Las Vegas Detention Basin	54.4 [b]	1,281	2,183	2,833	8,988
North Las Vegas Detention Basin Pipe and Spillway	54.4 [b]	1,292	2,186	2,839	6,322
Diversion Dike Overflow at North Las Vegas Detention Basin	54.4 [b]	0	0	194	6,838
Inflow to North Las Vegas Detention Basin	54.4 [b]	2,939	6,751	8,343	11,017
Inflow to North Las Vegas Detention Basin Diversion Dike	54.4 [b]	2,939	6,751	8,537	17,855
Outflow from Upper Las Vegas Wash Detention Basin	136.3 [c]	2,426	3,888	5,019	19,217
Inflow to Upper Las Vegas Wash Detention Basin	136.3 [c]	3,465	10,312	14,737	24,938

a Storm area is smaller than total tributary area
b Reference 10
c Reference 8
d Discharges based on upstream flow splits from hydraulic analysis

If applicable, discuss methods used to determine stillwater elevations and reference the Summary of Stillwater Elevations table:

Not applicable.

3.2 Hydraulic Analyses

State how cross sections were developed for all streams studied by detailed methods:

Cross sections were developed from four primary sources:

- aerial photogrammetry;
- field surveys;
- as-built plans for flood control facilities; and
- improvement plans for streets, bridges and development areas.

Aerial photogrammetry was used to develop topographic maps of the study area with a contour interval of 4 feet (Reference 13). Cross sections were developed by photogrammetric methods for most of the upper portion of the study area where there are few flood control channel improvements. Additional cross sections were developed directly from the aerial topographic mapping where determined necessary based on preliminary hydraulic analyses. Additional field surveys were conducted to obtain elevations for the bridge crossings of Upper Las Vegas Wash at Lone Mountain Road, Craig Road, and the Union Pacific Railroad Bridge. Field surveys were also conducted to increase the density of topographic data near the intersection of Losee Road and Lone Mountain Road, where flows from the wash cross Losee Road in two low water crossings. As-built plans for the King Charles Channel (References 14, 15), Improvements for 142 acres at Losee Road and Craig Road (Reference 16), Lone Mountain Road Bridge (Reference 17), North Las Vegas Detention Basin (Reference 18), Upper Las Vegas Wash Detention Basin and Interception Berm/Channel (Reference 19) were used to develop cross sections in these areas.

The following table describes the cross section data used:

Cross Section Station	**Data Source**
1+50 to 37+20	As-built plans - King Charles Diversion Channel Phase 1
37+20 to 58+53	As-built plans - King Charles Diversion Channel Phase 2; field survey at UPRR bridge

58+53 to 86+82	As-built improvement plans - 142 acre development at Losee Road and Craig Road; field survey at Craig Road bridge
87+80 to 88+61	As-built plans - Lone Mountain Road Bridge; field survey at Lone Mountain Road bridge; As-built improvement plans - 142 acre development and Losee Road and Craig Road
91+20	Aerial photogrammetry
92+37 to 94+29	Aerial topographic mapping
101+55 to 141+67	Aerial photogrammetry
143+68	Aerial topographic mapping
151+14	Aerial photogrammetry
156+67	Aerial topographic mapping
165+46 to 184+36	Aerial photogrammetry
184+62 to 192+15	Aerial topographic mapping
198+02 to 263+83	Aerial photogrammetry
270+00 to 273+03	Aerial topographic mapping
289+03 to 309+35	As-built plans - Las Vegas Detention Basin Flood Control Project
312+35 to 315+00	Aerial topographic mapping
320+44 to 555+70	Aerial photogrammetry
560+10 to 564+87	As-built plans - Upper Las Vegas Detention Basin and Interception Berm/Channel
59+059 to 749+97	Aerial photogrammetry

Describe how the dimensions of hydraulic structures were determined:

The dimensions of major hydraulic structures, including the outlet dams and outlet works for the two detention basins and their interception and diversion channels, were determined from as-built drawings. Field surveys were completed at all bridge crossings.

Explain how channel roughness factors (Manning's "n") were assigned. The "n" values for ALL streams studied by detailed methods (channel and overbank areas) should be given:

Channel roughness factors were determined based on standard hydraulic engineering references (References 20, 21), engineering judgment, and field observations. Limited sensitivity testing was conducted during hydraulic modeling to determine the effect of a range of 'n' values on model results. Final model roughness values were selected to represent a combination of roughness due to vegetation, bed and bank material, and bed form irregularity. The depth of flow was also considered in selecting appropriate 'n' values. The following Manning's 'n' values were assigned to various channel and overbank areas:

Channel/Overbank Type	**Manning's 'n'**
Concrete lined channel	0.014 to 0.017
Developed overbanks (Primarily pavement areas, smooth earth, or sparse landscaping)	0.030 to 0.035
Earth channels (constructed)	0.030
Unimproved wash channels (with vegetation)	0.040 to 0.045
Industrial lots (with obstructions)	0.045

State how water surface elevations were obtained for all streams studied by detailed methods:

The US Army Corps of Engineers HEC-2 program (Reference 22) was used as the primary tool for computation of water surface profiles for this study. This model was run in both subcritical and supercritical modes for various reaches of the study area. The results of the HEC-2 model were supplemented by independent calculations at bridges and culverts using the Federal Highway Administration HY-8 program (Reference 23) and by hand. Shallow overbank flooding depths and velocities were computed in some areas by hand using normal depth computations from Manning's equation.

Flood profiles were drawn showing computed water surface elevations for floods of the selected recurrence intervals. Peak discharges on the "A" Channel were found to produce backwater in the lower portion of the King Charles Channel with

higher water surface elevations than HEC-2 models for the corresponding recurrence intervals on the King Charles Channel. The water surfaces from backwater on the "A" Channel are shown in the profiles. Maximum basin stages in the North Las Vegas Detention Basin and Upper Las Vegas Detention Basin computed using the HEC-1 models, produced higher water surface elevations for the 50-, 100-, and 500-year flood events than the HEC-2 models for the portions of the wash immediately upstream of the basins. These elevations are reflected on the profiles.

The starting water surface elevations for the Upper Las Vegas Wash at the confluence with the "A" Channel were calculated using the slope area method. Water surface elevations at the N Channel were computed using supercritical profiles. These starting water surfaces match the water surface elevations calculated at the diversion from the King Charles Channel. Starting water surface elevations at the North Las Vegas Detention Basin were derived from HEC-1 routing of flows through the basin. The starting water surface elevations were taken as the basin stage at the time of the peak discharge. The starting water surface elevations in Upper Las Vegas Detention Basin were computed using the same methods.

The hydraulic analyses for this study were based on unobstructed flow through the wash and hydraulic structures except at Lone Mountain Road Bridge. Lone Mountain Road Bridge is the first bridge that Upper Las Vegas wash passes through moving downstream and is subject to high debris and sediment loads from the wash. The bridge is subject to pressure flow at the 500-year peak discharge. Under these conditions, the capacity of the bridge to transport large bed load sediments will be less than the capacity of the inflowing channel. Due to the high availability of cobble sized bed load that can be generated by progression of existing headcuts upstream of the bridge, opening was assumed blocked during the 500-year peak discharge.

The HEC-2 models and the HY-8 program were used to define the locations where channel and hydraulic structure capacities were inadequate to convey the peak flood discharges for various recurrence intervals. Where overbank flows remained hydraulically connected to the main wash or channel flows, the overbank flows were modeled with HEC-2, and the results used to delineate AE flood hazard zones. Where breakout flows were determined likely to become hydraulically separated from the main wash or channel, the breakout flow depths and velocities were estimated using normal depth computations, and the results of these computations used to delineate AO flood hazard zones. Breakout flows occur at the 500-year flood discharge near Azure and Losee Road, Lone Mountain Road, Craig Road, and the UPRR Bridge. A portion of these flows return to the main channel downstream in various locations within the study area. Overflow magnitudes were determined using HEC-2 and hand calculations. For

determination of the profiles in the main channel or wash downstream of breakout flows, the overflow was subtracted from the total flow upstream. Flows in the HEC-2 models decrease in a downstream direction as overflows are progressively subtracted from the main flow area at subsequent breakout locations.

Average 100-year flow depths in overflow areas were determined using normal-depth calculations. Areas of inundation for the 500-year flood discharge were determined by approximate methods using a combination of normal depth calculations, review of available topographic mapping, and field observation.

Shallow flooding is often characterized by highly unpredictable flow directions caused by low relief or shifting channels and high debris loads. Where such conditions exist, the entire area susceptible to this unpredictable flow was delineated as a zone of equal risk. Small scale topographic variations were averaged across inundated areas to determine flood depths.

Describe the methodology for wave height/runup, lacustrine, ice jam, alluvial fan flooding, and shallow flooding areas (where applicable):

Not applicable.

If applicable, reference the Transect Descriptions which should include: transect number, location, 100-year stillwater elevation, and maximum 100-year wave elevation.

Not applicable.

If performed, describe the hydraulic analyses for the approximate flooding sources:

No approximate flooding sources studied.

If applicable, reference the Transect Data Table which should include: Flooding Source (with the affected transects), 10-, 50-, 100-, and 500-year stillwater elevation, zone designation and Base Flood Elevation.

Not applicable.

If applicable, reference the Transect Location Map.

Not applicable.

Standard paragraphs in this section include paragraphs for cross sections, NGVD,

and unobstructed flow.

No modifications required to standard paragraphs, except that the Lone Mountain Road Bridge was assumed blocked in the 500-year event as described above.

Specify whether elevations are referenced to NGVD or NAVD or other datum, and give releveling dates, if any.

All elevations are referenced to NGVD (1929).

4.0 FLOODPLAIN MANAGEMENT APPLICATIONS

4.1 Floodplain Boundaries

Identify all maps used. Include the scale, contour interval, and type of map (topographic, compiled from aerial photographs, etc):

Flood boundaries for the 100- and 500-year flood discharges in the Upper Las Vegas Wash were delineated on 1:4,800 scale topographic maps with a contour interval of 4 feet (reference 24). Where flood boundaries for the 500-year flood discharge was located outside the extent of this mapping, the boundaries were determined using topographic mapping developed for the City of North Las Vegas at a scale of 1:4,800 with a contour interval of 2 feet (reference 25) and USGS quadrangle topographic maps, 1:24,000 (references 26 and 27).

Cross sections within the unimproved areas of the wash were obtained by aerial photogrammetry and interpolated from topographic maps. Cross sections at structures were obtained from as-built plans and verified by field inspections and surveys.

There is a datum difference between the NGVD 1929 and NAVD 1988 mapping from ranging 2.41 to 2.46 feet in the Upper Las Vegas Wash. The average difference between the control points was 2.43 feet. Therefore, 2.43 feet was subtracted from the photogrammetric control and the ERM elevations to convert from NAVD 1988 to NGVD 1929. Cross section elevations obtained from NAVD 1988 topographic mapping used in the hydraulic models were converted to NGVD 1929 by subtracting 2.4 feet.

Identify and reference all maps or methods used to delineate floodplain boundaries for approximate flooding sources:

Not applicable.

4.2 Floodways

List streams, if any, for which floodway widths extend beyond the corporate limits:

No floodway determined.

List streams affected by backwater:

The lower portion of the King Charles Channel is affected by backwater from the "A" Channel. These two channels have there confluence at the study area downstream boundary near Interstate 15. The "A" Channel backwater elevations were extended upstream to intersect with the computed water surface elevations in the King Charles Channel.

Provide method used for floodway computations:

No floodway determined.

Give reason why no floodway was delineated for streams or portions of streams:

Determination of a floodway was discussed, but not requested by community at the initial CCO meeting, due to anticipated confinement of 100-year flood in natural and constructed channel boundaries. The FEMA Project Officer agreed that a floodway was not required.

Identify any abnormal procedures (such as state-imposed surcharges of less than 1.0 foot) for floodway delineations:

No abnormal procedures.

7.0 OTHER STUDIES

Identify and reference all other FISs for contiguous communities and any other published reports or available data dealing with related flooding sources. All disagreements and discrepancies must be noted and resolved:

This report is for a restudy of one of the streams covered in the current Flood Insurance Study for Clark County, Nevada and Incorporated Areas (Reference 4). Changes in discharges and water surface profiles in this study are due to the recent construction of flood control facilities.

8.0 BIBLIOGRAPHY AND REFERENCES

List references with complete information, including date, place of publication, and scale (as applicable):

1. Clark County Regional Control District, August 1991 Master Plan Update of the Las Vegas Valley, 1991

2. U.S. Department of the Interior, Geological Survey, Geologic Map of Clark County, Nevada, Scale 1: 250,000, Contour interval 500 feet, 1964

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4. Federal Emergency Management Agency, Flood Insurance Study, Clark County Nevada and Incorporated Areas, 1995

5. U.S. Department of Agriculture, Soil Conservation Service, History of Flooding, Clark County, Nevada 1905 -1975, 1976

6. Clark County Regional Flood Control District, Annual Report 1992-1993, 1993

7. U.S. Department of the Army, Corps of Engineers, Hydrologic Documentation for Feasibility Study, Las Vegas Wash and Tributaries, 1988

8. James M. Montgomery, Las Vegas Valley Flood Insurance Study Hydrology Report, 1991

9 Boyle Engineering Corporation, Western and Eastern Tributaries of Range Wash Flood Control Facility Plan, 1991

10. Black & Veatch, North Las Vegas Detention Basin Outlet Modification Report,

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11. U.S. Department of the Army, Corps of Engineers, HEC-1 Flood Hydrograph Package Users Manual, 1987

12. Clark County Regional Flood Control District, Hydrologic Criteria and Drainage Design Manual, 1990

13. U.S. Department of Commerce, National Oceanic and Atmospheric Administration, Precipitation-Frequency Atlas of the Western United States, 1973

14. James M. Montgomery Consulting Engineers, Inc., King Charles Diversion Channel from N-Channel Phase I, 1987

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16. BSI Consultants, Inc., 142 Acres at Losee and Craig Road Site Improvement Plans, As-built drawings, 1997

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18. Montgomery Engineers of Nevada Consulting Engineers, Las Vegas Wash Detention Basin and Interception Control Project drawings, 1983

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20. Chow, Ven Te, Open-Channel Hydraulics, McGraw-Hill Publishing Company, 1959

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23. US Federal Highway Administration, HY-8 computer program

24. Kenney Aerial Mapping, Inc., Topographic Mapping of the Upper Las Vegas Wash, Scale 1:4800, Contour Interval 4 feet, NGVD 1929, 1996

25. Kenney Aerial Mapping, Inc., Topographic Mapping for the City of North Las Vegas, Scale 1:4800, Contour Interval 2 feet, NGVD 1929, 1996

26. US Geological Survey, Valley Quadrangle, Clark County, Nevada, Scale 1:24000, Contour Interval 20 feet, NGVD 1929, 1982

27. US Geological Survey, Las Vegas NE Quadrangle, Clark County, Nevada, Scale 1:24000, Contour Interval 10 feet, NGVD 1929, 1984

TSDN - Flood Insurance Study

Upper Las Vegas Wash
City of Las Vegas, City of North Las Vegas, Unincorporated Areas of Clark County
EMW - 95 - C - 4840

Summary of Flood Control Structure Review

This volume of the TSDN documents the review of existing flood control structures in the study area. The performance of the flood interception and detention facilities in the upper portion of the study area is critical to the development of realistic peak discharge estimates downstream in developed areas. The flood control structures of primary concern in this regard include the Upper Las Vegas Wash Interception Berm and Detention Basin, the Range Wash Diversion Dike, and the North Las Vegas Detention Basin and Diversion Dike. The structures in the upper portion of the study area are located on alluvial fans, and are thus subject to unpredictable flow paths and high sediment loads. The probable performance of these structures during a major flood event was reviewed based on available design information and field geomorphic reconnaissance. Other existing flood control structures in the lower portion of study area (King Charles Channel, N-Channel, etc.) were evaluated primarily through the use of hydraulic modeling. This modeling is described in Volumes 3 and 4 of the TSDN.

NHC prepared a memorandum in August 1996 describing the flood interception and detention structures in the upper portion of the study area and the available design information. This memorandum raised questions concerning the performance of these structures and their conformance with FEMA criteria.

In September 1996, the memorandum was discussed with FEMA and the Technical Evaluation Contractor (TEC) in a teleconference. It was agreed during this conversation that the Upper Las Vegas Interception Berm and Detention Basin had received adequate prior review by FEMA, and could be assumed to perform adequately during a major flood event. This assumption is conservative for the purpose of computing flows in the Upper Las Vegas Wash study area. No record of prior FEMA review of the North Las Vegas Detention Basin Diversion Dike was known at the time of the teleconference. It was agreed that the TEC would research the review history for this structure.

The performance of the West Range Wash Diversion Dike was considered uncertain given available information. A request was made by FEMA to Clark County Regional Flood Control District for additional data for the West Range Wash Diversion Dike in September 1996, and in November 1996 a letter from FEMA notified CCRFCD that work was stopped on the Upper Las Vegas Wash Flood Insurance Study until the questions regarding the West Range Wash were resolved. Additional technical information was submitted to FEMA, and in January 1997 a LOMR was issued for the West Range Wash based on the effects of the West Range Wash Diversion Dike.
In telephone conversations during March and April 1997, the TEC notified NHC that the North

Las Vegas Detention Basin Diversion Dike had not been previously reviewed by FEMA. NHC prepared a letter to FEMA summarizing the updated hydrology and preliminary hydraulic analysis at the structure. Based on the the preliminary analysis , the dike did not meet FEMA freeboard requirements for levees, and did not appear to be designed to withstand sustained overflows. FEMA was advised in this letter that NHC was unable to conclude, based on available information and FEMA guidelines, that the dike would withstand the 100-year flood without failure. NHC recommended confirming the hydrology and preliminary hydraulic analysis with CCRFCD, and proceeding with flood plain mapping for scenarios with and without the dike in place.

FEMA wrote a letter to CCRFCD in May 1997 notifying the district of the unexpected development at the diversion dike, and requesting confirmation of the hydrology and the hydraulic analysis. The CCRFCD subsequently retained a consultant to prepare an analysis of the structure. This report (Montgomery Watson, 1998) concludes that the structure would perform adequately in the 100-year event. After reviewing the report, NHC prepared an April 8, 1998 letter that provides comments and suggestions that may be used by FEMA in reviewing the report and the structure. As directed by FEMA's project officer, the study was completed by NHC for two independent cases, with and without the North Las Vegas Detention Basin Diversion Dike in place. For this reason, the TSDN is organized to clearly separate the engineering analyses for these two cases. The appropriate condition may be applied by FEMA to complete flood hazard mapping for the area after technical review of the diversion dike.

This volume of the TSDN (Volume 2) includes documentation and correspondence concerning review of the flood control structures, including the evaluations of the North Las Vegas Detention Basin Diversion Dike by NHC and CCRFCD. Volume 3 contains the engineering analyses for the 'With North Las Vegas Detention Basin Diversion Dike' case, and Volume 4 contains the analyses for the 'Without North Las Vegas Detention Basin Diversion Dike' case.

HYDROLOGY MEMORANDUM
UPPER LAS VEGAS WASH

1. Hydrology

1.1 Study Approach

The Upper Las Vegas Wash is an ephemeral desert stream draining a basin area of approximately 720 square miles originating in the Spring and Sheep Mountains upstream of the City of Las Vegas. Peak flows from the majority of the basin are controlled by two major detention basins: the North Las Vegas Detention Basin constructed in 1984 and the Upper Las Vegas Wash Detention Basin constructed in 1993. The tributary area to the North Las Vegas Detention Basin was increased by 48 square miles with construction of the Range Wash Diversion Dike in 1994. Figure 1-1 shows basin boundaries above the major flood control structures.

Previous hydrology studies for flood control facility design and for determining regulated flood discharges include work by the U.S. Army Corps of Engineers (1988), James M. Montgomery (1991), Boyle Engineering Corporation (1991) and by Black & Veatch (1993).

The approach and objectives for the current hydrologic analysis are to assess the adequacy of the previous analyses, and to update and re-run previously-developed Flood Insurance Study HEC-1 models as necessary to reflect existing flood control facilities.

1.2 Previous Hydrology Studies

The hydrology of the Upper Las Vegas Wash has been studied in numerous previous reports. Recent studies leading to the development of HEC-1 models adopted for use in the present work are listed below.

- U.S. Army Corps of Engineers (COE), South Pacific Division, "Hydrological Documentation for Feasibility Study, Las Vegas Wash and Tributaries, Clark County, Nevada," draft dated April 1988. That study provided a regional analysis of flood frequency data, including 20 years of peak flow data for USGS Gage 09419650, Las Vegas Wash at North Las Vegas. The Las Vegas Wash at this location reflects flows from the Upper Las Vegas Wash channel. The COE developed a computed probability 100-year regional flood frequency curve, reproduced here as Figure 1-2.

- Black & Veatch (B&V), "Flood Control Facilities Plan for the Northern Las Vegas Wash," August 1989. That study included the development of HEC-1 models with various storm centerings for the Upper Las Vegas Wash basin.

- Boyle Engineering Corporation, "Western and Eastern Tributaries of Range Wash Flood Control Facility Plan," prepared for City of North Las Vegas, June 1991. That study

included HEC-1 modeling and led to construction of the West Range Wash Diversion Dike which now diverts flow from 48 square miles of the Range Wash basin into the North Las Vegas Detention Basin.

- B&V, "Predesign Report for the Upper Las Vegas Wash Detention Basin," prepared for City of North Las Vegas, March 1991. That study included HEC-1 modeling of the upper portion of the Las Vegas Wash basin, and led to construction of the Upper Las Vegas Wash Detention Basin and an accompanying interception berm/channel extending to the west from that facility.

- James M. Montgomery (JMM), "Clark County Regional Flood Control District Las Vegas Valley Flood Insurance Study Hydrology Report," September 1991 (Adopted November 14, 1991). HEC-1 models for that study were based on the HEC-1 models developed by B&V (above). Model calibration was attained by matching previous COE and B&V discharges in an initial set of model runs which did not include proposed flood control facilities The proposed facilities were then introduced to the models to generate Flood Insurance Study (FIS) flows.

- B&V, "North Las Vegas Detention Basin Outlet Modification Report," prepared for City of North Las Vegas, August 25 1993. That report included HEC-1 modeling of 6 storm centerings to examine impacts of the Upper Las Vegas Wash Detention Basin and West Range Wash Diversion Dike on outflows from the North Las Vegas Detention Basin. This work led to modification of the North Las Vegas Detention Basin outlet structure by closing two of the five original outlet pipes.

A review of peak flow data through 1993 for the USGS Las Vegas Wash gage (Gage 09419650, Las Vegas Wash at North Las Vegas) found that no significant flood events have occurred since the COE's 1988 analysis that would substantially change the results of that assessment. The lack of additional significant events in the Las Vegas Wash would tend to lower the COE-estimated 100-year discharge for that station, but the COE's adopted regional analysis curve (Figure 1-2) already results in a slightly lower 100-year discharge estimate for that station than frequency analysis of the individual station gage records. The COE's regional analysis for 100-year peak discharge versus drainage area therefore continues to be a reasonable method for estimating unregulated peak flows for the Upper Las Vegas Wash basin.

Existing HEC-1 models of the Upper Las Vegas Wash were "calibrated" to the COE regional analysis curve, and should provide a reasonable estimate of unregulated peak flows. However, it should be noted that there was no calibration to the shape or volume of runoff hydrographs, apparently due to a lack of data for such calibration. The accuracy of the shape and volume of simulated runoff hydrographs, which are important to the performance of detention facilities, is therefore unknown. Hydrographs simulated by the existing HEC-1 models assume a hydrograph shape defined by the SCS unitgraph approach.

The previous analyses considered numerous separate storm centerings over the basin to identify storm configurations which produced the highest peak flows at various locations in the basin.

Multiple storm centerings were required because peak flows in the region result from cloudburst events having areas less than 200 square miles and that only cover a portion of the entire Upper Las Vegas Wash basin. For the present work, we have accepted the findings of the previous B&V (1993) and JMM (1991) studies as to which theoretical design storms are most critical for determining FIS discharges:

- The "Spring Mountain Storm" previously used by both JMM and B&V produces the highest uncontrolled peak inflows to the Upper Las Vegas Wash detention basin, as well as the highest peak outflows from both the Upper and North Las Vegas Wash detention basins. This storm was compared to the "Sheep Mountain Storm" by B&V (1993) and determined to be the critical storm for peak inflows and volumes to the North Las Vegas Detention Basin during design of outlet modifications. The Spring Mountain storm has been modeled as a 136.34 sq. mi. storm centered over the Spring Mountain Range. Spring Mountain storm HEC-1 models had previously been developed by JMM (1991) with 10-, 50-, and 100-year rainfall amounts. The Spring Mountain storm simulates a 100-year (uncontrolled) peak flow of 14,737 cfs into the Upper Las Vegas Wash detention basin. Considering the detention basin's total tributary area of approximately 516 sq. mi., the HEC-1 result, is consistent with the COE's regional analysis curve (Figure 1-2).

- The "Interbasin Storm" previously used by B&V produces the highest 100-year peak inflow to the North Las Vegas detention basin. The Interbasin storm has been modeled as a 54.37 sq. mi. storm covering the North Las Vegas Wash tributary area between the Upper and North Las Vegas Wash detention basins. A single Interbasin storm model had been developed by B&V (1993) to represent 100-year storm conditions only. The Interbasin storm simulates a 100-year (uncontrolled) peak flow of 8,537 cfs from the 54.37 sq. mi. basin and is consistent with the COE's regional analysis curve (Figure 1-2).

- An unnamed storm covering the entire 48.16 sq. mi. tributary area to the West Range Wash diversion dike produces the highest peak flows for the West Range Wash diversion dike. A HEC-1 model for this storm had previously been developed by Boyle (1991) for 100-year storm conditions only. This storm simulates a 100-year (uncontrolled) peak flow of 6,584 cfs from the 48.16 sq. mi. basin, which is about 13% lower than the 100-year peak flow indicated from the COE's regional analysis curve (Figure 1-2).

For purposes of the present work, the previously-developed Spring Mountain 10-, 50-, and 100-year HEC-1 models were updated to reflect the existing flood control facilities, and additional Interbasin storm models were developed to represent 10- and 50-year rainfall amounts. HEC-1 models representing 500-year rainfall amounts were developed for both the Spring Mountain and Interbasin storms.

No modifications were made to the HEC-1 model representing West Range Wash diversion dike flows, as FIS discharges for floodplain mapping were not required for this location. If required for other purposes, approximate 10- through 500-year values for West Range Wash diversion dike flows

could be estimated by multiplying Interbasin storm values by 0.89, which is the ratio of Interbasin storm to West Range Wash diversion dike basin areas.

1.3 Modifications to Existing HEC-1 models.

HEC-1 models developed by JMM (1991) for the Spring Mountain storm and by B&V (1993) for the Interbasin storm were used as the basis for hydrologic modeling in the present study. No changes were made to any of the previously-defined runoff or channel routing parameters including basin areas, curve numbers, loss rates, channel geometry, and channel routing coefficients. Furthermore, no changes were made to subbasin rainfall amounts for 10- through 100-year return periods, precipitation multipliers, or depth-area correction factors, all of which appeared to be consistent with values recommended by the Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual (1990).

Spring Mountain Storm Files

Spring Mountain 10-, 50-, and 100-year storm HEC-1 files for the present study are based on HEC-1 files prepared by JMM (1991) for the previous FIS hydrology study. Modifications to the JMM files consisted of updating the detention basin characteristics for existing conditions as follows:

- Stage-storage and stage-discharge relationships for the Upper Las Vegas Wash detention basin were updated to reflect as-built conditions. The 1991 JMM model had been based on a preliminary detention basin design which was revised prior to construction. The original (JMM, 1991) model SV, SE, and SQ data for the Upper Las Vegas Wash detention basin were replaced using the SV, SE, and SQ data from HEC-1 models prepared by B&V (1993). The B&V stage-storage and stage-discharge relationships for the Upper Las Vegas Wash detention basin were reviewed and found to adequately reflect as-built conditions.

- The stage-discharge relationship for the North Las Vegas Wash detention basin was updated to reflect the existing three-pipe outlet structure with a four-feet high, 53-feet wide upstream barrier wall. The 1991 JMM model had assumed a four-pipe outlet structure based on preliminary design data; however, two of the structure's original five outlet pipes were subsequently blocked following construction of the Upper Las Vegas Wash detention basin. The original (JMM, 1991) model SQ data for the North Las Vegas Wash detention basin, for stages above seven feet, were replaced using the discharge data presented by B&V (1993) for a three-pipe outlet structure. Discharges below about seven feet stage were found to be controlled by the upstream barrier wall which was not represented in any of the previously outlet rating curves. The rating curve for the barrier wall was computed for the current study by assuming orifice flow through the weep holes, plus weir flow at stages above four feet.

A Spring Mountain 500-year storm HEC-1 model was developed for the present study by modifying

the 100-year model to include 500-year rather than 100-year rainfall amounts. This differs from the approach taken in the previous JMM (1991) FIS study in which 500-year flows were estimated by extrapolation of the flows simulated for 10-, 50-, and 100-year return periods. The previous method is likely to underestimate 500-year flows in the Upper Las Vegas Wash system because the detention basins are sized to be filled during a 100-year event. A substantial loss of flow control should therefore be expected at more extreme events due to spillway flow.

Spring Mountain storm 500-year rainfall amounts for each model subbasin were determined by extrapolation of the rainfall amounts from the JMM (1991) 10-, 50-, and 100-year Spring Mountain storm HEC-1 models.

Interbasin Storm Files

Interbasin storm 10- through 500-year rainfall HEC-1 files for the present study are based on the 100-year Interbasin storm HEC-1 file prepared by B&V (1993). This storm covers the Las Vegas Wash basin area beginning immediately downstream from the Upper Las Vegas Wash detention basin and extending to the outlet of the North Las Vegas detention basin. Hydraulic characteristics for the North Las Vegas detention basin were revised to be the same as for the updated Spring Mountain storm models discussed above.

Subbasin rainfall amounts for the 100-year Interbasin storm are as presented in the original B&V model. Rainfall amounts for 10- and 50- year storms are based on the 10- and 50-year subbasin rainfall amounts presented by JMM (1991) for the Lower Central Valley storm, which covers all but two of the subbasins included in the Interbasin storm. Rainfall amounts from the JMM (1991) 10- and 50-year models were divided by a factor of 0.62 to remove the depth-area correction factor which had been applied to subbasin rainfall amounts in the original development of the Lower Central Valley models. 10- and 50- year, 6-hour rainfall amounts for the two subbasins (104 and 105) not covered by the Lower Central Valley models were determined from NOAA Atlas 2 for Nevada. The 10- and 50-year atlas amounts were increased by factors of 1.24 and 1.39 respectively, as recommended by the CCRFCD (1990). A depth-area correction factor of 0.66 was applied for all Interbasin storms.

Subbasin rainfall amounts for the 500-year Interbasin storm were determined by extrapolation of rainfall amounts from the 10-, 50-, and 100-year Interbasin storm models.

Input files for all HEC-1 models modified or created for the purposes of this study are provided in digital form on a diskette which accompanies this report.

1.4 Revised FIS Discharges

Table 1 summarizes the results of the HEC-1 modeling at various points along the Upper Las Vegas Wash system. Computation nodes are shown in Figure 1-3. Table 2 compares the current model

results with the previously adopted FIS flows.

The current model results for 10- through 100-year return periods are slightly lower than the previously-adopted FIS discharges. We do not consider the differences to be sufficiently large to warrant changing the previously-published 10- through 100-year flows which are currently being used by others for concurrent (downstream) floodplain mapping analyses.

The revised hydrologic analysis indicates a 500-year discharge downstream from the North Las Vegas detention basin which is about 80% larger than previously assumed. This increase in the 500-year discharge is due to a loss of detention basin flow control that was not specifically addressed in the previous FIS analysis.

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SPRING MOUNTAIN STORM HEC-1 MODEL

1998 ULV Wash FIS Restudy.

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**************************************
*                                    *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)*
*           FEBRUARY  1991           *
*            VERSION 4.0.1 (LOCAL)   *
*                                    *
*  RUN DATE  05/10/96  TIME  16:25:40*
*                                    *
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*                                    *
*    U.S. ARMY CORPS OF ENGINEERS    *
*    HYDROLOGIC ENGINEERING CENTER   *
*          609 SECOND STREET         *
*       DAVIS, CALIFORNIA 95616      *
*           (916) 551-1748           *
*                                    *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X        XX
X     X  X        X              X
XXXXXXX  XXXX     X        XXXXX  X
X     X  X        X              X
X     X  X        X     X        X
X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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


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

                    *DIAGRAM
              1     ID          FEMA FLOOD INSURANCE STUDY, 1996
              2     ID          UPPER LAS VEGAS WASH, CLARK COUNTY, NEVADA
              3     ID          SPRING MOUNTAIN 100-YEAR STORM
              4     ID
              5     ID          Current (05/96) model based on a HEC-1 model prepared by James M
              6     ID          Montgomery (JMM) in 1/91 for the Las Vegas Valley Flood Insurance
              7     ID          Study Hydrology Report dated 9/91.  Two modifications were made
              8     ID          to the source model.  First, Upper Las Vegas Detention Basin storage
              9     ID          and outflow characteristics were revised to reflect the as-built
             10     ID          configuration described by construction drawings dated 5/91 and HEC-1
             11     ID          models prepared in 1993 by Black & Veatch.  Second, the stage-outflow
             12     ID          relationship for the North Las Vegas Detention Basin was revised
             13     ID          to reflect the current three-pipe outlet condition (two of the five
             14     ID          pipes were blocked following construction of the upper basin) and the
             15     ID          hydraulic control created by the 4-foot high barrier wall located
             16     ID          upstream from the pipe inlets.
             17     ID
             18     ID          Remaining comments are from the original model dated 1/91.
             19     ID
             20     ID          CCRFCD LAS VEGAS VALLEY MASTER PLAN UPDATE
             21     ID          NORTHERN LAS VEGAS WASH - WESTERN TRIBUTARY
             22     ID          SPRING MOUNTAIN 100-YEAR STORM EXISTING CONDITIONS
             23     ID
             24     ID          Based on Northern Las Vegas Wash HEC-1 model by Black & Veatch, 8/89
             25     ID          CCRFCD DARF = 0.56 for 136 sq mi storm (JR card = 0.903) - JMM, 1/91
             26     ID          The storm area of 136 sq mi reflects the Spring Mtn Storm minus the
             27     ID          portion within the Gowan Area (which is not tributary to the Upper
             28     ID          Las Vegas Wash Detention Basin diversion)
             29     ID          Convert nat. channels fr/kinematic wave to Muskingum Routing-JMM, 7/90
             30     ID          All routing steps immediately d/s of a diversion converted to
             31     ID          Muskingum rouing to avoid zero flow, 8/90
             32     ID
             33     ID          This run models the diversion from the West Tributary to the proposed
             34     ID          Upper Las Vegas Wash Detention Basin, 1/91
             35     ID
*** FREE ***
             36     IT       6       0       0     200
             37     IO       5       0       0
             38     IN       5       0       0
             39     JR    PREC   0.903
                    * REMOVED GOWAN AREA SINCE IT IS NOT TRIBUTARY TO THE DIVERSION INTO THE UPPER
                    * LAS VEGAS WASH DETENTION BASIN

             40     KK     201
             41     KM   RUNOFF FROM SUBBASIN 201
             42     BA   5.543
             43     PB    2.44
             44     PC    .000    .020    .059    .080    .110    .144    .150    .160    .168    .171
             45     PC    .180    .182    .187    .190    .197    .202    .210    .220    .230    .241
             46     PC    .250    .259    .265    .280    .290    .300    .305    .309    .310    .317
             47     PC    .321    .327    .333    .346    .361    .381    .408    .430    .477    .514
             48     PC    .561    .630    .710    .720    .731    .752    .779    .790    .795    .804
             49     PC    .810    .820    .826    .840    .859    .889    .910    .938    .966    .970
             50     PC    .974    .979    .981    .983    .985    .989    .990    .992    .993    .996
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          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

             51     PC    .997    .999   1.00
             52     LS       0      80
             53     UD    .208

             54     KK     208
             55     KM   ROUTE SUBBASIN 201 THRU SUBBASIN 208
             56     RM       5   0.53    0.15

             57     KK     207
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 58          KM   RUNOFF FROM SUBBASIN 207
 59          BA   1.223
 60          PB    2.44
 61          LS      0      72
 62          UD    .358

 63          KK     208
 64          KM   ROUTE SUBBASIN 207 THRU SUBBASIN 208
 65          RM       2    0.20    0.15

 66          KK     208
 67          KM   RUNOFF FROM SUBBASIN 208
 68          BA   8.778
 69          PB    2.53
 70          LS      0      70
 71          UD    .833

 72          KK       .
 73          KM   COMBINE SUBBASINS 201, 207, & 208
 74          HC       3

 75          KK     218
 76          KM   ROUTE SUBBASINS 201, 207, & 208 THRU SUBBASIN 218
 77          RM       3    0.35    0.15

 78          KK     205
 79          KM   RUNOFF FROM SUBBASIN 205
 80          BA   9.587
 81          PB    2.53
 82          LS      0      78
 83          UD    .794

 84          KK     206
 85          KM   RUNOFF FROM SUBBASIN 206
 86          BA   6.635
 87          PB    2.36
 88          LS      0      64
 89          UD    .754

 90          KK     211
 91          KM   RUNOFF FROM SUBBASIN 211
 92          BA   3.691
 93          PB    2.44
 94          LS      0      80
 95          UD    .527
```



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

 96          KK       .
 97          KM   COMBINE SUBBASINS 205, 206, & 211
 98          HC       3

 99          KK     217
100          KM   ROUTE SUBBASINS 205, 206, & 211 THRU SUBBASIN 217
101          RM       4    0.40    0.15

102          KK       .
103          KM   COMBINE SUBBASINS 201, 205, 206, 207, 208, & 211
104          HC       2

105          KK     221
106          KM   ROUTE SUBBASINS 201, 205, 206, 207, 208, & 211 THRU SUBBASIN 221
107          RM       5    0.50    0.15

108          KK     222
109          KM   ROUTE SUBBASINS 201, 205, 206, 207, 208, & 211 THRU SUBBASIN 222
110          RM       5    0.51    0.15

111          KK     212
112          KM   RUNOFF FROM SUBBASIN 212
113          BA   5.641
114          PB    2.44
115          LS      0      82
116          UD    .403

117          KK     224
118          KM   ROUTE SUBBASIN 212 THRU SUBBASIN 224
119          RM       2    0.17    0.15

120          KK     222
121          KM   ROUTE SUBBASIN 212 THRU SUBBASIN 222
122          RM       6    0.63    0.15

123          KK       .
124          KM   COMBINE SUBBASINS 201, 205, 206, 207, 208, 211, & 212
125          HC       2

126          KK     223
127          KM   ROUTE SUBBASINS 201, 205, 206, 207, 208, 211, & 212 THRU SUBBASIN 223
128          RM      18    1.84    0.15

129          KK     202
130          KM   RUNOFF FROM SUBBASIN 202
131          BA   5.523
132          PB    2.44
133          LS      0      80
134          UD    .134
```



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

135          KK     203
136          KM   ROUTE SUBBASIN 202 THRU SUBBASIN 203
```

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137          RM       3    0.27    0.15

138          KK     203
139          KM   RUNOFF FROM SUBBASIN 203
140          BA   6.249
141          PB    2.62
142          LS       0      80
143          UD    .248

144          KK     204
145          KM   RUNOFF FROM SUBBASIN 204
146          BA   2.458
147          PB    2.62
148          LS       0      80
149          UD    .205

150          KK       .
151          KM   COMBINE SUBBASINS 202, 203, & 204
152          HC       3

153          KK     209
154          KM   ROUTE SUBBASINS 202, 203, & 204 THRU SUBBASIN 209
155          RM       4    0.40    0.15

156          KK     209
157          KM   RUNOFF FROM SUBBASIN 209
158          BA   2.824
159          PB    2.62
160          LS       0      69
161          UD    .500

162          KK     210
163          KM   RUNOFF FROM SUBBASIN 210
164          BA  9.4182
165          PB    2.53
166          LS       0      77
167          UD    .585

168          KK       .
169          KM   COMBINE SUBBASINS 202, 203, 204, 209, & 210
170          HC       3

171          KK     213
172          KM   ROUTE SUBBASINS 202, 203, 204, 209, & 210 THRU SUBBASIN 213
173          RM       5    0.54    0.15

174          KK     214
175          KM   RUNOFF FROM SUBBASIN 214
176          BA   7.167
177          PB    2.44
178          LS       0      80
179          UD    .869
```



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

180          KK     215
181          KM   RUNOFF FROM SUBBASIN 215
182          BA   9.983
183          PB    2.36
184          LS       0      78
185          UD    .717

186          KK     213
187          KM   RUNOFF FROM SUBBASIN 213
188          BA  16.253
189          PB    2.27
190          LS       0      77
191          UD   1.196

192          KK       .
193          KM   COMBINE SUBBASINS 202, 203, 204, 209, 210, 213, 214, & 215
194          HC       4

195          KK     223
196          KM   ROUTE SUBBASINS 202, 203, 204, 209, 210, 213,
197          KM    214, & 215 THRU SUBBASIN 223
198          RM       3    0.29    0.15

199          KK       V
200          RM       6    0.58    0.15

201          KK       V
202          RM      18    1.83    0.15

203          KK     223
204          KM   RUNOFF FROM SUBBASIN 223
205          BA  35.362
206          PB    1.74
207          LS       0      77
208          UD    3.44

209          KK WTRIBUS
210          HC       3

211          KK     DIV
             *  *** lines from 1/91 model removed 5/96
             * KM DIVERT ALL FLOW EAST ALONG INTERCEPTION BERM TO THE UPPER LAS VEGAS WASH
             * KM DETENTION BASIN
             * RK 9200 0.01 0.030 0 TRAP 300 3
             * KK ULWDB
             * KM     UPPER LAS VEGAS WASH DETENTION BASIN
             * KM     DATA FROM B&V PREDESIGN (SPILLWAY ELEV = 2372; 3-8' OUTLET PIPES)
             * RS 1 STOR -1
             * SV 0 40 75 110 250 500 920 1550 1700 1860
```

```
* SV 2060 2200 2380 2530 2750 3000 3450 4880 6680
* SE 2335 2340 2345 2350 2355 2360 2365 2370 2371 2372
* SE 2373 2374 2375 2376 2377 2378 2380 2385 2390
* SQ 0 585 1485 2370 2910 3300 3660 4140 4206 4272
* SQ 8823 17080 27775 40425 54764 70611 106254 215322 347908
```



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

 212      KM   DIVERT ALL FLOW EAST ALONG INTERCEPTION BERM/CHANNEL TO THE
 213      KM   UPPER LAS VEGAS WASH DETENTION BASIN (INVERT SLOPE 0.0067 ft./ft.)
 214      RK    9200  0.0067   0.030       0    TRAP     300       3

 215      KK       .
 216      KM   ROUTE FLOW FROM INTERCEPTION CHANNEL THROUGH WASH TO BASIN
 217      RK    5800  0.0083   0.030       0    TRAP     500       1

 218      KK   ULWDB
 219      KM       UPPER LAS VEGAS WASH DETENTION BASIN B&V FINAL DESIGN DATA
 220      KM         (SPILLWAY EL.= 2372; DBL 8'-0" SQ. OUTLET CONDUITS)
 221      RS       1    STOR      -1
 222      SV       0      12      80     170     320     560    1000    1610    1800    1980
 223      SV    2150    2330    2500    2690    2900    3100    3600    4950    6680
 224      SE    2335    2340    2345    2350    2355    2360    2365    2370    2371    2372
 225      SE    2373    2374    2375    2376    2377    2378    2380    2385    2390
 226      SQ       0     600    1700    2300    2800    3300    3750    4100    4170    4240
 227      SQ    6200    9960   15150   21140   28320   36220   54120  110170  180730

 228      KK     116
 229      KM   ROUTE UPPER LAS VEGAS WASH DETENTION BASIN OUTFLOW THRU SUBBASIN 116
 230      RM       5    0.50    0.15

 231      KK     109
 232      KM   ROUTE UPPER LAS VEGAS WASH DETENTION BASIN OUTFLOW THRU SUBBASIN 109
 233      RM       4    0.42    0.15

 234      KK   NLVIN
 235      KM   ROUTE UPPER LAS VEGAS WASH DETENTION BASIN OUTFLOW THRU SUBBASIN 101 TO
 236      KM   NORTH LAS VEGAS DETENTION BASIN
 237      RM       5    0.54    0.15

 238      KK       .
 239      KM   DIVERT FLOW FLOW AWAY FROM THE NORTH LAS VEGAS DETENTION BASIN
 240      DT DIVDIKE
 241      DI       0    2000    6000    8000    8200    8910   10225   11935   13565   15635
 242      DI   17775   20135   23000
 243      DQ       0       0       0       0       0     410    1225    2435    3565    5135
 244      DQ    6775    8635   11000

 245      KK  NLVDET
 246      KM   ROUTE NON-DIVERTED UPSTREAM FLOW THRU NLV DETENTION BASIN
 247      KM   OUTLET WORKS MODIFIED 3 PIPES OPEN (2 PIPES BLOCKED), BARRIER WALL INCLUDED
 248      RS       1    STOR      -1
 249      SV       0      25     100     190     430     665    1095    1285    1435    1540
 250      SV    1650    1825    1920    2000    2110    2200    2310    2430
 251      SE       0       2       4       6      10      14      21      24      26      27
 252      SE      28      30      31      32      33      34      35      36
          *  *** lines from 1/91 model removed 5/96
          * SQ 0 406 1328 1134 1751 2202 2822 3049 3192 3572
          * SQ 4180 5968 7095 8334 9676 11101 12630 14294
 253      SQ       0      77     117     597    1310    1660    2110    2260    2360    2690
 254      SQ    3050    4630    5710    7090    8610   10140   11670   13200
```



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

 255      KK       .
 256      KM   RECALL FLOW DIVERTED FROM THE NLV DETENTION BASIN AT THE DIVERSION DIKE
 257      DR DIVDIKE

 258      KK       .
 259      KM   COMBINE FLOW ROUTED THRU THE NLV DETENTION BASIN AND THE DIVERTED FLOW
 260      HC       2

 261      KK     303
 262      KM   ROUTE OUTFLOW THRU SUBBASIN 303
 263      RM      13    1.28    0.15

 264      KKRRBRIDGE
 265      KM   DIVERT FLOW IN EXCESS OF CAPACITY OF RR BRIDGE SOUTH ALONG RR TO "A" CHANNEL
 266      DTRRCHANNL
 267      DI       0    6000   20000
 268      DQ       0       0   13500

 269      KK     I15
 270      KM       DIVERT FLOW INTO KING CHARLES CHANNEL
 271      DT   KCHAR
 272      DI       0    1000   10000
 273      DQ       0     800    8000

 274      KK     NC1
 275      KM   ROUTE OUTFLOW FROM NLV DET. BASIN THRU "N" CHANNEL TO BARR ROAD
 276      RK     700  0.0058   0.016       0    TRAP      10       2

 277      KK       V
 278      RK    2000  0.0100   0.035       0    TRAP      30       2

 279      KK     NC2
 280      KM   ROUTE OUTFLOW FROM NLV DET. BASIN THRU "N" CHANNEL FROM BARR ROAD
 281      KM   TO GOWAN AVE.
 282      RK    1300   .0056    .030       0    TRAP      12       2

 283      KK     NC3
 284      KM   ROUTE OUTFLOW FROM NLV DET. BASIN THRU "N" CHANNEL FROM GOWAN AVE.
 285      KM   TO CHEYENNE AVE.
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```
 286          RK    2600   .0021    .030       0    TRAP      20     2.5

 287          KK     NC4
 288          KM   ROUTE OUTFLOW FROM NLV DET. BASIN THRU "N" CHANNEL FROM CHEYENNE AVE.
 289          KM   TO THE "N" CHANNEL DROP STRUCTURE (LINED CHANNEL)
 290          RK    1300    .003    .016       0    TRAP      18       2

 291          KK     NC5
 292          KM   ROUTE OUTFLOW FROM NLV DET. BASIN THRU "N" CHANNEL FROM DROP TO "A" CHANNEL
 293          KM   (LINED CHANNEL)
 294          RK     500    .001    .016       0    TRAP      18       2
1                                          HEC-1 INPUT                                                    PAGE  8

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


 295          KKRRBRIDGE
 296          DRRRCHANNL

 297          KKDUMMY_AREA
 298          KM   Add dummy subarea with near-zero area to the recalled RRCHANNEL diversion
 299          BA   0.001
 300          PB    2.00
 301          LS       0      80
 302          UD    1.00

 303          KKDUMMY_COMBINE
 304          KM   Combine dummy subarea with recalled RRCHANNEL diversion
 305          HC       2

 306          KKRRCHANNL
 307          RK    4900   .0041     .03       0    TRAP      40       2

 308          KK    I-15
 309          DR   KCHAR

 310          KKDUMMY_AREA
 311          KM   Add dummy subarea with near-zero area to the recalled KCHAR diversion
 312          BA   0.001
 313          PB    2.00
 314          LS       0      80
 315          UD    1.00

 316          KKDUMMY_COMBINE
 317          KM   Combine dummy subarea with recalled KCHAR diversion
 318          HC       2

 319          KK ACHANNL
 320          KM   COMBINE TWO DIVERSION RECALLS AT START OF "A" CHANNEL
 321          HC       2

 322          KK     AC1
 323          KM   ROUTE FLOW THRU "A" CHANNEL TO CIVIC CENTER DRIVE
 324          RK     750   .0092    .035       0    TRAP      12     1.5

 325          KK     AC2
 326          KM   ROUTE FLOW THRU "A" CHANNEL TO CHEYENNE AVE.
 327          RK    1600   .0065    .035       0    TRAP      37     2.5

 328          KK     AC3
 329          RK    1600   .0065    .030       0    TRAP      52     1.5

 330          KK     AC4
 331          KM   ROUTE FLOW IN "A" CHANNEL AT CHEYENNE AVE. TO INTERSECTION OF "N" CHANNEL
 332          RK    1650   .0053    .030       0    TRAP      70     1.5
1                                          HEC-1 INPUT                                                    PAGE  9

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


 333          KK NCHANNL
 334          KM   COMBINE ALL UPSTREAM SUBBASINS AT INTERSECTION OF "N" CHANNEL AND "A" CHANNEL
 335          HC       2

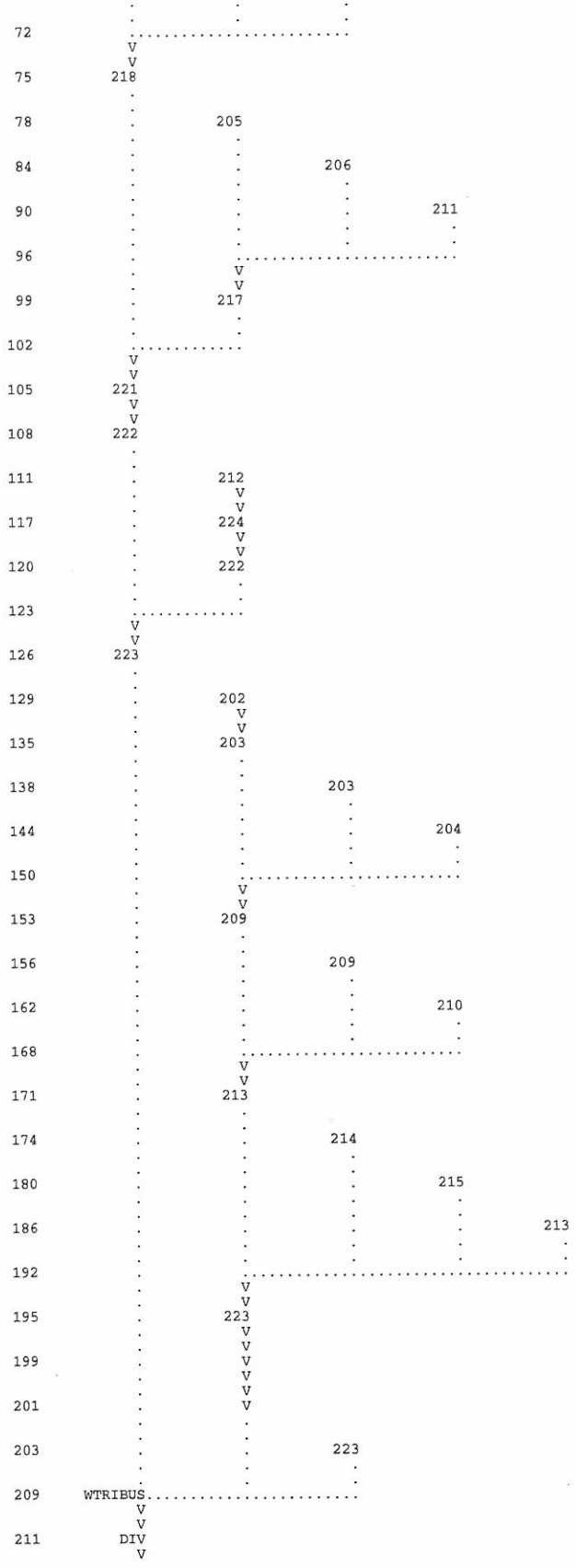
 336          KK     AC5
 337          KM   ROUTE ALL UPSTREAM SUBBASINS TO CAREY AVE. THRU "A" CHANNEL
 338          RK     450   .0053    .030       0    TRAP      70     1.5

 339          KK     AC6
 340          RK    1300   .0047    .030       0    TRAP      78     1.5

 341          KK  LKMEAD
 342          KM   ROUTE ALL UPSTREAM SUBBASINS FROM CAREY AVE. TO LAKE MEAD BLVD.
 343          KM   THRU "A" CHANNEL
 344          RK    4500    .004    .030       0    TRAP      96     1.5
 345          ZZ
1
             SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

  NO.      (.) CONNECTOR        (<---) RETURN OF DIVERTED OR PUMPED FLOW

   40        201
               V
               V
   54        208
               .
               .
   57          .        207
               .          V
               .          V
   63          .        208
               .          .
               .          .
   66          .          .        208
```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75 218
78 205
84 206
90 211
96
99 217
102
105 221
108 222
111 212
117 224
120 222
123
126 223
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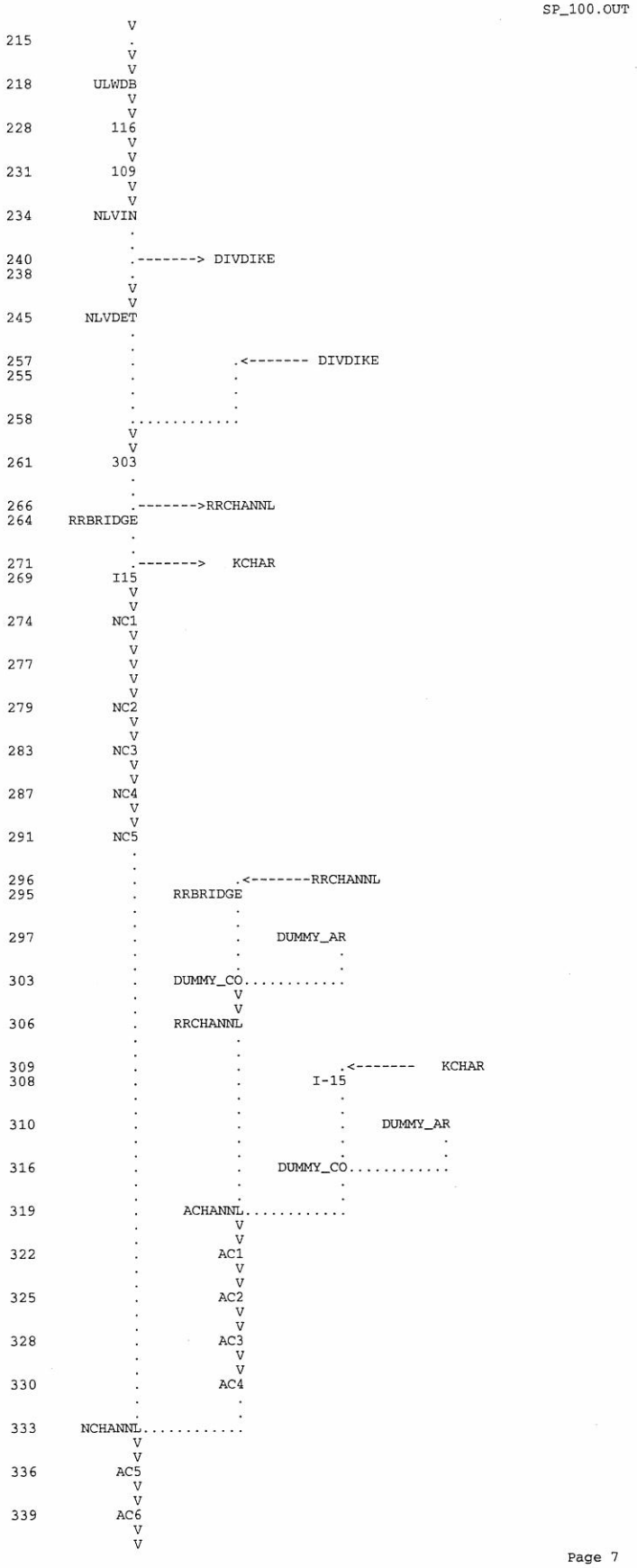
135 203
138 203
144 204
150
153 209
156 209
162 210
168
171 213
174 214
180 215
186 213
192
195 223
199
201
203 223
209 WTRIBUS
211 DIV


215
ULWDB
228
116
231
109
234
NLVIN
240
DIVDIKE
238
245
NLVDET
257
DIVDIKE
255
258
261
303
266
RRCHANNL
264
RRBRIDGE
271
KCHAR
269
I15
274
NC1
277
279
NC2
283
NC3
287
NC4
291
NC5
296
RRCHANNL
295
RRBRIDGE
297
DUMMY_AR
303
DUMMY_CO
306
RRCHANNL
309
KCHAR
308
I-15
310
DUMMY_AR
316
DUMMY_CO
319
ACHANNL
322
AC1
325
AC2
328
AC3
330
AC4
333
NCHANNL
336
AC5
339
AC6

341 LKMEAD

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*           FEBRUARY  1991              *
*            VERSION 4.0.1 (LOCAL)      *
*                                       *
*  RUN DATE  05/10/96  TIME  16:25:40   *
*                                       *
*****************************************
```


```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*          (916) 551-1748               *
*                                       *
*****************************************
```


FEMA FLOOD INSURANCE STUDY, 1996
UPPER LAS VEGAS WASH, CLARK COUNTY, NEVADA
SPRING MOUNTAIN 100-YEAR STORM

Current (05/96) model based on a HEC-1 model prepared by James M Montgomery (JMM) in 1/91 for the Las Vegas Valley Flood Insurance Study Hydrology Report dated 9/91. Two modifications were made to the source model. First, Upper Las Vegas Detention Basin storage and outflow characteristics were revised to reflect the as-built configuration described by construction drawings dated 5/91 and HEC-1 models prepared in 1993 by Black & Veatch. Second, the stage-outflow relationship for the North Las Vegas Detention Basin was revised to reflect the current three-pipe outlet condition (two of the five pipes were blocked following construction of the upper basin) and the hydraulic control created by the 4-foot high barrier wall located upstream from the pipe inlets.

Remaining comments are from the original model dated 1/91.

CCRFCD LAS VEGAS VALLEY MASTER PLAN UPDATE
NORTHERN LAS VEGAS WASH - WESTERN TRIBUTARY
SPRING MOUNTAIN 100-YEAR STORM EXISTING CONDITIONS

Based on Northern Las Vegas Wash HEC-1 model by Black & Veatch, 8/89
CCRFCD DARF = 0.56 for 136 sq mi storm (JR card = 0.903) - JMM, 1/91
The storm area of 136 sq mi reflects the Spring Mtn Storm minus the portion within the Gowan Area (which is not tributary to the Upper Las Vegas Wash Detention Basin diversion)
Convert nat. channels fr/kinematic wave to Muskingum Routing-JMM, 7/90
All routing steps immediately d/s of a diversion converted to Muskingum rouing to avoid zero flow, 8/90

This run models the diversion from the West Tributary to the proposed Upper Las Vegas Wash Detention Basin, 1/91

37 IO OUTPUT CONTROL VARIABLES

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

IT HYDROGRAPH TIME DATA

NMIN	6	MINUTES IN COMPUTATION INTERVAL
IDATE	1 0	STARTING DATE
ITIME	0000	STARTING TIME
NQ	200	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	1 0	ENDING DATE
NDTIME	1954	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL 0.10 HOURS
TOTAL TIME BASE 19.90 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION

NPLAN	1	NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
0.90

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 0.90
HYDROGRAPH AT					
+	201	5.54	1	FLOW	2080.
				TIME	3.60
ROUTED TO					
+	208	5.54	1	FLOW	1537.
				TIME	4.10
HYDROGRAPH AT					
+	207	1.22	1	FLOW	182.
				TIME	3.80
ROUTED TO					
+	208	1.22	1	FLOW	171.
				TIME	4.00
HYDROGRAPH AT					
+	208	8.78	1	FLOW	868.
				TIME	5.30
3 COMBINED AT					
+	.	15.54	1	FLOW	2405.
				TIME	4.20
ROUTED TO					
+	218	15.54	1	FLOW	2219.
				TIME	4.60
HYDROGRAPH AT					
+	205	9.59	1	FLOW	1747.
				TIME	4.30
HYDROGRAPH AT					
+	206	6.64	1	FLOW	348.
				TIME	5.40
HYDROGRAPH AT					
+	211	3.69	1	FLOW	887.
				TIME	4.00
3 COMBINED AT					
+	.	19.91	1	FLOW	2688.
				TIME	4.20
ROUTED TO					
	217	19.91	1	FLOW	2576.
				TIME	4.60
2 COMBINED AT					
+	.	35.46	1	FLOW	4796.
				TIME	4.60
ROUTED TO					
+	221	35.46	1	FLOW	4543.
				TIME	5.10
ROUTED TO					
+	222	35.46	1	FLOW	4360.
				TIME	5.70
HYDROGRAPH AT					
+	212	5.64	1	FLOW	1780.
				TIME	3.80
ROUTED TO					
+	224	5.64	1	FLOW	1702.
				TIME	4.00
ROUTED TO					
+	222	5.64	1	FLOW	1476.
				TIME	4.60
2 COMBINED AT					
+	.	41.10	1	FLOW	5368.
				TIME	5.70
ROUTED TO					
+	223	41.10	1	FLOW	4970.
				TIME	7.70
HYDROGRAPH AT					
+	202	5.52	1	FLOW	2259.
				TIME	3.60
ROUTED TO					
+	203	5.52	1	FLOW	1887.
				TIME	3.80
HYDROGRAPH AT					
+	203	6.25	1	FLOW	2450.
				TIME	3.60
HYDROGRAPH AT					
+	204	2.46	1	FLOW	1074.
				TIME	3.60
3 COMBINED AT					
+	.	14.23	1	FLOW	5034.
				TIME	3.70

ROUTED TO					
+	209	14.23	1	FLOW	4339.
				TIME	4.10
HYDROGRAPH AT					
+	209	2.82	1	FLOW	340.
				TIME	5.10
HYDROGRAPH AT					
+	210	9.42	1	FLOW	1879.
				TIME	4.00
3 COMBINED AT					
+	.	26.47	1	FLOW	6540.
				TIME	4.10
ROUTED TO					
+	213	26.47	1	FLOW	5797.
				TIME	4.60
HYDROGRAPH AT					
+	214	7.17	1	FLOW	1318.
				TIME	4.40
HYDROGRAPH AT					
+	215	9.98	1	FLOW	1645.
				TIME	4.20
HYDROGRAPH AT					
+	213	16.25	1	FLOW	1804.
				TIME	5.40
4 COMBINED AT					
+	.	59.88	1	FLOW	9985.
				TIME	4.60
ROUTED TO					
+	223	59.88	1	FLOW	9732.
				TIME	4.90
ROUTED TO					
+	V	59.88	1	FLOW	9341.
				TIME	5.60
ROUTED TO					
+	V	59.88	1	FLOW	8681.
				TIME	7.60
HYDROGRAPH AT					
+	223	35.36	1	FLOW	1093.
				TIME	7.60
3 COMBINED AT					
+	WTRIBUS	136.34	1	FLOW	14737.
				TIME	7.60
ROUTED TO					
+	DIV	136.34	1	FLOW	14736.
				TIME	7.70
ROUTED TO					
+	.	136.34	1	FLOW	14720.
				TIME	7.80
ROUTED TO					
+	ULWDB	136.34	1	FLOW	5019.
				TIME	9.70
			** PEAK STAGES IN FEET **		
			1	STAGE	2372.40
				TIME	9.70
ROUTED TO					
+	116	136.34	1	FLOW	4928.
				TIME	10.30
ROUTED TO					
+	109	136.34	1	FLOW	4866.
				TIME	10.70
ROUTED TO					
+	NLVIN	136.34	1	FLOW	4796.
				TIME	11.20
DIVERSION TO					
+	DIVDIKE	136.34	1	FLOW	0.
				TIME	0.10
HYDROGRAPH AT					
+	.	136.34	1	FLOW	4796.
				TIME	11.20
ROUTED TO					
+	NLVDET	136.34	1	FLOW	2839.
				TIME	17.80
			** PEAK STAGES IN FEET **		
			1	STAGE	27.42
				TIME	17.80
HYDROGRAPH AT					
.	.	0.00	1	FLOW	0.
				TIME	0.10
2 COMBINED AT					
+	.	136.34	1	FLOW	2839.

				TIME	17.80
ROUTED TO					
+	303	136.34	1	FLOW	2833.
				TIME	19.10
DIVERSION TO					
+	RRCHANNL	136.34	1	FLOW	0.
				TIME	0.10
HYDROGRAPH AT					
+	RRBRIDGE	136.34	1	FLOW	2833.
				TIME	19.10
DIVERSION TO					
+	KCHAR	136.34	1	FLOW	2266.
				TIME	19.10
HYDROGRAPH AT					
+	I15	136.34	1	FLOW	567.
				TIME	19.10
ROUTED TO					
+	NC1	136.34	1	FLOW	567.
				TIME	19.10
ROUTED TO					
+	V	136.34	1	FLOW	566.
				TIME	19.10
ROUTED TO					
+	NC2	136.34	1	FLOW	566.
				TIME	19.20
ROUTED TO					
+	NC3	136.34	1	FLOW	566.
				TIME	19.20
ROUTED TO					
+	NC4	136.34	1	FLOW	566.
				TIME	19.20
ROUTED TO					
+	NC5	136.34	1	FLOW	566.
				TIME	19.30
HYDROGRAPH AT					
+	RRBRIDGE	0.00	1	FLOW	0.
				TIME	0.10
HYDROGRAPH AT					
	DUMMY_AR	0.00	1	FLOW	0.
				TIME	4.50
2 COMBINED AT					
+	DUMMY_CO	0.00	1	FLOW	0.
				TIME	4.50
ROUTED TO					
+	RRCHANNL	0.00	1	FLOW	0.
				TIME	8.20
HYDROGRAPH AT					
+	I-15	0.00	1	FLOW	2266.
				TIME	19.10
HYDROGRAPH AT					
+	DUMMY_AR	0.00	1	FLOW	0.
				TIME	4.50
2 COMBINED AT					
+	DUMMY_CO	0.00	1	FLOW	2266.
				TIME	19.10
2 COMBINED AT					
+	ACHANNL	0.00	1	FLOW	2266.
				TIME	19.10
ROUTED TO					
+	AC1	0.00	1	FLOW	2266.
				TIME	19.10
ROUTED TO					
+	AC2	0.00	1	FLOW	2266.
				TIME	19.10
ROUTED TO					
+	AC3	0.00	1	FLOW	2266.
				TIME	19.10
ROUTED TO					
+	AC4	0.00	1	FLOW	2279.
				TIME	19.90
2 COMBINED AT					
+	NCHANNL	136.34	1	FLOW	2832.
				TIME	19.20
ROUTED TO					
+	AC5	136.34	1	FLOW	2832.
				TIME	19.20
ROUTED TO					
+	AC6	136.34	1	FLOW	2832.
				TIME	19.20

ROUTED TO
LKMEAD 136.34 1 FLOW 2832.
TIME 19.30

1

SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= 0.90									
	DIV MANE	2.99	14736.23	461.92	0.48	6.00	14735.65	462.00	0.48
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3514E+04 EXCESS=0.0000E+00 OUTFLOW=0.3514E+04 BASIN STORAGE=0.2276E+01 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	. MANE	2.07	14734.29	466.27	0.48	6.00	14720.41	468.00	0.48
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3515E+04 EXCESS=0.0000E+00 OUTFLOW=0.3513E+04 BASIN STORAGE=0.2134E+01 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	NC1 MANE	0.29	566.51	1146.38	0.05	6.00	566.50	1146.00	0.05
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3511E+03 EXCESS=0.0000E+00 OUTFLOW=0.3506E+03 BASIN STORAGE=0.4630E+00 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	V MANE	1.23	566.49	1148.49	0.05	6.00	566.45	1146.00	0.05
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3483E+03 EXCESS=0.0000E+00 OUTFLOW=0.3473E+03 BASIN STORAGE=0.1225E+01 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	NC2 MANE	0.76	566.45	1147.51	0.05	6.00	566.40	1152.00	0.05
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3468E+03 EXCESS=0.0000E+00 OUTFLOW=0.3457E+03 BASIN STORAGE=0.9998E+00 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	NC3 MANE	2.27	566.40	1154.27	0.05	6.00	566.40	1152.00	0.05
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3455E+03 EXCESS=0.0000E+00 OUTFLOW=0.3422E+03 BASIN STORAGE=0.3699E+01 PERCENT ERROR= -0.1									
FOR PLAN = 1 RATIO= 0.90									
	NC4 MANE	0.64	566.39	1153.09	0.05	6.00	566.35	1152.00	0.05
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3413E+03 EXCESS=0.0000E+00 OUTFLOW=0.3401E+03 BASIN STORAGE=0.1218E+01 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	NC5 MANE	0.43	566.35	1152.96	0.05	6.00	566.33	1158.00	0.05
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3400E+03 EXCESS=0.0000E+00 OUTFLOW=0.3395E+03 BASIN STORAGE=0.6101E+00 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	RRCHANNL MANE	6.00	0.11	493.12	0.64	6.00	0.11	492.00	0.64
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2390E-01 EXCESS=0.0000E+00 OUTFLOW=0.3440E-01 BASIN STORAGE=0.2686E-02 PERCENT ERROR= -55.2									
FOR PLAN = 1 RATIO= 0.90									
	AC1 MANE	0.30	2266.03	1146.43	13157.84	6.00	2266.01	1146.00	13148.67
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1405E+04 EXCESS=0.0000E+00 OUTFLOW=0.1403E+04 BASIN STORAGE=0.1749E+01 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	AC2 MANE	0.75	2265.98	1147.41	13101.38	6.00	2265.89	1146.00	13090.30
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1403E+04 EXCESS=0.0000E+00 OUTFLOW=0.1397E+04 BASIN STORAGE=0.5880E+01 PERCENT ERROR= -0.1									
FOR PLAN = 1 RATIO= 0.90									
	AC3 MANE	0.68	2284.16	1194.46	13048.25	6.00	2265.73	1146.00	13035.60
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1396E+04 EXCESS=0.0000E+00 OUTFLOW=0.1392E+04 BASIN STORAGE=0.5555E+01 PERCENT ERROR= -0.1									
FOR PLAN = 1 RATIO= 0.90									
	AC4 MANE	0.86	2296.82	1194.31	12978.20	6.00	2279.18	1194.00	12970.06
CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1390E+04 EXCESS=0.0000E+00 OUTFLOW=0.1384E+04 BASIN STORAGE=0.6485E+01 PERCENT ERROR= 0.0									
FOR PLAN = 1 RATIO= 0.90									
	AC5 MANE	0.25	2838.09	1194.12	0.24	6.00	2831.86	1152.00	0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1723E+04 EXCESS=0.0000E+00 OUTFLOW=0.1721E+04 BASIN STORAGE=0.1846E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.90

AC6	MANE	0.58	2854.92	1194.42	0.24	6.00	2831.76	1152.00	0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1721E+04 EXCESS=0.0000E+00 OUTFLOW=0.1715E+04 BASIN STORAGE=0.6804E+01 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.90

LKMEAD	MANE	2.28	2861.88	1195.82	0.23	6.00	2831.53	1158.00	0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1714E+04 EXCESS=0.0000E+00 OUTFLOW=0.1693E+04 BASIN STORAGE=0.2625E+02 PERCENT ERROR= -0.3

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

INTERBASIN STORM HEC-1 MODEL

1998 ULV Wash FIS Restudy.

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*           FEBRUARY  1991              *
*            VERSION 4.0.1 (LOCAL)      *
*                                       *
*  RUN DATE  05/14/96  TIME  10:34:05   *
*                                       *
*****************************************
```

```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 551-1748          *
*                                   *
*************************************
```

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

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

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

1 HEC-1 INPUT PAGE 1

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

                    *DIAGRAM
              1     ID          FEMA FLOOD INSURANCE STUDY, 1996
              2     ID          UPPER LAS VEGAS WASH, CLARK COUNTY, NEVADA
              3     ID          INTERBASIN 100-YEAR STORM
              4     ID
              5     ID          Current (05/96) model based on a HEC-1 model prepared by Black&Veatch
              6     ID          in 8/93 for the design of outlet modifications at the North Las Vegas
              7     ID          Detention Basin (NLVDB).  This storm centering generates the highest
              8     ID          100-year inflows to the NLVDB.
              9     ID
             10     ID          Modifications to the original B&V model were to adjust the outlet
             11     ID          rating for the NLVDB to reflect the four-foot high barrier wall in
             12     ID          front of the 3-pipe outlet.  Additional models were created to
             13     ID          represent 10, 50, and 500-year storms.
             14     ID
             15     ID          Remaining comments are from the original model dated 8/93.
             16     ID
             17     ID      This storm also known as "Gayles Storm" simulates a 54 square mile
             18     ID      storm centered downstream of the Upper Las Vegas Wash Detention Basin
             19     ID      but upstream of the North Las Vegas Detention Basin.  This model is based
             20     ID      original model developed by Black & Veatch during the predesign study for
             21     ID      Upper Las Vegas Wash Detention Basin.
             22     ID
             23     ID                Storm Area:    54.37 sq. miles
             24     ID                DARF:          0.66 (CCRFCD Drainage Manual)
             25     ID
             26     ID         10-yr  Precipitation Adjustment Ratio: 1.24 (CCRFCD Drainage Manual)
             27     ID         50-yr  Precipitation Adjustment Ratio: 1.39 (CCRFCD Drainage Manual)
             28     ID        100-yr  Precipitation Adjustment Ratio: 1.43 (CCRFCD Drainage Manual)
             29     ID
             30     ID        JR Card includes DARF for model
             31     ID        PB Cards are adjusted rainfall depth, NOAA Atas II amounts
             32     ID           times adjustment ratios given above.
             33     ID        PB Cards for 500-year storm based on frequency extrapolation of
             34     ID           10, 50, and 100-year data after precipitation ratio adjustments.
             35     ID
*** FREE ***
             36     IT       6       0       0     300
             37     IO       5       0       0
             38     IN       5       0       0
             39     JR    PREC    0.66

             40     KK     105
             41     KM    RUNOFF FROM SUBBASIN 105
             42     BA   6.898
             43     PB    3.72
             44     PC    .000    .020    .059    .080    .110    .144    .150    .160    .168    .171
             45     PC    .180    .182    .187    .190    .197    .202    .210    .220    .230    .241
             46     PC    .250    .259    .265    .280    .290    .300    .305    .309    .310    .317
             47     PC    .321    .327    .333    .346    .361    .381    .408    .430    .477    .514
             48     PC    .561    .630    .710    .720    .731    .752    .779    .790    .795    .804
             49     PC    .810    .820    .826    .840    .859    .889    .910    .938    .966    .970
             50     PC    .974    .979    .981    .983    .985    .989    .990    .992    .993    .996
             51     PC    .997    .999   1.00
             52     LS       0      86
```

1 HEC-1 INPUT PAGE 2

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

             53     UD    .773

             54     KK    104R
             55     KM    ROUTE SUBBASIN 105 THRU 104 (MTN)
             56     RM       1   0.157    0.15

             57     KK       V
             58     RM       2   0.295    0.15
```

```
 59          KK       V
 60          RM       1   0.139    0.15

 61          KK     104
 62          KM    RUNOFF FROM SUBBASIN 104
 63          BA   6.625
 64          PB    3.72
 65          LS       0       85
 66          UD    .628

 67          KK     103
 68          KM    RUNOFF FROM SUBBASIN 103
 69          BA   6.915
 70          PB    3.29
 71          LS       0       84
 72          UD    .324

 73          KK       .
 74          KM    COMBINE RUNOFF FROM SUBBASINS 103,104,105
 75          HC       3

 76          KK    102R
 77          KM    ROUTE SUBBASINS 103,104,105 THRU 102 (MTN)
 78          RM       1   0.144    0.15

 79          KK       V
 80          RM       1   0.209    0.15

 81          KK     102
 82          KM    RUNOFF FROM SUBBASIN 102
 83          BA   8.455
 84          PB    3.00
 85          LS       0       83
 86          UD    .369

 87          KK       .
 88          KM    COMBINE RUNOFF FROM SUBBASINS 102,103 104,105
 89          HC       2

 90          KK    101R
 91          KM    ROUTE SUBBASINS 102,103,104,105 THRU 101 (FAN)
 92          RM       2   0.401    0.15
1                                    HEC-1 INPUT                                    PAGE  3

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

 93          KK     101
 94          KM    RUNOFF FROM SUBBASIN 101
 95          BA   9.082
 96          PB    2.72
 97          LS       0       77
 98          UD   1.505

 99          KK       .
100          KM    COMBINE RUNOFF FROM SUBBASINS 101,102,103,104,105
101          HC       2

102          KK     111
103          KM    RUNOFF FROM SUBBASIN 111
104          BA   4.080
105          PB    3.15
106          LS       0       84
107          UD    .239

108          KK    116R
109          KM    ROUTE SUBBASIN 111 THRU 116 (FAN)
110          RM       1   0.191    0.15

111          KK       V
112          RM       2   0.400    0.15

113          KK     116
114          KM    RUNOFF FROM SUBBASIN 116
115          BA   5.189
116          PB    2.52
117          LS       0       78
118          UD   1.418

119          KK       .
120          KM    COMBINE SUBBASINS 111 & 116
121          HC       2

122          KK     110
123          KM    RUNOFF FROM SUBBASIN 110
124          BA   2.945
125          PB    3.00
126          LS       0       86
127          UD    .237

128          KK    109R
129          KM    ROUTE SUBBASIN 110 THRU 109 (FAN)
130          RM       1   0.183    0.15

131          KK       V
132          RM       2   0.386    0.15
1                                    HEC-1 INPUT                                    PAGE  4

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

133          KK     109
134          KM    RUNOFF FROM SUBBASIN 109
135          BA   4.183
136          PB    2.72
137          LS       0       78
```

```
138          UD   1.281

139          KK       .
140          KM    COMBINE RUNOFF FROM SUBBASINS 109,110,111,116
141          HC       3

142          KK    109R
143          KM    ROUTE SUBBASINS 109,110 111 & 116 THRU 109 (FAN)
144          RM       3   0.649    0.15

145          KK    101R
146          KM    ROUTE SUBBASINS 109,110,111 & 106 THRU 101 (FAN)
147          RM       3   0.821    0.15

148          KK       .
149          KM    COMBINE SUBBASINS 101,102,103,104,105,109,110,111,116
150          HC       2

151          KK       .
152          KM    DIVERT FLOW FLOW AWAY FROM THE NORTH LAS VEGAS DETENTION BASIN
153          DT DIVDIKE
154          DI       0    2000    6000    8000    8200    8910   10225   11935   13565   15635
155          DI   17775   20135   23000
156          DQ       0       0       0       0       0     410    1225    2435    3565    5135
157          DQ    6775    8635   11000

158          KK   NLVIN
159          KO       1
160          KM    ROUTE FLOW THRU INLET CHANNEL OF NORTH LAS VEGAS DETENTION BASIN
161          RK    2000   .0076    .016       0    TRAP      35       2

162          KK  NLVDET
163          KO       1
164          KM   ROUTE NON-DIVERTED UPSTREAM FLOW THRU NLV DETENTION BASIN
165          KM   OUTLET WORKS MODIFIED 3 PIPES OPEN (2 PIPES BLOCKED), BARRIER WALL INCLUDED
166          RS       1    STOR      -1
167          SV       0      25     100     190     430     665    1095    1285    1435    1540
168          SV    1650    1825    1920    2000    2110    2200    2310    2430
169          SE       0       2       4       6      10      14      21      24      26      27
170          SE      28      30      31      32      33      34      35      36
171          SQ       0      77     117     597    1310    1660    2110    2260    2360    2690
172          SQ    3050    4630    5710    7090    8610   10140   11670   13200

173          KK       .
174          KM    RECALL FLOW DIVERTED FROM THE NLV DETENTION BASIN AT THE DIVERSION DIKE
175          DR DIVDIKE
```



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

176          KK       .
177          KM    COMBINE FLOW ROUTED THRU THE NLV DETENTION BASIN AND THE DIVERTED FLOW
178          HC       2
179          ZZ
```

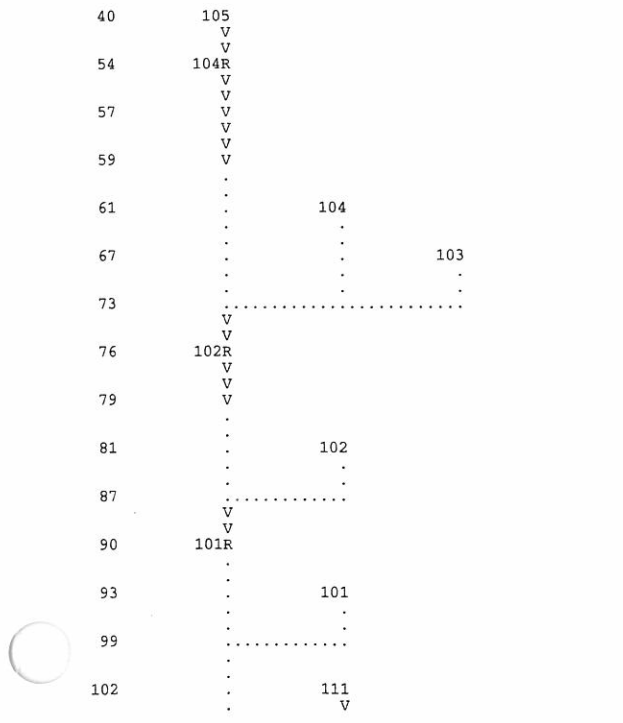
1

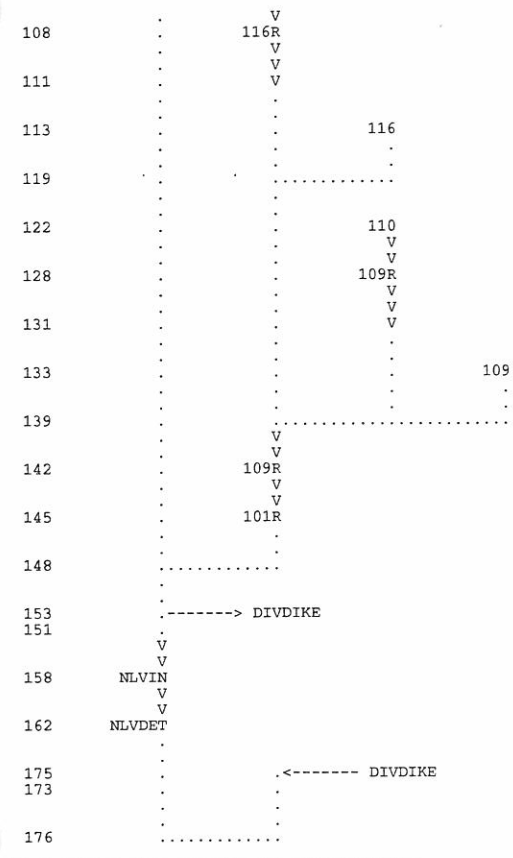
SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW





(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*          FEBRUARY  1991               *
*           VERSION 4.0.1 (LOCAL)       *
*                                       *
*  RUN DATE  05/14/96  TIME  10:34:05   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
```

FEMA FLOOD INSURANCE STUDY, 1996
UPPER LAS VEGAS WASH, CLARK COUNTY, NEVADA
INTERBASIN 100-YEAR STORM

Current (05/96) model based on a HEC-1 model prepared by Black&Veatch in 8/93 for the design of outlet modifications at the North Las Vegas Detention Basin (NLVDB). This storm centering generates the highest 100-year inflows to the NLVDB.

Modifications to the original B&V model were to adjust the outlet rating for the NLVDB to reflect the four-foot high barrier wall in front of the 3-pipe outlet. Additional models were created to represent 10, 50, and 500-year storms.

Remaining comments are from the original model dated 8/93.

This storm also known as "Gayles Storm" simulates a 54 square mile storm centered downstream of the Upper Las Vegas Wash Detention Basin but upstream of the North Las Vegas Detention Basin. This model is based original model developed by Black & Veatch during the predesign study for Upper Las Vegas Wash Detention Basin.

Storm Area: 54.37 sq. miles
DARF: 0.66 (CCRFCD Drainage Manual)

10-yr Precipitation Adjustment Ratio: 1.24 (CCRFCD Drainage Manual)
50-yr Precipitation Adjustment Ratio: 1.39 (CCRFCD Drainage Manual)
100-yr Precipitation Adjustment Ratio: 1.43 (CCRFCD Drainage Manual)

JR Card includes DARF for model
PB Cards are adjusted rainfall depth, NOAA Atas II amounts times adjustment ratios given above.
PB Cards for 500-year storm based on frequency extrapolation of 10, 50, and 100-year data after precipitation ratio adjustments.

37 IO OUTPUT CONTROL VARIABLES
IPRNT 5 PRINT CONTROL

```
                IPLOT          0  PLOT CONTROL
                QSCAL          0.  HYDROGRAPH PLOT SCALE

IT          HYDROGRAPH TIME DATA
                NMIN           6  MINUTES IN COMPUTATION INTERVAL
                IDATE      1   0  STARTING DATE
                ITIME        0000  STARTING TIME
                  NQ         300  NUMBER OF HYDROGRAPH ORDINATES
               NDDATE      2   0  ENDING DATE
               NDTIME        0554  ENDING TIME
               ICENT           19  CENTURY MARK

            COMPUTATION INTERVAL    0.10 HOURS
                TOTAL TIME BASE   29.90 HOURS

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

JP          MULTI-PLAN OPTION
                NPLAN          1  NUMBER OF PLANS

JR          MULTI-RATIO OPTION
              RATIOS OF PRECIPITATION
             0.66


*** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** *** ***


           **************
           *            *
158 KK     *     NLVIN  *
           *            *
           **************

159 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                ROUTE FLOW THRU INLET CHANNEL OF NORTH LAS VEGAS DETENTION BASIN

             HYDROGRAPH ROUTING DATA

161 RK          KINEMATIC WAVE STREAM ROUTING
                        L       2000.  CHANNEL LENGTH
                        S     0.0076  SLOPE
                        N      0.016  CHANNEL ROUGHNESS COEFFICIENT
                       CA       0.00  CONTRIBUTING AREA
                    SHAPE       TRAP  CHANNEL SHAPE
                       WD      35.00  BOTTOM WIDTH OR DIAMETER
                        Z       2.00  SIDE SLOPE
                   NDXMIN          2  MINIMUM NUMBER OF DX INTERVALS

                                                ***
                                  COMPUTED KINEMATIC PARAMETERS
                                       VARIABLE TIME STEP
                                    (DT SHOWN IS A MINIMUM)

                    ELEMENT    ALPHA       M         DT        DX       PEAK    TIME TO      VOLUME    MAXIMUM
                                                                                    PEAK                 CELERITY
                                                     (MIN)      (FT)     (CFS)    (MIN)        (IN)      (FPS)

                    MAIN         1.01      1.55       0.39    666.67   8341.18   330.45        0.73      38.92

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2110E+04  EXCESS=0.0000E+00 OUTFLOW=0.2110E+04 BASIN STORAGE=0.3481E-04 PERCENT ERROR=   0.0

                                       INTERPOLATED TO SPECIFIED COMPUTATION INTERVAL

                    MAIN         1.01      1.55       6.00             8339.62   330.00        0.73
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HYDROGRAPH AT STATION NLVIN
PLAN 1, RATIO = 0.66

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DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1		0000	1	0.	1		0730	76	2431.	1		1500	151	0.	1		2230	226	0.
1		0006	2	0.	1		0736	77	2180.	1		1506	152	0.	1		2236	227	0.
1		0012	3	0.	1		0742	78	1948.	1		1512	153	0.	1		2242	228	0.
1		0018	4	0.	1		0748	79	1736.	1		1518	154	0.	1		2248	229	0.
1		0024	5	0.	1		0754	80	1543.	1		1524	155	0.	1		2254	230	0.
1		0030	6	0.	1		0800	81	1367.	1		1530	156	0.	1		2300	231	0.
1		0036	7	0.	1		0806	82	1208.	1		1536	157	0.	1		2306	232	0.
1		0042	8	0.	1		0812	83	1065.	1		1542	158	0.	1		2312	233	0.
1		0048	9	0.	1		0818	84	937.	1		1548	159	0.	1		2318	234	0.
1		0054	10	0.	1		0824	85	822.	1		1554	160	0.	1		2324	235	0.
1		0100	11	0.	1		0830	86	721.	1		1600	161	0.	1		2330	236	0.
1		0106	12	0.	1		0836	87	632.	1		1606	162	0.	1		2336	237	0.
1		0112	13	0.	1		0842	88	554.	1		1612	163	0.	1		2342	238	0.
1		0118	14	0.	1		0848	89	485.	1		1618	164	0.	1		2348	239	0.
1		0124	15	1.	1		0854	90	424.	1		1624	165	0.	1		2354	240	0.
1		0130	16	3.	1		0900	91	372.	1		1630	166	0.	2		0000	241	0.
1		0136	17	7.	1		0906	92	326.	1		1636	167	0.	2		0006	242	0.

1	0142	18	13.	*	1	0912	93	285.	*	1	1642	168	0.	*	2	0012	243	0.
1	0148	19	23.	*	1	0918	94	250.	*	1	1648	169	0.	*	2	0018	244	0.
1	0154	20	38.	*	1	0924	95	220.	*	1	1654	170	0.	*	2	0024	245	0.
1	0200	21	61.	*	1	0930	96	193.	*	1	1700	171	0.	*	2	0030	246	0.
1	0206	22	92.	*	1	0936	97	170.	*	1	1706	172	0.	*	2	0036	247	0.
1	0212	23	132.	*	1	0942	98	150.	*	1	1712	173	0.	*	2	0042	248	0.
1	0218	24	182.	*	1	0948	99	132.	*	1	1718	174	0.	*	2	0048	249	0.
1	0224	25	240.	*	1	0954	100	117.	*	1	1724	175	0.	*	2	0054	250	0.
1	0230	26	302.	*	1	1000	101	103.	*	1	1730	176	0.	*	2	0100	251	0.
1	0236	27	366.	*	1	1006	102	91.	*	1	1736	177	0.	*	2	0106	252	0.
1	0242	28	427.	*	1	1012	103	81.	*	1	1742	178	0.	*	2	0112	253	0.
1	0248	29	483.	*	1	1018	104	71.	*	1	1748	179	0.	*	2	0118	254	0.
1	0254	30	536.	*	1	1024	105	63.	*	1	1754	180	0.	*	2	0124	255	0.
1	0300	31	589.	*	1	1030	106	56.	*	1	1800	181	0.	*	2	0130	256	0.
1	0306	32	649.	*	1	1036	107	50.	*	1	1806	182	0.	*	2	0136	257	0.
1	0312	33	727.	*	1	1042	108	44.	*	1	1812	183	0.	*	2	0142	258	0.
1	0318	34	839.	*	1	1048	109	39.	*	1	1818	184	0.	*	2	0148	259	0.
1	0324	35	1003.	*	1	1054	110	35.	*	1	1824	185	0.	*	2	0154	260	0.
1	0330	36	1244.	*	1	1100	111	31.	*	1	1830	186	0.	*	2	0200	261	0.
1	0336	37	1591.	*	1	1106	112	27.	*	1	1836	187	0.	*	2	0206	262	0.
1	0342	38	2072.	*	1	1112	113	24.	*	1	1842	188	0.	*	2	0212	263	0.
1	0348	39	2695.	*	1	1118	114	22.	*	1	1848	189	0.	*	2	0218	264	0.
1	0354	40	3419.	*	1	1124	115	19.	*	1	1854	190	0.	*	2	0224	265	0.
1	0400	41	4172.	*	1	1130	116	17.	*	1	1900	191	0.	*	2	0230	266	0.
1	0406	42	4881.	*	1	1136	117	15.	*	1	1906	192	0.	*	2	0236	267	0.
1	0412	43	5496.	*	1	1142	118	13.	*	1	1912	193	0.	*	2	0242	268	0.
1	0418	44	5988.	*	1	1148	119	12.	*	1	1918	194	0.	*	2	0248	269	0.
1	0424	45	6354.	*	1	1154	120	10.	*	1	1924	195	0.	*	2	0254	270	0.
1	0430	46	6611.	*	1	1200	121	9.	*	1	1930	196	0.	*	2	0300	271	0.
1	0436	47	6782.	*	1	1206	122	8.	*	1	1936	197	0.	*	2	0306	272	0.
1	0442	48	6908.	*	1	1212	123	7.	*	1	1942	198	0.	*	2	0312	273	0.
1	0448	49	7031.	*	1	1218	124	6.	*	1	1948	199	0.	*	2	0318	274	0.
1	0454	50	7191.	*	1	1224	125	5.	*	1	1954	200	0.	*	2	0324	275	0.
1	0500	51	7412.	*	1	1230	126	4.	*	1	2000	201	0.	*	2	0330	276	0.
1	0506	52	7691.	*	1	1236	127	4.	*	1	2006	202	0.	*	2	0336	277	0.
1	0512	53	7992.	*	1	1242	128	3.	*	1	2012	203	0.	*	2	0342	278	0.
1	0518	54	8217.	*	1	1248	129	3.	*	1	2018	204	0.	*	2	0348	279	0.
1	0524	55	8308.	*	1	1254	130	2.	*	1	2024	205	0.	*	2	0354	280	0.
1	0530	56	8340.	*	1	1300	131	2.	*	1	2030	206	0.	*	2	0400	281	0.
1	0536	57	8318.	*	1	1306	132	2.	*	1	2036	207	0.	*	2	0406	282	0.
1	0542	58	8248.	*	1	1312	133	2.	*	1	2042	208	0.	*	2	0412	283	0.
1	0548	59	8053.	*	1	1318	134	1.	*	1	2048	209	0.	*	2	0418	284	0.
1	0554	60	7741.	*	1	1324	135	1.	*	1	2054	210	0.	*	2	0424	285	0.
1	0600	61	7390.	*	1	1330	136	1.	*	1	2100	211	0.	*	2	0430	286	0.
1	0606	62	7026.	*	1	1336	137	1.	*	1	2106	212	0.	*	2	0436	287	0.
1	0612	63	6664.	*	1	1342	138	1.	*	1	2112	213	0.	*	2	0442	288	0.
1	0618	64	6311.	*	1	1348	139	1.	*	1	2118	214	0.	*	2	0448	289	0.
1	0624	65	5968.	*	1	1354	140	0.	*	1	2124	215	0.	*	2	0454	290	0.
1	0630	66	5631.	*	1	1400	141	0.	*	1	2130	216	0.	*	2	0500	291	0.
1	0636	67	5298.	*	1	1406	142	0.	*	1	2136	217	0.	*	2	0506	292	0.
1	0642	68	4963.	*	1	1412	143	0.	*	1	2142	218	0.	*	2	0512	293	0.
1	0648	69	4626.	*	1	1418	144	0.	*	1	2148	219	0.	*	2	0518	294	0.
1	0654	70	4287.	*	1	1424	145	0.	*	1	2154	220	0.	*	2	0524	295	0.
1	0700	71	3950.	*	1	1430	146	0.	*	1	2200	221	0.	*	2	0530	296	0.
1	0706	72	3618.	*	1	1436	147	0.	*	1	2206	222	0.	*	2	0536	297	0.
1	0712	73	3297.	*	1	1442	148	0.	*	1	2212	223	0.	*	2	0542	298	0.
1	0718	74	2991.	*	1	1448	149	0.	*	1	2218	224	0.	*	2	0548	299	0.
1	0724	75	2701.	*	1	1454	150	0.	*	1	2224	225	0.	*	2	0554	300	0.
				*					*					*					

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PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	29.90-HR
+ (CFS)	(HR)					
		(CFS)				
+ 8340.	5.50		4157.	1064.	854.	854.
		(INCHES)	0.711	0.728	0.728	0.728
		(AC-FT)	2062.	2110.	2110.	2110.

CUMULATIVE AREA = 54.37 SQ MI

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          *            *
162 KK    *   NLVDET   *
          *            *
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163 KO          OUTPUT CONTROL VARIABLES
                     IPRNT          1  PRINT CONTROL
                     IPLOT          0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE
                         ROUTE NON-DIVERTED UPSTREAM FLOW THRU NLV DETENTION BASIN
                         OUTLET WORKS MODIFIED 3 PIPES OPEN (2 PIPES BLOCKED), BARRIER WALL INCLUDED

              HYDROGRAPH ROUTING DATA

166 RS          STORAGE ROUTING
                     NSTPS          1  NUMBER OF SUBREACHES
                      ITYP       STOR  TYPE OF INITIAL CONDITION
                    RSVRIC      -1.00  INITIAL CONDITION
                         X       0.00 WORKING R AND D COEFFICIENT

167 SV            STORAGE        0.0      25.0     100.0     190.0     430.0     665.0    1095.0    1285.0    1435.0    1540.0
                              1650.0    1825.0    1920.0    2000.0    2110.0    2200.0    2310.0    2430.0

169 SE            ELEVATION      0.00      2.00      4.00      6.00     10.00     14.00     21.00     24.00     26.00     27.00
                              28.00     30.00     31.00     32.00     33.00     34.00     35.00     36.00

171 SQ            DISCHARGE        0.       77.      117.      597.     1310.     1660.     2110.     2260.     2360.     2690.
                              3050.     4630.     5710.     7090.     8610.    10140.    11670.    13200.
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HYDROGRAPH AT STATION NLVDET
PLAN 1, RATIO = 0.66

DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE	DA	MON	HRMN	ORD	OUTFLOW	STORAGE	STAGE
1		0000	1	0.	0.0	0.0	1		1000	101	2117.	1103.6	21.1	1		2000	201	246.	124.2	4.5
1		0006	2	0.	0.0	0.0	1		1006	102	2102.	1086.9	20.9	1		2006	202	235.	122.2	4.5
1		0012	3	0.	0.0	0.0	1		1012	103	2084.	1070.3	20.6	1		2012	203	225.	120.3	4.5
1		0018	4	0.	0.0	0.0	1		1018	104	2067.	1053.8	20.3	1		2018	204	216.	118.5	4.4
1		0024	5	0.	0.0	0.0	1		1024	105	2050.	1037.4	20.1	1		2024	205	206.	116.7	4.4
1		0030	6	0.	0.0	0.0	1		1030	106	2033.	1021.0	19.8	1		2030	206	197.	115.1	4.3
1		0036	7	0.	0.0	0.0	1		1036	107	2015.	1004.7	19.5	1		2036	207	189.	113.5	4.3
1		0042	8	0.	0.0	0.0	1		1042	108	1999.	988.5	19.3	1		2042	208	181.	111.9	4.3
1		0048	9	0.	0.0	0.0	1		1048	109	1982.	972.4	19.0	1		2048	209	173.	110.5	4.2
1		0054	10	0.	0.0	0.0	1		1054	110	1965.	956.4	18.7	1		2054	210	165.	109.1	4.2
1		0100	11	0.	0.0	0.0	1		1100	111	1948.	940.5	18.5	1		2100	211	158.	107.7	4.2
1		0106	12	0.	0.0	0.0	1		1106	112	1932.	924.7	18.2	1		2106	212	152.	106.5	4.1
1		0112	13	0.	0.0	0.0	1		1112	113	1915.	909.0	18.0	1		2112	213	145.	105.2	4.1
1		0118	14	0.	0.0	0.0	1		1118	114	1899.	893.4	17.7	1		2118	214	139.	104.1	4.1
1		0124	15	0.	0.0	0.0	1		1124	115	1883.	878.0	17.5	1		2124	215	133.	103.0	4.1
1		0130	16	0.	0.0	0.0	1		1130	116	1867.	862.6	17.2	1		2130	216	127.	101.9	4.0
1		0136	17	0.	0.1	0.0	1		1136	117	1851.	847.4	17.0	1		2136	217	122.	100.8	4.0
1		0142	18	0.	0.1	0.0	1		1142	118	1835.	832.3	16.7	1		2142	218	117.	99.9	4.0
1		0148	19	1.	0.3	0.0	1		1148	119	1819.	817.3	16.5	1		2148	219	116.	98.9	4.0
1		0154	20	2.	0.5	0.0	1		1154	120	1804.	802.4	16.2	1		2154	220	116.	97.9	3.9
1		0200	21	3.	0.9	0.1	1		1200	121	1788.	787.6	16.0	1		2200	221	115.	97.0	3.9
1		0206	22	5.	1.5	0.1	1		1206	122	1773.	773.0	15.8	1		2206	222	115.	96.0	3.9
1		0212	23	7.	2.4	0.2	1		1212	123	1758.	758.5	15.5	1		2212	223	114.	95.1	3.9
1		0218	24	11.	3.6	0.3	1		1218	124	1743.	744.1	15.3	1		2218	224	114.	94.1	3.8
1		0224	25	16.	5.2	0.4	1		1224	125	1728.	729.8	15.1	1		2224	225	113.	93.2	3.8
1		0230	26	23.	7.3	0.6	1		1230	126	1713.	715.6	14.8	1		2230	226	113.	92.3	3.8
1		0236	27	30.	9.8	0.8	1		1236	127	1698.	701.5	14.6	1		2236	227	112.	91.3	3.8
1		0242	28	40.	12.8	1.0	1		1242	128	1684.	687.6	14.4	1		2242	228	112.	90.4	3.7
1		0248	29	50.	16.2	1.3	1		1248	129	1669.	673.8	14.1	1		2248	229	111.	89.5	3.7
1		0254	30	62.	20.0	1.6	1		1254	130	1653.	660.0	13.9	1		2254	230	111.	88.6	3.7
1		0300	31	74.	24.1	1.9	1		1300	131	1632.	646.5	13.7	1		2300	231	110.	87.7	3.7
1		0306	32	79.	28.6	2.1	1		1306	132	1612.	633.1	13.5	1		2306	232	110.	86.7	3.6
1		0312	33	82.	33.6	2.2	1		1312	133	1593.	619.9	13.2	1		2312	233	109.	85.8	3.6
1		0318	34	85.	39.4	2.4	1		1318	134	1573.	606.8	13.0	1		2318	234	109.	84.9	3.6
1		0324	35	88.	46.3	2.6	1		1324	135	1554.	593.9	12.8	1		2324	235	108.	84.0	3.6
1		0330	36	93.	54.8	2.8	1		1330	136	1535.	581.1	12.6	1		2330	236	108.	83.1	3.6
1		0336	37	99.	65.7	3.1	1		1336	137	1516.	568.5	12.4	1		2336	237	108.	82.3	3.5
1		0342	38	106.	80.0	3.5	1		1342	138	1498.	556.1	12.1	1		2342	238	107.	81.4	3.5
1		0348	39	116.	98.8	4.0	1		1348	139	1479.	543.8	11.9	1		2348	239	107.	80.5	3.5
1		0354	40	237.	122.6	4.5	1		1354	140	1461.	531.6	11.7	1		2354	240	106.	79.6	3.5
1		0400	41	391.	151.4	5.1	1		1400	141	1443.	519.6	11.5	2		0000	241	106.	78.7	3.4
1		0406	42	569.	184.8	5.9	1		1406	142	1426.	507.8	11.3	2		0006	242	105.	77.9	3.4
1		0412	43	693.	222.5	6.5	1		1412	143	1408.	496.1	11.1	2		0012	243	105.	77.0	3.4
1		0418	44	816.	263.7	7.2	1		1418	144	1391.	484.5	10.9	2		0018	244	104.	76.1	3.4
1		0424	45	946.	307.4	8.0	1		1424	145	1374.	473.1	10.7	2		0024	245	104.	75.3	3.3
1		0430	46	1080.	352.6	8.7	1		1430	146	1357.	461.8	10.5	2		0030	246	103.	74.4	3.3
1		0436	47	1216.	398.5	9.5	1		1436	147	1341.	450.6	10.4	2		0036	247	103.	73.6	3.3
1		0442	48	1332.	444.5	10.2	1		1442	148	1324.	439.6	10.2	2		0042	248	102.	72.7	3.3
1		0448	49	1401.	490.8	11.0	1		1448	149	1306.	428.8	10.0	2		0048	249	102.	71.9	3.2
1		0454	50	1470.	537.7	11.8	1		1454	150	1275.	418.1	9.8	2		0054	250	102.	71.0	3.2
1		0500	51	1542.	585.6	12.6	1		1500	151	1244.	407.7	9.6	2		0100	251	101.	70.2	3.2
1		0506	52	1615.	635.0	13.5	1		1506	152	1214.	397.5	9.5	2		0106	252	101.	69.4	3.2
1		0512	53	1682.	686.2	14.3	1		1512	153	1184.	387.6	9.3	2		0112	253	100.	68.5	3.2
1		0518	54	1737.	739.0	15.2	1		1518	154	1155.	378.0	9.1	2		0118	254	100.	67.7	3.1
1		0524	55	1794.	792.7	16.1	1		1524	155	1127.	368.5	9.0	2		0124	255	99.	66.9	3.1
1		0530	56	1850.	846.4	17.0	1		1530	156	1100.	359.3	8.8	2		0130	256	99.	66.1	3.1
1		0536	57	1906.	899.8	17.8	1		1536	157	1073.	350.3	8.7	2		0136	257	98.	65.2	3.1
1		0542	58	1961.	952.2	18.7	1		1542	158	1047.	341.6	8.5	2		0142	258	98.	64.4	3.1
1		0548	59	2014.	1003.2	19.5	1		1548	159	1022.	333.0	8.4	2		0148	259	98.	63.6	3.0
1		0554	60	2065.	1051.6	20.3	1		1554	160	997.	324.7	8.2	2		0154	260	97.	62.8	3.0
1		0600	61	2111.	1096.8	21.0	1		1600	161	973.	316.5	8.1	2		0200	261	97.	62.0	3.0
1		0606	62	2145.	1138.8	21.7	1		1606	162	949.	308.6	8.0	2		0206	262	96.	61.2	3.0
1		0612	63	2175.	1177.5	22.3	1		1612	163	926.	300.9	7.8	2		0212	263	96.	60.4	2.9
1		0618	64	2203.	1213.1	22.9	1		1618	164	904.	293.3	7.7	2		0218	264	95.	59.6	2.9
1		0624	65	2229.	1245.5	23.4	1		1624	165	882.	285.9	7.6	2		0224	265	95.	58.8	2.9
1		0630	66	2252.	1274.9	23.8	1		1630	166	861.	278.7	7.5	2		0230	266	95.	58.1	2.9
1		0636	67	2271.	1301.4	24.2	1		1636	167	840.	271.7	7.4	2		0236	267	94.	57.3	2.9
1		0642	68	2287.	1324.9	24.5	1		1642	168	819.	264.8	7.2	2		0242	268	94.	56.5	2.8
1		0648	69	2300.	1345.6	24.8	1		1648	169	799.	258.1	7.1	2		0248	269	93.	55.7	2.8
1		0654	70	2312.	1363.4	25.0	1		1654	170	780.	251.6	7.0	2		0254	270	93.	55.0	2.8
1		0700	71	2322.	1378.3	25.2	1		1700	171	761.	245.2	6.9	2		0300	271	93.	54.2	2.8
1		0706	72	2330.	1390.3	25.4	1		1706	172	743.	239.0	6.8	2		0306	272	92.	53.4	2.8
1		0712	73	2336.	1399.6	25.5	1		1712	173	725.	233.0	6.7	2		0312	273	92.	52.7	2.7
1		0718	74	2341.	1406.3	25.6	1		1718	174	707.	227.1	6.6	2		0318	274	91.	51.9	2.7
1		0724	75	2344.	1410.4	25.7	1		1724	175	690.	221.3	6.5	2		0324	275	91.	51.2	2.7
1		0730	76	2345.	1412.3	25.7	1		1730	176	673.	215.6	6.4	2		0330	276	91.	50.4	2.7
1		0736	77	2345.	1411.9	25.7	1		1736	177	657.	210.2	6.3	2		0336	277	90.	49.7	2.7
1		0742	78	2343.	1409.6	25.7	1		1742	178	641.	204.8	6.2	2		0342	278	90.	48.9	2.6
1		0748	79	2340.	1405.5	25.6	1		1748	179	625.	199.6	6.2	2		0348	279	89.	48.2	2.6
1		0754	80	2336.	1399.7	25.5	1		1754	180	610.	194.5	6.1	2		0354	280	89.	47.4	2.6
1		0800	81	2332.	1392.5	25.4	1		1800	181	594.	189.5	6.0	2		0400	281	89.	46.7	2.6
1		0806	82	2326.	1383.8	25.3	1		1806	182	569.	184.7	5.9	2		0406	282	88.	46.0	2.6
1		0812	83	2319.	1374.0	25.2	1		1812	183	544.	180.1	5.8	2		0412	283	88.	45.2	2.5
1		0818	84	2312.	1363.2	25.0	1		1818	184	521.	175.7	5.7	2		0418	284	87.	44.5	2.5
1		0824	85	2304.	1351.4	24.9	1		1824	185	498.	171.5	5.6	2		0424	285	87.	43.8	2.5
1		0830	86	2296.	1338.7	24.7	1		1830	186	477.	167.4	5.5	2		0430	286	87.	43.1	2.5
1		0836	87	2287.	1325.4	24.5	1		1836	187	456.	163.6	5.4	2		0436	287	86.	42.4	2.5
1		0842	88	2278.	1311.4	24.4	1		1842	188	436.	159.9	5.3	2		0442	288	86.	41.7	2.4
1		0848	89	2268.	1296.9	24.2	1		1848	189	418.	156.4	5.3	2		0448	289	86.	41.0	2.4
1		0854	90	2258.	1282.0	24.0	1		1854	190	400.	153.0	5.2	2		0454	290	85.	40.2	2.4
1		0900	91	2246.	1266.7	23.7	1		1900	191	382.	149.8	5.1	2		0500	291	85.	39.5	2.4
1		0906	92	2233.	1251.0	23.5	1		1906	192	366.	146.7	5.0	2		0506	292	84.	38.8	2.4
1		0912	93	2221.	1235.2	23.2	1		1912	193	350.	143.7	5.0	2		0512	293	84.	38.2	2.4
1		0918	94	2208.	1219.1	23.0	1		1918	194	335.	140.9	4.9	2		0518	294	84.	37.5	2.3

1	0924	95	2195.	1202.8	22.7	*	1	1924	195	321.	138.2	4.8	*	2	0524	295	83.	36.8	2.3
1	0930	96	2182.	1186.5	22.4	*	1	1930	196	307.	135.6	4.8	*	2	0530	296	83.	36.1	2.3
1	0936	97	2169.	1170.0	22.2	*	1	1936	197	293.	133.1	4.7	*	2	0536	297	83.	35.4	2.3
1	0942	98	2156.	1153.4	21.9	*	1	1942	198	281.	130.7	4.7	*	2	0542	298	82.	34.7	2.3
1	0948	99	2143.	1136.8	21.7	*	1	1948	199	269.	128.4	4.6	*	2	0548	299	82.	34.0	2.2
1	0954	100	2130.	1120.2	21.4	*	1	1954	200	257.	126.3	4.6	*	2	0554	300	81.	33.4	2.2
						*							*						

****

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	29.90-HR
+ (CFS)	(HR)					
		(CFS)				
+ 2345.	7.50		2172.	1036.	840.	840.
		(INCHES)	0.371	0.708	0.716	0.716
		(AC-FT)	1077.	2054.	2077.	2077.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	29.90-HR
+ (AC-FT)	(HR)				
1412.	7.50	1191.	494.	401.	401.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	29.90-HR
+ (FEET)	(HR)				
25.70	7.50	22.42	10.76	8.90	8.90

CUMULATIVE AREA = 54.37 SQ MI

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 0.66
HYDROGRAPH AT					
+	105	6.90	1	FLOW	2376.
				TIME	4.20
ROUTED TO					
+	104R	6.90	1	FLOW	2304.
				TIME	4.30
ROUTED TO					
+	V	6.90	1	FLOW	2207.
				TIME	4.70
ROUTED TO					
+	V	6.90	1	FLOW	2174.
				TIME	4.80
HYDROGRAPH AT					
+	104	6.63	1	FLOW	2418.
				TIME	4.00
HYDROGRAPH AT					
+	103	6.91	1	FLOW	2668.
				TIME	3.70
3 COMBINED AT					
+	.	20.44	1	FLOW	5276.
				TIME	5.00
ROUTED TO					
+	102R	20.44	1	FLOW	5172.
				TIME	5.10
ROUTED TO					
+	V	20.44	1	FLOW	5033.
				TIME	5.20
HYDROGRAPH AT					
+	102	8.45	1	FLOW	2386.
				TIME	3.80
2 COMBINED AT					
+	.	28.89	1	FLOW	6476.
				TIME	5.10
ROUTED TO					
+	101R	28.89	1	FLOW	6236.
				TIME	5.40
HYDROGRAPH AT					
+	101	9.08	1	FLOW	694.
				TIME	5.70
2 COMBINED AT					
+	.	37.97	1	FLOW	6905.
				TIME	5.40
HYDROGRAPH AT					
+	111	4.08	1	FLOW	1644.
				TIME	3.60
ROUTED TO					
	116R	4.08	1	FLOW	1412.
				TIME	3.80
ROUTED TO					
+	V	4.08	1	FLOW	1152.

```
                                                TIME          4.20

 HYDROGRAPH AT
+                    116      5.19     1    FLOW          366.
                                             TIME          5.60

  2 COMBINED AT
+                      .      9.27     1    FLOW         1305.
                                             TIME          4.20

 HYDROGRAPH AT
+                    110      2.94     1    FLOW         1239.
                                             TIME          3.60

 ROUTED TO
+                   109R      2.94     1    FLOW         1068.
                                             TIME          3.80

 ROUTED TO
+                      V      2.94     1    FLOW          875.
                                             TIME          4.20

 HYDROGRAPH AT
+                    109      4.18     1    FLOW          364.
                                             TIME          5.50

  3 COMBINED AT
+                      .     16.40     1    FLOW         2379.
                                             TIME          4.20

 ROUTED TO
+                   109R     16.40     1    FLOW         2042.
                                             TIME          4.90

 ROUTED TO
+                   101R     16.40     1    FLOW         1887.
                                             TIME          6.30

  2 COMBINED AT
+                      .     54.37     1    FLOW         8537.
                                             TIME          5.50

 DIVERSION TO
+                DIVDIKE     54.37     1    FLOW          194.
                                             TIME          5.50

 HYDROGRAPH AT
+                      .     54.37     1    FLOW         8342.
                                             TIME          5.50

 ROUTED TO
                   NLVIN     54.37     1    FLOW         8340.
                                             TIME          5.50

 ROUTED TO
+                 NLVDET     54.37     1    FLOW         2345.
                                             TIME          7.50

                                        ** PEAK STAGES IN FEET **
                                        1    STAGE        25.70
                                             TIME          7.50

 HYDROGRAPH AT
+                      .      0.00     1    FLOW          194.
                                             TIME          5.50

  2 COMBINED AT
+                      .     54.37     1    FLOW         2345.
                                             TIME          7.50
1
                                             SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
                                                 (FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)
                                                                                  INTERPOLATED TO
                                                                                COMPUTATION INTERVAL
          ISTAQ    ELEMENT      DT        PEAK    TIME TO      VOLUME      DT        PEAK    TIME TO      VOLUME
                                                     PEAK                                       PEAK

                               (MIN)      (CFS)     (MIN)      (IN)     (MIN)      (CFS)     (MIN)        (IN)

        FOR PLAN = 1  RATIO= 0.66
           NLVIN  MANE         0.39    8341.18    330.45      0.73      6.00    8339.62    330.00        0.73

 CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2110E+04 EXCESS=0.0000E+00 OUTFLOW=0.2110E+04 BASIN STORAGE=0.3481E-04 PERCENT ERROR=   0.0


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

LOWER CENTRAL VALLEY STORM HEC-1 MODEL

1998 ULV Wash FIS Restudy.

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            FEBRUARY  1991             *
*             VERSION 4.0.1 (LOCAL)     *
*                                       *
*  RUN DATE  05/10/96  TIME  16:20:51   *
*                                       *
*****************************************
```


```
*************************************
*                                   *
*    U.S. ARMY CORPS OF ENGINEERS   *
*    HYDROLOGIC ENGINEERING CENTER  *
*          609 SECOND STREET        *
*       DAVIS, CALIFORNIA 95616     *
*           (916) 551-1748          *
*                                   *
*************************************
```


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

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

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

1 HEC-1 INPUT PAGE 1

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

                *DIAGRAM
             1  ID          FEMA FLOOD INSURANCE STUDY, 1996
             2  ID          UPPER LAS VEGAS WASH, CLARK COUNTY, NEVADA
             3  ID          LOWER CENTRAL VALLEY 100-YEAR STORM
             4  ID
             5  ID          Current (05/96) model based on a HEC-1 model prepared by James M
             6  ID          Montgomery (JMM) in 1/91 for the Las Vegas Valley Flood Insurance
             7  ID          Study Hydrology Report dated 9/91.  Two modifications were made
             8  ID          to the source model.  First, Upper Las Vegas Detention Basin storage
             9  ID          and outflow characteristics were revised to reflect the as-built
            10  ID          configuration described by construction drawings dated 5/91 and HEC-1
            11  ID          models prepared in 1993 by Black & Veatch.  Second, the stage-outflow
            12  ID          relationship for the North Las Vegas Detention Basin was revised
            13  ID          to reflect the current three-pipe outlet condition (two of the five
            14  ID          pipes were blocked following construction of the upper basin) and the
            15  ID          hydraulic control created by the 4-foot high barrier wall located
            16  ID          upstream from the pipe inlets.
            17  ID
            18  ID          Remaining comments are from the original model dated 1/91.
            19  ID
            20  ID          CCRFCD LAS VEGAS VALLEY MASTER PLAN UPDATE
            21  ID          Northern Las Vegas Wash - FIS FLOWS
            22  ID          Prepared by James M. Montgomery, Consulting Engineers, Inc., 1/91
            23  ID
            24  ID          Based on Black & Veatch Northern Las Vegas Wash HEC-1 Model, 8/89
            25  ID          Lower Central Valley 100-Year Storm, Existing Conditions
            26  ID          Additional subareas and facilities from Wallace, 7/88 (EAP.H1) & 8/88
            27  ID          (EPT.H1); VTN, 1/90 (3900EX4.DAT); & B&V La Madre Area, (LAME.DAT)
            28  ID          PB & CN values adjusted by JMM to be consistent with B&V values, 8/90
            29  ID
            30  ID          All routing steps immediately d/s of a diversion converted to
            31  ID          Muskingum routing to avoid zero flow, 8/90
            32  ID
            33  ID          Gowan-North & Gowan-South Detention Basins & Outfall Channel, Buffalo
            34  ID          Channel, Cheyenne Channel, Angel Park Detention Basin & Outfall
            35  ID          Channel and Hualapai Diversion included, 8/90
            36  ID
            37  ID          This data file models DARF's at certain locations where FIS flows are
            38  ID          required.  The original B&V data file used a factor of 0.62; ratios
            39  ID          of this factor are used in the JR card to model DA's at the points
            40  ID          of interest (JMM DARF's extracted from CCRFCD Design Manual):
            41  ID
            42  ID           PT OF              AREA          DARF      DARF/0.62     RATIO
            43  ID          INTEREST          (SQ MI)
            44  ID
            45  ID     RRBRIDGE, NC5, & 304    60.7 - 64.5     0.66        1.06          1
            46  ID          ACHANNL              111.6         0.59        0.95          2
            47  ID          NCHANNL              172.2         0.53        0.85          3
            48  ID
*** FREE ***
            49  IT       6       0       0     200
            50  IO       5       0       0
            51  IN       5       0       0
            52  JR    PREC    1.06    0.95    0.85
```

1 HEC-1 INPUT PAGE 2

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

            53  KK     112
            54  KM   RUNOFF FROM SUBBASIN 112
            55  BA   5.333
            56  PB    2.01
            57  PC    .000    .020    .059    .080    .110    .144    .150    .160    .168    .171
            58  PC    .180    .182    .187    .190    .197    .202    .210    .220    .230    .241
            59  PC    .250    .259    .265    .280    .290    .300    .305    .309    .310    .317
            60  PC    .321    .327    .333    .346    .361    .381    .408    .430    .477    .514
            61  PC    .561    .630    .710    .720    .731    .752    .779    .790    .795    .804
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PC    .810    .820    .826    .840    .859    .889    .910    .938    .966    .970
PC    .974    .979    .981    .983    .985    .989    .990    .992    .993    .996
PC    .997    .999    1.00
LS       0      82
UD    .462

KK     119
KM   RUNOFF FROM SUBBASIN 119
BA   2.739
PB    2.09
LS       0      82
UD    .346

KK       .
KM   COMBINE SUBBASINS 112 & 119
HC       2

KK     120
KM   ROUTE SUBBASINS 112 & 119 THRU SUBBASIN 120
RM       3    0.27    0.15

KK  125UDB
KM   ROUTE SUBBASINS 112 & 119 THRU SUBBASIN 125
RM       5    0.53    0.15

KK     117
KM   ROUTE SUBBASINS 112 & 119 THRU SUBBASIN 117
RM       4    0.43    0.15

KK     118
KM   RUNOFF FROM SUBBASIN 118
BA   5.079
PB    1.83
LS       0      84
UD    .233

KK     117
KM   ROUTE SUBBASIN 118 THRU SUBBASIN 117
RM       1    0.13    0.15
```



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

KK       V
RM       3    0.25    0.15

KK       V
RM       4    0.37    0.15

KK     117
KM   RUNOFF FROM SUBBASIN 117
BA   7.366
PB    1.66
LS       0      78
UD   1.699

KK       .
KM   COMBINE SUBBASINS 112, 117, 118, & 119
HC       3

KK   ULWDB
*  *** lines from 1/91 model removed 5/96
* KM     UPPER LAS VEGAS WASH DETENTION BASIN
* KM     DATA FROM B&V PREDESIGN (SPILLWAY ELEV = 2372; 3-8' OUTLET PIPES)
* RS 1 STOR -1
* SV 0 40 75 110 250 500 920 1550 1700 1860
* SV 2060 2200 2380 2530 2750 3000 3450 4880 6680
* SE 2335 2340 2345 2350 2355 2360 2365 2370 2371 2372
* SE 2373 2374 2375 2376 2377 2378 2380 2385 2390
* SQ 0 585 1485 2370 2910 3300 3660 4140 4206 4272
* SQ 8823 17080 27775 40425 54764 70611 106254 215322 347908
KM       UPPER LAS VEGAS WASH DETENTION BASIN B&V FINAL DESIGN DATA
KM          (SPILLWAY EL.= 2372; DBL 8'-0" SQ. OUTLET CONDUITS)
RS       1    STOR      -1
SV       0      12      80     170     320     560    1000    1610    1800    1980
SV    2150    2330    2500    2690    2900    3100    3600    4950    6680
SE    2335    2340    2345    2350    2355    2360    2365    2370    2371    2372
SE    2373    2374    2375    2376    2377    2378    2380    2385    2390
SQ       0     600    1700    2300    2800    3300    3750    4100    4170    4240
SQ    6200    9960   15150   21140   28320   36220   54120  110170  180730

KK     116
KM   ROUTE SUBBASINS 112, 117, 118, & 119 (ULVW BASIN OUTFLOW) THRU SUBBASIN 116
RM       5    0.50    0.15

KK     111
KM   RUNOFF FROM SUBBASIN 111
BA    4.08
PB    1.92
LS       0      84
UD    .239
```



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

KK     116
KM   ROUTE SUBBASIN 111 THRU SUBBASIN 116
RM       1    0.10    0.15

KK       V
RM       2    0.21    0.15

KK     116
KM   RUNOFF FROM SUBBASIN 116
```

```
133          BA   5.189
134          PB    1.66
135          LS       0       78
136          UD   1.418

137          KK       .
138          KM   COMBINE SUBBASINS 111, 112, 116, 117, 118, & 119
139          HC       3

140          KK     109
141          KM   ROUTE SUBBASINS 111, 112, 116, 117, 118, & 119 THRU SUBBASIN 109
142          RM       4    0.42    0.15

143          KK     110
144          KM   RUNOFF FROM SUBBASIN 110
145          BA   2.945
146          PB    1.83
147          LS       0       86
148          UD    .237

149          KK     109
150          KM   ROUTE SUBBASIN 110 THRU SUBBASIN 109
151          RM       1    0.09    0.15

152          KK       V
153          RM       2    0.19    0.15

154          KK     109
155          KM   RUNOFF FROM SUBBASIN 109
156          BA   4.183
157          PB    1.66
158          LS       0       78
159          UD   1.281

160          KK       .
161          KM   COMBINE SUBBASINS 109, 110, 111, 112, 116, 117, 118, & 119
162          HC       3

163          KK     101
164          KM   ROUTE SUBBASINS 109, 110, 111, 112, 116, 117, 118, & 119
165          KM   THRU SUBBASIN 101
166          RM       5    0.54    0.15
```

1 HEC-1 INPUT PAGE 5

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

167          KK     103
168          KM   RUNOFF FROM SUBBASIN 103
169          BA   6.195
170          PB    2.01
171          LS       0       84
172          UD    .324

173          KK     102
174          KM   ROUTE SUBBASIN 103 THRU SUBBASIN 102
175          RM       1    0.11    0.15

176          KK     102
177          KM   RUNOFF FROM SUBBASIN 102
178          BA   8.455
179          PB    1.83
180          LS       0       83
181          UD    .369

182          KK       .
183          KM   COMBINE SUBBASINS 102 & 103
184          HC       2

185          KK     101
186          KM   ROUTE SUBBASIN 102 & 103 THRU SUBBASIN 101
187          RM       1    0.11    0.15

188          KK       V
189          RM       2    0.22    0.15

190          KK     101
191          KM   RUNOFF FROM SUBBASIN 101
192          BA   9.082
193          PB    1.66
194          LS       0       77
195          UD   1.505

196          KK   NLVIN
197          KM   COMBINE SUBBASINS 101, 102, 103, 109, 110, 111, 112, 116, 117, 118, & 119
198          HC       3

199          KK       .
200          KM   DIVERT FLOW FLOW AWAY FROM THE NORTH LAS VEGAS DETENTION BASIN
201          DT DIVDIKE
202          DI       0    2000    6000    8000    8200    8910   10225   11935   13565   15635
203          DI   17775   20135   23000
204          DQ       0       0       0       0       0     410    1225    2435    3565    5135
205          DQ    6775    8635   11000

206          KK  NLVDET
207          KM   ROUTE NON-DIVERTED FLOW FROM SUBBASINS 101, 102, 103, 109, 110, 111, 112, 116
208          KM    117, 118, & 119 THRU NLV DETENTION BASIN
209          KM   OUTLET WORKS MODIFIED 3 PIPES OPEN (2 PIPES BLOCKED), BARRIER WALL INCLUDED
210          RS       1    STOR      -1
211          SV       0      25     100     190     430     665    1095    1285    1435    1540
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

212          SV    1650    1825    1920    2000    2110    2200    2310    2430
```

```
213          SE       0       2       4       6      10      14      21      24      26      27
214          SE      28      30      31      32      33      34      35      36
             *  *** lines from 1/91 model removed 5/96
             * SQ 0 406 1328 1134 1751 2202 2822 3049 3192 3572
             * SQ 4180 5968 7095 8334 9676 11101 12630 14294
215          SQ       0      77     117     597    1310    1660    2110    2260    2360    2690
216          SQ    3050    4630    5710    7090    8610   10140   11670   13200

217          KK       .
218          KM   RECALL FLOW DIVERTED FROM THE NLV DETENTION BASIN AT THE DIVERSION DIKE
219          DR DIVDIKE

220          KK       .
221          KM   COMBINE FLOW ROUTED THRU THE NLV DETENTION BASIN AND THE DIVERTED FLOW
222          HC       2

223          KK     303
224          KM   ROUTE OUTFLOW THRU SUBBASIN 303
225          RM      13    1.28    0.15

226          KKRRBRIDGE
227          KM   DIVERT FLOW IN EXCESS OF CAPACITY OF RR BRIDGE SOUTH ALONG RR TO "A" CHANNEL
228          DTRRCHANNL
229          DI       0    6000   20000
230          DQ       0       0   13500

231          KK     I15
232          KM       DIVERT FLOW INTO KING CHARLES CHANNEL
233          DT   KCHAR
234          DI       0    1000   10000
235          DQ       0     800    8000

236          KK     NC1
237          KM   ROUTE OUTFLOW FROM NLV DET. BASIN THRU "N" CHANNEL TO BARR ROAD
238          RK     700  0.0058   0.016       0    TRAP      10       2

239          KK       V
240          RK    2000  0.0100   0.035       0    TRAP      30       2

241          KK     NC2
242          KM   ROUTE 302 & 303 AND UPSTREAM SUBBASINS THRU "N" CHANNEL FROM BARR ROAD
243          KM   TO GOWAN AVE.
244          RK    1300   .0056    .030       0    TRAP      12       2

245          KK     NC3
246          KM   ROUTE 302 & 303 AND UPSTREAM SUBBASINS THRU "N" CHANNEL FROM GOWAN AVE.
247          KM   TO CHEYENNE AVE.
248          RK    2600   .0021    .030       0    TRAP      20     2.5
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LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

249          KK     NC4
250          KM   ROUTE SUBBASINS 302, & 303 AND UPSTREAM SUBBASINS THRU "N" CHANNEL
251          KM   FROM CHEYENNE AVE. TO THE "N" CHANNEL DROP STRUCTURE (LINED CHANNEL)
252          RK    1300    .003    .016       0    TRAP      18       2

253          KK     NC5
254          KM   ROUTE SUBBASINS 302, & 303 AND UPSTREAM SIBBASINS THRU "N" CHANNEL FROM DROP
255          KM   TO "A" CHANNEL (LINED CHANNEL)
256          RK     500    .001    .016       0    TRAP      18       2
257          KM   ********************** BEGIN GOWAN MODEL (by others) **********************

258          KK    AP.1
259          KM       Begin subareas tributary to Gowan-South Detention Basin
260          KM       Begin subareas tributary to Angel Park Detention Basin
261          KM       From Wallace Angel Park Model
262          BA   0.001
263          PB     2.1
264          LS       0      89
265          UD    0.62

266          KK       V
267          KM   Route AP.1
268          RM       7    0.67    0.15

269          KK    AP.2
270          KM   One-third of subbasin AP.2
271          KM   From Wallace Angel Park Model
272          BA   0.853
273          PB     2.0
274          LS       0      87
275          UD   0.363

276          KK       .
277          KM   Combine AP.1 & AP.2
278          HC       2

279          KK       V
280          RM      11    1.06    0.15

281          KK    AP.3
282          BA    3.62
283          PB     1.9
284          LS       0      89
285          UD    2.41

286          KK    AP.4
287          KM   From Wallace Angel Park Model
288          BA   0.001
289          PB     1.8
290          LS       0      89
291          UD    1.03
```

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

 292        KK       .
 293        KM   Combine AP.1, AP.2, AP.3, AP.4
 294        HC       3

 295        KK    AP.5
 296        KM   From Wallace Angel Park Model
 297        BA   0.001
 298        PB     2.1
 299        LS       0       89
 300        UD    0.39

 301        KK       V
 302        KM   Route AP.5
 303        RM       8    0.82    0.15

 304        KK    AP.6
 305        BA   0.001
 306        PB     2.1
 307        LS       0       88
 308        UD    0.75

 309        KK       .
 310        KM   Combine AP.5 & AP.6
 311        HC       2

 312        KK       V
 313        KM   Route AP.5 & AP.6
 314        RM       7    0.66    0.15

 315        KK    AP.7
 316        KM      One-half of subbasin AP.7
 317        BA    1.02
 318        PB     1.9
 319        LS       0       86
 320        UD    0.59

 321        KK   N_CHN
 322        KM   COMBINE NORTH CHANNEL FLOWS
 323        HC       2

 324        KK    GD.1
 325        KM   Begin subareas tributary to Hualapai Diversion
 326        KM   From VTN (PB & CN from B&V-La Madre)
 327        BA   0.001
 328        PB     2.2
 329        LS       0       87
 330        UD    0.62

 331        KK       V
 332        KM   Route GD.1
 333        RM       2    0.24    0.15
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

 334        KK       V
 335        KM   Routing Cont'd
 336        RM       3    0.27    0.15

 337        KK    GD.2
 338        KM   From VTN
 339        BA   0.001
 340        PB     2.0
 341        LS       0       89
 342        UD    0.83

 343        KK       .
 344        KM   Combine GD.1 & GD.2
 345        HC       2

 346        KK  TO_DIV
 347        KM   ROUTE GD.1 & GD.2 TO HUALAPAI DIVERSION
 348        RM       3    0.34    0.15

 349        KK    GD.3(=AP.12)
 350        KM   From VTN
 351        BA    0.80
 352        PB     1.9
 353        LS       0       87
 354        UD    0.32

 355        KKHUALAPAI
 356        KM   Combine subareas tributary to Hualapai Diverison (GD.1, GD.2 & GD.3)
 357        HC       2

 358        KK     HUA& NO.CH
 359        KM   Combine No.Ch Flows w/Hualapai Diverted Flows (AP Subareas+Div. GD Subareas)
 360        HC       2

 361        KK       V
 362        KM   Route Combined Flows
 363        RK    5500    .023     .04       0    TRAP     100       2

 364        KK       V
 365        KM   Routing Cont'd
 366        RK    4500    .004     .03       0    TRAP      30       4

 367        KK    AP.8
 368        BA    0.93
 369        PB     1.9
 370        LS       0       89
 371        UD    0.62
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 372          KK     BOX
 373          KM   SUMMERLIN PARKWAY CULVERT
 374          HC       2
1                                    HEC-1 INPUT                                                    PAGE 10

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

 375          KK       V
 376          KM   ROUTE TO ANGEL PARK DETENTION BASIN
 377          RK    3000    .027     .04       0    TRAP     100       2

 378          KK    AP.9
 379          BA    0.68
 380          PB     1.8
 381          LS       0      89
 382          UD     .83

 383          KK  N_CHAN
 384          KM   INTERIM TOTAL AT ANGEL PARK DUE TO HUALAPAI DIVERSION
 385          HC       2

 386          KKANGEL.PK
 387          KM   EXISTING TOTAL AT ANGEL PARK DETENTION BASIN (AP.1 - AP.9 & GD.1 - GD.3)
 388          HC       2

 389          KKSPILLWAY
 390          KM   ANGEL PARK RETENTION - SPILLWAY RATING CURVES
 391          KM   Data remains same as B&V Lower Central Valley Storm Existing Conditions run
 392          RS       1    STOR      -1
 393          SV       0       3      22      45      80     125     190     270     369     492
 394          SV     630     780     942    1115    1209
 395          SE    2596    2598    2600    2602    2604    2606    2608    2610    2612    2614
 396          SE    2616    2618    2620    2622    2623
 397          SL  2592.5    3.14     0.6     0.5
 398          SS  2619.1    1275     3.2     1.5

 399          KKAP_TO_VEGAS/PIONEER
 400          KM   ROUTE ANGEL PARK OUTFALL TO VEGAS/PIONEER VIA VEGAS DRIVE OUTFALL
 401          KM   From VTN
 402          RK    7500    0.03   0.012       0    CIRC       5       0

 403          KKBUFFALO_1
 404          KM   ROUTE FLOWS FROM VEGAS/PIONEER IN BUFFALO CHANNEL (from VTN)
 405          RK    1500    0.02    0.03       0    TRAP      20       4

 406          KK    GD.7
 407          KM   INTERSECTION OF LAKE MEAD & BUFFALO
 408          BA    1.13
 409          PB     1.8
 410          LS       0      89
 411          UD    1.38

 412          KKBUFFALO_1
 413          KM   Combine GD.7 W/ Buffalo Channel
 414          HC       2
1                                    HEC-1 INPUT                                                    PAGE 11

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

 415          KKBUFFALO_2
 416          KM   ROUTE FLOWS TO GOWAN-SOUTH DETENTION BASIN (from VTN)
 417          RK    5000   0.005   0.025       0    TRAP      30       4

 418          KK    GD.4
 419          KM   From B&V-La Madre
 420          BA   0.001
 421          PB     2.0
 422          LS       0      88
 423          UD    0.62

 424          KK       V
 425          KM   ALLUVIAL FAN BRAIDED CHANEL ROUTING (FEMA)
 426          RM       7    0.74    0.15

 427          KK    GD.5
 428          BA    3.31
 429          PB     1.9
 430          LS       0      86
 431          UD    1.38

 432          KK       .
 433          KM   Combine GD.4 & GD.5 at the INTERSECTION OF RAMPART AND LAKE MEAD
 434          HC       2

 435          KK       V
 436          KM   ROUTE NORTH ALONG RAMPART
 437          RM       4    0.43    0.15

 438          KK    GD.6
 439          KM   DEL WEBB-SUN CITY SUMMERLIN
 440          BA     1.6
 441          PB     1.8
 442          LS       0      86
 443          UD     .96

 444          KK       .
 445          KM   Combine GD.4 - GD.6 at the INTERSECTION OF RAMPART AND CHEYENNE
 446          HC       2

 447          KK       V
 448          KM   ROUTE TO BUFFALO along Cheyenne Channel
 449          RK    5500    .015    .015       0    TRAP      20       2
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450          KK    GD.8
451          KM   R.A. HOMES-DESERT SHORES
452          BA    1.53
453          PB     1.7
454          LS       0      85
455          UD    1.11
1                                        HEC-1 INPUT                                        PAGE 12

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

456          KK       .
457          KM   INFLOW FROM WEST INTO GOWAN-SOUTH DETENTION BASIN
458          HC       2

459          KK   GD.34
460          KM   AREA BETWEEN BUFFALO AND OK GRAGSON HWY
461          BA    3.84
462          PB     1.7
463          LS       0      84
464          UD    1.72

465          KKGOWAN_SOUTH
466          KM   TOTAL INFLOW TO GOWAN-SOUTH DETENTION BASIN
467          HC       3

468          KK  DET.GS
469          KM   Gowan-South Detention Basin data from VTN
470          RS       1    STOR      -1
471          SV       0     9.8     113     435     454     680
472          SE    2326    2330    2340  2349.6    2350    2354
473          SQ       0     112     328     455     459   30700

474          KK R.GSOUT
475          KM   ROUTE GOWAN-SOUTH OUTFLOW TO GOWAN-NORTH DETENTION BASIN
476          RK    3200   0.007   0.012       0    CIRC       5       0

477          KK    GD.9
478          KM   Begin subareas tributary to Gowan-North Detention Basin
479          KM   From B&V-LaMadre
480          BA   0.001
481          PB     2.1
482          LS       0      89
483          UD    0.30

484          KK       V
485          RM       5    0.52    0.15

486          KK   GD.10
487          KM   From B&V-LaMadre
488          BA   0.001
489          PB     1.9
490          LS       0      88
491          UD    0.90

492          KK       .
493          KM   Combine GD.9 & GD.10
494          HC       2

495          KK       V
496          KM   ROUTE EAST TO GOWAN-NORTH DETENTION BASIN
497          RM       6    0.61    0.15
1                                        HEC-1 INPUT                                        PAGE 13

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

498          KK       V
499          KM   Routing Cont'd
500          RM       7    0.74    0.15

501          KK   GD.11
502          KM   From B&V-LaMadre
503          BA    3.17
504          PB     1.8
505          LS       0      85
506          UD    2.44

507          KK       .
508          KM   INFLOW FROM WEST INTO GOWAN-NORTH (GD.9 - GD.11)
509          HC       2

510          KK   GD.33
511          KM   From Wallace EPT.H1
512          BA   0.001
513          PB     1.9
514          LS       0      89
515          UD     3.5

516          KK  RANCHO
517          KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
518          KM   From Wallace
519          DTCULVERTS
520          DI       0    1545    3129    4000    8000
521          DQ       0    1545    1545    2416    6416

522          KK       V
523          KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
524          KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
525          RM       2    0.15    0.15

526          KK  GD.32C
527          KM   One-half of subbasin GD.32C
528          BA   0.365
529          PB     1.9
530          LS       0      86
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UD    0.27

KK       .
KM   Combine GD.32 & GD.33
HC       2

KK  RANCHO
KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
KM   From Wallace
DTCULVERTS
DI       0     900    2484    4000    8000
DQ       0     900     900    2416    6416
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1 HEC-1 INPUT PAGE 14

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

KK       V
KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
RM       1    0.14    0.15

KK   GD.30
KM   From Wallace
KM   LARGE, FORESTED AREA EXTENDING TO MOUNT CHARLESTON
BA   0.001
PB    2.23
LS       0      80
UD    2.69

KK       V
KM   ROUTE WEST TO RANCHO (HWY 95)
RM      12    1.23    0.15

KK  GD.31B
KM   One-half of subbasin GD.31B
BA   0.665
PB     1.9
LS       0      81
UD    0.97

KK       .
KM   Combine GD.30 - GD.33
HC       3

KK  RANCHO
KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
DTCULVERTS
DI       0     520    1889    4000    8000
DQ       0     520     520    2631    6631

KK       V
KM   ROUTE SOUTH ALONG WEST SIDE OF RANCHO (HWY 95)
KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
RM       1    0.14    0.15

KK   GD.28
KM   From Wallace
BA   0.001
PB     1.8
LS       0      77
UD    2.52

KK       .
KM   Combine GD.28 & GD.30 - GD.33
HC       2
```

1 HEC-1 INPUT PAGE 15

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

KK  RANCHO
KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
DTCENTNIAL
DI       0    1040    5456    8000
DQ       0    1040    1040    3585

KK       V
KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
RM       1    0.07    0.15

KK   GD.25
KM   From Wallace
BA   0.001
PB     2.0
LS       0      89
UD    1.09

KK       V
RM       7    0.69    0.15

KK   GD.26
KM   From Wallace
BA   0.001
PB     1.9
LS       0      78
UD    1.23

KK       .
KM   Combine GD.25 & GD.26
HC       2

KK       V
KM   ROUTE WEST TO ANN ROAD AND HWY 95
KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
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611          RM       4    0.43    0.15

612          KK       V
613          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
614          RM       5    0.49    0.15

615          KK   GD.27
616          KM   From Wallace
617          BA    1.13
618          PB     1.8
619          LS       0      78
620          UD    1.61

621          KK       .
622          KM   Combine GD.25-GD.28 & GD.30-GD.33 at the INTERSECTION OF ANN ROAD AND HWY 95
623          HC       3
1                                    HEC-1 INPUT                                    PAGE 16

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

624          KK       V
625          KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
626          RK    3000   0.009   0.025       0    TRAP      50       3

627          KK       V
628          RK    3000   0.004   0.022       0    TRAP      25       8

629          KK   GD.29
630          KM   From Wallace
631          BA    0.76
632          PB     1.8
633          LS       0      77
634          UD    1.49

635          KK       V
636          RK    8000    0.01   0.025       0    TRAP      20       8

637          KK    PDGC
638          KM   PAINTED DESERT GOLF COURSE
639          KM   From Wallace
640          BA    0.53
641          PB     1.7
642          LS       0      80
643          UD     1.2

644          KK       .
645          KM   Combine GD.25 - GD.33 & PDGC at the SOUTH SIDE OF PAINTED DESERT AT HWY 95
646          HC       3

647          KK  RANCHO
648          KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
649          DTP.DESERT
650          DI       0     233    1318    8000
651          DQ       0     233     233    6915

652          KK       V
653          KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
654          KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
655          RM       1    0.14    0.15

656          KK   GD.21
657          KM   From Wallace
658          BA   0.001
659          PB     2.1
660          LS       0      89
661          UD    0.72

662          KK       V
663          RM       8    0.81    0.15
1                                    HEC-1 INPUT                                    PAGE 17

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

664          KK   GD.22
665          KM   From Wallace
666          BA   0.001
667          PB     2.0
668          LS       0      86
669          UD     1.5

670          KK   GD.23
671          KM   From Wallace
672          BA   0.001
673          PB     2.0
674          LS       0      86
675          UD    1.41

676          KK       .
677          KM   Combine GD.21 - GD.23
678          HC       3

679          KK       V
680          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
681          RM       7    0.65    0.15

682          KK   GD.24
683          KM   From Wallace
684          BA    0.64
685          PB     1.8
686          LS       0      77
687          UD     1.2

688          KK       .
689          KM   Combine GD.21 - GD.24
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690          HC       2

691          KK       V
692          KM   ROUTE WEST TO HWY 95
693          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
694          RM       7    0.65    0.15

695          KK   GD.18
696          KM   From Wallace
697          BA   0.001
698          PB     2.1
699          LS       0      89
700          UD    0.31

701          KK       V
702          RM       6    0.62    0.15

703          KK   GD.19
704          KM   From Wallace
705          BA   0.001
706          PB     1.9
707          LS       0      82
708          UD    1.24
1                                        HEC-1 INPUT                                        PAGE 18

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

709          KK       .
710          KM   Combine GD.18 & GD.19
711          HC       2

712          KK       V
713          KM   ROUTE WEST TO HWY 95 AT CRAIG ROAD
714          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
715          RM       9    0.88    0.15

716          KK   GD.20
717          KM   From Wallace
718          BA    2.35
719          PB     1.7
720          LS       0      82
721          UD    2.51

722          KK       .
723          KM   Combine GD.18 - GD.33 & PDGC at the INTERSECTION OF CRAIG ROAD AND HWY 95
724          HC       4

725          KK  HWY.95
726          KM   DIVERT CAPACITY OF BRIDGE AT CRAIG ROAD
727          DT   CRAIG
728          DI       0     465    2056   10000
729          DQ       0     465     465    8409

730          KK       V
731          KM   ROUTE SOUTH ALONG WEST SIDE OF ORAN GRAGSON HWY TO ALEXANDER ROAD
732          KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
733          RM       1    0.07    0.15

734          KK   GD.15
735          KM   From Wallace
736          BA   0.001
737          PB     2.1
738          LS       0      88
739          UD    0.48

740          KK       V
741          RM       7    0.74    0.15

742          KK   GD.16
743          KM   From Wallace
744          BA   0.001
745          PB     2.1
746          LS       0      82
747          UD    1.63

748          KK       .
749          HC       2
1                                        HEC-1 INPUT                                        PAGE 19

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

750          KK       V
751          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
752          RM      10    1.01    0.15

753          KK   GD.17
754          KM   From Wallace
755          BA    0.56
756          PB     1.9
757          LS       0      80
758          UD     2.0

759          KK       .
760          KM   Combine GD.15 - GD.17
761          HC       3

762          KK   HWY95
763          KM   DIVERT CAPACITY OF CULVERT AT ALEXANDER ROAD UNDER HWY
764          DTALEXANDR
765          DI       0     155    1746   10000
766          DQ       0     155     155    8409

767          KK       V
768          KM   ROUTE SOUTH ALONG WEST SIDE OF ORAN GRAGSON HWY TO GOWAN ROAD
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 769          KM   Convert from kinematic wave to Muskingum routing to avoid zero flow
 770          RM       1    0.11    0.15

 771          KK   GD.12
 772          KM   From Wallace
 773          BA   0.001
 774          PB     2.1
 775          LS       0      89
 776          UD     0.3

 777          KK       V
 778          RM       4    0.42    0.15

 779          KK   GD.13
 780          KM   From Wallace
 781          BA   0.001
 782          PB     2.0
 783          LS       0      86
 784          UD    1.10

 785          KK       .
 786          KM   Combine GD.12 & GD.13
 787          HC       2

 788          KK       V
 789          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
 790          RM       4    0.43    0.15
1                                    HEC-1 INPUT                                    PAGE 20

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

 791          KK       V
 792          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
 793          RM      11    1.06    0.15

 794          KK  GD.14A
 795          KM   From Wallace
 796          BA    1.71
 797          PB     1.8
 798          LS       0      81
 799          UD    0.88

 800          KK       .
 801          KM   Combine GD.12, GD.13 & GD.14A
 802          HC       2

 803          KK       V
 804          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
 805          RM       5    0.53    0.15

 806          KK  GD.14B
 807          KM   From Wallace
 808          BA    0.68
 809          PB     1.7
 810          LS       0      83
 811          UD    1.67

 812          KK       .
 813          KM   Combine GD.12, GD.13, GD.14A, GD.14B & GD.15 - GD.17
 814          HC       3

 815          KK   GN_IN
 816          KM   TOTAL INFLOW TO GOWAN-NORTH (including Gowan-South Outflow)
 817          HC       3

 818          KK  DET.GN
 819          KM   ROUTE FLOW THROUGH GOWAN-NORTH DETENTION BASIN: 72" RCP OUTLET
 820          KM   From VTN
 821          RS       1    STOR      -1
 822          SV       0      28      46     113     774     885    1163
 823          SE    2308    2311    2312    2314    2324  2325.5    2329
 824          SQ       0       0     126     251     519     539   35800

 825          KKR.G-UPS.
 826          KM   ROUTE GOWAN-NORTH DETENTION BASIN OUTFLOW TO UNDERPASS
 827          RK    2000   0.005   0.013       0    CIRC       6       0

 828          KK       V
 829          KM   Route Gowan outflow along Gowan Outfall Channel
 830          RK    7000   0.009   0.015       0    TRAP      10       0
1                                    HEC-1 INPUT                                    PAGE 21

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

 831          KK       .
 832          KM   Recall flow diverted at Craig Road
 833          DR   CRAIG

 834          KK       V
 835          KM   Route to Rancho
 836          RM       4    0.42    0.15

 837          KK       .
 838          KM   Recall flow diverted at Alexander
 839          DRALEXANDR

 840          KK       V
 841          KM   Route to Rancho
 842          RM       9    0.92    0.15

 843          KK       .
 844          KM   Combine Gowan Outfall Channel with flows diverted at Craig and Alexander
 845          KM   at Rancho
 846          HC       3
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847          KK       V
848          KM   Route combined flows downstream of Rancho in Gowan Outfall Channel (Wallace
849          KM   App. F)
850          RK    8400   0.007   0.015       0    TRAP      10       0

851          KK       V
852          KM   Routing Cont'd
853          RK    4000   0.005   0.015       0    TRAP      10       0

854          KK       V
855          KM   Routing Cont'd
856          RK    4000   0.005   0.015       0    TRAP      10       0

857          KK       .
858          KM   Begin modeling of subareas on the east side of Rancho Road
859          KM   Recall flow diverted at Centenial
860          DRCENTNIAL

861          KK       .
862          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
863          RM      20    2.03    0.15

864          KK   EPT.1
865          BA    3.76
866          PB     1.7
867          LS       0      85
868          UD    3.36
1                                        HEC-1 INPUT                                        PAGE 22

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

869          KK       .
870          KM   Combine EPT.1 & flow diverted at Centenial
871          HC       2

872          KK       V
873          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
874          RM       8    0.76    0.15

875          KK       .
876          KM   Recall flow diverted at Painted Desert
877          DRP.DESERT

878          KK       V
879          KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
880          RM      20    2.03    0.15

881          KK   EPT.3
882          BA   4.391
883          PB     1.7
884          LS       0      88
885          UD    3.67

886          KK       .
887          KM   Combine EPT.1, EPT.3 & flows diverted at P. Desert & Centenial
888          HC       3

889          KK   EPT.4
890          BA   1.372
891          PB     1.7
892          LS       0      89
893          UD     2.7

894          KK       V
895          RM       9    0.88    0.15

896          KK       .
897          KM   Combine EPT.1, EPT.3, EPT.4 & flows diverted at P.Desert & Centenial at
898          KM   Gowan Outfall Channel
899          HC       2

900          KK       .
901          KM   Combine EPT.1, EPT.3, EPT.4, Gowan outflow & flows diverted at Craig,
902          KM   Alexander, Painted Desert & Centenial
903          HC       2

904          KK   EPT.5
905          BA   3.005
906          PB     1.7
907          LS       0      87
908          UD     4.7
1                                        HEC-1 INPUT                                        PAGE 23

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

909          KK       .
910          KM   Combine EPT.1, EPT.3, EPT.4, EPT.5, Gowan outflow & flows diverted at Craig,
911          KM   Alexander, Painted Desert & Centenial
912          HC       2

913          KK       V
914          RK   10000    .013    .015       0    TRAP      10       0

915          KK   EPT.2
916          BA   1.492
917          PB     1.7
918          LS       0      85
919          UD    2.51

920          KK  LVWASH
921          KM   Combine entire Gowan Area at the PROJECT TERMINUS AT LAS VEGAS WASH
922          HC       2
923          KM   ************************** END GOWAN MODEL **********************************
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KKGOWANDIV
KM   RECALL FLOW DIVERTED IN GOWAN MODEL
DRCULVERTS

KK     301
KM   ROUTE DIVERTED GOWAN FLOW THRU SUBBASIN 301
RM      22    2.17    0.15

KK     301
KM   RUNOFF FROM SUBBASIN 301
BA  18.616
PB     1.9
LS       0       85
UD     4.3

KK WTRIBUS
KM   COMBINE SUBBASIN 301 & DIVERTED GOWAN FLOW
HC       2

KKWTRIBTOT
KM   COMBINE SUBBASIN 301, GOWAN OUTFALL, AND DIVERTED GOWAN FLOW
HC       2

KK     304
KM   ROUTE SUBBASIN 301 & GOWAN OUTFALL THRU SUBBASIN 304 TO CRAIG ROAD
RM       3    0.28    0.15

KK    SNIC
KM   ROUTE SUBBASIN 301 & GOWAN OUTFALL THRU THE SOUTHERN NEVADA INDUSTRIAL CENTER
KM   FLOOD CONTROL CHANNEL FROM CRAIG ROAD TO ALEXANDER
RK    3850   .0122   0.016       0    TRAP      20       2
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK     LBC
KM   ROUTE SUBBASIN 301 & GOWAN OUTFALL THRU THE LOSEE BRIDGE CHANNEL
KM   FROM ALEXANDER TO THE BEGINNING OF THE "A" CHANNEL
RK    2800    .002   0.016       0    TRAP      80       2

KK    310W
KM   RUNOFF FROM WESTERN PORTION OF SUBBASIN 310
BA      .8
PB    1.66
LS       0      87       0       0      87
UK     150    .010      .3      38
UK     300    .015     .25      62
RK    1000   .0075     .02    .013    TRAP      51       0
RK    2600   .0075     .02      .2    TRAP      80       0
RK    8700   .0150     .02       0    TRAP     100       0

KK   R310W
KM   ROUTE RUNOFF FROM 310W TO 310E
RK   10500    .015     .02       0    TRAP     100       0

KK    310E
KM   RUNOFF FROM EASTERN PORTION OF SUBBASIN 310
BA   1.238
PB    1.66
LS       0      86       0       0      83
UK     150     .01      .3      46
UK     300    .015     .25      54
RK    1000   .0075     .02    .019    TRAP      51       0
RK    2000   .0075     .02     .31    TRAP      80       0
RK   10500    .015     .02       0    TRAP     100       0

KK    310E
KM   COMBINE ROUTED 310W WITH 310E
HC       2

KK   R310E
KM   ROUTE FROM 310E TO 311W
RK    5300   .0132     .02       0    TRAP     100       0

KK    311W
KM   RUNOFF FROM WESTERN PORTION OF SUBBASIN 311
BA     .96
PB    1.66
LS       0      85       0       0      83
UK     150    .010      .3      60
UK     300   .0132     .25      40
RK     650   .0065     .02     .01    TRAP      51       0
RK    2200   .0065     .02     .14    TRAP      80       0
RK    5300   .0132     .02       0    TRAP     100       0
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LINE        ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

KK    311W
KM   COMBINE ROUTED 310E WITH 311W
HC       2

KK   R311W
KM   ROUTE FROM 311W TO 311E
RK    7500   .0132     .02       0    TRAP     100       0

KK    311E
KM   RUNOFF FROM EASTERN PORTION OF SUBBASIN 311
BA     .77
PB    1.66
LS       0      75       0       0      72
UK     150    .010      .3      75
UK     300   .0132     .25      25
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1005          RK     650   .0065     .02    .008    TRAP      51
1006          RK    2200   .0065     .02     .11    TRAP      80       0
1007          RK    7500   .0132     .02       0    TRAP     100       0

1008          KK    311E
1009          KM   COMBINE ROUTED 311W WITH 311E
1010          HC       2

1011          KK    309W
1012          KM   RUNOFF FROM WESTERN PORTION OF SUBBASIN 309
1013          BA     .81
1014          PB    1.66
1015          LS       0      71       0       0      70
1016          UK     150     .01      .3      22
1017          UK     300   .0144     .25      78
1018          RK    1000    .007     .02    .013    TRAP      51       0
1019          RK    2600    .007     .02     .20    TRAP      80       0
1020          RK    8700   .0144     .02       0    TRAP     100       0

1021          KK   R309W
1022          KM   ROUTE FROM 309W TO 309E
1023          RK   21000   .0144     .02       0    TRAP     100       0

1024          KK    309E
1025          KM   RUNOFF FROM EASTERN PORTION OF SUBBASIN 309
1026          BA    1.19
1027          PB    1.66
1028          LS       0      87       0       0      80
1029          UK     150     .01      .3      52
1030          UK     300   .0144     .25      48
1031          RK    1000    .007     .02    .019    TRAP      51       0
1032          RK    2600    .007     .02     .30    TRAP      80       0
1033          RK   21000   .0144     .02       0    TRAP     100       0
1                                          HEC-1 INPUT                                                    PAGE 26

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


1034          KK    309E
1035          KM   COMBINE ROUTED 309W WITH 309E
1036          HC       2

1037          KK       .
1038          KM   COMBINE RUNOFF FROM SUBBASINS 309, 310, & 311
1039          HC       2

1040          KK    FCP1
1041          KM   ROUTE 309, 310, & 311 THRU FREEWAY CHANNEL FROM OWENS AVE.
1042          KM   TO LAKE MEAD BLVD.
1043          RK     410   .0045    .016       0    CIRC       5       0

1044          KK    FCP2
1045          RK     740   .0048    .016       0    CIRC     5.5       0

1046          KK   FCBC1
1047          RK     800   .0056    .016       0    TRAP       8       0

1048          KK     FC1
1049          RK    1250   .0195    .016       0    TRAP       8       0

1050          KKFCBC2/FC2/FCBC3
1051          KM   COMBINE FCBC2, FC2, & FCBC3 ROUTING STEPS
1052          RK    1430     .03    .016       0    TRAP       7       0

1053          KK   307NW
1054          KM   RUNOFF FROM NORTHWEST PORTION OF SUBBASIN 307
1055          BA    1.33
1056          PB    1.66
1057          LS       0      85       0       0      87
1058          UK     150    .010      .3      32
1059          UK     300    .011     .25      68
1060          RK    1000   .0055     .02    .017    TRAP      51       0
1061          RK    2600   .0055     .02     .27    TRAP      80       0
1062          RK    6400    .011     .02       0    TRAP     100       0

1063          KK  R307NW
1064          KM   ROUTE FROM 307NW TO 307NE
1065          RK    4000    .011     .02       0    TRAP     100       0

1066          KK   307NE
1067          KM   RUNOFF FROM NORTHEAST PORTION OF SUBBASIN 307
1068          BA     .64
1069          PB    1.66
1070          LS       0      87       0       0      87
1071          UK     150    .010      .3      11
1072          UK     300    .011     .25      89
1073          RK    1000   .0055     .02    .013    TRAP      51       0
1074          RK    2600   .0055     .02     .21    TRAP      80       0
1075          RK    4000    .011     .02       0    TRAP     100       0
1                                          HEC-1 INPUT                                                    PAGE 27

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


1076          KK   307NE
1077          KM   COMBINE ROUTED 307NW WITH 307NE
1078          HC       2

1079          KK       .
1080          KM   COMBINE NORTHERN PORTION OF SUBBASIN 307 AT CHEYENNE AVENUE AND RANCHO DRIVE
1081          HC       2

1082          KK       V
1083          KM   ROUTE FLOW ALONG RANCHO DRIVE TO SMOKE RANCH ROAD
1084          RM       4    0.37    0.15
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1085          KK   307SW
1086          KM   RUNOFF FROM SOUTHWEST PORTION OF SUBBASIN 307
1087          BA     1.1
1088          PB    1.66
1089          LS       0      61       0       0      64
1090          UK     150    .010      .3      16
1091          UK     300    .011     .25      84
1092          RK    1000   .0055     .02     .01    TRAP      51
1093          RK    2200   .0055     .02     .16    TRAP      80
1094          RK    6100    .011     .02       0    TRAP     100       0

1095          KK  R307SW
1096          KM   ROUTE FROM 307SW TO 307SE
1097          RK    7300    .011     .02       0    TRAP     100       0

1098          KK   307SE
1099          KM   RUNOFF FROM SOUTHEAST PORTION OF SUBBASIN 307
1100          BA    1.58
1101          PB    1.66
1102          LS       0      85       0       0      87
1103          UK     150     .01      .3      40
1104          UK     300    .011     .25      60
1105          RK    1000   .0055     .02     .01    TRAP      51       0
1106          RK    2200   .0055     .02     .17    TRAP      80       0
1107          RK    7300    .011     .02       0    TRAP     100       0

1108          KK   307SE
1109          KM   COMBINE ROUTED 307SW WITH 307SE
1110          HC       2

1111          KK       .
1112          KM   COMBINE FLOW AT SMOKE RANCH ROAD AND RANCHO DRIVE
1113          HC       2

1114          KK       V
1115          KM   ROUTE FLOW TO LAKE MEAD BLVD. ALONG RANCHO DRIVE
1116          RM       2    0.18    0.15
```



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

1117          KK    308W
1118          KM   RUNOFF FROM WESTERN PORTION OF SUBBASIN 308
1119          BA     .81
1120          PB    1.66
1121          LS       0      71       0       0      70
1122          UK     150     .01      .3      19
1123          UK     300   .0134     .25      81
1124          RK    1000    .006     .02    .017    TRAP      51       0
1125          RK    2600    .006     .02     .27    TRAP      80       0
1126          RK    8700   .0134     .02       0    TRAP     100       0

1127          KK   R308W
1128          KM   ROUTE FROM 308W TO 308E
1129          RK    6500   .0134     .02       0    TRAP     100       0

1130          KK    308E
1131          KM   RUNOFF FROM EASTERN PORTION OF SUBBASIN 308
1132          BA     .72
1133          PB    1.66
1134          LS       0      85       0       0      87
1135          UK     150     .01      .3      59
1136          UK     300   .0134     .25      41
1137          RK    1000    .006     .02    .015    TRAP      51       0
1138          RK    2600    .006     .02     .24    TRAP      80       0
1139          RK    6500   .0134     .02       0    TRAP     100       0

1140          KK    308E
1141          KM   COMBINE ROUTED 308W WITH 308E
1142          HC       2

1143          KK       .
1144          KM   COMBINE RUNOFF FROM SUBBBASINS 307 & 308
1145          HC       2

1146          KKR307/308
1147          KM   ROUTE SUBBASINS 307 & 308 THRU 312W
1148          RK    6100   .0132     .02       0    TRAP     100       0

1149          KK    312W
1150          KM   RUNOFF FROM WESTERN PORTION OF SUBBBASIN 312
1151          KM   ROUTE SUBBASINS 307 & 308 THRU SUBBASIN 312
1152          BA     .77
1153          PB    1.66
1154          LS       0      81       0       0      80
1155          UK     150    .010      .3      20
1156          UK     300   .0132     .25      80
1157          RK    1000   .0065     .02    .012    TRAP      51       0
1158          RK    2600   .0065     .02    .175    TRAP      80       0
1159          RK    6100   .0132     .02       0    TRAP     100       0
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LINE          ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

1160          KK    312W
1161          KM   COMBINE ROUTED 307 & 308 WITH 312W
1162          HC       2

1163          KK   R312W
1164          KM   ROUTE FROM 312W TO 312E
1165          RK    6100   .0132     .02       0    TRAP     100       0

1166          KK    312E
1167          KM   RUNOFF FROM EASTERN PORTION OF SUBBASIN 312
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1168          BA      .7
1169          PB    1.66
1170          LS       0      79       0       0      76
1171          UK     150    .010      .3      50
1172          UK     300   .0132     .25      50
1173          RK     500   .0065     .02    .012    TRAP      51       0
1174          RK    2600   .0065     .02    .175    TRAP      80       0
1175          RK    6100   .0132     .02       0    TRAP     100       0

1176          KK    312E
1177          KM   COMBINE ROUTED 312W WITH 312E
1178          HC       2

1179          KK     306
1180          KM   RUNOFF FROM SUBBASIN 306
1181          BA   5.073
1182          PB    1.66
1183          LS       0      84
1184          UD    3.02

1185          KK       .
1186          KM   COMBINE RUNOFF SUBBASINS 306, 307, 308, 309, 310, 311, & 312
1187          HC       3

1188          KK     FC3
1189          KM   ROUTE SUBBASINS 306, 307, 308, 309, 310, 311, & 312 FROM LAKE MEAD BLVD.
1190          KM   TO THE "A" CHANNEL THRU THE FREEWAY CHANNEL
1191          RK     900   .0012    .016       0    TRAP      10     1.5

1192          KK FC4/FC5
1193          RK     600  0.0012   0.016       0    TRAP      24     1.5

1194          KK     FC6
1195          RK    5150   .0011    .016       0    TRAP      16     1.5

1196          KK     FC7
1197          RK    2400   .0010    .016       0    TRAP      20     1.5

1198          KKFCBC4/FC8
1199          KM   COMBINE FCBC4 & FC8 ROUTING STEPS
1200          RK    3475   .0012    .016       0    TRAP      20     1.5
```



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

1201          KK     302
1202          KM   RUNOFF SUBBASIN 302
1203          BA  12.113
1204          PB    1.66
1205          LS       0      86
1206          UD     3.1

1207          KK     303
1208          KM   ROUTE SUBBASIN 302 THRU SUBBASIN 303
1209          RM       8    0.83    0.15

1210          KK     303
1211          KM   RUNOFF FROM 303
1212          BA  10.217
1213          PB    1.66
1214          LS       0      84
1215          UD    4.24

1216          KK       .
1217          KM   COMBINE FLOW FROM SUBBASINS 302 & 303 AT THE "A" CHANNEL
1218          HC       2

1219          KK     304
1220          KM   RUNOFF FROM SUBBASIN 304
1221          BA   2.903
1222          PB    1.66
1223          LS       0      86
1224          UD    1.98

1225          KK     305
1226          KM   RUNOFF FROM SUBBASIN 305
1227          BA   3.298
1228          PB    1.66
1229          LS       0      87
1230          UD    1.49

1231          KK       .
1232          KM   COMBINE SUBBASINS 304 & 305 AT THE "A" CHANNEL
1233          HC       2

1234          KKRRBRIDGE
1235          DRRRCHANNL

1236          KKDUMMY_AREA
1237          KM   Add dummy subarea with near-zero area to the recalled RRCHANNEL diversion
1238          BA   0.001
1239          PB    2.00
1240          LS       0      80
1241          UD    1.00
```



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

1242          KKDUMMY_COMBINE
1243          KM   Combine dummy subarea with recalled RRCHANNEL diversion
1244          HC       2

1245          KKRRCHANNL
1246          RK    4900   .0041     .03       0    TRAP      40       2
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1247          KK    I-15
1248          DR   KCHAR

1249          KKDUMMY_AREA
1250          KM   Add dummy subarea with near-zero area to the recalled KCHAR diversion
1251          BA   0.001
1252          PB    2.00
1253          LS       0      80
1254          UD    1.00

1255          KKDUMMY_COMBINE
1256          KM   Combine dummy subarea with recalled KCHAR diversion
1257          HC       2

1258          KK ACHANNL
1259          KM   COMBINE ALL SUBBASINS AT START OF "A" CHANNEL
1260          HC       5

1261          KK AC1/AC2
1262          KM   COMBINE ROUTING STEPS AC1 AND AC2 (use wtd avg for invert slope, width, ss)
1263          KM   ROUTE FLOW THRU "A" CHANNEL TO CIVIC CENTER DRIVE THEN TO CHEYENNE AVE.
1264          RK    2350  0.0074   0.035       0    TRAP      30       2

1265          KK     AC3
1266          RK    1600   .0065    .030       0    TRAP      52     1.5

1267          KK     AC4
1268          KM   ROUTE FLOW IN "A" CHANNEL AT CHEYENNE AVE. TO INTERSECTION OF "N" CHANNEL
1269          RK    1650   .0053    .030       0    TRAP      70     1.5

1270          KK NCHANNL
1271          KM   COMBINE ALL UPSTREAM SUBBASINS AT INTERSECTION OF "N" CHANNEL AND "A" CHANNEL
1272          HC       2
              * Truncate this run at NCHANNL
1273          ZZ
```

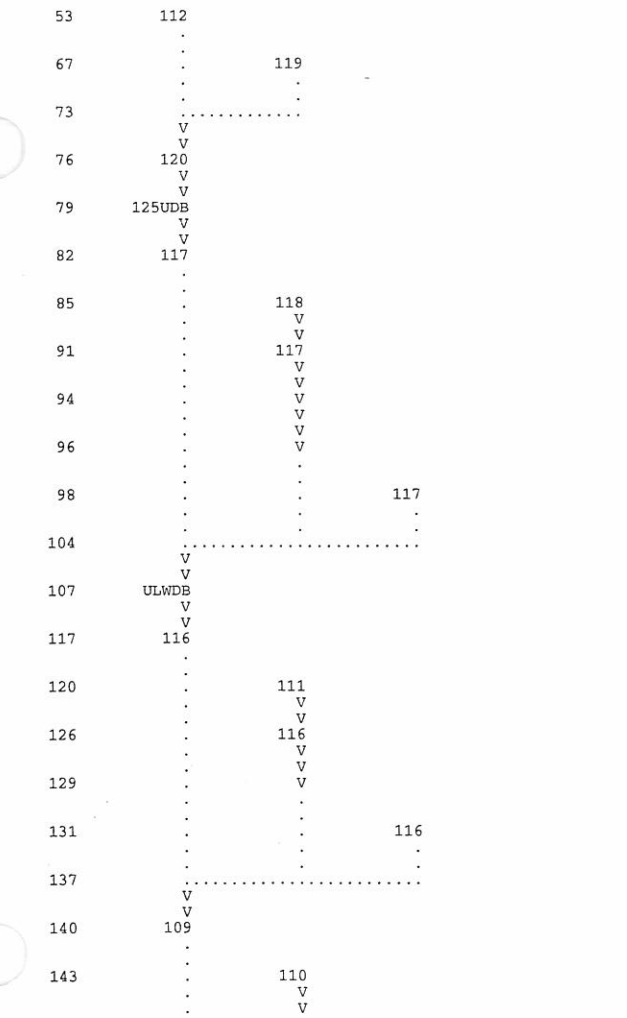
1

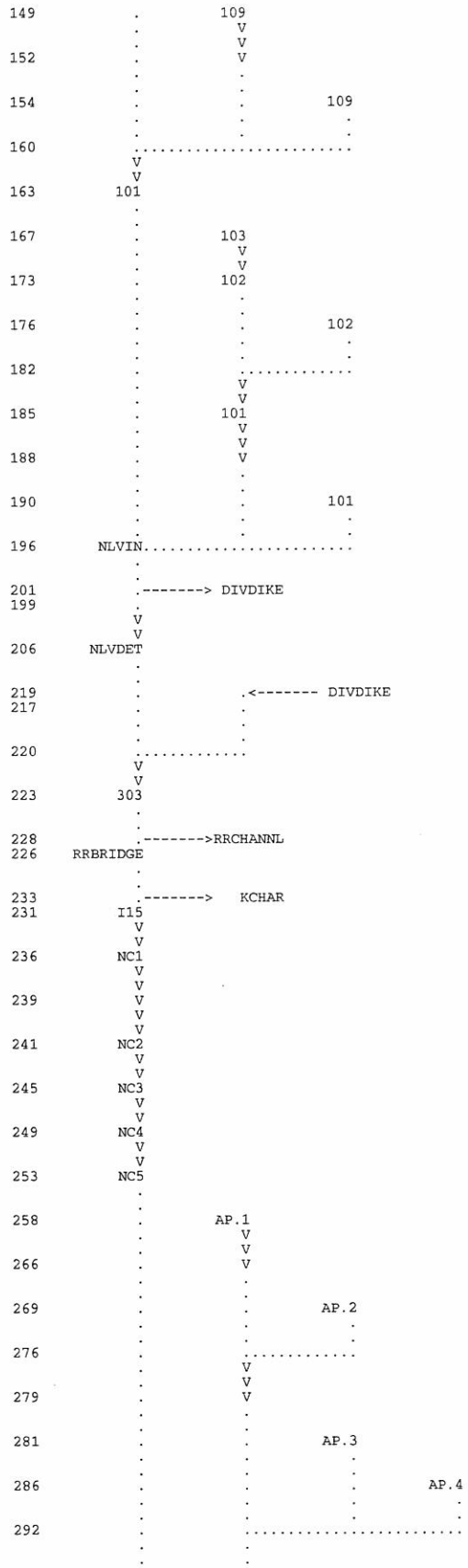
SCHEMATIC DIAGRAM OF STREAM NETWORK

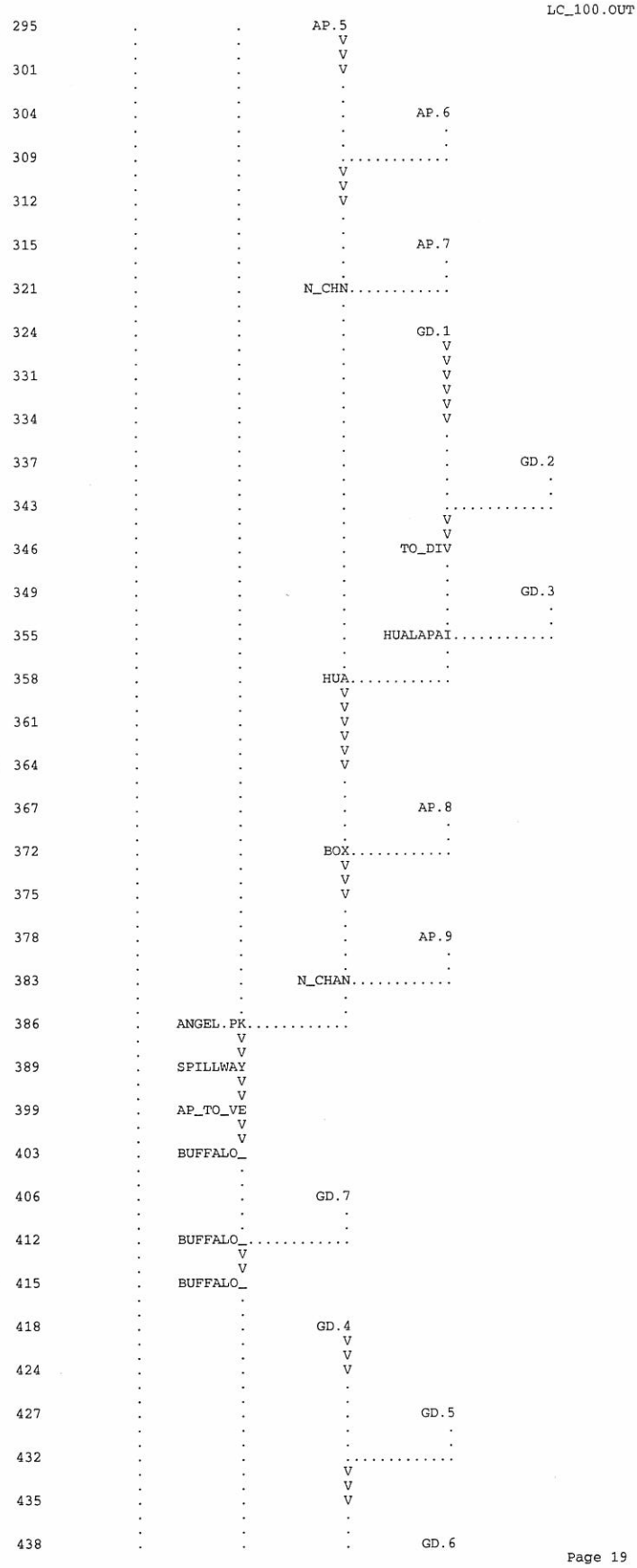
INPUT LINE NO.

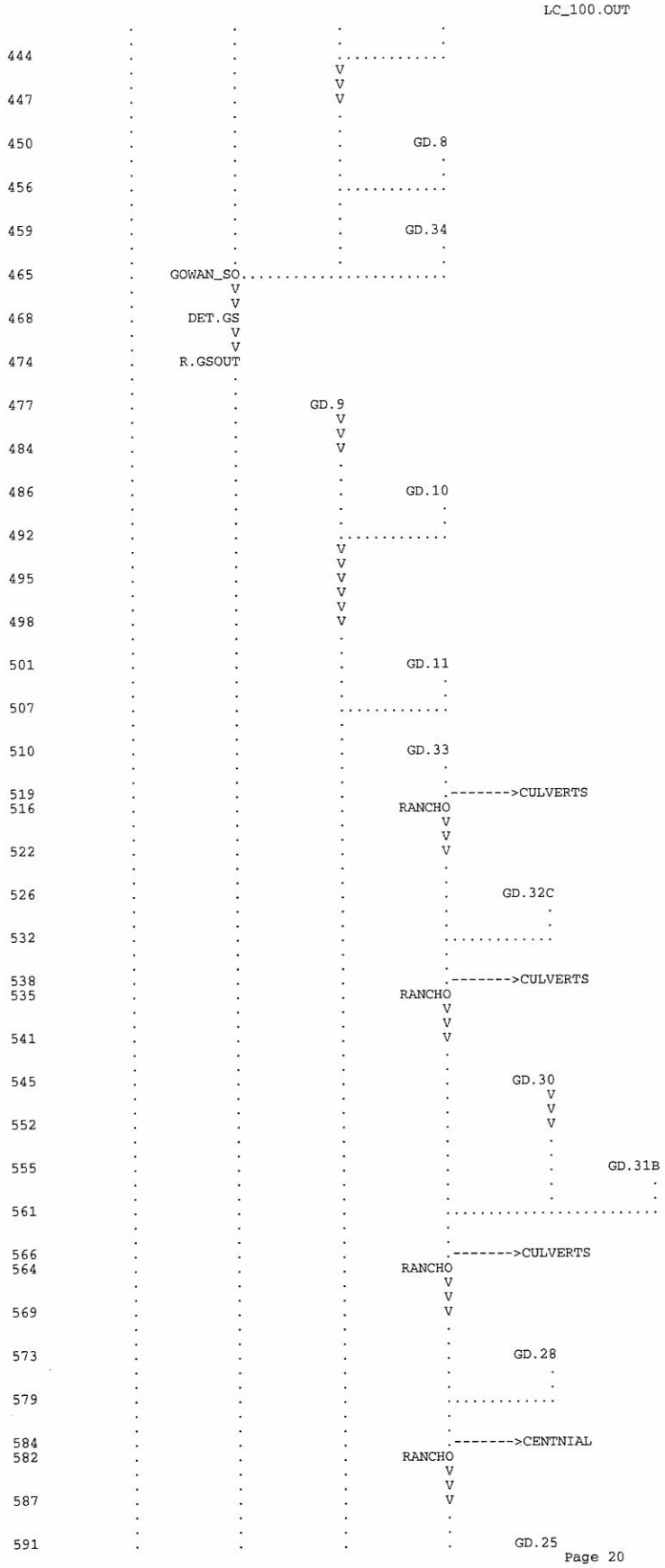
(V) ROUTING (---->) DIVERSION OR PUMP FLOW

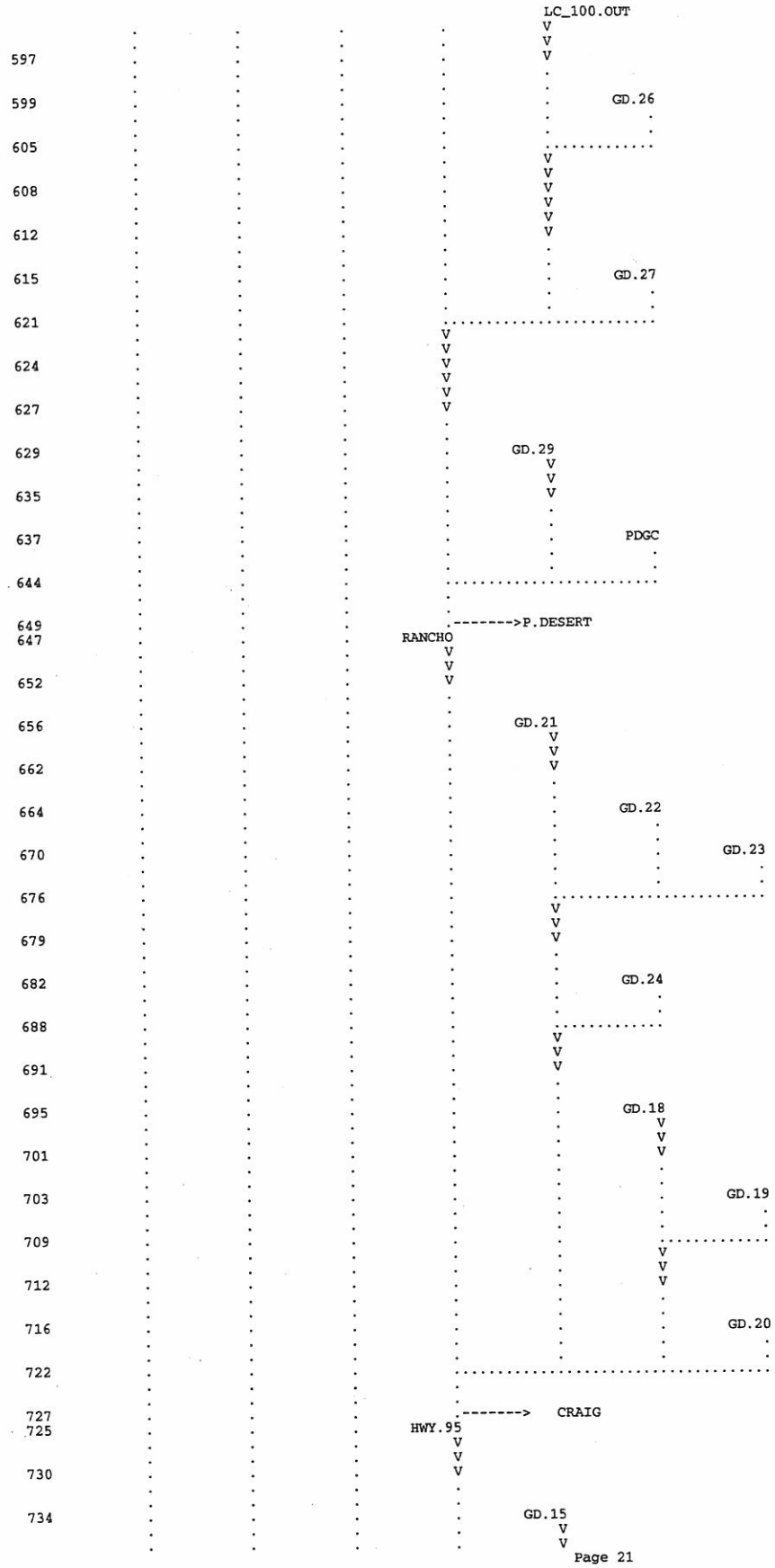
(.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW

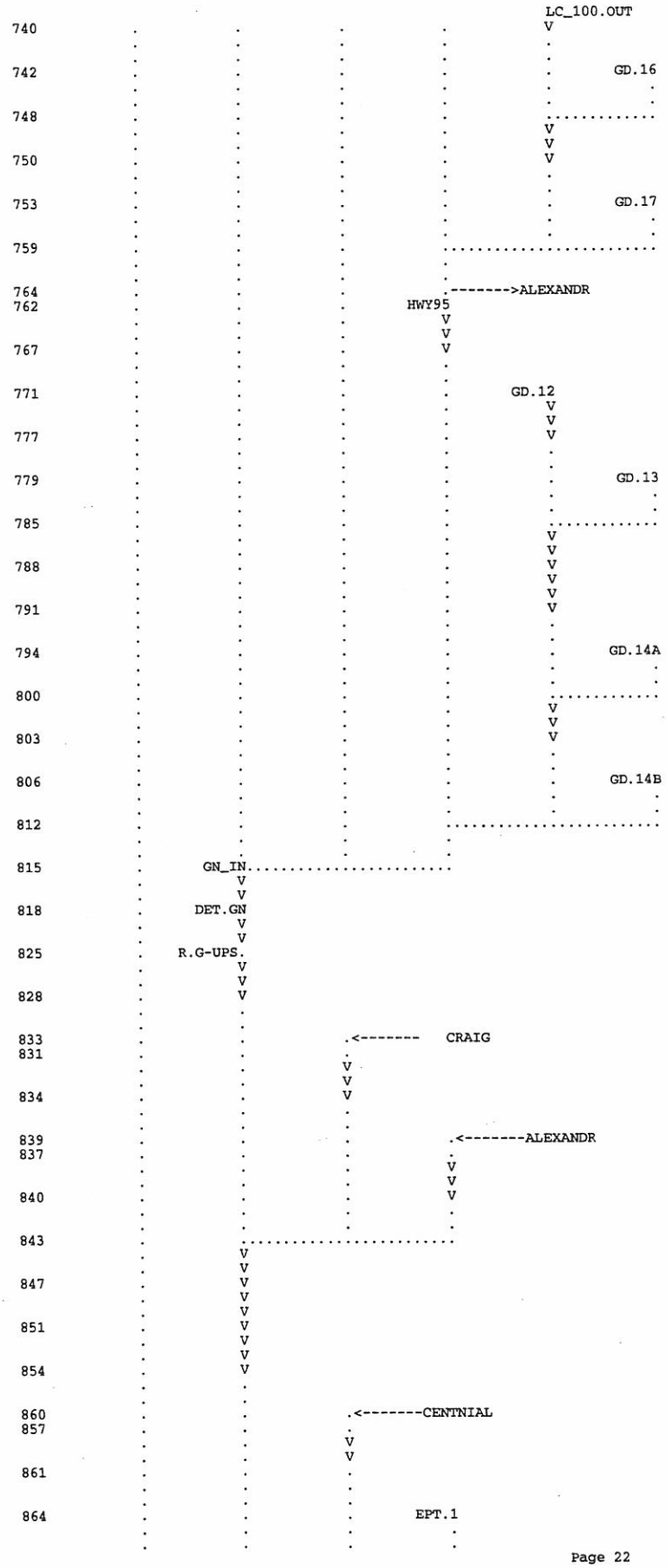


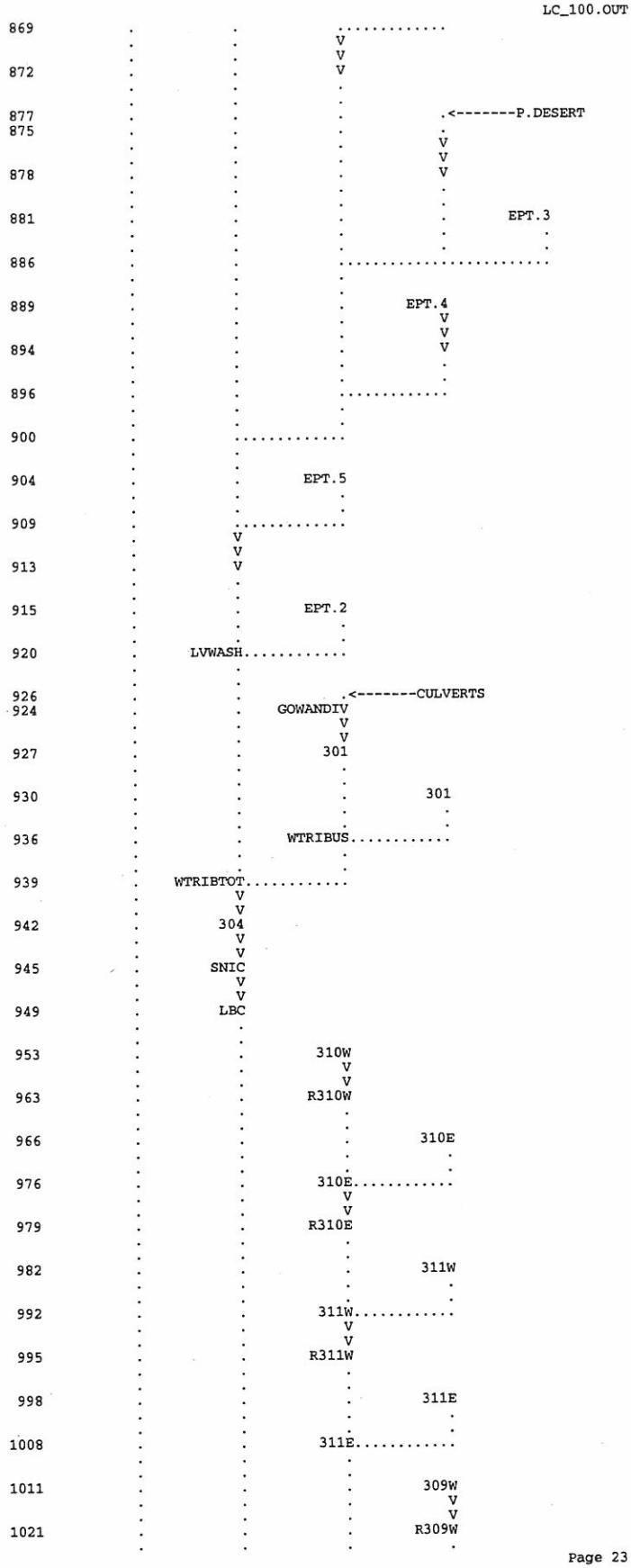

109
109
102
102
101
101
NLVIN
DIVDIKE
DIVDIKE
NLVDET
303
RRCHANNL
RRBRIDGE
KCHAR
I15
NC1
NC2
NC3
NC4
NC5
AP.1
AP.2
AP.3
AP.4

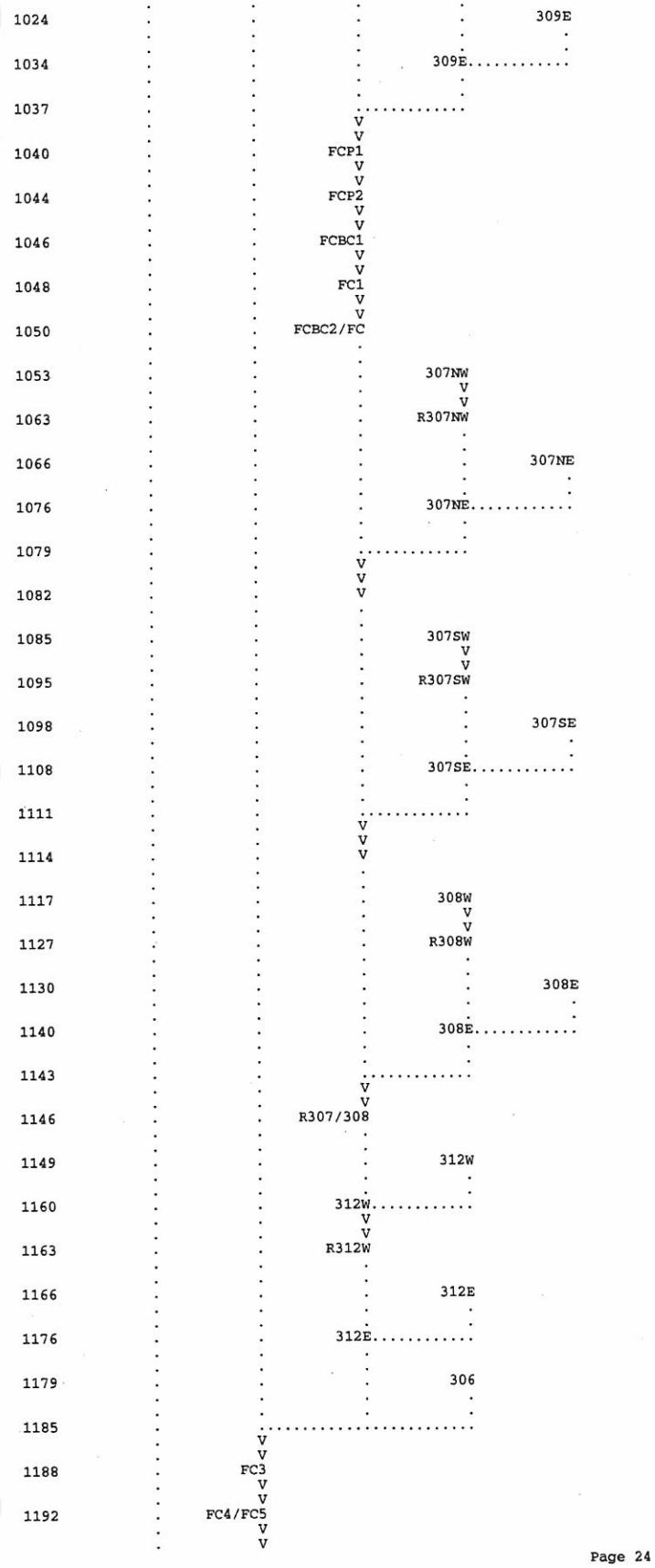

AP.5
AP.6
AP.7
N_CHN
GD.1
GD.2
TO_DIV
GD.3
HUALAPAI
HUA
AP.8
BOX
AP.9
N_CHAN
ANGEL.PK
SPILLWAY
AP_TO_VE
BUFFALO_
GD.7
BUFFALO_
GD.4
GD.5
GD.6

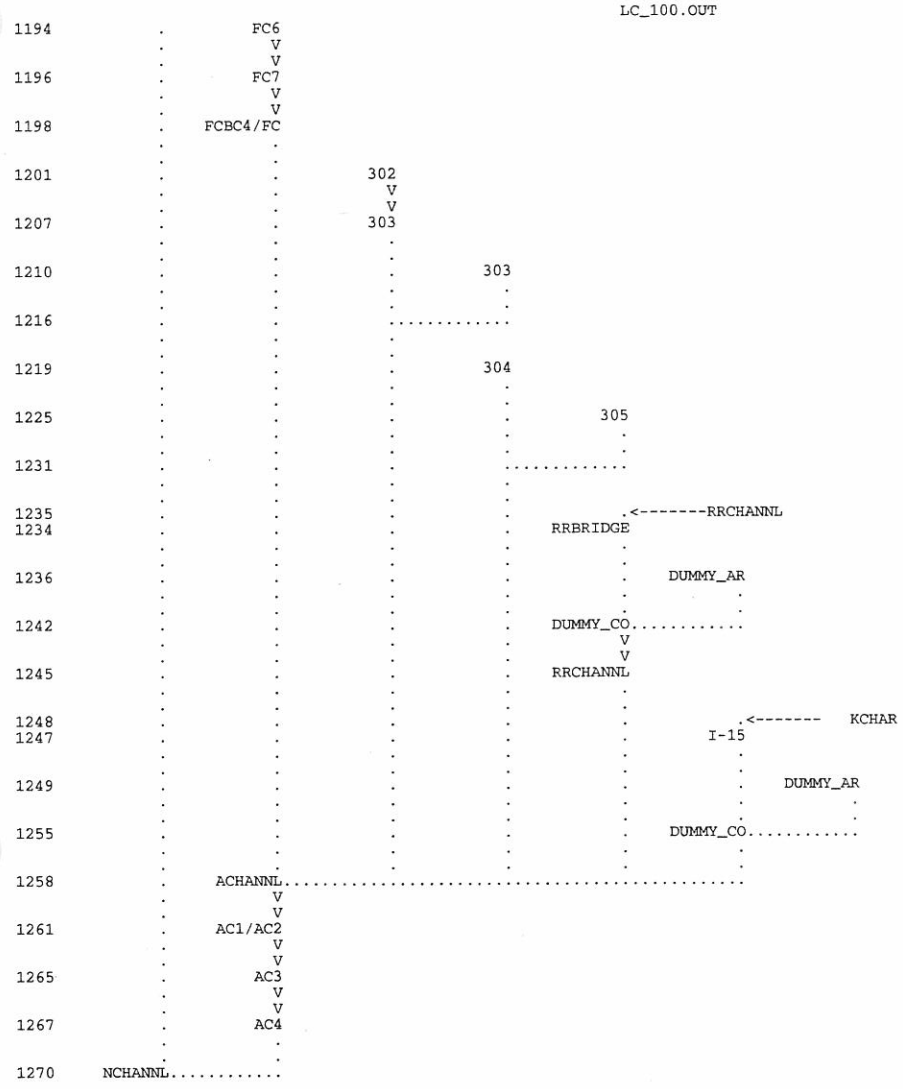

GD.8
GD.34
GOWAN_SO
DET.GS
R.GSOUT
GD.9
GD.10
GD.11
GD.33
CULVERTS
RANCHO
GD.32C
CULVERTS
RANCHO
GD.30
GD.31B
CULVERTS
RANCHO
GD.28
CENTNIAL
RANCHO
GD.25


LC_100.OUT
597
599
GD.26
605
608
612
615
GD.27
621
624
627
629
GD.29
635
637
PDGC
644
649
->P.DESERT
647
RANCHO
652
656
GD.21
662
664
GD.22
670
GD.23
676
679
682
GD.24
688
691
695
GD.18
701
703
GD.19
709
712
716
GD.20
722
727
->
CRAIG
725
HWY.95
730
734
GD.15


LC_100.OUT
740
742
GD.16
748
750
753
GD.17
759
764
762
ALEXANDR
HWY95
767
771
GD.12
777
779
GD.13
785
788
791
794
GD.14A
800
803
806
GD.14B
812
815
GN_IN
818
DET.GN
825
R.G-UPS
828
833
831
CRAIG
834
839
837
ALEXANDR
840
843
847
851
854
860
857
CENTNIAL
861
864
EPT.1


P.DESERT
EPT.3
EPT.4
EPT.5
EPT.2
LVWASH
CULVERTS
GOWANDIV
301
WTRIBUS
WTRIBTOT
304
SNIC
LBC
310W
R310W
310E
R310E
311W
311W
R311W
311E
311E
309W
R309W


1024
309E
1034
309E
1037
1040
FCP1
1044
FCP2
1046
FCBC1
1048
FC1
1050
FCBC2/FC
1053
307NW
1063
R307NW
1066
307NE
1076
307NE
1079
1082
1085
307SW
1095
R307SW
1098
307SE
1108
307SE
1111
1114
1117
308W
1127
R308W
1130
308E
1140
308E
1143
1146
R307/308
1149
312W
1160
312W
1163
R312W
1166
312E
1176
312E
1179
306
1185
1188
FC3
1192
FC4/FC5



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*          FEBRUARY  1991               *
*           VERSION 4.0.1 (LOCAL)       *
*                                       *
*  RUN DATE  05/10/96  TIME  16:20:51   *
*                                       *
*****************************************
```

```
*****************************************
*                                       *
*    U.S. ARMY CORPS OF ENGINEERS       *
*    HYDROLOGIC ENGINEERING CENTER      *
*          609 SECOND STREET            *
*       DAVIS, CALIFORNIA 95616         *
*           (916) 551-1748              *
*                                       *
*****************************************
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FEMA FLOOD INSURANCE STUDY, 1996
UPPER LAS VEGAS WASH, CLARK COUNTY, NEVADA
LOWER CENTRAL VALLEY 100-YEAR STORM

Current (05/96) model based on a HEC-1 model prepared by James M Montgomery (JMM) in 1/91 for the Las Vegas Valley Flood Insurance Study Hydrology Report dated 9/91. Two modifications were made to the source model. First, Upper Las Vegas Detention Basin storage and outflow characteristics were revised to reflect the as-built configuration described by construction drawings dated 5/91 and HEC-1 models prepared in 1993 by Black & Veatch. Second, the stage-outflow relationship for the North Las Vegas Detention Basin was revised to reflect the current three-pipe outlet condition (two of the five pipes were blocked following construction of the upper basin) and the hydraulic control created by the 4-foot high barrier wall located upstream from the pipe inlets.

Remaining comments are from the original model dated 1/91.

CCRFCD LAS VEGAS VALLEY MASTER PLAN UPDATE
Northern Las Vegas Wash - FIS FLOWS
Prepared by James M. Montgomery, Consulting Engineers, Inc., 1/91

Based on Black & Veatch Northern Las Vegas Wash HEC-1 Model, 8/89

Lower Central Valley 100-Year Storm, Existing Conditions
Additional subareas and facilities from Wallace, 7/88 (EAP.H1) & 8/88 (EPT.H1); VTN, 1/90 (3900EX4.DAT); & B&V La Madre Area, (LAME.DAT)
PB & CN values adjusted by JMM to be consistent with B&V values, 8/90

All routing steps immediately d/s of a diversion converted to Muskingum routing to avoid zero flow, 8/90

Gowan-North & Gowan-South Detention Basins & Outfall Channel, Buffalo Channel, Cheyenne Channel, Angel Park Detention Basin & Outfall Channel and Hualapai Diversion included, 8/90

This data file models DARF's at certain locations where FIS flows are required. The original B&V data file used a factor of 0.62; ratios of this factor are used in the JR card to model DA's at the points of interest (JMM DARF's extracted from CCRFCD Design Manual):

PT OF INTEREST	AREA (SQ MI)	DARF	DARF/0.62	RATIO
RRBRIDGE, NC5, & 304	60.7 - 64.5	0.66	1.06	1
ACHANNL	111.6	0.59	0.95	2
NCHANNL	172.2	0.53	0.85	3

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

   IT          HYDROGRAPH TIME DATA
                     NMIN          6  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        200  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      1   0  ENDING DATE
                   NDTIME       1954  ENDING TIME
                    ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL     0.10 HOURS
                    TOTAL TIME BASE    19.90 HOURS

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

   JP          MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS

   JR          MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
               1.06      0.95      0.85

      *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1


      *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1


      *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1


      *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  2


      *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1


      *** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION=  1


      *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

      *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

      *** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

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*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 2

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 1

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT WARNING TIME STEP CALCULATION FAILED TO CONVERGE. STABILITY PROBLEMS MAY RESULT

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 1

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 2

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 2

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 2

*** FDKRUT - NEWTON RAPHSON FAILEDFIXED POINT ITERATION USED - ITERATION= 1

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2	RATIO 3
					1.06	0.95	0.85
HYDROGRAPH AT							
+	112	5.33	1	FLOW	1466.	1172.	918.
				TIME	3.90	3.90	3.90

HYDROGRAPH AT							
+	119	2.74	1	FLOW	932.	746.	586.
				TIME	3.70	3.70	3.70
2 COMBINED AT							
+	.	8.07	1	FLOW	2363.	1888.	1477.
				TIME	3.80	3.80	3.80
ROUTED TO							
+	120	8.07	1	FLOW	2218.	1774.	1390.
				TIME	4.10	4.10	4.10
ROUTED TO							
+	125UDB	8.07	1	FLOW	1987.	1593.	1251.
				TIME	4.70	4.70	4.70
ROUTED TO							
+	117	8.07	1	FLOW	1868.	1494.	1171.
				TIME	5.10	5.10	5.10
HYDROGRAPH AT							
+	118	5.08	1	FLOW	1822.	1466.	1157.
				TIME	3.60	3.60	3.60
ROUTED TO							
+	117	5.08	1	FLOW	1625.	1307.	1036.
				TIME	3.70	3.80	3.80
ROUTED TO							
+	V	5.08	1	FLOW	1504.	1209.	953.
				TIME	4.00	4.00	4.00
ROUTED TO							
+	V	5.08	1	FLOW	1361.	1095.	865.
				TIME	4.40	4.40	4.40
HYDROGRAPH AT							
+	117	7.37	1	FLOW	551.	419.	310.
				TIME	5.80	5.90	5.90
3 COMBINED AT							
+	.	20.52	1	FLOW	2948.	2358.	1865.
				TIME	5.20	5.30	5.40
ROUTED TO							
+	ULWDB	20.52	1	FLOW	2241.	1907.	1632.
				TIME	6.10	6.10	5.90
			** PEAK STAGES IN FEET **				
			1	STAGE	2349.51	2346.72	2344.69
				TIME	6.10	6.10	5.90
ROUTED TO							
+	116	20.52	1	FLOW	2230.	1898.	1615.
				TIME	6.60	6.60	6.40
HYDROGRAPH AT							
+	111	4.08	1	FLOW	1580.	1278.	1015.
				TIME	3.60	3.60	3.60
ROUTED TO							
+	116	4.08	1	FLOW	1479.	1196.	949.
				TIME	3.70	3.70	3.70
ROUTED TO							
+	V	4.08	1	FLOW	1330.	1074.	854.
				TIME	3.90	3.90	4.00
HYDROGRAPH AT							
+	116	5.19	1	FLOW	419.	320.	238.
				TIME	5.60	5.60	5.70
3 COMBINED AT							
+	.	29.79	1	FLOW	2827.	2329.	1871.
				TIME	5.30	5.40	6.30
ROUTED TO							
+	109	29.79	1	FLOW	2733.	2279.	1859.
				TIME	5.80	5.90	6.60
HYDROGRAPH AT							
+	110	2.94	1	FLOW	1195.	979.	789.
				TIME	3.60	3.60	3.60
ROUTED TO							
+	109	2.94	1	FLOW	1132.	927.	748.
				TIME	3.70	3.70	3.70
ROUTED TO							
+	V	2.94	1	FLOW	1034.	847.	683.
				TIME	3.90	3.90	3.90
HYDROGRAPH AT							
+	109	4.18	1	FLOW	348.	266.	199.
				TIME	5.50	5.50	5.60
3 COMBINED AT							
+	.	36.91	1	FLOW	3230.	2644.	2095.
				TIME	5.70	5.80	5.70
ROUTED TO							
+	101	36.91	1	FLOW	3160.	2601.	2068.
				TIME	6.30	6.30	6.40
HYDROGRAPH AT							

	103	6.20	1	FLOW	2309.	1877.	1500.
				TIME	3.70	3.70	3.70
ROUTED TO							
+	102	6.20	1	FLOW	2181.	1771.	1413.
				TIME	3.80	3.80	3.80
HYDROGRAPH AT							
+	102	8.45	1	FLOW	2291.	1827.	1427.
				TIME	3.80	3.80	3.80
2 COMBINED AT							
+	.	14.65	1	FLOW	4472.	3598.	2840.
				TIME	3.80	3.80	3.80
ROUTED TO							
+	101	14.65	1	FLOW	4291.	3449.	2718.
				TIME	3.90	3.90	3.90
ROUTED TO							
+	V	14.65	1	FLOW	3995.	3209.	2541.
				TIME	4.10	4.20	4.20
HYDROGRAPH AT							
+	101	9.08	1	FLOW	661.	498.	364.
				TIME	5.70	5.70	5.80
3 COMBINED AT							
+	NLVIN	60.65	1	FLOW	5575.	4502.	3576.
				TIME	5.40	5.40	5.40
DIVERSION TO							
+	DIVDIKE	60.65	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	.	60.65	1	FLOW	5575.	4502.	3576.
				TIME	5.40	5.40	5.40
ROUTED TO							
+	NLVDET	60.65	1	FLOW	2048.	1797.	1561.
				TIME	8.60	8.40	8.20
			** PEAK STAGES IN FEET **				
			1	STAGE	20.03	16.12	12.87
				TIME	8.60	8.40	8.20
HYDROGRAPH AT							
+	.	0.00	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
2 COMBINED AT							
	.	60.65	1	FLOW	2048.	1797.	1561.
				TIME	8.60	8.40	8.20
ROUTED TO							
+	303	60.65	1	FLOW	2044.	1793.	1557.
				TIME	9.90	9.70	9.50
DIVERSION TO							
+	RRCHANNL	60.65	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	RRBRIDGE	60.65	1	FLOW	2044.	1793.	1557.
				TIME	9.90	9.70	9.50
DIVERSION TO							
+	KCHAR	60.65	1	FLOW	1635.	1434.	1245.
				TIME	9.90	9.70	9.50
HYDROGRAPH AT							
+	I15	60.65	1	FLOW	409.	359.	311.
				TIME	9.90	9.70	9.50
ROUTED TO							
+	NC1	60.65	1	FLOW	409.	359.	311.
				TIME	9.90	9.70	9.50
ROUTED TO							
+	V	60.65	1	FLOW	409.	359.	311.
				TIME	9.90	9.70	9.50
ROUTED TO							
+	NC2	60.65	1	FLOW	409.	359.	311.
				TIME	10.00	9.80	9.50
ROUTED TO							
+	NC3	60.65	1	FLOW	409.	359.	311.
				TIME	10.00	9.80	9.60
ROUTED TO							
+	NC4	60.65	1	FLOW	409.	359.	311.
				TIME	10.10	9.90	9.60
ROUTED TO							
+	NC5	60.65	1	FLOW	409.	359.	311.
				TIME	10.10	9.90	9.70
HYDROGRAPH AT							
	AP.1	0.00	1	FLOW	0.	0.	0.
				TIME	4.00	4.00	4.00
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.70	4.70	4.70

HYDROGRAPH AT							
+	AP.2	0.85	1	FLOW	354.	294.	240.
				TIME	3.70	3.70	3.70
2 COMBINED AT							
+	.	0.85	1	FLOW	354.	294.	241.
				TIME	3.70	3.70	3.70
ROUTED TO							
+	V	0.85	1	FLOW	279.	232.	190.
				TIME	4.80	4.80	4.90
HYDROGRAPH AT							
+	AP.3	3.62	1	FLOW	595.	502.	419.
				TIME	6.30	6.30	6.30
HYDROGRAPH AT							
+	AP.4	0.00	1	FLOW	0.	0.	0.
				TIME	4.40	4.50	4.50
3 COMBINED AT							
+	.	4.47	1	FLOW	760.	642.	537.
				TIME	6.10	6.10	6.10
HYDROGRAPH AT							
+	AP.5	0.00	1	FLOW	0.	0.	0.
				TIME	3.80	3.80	3.80
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.60	4.60	4.60
HYDROGRAPH AT							
+	AP.6	0.00	1	FLOW	0.	0.	0.
				TIME	4.10	4.20	4.20
2 COMBINED AT							
+	.	0.00	1	FLOW	1.	1.	0.
				TIME	4.50	4.50	4.50
ROUTED TO							
+	V	0.00	1	FLOW	1.	1.	0.
				TIME	5.20	5.20	5.20
HYDROGRAPH AT							
+	AP.7	1.02	1	FLOW	291.	239.	193.
				TIME	4.00	4.00	4.00
2 COMBINED AT							
+	N_CHN	1.02	1	FLOW	291.	239.	193.
				TIME	4.00	4.00	4.00
HYDROGRAPH AT							
+	GD.1	0.00	1	FLOW	0.	0.	0.
				TIME	4.00	4.00	4.00
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.30	4.30	4.30
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.50	4.50	4.60
HYDROGRAPH AT							
+	GD.2	0.00	1	FLOW	0.	0.	0.
				TIME	4.20	4.20	4.20
2 COMBINED AT							
+	.	0.00	1	FLOW	1.	1.	0.
				TIME	4.40	4.40	4.40
ROUTED TO							
+	TO_DIV	0.00	1	FLOW	1.	1.	0.
				TIME	4.80	4.80	4.80
HYDROGRAPH AT							
+	GD.3	0.80	1	FLOW	326.	270.	221.
				TIME	3.70	3.70	3.70
2 COMBINED AT							
+	HUALAPAI	0.80	1	FLOW	326.	270.	221.
				TIME	3.70	3.70	3.70
2 COMBINED AT							
+	HUA	1.82	1	FLOW	566.	466.	378.
				TIME	3.80	3.80	3.80
ROUTED TO							
+	V	1.82	1	FLOW	562.	461.	372.
				TIME	3.90	3.90	3.90
ROUTED TO							
+	V	1.82	1	FLOW	557.	456.	371.
				TIME	4.00	4.10	4.10
HYDROGRAPH AT							
+	AP.8	0.93	1	FLOW	309.	260.	215.
				TIME	4.00	4.00	4.00
2 COMBINED AT							
	BOX	2.75	1	FLOW	866.	713.	585.
				TIME	4.00	4.00	4.10
ROUTED TO							

	V	2.75	1	FLOW	861.	713.	580.
				TIME	4.10	4.10	4.10
HYDROGRAPH AT							
+	AP.9	0.68	1	FLOW	177.	148.	122.
				TIME	4.20	4.30	4.30
2 COMBINED AT							
+	N_CHAN	3.43	1	FLOW	1033.	856.	698.
				TIME	4.10	4.10	4.20
2 COMBINED AT							
+	ANGEL.PK	7.91	1	FLOW	1382.	1165.	970.
				TIME	5.30	5.30	5.30
ROUTED TO							
+	SPILLWAY	7.91	1	FLOW	67.	64.	62.
				TIME	10.40	10.30	10.10
			** PEAK STAGES IN FEET **				
			1	STAGE	2612.01	2610.66	2609.36
				TIME	10.50	10.30	10.10
ROUTED TO							
+	AP_TO_VE	7.91	1	FLOW	67.	64.	62.
				TIME	10.50	10.30	10.10
ROUTED TO							
+	BUFFALO_	7.91	1	FLOW	67.	64.	62.
				TIME	10.50	10.40	10.20
HYDROGRAPH AT							
+	GD.7	1.13	1	FLOW	225.	188.	157.
				TIME	5.00	5.10	5.20
2 COMBINED AT							
+	BUFFALO_	9.04	1	FLOW	281.	244.	210.
				TIME	5.10	5.20	5.30
ROUTED TO							
+	BUFFALO_	9.04	1	FLOW	281.	244.	210.
				TIME	5.30	5.40	5.50
HYDROGRAPH AT							
+	GD.4	0.00	1	FLOW	0.	0.	0.
				TIME	4.00	4.00	4.00
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.80	4.80	4.80
HYDROGRAPH AT							
+	GD.5	3.31	1	FLOW	604.	500.	409.
				TIME	5.20	5.30	5.30
2 COMBINED AT							
+	.	3.31	1	FLOW	604.	500.	409.
				TIME	5.20	5.30	5.30
ROUTED TO							
+	V	3.31	1	FLOW	600.	496.	406.
				TIME	5.60	5.70	5.70
HYDROGRAPH AT							
+	GD.6	1.60	1	FLOW	316.	258.	207.
				TIME	4.40	4.40	4.50
2 COMBINED AT							
+	.	4.91	1	FLOW	858.	709.	580.
				TIME	5.40	5.50	5.50
ROUTED TO							
+	V	4.91	1	FLOW	857.	709.	579.
				TIME	5.50	5.50	5.50
HYDROGRAPH AT							
+	GD.8	1.53	1	FLOW	233.	188.	148.
				TIME	4.70	4.70	4.80
2 COMBINED AT							
+	.	6.44	1	FLOW	1074.	886.	724.
				TIME	5.40	5.50	5.50
HYDROGRAPH AT							
+	GD.34	3.84	1	FLOW	468.	378.	300.
				TIME	5.70	5.80	5.80
3 COMBINED AT							
+	GOWAN_SO	19.32	1	FLOW	1811.	1498.	1224.
				TIME	5.50	5.50	5.60
ROUTED TO							
+	DET.GS	19.32	1	FLOW	413.	385.	361.
				TIME	7.90	7.90	7.70
			** PEAK STAGES IN FEET **				
			1	STAGE	2346.39	2344.29	2342.52
				TIME	7.90	7.90	7.70
ROUTED TO							
+	R.GSOUT	19.32	1	FLOW	413.	385.	361.
				TIME	8.00	7.90	7.80
HYDROGRAPH AT							
+	GD.9	0.00	1	FLOW	1.	0.	0.
				TIME	3.70	3.70	3.70

ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.20	4.20	4.20
HYDROGRAPH AT							
+	GD.10	0.00	1	FLOW	0.	0.	0.
				TIME	4.30	4.30	4.30
2 COMBINED AT							
+	.	0.00	1	FLOW	1.	1.	0.
				TIME	4.20	4.20	4.20
ROUTED TO							
+	V	0.00	1	FLOW	1.	1.	0.
				TIME	4.90	4.90	4.90
ROUTED TO							
+	V	0.00	1	FLOW	1.	0.	0.
				TIME	5.60	5.60	5.60
HYDROGRAPH AT							
+	GD.11	3.17	1	FLOW	374.	306.	246.
				TIME	6.40	6.40	6.50
2 COMBINED AT							
+	.	3.17	1	FLOW	375.	306.	246.
				TIME	6.40	6.40	6.50
HYDROGRAPH AT							
+	GD.33	0.00	1	FLOW	0.	0.	0.
				TIME	7.20	7.20	7.10
DIVERSION TO							
+	CULVERTS	0.00	1	FLOW	0.	0.	0.
				TIME	7.20	7.20	7.10
HYDROGRAPH AT							
+	RANCHO	0.00	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.32C	0.37	1	FLOW	147.	122.	99.
				TIME	3.70	3.70	3.70
2 COMBINED AT							
+	.	0.37	1	FLOW	147.	122.	99.
				TIME	3.70	3.70	3.70
DIVERSION TO							
+	CULVERTS	0.37	1	FLOW	147.	122.	99.
				TIME	3.70	3.70	3.70
HYDROGRAPH AT							
+	RANCHO	0.37	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	0.37	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.30	0.00	1	FLOW	0.	0.	0.
				TIME	6.60	6.60	6.60
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	7.70	7.90	7.90
HYDROGRAPH AT							
+	GD.31B	0.67	1	FLOW	102.	80.	61.
				TIME	4.50	4.50	4.50
3 COMBINED AT							
+	.	1.03	1	FLOW	102.	80.	61.
				TIME	4.50	4.50	4.50
DIVERSION TO							
+	CULVERTS	1.03	1	FLOW	102.	80.	61.
				TIME	4.50	4.50	4.50
HYDROGRAPH AT							
+	RANCHO	1.03	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	1.03	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.28	0.00	1	FLOW	0.	0.	0.
				TIME	6.50	6.50	6.70
2 COMBINED AT							
+	.	1.03	1	FLOW	0.	0.	0.
				TIME	6.50	6.50	6.70
DIVERSION TO							
+	CENTNIAL	1.03	1	FLOW	0.	0.	0.
				TIME	6.50	6.50	6.70
HYDROGRAPH AT							

	RANCHO	1.03	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	1.03	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.25	0.00	1	FLOW	0.	0.	0.
				TIME	4.50	4.50	4.50
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	5.30	5.30	5.30
HYDROGRAPH AT							
+	GD.26	0.00	1	FLOW	0.	0.	0.
				TIME	5.20	5.40	5.50
2 COMBINED AT							
+	.	0.00	1	FLOW	0.	0.	0.
				TIME	5.30	5.30	5.30
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	5.70	5.80	5.80
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	6.20	6.30	6.30
HYDROGRAPH AT							
+	GD.27	1.13	1	FLOW	105.	81.	61.
				TIME	5.70	5.80	5.80
3 COMBINED AT							
+	.	2.16	1	FLOW	105.	81.	61.
				TIME	5.70	5.80	5.80
ROUTED TO							
+	V	2.16	1	FLOW	105.	81.	61.
				TIME	5.80	5.90	5.90
ROUTED TO							
+	V	2.16	1	FLOW	105.	81.	61.
				TIME	5.90	6.00	6.10
HYDROGRAPH AT							
+	GD.29	0.76	1	FLOW	67.	52.	39.
				TIME	5.60	5.70	5.70
ROUTED TO							
	V	0.76	1	FLOW	67.	52.	38.
				TIME	5.90	6.00	6.10
HYDROGRAPH AT							
+	PDGC	0.53	1	FLOW	55.	43.	33.
				TIME	5.30	5.40	5.50
3 COMBINED AT							
+	.	3.45	1	FLOW	222.	171.	128.
				TIME	5.80	5.90	6.00
DIVERSION TO							
+	P.DESERT	3.45	1	FLOW	222.	171.	128.
				TIME	5.80	5.90	6.00
HYDROGRAPH AT							
+	RANCHO	3.45	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	3.45	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.21	0.00	1	FLOW	0.	0.	0.
				TIME	4.10	4.10	4.10
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.90	5.00	5.00
HYDROGRAPH AT							
+	GD.22	0.00	1	FLOW	0.	0.	0.
				TIME	5.40	5.30	5.30
HYDROGRAPH AT							
+	GD.23	0.00	1	FLOW	0.	0.	0.
				TIME	5.20	5.30	5.30
3 COMBINED AT							
+	.	0.00	1	FLOW	1.	1.	0.
				TIME	5.00	5.00	5.00
ROUTED TO							
+	V	0.00	1	FLOW	1.	1.	0.
				TIME	5.70	5.70	5.70
HYDROGRAPH AT							
+	GD.24	0.64	1	FLOW	60.	47.	35.
				TIME	5.50	5.50	5.60
2 COMBINED AT							
+	.	0.64	1	FLOW	61.	47.	36.
				TIME	5.50	5.50	5.60

ROUTED TO							
+	V	0.64	1	FLOW	60.	47.	35.
				TIME	6.00	6.10	6.20
HYDROGRAPH AT							
+	GD.18	0.00	1	FLOW	1.	0.	0.
				TIME	3.70	3.70	3.70
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.30	4.30	4.30
HYDROGRAPH AT							
+	GD.19	0.00	1	FLOW	0.	0.	0.
				TIME	5.10	5.10	5.30
2 COMBINED AT							
+	.	0.00	1	FLOW	1.	0.	0.
				TIME	4.30	4.40	4.40
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	5.30	5.30	5.30
HYDROGRAPH AT							
+	GD.20	2.35	1	FLOW	199.	157.	122.
				TIME	6.50	6.60	6.60
4 COMBINED AT							
+	.	6.45	1	FLOW	256.	202.	155.
				TIME	6.40	6.40	6.50
DIVERSION TO							
+	CRAIG	6.45	1	FLOW	256.	202.	155.
				TIME	6.40	6.40	6.50
HYDROGRAPH AT							
+	HWY.95	6.45	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	6.45	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.15	0.00	1	FLOW	0.	0.	0.
				TIME	3.90	3.90	3.90
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.60	4.60	4.60
HYDROGRAPH AT							
+	GD.16	0.00	1	FLOW	0.	0.	0.
				TIME	5.50	5.50	5.60
2 COMBINED AT							
+	.	0.00	1	FLOW	0.	0.	0.
				TIME	4.70	4.70	4.70
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	5.80	5.80	5.80
HYDROGRAPH AT							
+	GD.17	0.56	1	FLOW	60.	48.	37.
				TIME	6.10	6.10	6.10
3 COMBINED AT							
+	.	7.01	1	FLOW	61.	48.	37.
				TIME	6.00	6.10	6.10
DIVERSION TO							
+	ALEXANDR	7.01	1	FLOW	61.	48.	37.
				TIME	6.00	6.10	6.10
HYDROGRAPH AT							
+	HWY95	7.01	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
ROUTED TO							
+	V	7.01	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	GD.12	0.00	1	FLOW	1.	0.	0.
				TIME	3.70	3.70	3.70
ROUTED TO							
+	V	0.00	1	FLOW	0.	0.	0.
				TIME	4.10	4.10	4.10
HYDROGRAPH AT							
+	GD.13	0.00	1	FLOW	0.	0.	0.
				TIME	4.60	4.60	4.60
2 COMBINED AT							
+	.	0.00	1	FLOW	1.	1.	0.
				TIME	4.20	4.20	4.20
ROUTED TO							
	V	0.00	1	FLOW	1.	0.	0.
				TIME	4.60	4.60	4.60
ROUTED TO							

	V	0.00	1	FLOW	1.	0.	0.
				TIME	5.70	5.70	5.70
HYDROGRAPH AT							
+	GD.14A	1.71	1	FLOW	246.	191.	144.
				TIME	4.40	4.40	4.40
2 COMBINED AT							
+	.	1.71	1	FLOW	247.	191.	144.
				TIME	4.40	4.40	4.40
ROUTED TO							
+	V	1.71	1	FLOW	236.	183.	140.
				TIME	5.00	5.00	5.80
HYDROGRAPH AT							
+	GD.14B	0.68	1	FLOW	79.	63.	50.
				TIME	5.70	5.70	5.80
3 COMBINED AT							
+	.	9.40	1	FLOW	304.	239.	190.
				TIME	5.00	5.70	5.80
3 COMBINED AT							
+	GN_IN	31.90	1	FLOW	1022.	881.	759.
				TIME	6.00	6.10	6.10
ROUTED TO							
+	DET.GN	31.90	1	FLOW	329.	309.	290.
				TIME	17.40	15.30	13.40
			** PEAK STAGES IN FEET **				
			1	STAGE	2316.91	2316.16	2315.47
				TIME	17.30	15.30	13.30
ROUTED TO							
+	R.G-UPS.	31.90	1	FLOW	329.	309.	290.
				TIME	17.40	15.30	13.40
ROUTED TO							
+	V	31.90	1	FLOW	329.	309.	290.
				TIME	19.90	15.40	13.40
HYDROGRAPH AT							
+	.	0.00	1	FLOW	256.	202.	155.
				TIME	6.40	6.40	6.50
ROUTED TO							
+	V	0.00	1	FLOW	254.	200.	154.
				TIME	6.80	6.80	6.90
HYDROGRAPH AT							
+	.	0.00	1	FLOW	61.	48.	37.
				TIME	6.00	6.10	6.10
ROUTED TO							
+	V	0.00	1	FLOW	59.	47.	36.
				TIME	7.00	7.00	7.00
3 COMBINED AT							
+	.	31.90	1	FLOW	593.	516.	450.
				TIME	7.00	7.00	7.00
ROUTED TO							
+	V	31.90	1	FLOW	593.	515.	450.
				TIME	7.00	7.10	7.10
ROUTED TO							
+	V	31.90	1	FLOW	593.	515.	449.
				TIME	7.00	7.10	7.10
ROUTED TO							
+	V	31.90	1	FLOW	593.	515.	449.
				TIME	7.10	7.10	7.20
HYDROGRAPH AT							
+	.	0.00	1	FLOW	0.	0.	0.
				TIME	6.50	6.50	6.70
ROUTED TO							
+	.	0.00	1	FLOW	0.	0.	0.
				TIME	8.50	8.50	8.70
HYDROGRAPH AT							
+	EPT.1	3.76	1	FLOW	316.	256.	204.
				TIME	7.30	7.30	7.40
2 COMBINED AT							
+	.	3.76	1	FLOW	316.	256.	204.
				TIME	7.30	7.30	7.40
ROUTED TO							
+	V	3.76	1	FLOW	313.	254.	202.
				TIME	8.00	8.10	8.10
HYDROGRAPH AT							
+	.	0.00	1	FLOW	222.	171.	128.
				TIME	5.80	5.90	6.00
ROUTED TO							
+	V	0.00	1	FLOW	211.	162.	121.
				TIME	7.80	7.90	8.00
HYDROGRAPH AT							
+	EPT.3	4.39	1	FLOW	420.	348.	284.
				TIME	7.50	7.50	7.50

3 COMBINED AT							
+	.	8.15	1	FLOW	936.	756.	602.
				TIME	7.80	7.80	7.90
HYDROGRAPH AT							
+	EPT.4	1.37	1	FLOW	176.	147.	122.
				TIME	6.50	6.60	6.60
ROUTED TO							
+	V	1.37	1	FLOW	174.	145.	120.
				TIME	7.40	7.50	7.50
2 COMBINED AT							
+	.	9.52	1	FLOW	1106.	898.	719.
				TIME	7.70	7.80	7.80
2 COMBINED AT							
+	.	41.42	1	FLOW	1674.	1394.	1153.
				TIME	7.50	7.60	7.70
HYDROGRAPH AT							
+	EPT.5	3.01	1	FLOW	218.	179.	145.
				TIME	8.50	8.60	8.60
2 COMBINED AT							
+	.	44.42	1	FLOW	1875.	1559.	1287.
				TIME	7.60	7.70	7.70
ROUTED TO							
+	V	44.42	1	FLOW	1874.	1559.	1287.
				TIME	7.70	7.70	7.80
HYDROGRAPH AT							
+	EPT.2	1.49	1	FLOW	156.	126.	101.
				TIME	6.50	6.50	6.50
2 COMBINED AT							
+	LVWASH	45.92	1	FLOW	1993.	1654.	1362.
				TIME	7.60	7.60	7.70
HYDROGRAPH AT							
+	GOWANDIV	0.00	1	FLOW	0.	0.	0.
				TIME	7.20	7.20	7.10
ROUTED TO							
+	301	0.00	1	FLOW	0.	0.	0.
				TIME	9.40	9.30	9.30
HYDROGRAPH AT							
	301	18.62	1	FLOW	1563.	1278.	1029.
				TIME	8.10	8.20	8.20
2 COMBINED AT							
+	WTRIBUS	18.62	1	FLOW	1564.	1278.	1029.
				TIME	8.10	8.20	8.20
2 COMBINED AT							
+	WTRIBTOT	64.53	1	FLOW	3520.	2903.	2371.
				TIME	7.80	7.80	7.90
ROUTED TO							
+	304	64.53	1	FLOW	3513.	2897.	2366.
				TIME	8.10	8.10	8.20
ROUTED TO							
+	SNIC	64.53	1	FLOW	3513.	2897.	2366.
				TIME	8.10	8.10	8.20
ROUTED TO							
+	LBC	64.53	1	FLOW	3512.	2896.	2364.
				TIME	8.10	8.20	8.20
HYDROGRAPH AT							
+	310W	0.80	1	FLOW	172.	129.	95.
				TIME	4.20	4.40	4.60
ROUTED TO							
+	R310W	0.80	1	FLOW	169.	125.	94.
				TIME	4.50	4.80	5.00
HYDROGRAPH AT							
+	310E	1.24	1	FLOW	205.	148.	113.
				TIME	4.30	4.50	5.20
2 COMBINED AT							
+	310E	2.04	1	FLOW	356.	260.	204.
				TIME	4.50	4.80	5.10
ROUTED TO							
+	R310E	2.04	1	FLOW	354.	259.	204.
				TIME	4.60	4.90	5.20
HYDROGRAPH AT							
+	311W	0.96	1	FLOW	165.	120.	88.
				TIME	4.20	4.30	5.20
2 COMBINED AT							
+	311W	3.00	1	FLOW	483.	361.	292.
				TIME	4.60	4.90	5.20
ROUTED TO							
	R311W	3.00	1	FLOW	475.	360.	291.
				TIME	4.70	5.10	5.40
HYDROGRAPH AT							

	311E	0.77	1	FLOW	51.	35.	21.
				TIME	5.50	5.80	6.20
2 COMBINED AT							
+	311E	3.77	1	FLOW	487.	378.	296.
				TIME	4.80	5.40	5.40
HYDROGRAPH AT							
+	309W	0.81	1	FLOW	30.	17.	8.
				TIME	6.10	6.70	7.60
ROUTED TO							
+	R309W	0.81	1	FLOW	30.	17.	8.
				TIME	7.60	8.50	10.10
HYDROGRAPH AT							
+	309E	1.19	1	FLOW	155.	124.	96.
				TIME	5.10	5.30	5.50
2 COMBINED AT							
+	309E	2.00	1	FLOW	155.	124.	96.
				TIME	5.10	5.30	5.50
2 COMBINED AT							
+	.	5.77	1	FLOW	636.	502.	391.
				TIME	4.80	5.40	5.50
ROUTED TO							
+	FCP1	5.77	1	FLOW	635.	502.	391.
				TIME	4.80	5.40	5.50
ROUTED TO							
+	FCP2	5.77	1	FLOW	634.	502.	391.
				TIME	4.80	5.40	5.50
ROUTED TO							
+	FCBC1	5.77	1	FLOW	633.	502.	391.
				TIME	4.80	5.40	5.50
ROUTED TO							
+	FC1	5.77	1	FLOW	631.	502.	391.
				TIME	4.80	5.40	5.50
ROUTED TO							
+	FCBC2/FC	5.77	1	FLOW	630.	501.	391.
				TIME	4.80	5.40	5.50
HYDROGRAPH AT							
+	307NW	1.33	1	FLOW	272.	201.	146.
				TIME	4.20	4.40	4.60
ROUTED TO							
+	R307NW	1.33	1	FLOW	270.	200.	146.
				TIME	4.30	4.50	4.70
HYDROGRAPH AT							
+	307NE	0.64	1	FLOW	134.	100.	73.
				TIME	4.20	4.40	4.60
2 COMBINED AT							
+	307NE	1.97	1	FLOW	402.	299.	218.
				TIME	4.30	4.40	4.70
2 COMBINED AT							
+	.	7.74	1	FLOW	930.	751.	594.
				TIME	4.80	5.30	5.40
ROUTED TO							
+	V	7.74	1	FLOW	918.	741.	580.
				TIME	5.50	5.70	5.80
HYDROGRAPH AT							
+	307SW	1.10	1	FLOW	9.	3.	1.
				TIME	7.80	9.60	13.70
ROUTED TO							
+	R307SW	1.10	1	FLOW	9.	3.	1.
				TIME	8.60	10.90	16.10
HYDROGRAPH AT							
+	307SE	1.58	1	FLOW	312.	235.	169.
				TIME	4.30	4.40	4.60
2 COMBINED AT							
+	307SE	2.68	1	FLOW	312.	235.	169.
				TIME	4.30	4.40	4.60
2 COMBINED AT							
+	.	10.42	1	FLOW	1150.	910.	709.
				TIME	5.30	5.60	5.70
ROUTED TO							
+	V	10.42	1	FLOW	1143.	905.	703.
				TIME	5.50	5.70	5.90
HYDROGRAPH AT							
+	308W	0.81	1	FLOW	30.	17.	8.
				TIME	6.10	6.70	7.60
ROUTED TO							
+	R308W	0.81	1	FLOW	30.	17.	8.
				TIME	6.50	7.20	8.30
HYDROGRAPH AT							
+	308E	0.72	1	FLOW	144.	107.	77.
				TIME	4.20	4.40	4.60

2 COMBINED AT							
+	308E	1.53	1	FLOW	144.	107.	77.
				TIME	4.20	4.40	4.60
2 COMBINED AT							
+	.	11.95	1	FLOW	1242.	976.	756.
				TIME	5.40	5.70	5.90
ROUTED TO							
+	R307/308	11.95	1	FLOW	1241.	974.	755.
				TIME	5.50	5.80	6.00
HYDROGRAPH AT							
+	312W	0.77	1	FLOW	83.	66.	48.
				TIME	5.20	5.30	5.50
2 COMBINED AT							
+	312W	12.72	1	FLOW	1319.	1031.	796.
				TIME	5.50	5.70	6.00
ROUTED TO							
+	R312W	12.72	1	FLOW	1317.	1031.	795.
				TIME	5.50	5.80	6.00
HYDROGRAPH AT							
+	312E	0.70	1	FLOW	63.	47.	32.
				TIME	5.30	5.40	5.60
2 COMBINED AT							
+	312E	13.42	1	FLOW	1377.	1072.	824.
				TIME	5.50	5.80	6.00
HYDROGRAPH AT							
+	306	5.07	1	FLOW	412.	330.	260.
				TIME	7.00	7.00	7.10
3 COMBINED AT							
+	.	83.02	1	FLOW	4256.	3532.	2891.
				TIME	7.60	7.70	7.70
ROUTED TO							
+	FC3	83.02	1	FLOW	4256.	3532.	2890.
				TIME	7.60	7.70	7.70
ROUTED TO							
+	FC4/FC5	83.02	1	FLOW	4256.	3532.	2890.
				TIME	7.70	7.70	7.70
ROUTED TO							
+	FC6	83.02	1	FLOW	4255.	3530.	2890.
				TIME	7.70	7.70	7.80
ROUTED TO							
+	FC7	83.02	1	FLOW	4254.	3530.	2889.
				TIME	7.70	7.80	7.80
ROUTED TO							
+	FCBC4/FC	83.02	1	FLOW	4253.	3529.	2888.
				TIME	7.80	7.80	7.90
HYDROGRAPH AT							
+	302	12.11	1	FLOW	1109.	904.	726.
				TIME	7.00	7.00	7.10
ROUTED TO							
+	303	12.11	1	FLOW	1098.	895.	719.
				TIME	7.90	7.90	7.90
HYDROGRAPH AT							
+	303	10.22	1	FLOW	629.	503.	395.
				TIME	8.10	8.20	8.20
2 COMBINED AT							
+	.	22.33	1	FLOW	1722.	1394.	1111.
				TIME	7.90	8.00	8.00
HYDROGRAPH AT							
+	304	2.90	1	FLOW	359.	294.	237.
				TIME	5.90	6.00	6.00
HYDROGRAPH AT							
+	305	3.30	1	FLOW	495.	408.	333.
				TIME	5.40	5.40	5.50
2 COMBINED AT							
+	.	6.20	1	FLOW	837.	687.	557.
				TIME	5.60	5.60	5.70
HYDROGRAPH AT							
+	RRBRIDGE	0.00	1	FLOW	0.	0.	0.
				TIME	0.10	0.10	0.10
HYDROGRAPH AT							
+	DUMMY_AR	0.00	1	FLOW	0.	0.	0.
				TIME	4.50	4.50	5.30
2 COMBINED AT							
+	DUMMY_CO	0.00	1	FLOW	0.	0.	0.
				TIME	4.50	4.50	5.30
ROUTED TO							
+	RRCHANNL	0.00	1	FLOW	0.	0.	0.
				TIME	7.70	8.00	9.20
HYDROGRAPH AT							

	I-15	0.00	1	FLOW	1635.	1434.	1245.
				TIME	9.90	9.70	9.50
HYDROGRAPH AT							
+	DUMMY_AR	0.00	1	FLOW	0.	0.	0.
				TIME	4.50	4.50	5.30
2 COMBINED AT							
+	DUMMY_CO	0.00	1	FLOW	1635.	1434.	1245.
				TIME	9.90	9.70	9.50
5 COMBINED AT							
+	ACHANNL	111.56	1	FLOW	7735.	6470.	5326.
				TIME	7.80	7.80	7.90
ROUTED TO							
+	AC1/AC2	111.56	1	FLOW	7734.	6469.	5326.
				TIME	7.80	7.80	7.90
ROUTED TO							
+	AC3	111.56	1	FLOW	7734.	6468.	5325.
				TIME	7.80	7.80	7.90
ROUTED TO							
+	AC4	111.56	1	FLOW	7733.	6467.	5324.
				TIME	7.80	7.90	7.90
2 COMBINED AT							
+	NCHANNL	172.20	1	FLOW	8100.	6797.	5610.
				TIME	7.80	7.90	8.00

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SUMMARY OF KINEMATIC WAVE - MUSKINGUM-CUNGE ROUTING
(FLOW IS DIRECT RUNOFF WITHOUT BASE FLOW)

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	INTERPOLATED TO COMPUTATION INTERVAL DT	PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= 1.06									
NC1	MANE	0.37	408.85	594.70	0.11	6.00	408.84	594.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3435E+03 EXCESS=0.0000E+00 OUTFLOW=0.3433E+03 BASIN STORAGE=0.1099E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95									
NC1	MANE	0.44	358.60	582.57	0.08	6.00	358.59	582.00	0.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2726E+03 EXCESS=0.0000E+00 OUTFLOW=0.2726E+03 BASIN STORAGE=0.6440E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85									
NC1	MANE	0.44	311.34	569.94	0.07	6.00	311.34	570.00	0.07

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2106E+03 EXCESS=0.0000E+00 OUTFLOW=0.2106E+03 BASIN STORAGE=0.5238E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06									
V	MANE	1.34	408.83	596.13	0.11	6.00	408.80	594.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3433E+03 EXCESS=0.0000E+00 OUTFLOW=0.3428E+03 BASIN STORAGE=0.6045E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95									
V	MANE	1.32	358.59	584.22	0.08	6.00	358.57	582.00	0.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2726E+03 EXCESS=0.0000E+00 OUTFLOW=0.2723E+03 BASIN STORAGE=0.3681E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85									
V	MANE	1.36	311.34	572.22	0.07	6.00	311.33	570.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2106E+03 EXCESS=0.0000E+00 OUTFLOW=0.2102E+03 BASIN STORAGE=0.2993E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06									
NC2	MANE	0.94	408.80	595.89	0.11	6.00	408.80	600.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3427E+03 EXCESS=0.0000E+00 OUTFLOW=0.3424E+03 BASIN STORAGE=0.3421E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95									
NC2	MANE	0.84	358.57	583.71	0.08	6.00	358.55	588.00	0.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2722E+03 EXCESS=0.0000E+00 OUTFLOW=0.2719E+03 BASIN STORAGE=0.2048E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85									
NC2	MANE	0.88	311.32	572.16	0.06	6.00	311.30	570.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2102E+03 EXCESS=0.0000E+00 OUTFLOW=0.2101E+03 BASIN STORAGE=0.1600E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06									
NC3	MANE	2.51	408.79	604.64	0.11	6.00	408.77	600.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3423E+03 EXCESS=0.0000E+00 OUTFLOW=0.3414E+03 BASIN STORAGE=0.1116E+01 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.95

NC3	MANE	2.62	358.54	592.61	0.08	6.00	358.53	588.00	0.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2719E+03 EXCESS=0.0000E+00 OUTFLOW=0.2713E+03 BASIN STORAGE=0.6817E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

NC3	MANE	2.74	311.30	575.47	0.06	6.00	311.29	576.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2100E+03 EXCESS=0.0000E+00 OUTFLOW=0.2096E+03 BASIN STORAGE=0.5193E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

NC4	MANE	0.77	408.77	601.60	0.11	6.00	408.77	606.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3410E+03 EXCESS=0.0000E+00 OUTFLOW=0.3407E+03 BASIN STORAGE=0.3218E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

NC4	MANE	0.78	358.53	589.61	0.08	6.00	358.52	594.00	0.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2712E+03 EXCESS=0.0000E+00 OUTFLOW=0.2709E+03 BASIN STORAGE=0.1975E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

NC4	MANE	0.72	311.29	577.93	0.06	6.00	311.26	576.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2095E+03 EXCESS=0.0000E+00 OUTFLOW=0.2093E+03 BASIN STORAGE=0.1466E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

NC5	MANE	0.50	408.76	606.32	0.11	6.00	408.76	606.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3407E+03 EXCESS=0.0000E+00 OUTFLOW=0.3405E+03 BASIN STORAGE=0.1802E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

NC5	MANE	0.54	358.52	594.18	0.08	6.00	358.52	594.00	0.08

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2709E+03 EXCESS=0.0000E+00 OUTFLOW=0.2708E+03 BASIN STORAGE=0.1106E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

NC5	MANE	0.48	311.26	577.23	0.06	6.00	311.25	582.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2093E+03 EXCESS=0.0000E+00 OUTFLOW=0.2092E+03 BASIN STORAGE=0.8155E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

V	MANE	3.48	565.06	235.24	0.89	6.00	561.86	234.00	0.89

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8612E+02 EXCESS=0.0000E+00 OUTFLOW=0.8633E+02 BASIN STORAGE=0.7206E-02 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 0.95

V	MANE	3.74	465.14	235.82	0.73	6.00	460.81	234.00	0.73

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7078E+02 EXCESS=0.0000E+00 OUTFLOW=0.7095E+02 BASIN STORAGE=0.6199E-02 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 0.85

V	MANE	4.03	375.82	235.23	0.59	6.00	372.10	234.00	0.59

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5747E+02 EXCESS=0.0000E+00 OUTFLOW=0.5766E+02 BASIN STORAGE=0.7762E-02 PERCENT ERROR= -0.3

FOR PLAN = 1 RATIO= 1.06

V	MANE	3.53	557.46	240.14	0.89	6.00	556.84	240.00	0.89

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8633E+02 EXCESS=0.0000E+00 OUTFLOW=0.8641E+02 BASIN STORAGE=0.8356E-02 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.95

V	MANE	3.78	460.26	241.49	0.73	6.00	455.96	246.00	0.73

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7095E+02 EXCESS=0.0000E+00 OUTFLOW=0.7101E+02 BASIN STORAGE=0.8245E-02 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.85

V	MANE	3.98	371.76	245.74	0.59	6.00	371.45	246.00	0.59

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5766E+02 EXCESS=0.0000E+00 OUTFLOW=0.5774E+02 BASIN STORAGE=0.8090E-02 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 1.06

V	MANE	1.55	864.34	244.19	0.94	6.00	861.39	246.00	0.94

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1380E+03 EXCESS=0.0000E+00 OUTFLOW=0.1381E+03 BASIN STORAGE=0.1196E-01 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.95

V	MANE	1.79	712.74	244.38	0.78	6.00	712.64	246.00	0.78

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1141E+03 EXCESS=0.0000E+00 OUTFLOW=0.1141E+03 BASIN STORAGE=0.1204E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

V	MANE	1.92	583.52	249.23	0.64	6.00	580.13	246.00	0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9339E+02 EXCESS=0.0000E+00 OUTFLOW=0.9340E+02 BASIN STORAGE=0.1120E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

AP_TO_VE	MANE	1.79	66.74	632.85	0.23	6.00	66.74	636.00	0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9552E+02 EXCESS=0.0000E+00 OUTFLOW=0.9526E+02 BASIN STORAGE=0.3113E+00 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.95

AP_TO_VE	MANE	1.68	64.38	622.51	0.22	6.00	64.38	624.00	0.22

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9210E+02 EXCESS=0.0000E+00 OUTFLOW=0.9176E+02 BASIN STORAGE=0.3188E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

AP_TO_VE	MANE	1.81	62.01	609.91	0.21	6.00	62.01	612.00	0.21

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8856E+02 EXCESS=0.0000E+00 OUTFLOW=0.8828E+02 BASIN STORAGE=0.2928E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

BUFFALO_	MANE	1.34	66.74	637.76	0.22	6.00	66.74	636.00	0.22

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9513E+02 EXCESS=0.0000E+00 OUTFLOW=0.9481E+02 BASIN STORAGE=0.2981E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

BUFFALO_	MANE	1.34	64.38	626.84	0.22	6.00	64.38	624.00	0.22

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9173E+02 EXCESS=0.0000E+00 OUTFLOW=0.9144E+02 BASIN STORAGE=0.2923E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

BUFFALO_	MANE	1.34	62.01	614.25	0.21	6.00	62.01	612.00	0.21

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8820E+02 EXCESS=0.0000E+00 OUTFLOW=0.8799E+02 BASIN STORAGE=0.2865E+00 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 1.06

BUFFALO_	MANE	4.02	281.30	315.96	0.31	6.00	281.26	318.00	0.31

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1522E+03 EXCESS=0.0000E+00 OUTFLOW=0.1509E+03 BASIN STORAGE=0.1645E+01 PERCENT ERROR= -0.2

FOR PLAN = 1 RATIO= 0.95

BUFFALO_	MANE	4.11	243.64	320.29	0.29	6.00	243.61	324.00	0.29

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1392E+03 EXCESS=0.0000E+00 OUTFLOW=0.1377E+03 BASIN STORAGE=0.1601E+01 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 0.85

BUFFALO_	MANE	4.42	209.86	329.05	0.26	6.00	209.78	330.00	0.26

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1272E+03 EXCESS=0.0000E+00 OUTFLOW=0.1259E+03 BASIN STORAGE=0.1455E+01 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 1.06

V	MANE	1.35	857.68	327.02	0.83	6.00	856.85	330.00	0.83

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2184E+03 EXCESS=0.0000E+00 OUTFLOW=0.2184E+03 BASIN STORAGE=0.2821E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

V	MANE	1.32	709.43	332.16	0.68	6.00	709.40	330.00	0.68

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1787E+03 EXCESS=0.0000E+00 OUTFLOW=0.1787E+03 BASIN STORAGE=0.2405E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

V	MANE	1.47	579.99	332.23	0.55	6.00	579.47	330.00	0.55

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1444E+03 EXCESS=0.0000E+00 OUTFLOW=0.1444E+03 BASIN STORAGE=0.2612E-03 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

R.GSOUT	MANE	1.00	412.54	479.97	0.46	6.00	412.54	480.00	0.46

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4762E+03 EXCESS=0.0000E+00 OUTFLOW=0.4754E+03 BASIN STORAGE=0.7008E+00 PERCENT ERROR= 0.0

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          FOR PLAN = 1  RATIO= 0.95
           R.GSOUT  MANE          1.02    384.80    474.78      0.41      6.00    384.80    474.00        0.41

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4197E+03 EXCESS=0.0000E+00 OUTFLOW=0.4192E+03 BASIN STORAGE=0.5230E+00 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.85
           R.GSOUT  MANE          1.01    361.33    464.52      0.35      6.00    361.33    468.00        0.35

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3625E+03 EXCESS=0.0000E+00 OUTFLOW=0.3620E+03 BASIN STORAGE=0.4237E+00 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
                 V  MANE          2.98    105.08    348.96      0.23      6.00    105.02    348.00        0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2622E+02 EXCESS=0.0000E+00 OUTFLOW=0.2622E+02 BASIN STORAGE=0.1064E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.95
                 V  MANE          3.24     81.14    353.49      0.17      6.00     81.11    354.00        0.17

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2002E+02 EXCESS=0.0000E+00 OUTFLOW=0.2002E+02 BASIN STORAGE=0.1075E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.85
                 V  MANE          3.59     61.14    356.78      0.13      6.00     61.07    354.00        0.13

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1491E+02 EXCESS=0.0000E+00 OUTFLOW=0.1491E+02 BASIN STORAGE=0.1025E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
                 V  MANE          3.58    104.97    356.01      0.23      6.00    104.82    354.00        0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2622E+02 EXCESS=0.0000E+00 OUTFLOW=0.2622E+02 BASIN STORAGE=0.1099E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.95
                 V  MANE          3.87     81.03    360.13      0.17      6.00     81.03    360.00        0.17

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2003E+02 EXCESS=0.0000E+00 OUTFLOW=0.2003E+02 BASIN STORAGE=0.1222E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.85
                 V  MANE          4.18     61.06    362.97      0.13      6.00     61.04    366.00        0.13

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1491E+02 EXCESS=0.0000E+00 OUTFLOW=0.1491E+02 BASIN STORAGE=0.1235E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
                 V  MANE          6.00     67.38    359.35      0.40      6.00     67.37    354.00        0.40

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1620E+02 EXCESS=0.0000E+00 OUTFLOW=0.1621E+02 BASIN STORAGE=0.1127E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.95
                 V  MANE          6.00     51.55    357.99      0.30      6.00     51.53    360.00        0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1224E+02 EXCESS=0.0000E+00 OUTFLOW=0.1225E+02 BASIN STORAGE=0.1147E-02 PERCENT ERROR=   -0.1

          FOR PLAN = 1  RATIO= 0.85
                 V  MANE          5.77     38.47    369.09      0.22      6.00     38.44    366.00        0.22

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8994E+01 EXCESS=0.0000E+00 OUTFLOW=0.8996E+01 BASIN STORAGE=0.1031E-02 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
           R.G-UPS.  MANE          0.75    328.91   1045.76      0.24      6.00    328.91   1050.00        0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4010E+03 EXCESS=0.0000E+00 OUTFLOW=0.4003E+03 BASIN STORAGE=0.6315E+00 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.95
           R.G-UPS.  MANE          0.75    308.77    919.48      0.22      6.00    308.77    918.00        0.22

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3745E+03 EXCESS=0.0000E+00 OUTFLOW=0.3738E+03 BASIN STORAGE=0.5978E+00 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.85
           R.G-UPS.  MANE          0.76    290.37    805.18      0.21      6.00    290.37    804.00        0.20

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3492E+03 EXCESS=0.0000E+00 OUTFLOW=0.3487E+03 BASIN STORAGE=0.5589E+00 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
                 V  MANE          1.61    332.10   1194.83      0.23      6.00    328.98   1194.00        0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4002E+03 EXCESS=0.0000E+00 OUTFLOW=0.3983E+03 BASIN STORAGE=0.2225E+01 PERCENT ERROR=   -0.1
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          FOR PLAN = 1  RATIO= 0.95
                V  MANE          1.69    308.77    921.72      0.22      6.00    308.77    924.00        0.22

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3738E+03 EXCESS=0.0000E+00 OUTFLOW=0.3723E+03 BASIN STORAGE=0.2096E+01 PERCENT ERROR=  -0.2

          FOR PLAN = 1  RATIO= 0.85
                V  MANE          1.71    290.37    806.34      0.20      6.00    290.37    804.00        0.20

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3485E+03 EXCESS=0.0000E+00 OUTFLOW=0.3468E+03 BASIN STORAGE=0.2003E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 1.06
                V  MANE          1.69    593.09    420.49      0.29      6.00    593.09    420.00        0.29

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4945E+03 EXCESS=0.0000E+00 OUTFLOW=0.4920E+03 BASIN STORAGE=0.2968E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 0.95
                V  MANE          1.66    515.58    423.77      0.26      6.00    515.31    426.00        0.26

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4470E+03 EXCESS=0.0000E+00 OUTFLOW=0.4448E+03 BASIN STORAGE=0.2809E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 0.85
                V  MANE          1.72    449.62    423.95      0.24      6.00    449.61    426.00        0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4042E+03 EXCESS=0.0000E+00 OUTFLOW=0.4017E+03 BASIN STORAGE=0.2662E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 1.06
                V  MANE          0.91    593.02    421.33      0.29      6.00    592.83    420.00        0.29

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4915E+03 EXCESS=0.0000E+00 OUTFLOW=0.4901E+03 BASIN STORAGE=0.1563E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.95
                V  MANE          1.02    515.30    425.92      0.26      6.00    515.30    426.00        0.26

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4442E+03 EXCESS=0.0000E+00 OUTFLOW=0.4430E+03 BASIN STORAGE=0.1480E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 0.85
                V  MANE          1.04    449.56    428.50      0.24      6.00    449.42    426.00        0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4016E+03 EXCESS=0.0000E+00 OUTFLOW=0.4005E+03 BASIN STORAGE=0.1405E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 1.06
                V  MANE          0.98    592.79    422.48      0.29      6.00    592.60    426.00        0.29

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4900E+03 EXCESS=0.0000E+00 OUTFLOW=0.4889E+03 BASIN STORAGE=0.1566E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 0.95
                V  MANE          0.99    515.25    427.21      0.26      6.00    515.18    426.00        0.26

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4428E+03 EXCESS=0.0000E+00 OUTFLOW=0.4413E+03 BASIN STORAGE=0.1482E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.85
                V  MANE          0.91    449.42    428.04      0.23      6.00    449.32    432.00        0.23

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4002E+03 EXCESS=0.0000E+00 OUTFLOW=0.3990E+03 BASIN STORAGE=0.1404E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 1.06
                V  MANE          1.01   1875.36    458.09      0.44      6.00   1874.32    462.00        0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1046E+04 EXCESS=0.0000E+00 OUTFLOW=0.1043E+04 BASIN STORAGE=0.2998E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.95
                V  MANE          1.12   1559.13    463.40      0.38      6.00   1558.97    462.00        0.38

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.8945E+03 EXCESS=0.0000E+00 OUTFLOW=0.8924E+03 BASIN STORAGE=0.2845E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 0.85
                V  MANE          1.28   1287.14    464.19      0.32      6.00   1286.83    468.00        0.32

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7622E+03 EXCESS=0.0000E+00 OUTFLOW=0.7601E+03 BASIN STORAGE=0.2685E+01 PERCENT ERROR=  -0.1

          FOR PLAN = 1  RATIO= 1.06
              SNIC  MANE          0.63   3512.94    487.03      0.55      6.00   3512.68    486.00        0.55

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1880E+04 EXCESS=0.0000E+00 OUTFLOW=0.1878E+04 BASIN STORAGE=0.1808E+01 PERCENT ERROR=   0.0
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          FOR PLAN = 1  RATIO= 0.95
              SNIC  MANE          0.66    2897.38     487.67       0.46       6.00    2896.50     486.00         0.46

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1572E+04 EXCESS=0.0000E+00 OUTFLOW=0.1570E+04 BASIN STORAGE=0.1693E+01 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.85
              SNIC  MANE          0.76    2365.71     493.23       0.38       6.00    2365.50     492.00         0.38

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1304E+04 EXCESS=0.0000E+00 OUTFLOW=0.1303E+04 BASIN STORAGE=0.1582E+01 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
               LBC  MANE          1.01    3512.40     487.52       0.54       6.00    3511.56     486.00         0.54

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1879E+04 EXCESS=0.0000E+00 OUTFLOW=0.1875E+04 BASIN STORAGE=0.3599E+01 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.95
               LBC  MANE          1.22    2896.46     488.82       0.46       6.00    2896.26     492.00         0.46

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1570E+04 EXCESS=0.0000E+00 OUTFLOW=0.1567E+04 BASIN STORAGE=0.3384E+01 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 0.85
               LBC  MANE          1.26    2365.33     494.70       0.38       6.00    2364.50     492.00         0.38

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1303E+04 EXCESS=0.0000E+00 OUTFLOW=0.1300E+04 BASIN STORAGE=0.3176E+01 PERCENT ERROR=    0.0

          FOR PLAN = 1  RATIO= 1.06
              310W  MANE          5.94     148.70     260.63       0.64       6.00     147.96     258.00         0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2768E+02 OUTFLOW=0.2718E+02 BASIN STORAGE=0.1537E+00 PERCENT ERROR=    1.3

          FOR PLAN = 1  RATIO= 1.06
              310W  MANE          5.70     174.39     253.92       0.71       6.00     171.81     252.00         0.71

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3081E+02 OUTFLOW=0.3032E+02 BASIN STORAGE=0.1527E+00 PERCENT ERROR=    1.1

          FOR PLAN = 1  RATIO= 0.95
              310W  MANE          6.00     129.01     260.11       0.58       6.00     128.62     264.00         0.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2514E+02 OUTFLOW=0.2466E+02 BASIN STORAGE=0.1607E+00 PERCENT ERROR=    1.3

          FOR PLAN = 1  RATIO= 0.85
              310W  MANE          5.59      95.31     275.19       0.46       6.00      94.99     276.00         0.46

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2025E+02 OUTFLOW=0.1980E+02 BASIN STORAGE=0.1654E+00 PERCENT ERROR=    1.4

          FOR PLAN = 1  RATIO= 1.06
             R310W  MANE          5.75     171.16     271.50       0.71       6.00     168.82     270.00         0.71

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3028E+02 EXCESS=0.0000E+00 OUTFLOW=0.3047E+02 BASIN STORAGE=0.1820E+00 PERCENT ERROR=   -1.2

          FOR PLAN = 1  RATIO= 0.95
             R310W  MANE          6.00     127.17     285.27       0.57       6.00     124.76     288.00         0.57

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2464E+02 EXCESS=0.0000E+00 OUTFLOW=0.2449E+02 BASIN STORAGE=0.1756E+00 PERCENT ERROR=   -0.1

          FOR PLAN = 1  RATIO= 0.85
             R310W  MANE          5.82      94.60     295.90       0.47       6.00      94.06     300.00         0.47

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1980E+02 EXCESS=0.0000E+00 OUTFLOW=0.2003E+02 BASIN STORAGE=0.1824E+00 PERCENT ERROR=   -2.1

          FOR PLAN = 1  RATIO= 1.06
              310E  MANE          5.28     174.02     263.95       0.52       6.00     173.97     264.00         0.52

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3515E+02 OUTFLOW=0.3452E+02 BASIN STORAGE=0.2076E+00 PERCENT ERROR=    1.2

          FOR PLAN = 1  RATIO= 1.06
              310E  MANE          6.29     205.07     254.21       0.59       6.00     205.02     258.00         0.59

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3952E+02 OUTFLOW=0.3887E+02 BASIN STORAGE=0.1776E+00 PERCENT ERROR=    1.2

          FOR PLAN = 1  RATIO= 0.95
              310E  MANE          5.61     147.73     269.85       0.47       6.00     147.63     270.00         0.47

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3163E+02 OUTFLOW=0.3101E+02 BASIN STORAGE=0.2099E+00 PERCENT ERROR=    1.3

          FOR PLAN = 1  RATIO= 0.85
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310E	MANE	6.00	113.70	314.93	0.37	6.00	113.36	312.00	0.37

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2491E+02 OUTFLOW=0.2434E+02 BASIN STORAGE=0.2074E+00 PERCENT ERROR= 1.4

FOR PLAN = 1 RATIO= 1.06

R310E	MANE	3.07	354.32	275.93	0.64	6.00	354.21	276.00	0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6929E+02 EXCESS=0.0000E+00 OUTFLOW=0.6908E+02 BASIN STORAGE=0.1423E+00 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.95

R310E	MANE	3.37	259.85	295.07	0.51	6.00	258.99	294.00	0.51

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.5548E+02 EXCESS=0.0000E+00 OUTFLOW=0.5531E+02 BASIN STORAGE=0.1358E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

R310E	MANE	3.70	204.09	312.03	0.41	6.00	204.09	312.00	0.41

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4434E+02 EXCESS=0.0000E+00 OUTFLOW=0.4417E+02 BASIN STORAGE=0.1364E+00 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 1.06

311W	MANE	3.87	139.84	256.28	0.51	6.00	138.81	258.00	0.51

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2679E+02 OUTFLOW=0.2635E+02 BASIN STORAGE=0.1283E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 1.06

311W	MANE	3.64	165.70	250.86	0.58	6.00	165.26	252.00	0.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3015E+02 OUTFLOW=0.2970E+02 BASIN STORAGE=0.1218E+00 PERCENT ERROR= 1.1

FOR PLAN = 1 RATIO= 0.95

311W	MANE	4.11	119.52	257.33	0.46	6.00	119.52	258.00	0.46

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2408E+02 OUTFLOW=0.2367E+02 BASIN STORAGE=0.1236E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 0.85

311W	MANE	4.71	88.23	313.09	0.36	6.00	88.10	312.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1892E+02 OUTFLOW=0.1853E+02 BASIN STORAGE=0.1236E+00 PERCENT ERROR= 1.4

FOR PLAN = 1 RATIO= 1.06

R311W	MANE	3.75	478.05	285.17	0.62	6.00	474.86	282.00	0.62

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9885E+02 EXCESS=0.0000E+00 OUTFLOW=0.9849E+02 BASIN STORAGE=0.2496E+00 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.95

R311W	MANE	4.18	360.06	304.62	0.49	6.00	359.63	306.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.7896E+02 EXCESS=0.0000E+00 OUTFLOW=0.7866E+02 BASIN STORAGE=0.2474E+00 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.85

R311W	MANE	4.63	291.79	322.46	0.39	6.00	291.33	324.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6269E+02 EXCESS=0.0000E+00 OUTFLOW=0.6244E+02 BASIN STORAGE=0.2437E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

311E	MANE	5.50	42.24	339.06	0.20	6.00	42.15	336.00	0.20

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.8698E+01 OUTFLOW=0.8411E+01 BASIN STORAGE=0.1319E+00 PERCENT ERROR= 1.8

FOR PLAN = 1 RATIO= 1.06

311E	MANE	6.00	51.46	331.45	0.24	6.00	51.34	330.00	0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1034E+02 OUTFLOW=0.1003E+02 BASIN STORAGE=0.1243E+00 PERCENT ERROR= 1.8

FOR PLAN = 1 RATIO= 0.95

311E	MANE	5.96	35.14	346.37	0.17	6.00	34.98	348.00	0.17

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.7413E+01 OUTFLOW=0.7150E+01 BASIN STORAGE=0.1274E+00 PERCENT ERROR= 1.8

FOR PLAN = 1 RATIO= 0.85

311E	MANE	6.00	21.61	368.74	0.12	6.00	21.47	372.00	0.12

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.5095E+01 OUTFLOW=0.4858E+01 BASIN STORAGE=0.1257E+00 PERCENT ERROR= 2.2

FOR PLAN = 1 RATIO= 1.06

309W	MANE	5.90	22.64	384.32	0.12	6.00	22.62	384.00	0.12

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.5639E+01 OUTFLOW=0.5349E+01 BASIN STORAGE=0.1648E+00 PERCENT ERROR= 2.2

FOR PLAN = 1 RATIO= 1.06

309W	MANE	5.95	30.35	366.98	0.15	6.00	30.26	366.00	0.15

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.6969E+01 OUTFLOW=0.6651E+01 BASIN STORAGE=0.1689E+00 PERCENT ERROR= 2.1

FOR PLAN = 1 RATIO= 0.95

309W	MANE	5.80	17.04	402.23	0.10	6.00	17.03	402.00	0.10

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4621E+01 OUTFLOW=0.4342E+01 BASIN STORAGE=0.1618E+00 PERCENT ERROR= 2.5

FOR PLAN = 1 RATIO= 0.85

309W	MANE	6.00	8.21	455.90	0.06	6.00	8.21	456.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2853E+01 OUTFLOW=0.2592E+01 BASIN STORAGE=0.1650E+00 PERCENT ERROR= 3.4

FOR PLAN = 1 RATIO= 1.06

R309W	MANE	6.00	30.15	455.84	0.17	6.00	30.13	456.00	0.17

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6646E+01 EXCESS=0.0000E+00 OUTFLOW=0.7351E+01 BASIN STORAGE=0.5630E+00 PERCENT ERROR= -19.1

FOR PLAN = 1 RATIO= 0.95

R309W	MANE	6.00	16.92	514.39	0.11	6.00	16.88	510.00	0.11

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4332E+01 EXCESS=0.0000E+00 OUTFLOW=0.4879E+01 BASIN STORAGE=0.5540E+00 PERCENT ERROR= -25.4

FOR PLAN = 1 RATIO= 0.85

R309W	MANE	6.00	8.17	606.06	0.06	6.00	8.17	606.00	0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2584E+01 EXCESS=0.0000E+00 OUTFLOW=0.2722E+01 BASIN STORAGE=0.5666E+00 PERCENT ERROR= -27.2

FOR PLAN = 1 RATIO= 1.06

309E	MANE	6.00	138.51	314.78	0.50	6.00	138.45	312.00	0.50

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3261E+02 OUTFLOW=0.3180E+02 BASIN STORAGE=0.4115E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 1.06

309E	MANE	6.00	155.36	308.43	0.56	6.00	155.32	306.00	0.56

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3668E+02 OUTFLOW=0.3583E+02 BASIN STORAGE=0.4399E+00 PERCENT ERROR= 1.1

FOR PLAN = 1 RATIO= 0.95

309E	MANE	6.00	124.60	316.82	0.45	6.00	124.50	318.00	0.45

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2932E+02 OUTFLOW=0.2852E+02 BASIN STORAGE=0.4342E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 0.85

309E	MANE	6.00	95.78	328.15	0.35	6.00	95.73	330.00	0.35

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2307E+02 OUTFLOW=0.2235E+02 BASIN STORAGE=0.4099E+00 PERCENT ERROR= 1.4

FOR PLAN = 1 RATIO= 1.06

FCP1	MANE	0.21	635.52	288.38	0.49	6.00	635.01	288.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1516E+03 EXCESS=0.0000E+00 OUTFLOW=0.1516E+03 BASIN STORAGE=0.4616E-02 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FCP1	MANE	0.21	502.01	324.23	0.39	6.00	501.96	324.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1191E+03 EXCESS=0.0000E+00 OUTFLOW=0.1191E+03 BASIN STORAGE=0.4563E-02 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FCP1	MANE	0.21	391.20	330.09	0.30	6.00	391.19	330.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9225E+02 EXCESS=0.0000E+00 OUTFLOW=0.9224E+02 BASIN STORAGE=0.4510E-02 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FCP2	MANE	0.36	634.69	288.58	0.49	6.00	633.60	288.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1516E+03 EXCESS=0.0000E+00 OUTFLOW=0.1516E+03 BASIN STORAGE=0.8037E-02 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FCP2	MANE	0.32	501.91	324.57	0.39	6.00	501.78	324.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1191E+03 EXCESS=0.0000E+00 OUTFLOW=0.1191E+03 BASIN STORAGE=0.7944E-02 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FCP2	MANE	0.43	391.11	330.51	0.30	6.00	391.08	330.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9225E+02 EXCESS=0.0000E+00 OUTFLOW=0.9224E+02 BASIN STORAGE=0.7859E-02 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FCBC1	MANE	0.23	633.42	288.55	0.49	6.00	632.61	288.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1516E+03 EXCESS=0.0000E+00 OUTFLOW=0.1516E+03 BASIN STORAGE=0.1831E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FCBC1	MANE	0.30	501.72	324.28	0.39	6.00	501.66	324.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1191E+03 EXCESS=0.0000E+00 OUTFLOW=0.1191E+03 BASIN STORAGE=0.1816E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FCBC1	MANE	0.19	391.05	330.28	0.30	6.00	390.98	330.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9226E+02 EXCESS=0.0000E+00 OUTFLOW=0.9224E+02 BASIN STORAGE=0.1799E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FC1	MANE	0.31	632.44	288.57	0.49	6.00	631.43	288.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1516E+03 EXCESS=0.0000E+00 OUTFLOW=0.1516E+03 BASIN STORAGE=0.1975E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FC1	MANE	0.29	501.60	324.46	0.39	6.00	501.53	324.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1191E+03 EXCESS=0.0000E+00 OUTFLOW=0.1191E+03 BASIN STORAGE=0.1958E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FC1	MANE	0.21	390.95	330.44	0.30	6.00	390.84	330.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9226E+02 EXCESS=0.0000E+00 OUTFLOW=0.9223E+02 BASIN STORAGE=0.1943E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FCBC2/FC	MANE	0.27	631.31	288.73	0.49	6.00	630.16	288.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1517E+03 EXCESS=0.0000E+00 OUTFLOW=0.1516E+03 BASIN STORAGE=0.1891E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FCBC2/FC	MANE	0.32	501.47	324.39	0.39	6.00	501.39	324.00	0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1192E+03 EXCESS=0.0000E+00 OUTFLOW=0.1191E+03 BASIN STORAGE=0.1873E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FCBC2/FC	MANE	0.22	390.78	330.29	0.30	6.00	390.68	330.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.9226E+02 EXCESS=0.0000E+00 OUTFLOW=0.9223E+02 BASIN STORAGE=0.1859E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

307NW	MANE	4.04	232.72	257.22	0.61	6.00	232.09	258.00	0.61

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4392E+02 OUTFLOW=0.4318E+02 BASIN STORAGE=0.2276E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 1.06

307NW	MANE	3.83	272.05	251.40	0.68	6.00	271.79	252.00	0.68

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4899E+02 OUTFLOW=0.4824E+02 BASIN STORAGE=0.2273E+00 PERCENT ERROR= 1.1

FOR PLAN = 1 RATIO= 0.95

307NW	MANE	4.23	202.53	262.82	0.55	6.00	201.37	264.00	0.55

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3980E+02 OUTFLOW=0.3912E+02 BASIN STORAGE=0.2137E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 0.85

307NW	MANE	4.81	146.02	270.47	0.44	6.00	145.66	276.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3189E+02 OUTFLOW=0.3121E+02 BASIN STORAGE=0.2248E+00 PERCENT ERROR= 1.4

FOR PLAN = 1 RATIO= 1.06

R307NW	MANE	2.66	269.92	256.48	0.68	6.00	269.81	258.00	0.68

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4826E+02 EXCESS=0.0000E+00 OUTFLOW=0.4809E+02 BASIN STORAGE=0.7468E-01 PERCENT ERROR= 0.2

FOR PLAN = 1 RATIO= 0.95

R307NW	MANE	2.94	201.30	268.45	0.55	6.00	200.28	270.00	0.55

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3908E+02 EXCESS=0.0000E+00 OUTFLOW=0.3896E+02 BASIN STORAGE=0.7315E-01 PERCENT ERROR= 0.1

FOR PLAN = 1 RATIO= 0.85

R307NW	MANE	3.39	145.64	279.69	0.44	6.00	145.55	282.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3120E+02 EXCESS=0.0000E+00 OUTFLOW=0.3111E+02 BASIN STORAGE=0.7527E-01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

307NE	MANE	3.33	115.50	257.68	0.64	6.00	115.42	258.00	0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2215E+02 OUTFLOW=0.2177E+02 BASIN STORAGE=0.1199E+00 PERCENT ERROR= 1.1

FOR PLAN = 1 RATIO= 1.06

307NE	MANE	3.24	134.35	254.63	0.71	6.00	134.27	252.00	0.71

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2465E+02 OUTFLOW=0.2427E+02 BASIN STORAGE=0.1182E+00 PERCENT ERROR= 1.0

FOR PLAN = 1 RATIO= 0.95

307NE	MANE	3.50	100.43	263.17	0.58	6.00	100.17	264.00	0.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2011E+02 OUTFLOW=0.1976E+02 BASIN STORAGE=0.1192E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 0.85

307NE	MANE	3.95	73.34	271.72	0.46	6.00	73.17	276.00	0.46

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1620E+02 OUTFLOW=0.1584E+02 BASIN STORAGE=0.1174E+00 PERCENT ERROR= 1.5

FOR PLAN = 1 RATIO= 1.06

307SW	MANE	6.00	5.33	515.28	0.04	6.00	5.33	516.00	0.04

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2491E+01 OUTFLOW=0.2148E+01 BASIN STORAGE=0.2070E+00 PERCENT ERROR= 5.5

FOR PLAN = 1 RATIO= 1.06

307SW	MANE	5.53	9.18	468.60	0.05	6.00	9.17	468.00	0.05

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3486E+01 OUTFLOW=0.3127E+01 BASIN STORAGE=0.2125E+00 PERCENT ERROR= 4.2

FOR PLAN = 1 RATIO= 0.95

307SW	MANE	5.90	3.08	577.78	0.02	6.00	3.08	576.00	0.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1781E+01 OUTFLOW=0.1448E+01 BASIN STORAGE=0.2032E+00 PERCENT ERROR= 7.3

FOR PLAN = 1 RATIO= 0.85

307SW	MANE	5.95	0.68	823.08	0.01	6.00	0.68	822.00	0.01

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.7071E+00 OUTFLOW=0.3969E+00 BASIN STORAGE=0.1963E+00 PERCENT ERROR= 16.1

FOR PLAN = 1 RATIO= 1.06

R307SW	MANE	6.00	9.17	516.90	0.05	6.00	9.16	516.00	0.05

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3123E+01 EXCESS=0.0000E+00 OUTFLOW=0.2935E+01 BASIN STORAGE=0.1820E+00 PERCENT ERROR= 0.2

FOR PLAN = 1 RATIO= 0.95

R307SW	MANE	6.00	3.08	655.40	0.02	6.00	3.07	654.00	0.02

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1443E+01 EXCESS=0.0000E+00 OUTFLOW=0.1266E+01 BASIN STORAGE=0.1841E+00 PERCENT ERROR= -0.5

FOR PLAN = 1 RATIO= 0.85

R307SW	MANE	6.00	0.68	973.72	0.00	6.00	0.68	972.00	0.00

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3963E+00 EXCESS=0.0000E+00 OUTFLOW=0.2282E+00 BASIN STORAGE=0.1770E+00 PERCENT ERROR= -2.3

FOR PLAN = 1 RATIO= 1.06

307SE	MANE	4.32	268.90	258.33	0.60	6.00	268.20	258.00	0.60

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.5155E+02 OUTFLOW=0.5063E+02 BASIN STORAGE=0.2951E+00 PERCENT ERROR= 1.2

FOR PLAN = 1 RATIO= 1.06

307SE	MANE	4.07	314.78	256.60	0.67	6.00	312.31	258.00	0.67

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.5754E+02 OUTFLOW=0.5660E+02 BASIN STORAGE=0.2981E+00 PERCENT ERROR= 1.1

```
          FOR PLAN = 1  RATIO= 0.95
             307SE  MANE          4.66    235.05    263.94      0.54      6.00    235.01    264.00        0.54

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4669E+02 OUTFLOW=0.4583E+02 BASIN STORAGE=0.2817E+00 PERCENT ERROR=   1.2

          FOR PLAN = 1  RATIO= 0.85
             307SE  MANE          5.29    169.18    276.50      0.43      6.00    168.87    276.00        0.43

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.3736E+02 OUTFLOW=0.3650E+02 BASIN STORAGE=0.2999E+00 PERCENT ERROR=   1.5

          FOR PLAN = 1  RATIO= 1.06
              308W  MANE          6.00     22.21    385.17      0.12      6.00     22.16    384.00        0.12

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.5616E+01 OUTFLOW=0.5315E+01 BASIN STORAGE=0.1688E+00 PERCENT ERROR=   2.4

          FOR PLAN = 1  RATIO= 1.06
              308W  MANE          6.00     29.67    367.58      0.15      6.00     29.53    366.00        0.15

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.6944E+01 OUTFLOW=0.6616E+01 BASIN STORAGE=0.1717E+00 PERCENT ERROR=   2.2

          FOR PLAN = 1  RATIO= 0.95
              308W  MANE          5.97     16.65    403.34      0.10      6.00     16.62    402.00        0.10

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.4601E+01 OUTFLOW=0.4320E+01 BASIN STORAGE=0.1636E+00 PERCENT ERROR=   2.6

          FOR PLAN = 1  RATIO= 0.85
              308W  MANE          6.00      7.97    457.44      0.06      6.00      7.97    456.00        0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2837E+01 OUTFLOW=0.2569E+01 BASIN STORAGE=0.1643E+00 PERCENT ERROR=   3.7

          FOR PLAN = 1  RATIO= 1.06
             R308W  MANE          5.87     29.52    390.00      0.15      6.00     29.52    390.00        0.15

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.6616E+01 EXCESS=0.0000E+00 OUTFLOW=0.6489E+01 BASIN STORAGE=0.1162E+00 PERCENT ERROR=   0.2

          FOR PLAN = 1  RATIO= 0.95
             R308W  MANE          6.00     16.61    433.08      0.10      6.00     16.53    432.00        0.10

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4309E+01 EXCESS=0.0000E+00 OUTFLOW=0.4182E+01 BASIN STORAGE=0.1180E+00 PERCENT ERROR=   0.2

          FOR PLAN = 1  RATIO= 0.85
             R308W  MANE          6.00      7.95    501.06      0.06      6.00      7.94    498.00        0.06

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2566E+01 EXCESS=0.0000E+00 OUTFLOW=0.2445E+01 BASIN STORAGE=0.1207E+00 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 1.06
              308E  MANE          4.97    124.60    256.26      0.58      6.00    124.01    258.00        0.58

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2281E+02 OUTFLOW=0.2242E+02 BASIN STORAGE=0.1245E+00 PERCENT ERROR=   1.2

          FOR PLAN = 1  RATIO= 1.06
              308E  MANE          4.63    144.34    250.59      0.65      6.00    144.19    252.00        0.65

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2550E+02 OUTFLOW=0.2510E+02 BASIN STORAGE=0.1202E+00 PERCENT ERROR=   1.1

          FOR PLAN = 1  RATIO= 0.95
              308E  MANE          5.24    107.88    261.65      0.53      6.00    106.79    264.00        0.53

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.2063E+02 OUTFLOW=0.2026E+02 BASIN STORAGE=0.1187E+00 PERCENT ERROR=   1.3

          FOR PLAN = 1  RATIO= 0.85
              308E  MANE          5.97     77.23    274.53      0.42      6.00     76.91    276.00        0.42

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1646E+02 OUTFLOW=0.1610E+02 BASIN STORAGE=0.1166E+00 PERCENT ERROR=   1.5

          FOR PLAN = 1  RATIO= 1.06
          R307/308  MANE          2.14   1241.63    328.39      0.49      6.00   1240.77    330.00        0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3149E+03 EXCESS=0.0000E+00 OUTFLOW=0.3142E+03 BASIN STORAGE=0.5224E+00 PERCENT ERROR=   0.1

          FOR PLAN = 1  RATIO= 0.95
          R307/308  MANE          2.32    975.40    346.04      0.39      6.00    974.25    348.00        0.39

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2491E+03 EXCESS=0.0000E+00 OUTFLOW=0.2485E+03 BASIN STORAGE=0.5040E+00 PERCENT ERROR=   0.0
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FOR PLAN = 1 RATIO= 0.85

R307/308	MANE	2.57	755.73	358.50	0.30	6.00	754.90	360.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1942E+03 EXCESS=0.0000E+00 OUTFLOW=0.1937E+03 BASIN STORAGE=0.4962E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

312W	MANE	5.78	73.39	318.46	0.36	6.00	73.36	318.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1537E+02 OUTFLOW=0.1495E+02 BASIN STORAGE=0.1484E+00 PERCENT ERROR= 1.8

FOR PLAN = 1 RATIO= 1.06

312W	MANE	5.41	83.66	314.47	0.42	6.00	83.36	312.00	0.42

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1762E+02 OUTFLOW=0.1721E+02 BASIN STORAGE=0.1430E+00 PERCENT ERROR= 1.6

FOR PLAN = 1 RATIO= 0.95

312W	MANE	6.00	65.88	322.34	0.32	6.00	65.63	318.00	0.32

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1357E+02 OUTFLOW=0.1320E+02 BASIN STORAGE=0.1372E+00 PERCENT ERROR= 1.7

FOR PLAN = 1 RATIO= 0.85

312W	MANE	5.26	48.38	329.47	0.24	6.00	48.36	330.00	0.24

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1021E+02 OUTFLOW=0.9868E+01 BASIN STORAGE=0.1466E+00 PERCENT ERROR= 1.9

FOR PLAN = 1 RATIO= 1.06

R312W	MANE	2.08	1318.81	333.46	0.49	6.00	1316.84	330.00	0.49

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3314E+03 EXCESS=0.0000E+00 OUTFLOW=0.3308E+03 BASIN STORAGE=0.5518E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

R312W	MANE	2.30	1031.08	347.06	0.38	6.00	1030.80	348.00	0.38

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2616E+03 EXCESS=0.0000E+00 OUTFLOW=0.2610E+03 BASIN STORAGE=0.5454E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

R312W	MANE	2.52	795.39	362.64	0.30	6.00	795.05	360.00	0.30

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2034E+03 EXCESS=0.0000E+00 OUTFLOW=0.2028E+03 BASIN STORAGE=0.5431E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

312E	MANE	5.01	54.52	322.70	0.29	6.00	54.42	318.00	0.29

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1099E+02 OUTFLOW=0.1072E+02 BASIN STORAGE=0.1012E+00 PERCENT ERROR= 1.6

FOR PLAN = 1 RATIO= 1.06

312E	MANE	6.00	63.19	317.91	0.33	6.00	63.18	318.00	0.33

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.1278E+02 OUTFLOW=0.1248E+02 BASIN STORAGE=0.1050E+00 PERCENT ERROR= 1.6

FOR PLAN = 1 RATIO= 0.95

312E	MANE	5.27	46.70	327.72	0.25	6.00	46.67	324.00	0.25

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.9573E+01 OUTFLOW=0.9311E+01 BASIN STORAGE=0.9888E-01 PERCENT ERROR= 1.7

FOR PLAN = 1 RATIO= 0.85

312E	MANE	6.00	32.30	335.77	0.18	6.00	32.29	336.00	0.18

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.0000E+00 EXCESS=0.6960E+01 OUTFLOW=0.6722E+01 BASIN STORAGE=0.1039E+00 PERCENT ERROR= 1.9

FOR PLAN = 1 RATIO= 1.06

FC3	MANE	0.33	4256.33	456.92	0.54	6.00	4255.81	456.00	0.54

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2374E+04 EXCESS=0.0000E+00 OUTFLOW=0.2374E+04 BASIN STORAGE=0.8051E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FC3	MANE	0.44	3531.80	462.48	0.44	6.00	3531.75	462.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1961E+04 EXCESS=0.0000E+00 OUTFLOW=0.1961E+04 BASIN STORAGE=0.7540E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FC3	MANE	0.35	2890.49	462.70	0.36	6.00	2890.12	462.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1606E+04 EXCESS=0.0000E+00 OUTFLOW=0.1606E+04 BASIN STORAGE=0.7039E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FC4/FC5	MANE	0.33	4255.80	456.64	0.54	6.00	4255.57	462.00	0.54

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2374E+04 EXCESS=0.0000E+00 OUTFLOW=0.2373E+04 BASIN STORAGE=0.6313E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FC4/FC5	MANE	0.25	3531.68	462.43	0.44	6.00	3531.61	462.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1961E+04 EXCESS=0.0000E+00 OUTFLOW=0.1960E+04 BASIN STORAGE=0.5931E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FC4/FC5	MANE	0.26	2890.10	462.62	0.36	6.00	2889.82	462.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1606E+04 EXCESS=0.0000E+00 OUTFLOW=0.1605E+04 BASIN STORAGE=0.5557E+00 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FC6	MANE	1.73	4255.49	463.12	0.53	6.00	4255.46	462.00	0.53

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2373E+04 EXCESS=0.0000E+00 OUTFLOW=0.2367E+04 BASIN STORAGE=0.5128E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FC6	MANE	1.74	3531.15	464.39	0.44	6.00	3530.20	462.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1960E+04 EXCESS=0.0000E+00 OUTFLOW=0.1956E+04 BASIN STORAGE=0.4803E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FC6	MANE	1.78	2889.78	466.26	0.36	6.00	2889.67	468.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1605E+04 EXCESS=0.0000E+00 OUTFLOW=0.1602E+04 BASIN STORAGE=0.4491E+01 PERCENT ERROR= -0.1

FOR PLAN = 1 RATIO= 1.06

FC7	MANE	0.86	4255.20	463.34	0.53	6.00	4254.44	462.00	0.53

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2367E+04 EXCESS=0.0000E+00 OUTFLOW=0.2365E+04 BASIN STORAGE=0.2585E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FC7	MANE	0.83	3530.18	463.95	0.44	6.00	3530.03	468.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1955E+04 EXCESS=0.0000E+00 OUTFLOW=0.1952E+04 BASIN STORAGE=0.2430E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FC7	MANE	0.92	2889.47	469.39	0.36	6.00	2888.91	468.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1600E+04 EXCESS=0.0000E+00 OUTFLOW=0.1598E+04 BASIN STORAGE=0.2273E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

FCBC4/FC	MANE	1.05	4254.29	463.95	0.53	6.00	4253.47	468.00	0.53

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2365E+04 EXCESS=0.0000E+00 OUTFLOW=0.2361E+04 BASIN STORAGE=0.3538E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.95

FCBC4/FC	MANE	1.15	3529.96	470.29	0.44	6.00	3529.49	468.00	0.44

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1952E+04 EXCESS=0.0000E+00 OUTFLOW=0.1949E+04 BASIN STORAGE=0.3320E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 0.85

FCBC4/FC	MANE	1.20	2888.80	471.04	0.36	6.00	2888.33	474.00	0.36

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.1598E+04 EXCESS=0.0000E+00 OUTFLOW=0.1594E+04 BASIN STORAGE=0.3112E+01 PERCENT ERROR= 0.0

FOR PLAN = 1 RATIO= 1.06

RRCHANNL	MANE	5.97	0.16	463.63	0.87	6.00	0.16	462.00	0.87

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3397E-01 EXCESS=0.0000E+00 OUTFLOW=0.4643E-01 BASIN STORAGE=0.2761E-02 PERCENT ERROR= -44.8

FOR PLAN = 1 RATIO= 0.95

RRCHANNL	MANE	5.97	0.12	484.09	0.71	6.00	0.12	486.00	0.71

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2680E-01 EXCESS=0.0000E+00 OUTFLOW=0.3782E-01 BASIN STORAGE=0.2665E-02 PERCENT ERROR= -51.1

FOR PLAN = 1 RATIO= 0.85

RRCHANNL	MANE	6.00	0.09	550.79	0.57	6.00	0.09	552.00	0.57

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.2076E-01 EXCESS=0.0000E+00 OUTFLOW=0.3018E-01 BASIN STORAGE=0.2656E-02 PERCENT ERROR= -58.2

FOR PLAN = 1 RATIO= 1.06

```
          AC1/AC2  MANE          0.62    7734.44     468.74       0.79       6.00    7734.33     468.00         0.79

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4713E+04 EXCESS=0.0000E+00 OUTFLOW=0.4709E+04 BASIN STORAGE=0.3515E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.95
          AC1/AC2  MANE          0.64    6469.86     469.13       0.64       6.00    6468.73     468.00         0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3828E+04 EXCESS=0.0000E+00 OUTFLOW=0.3825E+04 BASIN STORAGE=0.2868E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.85
          AC1/AC2  MANE          0.67    5326.02     475.43       0.51       6.00    5325.69     474.00         0.51

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3063E+04 EXCESS=0.0000E+00 OUTFLOW=0.3060E+04 BASIN STORAGE=0.2605E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 1.06
               AC3  MANE          0.44    7734.12     468.50       0.79       6.00    7733.87     468.00         0.79

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4709E+04 EXCESS=0.0000E+00 OUTFLOW=0.4706E+04 BASIN STORAGE=0.2607E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.95
               AC3  MANE          0.52    6468.60     469.24       0.64       6.00    6467.53     468.00         0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3825E+04 EXCESS=0.0000E+00 OUTFLOW=0.3823E+04 BASIN STORAGE=0.2143E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.85
               AC3  MANE          0.46    5325.53     474.67       0.51       6.00    5325.12     474.00         0.51

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3061E+04 EXCESS=0.0000E+00 OUTFLOW=0.3059E+04 BASIN STORAGE=0.1946E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 1.06
               AC4  MANE          0.54    7733.59     469.15       0.79       6.00    7733.10     468.00         0.79

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.4706E+04 EXCESS=0.0000E+00 OUTFLOW=0.4703E+04 BASIN STORAGE=0.3175E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.95
               AC4  MANE          0.51    6467.52     469.28       0.64       6.00    6467.33     474.00         0.64

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3823E+04 EXCESS=0.0000E+00 OUTFLOW=0.3820E+04 BASIN STORAGE=0.2612E+01 PERCENT ERROR=   0.0

          FOR PLAN = 1  RATIO= 0.85
               AC4  MANE          0.57    5325.02     475.24       0.51       6.00    5324.25     474.00         0.51

CONTINUITY SUMMARY (AC-FT) - INFLOW=0.3059E+04 EXCESS=0.0000E+00 OUTFLOW=0.3057E+04 BASIN STORAGE=0.2368E+01 PERCENT ERROR=   0.0


*** NORMAL END OF HEC-1 ***
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UPPER LAS VEGAS WASH CHANNEL DESIGN FLOW HYDROLOGY

VTN Nevada.

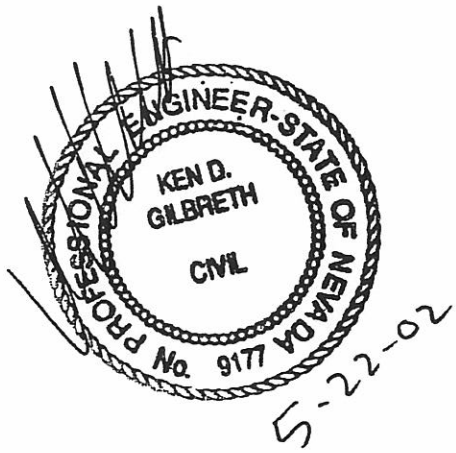
70% DESIGN REPORT
FOR THE
UPPER LAS VEGAS WASH CHANNEL

Submitted to:

CITY OF NORTH LAS VEGAS

DEPARTMENT OF PUBLIC WORKS

Prepared by:



vtn nevada

May 2002

3.0 HYDROLOGY

The *HEC-1 Flood Hydrograph Computer Model* was developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center in the late 1970's, and then adopted by the *CCRFCD Hydrologic Criteria and Drainage Design Manual* for rainfall and runoff predictions. The model is used to simulate the surface runoff response of a watershed to a design rainfall event. Each subbasin in the watershed is described by a set of parameters that specify the subbasin drainage and storm characteristics. These basin parameters include precipitation, area, curve number, and lag time.

3.1 Physical Characteristics of a Watershed

Several physical characteristics of a watershed are required for the SCS unit hydrograph method. The model created for this drainage study incorporates and/or modifies the characteristics established by the MPU study. This section describes the measurements of these parameters and drainage characteristics.

3.1.1 Basin Area

Based on flow patterns, the study area is divided into 71 subbasins to allow for the identification of runoff rates at specific locations (see Figure 2). For the SCS unit hydrograph method adopted by the CCRFCD, the basin area is one of the four SCS unit hydrograph parameters input to the HEC-1 computer model. The study area subbasin boundaries were developed utilizing USGS 7.5-minute topography, and from referencing hydrology studies of existing and proposed developments in the area.

As shown on the Drainage Basin Map, Figure 2, the watershed is bounded by Grand Teton Drive to the north, the Western Tributary to the south, Pecos Road to the east, and Decatur Boulevard to the west. The tributary area is approximately 13.6 square miles. Runoff variables such as curve number (CN), lag times, basin area and precipitation are summarized in Appendix C.

3.1.2 Basin Slope

The slope of the entire watershed is in an southeasterly direction. The runoff for this project's watershed is currently conveyed southeastward by existing washes and surface streets. Subbasin slope is an important drainage parameter that determines the speed with which flows collect in a downstream direction. When a subbasin has an area greater than 1.0 square mile, 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 square mile, both the overland flow time and channel flow time will be used to determine the lag time.

3.1.3 Lag Time

For the computation of the subbasin lag time, a Manning "n" coefficient of 0.016 was used for pavement and 0.015 was used for concrete lined channels. Lag times for each subbasin were calculated using the procedure outlined in *the CCRFCD Hydrologic Criteria and Drainage Design Manual*. The following equation would be used for drainage basins with areas greater than 1.0 square mile:

$$LagTime = 20 * K_n * \left[\frac{L * L_c}{\sqrt{(S)}}\right]^{\frac{1}{3}}$$

where:

K_n=Manning's "n"
L= Water course length in miles
L_C = Water course length to a point opposite the centroid, in miles
S= Slope in feet/mile

The following equations are used for drainage basins with areas less than 1.0 square mile:

$$LagTime = 0.6 * T_c$$

$$T_c = T_i + T_t$$

$$T_i = \frac{1.8 * (1.1K) * L_n^{\frac{1}{3}}}{S^{\frac{1}{3}}}$$

$$K = 0.0132 * CN0.39$$

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 foot maximum for rural areas, 300 foot maximum for urban areas)
K = Flow resistance coefficient
S = Average basin slope (percent)

3.1.4 Basin Centroid

The location of a subbasin centroid is the geometric center of the subbasin. If the subbasin has an area greater than 1.0 square mile, the length from the subbasin centroid to the outlet and the total length of the watercourse through the subbasin are used to calculate the lag time for the subbasin storm hydrograph. For a subbasin with an area less than 1.0 square mile, the time of concentration of the subbasin needs to be determined as the accumulated flow times of overland flow and channel flow along the water course. The lag time for such a subbasin is estimated at sixty percent of the time of concentration of the subbasin, according to the *CCRFCD Hydrologic Criteria and Drainage Design Manual*.

3.2 Geology and Soil

The project area is part of the northeast section of the Las Vegas Valley. For the purpose of this hydrologic analysis, infiltration losses are related to the SCS Soil Classifications. SCS soils fall into four hydrologic soil 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 has a low infiltration, such as for clay soil. The SCS Soil types within the offsite drainage area, and their corresponding hydrologic soil groups, were identified from the Soil Survey of Las Vegas Valley Area, Clark County, Nevada, and are shown in the following table:

TABLE 3.1
SOIL HYDROLOGIC CLASSIFICATION

SOIL MAP UNIT	SCS SOIL NAME	HYDROLOGIC SOIL GROUP
112	Arizo very gravelly loamy sand, flooded, 0 to 4 percent slopes	A
117	Arizo very gravelly fine sandy loam, 2 to 8 percent slopes	A
140	Casaga very gravelly sandy clay loam, 0 to 8 percent slopes	C
200	Glencarb silt loam	B
300	Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes	D
305	Las Vegas-Destazo complex, 0 to 2 percent slopes	D
540	Weiser extremely gravelly fine sandy loam, 2 to 8 percent slopes	B
542	Weiser-Aztec complex, 2 to 8 percent slopes	B
610	Pits, gravel	-
630	Badland	-

3.3 Land Use

The land use within the project area is a mixture of low density residential, commercial, and public facility sites. Zoning throughout the watershed consists of a combination of Residential (ranch estates (R-E), single family (R-1), and single family/compact lot (R-CL)), Planned Unit Development (PUD), Industrial (general (M-2) and business park (M-1)), Neighborhood Commercial (C-1), and some Unincorporated properties. Zoning along the proposed alignment is R-E, Residential Ranch Estates and M-2, General Industrial. All subbasins are assumed to be completely developed with full street improvements throughout the watershed.

3.4 Rainfall Analysis

3.4.1 Point Precipitation Values

Using the methods in the *CCRFCD Hydrologic Criteria and Drainage Design Manual*, the 100-year storm runoff hydrograph generated from the subbasin can be found using the 100-year six-hour rainfall values with local adjustment, given in the *Precipitation-Frequency Atlas of the Western United States, Volume 2* (NOAA 1973). The 100-year six-hour precipitation values can also be found in the *CCRFCD Hydrologic Criteria and Drainage Design Manual*. For this study, the point precipitation value for a subbasin was determined to be the value at the subbasin centroid.

3.4.2 Area Reduction

The point precipitation values are related to rainfall intensity at an isolated point. Since the rainfall occurs over an extensive area simultaneously, with the more intense rainfall occurring near the center of the storm, a reduction factor is used to adjust the point precipitation when modeling the rainfall decay characteristics over a large area. The rainfall Depth Area Reduction Factors (DARF) were developed by the National Oceanic and Atmospheric Administration (NOAA) for the purpose of converting a point precipitation depth to an average precipitation over the entire storm area. The DARF ratios used in this study were obtained from the *CCRFCD Hydrologic Criteria and Drainage Design Manual.*

3.4.3 Rainfall Pattern

The Percent of Total Depth tabulation recommended by the USACE, Los Angeles District in 1988, was adopted for rainfall/runoff predictions in the Las Vegas Valley. For those channels and design points where the tributary watershed is less than 8.0 square miles, the SDN3 distribution is used. The SDN5 distribution is used if the total area of the watershed exceeds 12 square miles and the SDN4 is for area between 8.0 and 12.0 square miles. The analysis performed by VTN incorporated all three of the storm distributions. See Appendix C for HEC-1 models used in this study.

3.4.4 Precipitation Losses

Major precipitation losses consist of infiltration losses determined by the soil type and depression losses caused by land uses. Infiltration losses occur throughout the storm event, while depression losses only occur during the initial period of the storm. The difference between the total precipitation volume and the loss volume is the direct runoff volume.

The SCS curve number method was developed to compute both types of precipitation losses. This method uses the curve number (CN) index to relate precipitation losses to soil type, land use, and vegetative cover conditions.

3.5 Unit Hydrograph and Storm Hydrograph

In this analysis, the SCS dimensionless unit hydrograph method provided by HEC-1 modeling was used to predict storm hydrographs. This unit hydrograph consists of a single parameter, the lag time, which is the period of time between the mass center of rainfall excess and the peak of the unit hydrographs. For each subbasin, the SCS method requires input variables of subbasin area in square miles, lag time in hours, the

SCS curve number, rainfall distribution, and precipitation values in inches.

3.5.1 Hydrograph Routing

Storm hydrographs generated from subbasins have to be conveyed downstream through a drainage network, which may consist of channels, detention basins, basin diversion, etc. Channel routing methods are numerical simulations of flood wave movements along a drainage network, and transform a hydrograph, adjusting for the travel time and channel storage volume. Channel routing accounts for the time required for the hydrograph to travel from one design point to another. It may transform a hydrograph due to attenuation of the hydrograph peak and storage of storm water runoff in the channel.

In this study, the kinematic wave routing procedures were used to model storm water movements in the channel reaches. The kinematic wave method of routing hydrographs adjusts for travel time but does not attenuate the peak flow. This method is recommended for flow modeling in uniform channels, such as pipes and improved channels. The parameters used for this method are the shape of the channel cross section, channel reach length, channel slope, and channel roughness.

3.6 Summary of HEC-1 Flood Hydrograph Program Input

To use the HEC-1 computer model, the drainage system in a watershed is converted into a node-link type of system. A node is placed at the subbasin outlet or at a design point along the water course. Links between nodes represent conveyance elements in the drainage system. Hydrographs are computed for each subbasin and are placed at the subbasin outlet node. These hydrographs are then routed and/or combined according to the drainage basin network configuration through links. The DARF is known at each design point and is used to determine the peak flow at the design point depending on the contributing area.

The HEC-1 output for the VTN model is included in Appendix C.

4.0 HYDROLOGIC ANALYSIS

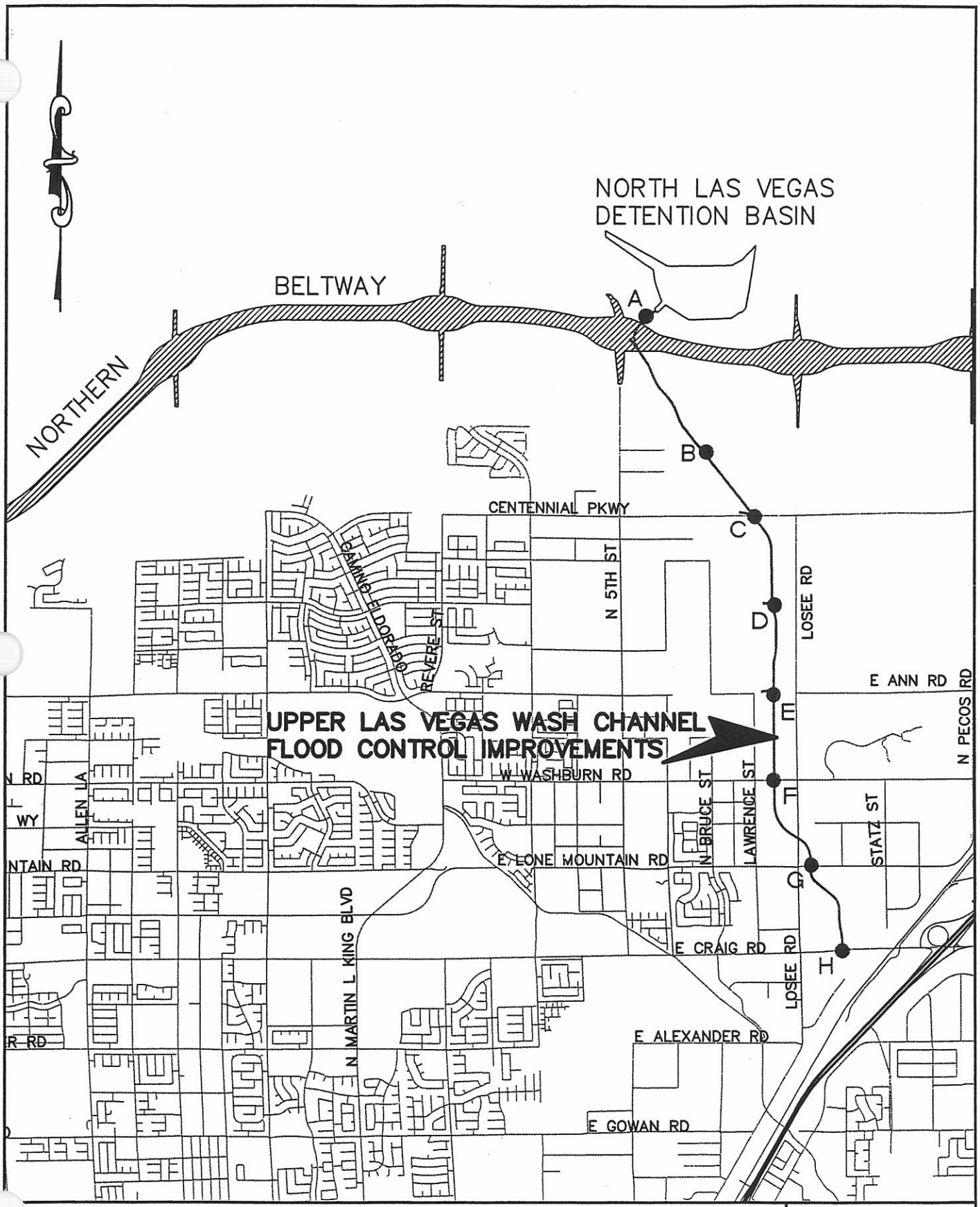
The HEC-1 model for the Upper Las Vegas Wash Channel Project incorporates ten (10) design points and is found in Appendix C. Table 4.1 summarizes the design point locations and the resulting flows from the VTN hydrology model, and provides a comparison with the 1997 MPU flows. Figure 3 is a schematic drawing identifying the design points.

TABLE 4.1: FLOWS AT DESIGN POINTS

VTN DESIGN POINT	LOCATION	MPU FACILITY ID	PEAK FLOWS AT CONFLUENCE LOCATIONS[1] (cfs)	'97 MPU DESIGN FLOWS[1] (cfs)	PB DESIGN FLOWS[1] (cfs)	VTN DESIGN FLOWS[1] (cfs)
EKEA	Beltway Channel	EKEA 0000	-	2,081	3,750	4,144
NLVDET	North Las Vegas Detention Basin Outlet	LVUP 0405	-	1,659	2,615	2,691
BELT	Inflow from Onsite of the Beltway	-	-	-	-	548
A	Beltway Channel/NLVDB Outlet Combination	LVUP 0210	-	3,148	3,815	4,614
B	Deer Springs Way	LVUP 0210	-	3,148	-	4,813
C	Centennial Parkway	LVUP 0210	2,500	3,148	-	5,881
D	Tropical Parkway	LVUP 0182	950	4,250	-	6,378
E	Ann Road	LVUP 0155	700	4,516	-	6,796
F	Washburn Road	LVUP 0079	-	4,516	-	6,940
G	Lone Mountain	LVUP 0071	-	4,516	-	6,940
H	Craig Road	LVUP 0001	-	5,965	-	6,940

[1] 100-year design flows

The 1997 MPU study used a similar overall size for the watershed, however, the subbasins were considerably larger. Several small subbasins with varying lag times and similar CN's will produce flows in excess of flows produced by a single subbasin. As a result, the VTN design flows are higher than the 1997 MPU



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DESIGN FLOW SCHEMATIC
UPPER LAS VEGAS WASH CHANNEL
FLOOD CONTROL IMPROVEMENTS

FIGURE 3

10/28/2002

flows, as shown in Table 4.1. The 1997 MPU also proposed a trapezoidal channel section for the ULVW Channel facility. Due to the large flowrates, hydraulic constraints, and right-of-way constraints, a rectangular channel section is proposed in this report.

Various hydrology studies were referenced and incorporated into the hydrology model for this project. These studies (see references) apply to existing and proposed developments adjacent to the proposed ULVW Channel alignment. VTN obtained the revised subbasin map for the Northern Las Vegas Wash Watershed from PBS&J for the 2002 MPU study, which was used as the base model for the hydrologic analysis in this report. The overall boundary of the tributary watershed to the ULVW Channel varies little between the 2002 MPU study and the watershed used for this study; the 2002 MPU tributary area to the ULVW Channel is 13.8 sq. mi., as compared to the 13.6 sq. mi. area considered for this analysis. However, modifications were made to the 2002 MPU subbasin boundaries based upon the referenced studies. The 2002 MPU study uses 41 subbasins to describe the ULVW Channel Watershed, whereas the VTN study uses 71 subbasins.

For the VTN model, subbasins on the north side of the Las Vegas Beltway were adopted from a combination of the January 2001 Parsons Brinckerhoff study (reference 6) and the October 2000 VTN study (reference 10). Seven subbasins were added to account for flows along the Las Vegas Beltway. The subbasins to the south of the Beltway were taken from the 2002 MPU subbasin map with the exception of two subbasins that were modified to better reflect future conditions. The curve numbers for the modified subbasins used in the VTN model are based on soil types and on the land uses for a fully developed condition (Table C1 in Appendix C). Table C2 in Appendix C shows the subbasin parameters for the unmodified subbasins.

HCDDM Exhibits

SIX HOUR DEPTH-AREA REDUCTION FACTORS

Drainage Area (Square Miles)	Six-Hour Depth-Area Reduction Factor
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.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

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	Dat

REFERENCE:

TABLE 503

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

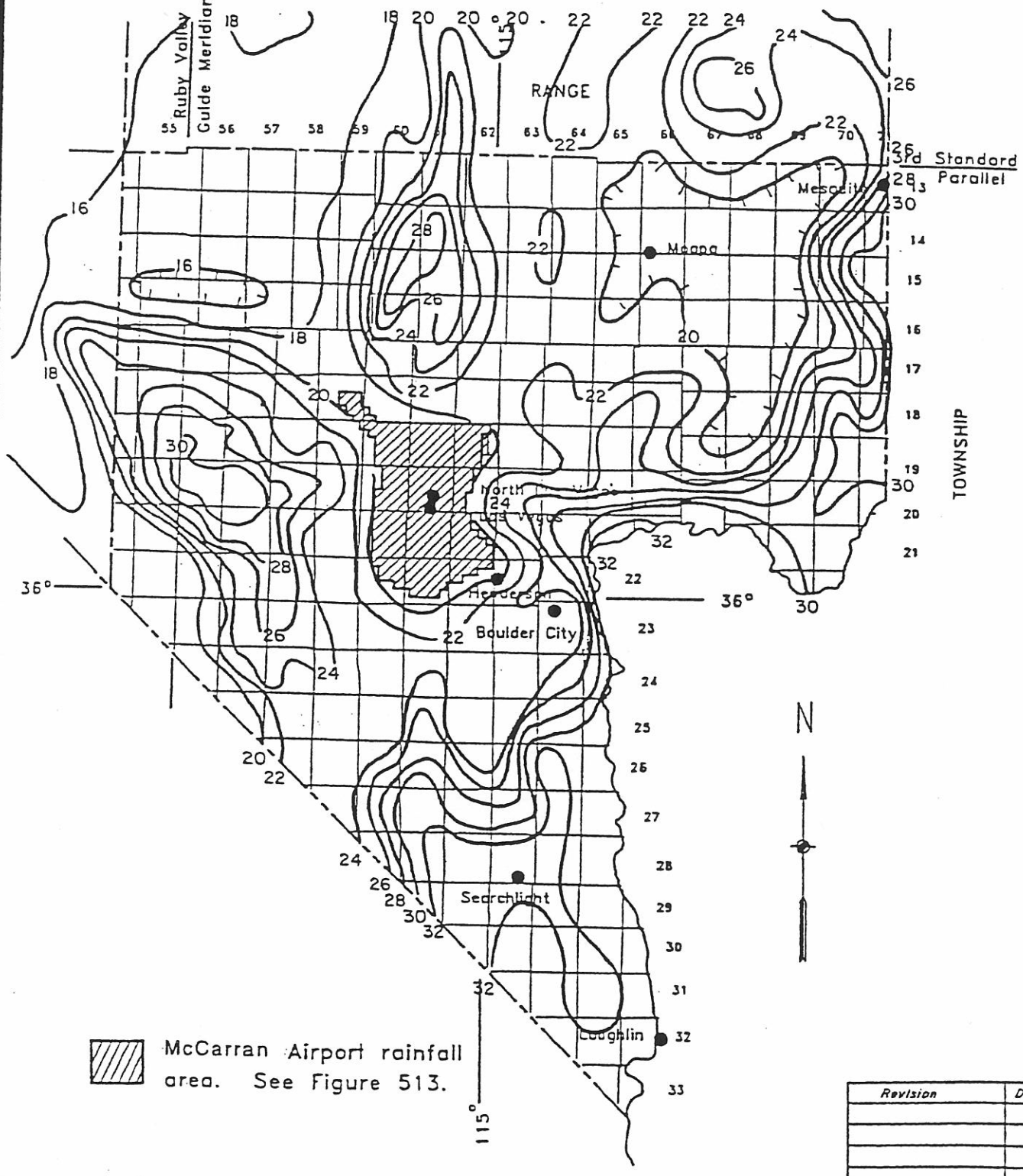
NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

RAINFALL DEPTH-DURATION-FREQUENCY
100-YEAR, 6-HOUR
(DEPTHS IN TENTHS OF INCHES)



Revision	Date

WRC ENGINEERING

REFERENCE:
NOAA ATLAS 2, VOLUME VII NEVADA, 1973

FIGURE 506

Subbasin Parameters

TABLE C1
Upper Las Vegas Wash Channel
REVISED BASIN AREAS AND LAG TIMES FOR HEC-1 MODEL
REVISED FOR OFFSITE SUBBASINS AND ROUTING

SUB-BASIN DATA				INITIAL/OVERLAND TIME t_i			TRAVEL TIME t_t				CONC. TIME	t_c CHECK (URBANIZED BASINS)		FINAL CONC.	LAG TIME
DESIG.	AREA mi^2	CN	K[1]	LENGH L_i(ft)	SLOPE S_i(%)	t_i[2] (min.)	LENGTH L(ft)	SLOPE S_t(%)	VELOCITY V(fps)[3]	t_t[4] (min.)	t_c[5] (min.)	TOTAL LENGTH	t_c[6] (min.)	t_c (min.)	t_{LAG}[7] (hours)
BW01	0.0558	98.0	0.904	60	2.00	2.2	3,410	0.47	2.1	27.1	29.3	3,470	29.3	29.3	0.293
BW02	0.0885	98.0	0.904	60	2.00	2.2	3,445	0.57	2.3	24.9	27.0	3,505	29.5	27.0	0.270
BW03	0.0663	98.0	0.904	60	2.00	2.2	3,045	0.50	2.2	23.5	25.6	3,105	27.3	25.6	0.256
BW04	0.0427	98.0	0.904	60	2.00	2.2	2,635	0.57	2.3	19.0	21.2	2,695	25.0	21.2	0.212
BW05	0.0658	98.0	0.904	60	2.00	2.2	2,655	0.58	2.3	19.0	21.2	2,715	25.1	21.2	0.212
BW06	0.0644	98.0	0.904	60	2.00	2.2	2,670	1.72	4.0	11.1	13.3	2,730	25.2	13.3	0.133
BW07	0.0773	98.0	0.904	60	2.00	2.2	3,245	1.50	3.7	14.4	16.6	3,305	28.4	16.6	0.166
NN089-C1	0.1532	85.0	0.732	100	1.00	6.6	3,200	1.00	2.9	18.1	24.8	3,300	28.3	24.8	0.248
NN156-C1	0.1374	73.6	0.582	100	1.00	9.3	3,300	1.00	2.9	18.7	28.0	3,400	28.9	28.0	0.280

Note:

(1) $K = 0.0132C_n - 0.39$

(2) $t_i = \dfrac{1.8(1.1-K)L_i^{1/2}}{S_i^{1/3}}$

(3) $V = CS_t^{1/2}$

where C = 30.6 for Roadway subbasins BW01 ~ BW07
C = 29.4 for UNNAMED1 and UNNAMED2
(See CCRFCD Manual pp606)

(4) $t = \dfrac{L}{60V}$

(5) $t_c = t_i + t_t$

(6) $t_c = \dfrac{L}{180} + 10$

(7) $t_{LAG} = 0.6t_c$

TABLE C2
Upper Las Vegas Wash Channel
RESEARCHED BASIN PARAMETERS FOR HEC-1 MODEL
BASIN PARAMETERS TAKEN FROM VARIOUS SOURCES

SUB-BASIN	AREA (mi^2)	CN	LAG TIME (hours)	SOURCE
NW208	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW209	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW210	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW211	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW218	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW219	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW220	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
MW221	0.1250	88.0	0.210	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW228	0.1250	88.2	0.209	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW229	0.1250	89.0	0.206	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW230A	0.1310	91.6	0.270	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW230B	0.1310	91.6	0.270	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW238	0.0980	90.0	0.147	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW239	0.1250	90.0	0.201	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW240A	0.1310	91.6	0.270	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW240B	0.1310	91.6	0.270	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW241	0.1420	89.0	0.270	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW242A	0.1320	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW242B	0.1320	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW243	0.1420	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW244A	0.1320	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW244B	0.1320	89.0	0.270	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW245	0.1420	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW246A	0.1240	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW246B	0.0790	89.0	? 0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW247	0.1570	89.0	0.260	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
NW248	0.0550	89.0	0.180	Parsons Brinckerhoff Study - Northern Beltway-North Fifth Street to Pecos Road (REF 6)
CEN4A1	0.1250	88.0	0.210	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4A2	0.1250	88.0	0.210	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4A3	0.1250	88.7	0.207	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4A4	0.1250	89.0	0.206	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4B1	0.1250	93.5	0.185	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4B2	0.1090	92.3	0.162	VTN - Northern Beltway-Jones Boulevard to Simmons Street

SUB-BASIN	AREA (mi^2)	CN	LAG TIME (hours)	SOURCE
CEN4B3	0.1250	94.0 93.5	0.183	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4B4	0.0280	94.5	0.101	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4C1	0.0900	90.0 88.8	0.163	VTN - Northern Beltway-Jones Boulevard to Simmons Street
CEN4C2	0.0320	90.0	0.103	VTN - Northern Beltway-Jones Boulevard to Simmons Street
NN060-C	0.5380	89.7	0.276	Preliminary 2002 MPU
NN062-C	0.4740	87.9	0.284	Preliminary 2002 MPU
NN078-C	0.4250	87.9	0.408	Preliminary 2002 MPU
NN081-C	0.3120	87.7	0.380	Preliminary 2002 MPU
NN089-C	0.4380	91.0	0.331	Preliminary 2002 MPU
NN093-C	0.3240	88.9	0.264	Preliminary 2002 MPU
NN095-C	0.2600	87.7	0.314	Preliminary 2002 MPU
NN099-C	0.2100	87.7	0.260	Preliminary 2002 MPU
NN109-C	0.2620	89.8	0.229	Preliminary 2002 MPU
NN111-C	0.2650	81.2	0.372	Preliminary 2002 MPU
NN113-C	0.5430	81.6	0.467	Preliminary 2002 MPU
NN128-C	0.2950	82.6	0.552	Preliminary 2002 MPU
NN129-C	0.2370	88.1	0.403	Preliminary 2002 MPU
NN137-C	0.2580	80.2	0.274	Preliminary 2002 MPU
NN138-C	0.2870	82.0	0.509	Preliminary 2002 MPU
NN141-C	0.4360	85.4	0.446	Preliminary 2002 MPU
NN142-C	0.3170	77.7	0.501	Preliminary 2002 MPU
NN144-C	0.1890	67.9	0.356	Preliminary 2002 MPU
NN146-C	0.4750	87.0	0.517	Preliminary 2002 MPU
NN153-C	0.3330	78.1	0.468	Preliminary 2002 MPU
NN156-C	0.2790	73.6	0.386	Preliminary 2002 MPU
NN166-C	0.2420	71.8	0.354	Preliminary 2002 MPU
NN170-C	0.4020	80.7	0.477	Preliminary 2002 MPU
NN174-C	0.3310	92.6	0.404	Preliminary 2002 MPU
NN175-C	0.3440	94.1	0.462	Preliminary 2002 MPU

HEC-1 Models

ULVWSDN4.dat

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*****************************************                                  *****************************************
*                                       *                                  *                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                                  *    U.S. ARMY CORPS OF ENGINEERS       *
*            SEPTEMBER 1990             *                                  *    HYDROLOGIC ENGINEERING CENTER      *
*             VERSION 4.0               *                                  *          609 SECOND STREET            *
*                                       *                                  *       DAVIS, CALIFORNIA 95616         *
*   N DATE  10/25/2001  TIME  14:45:26  *                                  *           (916) 756-1104              *
*                                       *                                  *                                       *
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X     X  XXXXXXX   XXXXX           X
X     X  X        X     X         XX
X     X  X        X                X
XXXXXXX  XXXX     X        XXXXX   X
X     X  X        X                X
X     X  X        X     X          X
X     X  XXXXXXX   XXXXX          XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

HEC-1 INPUT PAGE 1

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

            *DIAGRAM
*** FREE ***
            ID          ***************************************************
            ID          *      UPPER LAS VEGAS WASH CHANNEL PROJECT       *
            ID          *                                                 *
            ID          *           OFF-SITE HYDROLOGY ANALYSIS           *
            ID          *                                                 *
            ID          ***************************************************
            ID
            ID    PREPARED FOR: CITY OF NORTH LAS VEGAS
            ID    PREPARED BY:  VTN NEVADA
            ID    DATE:  10/25/2001
            ID    FILE:  ULVWSDN4.DAT
            ID
            ID    STORM: SDN4
            ID    FUTURE CONDITION, FUTURE FACILITIES
            ID
            ID          Subbasins north of Beltway from Decatur Boulevard to Clayton Street
            ID          are based on "Northern segment of the Las Vegas Beltway Jones
            ID          Boulevard to Simmons Street (100% Submittal)" (CCRFCD, VTN, 10/2000)
            ID          Subbasins north of Beltway from Clayton Street to 5th Street are
            ID          based on "Northern Beltway North Fifth Street to Pecos Road (Final)"
            ID          (CCRFCD, PB, 1/2001)
            ID
            ID          Subbasins south of Beltway are based on MPU 2002 by PBS&J. Subbasins
            ID          adjacent to Beltway and Upper Las Vegas Wash Channel have been revised
            ID
            ID          Runoff from the Beltway roadway surface will be conveyed through storm
            ID          drain along the Beltway and discharge into Upper Las Vegas Wash Channe
            ID          at North 5th Street.
            ID
            ID          All subareas in this file are in the McCarran Airport Rainfall Area
            ID          (100-yr, 6-hr ppn = 2.774 in.); precipitation (PB) cards include
            ID          CCRFCD 1.43 adjustment, but no DARF's; SDN 4; use DARF's (JR card)
            ID          based on the following table:
            ID
            ID           No.     Collecting Point                  Drainage Area     DARF
            ID          -----    ----------------                  -------------     -----
            ID            1            EKEA                          4.38 sq mi      0.908
            ID            2            EKEA+Beltway                  4.84 sq mi      0.906
            ID            3            A(EKEA+Beltway+NLVDB)         4.84 sq mi      0.906
            ID            4            B                             4.99 sq mi      0.905
            ID            5            Centennial                    2.75 sq mi      0.923
            ID            6            C                             8.33 sq mi      0.877
            ID            7            Tropical                      1.27 sq mi      0.959
            ID            8            D                             9.60 sq mi      0.864
            ID            9            Ann                           1.21 sq mi      0.962
            ID           10            E                            11.09 sq mi      0.852
            ID           11            F                            11.81 sq mi      0.847
            ID           12            G                            12.93 sq mi      0.839
            ID           13            H                            13.60 sq mi      0.835
            ID
            IT       5       0       0     300
            IO       5       0       0
            IN       5       0       0
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  54      JR    PREC   0.877   0.864   0.852   0.847
          *
  55      KK  CEN4B3
  56      KM   Runoff from subarea CEN4B3
  57      BA   0.125
  58      PB   2.774
  59      PC   0.000   0.020   0.058   0.075   0.099   0.126   0.137   0.145   0.149   0.151
  60      PC   0.155   0.156   0.159   0.162   0.169   0.172   0.179   0.189   0.201   0.211
  61      PC   0.220   0.228   0.232   0.240   0.246   0.252   0.260   0.269   0.276   0.283
  62      PC   0.286   0.292   0.302   0.312   0.321   0.332   0.352   0.376   0.415   0.462
  63      PC   0.530   0.610   0.710   0.732   0.756   0.782   0.799   0.813   0.823   0.830
  64      PC   0.835   0.844   0.851   0.864   0.885   0.908   0.924   0.944   0.968   0.973
  65      PC   0.978   0.982   0.984   0.986   0.988   0.991   0.992   0.993   0.994   0.997
  66      PC   0.998   0.999   1.000
  67      LS       0    94.0
  68      UD   0.183
          *
  69      KK RCEN4B3
  70      KM   ROUTE TO CEN4B4
  71      RK    2500   0.002   0.015       0    TRAP      40       2
          *
  72      KK  CEN4B1
  73      BA   0.125
  74      PB   2.774
  75      LS       0    93.5
  76      UD   0.185
          *
  77      KK RCEN4B1
  78      KM   ROUTE TO CEN4B4
  79      RK    2000   0.005   0.015       0    TRAP      40       2
          *
  80      KK  CEN4B4
  81      BA   0.028
  82      PB   2.774
  83      LS       0    94.5
  84      UD   0.101
          *
  85      KK CCEN4B4
  86      KM   COMBINE RCEN4B1 AND CEN4B4
  87      HC       2
          *
  88      KKCCCEN4B4
  89      KM   COMBINE RCEN4B3 AND CCEN4B4
  90      HC       2
          *
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  91      KKRCCEN4B4
  92      KM   ROUTE TO CEN4B2
  93      RK    2000   0.005   0.015       0    TRAP      40       2
          *

  94      KK  CEN4A3
  95      BA   0.125
  96      PB   2.774
  97      LS       0    88.7
  98      UD   0.207
          *

  99      KK RCEN4A3
 100      KM   ROUTE TO CEN4B2
 101      RK    2250   0.006   0.015       0    TRAP      40       2
          *

 102      KK  CEN4B2
 103      BA   0.109
 104      PB   2.774
 105      LS       0    92.3
 106      UD   0.162
          *

 107      KK CCEN4B2
 108      KM   COMBINE RCEN4A3 AND CEN4B2
 109      HC       2
          *

 110      KKCCCEN4B2
 111      KM   COMBINE RCCEN4B4 AND CCEN4B2
 112      HC       2
          *

 113      KKRCCEN4B2
 114      KM   ROUTE TO CEN4A4
 115      RK    1500   0.004   0.015       0    TRAP      40       2
          *

 116      KK  CEN4A1
 117      BA   0.125
 118      PB   2.774
 119      LS       0    88.0
 120      UD   0.210
          *

 121      KK RCEN4A1
 122      KM   ROUTE TO CEN4A4
 123      RK    2950   0.007   0.015       0    TRAP      40       2
          *
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  124     KK  CEN4A4
  125     BA   0.125
  126     PB   2.774
  127     LS       0    89.0
  128     UD   0.206
          *

  129     KK CCEN4A4
  130     KM   COMBINE RCEN4A1 AND CEN4A4
  131     HC       2
          *

  132     KKCCCEN4A4
  133     KM   COMBINE RCCEN4B2 AND CCEN4A4
  134     HC       2
          *

  135     KKRCCEN4A4
  136     KM   ROUTE TO CEN4C2
  137     RK    1500   0.002   0.015       0    TRAP      40       2
          *

  138     KK   NW208
  139     BA   0.125
  140     PB   2.774
  141     LS       0    88.0
  142     UD   0.210
          *

  143     KK  RNW208
  144     KM   ROUTE TO CEN4A2
  145     RK    2950   0.007   0.015       0    TRAP      40       2
          *

  146     KK  CEN4A2
  147     BA   0.125
  148     PB   2.774
  149     LS       0    88.0
  150     UD   0.210
          *

  151     KK CCEN4A2
  152     KM   COMBINE RNW208 AND CEN4A2
  153     HC       2
          *

  154     KKRCCEN4A2
  155     KM   ROUTE TO CEN4C2
  156     RK    1500   0.007   0.015       0    TRAP      40       2
          *
```

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

  157     KK  CEN4C2
  158     BA   0.032
  159     PB   2.774
  160     LS        0    90.0
  161     UD   0.103
          *

  162     KK CCEN4C2
  163     KM   COMBINE RCCEN4A2 AND CEN4C2
  164     HC        2
          *

  165     KKCCCEN4C2
  166     KM   COMBINE RCCEN4A4 AND CCEN4C2
  167     HC        2
          *

  168     KKRCCEN4A2
  169     KM   ROUTE TO CEN4C1
  170     RK    2000   0.002   0.015       0    TRAP      40       2
          *

  171     KK   NW209
  172     BA   0.125
  173     PB   2.774
  174     LS        0    88.0
  175     UD   0.210
          *

  176     KK  RNW209
  177     KM   ROUTE TO NW218
  178     RK    2950   0.007   0.015       0    TRAP      40       2
          *

  179     KK   NW218
  180     BA   0.125
  181     PB   2.774
  182     LS        0    88.0
  183     UD   0.210
          *

  184     KK  CNW218
  185     KM   COMBINE RNW209 AND NW218
  186     HC        2
          *

  187     KK RCNW218
  188     KM   ROUTE TO CEN4C1
  189     RK    2250   0.007   0.015       0    TRAP      40       2
          *
```

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

  190     KK  CEN4C1
  191     BA   0.090
  192     PB   2.774
  193     LS      0    90.0
  194     UD   0.163
          *

  195     KK CCEN4C1
  196     KM   COMBINE RCNW218 AND CEN4C1
  197     HC       2
          *

  198     KKCCCEN4C1
  199     KM   COMBINE RCCEN4C2 AND CCEN4C1
  200     HC       2
          *

  201     KKRCCEN4C1
  202     KM   ROUTE TO NW228
  203     RK    1500   0.002   0.015       0    TRAP      40       2
          *

  204     KK   NW210
  205     BA   0.125
  206     PB   2.774
  207     LS      0    88.0
  208     UD   0.210
          *

  209     KK  RNW210
  210     KM   ROUTE TO NW219
  211     RK    2950   0.007   0.015       0    TRAP      40       2
          *

  212     KK   NW219
  213     BA   0.125
  214     PB   2.774
  215     LS      0    88.0
  216     UD   0.210
          *

  217     KK  CNW219
  218     KM   COMBINE RNW210 AND NW219
  219     HC       2
          *

  220     KK RCNW219
  221     KM   ROUTE TO NW228
  222     RK    2950   0.007   0.015       0    TRAP      40       2
          *
```

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

  223     KK   NW228
  224     BA   0.125
  225     PB   2.774
  226     LS      0    88.2
  227     UD   0.209
          *

  228     KK  CNW228
  229     KM   COMBINE RCNW219 AND NW228
  230     HC      2
          *

  231     KK CCNW228
  232     KM   COMBINE RCCEN4C1 AND CNW228
  233     HC      2
          *

  234     KKRCCNW228
  235     KM   ROUTE TO NW238
  236     RK    2640    0.01   0.015       0    TRAP     40       2
          *

  237     KK   NW211
  238     BA   0.125
  239     PB   2.774
  240     LS      0    88.0
  241     UD   0.210
          *

  242     KK  RNW211
  243     KM   ROUTE TO NW220
  244     RK    2950   0.007   0.015       0    TRAP     40       2
          *

  245     KK   NW220
  246     BA   0.125
  247     PB   2.774
  248     LS      0    88.0
  249     UD   0.210
          *

  250     KK  CNW220
  251     KM   COMBINE RNW211 AND NW220
  252     HC      2
          *

  253     KK RCNW220
  254     KM   ROUTE TO NW229
  255     RK    2950   0.007   0.015       0    TRAP     40       2
          *
```

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

  256     KK   NW229
  257     BA   0.125
  258     PB   2.774
  259     LS      0    89.0
  260     UD   0.206
          *

  261     KK  CNW229
  262     KM   COMBINE RCNW220 AND NW229
  263     HC       2
          *

  264     KK RCNW229
  265     KM   ROUTE TO NW238
  266     RK    2950    0.01   0.015       0    TRAP      40       2
          *

  267     KK   NW238
  268     BA   0.098
  269     PB   2.774
  270     LS      0    90.0
  271     UD   0.147
          *

  272     KK  CNW238
  273     KM   COMBINE RCNW229 AND NW238
  274     HC       2
          *

  275     KK CCNW238
  276     KM   COMBINE RCCNW228 AND CNW238
  277     HC       2
          *

  278     KK   NW221
  279     BA   0.125
  280     PB   2.774
  281     LS      0    88.0
  282     UD   0.210
          *

  283     KK  RNW221
  284     KM   ROUTE TO NW230A
  285     RK    2950   0.006   0.015       0    TRAP      40       2
          *

  286     KK  NW230A
  287     BA   0.131
  288     PB   2.774
  289     LS      0    91.6
  290     UD    0.27
          *
```

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

  291     KK CNW230A
  292     KM   COMBINE RNW221 AND NW230A
  293     HC       2
          *

  294     KKRCNW230A
  295     KM   ROUTE TO NW239
  296     RK    2950   0.006   0.015       0    TRAP      40       2
          *

  297     KK   NW239
  298     BA   0.125
  299     PB   2.774
  300     LS       0    90.0
  301     UD   0.201
          *

  302     KK  CNW239
  303     KM   COMBINE RCNW230A AND NW239
  304     HC       2
          *

  305     KK CCNW239
  306     KM   COMBINE CNW239 AND CCNW238
  307     HC       2
          *

  308     KKRCCNW239
  309     KM   ROUTE TO NW241
  310     RK    2800   0.008   0.015       0    TRAP      40       2
          *

  311     KK  NW230B
  312     BA   0.131
  313     PB   2.774
  314     LS       0    91.6
  315     UD    0.27
          *

  316     KK RNW230B
  317     KM   ROUTE TO NW240A
  318     RK    2950   0.007   0.015       0    TRAP      40       2
          *

  319     KK  NW240A
  320     BA   0.131
  321     PB   2.774
  322     LS       0    91.6
  323     UD    0.27
          *
```

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

  324     KK CNW240A
  325     KM   COMBINE RNW230B AND NW240A
  326     HC       2
          *

  327     KK RNW240A
  328     KM   ROUTE TO NW241
  329     RK    3500   0.008   0.015       0    TRAP      40       2
          *

  330     KK   NW241
  331     BA   0.142
  332     PB   2.774
  333     LS       0    89.0
  334     UD    0.27
          *

  335     KK  CNW241
  336     KM   COMBINE RNW240A AND NW241
  337     HC       2
          *

  338     KK CCNW241
  339     KM   COMBINE RCCNW239 AND CNW241
  340     HC       2
          *

  341     KKRCCNW241
  342     KM   ROUTE TO NW243
  343     RK    2640   0.006   0.015       0    TRAP      40       2
          *

  344     KK  NW240B
  345     BA   0.131
  346     PB   2.774
  347     LS       0    91.6
  348     UD    0.27
          *

  349     KK RNW240B
  350     KM   ROUTE TO NW242A
  351     RK    2950   0.007   0.015       0    TRAP      40       2
          *

  352     KK  NW242A
  353     BA   0.132
  354     PB   2.774
  355     LS       0    89.0
  356     UD    0.26
          *
```

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

  357         KK CNW242A
  358         KM   COMBINE RNW240B AND NW242A
  359         HC       2
              *

  360         KK RNW242A
  361         KM   ROUTE TO NW243
  362         RK    3200   0.008   0.015       0    TRAP      40       2
              *

  363         KK   NW243
  364         BA   0.142
  365         PB   2.774
  366         LS       0    89.0
  367         UD    0.26
              *

  368         KK  CNW243
  369         KM   COMBINE RNW242A AND NW243
  370         HC       2
              *

  371         KK CCNW243
  372         KM   COMBINE RCCNW241 AND CNW243
  373         HC       2
              *

  374         KKRCCNW243
  375         KM   ROUTE TO NW245
  376         RK    3200   0.008   0.015       0    TRAP      40       2
              *

  377         KK  NW242B
  378         BA   0.132
  379         PB   2.774
  380         LS       0    89.0
  381         UD    0.26
              *

  382         KK RNW242B
  383         KM   ROUTE TO NW244A
  384         RK    2950   0.007   0.015       0    TRAP      40       2
              *

  385         KK  NW244A
  386         BA   0.132
  387         PB   2.774
  388         LS       0    89.0
  389         UD    0.26
              *
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```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  390     KK CNW244A
  391     KM   COMBINE RNW242B AND NW244A
  392     HC       2
          *

  393     KK RNW244A
  394     KM   ROUTE TO NW245
  395     RK    3200   0.008   0.015       0    TRAP      40       2
          *

  396     KK   NW245
  397     BA   0.142
  398     PB   2.774
  399     LS       0    89.0
  400     UD    0.26
          *

  401     KK  CNW245
  402     KM   COMBINE RNW244A AND NW245
  403     HC       2
          *

  404     KK CCNW245
  405     KM   COMBINE RCCNW243 AND CNW245
  406     HC       2
          *

  407     KKRCCNW245
  408     KM   ROUTE TO NW247
  409     RK    3200   0.008   0.015       0    TRAP      40       2
          *

  410     KK  NW244B
  411     BA   0.132
  412     PB   2.774
  413     LS       0    89.0
  414     UD    0.27
          *

  415     KK RNW244B
  416     KM   ROUTE TO NW246A
  417     RK    2950   0.007   0.015       0    TRAP      40       2
          *

  418     KK  NW246A
  419     BA   0.124
  420     PB   2.774
  421     LS       0    89.0
  422     UD    0.26
          *
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  423     KK  NW246B
  424     BA   0.079
  425     PB   2.774
  426     LS      0    89.0
  427     UD    0.26
          *

  428     KK RNW246B
  429     KM   ROUTE TO NW246A
  430     RK    1500   0.002   0.015      0    TRAP      40       2
          *

  431     KK  CNW246
  432     KM   COMBINE RNW244B, RNW246B AND NW246A
  433     HC       3
          *

  434     KK RCNW246
  435     KM   ROUTE TO NW247
  436     RK    3200   0.008   0.015       0    TRAP      40       2
          *

  437     KK   NW248
  438     BA   0.055
  439     PB   2.774
  440     LS      0    89.0
  441     UD    0.18
          *

  442     KK  RNW248
  443     KM   ROUTE TO NW247
  444     RK    1250   0.010   0.015       0    TRAP      40       2
          *

  445     KK   NW247
  446     BA   0.157
  447     PB   2.774
  448     LS      0    89.0
  449     UD    0.26
          *

  450     KK  CNW247
  451     KM   COMBINE RCCNW245, RCNW246, RNW248 AND NW247
  452     HC       4
          *
          *

  453     KK    BW01
  454     BA   0.056
  455     PB   2.774
  456     LS      0    98.0
  457     UD   0.293
          *
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```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  458         KK   RBW01
  459         KM   ROUTE TO BW02
  460         RD    3445   0.006   0.015       0    CIRC     5.0
              *

  461         KK    BW02
  462         BA   0.089
  463         PB   2.774
  464         LS       0    98.0
  465         UD   0.270
              *

  466         KK   CBW02
  467         KM   COMBINE RBW01 AND BW02
  468         HC       2
              *

  469         KK  RCBW02
  470         KM   ROUTE TO BW03
  471         RD    3045   0.005   0.015       0    CIRC     5.5
              *

  472         KK    BW03
  473         BA   0.066
  474         PB   2.774
  475         LS       0    98.0
  476         UD   0.256
              *

  477         KK   CBW03
  478         KM   COMBINE RCBW02 AND BW03
  479         HC       2
              *

  480         KK  RCBW03
  481         KM   ROUTE TO BW04
  482         RD    2635   0.006   0.015       0    CIRC     6.0
              *

  483         KK    BW04
  484         BA   0.043
  485         PB   2.774
  486         LS       0    98.0
  487         UD   0.212
              *

  488         KK   CBW04
  489         KM   COMBINE RCBW03 AND BW04
  490         HC       2
              *
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  491     KK  RCBW04
  492     KM   ROUTE TO BW05
  493     RD    2655   0.006   0.015       0    CIRC     6.5
          *

  494     KK    BW05
  495     BA   0.066
  496     PB   2.774
  497     LS       0    98.0
  498     UD   0.212
          *

  499     KK   CBW05
  500     KM   COMBINE RCBW04 AND BW05
  501     HC       2
          *

  502     KK  RCBW05
  503     KM   ROUTE TO BW06
  504     RD    2670   0.017   0.015       0    CIRC     6.5
          *

  505     KK    BW06
  506     BA   0.064
  507     PB   2.774
  508     LS       0    98.0
  509     UD   0.133
          *

  510     KK   CBW06
  511     KM   COMBINE RCBW05 AND BW06
  512     HC       2
          *

  513     KK  RCBW06
  514     KM   ROUTE TO BW07
  515     RD    3245   0.015   0.015       0    CIRC     6.5
          *

  516     KK    BW07
  517     BA   0.077
  518     PB   2.774
  519     LS       0    98.0
  520     UD   0.166
          *

  521     KK   CBW07
  522     KM   COMBINE RCBW06 AND BW07
  523     HC       2
          *
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```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  524         KK CCNW247
  525         KM   COMBINE CBW07 AND CNW247
  526         HC       2
              *
              *

  527         KK  NLVDET
  528         KM   OUTFLOW FROM NLV DETENTION BASIN (FROM NLVDB.DAT,
  529         KM   CCRFCD LAS VEGAS VALLEY MASTER PLAN UPDATE, VTN, 1/97)
  530         BA     0.0
  531         QI       0       0       0       0       0       0       0       0       0       0
  532         QI       0       0       0       0       0       0       0       0       0       0
  533         QI       0       0       0       0       0       0       0       0       1       1
  534         QI       2       3       5       7      10      13      16      20      23      28
  535         QI      33      40      49      62      80     106     145     202     284     402
  536         QI     526     688     886    1113    1323    1276    1215    1138    1226    1320
  537         QI    1412    1506    1604    1705    1793    1869    1946    2022    2098    2174
  538         QI    2236    2291    2343    2392    2437    2479    2516    2550    2580    2606
  539         QI    2628    2646    2662    2673    2682    2688    2691    2691    2689    2685
  540         QI    2679    2672    2662    2652    2640    2627    2614    2599    2583    2567
  541         QI    2551    2533    2516    2498    2479    2461    2442    2423    2403    2384
  542         QI    2364    2345    2325    2305    2285    2266    2246    2226    2207    2182
  543         QI    2156    2130    2105    2079    2054    2029    2005    1980    1956    1932
  544         QI    1908    1884    1861    1838    1815    1793    1770    1747    1718    1689
  545         QI    1661    1633    1605    1578    1551    1525    1499    1474    1449    1425
  546         QI    1400    1377    1353    1330    1308    1285    1263    1242    1221    1200
  547         QI    1179    1159    1140    1146    1163    1180    1197    1214    1232    1250
  548         QI    1268    1287    1306    1325    1237    1139    1048     964     887     817
  549         QI     752     692     638     587     541     498     459     423     385     346
  550         QI     311     279     251     226     203     183     165     149     134     121
  551         QI     110      99      90      81      74      67      61      56      51      46
  552         QI      42      39      36      33      30      28      26      24      22      21
  553         QI      19      18      17      16      15      14      13      13      12      11
  554         QI      11      10      10       9       9       9       8       8       8       7
  555         QI       7       7       7       7       6       6       6       6       6       6
  556         QI       6       5       5       5       5       5       5       5       5       5
  557         QI       5       4       4       4       4       4       4       4       4       4
  558         QI       4       4       4       4       4       4       3       3       3       3
  559         QI       3       3       3       3       3       3       3       3       3       3
  560         QI       3       3       3       3       3       3       3       3       3       3
              *

  561         KK CNLVDET
  562         KM   COMBINE CNW247 WITH NLV DETENTION BASIN OUTFALL
  563         HC       2
              *

  564         KKRCNLVDET
  565         KM  ROUTE CNLVDET TO UNNMD1
  566         KM  FACILITY = UPPER LAS VEGAS WASH
  567         KM  FACILITY ID-MILE = LVUP 0210
  568         KM  LINING = CONCRETE
  569         RD    3300    0.01   0.015       0    TRAP      42       0
              *
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LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  570     KKNN089-C1
  571     BA   0.153
  572     PB    2.77
  573     LS       0    85.0
  574     UD   0.248
          *

  575     KK C089-C1
  576     KM  COMBINE RCNLVDET AND NN089-C1
  577     HC       2
          *

  578     KKRC089-C1
  579     KM  ROUTE C089-C1 TO NN138-C
  580     RD    3300   0.011   0.015       0    TRAP      46       0
          *

  581     KK NN137-C
  582     BA   0.258
  583     PB    2.77
  584     LS       0    80.2
  585     UD   0.274
          *

  586     KK RC137-C
  587     KM  ROUTE CNN137-C TO NN138-C
  588     KM  FACILITY = UPPER LAS VEGAS WASH
  589     KM  FACILITY ID-MILE = LVUP 0210
  590     KM  LINING = CONCRETE
  591     RD    1000    0.01   0.015       0    TRAP      46       0
          *

  592     KK NN060-C
  593     BA   0.538
  594     PB    2.77
  595     LS       0    89.7
  596     UD   0.276
          *

  597     KKRNN060-C
  598     KM  ROUTE NN060-C TO NN062-C
  599     KM  STREET NAME = DEER SPRINGS TO CONCORD
  600     RD    3700   0.015   0.016       0    TRAP       0      50
          *

  601     KK NN062-C
  602     BA   0.474
  603     PB    2.77
  604     LS       0    87.9
  605     UD   0.284
          *
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```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

  606         KKCNN062-C
  607         KM  COMBINE NN062-C AND RNN060-C
  608         KM  CENTENNIAL CHANNEL EAST @ CONCORD
  609         HC       2
              *

  610         KK RC062-C
  611         KM  ROUTE CNN062-C TO NN078-C
  612         KM  FACILITY = CENTENNIAL CHANNEL EAST
  613         KM  FACILITY ID-MILE = CNEA 0117
  614         KM  LINING = CONCRETE
  615         RD    1400   0.014   0.015       0    TRAP      10       2
              *

  616         KK NN078-C
  617         BA   0.425
  618         PB    2.77
  619         LS       0    87.9
  620         UD   0.408
              *

  621         KKCNN078-C
  622         KM  COMBINE NN078-C AND RC062-C
  623         KM  CENTENNIAL CHANNEL EAST @ REVERE
  624         HC       2
              *

  625         KK RC078-C
  626         KM  ROUTE CNN078-C TO NN093-C
  627         KM  FACILITY = CENTENNIAL CHANNEL EAST
  628         KM  FACILITY ID-MILE = CNEA 0089
  629         KM  LINING = CONCRETE
  630         RD    2600    0.01   0.015       0    TRAP      12       2
              *

  631         KK NN093-C
  632         BA   0.324
  633         PB    2.77
  634         LS       0    88.9
  635         UD   0.264
              *

  636         KKCNN093-C
  637         KM  COMBINE NN093-C AND RC078-C
  638         KM  CENTENNIAL CHANNEL EAST @ COMMERCE
  639         HC       2
              *

  640         KK RC093-C
  641         KM  ROUTE CNN093-C TO NN109-C
  642         KM  FACILITY = CENTENNIAL CHANNEL EAST
  643         KM  FACILITY ID-MILE = CNEA 0089
  644         KM  LINING = CONCRETE
  645         RD    2600   0.012   0.015       0    TRAP      12       2
              *
```

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

  646     KK NN089-C
  647     BA   0.438
  648     PB    2.77
  649     LS       0    91.0
  650     UD   0.331
          *

  651     KKRNN089-C
  652     KM  ROUTE NN089-C TO NN109-C
  653     KM  STREET NAME = GOLDFIELD
  654     RD    3600   0.008   0.016       0    TRAP       0      50
          *

  655     KK NN109-C
  656     BA   0.262
  657     PB    2.77
  658     LS       0    89.8
  659     UD   0.229
          *

  660     KKCNN109-C
  661     KM  COMBINE NN109-C, RNN089-C AND RC093-C
  662     KM  CENTENNIAL CHANNEL EAST @ GOLDFIELD
  663     HC       3
          *

  664     KK RC109-C
  665     KM  ROUTE CNN109-C TO NN138-C
  666     KM  FACILITY = CENTENNIAL CHANNEL EAST
  667     KM  FACILITY ID-MILE = CNEA 0000
  668     KM  LINING = CONCRETE
  669     RD    3200   0.004   0.015       0    TRAP      14       2
          *

  670     KK NN138-C
  671     BA   0.287
  672     PB    2.77
  673     LS       0    82.0
  674     UD   0.509
          *

  675     KKCNN138-C
  676     KM  COMBINE NN138-C AND RC109-C
  677     KM  CENTENNIAL CHANNEL EAST FLOW @ UPPER LAS VEGAS WASH
  678     HC       2
          *

  679     KK NN153-C
  680     BA   0.333
  681     PB    2.77
  682     LS       0    78.1
  683     UD   0.468
          *
```

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

  684     KKCNN153-C
  685     KM  COMBINE NN153-C, CNN138-C, RC089-C1 AND RC137-C
  686     KM  UPPER LAS VEGAS WASH @ CENTENNIAL
  687     HC       4
          *

  688     KK RC153-C
  689     KM  ROUTE CNN153-C TO NN141-C
  690     KM  FACILITY = UPPER LAS VEGAS WASH
  691     KM  FACILITY ID-MILE = LVUP 0182
  692     KM  LINING = CONCRETE
  693     RD    2900    0.01   0.015       0    TRAP      50       0
          *

  694     KK NN081-C
  695     BA   0.312
  696     PB    2.77
  697     LS       0    87.7
  698     UD   0.380
          *

  699     KKRNN081-C
  700     KM  ROUTE NN081-C TO NN095-C
  701     KM  FACILITY = TROPICAL ROAD CHANNEL EAST
  702     KM  FACILITY ID-MILE = TREA 0180
  703     KM  LINING = RCP
  704     RD    2600   0.021   0.013       0    CIRC      6       0
          *

  705     KK NN095-C
  706     BA   0.260
  707     PB    2.77
  708     LS       0    87.7
  709     UD   0.314
          *

  710     KKCNN095-C
  711     KM  COMBINE NN195-C AND RNN081-C
  712     KM  TROPICAL CHANNEL EAST @ COMMERCE
  713     HC       2
          *

  714     KK RC095-C
  715     KM  ROUTE CNN095-C TO NN111-C
  716     KM  FACILITY = TROPICAL ROAD CHANNEL EAST
  717     KM  FACILITY ID-MILE = TREA 0000
  718     KM  LINING = RCB
  719     RD    2700   0.009   0.013       0    DEEP      10       0
          *
```

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

  720         KK NN111-C
  721         BA   0.265
  722         PB    2.77
  723         LS       0    81.2
  724         UD   0.372
              *

  725         KKCNN111-C
  726         KM  COMBINE NN111-C AND RC095-C
  727         KM  TROPICAL CHANNEL EAST @ 5TH
  728         HC       2
              *

  729         KK RC111-C
  730         KM  ROUTE CNN111-C TO NN141-C
  731         KM  FACILITY = TROPICAL ROAD CHANNEL EAST
  732         KM  FACILITY ID-MILE = TREA 0000
  733         KM  LINING = RCB
  734         RD    4300   0.004   0.013       0    DEEP      10       0
              *

  735         KK NN141-C
  736         BA   0.436
  737         PB    2.77
  738         LS       0    85.4
  739         UD   0.446
              *

  740         KKCNN141-C
  741         KM  COMBINE NN141-C AND RC111-C
  742         KM  TROPICAL CHANNEL EAST FLOW @ UPPER LAS VEGAS WASH
  743         HC       2
              *

  744         KK 2C141-C
  745         KM  COMBINE CNN141-C AND RC153-C
  746         KM  UPPER LAS VEGAS WASH @ TROPICAL
  747         HC       2
              *

  748         KK RC141-C
  749         KM  ROUTE 2C141-C TO UNNMD2
  750         KM  FACILITY = UPPER LAS VEGAS WASH
  751         KM  FACILITY ID-MILE = LVUP 0155
  752         KM  LINING = CONCRETE
  753         RD    2700   0.009   0.015       0    TRAP      50       0
              *

  754         KK NN099-C
  755         BA   0.210
  756         PB    2.77
  757         LS       0    87.7
  758         UD   0.260
              *
```

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

  759         KKRNN099-C
  760         KM  ROUTE NN099-C TO NN113-C
  761         KM  FACILITY = ANN ROAD CHANNEL EAST
  762         KM  FACILITY ID-MILE = ANEA 0000
  763         KM  LINING = CONCRETE
  764         RD    2700   0.011   0.015       0    TRAP      10       2
              *

  765         KK NN113-C
  766         BA   0.543
  767         PB    2.77
  768         LS       0    81.6
  769         UD   0.467
              *

  770         KKCNN113-C
  771         KM  COMBINE NN113-C AND RNN099-C
  772         KM  ANN ROAD CHANNEL EAST @ 5TH
  773         HC       2
              *

  774         KK RC113-C
  775         KM  ROUTE CNN113-C TO NN142-C
  776         KM  FACILITY = ANN ROAD CHANNEL EAST
  777         KM  FACILITY ID-MILE = ANEA 0000
  778         KM  LINING = CONCRETE
  779         RD    4200   0.008   0.015       0    TRAP      10       2
              *

  780         KK NN142-C
  781         BA   0.317
  782         PB    2.77
  783         LS       0    77.7
  784         UD   0.501
              *

  785         KKCNN142-C
  786         KM  COMBINE NN142-C AND RC113-C
  787         KM  ANN ROAD CHANNEL EAST
  788         HC       2
              *

  789         KK RC142-C
  790         KM  ROUTE CNN142-C TO UNNMD2
  791         KM  FACILITY = ANN ROAD CHANNEL EAST
  792         KM  FACILITY ID-MILE = ANEA 0000
  793         KM  LINING = CONCRETE
  794         RD     750   0.011   0.015       0    TRAP      10       0
              *
```

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

  795     KKNN156-C1
  796     BA   0.137
  797     PB    2.77
  798     LS       0    82.6
  799     UD   0.280
          *

  800     KK C156-C1
  801     KM  COMBINE NN156-C1 AND RC142-C
  802     KM  ANN ROAD CHANNEL EAST FLOW @ UPPER LAS VEGAS WASH
  803     HC       2
          *

  804     KK NN156-C
  805     BA   0.279
  806     PB    2.77
  807     LS       0    73.6
  808     UD   0.386
          *

  809     KK  R156-C
  810     KM  ROUTE NN156-C TO UNNMD2
  811     KM  FACILITY = UPPER LAS VEGAS WASH
  812     KM  FACILITY ID-MILE = LVUP 0155
  813     KM  LINING = CONCRETE
  814     RD    1000   0.006   0.015       0    TRAP      50       0
          *

  815     KKCC156-C1
  816     KM  COMBINE C156-C1, RC141-C, R156-C
  817     KM  UPPER LAS VEGAS WASH @ ANN
  818     HC       3
          *

  819     KK RC156-C
  820     KM  ROUTE CNN156-C TO NN144-C
  821     KM  FACILITY = UPPER LAS VEGAS WASH
  822     KM  FACILITY ID-MILE = LVUP 0079
  823     KM  LINING = CONCRETE
  824     RD    2630   0.006   0.015       0    TRAP      50       0
          *

  825     KK NN128-C
  826     BA   0.295
  827     PB    2.77
  828     LS       0    82.6
  829     UD   0.552
          *
```

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

  830     KKRNN128-C
  831     KM  ROUTE NN128-C TO NN144-C
  832     KM  STREET NAME = HAMMER TO 5TH TO WASHBURN
  833     RD    3500   0.008   0.016       0    TRAP       0      50
          *

  834     KK NN129-C
  835     BA   0.237
  836     PB    2.77
  837     LS       0    88.1
  838     UD   0.403
          *

  839     KKRNN129-C
  840     KM  ROUTE NN129-C TO NN144-C
  841     KM  STREET NAME = WASHBURN
  842     RD    2000    0.01   0.016       0    TRAP       0      50
          *

  843     KK NN144-C
  844     BA   0.189
  845     PB    2.77
  846     LS       0    67.9
  847     UD   0.356
          *

  848     KKCNN144-C
  849     KM  COMBINE NN144-C, RNN129-C, RNN128-C AND RC156-C
  850     KM  UPPER LAS VEGAS WASH @ WASHBURN
  851     HC       4
          *

  852     KK RC144-C
  853     KM  ROUTE CNN144-C TO NN170-C
  854     KM  FACILITY = UPPER LAS VEGAS WASH
  855     KM  FACILITY ID-MILE = LVUP 0071
  856     KM  LINING = CONCRETE
  857     RD    3310   0.009   0.015       0    TRAP      50       0
          *

  858     KK NN146-C
  859     BA   0.475
  860     PB    2.77
  861     LS       0    87.0
  862     UD   0.517
          *

  863     KK NN166-C
  864     BA   0.242
  865     PB    2.77
  866     LS       0    71.8
  867     UD   0.354
          *
```

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

  868     KKRNN166-C
  869     KM  ROUTE NN166-C TO NN170-C
  870     KM  STREET NAME = STATZ
  871     RD    6000    0.01   0.016       0    TRAP       0      50
          *

  872     KK NN170-C
  873     BA   0.402
  874     PB    2.77
  875     LS       0    80.7
  876     UD   0.477
          *

  877     KKCNN170-C
  878     KM  COMBINE NN170-C, RNN166-C, NN146-C AND RC144-C
  879     KM  UPPER LAS VEGAS WASH @ RED COACH AND STATZ
  880     HC       4
          *

  881     KK RC170-C
  882     KM  ROUTE CNN170-C TO NN174-C
  883     KM  FACILITY = UPPER LAS VEGAS WASH
  884     KM  FACILITY ID-MILE = LVUP 0001
  885     KM  LINING = CONCRETE
  886     RD    2630   0.005   0.015       0    TRAP      50       0
          *

  887     KK NN175-C
  888     BA   0.344
  889     PB    2.77
  890     LS       0    94.1
  891     UD   0.462
          *

  892     KK NN174-C
  893     BA   0.331
  894     PB    2.77
  895     LS       0    92.6
  896     UD   0.404
          *

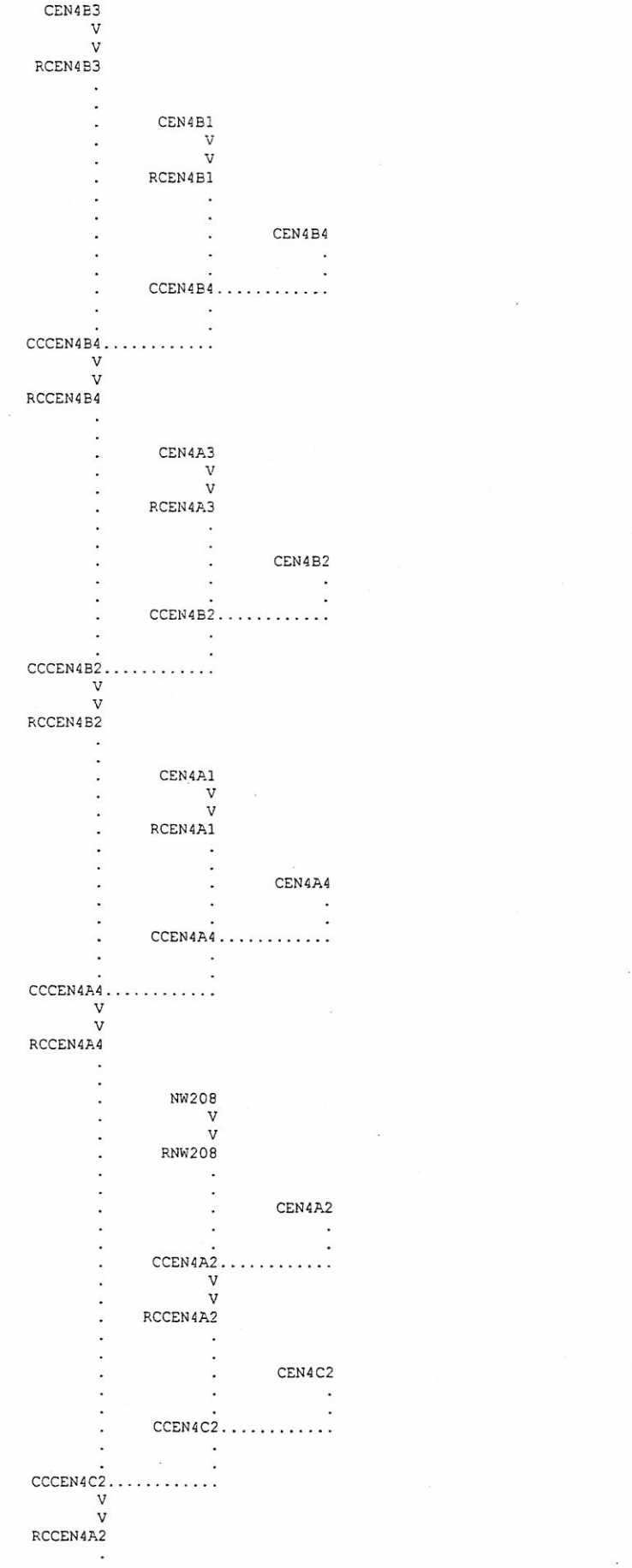
  897     KKCNN174-C
  898     KM  COMBINE NN174-C, NN175-C AND RC170-C
  899     KM  UPPER LAS VEGAS WASH @ CRAIG
  900     HC       3
          *
          *
  901     ZZ
```

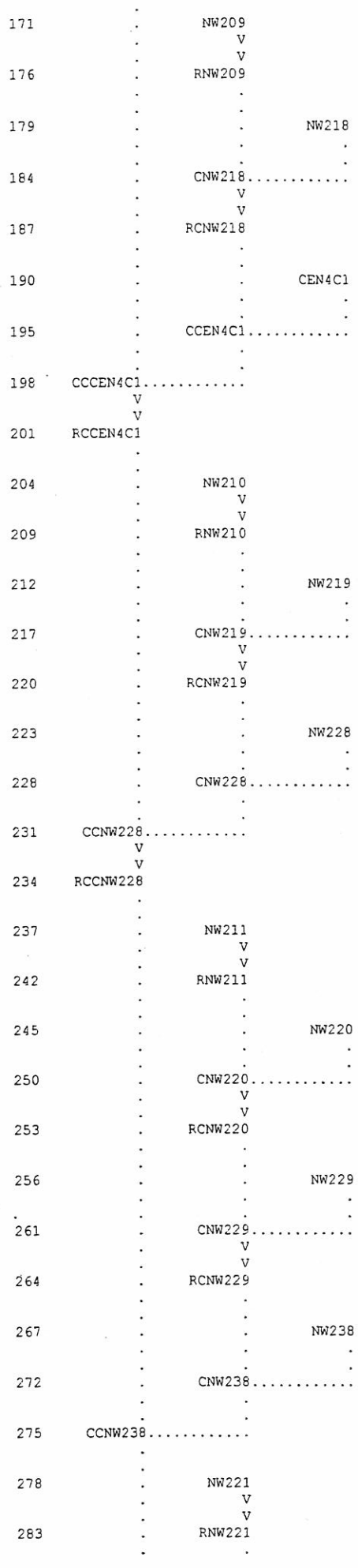
SCHEMATIC DIAGRAM OF STREAM NETWORK

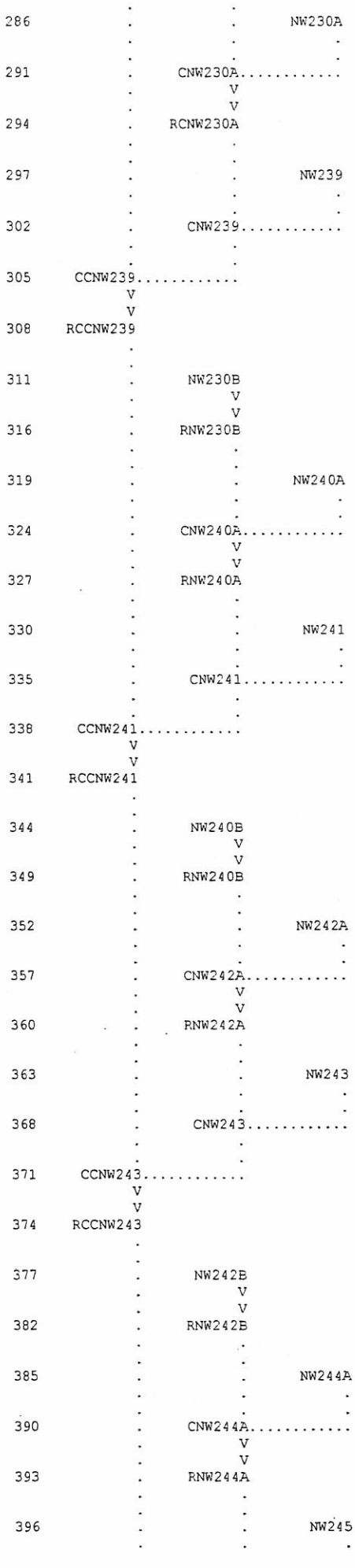
INPUT LINE NO.

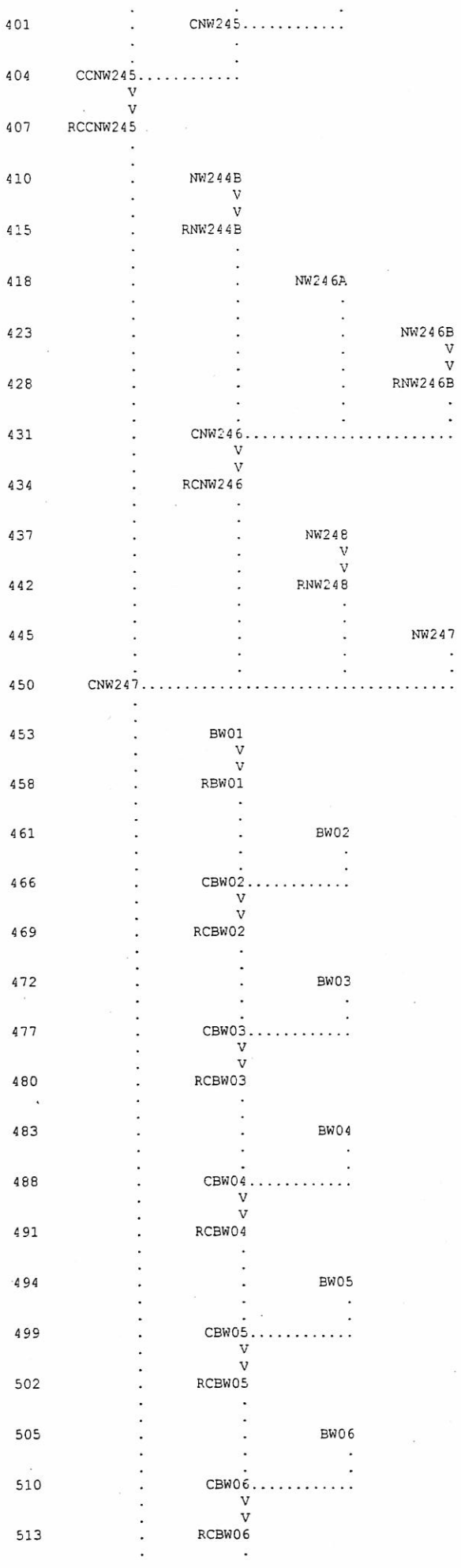
(V) ROUTING (---->) DIVERSION OR PUMP FLOW

(.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW




171 NW209
176 RNW209
179 NW218
184 CNW218
187 RCNW218
190 CEN4C1
195 CCEN4C1
198 CCCEN4C1
201 RCCEN4C1
204 NW210
209 RNW210
212 NW219
217 CNW219
220 RCNW219
223 NW228
228 CNW228
231 CCNW228
234 RCCNW228
237 NW211
242 RNW211
245 NW220
250 CNW220
253 RCNW220
256 NW229
261 CNW229
264 RCNW229
267 NW238
272 CNW238
275 CCNW238
278 NW221
283 RNW221


286 NW230A
291 CNW230A
294 RCNW230A
297 NW239
302 CNW239
305 CCNW239
308 RCCNW239
311 NW230B
316 RNW230B
319 NW240A
324 CNW240A
327 RNW240A
330 NW241
335 CNW241
338 CCNW241
341 RCCNW241
344 NW240B
349 RNW240B
352 NW242A
357 CNW242A
360 RNW242A
363 NW243
368 CNW243
371 CCNW243
374 RCCNW243
377 NW242B
382 RNW242B
385 NW244A
390 CNW244A
393 RNW244A
396 NW245


401 CNW245
404 CCNW245
407 RCCNW245
410 NW244B
415 RNW244B
418 NW246A
423 NW246B
428 RNW246B
431 CNW246
434 RCNW246
437 NW248
442 RNW248
445 NW247
450 CNW247
453 BW01
458 RBW01
461 BW02
466 CBW02
469 RCBW02
472 BW03
477 CBW03
480 RCBW03
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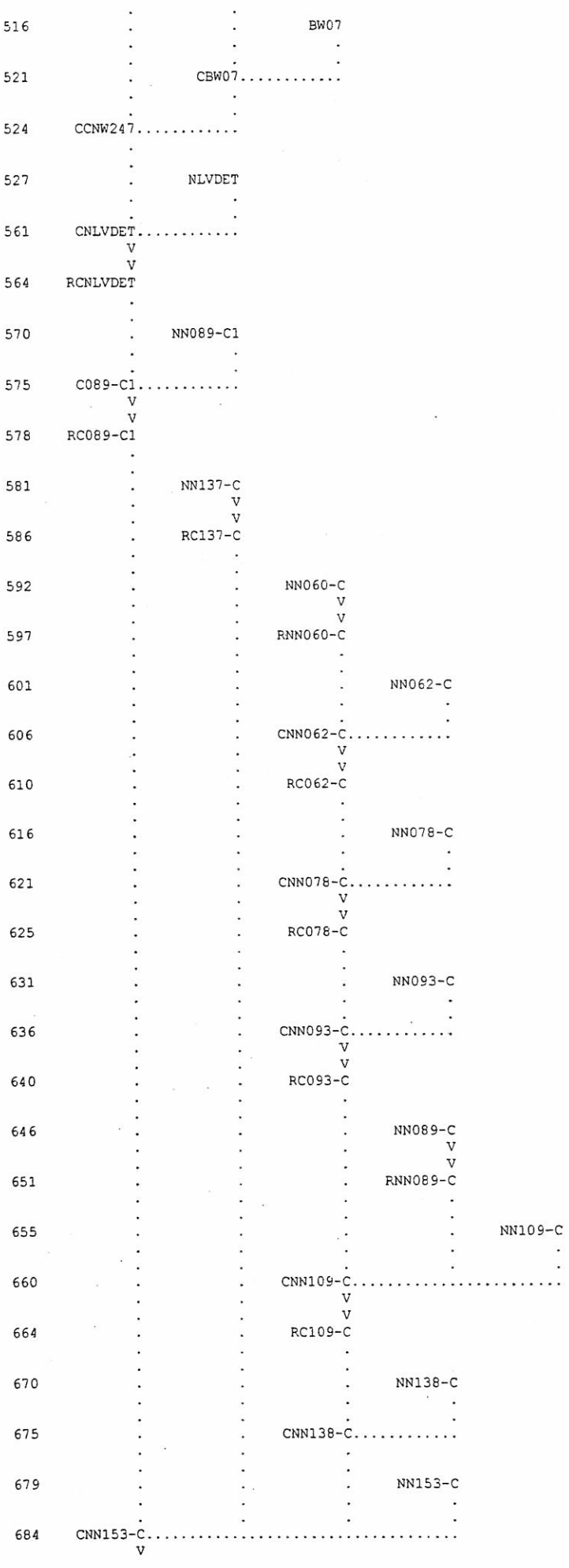
505 BW06
510 CBW06
513 RCBW06


516 BW07
521 CBW07
524 CCNW247
527 NLVDET
561 CNLVDET
564 RCNLVDET
570 NN089-C1
575 C089-C1
578 RC089-C1
581 NN137-C
586 RC137-C
592 NN060-C
597 RNN060-C
601 NN062-C
606 CNN062-C
610 RC062-C
616 NN078-C
621 CNN078-C
625 RC078-C
631 NN093-C
636 CNN093-C
640 RC093-C
646 NN089-C
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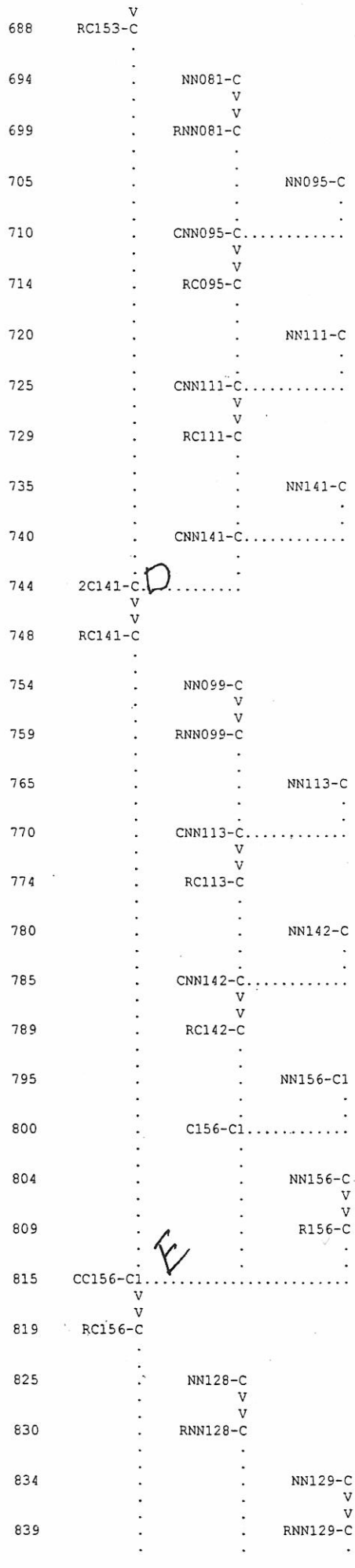
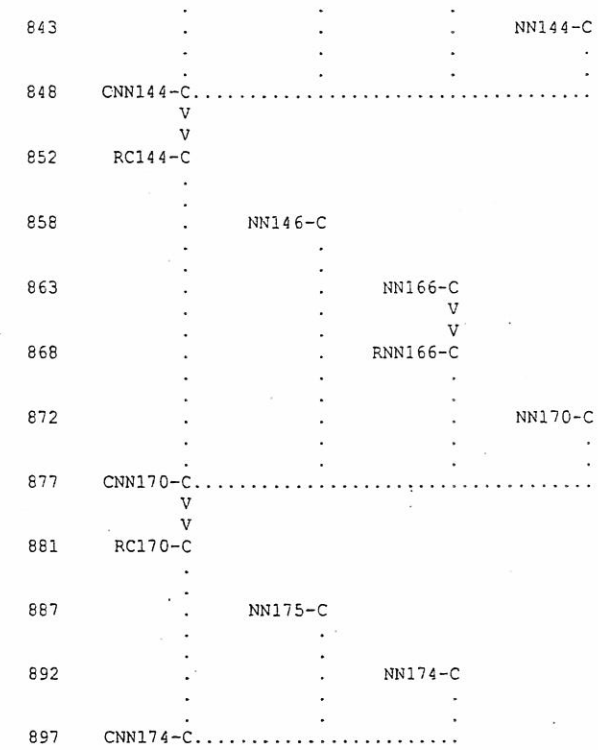
675 CNN138-C
679 NN153-C
684 CNN153-C


688 RC153-C
694 NN081-C
699 RNN081-C
705 NN095-C
710 CNN095-C
714 RC095-C
720 NN111-C
725 CNN111-C
729 RC111-C
735 NN141-C
740 CNN141-C
744 2C141-C
748 RC141-C
754 NN099-C
759 RNN099-C
765 NN113-C
770 CNN113-C
774 RC113-C
780 NN142-C
785 CNN142-C
789 RC142-C
795 NN156-C1
800 C156-C1
804 NN156-C
809 R156-C
815 CC156-C1
819 RC156-C
825 NN128-C
830 RNN128-C
834 NN129-C
839 RNN129-C



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*            SEPTEMBER 1990             *
*             VERSION 4.0               *
*                                       *
*  N DATE  10/25/2001  TIME  14:45:26   *
*                                       *
*****************************************
```


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


```
*************************************************
*      UPPER LAS VEGAS WASH CHANNEL PROJECT     *
*                                               *
*          OFF-SITE HYDROLOGY ANALYSIS          *
*                                               *
*************************************************
```

PREPARED FOR: CITY OF NORTH LAS VEGAS
PREPARED BY: VTN NEVADA
DATE: 10/25/2001
FILE: ULVWSDN4.DAT

STORM: SDN4
FUTURE CONDITION, FUTURE FACILITIES

Subbasins north of Beltway from Decatur Boulevard to Clayton Street are based on "Northern segment of the Las Vegas Beltway Jones Boulevard to Simmons Street (100% Submittal)" (CCRFCD, VTN, 10/2000) Subbasins north of Beltway from Clayton Street to 5th Street are based on "Northern Beltway North Fifth Street to Pecos Road (Final)" (CCRFCD, PB, 1/2001)

Subbasins south of Beltway are based on MPU 2002 by PBS&J. Subbasins adjacent to Beltway and Upper Las Vegas Wash Channel have been revised

Runoff from the Beltway roadway surface will be conveyed through storm drain along the Beltway and discharge into Upper Las Vegas Wash Channe at North 5th Street.

All subareas in this file are in the McCarran Airport Rainfall Area (100-yr, 6-hr ppn = 2.774 in.); precipitation (PB) cards include CCRFCD 1.43 adjustment, but no DARF's; SDN 4; use DARF's (JR card) based on the following table:

No.	Collecting Point	Drainage Area	DARF
1	EKEA	4.38 sq mi	0.908
2	EKEA+Beltway	4.84 sq mi	0.906
3	A(EKEA+Beltway+NLVDB)	4.84 sq mi	0.906
4	B	4.99 sq mi	0.905
5	Centennial	2.75 sq mi	0.923
6	C	8.33 sq mi	0.877
7	Tropical	1.27 sq mi	0.959
8	D	9.60 sq mi	0.864
9	Ann	1.21 sq mi	0.962
10	E	11.09 sq mi	0.852
11	F	11.81 sq mi	0.847
12	G	12.93 sq mi	0.839
13	H	13.60 sq mi	0.835

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

   IT          HYDROGRAPH TIME DATA
                     NMIN          5  MINUTES IN COMPUTATION INTERVAL
                    IDATE      1   0  STARTING DATE
                    ITIME       0000  STARTING TIME
                       NQ        300  NUMBER OF HYDROGRAPH ORDINATES
                   NDDATE      2   0  ENDING DATE
                   NDTIME       0055  ENDING TIME
                    ICENT         19  CENTURY MARK

                 COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE   24.92 HOURS

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

   JP          MULTI-PLAN OPTION
                    NPLAN          1  NUMBER OF PLANS
```

```
JR          MULTI-RATIO OPTION
                RATIOS OF PRECIPITATION
                .88       .86       .85       .85
```

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .88	RATIO 2 .86	RATIO 3 .85	RATIO 4 .85
HYDROGRAPH AT								
+	CEN4B3	.13	1	FLOW	143.	140.	138.	137.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RCEN4B3	.13	1	FLOW	139.	136.	136.	135.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4B1	.13	1	FLOW	140.	137.	135.	134.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RCEN4B1	.13	1	FLOW	134.	131.	129.	128.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4B4	.03	1	FLOW	37.	37.	36.	36.
				TIME	3.50	3.50	3.50	3.50
2 COMBINED AT								
+	CCEN4B4	.15	1	FLOW	162.	159.	156.	155.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CCCEN4B4	.28	1	FLOW	294.	288.	286.	283.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCCEN4B4	.28	1	FLOW	290.	284.	281.	279.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4A3	.13	1	FLOW	108.	106.	104.	103.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RCEN4A3	.13	1	FLOW	107.	105.	103.	102.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4B2	.11	1	FLOW	122.	120.	118.	117.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CCEN4B2	.23	1	FLOW	217.	213.	208.	206.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CCCEN4B2	.51	1	FLOW	499.	489.	482.	478.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCCEN4B2	.51	1	FLOW	493.	483.	475.	472.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4A1	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RCEN4A1	.13	1	FLOW	103.	100.	99.	97.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4A4	.13	1	FLOW	110.	108.	106.	105.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CCEN4A4	.25	1	FLOW	210.	205.	202.	199.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCCEN4A4	.76	1	FLOW	703.	688.	677.	671.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCCEN4A4	.76	1	FLOW	684.	669.	657.	651.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW208	.13	1	FLOW	104.	101.	99.	98.

				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RNW208	.13	1	FLOW	103.	100.	99.	97.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4A2	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CCEN4A2	.25	1	FLOW	206.	200.	197.	194.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCCEN4A2	.25	1	FLOW	201.	196.	192.	190.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4C2	.03	1	FLOW	36.	35.	35.	34.
				TIME	3.50	3.50	3.50	3.50
2 COMBINED AT								
+	CCEN4C2	.28	1	FLOW	222.	216.	212.	210.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCCEN4C2	1.04	1	FLOW	906.	885.	869.	861.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCCEN4A2	1.04	1	FLOW	887.	869.	854.	847.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW209	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RNW209	.13	1	FLOW	103.	100.	99.	97.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW218	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CNW218	.25	1	FLOW	206.	200.	197.	194.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCNW218	.25	1	FLOW	198.	193.	189.	187.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	CEN4C1	.09	1	FLOW	92.	90.	88.	88.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CCEN4C1	.34	1	FLOW	276.	269.	264.	261.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCCEN4C1	1.38	1	FLOW	1141.	1117.	1098.	1088.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCCEN4C1	1.38	1	FLOW	1141.	1116.	1096.	1086.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW210	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RNW210	.13	1	FLOW	103.	100.	99.	97.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW219	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CNW219	.25	1	FLOW	206.	200.	197.	194.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCNW219	.25	1	FLOW	199.	194.	191.	189.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW228	.13	1	FLOW	105.	103.	101.	100.
				TIME	3.58	3.58	3.58	3.58

2 COMBINED AT								
+	CNW228	.38	1	FLOW	299.	292.	285.	283.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCNW228	1.76	1	FLOW	1426.	1395.	1370.	1357.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCCNW228	1.76	1	FLOW	1418.	1387.	1360.	1348.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW211	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RNW211	.13	1	FLOW	103.	100.	99.	97.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW220	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CNW220	.25	1	FLOW	206.	200.	197.	194.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCNW220	.25	1	FLOW	199.	194.	191.	189.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW229	.13	1	FLOW	110.	108.	106.	105.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CNW229	.38	1	FLOW	303.	295.	289.	286.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCNW229	.38	1	FLOW	295.	288.	283.	280.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW238	.10	1	FLOW	102.	100.	98.	98.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CNW238	.47	1	FLOW	367.	358.	351.	347.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCNW238	2.23	1	FLOW	1772.	1733.	1700.	1684.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW221	.13	1	FLOW	104.	101.	99.	98.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RNW221	.13	1	FLOW	103.	100.	99.	98.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW230A	.13	1	FLOW	117.	115.	113.	112.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW230A	.26	1	FLOW	220.	215.	211.	210.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCNW230A	.26	1	FLOW	217.	212.	208.	207.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW239	.13	1	FLOW	117.	114.	112.	111.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CNW239	.38	1	FLOW	313.	306.	300.	298.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCNW239	2.61	1	FLOW	2081.	2034.	1996.	1978.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCCNW239	2.61	1	FLOW	2064.	2017.	1977.	1959.
				TIME	3.75	3.75	3.75	3.75

HYDROGRAPH AT								
+	NW230B	.13	1	FLOW	117.	115.	113.	112.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNW230B	.13	1	FLOW	116.	113.	111.	111.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW240A	.13	1	FLOW	117.	115.	113.	112.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW240A	.26	1	FLOW	226.	221.	217.	216.
				TIME	3.67	3.75	3.67	3.75
ROUTED TO								
+	RNW240A	.26	1	FLOW	226.	221.	217.	215.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW241	.14	1	FLOW	113.	111.	109.	108.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW241	.40	1	FLOW	333.	327.	320.	318.
				TIME	3.75	3.75	3.75	3.75
2 COMBINED AT								
+	CCNW241	3.02	1	FLOW	2397.	2343.	2298.	2276.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCCNW241	3.02	1	FLOW	2358.	2303.	2256.	2235.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW240B	.13	1	FLOW	117.	115.	113.	112.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNW240B	.13	1	FLOW	116.	113.	111.	111.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW242A	.13	1	FLOW	107.	105.	103.	102.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW242A	.26	1	FLOW	216.	211.	208.	206.
				TIME	3.67	3.67	3.67	3.75
ROUTED TO								
+	RNW242A	.26	1	FLOW	216.	211.	207.	205.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW243	.14	1	FLOW	115.	113.	111.	110.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW243	.41	1	FLOW	323.	317.	311.	308.
				TIME	3.75	3.75	3.75	3.75
2 COMBINED AT								
+	CCNW243	3.42	1	FLOW	2682.	2620.	2567.	2543.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCCNW243	3.42	1	FLOW	2625.	2570.	2521.	2500.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NW242B	.13	1	FLOW	107.	105.	103.	102.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNW242B	.13	1	FLOW	105.	104.	101.	100.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW244A	.13	1	FLOW	107.	105.	103.	102.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW244A	.26	1	FLOW	207.	202.	198.	196.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNW244A	.26	1	FLOW	206.	202.	198.	196.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								

+	NW245	.14	1	FLOW	115.	113.	111.	110.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNW245	.41	1	FLOW	314.	307.	301.	298.
				TIME	3.75	3.75	3.75	3.75
2 COMBINED AT								
+	CCNW245	3.83	1	FLOW	2930.	2861.	2801.	2777.
				TIME	3.75	3.75	3.75	3.83
ROUTED TO								
+	RCCNW245	3.83	1	FLOW	2919.	2856.	2800.	2776.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NW244B	.13	1	FLOW	105.	103.	101.	100.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNW244B	.13	1	FLOW	104.	102.	100.	99.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW246A	.12	1	FLOW	101.	98.	97.	96.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW246B	.08	1	FLOW	64.	63.	61.	61.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNW246B	.08	1	FLOW	63.	62.	61.	60.
				TIME	3.75	3.75	3.75	3.75
3 COMBINED AT								
+	CNW246	.34	1	FLOW	261.	256.	250.	249.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCNW246	.34	1	FLOW	259.	253.	248.	246.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NW248	.05	1	FLOW	52.	51.	50.	49.
				TIME	3.58	3.58	3.58	3.58
ROUTED TO								
+	RNW248	.05	1	FLOW	49.	48.	47.	46.
				TIME	3.67	3.67	3.67	3.67
HYDROGRAPH AT								
+	NW247	.16	1	FLOW	127.	125.	122.	121.
				TIME	3.67	3.67	3.67	3.67
4 COMBINED AT								
+	CNW247	4.38	1	FLOW	3305.	3234.	3171.	3144.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	BW01	.06	1	FLOW	59.	58.	57.	57.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RBW01	.06	1	FLOW	58.	57.	56.	56.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	BW02	.09	1	FLOW	97.	96.	94.	94.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CBW02	.15	1	FLOW	149.	147.	145.	144.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RCBW02	.15	1	FLOW	148.	145.	143.	142.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	BW03	.07	1	FLOW	73.	72.	71.	71.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CBW03	.21	1	FLOW	214.	211.	208.	206.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCBW03	.21	1	FLOW	208.	206.	203.	201.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	BW04	.04	1	FLOW	51.	50.	50.	49.

				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CBW04	.25	1	FLOW	249.	246.	242.	241.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCBW04	.25	1	FLOW	245.	241.	238.	236.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	BW05	.07	1	FLOW	79.	77.	76.	76.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CBW05	.32	1	FLOW	304.	300.	295.	293.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCBW05	.32	1	FLOW	300.	295.	291.	289.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	BW06	.06	1	FLOW	86.	85.	84.	83.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CBW06	.38	1	FLOW	344.	338.	334.	332.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RCBW06	.38	1	FLOW	343.	338.	333.	330.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	BW07	.08	1	FLOW	101.	99.	98.	97.
				TIME	3.58	3.58	3.58	3.58
2 COMBINED AT								
+	CBW07	.46	1	FLOW	414.	409.	403.	399.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CCNW247	4.84	1	FLOW	3693.	3615.	3546.	3516.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NLVDET	.00	1	FLOW	2691.	2691.	2691.	2691.
				TIME	7.17	7.17	7.17	7.17
2 COMBINED AT								
+	CNLVDET	4.84	1	FLOW	3838.	3760.	3691.	3661.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RCNLVDET	4.84	1	FLOW	3813.	3735.	3663.	3633.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN089-C1	.15	1	FLOW	104.	101.	99.	98.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	C089-C1	4.99	1	FLOW	3895.	3814.	3741.	3710.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RC089-C1	4.99	1	FLOW	3844.	3762.	3686.	3651.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN137-C	.26	1	FLOW	127.	123.	120.	118.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RC137-C	.26	1	FLOW	126.	122.	119.	117.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NN060-C	.54	1	FLOW	437.	428.	420.	416.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNN060-C	.54	1	FLOW	432.	423.	414.	411.
				TIME	3.75	3.75	3.75	3.83
HYDROGRAPH AT								
+	NN062-C	.47	1	FLOW	348.	341.	333.	330.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNN062-C	1.01	1	FLOW	772.	755.	739.	733.
				TIME	3.75	3.75	3.75	3.75

ROUTED TO								
+	RC062-C	1.01	1	FLOW	760.	744.	729.	722.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NN078-C	.43	1	FLOW	264.	258.	253.	250.
				TIME	3.83	3.83	3.83	3.83
2 COMBINED AT								
+	CNN078-C	1.44	1	FLOW	1017.	995.	975.	965.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RC078-C	1.44	1	FLOW	1012.	991.	967.	962.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN093-C	.32	1	FLOW	260.	254.	249.	247.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	CNN093-C	1.76	1	FLOW	1224.	1201.	1172.	1164.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RC093-C	1.76	1	FLOW	1222.	1197.	1169.	1163.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN089-C	.44	1	FLOW	346.	339.	333.	330.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RNN089-C	.44	1	FLOW	344.	337.	331.	328.
				TIME	3.83	3.83	3.83	3.92
HYDROGRAPH AT								
+	NN109-C	.26	1	FLOW	228.	224.	219.	217.
				TIME	3.67	3.67	3.67	3.67
3 COMBINED AT								
+	CNN109-C	2.46	1	FLOW	1730.	1695.	1657.	1647.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RC109-C	2.46	1	FLOW	1705.	1670.	1633.	1621.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN138-C	.29	1	FLOW	116.	112.	109.	108.
				TIME	3.92	3.92	4.00	4.00
2 COMBINED AT								
+	CNN138-C	2.75	1	FLOW	1815.	1777.	1736.	1723.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN153-C	.33	1	FLOW	111.	107.	104.	103.
				TIME	3.92	3.92	3.92	3.92
4 COMBINED AT								
+	CNN153-C	8.33	1	FLOW	5881.	5755.	5633.	5582.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RC153-C	8.33	1	FLOW	5804.	5682.	5570.	5529.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN081-C	.31	1	FLOW	197.	193.	189.	187.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RNN081-C	.31	1	FLOW	197.	193.	188.	187.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN095-C	.26	1	FLOW	180.	176.	173.	171.
				TIME	3.75	3.75	3.75	3.75
2 COMBINED AT								
+	CNN095-C	.57	1	FLOW	372.	363.	355.	352.
				TIME	3.75	3.75	3.75	3.75
ROUTED TO								
+	RC095-C	.57	1	FLOW	368.	361.	352.	349.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN111-C	.26	1	FLOW	120.	117.	113.	112.
				TIME	3.83	3.83	3.83	3.83

2 COMBINED AT								
+	CNN111-C	.84	1	FLOW	488.	477.	465.	462.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RC111-C	.84	1	FLOW	485.	475.	463.	459.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN141-C	.44	1	FLOW	227.	221.	216.	214.
				TIME	3.83	3.83	3.83	3.83
2 COMBINED AT								
+	CNN141-C	1.27	1	FLOW	711.	696.	679.	673.
				TIME	3.92	3.92	3.92	3.92
2 COMBINED AT								
+	2C141-C	9.60	1	FLOW	6516.	6378.	6249.	6202.
				TIME	3.92	3.92	3.92	3.92
ROUTED TO								
+	RC141-C	9.60	1	FLOW	6506.	6365.	6238.	6183.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN099-C	.21	1	FLOW	160.	157.	153.	152.
				TIME	3.67	3.67	3.67	3.67
ROUTED TO								
+	RNN099-C	.21	1	FLOW	155.	154.	149.	147.
				TIME	3.75	3.75	3.75	3.75
HYDROGRAPH AT								
+	NN113-C	.54	1	FLOW	225.	219.	213.	210.
				TIME	3.92	3.92	3.92	3.92
2 COMBINED AT								
+	CNN113-C	.75	1	FLOW	362.	353.	345.	341.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RC113-C	.75	1	FLOW	361.	353.	345.	340.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN142-C	.32	1	FLOW	99.	96.	93.	92.
				TIME	4.00	4.00	4.00	4.00
2 COMBINED AT								
+	CNN142-C	1.07	1	FLOW	459.	448.	436.	431.
				TIME	3.92	3.92	3.92	3.92
ROUTED TO								
+	RC142-C	1.07	1	FLOW	458.	447.	435.	430.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN156-C1	.14	1	FLOW	77.	75.	73.	72.
				TIME	3.67	3.67	3.67	3.67
2 COMBINED AT								
+	C156-C1	1.21	1	FLOW	516.	503.	490.	484.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN156-C	.28	1	FLOW	73.	71.	68.	67.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	R156-C	.28	1	FLOW	73.	70.	68.	67.
				TIME	3.92	3.92	3.92	3.92
3 COMBINED AT								
+	CC156-C1	11.09	1	FLOW	7095.	6939.	6796.	6735.
				TIME	3.92	3.92	3.92	3.92
ROUTED TO								
+	RC156-C	11.09	1	FLOW	7057.	6897.	6749.	6689.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN128-C	.29	1	FLOW	118.	115.	112.	111.
				TIME	4.00	4.00	4.00	4.00
ROUTED TO								
+	RNN128-C	.29	1	FLOW	118.	115.	112.	111.
				TIME	4.17	4.17	4.17	4.17
HYDROGRAPH AT								
+	NN129-C	.24	1	FLOW	149.	146.	143.	142.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								

+	RNN129-C	.24	1	FLOW	150.	146.	143.	142.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN144-C	.19	1	FLOW	30.	29.	27.	27.
				TIME	3.83	3.92	3.92	3.92
4 COMBINED AT								
+	CNN144-C	11.81	1	FLOW	7326.	7158.	7003.	6940.
				TIME	3.92	3.92	3.92	3.92
ROUTED TO								
+	RC144-C	11.81	1	FLOW	7243.	7071.	6911.	6849.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN146-C	.47	1	FLOW	249.	243.	238.	236.
				TIME	3.92	3.92	3.92	3.92
HYDROGRAPH AT								
+	NN166-C	.24	1	FLOW	57.	55.	53.	52.
				TIME	3.83	3.83	3.83	3.83
ROUTED TO								
+	RNN166-C	.24	1	FLOW	56.	54.	52.	50.
				TIME	4.17	4.17	4.17	4.17
HYDROGRAPH AT								
+	NN170-C	.40	1	FLOW	156.	151.	147.	146.
				TIME	3.92	3.92	3.92	3.92
4 COMBINED AT								
+	CNN170-C	12.93	1	FLOW	7665.	7479.	7305.	7238.
				TIME	3.92	3.92	3.92	3.92
ROUTED TO								
+	RC170-C	12.93	1	FLOW	7611.	7448.	7287.	7230.
				TIME	4.00	4.00	4.00	4.00
HYDROGRAPH AT								
+	NN175-C	.34	1	FLOW	260.	256.	251.	250.
				TIME	3.83	3.83	3.83	3.83
HYDROGRAPH AT								
+	NN174-C	.33	1	FLOW	253.	248.	244.	242.
				TIME	3.83	3.83	3.83	3.83
3 COMBINED AT								
+	CNN174-C	13.60	1	FLOW	8072.	7901.	7732.	7672.
				TIME	4.00	4.00	4.00	4.00

–

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

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APPENDIX D

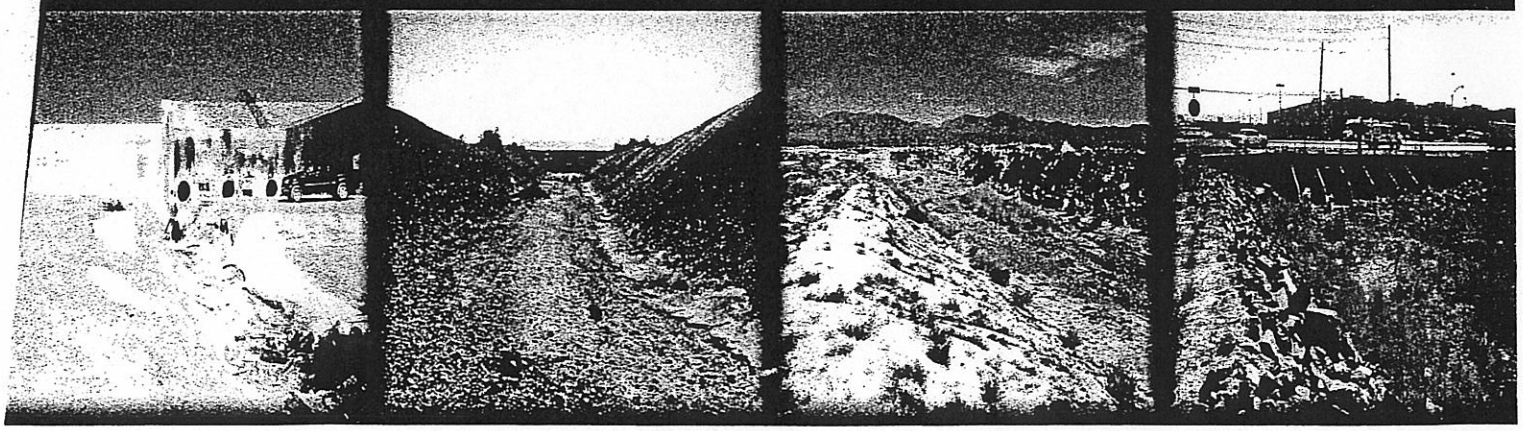
Reference Hydraulics

NLV. DI.C.OO

UPPER LAS VEGAS WASH CHANNEL

CITY OF
NORTH LAS VEGAS
Your Community of Choice

90% Design Report



Provided By: vtn nevada

October 2002

5.0 HYDRAULIC ANALYSIS

5.1 Design Criteria

The hydraulic calculations and channel design presented in this report were performed in accordance with the criteria established in Clark County Regional Flood Control District's (CCRFCD) *Hydrologic Criteria and Drainage Design Manual 1999* and criteria established by the United States Army Corps of Engineers (USACE). WSPG was used to model the flows through the ULVW channel from the Outflow Channel of the North Las Vegas Detention Basin to Craig Road. Pulsating flow (roll waves and shock waves) analysis was based on the method presented in French's *Open Channel Hydraulics*.

5.2 Design Flows

Based on the hydrology analysis in Section 4.0 and presented in Appendix C, the peak design flow for each channel section is listed in the following table:

TABLE 5.1 – CHANNEL DESIGN FLOWS

Channel Section	Channel Reach[1]	Description	Design Flow (cfs)
EKEA[2]	Beltway Channel	North 5th Street To the ULVW Channel	**3,750**
NLVDB[3]	North Las Vegas Detention Basin Outflow Channel	Outflow Channel To the ULVW Channel	**2,690**
BELT	Beltway	Inflow from onsite of the Beltway	**548**
A to B	Sta. 10+00 to Sta. 41+75	Start of ULVW Channel to Deer Springs Way	**4,810**
B to C	Sta. 41+75 to Sta. 74+00	Deer Springs Way to Centennial Parkway	**5,880**
C to D	Sta. 74+00 to Sta. 102+00	Centennial Parkway to Tropical Parkway	**6,380**
D to E	Sta. 102+00 to Sta. 129+50	Tropical Parkway to Ann Road	**6,800**
E to F	Sta. 129+50 to Sta. 155+75	Ann Road to Washburn Road	**6,940**
F to G	Sta. 155+75 to Sta. 187+00	Washburn Road to Lone Mountain Road	**6,940**
G to H	Sta. 187+00 to Sta. 215+00	Lone Mountain Road to Craig Road	**6,940**

[1] Stations based on Alternative 1 alignment
[2] Flow in EKEA channel at North Fifth
[3] Outfall from North Las Vegas Detention Basin

5.3 Basic Channel Hydraulics

5.3.1 Air Entrainment

Air entrainment should be considered in the design of rapid flow channels. The entrainment of air may result in the bulking of flow and may necessitate increased wall heights. There is no appreciable air entrainment when the Froude number is less than 1.6. According to the Corps of Engineers (COE, EM 1110-2-1601, and WASURO User's Manual), the depth of flow with air entrainment is given by the following equation:

$$\frac{y^*}{y} = \begin{cases} 0.906(e)^{0.0615F_r} & F_r \le 8.2 \\ 0.620(e)^{0.1051F_r} & F > 8.2 \end{cases}$$

where : y^* = the depth with air

y = the depth without air

e = a constant, equal to 2.71828

F_r = the Froude number

The equation for the Froude number is:

$$F_r = \frac{V}{\sqrt{g\,(A/T)}}$$

Where V is the velocity of flow, A is the area of flow, T is the width of water surface, and g is the acceleration due to gravity. Air entrainment calculations are included in Section 5.5 (Table 5.2).

5.3.2 Superelevation

According to CCRFCD, the superelevation in a curved channel section is calculated from the following formula:

$$\Delta y = C\frac{V^2 W}{gR}$$

where:

Δy = superelevation (rise in water between a theoretical level water surface at the center-line and outside water surface elevation)

C = coefficient, C = 1 for rapid flow in simple circular rectangular and trapezoidal channels

V = mean channel velocity

W = channel width at the water surface elevation

g = acceleration of gravity

R = radius of channel center-line curvature

A curved channel section with a small radius may result in considerable superelevation in the channel. The largest possible radius should be used. According to CCRFCD, the minimum radius in Clark County is 50 feet and the maximum allowable superelevation is 2 feet. Superelevation calculations are included in Section 5.5 (Table 5.2).

5.3.3 Cross Waves

Cross waves will form in a curved channel when the flow is supercritical. For a rectangular channel, the flow depth along the channel walls can be computed as follows:

$$y = \frac{V^2}{g}\sin^2(\beta + \frac{\theta}{2})$$

where

$$\sin\beta = \frac{1}{Fr} = \frac{\sqrt{gy}}{V}$$

$$\theta = \tan^{-1}\frac{2b}{(2r_c + b)\tan\beta}$$

and V = velocity, b = width of the channel, r_c = radius of the centerline of the channel, θ = deflection angle or central angle, which is positive for depths along the outer wall and negative for depths along the inner wall, and β = angle of wave front.

According to experimental investigations made by Ippen and Knapp, the maximum superelevation caused by cross waves in supercritical flows is V^2/gr_c (Chow, 1959). This superelevation

calculation is included in Table 5.2. Hence, a separate calculation for the cross waves is not needed.

5.3.4 Pulsating Flow

5.3.4.1 Transition Point

In supercritical flow, when the slope of a channel is very steep or if the Froude number is high, the flow may become unstable. Roll waves may develop in these channels and hydraulic bores or shock waves may be formed. Escoffier and Boyd developed a relationship for the transition point between stable and unstable flow (French, 1985). In this development, if

$$J > \left| 5.723 \frac{\rho^{1/3}}{\delta^{1/2}} \frac{d\zeta}{d\rho} \right|$$

then, the flow is unstable. In the above equation

$$\zeta = \frac{y}{b}$$

$$\rho = \frac{R}{b}$$

$$J = \frac{b^{1/6}\sqrt{S}}{n}$$

where b = bottom width of channel for rectangular and trapezoidal sections and diameter for circular sections

y = flow depth

D = hydraulic depth

R = hydraulic radius

S = channel slope

n = Manning's roughness coefficient.

In the above equation, $d\zeta/d\rho$ can be further expressed as the following equation:

$$\frac{d\zeta}{d\rho} = \frac{P}{T - 2R\sqrt{1+Z^2}}$$

where P is the wetted perimeter, T is the water surface width, and Z is the reciprocal of side

slope (vertical : horizontal = 1 : Z). If the flow is unstable, roll waves may develop and shock waves may form, provided the channel is long enough. If pulsating flow can be expected, then a new Manning's n for pulsating flow is used in calculating flow parameters, and the height of wall is increased to accommodate the possible maximum flow depth caused by roll waves or shock waves. These parameters are discussed further in Sections 5.3.4.2 and 5.3.4.3.

5.3.4.2 Maximum Flow Depth

The maximum depth of pulsating flow is given by the following equation (French, 1985):

$$y(\max)_{\max} = \bar{y}(\max) + 2.58\,\sigma_{y(\max)}$$

where $y(max)_{max}$ = maximum depth of flow downstream
$\bar{y}(max)$ = mean value of y(max)
$\sigma_{y(max)}$ = standard deviation of y(max)

The above equation can be used in conjunction with Figures 13.15 and 13.16 (French, P627-628) to estimate the maximum downstream depth of flow. From Table 13.7 (French), it can be seen that for a channel slope S < 0.05011, and Froude number Fr < 3.71, roll waves will begin to appear at a distance greater than $2100y_n$ downstream and shock waves at a distance greater than $2600y_n$ downstream, where y_n is the normal depth of flow.

5.3.4.3 Manning's n for Pulsating Flow

Manning's n for pulsating flow can be computed from the following equation (COE, Hydraulic Design of Flood Control Channels, EM 1110-2-1601,1994):

$$\frac{0.0463\,R^{1/6}}{n} = 4.04 - \log_{10}\left(\frac{F}{F_s}\right)^{2/3}$$

where

$$F_s = \frac{\xi}{\sqrt{g}\,\zeta^{3/2}(1+Z\zeta)}$$

where Z is the side slope of the channel and

$$\xi = \frac{Q}{b^{5/2}}, \quad \zeta = \frac{d}{b}$$

where Q is the total discharge and b is the bottom width.

5.3.5 Freeboard

CCRFCD requires the minimum freeboard as follows:
For supercritical flow channels,

$$F_b = 1.0 + 0.025V(y)^{1/3}$$

where, y is the depth of the flow and V is the velocity of the flow.

5.4 Proposed Channel

The project begins at the outflow structure of the North Las Vegas Detention Basin where an approximately 250-foot transition will convey flows from a 53.4'x12' rectangular concrete channel to match the proposed Parsons Brinckerhoff 25'x9' rectangular channel. Approximately 650 feet to the south of the transition, 2-12'x9' RCBs and 2-10'x9' RCBs, which connect to the proposed 2-10'x9' RCBs for the Beltway Project, will convey flows to the EKEA/NLVDB confluence which begins the ULVW Channel. The ULVW Channel is proposed to be a concrete lined rectangular channel. A 12 foot maintenance road is provided on each side of the channel between the EKEA/NLVDB confluence and the Craig Road bridge. The minimum channel bottom width is 42 feet, which would accommodate maintenance vehicle access. The minimum Right-of-Way requirements are illustrated on the Right-of-Way sheets provided in the 70% Design Plan set dated 5/22/2002 that accompany this report. Figure 4 presents a schematic diagram of the Upper Las Vegas Wash Channel relative to the existing floodplain (for Plan and Profile sheets of the Channel, see the 70% Design Plan set).

The Upper Las Vegas Wash Channel is approximately 3.85 miles in length. The ULVW Channel project begins at the downstream end of the North Las Vegas Detention Basin Outflow structure, where a transition structure conveys the basin outflow from the existing 53.4'x12' rectangular channel to an existing 25'x9'

rectangular channel by Parsons Brinckerhoff at Sta. 0+72.43 (P/B "CH2" Sta. 803+50.00). Approximately 650 ft. to the south, a 389.15' section of 2-10'x9'RCB and a 26.87' section of 2-12'x9'RCB combine flows at the EKEA/NLVDB confluence, Sta. 10+00.00. The Channel transitions to a 42'x9' rectangular concrete channel after the confluence structure. A 42'x9' RCB is proposed at the Deer Springs Way crossing. The Channel transitions to a 46'x9' rectangular channel after Deer Springs Way. The Channel becomes a 46'x9' RCB at the intersection with Centennial Parkway just before the Centennial confluence. Downstream of the RCB, a confluence structure collects flow from the Centennial Channel. At the downstream end of the Confluence, the Channel transitions to a 50'x9' rectangular concrete channel.

There is another confluence structure at Tropical Parkway where a 10'x7' RCB with a 150 foot radius conveys flows from the Tropical Parkway Channel in to the ULVW Channel. After the Tropical confluence, the ULVW Channel transitions to a 50'x9' rectangular concrete. A 50'x9' RCB is proposed at the Ann Road crossing. A confluence structure at Ann Road conveys flows from the Ann Road Channel into the ULVW Channel via a 10'x7' RCB with a 150 foot radius. After the confluence at Ann Road, the Channel transitions into a 56'x9' rectangular concrete channel. A 56'x9' RCB conveys flows under Washburn Road. After Washburn Road, the Channel becomes a 56'x12' rectangular channel. A 56'x8' RCB conveys flows under Losee Road. The Channel returns to a 56'x9' rectangular channel downstream of Losee Road. A 56'x7' RCB is proposed at Lone Mountain Road. After Lone Mountain Road, the Channel becomes a 56'x9' open channel and transitions to a 56'x10' open channel at Sta. 204+66.14. Access Ramps are located Sta. 13+36.00, at Sta. 41+65.00, at Sta. 85+55.00, at Sta. 111+00.00, at Sta. 133+25.00, at Sta. 156+50.00, and at Sta. 192+30.00. The downstream end of the ULVW Channel was designed so that the existing Craig Road bridge structure would not need to be modified.

5.5 Channel Hydraulics Summary

The hydraulic analysis for the proposed channel was performed using Water Surface Pressure Gradient (WSPG) software for each alternative. A table describing the channel properties and design flows for each WSPG model is included in Appendix D. The WSPG output for each model is also included in Appendix D.

A Hydraulic Summary Table is provided in Table 5.2. Based on the computed flow depths and velocities given by WSPG, the Froude number was calculated at each station and the depth of flow with air entrainment was calculated, if the Froude number was greater than 1.6. In addition, the flow area, the width of water surface, the superelevation in the curved section, the required freeboard, and the minimum wall height are

provided in the tables.

Pulsating flow (roll waves and shock waves) may occur in rapid flow channels. According to French [3], for channel slope S<0.05011, and Froude number FR<3.71, roll waves will begin to appear at a distance greater than $2100y_n$ downstream, and shock waves at a distance great than $2600y_n$ downstream, where y_n is the normal depth of flow. There are no uniform channel sections within the project limits greater than these distances. Hence, no roll waves or shock waves will form within the channel. It is therefore unnecessary to adjust the height of the channel wall for these parameters.

UPPER LAS VEGAS WASH CHANNEL WSPG ANALYSIS

VTN Nevada.

WSPG Models

ULVW.out

Manning's n = 0.015

Upper Las Vegas Wash Channel
(WSPG File: ULVW.OUT)

Calculated by: J.G.
Date: 10/22/2002
Checked by:
Date:

Table A-1 CHANNEL PROPERTIES AND DESIGN FLOWS

Channel Station	WSPG Station	Design Flow (cfs)	Segment Length (ft)	Channel Type	Central Line Properties	Invert Elevation (ft)	Invert Slope
-2+35.78	312+35.77	2,690				2106.00	
			74.65	53.4' x 12' RECT	Straight		
-1+61.13	311+61.12					2105.66	0.62%
-1+61.13	311+61.12					2105.66	
			286.96	Transition	Straight		
1+25.83	308+74.16					2103.74	
1+25.83	308+74.16					2103.74	
			39.82	25' x 9' RECT	Straight		0.68%
1+65.65	308+34.34					2103.47	
1+65.65	308+34.34					2103.47	
			140.28	2-12'x9' RCBs			0.96%
3+05.93	306+94.06					2102.13	
3+05.93	306+94.06					2102.13	
			211.44	25' x 9' RECT			
5+17.37	304+82.62					2100.03	0.99%
5+17.37	304+82.62				Curved:	2100.03	
			179.55	2-12'x9' RCBs	PC= 1+65.65		
6+96.92	303+03.07				PT= 10+03.56	2098.25	
6+96.92	303+03.07				R= 575	2098.25	
			125.81	25' x 9' RECT	L= 837.91		1.05%
8+22.73	301+77.26					2096.93	
8+22.73	301+77.26					2096.93	
			153.86	2-12'x9' RCBs			0.99%
9+76.59	300+23.40					2095.41	
9+76.59	300+23.40					2095.41	
			26.97	2-12'x9' RCBs			0.78%
10+03.56	299+96.43	2,690				2095.20	
10+03.56	299+96.43	2,690				2095.20	
			100.00	Confluence with 2 - 10'x9' RCBs	Straight		
11+03.56	298+96.43	4,810				2093.92	
11+03.56	298+96.43	4,810				2093.92	
			100.00	Transition	Straight		1.28%
12+03.56	297+96.43					2092.64	
12+03.56	297+96.43					2092.64	
			346.44	42' x 8' RECT	Straight		
15+50.00	294+49.99					2088.21	
15+50.00	294+49.99					2088.21	
			400.00	42' x 8' RECT	Straight		0.90%
19+50.00	290+49.99					2084.60	
19+50.00	290+49.99					2084.60	
			225.00	42' x 8' RECT	Straight		
21+75.00	288+24.99					2081.72	
21+75.00	288+24.99					2081.72	
			160.00	42'x8' RCB	Straight		
23+35.00	286+64.99			(1-10" pier)		2079.68	
23+35.00	286+64.99					2079.68	
			127.96	42' x 8' RECT	Straight		1.28%
24+62.96	285+37.03					2078.04	
24+62.96	285+37.03				Curved:	2078.04	
					PC= 24+62.96		
			623.96	42' x 8' RECT	PT= 30+86.92		
					R= 2000		
30+86.92	279+13.07	4,810			L= 623.96	2070.06	

Channel Station	WSPG Station	Design Flow (cfs)	Segment Length (ft)	Channel Type	Central Line Properties	Invert Elevation (ft)	Invert Slope
30+86.92	279+13.07	4,810				2070.06	
			223.09	42' x 8' RECT	Straight		1.50%
33+10.01	276+89.98					2066.71	
33+10.01	276+89.98					2066.71	
			289.99	42' x 8' RECT	Curved: PC= 33+10.01 PT= 38+71.99 R= 1500		
36+00.00	273+99.99				L= 561.98	2063.00	
36+00.00	273+99.99					2063.00	
			271.99	42'x8' RCB (1-10" pier)			
38+71.99	271+28.00					2059.53	
38+71.99	271+28.00					2059.53	1.28%
			48.01	42' x 8' RECT	Straight		
39+20.00	270+79.99	4,810				2058.91	
39+20.00	270+79.99	4,810				2058.91	
			100.00	Assumed Confluence	Straight		
40+20.00	269+79.99	5,880				2057.63	
40+20.00	269+79.99	5,880				2057.63	
			910.00	46' x 8' RECT	Straight		
49+30.00	260+69.99					2046.00	
49+30.00	260+69.99					2046.00	
			1270.00	46' x 8' RECT	Straight		0.70%
62+00.00	247+99.99					2037.10	
62+00.00	247+99.99					2037.10	
			300.00	46' x 8' RECT	Straight		1.03%
65+00.00	244+99.99					2034.00	
65+00.00	244+99.99					2034.00	
			530.00	46' x 8' RECT	Straight		0.52%
70+30.00	239+69.99					2031.22	
70+30.00	239+69.99					2031.22	
			225.76	46' x 9' RCB (1-10" pier)	Straight		1.83%
72+55.76	237+44.23	5,880				2027.09	
72+55.76	237+44.23	5,880				2027.09	
			180.00	Confluence (90'x9')	Straight		0.72%
74+35.76	235+64.23	6,380				2025.80	
74+35.76	235+64.23	6,380				2025.80	
			300.86	Transition	Straight		1.57%
77+36.62	232+63.37					2021.09	
77+36.62	232+63.37				Curved: PC= 77+36.62	2021.09	
			524.03	50' x 11' RECT	PT= 82+60.65 R= 785		
82+60.65	227+39.34				L= 524.03	2017.06	
82+60.65	227+39.34					2017.06	
			1025.65	50' x 11' RECT	Straight		0.77%
92+86.30	217+13.69					2009.16	
92+86.30	217+13.69				Curved: PC= 92+86.30	2009.16	
			132.81	50' x 11' RECT	PT= 94+19.11 R= 1037		
94+19.11	215+80.88				L= 132.81	2008.14	
94+19.11	217+13.69					2008.14	
			226.52	50' x 11' RECT	Straight		
96+45.63	213+54.36					2003.65	
96+45.63	213+54.36				Curved: PC= 96+45.63	2003.65	1.98%
			116.18	50' x 11' RECT	PT= 97+61.81 R= 963		
97+61.81	212+38.18	6,380			L= 116.18	2001.35	

Channel Station	WSPG Station	Design Flow (cfs)	Segment Length (ft)	Channel Type	Central Line Properties	Invert Elevation (ft)	Invert Slope
97+61.81	212+38.18	6,380	160.14	50' x 11' RECT	Straight	2001.35	
99+21.95	210+78.04					1998.17	
99+21.95	210+78.04		115.26	50' x 8' RCB (1-10" pier)	Curved: PC= 99+21.95 PT= 100+37.21 R= 500 L= 115.26	1998.17	1.98%
100+37.21	209+62.78					1995.89	
100+37.21	209+62.78		57.51	50' x 8' RCB (1-10" pier)	Straight	1995.89	
100+94.72	209+05.27	6,380				1994.75	
100+94.72	209+05.27	6,380	125.00	Confluence (62'x10' RECT)	Straight	1994.75	
102+19.72	207+80.27	6,800				1992.50	1.80%
102+19.72	207+80.27	6,800	180.00	Transition	Straight	1992.50	
103+99.72	206+00.27					1989.26	
103+99.72	206+00.27		58.04	50' x 9' RECT	Straight	1989.26	
104+57.76	205+42.23					1988.79	
104+57.76	205+42.23		124.30	50' x 9.5' RECT	Curved: PC= 104+57.76 PT= 105+82.06 R= 500 L= 124.30	1988.79	0.62%
105+82.06	204+17.93					1987.77	
105+82.06	204+17.93		784.72	50' x 9' RECT	Straight	1987.77	
113+66.78	196+33.21					1981.36	
113+66.78	196+33.21		269.13	50' x 9' RECT	Curved: PC= 113+66.78 PT= 116+35.91 R= 1000 L= 269.13	1981.36	
116+35.91	193+64.08					1979.99	
116+35.91	193+64.08		281.56	50' x 9' RECT	Curved: PC= 116+35.91 PT= 119+17.47 R= 1000 L= 281.56	1979.99	0.51%
119+17.47	190+82.52					1978.56	
119+17.47	190+82.52		592.53	50' x 9' RECT	Straight	1978.56	
125+10.00	184+89.99					1975.55	
125+10.00	184+89.99		290.09	50' x 9' RCB (1-10" pier)	Straight	1975.55	0.56%
128+00.09	181+99.90	6,800				1973.93	
128+00.09	181+99.90	6,800	125.00	Confluence (62'x6' RECT)	Straight	1973.93	
129+25.09	180+74.90	6,940				1973.10	
129+25.09	180+74.90	6,940	180.00	Transition	Straight	1973.10	0.67%
131+05.09	178+94.90					1971.90	
131+05.09	178+94.90		1644.91	56' x 9' RECT	Straight	1971.90	
147+50.00	162+49.99					1960.92	
147+50.00	162+49.99		545.00	56' x 9' RECT	Straight	1960.92	1.14%
152+95.00	157+04.99					1954.72	
152+95.00	157+04.99		150.00	56' x 9' RCB (2-10.5" pier)	Straight	1954.72	
154+45.00	155+54.99					1953.97	0.50%
154+45.00	155+54.99		720.91	56' x 11' RECT	Straight	1953.97	
161+65.91	148+34.08	6,940				1950.37	

Channel Station	WSPG Station	Design Flow (cfs)	Segment Length (ft)	Channel Type	Central Line Properties	Invert Elevation (ft)	Invert Slope
161+65.91	148+34.08	6,940				1950.37	
			419.09	56' x 11' RECT	Curved: PC= 161+65.91 PT= 171+86.11 R= 1000 L= 1020.20		0.50%
165+85.00	144+14.99					1948.27	
165+85.00	144+14.99		601.11	56' x 11' RECT		1948.27	
171+86.11	138+13.88					1941.42	1.14%
171+86.11	138+13.88		93.89	56' x 11' RECT	Straight	1941.42	
172+80.00	137+19.99					1940.35	
172+80.00	137+19.99		239.48	56' x 8' RCB (2-10.5" pier)	Straight	1940.35	0.48%
175+19.48	134+80.51					1939.20	
175+19.48	134+80.51		480.52	56' x 9' RECT	Curved: PC= 175+19.48 PT= 182+40.27 R= 700 L= 720.79	1939.20	0.71%
180+00.00	129+99.99					1935.80	
180+00.00	129+99.99		240.27	56' x 9' RECT		1935.80	
182+40.27	127+59.72					1933.58	0.92%
182+40.27	127+59.72		154.73	56' x 9' RECT	Straight	1933.58	
183+95.00	126+04.99					1932.15	
183+95.00	126+04.99		145.00	56' x 7' RCB (2-10.5" pier)	Straight	1932.15	0.50%
185+40.00	124+59.99					1931.42	
185+40.00	124+59.99		41.37	56' x 9.5' RECT	Straight	1931.42	
185+81.37	124+18.62					1931.23	
185+81.37	124+18.62		446.47	56' x 9.5' RECT	Curved: PC= 185+81.37 PT= 190+27.84 R= 500 L= 446.47	1931.23	0.46%
190+27.84	119+72.15					1929.18	
190+27.84	119+72.15		633.78	56' x 9' RECT	Straight	1929.18	
196+61.62	113+38.37					1926.04	
196+61.62	113+38.37		433.69	56' x 9.5' RECT	Curved: PC= 196+61.62 PT= 200+95.30 R= 500 L= 433.69	1926.04	0.50%
200+95.30	109+04.69					1923.89	
200+95.30	109+04.69		365.54	56' x 9' RECT	Straight	1923.89	
204+60.84	105+39.15					1922.08	
204+60.84	105+39.15		222.77	56' x 10' RECT	Curved: PC= 204+60.84 PT= 206+83.62 R= 1000 L= 222.77	1922.08	
206+83.62	103+16.37					1920.63	
206+83.62	103+16.37		106.68	56' x 10' RECT	Straight	1920.63	0.65%
207+90.30	102+09.69					1919.94	
207+90.30	102+09.69		238.53	56' x 10' RECT	Curved: PC= 207+90.30 PT= 210+28.83 R= 1019 L= 238.53	1919.94	
210+28.83	99+71.16	6,940				1918.38	

Channel Station	WSPG Station	Design Flow (cfs)	Segment Length (ft)	Channel Type	Central Line Properties	Invert Elevation (ft)	Invert Slope
210+28.83	99+71.16	6,940	50.31	56' x 10' RECT	Straight	1918.38	1.01%
210+79.14	99+20.85					1917.87	
210+79.14	99+20.85		224.20	Transition	Straight	1917.87	
213+03.34	96+96.65					1915.60	
213+03.34	96+96.65		119.41	7-8'x8' RCBs	Straight	1915.60	0.24%
214+22.75	95+77.24					1915.31	
214+22.75	95+77.24		48.72	62' x 8' RECT	Straight	1915.31	0.80%
214+71.47	95+28.52					1914.92	
214+71.47	95+28.52		48.75	62' x 8' RECT	Straight	1914.92	0.78%
215+20.22	94+79.77					1914.54	
215+20.22	94+79.77		50.11	62' x 8' RECT	Straight	1914.54	0.20%
215+70.33	94+29.66					1914.44	
215+70.33	94+29.66		49.94	62' x 8' RECT	Straight	1914.44	0.38%
216+20.27	93+79.72					1914.25	
216+20.27	93+79.72		50.30	62' x 8' RECT	Straight	1914.25	0.46%
216+70.57	93+29.42					1914.02	
216+70.57	93+29.42		50.25	62' x 8' RECT	Straight	1914.02	0.70%
217+20.82	92+79.17					1913.67	
217+20.82	92+79.17		49.54	62' x 8' RECT	Straight	1913.67	0.85%
217+70.36	92+29.63					1913.25	
217+70.36	92+29.63		50.48	62' x 8' RECT	Straight	1913.25	0.52%
218+20.84	91+79.15					1912.99	
218+20.84	91+79.15		50.00	62' x 8' RECT	Straight	1912.99	1.06%
218+70.84	91+29.15					1912.46	
218+70.84	91+29.15		49.04	62' x 8' RECT	Straight	1912.46	0.63%
219+19.88	90+80.11					1912.15	
219+19.88	90+80.11		50.71	62' x 8' RECT	Straight	1912.15	0.71%
219+70.59	90+29.40					1911.79	
219+70.59	90+29.40		49.53	62' x 8' RECT	Straight	1911.79	0.77%
220+20.12	89+79.87	6,940				1911.41	

WATER SURFACE PROFILE - TITLE CARD LISTING

IN E NO 1 IS -

Upper Las Vegas Wash Channel

ING LINE NO 2 IS -

Q = 2,690cfs @ NLVDB Outfall

ING LINE NO 3 IS -

WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

F0515P

WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING

NO	CHN TYPE	NO OF PIERS	AVE PIER WIDTH	HEIGHT 1 DIAMETER	BASE WIDTH	ZL	ZR	INV DROP	Y(1)	Y(2)	Y(3)	Y(4)	Y(5)	Y(6)	Y(7)	Y(8)	Y(9)	Y(10)
1	2	0	0.00	9.50	62.00			0.00										
2	3	6	1.00	8.00	62.00	0.00	0.00	0.00										
3	2	0	0.00	10.00	56.00			0.00										
4	2	0	0.00	9.00	56.00			0.00										
5	2	0	0.00	9.50	56.00			0.00										
6	3	2	0.88	7.00	56.00	0.00	0.00	0.00										
7	3	2	0.88	8.00	56.00	0.00	0.00	0.00										
8	2	0	0.00	11.00	56.00			0.00										
9	3	2	0.88	9.00	56.00	0.00	0.00	0.00										
10	2	0	0.00	9.00	62.00			0.00										
11	2	0	0.00	11.00	50.00			0.00										
12	2	0	0.00	7.00	10.00			0.00										
13	3	1	0.83	9.00	50.00	0.00	0.00	0.00										
14	2	0	0.00	9.00	50.00			0.00										
15	2	0	0.00	9.50	50.00			0.00										
16	3	1	0.83	8.00	50.00	0.00	0.00	0.00										
17	2	0	0.00	11.00	90.00			0.00										
18	2	0	0.00	8.00	46.00			0.00										
19	3	1	0.83	6.00	42.00	0.00	0.00	0.00										
20	3	1	0.83	9.00	46.00	0.00	0.00	0.00										
21	2	0	0.00	8.00	42.00			0.00										
22	2	0	0.00	8.00	20.00			0.00										
23	3	1	0.83	8.00	42.00	0.00	0.00	0.00										
24	2	0	0.00	8.00	49.67			0.00										
25	2	0	0.00	9.00	25.00			0.00										
26	3	1	0.67	9.00	20.67	0.00	0.00	0.00										
27	3	1	1.00	9.00	25.00	0.00	0.00	0.00										
28	2	0	0.00	12.00	53.40			0.00										

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ENT NO 1 IS A SYSTEM OUTLET * * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	8979.87	1911.41	1	0.00

ENT NO 2 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9029.40	1911.79	1	0.015	0.00	0.00	0.00	0

ENT NO 3 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9080.11	1912.15	1	0.015	0.00	0.00	0.00	0

ENT NO 4 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9129.15	1912.46	1	0.015	0.00	0.00	0.00	0

ENT NO 5 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9179.15	1912.99	1	0.015	0.00	0.00	0.00	0

ENT NO 6 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9229.63	1913.25	1	0.015	0.00	0.00	0.00	0

ENT NO 7 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9279.17	1913.67	1	0.015	0.00	0.00	0.00	0

ENT NO 8 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9329.42	1914.02	1	0.015	0.00	0.00	0.00	0

ENT NO 9 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9379.72	1914.25	1	0.015	0.00	0.00	0.00	0

ENT NO 10 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9429.66	1914.44	1	0.015	0.00	0.00	0.00	0

ENT NO 11 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9479.77	1914.54	1	0.015	0.00	0.00	0.00	0

ENT NO 12 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9528.52	1914.92	1	0.015	0.00	0.00	0.00	0

ENT NO 13 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9577.24	1915.31	1	0.015	0.00	0.00	0.00	0

ENT NO 14 IS A BRIDGE EXIT *

U/S DATA	STATION	INVERT	SECT
	9577.24	1915.31	2

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ME 15 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9696.65	1915.60	2	0.015	0.00	0.00	0.00	0

MENT NO 16 IS A BRIDGE ENTRANCE *

U/S DATA	STATION	INVERT	SECT	FP
	9696.65	1915.60	1	0.015

MENT NO 17 IS A TRANSITION * * *

U/S DATA	STATION	INVERT	SECT	N
	9920.85	1917.87	3	0.015

MENT NO 18 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9971.16	1918.38	3	0.015	0.00	0.00	0.00	0

MENT NO 19 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10209.69	1919.94	3	0.015	1019.00	13.41	0.00	0

MENT NO 20 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10316.37	1920.63	3	0.015	0.00	0.00	0.00	0

MENT NO 21 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10539.15	1922.08	3	0.015	1000.00	12.76	0.00	0

ING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

MENT NO 22 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10904.69	1923.89	4	0.015	0.00	0.00	0.00	0

ING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

MENT NO 23 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	11338.37	1926.04	5	0.015	500.00	49.70	0.00	0

ING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

ME 24 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	11972.15	1929.18	4	0.015	0.00	0.00	0.00	0

ING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

MENT NO 25 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12418.62	1931.23	5	0.015	500.00	51.16	0.00	0

MENT NO 26 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12459.99	1931.42	5	0.015	0.00	0.00	0.00	0

MENT NO 27 IS A BRIDGE EXIT *

U/S DATA	STATION	INVERT	SECT
	12459.99	1931.42	6

WATER SURFACE PROFILE - ELEMENT CARD LISTING

4EI	28 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		12604.99	1932.15	6	0.015	0.00	0.00	0.00	0
4ENT NO	29 IS A BRIDGE ENTRANCE				*				
	U/S DATA	STATION	INVERT	SECT	FP				
		12604.99	1932.15	4	1.000				
4ENT NO	30 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		12759.72	1933.58	4	0.015	0.00	0.00	0.00	0
4ENT NO	31 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		12999.99	1935.80	4	0.015	700.00	39.33	0.00	0
4ENT NO	32 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		13480.51	1939.20	4	0.015	700.00	19.67	0.00	0
4ENT NO	33 IS A BRIDGE EXIT				*				
	U/S DATA	STATION	INVERT	SECT					
		13480.51	1939.20	7					
4ENT NO	34 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		13719.99	1940.35	7	0.015	0.00	0.00	0.00	0
4ENT NO	35 IS A BRIDGE ENTRANCE				*				
	U/S DATA	STATION	INVERT	SECT	FP				
		13719.99	1940.35	8	1.000				
4ENT NO	36 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		13813.88	1941.42	8	0.015	0.00	0.00	0.00	0
4ENT NO	37 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		14414.99	1948.27	8	0.015	1000.00	34.44	0.00	0
MENT NO	38 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		14834.08	1950.37	8	0.015	1000.00	24.01	0.00	0
MENT NO	39 IS A REACH		*	*	*				
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		15554.99	1953.97	8	0.015	0.00	0.00	0.00	0
MENT NO	40 IS A BRIDGE EXIT				*				
	U/S DATA	STATION	INVERT	SECT					
		15554.99	1953.97	9					

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ME 41 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	15704.99	1954.72	9	0.015	0.00	0.00	0.00	0

MENT NO 42 IS A BRIDGE ENTRANCE

U/S DATA	STATION	INVERT	SECT	FP
	15704.99	1954.72	4	1.000

MENT NO 43 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	16249.99	1960.92	4	0.015	0.00	0.00	0.00	0

MENT NO 44 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	17894.90	1971.90	4	0.015	0.00	0.00	0.00	0

MENT NO 45 IS A TRANSITION

U/S DATA	STATION	INVERT	SECT	N
	18074.90	1973.10	10	0.015

MENT NO 46 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	18199.90	1973.93	11	12	0	0.015	140.0	0.0	1973.93	0.00	0.10	0.00

MENT NO 47 IS A BRIDGE EXIT

U/S DATA	STATION	INVERT	SECT
	18199.90	1973.93	13

MENT NO 48 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	18489.99	1975.55	13	0.015	0.00	0.00	0.00	0

MENT NO 49 IS A BRIDGE ENTRANCE

U/S DATA	STATION	INVERT	SECT	FP
	18489.99	1975.55	14	1.000

MENT NO 50 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	19082.52	1978.56	14	0.015	0.00	0.00	0.00	0

MENT NO 51 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	19364.08	1979.99	14	0.015	1000.00	16.13	0.00	0

MENT NO 52 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	19633.21	1981.36	14	0.015	1000.00	15.42	0.00	0

WATER SURFACE PROFILE - ELEMENT CARD LISTING

:ME 53 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	20417.93	1987.77	14	0.015	0.00	0.00	0.00	0

IING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

:MENT NO 54 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	20542.23	1988.79	15	0.015	500.00	14.24	0.00	0

IING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

:MENT NO 55 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	20600.27	1989.26	14	0.015	0.00	0.00	0.00	0

:MENT NO 56 IS A TRANSITION * * *

	STATION	INVERT	SECT	N
U/S DATA	20780.27	1992.50	10	0.015

:MENT NO 57 IS A JUNCTION * * * * * * *

	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
U/S DATA	20905.27	1994.75	11	12	0	0.015	420.0	0.0	1994.75	0.00	0.10	0.00

:MENT NO 58 IS A BRIDGE EXIT *

	STATION	INVERT	SECT
U/S DATA	20905.27	1994.75	16

:MENT NO 59 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	20962.78	1995.89	16	0.015	0.00	0.00	0.00	0

:MENT NO 60 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	21078.04	1998.17	16	0.015	500.00	13.21	0.00	0

:MENT NO 61 IS A BRIDGE ENTRANCE *

	STATION	INVERT	SECT	FP
U/S DATA	21078.04	1998.17	11	1.000

:MF 62 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	21238.18	2001.35	11	0.015	0.00	0.00	0.00	0

:MENT NO 63 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	21354.36	2003.65	11	0.015	963.00	6.91	0.00	0

:MENT NO 64 IS A REACH * * *

	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
U/S DATA	21580.88	2008.14	11	0.015	0.00	0.00	0.00	0

WATER SURFACE PROFILE - ELEMENT CARD LISTING

MEN 65 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	21713.69	2009.16	11	0.015	1037.00	7.34	0.00	0

MENT NO 66 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	22739.34	2017.06	11	0.015	0.00	0.00	0.00	0

MENT NO 67 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	23263.37	2021.09	11	0.015	785.00	38.25	0.00	0

MENT NO 68 IS A TRANSITION

U/S DATA	STATION	INVERT	SECT	N
	23564.23	2025.80	17	0.015

MENT NO 69 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	23744.23	2027.09	18	19	0	0.015	500.0	0.0	2027.09	0.00	0.10	0.00

MENT NO 70 IS A BRIDGE EXIT

U/S DATA	STATION	INVERT	SECT
	23744.23	2027.09	20

MENT NO 71 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	23969.99	2031.22	20	0.015	0.00	0.00	0.00	0

MENT NO 72 IS A BRIDGE ENTRANCE

U/S DATA	STATION	INVERT	SECT	FP
	23969.99	2031.22	18	1.000

MENT NO 73 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	24499.99	2034.00	18	0.015	0.00	0.00	0.00	0

MENT NO 74 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	24799.99	2037.10	18	0.015	0.00	0.00	0.00	0

MENT NO 75 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	26069.99	2046.00	18	0.015	0.00	0.00	0.00	0

MENT NO 76 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	26979.99	2057.63	18	0.015	0.00	0.00	0.00	0

MENT NO 77 IS A JUNCTION

U/S DATA	STATION	INVERT	SECT	LAT-1	LAT-2	N	Q3	Q4	INVERT-3	INVERT-4	PHI 3	PHI 4
	27079.99	2058.91	21	22	0	0.015	1070.0	0.0	2058.91	0.00	0.10	0.00

WATER SURFACE PROFILE - ELEMENT CARD LISTING

EN	78 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		27128.00	2059.53	21	0.015	0.00	0.00	0.00	0
ENT NO	79 IS A BRIDGE EXIT			*					
	U/S DATA	STATION	INVERT	SECT					
		27128.00	2059.53	23					
ENT NO	80 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		27399.99	2063.00	23	0.015	1500.00	10.39	0.00	0
ENT NO	81 IS A BRIDGE ENTRANCE			*					
	U/S DATA	STATION	INVERT	SECT	FP				
		27399.99	2063.00	21	1.000				
ENT NO	82 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		27689.98	2066.71	21	0.015	1500.00	11.08	0.00	0
ENT NO	83 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		27913.07	2070.06	21	0.015	0.00	0.00	0.00	0
ENT NO	84 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		28537.03	2078.04	21	0.015	2000.00	17.88	0.00	0
ENT NO	85 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		28664.99	2079.68	21	0.015	0.00	0.00	0.00	0
ENT NO	86 IS A BRIDGE EXIT			*					
	U/S DATA	STATION	INVERT	SECT					
		28664.99	2079.68	23					
ENT NO	87 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		28824.99	2081.72	23	0.015	0.00	0.00	0.00	0
EN	88 IS A BRIDGE ENTRANCE			*					
	U/S DATA	STATION	INVERT	SECT	FP				
		28824.99	2081.72	21	1.000				
ENT NO	89 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		29049.99	2084.60	21	0.015	0.00	0.00	0.00	0
ENT NO	90 IS A REACH	*	*	*					
	U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
		29449.99	2088.21	21	0.015	0.00	0.00	0.00	0

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ME 91 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
29796.43 2092.64 21 0.015 0.00 0.00 0.00 0

MENT NO 92 IS A TRANSITION * * *
U/S DATA STATION INVERT SECT N
29896.43 2093.92 24 0.015

MENT NO 93 IS A JUNCTION * * * * * * *
U/S DATA STATION INVERT SECT LAT-1 LAT-2 N Q3 Q4 INVERT-3 INVERT-4 PHI 3 PHI 4
29996.43 2095.20 25 26 0 0.015 2120.0 0.0 2095.20 0.00 0.10 0.00

MENT NO 94 IS A BRIDGE EXIT *
U/S DATA STATION INVERT SECT
29996.43 2095.20 27

MENT NO 95 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
30023.40 2095.41 27 0.015 575.00 2.68 0.00 0

MENT NO 96 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
30177.26 2096.93 27 0.015 575.00 15.33 0.00 0

MENT NO 97 IS A BRIDGE ENTRANCE *
U/S DATA STATION INVERT SECT FP
30177.26 2096.93 25 1.000

MENT NO 98 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
30303.07 2098.25 25 0.015 575.00 12.54 0.00 0

MENT NO 99 IS A BRIDGE EXIT *
U/S DATA STATION INVERT SECT
30303.07 2098.25 27

MENT NO 100 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
30482.62 2100.03 27 0.015 575.00 17.89 0.00 0

MEN 101 IS A BRIDGE ENTRANCE *
U/S DATA STATION INVERT SECT FP
30482.62 2100.03 25 1.000

MENT NO 102 IS A REACH * * *
U/S DATA STATION INVERT SECT N RADIUS ANGLE ANG PT MAN H
30694.06 2102.13 25 0.015 575.00 21.07 0.00 0

MENT NO 103 IS A BRIDGE EXIT *
U/S DATA STATION INVERT SECT
30694.06 2102.13 27

WATER SURFACE PROFILE - ELEMENT CARD LISTING

ME 104 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	30834.34	2103.47	27	0.015	575.00	13.98	0.00	0

MENT NO 105 IS A BRIDGE ENTRANCE *

U/S DATA	STATION	INVERT	SECT	FP
	30834.34	2103.47	25	1.000

MENT NO 106 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	30874.16	2103.74	25	0.015	0.00	0.00	0.00	0

MENT NO 107 IS A TRANSITION * * *

U/S DATA	STATION	INVERT	SECT	N
	31161.12	2105.66	28	0.015

MENT NO 108 IS A REACH * * *

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	31235.77	2106.00	28	0.015	0.00	0.00	0.00	0

MENT NO 109 IS A SYSTEM HEADWORKS * *

U/S DATA	STATION	INVERT	SECT	W S ELEV
	31235.77	2106.00	28	0.00

DIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

ARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
79.87	1911.41	5.170	1916.580	6940.0	21.65	7.279	1923.859	0.00	7.303		9.50	62.00	0.00	0	0.00
49.53	0.00767					.006500	0.32			4.920			0.00		
29.40	1911.79	5.202	1916.992	6940.0	21.52	7.189	1924.181	0.00	7.303		9.50	62.00	0.00	0	0.00
50.71	0.00710					.006397	0.32			5.042			0.00		
80.11	1912.15	5.222	1917.372	6940.0	21.43	7.133	1924.505	0.00	7.303		9.50	62.00	0.00	0	0.00
49.04	0.00632					.006360	0.31			5.232			0.00		
29.15	1912.46	5.221	1917.681	6940.0	21.44	7.137	1924.818	0.00	7.303		9.50	62.00	0.00	0	0.00
50.00	0.01060					.006115	0.31			4.441			0.00		
79.15	1912.99	5.358	1918.348	6940.0	20.89	6.777	1925.125	0.00	7.303		9.50	62.00	0.00	0	0.00
50.48	0.00515					.005910	0.30			5.585			0.00		
29.63	1913.25	5.333	1918.583	6940.0	20.99	6.841	1925.424	0.00	7.303		9.50	62.00	0.00	0	0.00
49.54	0.00848					.005804	0.29			4.766			0.00		
79.17	1913.67	5.421	1919.091	6940.0	20.65	6.621	1925.712	0.00	7.303		9.50	62.00	0.00	0	0.00
50.25	0.00696					.005577	0.28			5.073			0.00		
29.42	1914.02	5.470	1919.490	6940.0	20.46	6.503	1925.993	0.00	7.303		9.50	62.00	0.00	0	0.00
50	.00457					.005555	0.28			5.802			0.00		
79.72	1914.25	5.435	1919.685	6940.0	20.60	6.587	1926.272	0.00	7.303		9.50	62.00	0.00	0	0.00
49.94	0.00380					.005719	0.29			6.154			0.00		
29.66	1914.44	5.370	1919.810	6940.0	20.85	6.748	1926.558	0.00	7.303		9.50	62.00	0.00	0	0.00
50.11	0.00200					.006054	0.30			7.582			0.00		
79.77	1914.54	5.243	1919.783	6940.0	21.35	7.078	1926.861	0.00	7.303		9.50	62.00	0.00	0	0.00
48.75	0.00779					.006195	0.30			4.895			0.00		

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

ATION / ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO. / ZR	ZL	NO PIER	AVBPR
528.52	1914.92	5.289	1920.209	6940.0	21.16	6.954	1927.163	0.00	7.303		9.50	62.00	0.00	0	0.00
48.72	0.00800					.006000	0.29		4.854			0.00			
577.24	1915.31	5.351	1920.661	6940.0	20.92	6.795	1927.456	0.00	7.303		9.50	62.00	0.00	0	0.00
DGE EXIT												0.00			
577.24	1915.31	6.434	1921.744	6940.0	19.26	5.762	1927.506	0.00	7.815		8.00	62.00	0.00	6	1.00
22.39	0.00243					.011907	0.27		8.000			0.00			
599.63	1915.36	6.196	1921.560	6940.0	20.00	6.211	1927.771	0.00	7.815		8.00	62.00	0.00	6	1.00
30.69	0.00243					.013269	0.41		8.000			0.00			
630.32	1915.44	5.908	1921.347	6940.0	20.98	6.832	1928.179	0.00	7.815		8.00	62.00	0.00	6	1.00
32.54	0.00243					.014976	0.49		8.000			0.00			
662.86	1915.52	5.633	1921.151	6940.0	22.00	7.515	1928.666	0.00	7.815		8.00	62.00	0.00	6	1.00
33.79	0.00243					.016914	0.57		8.000			0.00			
696.65	1915.60	5.371	1920.971	6940.0	23.07	8.267	1929.238	0.00	7.815		8.00	62.00	0.00	6	1.00
DGE ENTRANCE												0.00			
696.65	1915.60	4.657	1920.257	6940.0	24.04	8.972	1929.229	0.00	7.303		9.50	62.00	0.00	0	0.00
IS [illegible]	0.01013					.007796	1.75					0.00			
920[illegible]	1917.87	5.580	1923.450	6940.0	22.21	7.658	1931.108	0.00	7.815		10.00	56.00	0.00	0	0.00
50.31	0.01014					.006268	0.32		4.833			0.00			
971.16	1918.38	5.697	1924.077	6940.0	21.75	7.348	1931.425	0.81	7.815		10.00	56.00	0.00	0	0.00
038.53	0.00654					.005907	1.41		5.561			0.00			
009.69	1919.94	5.797	1925.737	6940.0	21.38	7.097	1932.834	0.00	7.815		10.00	56.00	0.00	0	0.00
06.68	0.00647					.005656	0.60		5.581			0.00			

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

TION / LEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
16.37	1920.63	5.858	1926.488	6940.0	21.16	6.950	1933.438	0.78	7.815	10.00	56.00	0.00	0	0.00
22.78	0.00651					.005260	1.17		5.569			0.00		
39.15	1922.08	6.081	1928.161	6940.0	20.38	6.449	1934.610	0.00	7.815	9.00	56.00	0.00	0	0.00
65.54	0.00495					.004958	1.81		6.082			0.00		
04.69	1923.89	6.079	1929.969	6940.0	20.39	6.453	1936.422	1.45	7.815	9.50	56.00	0.00	0	0.00
33.68	0.00496					.004962	2.15		6.080			0.00		
38.37	1926.04	6.078	1932.118	6940.0	20.39	6.456	1938.574	0.00	7.815	9.00	56.00	0.00	0	0.00
33.78	0.00495					.004985	3.16		6.081			0.00		
72.15	1929.18	6.061	1935.241	6940.0	20.45	6.492	1941.733	1.45	7.815	9.50	56.00	0.00	0	0.00
46.47	0.00459					.005397	2.41		6.233			0.00		
18.62	1931.23	5.784	1937.014	6940.0	21.43	7.129	1944.143	0.00	7.815	9.50	56.00	0.00	0	0.00
41.37	0.00459					.005843	0.24		6.232			0.00		
59.99	1931.42	5.749	1937.169	6940.0	21.56	7.216	1944.385	0.00	7.815	9.50	56.00	0.00	0	0.00
GE EXIT												0.00		
59.99	1931.42	6.070	1937.490	6940.0	21.08	6.900	1944.390	0.00	7.000	7.00	56.00	0.00	2	0.88
37	.00503					.008289	0.31		7.000			0.00		
97.75	1931.61	5.977	1937.587	6940.0	21.41	7.115	1944.702	0.00	7.000	7.00	56.00	0.00	2	0.88
07.24	0.00503					.009075	0.97		7.000			0.00		
04.99	1932.15	5.699	1937.849	6940.0	22.45	7.827	1945.676	0.00	7.000	7.00	56.00	0.00	2	0.88
GE ENTRANCE												0.00		
04.99	1932.15	5.184	1937.334	6940.0	23.91	8.875	1946.209	0.00	7.815	9.00	56.00	0.00	0	0.00
54.73	0.00924					.007938	1.23		4.978			0.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
59.72	1933.58	5.270	1938.850	6940.0	23.52	8.588	1947.438	1.37	7.815		9.00	56.00	0.00	0	0.00
40.27	0.00924					.007246	1.74			4.978			0.00		
99.99	1935.80	5.503	1941.303	6940.0	22.52	7.876	1949.179	1.26	7.815		9.00	56.00	0.00	0	0.00
30.52	0.00708					.006443	3.10			5.422			0.00		
30.51	1939.20	5.678	1944.878	6940.0	21.83	7.397	1952.275	0.00	7.815		9.00	56.00	0.00	0	0.00
GE EXIT													0.00		
30.51	1939.20	5.986	1945.186	6940.0	21.37	7.094	1952.280	0.00	7.983		8.00	56.00	0.00	2	0.88
53.11	0.00480					.008729	0.46			7.336			0.00		
33.62	1939.45	5.843	1945.298	6940.0	21.90	7.445	1952.743	0.00	7.983		8.00	56.00	0.00	2	0.88
97.03	0.00480					.009673	0.94			7.336			0.00		
30.65	1939.92	5.571	1945.492	6940.0	22.97	8.190	1953.682	0.00	7.983		8.00	56.00	0.00	2	0.88
89.34	0.00480					.011067	0.99			7.336			0.00		
19.99	1940.35	5.312	1945.662	6940.0	24.09	9.009	1954.671	0.00	7.983		8.00	56.00	0.00	2	0.88
GE ENTRANCE													0.00		
19.99	1940.35	4.869	1945.219	6940.0	25.45	10.061	1955.280	0.00	7.815		11.00	56.00	0.00	0	0.00
93	.01140					.009750	0.92			4.656			0.00		
13.80	1941.42	4.919	1946.339	6940.0	25.19	9.856	1956.195	1.10	7.815		11.00	56.00	0.00	0	0.00
69.22	0.01140					.009458	0.65			4.656			0.00		
83.10	1942.21	4.964	1947.173	6940.0	24.96	9.677	1956.850	1.08	7.815		11.00	56.00	0.00	0	0.00
34.37	0.01140					.008677	2.03			4.656			0.00		
17.47	1944.88	5.207	1950.086	6940.0	23.80	8.798	1958.884	0.99	7.815		11.00	56.00	0.00	0	0.00
39.19	0.01140					.007476	1.04			4.656			0.00		

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ATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
256.66	1946.47	5.461	1951.927	6940.0	22.69	7.998	1959.925	0.90	7.815		11.00	56.00	0.00	0	0.00
93.00	0.01140					.006444	0.60			4.656			0.00		
349.66	1947.53	5.727	1953.253	6940.0	21.64	7.271	1960.524	0.81	7.815		11.00	56.00	0.00	0	0.00
65.33	0.01140					.005557	0.36			4.656			0.00		
414.99	1948.27	6.007	1954.277	6940.0	20.63	6.610	1960.887	0.74	7.815		11.00	56.00	0.00	0	0.00
419.09	0.00501					.005262	2.21			6.059			0.00		
334.08	1950.37	5.922	1956.292	6940.0	20.93	6.800	1963.092	0.00	7.815		11.00	56.00	0.00	0	0.00
401.36	0.00499					.005667	2.27			6.066			0.00		
235.44	1952.37	5.731	1958.105	6940.0	21.63	7.262	1965.367	0.00	7.815		11.00	56.00	0.00	0	0.00
319.55	0.00499					.006432	2.06			6.066			0.00		
554.99	1953.97	5.464	1959.434	6940.0	22.68	7.988	1967.422	0.00	7.815		11.00	56.00	0.00	0	0.00
DGE EXIT													0.00		
554.99	1953.97	5.739	1959.709	6940.0	22.29	7.718	1967.427	0.00	7.983		9.00	56.00	0.00	2	0.88
57.37	0.00500					.009874	0.57			7.228			0.00		
512.36	1954.26	5.584	1959.841	6940.0	22.91	8.153	1967.994	0.00	7.983		9.00	56.00	0.00	2	0.88
92	0.00500					.010996	1.02			7.228			0.00		
'04	1954.72	5.324	1960.044	6940.0	24.03	8.968	1969.012	0.00	7.983		9.00	56.00	0.00	2	0.88
DGE ENTRANCE													0.00		
'04.99	1954.72	4.879	1959.599	6940.0	25.40	10.019	1969.618	0.00	7.815		9.00	56.00	0.00	0	0.00
214.69	0.01138					.009417	2.02			4.659			0.00		
919.68	1957.16	5.022	1962.184	6940.0	24.68	9.457	1971.641	0.00	7.815		9.00	56.00	0.00	0	0.00
204.37	0.01138					.008369	1.71			4.659			0.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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TION / LEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
24.05	1959.49	5.267	1964.754	6940.0	23.53	8.597	1973.351	0.00	7.815	9.00	56.00	0.00	0	0.00
25.94	0.01138					.007212	0.91		4.659			0.00		
49.99	1960.92	5.524	1966.444	6940.0	22.43	7.815	1974.259	0.00	7.815	9.00	56.00	0.00	0	0.00
60.28	0.00668					.006677	1.07		5.524			0.00		
10.27	1961.99	5.524	1967.514	6940.0	22.43	7.815	1975.329	0.00	7.815	9.00	56.00	0.00	0	0.00
77.37	0.00668					.006489	6.34		5.524			0.00		
87.64	1968.51	5.628	1974.142	6940.0	22.02	7.529	1981.671	0.00	7.815	9.00	56.00	0.00	0	0.00
07.26	0.00668					.005867	2.98		5.524			0.00		
94.90	1971.90	5.903	1977.803	6940.0	21.00	6.845	1984.648	0.00	7.815	9.00	56.00	0.00	0	0.00
S STR	0.00667					.006569	1.18					0.00		
74.90	1973.10	4.913	1978.013	6940.0	22.78	8.060	1986.073	0.00	7.303	9.00	62.00	0.00	0	0.00
T STR	0.00664					.006223	0.78					0.00		
99.90	1973.93	6.616	1980.546	6800.0	20.56	6.561	1987.107	0.00	8.315	11.00	50.00	0.00	0	0.00
GE EXIT												0.00		
99.90	1973.93	6.850	1980.780	6800.0	20.19	6.330	1987.110	0.00	8.408	9.00	50.00	0.00	1	0.83
90	0.00558					.005886	1.71		6.926			0.00		
89.	1975.55	6.751	1982.301	6800.0	20.49	6.516	1988.817	0.00	8.408	9.00	50.00	0.00	1	0.83
GE ENTRANCE												0.00		
89.99	1975.55	6.331	1981.881	6800.0	21.48	7.165	1989.046	0.00	8.315	9.00	50.00	0.00	0	0.00
82.84	0.00508					.005456	0.45		6.468			0.00		
72.83	1975.97	6.307	1982.278	6800.0	21.56	7.221	1989.499	0.00	8.315	9.00	50.00	0.00	0	0.00
09.69	0.00508					.005921	3.02		6.468			0.00		

WATER SURFACE PROFILE LISTING

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TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
32.52	1978.56	6.013	1984.573	6800.0	22.62	7.943	1992.516	0.79	8.315		9.00	50.00	0.00	0	0.00
31.56	0.00508					.006838	1.93			6.469			0.00		
64.08	1979.99	5.742	1985.732	6800.0	23.68	8.710	1994.442	0.87	8.315		9.00	50.00	0.00	0	0.00
69.16	0.00509					.007483	0.52			6.464			0.00		
33.24	1980.34	5.663	1986.005	6800.0	24.02	8.956	1994.961	0.90	8.315		9.00	50.00	0.00	0	0.00
99.97	0.00509					.008251	1.65			6.464			0.00		
33.21	1981.36	5.399	1986.759	6800.0	25.19	9.852	1996.611	0.00	8.315		9.00	50.00	0.00	0	0.00
71.62	0.00817					.009430	4.45			5.543			0.00		
04.83	1985.21	5.192	1990.404	6800.0	26.19	10.655	2001.059	0.00	8.315		9.00	50.00	0.00	0	0.00
13.10	0.00817					.010801	3.38			5.543			0.00		
17.93	1987.77	4.950	1992.720	6800.0	27.47	11.720	2004.440	2.34	8.315		9.50	50.00	0.00	0	0.00
24.30	0.00821					.012071	1.50			5.534			0.00		
42.23	1988.79	4.827	1993.617	6800.0	28.17	12.325	2005.942	0.00	8.315		9.00	50.00	0.00	0	0.00
58.04	0.00810					.012816	0.74			5.558			0.00		
00.27	1989.26	4.762	1994.022	6800.0	28.56	12.665	2006.687	0.00	8.315		9.00	50.00	0.00	0	0.00
S	.01800					.015315	2.76						0.00		
80.27	1992.50	3.742	1996.242	6800.0	29.31	13.340	2009.582	0.00	7.204		9.00	62.00	0.00	0	0.00
T STR	0.01800					.016466	2.06						0.00		
05.27	1994.75	4.341	1999.091	6380.0	29.39	13.416	2012.507	0.00	7.969		11.00	50.00	0.00	0	0.00
GE EXIT													0.00		
05.27	1994.75	4.428	1999.178	6380.0	29.30	13.331	2012.509	0.00	8.000		8.00	50.00	0.00	1	0.83
57.51	0.01982					.018003	1.04			4.298			0.00		

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ATION / ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH		HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
962.78	1995.89	4.449	2000.339	6380.0	29.16	13.206	2013.545	0.00	8.000		8.00	50.00	0.00	1	0.83
115.26	0.01978					.017569	2.03			4.301			0.00		
078.04	1998.17	4.502	2002.672	6380.0	28.82	12.899	2015.571	0.00	8.000		8.00	50.00	0.00	1	0.83
DGE ENTRANCE													0.00		
078.04	1998.17	4.325	2002.495	6380.0	29.50	13.513	2016.008	0.00	7.969		11.00	50.00	0.00	0	0.00
160.14	0.01986					.014687	2.35			4.003			0.00		
238.18	2001.35	4.494	2005.844	6380.0	28.40	12.520	2018.364	1.30	7.969		11.00	50.00	0.00	0	0.00
116.18	0.01980					.012989	1.51			4.007			0.00		
354.36	2003.65	4.679	2008.329	6380.0	27.27	11.547	2019.876	0.00	7.969		11.00	50.00	0.00	0	0.00
10.79	0.01982					.012085	0.13			4.005			0.00		
365.15	2003.86	4.700	2008.564	6380.0	27.15	11.444	2020.008	0.00	7.969		11.00	50.00	0.00	0	0.00
93.77	0.01982					.011173	1.05			4.005			0.00		
458.92	2005.72	4.930	2010.652	6380.0	25.88	10.404	2021.056	0.00	7.969		11.00	50.00	0.00	0	0.00
69.20	0.01982					.009632	0.67			4.005			0.00		
528.12	2007.09	5.170	2012.264	6380.0	24.68	9.458	2021.722	0.00	7.969		11.00	50.00	0.00	0	0.00
52	0.01982					.008308	0.44			4.005			0.00		
580	2008.14	5.423	2013.563	6380.0	23.53	8.598	2022.161	0.83	7.969		11.00	50.00	0.00	0	0.00
132.81	0.00768					.007698	1.02			5.426			0.00		
713.69	2009.16	5.421	2014.581	6380.0	23.54	8.603	2023.184	0.00	7.969		11.00	50.00	0.00	0	0.00
42.88	0.00770					.007701	0.33			5.421			0.00		
756.57	2009.49	5.421	2014.912	6380.0	23.54	8.603	2023.515	0.00	7.969		11.00	50.00	0.00	0	0.00
982.77	0.00770					.007455	7.33			5.421			0.00		

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:LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
'39.34	2017.06	5.538	2022.598	6380.0	23.04	8.243	2030.841	1.05	7.969		11.00	50.00	0.00	0	0.00
70.82	0.00769					.007171	0.51			5.423			0.00		
)10.16	2017.61	5.557	2023.162	6380.0	22.96	8.188	2031.350	1.04	7.969		11.00	50.00	0.00	0	0.00
53.21	0.00769					.006646	3.01			5.423			0.00		
63.37	2021.09	5.828	2026.918	6380.0	21.89	7.443	2034.361	0.00	7.969		11.00	50.00	0.00	0	0.00
IS STR	0.01565					.011617	3.50						0.00		
)64.23	2025.80	2.843	2028.643	6380.0	24.94	9.657	2038.300	0.00	5.385		11.00	90.00	0.00	0	0.00
:T STR	0.00717					.013438	2.42						0.00		
'44.23	2027.09	5.053	2032.143	5880.0	25.30	9.937	2042.080	0.00	7.978		8.00	46.00	0.00	0	0.00
)GE EXIT													0.00		
'44.23	2027.09	5.178	2032.268	5880.0	25.14	9.814	2042.082	0.00	8.076		9.00	46.00	0.00	1	0.83
68.21	0.01829					.011322	0.77			4.471			0.00		
12.44	2028.34	5.360	2033.698	5880.0	24.29	9.158	2042.856	0.00	8.076		9.00	46.00	0.00	1	0.83
69.34	0.01829					.010059	0.70			4.471			0.00		
81.78	2029.61	5.622	2035.228	5880.0	23.16	8.326	2043.554	0.00	8.076		9.00	46.00	0.00	1	0.83
50	0.01829					.008765	0.44			4.471			0.00		
32.41	2030.53	5.896	2036.429	5880.0	22.08	7.569	2043.998	0.00	8.076		9.00	46.00	0.00	1	0.83
37.58	0.01829					.007642	0.29			4.471			0.00		
69.99	2031.22	6.184	2037.404	5880.0	21.05	6.881	2044.285	0.00	8.076		9.00	46.00	0.00	1	0.83
)GE ENTRANCE													0.00		
69.99	2031.22	5.810	2037.030	5880.0	22.00	7.516	2044.546	0.00	7.978		8.00	46.00	0.00	0	0.00
49.16	0.00524					.006438	0.32			6.193			0.00		

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TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
19.15	2031.48	5.774	2037.252	5880.0	22.14	7.611	2044.863	0.00	7.978		8.00	46.00	0.00	0	0.00
78.67	0.00524					.007012	1.95			6.193			0.00		
97.82	2032.94	5.505	2038.445	5880.0	23.22	8.372	2046.817	0.00	7.978		8.00	46.00	0.00	0	0.00
02.17	0.00524					.008119	1.64			6.193			0.00		
99.99	2034.00	5.249	2039.249	5880.0	24.35	9.209	2048.458	0.00	7.978		8.00	46.00	0.00	0	0.00
69.42	0.01033					.008591	0.60			4.967			0.00		
69.41	2034.72	5.298	2040.015	5880.0	24.13	9.040	2049.055	0.00	7.978		8.00	46.00	0.00	0	0.00
30.58	0.01033					.007890	1.82			4.967			0.00		
99.99	2037.10	5.556	2042.656	5880.0	23.01	8.218	2050.874	0.00	7.978		8.00	46.00	0.00	0	0.00
96.77	0.00701					.007446	2.21			5.634			0.00		
96.76	2039.18	5.491	2044.671	5880.0	23.28	8.414	2053.085	0.00	7.978		8.00	46.00	0.00	0	0.00
99.46	0.00701					.008181	4.09			5.634			0.00		
96.22	2042.68	5.236	2047.916	5880.0	24.41	9.255	2057.171	0.00	7.978		8.00	46.00	0.00	0	0.00
76.14	0.00701					.009477	2.62			5.634			0.00		
72.36	2044.62	4.992	2049.607	5880.0	25.61	10.180	2059.787	0.00	7.978		8.00	46.00	0.00	0	0.00
97	0.00701					.010984	2.17			5.634			0.00		
69.	2046.00	4.760	2050.760	5880.0	26.85	11.198	2061.958	0.00	7.978		8.00	46.00	0.00	0	0.00
86.95	0.01278					.011378	3.27			4.638			0.00		
56.94	2049.67	4.873	2054.540	5880.0	26.23	10.683	2065.223	0.00	7.978		8.00	46.00	0.00	0	0.00
85.45	0.01278					.010211	2.91			4.638			0.00		
42.39	2053.32	5.111	2058.426	5880.0	25.01	9.712	2068.138	0.00	7.978		8.00	46.00	0.00	0	0.00
59.64	0.01278					.008812	1.41			4.638			0.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
02.03	2055.36	5.361	2060.717	5880.0	23.85	8.829	2069.546	0.00	7.978		8.00	46.00	0.00	0	0.00
04.62	0.01278					.007609	0.80			4.638			0.00		
06.65	2056.69	5.622	2062.315	5880.0	22.74	8.026	2070.341	0.00	7.978		8.00	46.00	0.00	0	0.00
73.34	0.01278					.006573	0.48			4.638			0.00		
79.99	2057.63	5.897	2063.527	5880.0	21.68	7.297	2070.824	0.00	7.978		8.00	46.00	0.00	0	0.00
T STR	0.01280					.008774	0.88						0.00		
79.99	2058.91	4.506	2063.416	4810.0	25.41	10.028	2073.444	0.00	7.415		8.00	42.00	0.00	0	0.00
48.01	0.01291					.011373	0.55			4.336			0.00		
28.00	2059.53	4.528	2064.058	4810.0	25.29	9.933	2073.991	0.00	7.415		8.00	42.00	0.00	0	0.00
GE EXIT													0.00		
28.00	2059.53	4.647	2064.177	4810.0	25.14	9.816	2073.993	0.00	7.514		8.00	42.00	0.00	1	0.83
71.99	0.01276					.014160	3.85			4.756			0.00		
99.99	2063.00	4.534	2067.534	4810.0	25.77	10.310	2077.844	0.00	7.514		8.00	42.00	0.00	1	0.83
GE ENTRANCE													0.00		
99.99	2063.00	4.311	2067.311	4810.0	26.56	10.957	2078.268	0.61	7.415		8.00	42.00	0.00	0	0.00
89	0.01279					.013324	3.86			4.349			0.00		
89.	2066.71	4.274	2070.984	4810.0	26.80	11.150	2082.134	0.00	7.415		8.00	42.00	0.00	0	0.00
23.09	0.01502					.012981	2.90			4.131			0.00		
13.07	2070.06	4.386	2074.446	4810.0	26.11	10.585	2085.031	0.44	7.415		8.00	42.00	0.00	0	0.00
23.96	0.01279					.011634	7.26			4.349			0.00		
37.03	2078.04	4.592	2082.632	4810.0	24.94	9.660	2092.292	0.00	7.415		8.00	42.00	0.00	0	0.00
27.96	0.01282					.010472	1.34			4.346			0.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
64.99	2079.68	4.689	2084.369	4810.0	24.42	9.263	2093.632	0.00	7.415		8.00	42.00	0.00	0	0.00
GE EXIT													0.00		
64.99	2079.68	4.816	2084.496	4810.0	24.26	9.138	2093.634	0.00	7.514		8.00	42.00	0.00	1	0.83
60.00	0.01275					.012182	1.95			4.757			0.00		
24.99	2081.72	4.848	2086.568	4810.0	24.10	9.018	2095.586	0.00	7.514		8.00	42.00	0.00	1	0.83
GE ENTRANCE													0.00		
24.99	2081.72	4.596	2086.316	4810.0	24.92	9.643	2095.959	0.00	7.415		8.00	42.00	0.00	0	0.00
25.00	0.01280					.010093	2.27			4.348			0.00		
49.99	2084.60	4.803	2089.403	4810.0	23.84	8.827	2098.230	0.00	7.415		8.00	42.00	0.00	0	0.00
00.00	0.00903					.009719	3.89			4.868			0.00		
49.99	2088.21	4.704	2092.914	4810.0	24.35	9.205	2102.119	0.00	7.415		8.00	42.00	0.00	0	0.00
40.65	0.01279					.009515	1.34			4.350			0.00		
90.64	2090.01	4.873	2094.882	4810.0	23.50	8.576	2103.458	0.00	7.415		8.00	42.00	0.00	0	0.00
22.99	0.01279					.008383	1.03			4.350			0.00		
13.63	2091.58	5.111	2096.692	4810.0	22.41	7.796	2104.488	0.00	7.415		8.00	42.00	0.00	0	0.00
82	0.01279					.007241	0.60			4.350			0.00		
96.43	2092.64	5.361	2098.001	4810.0	21.36	7.087	2105.088	0.00	7.415		8.00	42.00	0.00	0	0.00
S STR	0.01280					.007810	0.78						0.00		
96.43	2093.92	4.336	2098.256	4810.0	22.33	7.745	2106.001	0.00	6.630		8.00	49.67	0.00	0	0.00
T STR	0.01280					.007949	0.79						0.00		
96.43	2095.20	5.374	2100.574	2690.0	20.02	6.225	2106.799	0.00	7.113		9.00	25.00	0.00	0	0.00
GE EXIT													0.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
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:TION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
:LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
)96.43	2095.20	5.791	2100.991	2690.0	19.35	5.817	2106.808	0.00	7.309		9.00	25.00	0.00	1	1.00
26.97	0.00779					.009108	0.25			6.123			0.00		
)23.40	2095.41	5.756	2101.166	2690.0	19.47	5.887	2107.053	0.00	7.309		9.00	25.00	0.00	1	1.00
53.86	0.00988					.008848	1.36			5.601			0.00		
77.26	2096.93	5.921	2102.851	2690.0	18.93	5.564	2108.415	0.00	7.309		9.00	25.00	0.00	1	1.00
)GE ENTRANCE													0.00		
77.26	2096.93	5.110	2102.040	2690.0	21.06	6.885	2108.925	0.60	7.113		9.00	25.00	0.00	0	0.00
25.81	0.01049					.007595	0.96			4.683			0.00		
)03.07	2098.25	5.350	2103.600	2690.0	20.11	6.281	2109.881	0.00	7.113		9.00	25.00	0.00	0	0.00
)GE EXIT													0.00		
)03.07	2098.25	5.760	2104.010	2690.0	19.46	5.879	2109.889	0.00	7.309		9.00	25.00	0.00	1	1.00
79.55	0.00991					.008696	1.56			5.594			0.00		
82.62	2100.03	5.997	2106.027	2690.0	18.69	5.424	2111.451	0.00	7.309		9.00	25.00	0.00	1	1.00
)GE ENTRANCE													0.00		
82.62	2100.03	5.155	2105.185	2690.0	20.87	6.765	2111.950	0.59	7.113		9.00	25.00	0.00	0	0.00
17	0.00993					.007497	0.88			4.771			0.00		
99.	2101.20	5.347	2106.542	2690.0	20.12	6.288	2112.830	0.55	7.113		9.00	25.00	0.00	0	0.00
94.16	0.00993					.006633	0.62			4.771			0.00		
94.06	2102.13	5.608	2107.738	2690.0	19.19	5.716	2113.454	0.00	7.113		9.00	25.00	0.00	0	0.00
)GE EXIT													0.00		
94.06	2102.13	6.111	2108.241	2690.0	18.34	5.224	2113.465	0.00	7.309		9.00	25.00	0.00	1	1.00
66.77	0.00955					.007471	0.50			5.672			0.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 10/22/2002

ATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
LEM	SO					SF AVE	HF			NORM DEPTH			ZR		
760.83	2102.77	6.334	2109.102	2690.0	17.69	4.862	2113.964	0.00	7.309		9.00	25.00	0.00	1	1.00
46.46	0.00955					.006694	0.31			5.672			0.00		
807.29	2103.21	6.644	2109.856	2690.0	16.87	4.420	2114.276	0.00	7.309		9.00	25.00	0.00	1	1.00
21.25	0.00955					.005905	0.13			5.672			0.00		
828.54	2103.41	6.968	2110.383	2690.0	16.09	4.018	2114.401	0.00	7.309		9.00	25.00	0.00	1	1.00
5.80	0.00955					.005211	0.03			5.672			0.00		
834.34	2103.47	7.309	2110.779	2690.0	15.33	3.652	2114.431	0.00	7.309		9.00	25.00	0.00	1	1.00
GE ENTRANCE													0.00		
834.34	2103.47	8.920	2112.390	2690.0	12.06	2.259	2114.649	0.00	7.113		9.00	25.00	0.00	0	0.00
37.68	0.00678					.001760	0.07			5.430			0.00		
872.02	2103.72	8.505	2112.230	2690.0	12.65	2.485	2114.715	0.00	7.113		9.00	25.00	0.00	0	0.00
2.14	0.00678					.001885	0.00			5.430			0.00		
874.16	2103.74	8.480	2112.220	2690.0	12.69	2.500	2114.720	0.00	7.113		9.00	25.00	0.00	0	0.00
S STR	0.00669					.001069	0.31						0.00		
61.12	2105.66	9.093	2114.753	2690.0	5.54	0.477	2115.230	0.00	4.289		12.00	53.40	0.00	0	0.00
74	0.00456					.000260	0.02			3.530			0.00		
35.77	2106.00	8.732	2114.732	2690.0	5.77	0.517	2115.249	0.00	4.289		12.00	53.40	0.00	0	0.00

APPENDIX E

Design Plans

UPPER LAS VEGAS WASH CHANNEL IMPROVEMENT PLANS

VTN Nevada.

DEPARTMENT OF PUBLIC WORKS

UPPER LAS VEGAS WASH CHANNEL

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

BID NO. 1157

LABOR COMMISSION NO. PWP-CL-2004-89

FUNDED BY:

CLARK COUNTY
REGIONAL FLOOD CONTROL DISTRICT

ALL DRAWINGS, SPECIFICATIONS AND SPECIAL TECHNICAL REQUIREMENTS ASSOCIATED WITH THE PROJECT AND IMPROVEMENTS PRESENTED HEREIN HAS BEEN ACCOMPLISHED UNDER THE SUPERVISION OF RESPONSIBLE PROFESSIONAL(S) HAVING THE APPROPRIATE REGISTRATION TO SERVE IN THIS CAPACITY BASED ON THE SCOPE OF THIS SPECIFIC PROJECT, AND IN ACCORDANCE WITH THE STATUTORY PROVISIONS OF THE NEVADA REVISED STATUTES (NRS) AND THE NEVADA ADMINISTRATIVE CODE (NAC) INCLUDING: NRS 278, 338, NRS 623; NRS 625; NAC 338, NAC 623 AND NAC 625 CERTIFICATION SIGNIFYING COMPLIANCE WITH STATUTORY AND RELATED ADMINISTRATIVE CODE REQUIREMENTS IS HEREBY PROVIDED BY THE RESPONSIBLE PROFESSIONAL(S) IN THE FORM OF A STAMP OR SEAL PLACED ON THE PROJECT DOCUMENTS.

SHEET INDEX

DRAWING NO.	DRAWING TITLE
G1	COVER SHEET
G2	GENERAL NOTES, ABBREVIATIONS AND LEGEND
G3	CITY OF NORTH LAS VEGAS STANDARD NOTES
SC1 – SC4	CNLV SURVEY CONTROL AND PARCEL MAP INFORMATION
PL01/PR01–PL21/PR21	CHANNEL PLANS & PROFILES
PL09/PR09–PL11/PR11A	ADDITIVE ALTERNATES 1 & 2 – CHANNEL PLANS & PROFILES
GR1–GR8	CHANNEL GRADING PLANS
DB1	DETENTION BASIN BORROW AREA GRADING PLAN
F01 – F21	FENCE, GATE AND SIGN PLAN
S1	SECTIONS, DETAILS AND GENERAL STRUCTURAL NOTES
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SD1 – SD14	STRUCTURAL DETAILS AND SECTIONS
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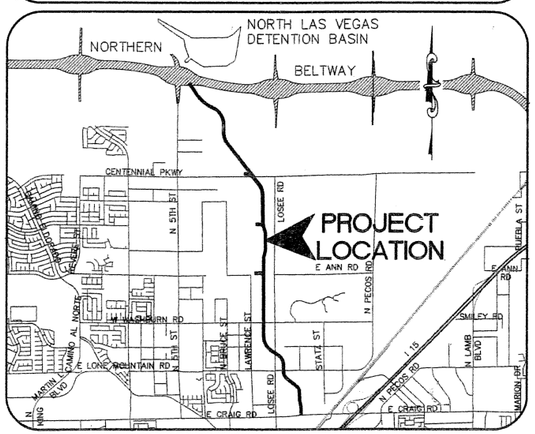
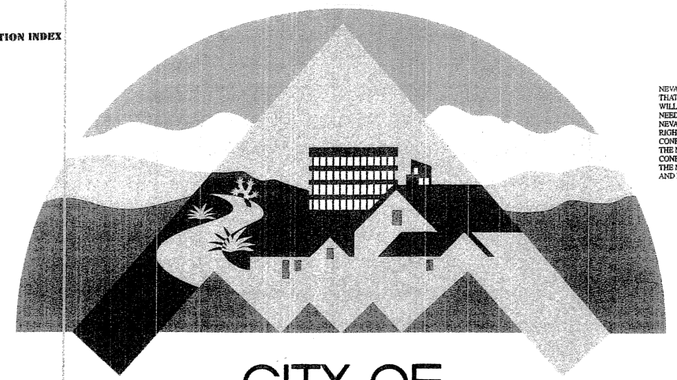
D3	CHANNEL LADDER DETAILS
D4	GATE AND FENCE DETAILS
D5	POST AND CABLE RAILING DETAILS
D6	FLOOD CONTROL MONITORING STATION DETAILS
UPL1	CENTENNIAL UTILITY RELOCATION PLAN
UPR1	CENTENNIAL WATER LINE RELOCATION – PROFILE
W1–W2	WATER LINE DETAILS



VICINITY MAP

NOT TO SCALE

REFER TO G2 FOR
ISSUED FOR CONSTRUCTION INDEX



NEVADA POWER COMPANY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NEVADA POWER COMPANY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.

CITY OF
NORTH LAS VEGAS
Your Community of Choice

"The affixed Sprint Nevada approval does not assume or guarantee liability for known or unknown conflicts with existing or proposed improvements. Resolution of any conflict will be accomplished pursuant to Local Ordinances, Nevada Revised Statutes and/or Public Utility Commission Rules and Regulations."

BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS N00°19'43"E BEING THE EAST LINE OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 26, T19S, R61E AS DEFINED BY THE MERIDIAN OF THE CITY OF NORTH LAS VEGAS USER DEFINED TRANSVERSE MERCATOR PROJECTION; SAID MERIDIAN BEING COINCIDENT WITH 115°05'53.00204" WEST OF THE GREENWICH MERIDIAN. ORIENTATION IS DEFINED BY THE HEIGHT ACCURACY REFERENCE NETWORK OF NEVADA, NATIONAL GEODETIC SURVEY. (EPOCH 1999.37)

BENCHMARK

NLV9123NNW6 ELEV. 641.227 METERS (2104.48') BLM BRASS CAP WITH ALUMINUM DISK TIED TO PIPE STAMPED NORTH LAS VEGAS BM AT THE INTERSECTION OF ELKHORN RD & BRUCE

526124 ELEV. 621.673 (2039.606) 1' DIA. CONC. MON. 50' EAST OF POWER POLE #2/10 SOUTHWEST OF THE NORTH QUARTER CORNER SECTION 26-19-61

NLV9135N4 ELEV.609.020 METERS (1998.093) 2" CNLV BC AT INTERSECTION ANN & BRUCE

AVOID OVERHEAD POWER LINE CONTACT. IT'S COSTLY
Call before you Overhead
1-702-593-6111
NEVADA POWER ENVIRONMENT AND SAFETY SERVICES DEPARTMENT

AVOID CUTTING UNDERGROUND UTILITY LINES. IT'S COSTLY.
Call before you Dig
1-800-227-2600
UNDERGROUND SERVICE (USA)

APPROVALS:

Robert M. Harary ROBERT M. HARARY, P.E. ASSITANT DIRECTOR OF PUBLIC WORKS / ENGINEERING SERVICES	1/22/04 DATE
FOR Robert M. Harary BRIAN D. MARTIN, P.E. PRINCIPAL ENGINEER / ENGINEERING SERVICES	1/22/04 DATE
Lenny Badger LENNY BADGER, P.E. MANAGER, DEVELOPMENT AND FLOOD CONTROL	1/21/04 DATE
Gale Wm. Fraser II GALE Wm. FRASER II, P.E. GENERAL MANAGER / CHIEF ENGINEER CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT	1/21/04 DATE

REVIEWED BY:

Raymond H. Burke RAYMOND H. BURKE ASSISTANT DIRECTOR OF PUBLIC WORKS/TRANSPORTATION SERVICES	1/22/04 DATE
John Runiks FOR: JOHN RUNIKS MANAGER, ROADWAY OPERATIONS	1/21/04 DATE
Randal D. Cagle for Lenny M. Badger RANDAL D. CAGLE, SR/WA MANAGER, REAL PROPERTY SERVICES	1/21/04 DATE
Dale Daffern DALE DAFFERN, P.E. MANAGER, CONSTRUCTION SERVICES	1/21/04 DATE
Bartlett C. Dalton BARTLETT C. DALTON, P.L.S. CITY SURVEYOR	21 JAN 04 DATE
Leslie Long LESLIE LONG, P.E. MANAGER, TECHNICAL SERVICES	1/21/04 DATE
Kirk Medina KIRK MEDINA MANAGER, OPERATIONS	1/21/04 DATE
Robert A. McLaughlin ROBERT A. McLAUGHLIN, P.E. MANAGER, ENGINEERING SERVICES	1/26/04 DATE
Sandy Larsen Sandy Larsen NEVADA POWER COMPANY	1-15-04 DATE
EDGARDO ESTANISLAO SOUTHWEST GAS	1-19-04 DATE
Kern River KERN RIVER PIPELINE	1.16.04 DATE
Stephen C. Smith SPRINT	Jan. 16, 2004 DATE
Chisel Gonzalez COX COMMUNICATIONS LAS VEGAS INC.	1/15/04 DATE

* APPROVAL OF THESE IMPROVEMENT DRAWINGS AND SPECIFICATIONS IS MADE BASED ON THE REPRESENTATIONS MADE BY THE PROFESSIONAL(S) THAT THEY HAVE EXECUTED THEIR RESPONSIBILITIES AND PREPARED COMPLETE DOCUMENTS WHICH COMPLY WITH CITY OF NORTH LAS VEGAS REQUIREMENTS FOR CONSTRUCTION OF THE IMPROVEMENTS DEPICTED HEREIN.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			

SCALE: N/A
DESIGN: JNG/DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

KEN D. GILBRETH
STATE OF NEVADA
No. 9177
CIVIL
1-21-04

nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) COVER SHEET

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

SHEET NO.

G1

1 OF 123 SHEETS

SHEET INDEX

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UPR1	CENTENNIAL WATER LINE RELOCATION – PROFILE
UPL2	CENTENNIAL/LAWRENCE WATERLINE RELOCATIONS PLAN
UPL3	LOSEE WATERLINE RELOCATION PLAN
W1–W2	WATER LINE DETAILS

ABBREVIATIONS

&	AND
@	AT
AC	ASPHALTIC CONCRETE
ALT	ALTERNATE
ANG.	ANGLE
APN	ASSESSORS PARCEL NUMBER
APPROX	APPROXIMATE
ASSY	ASSEMBLY
ASTM	AMERICAN SOCIETY OF TESTING MATERIALS
BC	BOLT CIRCLE or BRASS CAP
BFV	BUTTERFLY VALVE
BK	BOOK
BLK	BLOCK
CCRFCD	CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
CCSD	CLARK COUNTY SANITATION DISTRICT
CFS	CUBIC FEET PER SECOND
CHAN	CHANNEL
CI	CUBIC INCH
CL OR ℄	CENTER LINE
CLR	CLEAR
CLF	CHAIN LINK FENCE
CNLV	CITY OF NORTH LAS VEGAS
COMB	COMBINATION
CONC	CONCRETE
CONST	CONSTRUCT
D OR Δ	DELTA
DI	DUCTILE IRON
DIA	DIAMETER
DWG	DRAWING
DWGS	DRAWINGS
E	EAST
EG	EXISTING GROUND
EL OR ELEV	ELEVATION
ELEC	ELECTRICAL
EP	EDGE OF PAVEMENT
ESMT	EASEMENT
ETC	ETCETERA
EX OR EXIST	EXISTING
FG	FINISH GRADE
FL	FLOW LINE
FLG	FLANGE
FO	FIBER OPTICS
FT	FEET
FUT	FUTURE
GALV	GALVANIZED
H or HORIZ	HORIZONTAL
HD	HEAD
HGL	HYDRAULIC GRADE LINE
INST	INSTRUMENT
INV	INVERT
IQAC	INTERAGENCY QUALITY ASSURANCE COMMITTEE
L	LENGTH
LF	LINEAL FEET
LG	LONG
LT	LEFT
MAINT	MAINTENANCE
MAX	MAXIMUM
MECH	MECHANICAL
MIN	MINIMUM
MJ	MECHANICAL JOINT
MLC	MORTAR LINED AND COATED
MLCP	MORTAR LINED AND COATED PIPE
MOD	MODIFIED
N	NORTH
N.D.O.T.	NEVADA DEPARTMENT OF TRANSPORTATION
NTS	NOT TO SCALE
NC	NATIONAL COARSE THREAD
NO	NUMBER
NRS	NEVADA REVISED STATUTES/NON–RISING STEM
NW	NORTHWEST
OC	ON CENTER
OD	OUTSIDE DIAMETER
OH	OVERHEAD
PG	PROFILE GRADE
P/R	PATENT RESERVATION
PC	POINT OF CURVATURE
PCC	POINT OF COMPOUND CURVE
PE	PLAIN END/POLYETHYLENE PIPE
PG	PROFILE GRADE
PKWY	PARKWAY
PLS	PROFESSIONAL LAND SURVEYOR
PO	PUSH ON
PROP	PROPOSED
PSI	POUNDS PER SQUARE INCH
PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE
R/W	RIGHT OF WAY
R	RADIUS
RCB	REINFORCED CONCRETE BOX
RCP	REINFORCED CONCRETE PIPE
RD	ROAD
RECT	RECTANGULAR
REQD	REQUIRED
RFCD	REGIONAL FLOOD CONTROL DISTRICT
RJ	RIGID JOINT
RP	RADIUS POINT
RT	RIGHT
S	SOUTH OR SLOPE
S/W	SIDEWALK
SCH	SCHEDULE
SD	STORM DRAIN
SDMH	STORM DRAIN MANHOLE
SEC	SECTION
SHT	SHEET
SPECS	SPECIFICATIONS
SQ	SQUARE
SS	SANITARY SEWER/STAINLESS STEEL
SSMH	SANITARY SEWER MANHOLE
ST	STREET
STA	STATION
STD	STANDARD
STL	STEEL
SWG	SOUTHWEST GAS COMPANY
T	TANGENT
T.C.E.	TEMPORARY CONSTRUCTION EASEMENT
TEL	TELEPHONE
TEMP	TEMPORARY
THK	THICK
THR	THRUST
TOW	TOP OF WALL
TRAP	TRAPEZOIDAL
TYP	TYPICAL
UDACS	UNIFORM DESIGN AND CONSTRUCTION STANDARDS
UG	UNDERGROUND
U.N.O.	UNLESS NOTED OTHERWISE
V or VERT	V or VERTICAL
VAR	VARIES
VICT	VICINITY
W	WEST
W/	WITH

GENERAL LEGEND

- EXISTING CURB & GUTTER
- EXISTING EDGE OF PAVEMENT
- EXISTING RIGHT–OF–WAY
- CATV — EXISTING CABLE TELEVISION LINE(S)
- 4" G — EXISTING GAS LINE (SIZE VARIES)
- 12" SS — EXISTING SEWER LINE (SIZE VARIES)
- 8" W — EXISTING WATER LINE (SIZE VARIES)
- TEL — EXISTING TELEPHONE CABLE/CONDUIT(S)
- 18" SD — EXISTING STORM DRAIN (SIZE VARIES)
- UGE — EXISTING UNDERGROUND ELECTRIC LINE(S)
- EXISTING FENCE LINE
- EXISTING FISSURE LOCATION
- EXISTING VALVE
- EXISTING MANHOLE OR POWER POLE
- (2220.25) EXISTING ELEVATION
- EXISTING SECTION LINE
- EXISTING RIGHT–OF–WAY LINE
- PROPOSED TEMPORARY GRADING EASEMENT
- PROPOSED CHAIN LINK FENCE LINE
- PROPOSED DOUBLE SWING GATE
- PROPOSED CONCRETE CHANNEL BOTTOM (PROFILE)
- PROPOSED MAINTENANCE ROAD
- PROPOSED RIP RAP
- ASPHALT REPLACEMENT
- NEW PAVEMENT

UTILITY CONTACT LIST

UTILITY	CONTACT	PHONE NO.
AT & T FIBER OPTIC CABLE	L.E. (EARL) ALVEY	736–3470
COX COMMUNICATIONS	DONEY VILLAREAL	939–1133
CITY OF NORTH LAS VEGAS	LISA RURA	663–1561
LVACTS	NEIL T. ROHLEDER	229–6611
MCI WORLD–COM	MIKE VANDENBERG	801–364–8625
NEVADA POWER – DISTRIBUTION	PAT BROWN	657–4335
NEVADA POWER – TRANSMISSION	PHILIP HALFEREY	227–2330
SNWA	MARIE GREEN	862–3259
SOUTHWEST GAS	ROBERT MIDDAG	365–2071
KERN RIVER PIPELINE	RICK WONNER	244–7614
SPRINT	JANIE STOKES	244–7614

Avoid overhead power line contact. 2 working days **Call before you Overhead** 1-702-593-6111 Nevada Power Environment and Safety Services Department

Avoid cutting underground utility lines. It's costly. 2 working days **Call before you Dig** 1-800-227-2600 Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1	REVISED FOR CONFORMED SET	5/24/2004	VTN

SCALE: N/A
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/24/2004
PROJECT NO:
FILE NAME:

KENNETH DILBRETH — STATE OF NEVADA — No. 9177 — PROFESSIONAL ENGINEER — 5/24/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) ABBREVIATIONS, LEGEND & GENERAL NOTES

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. G2

SHT. 2 OF 128

ISSUED FOR CONSTRUCTION

GENERAL CONSTRUCTION NOTES

1. THE CONTRACTOR IS RESPONSIBLE FOR SECURING ALL PROJECT PERMITS, EXCEPT THOSE NOTED AS HAVING BEEN OBTAINED BY THE CITY, AND COMPLYING WITH ALL TERMS AND CONDITIONS IMPOSED BY THE PERMITTING AGENCIES.
2. THE CONTRACTOR SHALL PROVIDE AT LEAST SEVENTY-TWO (72) HOURS NOTICE TO EACH OF THE FOLLOWING AGENCIES CONFIRMING THE SCHEDULED START OF CONSTRUCTION:

CITY OF NORTH LAS VEGAS UTILITIES DIVISION	(702) 633-1290
COX COMMUNICATION	(702) 385-3644
NEVADA POWER COMPANY	(702) 227-2600
SPRINT TELEPHONE COMPANY	(702) 227-2600
SOUTHWEST GAS CORPORATION	(702) 365-2296
KERN RIVER PIPELINE	(702) 399-1612

3. INFORMATION NOTED ON THE DRAWINGS CONCERNING THE EXISTENCE AND LOCATION OF EXISTING UNDERGROUND UTILITIES AND OTHER UNDERGROUND STRUCTURES WERE OBTAINED BY A SEARCH OF AVAILABLE RECORDS. THE CITY OF NORTH LAS VEGAS (CITY), AND RESPONSIBLE PROFESSIONAL MAKE NO ASSURANCES CONCERNING THE ACCURACY OF SUCH INFORMATION. THE CONTRACTOR SHALL EXERCISE CAUTION AND USE BEST AVAILABLE CONSTRUCTION TECHNIQUES TO DETERMINE THE ACTUAL LOCATION OF AND PROTECTION FOR ALL UNDERGROUND UTILITIES WHETHER OR NOT THEY ARE SHOWN ON THE PLANS. THE CONTRACTOR SHALL:

CALL BEFORE YOU DIG	1-800-227-2600
CALL BEFORE YOU OVERHEAD	1-702-593-6111

4. THE CONTRACTOR SHALL EXERCISE CAUTION AND USE BEST AVAILABLE CONSTRUCTION TECHNIQUES TO PROTECT AND PRESERVE EXISTING PERMANENT SURVEY MONUMENTS. ALL SURVEY MONUMENTS DISTURBED SHALL BE REPLACED AND/OR REHABILITATED IN ACCORDANCE WITH STANDARDS BY A PROFESSIONAL LAND SURVEYOR RETAINED BY THE CONTRACTOR.
5. THE CONTRACTOR SHALL EXERCISE CAUTION AND USE BEST AVAILABLE CONSTRUCTION TECHNIQUES TO PROTECT AND PRESERVE EXISTING PUBLIC AND PRIVATE FEATURES LOCATED IN CLOSE PROXIMITY TO OR ABUTTING IMPROVEMENTS SHOWN ON THESE PLANS. RESTORATION OF DAMAGED FEATURES SHALL BE ACCOMPLISHED BY THE CONTRACTOR AT THE CONTRACTOR'S EXPENSE TO THE SATISFACTION OF THE CONSTRUCTION MANAGER.
6. THE LOCATION OF ALL SAWCUT LINES FOR THE PROJECT WILL BE DETERMINED BY THE CONSTRUCTION MANAGER IF THE LOCATION IS NOT CLEARLY SHOWN ON THE DRAWINGS OR IF EXISTING CONDITIONS REQUIRE ADJUSTMENT TO THE LOCATION SHOWN ON THE DRAWINGS.
7. THE CONTRACTOR SHALL COOPERATE AND COORDINATE WITH THE CONSTRUCTION MANAGER IN PROVIDING INGRESS AND EGRESS TO ABUTTING PROPERTIES, AND SHALL PROTECT SUCH PROPERTIES FROM PROJECT RELATED STORM WATER AND NUISANCE RUNOFF BY PROVIDING TEMPORARY POSITIVE DRAINAGE CONTROL.
8. PLANTMIX BITUMINOUS ASPHALT SHALL BE FINISHED TO A HEIGHT OF BETWEEN 3/8 INCHES AND 5/8 INCHES ABOVE THE LIP OF CURB GUTTERS AND VALLEY GUTTERS.
9. TYPE V CEMENT SHALL BE USED FOR ALL OFF-SITE IMPROVEMENTS.
10. CURB AND GUTTER HAVING A DESIGN GRADE OF 0.5 PERCENT OR LESS SHALL BE CONTRUCTED BY FORMING. FORM GRADES AND ELEVATIONS SHALL BE VERIFIED PRIOR TO PLACEMENT OF CONCRETE AND WATER FLOW TESTED AS SOON AFTER PLACEMENT AS AS CURING ALLOWS.
11. CONCRETE AND ASPHALT CONCRETE MIX DESIGNS SHALL BE PROJECT SPECIFIC, INTER-AGENCY QUALITY ASSURANCE COMMITTEE (IQAC) LISTED, AND APPROVED BY THE CONSTRUCTION MANAGER AND CONSTRUCTION SERVICES DIVISION PRIOR TO PLACEMENTS.
12. UTILITY BOXES AND VAULTS LOCATED IN THE SIDEWALK AREA ARE TO BE CONSTRUCTED TO THE FINISH DESIGN GRADE. THE ELEVATION SHALL BE CONSISTENT WITH THAT REQUIRED FOR THE STANDARD CONCRETE CITY SIDEWALK EVEN IF THE CONCRETE SIDEWALK CONSTRUCTION IS DEFERRED TO A FUTURE DATE.
13. THE CONTRACTOR SHALL PROVIDE REASONABLE ACCOMMODATIONS FOR CITY SURVEY DIVISION TO OBTAIN GPS/GIS DATA ON ALL UNDERGROUND UTILITIES AND INFRASTRUCTURE.
14. ALL OFF-SITE IMPROVEMENTS SUBGRADE MUST BE CERTIFIED BY THE CONSTRUCTION SERVICES DIVISION.
15. THE CONTRACTOR SHALL INSCRIBE AN "S", 3-INCHES IN HEIGHT, INTO THE CURB AT THE POINT WHERE THE SEWER LATERAL ENTERS EACH SUBDIVISION LOT OR PRIVATE LAND PARCEL.
16. A SOILS REPORT HAS BEEN PERFORMED BY KLEINFELDER AND IS AVAILABLE FOR PURCHASE AT THE CITY'S PUBLIC WORKS DEPARTMENT ENGINEERING SERVICES. THIS GEOTECHNICAL REPORT IS A REFERENCED DOCUMENT ONLY AND IS NOT PART OF THE CONTRACT. KLEINFELDER REPORT NO. 31-110042, DATED APRIL 19, 2002.

GENERAL WATER LINE CONSTRUCTION NOTES

1. NO WATER MAIN MAY BE SHUT DOWN TO MAKE CONNECTIONS WITHOUT PRIOR APPROVAL OF THE CITY'S MANAGER OF UTILITIES.
2. ALL WATER METERS TWO (2) INCHES AND SMALLER SHALL BE OBTAINED FROM THE CITY. REQUESTS FOR WATER METERS MUST BE MADE TO THE NORTH LAS VEGAS UTILITIES DIVISION AT LEAST ONE (1) BUSINESS DAY PRIOR TO PICKUP. (TELEPHONE NUMBER (702) 633-1277).
3. ALL SERVICE LATERALS TWO (2) INCHES AND SMALLER SHALL BE COPPER TUBING WITH APPROVED SERVICE SADDLES. CORPORATION STOPS AND ANGLE METER STOPS SHALL BE THE SAME SIZE AS THE SERVICE LATERAL. ANGLE METER STOPS AND METER SHALL BE CENTERED IN THE METER BOX.
4. ALL METER BOXES SHALL BE EQUIPPED WITH TRAFFIC BEARING COVERS AND INSTALLED TO THE FINISH DESIGN GRADE AND ELEVATION. IF SUCH IS NOT SHOWN ON THE PLANS, THE ELEVATION WILL BE ESTABLISHED BY THE CONSTRUCTION MANAGER.
5. WARNING TAPE SHALL BE REQUIRED ABOVE ALL WATER MAINS, SERVICE LATERALS THAT ARE SIX (6) INCHES AND LARGER, AND ANY SERVICE LATERAL NOT INSTALLED PERPENDICULAR TO THE MAIN LINE.
6. ALL WATER MAINS SHALL BE FILLED, PRESSURE TESTED IN ACCORDANCE WITH THE SPECIAL PROVISIONS, DISINFECTED, FLUSHED, REFILLED AND AN ACCEPTABLE WATER SAMPLE OBTAINED, PRIOR TO CONNECTION TO THE CITY'S WATER DISTRIBUTION SYSTEM. WATER QUALITY SAMPLES WILL BE COLLECTED BY THE CITY. CONTACT THE CITY UTILITIES DIVISION TWENTY-FOUR (24) HOURS IN ADVANCE TO SCHEDULE SAMPLING.
7. ALL BACKFLOW PREVENTION ASSEMBLIES SHALL BE TESTED AND CERTIFIED BY THE CITY PRIOR TO PLACING THE WATER SYSTEM IN SERVICE. CONTACT THE CITY UTILITIES DIVISION TWENTY-FOUR (24) HOURS IN ADVANCE TO SCHEDULE TESTING.
8. ON ANY BUILDING CONSTRUCTION PROJECT UTILIZING COMBUSTIBLE CONSTRUCTION, THE CONTRACTOR SHALL INSTALL ACCESSIBLE FIRE HYDRANTS BEFORE ACTUAL CONSTRUCTION COMMENCES. FIRE HYDRANTS SHALL BE PROVIDED WITHIN 300 FEET OF COMBUSTIBLE MATERIAL STORAGE AND FRAMING CONSTRUCTION. A HYDRANT FLOW TEST IS REQUIRED, WHICH SHALL INCLUDE STATIC PRESSURE AND WATER FLOW VOLUME SHOWING THE ABILITY TO MEET THE REQUIRED FIRE FLOW, AND MUST BE PRESENTED TO THE NORTH LAS VEGAS FIRE DEPARTMENT AND PUBLIC WORKS.

GENERAL GRADING AND DRAINAGE NOTES

1. THE CONTRACTOR'S OPERATIONS SHALL NOT TRESPASS BEYOND THE PROJECT PROPERTY LINES UNLESS A PERMIT OR WRITTEN AUTHORIZATION HAS BEEN OBTAINED FROM THE PROPERTY OWNER(S) INVOLVED. COPIES OF SUCH WRITTEN AUTHORIZATION SHALL BE FURNISHED TO THE CONSTRUCTION MANAGER PRIOR TO START OF CONSTRUCTION.
2. THE CONSTRUCTION MANAGER SHALL BE NOTIFIED TWO (2) WORKING DAYS BEFORE ANY ON-SITE CONSTRUCTION WORK BEGINS.
3. THE CONSTRUCTION SERVICES DIVISION SHALL CERTIFY THAT ALL FILLS, FOUNDATIONS AND SUBGRADES MEET THE MINIMUM COMPACTION REQUIREMENTS PRIOR TO PLACING CONCRETE.

GENERAL TRAFFIC AND WIRING NOTES

1. THE CONTRACTOR SHALL SUBMIT A WRITTEN AND DIAGRAMED TRAFFIC CONTROL AND BARRICADE PLAN ON 24" x 36" REPRODUCIBLE MYLAR FOR APPROVAL. ALL BARRICADING, CONSTRUCTION SIGNING, TRAFFIC DELINEATION AND MARKINGS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES AND / OR WORK ZONE TRAFFIC CONTROL HANDBOOK. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO SEE THAT ALL TRAFFIC CONTROL DEVICES ARE INSTALLED IN ACCORDANCE WITH THE APPROVED TRAFFIC CONTROL AND BARRICADE PLAN AND ARE PROPERLY INSTALLED AND MAINTAINED THROUGHOUT THE DURATION OF THE PROJECT.
2. IF THE PROJECT IMPROVEMENTS NECESSITATE, TEMPORARY REMOVAL AND/OR RELOCATION OF TRAFFIC CONTROL SIGNS, MARKINGS OR ANY OTHER TRAFFIC CONTROL DEVICES, THEY SHALL BE MAINTAINED THROUGHOUT THE ENTIRE DURATION OF THE PROJECT AND SHALL BE RESTORED TO THE SATISFACTION OF THE CONSTRUCTION MANAGER.
3. PAINTED MARKINGS SHALL NOT BE USED FOR TEMPORARY CONDITIONS. ALL TEMPORARY MARKINGS SHALL BE A REMOVABLE GRADE TAPE. ALL OTHER MARKINGS SHALL BE PER CLARK COUNTY UNIFORM STANDARD DRAWING 244 THROUGH 248 AND MEET THE SATISFACTION OF THE MANAGER OF ROADWAY OPERATIONS.
4. ALL PERMANENT TRAFFIC CONTROL DEVICES SHALL BE PROPERLY INSTALLED IN ACCORDANCE WITH THE LATEST EDITION OF THE MUTCD AND/OR THE RTC STANDARDS PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE STREETS, REGARDLESS OF THE STATUS OF THEIR COMPLETION.
5. ALL TEMPORARY REGULATORY SIGNAGE SHALL BE GROUND MOUNTED IN ACCORDANCE WITH THE UNIFORM STANDARD DRAWING NUMBER 249 AND MEET THE MOST RECENT MUTCD REQUIREMENTS.
6. THE LOCATIONS OF CONDUIT ENDS OF ALL CONDUIT IN STRUCTURES OR TERMINATING AT CURBS SHALL BE MARKED BY A (X) AT LEAST 3 INCHES HIGH CUT INTO THE FACE OF CURBS, GUTTER, OR WALL DIRECTLY ABOVE THE CONDUIT. ALL CONDUITS AT LIMITS OF CONSTRUCTION SHALL BE STUBBED AND CAPPED 5 FEET PAST PROPERTY LINE AND/OR CONNECTED TO EXISTING STREET LIGHTING CONDUIT.
7. ALL CONDUITS FOR FUTURE USE SHALL BE BLOWN OUT WITH COMPRESSED AIR, CLEANED AND PROVIDED WITH A 200 POUND PULL LINE; ALL ENDS OF CONDUITS SHALL BE CAPPED.
8. ALL SERVICE PANELS SHALL BE PER CLARK COUNTY UNIFORM STANDARD SPECIFICATION DRAWING NO. 330. THE PHOTO CELL SHALL BE A TYPE II, TORK 2007 OR EQUAL AND BE MOUNTED ON TOP OF THE NEAREST PERMANENT STREET LIGHT POLE. A SWITCH SHALL BE INCLUDED FOR MANUAL OPERATION (USS 623 L.02.06).
9. THE CONSTRUCTION SERVICES DIVISION SHALL BE NOTIFIED 24 HOURS IN ADVANCE TO SCHEDULE AN INSPECTION OF THE WIRING MAKEUP/SERVICE POINT.
10. STREET LIGHTS SHALL BE PLACED IN ACCORDANCE WITH UNIFORM STANDARD DRAWING NUMBER 320 THRU 320A, UNLESS OTHERWISE NOTED. STANDARDS AND MAST ARMS SHALL BE GALVANIZED IN ACCORDANCE WITH ASTM A-120.
11. "NO PARKING" ZONES AT CURB RETURNS, FIRE HYDRANT ZONES AND SCHOOL ZONES SHALL BE PAINTED RED TO THE LIMITS NOTED ON THE PLANS.

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Nevada Power Environment and Safety Services Department

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Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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PROJECT NO:
FILE NAME:

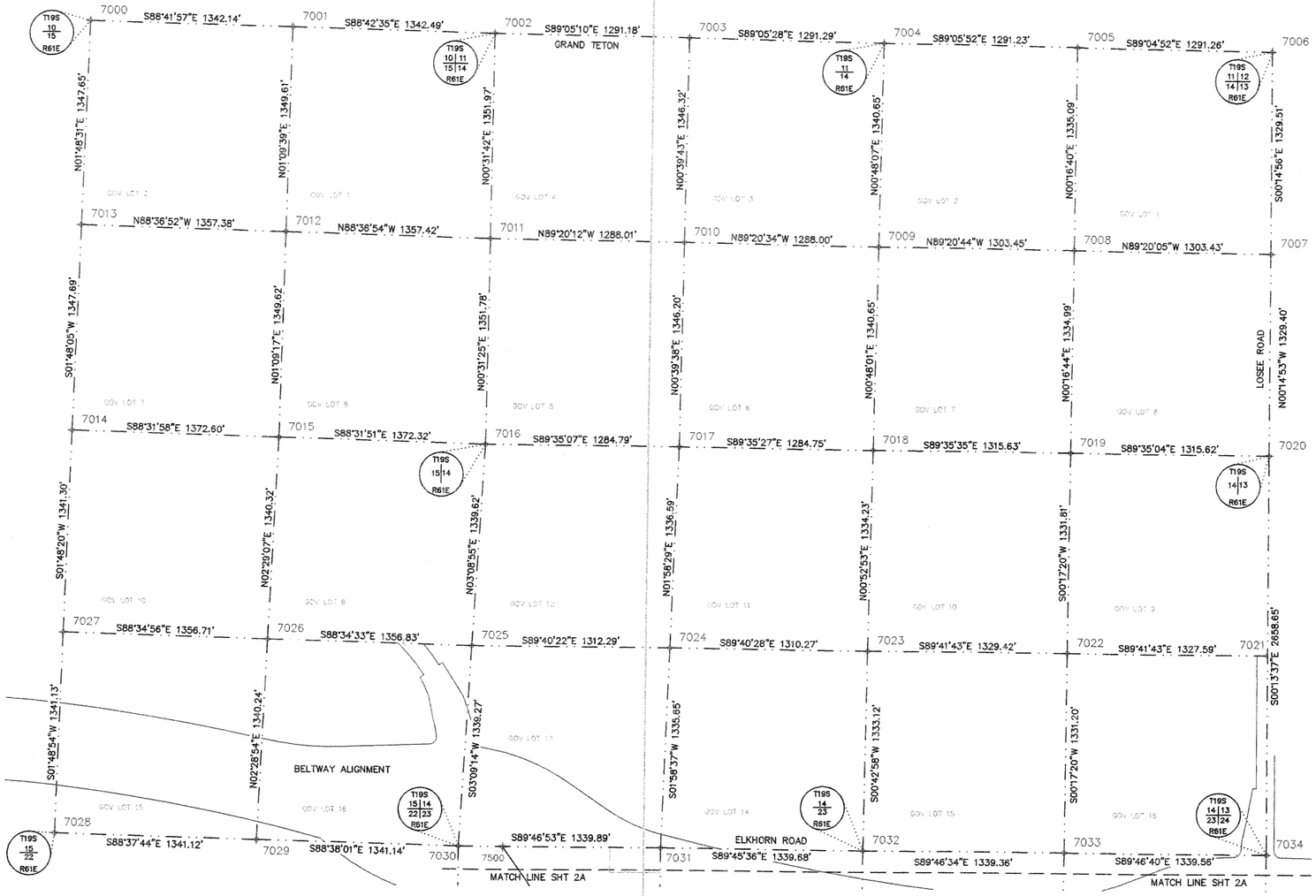
SCALE: N/A
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177
1/21/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) CITY OF NORTH LAS VEGAS GENERAL NOTES
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
G3
SHT. 3 OF 128



BASIS OF BEARINGS

THE BASIS OF BEARINGS FOR THIS SURVEY IS N 00° 19' 43"E BEING THE EAST LINE OF THE SOUTHEAST QUARTER OF THE SOUTHWEST QUARTER OF SECTION 26, T19S, R61E AS DEFINED BY THE MERIDIAN OF THE CITY OF NORTH LAS VEGAS USER DEFINED TRANSVERSE MERCATOR PROJECTION; SAID MERIDIAN BEING COINCIDENT WITH 115°05' 53.00204" WEST OF THE GREENWICH MERIDIAN. ORIENTATION IS DEFINED BY THE HIGH ACCURACY REFERENCE NETWORK OF NEVADA, NATIONAL GEODETIC SURVEY. (EPOCH 1999.37)

CITY OF NORTH LAS VEGAS USER DEFINED TRANSVERSE MERCATOR PROJECTION PARAMETERS:

CENTRAL MERIDIAN = 115°05' 53.00204" WEST
LATITUDE OF ORIGIN = 36°15' 00.000607" NORTH
ORIGIN NORTHING = 75000.0000 U.S. FEET
ORIGIN EASTING = 75000.0000 U.S. FEET
SCALE ALONG CENTRAL MERIDIAN = 1.000093468437

REFERENCE ELLIPSOID = GRS-80
SEMI-MAJOR AXIS = 20,925,604.474 U.S. FEET
FLATTENING (1/f) = 298.25722154
X TRANSLATION = 0.0000
Y TRANSLATION = 0.0000
Z TRANSLATION = 0.0000

VERTICAL ADJUSTMENT PARAMETERS:

A VERTICAL ADJUSTMENT HAS BEEN APPLIED USING A PRIMARY RESIDUAL GEOID MODEL BASED UPON THE ORIGINAL PARAMETERS OF GEOID '99 AND FURTHER REFINED USING LOCAL ELEVATIONS. THE ORTHOMETRIC ELEVATIONS USED TO DEVELOP SAID PRIMARY RESIDUAL MODEL ARE IN REFERENCE TO THE NORTH AMERICAN VERTICAL DATUM OF 1988 AND WERE TAKEN FROM THE CITY OF NORTH LAS VEGAS BENCHMARK BOOK, REVISED, AUGUST 1ST, 1997.

SURVEYOR'S NOTE:

MEASUREMENTS FOR THIS SURVEY WERE COMPILED UTILIZING TRIMBLE 4000SSI AND 4700 DUAL FREQUENCY GLOBAL POSITIONING (GPS) RECEIVERS OPERATED IN THE FAST-STATIC AND KINEMATIC MODES. INFORMATION PERTAINING TO THIS SURVEY IS ON FILE AND MAY BE REVIEWED AT THE OFFICE OF THE NORTH LAS VEGAS CITY SURVEYOR DURING NORMAL BUSINESS HOURS.

BENCHMARKS

NLV9123NNW6 ELEV. 641.227 METERS (2104.48') BLM BRASS CAP WITH ALUMINUM DISK TIED TO PIPE STAMPED NORTH LAS VEGAS BM AT THE INTERSECTION OF ELKHORN RD. AND BRUCE

526124 ELEV. 621.673 (2039.606) 1' DIA. CONC. MON. 50' EAST OF POWER POLE #2/10 SOUTHWEST OF THE NORTH QUARTER CORNER SECTION 26-19-61

NLV9135N4 ELEV.609.020 METERS (1998.093) 2" CNLV BC AT INTERSECTION ANN AND BRUCE

N

SCALE 1" = 400'

CHANNEL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7500	89933.5889	64419.2088	STA. 6 + 14.22 MATCH EXISTING

SECTIONAL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7000	95376.326	61612.479	FOUND 4" BLM BRASS CAP
7001	95345.858	62954.277	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7002	95315.630	64296.424	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 9399"
7003	95295.038	65587.438	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7004	95274.552	66878.566	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7005	95254.221	68169.640	FOUND TYPE II W/2 1/2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7006	95233.513	69460.730	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 10160"
7007	93904.018	69466.507	FOUND TYPE II W/2 1/2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7008	93919.151	68163.168	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7009	93934.037	66859.798	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7010	93948.808	65571.882	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7011	93963.717	64283.956	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7012	93996.524	62926.933	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7013	94029.343	61569.946	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7014	92682.322	61527.584	FOUND 2" BRASS CAP MARKED "CNLV PLS 10160"
7015	92647.177	62899.735	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7016	92611.992	64271.605	FOUND 4" BLM BRASS CAP
7017	92602.695	65556.360	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7018	92593.521	66841.073	FOUND TYPE II W/2 1/2" ALUMINUM CAP MARKED "CNLV PLS 9399"
7019	92584.176	68156.673	FOUND TYPE II W/2 1/2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7020	92574.633	69472.260	FOUND TYPE II W/2 1/2" BRASS CAP MARKED "CNLV PLS 9399"
7021	91245.318	69477.527	CALCULATED
7022	91252.381	68149.955	CALCULATED
7023	91259.453	66820.549	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7024	91266.897	65510.300	FOUND 2" ALUMINUM CAP MARKED "CNLV PLS 10160"
7025	91274.393	64198.027	FOUND 1" ALUMINUM CAP MARKED "PLS 7755"
7026	91308.114	62841.617	FOUND 1" ALUMINUM CAP MARKED "PLS 7755"
7027	91341.683	61485.325	FOUND 1" ALUMINUM CAP MARKED "PLS 7755"
7028	90001.224	61442.850	FOUND 4" BLM BRASS CAP
7029	89969.132	62783.585	FOUND 4" BLM BRASS CAP
7030	89937.154	64124.345	FOUND BLM BRASS CAP
7031	89932.044	65464.223	FOUND 4" BLM BRASS CAP
7032	89926.435	66803.887	FOUND 4" BLM BRASS CAP
7033	89921.201	68143.240	FOUND 4" BLM BRASS CAP
7034	89916.004	69482.793	FOUND 3 1/2" BLM BRASS CAP

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			

SCALE: 1" = 400'
DESIGN:
DRAWN: T. COCHRAN
CHECKED: D. FITZGERALD
APPROVED: B. DALTON
DATE:

STATE OF NEVADA — BARTLETT C. DALTON — No. 10160 — PROFESSIONAL ENGINEER — Exp. 12-31-04

DEPT. OF PUBLIC WORKS — SURVEY DIVISION — 2200 CIVIC CENTER DRIVE, NORTH LAS VEGAS, NEVADA

SURVEY CONTROL PLAN

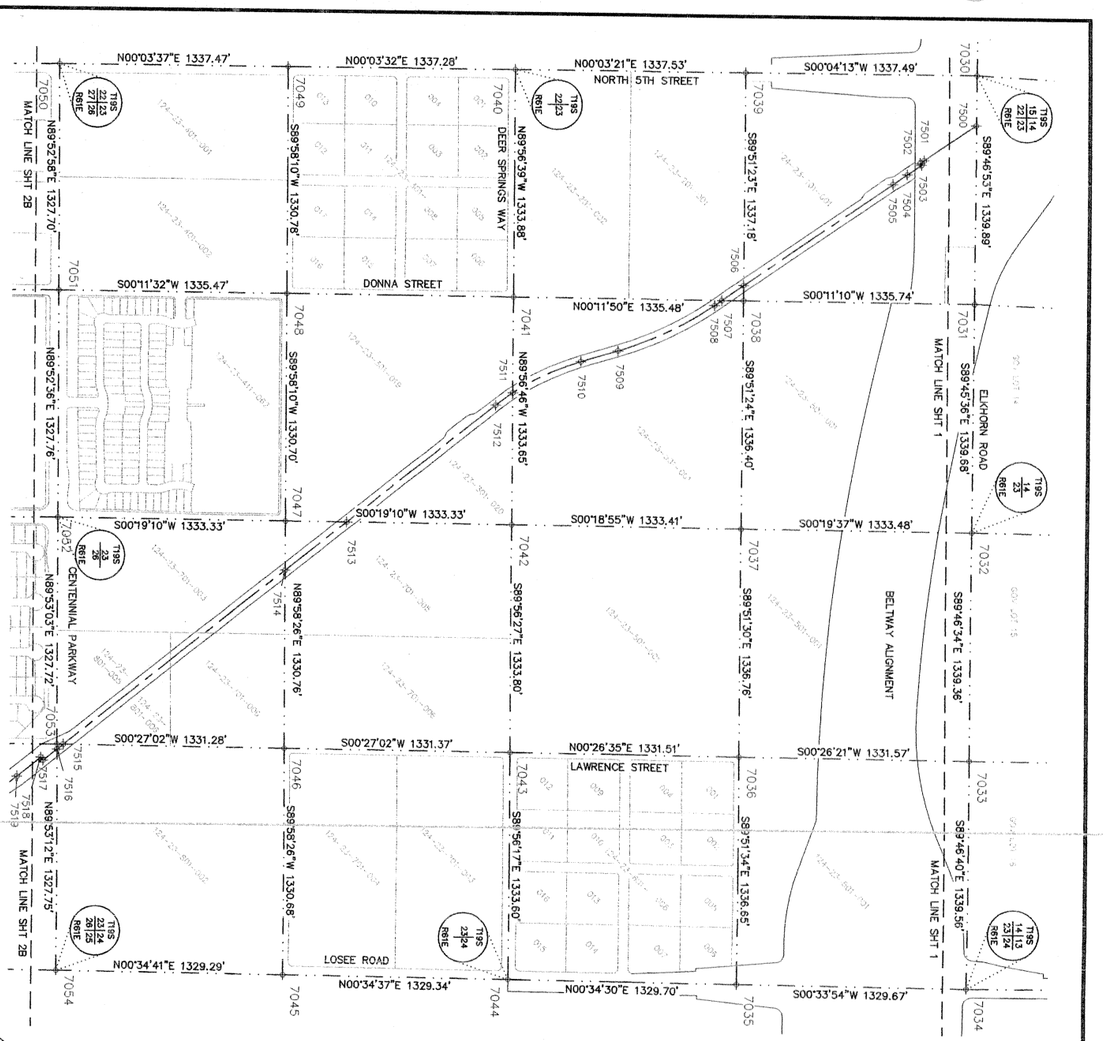
(DRAWING TITLE)

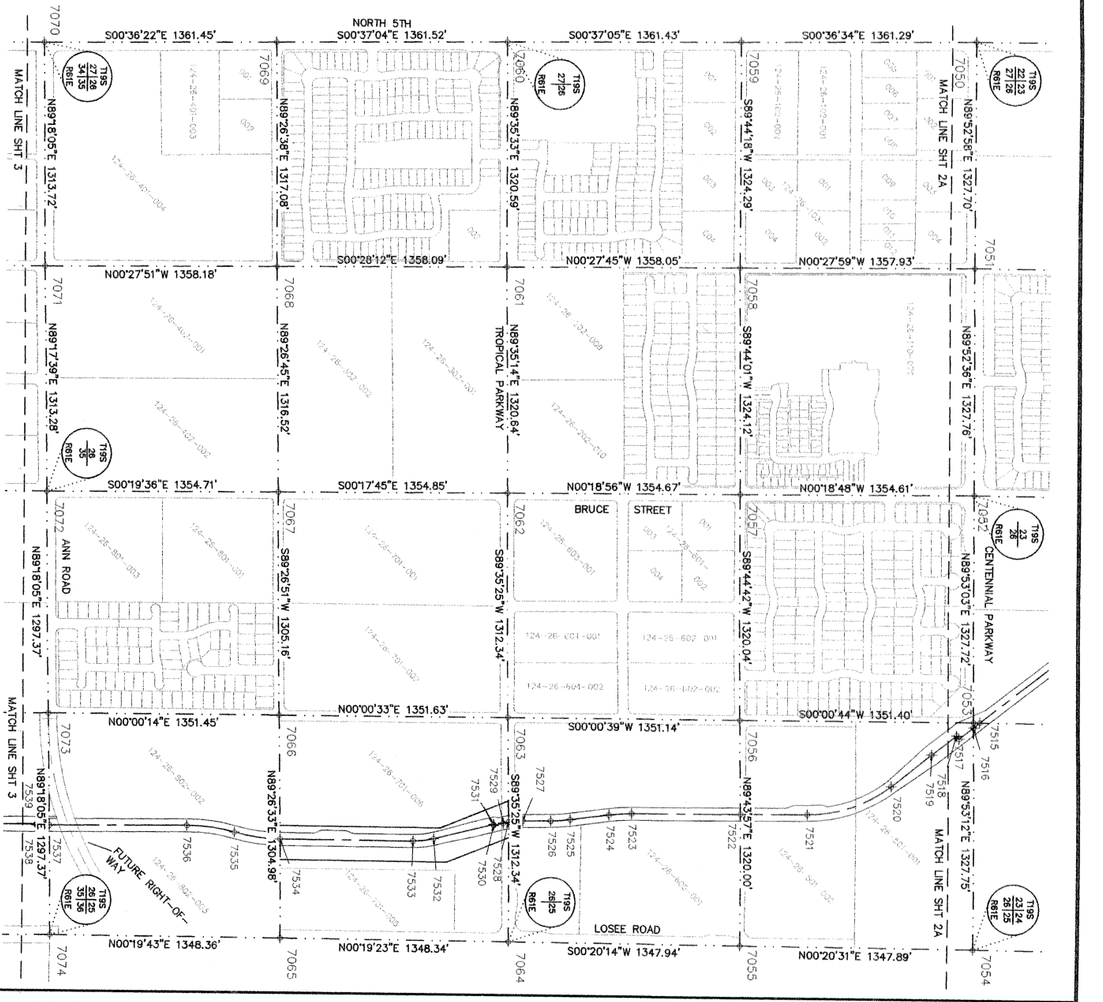
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(PROJECT TITLE)

(LOCATION)

SHEET NO.
SC1
OF SC4 SHEETS





SCALE 1" = 400'

CHANNEL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7500	8893.5689	84419.2088	STA 6 + 14.22 MATCH EXISTING
7501	8867.1479	84628.3827	BEGIN TRANSITION
7502	8862.4433	84653.6734	STA 10 + 03.56 BEGIN CONFLUENCE
7503	8862.4433	84653.6734	STA 10 + 03.56
7504	8854O.4748	84710.8949	STA 11 + 03.56
7505	8845.5053	84768.2564	STA 12 + 03.56
7506	8849.3971	85439.4491	CHANNEL / SECTIONLINE
7507	8849.3971	85439.4491	CHANNEL / SECTIONLINE
7508	8847.6.1958	84469.6392	STA 24 + 62.68 P.C.
7509	8787.7010	84276.1463	STA 30 + 86.92 P.T.
7510	8786O.3128	84015.0821	CHANNEL / SECTIONLINE
7511	8786O.3128	84015.0821	CHANNEL / SECTIONLINE
7512	8716O.2438	84008.2502	STA 38 + 7.89 P.T.
7513	8687.2005	84007.0783	CHANNEL / SECTIONLINE
7514	8687.2005	84007.0783	CHANNEL / SECTIONLINE
7515	8463.9360	84102.0804	CHANNEL / SECTIONLINE
7516	8459.7016	84530.9416	CHANNEL / SECTIONLINE
7517	8459.7016	84530.9416	CHANNEL / SECTIONLINE
7518	8459.7016	84530.9416	CHANNEL / SECTIONLINE
7519	8435.9714	84587.3745	STA 74 + 35.76

CHANNEL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7520	8412.6.683	84478.8004	STA 77 + 36.62 P.C.
7521	8353.8.5238	84649.7803	STA 82 + 60.85 P.T.
7522	8360.8.8165	84851.7638	CHANNEL / SECTIONLINE
7523	8360.8.8165	84851.7638	CHANNEL / SECTIONLINE
7524	8240.4825	84863.1277	STA 94 + 19.11 P.C.
7525	8225.5.9719	84864.1925	STA 96 + 45.63 P.C.
7526	8225.5.9719	84864.1925	STA 96 + 45.63 P.C.
7527	8240.1645	84702.6350	STA 97 + 61.81 P.T.
7528	8187.4913	84712.5453	CHANNEL / SECTIONLINE
7529	8188.9734	84719.2985	STA 100 + 37.21 P.T.
7530	8160.1707	84773.1640	STA 100 + 94.72
7531	8160.1707	84773.1640	STA 100 + 94.72
7532	8156.3351	84814.6643	STA 104 + 57.78 P.C.
7533	8133.5.2295	84859.3364	STA 105 + 80.00 P.T.
7534	8133.5.2295	84859.3364	STA 105 + 80.00 P.T.
7535	8028.8.8264	84882.4854	STA 115 + 85.76 P.C.
7536	8004.7200	84948.9862	STA 119+17.47 P.T.
7537	7998.0027	84925.5028	CHANNEL / SECTIONLINE
7538	7972.2.0715	84756.0018	STA 128+00.09

SECTIONAL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7031	8893.2.044	16464.7.23	FOUND 2" BLM BRASS CAP
7032	8892.6.435	16860.3.867	FOUND 2" BLM BRASS CAP
7033	8892.7.201	85143.2.40	FOUND 2" BLM BRASS CAP
7034	8892.7.248	85426.3.248	FOUND 2" BLM BRASS CAP
7035	8858.3.971	85469.2.682	FOUND 2" BLM BRASS CAP
7036	8858.9.674	85133.0.341	FOUND 2" BLM BRASS CAP
7037	8858.9.376	84780.2.80	FOUND 2" BLM BRASS CAP
7038	8859.9.669	84422.7.07	FOUND 2" BLM BRASS CAP
7039	8859.9.669	84422.7.07	FOUND 2" BLM BRASS CAP
7040	8720.2.141	84124.4.05	FOUND 2" BLM BRASS CAP
7041	8720.2.589	83745.2.89	FOUND 2" BLM BRASS CAP
7042	8720.2.589	83745.2.89	FOUND 2" BLM BRASS CAP
7043	8728.2.208	83722.7.36	FOUND 2" BLM BRASS CAP
7044	8726.5.764	83456.3.37	FOUND 2" BLM BRASS CAP
7045	8726.5.764	83456.3.37	FOUND 2" BLM BRASS CAP
7046	8582.8.281	83812.7.82	FOUND 2" BLM BRASS CAP
7047	8589.8.273	83781.5.09	CALCULATED
7048	8589.8.273	83781.5.09	CALCULATED
7049	8589.5.965	83450.8.07	CALCULATED
7050	8589.5.965	83450.8.07	CALCULATED
7051	8459.0.104	83446.3.24	FOUND 2 1/2" BRASS CAP
7052	8459.2.862	86774.0.76	FOUND BLM BRASS CAP

SECTIONAL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7053	8459.2.862	86774.0.76	FOUND BLM BRASS CAP
7054	8458.8.270	87429.5.38	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7055	8325.0.409	87421.4.92	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7056	8325.0.409	87421.4.92	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7057	8325.0.409	87421.4.92	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7058	8325.0.409	87421.4.92	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7059	8324.8.248	88101.5.08	FOUND 5/8" REBAR (NO CAP)
7060	8324.8.248	88101.5.08	FOUND 5/8" REBAR (NO CAP)
7061	8324.8.248	88101.5.08	FOUND 5/8" REBAR (NO CAP)
7062	8324.8.248	88101.5.08	FOUND 5/8" REBAR (NO CAP)
7063	8189.3.111	88101.2.51	CALCULATED
7064	8189.3.111	88101.2.51	CALCULATED
7065	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7066	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7067	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7068	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7069	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7070	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7071	7915.6.025	87490.4.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7072	7915.6.025	87490.4.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7073	7915.6.025	87490.4.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7074	7920.5.205	88169.2.20	FOUND 3" BRASS CAP MARKED "PLS 4041"

SECTIONAL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7054	8458.8.270	87429.5.38	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7055	8325.0.409	87421.4.92	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7056	8324.8.248	88101.5.08	FOUND 5/8" REBAR (NO CAP)
7057	8324.8.248	88101.5.08	FOUND 5/8" REBAR W/1" ALUMINUM CAP (ILLEGIBLE)
7058	8323.2.216	87457.3.76	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7059	8324.8.168	87133.1.01	FOUND 5/8" REBAR W/1" ALUMINUM CAP "ONLY PLS 9389"
7060	8189.4.820	87447.7.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7061	8189.3.111	88101.2.51	CALCULATED
7062	8188.3.729	86788.9.41	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7063	8189.3.111	88101.2.51	CALCULATED
7064	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7065	8054.4.193	87435.5.61	FOUND 2" BRASS CAP MARKED "ONLY PLS 10160"
7066	8054.4.479	88101.0.33	FOUND 2" ALUMINUM CAP MARKED "5293"
7067	8054.4.479	88101.0.33	FOUND 2" ALUMINUM CAP MARKED "5293"
7068	8052.8.895	86795.9.36	FOUND 5/8" REBAR W/ALUMINUM CAP MARKED "PLS 5094"
7069	8052.8.895	86795.9.36	FOUND 5/8" REBAR W/ALUMINUM CAP MARKED "PLS 5094"
7070	8052.8.895	86795.9.36	FOUND 5/8" REBAR AND ALUMINUM CAP MARKED "PLS 7812"
7071	7915.6.025	87490.4.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7072	7915.6.025	87490.4.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7073	7915.6.025	87490.4.86	FOUND 2 1/2" BRASS CAP MARKED "ONLY PLS 9389"
7074	7920.5.205	88169.2.20	FOUND 3" BRASS CAP MARKED "PLS 4041"

CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

SHEET NO. SC2 OF SC4 SHEETS

(DRAWING TITLE) SURVEY CONTROL PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

CITY OF NORTH LAS VEGAS
Team Engineering of Nevada
SURVEY DIVISION
DEPT. OF PUBLIC WORKS
50 EAST BROOKS AVENUE
NORTH LAS VEGAS, NEVADA

BARTLETT C DALTON
Exp: 12-31-04
No. 10160
STATE OF NEVADA
14 JAN 04

SCALE: 1" = 400'
DESIGN:
DRAWN: T. COCHRAN
CHECKED: D. FITZGERALD
APPROVED: B. DALTON
DATE:

REVISIONS			
NO.	DESCRIPTION	DATE	BY
△			
△			
△			
△			



SECTIONAL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7070	79142.007	64176.866	FOUND 5/8" REBAR (NO CAP)
7071	79158.025	65490.486	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 9399"
7072	79174.204	66803.663	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 9399"
7073	79190.025	68100.942	CALULATED FROM PREVIOUSLY KNOWN POSITION
7074	79205.846	69398.220	FOUND 3" BRASS CAP MARKED "PLS 4047"
7075	77879.537	69409.410	FOUND 5/8" REBAR (NO CAP) CHECKED FROM TIES PLS 9399
7076	77868.013	68107.705	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 9399"
7077	77856.404	66805.928	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 9399"
7078	77844.914	65491.399	CALCULATED
7079	77833.265	64177.198	FOUND 5/8" REBAR W/ALUMINUM CAP (ILLEGIBLE)
7080	76524.596	64177.065	FOUND TYPE I W/2" BRASS CAP MARKED "CNLV P.S 10160"
7081	76531.656	65492.709	CALCULATED
7082	76538.716	66808.353	FOUND TYPE I W/2" BRASS CAP MARKED "CNLV P.S 10160"
7083	76546.051	68114.545	FOUND 4" CNLV ALUMINUM MONUMENT
7084	76553.238	69420.680	FOUND TYPE I W/3" BRASS CAP MARKED "PLS 9105"
7085	76552.620	70760.272	CALCULATED
7086	76552.003	72099.864	FOUND TYPE I W/2" BRASS CAP MARKED "PLS 7139"
7087	75222.781	72103.252	FOUND TYPE II W/2" BRASS CAP MARKED "PLS 7139"
7088	75224.865	70767.574	CALCULATED
7089	75226.952	69431.867	FOUND 1" ALUMINUM CAP MARKED "PLS 9105"
7090	75221.481	68121.382	FOUND 2" BRASS CAP MARKED "CNLV PLS 9399"
7091	75216.071	66810.719	CALCULATED
7092	75210.310	65493.630	FOUND 2 1/2" BRASS CAP MARKED "CNLV PLS 10160"
7093	75204.549	64176.390	CALCULATED
7094	73884.566	64175.650	FOUND 2" BRASS CAP MARKED "CNLV PLS 10160"
7095	73889.059	65494.561	FOUND 2" BRASS CAP MARKED "CNLV PLS 10160"
7096	73893.425	66813.085	FOUND TYPE I W/2" BRASS CAP MARKED "CNLV P.S 10160"
7097	73897.081	68128.113	CALCULATED
7098	73900.673	69443.207	FOUND TYPE I W/2" BRASS CAP NOT MARKED
7099	73897.109	70774.913	FOUND TYPE II W/2" BRASS CAP MARKED "PLS 8431"
7100	73893.477	72106.556	FOUND TYPE I W/2" BRASS CAP MARKED "PLS 7139"
7101	73890.934	74786.180	FOUND TYPE II W/2" BRASS CAP MARKED "PLS 8431"

CHANNEL CONTROL

PT #	NORTHING	EASTING	DESCRIPTION
7537	79198.0077	68755.5026	CHANNEL / SECTIONLINE
7538	78122.1125	68756.0216	STA 128+00.09
7539	78122.0715	68750.0218	STA 128+00.09
7540	77873.7750	68758.5579	CHANNEL / SECTIONLINE
7541	76549.6445	68767.6125	CHANNEL / SECTIONLINE
7542	75756.3342	68773.0373	STA 161+65.9107 P.C.
7543	75224.8579	68930.2698	CHANNEL / SECTIONLINE
7544	74907.4021	69255.6578	STA 171+86.11 P.T.
7545	74798.6609	69435.5290	CHANNEL / SECTIONLINE
7546	74734.9287	69540.9498	STA 175+19.48 P.C.
7547	74134.0289	69878.7980	STA 182+40.27 P.T.
7548	73899.5089	69878.1746	CHANNEL / SECTIONLINE
7549	73792.9340	69877.8913	STA 185+81.37 P.C.

N

SCALE 1" = 400'

CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

SCALE: 1" = 400'
DESIGN:
DRAWN: T. COCHRAN
CHECKED: D. FITZGERALD
APPROVED: B. DALTON
DATE:

STATE OF NEVADA — BARTLETT C. DALTON — Exp. 12-31-04 — PROFESSIONAL ENGINEER — 10160 — 12 JAN 04

DEPT. OF PUBLIC WORKS — SURVEY DIVISION — CITY OF NORTH LAS VEGAS — NORTH LAS VEGAS, NEVADA

(DRAWING TITLE) SURVEY CONTROL PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

SHEET NO. SC3 OF SC4 SHEETS

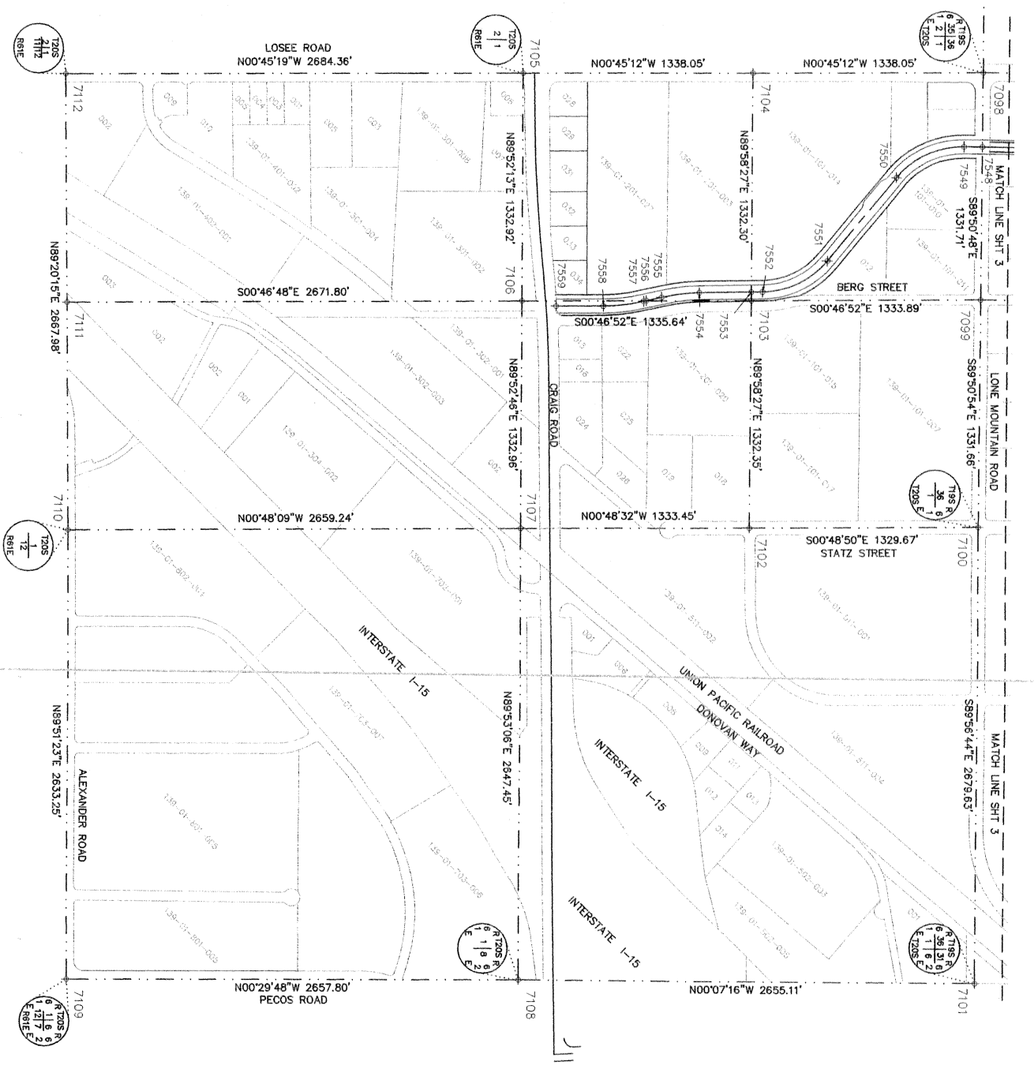
ISSUED FOR CONSTRUCTION

P.T.#	NORTHING	EASTING	DESCRIPTION
7098	73900.673	68443.707	FOUND TYPE I W/2" BRASS CAP NOT MARKED
7099	73887.109	70774.913	FOUND TYPE I W/2" BRASS CAP MARKED "PLS 8431"
7100	73880.934	73428.180	FOUND TYPE I W/2" BRASS CAP MARKED "PLS 7837"
7101	73880.934	74788.180	FOUND TYPE I W/2" BRASS CAP MARKED "PLS 7837"
7102	72563.944	73128.444	FOUND TYPE I W/2" BRASS CAP MARKED "PLS 8431"
7103	72562.739	69460.801	FOUND NAIL AND SHINER W/BRASS CAP WITH TIES
7104	72562.739	69460.801	FOUND NAIL AND SHINER W/BRASS CAP WITH TIES
7105	71224.864	69478.395	FOUND 4" CNLV ALUMINUM MONUMENT
7106	71227.592	70871.301	FOUND TYPE I W/2" BRASS CAP NOT MARKED
7107	71226.832	74791.788	FOUND 2" ALUMINUM CAP MARKED "PLS 8431"
7108	71226.832	74791.788	FOUND 2" ALUMINUM CAP MARKED "PLS 8431"
7109	68578.133	74814.828	FOUND 2 1/2" ALUMINUM CAP MARKED "CNLV PLS 9399"
7110	68567.534	72481.587	FOUND 6" CONCRETE CYLINDER W/NAIL AND TAG MARKED "RE/PLS 280"
7112	68840.680	69813.760	FOUND 4" CNLV ALUMINUM MONUMENT

SECTIONAL CONTROL

P.T.#	NORTHING	EASTING	DESCRIPTION
7548	73899.5089	69878.1748	CHANNEL / SECTIONLINE
7549	73792.8540	69877.8913	STA 185+81.37 P.C.
7550	73792.8540	70005.2860	STA 190+27.64 P.I.
7551	73402.9780	70005.2860	STA 194+27.64 P.I.
7552	72627.0670	70741.0003	STA 202+94.50 P.I.
7553	72563.3184	70741.6654	CHANNEL / SECTIONLINE
7554	72563.3184	70775.8004	STA 204+60.84 P.C.
7555	72041.5054	70775.8004	STA 204+60.84 P.C.
7556	71941.4704	70801.4172	CHANNEL / SECTIONLINE
7557	71917.8649	70802.3375	STA 207+90.50 P.C.
7558	71917.8649	70802.3375	STA 207+90.50 P.C.
7559	71427.3222	70838.0898	STA 212+48.63 P.I.
			STA 212+48.63 P.I.

CHANNEL CONTROL



SCALE 1" = 400'

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CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

SHEET NO. SC4 OF SC# SHEETS

(DRAWING TITLE) SURVEY CONTROL PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

CITY OF NORTH LAS VEGAS
"Your Hometown of Choice"
SURVEY DIVISION
DEPT. OF PUBLIC WORKS
50 EAST BROOKS AVENUE
NORTH LAS VEGAS, NEVADA

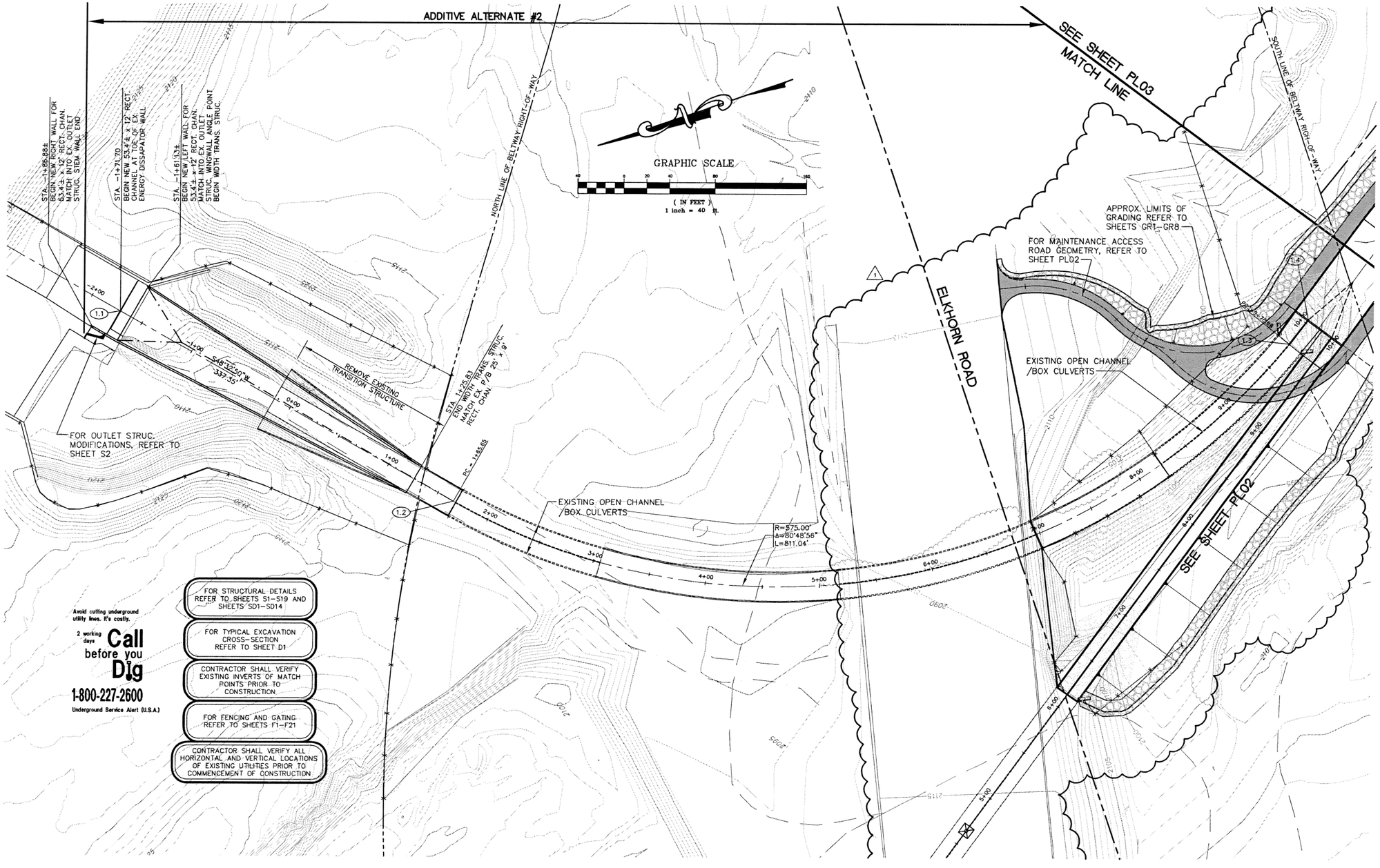
BARTLETT C DALTON
Exp: 12-31-04
No. 10160
STATE OF NEVADA
PROFESSIONAL LAND SURVEYOR
4 JAN 07

SCALE:	1" = 400'
DESIGN:	
DRAWN:	T. COCHRAN
CHECKED:	D. FITZGERALD
APPROVED:	B. DALTON
DATE:	

REVISIONS			
NO.	DESCRIPTION	DATE	BY
△			
△			
△			
△			

CENTERLINE / MAINTENANCE ROAD CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
(1.1)	90415.8871	64783.8472	BEGIN CONST.
(1.2)	90389.5288	64754.0052	P.C.
(1.3)	89651.5804	64648.4634	P.C.C.
(1.4)	89629.1976	64663.3388	P.T.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/24/2004

PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 6/30/06
No. 9117

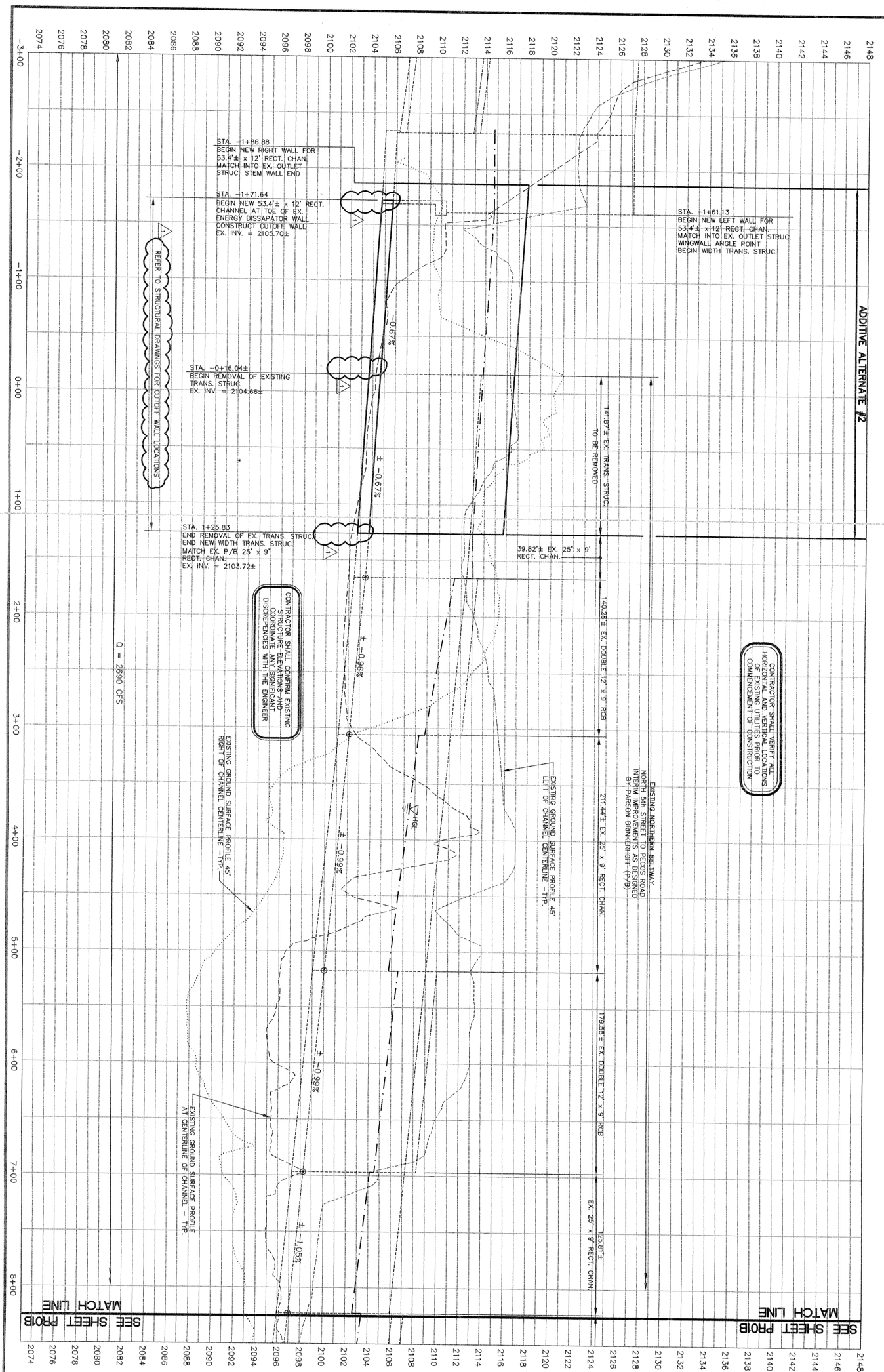
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - BASIN OUTFALL

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL01
SHT. X OF X



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PR01A
DRAWING NO.
SHT. 9 OF 12

(DRAWING TITLE)
BASIN OUTLET PROFILE - STA. -3+00 TO STA. 8+25

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

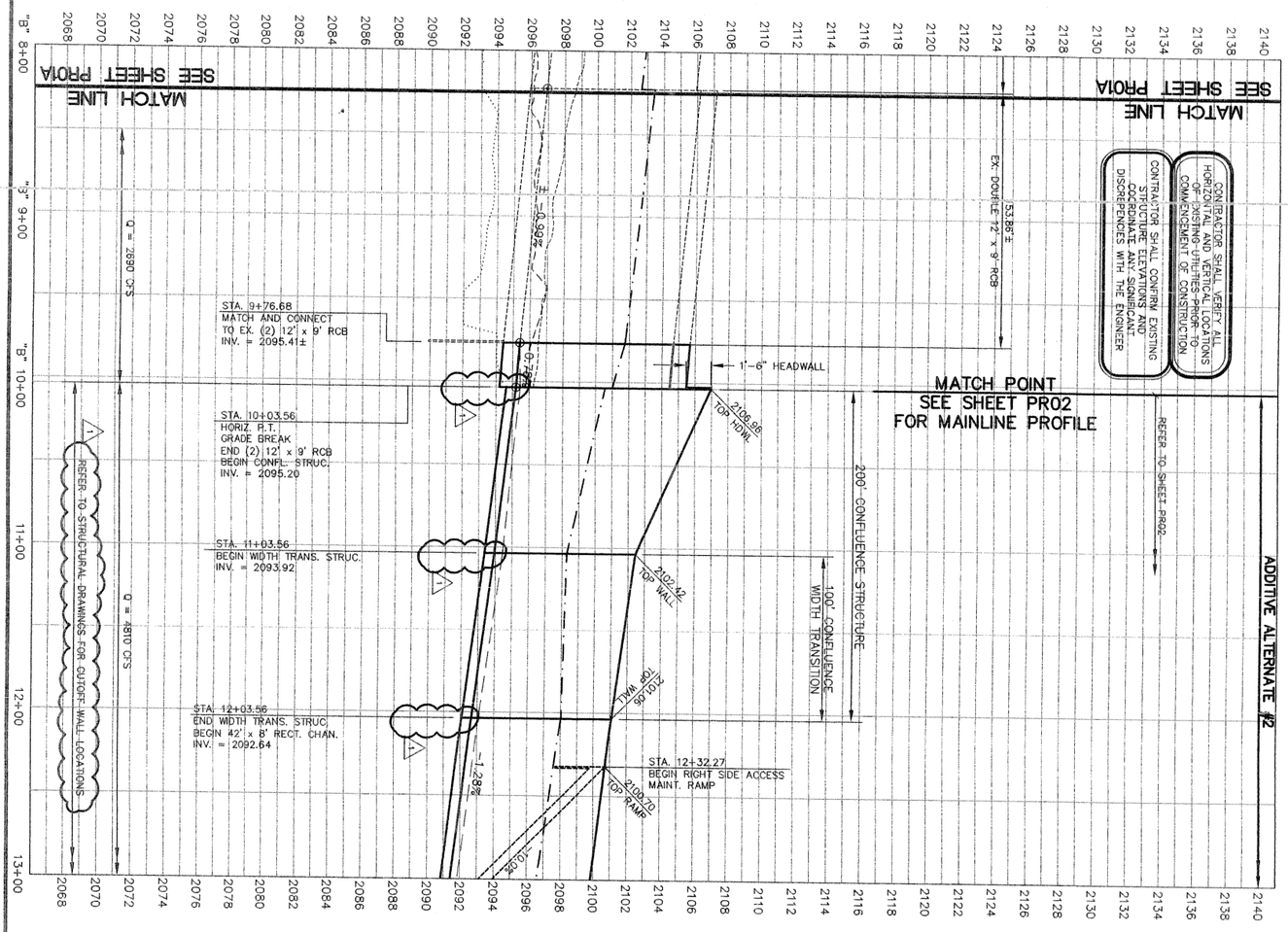
PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
NO. 9177
CIVIL
12/14

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	
APPROVED:	
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR01B

SHT 10 OF 128

(DRAWING TITLE)
BASIN OUTLET PROFILE - STA. 8+25 TO STA. 10+00

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			
△			

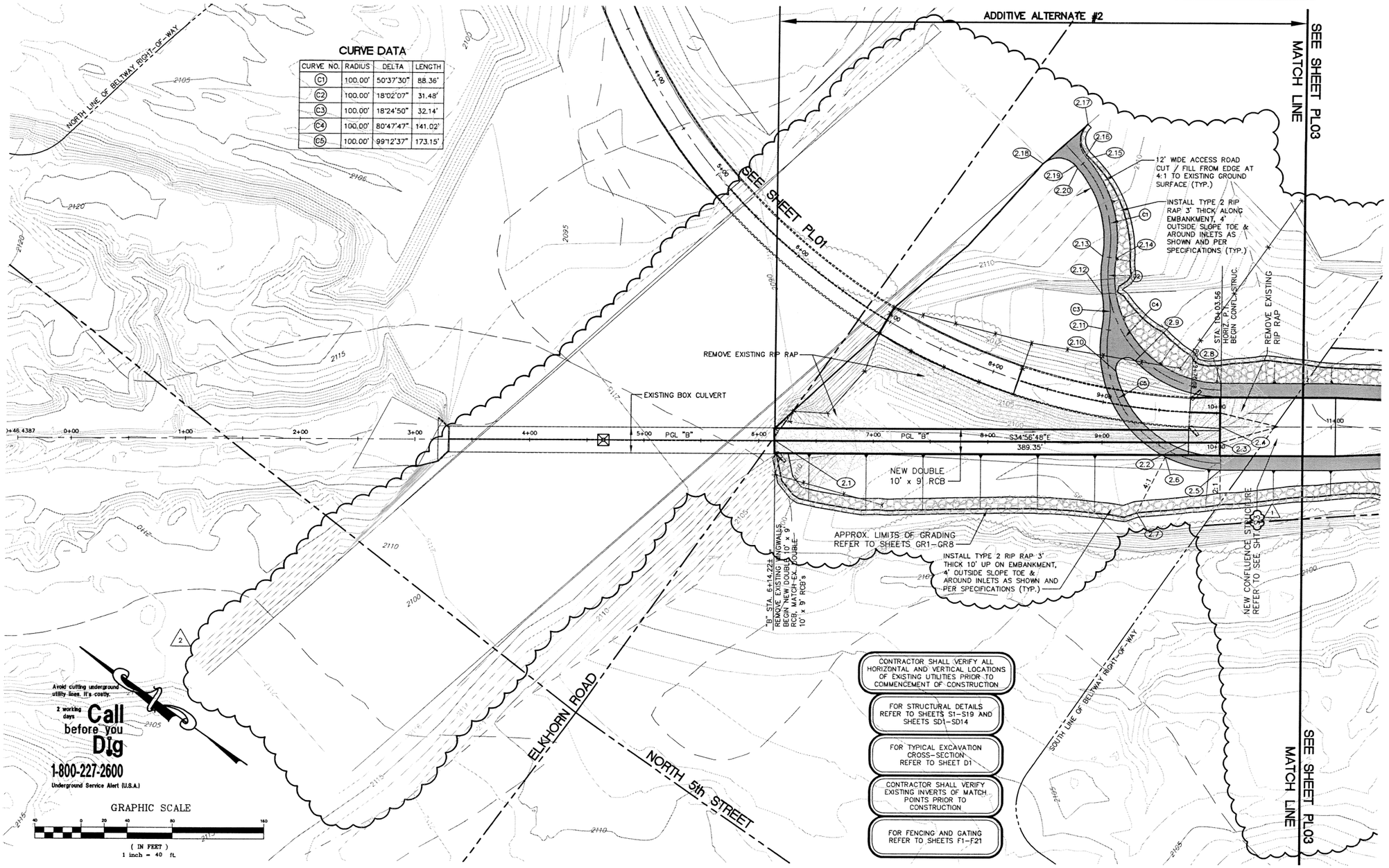
PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION	POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION	POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION	POINT NO.	NORTHING	EASTING	ELEVATION	DESCRIPTION
2.1	89933.5889	64419.2088	2098.84±	MATCH EX. INV.	2.6	89646.3379	64604.4813	2107.53	BEG. SLOPE TRANS.	2.11	89756.8894	64663.3764	2104.36	P.R.C.	2.16	89856.0989	64777.6584	2111.48	P.T.
2.2	89637.1279	64626.3827	2095.46	BEGIN TRANS.	2.7	89638.5136	64549.9937	(2093.77±)	SLOPE TOE	2.12	89774.1183	64688.0336	2102.49	P.R.C.	2.17	89870.9783	64801.7126	(2112.79±)	MATCH RDWY.
2.3	89614.4478	64642.2321	2095.20	END TRANS.	2.8	89644.2170	64684.8167	2107.20	P.T.	2.13	89793.2403	64715.2086	2104.99	P.R.C.	2.18	898882.9055	64751.0989	(2113.00±)	MATCH RDWY.
2.4	89622.4433	64653.6734	2095.20	BEGIN CONFL.	2.9	89716.6025	64657.5012	2105.69	P.C.C.	2.14	89782.4654	64720.4907	2104.75	P.R.C.	2.19	89858.8513	64765.9783	2111.42	P.T.
2.5	89600.6862	64622.5185	2107.20	P.T.	2.10	89725.1311	64640.3042	2106.60	P.C.C.	2.15	89853.3311	64777.0062	2111.28	P.C.	2.20	89856.0835	64765.3261	2111.21	P.C.

CURVE DATA

CURVE NO.	RADIUS	DELTA	LENGTH
C1	100.00'	50°37'30"	88.36'
C2	100.00'	18°02'07"	31.48'
C3	100.00'	18°24'50"	32.14'
C4	100.00'	80°47'47"	141.02'
C5	100.00'	99°12'37"	173.15'



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS		
NO.	DESCRIPTION	DATE: BY
1	REVISED PER ADDENDUM #2	2/16/2004 VTN
2	REVISED PER CHANGE ORDER NO. 1	6/09/2004 VTN
3		
4		
5		

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/24/2004
PROJECT NO:
FILE NAME:

KEN D. GILBRETH, P.E. No. 9717, CIVIL, STATE OF NEVADA, PROFESSIONAL ENGINEER

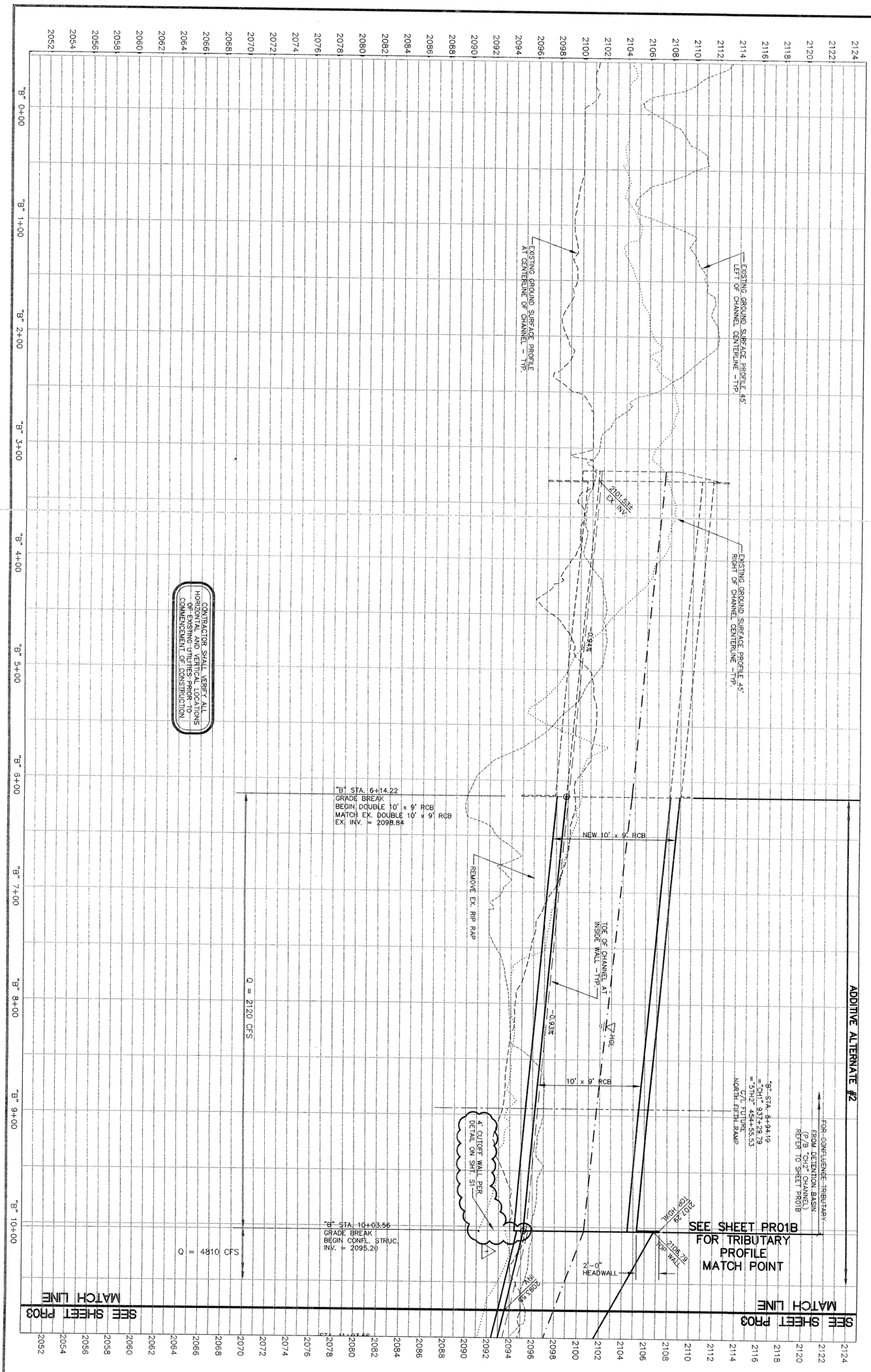
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

[DRAWING TITLE] PLAN VIEW - STA. -0+50 TO STA. 10+75

[PROJECT TITLE] UPPER LAS VEGAS WASH CHANNEL

[LOCATION] NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL02
SHT. X OF X



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR02

SHT. 12 OF 128

(DRAWING TITLE) PROFILE - STA. 0+00 TO STA. 10+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
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LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

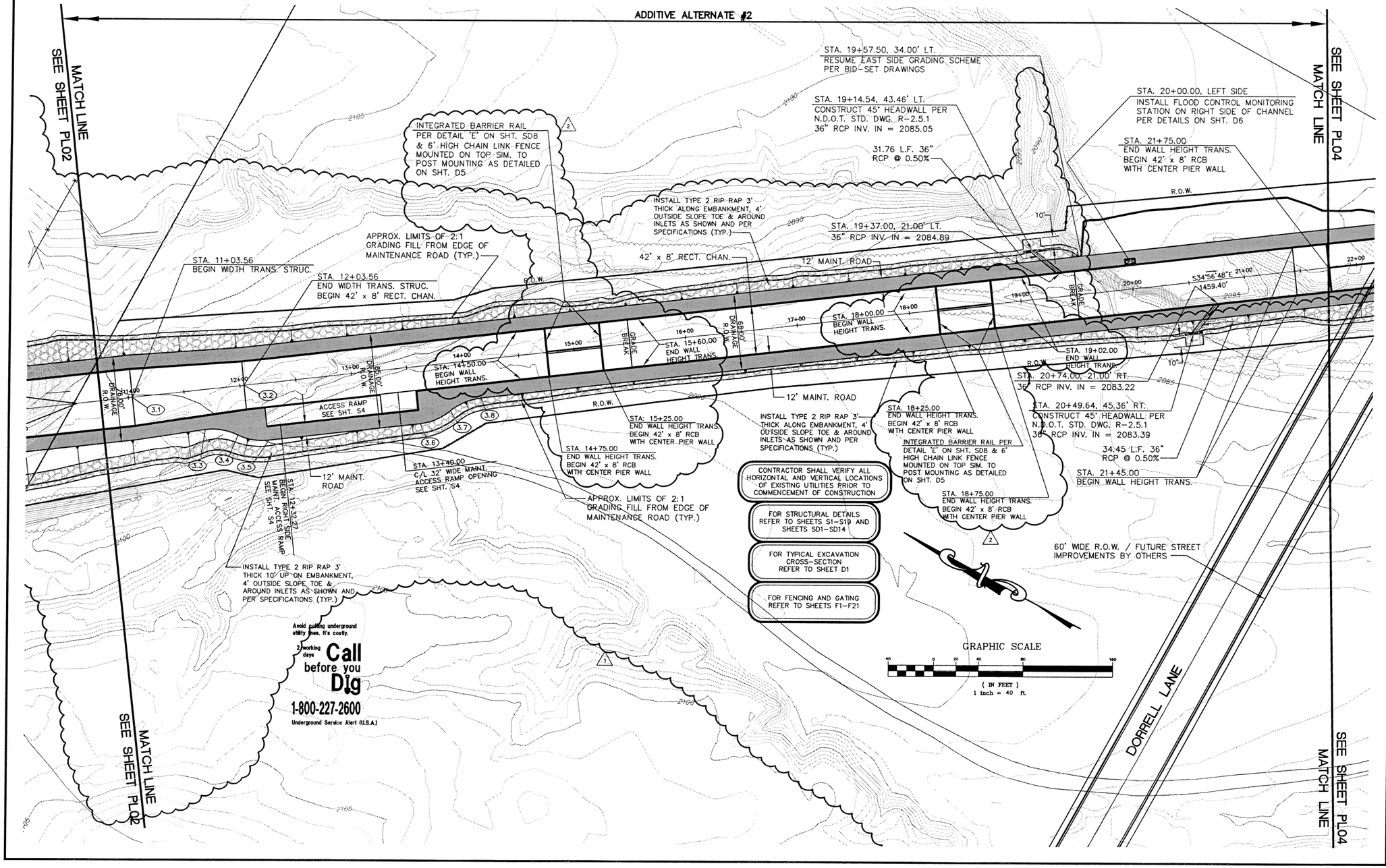
REVISIONS

NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			
△			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
(3.1)	89540.4748	64710.9549	BEG. WIDTH TRANS.	(3.5)	89415.1543	64736.3127	RD. EDGE P.T.
(3.2)	89458.5063	64768.2364	END WIDTH TRANS.	(3.6)	89303.5215	64814.3244	RD. EDGE P.C.
(3.3)	89469.4830	64717.2081	RD. EDGE P.C.	(3.7)	89285.5309	64837.2665	RD. EDGE P.R.C.
(3.4)	89441.5111	64727.3492	RD. EDGE P.R.C.	(3.8)	89267.5403	64860.2086	RD. EDGE P.T.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE:	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
2	REVISED PER FOOLS CHANGE ORDER	3/11/2005	VTN
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/04/2004
PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/06 No. 9177

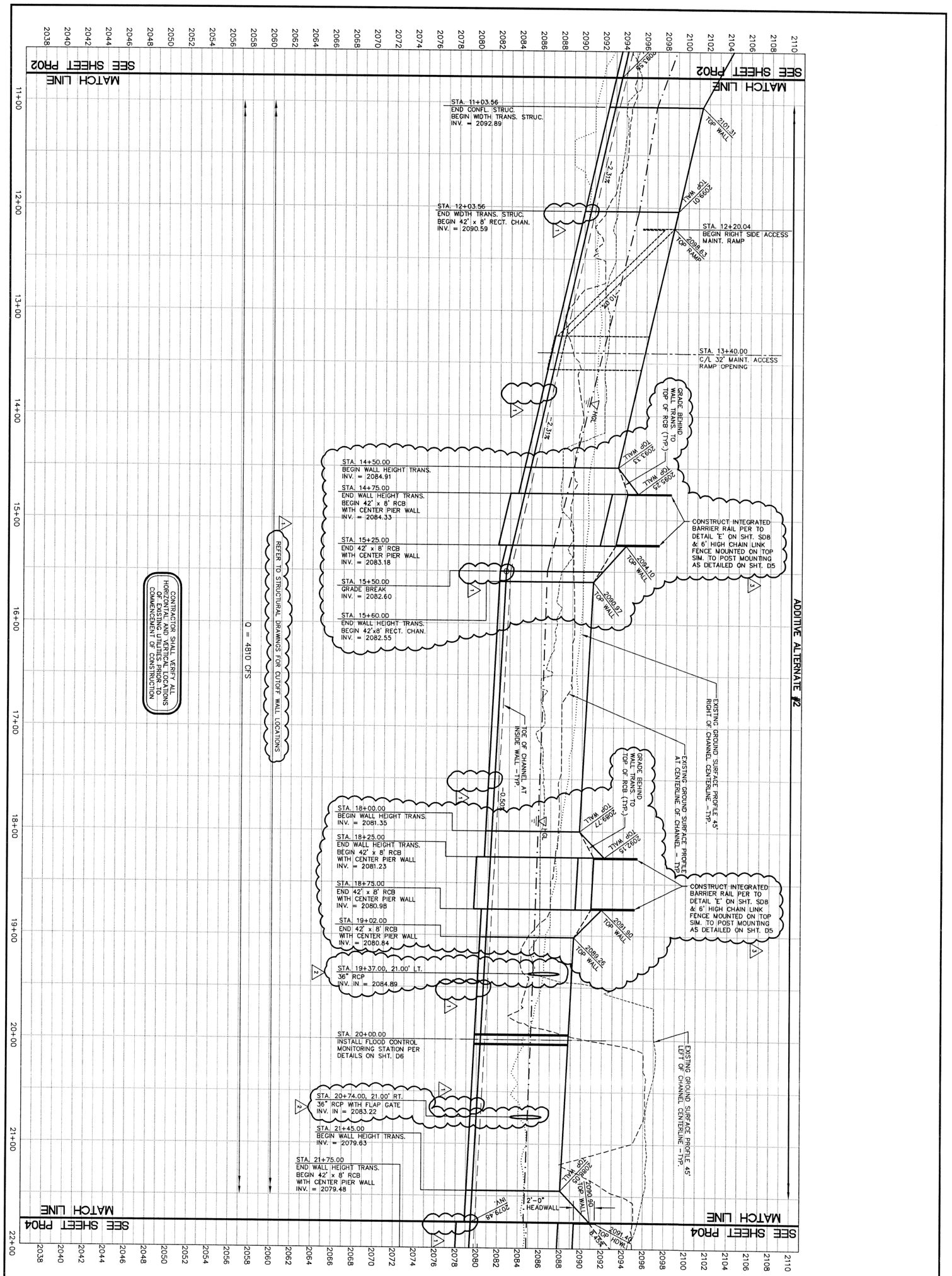
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2566
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 10+75 TO STA. 21+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL03
SHT. X OF X



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR03 SHT. X OF X

(DRAWING TITLE) **PROFILE - STA. 10+75 TO STA. 21+75**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
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LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177

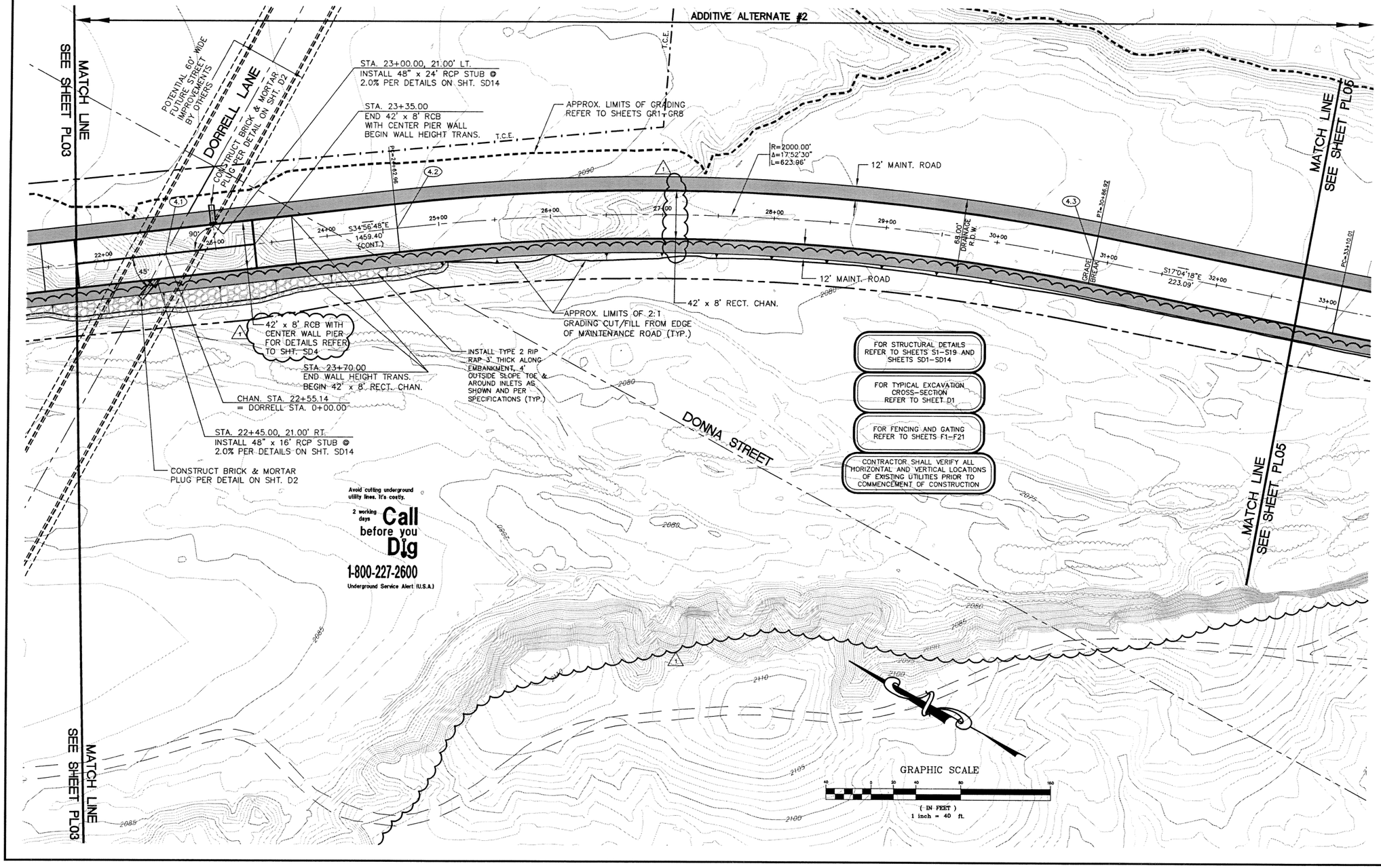
SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/07/2005

REVISIONS			
NO.	DESCRIPTION	DATE	BY
4	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
3	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
2	REVISED PER FOCUS CHANGE ORDER	1/10/2005	VTN
1			
0			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
(4.1)	88596.5399	65370.5987	C/L – C/L
(4.2)	88426.1958	65489.6392	P.C.
(4.3)	87867.7010	65762.1463	P.T.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/11/2004
PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBREATH CIVIL No. 9177

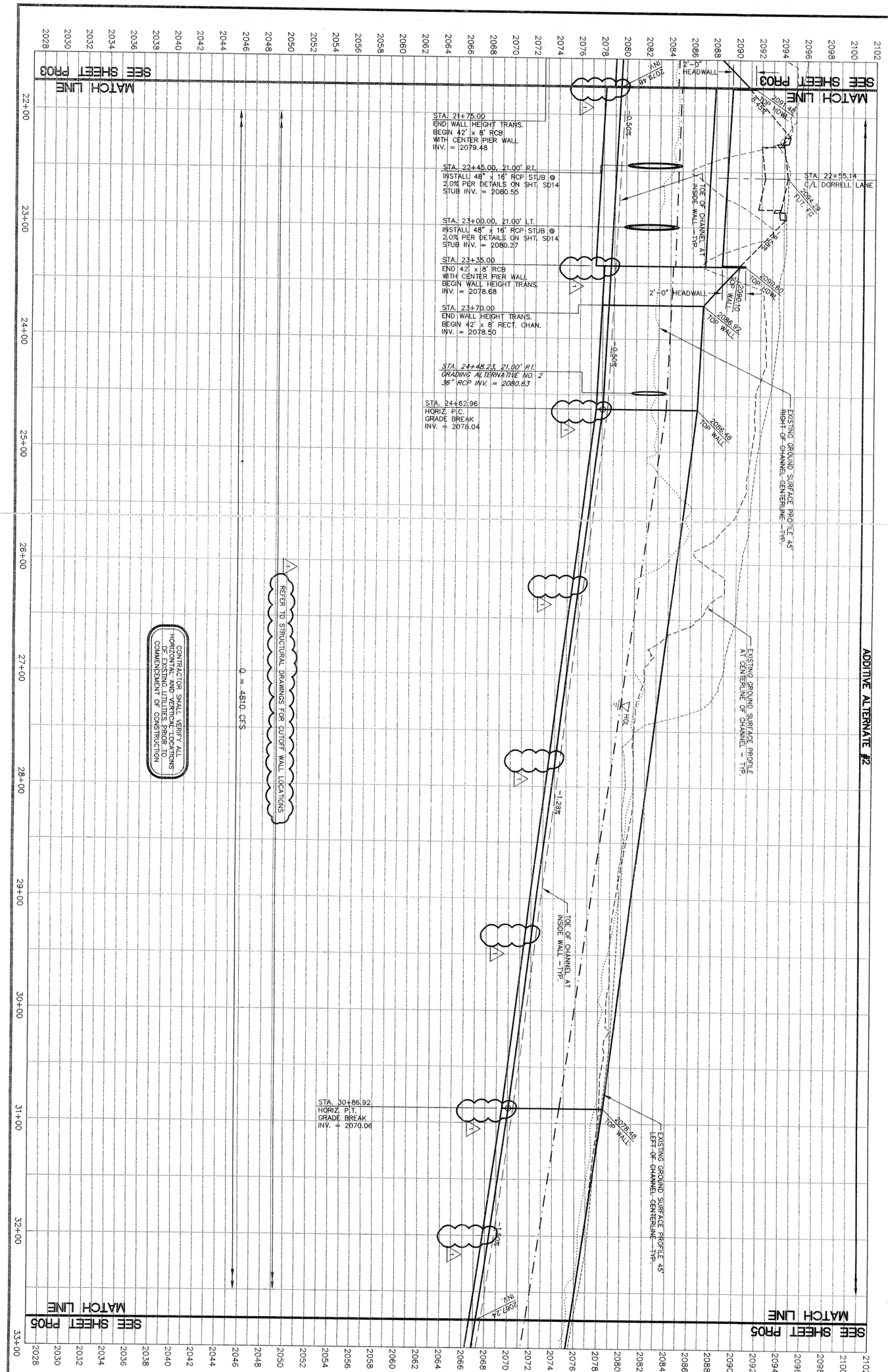
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 21+75 TO STA. 32+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

DRAWING NO.
PL04
SHT. X OF X



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PR04 — DRAWING NO. — SHT. 16 OF 123

(DRAWING TITLE) **PROFILE - STA. 21+75 TO STA. 32+75**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

VTN nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER STATE OF NEVADA — KEN D. GILBRETH — EXP. 06/30/06 — CIVIL — No. 9177 — 1/21/04

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

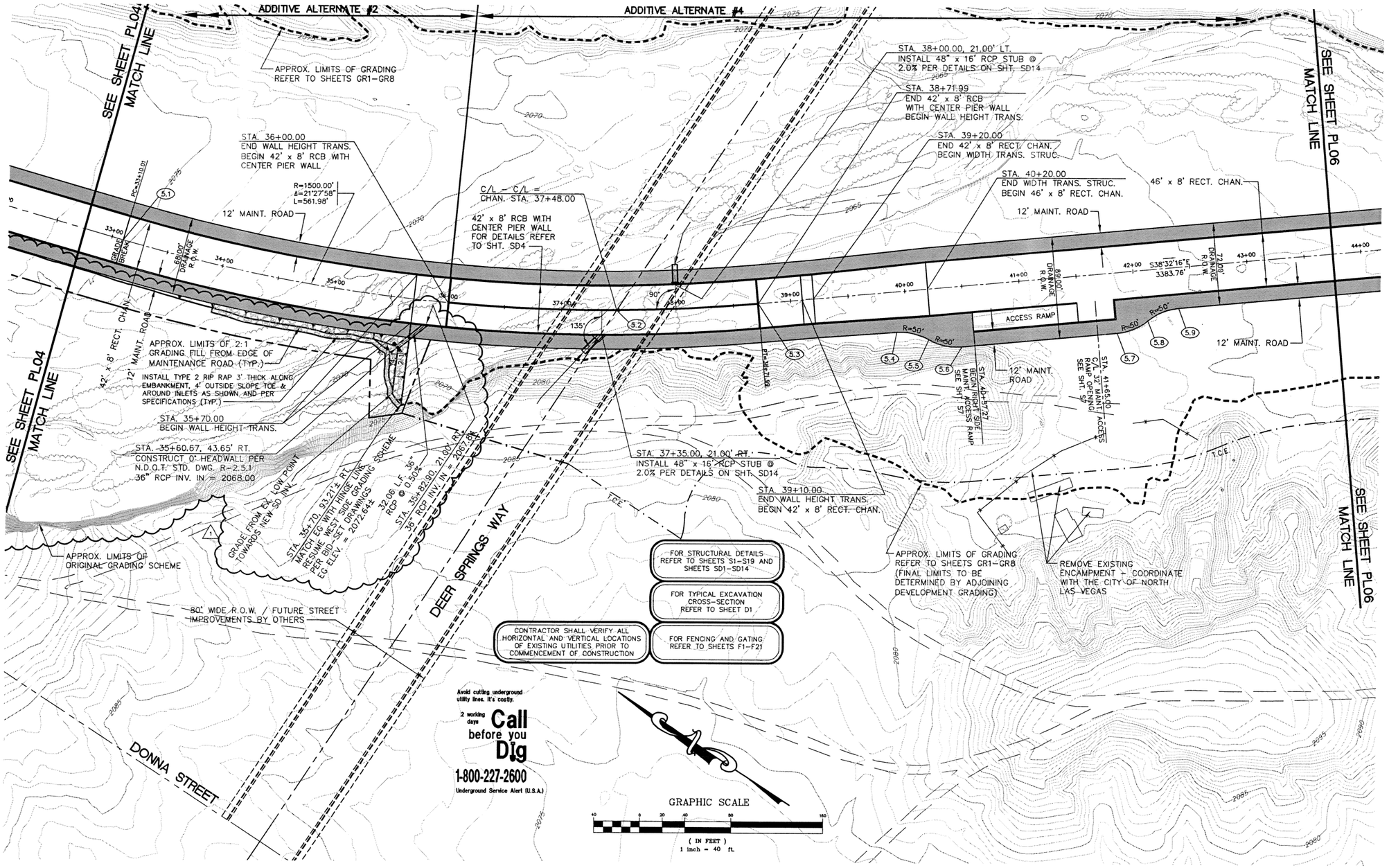
REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
(5.1)	87654.4384	65827.6390	P.C.	(5.4)	87045.7598	66134.1739	RD. EDGE P.C.	(5.7)	86884.7370	66239.9373	RD. EDGE P.C.
(5.2)	87260.3128	66015.0922	C/L – C/L	(5.5)	87018.9023	66144.3259	RD. EDGE P.R.C.	(5.8)	86868.2187	66263.9611	RD. EDGE P.R.C.
(5.3)	87160.2438	66088.2502	P.T.	(5.6)	86991.2566	66155.0930	RD. EDGE P.T.	(5.9)	86851.7004	66287.9850	RD. EDGE P.T.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/04/2004
PROJECT NO:
FILE NAME:

NEVADA STATE OF NEVADA KEN D. SMITH 9177 CIVIL PROFESSIONAL ENGINEER

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2725 SOUTH JONES BOULEVARD
SUITE 300 LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 361-2597

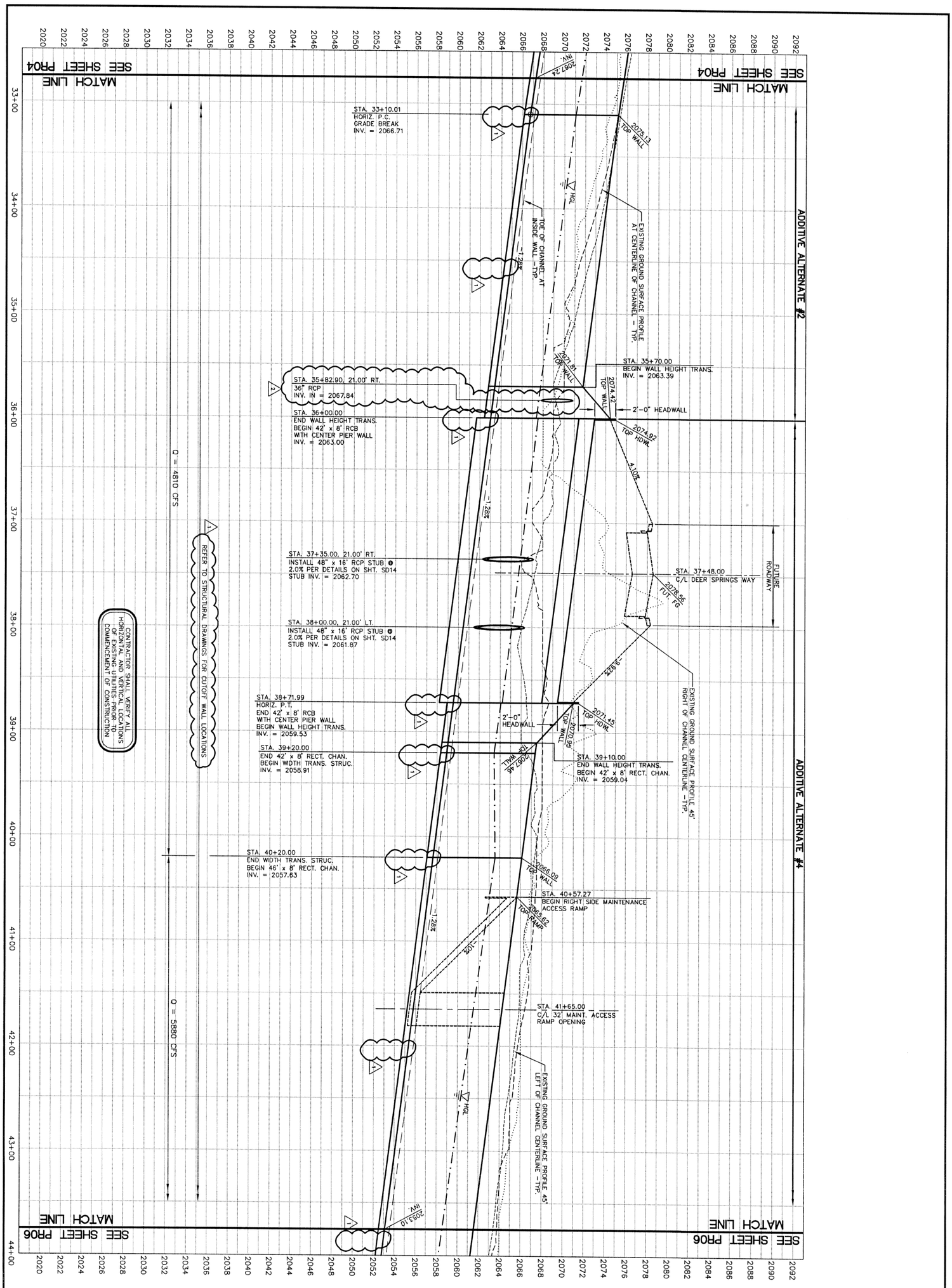
(DRAWING TITLE) PLAN VIEW - STA. 32+75 TO STA. 43+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. PL05

SHT. X OF X



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

SHT. X OF X

PR05

DRAWING NO.

(DRAWING TITLE)

PROFILE - STA. 32+75 TO STA. 43+75

(PROJECT TITLE)

UPPER LAS VEGAS WASH CHANNEL

(LOCATION)

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

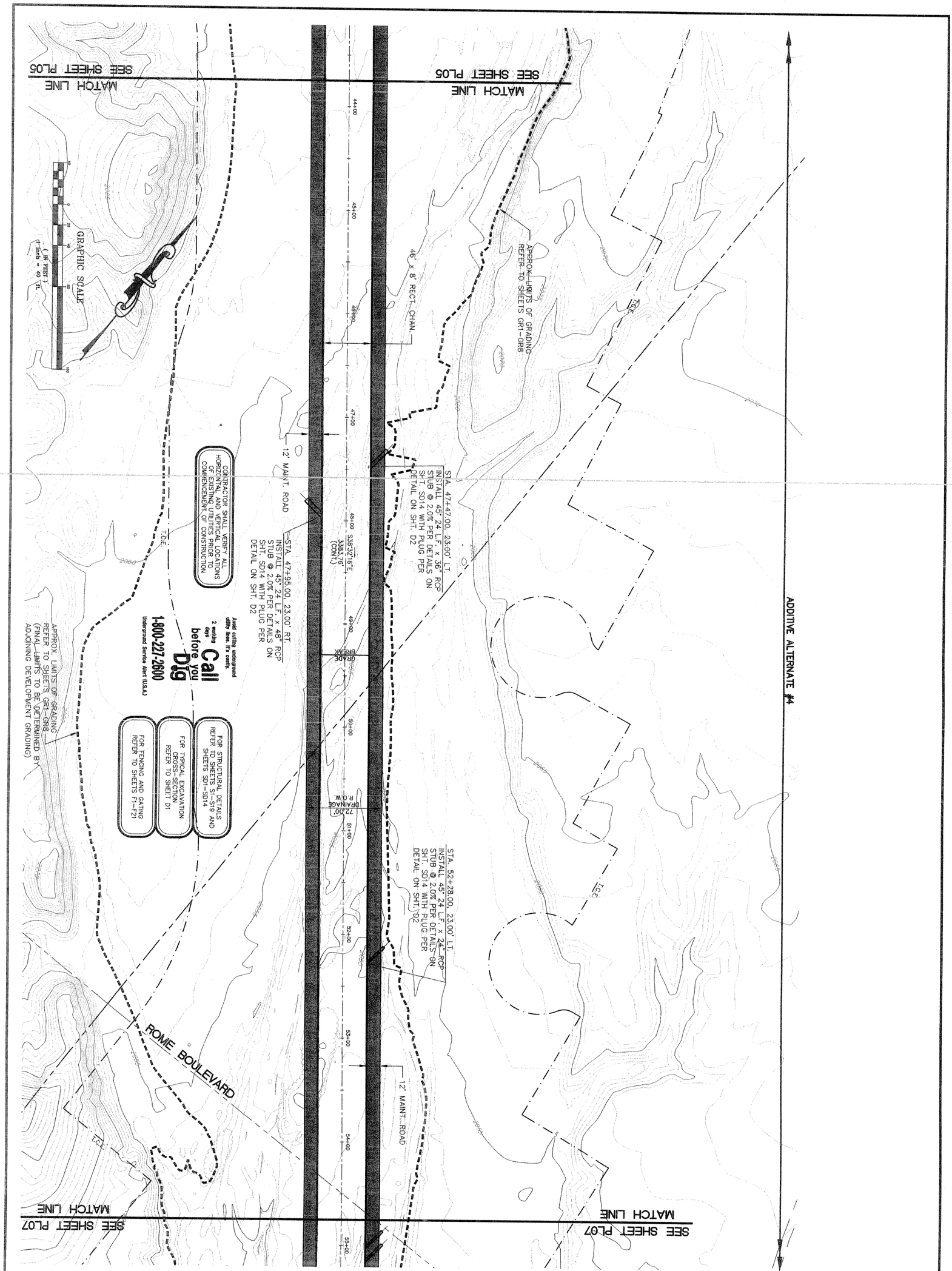
VTN nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
NO. 9177

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/04/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	VIN
2	REVISED PER CHANGE ORDER NO. 1	5/09/2004	VIN
3			
4			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PL06 SHT. 19 OF 28

(DRAWING TITLE) **PLAN VIEW - STA. 43+75 TO STA. 54+75**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
CIVIL
NO. 9177

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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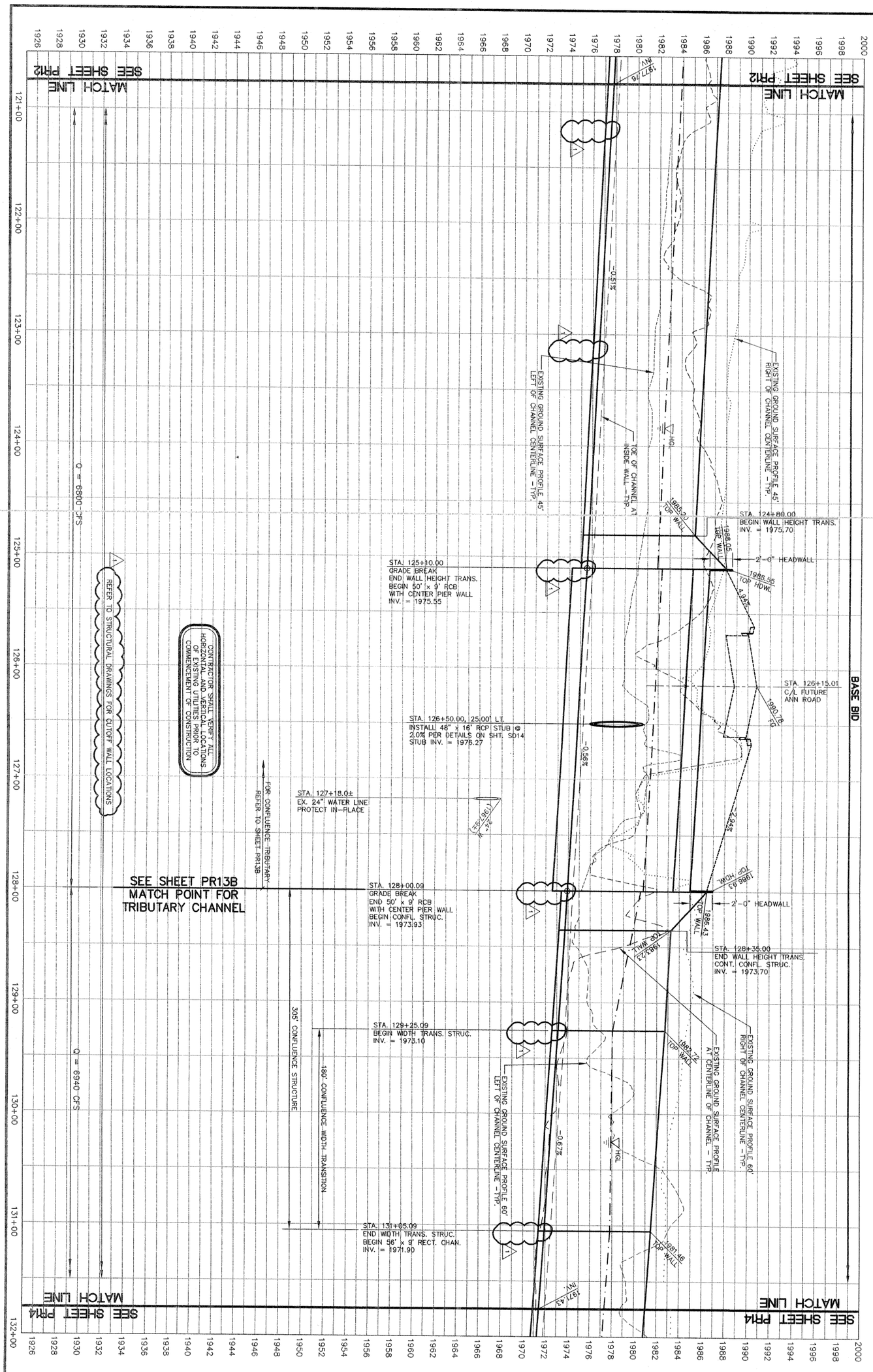
△			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR13A

SHT. 36 OF 128

(DRAWING TITLE) **PROFILE - STA. 120+75 TO STA. 131+75**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
• CONSULTING ENGINEERS
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• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			
△			

PROJECT NO: FILE NAME:

BASE BID

REFER TO SHEET PR13A

MATCH POINT
SEE SHEET PR13A
FOR MAINLINE PROFILE

FUTURE FINISHED GROUND SURFACE PROFILE 45' RIGHT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL – TYP.

EXISTING GROUND SURFACE PROFILE 45' LEFT OF CHANNEL CENTERLINE – TYP.

FINISHED GROUND SURFACE PROFILE AT CHANNEL CENTERLINE – TYP.

MAINT. ROAD

EXISTING GROUND SURFACE PROFILE 60' RIGHT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE 45' LEFT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL – TYP.

1988.43 TOP WALL

STA. 128+35.00
END WALL HEIGHT TRANS.
BEGIN 50' x 9' RECT. CHAN.
INV. = 1973.70

1983.23 TOP WALL

1982.72 TOP WALL

1981.46 TOP WALL

1986.27 TOP RAMP

STA. 132+07.57
BEGIN RIGHT SIDE MAINTENANCE ACCESS RAMP

STA. 133+20.00
C/L 32' MAINTENANCE ACCESS RAMP OPENING

HGL

HGL

HGL

40' HEADWALL

-0.59%

-0.67%

24" W (1970.4±)

"A" STA. 124+79.65
BEGIN 10' x 7' RCB
CONSTRUCT BRICK & MORTAR PLUG PER DETAIL ON SHT. D2
INV. = 1975.82

"A" STA. 125+29.65
HORIZ. P.I.
INV. = 1975.53

"A" STA. 127+13.6±
EX. 24" WATER LINE
PROTECT IN-PLACE
(ELEVATION AS SHOWN IS INTERPOLATED FROM POTHOLE DATA)

"A" STA. 128+00.09
GRADE BREAK
END 10' x 7' RCB
BEGIN CONFL. STRUC.
INV. = 1973.93

STA. 128+26.09
BEGIN WIDTH TRANS. STRUC.
INV. = 1973.10

STA. 131+05.09
END WIDTH TRANS. STRUC.
BEGIN 50' x 9' RECT. CHAN.
INV. = 1971.90

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION.

150' CONFLUENCE WIDTH TRANSITION

305' CONFLUENCE STRUCTURE

Q = 140 CFS
(LATERAL PEAK Q = 710 CFS)

Q = 6940 CFS

1 REFER TO STRUCTURAL DRAWINGS FOR CUTOFF WALL LOCATIONS

"A" 122+00 "A" 123+00 "A" 124+00 "A" 125+00 "A" 126+00 "A" 127+00 "A" 128+00 "A" 129+00 "A" 130+00 "A" 131+00 "A" 132+00 "A" 133+00

2010 2008 2006 2004 2002 2000 1998 1996 1994 1992 1990 1988 1986 1984 1982 1980 1978 1976 1974 1972 1970 1968 1966 1964 1962 1960 1958 1956 1954 1952 1950 1948 1946 1944 1942 1940 1938

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
2	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KOG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. KOESTER No. 9171 CIVIL

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2697

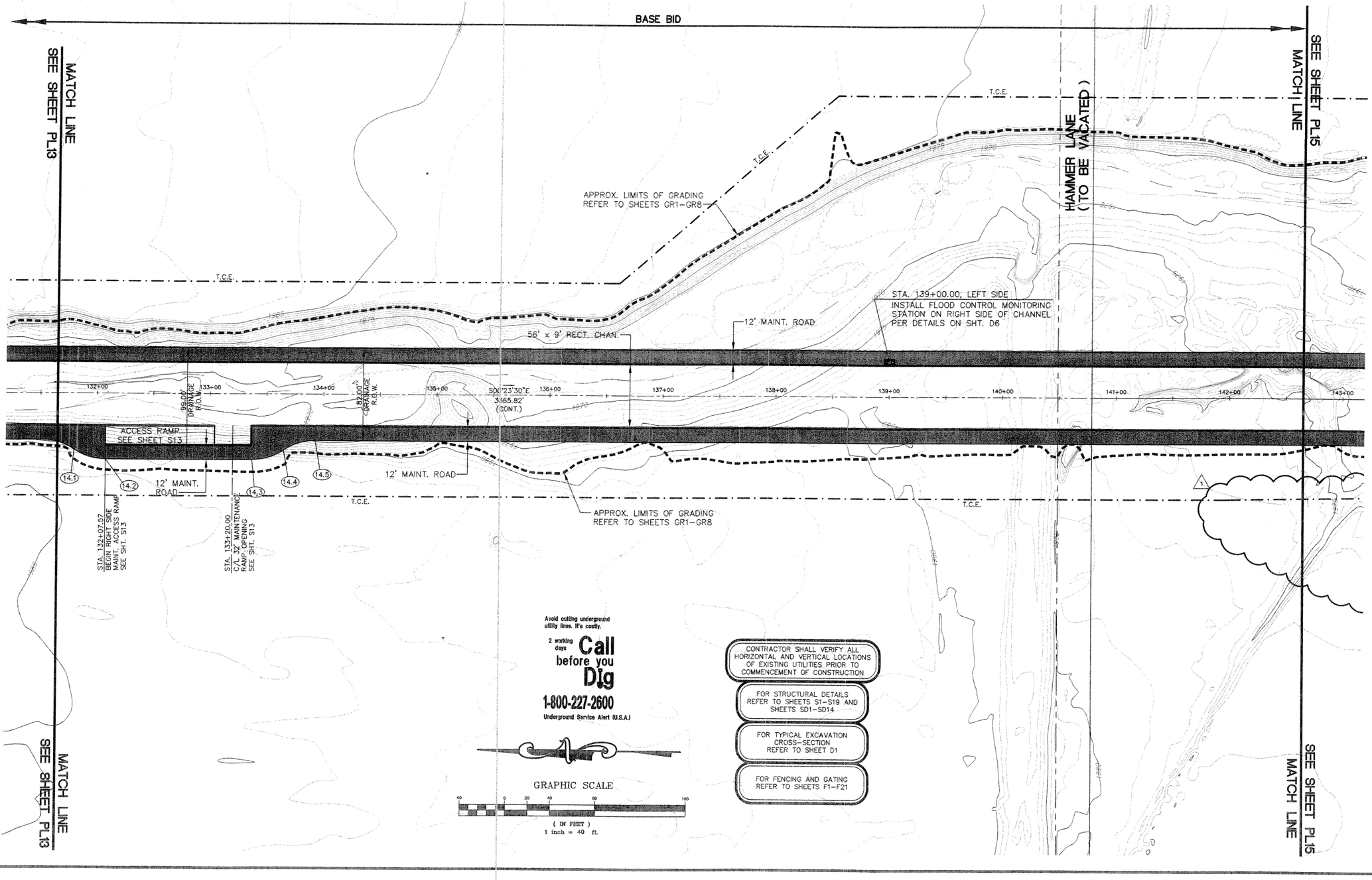
(DRAWING TITLE) ANN ROAD CONFLUENCE TRIBUTARY PROFILE
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR13B
SHT. 37 OF 128

ISSUED FOR CONSTRUCTION

CENTERLINE / MAINTENANCE ROAD CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
14.1	78742.1449	68703.1186	RD. EDGE P.R.C.
14.2	78714.1992	68694.8095	RD. EDGE P.T.
14.3	78584.7822	68695.6945	RD. EDGE P.T.
14.4	78556.9528	68704.3850	RD. EDGE P.R.C.
14.5	78529.1234	68713.0755	RD. EDGE P.T.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 3	3/14/2004	VTN

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

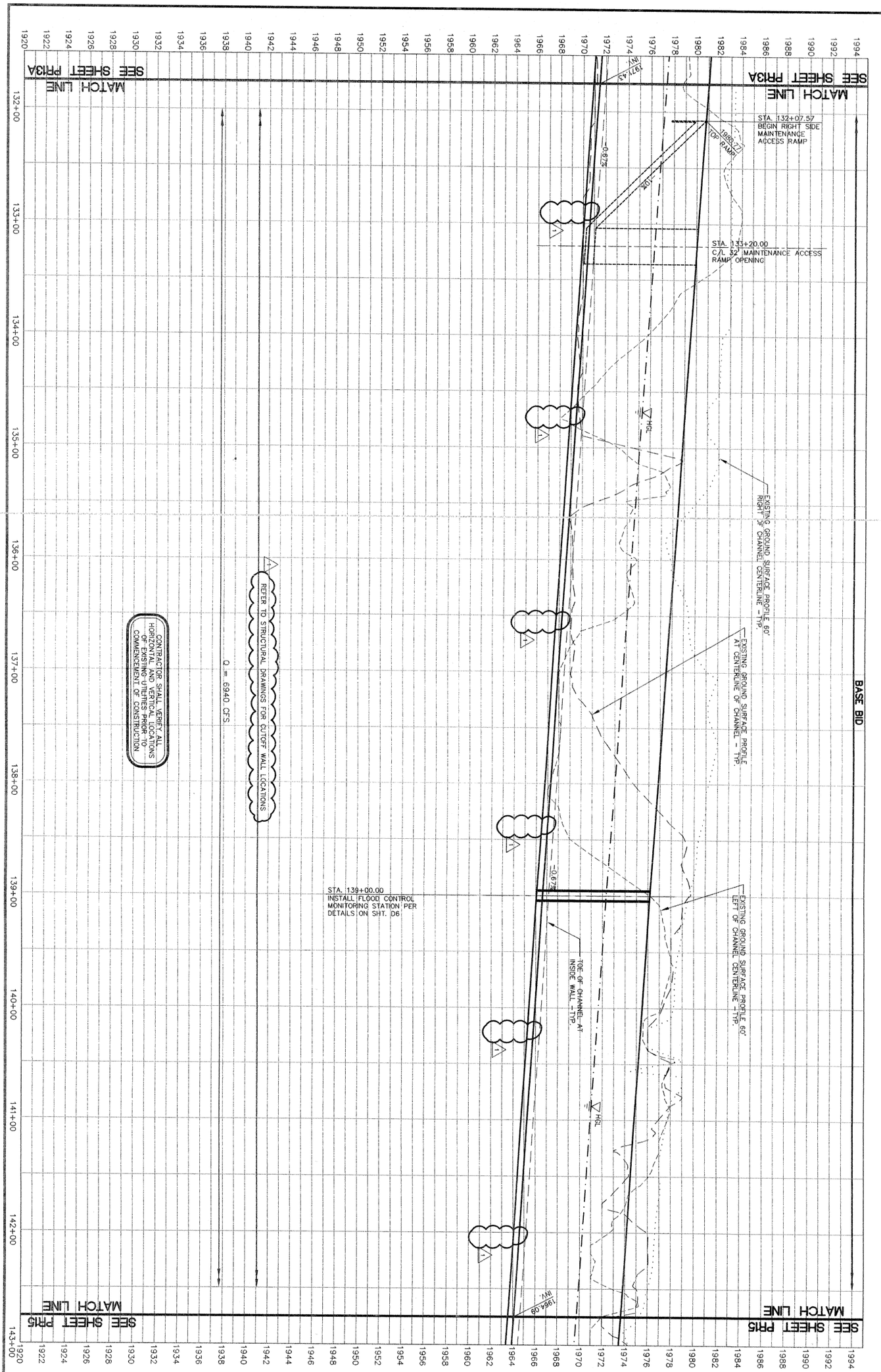
vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 131+75 TO STA. 142+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL14
SHT. 38 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PR14
SHT. 39 OF 48
DRAWING NO.

(DRAWING TITLE)
PROFILE - STA. 131+75 TO STA. 142+75

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

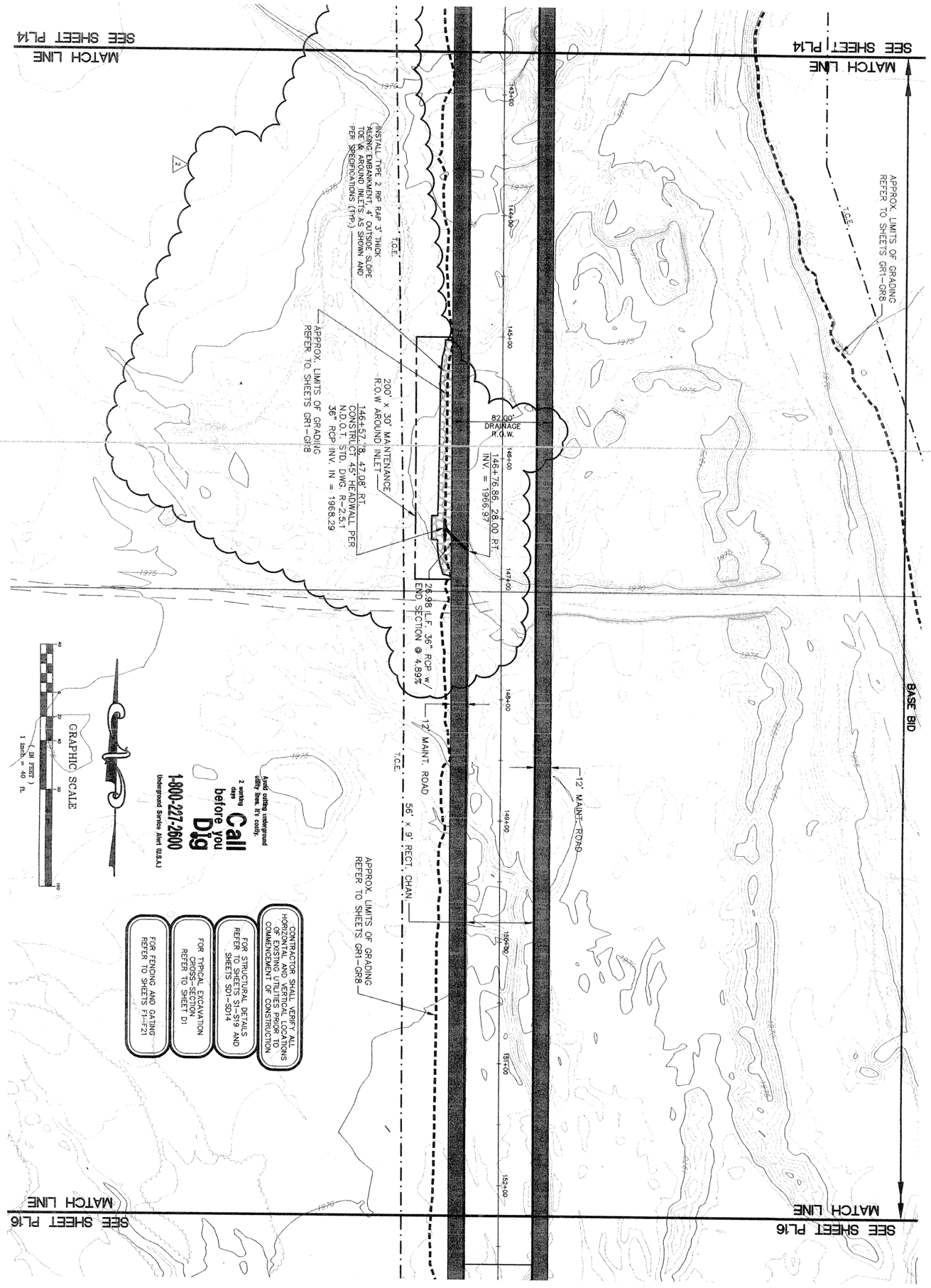
PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
No. 9177
CIVIL

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
2			
3			
4			
5			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PL15

SHT. 40 OF 128

(DRAWING TITLE) PLAN VIEW - STA. 142+75 TO STA. 152+25

(PROJECT TITLE) ~~UPPER LAS VEGAS WASH CHANNEL~~

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
3/11/04

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	2/12/2004	VTN
2	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			
△			

PROJECT NO: FILE NAME:

BASE BID

MATCH LINE SEE SHEET PR14

SEE SHEET PR16 MATCH LINE

EXISTING GROUND SURFACE PROFILE 60' LEFT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE 60' RIGHT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL – TYP.

1970.48 TOP WALL

HGL

1964.08 INV.

-0.67%

TOE OF CHANNEL AT INSIDE WALL – TYP.

HGL

-1.14%

1955.52 INV.

STA. 146+76.86
INSTALL 36" x 26.98 LF RCP @ 4.82%
18" INV. IN = 1966.97

STA. 147+50.00
GRADE BREAK
INV. = 1960.92

REFER TO STRUCTURAL DRAWINGS FOR CUTOFF WALL LOCATIONS

Q = 6940 CFS

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

MATCH LINE SEE SHEET PR14

SEE SHEET PR16 MATCH LINE

1994 1992 1990 1988 1986 1984 1982 1980 1978 1976 1974 1972 1970 1968 1966 1964 1962 1960 1958 1956 1954 1952 1950 1948 1946 1944 1942 1940 1938 1936 1934 1932 1930 1928 1926 1924 1922 1920

143+00 144+00 145+00 146+00 147+00 148+00 149+00 150+00 151+00 152+00

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	2/12/2004	VTN
2	REVISED PER ADDENDUM NO. 2	2/23/2004	VTN
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
4			
5			

REVISIONS

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROJECT NO:
FILE NAME:

STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/05 No. 9177 CIVIL

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2566
FAX (702) 362-2597

PROFILE - STA. 142+75 TO STA. 152+25

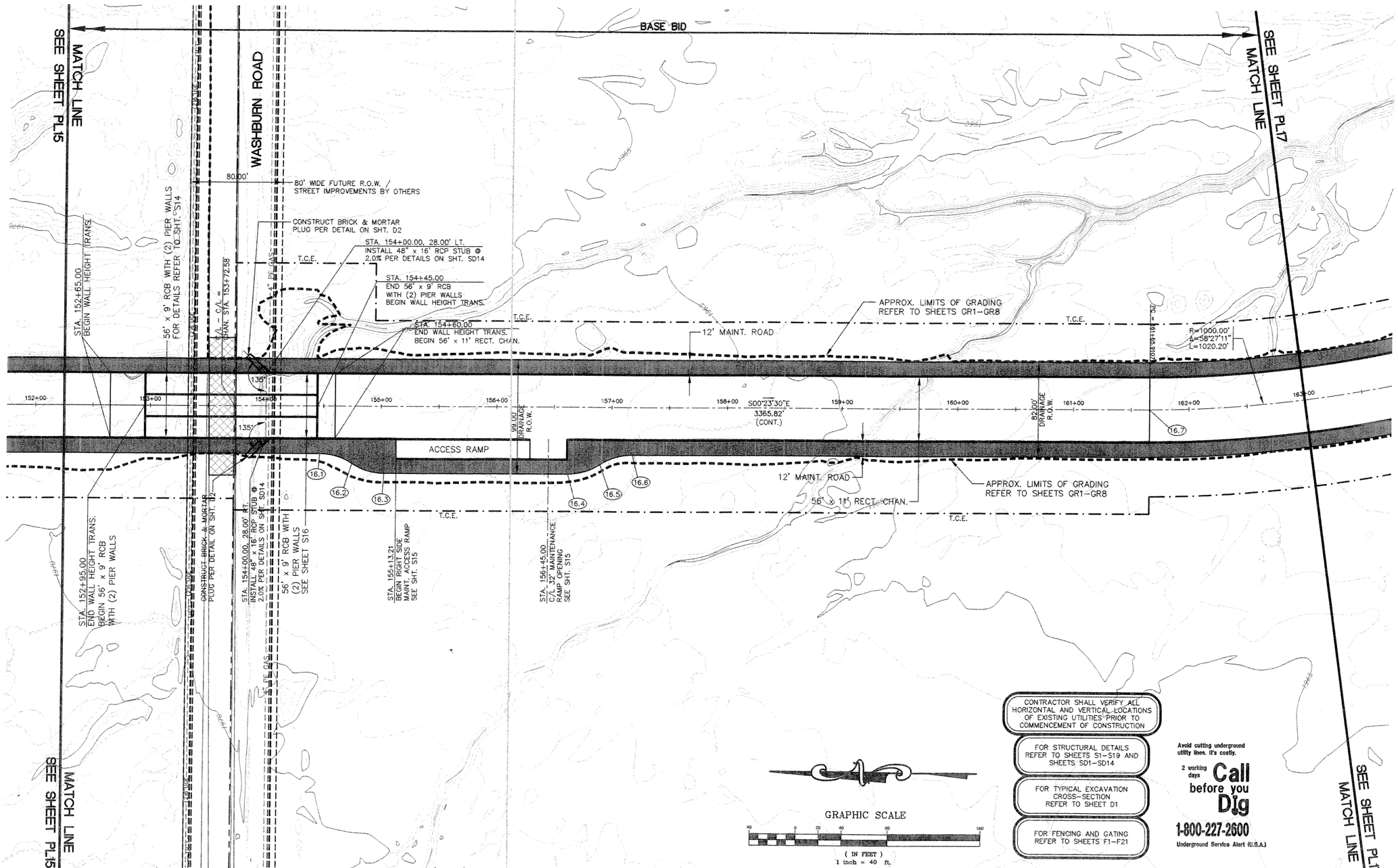
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR15

SHT. 41 OF 128

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
16.1	76475.0441	68727.1217	RD. EDGE P.C.	16.5	76232.0072	68720.2834	RD. EDGE P.R.C.
16.2	76447.0985	68718.8126	RD. EDGE P.R.C.	16.6	76204.1778	68728.9739	RD. EDGE P.T.
16.3	76419.1528	68710.5035	RD. EDGE P.T.	16.7	75756.3342	68773.0373	P.C.
16.4	76259.8366	68711.5929	RD. EDGE P.C.				



GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1

FOR FENCING AND GATING REFER TO SHEETS F1-F21

Avoid cutting underground utility lines. it's costly.
2 working days **Call before you Dig**
1-800-227-2600
Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/17/2004	VTN

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA
WENDY D. GILBRETH
No. 9177
CIVIL

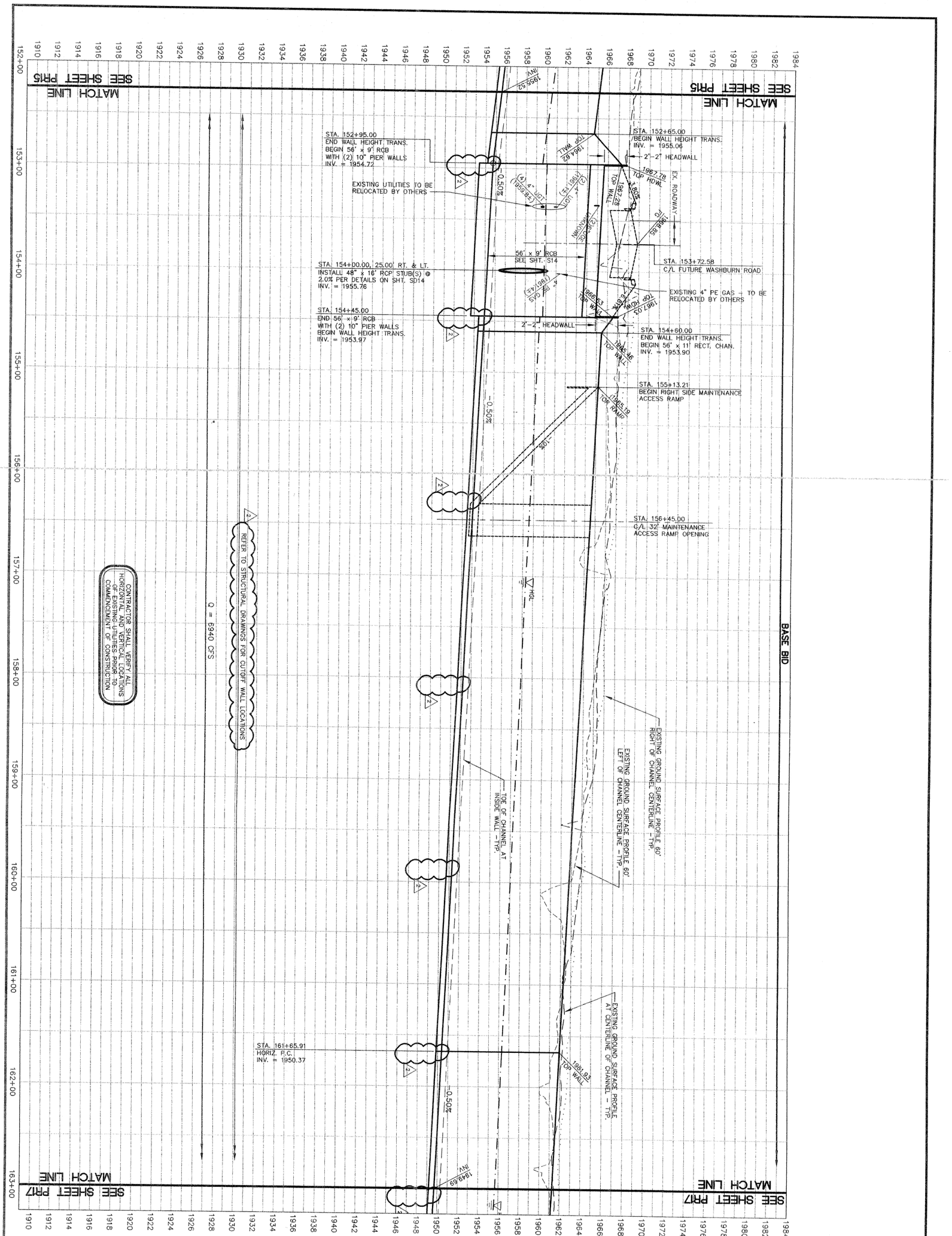
vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 153+75 TO STA. 164+75 (1)

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL16
SHT. 42 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR16 SHT. 43 OF 128

(DRAWING TITLE) **PROFILE - STA. 153+75 TO STA. 164+75** (1)

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

VTN nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

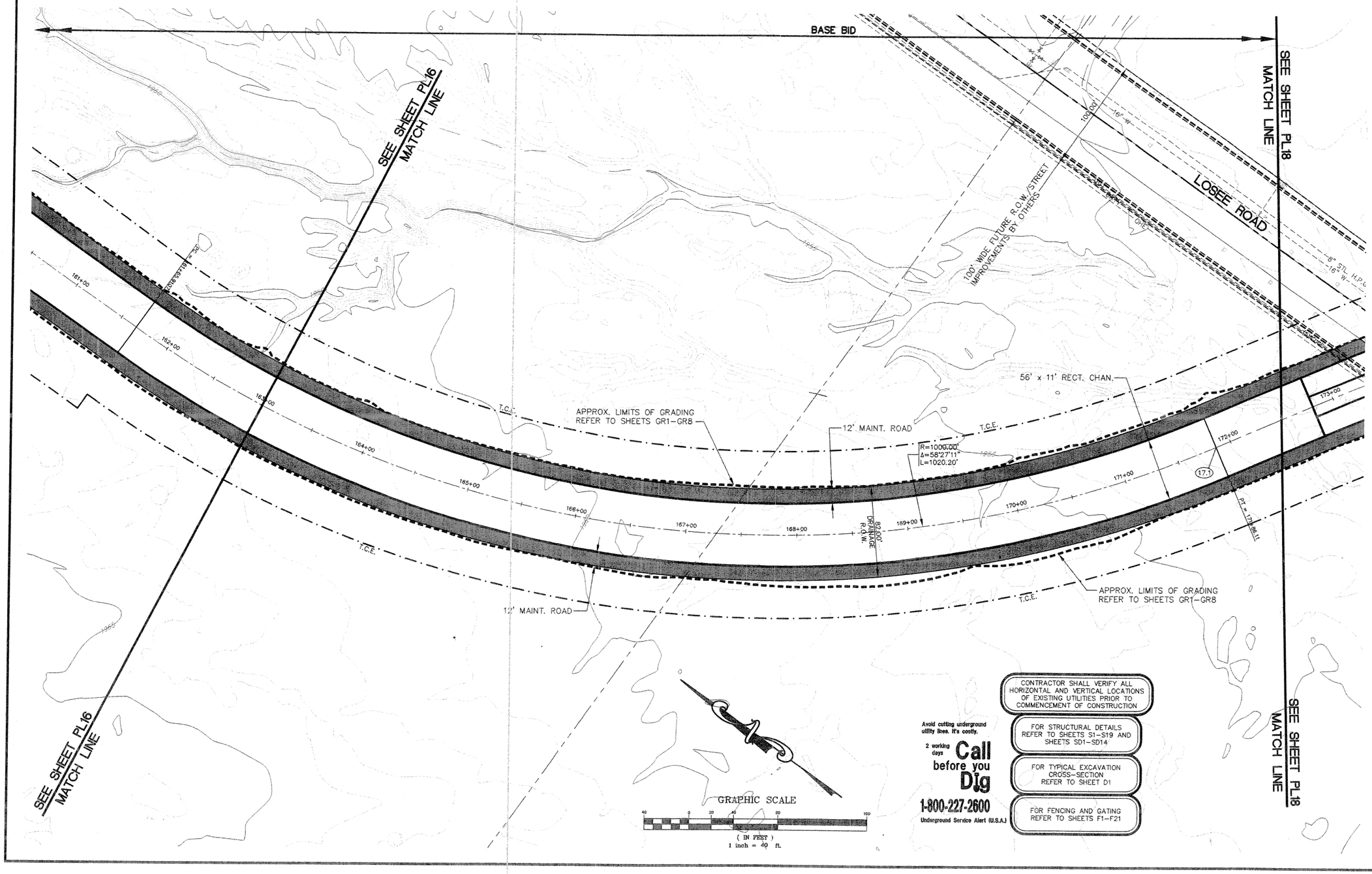
NO.	DESCRIPTION	DATE	BY
4	REVISED FOR ADDENDUM NO. 1	5/11/2004	VTN
4	REVISED FOR ADDENDUM NO. 2	5/24/2004	VTN
4			
4			

PROJECT NO: FILE NAME:

THESE PLANS ARE COPYRIGHTED

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
17.1	74907.4021	69255.6578	P.T.



CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1

FOR FENCING AND GATING REFER TO SHEETS F1-F21

Avoid cutting underground utility lines. It's costly.

2 working days **Call before you Dig**

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Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED FOR CONFORMED SET	5/11/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 08/30/05 CIVIL No. 9177 12/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 164+75 TO STA. 175+75 1

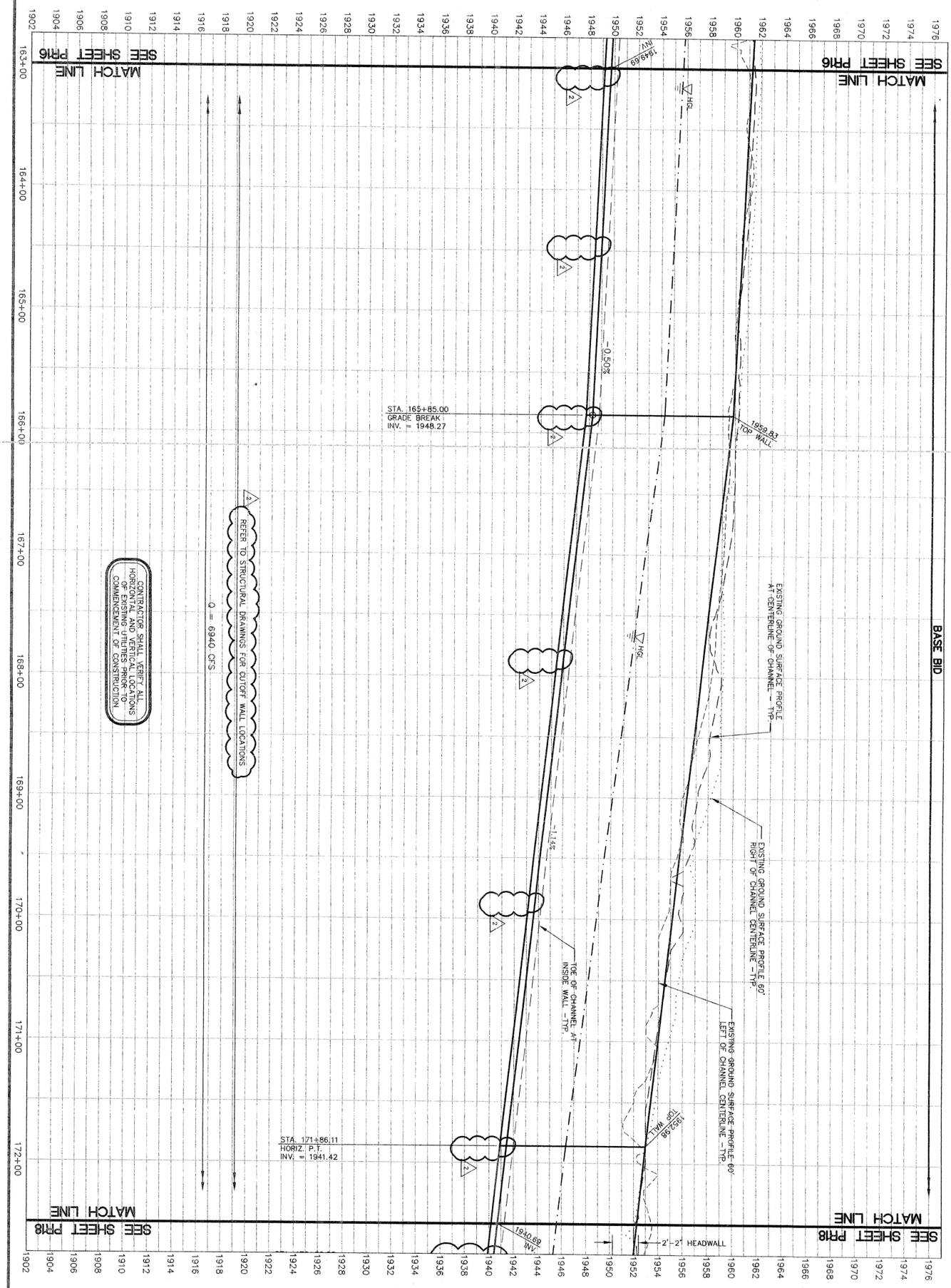
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

PL17

SHT. 44 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR17

SHT: 45 OF 128

(DRAWING TITLE) PROFILE - STA. 164+75 TO STA. 175+75 △1

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

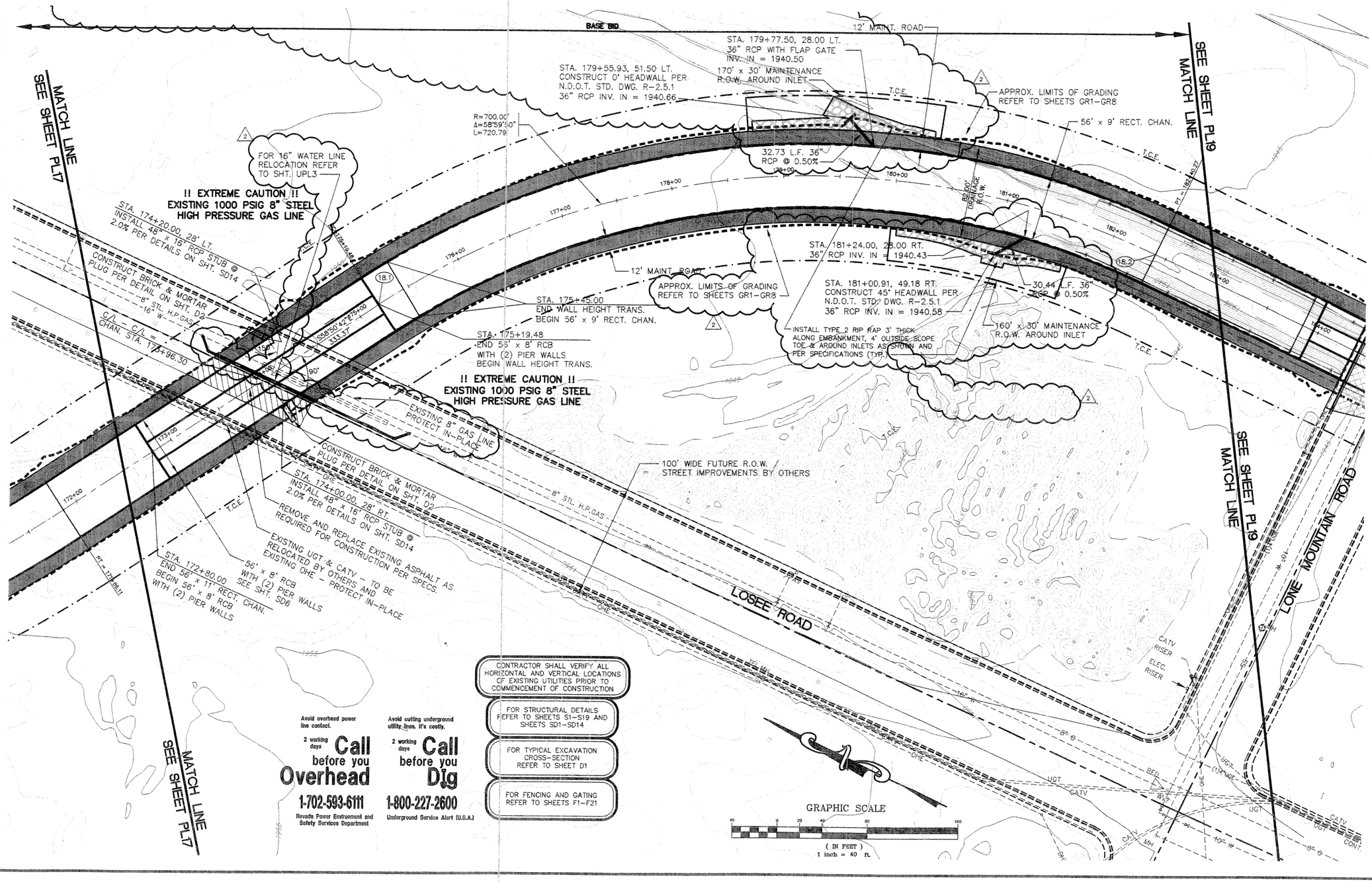
NO.	DESCRIPTION	DATE	BY
△1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN
△2	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
(18.1)	74734.9287	69540.9498	P.C.
(18.2)	74134.0289	69878.7980	P.T.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	2/12/2004	VTN
2	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
3			
4			
5			

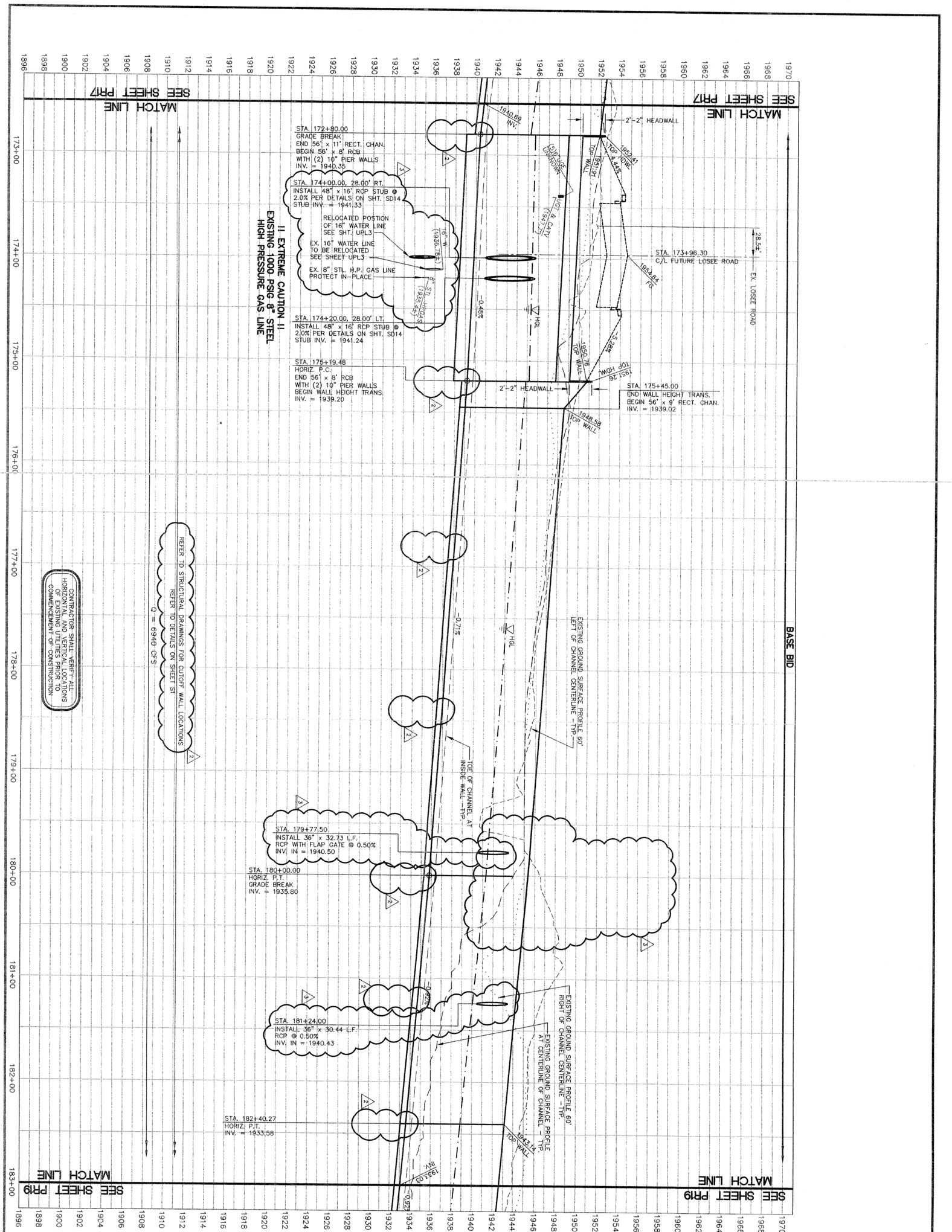
SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO:
FILE NAME:

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/05 No 9177

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2600
FAX (702) 362-2697

(DRAWING TITLE) PLAN VIEW - (STA. 172+50 TO STA. 183+00)
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL18
SHT. 16 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PR18
SHEET OF 128
DRAWING NO.

(DRAWING TITLE)
PROFILE - STA. 172+50 TO STA. 183+00 1

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

SCALE:	1"=40'
DESIGN:	VTN
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	3/11/2004

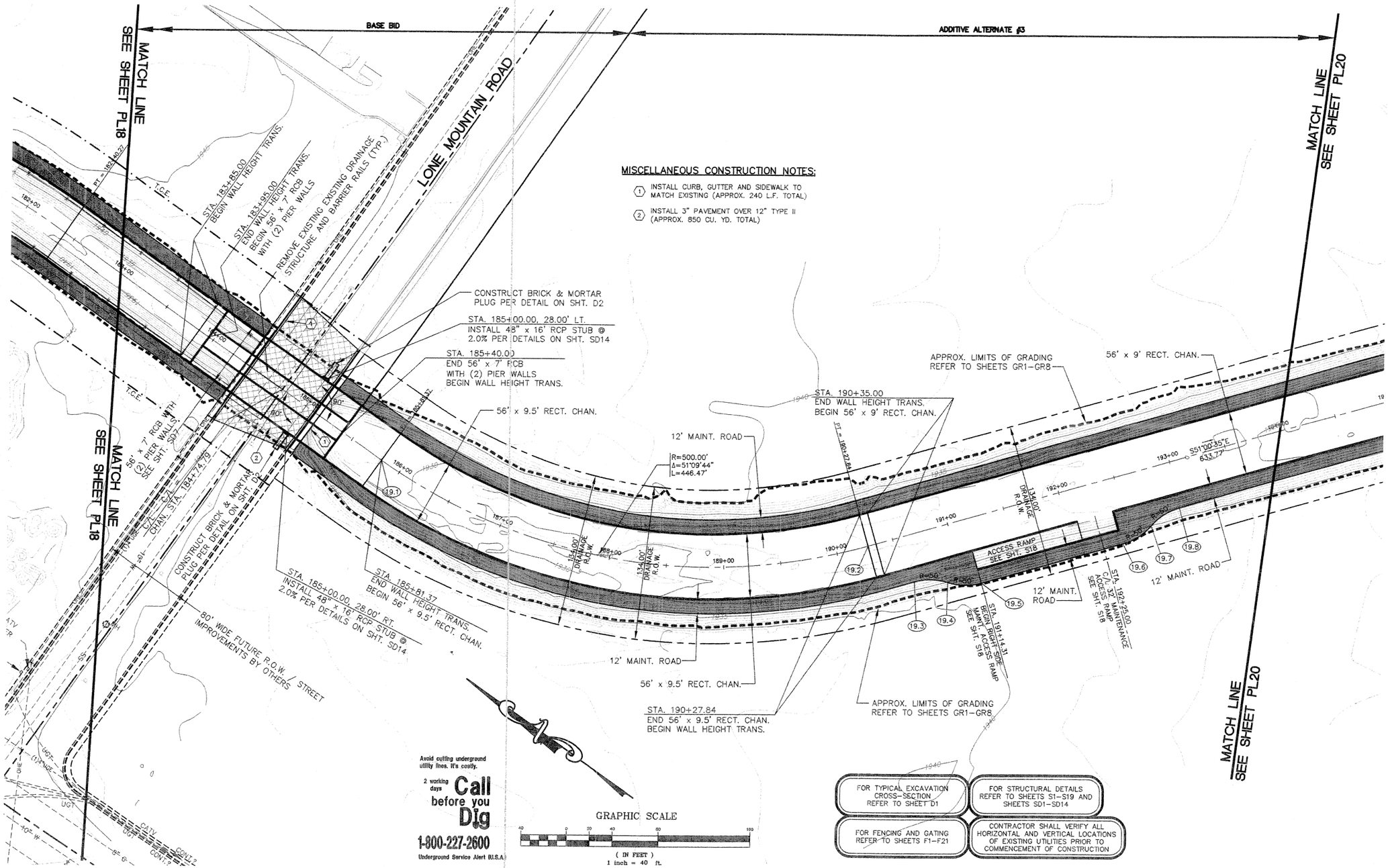
REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	2/12/2004	VTN
2	REVISED PER ADDENDUM NO. 2	2/23/2004	VTN
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
19.1	73792.9340	69877.8913	P.C.	19.5	73303.4926	70094.0109	RD. EDGE P.T.
19.2	73402.9780	70063.2960	P.T.	19.6	73223.1517	70193.2585	RD EDGE P.C.
19.3	73351.7997	70061.3547	RD. EDGE P.C.	19.7	73212.2115	70220.2827	RD. EDGE P.R.C.
19.4	73327.6462	70077.6828	RD. EDGE P.R.C.	19.8	73201.2713	70247.3070	RD. EDGE P.T.



MISCELLANEOUS CONSTRUCTION NOTES:

1. INSTALL CURB, GUTTER AND SIDEWALK TO MATCH EXISTING (APPROX. 240 L.F. TOTAL)
2. INSTALL 3" PAVEMENT OVER 12" TYPE II (APPROX. 850 CU. YD. TOTAL)

Avoid cutting underground utility lines. It's costly.

2 working days **Call before you Dig**

1-800-227-2600

Underground Service Alert (U.S.A.)

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1	FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14
FOR FENCING AND GATING REFER TO SHEETS F1-F21	CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/06 CIVIL No. 9171 1/21/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 186+75 TO STA. 197+75 1

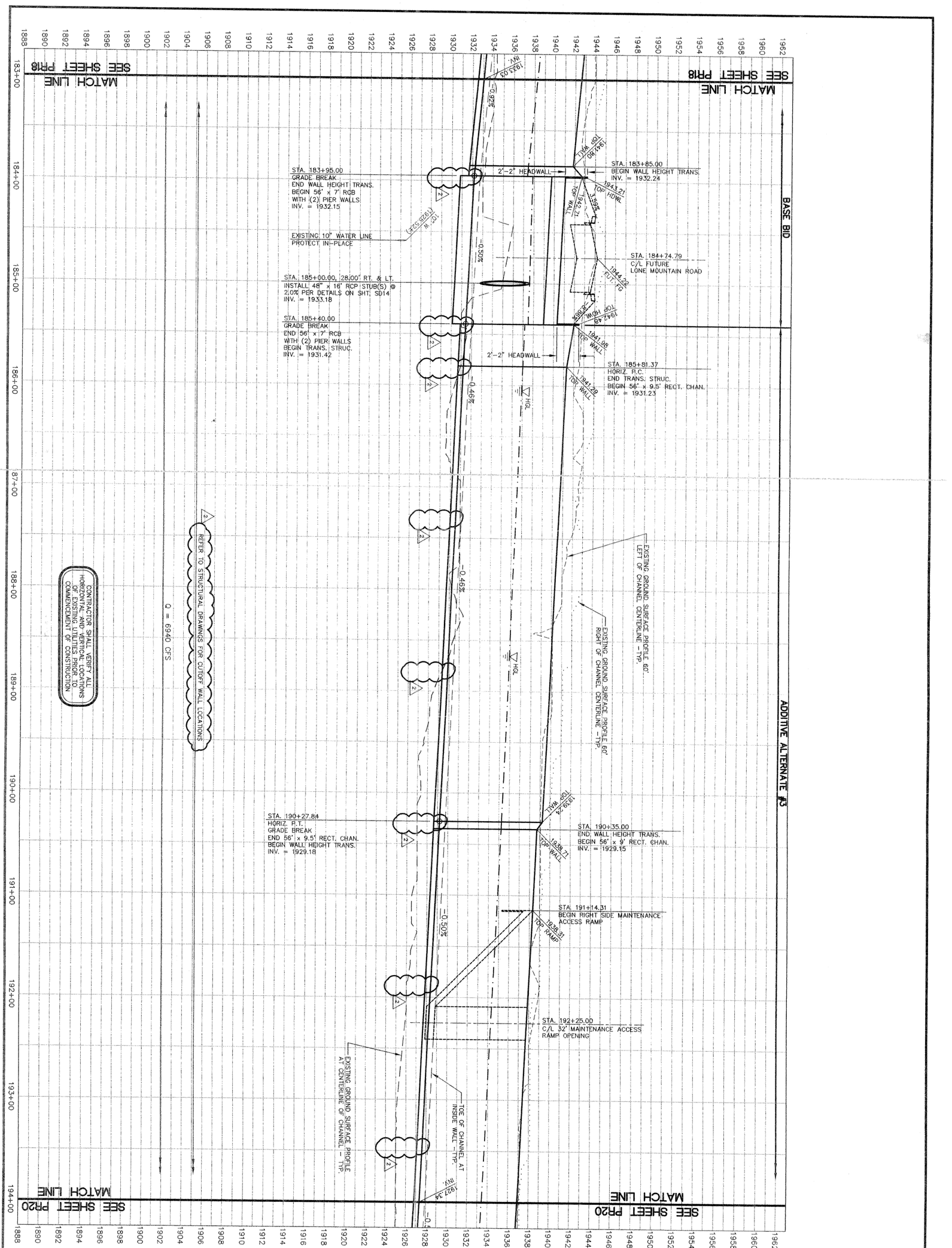
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

PL19

SHT. 48 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PR19
SHEET # OF 128
DRAWING NO.

(DRAWING TITLE)
PROFILE - STA. 186+75 TO STA. 197+75 (1)

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD
(LOCATION)

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
CIVIL
No. 9177

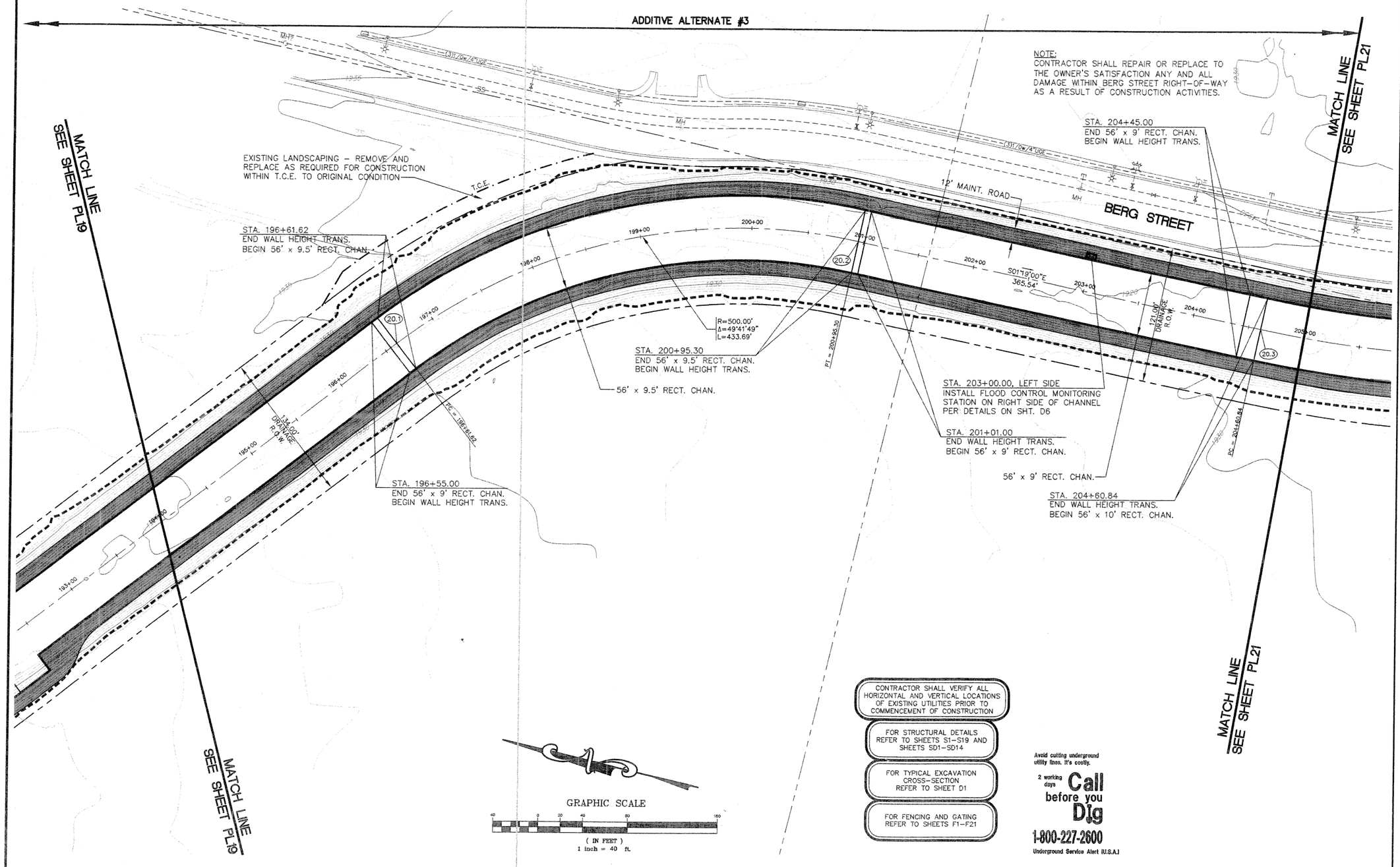
SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN
2	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
20.1	73004.2159	70555.8989	P.C.
20.2	72627.0570	70741.2003	P.T.
20.3	72261.6131	70749.6004	P.C.



CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1

FOR FENCING AND GATING REFER TO SHEETS F1-F21

Avoid cutting underground utility lines. It's costly.

2 working days **Call before you Dig**

1-800-227-2600

Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 197+75 TO STA. 208+75

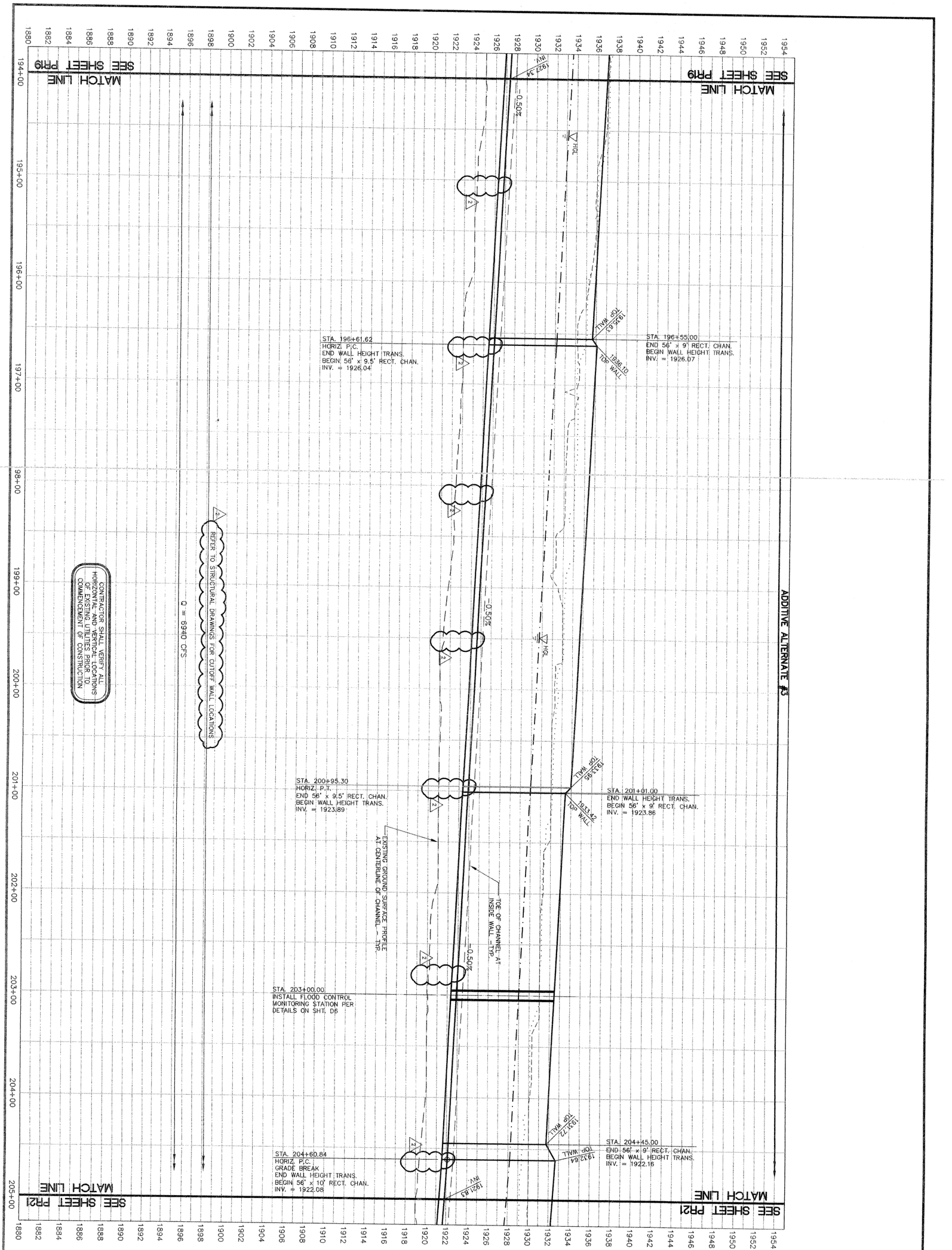
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

PL20

SHT. 50 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR20

SHT: 51 OF 128

(DRAWING TITLE) PROFILE - STA. 197+75 TO STA. 208+75 (1)

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
NO. 9177
1/21/04

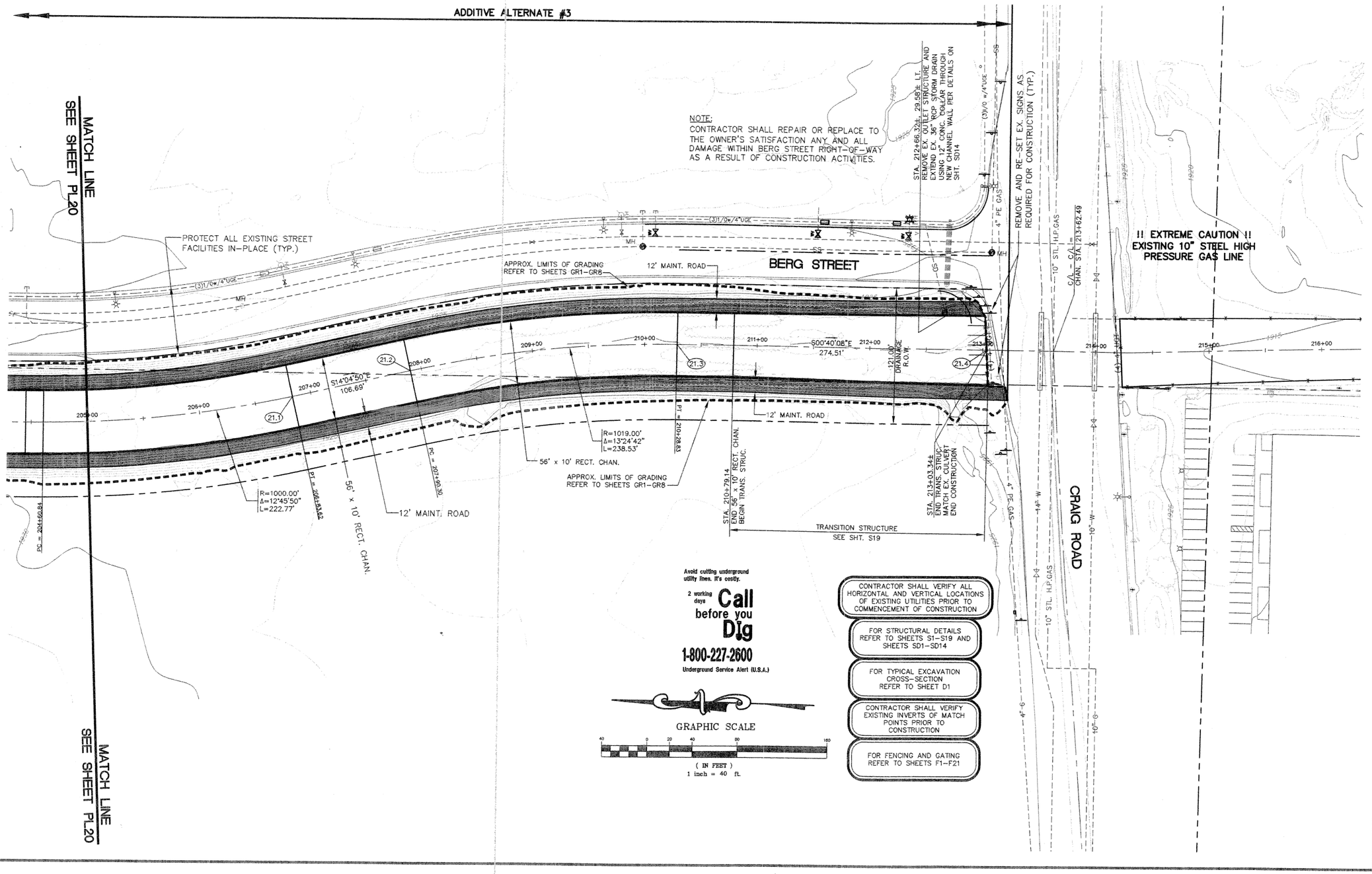
SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN
2	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
3			
4			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
(21.1)	72041.3054	70779.3821	P.T.	(21.3)	71701.8126	70835.8847	P.T.
(21.2)	71937.8249	70805.3375	P.C.	(21.4)	71427.3222	70839.0898	MATCH EX. STRUC.



Avoid cutting underground utility lines. It's costly.
2 working days **Call before you Dig**
1-800-227-2600
Underground Service Alert (U.S.A.)

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

- CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION
- FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14
- FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1
- CONTRACTOR SHALL VERIFY EXISTING INVERTS OF MATCH POINTS PRIOR TO CONSTRUCTION
- FOR FENCING AND GATING REFER TO SHEETS F1-F21

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

STATE OF NEVADA — KEN D. GILBRETH — EXP. 06/30/05 — CIVIL — No 9177 — PROFESSIONAL ENGINEER

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2600
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW STA. 208+75 TO STA. 218+90
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL21
SHT 52 OF 128

ADDITIVE ALTERNATE #3

MATCH LINE SEE SHEET PR20

EXISTING GROUND SURFACE PROFILE 60' RIGHT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE 60' LEFT OF CHANNEL CENTERLINE – TYP.

1931.19 TOP WALL

1930.50 TOP WALL

1928.94 TOP WALL

1928.43 TOP WALL

1926.50 TOP WALL

HGL

1921.83 INV.

END WALL HEIGHT TRANS. BEGIN 36" x 10' RECT. CHAN. INV. = 1922.08

-0.65%

-1.01%

-0.24% ±

TOE OF CHANNEL AT INSIDE WALL – TYP.

STA. 213+62.49 C/L CRAIG ROAD

1915.31± EX. INV.

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL – TYP.

STA. 206+83.62 HORIZ. P.T. INV. = 1920.63

STA. 207+90.30 HORIZ. P.C. INV. = 1919.94

STA. 210+28.83 HORIZ. P.T. GRADE BREAK INV. = 1918.38

STA. 210+79.14 END 36" x 10' RECT. CHAN. BEGIN TRANSITION STRUCTURE INV. = 1917.87

STA. 212+66.32± 29.58'± LT. REMOVE EX. OUTLET STRUCTURE AND EXTEND EX. 36" RCP STORM DRAIN USING 12" CONC. COLLAR THROUGH NEW CHANNEL WALL PER DETAILS ON SHT. SD14 NEW 36" INV. = 1917.48±

STA. 213+03.34± END TRANS. STRUC. MATCH EX. CULVERT INV. = 1915.60± END CONSTRUCTION

2 REFER TO STRUCTURAL DRAWINGS FOR CUTOFF WALL LOCATIONS

Q = 6940 CFS

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

MATCH LINE SEE SHEET PR20

1948 1946 1944 1942 1940 1938 1936 1934 1932 1930 1928 1926 1924 1922 1920 1918 1916 1914 1912 1910 1908 1906 1904 1902 1900 1898 1896 1894 1892 1890 1888 1886 1884 1882 1880 1878 1876 1874

205+00 206+00 207+00 208+00 209+00 210+00 211+00 212+00 213+00 214+00 215+00 216+00

CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/17/2004	VTN
2	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			

SCALE: 1" = 40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

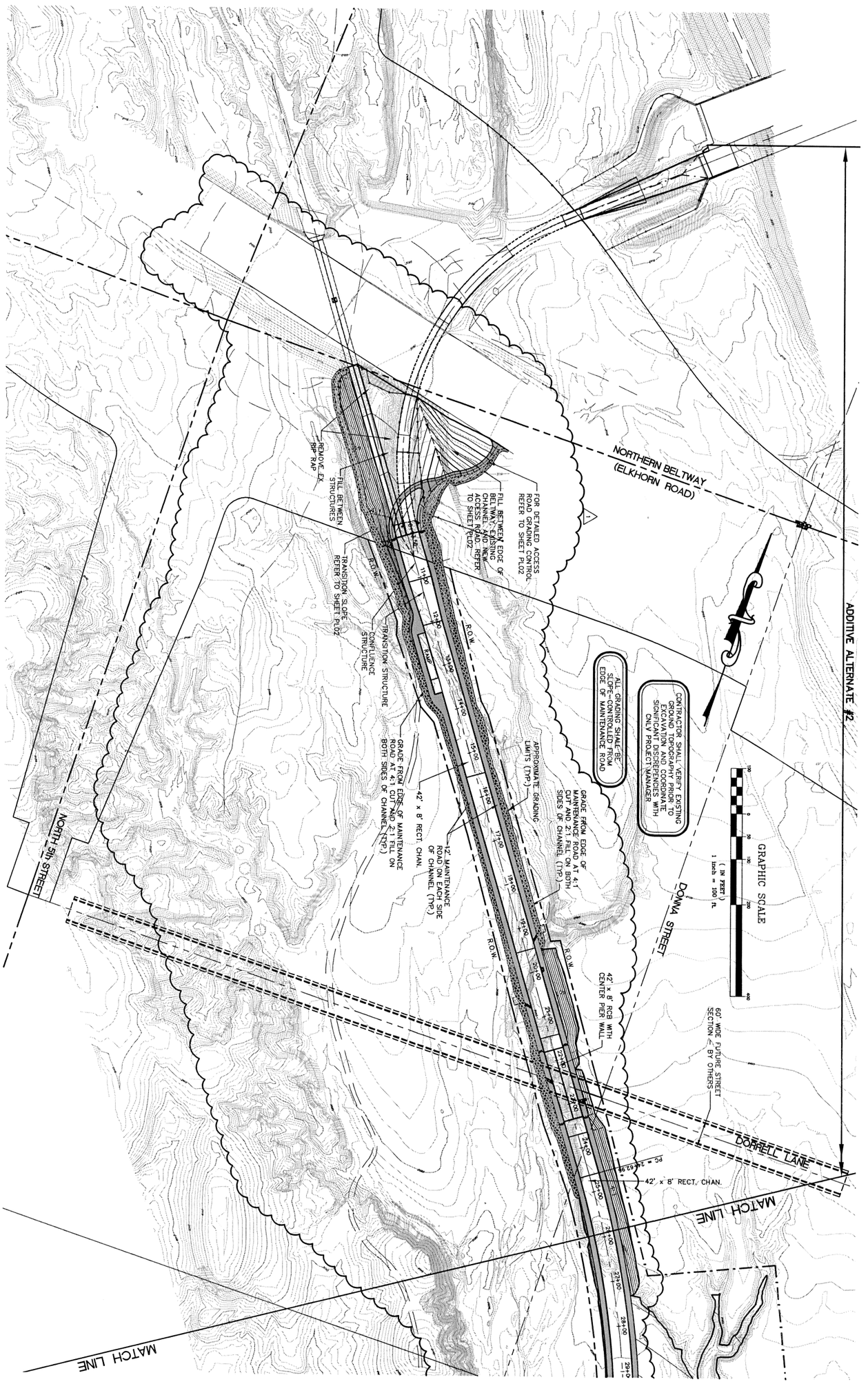
STATE OF NEVADA – KEN D. GILBRETH – No. 9177 – CIVIL – PROFESSIONAL ENGINEER – 1/21/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7450
FAX (702) 362-2597

(DRAWING TITLE) PROFILE STA. 208+75 TO STA. 218+90 1
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. PR21
SHT. 53 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. GR1 SHT. X OF X

(DRAWING TITLE) **CHANNEL GRADING PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

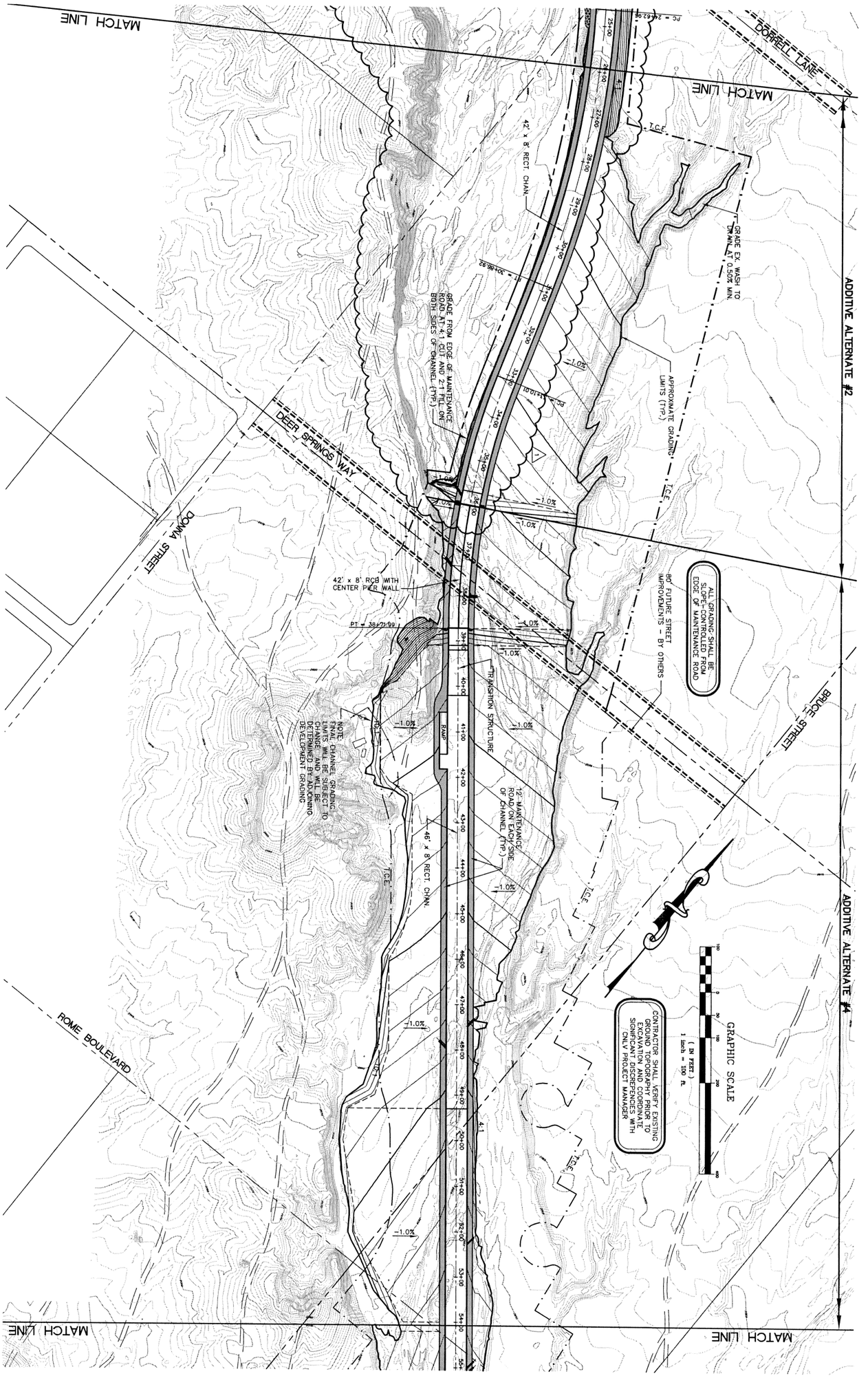
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177

SCALE: 1"=100'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. GR2 SHT X OF X

(DRAWING TITLE) **CHANNEL GRADING PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD**

VTN nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177

SCALE: 1"=100'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
2			
3			
4			
5			

PROJECT NO: FILE NAME:

ADDITIVE ALTERNATE #4

BASE BID

MATCH LINE

ROME BOULEVARD

LAWRENCE STREET

GRAPHIC SCALE

(IN FEET)
1 inch = 100 ft.

100' FUTURE STREET IMPROVEMENTS - BY OTHERS

CENTENNIAL PARKWAY

REGENA AVENUE

ALL GRADING SHALL BE SLOPE-CONTROLLED FROM EDGE OF MAINTENANCE ROAD

APPROXIMATE GRADING LIMITS (TYP.)

T.C.E.

12' MAINTENANCE ROAD ON EACH SIDE OF CHANNEL (TYP.)

42" x 9" RCB WITH CENTER PIER WALL

GRADE FROM EDGE OF MAINTENANCE ROAD AT 4:1 CUT AND 2:1 FILL SOUTH OF CENTENNIAL BOULEVARD ON BOTH SIDES OF CHANNEL (TYP.)

CONFLUENCE STRUCTURE

TRANSITION STRUCTURE

REFER TO SHT PL09 FOR DRAINAGE INLET

R.O.W.

46' x 8' RECT. CHAN.

42" x 6" RCB WITH CENTER PIER WALL

50' x 11' RECT. CHAN.

APPROXIMATE GRADING LIMITS (TYP.)

TRANSITION STRUCTURE BY OTHERS

NOTE:
FINAL CHANNEL GRADING LIMITS WILL BE SUBJECT TO CHANGE AND WILL BE DETERMINED BY ADJOINING DEVELOPMENT GRADING

P.I. = 66+05.68

CONTRACTOR SHALL VERIFY EXISTING GROUND TOPOGRAPHY PRIOR TO EXCAVATION AND COORDINATE SIGNIFICANT DISCREPENCIES WITH CNLV PROJECT MANAGER

DRAINAGE STRUCTURE BY OTHERS

BRUCE STREET

AZURE

MATCH LINE

MATCH LINE

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
4	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			
△			

SCALE: 1"=100'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROJECT NO:

FILE NAME:

STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
No. 9177
PROFESSIONAL ENGINEER
CIVIL

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-8995
FAX (702) 362-2597

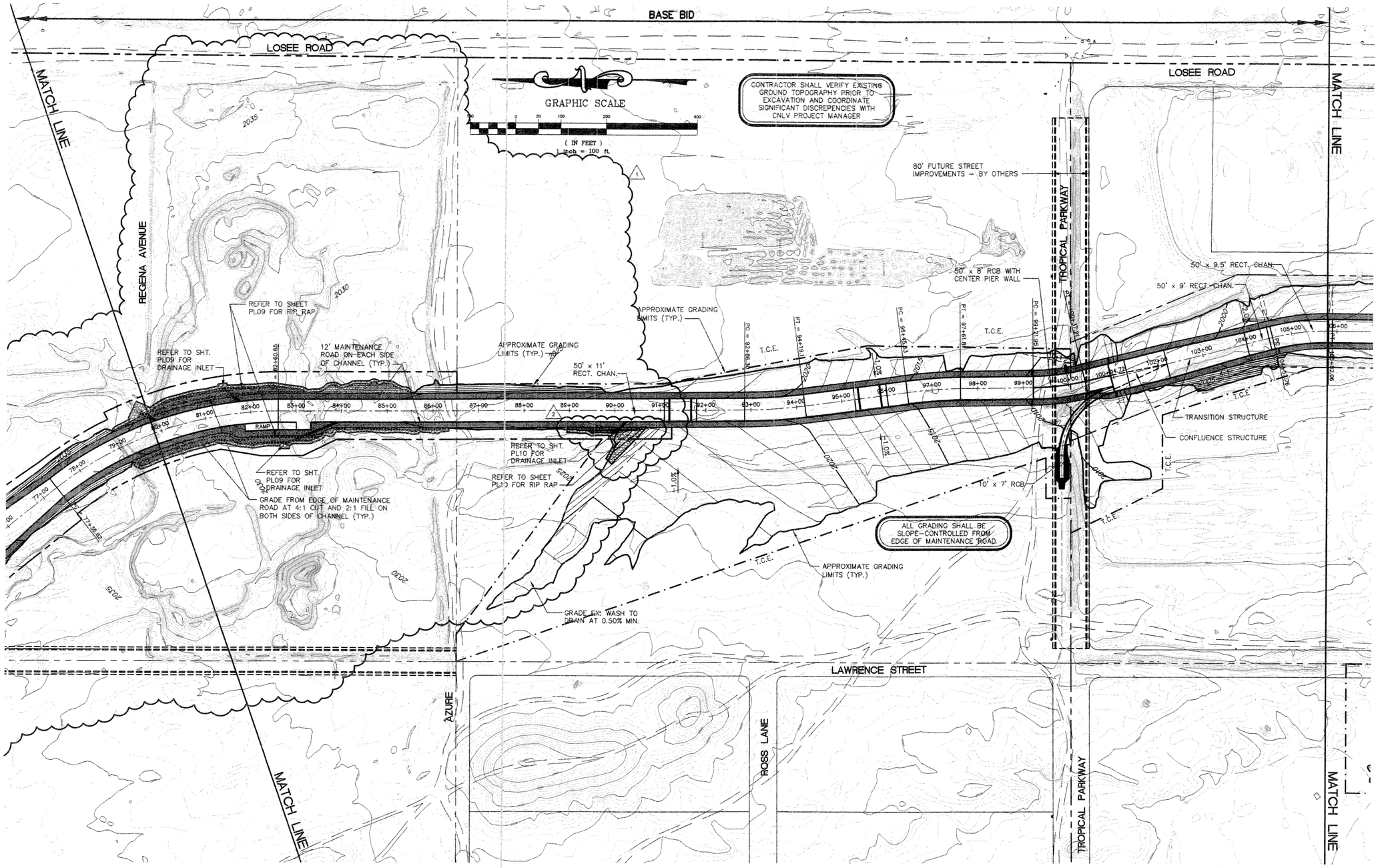
DRAWING TITLE
CHANNEL GRADING PLAN

PROJECT TITLE
UPPER LAS VEGAS WASH CHANNEL
LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

LOCATION

DRAWING NO.
GR3
SHT. 56 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△	REVISED PER ADDENDUM NO. 4	6/08/2004	VTN
△			
△			

PROJECT NO: FILE NAME:

SCALE: 1"=100'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177
3-12-04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

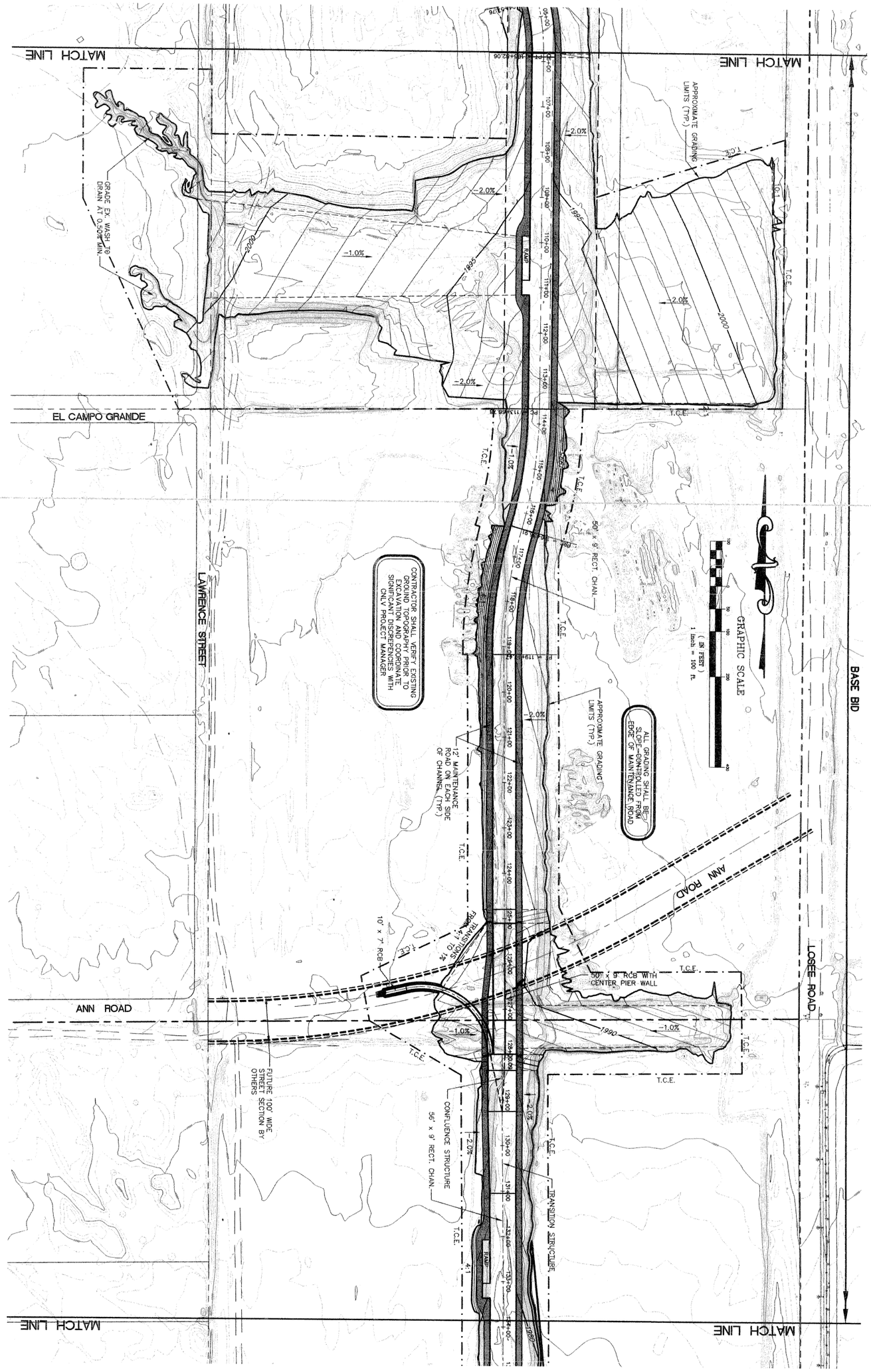
(DRAWING TITLE) CHANNEL GRADING PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
GR4
SHT. 57 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. GR5

SHT. 58 OF 128

(DRAWING TITLE) CHANNEL GRADING PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 09/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=100'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
△			
△			
△			
△			
△			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION

BASE BID

MATCH LINE

LOSEE ROAD

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

CONTRACTOR SHALL VERIFY EXISTING GROUND TOPOGRAPHY PRIOR TO EXCAVATION AND COORDINATE SIGNIFICANT DISCREPENCIES WITH ONLV PROJECT MANAGER

APPROXIMATE GRADING LIMITS (TYP.)

T.C.E.

10:1

1980

1975

1970

1965

1.0%

2.0%

4:1

56' x 9' RECT. CHAN.

56' x 11' RECT. CHAN.

56' x 9' RCB WITH DIVIDING PIER WALLS

RAMP

12' MAINTENANCE ROAD ON EACH SIDE OF CHANNEL (TYP.)

REFER TO SHT. PL15 FOR DRAINAGE INLET

GRADE FROM EDGE OF WEST SIDE MAINTENANCE ROAD AT 2:1 BETWEEN STA. 145+00 AND STA. 147+11

ALL GRADING SHALL BE SLOPE-CONTROLLED FROM EDGE OF MAINTENANCE ROAD

WASHBURN ROAD

FUTURE 80' WIDE STREET SECTION BY OTHERS

LAWRENCE STREET

PC = 161+18.18

53+00 134+00 135+00 136+00 137+00 138+00 139+00 140+00 141+00 142+00 143+00 144+00 145+00 146+00 147+00 148+00 149+00 150+00 151+00 152+00 153+00 154+00 155+00 156+00 157+00 158+00 159+00 160+00 161+00 162+00

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN

SCALE: 1"=100'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROJECT NO: FILE NAME:

NEVADA STATE OF NEVADA — KEN D. GILBRETH — EXP. 06/30/05 — PROFESSIONAL ENGINEER — CIVIL — No. 9171

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2267

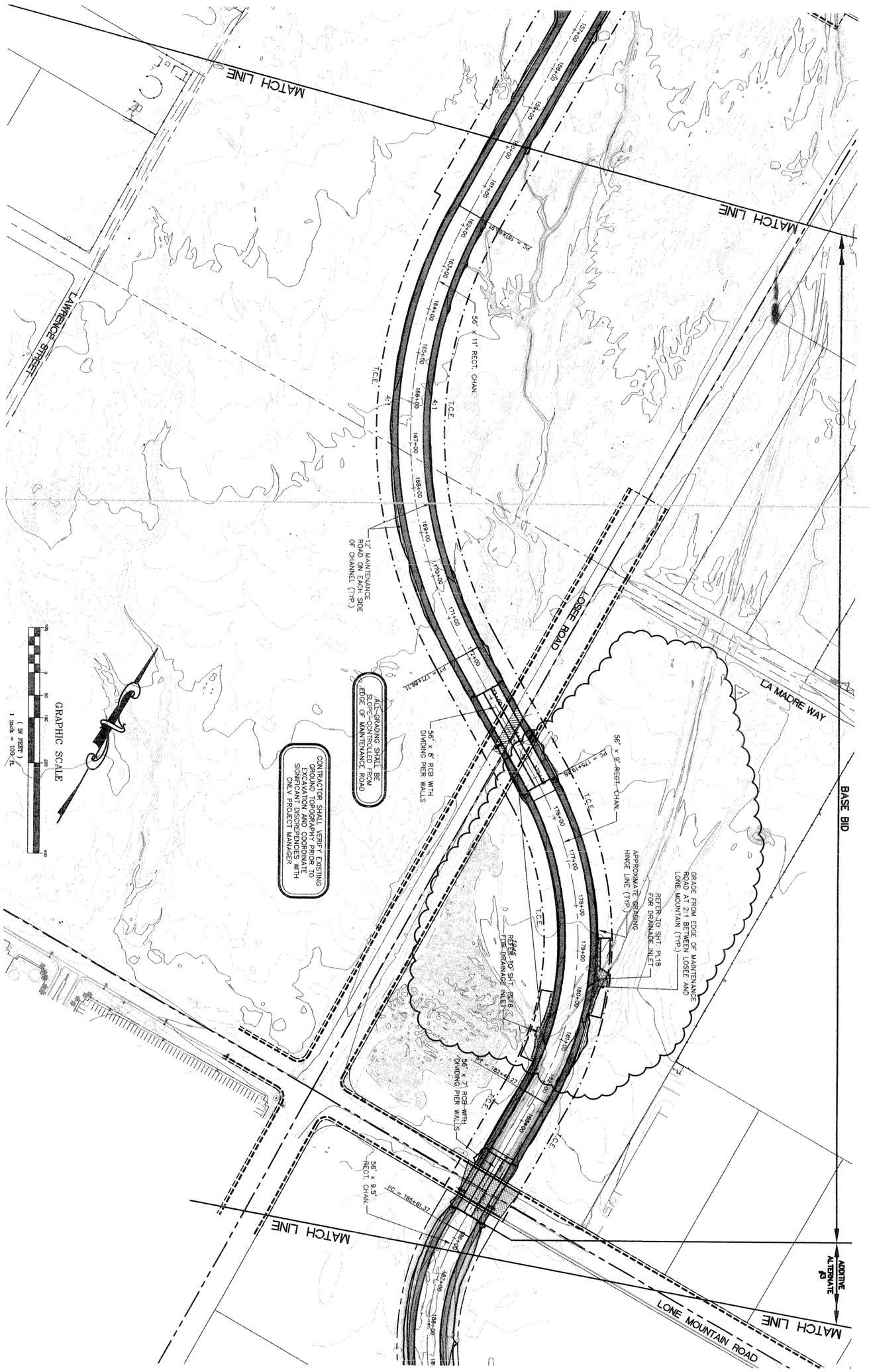
CHANNEL GRADING PLAN

UPPER LAS VEGAS WASH CHANNEL

LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
GR6
SHT. 59 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE)
CHANNEL GRADING PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

DRAWING NO. GR7 SHT 60 OF 128

VTN nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
NO. 9177

SCALE:	1"=100'
DESIGN:	VTN
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	3/11/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			
△			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION

ADDITIVE ALTERNATE #3

CONTRACTOR SHALL VERIFY EXISTING GROUND TOPOGRAPHY PRIOR TO EXCAVATION AND COORDINATE SIGNIFICANT DISCREPENCIES WITH CNLV PROJECT MANAGER

GRAPHIC SCALE

100 0 50 100 200 400

(IN FEET)
1 inch = 100 ft.

BERG STREET

MATCH LINE

LONE MOUNTAIN ROAD

TRANSITION 10:1 TO 4:1

TRANSITION 10:1 TO 4:1

56' x 9.5' RECT. CHAN.

TRANSITION STRUCTURE

ALL GRADING SHALL BE SLOPE-CONTROLLED FROM EDGE OF MAINTENANCE ROAD

12' MAINTENANCE ROAD ON EACH SIDE OF CHANNEL (TYP.)

APPROXIMATE GRADING LIMITS (TYP.)

CRAIG ROAD

LOSEE ROAD

MATCH LINE

56' x 9.5' RECT. CHAN.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1			
2			
3			
4			
5			

SCALE: 1"=100'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/06 CIVIL No. 9177

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-7500
FAX (702) 362-2597

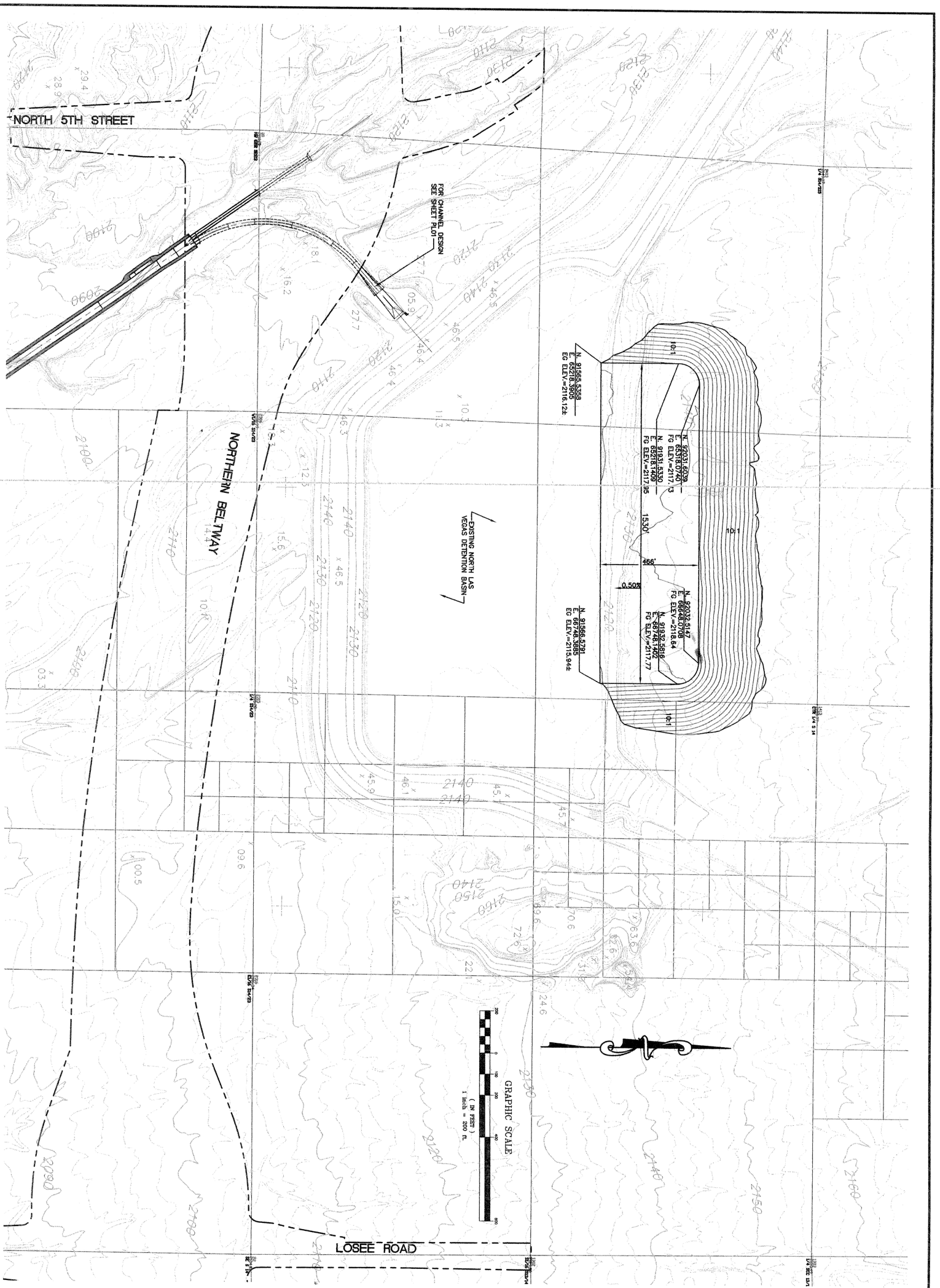
CHANNEL GRADING PLAN

UPPER LAS VEGAS WASH CHANNEL

LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
GR8
SHT. 61 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE)
DETENTION BASIN BORROW AREA GRADING PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

DRAWING NO. DB1 SHEET 62 OF 128

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/30/05
CIVIL
NO. 9171

SCALE:	1" = 200'
DESIGN:	BKP
DRAWN:	BKP/DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
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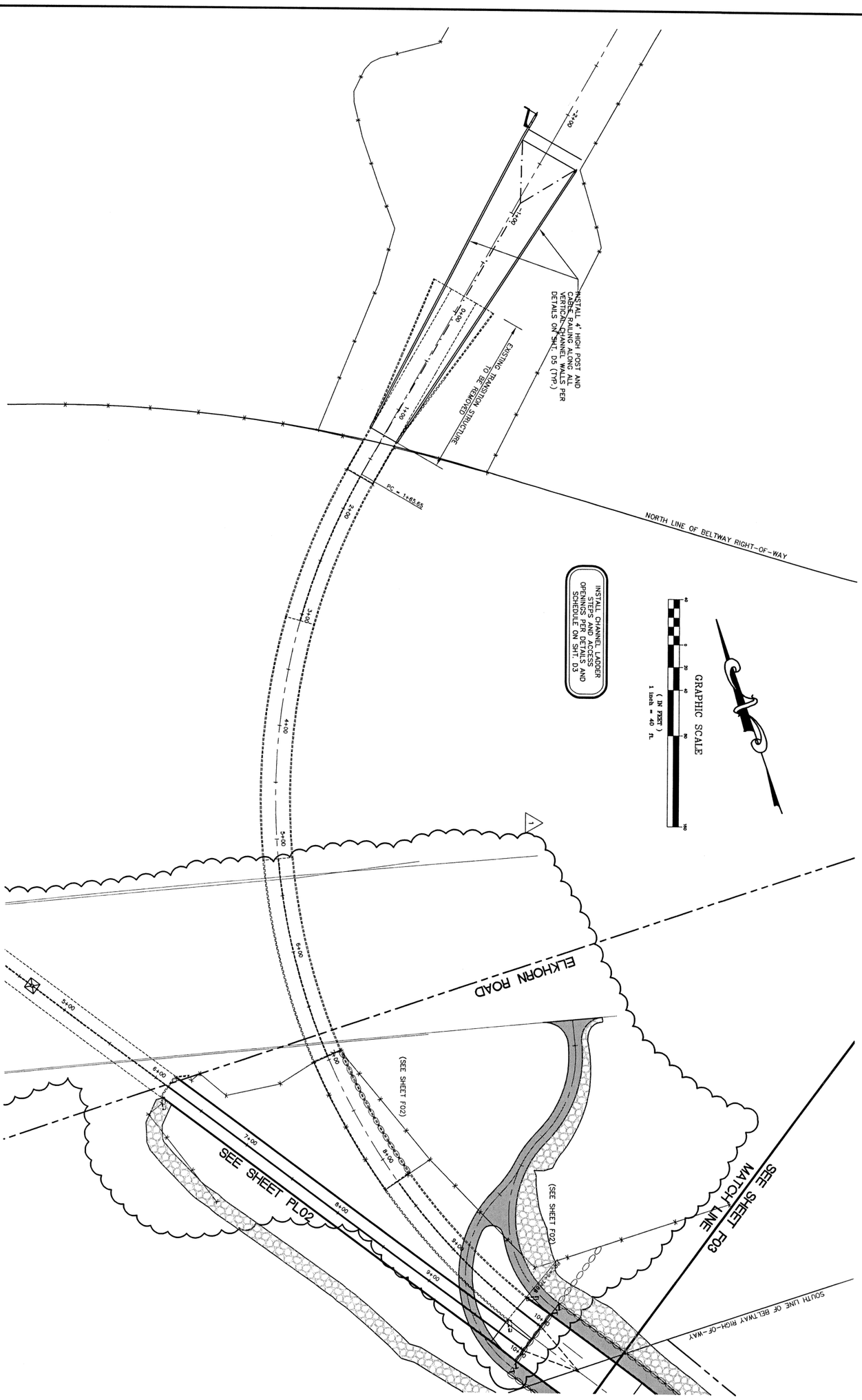
△			
△			
△			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F01 SHT X OF X

(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

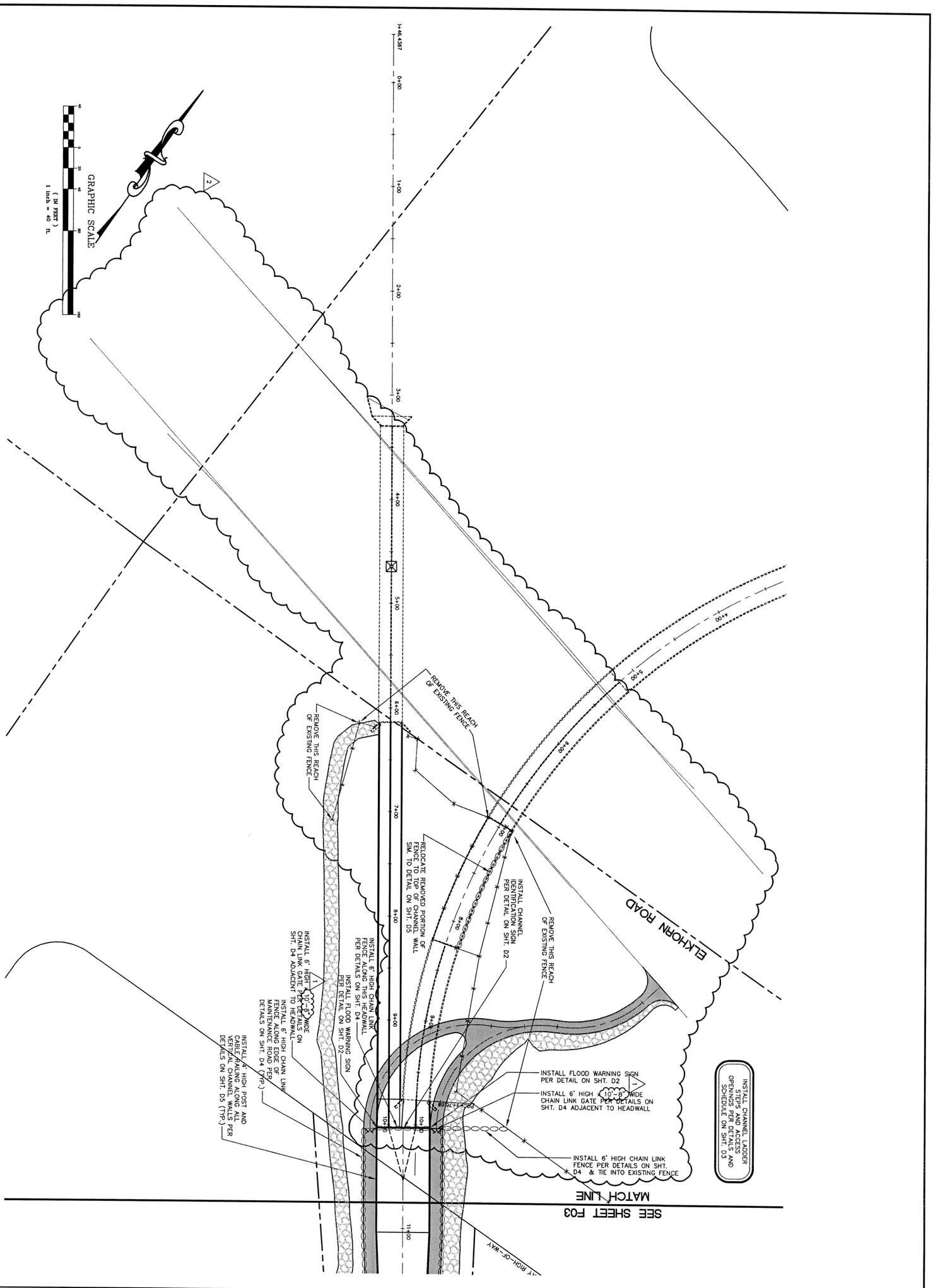
PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	5/11/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F02 SHT X OF X

[DRAWING TITLE]
FENCE, GATE AND SIGN PLAN

[PROJECT TITLE]
UPPER LAS VEGAS WASH CHANNEL

[LOCATION]
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/11/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #2	2/16/2004	VTN
2	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VTN
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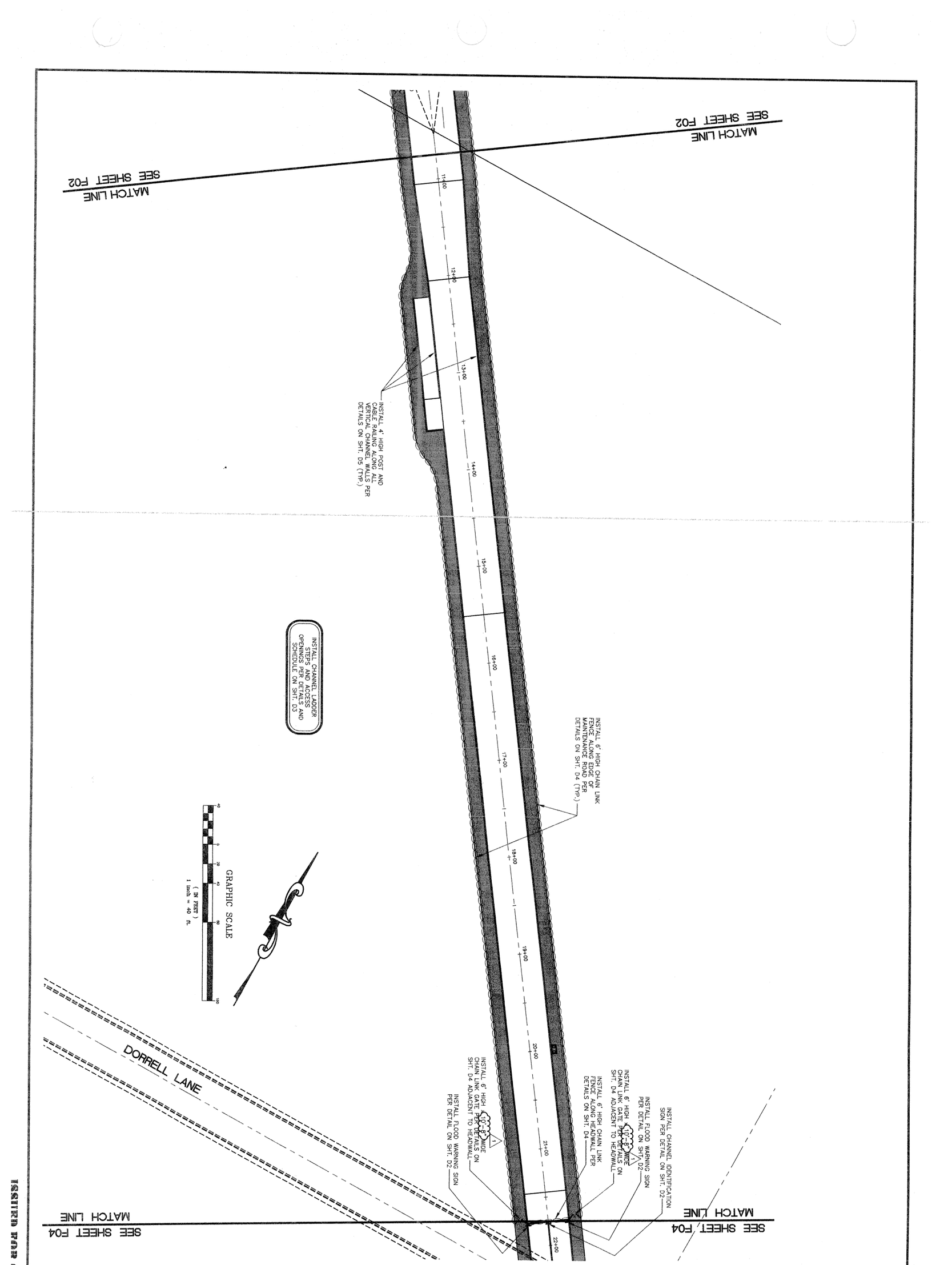
PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F03 SHT 5 OF 18

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

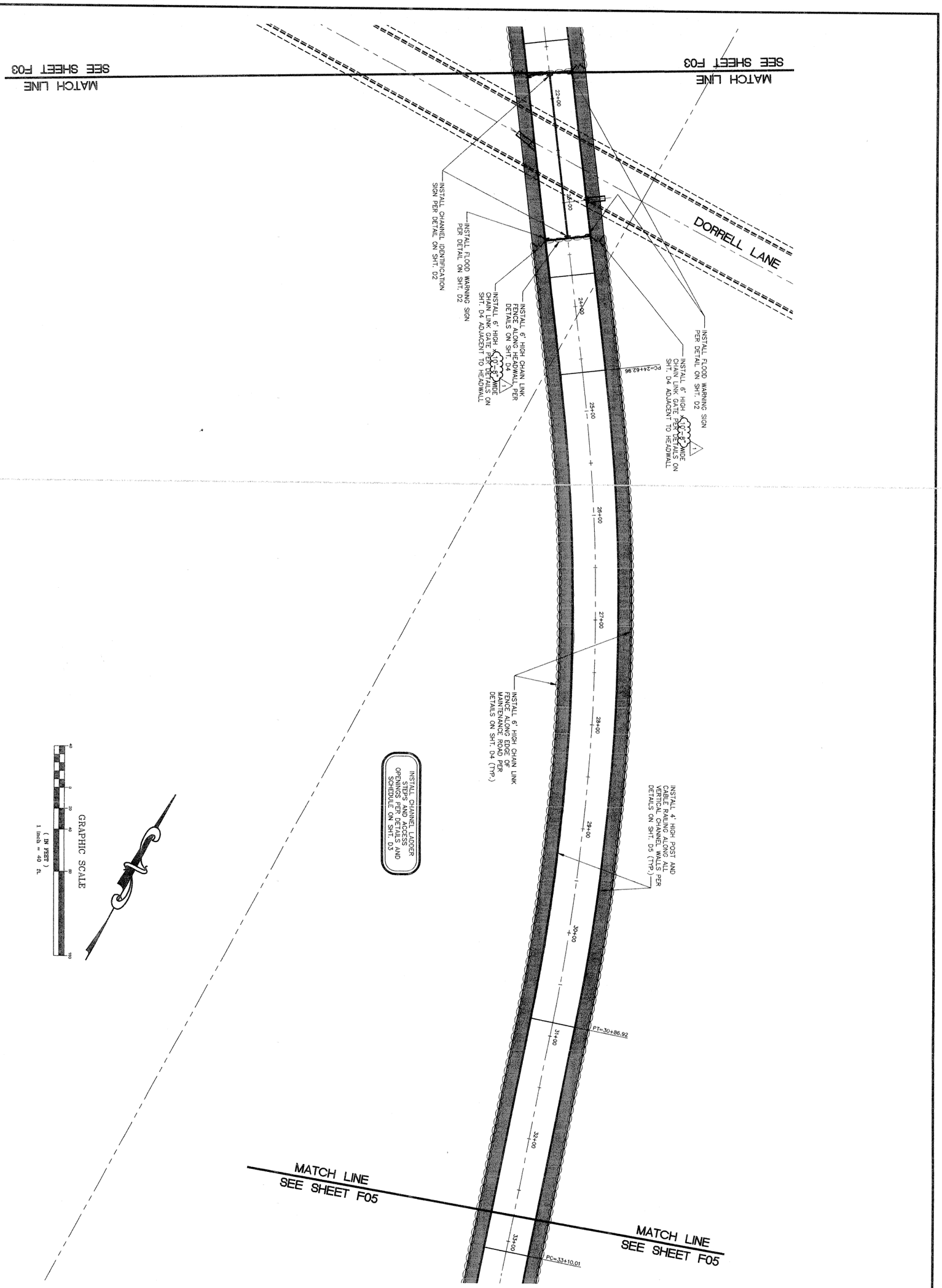
PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
No. 9177
CIVIL
1/21/04

SCALE:	1" = 40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

DRAWING NO. F04
SHT. 66 OF 128

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
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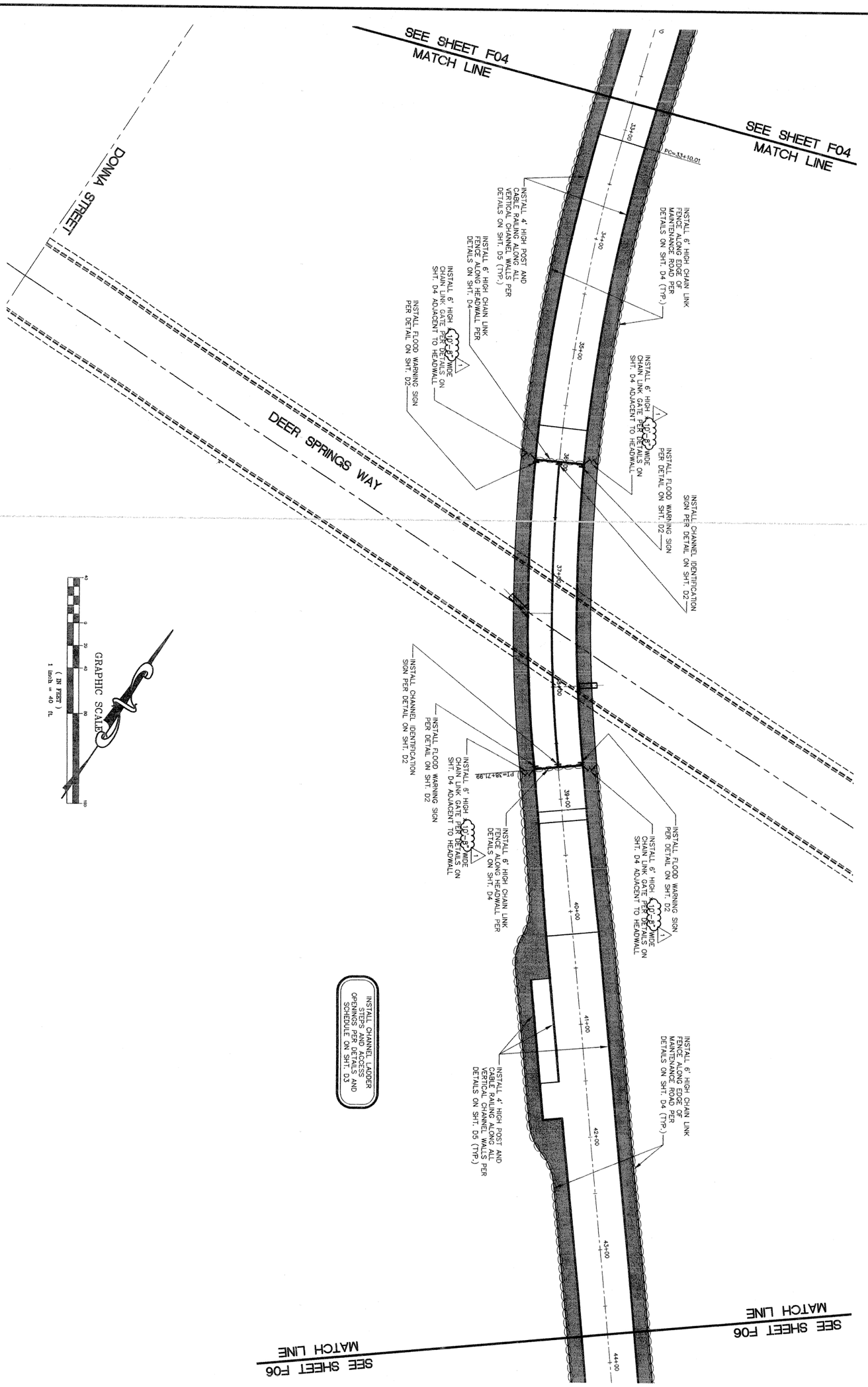
3			
4			
5			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

DRAWING NO. F05
SHT 67 OF 128

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
NO. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
2			
3			
4			
5			

PROJECT NO: FILE NAME:

INSTALL CHANNEL LADDER
STEPS AND ACCESS
OPENINGS PER DETAILS AND
SCHEDULE ON SHT. D3

INSTALL 6' HIGH CHAIN LINK
FENCE ALONG EDGE OF
MAINTENANCE ROAD PER
DETAILS ON SHT. D4 (TYP.)

INSTALL 4' HIGH POST AND
CABLE RAILING ALONG ALL
VERTICAL CHANNEL WALLS PER
DETAILS ON SHT. D5 (TYP.)

44+00 45+00 46+00 47+00 48+00 49+00 50+00 51+00 52+00 53+00 54+00 55+00

ROME BOULEVARD

MATCH LINE
SEE SHEET F05

MATCH LINE
SEE SHEET F05

SEE SHEET F07
MATCH LINE

SEE SHEET F07
MATCH LINE

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2721 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBERTH
No. 9177
CIVIL
PROFESSIONAL ENGINEER - STATE OF ARIZONA

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

NO.	REVISIONS DESCRIPTION	DATE	BY
1			
2			
3			
4			
5			

PROJECT NO:
FILE NAME:

(DRAWING TITLE) FENCE, GATE AND SIGN PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
F06
SHT. 68 OF 128

ISSUED FOR CONSTRUCTION

MATCH LINE
SEE SHEET F06

INSTALL CHANNEL LADDER STEPS AND ACCESS OPENINGS PER DETAILS AND SCHEDULE ON SHT. D3

INSTALL 6' HIGH CHAIN LINK FENCE ALONG EDGE OF MAINTENANCE ROAD PER DETAILS ON SHT. D4 (TYP.)

55+00 56+00 57+00 58+00 59+00 60+00 61+00 62+00 63+00 64+00 65+00 66+00

INSTALL 4' HIGH POST AND CABLE RAILING ALONG ALL VERTICAL CHANNEL WALLS PER DETAILS ON SHT. D5 (TYP.)

SEE SHEET F08
MATCH LINE

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft.

MATCH LINE
SEE SHEET F06

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
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△			
△			
△			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2997

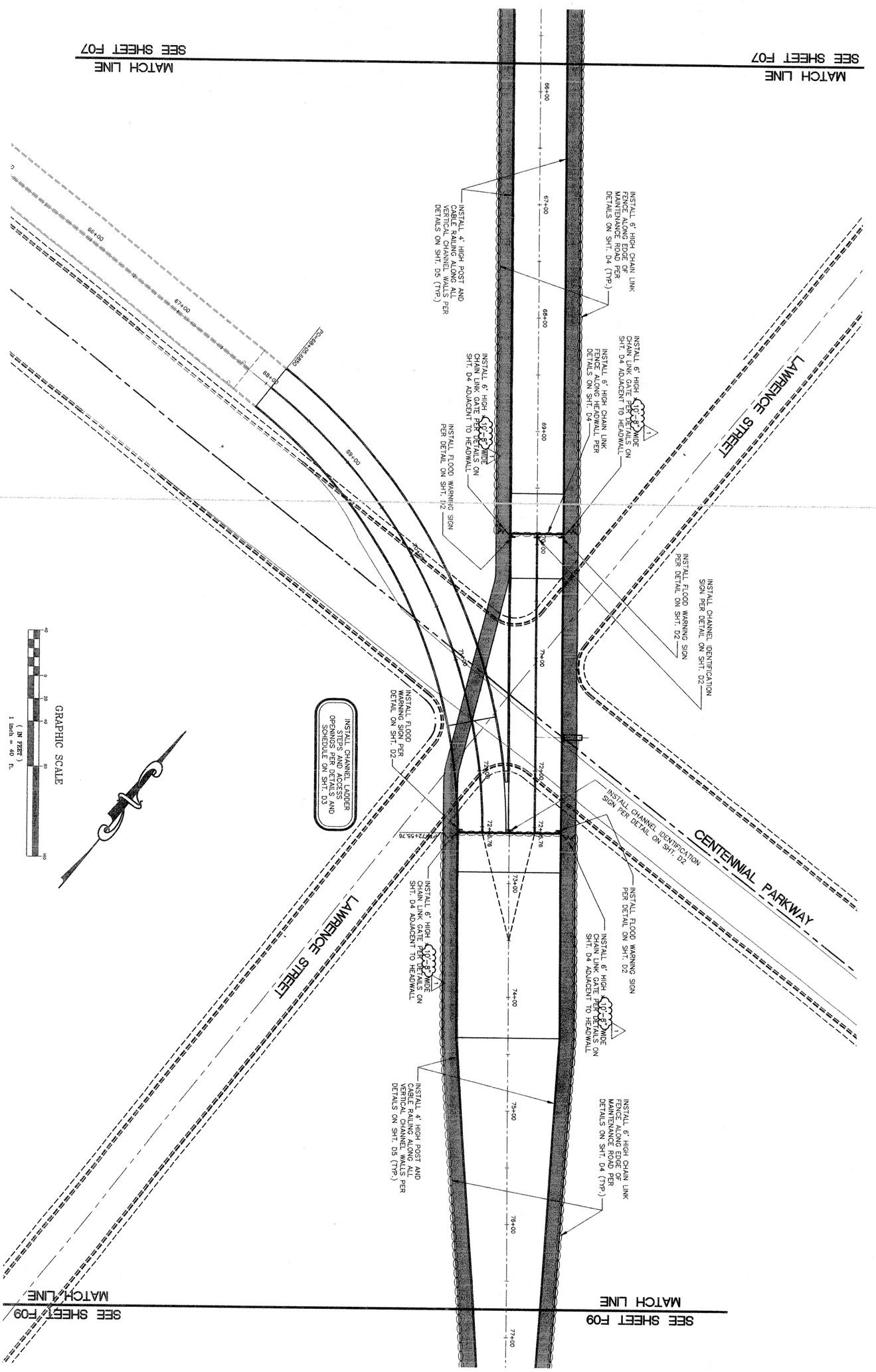
(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
F07
SHT. 69 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F08 SHT. 7 OF 128

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
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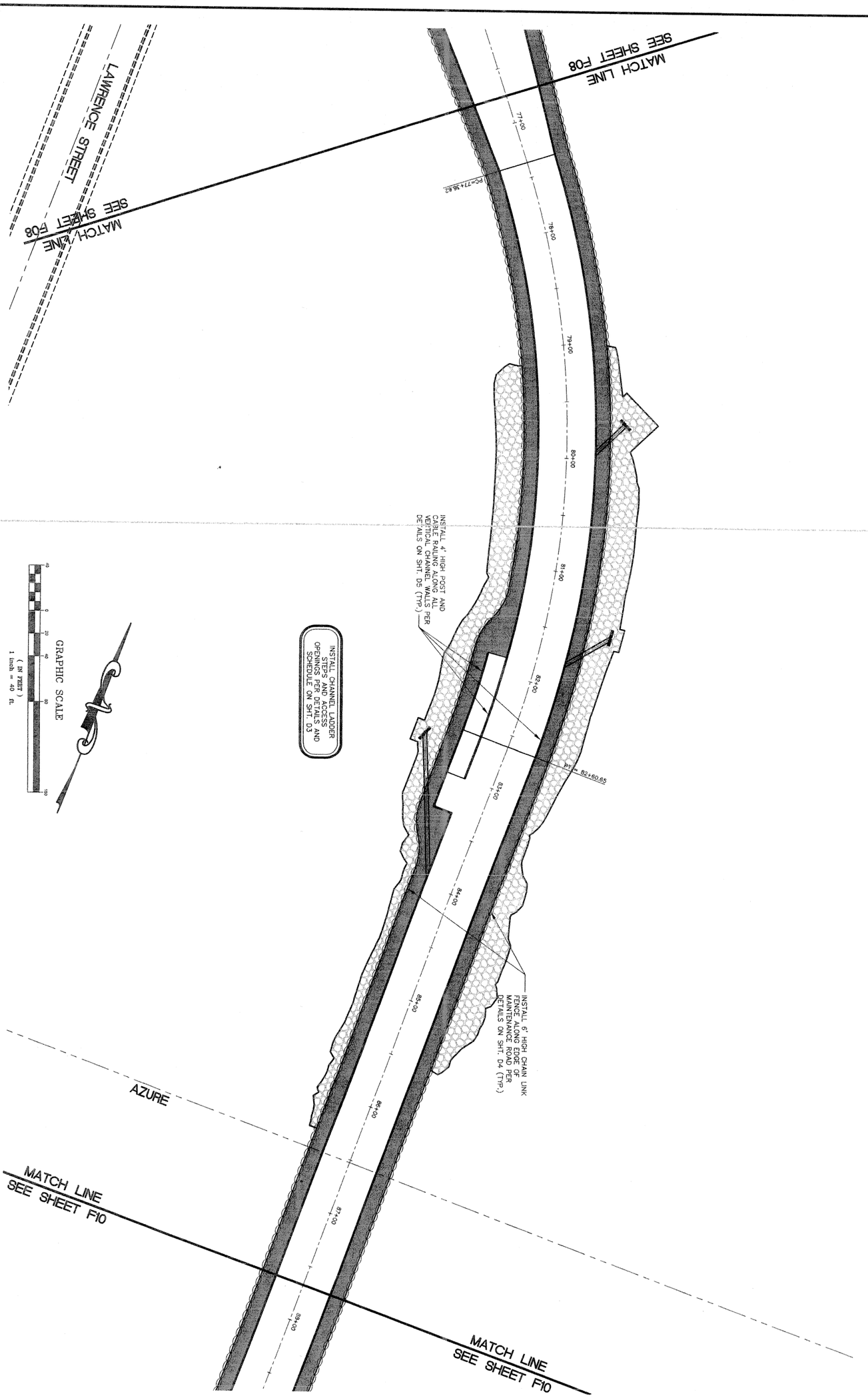
3			
4			
5			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F09 SHT 71 OF 128

(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 09/30/05
No. 9177
CIVIL
1/21/04

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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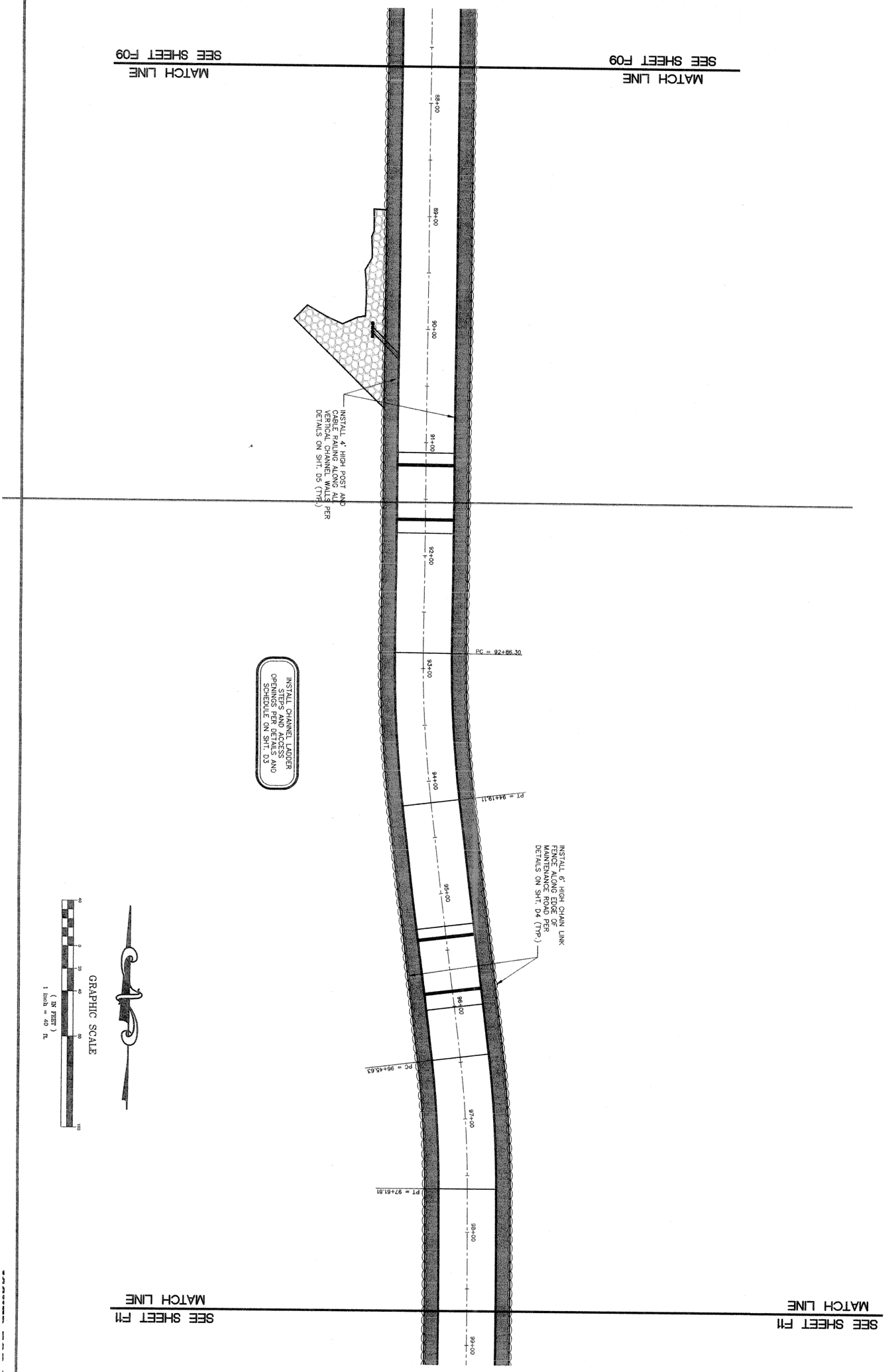
PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F10 SHT. 42 OF 185

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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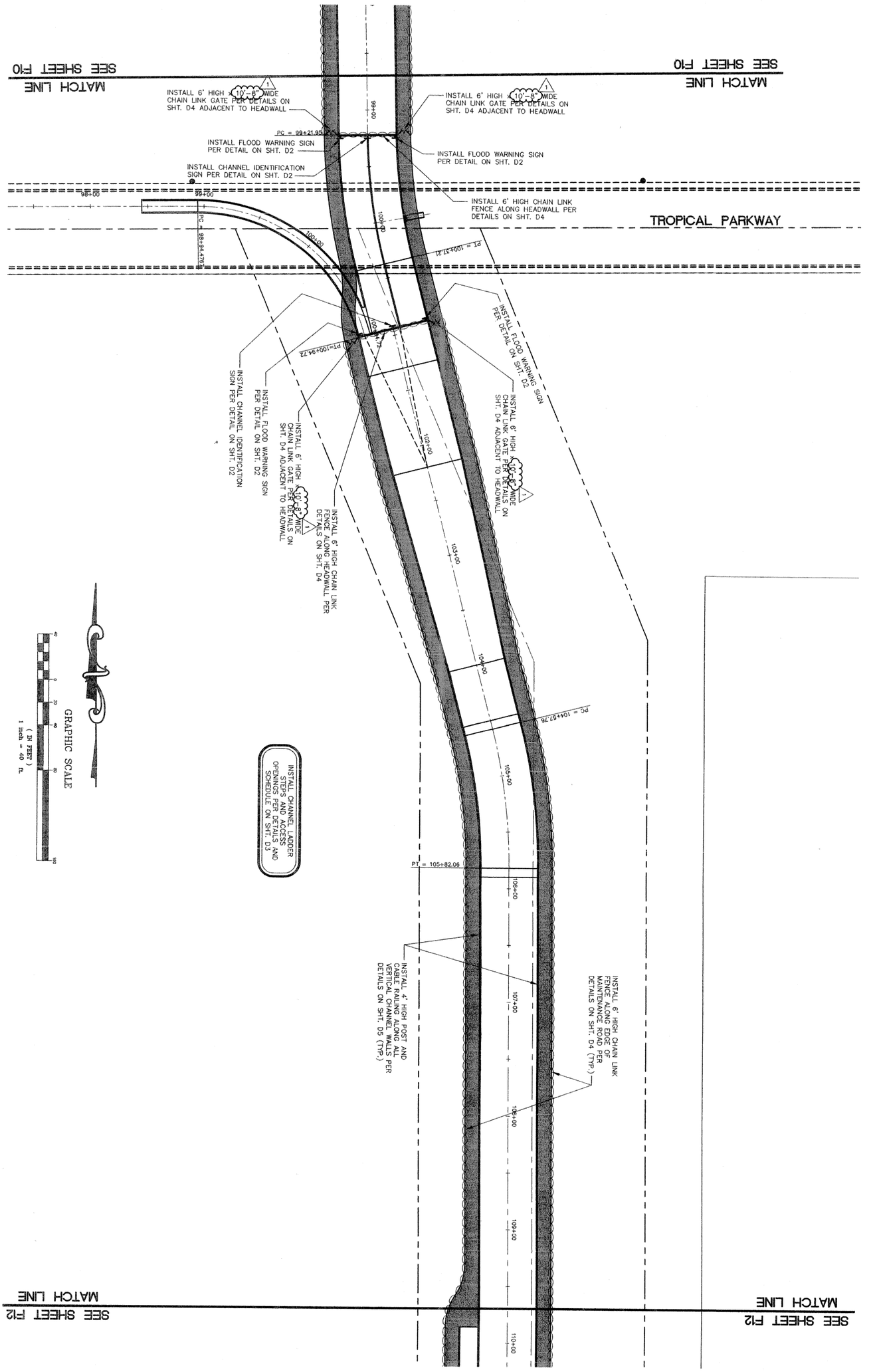
PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F11 SHT 13 OF 28

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No 9177

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
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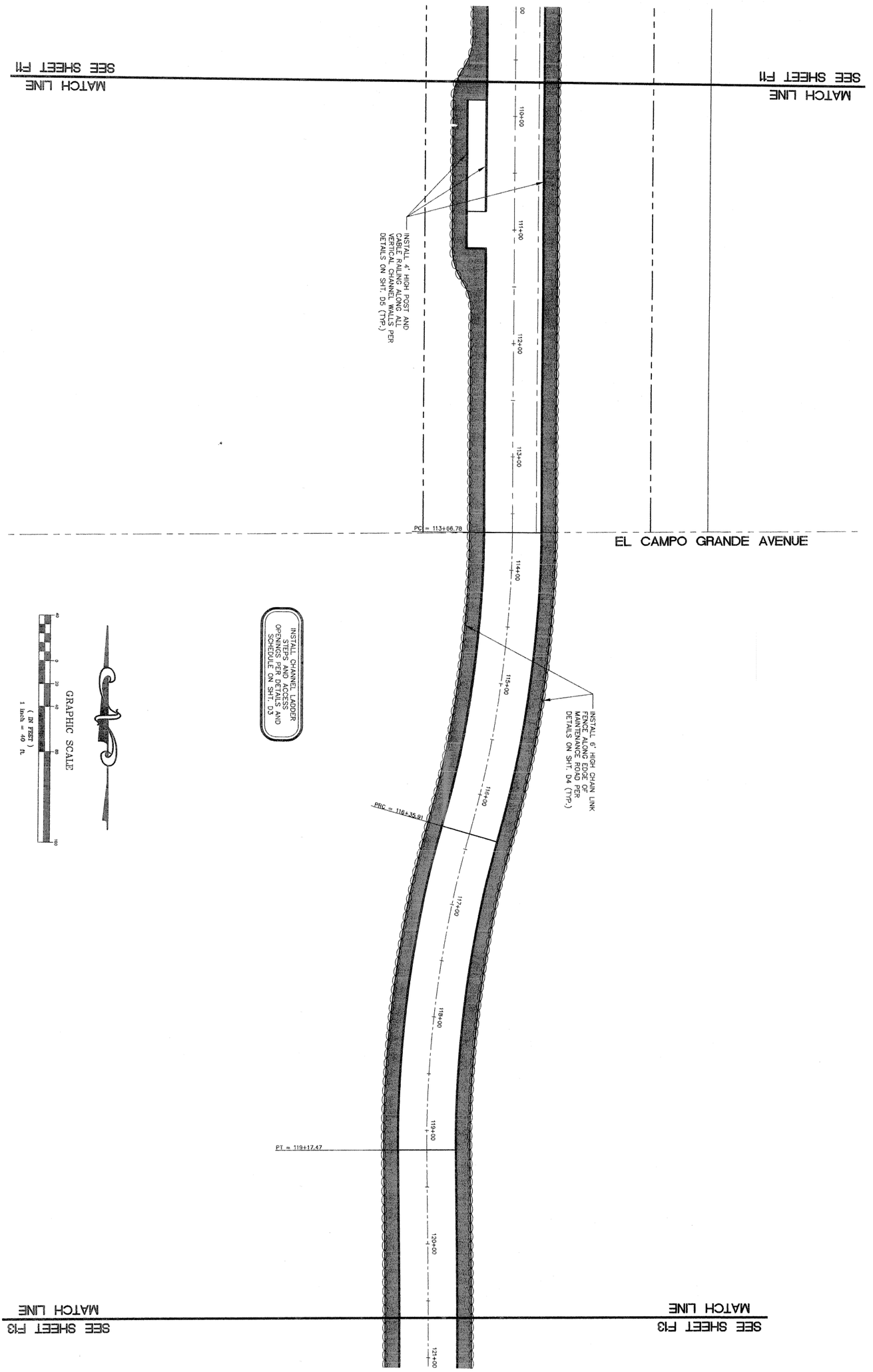
PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F12 SHT 74 OF 138

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/06
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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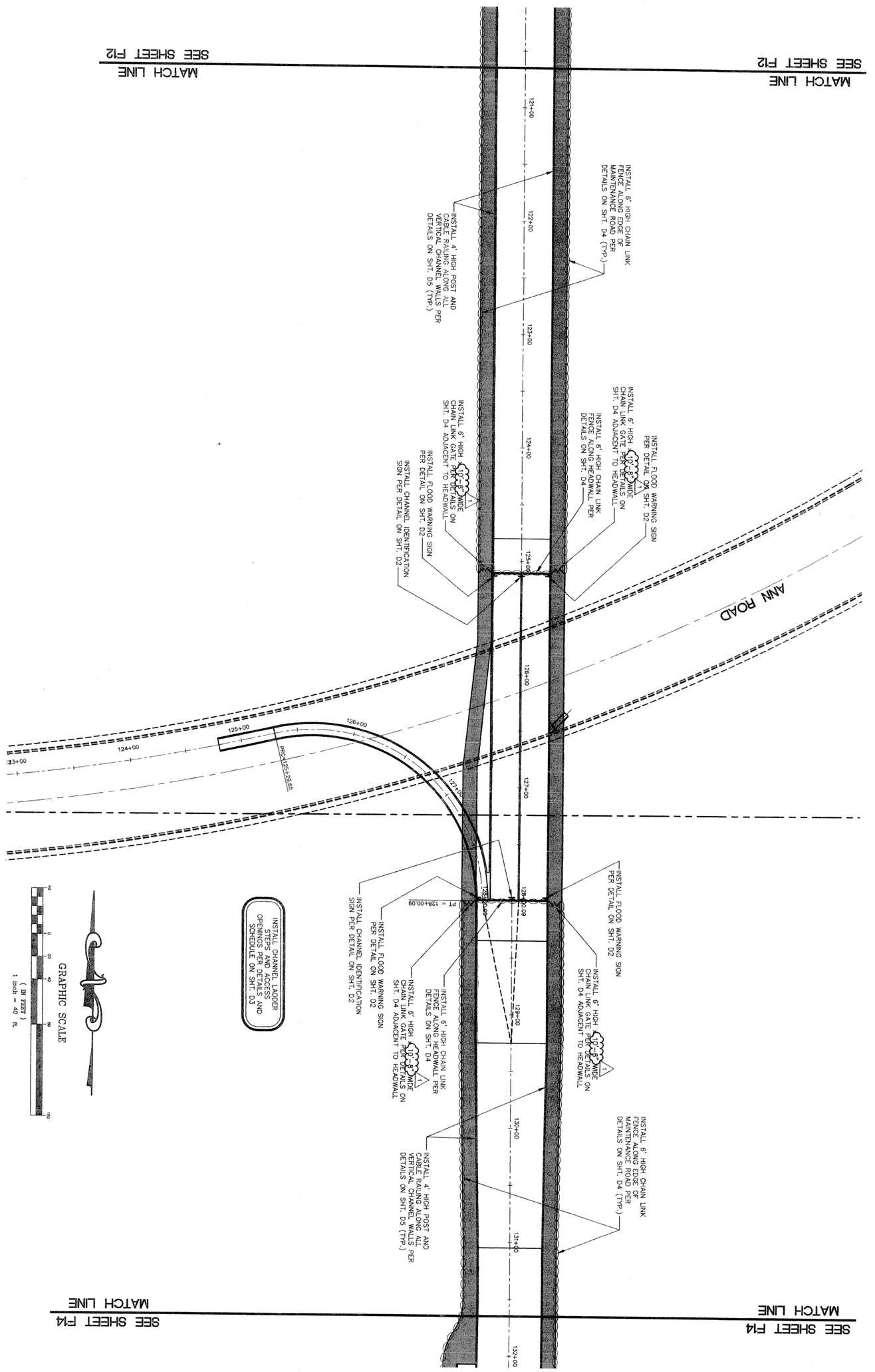
△			

PROJECT NO: FILE NAME:

REPRODUCTIONS NOT VERIFIED



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F13 SHT. 45 OF 138

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
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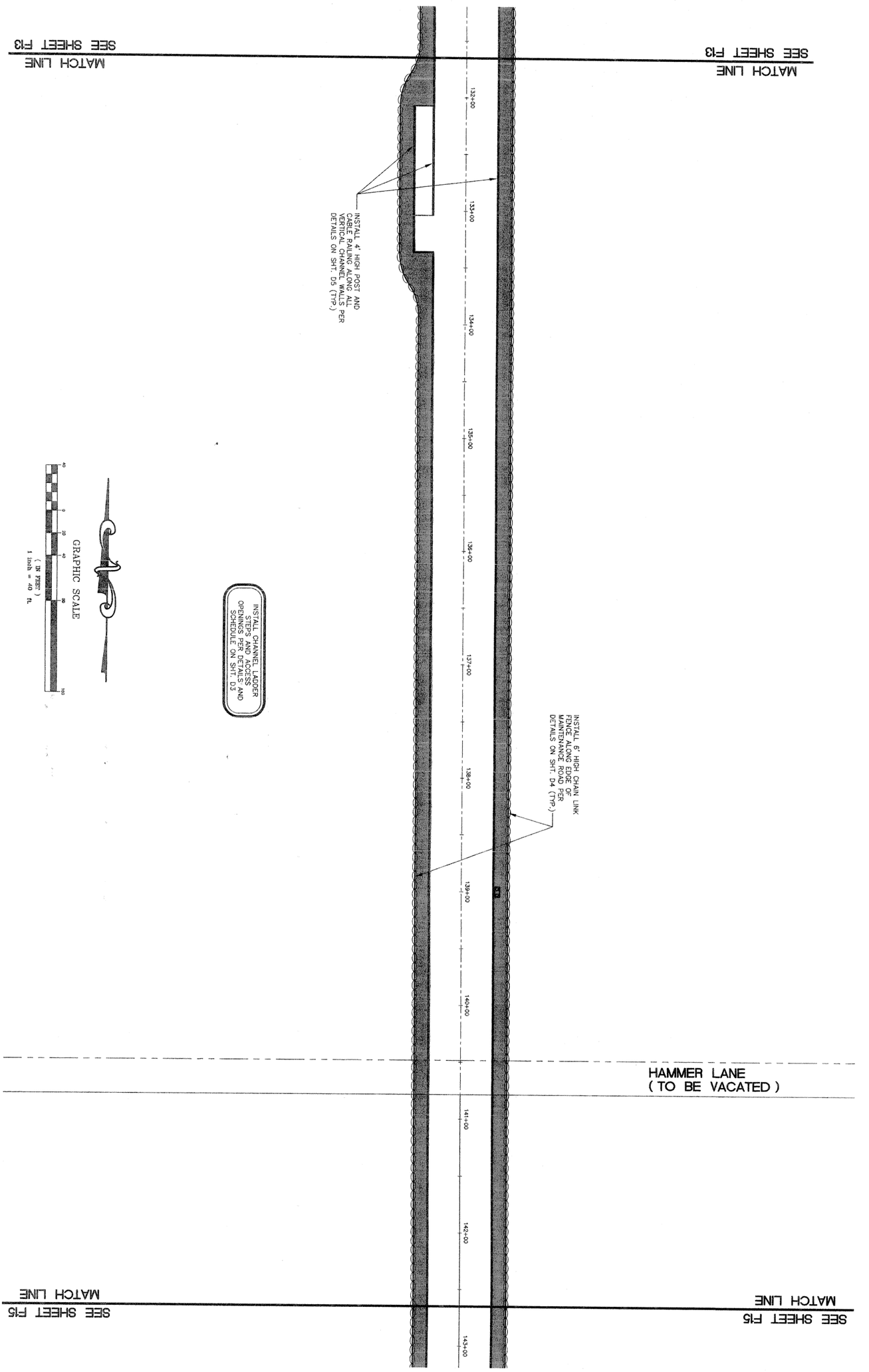
4			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION



ISSUED FOR CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F14 SHT. 14 OF 126

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
No. 9177
CIVIL
1/21/04

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
△			
△			
△			
△			
△			

PROJECT NO: FILE NAME:

MATCH LINE
SEE SHEET F14

SEE SHEET F16
MATCH LINE

INSTALL 6' HIGH CHAIN LINK FENCE ALONG EDGE OF MAINTENANCE ROAD PER DETAILS ON SHT. D4 (TYP.)

143+00 144+00 145+00 146+00 147+00 148+00 149+00 150+00 151+00 152+00

INSTALL 4' HIGH POST AND CABLE RAILING ALONG ALL VERTICAL CHANNEL WALLS PER DETAILS ON SHT. D5 (TYP.)

INSTALL CHANNEL LADDER STEPS AND ACCESS OPENINGS PER DETAILS AND SCHEDULE ON SHT. D3

GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)
1 inch = 40 ft

MATCH LINE
SEE SHEET F14

SEE SHEET F16
MATCH LINE

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
△			
△			
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△			
△			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

REGISTERED ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
No. 9177
PROFESSIONAL ENGINEER
1/21/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7500
FAX (702) 362-2597

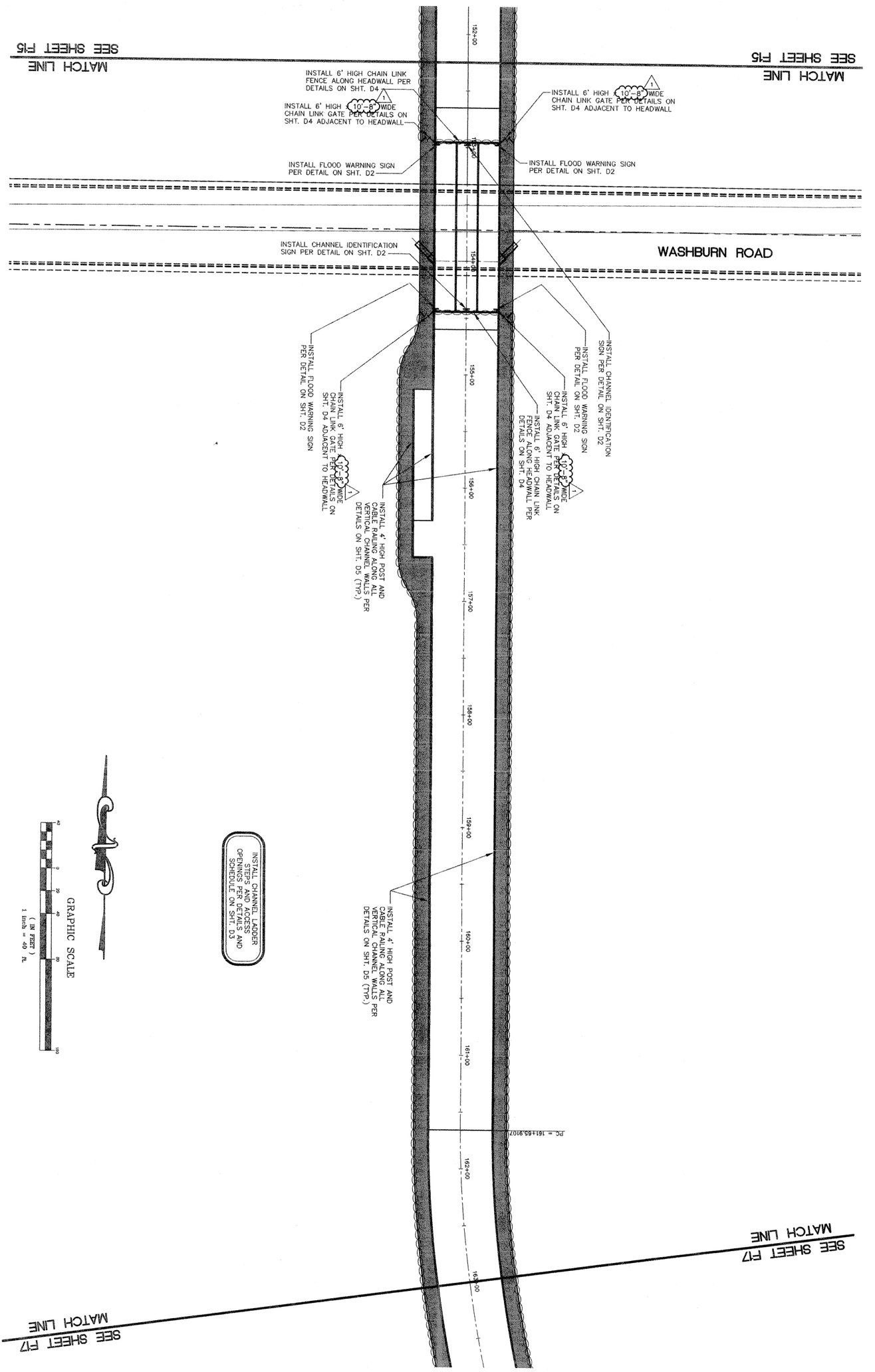
(DRAWING TITLE) FENCE, GATE AND SIGN PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
F15
SHT. 74 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

SHT. 48 OF 128

DRAWING NO. F16

(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
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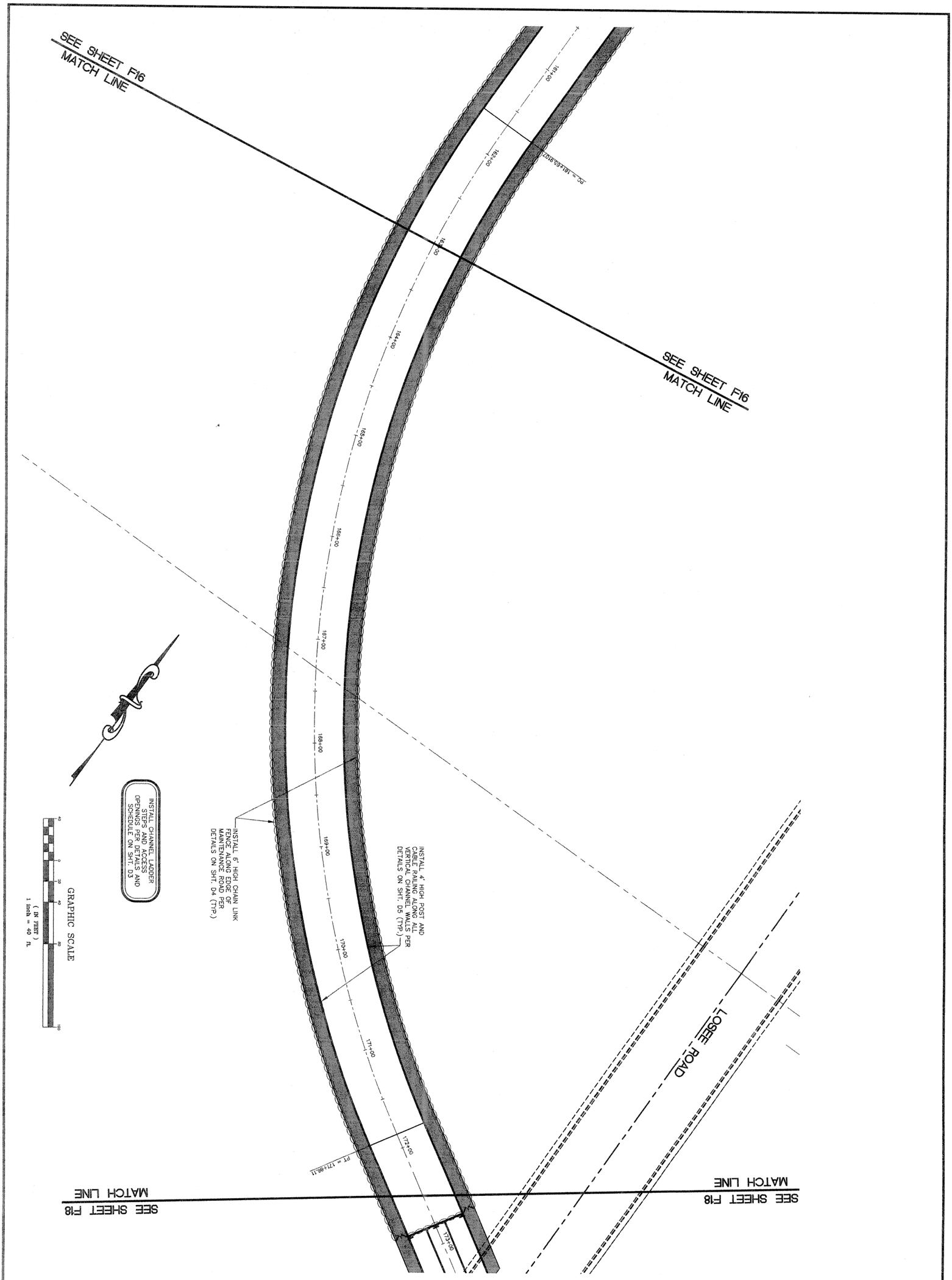
3			
4			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F17

SHT. 79 OF 128

(DRAWING TITLE)

FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)

UPPER LAS VEGAS WASH CHANNEL

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
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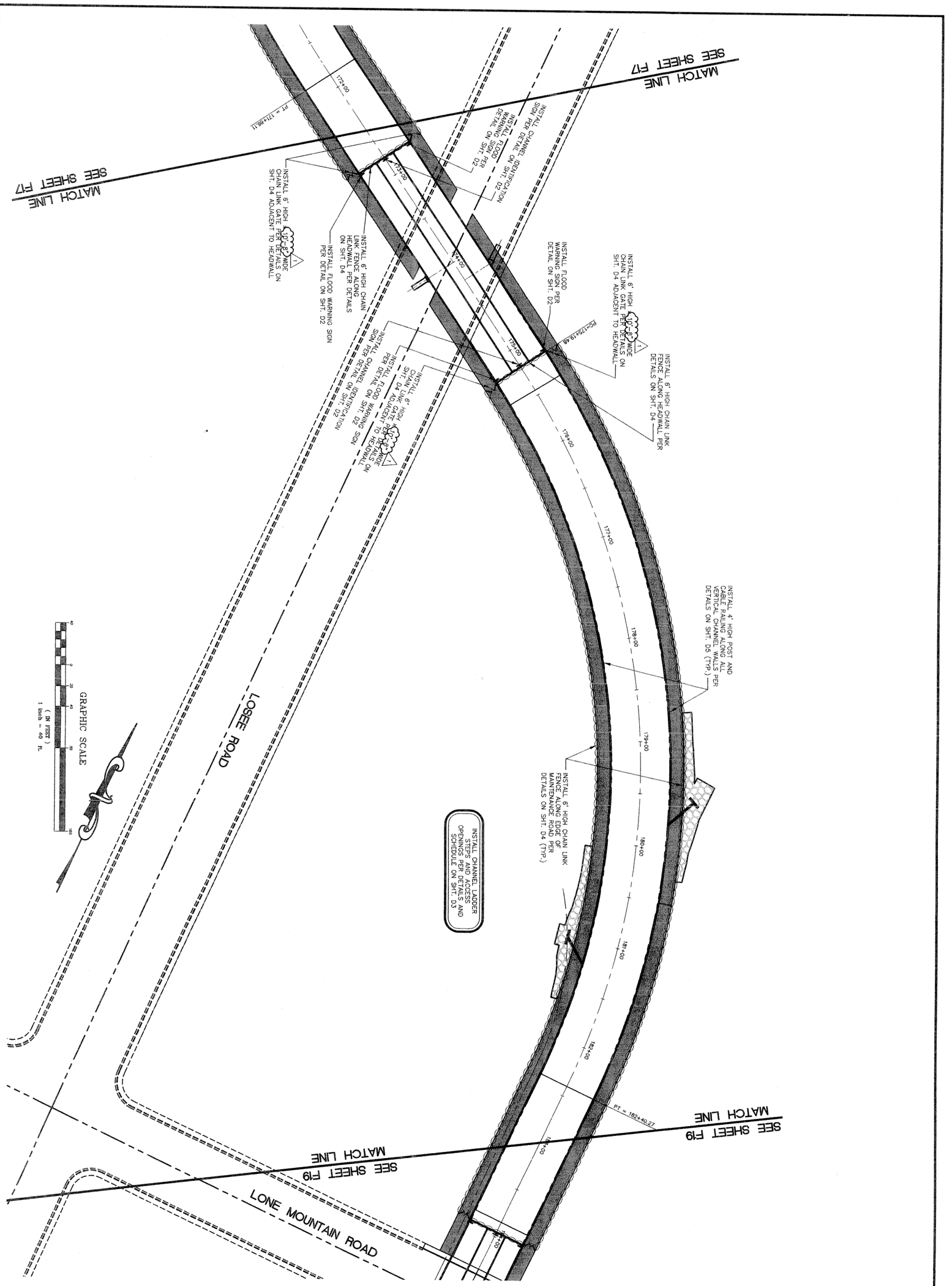
△			
△			
△			
△			

PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F18 SHT. 18 OF 128

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

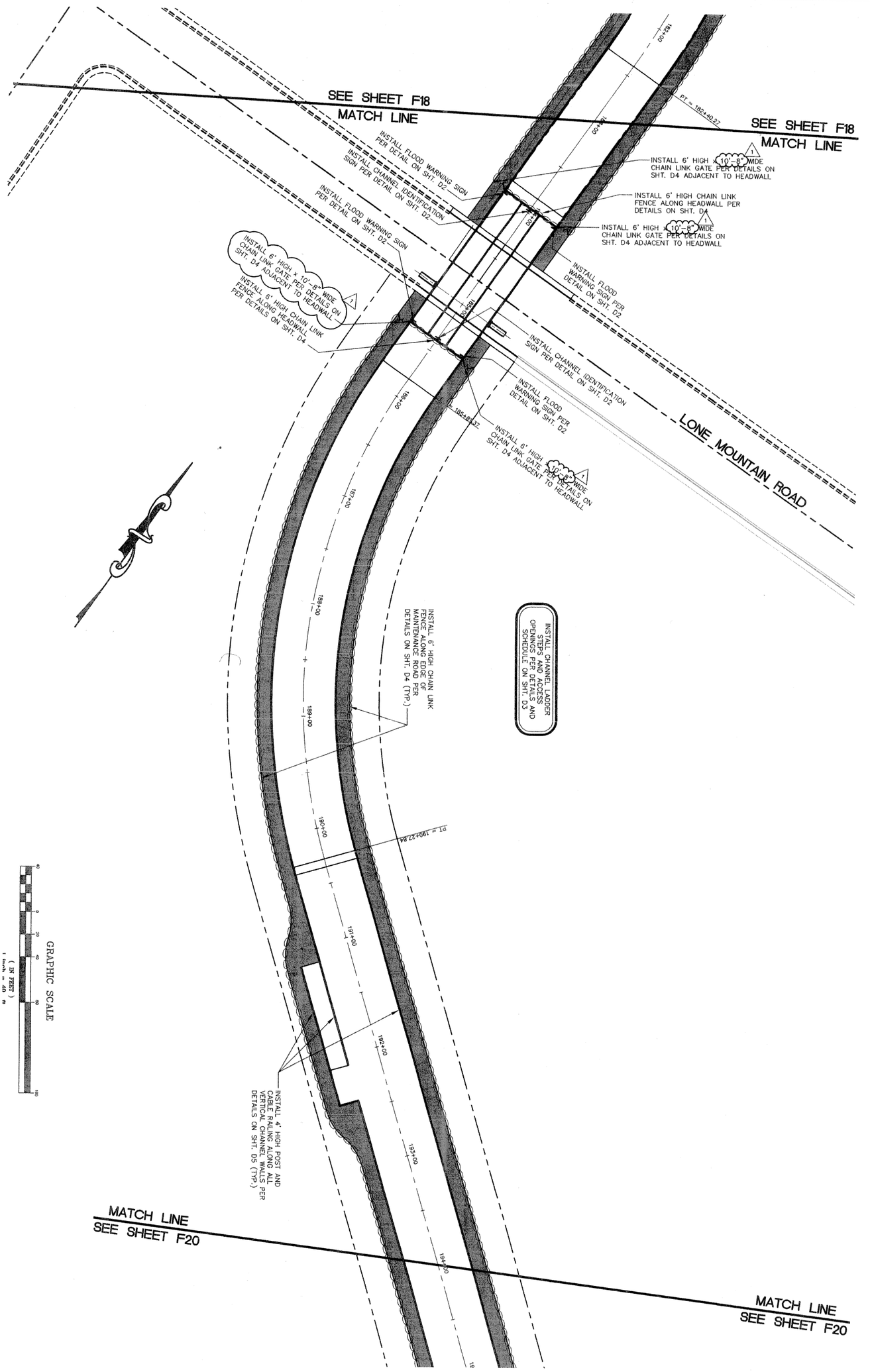
SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VIN
2			
3			
4			

PROJECT NO: FILE NAME:

ACCEPTED AS CONSTRUCTED



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F19 SHT. 81 OF 128

(DRAWING TITLE)
FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD
(LOCATION)

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
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FAX (702) 362-2527

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D GILBRETH
EXP. 08/30/05
CIVIL
No. 9177

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNC
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM #1	2/16/2004	VTN
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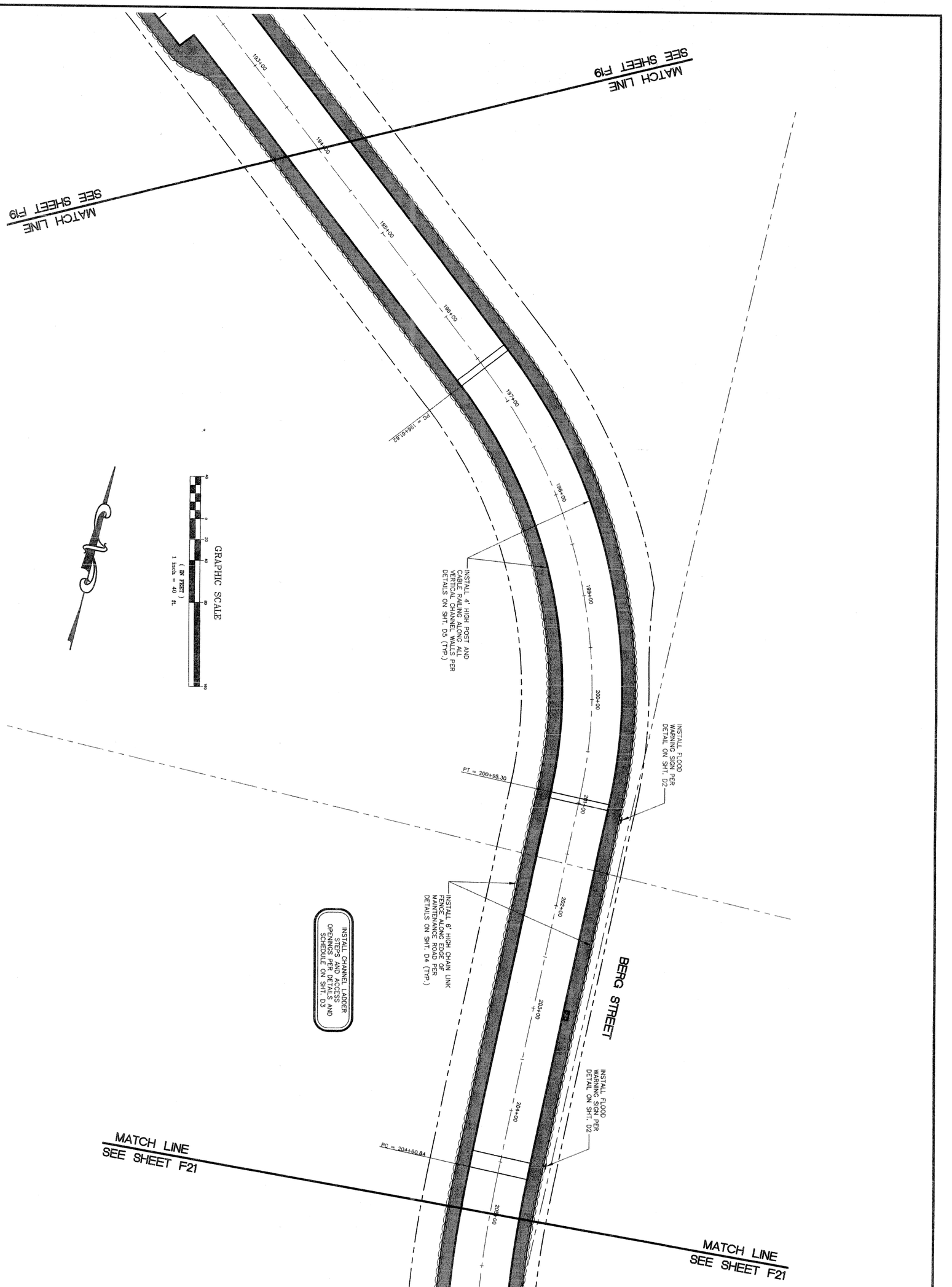
PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F20

SHT. 82 OF 128

(DRAWING TITLE)

FENCE, GATE AND SIGN PLAN

(PROJECT TITLE)

UPPER LAS VEGAS WASH CHANNEL

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
• CONSULTING ENGINEERS
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2727 SOUTH RAINBOW BOULEVARD
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PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
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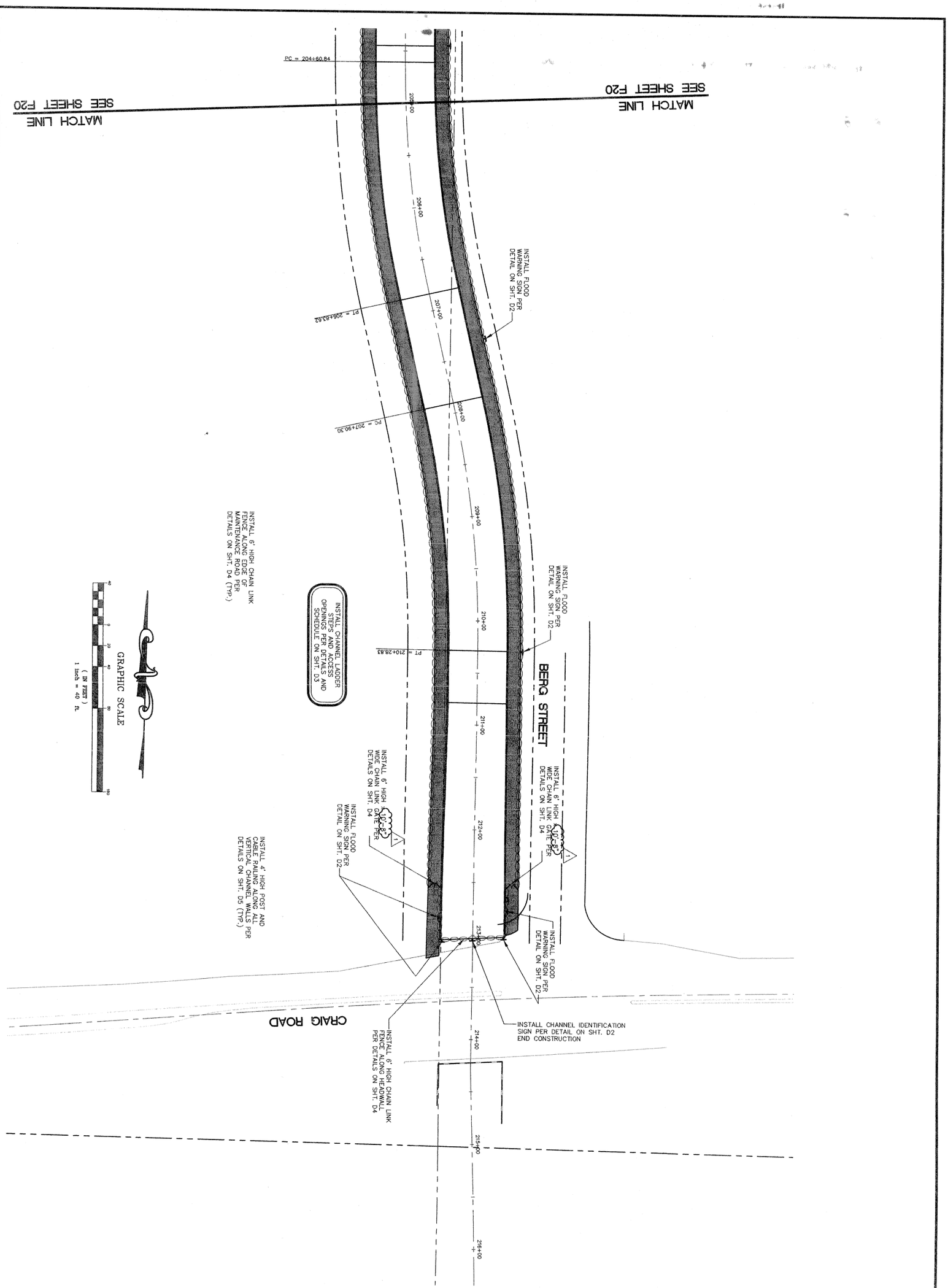
PROJECT NO: FILE NAME:



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. F21 SHT 83 OF 128

(DRAWING TITLE) **FENCE, GATE AND SIGN PLAN**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

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FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177

SCALE:	1"=40'
DESIGN:	DJB
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	1/21/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
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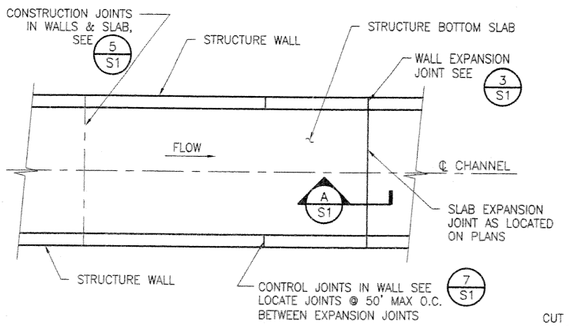
3			
4			

PROJECT NO: FILE NAME:

ACCEPTED FOR CONSTRUCTION

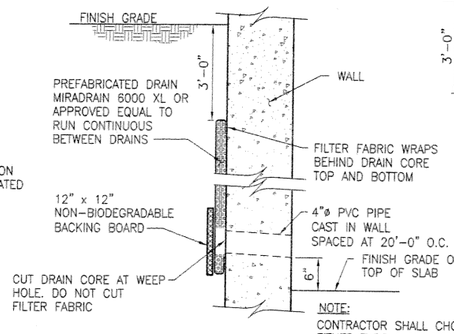


NOTES:

1. CONSTRUCTION JOINTS MAY BE USED AT END OF DAYS CONCRETE PLACEMENT AND AS REQUIRED BY CONTRACTOR.
2. CONSTRUCTION JOINTS MUST BE COINCIDENT WITH WEEPHOLE LOCATION.

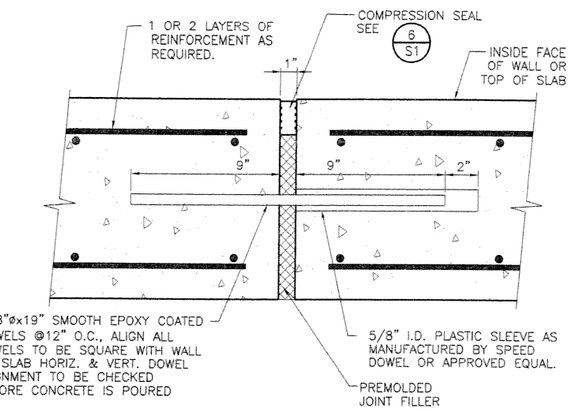
TYPICAL PLAN VIEW FOR JOINTS IN OPEN CHANNEL 1/S1

SCALE: N.T.S.



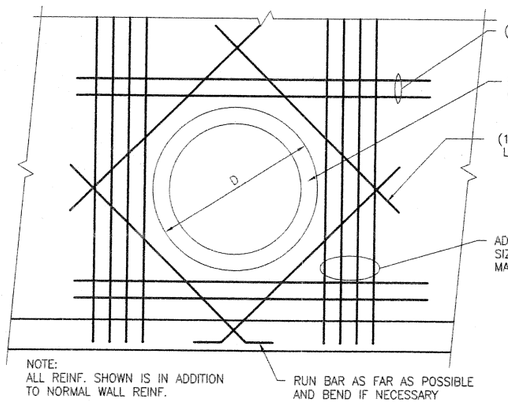
WALL DRAIN TYPICAL DETAIL 2/S1

SCALE: N.T.S.



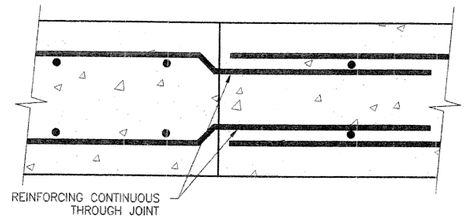
EXPANSION JOINT DETAIL 3/S1

SCALE: N.T.S.



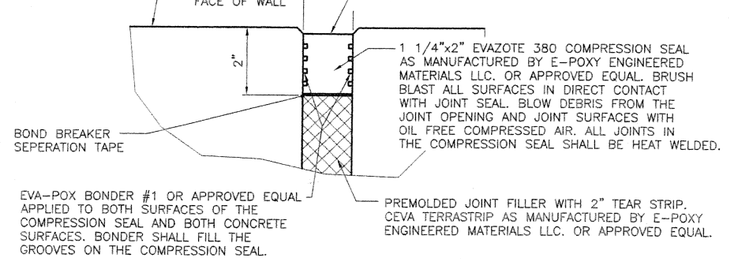
TYPICAL REINF. AT PENETRATION IN CHANNEL WALL 4/S1

SCALE: N.T.S.



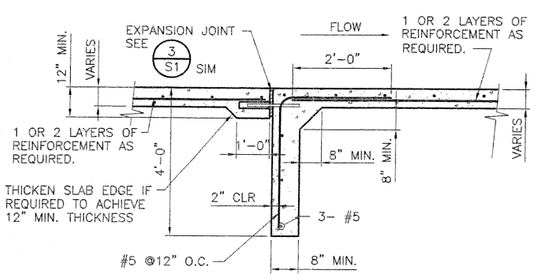
WALL AND SLAB CONSTRUCTION JOINT DETAIL 5/S1

SCALE: N.T.S.



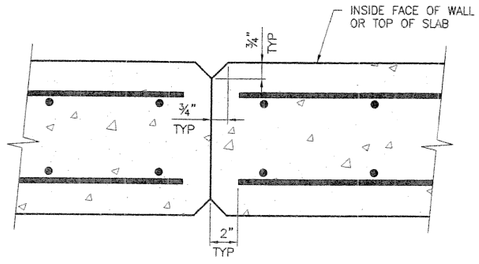
COMPRESSION SEAL DETAIL 6/S1

SCALE: N.T.S.



EXPANSION JOINT SECTION AT BOTTOM SLAB A/S1

SCALE: N.T.S.



WALL CONTROL JOINT DETAIL 7/S1

SCALE: N.T.S.

GENERAL STRUCTURAL NOTES

1. DESIGN CRITERIA: ACI 318-99, AASHTO "STANDARD SPECIFICATIONS FOR HIGHWAY BRIDGES, 16TH EDITION"
2. DESIGN LIVE LOAD IS AASHTO HS20-44 TRUCK LOADING.
3. PORTLAND CEMENT SHALL CONFORM TO A.S.T.M. C-150, TYPE V AGGREGATE SHALL CONFORM TO A.S.T.M. C-33
4. ALL STRUCTURAL CONCRETE SHALL DEVELOP A MINIMUM COMPRESSIVE STRENGTH OF 4500 PSI AT 28 DAYS.
5. ALL REINFORCEMENT STEEL SHALL BE ASTM DESIGNATION A615 GRADE 60.
6. COVERAGE FOR REINFORCING BARS, EXCEPT WHERE OTHERWISE SHOWN, SHALL BE: 3" FOR CONCRETE PLACED AGAINST EARTH; 2" FOR OTHERS.
7. USE 3/4" CHAMFER ON ALL EXPOSED CORNERS.
8. ALL REINFORCING BAR LAP SPLICES SHALL CONFORM TO ACI 318-99.
9. TRANSVERSE JOINTS IN WALLS AND SLABS TO BE LOCATED IN THE SAME PLANE. NO STAGGERING OF JOINTS WILL BE PERMITTED.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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SCALE: AS NOTED
DESIGN: DWS
DRAWN: ELY
CHECKED:
APPROVED:
DATE: 1/21/04
PROJECT NO:
FILE NAME:

DAVID W. SEELEY NEVADA No. 11751 PROFESSIONAL ENGINEER 1/21/04

nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7700
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(DRAWING TITLE) SECTIONS, DETAILS AND STRUCTURAL NOTES

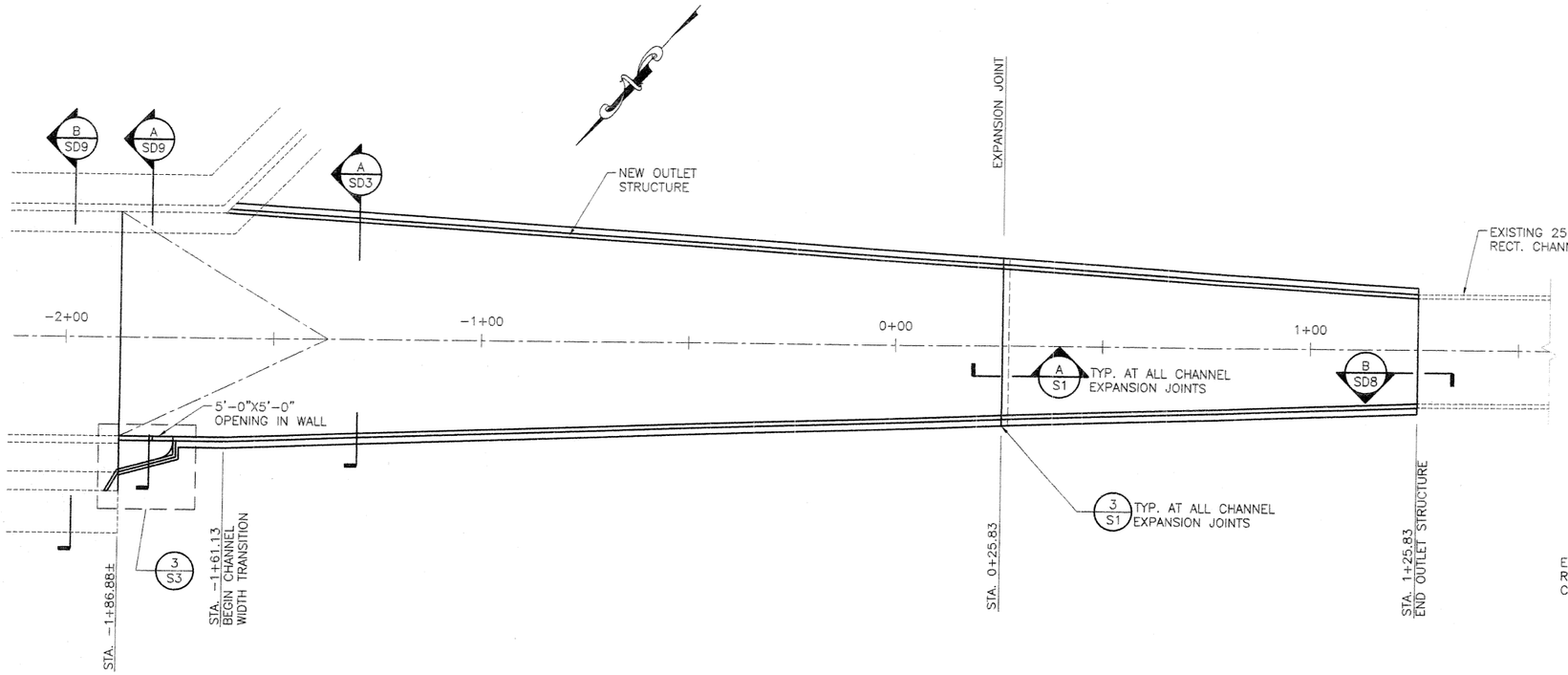
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

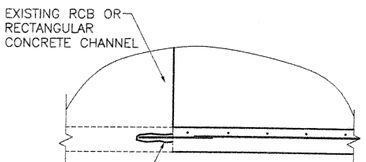
DRAWING NO. S1

SHT. 84 OF 128

ISSUED FOR CONSTRUCTION



BASIN OUTLET STRUCTURE PLAN (1/S2)
SCALE: 1/16" = 1'-0"



SECTION (A/S2)
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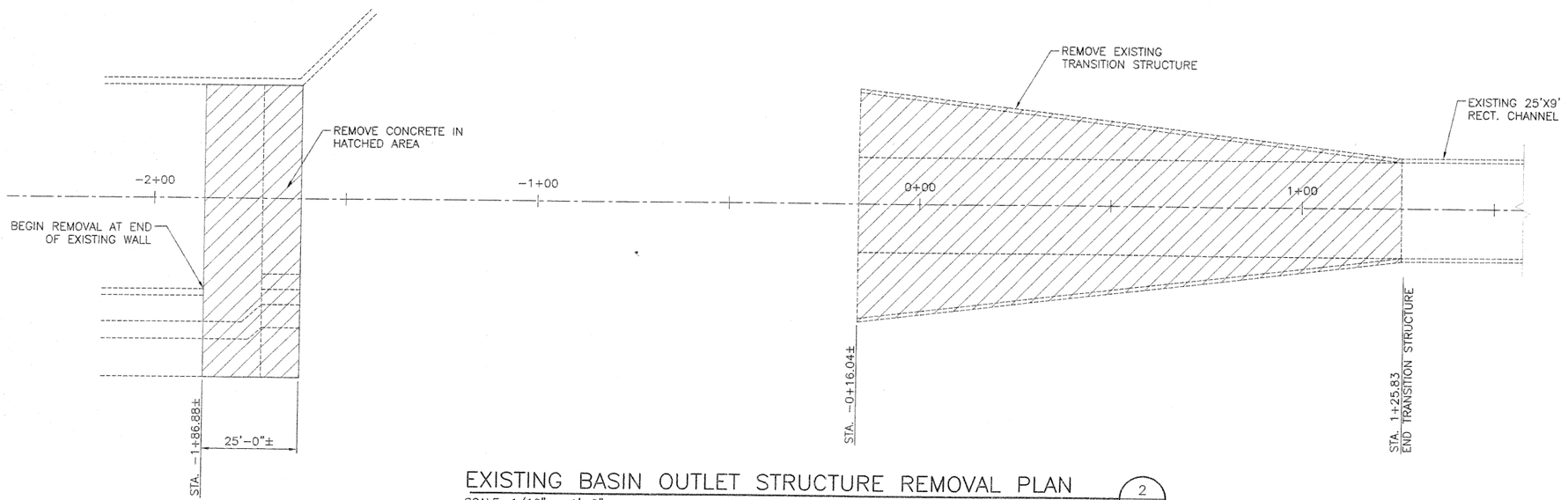

EXISTING BASIN OUTLET STRUCTURE REMOVAL PLAN (2/S2)
SCALE: 1/16" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
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5			

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04
PROJECT NO:
FILE NAME:

ENGINEER STATE OF NEVADA DAVID W. SEELEY No. 11751 PROFESSIONAL ENGINEER 6/30/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
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LAS VEGAS, NEVADA 89146-3148
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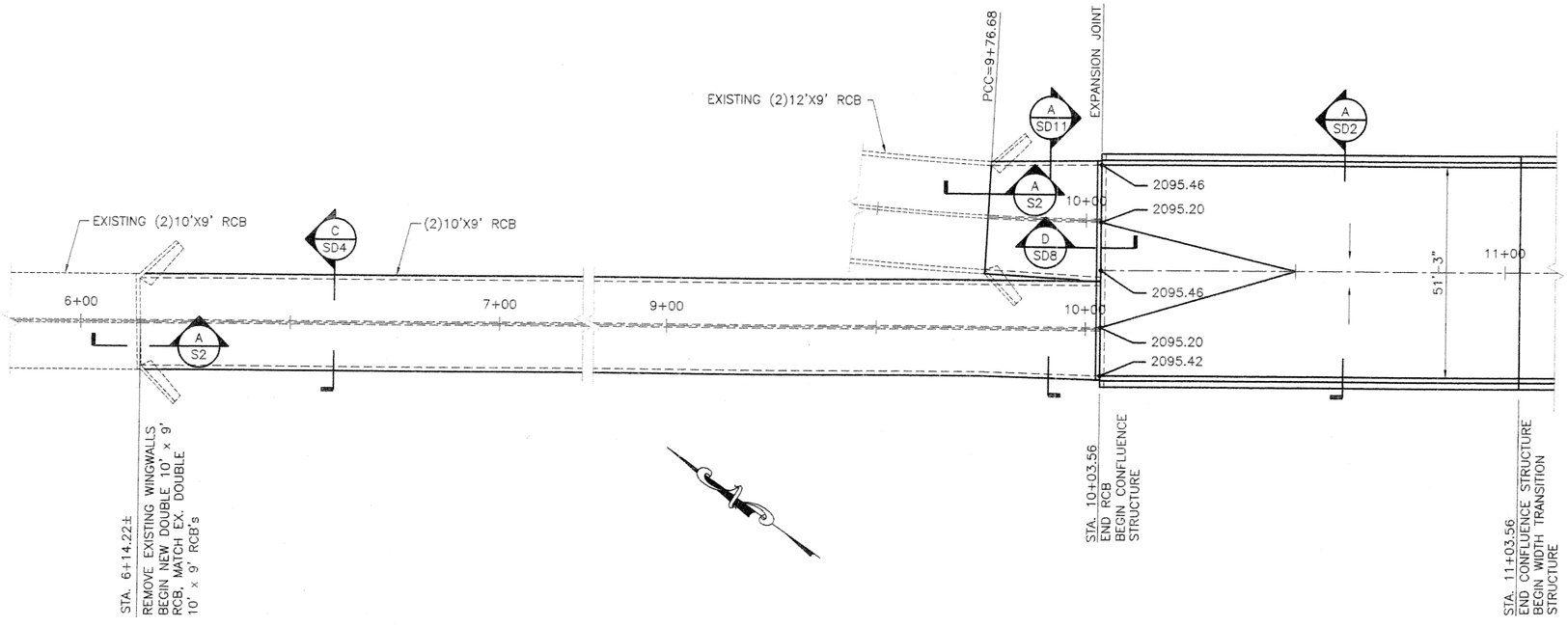
(DRAWING TITLE) OUTLET STRUCTURE PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

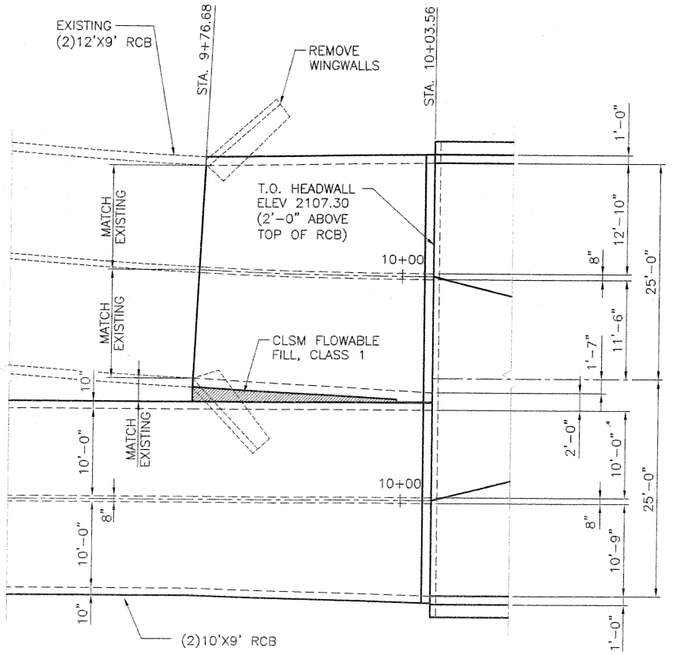
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
S2
SHT. 85 OF 128



CONFLUENCE STRUCTURE PLAN AT STA. 10+00 (1/S3)

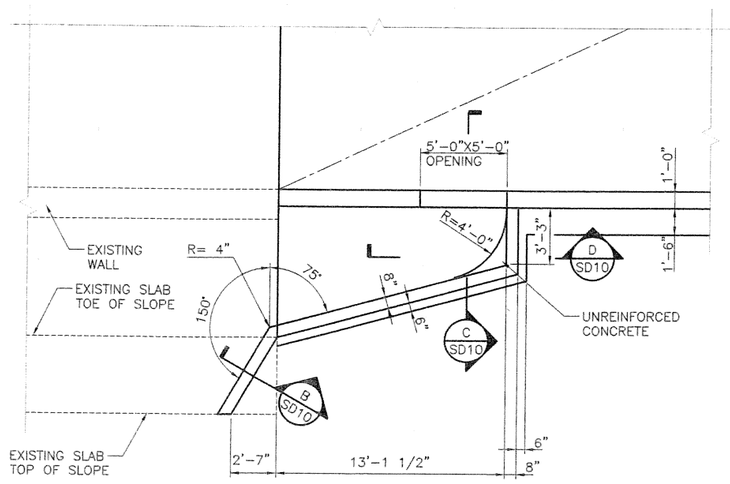
SCALE: 1/16" = 1'-0"



NOTES:
CLSM FLOWABLE FILL, CLASS 1 WILL BE UTILIZED IN ALL CONFINED BACKFILL AREAS WITH A NOMINAL DIMENSION OF 2 FEET OR LESS.

ENLARGED PLAN STA. 9+76.68 TO 10+03.56 (2/S3)

SCALE: 1/8" = 1'-0"



LOW FLOW OUTLET DETAIL (3/S3)

SCALE: 1/4" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE) CONFLUENCE STRUCTURE PLAN AT STA. 10+00

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp. 6/30/04
1/21/04

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

REVISIONS

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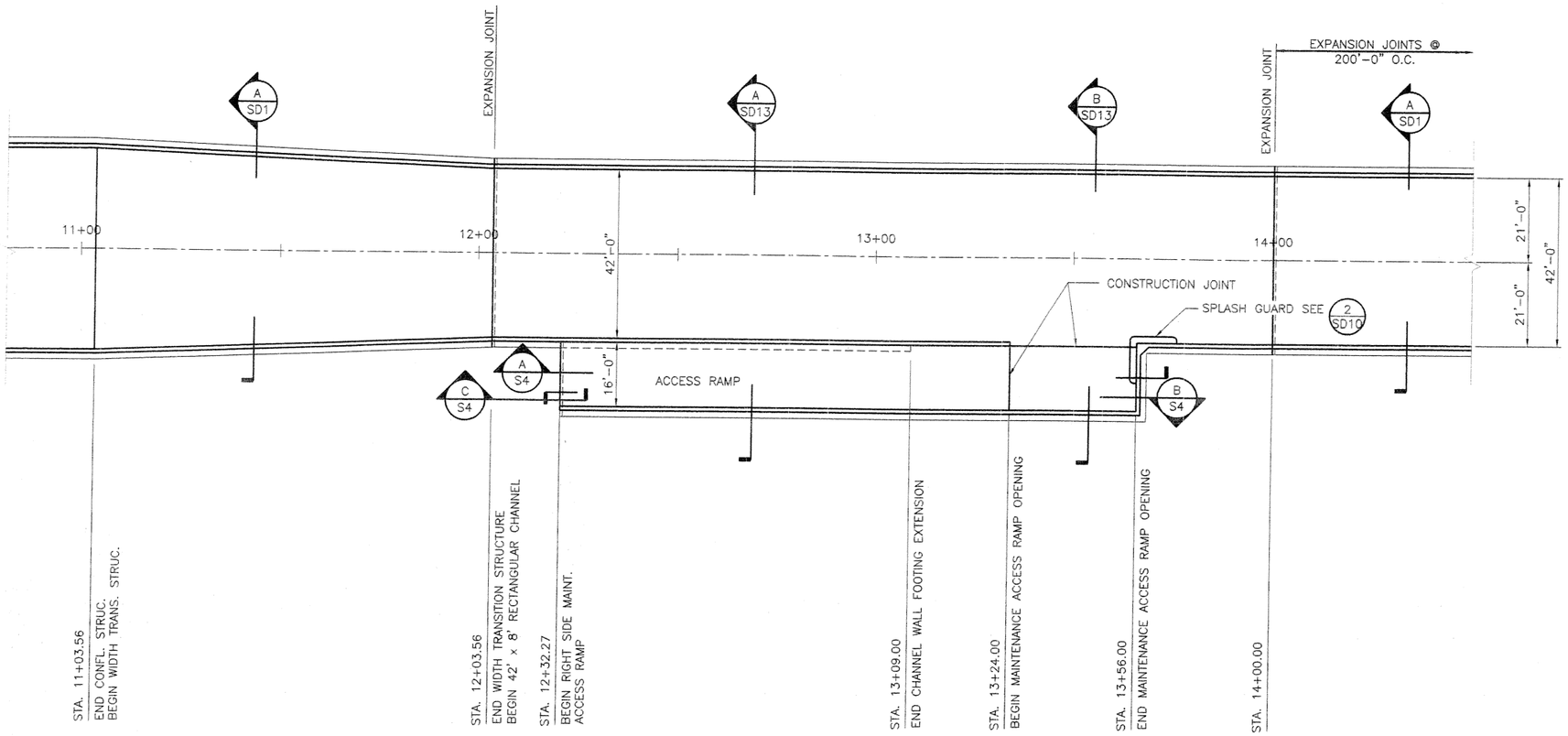
PROJECT NO:
FILE NAME:

DRAWING NO.
S3

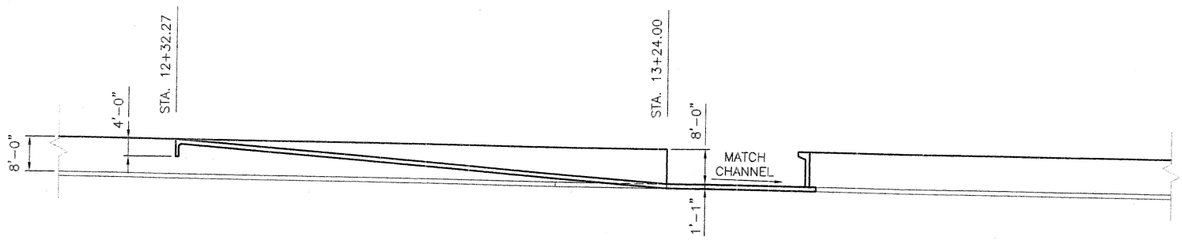
SHT. 86 OF 128

ISSUED FOR CONSTRUCTION



STA 13+40 MAINTENANCE ACCESS RAMP PLAN (1 / S4)

SCALE: 1/16" = 1'-0"



SECTION (A / S4)

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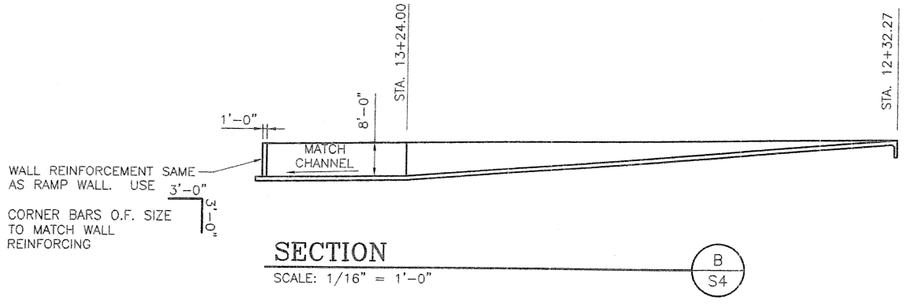

SECTION (B / S4)

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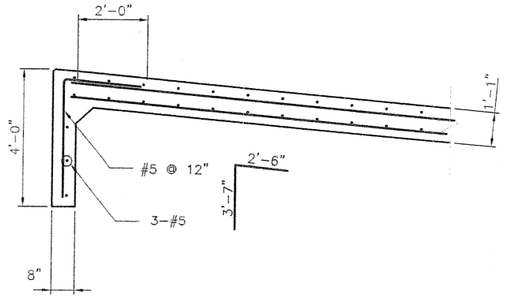

CHANNEL SECTION (C / S4)

SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA/ELY
CHECKED:
APPROVED:
DATE: 1/21/04

ENGINEER: STATE OF NEVADA — DAVID W. SEELY — No. 11751 — EXPIRES 6/30/04 — 1/21/04

PROJECT NO:
FILE NAME:

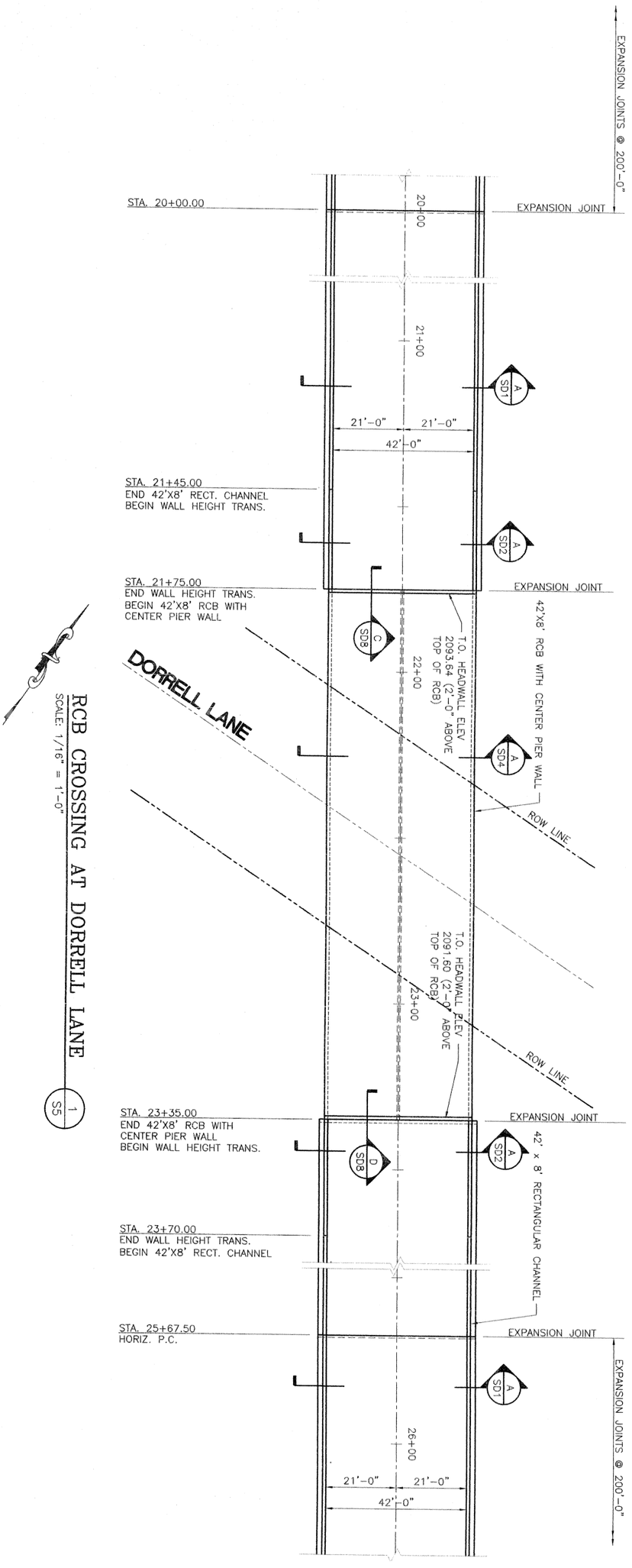
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) ACCESS RAMP AT STA. 13+40 PLAN AND ELEVATION

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD
(LOCATION)

DRAWING NO.
S4
SHT. 87 OF 128

ISSUED FOR CONSTRUCTION



RCB CROSSING AT DORRELL LANE

SCALE: 1/16" = 1'-0"

1 / S5

ISSUED FOR CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S5 SHT. 68 OF 128

(DRAWING TITLE) **RCB CROSSING AT DORRELL LANE**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

VTN nevada
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• PLANNERS
• LAND SURVEYORS
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LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp 6/30/06
1/21/04

SCALE:	AS SHOWN
DESIGN:	DWS
DRAWN:	ALA/ELY
CHECKED:	
APPROVED:	
DATE:	1/21/04

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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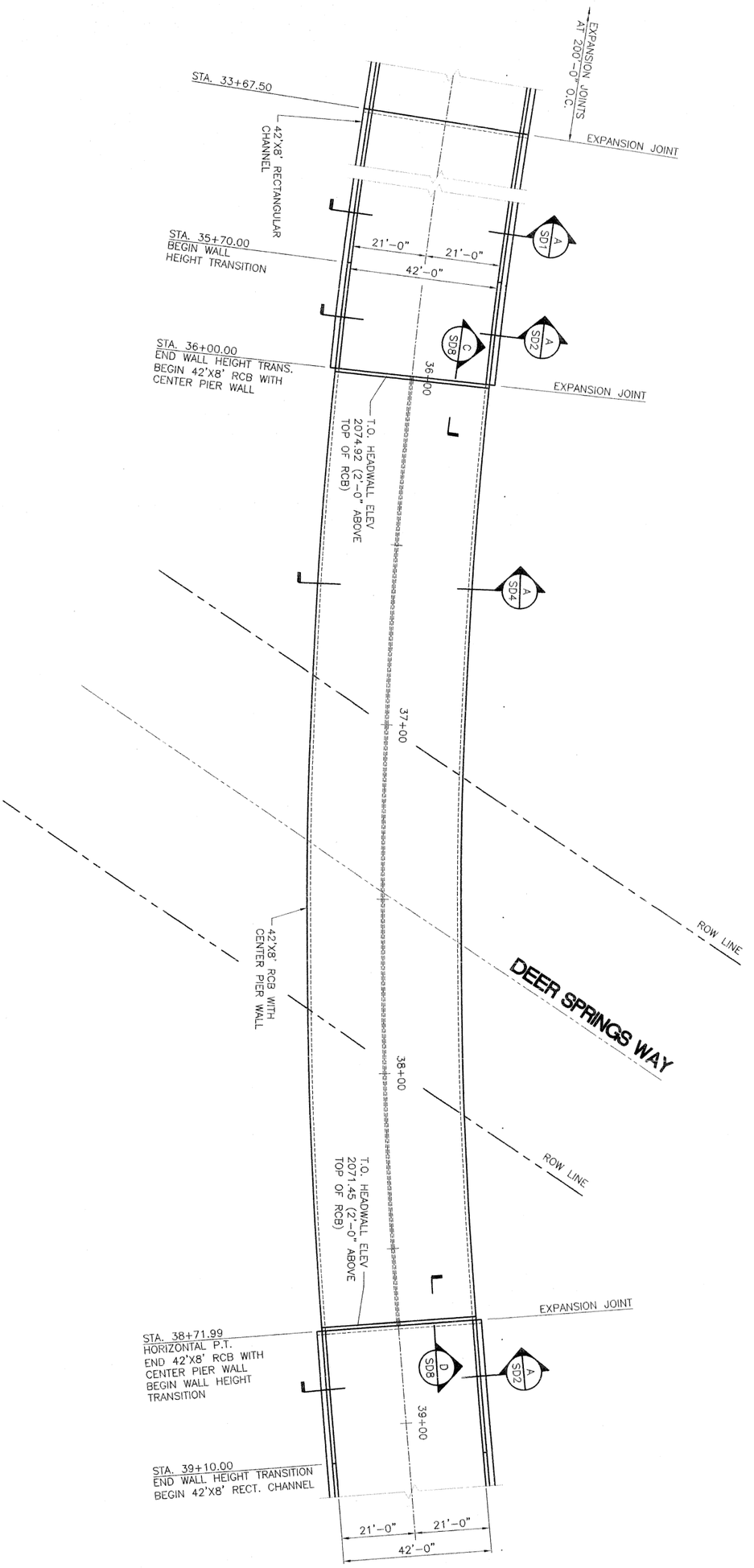
PROJECT NO: FILE NAME:



RCB CROSSING AT DEER SPRINGS WAY

SCALE: 1/16" = 1'-0"

1/S6

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S6 SHT. 8 OF 38

(DRAWING TITLE) PLAN - RCB CROSSING AT DEER SPRINGS WAY

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

VTN nevada
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FAX (702) 362-2597

REGISTERED PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11757
EXP. 6/30/05
7/21/04

SCALE: AS SHOWN	
DESIGN: DWS	
DRAWN: ALA	
CHECKED:	
APPROVED:	
DATE: 1/21/04	

REVISIONS			
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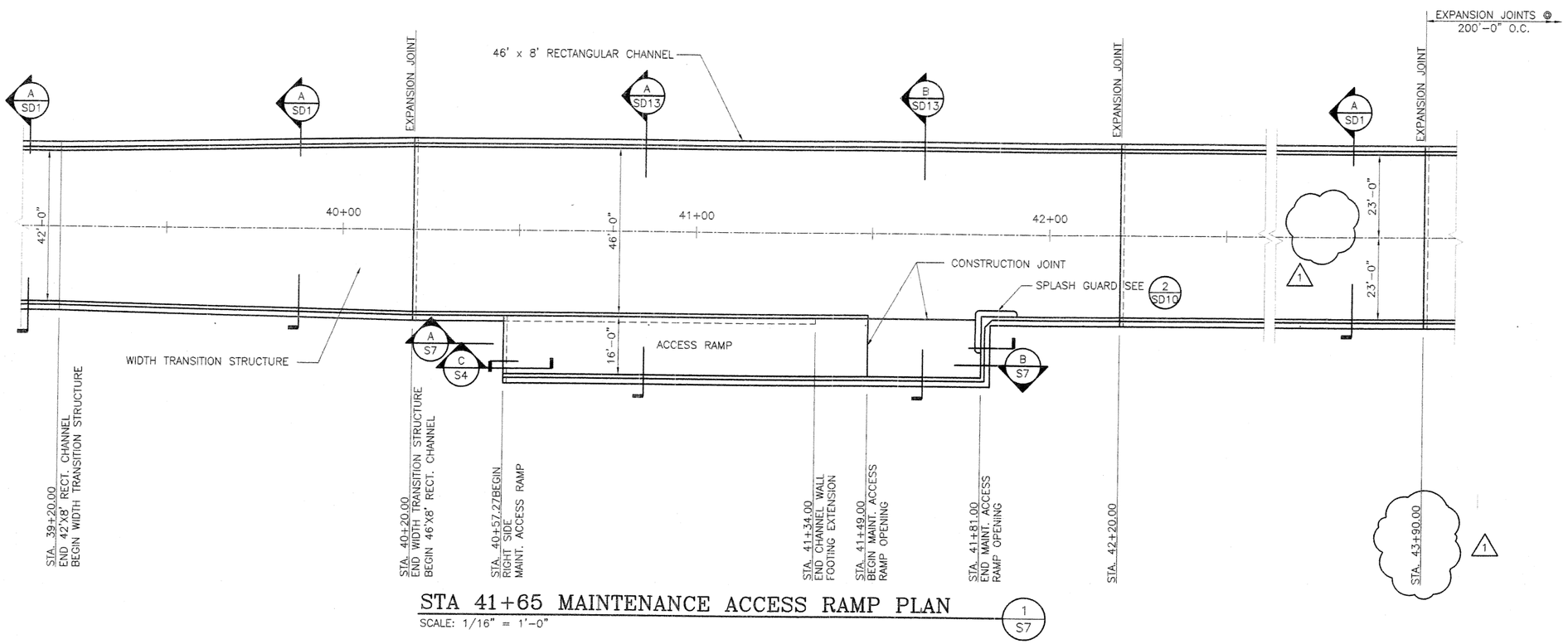
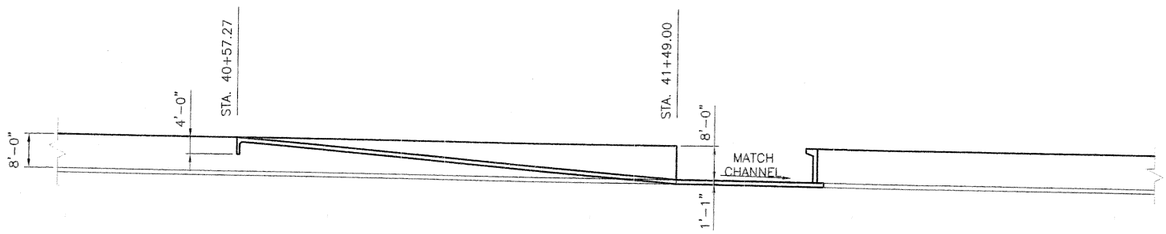
PROJECT NO: FILE NAME:



STA 41+65 MAINTENANCE ACCESS RAMP PLAN (1 / S7)
SCALE: 1/16" = 1'-0"



SECTION (A / S7)
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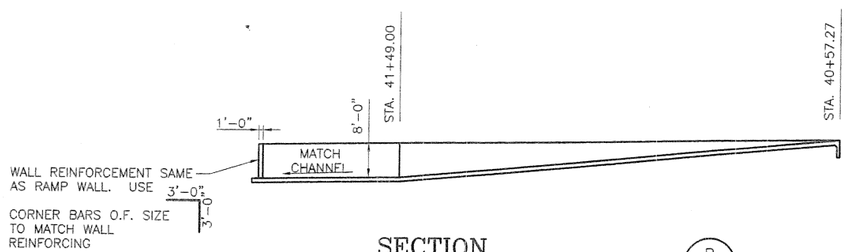


SECTION (B / S7)
SCALE: 1/16" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM 3	3/15/04	DWS

PROJECT NO: FILE NAME:

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROFESSIONAL ENGINEER - STATE OF NEVADA DAVID W. SEELEY No. 11751 EXP. 6/30/04 3/12/04

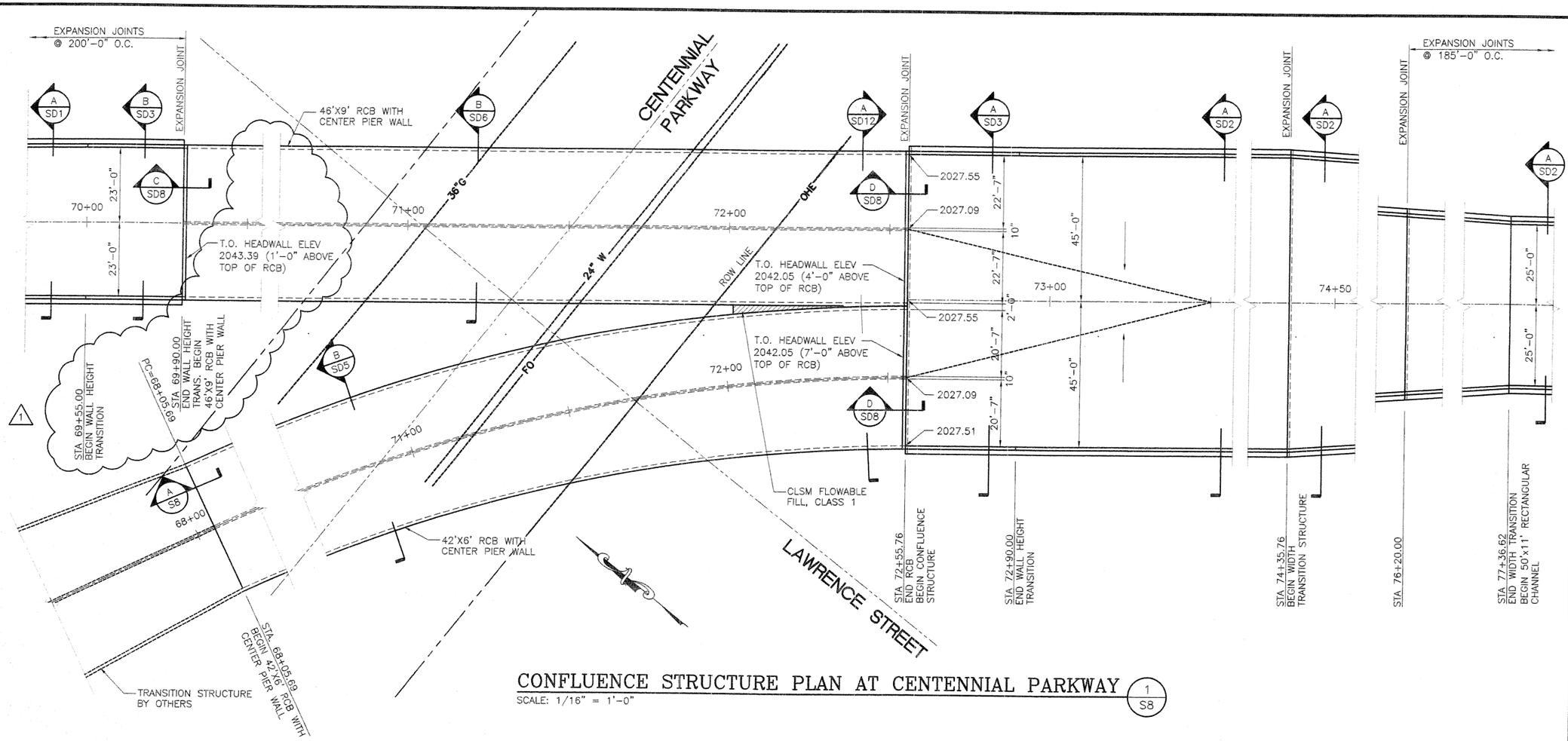
vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD LAS VEGAS, NEVADA 89146-5148 PHONE (702) 873-7550 FAX (702) 362-2597

(DRAWING TITLE) ACCESS RAMP AT STA. 41+65 PLAN AND ELEVATIONS
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. S7

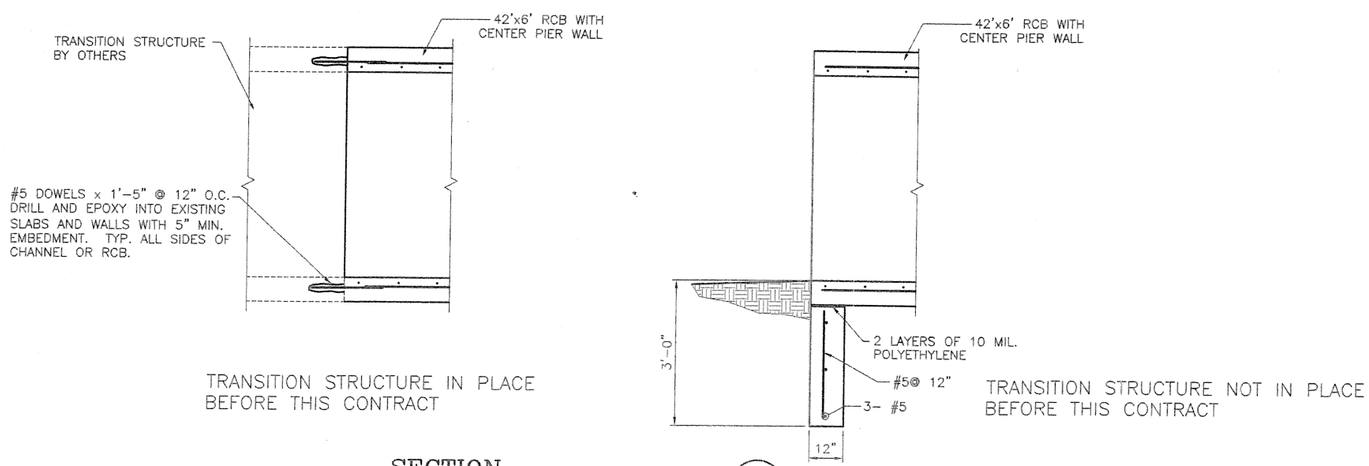
SHT. 90 OF 128

ISSUED FOR CONSTRUCTION



CONFLUENCE STRUCTURE PLAN AT CENTENNIAL PARKWAY (1/S8)

SCALE: 1/16" = 1'-0"



SECTION (A/S8)

SCALE: N.T.S.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM 3	3/15/04	DWS

PROJECT NO: FILE NAME:

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA/ELY
CHECKED:
APPROVED:
DATE: 1/21/04

PROFESSIONAL ENGINEER - STATE OF NEVADA DAVID W. SEELEY No. 11751 EXP. 6/30/04 3/12/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) CONFLUENCE STRUCTURE PLAN AT CENTENNIAL PARKWAY

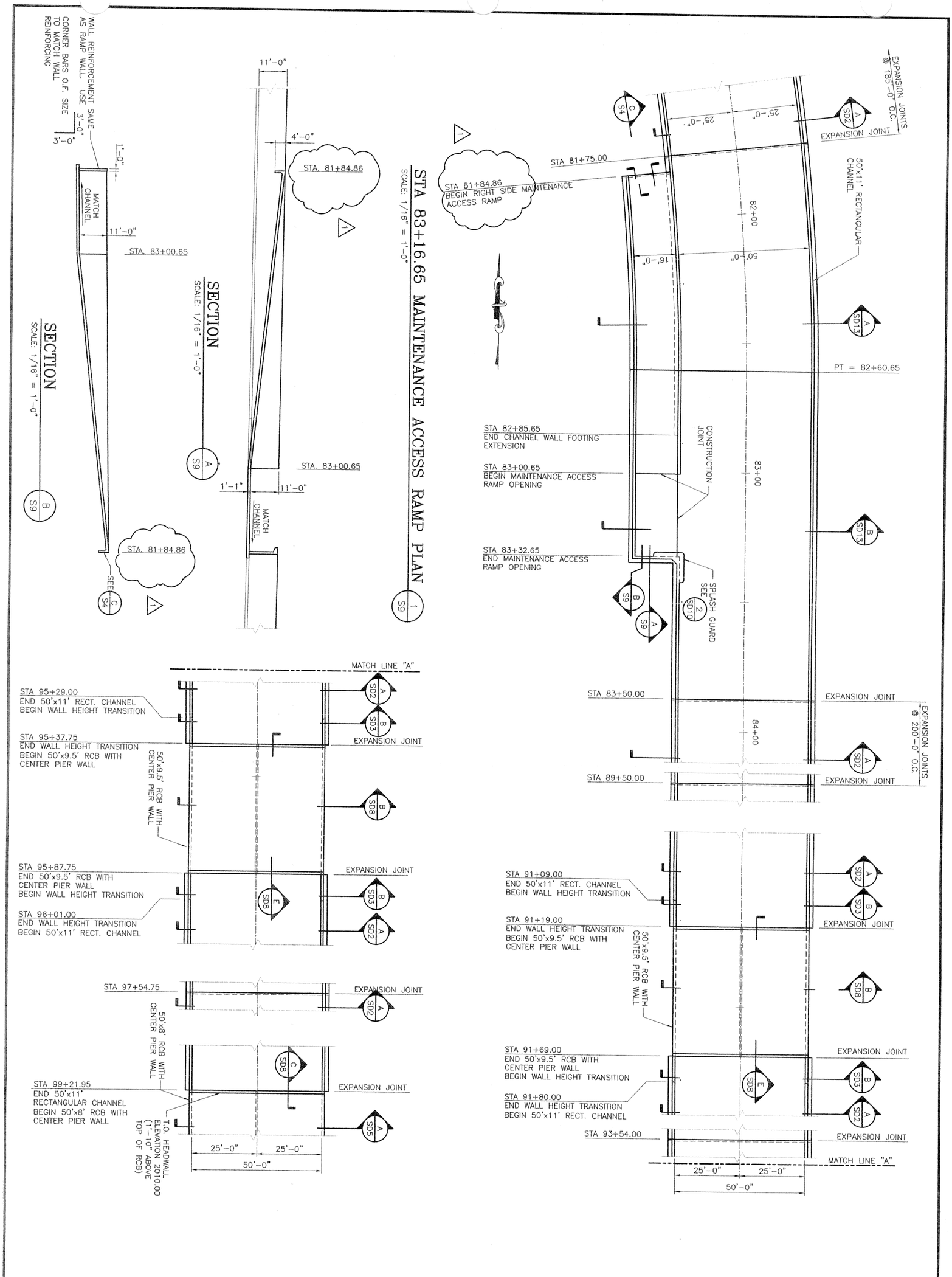
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. S8

SHT. 91 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S9

SHT. 92 OF 128

(DRAWING TITLE) ACCESS RAMP AT STA. 83+16.65 PLAN AND ELEVATIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp. 6/30/04 6/9/04

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA/ELY
CHECKED:
APPROVED:
DATE: 1/21/04

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM 3	3/15/04	DWS

PROJECT NO:
FILE NAME:

ISSUED FOR CONSTRUCTION

ADDITIVE ALTERNATE #4

SEE SHEET PR05 MATCH LINE

SEE SHEET PR07 MATCH LINE

EXISTING GROUND SURFACE PROFILE 45' RIGHT OF CHANNEL CENTERLINE – TYP.

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL – TYP.

EXISTING GROUND SURFACE PROFILE 45' LEFT OF CHANNEL CENTERLINE – TYP.

HGL

2053.10 INV.

-1.28%

TOE OF CHANNEL AT INSIDE WALL – TYP.

2054.46 TOP WALL

-0.70%

2042.18 INV.

STA. 47+47.00, 23.00' LT.
INSTALL 45° 24 L.F. x 36" RCP STUB
@ 2.0% PER DETAILS ON SHT. SD14
WITH PLUG PER DETAIL ON SHT. 02
INV. INTO CHANNEL = 2052.04

STA. 47+95.00, 23.00' RT.
INSTALL 45° 24 L.F. x 48" RCP STUB
@ 2.0% PER DETAILS ON SHT. SD14
WITH PLUG PER DETAIL ON SHT. 02
INV. INTO CHANNEL = 2050.29

STA. 49+30.00
GRADE BREAK
INV. = 2046.00

STA. 52+28.00, 23.00' LT.
INSTALL 45° 24 L.F. x 24" RCP STUB
@ 2.0% PER DETAILS ON SHT. SD14
WITH PLUG PER DETAIL ON SHT. 02
INV. INTO CHANNEL = 2048.14

REFER TO STRUCTURAL DRAWINGS FOR CUTOFF WALL LOCATIONS

Q = 5880 CFS

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

2074 2072 2070 2068 2066 2064 2062 2060 2058 2056 2054 2052 2050 2048 2046 2044 2042 2040 2038 2036 2034 2032 2030 2028 2026 2024 2022 2020 2018 2016 2014 2012 2010 2008 2006 2004 2002 2000

44+00 45+00 46+00 47+00 48+00 49+00 50+00 51+00 52+00 53+00 54+00 55+00

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
4	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
3			
2			
1			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

NEVADA STATE OF NEVADA KEN D. GILBRETH No. 9177 CIVIL

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PROFILE - STA. 43+75 TO STA.54+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR06
SHT. 20 OF 128

ISSUED FOR CONSTRUCTION

ADDITIVE ALTERNATE #4

MATCH LINE SEE SHEET PL06

STA. 55+02.00, 23.00' LT.
INSTALL 45° 24 L.F. x 24" RCP STUB @ 2.0% PER DETAILS ON SHT. SD14 WITH PLUG PER DETAIL ON SHT. D2

STA. 55+15.00, 23.00' LT.
INSTALL 45° 24 L.F. x 24" RCP STUB @ 2.0% PER DETAILS ON SHT. SD14 WITH PLUG PER DETAIL ON SHT. D2

STA. 58+48.00, 23.00' LT.
INSTALL 45° 24 L.F. x 36" RCP STUB @ 2.0% PER DETAILS ON SHT. SD14 WITH PLUG PER DETAIL ON SHT. D2

STA. 61+66.00, 23.00' LT.
INSTALL 45° 24 L.F. x 18" RCP STUB @ 2.0% PER DETAILS ON SHT. SD14 WITH PLUG PER DETAIL ON SHT. D2

APPROX. LIMITS OF GRADING
REFER TO SHEETS GR1-GR8

T.C.E.

12' MAINT. ROAD

55+00 56+00 57+00 58+00 59+00 60+00 61+00 62+00 63+00 64+00 65+00 66+00

72.00' DRAINAGE R.O.W.

(CONT.)

GRADE BREAK

GRADE BREAK

46' x 8' RECT. CHAN.

SEE SHEET PL08 MATCH LINE

MATCH LINE SEE SHEET PL06

APPROX. LIMITS OF GRADING
REFER TO SHEETS GR1-GR8
(FINAL LIMITS TO BE DETERMINED BY ADJOINING DEVELOPMENT GRADING)

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

Avoid cutting underground utility lines. It's costly.
2 working days
Call before you Dig
1-800-227-2600
Underground Service Alert (U.S.A.)

FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1

FOR FENCING AND GATING REFER TO SHEETS F1-F21

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 6/30/06 No 9177

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2272 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7450
FAX (702) 362-2997

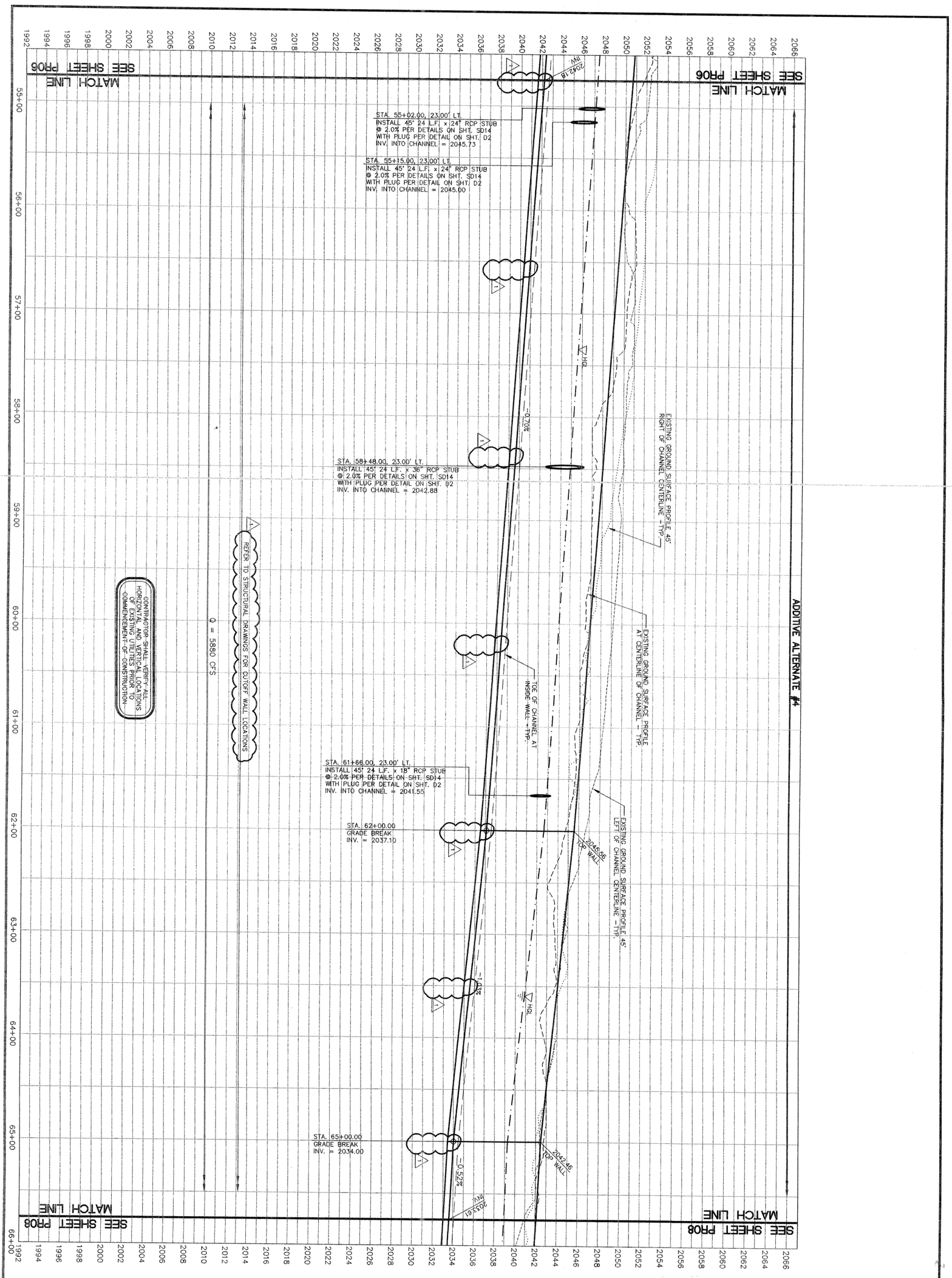
(DRAWING TITLE) PLAN VIEW - STA. 54+75 TO STA. 65+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL07
SHT. 21 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR07

SHT. 22 OF 128

(DRAWING TITLE) PROFILE - STA. 54+75 TO STA. 65+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

REVISIONS

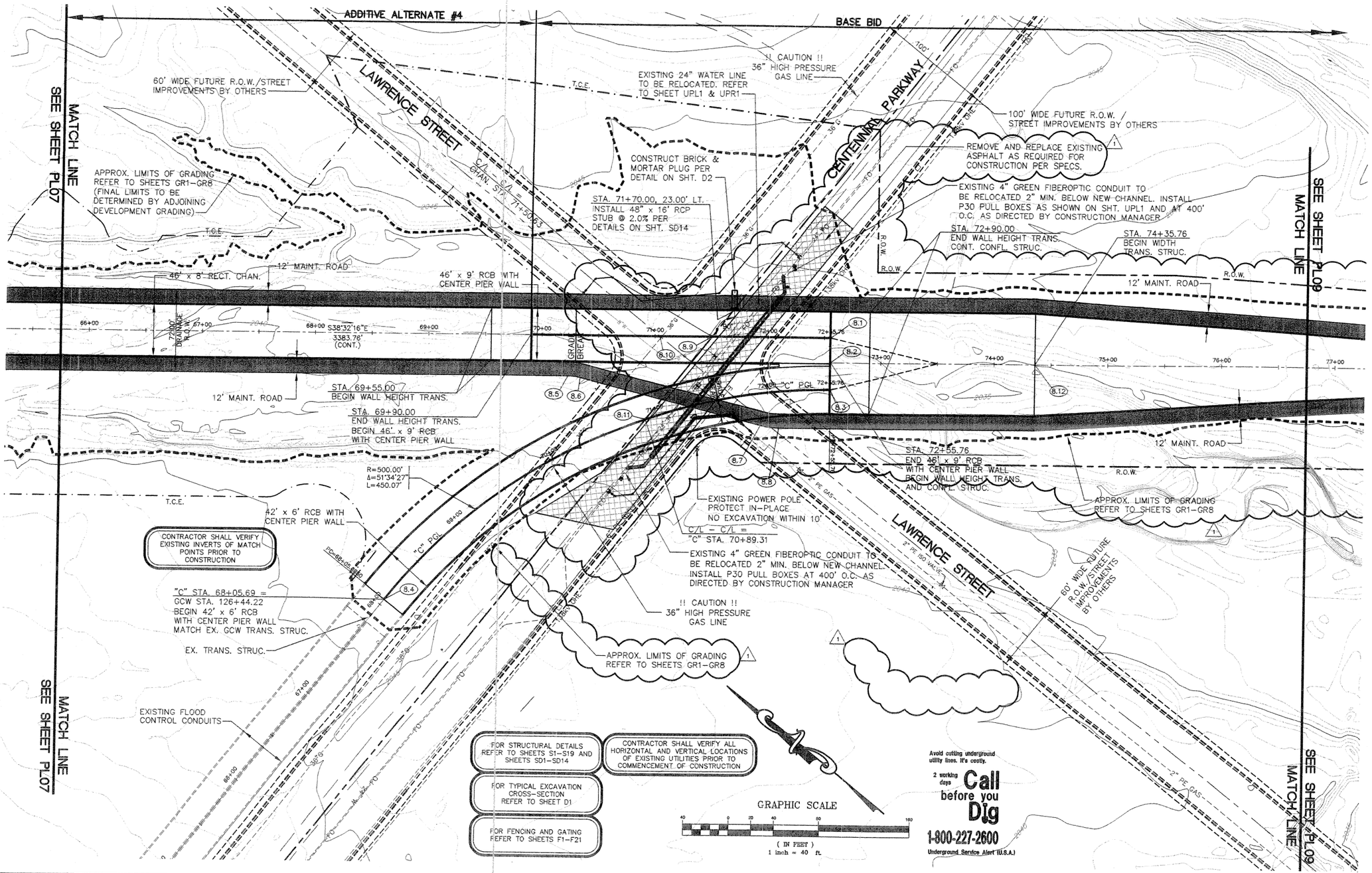
NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			
△			

PROJECT NO: FILE NAME:

ISSUED FOR CONSTRUCTION

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
(8.1)	84513.4736	68196.4373	END RCB	(8.5)	84672.8297	68023.4839	RD. EDGE P.C.	(8.9)	84595.7016	68130.9416	C/L – C/L
(8.2)	84499.7669	68179.2290	BEGIN CONFL.	(8.6)	84663.5175	68029.1715	RD. EDGE P.T.	(8.10)	84631.9361	68102.0804	C/L – C/L
(8.3)	84484.8142	68160.4563	END RCB	(8.7)	84513.0745	68097.0739	RD. EDGE P.C.	(8.11)	84595.5135	68037.1911	C/L – C/L
(8.4)	84673.2980	67768.3795	BEGIN RCB, P.C.	(8.8)	84499.1061	68105.6053	RD. EDGE P.T.	(8.12)	84358.9714	68291.3745	BEG. TRANS. STRUC.



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			
△			
△			

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO:
FILE NAME:

REGISTERED ENGINEER — STATE OF NEVADA — KEN D. GILBRETH — EXP. 06/30/06 — No 9171 — PROFESSIONAL ENGINEER — 3/11/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2599
FAX (702) 362-2597

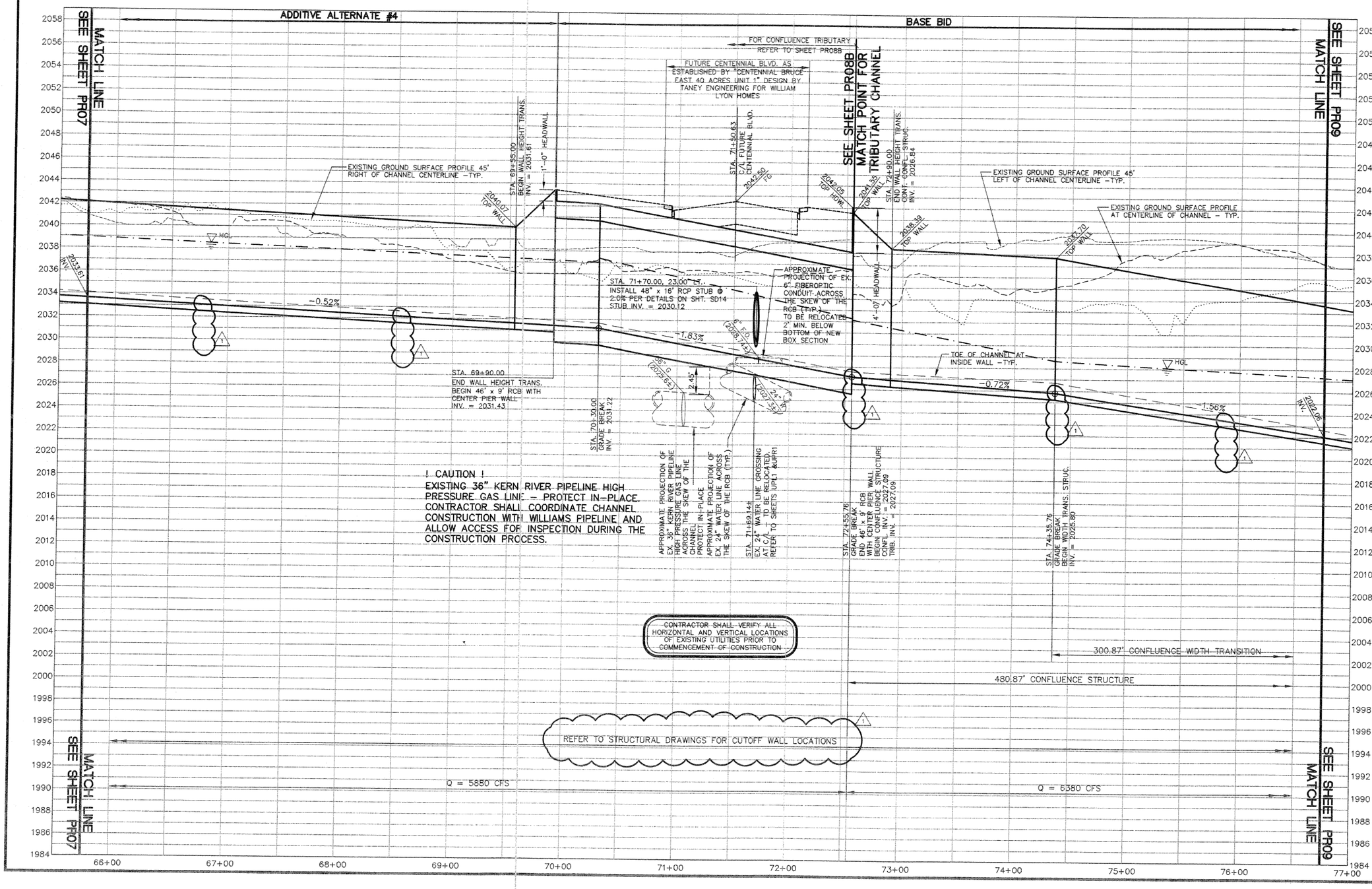
(DRAWING TITLE) PLAN VIEW - STA. 65+75 TO STA. 76+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. PL08

SHT. 23 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 08/30/05 No. 9177 1/21/04

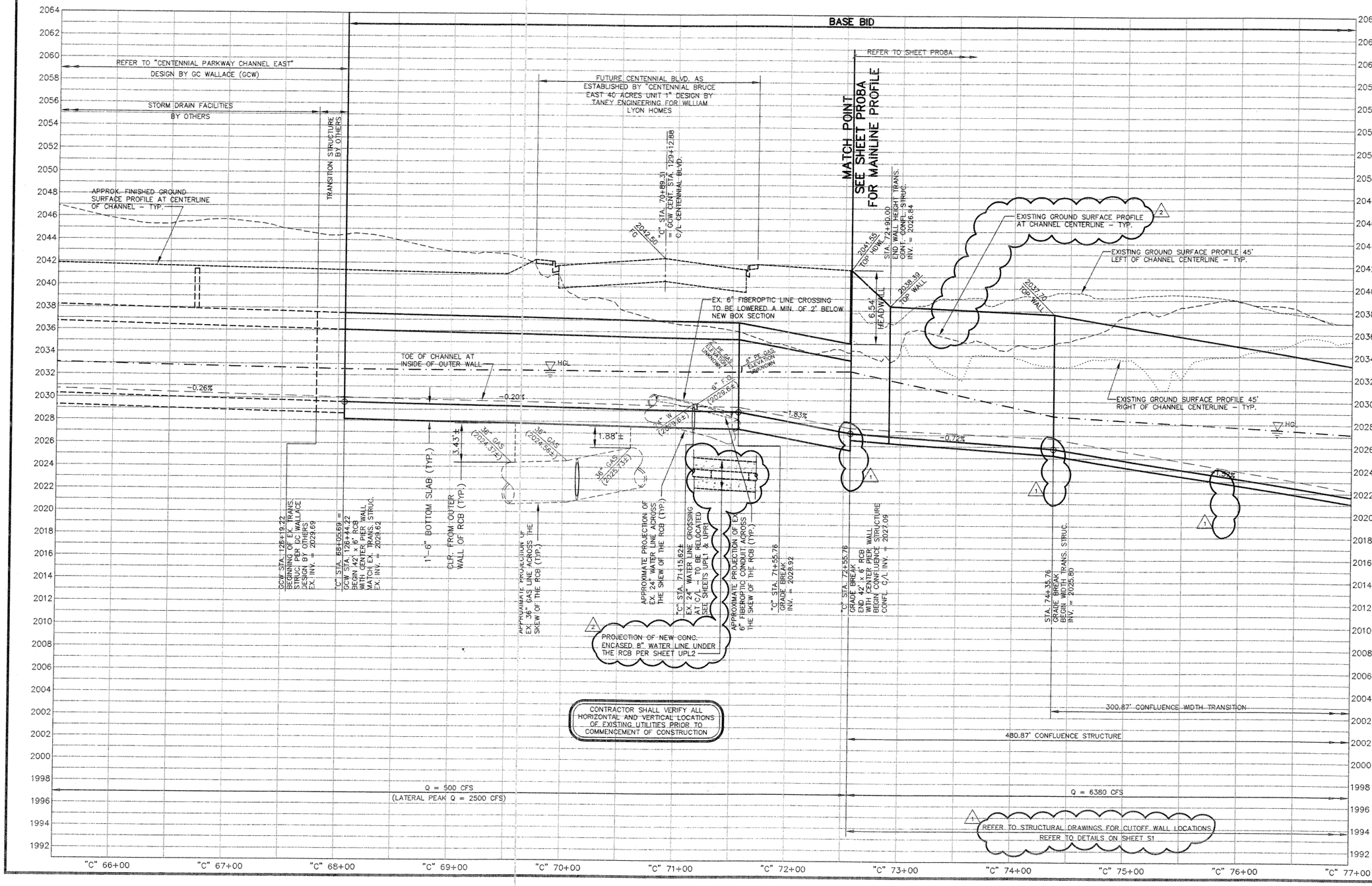
vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PROFILE - STA. 65+75 TO STA. 76+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR08A
SHT. 24 OF 128



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
2	REVISED PER ADDENDUM NO. 2	2/23/2004	VTN
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/05 CIVIL No. 9177 3/11/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) PROFILE - CENTENNIAL BLVD. CONFLUENCE TRIBUTARY

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

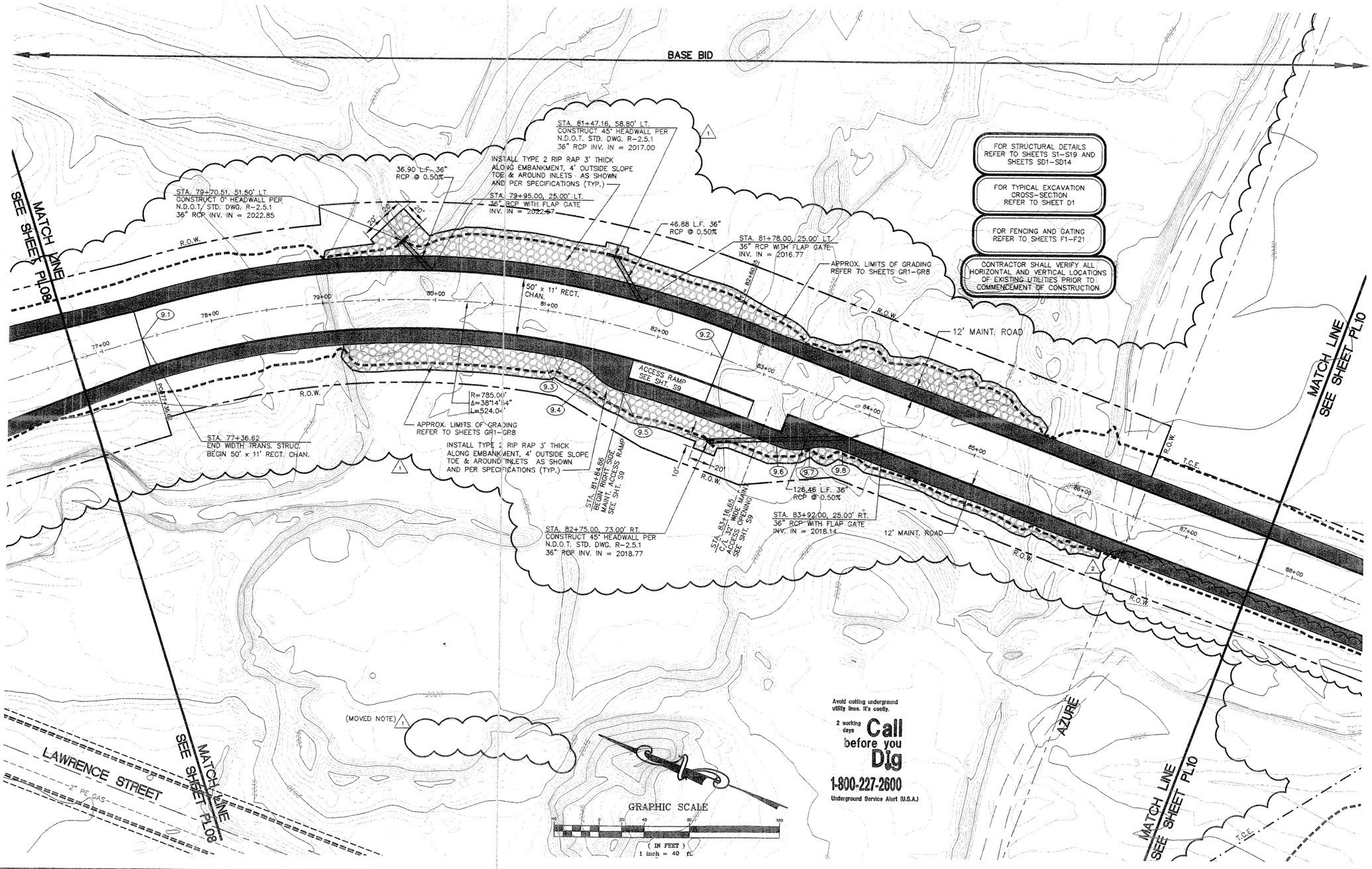
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR08B
SHT. 25 OF 128

ISSUED FOR CONSTRUCTION

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
(9.1)	84123.6383	68478.8204	P.C.	(9.5)	83711.7309	68590.7048	RD. EDGE P.R.C.
(9.2)	83638.5238	68649.7853	P.T.	(9.6)	83565.2470	68595.1547	RD. EDGE P.C.
(9.3)	83739.4529	68599.5148	RD. EDGE P.C.C.	(9.7)	83537.4021	68603.7954	RD. EDGE P.R.C.
(9.4)	83738.7203	68595.3807	RD. EDGE P.R.C.	(9.8)	83509.5572	68612.4362	RD. EDGE P.T.



Avoid cutting underground utility lines. It's costly.
2 working days **Call before you Dig**
1-800-227-2600
Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
2	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
4	REVISED PER ADDENDUM NO. 4	6/10/2004	VTN
1			
3			
5			

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO: 9177
FILE NAME:

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EDP #9906 (702) 883-4042 — 6/10/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

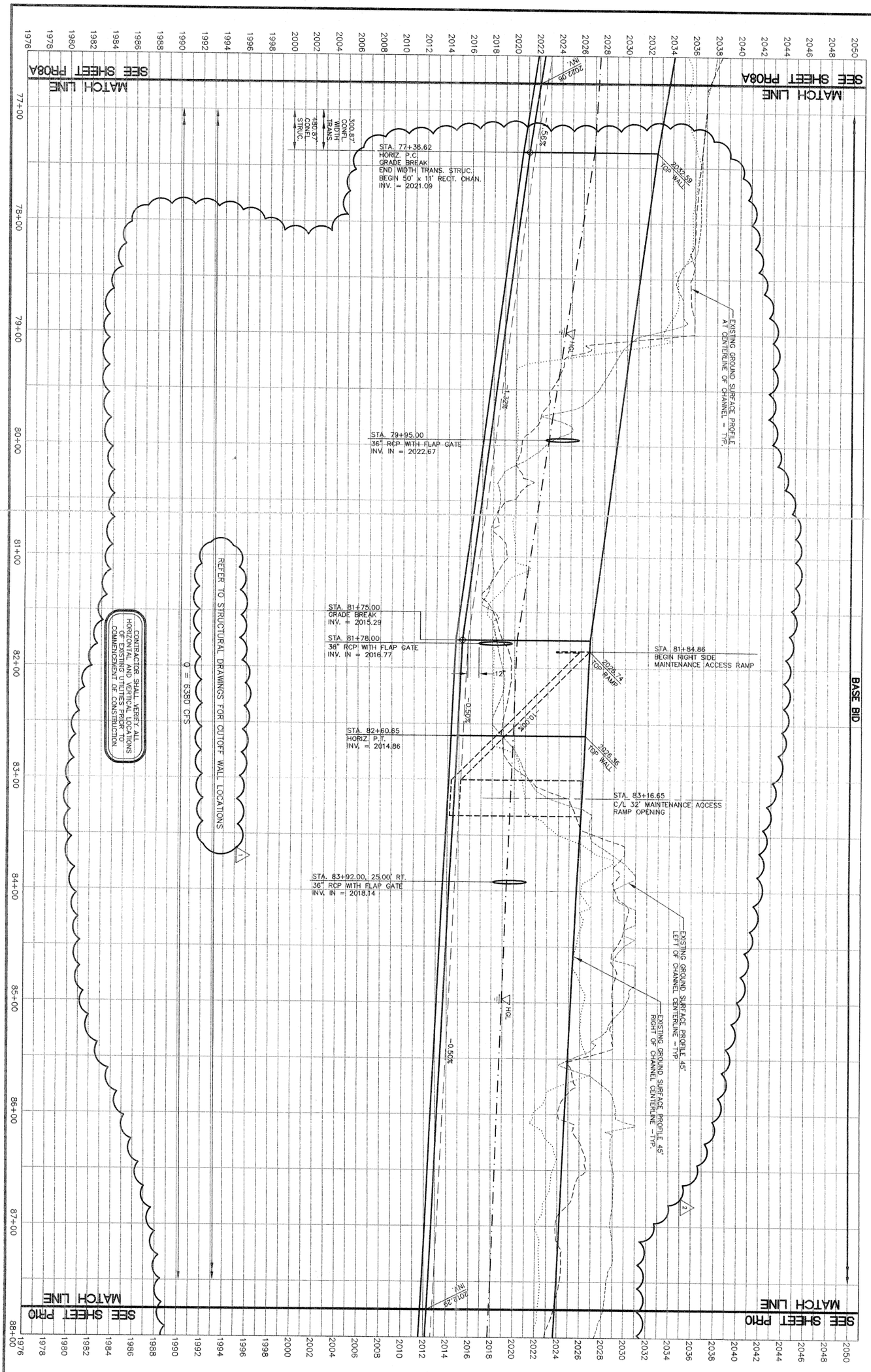
(DRAWING TITLE) PLAN VIEW - STA. 76+75 TO STA. 87+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

DRAWING NO.
PL09
SHT. 26 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. PR09

SHT. 27 OF 128

(DRAWING TITLE)

PROFILE - STA. 76+75 TO STA. 87+75

(PROJECT TITLE)

UPPER LAS VEGAS WASH CHANNEL

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
3/12/04

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

REVISIONS

NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	2/23/2004	VTN
△	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			
△			

PROJECT NO: FILE NAME:

CENTERLINE / MAINTENANCE ROAD CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
10.1	82612.8866	68654.9652	P.C.
10.2	82480.4825	68664.1271	P.T.
10.3	82255.9715	68694.1925	P.C.
10.4	82140.1645	68702.6381	P.T.

BASE BID

MATCH LINE SEE SHEET PL09

SEE SHEET PL11 MATCH LINE

STATIONARY BOLLARD LOCATIONS

1. STA. 91+21.00, 26.75' LT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4
2. STA. 91+67.00, 26.75' LT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4
3. STA. 91+21.00, 26.75' RT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4
4. STA. 91+67.00, 26.75' RT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1

FOR FENCING AND GATING REFER TO SHEETS F1-F21

MISCELLANEOUS CONSTRUCTION NOTES:

9. INSTALL 6' HIGH CHAIN LINK FENCE ON TOP OF BARRIER RAIL MOUNTED SIMILAR TO POST MOUNTING AS DETAILED ON SHT. D5

APPROX. LIMITS OF GRADING REFER TO SHEETS GR1-GR8

T.O.E.

T.C.E.

20.00'

STA. 90+25.00, 25.00' LT.
36" RCP INV. IN = 2017.09

S00°17'22"E
1025.65'
(CONT.)

14.40 L.F. 36" RCP @ 0.50%

R.O.W.

STA. 90+00.67, 49.33' RT.
CONSTRUCT 45° HEADWALL PER N.D.O.T. STD. DWG. R-2.5.1
36" RCP INV. IN = 2017.26

INSTALL TYPE 2 RIP RAP 3' THICK ALONG EMBANKMENT, 4' OUTSIDE SLOPE TOE & AROUND INLETS AS SHOWN AND PER SPECIFICATIONS (TYP.)

STA. 91+09.00
BEGIN WALL HEIGHT TRANS.

STA. 91+19.00
END 50' x 11' RECT. CHAN.
BEGIN 50' x 9.5' RCB
WITH 12" CENTER PIER WALL
& INTEGRATED BARRIER RAIL

STA. 91+69.00
END 50' x 9.5' RCB
WITH 12" CENTER PIER WALL
& INTEGRATED BARRIER RAIL
BEGIN 50' x 11' RECT. CHAN.

STA. 91+80.00
END WALL HEIGHT TRANS.
BEGIN 50' x 11' RECT. CHAN.

76.00' DRAINAGE R.O.W.

GRADE BREAK

PC = 92+48.00

PT = 94+19.11

R=1037.00'
Δ=07°20'17"
L=132.81'

S07°37'39"E
226.52'

50' x 11' RECT. CHAN.

STATIONARY BOLLARD LOCATIONS

5. STA. 95+39.75, 26.75' LT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4
6. STA. 95+85.75, 26.75' LT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4
7. STA. 95+39.75, 26.75' RT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4
8. STA. 95+39.75, 26.75' RT. INSTALL STATIONARY BOLLARD PER DETAIL ON SHT. D4

STA. 95+29.00
BEGIN WALL HEIGHT TRANS.

STA. 95+37.75
END WALL HEIGHT TRANS.
BEGIN 50' x 9.5' RCB
WITH 12" CENTER PIER WALL
& INTEGRATED BARRIER RAIL

STA. 95+87.75
END 50' x 9.5' RCB
WITH 12" CENTER PIER WALL
& INTEGRATED BARRIER RAIL
BEGIN WALL HEIGHT TRANS.

STA. 96+01.00
END WALL HEIGHT TRANS.
BEGIN 50' x 11' RECT. CHAN.

PC = 96+56.83

PT = 97+19.82

R=963.00'
Δ=06°54'46"
L=116.19'

S00°42'53"E
160.13'

Avoid cutting underground utility lines. It's costly.
2 working days **Call before you Dig**
1-800-227-2600
Underground Service Alert (U.S.A.)

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
4	REVISED PER ADDENDUM NO. 4	6/10/2004	VTN
△			
△			
△			

REVISIONS

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROJECT NO:
FILE NAME:

KEN D. GILBRETH — No. 9177 — STATE OF NEVADA — PROFESSIONAL ENGINEER — CIVIL

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

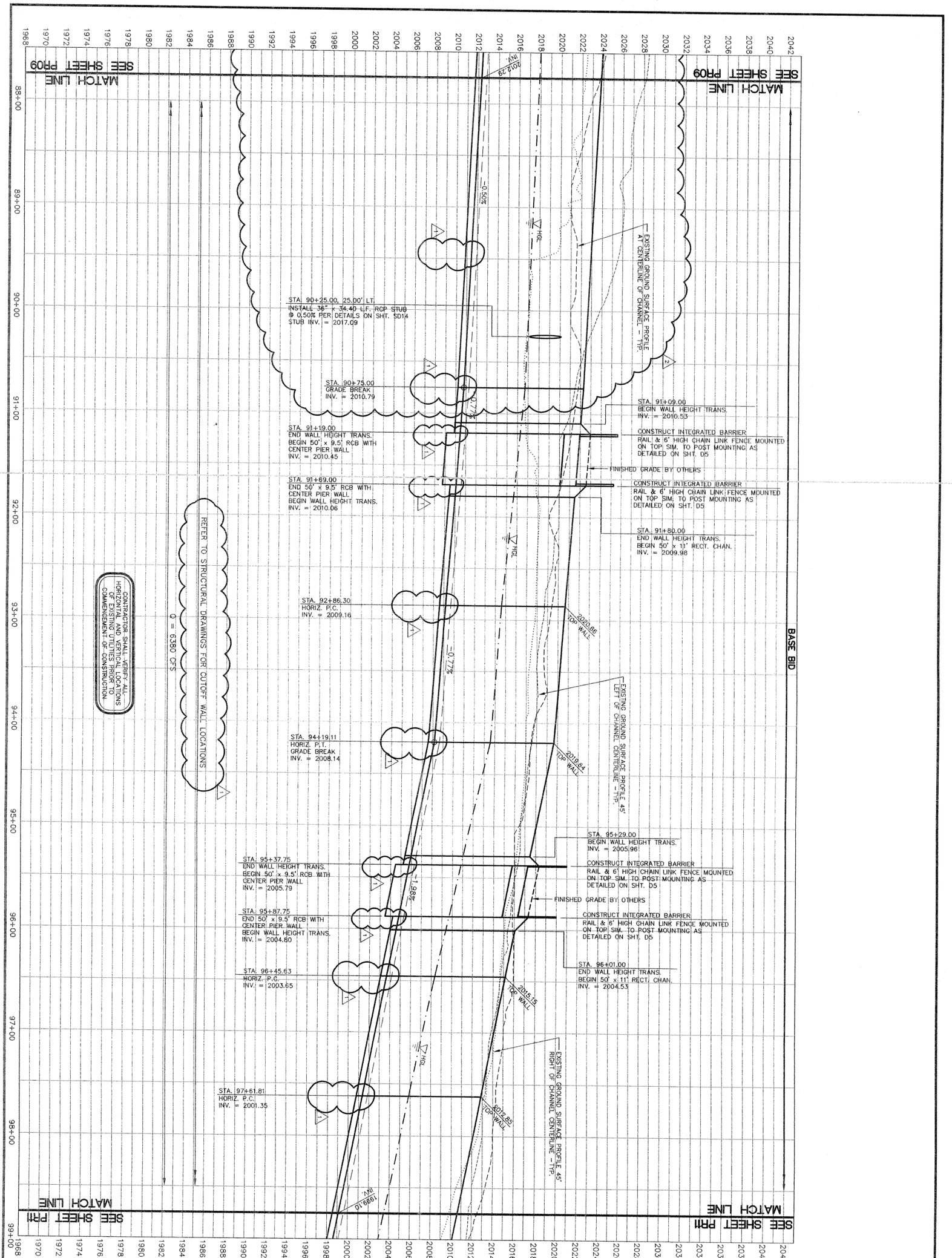
(DRAWING TITLE) PLAN VIEW - STA. 87+75 TO STA. 98+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL10
SHT 28 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PR10
SHT 29 OF 128
DRAWING NO.

(DRAWING TITLE)
PROFILE - STA. 87+75 TO STA. 98+75

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER STATE OF NEVADA
KEN D. GILBRETH
EXP. 08/20/05
No. 9177
CIVIL

SCALE:	1"=40'
DESIGN:	VTN
DRAWN:	DJB
CHECKED:	JNG
APPROVED:	KDG
DATE:	3/11/2004

REVISIONS

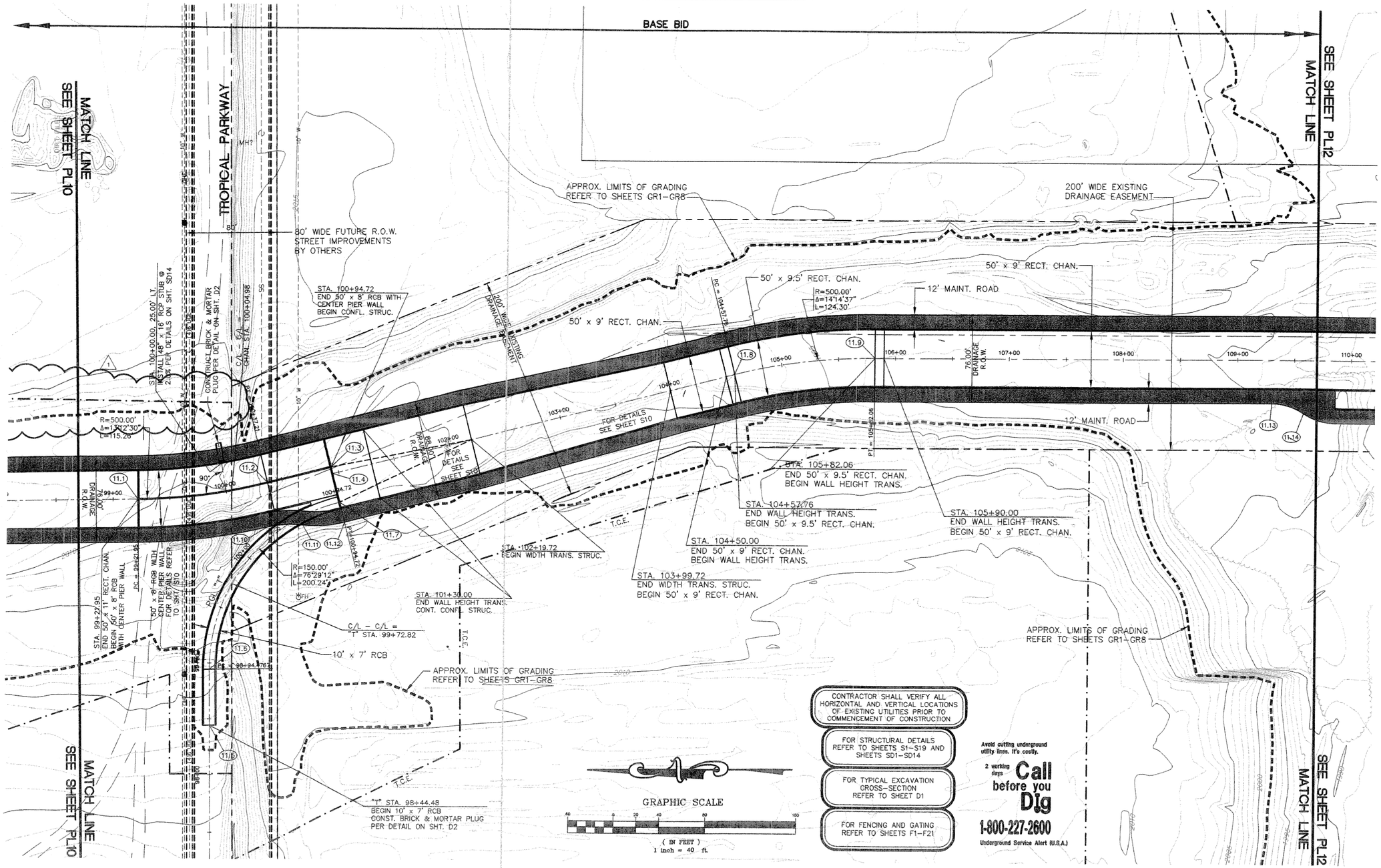
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	2/23/2004	VTN
2	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
3			
4			
5			

PROJECT NO: FILE NAME:

REVISED PER ADDENDUM NO. 3

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
11.1	81980.0449	68704.6355	P.C.	11.6	81916.3583	68555.3988	P.C.	11.11	81834.9032	68682.0801	RD. EDGE P.R.C.
11.2	81865.9734	68719.2865	P.T.	11.7	81802.4547	68702.0642	END RCB, P.T.	11.12	81798.1236	68684.5930	RD. EDGE P.T.
11.3	81810.1544	68733.1240	END RCB	11.8	81456.3351	68814.6543	P.C.	11.13	80985.2934	68789.3895	RD. EDGE P.C.
11.4	81808.7107	68727.3003	BEGIN CONFL.	11.9	81333.2295	68829.3364	P.T.	11.14	80957.4532	68780.7336	RD. EDGE P.R.C.
11.5	81916.0009	68505.4001	BEGIN RCB	11.10	81865.9292	68680.2310	RD. EDGE P.R.C.				



CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

FOR STRUCTURAL DETAILS REFER TO SHEETS S1-S19 AND SHEETS SD1-SD14

FOR TYPICAL EXCAVATION CROSS-SECTION REFER TO SHEET D1

FOR FENCING AND GATING REFER TO SHEETS F1-F21

Avoid cutting underground utility lines. It's costly.

2 working days **Call before you Dig**

1-800-227-2600

Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 3	3/14/2004	VTN
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

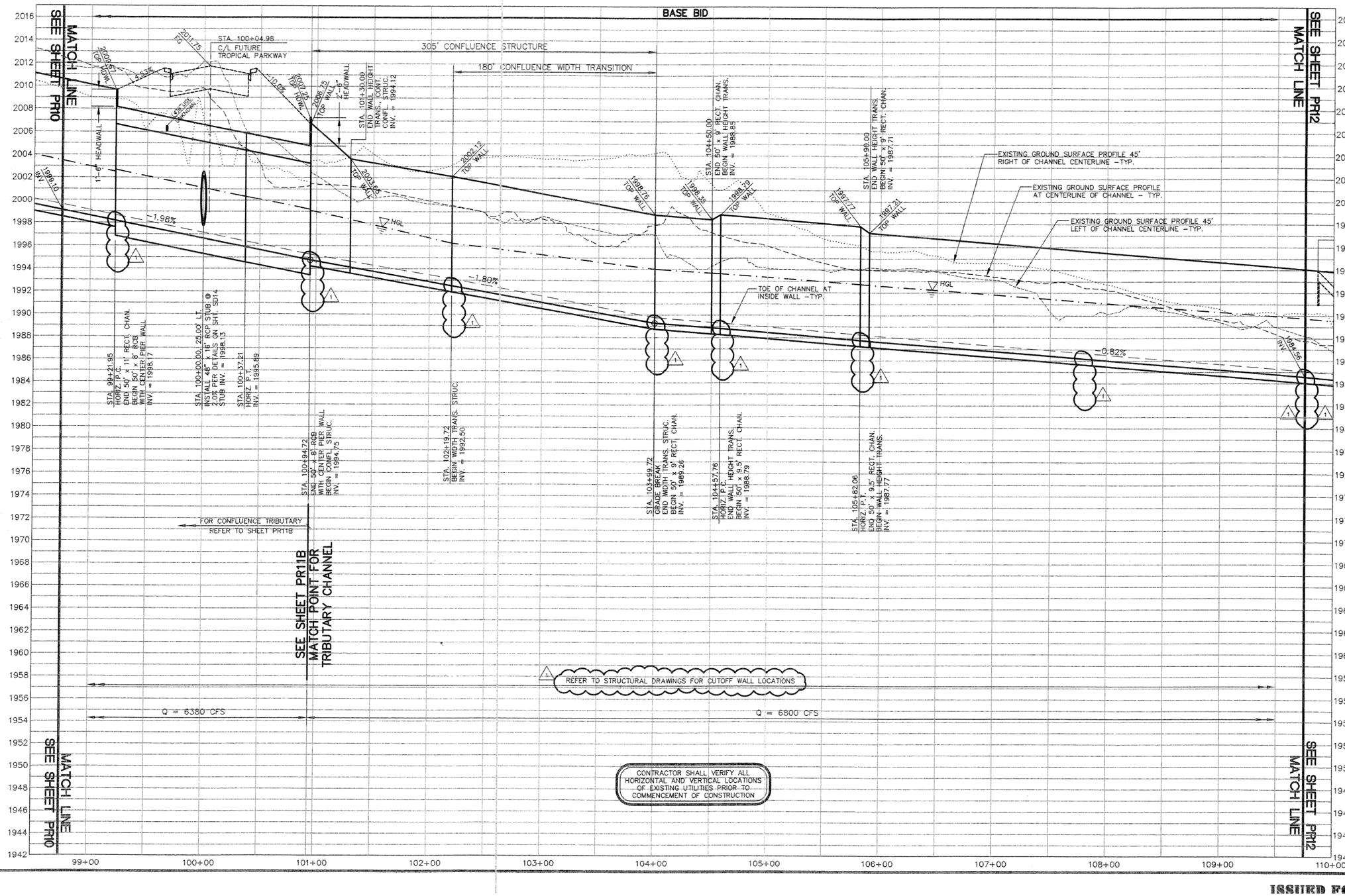
KEN D. GILBRETH, REG. EXP. 06/30/06, PROFESSIONAL ENGINEER, STATE OF NEVADA, No. 9117, CIVIL

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2599
FAX (702) 362-2597

(DRAWING TITLE) PLAN VIEW - STA. 98+75 TO STA. 109+75
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. PL11
SHT. 30 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBERT CIVIL No. 9177

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2697

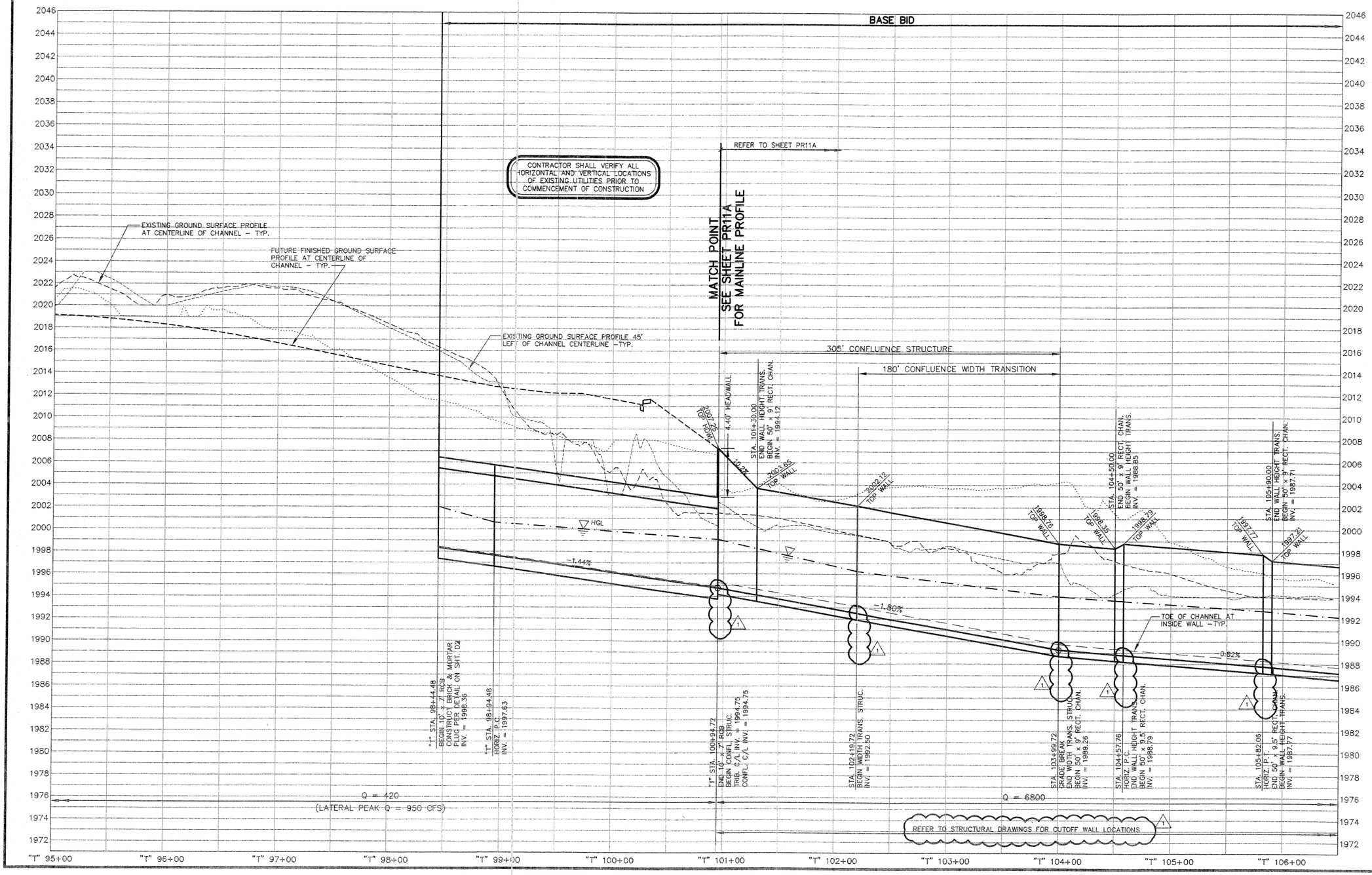
(DRAWING TITLE) PROFILE - STA. 98+75 TO STA. 109+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR11A
SHT. 31 OF 128

ISSUED FOR CONSTRUCTION



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
△			
△			
△			

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 08/30/05 CIVIL No. 9177 1/21/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) TROPICAL PARKWAY CONFLUENCE TRIBUTARY PROFILE

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

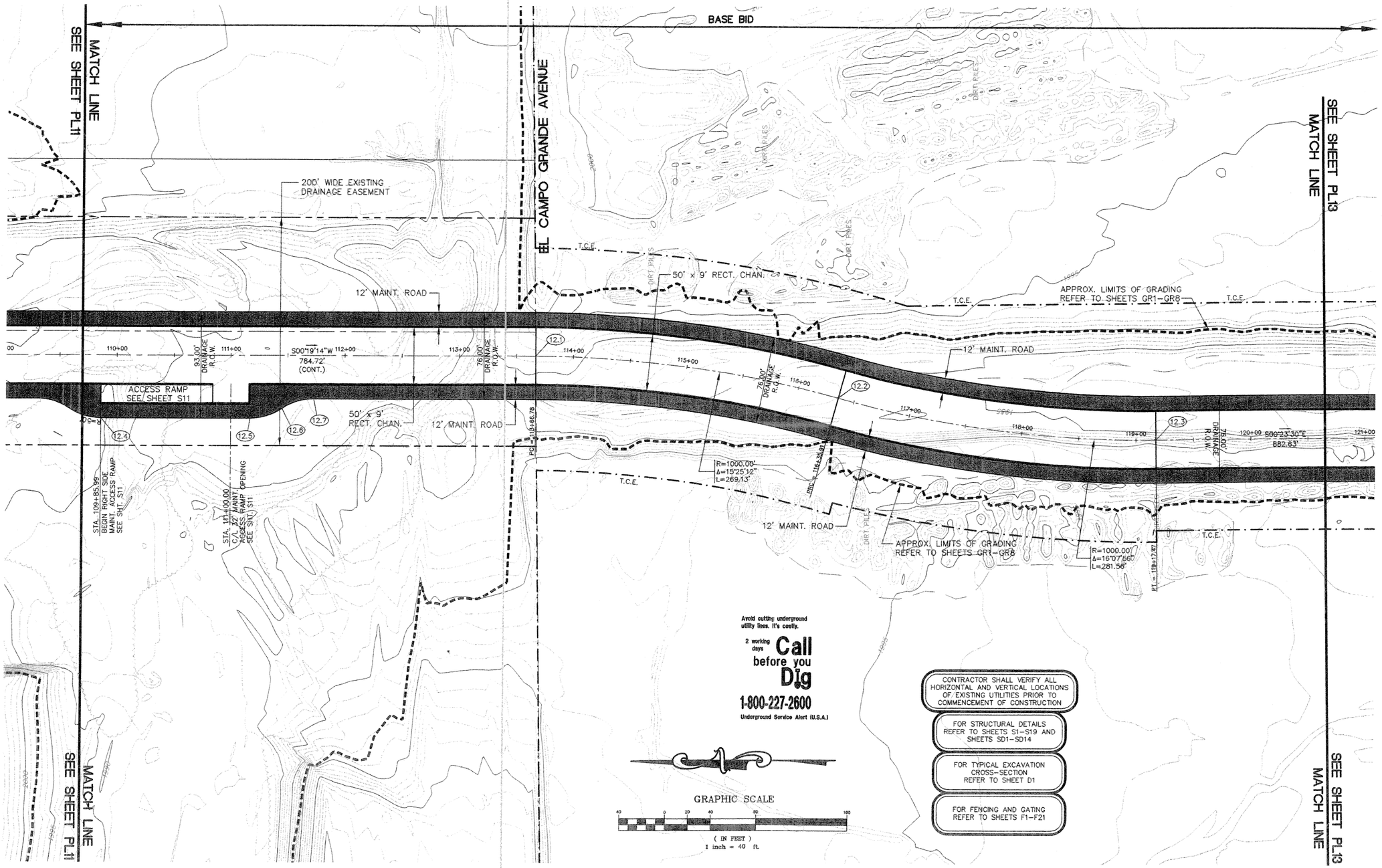
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PR11B
SHT. 32 OF 128

ISSUED FOR CONSTRUCTION

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
12.1	80548.5244	68824.9464	P.C.	12.5	80798.6051	68771.3447	RD. EDGE P.C.
12.2	80282.8384	68787.4624	P.R.C.	12.6	80770.6698	68779.6886	RD. EDGE P.R.C.
12.3	80004.7200	68749.9862	P.T.	12.7	80742.7505	68788.0325	RD. EDGE P.T.
12.4	80929.6131	68772.0777	RD. EDGE P.T.				



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

PLAN VIEW - STA. 109+75 TO STA. 120+75

UPPER LAS VEGAS WASH CHANNEL

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. PL12

SHT. 33 OF 126

REVISIONS

NO.	DESCRIPTION	DATE	BY

PROJECT NO:

FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

KEN D. GILBRETH EXP. 06/30/05 CIVIL No. 9171 PROFESSIONAL ENGINEER STATE OF NEVADA 12/1/04

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
27227 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2997

ISSUED FOR CONSTRUCTION

BASE BID

MATCH LINE SEE SHEET PR11A

STA. 109+85.99 BEGIN RIGHT SIDE MAINTENANCE ACCESS RAMP

1993.97 TOP RAMP

-10%

1984.56 INV.

STA. 111+00.00 C/L 32' MAINTENANCE ACCESS RAMP OPENING

HGL

EXISTING GROUND SURFACE PROFILE 45' LEFT OF CHANNEL CENTERLINE – TYP.

1990.85 TOP WALL

-0.82%

STA. 112+60.75 HORIZ. P.C. GRADE BREAK INV. = 1981.36

-0.51%

EXISTING GROUND SURFACE PROFILE 45' RIGHT OF CHANNEL CENTERLINE – TYP.

1985.49 TOP WALL

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL – TYP.

HGL

TOE OF CHANNEL AT INSIDE WALL – TYP.

STA. 116+35.91 HORIZ. P.R.C. INV. = 1979.99

1998.06 TOP WALL

-0.51%

STA. 119+17.47 HORIZ. P.T. INV. = 1978.56

1977.16 INV.

MATCH LINE SEE SHEET PR13

1 REFER TO STRUCTURAL DRAWINGS FOR CUTOFF WALL LOCATIONS

Q = 6800 CFS

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

2006 2004 2002 2000 1998 1996 1994 1992 1990 1988 1986 1984 1982 1980 1978 1976 1974 1972 1970 1968 1966 1964 1962 1960 1958 1956 1954 1952 1950 1948 1946 1944 1942 1940 1938 1936 1934 1932

110+00 111+00 112+00 113+00 114+00 115+00 116+00 117+00 118+00 119+00 120+00 121+00

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	VTN
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KOG
DATE: 1/21/2004

REGISTERED PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/05 No 9177

PROJECT NO:
FILE NAME:

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2600
FAX (702) 362-2597

(DRAWING TITLE)
PROFILE - STA. 109+75 TO STA. 120+75

(PROJECT TITLE)
UPPER LAS VEGAS WASH CHANNEL

(LOCATION)
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

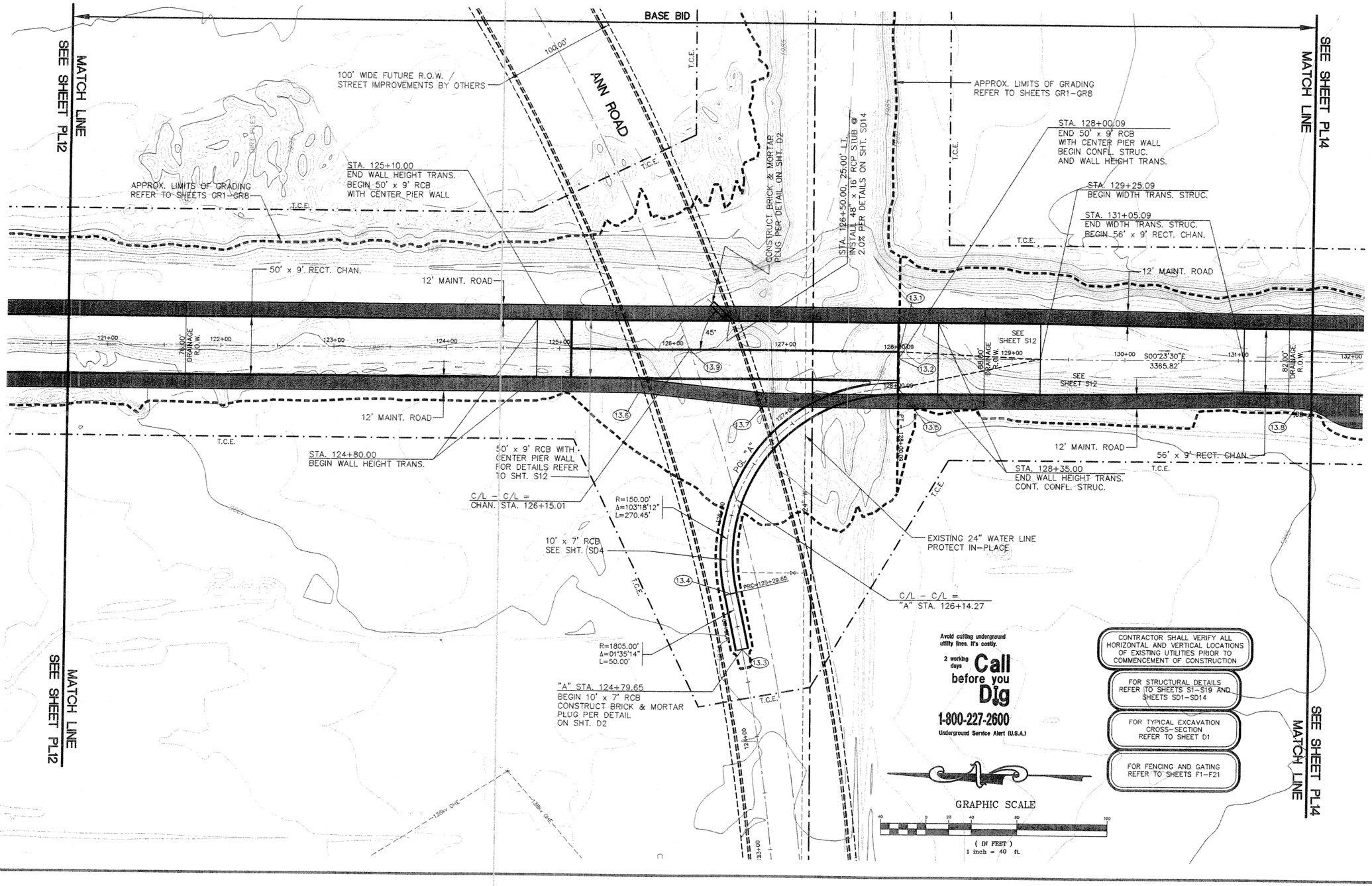
DRAWING NO.
PR12

SHT. 34 OF 128

ISSUED FOR CONSTRUCTION

CENTERLINE / MAINTENANCE ROAD
CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION	POINT NO.	NORTHING	EASTING	DESCRIPTION
(13.1)	79122.1125	68756.0216	END RCB	(13.5)	79121.8937	68724.0224	END RCB, P.T.	(13.7)	79241.2607	68705.2057	RD. EDGE ANGLE PT.
(13.2)	79122.0715	68750.0218	BEGIN CONFL.	(13.6)	79351.3972	68716.4528	RD. EDGE ANGLE PT.	(13.8)	78770.0905	68711.4277	RD. EDGE P.C.
(13.3)	79255.4399	68489.7763	BEGIN RCB	(13.4)	79266.6034	68538.5125	P.R.C.	(13.9)	79307.1906	68754.7560	C/L – C/L



CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
△			
△			
△			
△			
△			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP. 06/30/06 CIVIL No. 9177

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
(702) 362-3500
FAX (702) 362-2597

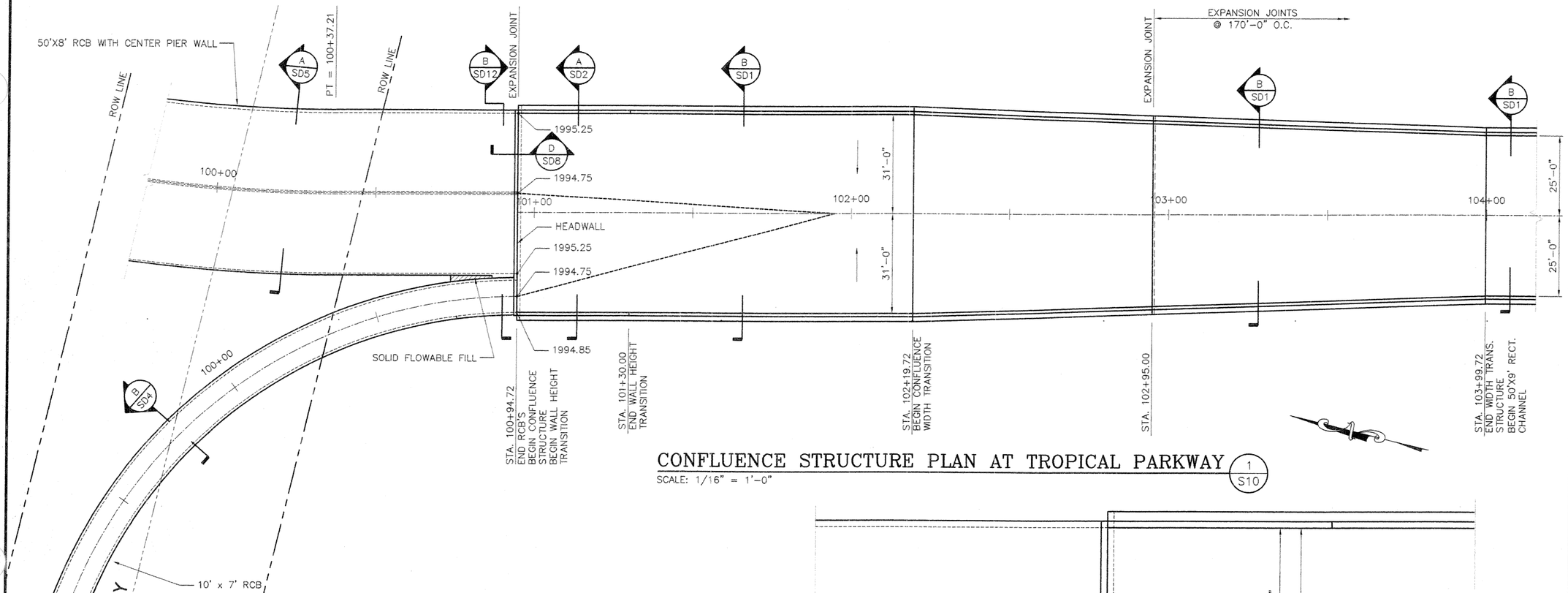
(DRAWING TITLE) PLAN VIEW – STA. 120+75 TO STA. 131+75

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

DRAWING NO.
PL13

SHT 35 OF 128



CONFLUENCE STRUCTURE PLAN AT TROPICAL PARKWAY (1/S10)
SCALE: 1/16" = 1'-0"

ENLARGED PLAN STA 100+50.00 TO 101+50.00 (2/S10)
SCALE: 1/8" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1			
2			
3			
4			
5			

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

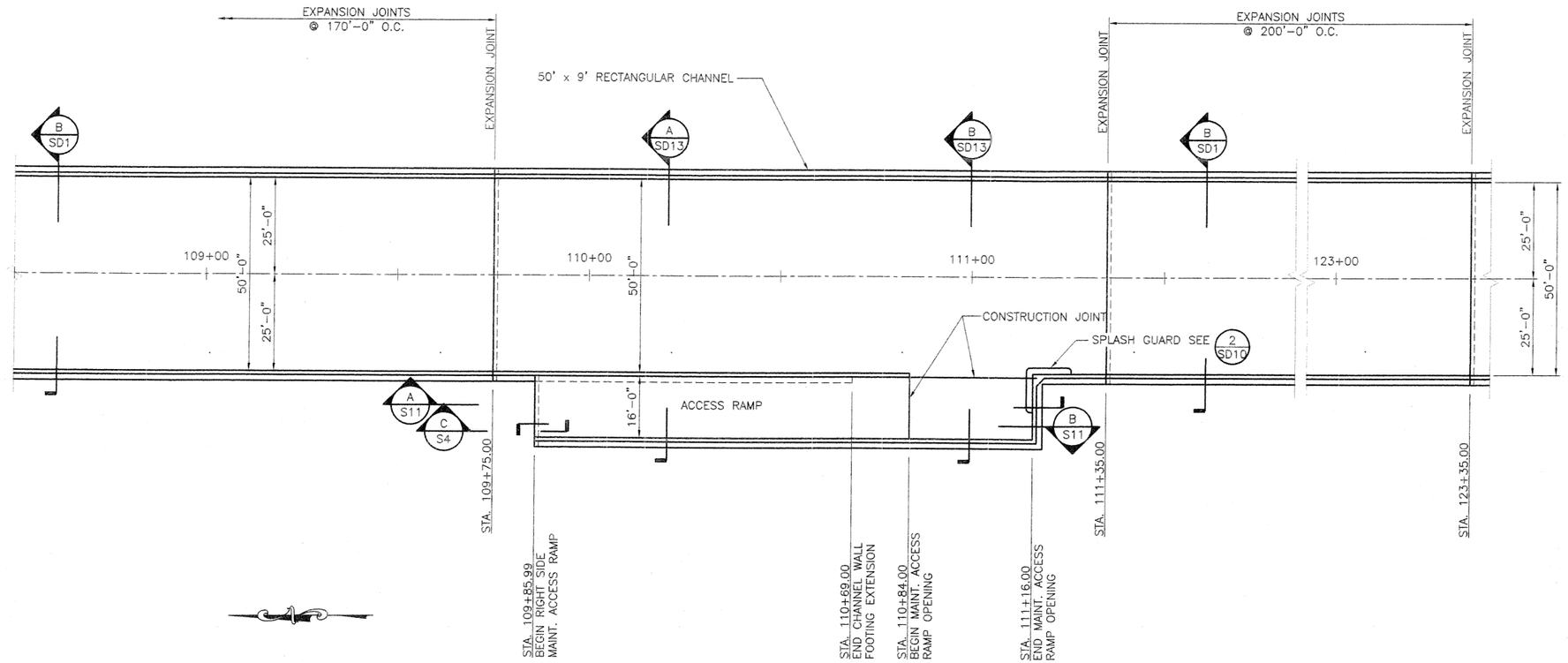
STATE OF NEVADA — DAVID W. SEELEY — No. 11751 — PROFESSIONAL ENGINEER — CIVIL — Exp. 12/31/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 382-1170
FAX (702) 382-2597

(DRAWING TITLE) CONFLUENCE STRUCTURE PLAN AT TROPICAL PARKWAY
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
S10
SHT. 93 OF 128

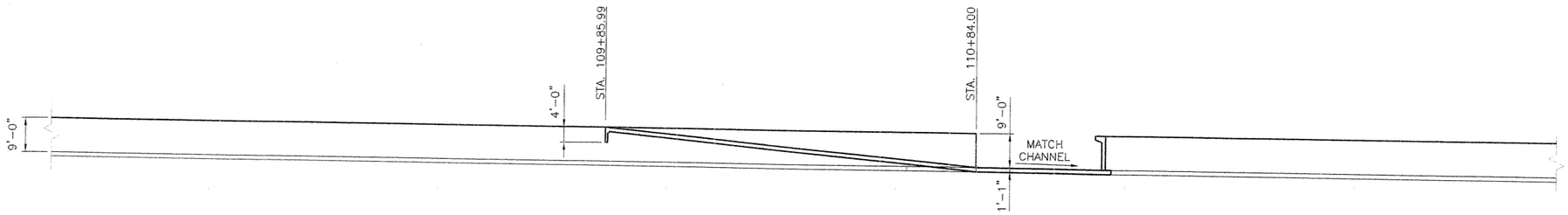
ISSUED FOR CONSTRUCTION



STA 111+00 MAINTENANCE ACCESS RAMP PLAN

SCALE: 1/16" = 1'-0"

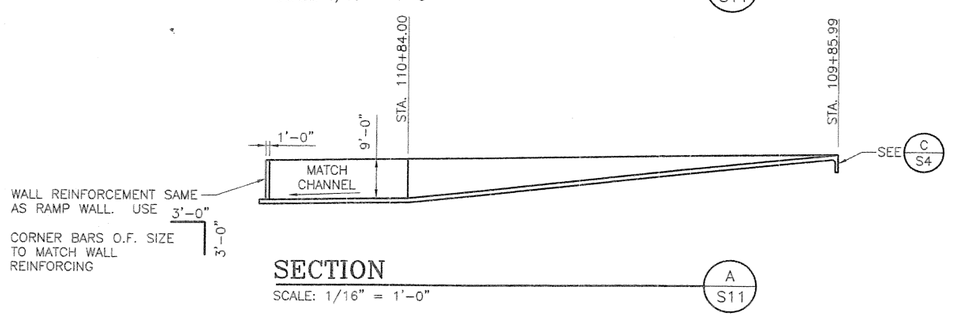
1 / S11



SECTION

SCALE: 1/16" = 1'-0"

A / S11



SECTION

SCALE: 1/16" = 1'-0"

A / S11

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
3			
4			

SCALE: AS SHOWN
DESIGN: DMS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

ENGINEER - STATE OF NEVADA - DAVID W. SEELEY - No. 11751 - PROFESSIONAL ENGINEER - 1/21/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 舒-2500
FAX (702) 382-2597

(DRAWING TITLE) ACCESS RAMP AT STA. 111+00 PLAN AND ELEVATIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

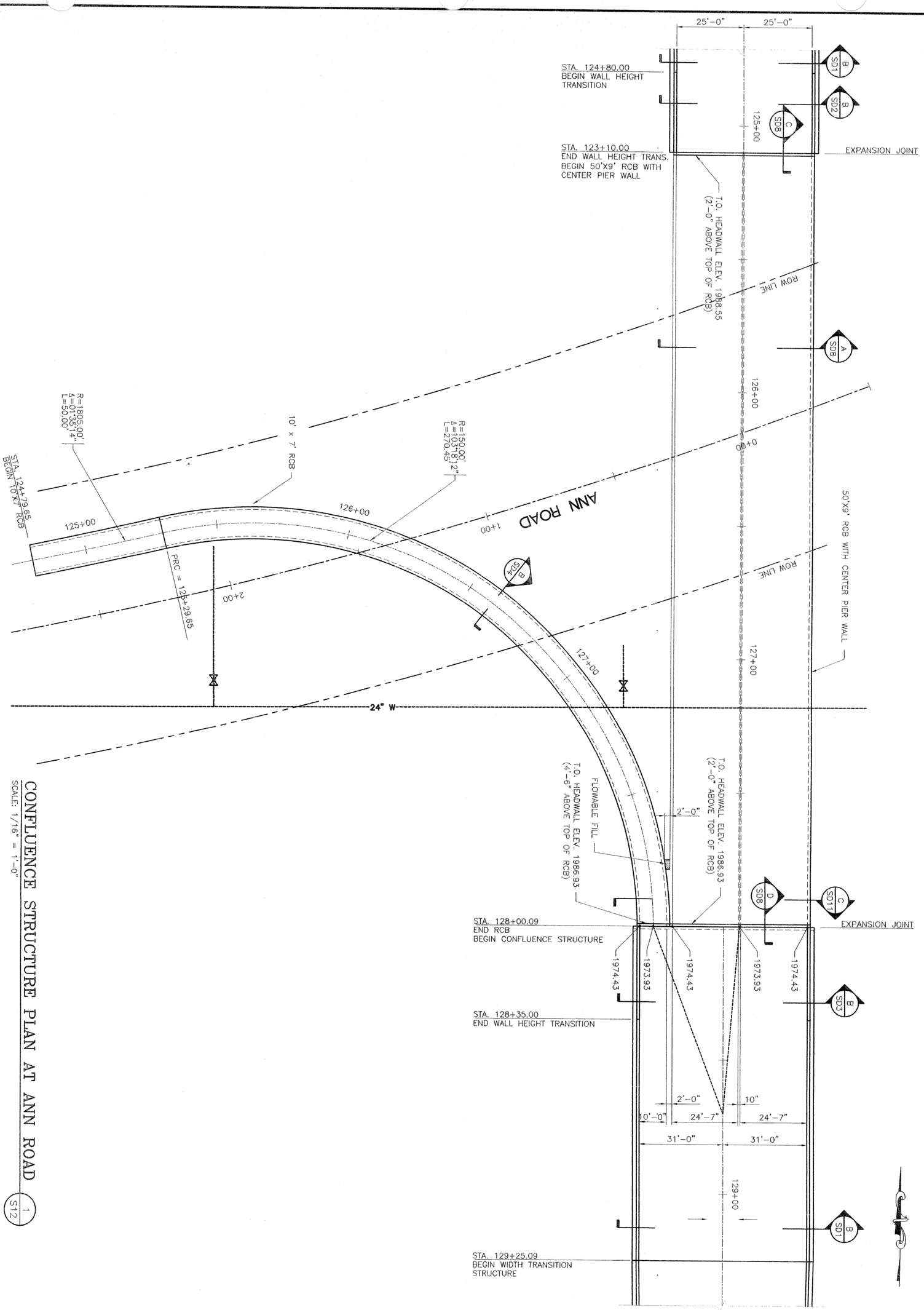
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

S11

SHT. 94 OF 128

ISSUED FOR CONSTRUCTION



CONFLUENCE STRUCTURE PLAN AT ANN ROAD

SCALE: 1/16" = 1'-0"

1 / S12

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S12 SHT. 95 OF 128

(DRAWING TITLE) CONFLUENCE STRUCTURE PLAN AT ANN ROAD

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

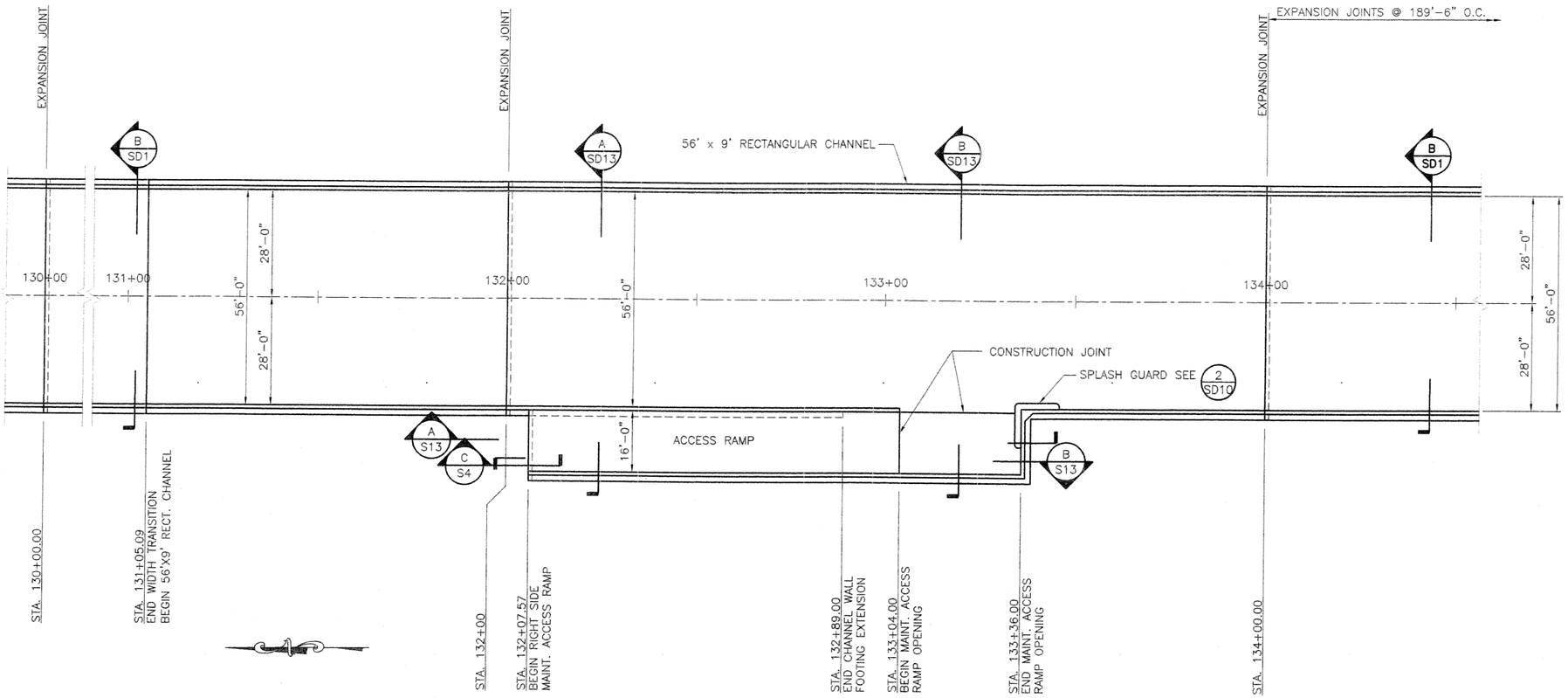
vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

DAVID W. SEELEY — No. 11751 — REGISTERED PROFESSIONAL ENGINEER — STATE OF NEVADA
EXPIRES 6/30/05 — 1/21/04

SCALE:	AS SHOWN
DESIGN:	DWS
DRAWN:	ALA
CHECKED:	
APPROVED:	
DATE:	1/21/04

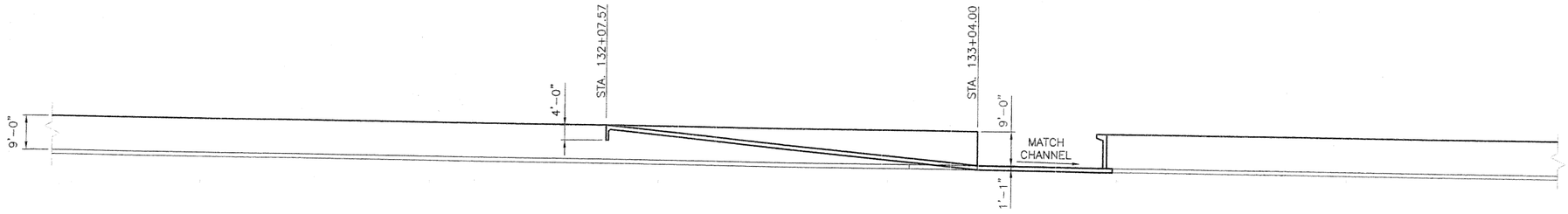
REVISIONS			
NO.	DESCRIPTION	DATE	BY
Δ			
Δ			
Δ			
Δ			

PROJECT NO: FILE NAME:



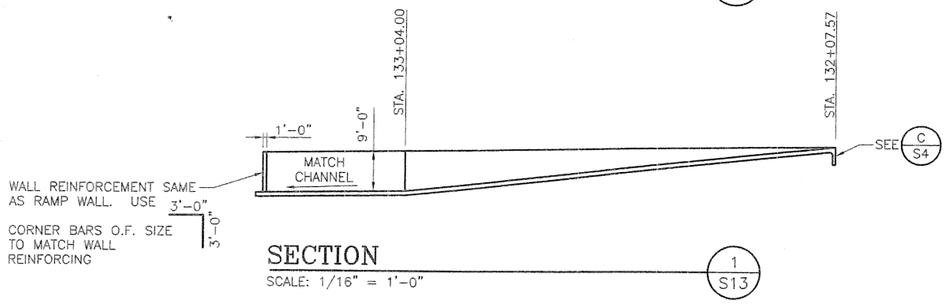
STA 133+20 MAINTENANCE ACCESS RAMP PLAN (1 / S13)

SCALE: 1/16" = 1'-0"



SECTION (1 / S13)

SCALE: 1/16" = 1'-0"



SECTION (1 / S13)

SCALE: 1/16" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2987

ENGINEER - STATE OF NEVADA - DAVID W. SEELEY - No. 11175 - 1/30/04 - EXPIRES 6/30/04

(DRAWING TITLE) ACCESS RAMP AT STA. 133+20 PLAN AND ELEVATIONS

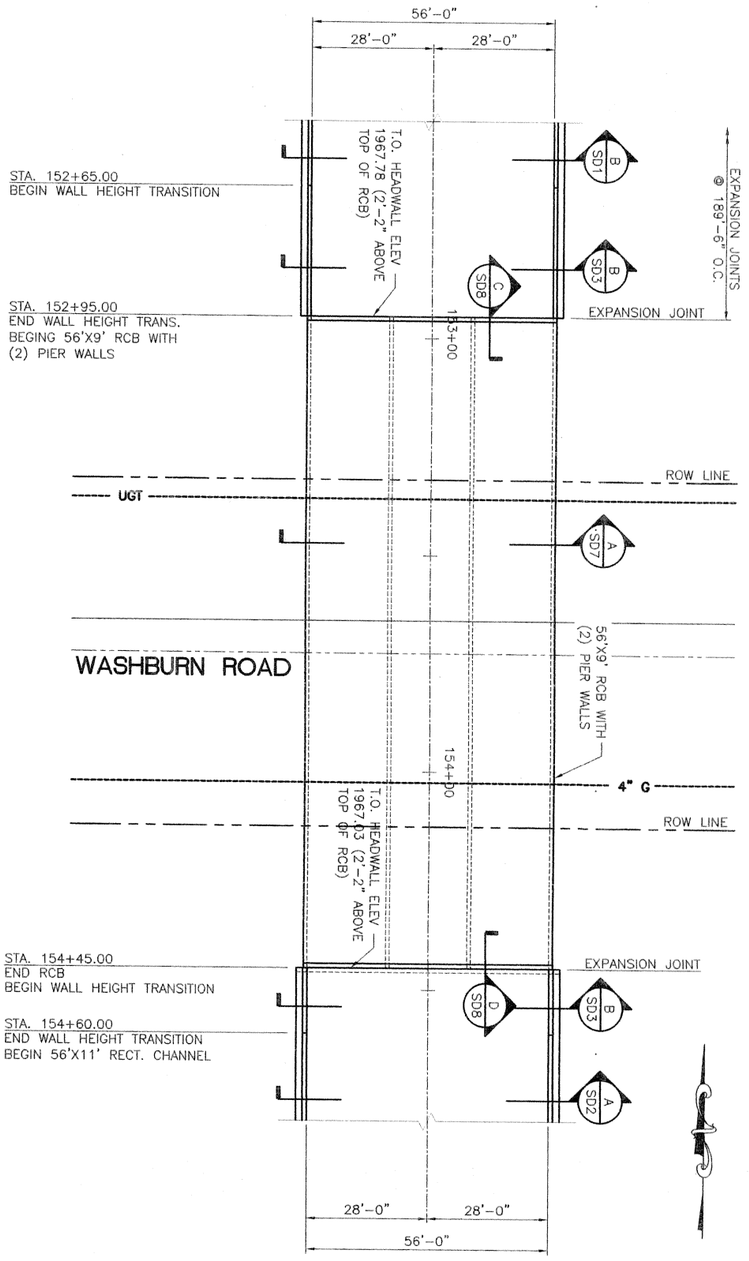
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. S13

SHT. 96 OF 128

ISSUED FOR CONSTRUCTION



RCB CROSSING AT WASHBURN ROAD

SCALE: 1/16" = 1'-0"

1 S14

ISSUED FOR CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S14 SHT 67 OF 128

(DRAWING TITLE) **PLAN - RCB CROSSING AT WASHBURN ROAD**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

vtn nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp 6/30/05
1/21/04

SCALE:	AS SHOWN
DESIGN:	DWS
DRAWN:	ALA
CHECKED:	
APPROVED:	
DATE:	1/21/04

REVISIONS			
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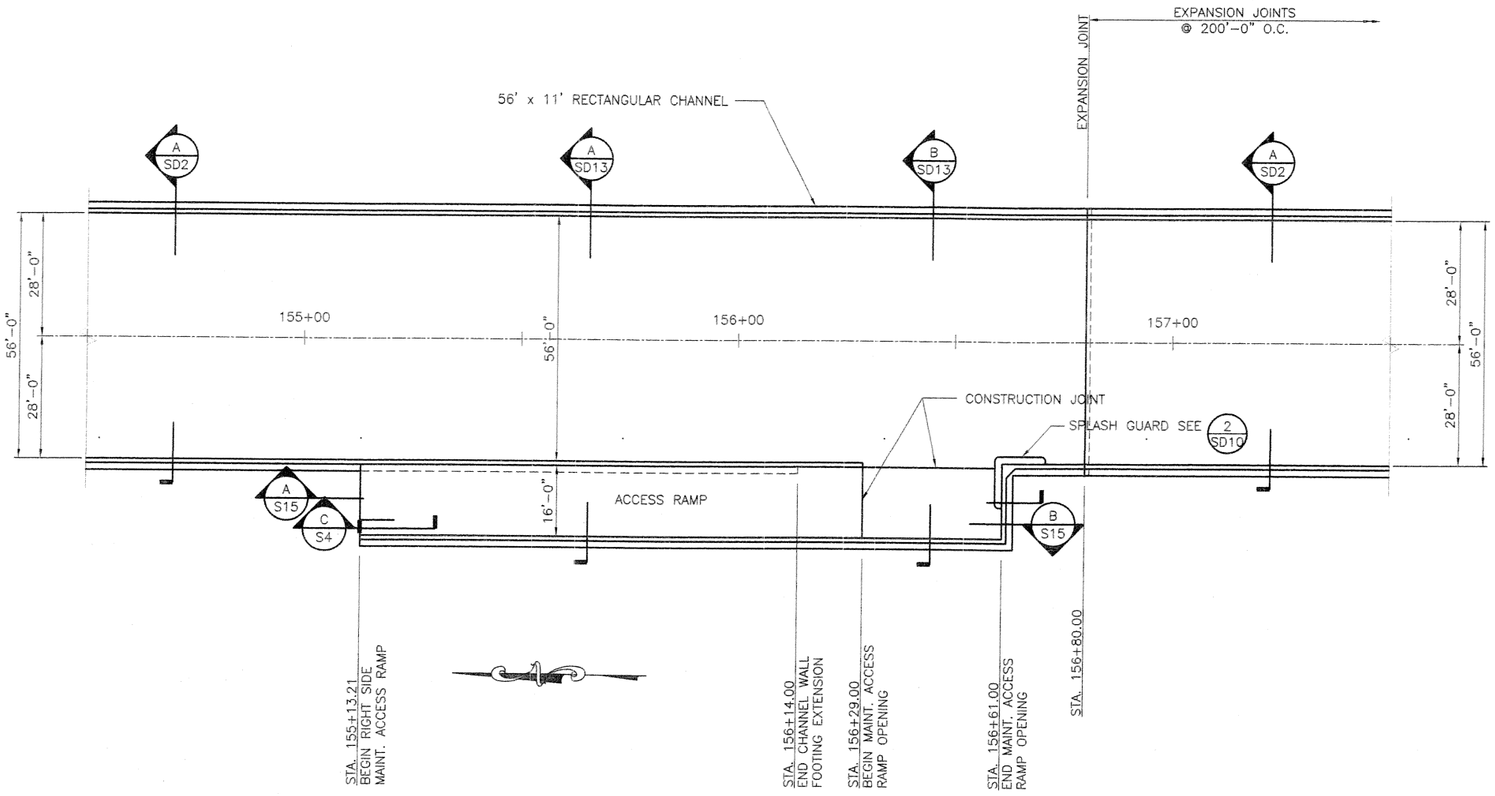
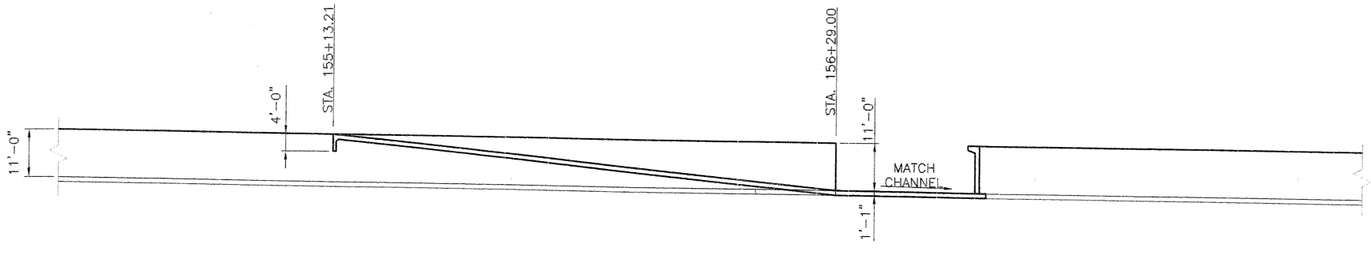
PROJECT NO: FILE NAME:



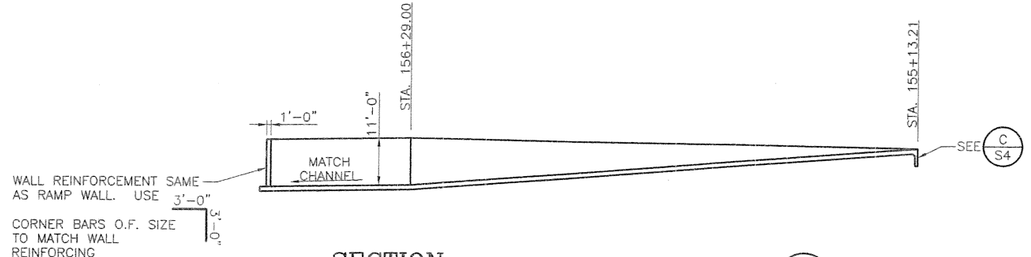
STA 156+45 MAINTENANCE ACCESS RAMP PLAN (1 / S15)

SCALE: 1/16" = 1'-0"



SECTION (A / S15)

SCALE: 1/16" = 1'-0"



SECTION (B / S15)

SCALE: 1/16" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE) ACCESS RAMP AT STA. 156+45 - PLAN AND ELEVATION

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

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• PLANNERS
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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
CIVIL
No. 11751
EXP. 6/30/04
1/21/04

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

REVISIONS

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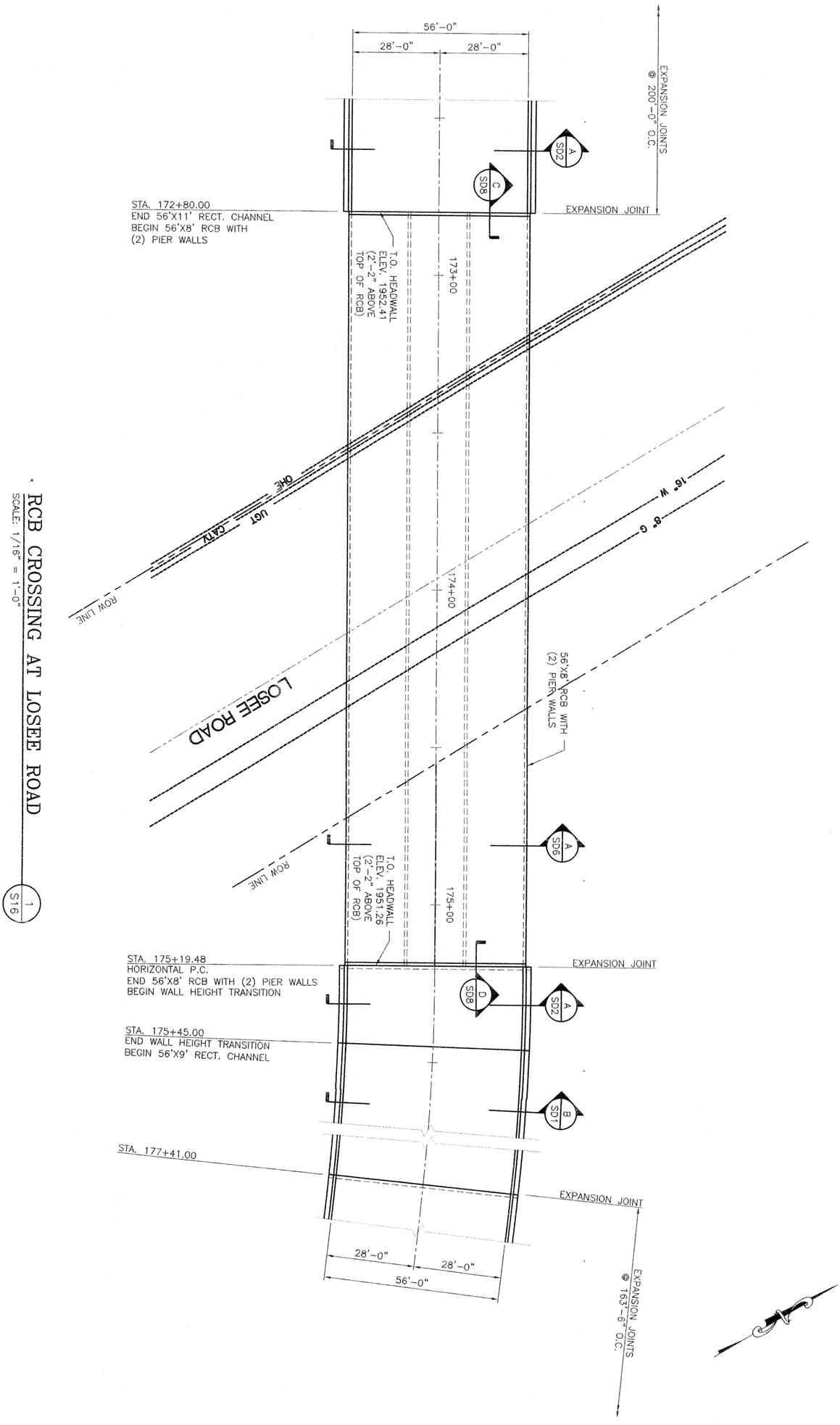
PROJECT NO:
FILE NAME:

DRAWING NO.
S15
SHT. 98 OF 128

ISSUED FOR CONSTRUCTION



RCB CROSSING AT LOSEE ROAD
SCALE: 1/16" = 1'-0"
1 S16

ISSUED FOR CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S16 SHEET 99 OF 128

(DRAWING TITLE) **PLAN - RCB CROSSING AT LOSEE ROAD**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

VTN nevada
- CONSULTING ENGINEERS
- PLANNERS
- LAND SURVEYORS

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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11151
Exp 6/30/04
1/21/04

SCALE:	AS SHOWN
DESIGN:	DWS
DRAWN:	ALA
CHECKED:	
APPROVED:	
DATE:	1/21/04

REVISIONS			
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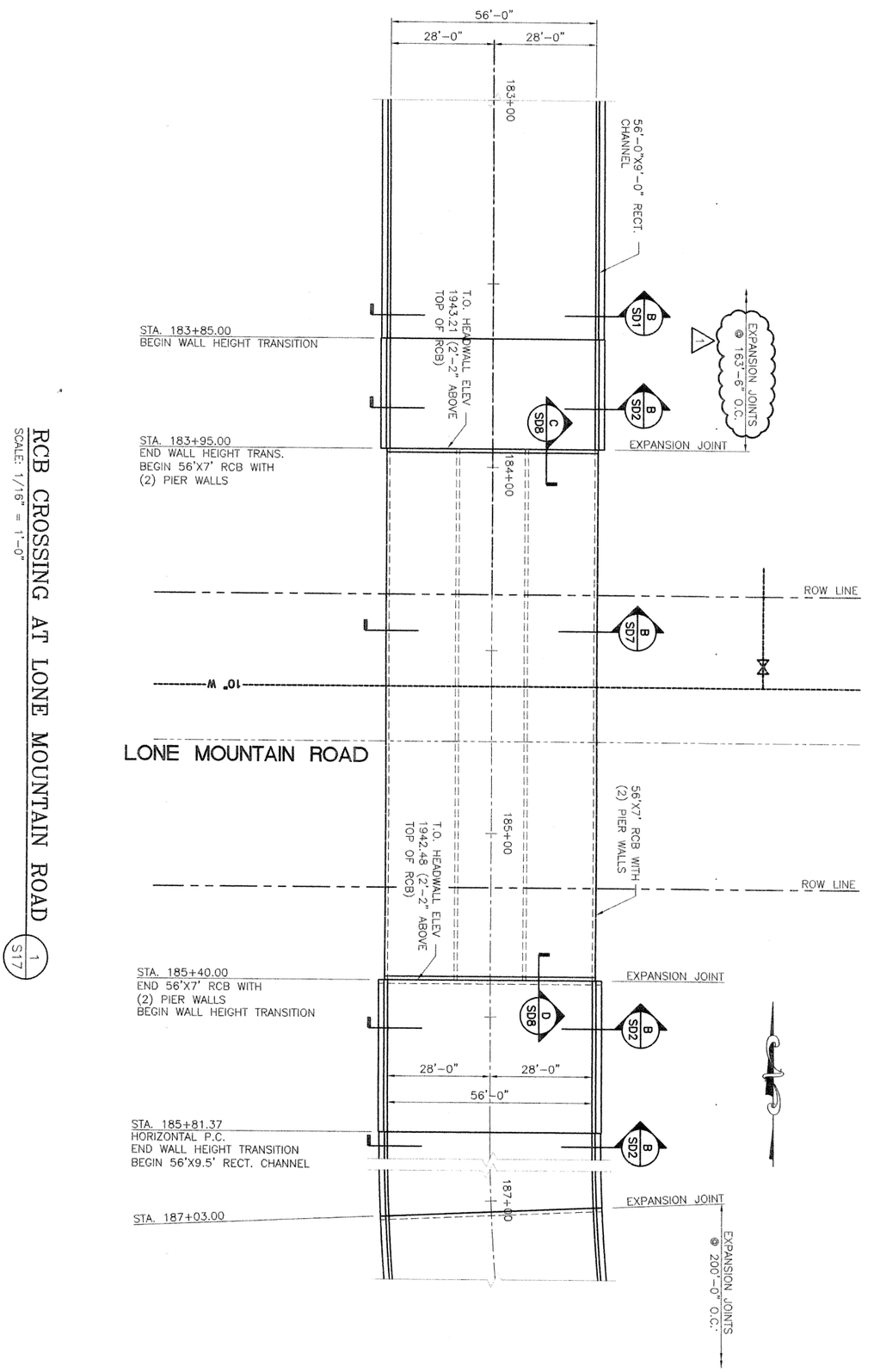
PROJECT NO: FILE NAME:



RCB CROSSING AT LONE MOUNTAIN ROAD

SCALE: 1/16" = 1'-0"

1 S17

ISSUED FOR CONSTRUCTION

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

DRAWING NO. S17 SHT. 100 OF 128

(DRAWING TITLE) **PLAN - RCB CROSSING AT LONE MOUNTAIN ROAD**

(PROJECT TITLE) **UPPER LAS VEGAS WASH CHANNEL**

(LOCATION) **NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD**

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- PLANNERS
- LAND SURVEYORS

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FAX (702) 362-2597

PROFESSIONAL ENGINEER-STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp. 6/30/04
6/1/04

SCALE:	AS SHOWN
DESIGN:	DWS
DRAWN:	ALA
CHECKED:	
APPROVED:	
DATE:	1/21/04

REVISIONS

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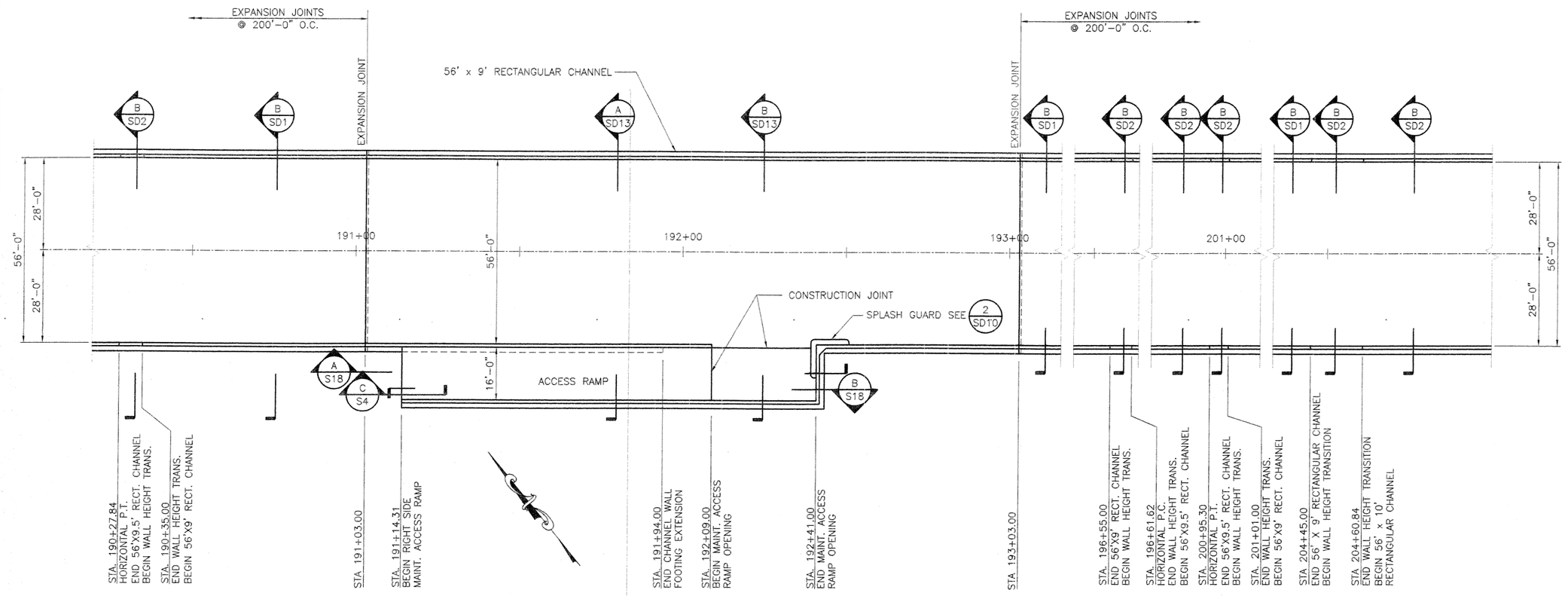
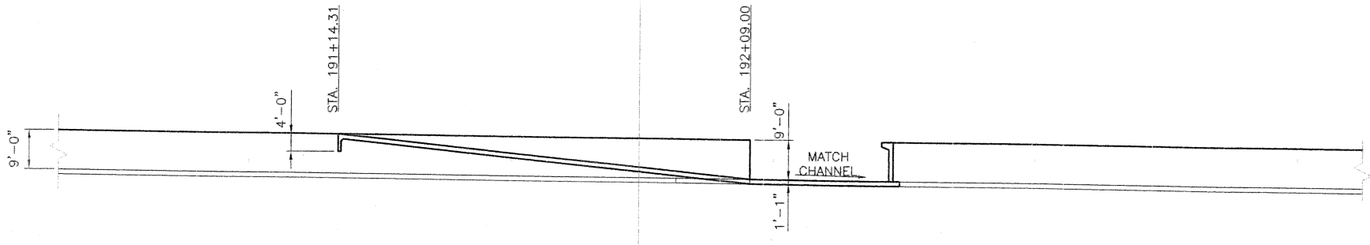
PROJECT NO: FILE NAME:



STA 192+25 MAINTENANCE ACCESS RAMP PLAN

SCALE: 1/16" = 1'-0"

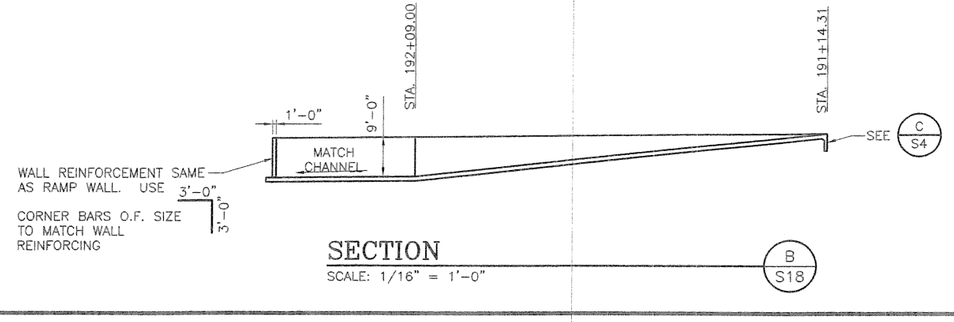
1 S18



SECTION

SCALE: 1/16" = 1'-0"

A S18



SECTION

SCALE: 1/16" = 1'-0"

B S18

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
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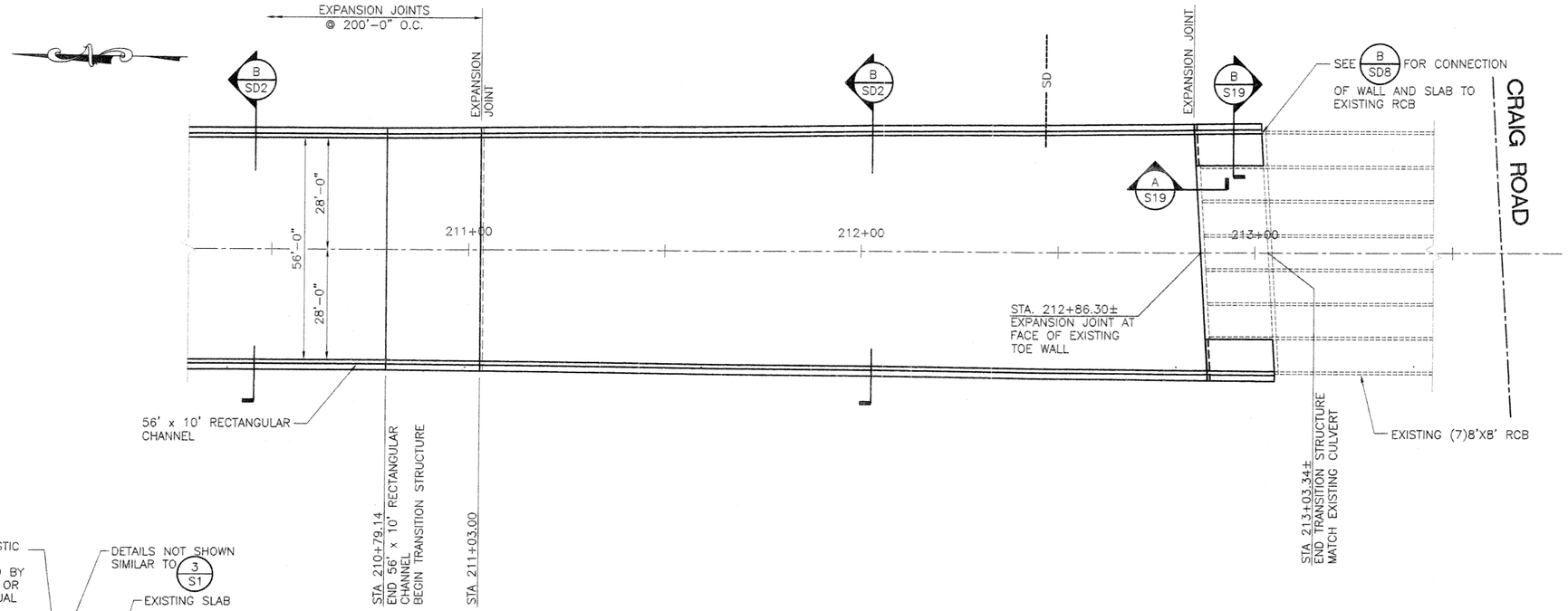
(DRAWING TITLE) ACCESS RAMP AT STA. 192+25 PLAN AND ELEVATION

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

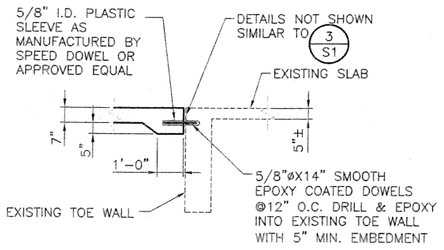
DRAWING NO.
S18
SHT. 101 OF 128

ISSUED FOR CONSTRUCTION



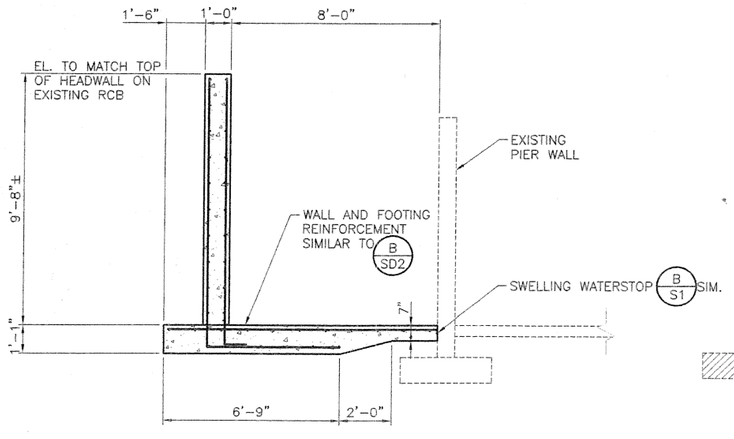
TRANSITION STRUCTURE PLAN AT CRAIG ROAD (1/S19)

SCALE: 1/16" = 1'-0"



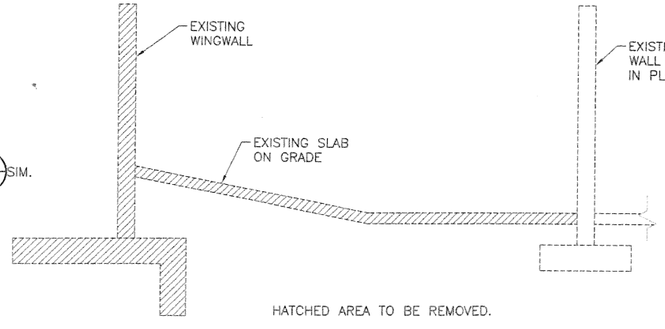
EXPANSION JOINT SECTION (A/S19)

SCALE: 3/8" = 1'-0"



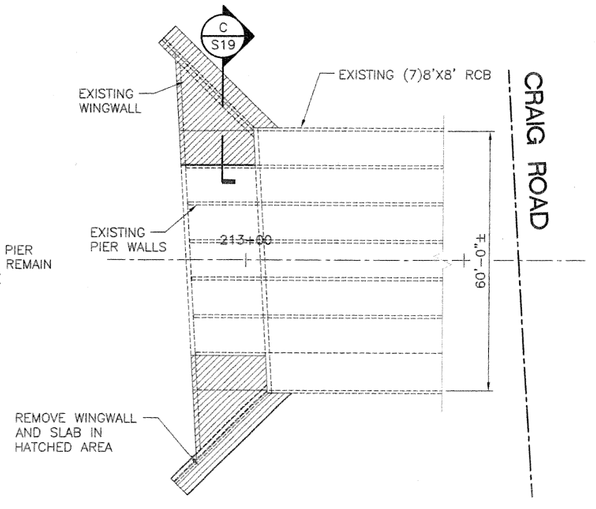
SECTION (B/S19)

SCALE: 3/8" = 1'-0"



SECTION (C/S19)

SCALE: 3/8" = 1'-0"



EXISTING CULVERT REMOVAL PLAN (2/S19)

SCALE: 1/16" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
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SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2987

STATE OF NEVADA — PROFESSIONAL ENGINEER — DAVID W. SEELEY — No. 11175 — 1/21/04 — EXPIRES 6/30/05

(DRAWING TITLE) TRANSITION STRUCTURE AT CRAIG ROAD

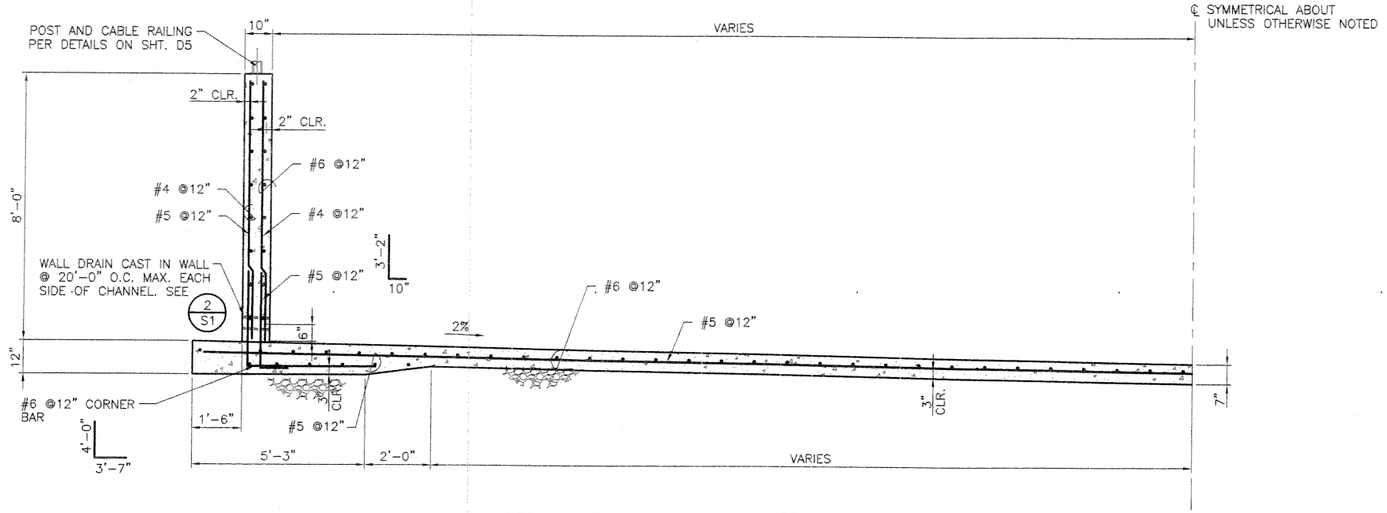
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. S19

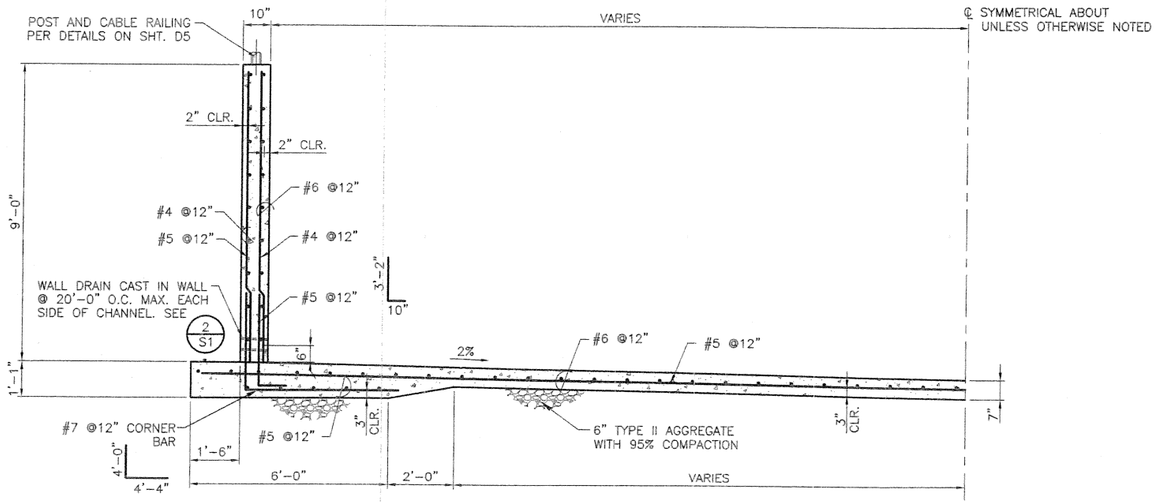
SHT. 10 OF 28

ISSUED FOR CONSTRUCTION



CHANNEL SECTION (A / SD1)

SCALE: 1/2" = 1'-0"



CHANNEL SECTION (B / SD1)

SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
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SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

ENGINEER - STATE OF NEVADA - DAVID W. SEELY - No. 11151 - PROFESSIONAL - 6/30/04

vtn nevada
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2272 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
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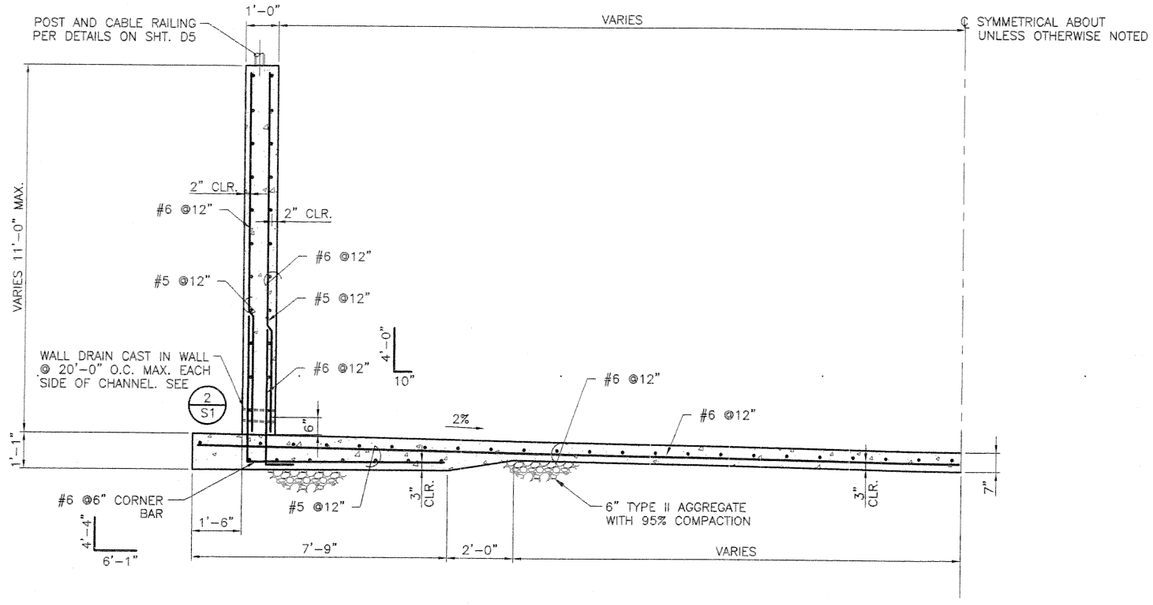
(DRAWING TITLE) CHANNEL SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD
(LOCATION)

DRAWING NO.
SD1
SHT. 03 OF 12

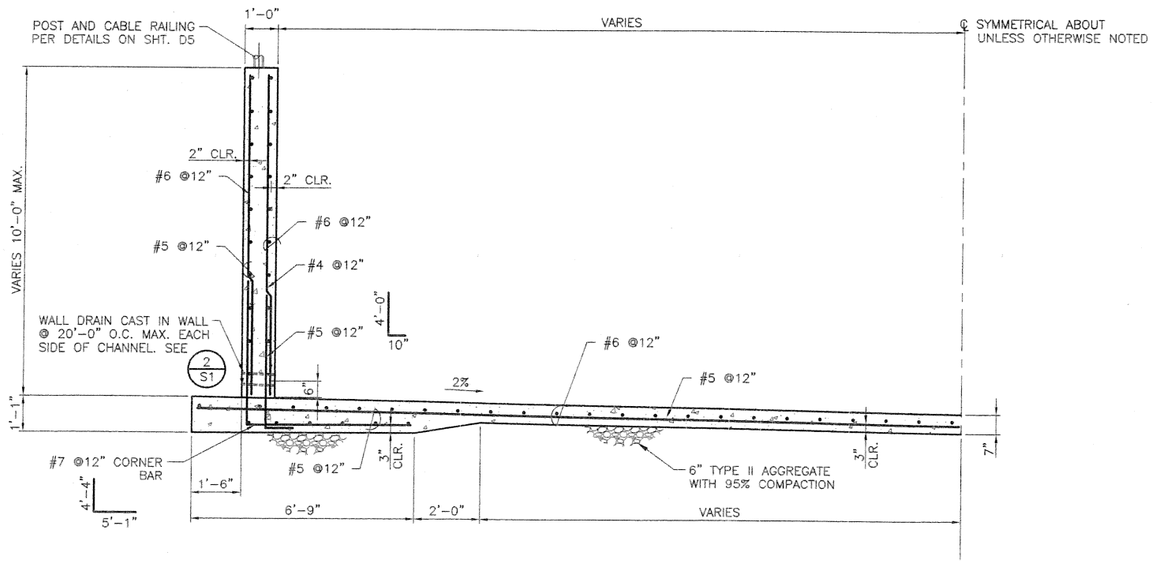
ISSUED FOR CONSTRUCTION



CHANNEL SECTION

SCALE: 1/2" = 1'-0"

A
SD2



CHANNEL SECTION

SCALE: 1/2" = 1'-0"

B
SD2

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE) CHANNEL SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
CIVIL
No. 11175
6/30/04
7/21/04

SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

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PROJECT NO:

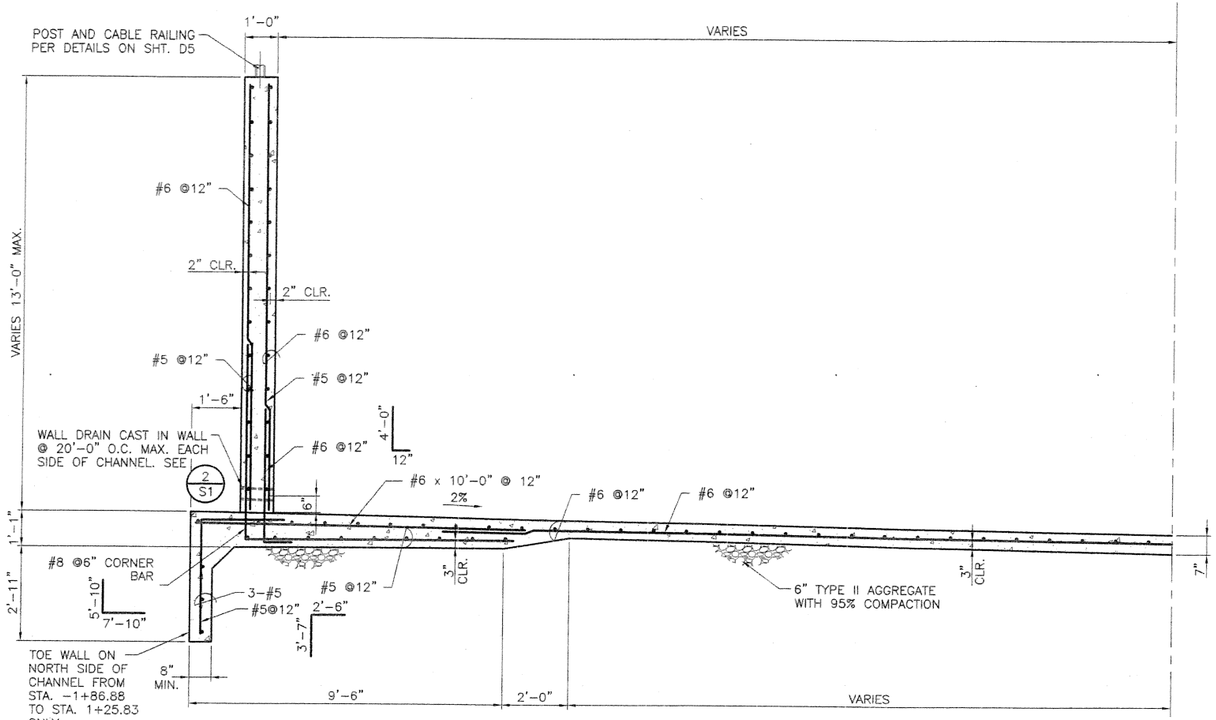
FILE NAME:

DRAWING NO.

SD2

SHT. 104 OF 128

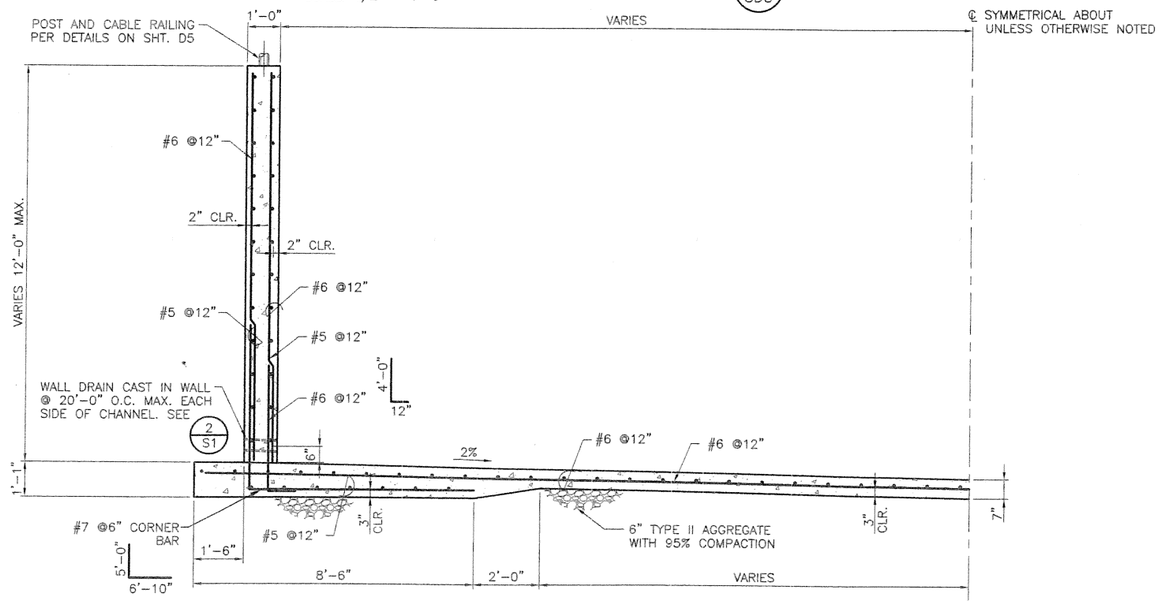
ISSUED FOR CONSTRUCTION



CHANNEL SECTION

SCALE: 1/2" = 1'-0"

A
SD3



CHANNEL SECTION

SCALE: 1/2" = 1'-0"

B
SD3

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
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SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

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PLANNERS
LAND SURVEYORS
2272 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
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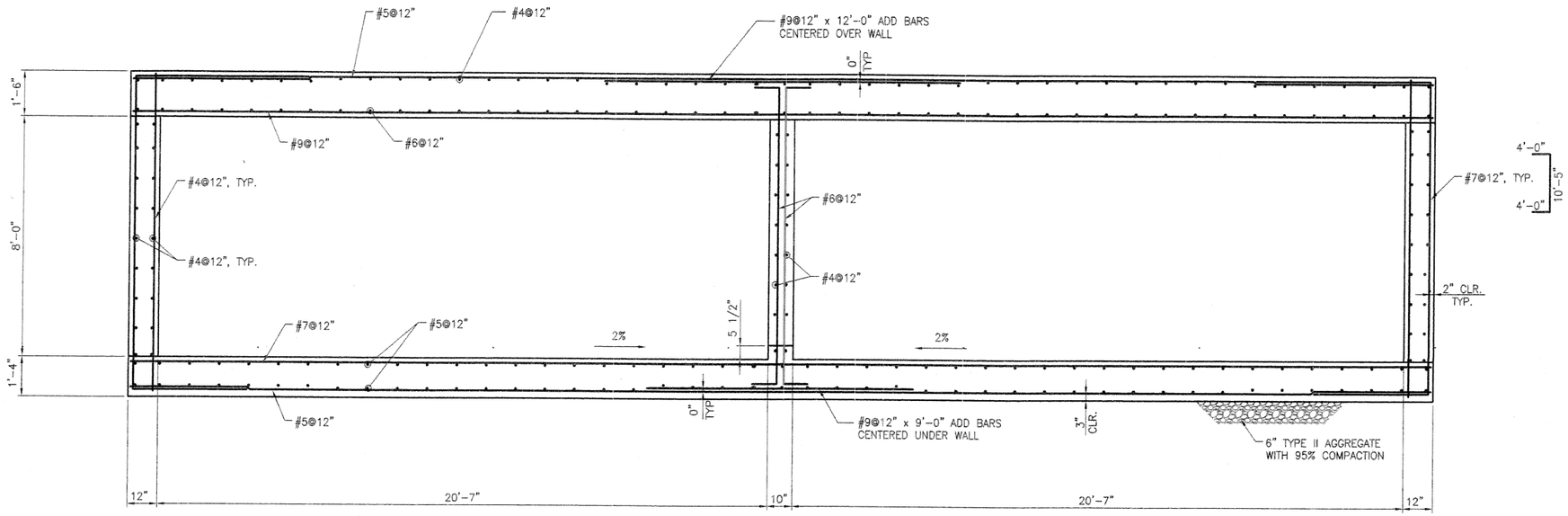
(DRAWING TITLE) CHANNEL SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(LOCATION)

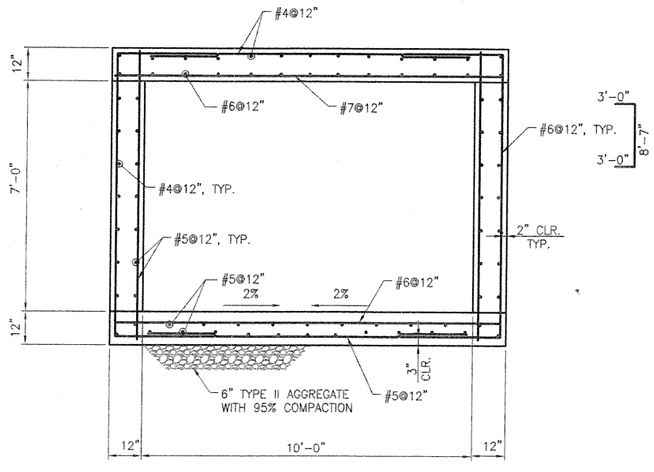
DRAWING NO.
SD3
SHT: 05 OF 28

ISSUED FOR CONSTRUCTION



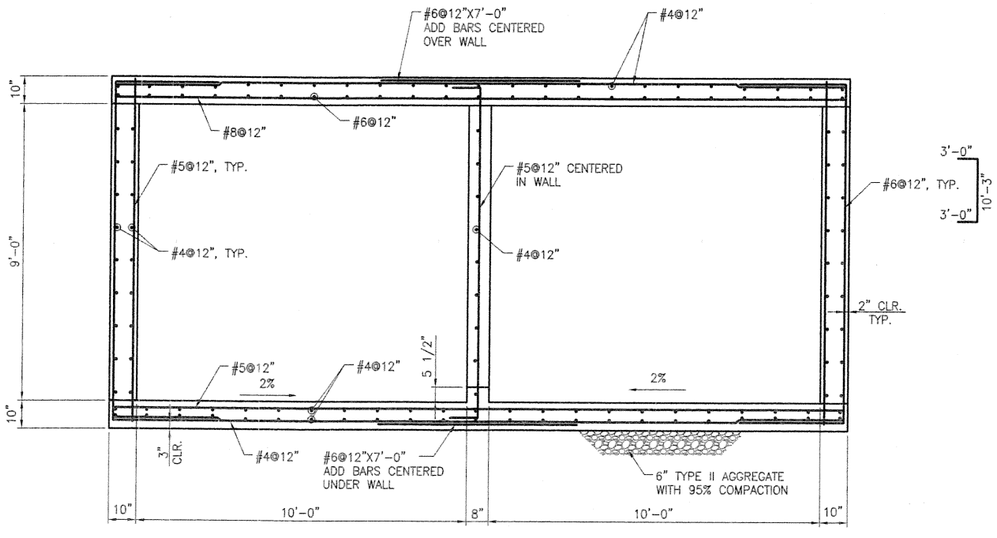
42' x 8' RCB WITH CENTER PIER WALL (A / SD4)

SCALE: 1/2" = 1'-0"



10' x 7' RCB (B / SD4)

SCALE: 1/2" = 1'-0"



(2) 10' x 9' RCB (C / SD4)

SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

RCB SECTIONS

UPPER LAS VEGAS WASH CHANNEL

NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

(DRAWING TITLE) (PROJECT TITLE) (LOCATION)

DRAWING NO. SD4

SHT. 106 OF 128

REVISIONS

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PROJECT NO: FILE NAME:

SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROFESSIONAL ENGINEER - STATE OF NEVADA DAVID W. SEELEY No. 11751 Exp. 6/30/04 1/21/04

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LAND SURVEYORS
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LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
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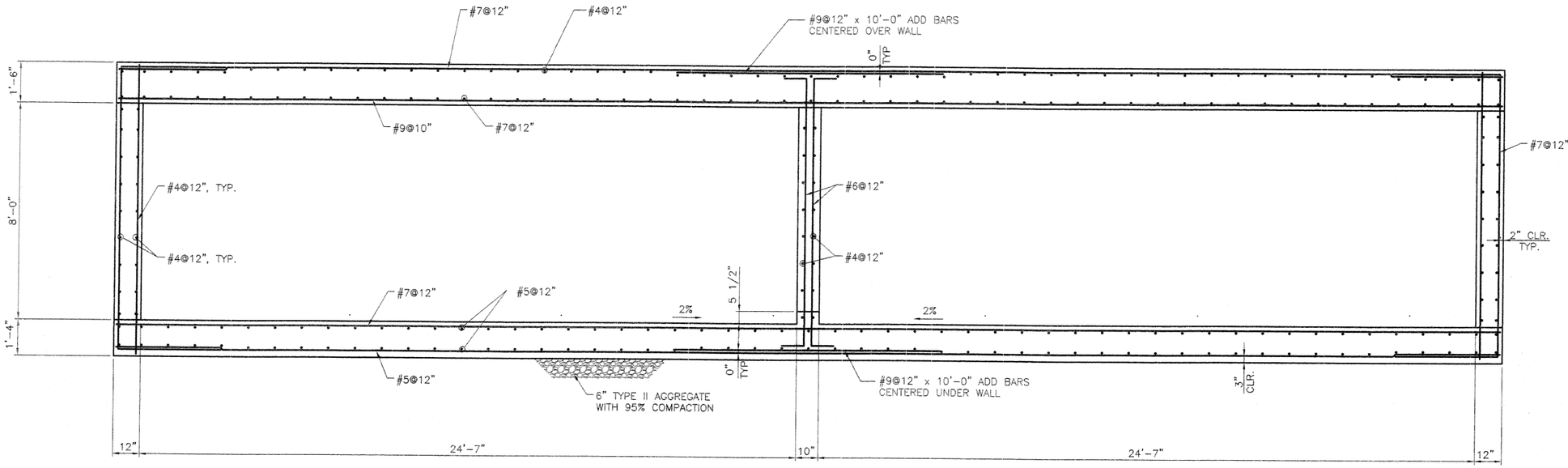
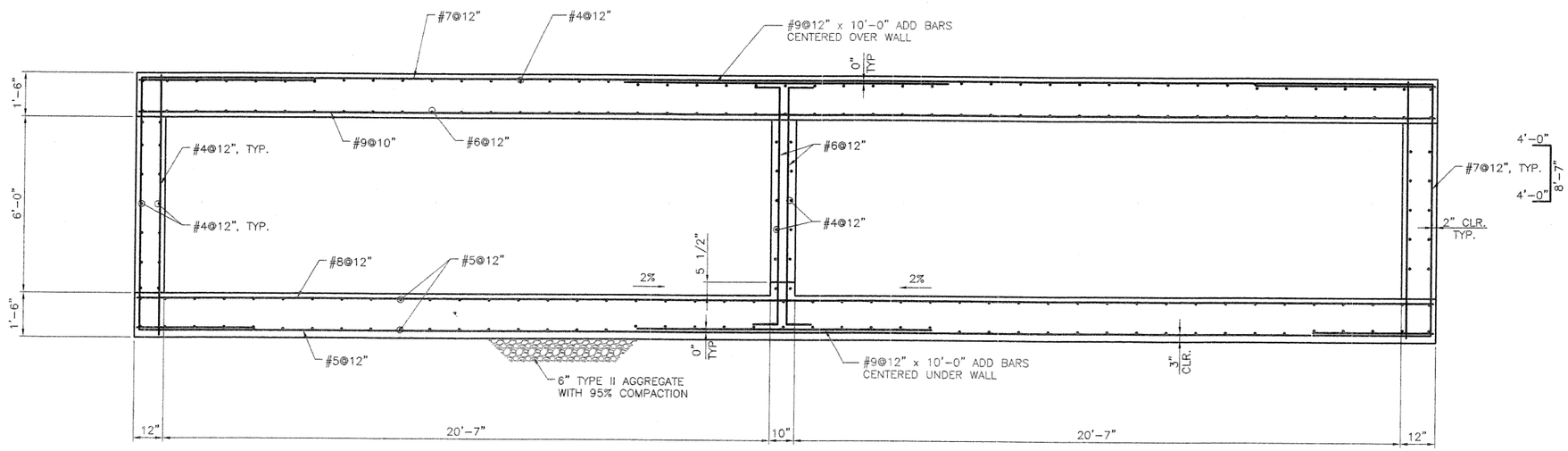


50' x 8' RCB WITH CENTER PIER WALL (A / SD5)

SCALE: 1/2" = 1'-0"



42' x 6' RCB WITH CENTER PIER WALL (B / SD5)

SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
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SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER - STATE OF NEVADA - DAVID W. SEELEY - No. 11751 - 6/30/04

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PLANNERS
LAND SURVEYORS
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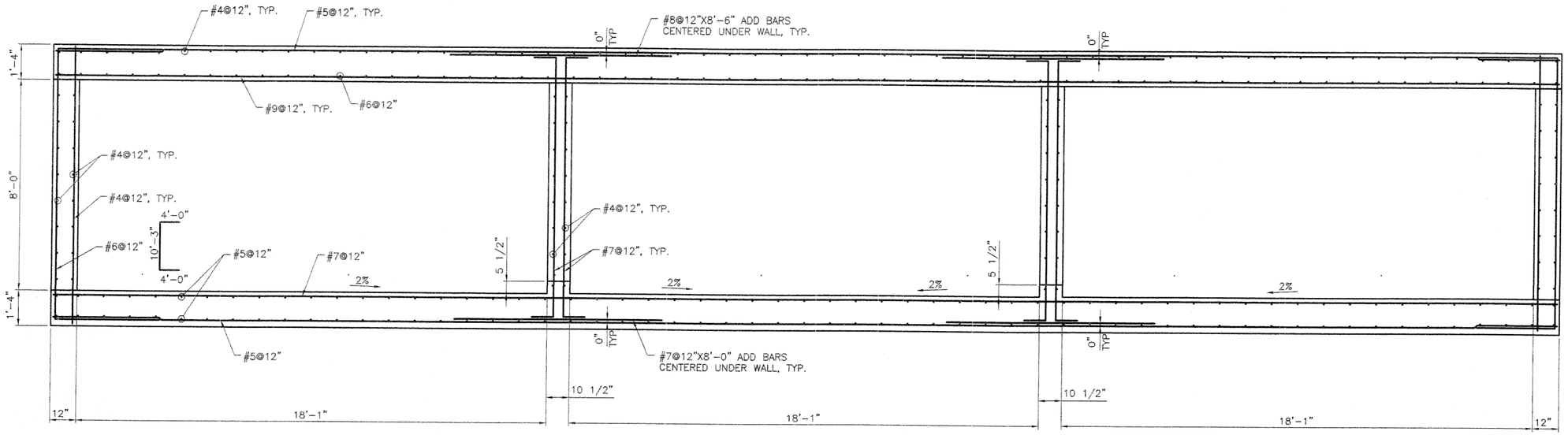
(DRAWING TITLE) RCB SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

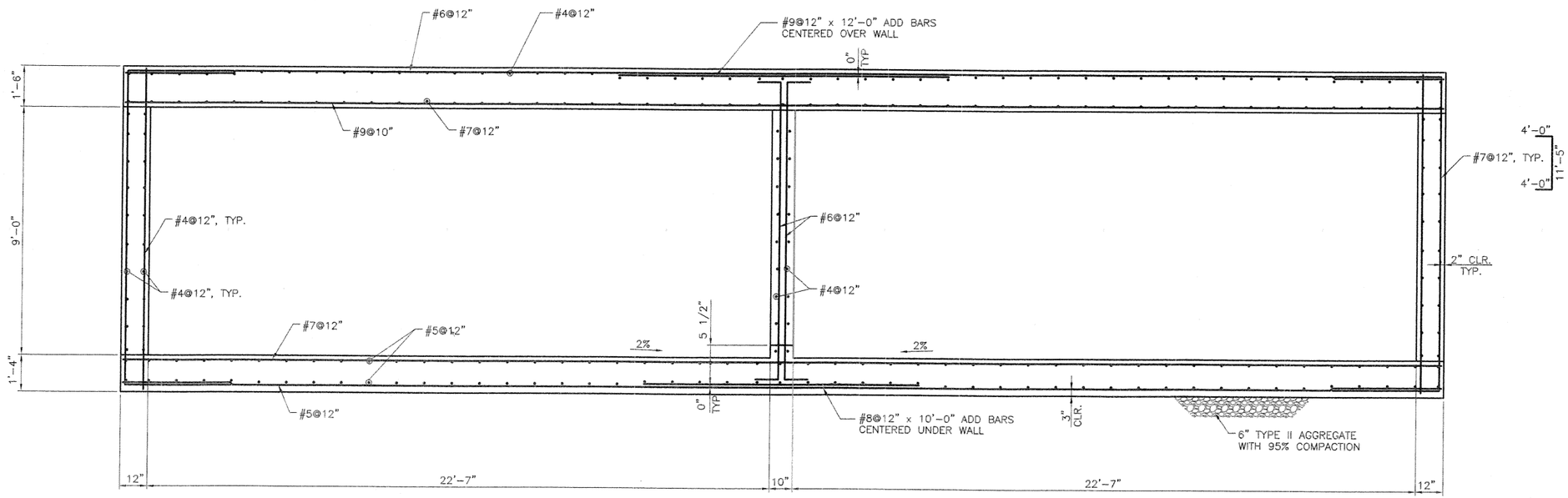
DRAWING NO.
SD5
SHT. 107 OF 128

ISSUED FOR CONSTRUCTION



56' x 8' RCB WITH (2) PIER WALLS (A / SD6)

SCALE: 1/2" = 1'-0"



46' x 9' RCB WITH CENTER PIER WALLS (B / SD6)

SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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PROJECT NO: FILE NAME:

SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
6/30/04 1/21/04

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• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) RCB SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

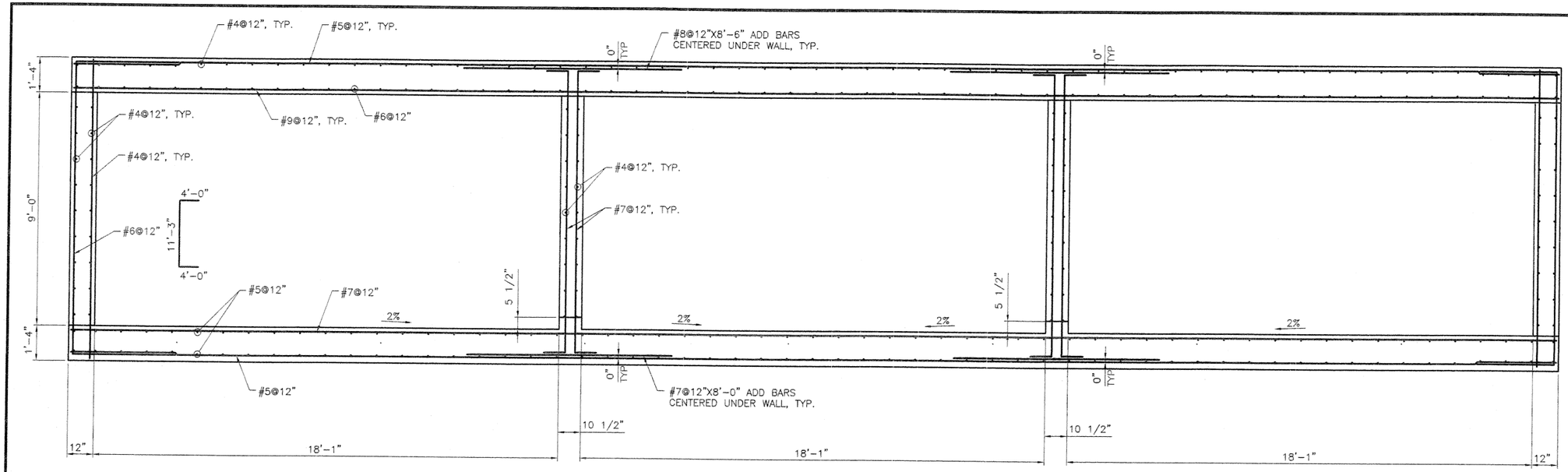
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

SD6

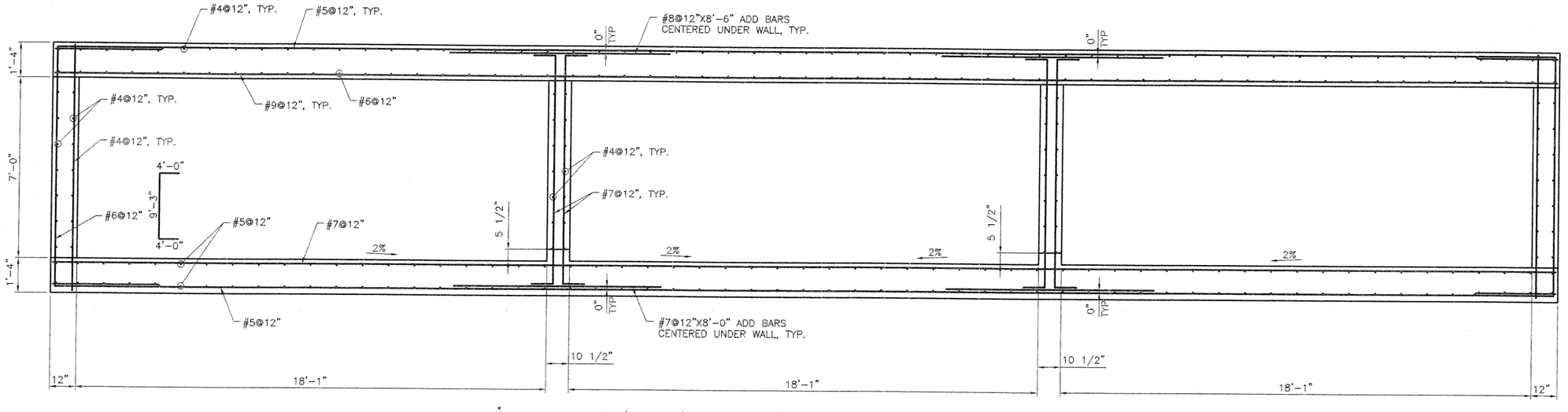
SHT. 108 OF 128

ISSUED FOR CONSTRUCTION



56' x 9' RCB WITH (2) PIER WALLS (A / SD7)

SCALE: 1/2" = 1'-0"



56' x 7' RCB WITH (2) PIER WALLS (B / SD7)

SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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PROJECT NO:

FILE NAME:

SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ALA
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APPROVED:
DATE: 1/21/04

PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEEMEY
No. 11751
Exp. 6/30/04 1/21/04

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(DRAWING TITLE) RCB SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

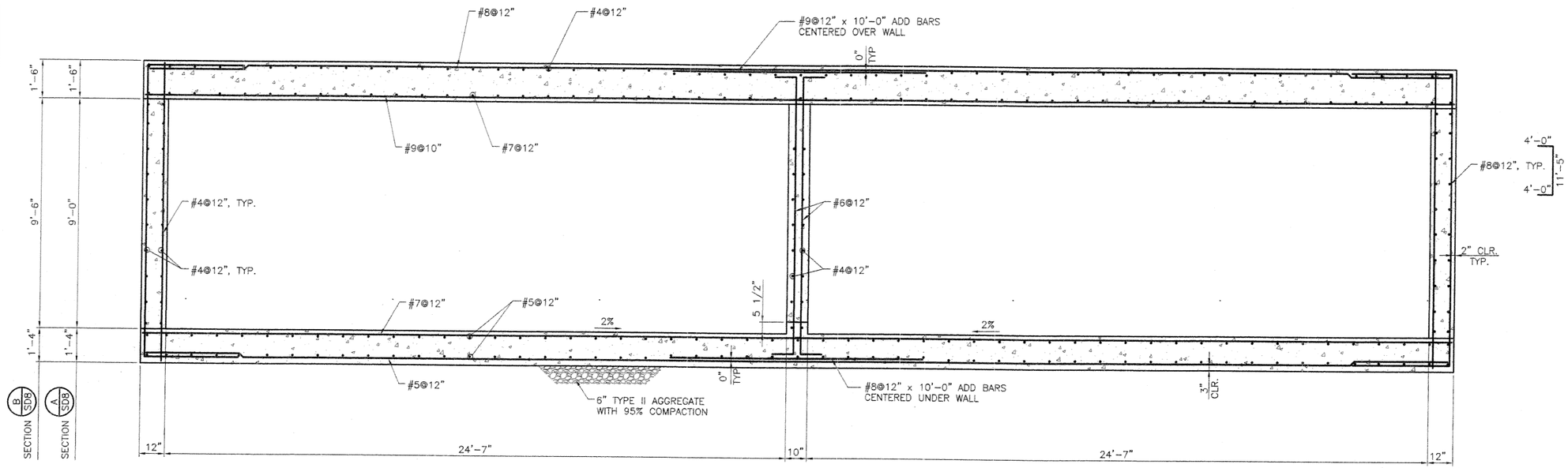
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

SD7

SHT. 109 OF 128

ISSUED FOR CONSTRUCTION



50' x 9' RCB WITH CENTER PIER WALL

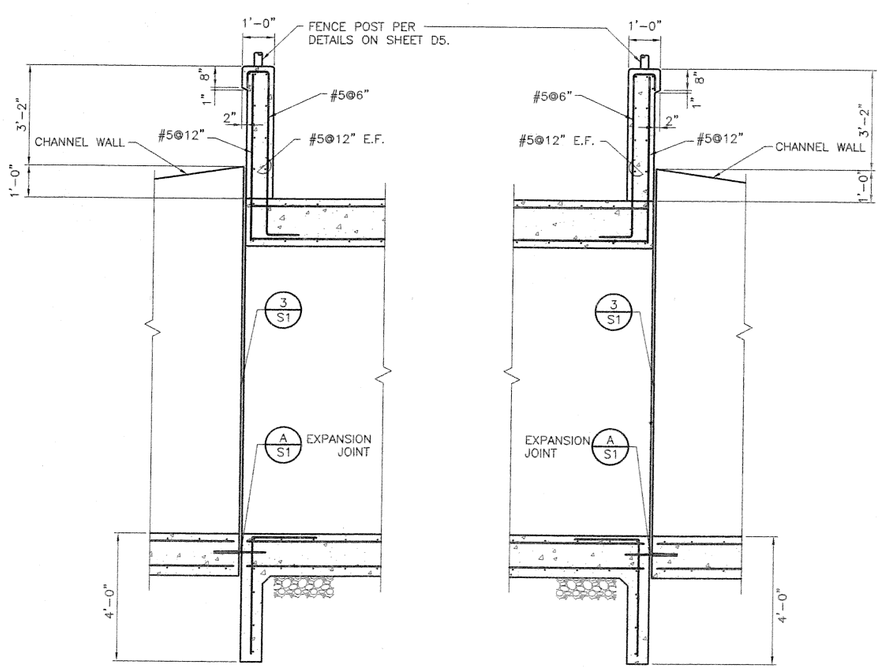
SCALE: 1/2" = 1'-0"

A SD8

50' x 9'-6" RCB WITH CENTER PIER WALL

SCALE: 1/2" = 1'-0"

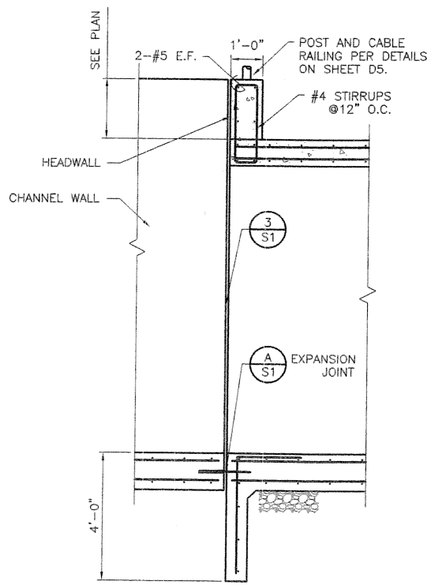
B SD8



SECTION

SCALE: N.T.S.

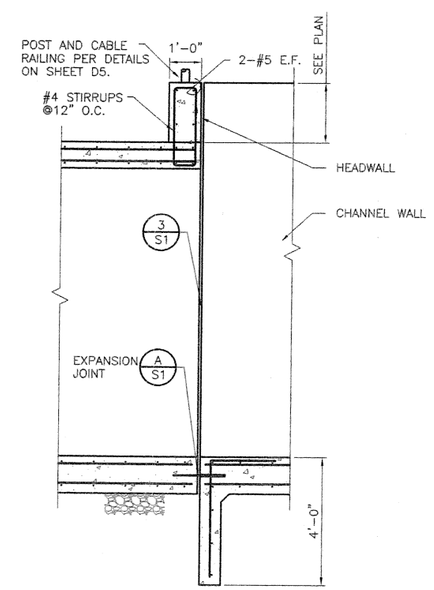
E SD8



SECTION

SCALE: N.T.S.

C SD8



SECTION

SCALE: N.T.S.

D SD8

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1			
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5			

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

PROJECT NO:
FILE NAME:

ENGINEER - STATE OF NEVADA - DAVID W. SEELEY - No. 11175 - 1/21/04 - EXPIRES

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PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7500
FAX (702) 362-2987

(DRAWING TITLE) RCB SECTIONS AND DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

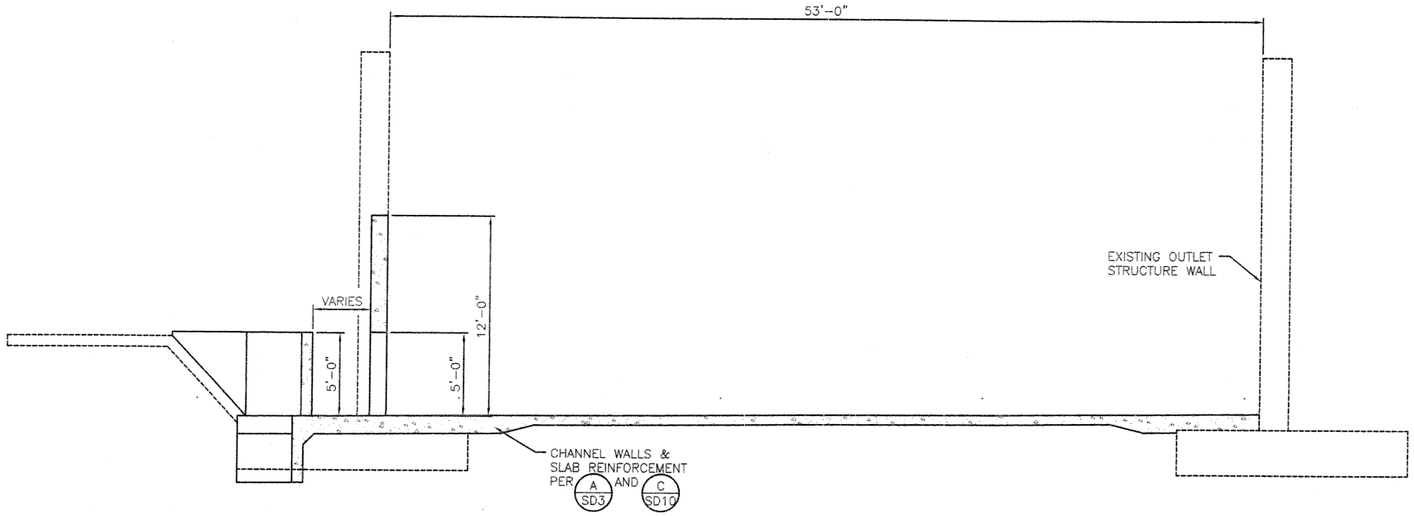
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

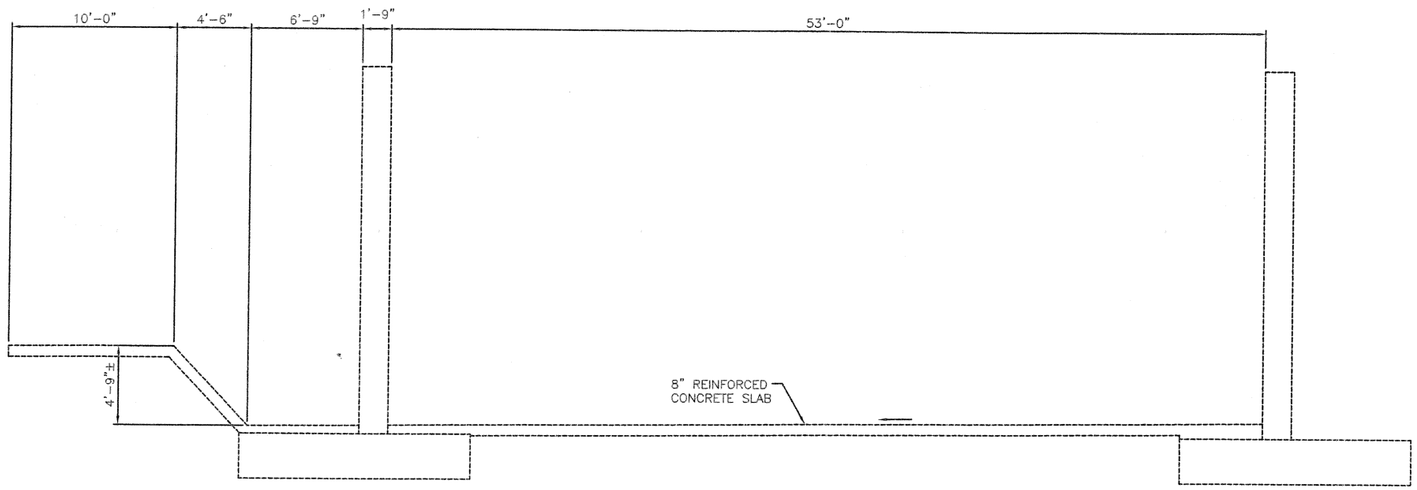
SD8

SHT. 110 OF 128

ISSUED FOR CONSTRUCTION



OUTLET STRUCTURE SECTION A SD9
SCALE: 1/4" = 1'-0"



EXISTING OUTLET STRUCTURE SECTION B SD9
SCALE: 1/4" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

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SCALE: AS SHOWN
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DRAWN: ELY
CHECKED:
APPROVED:
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PROJECT NO:
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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp. 6/30/04 7/21/04

vtn nevada
CONSULTING ENGINEERS
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2727 SOUTH RAINBOW BOULEVARD
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FAX (702) 362-2597

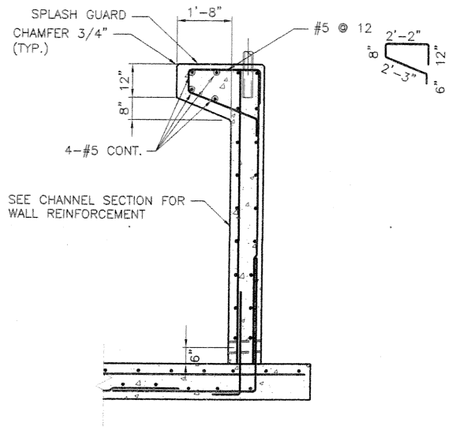
(DRAWING TITLE) CHANNEL SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

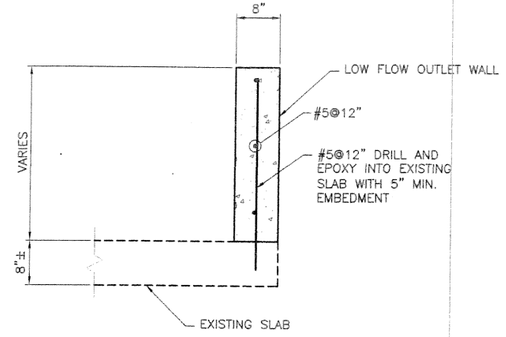
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
SD9
SHT. 111 OF 128

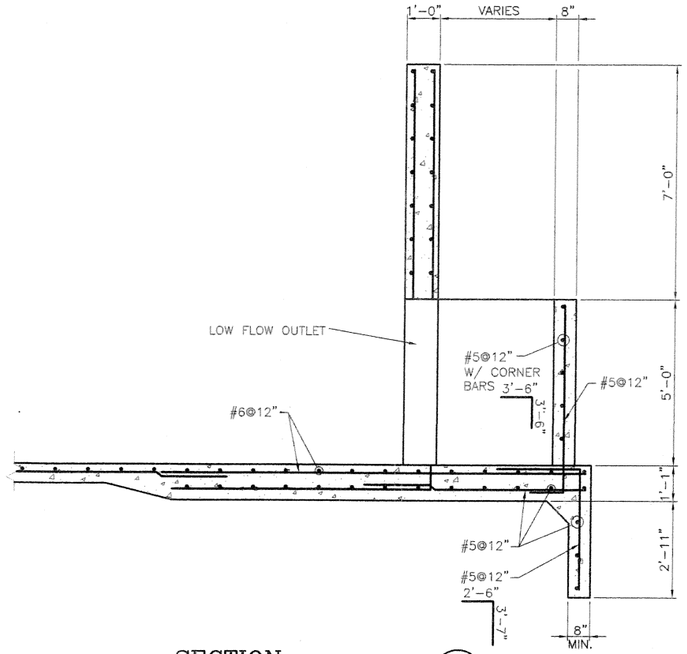
ISSUED FOR CONSTRUCTION



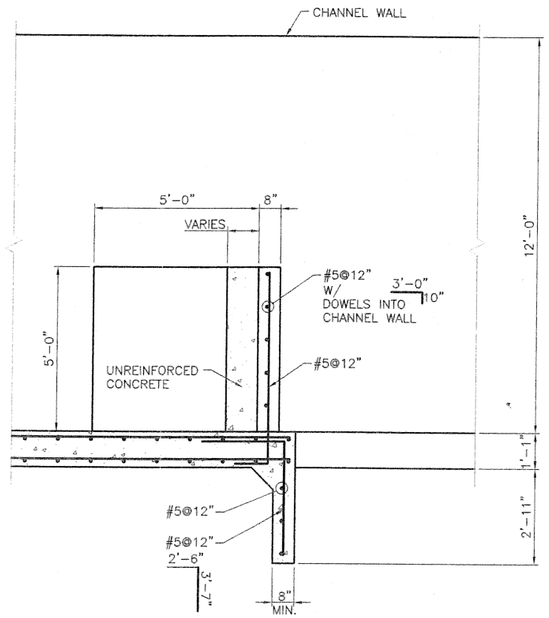
WALL SECTION (A SD10)
SCALE: 1/2" = 1'-0"



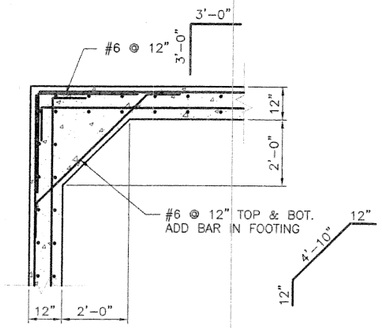
SECTION (B SD10)
SCALE: 1" = 1'-0"



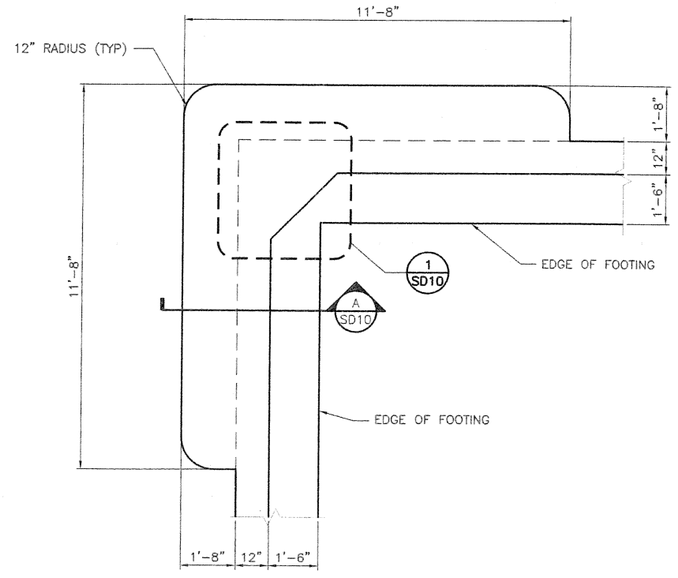
SECTION (C SD10)
SCALE: 1/2" = 1'-0"



SECTION (D SD10)
SCALE: 1/2" = 1'-0"



CORNER DETAIL (1 SD10)
SCALE: 1/2" = 1'-0"



SPLASH GUARD DETAIL (2 SD10)
SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
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SCALE: AS SHOWN
DESIGN: DWL
DRAWN: ELY
CHECKED:
APPROVED:
DATE: 1/21/04
PROJECT NO:
FILE NAME:

ENGINEER - STATE OF NEVADA - DAVID W. SEELEY - No. 11175 - PROFESSIONAL - Exp. 6/30/05

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FAX (702) 362-2987

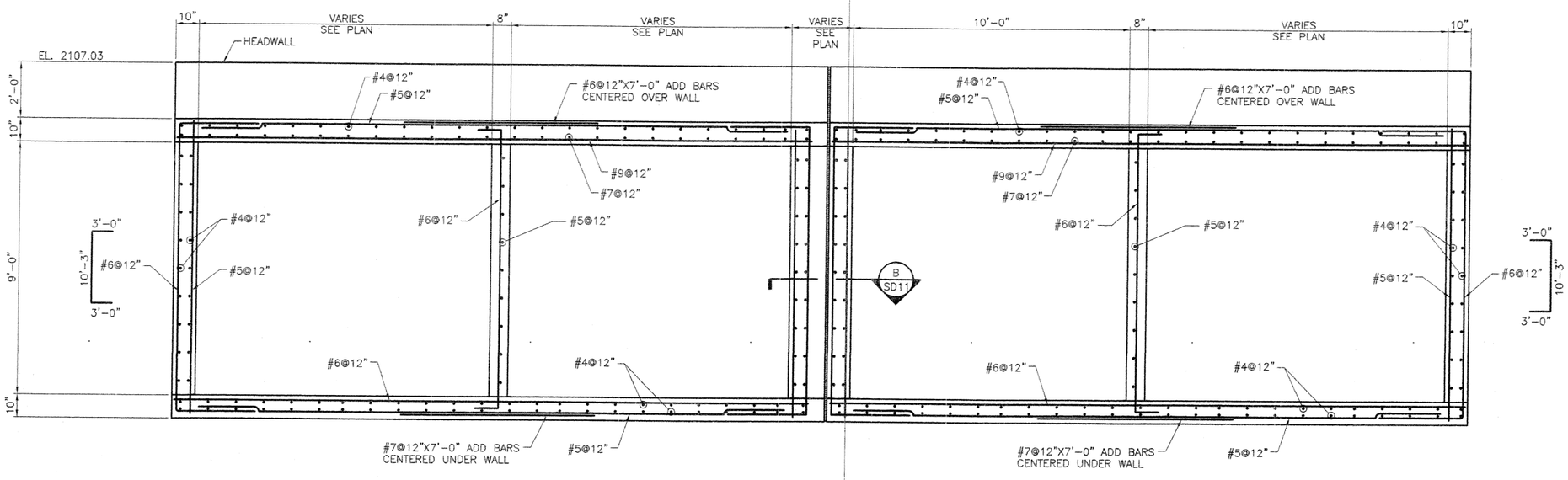
(DRAWING TITLE) CHANNEL SECTIONS AND DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD
(LOCATION)

DRAWING NO. SD10

SHT. 12 OF 28

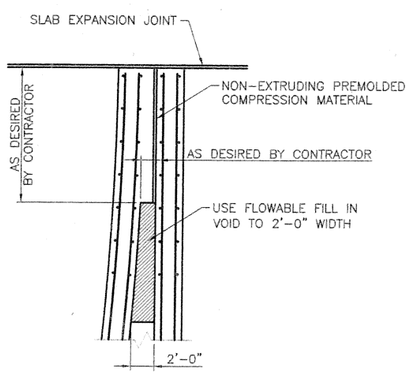
ISSUED FOR CONSTRUCTION



CONFLUENCE STRUCTURE SECTION

SCALE: 1/2" = 1'-0"

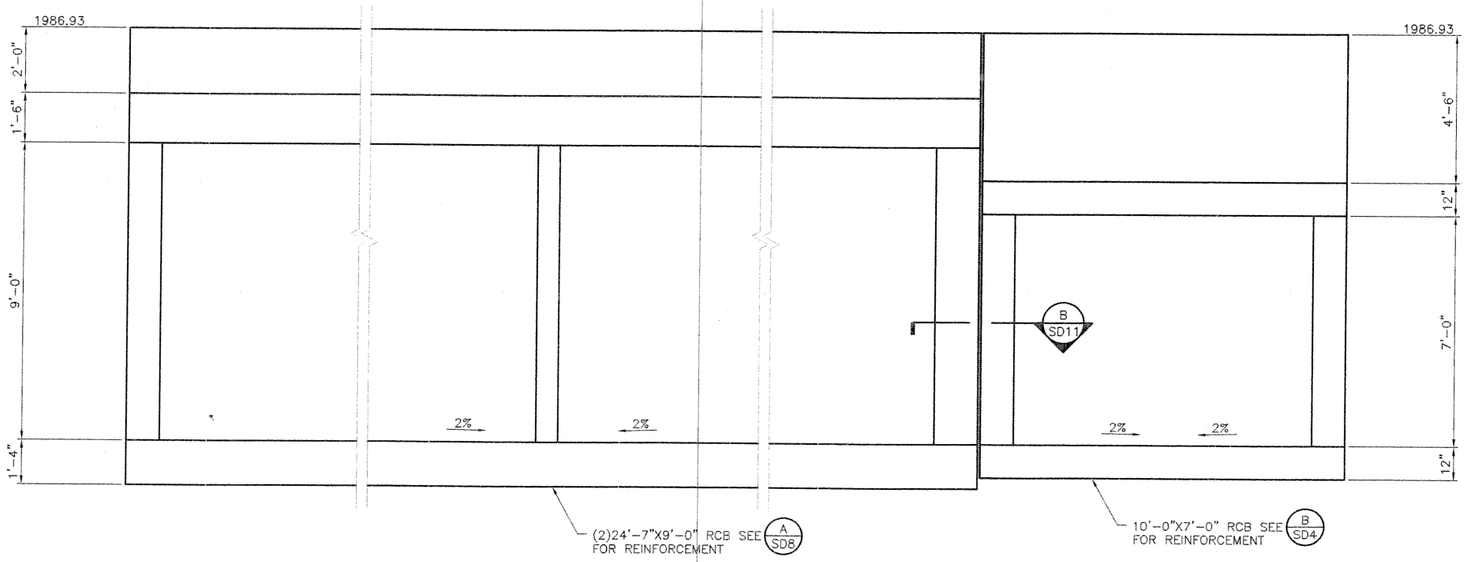
(A SD11)



SECTION

SCALE: 1/2" = 1'-0"

(B SD11)



CONFLUENCE STRUCTURE SECTION

SCALE: 1/2" = 1'-0"

(C SD11)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
1			
2			
3			
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SCALE: AS SHOWN
DESIGN: DWS
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APPROVED:
DATE: 1/21/04

PROJECT NO:

FILE NAME:

STATE OF NEVADA — PROFESSIONAL ENGINEER — DAVID W. SEELEY — No. 11151 — 1/21/04

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2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7500
FAX (702) 382-2297

(DRAWING TITLE) RCB SECTIONS AND DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

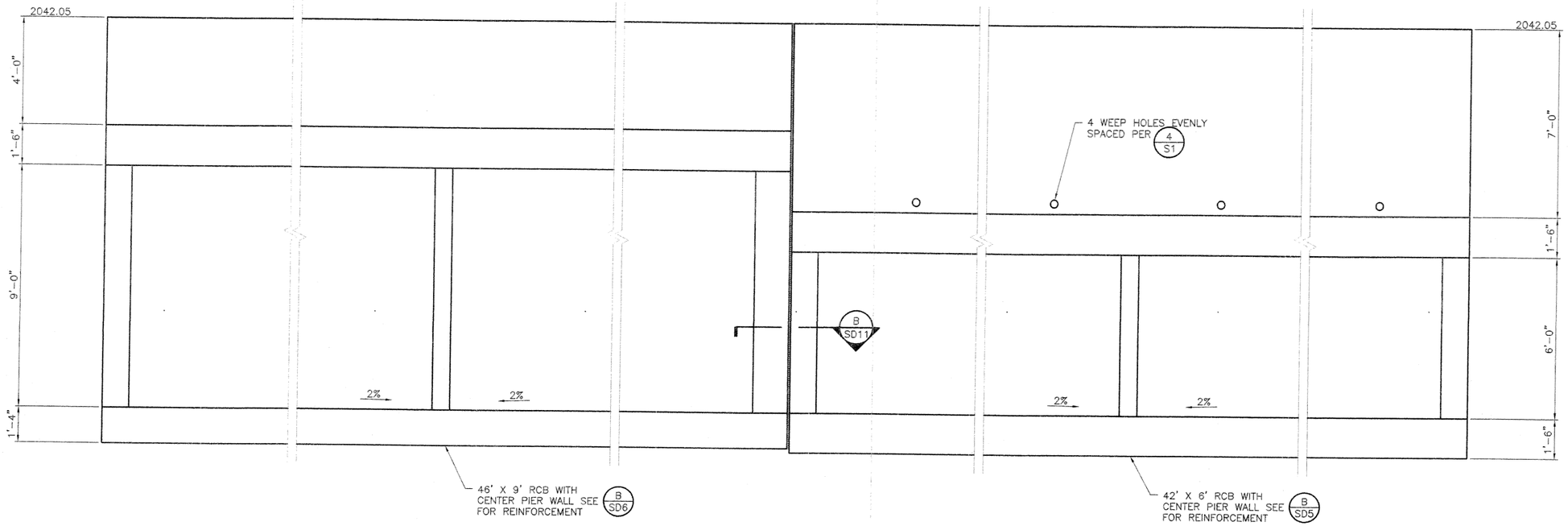
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

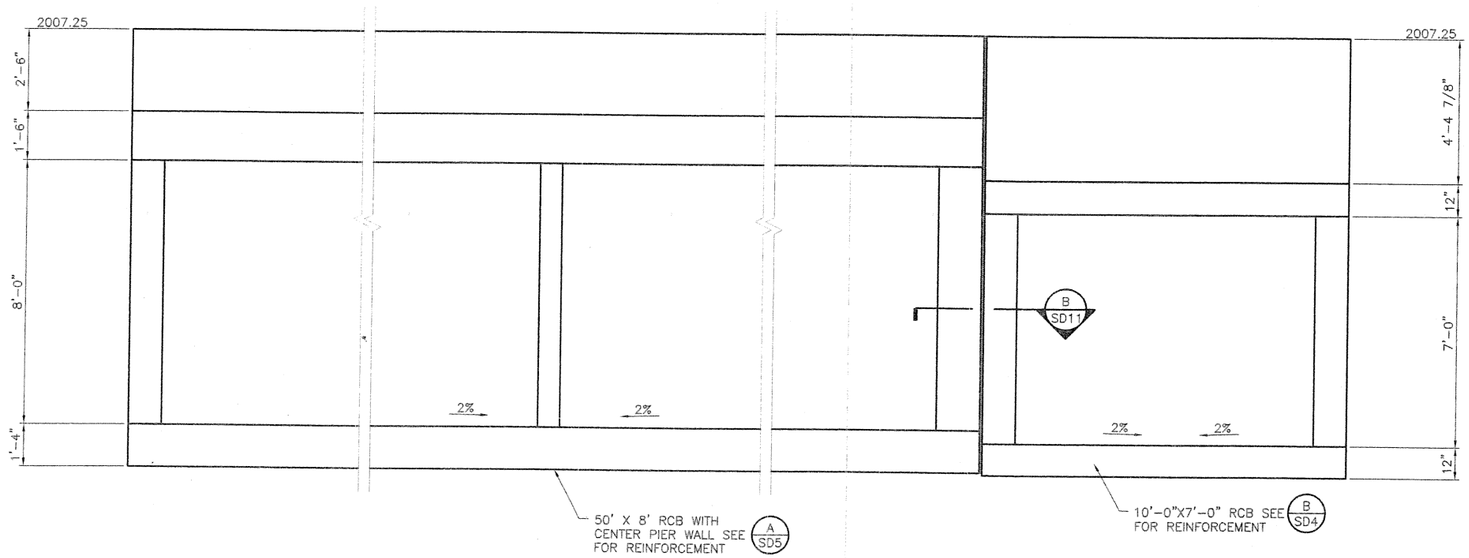
SD11

SHT. 13 OF 28

ISSUED FOR CONSTRUCTION



CONFLUENCE STRUCTURE SECTION A/SD12
SCALE: 1/2" = 1'-0"



CONFLUENCE STRUCTURE SECTION B/SD12
SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

(DRAWING TITLE) RCB SECTIONS AND DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. SD12

SHT. 114 OF 128

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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
6/30/04 1/21/04

SCALE: AS SHOWN
DESIGN: DWS
DRAWN: ALA
CHECKED:
APPROVED:
DATE: 1/21/04

REVISIONS

NO.	DESCRIPTION	DATE	BY
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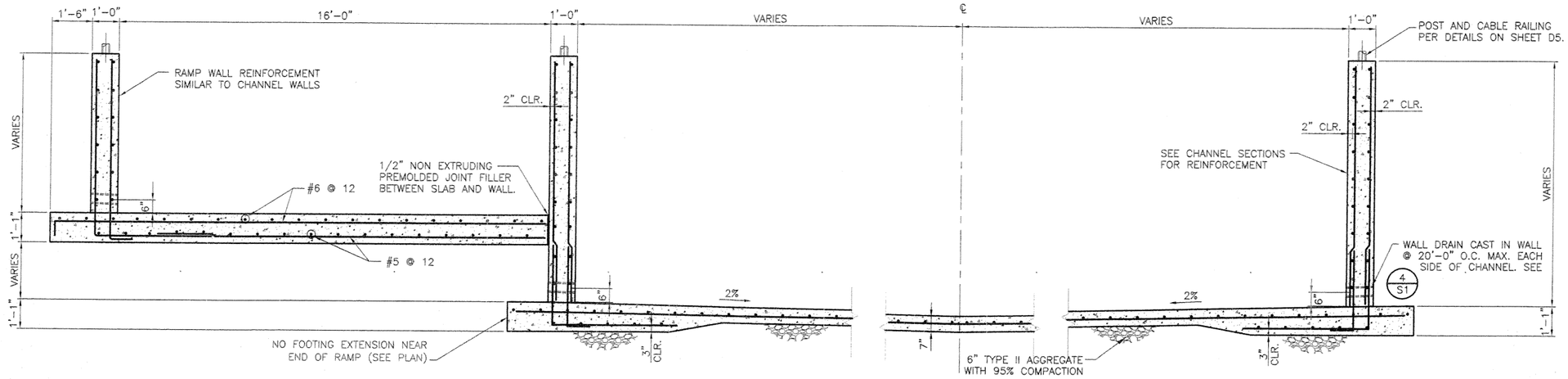
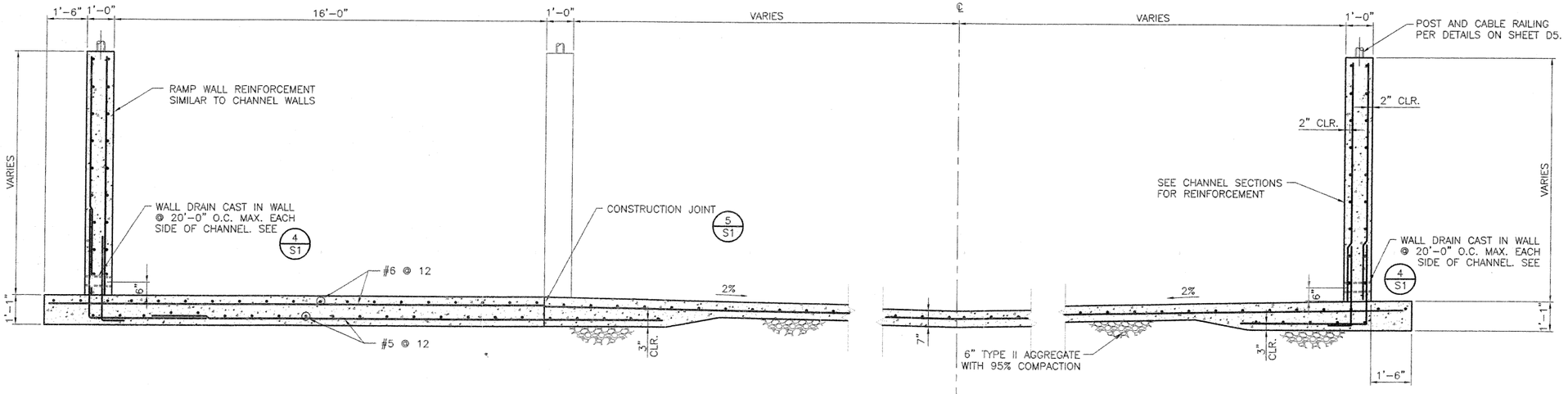
PROJECT NO:
FILE NAME:

ISSUED FOR CONSTRUCTION



CHANNEL RAMP SECTION (A/SD13)
SCALE: 1/2" = 1'-0"



CHANNEL RAMP SECTION (B/SD13)
SCALE: 1/2" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
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DRAWN: ELY
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APPROVED:
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PROFESSIONAL ENGINEER - STATE OF NEVADA
DAVID W. SEELEY
No. 11751
Exp. 6/30/04 1/21/04

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FAX (702) 362-2597

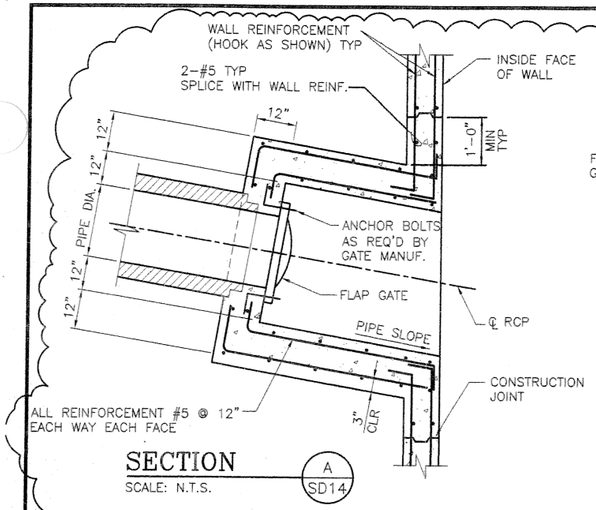
(DRAWING TITLE) CHANNEL SECTIONS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
SD13
SHT. 115 OF 128

ISSUED FOR CONSTRUCTION



SECTION A SD14
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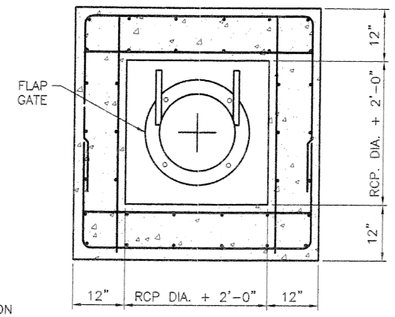
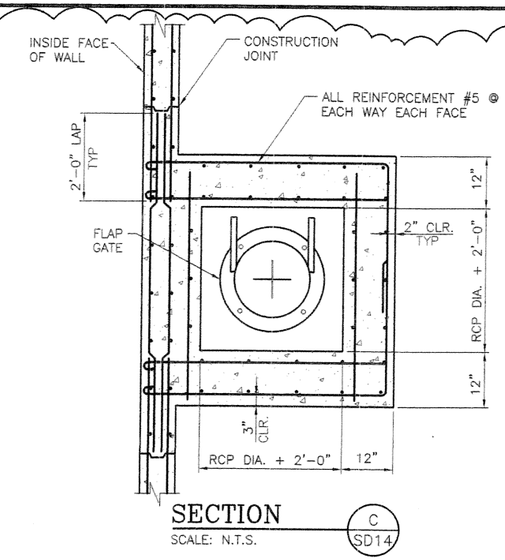
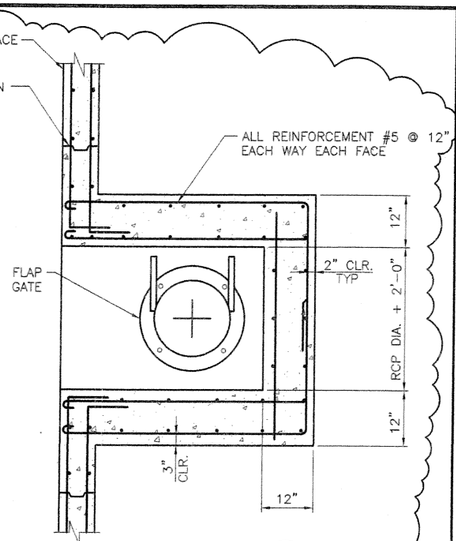


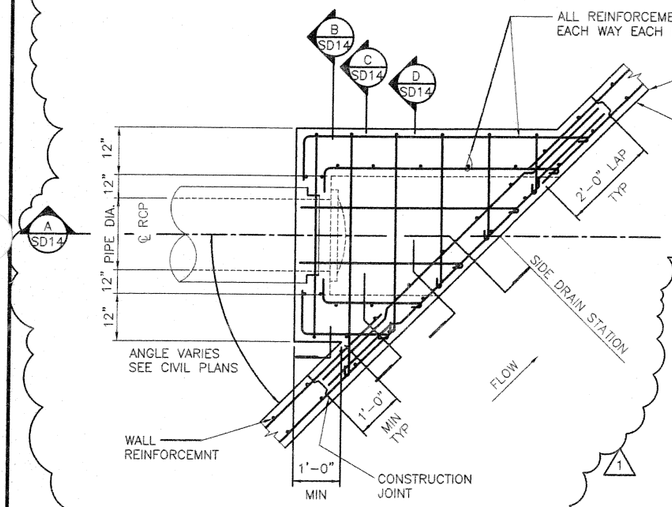
SECTION B SD14
SCALE: N.T.S.



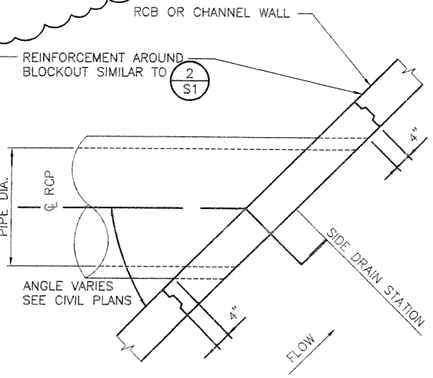
SECTION C SD14
SCALE: N.T.S.



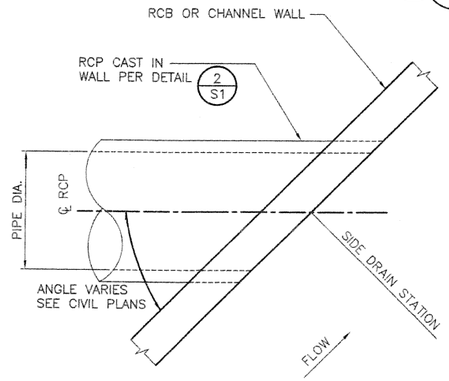
SECTION D SD14
SCALE: N.T.S.



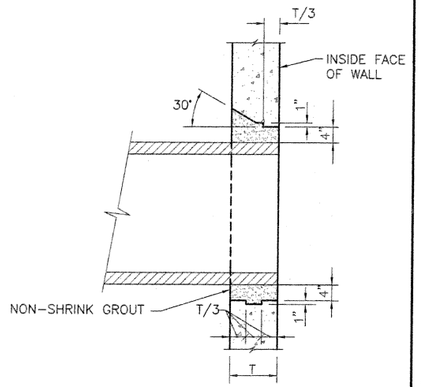
OPTION 1 – PLAN 1 SD14
SCALE: N.T.S.



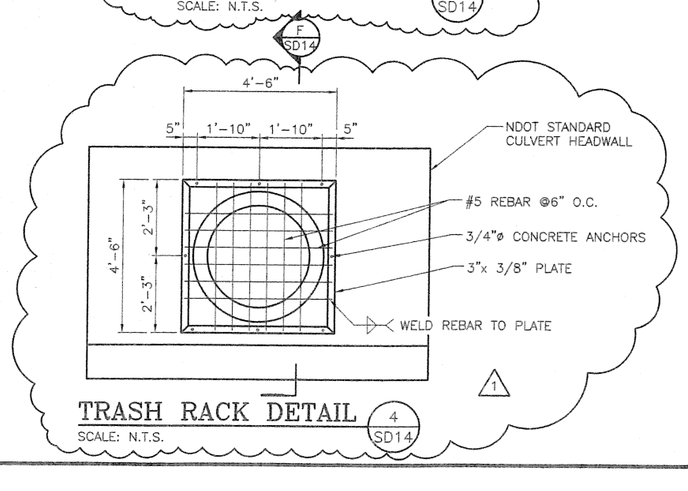
OPTION 2 – PLAN 2 SD14
SCALE: N.T.S.



OPTION 3 – PLAN 3 SD14
SCALE: N.T.S.

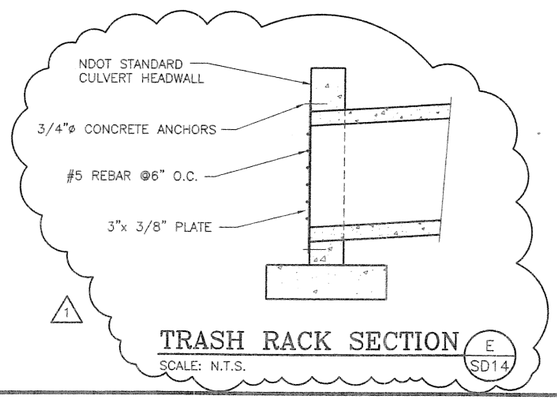


SECTION E SD14
SCALE: N.T.S.



TRASH RACK DETAIL 4 SD14
SCALE: N.T.S.

PIPE PENETRATION DETAILS



TRASH RACK SECTION E SD14
SCALE: N.T.S.

NOTE:
1. CONTRACTOR MAY SELECT OPTION 1, 2 OR 3 FOR RCP PIPE PENETRATIONS OF RCB OR CHANNEL WALLS.
2. WHERE FLAP GATES ARE CALLED FOR ON PLANS ONLY OPTION 1 SHALL BE USED.

1

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS		
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM 3	3/15/04	DWS

SCALE: AS SHOWN
DESIGN: DWS
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APPROVED:
DATE: 1/21/04
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FILE NAME:

PROFESSIONAL ENGINEER - STATE OF NEVADA - DAVID W. SEELEY - No. 11151 - 3/21/04

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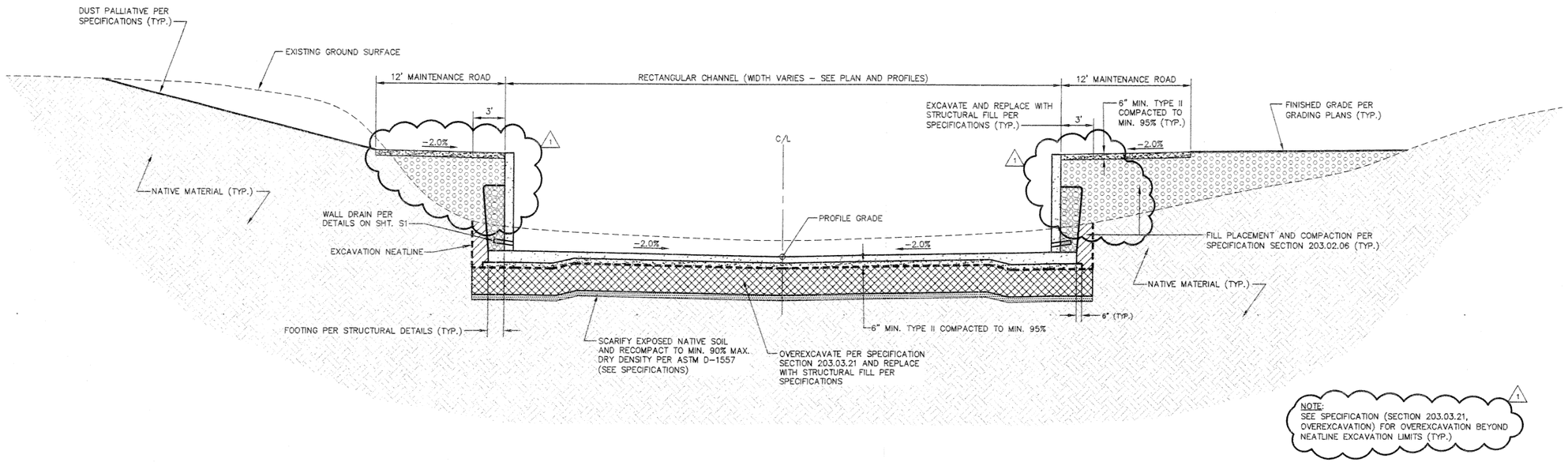
FAX (702) 382-2597

(DRAWING TITLE) PIPE PENETRATION DETAILS
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

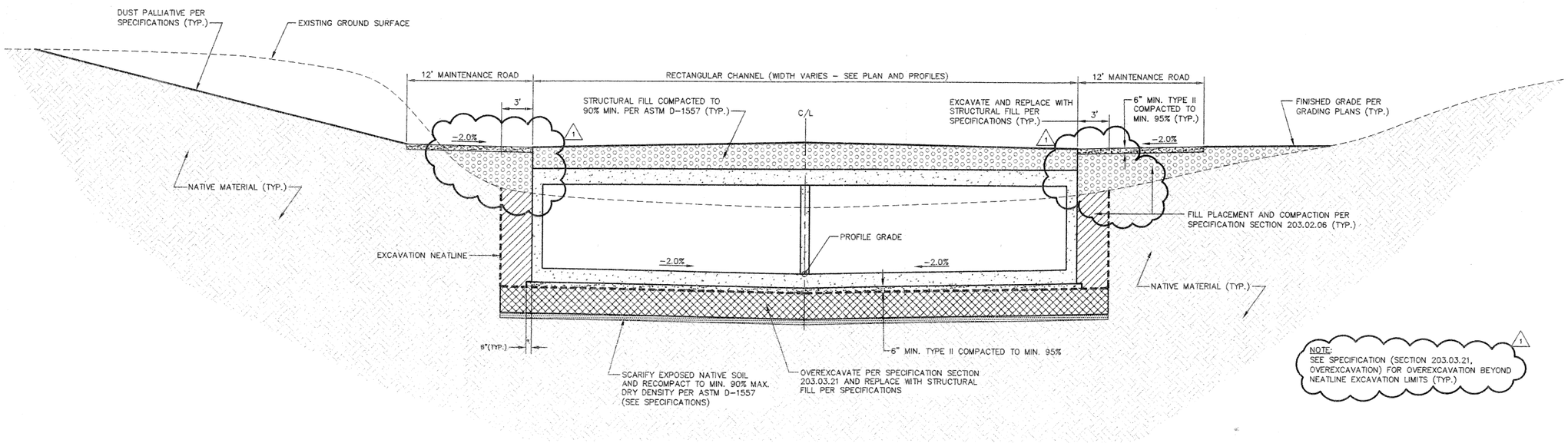
DRAWING NO.
SD14
SHT. 116 OF 128

ISSUED FOR CONSTRUCTION



RECTANGULAR CHANNEL EXCAVATION AND STRUCTURAL FILL SECTION

NO SCALE



REINFORCED CONCRETE BOX (RCB) EXCAVATION AND STRUCTURAL FILL SECTION

NO SCALE

Avoid overhead power line contact.
2 working days Call before you Overhead
1-702-593-6111
Nevada Power Environment and Safety Services Department

Avoid cutting underground utility lines. It's costly.
2 working days Call before you Dig
1-800-227-2600
Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
2			
3			
4			

PROJECT NO: FILE NAME:

SCALE: N/A
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
3-11-04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) TYPICAL EXCAVATION SECTIONS

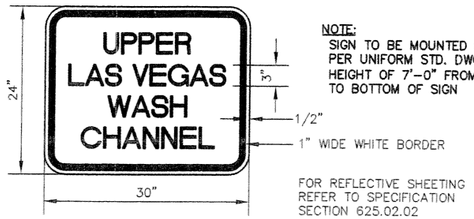
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. D1

SHT. 117 OF 128

ISSUED FOR CONSTRUCTION

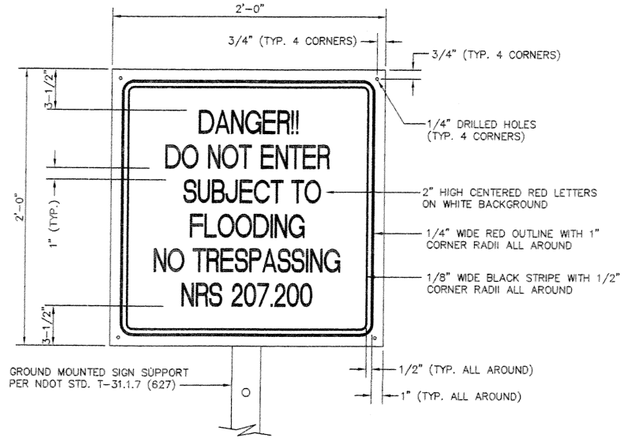


NOTE:
SIGN TO BE MOUNTED ON 2" SIGN POST PER UNIFORM STD. DWG. NO. 249 AT A HEIGHT OF 7'-0" FROM GROUND SURFACE TO BOTTOM OF SIGN

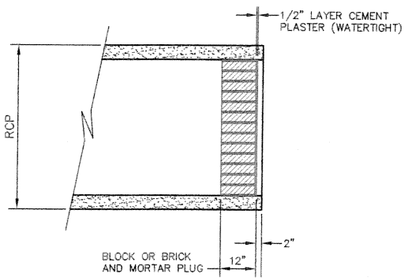
FOR REFLECTIVE SHEETING REFER TO SPECIFICATION SECTION 625.02.02

GREEN SIGN PANEL WITH 3" HIGH WHITE LETTERING

CHANNEL IDENTIFICATION SIGN DETAIL
N.T.S.



FLOOD WARNING SIGN DETAIL
N.T.S.



BRICK AND MORTAR
RCB / RCP PLUG
N.T.S.

Avoid overhead power line contact.
2 working days Call before you Overhead
1-702-593-6111
Nevada Power Environment and Safety Services Department

Avoid cutting underground utility lines. It's costly.
2 working days Call before you Dig
1-800-227-2600
Underground Service Alert (U.S.A.)

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS

NO.	DESCRIPTION	DATE	BY
△			
△			
△			
△			
△			

PROJECT NO: FILE NAME:

SCALE: N/A
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
1/21/04

vtn nevada
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2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

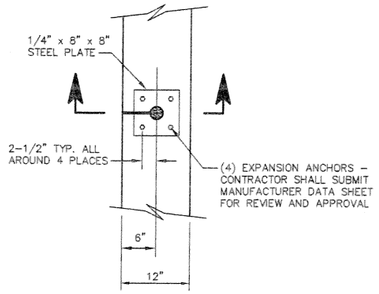
(DRAWING TITLE) SIGN AND PLUG DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

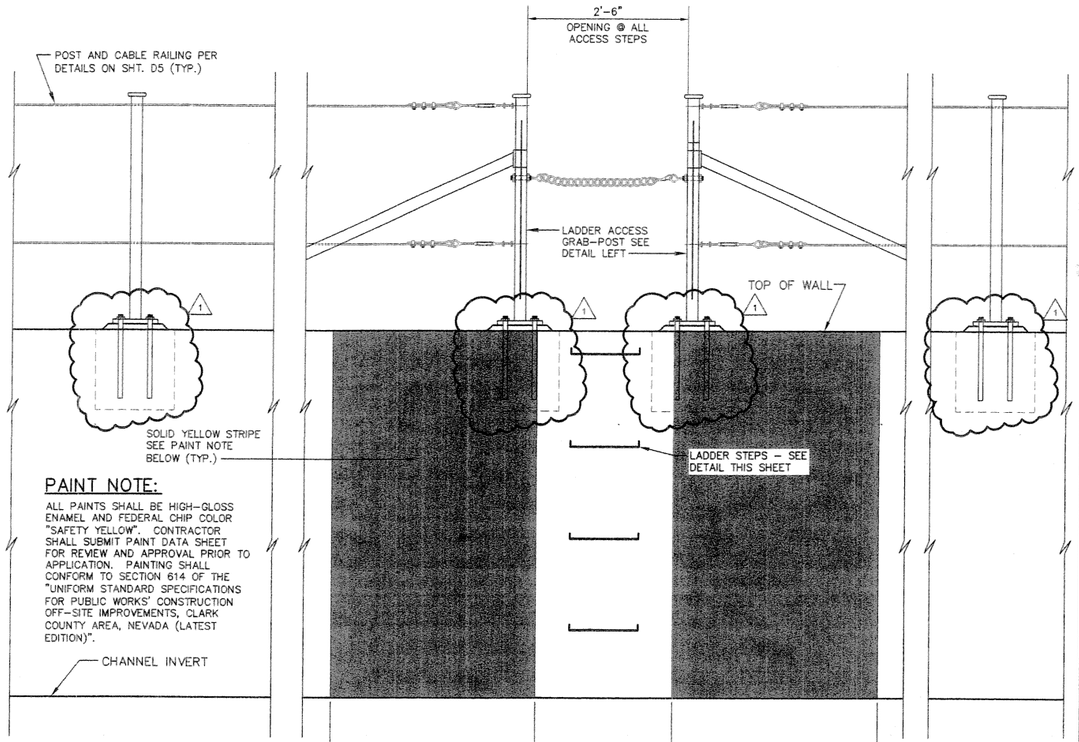
DRAWING NO.
D2
SHT. 118 OF 128

ISSUED FOR CONSTRUCTION



PLAN

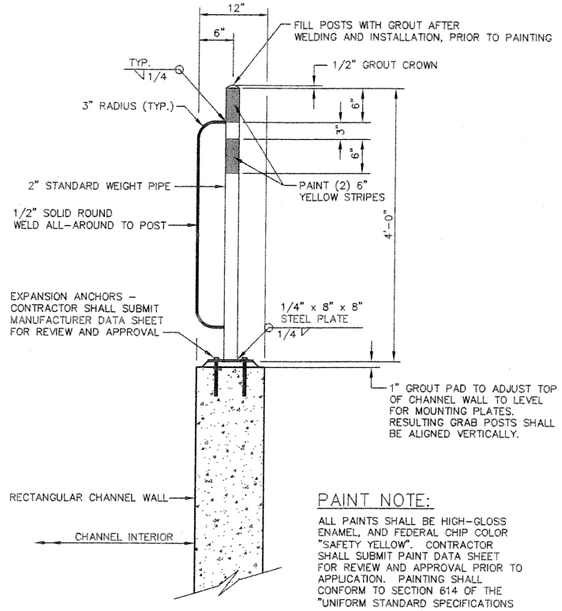
CHANNEL LADDER LOCATION SCHEDULE			
STATION	OFFSET	STATION	OFFSET
-0+50	19.47' RT.	111+60	25' RT.
-0+10	20.54' LT.	112+10	25' LT.
10+50	25' RT.	118+10	25' RT.
11+00	25' LT.	118+62	25' LT.
17+00	21' RT.	124+50	25' RT.
17+42	21' LT.	125+00	25' LT.
23+42	21' RT.	131+00	28.08' RT.
23+84	21' LT.	131+56	28' LT.
29+84	21' RT.	137+56	28' RT.
30+25	21' LT.	138+12	28' LT.
35+34	21' RT.	144+12	28' RT.
35+75	21' LT.	144+68	28' LT.
42+00	23' RT.	150+68	28' RT.
42+46	23' LT.	151+24	28' LT.
48+46	23' RT.	157+24	28' RT.
48+92	23' LT.	157+80	28' LT.
54+92	23' RT.	163+80	28' RT.
55+38	23' LT.	164+40	28' LT.
61+38	23' RT.	170+40	28' RT.
61+84	23' LT.	171+00	28' LT.
67+84	23' RT.	177+00	28' RT.
68+30	23' LT.	177+52	28' LT.
74+30	45' RT.	183+25	28' RT.
75+15	39.73' LT.	183+81	28' LT.
81+15	25' RT.	189+80	28' RT.
81+62	25' LT.	190+42	28' LT.
87+62	25' RT.	196+42	28' RT.
88+12	25' LT.	196+95	28' LT.
94+12	25' RT.	202+95	28' RT.
94+62	25' LT.	203+51	28' LT.
98+65	25' RT.	209+51	28' RT.
99+15	25' LT.	210+04	28' LT.
105+15	25' RT.	212+35	30.06' RT.
105+60	25' LT.	212+95	29.88' LT.



PAINT NOTE:

ALL PAINTS SHALL BE HIGH-GLOSS ENAMEL AND FEDERAL CHIP COLOR "SAFETY YELLOW". CONTRACTOR SHALL SUBMIT PAINT DATA SHEET FOR REVIEW AND APPROVAL PRIOR TO APPLICATION. PAINTING SHALL CONFORM TO SECTION 614 OF THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS' CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA (LATEST EDITION)".

STEP ELEVATION
SCALE: 1"=1'-0"



SECTION

PAINT NOTE:

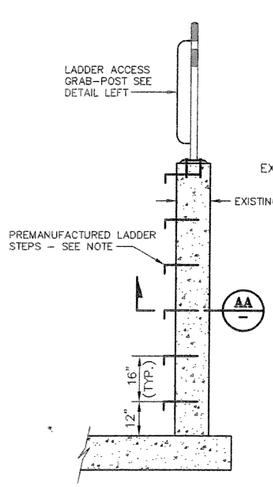
ALL PAINTS SHALL BE HIGH-GLOSS ENAMEL, AND FEDERAL CHIP COLOR "SAFETY YELLOW". CONTRACTOR SHALL SUBMIT PAINT DATA SHEET FOR REVIEW AND APPROVAL PRIOR TO APPLICATION. PAINTING SHALL CONFORM TO SECTION 614 OF THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS' CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA (LATEST EDITION)".

LADDER ACCESS GRAB-POST NOTE:

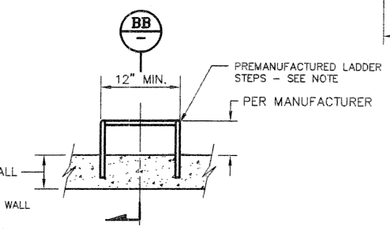
ALL GRAB-POST COMPONENTS SHALL BE HOT-DIPPED GALVANIZED AFTER FABRICATION. PAINT STRIPES WITH YELLOW ENAMEL AFTER INSTALLATION. (SEE PAINT NOTE). GRAB-POSTS SHALL BE INSTALLED AT EXISTING LADDER LOCATIONS AS WELL AS CHANGE ORDER LADDER LOCATIONS ON ALL RECTANGULAR CHANNEL SECTIONS.

TYPICAL LADDER ACCESS GRAB-POST

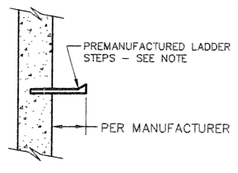
SCALE: 1"=1'-0"



RECTANGULAR CHANNEL LADDER
NO SCALE



STEP DETAIL AA
SCALE: 1"=1'-0"



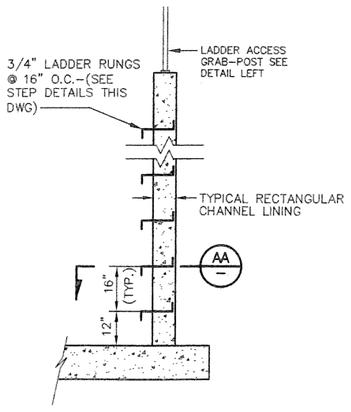
STEP DETAIL BB
SCALE: 1"=1'-0"

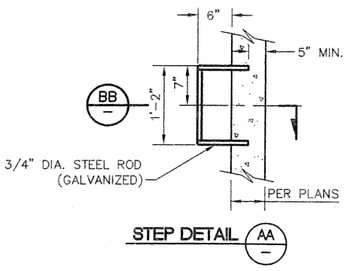
PREMANUFACTURED LADDER NOTE:

LADDER STEPS SHALL "NEENAH R-1982-F" OR APPROVED EQUIVALENT. THEY SHALL BE UV RESISTANT (NO POLYPROPYLENE WILL BE ALLOWED) PREMANUFACTURED COMPONENTS DESIGNED SPECIFICALLY FOR INSTALLATION INTO EXISTING CONCRETE STRUCTURES TO RESIST PULLOUT FORCES OF A MINIMUM OF 1500 POUNDS. CONTRACTOR SHALL SUBMIT MANUFACTURER DATA SHEET FOR REVIEW AND APPROVAL. ONCE APPROVAL IS OBTAINED, THE STEPS SHALL BE INSTALLED IN STRICT ACCORDANCE WITH THE MANUFACTURERS RECOMMENDATIONS. PULLOUT RESISTANCE TESTS MAY BE PERFORMED AFTER INSTALLATION AT THE OWNER'S AND/OR ENGINEER'S DISCRETION.

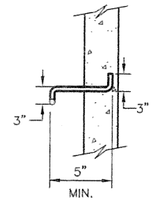
TYPICAL CHANNEL LADDER DETAIL - DRILL AND EPOXY (OPTION 1)

SCALE: 1/2"=1'-0"





STEP DETAIL AA



STEP DETAIL BB

TYPICAL CHANNEL LADDER DETAIL - CAST IN-PLACE (OPTION 2)

N.T.S.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN

SCALE: AS NOTED
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER - STATE OF NEVADA - KEN D. GILBRETH - EXP. 09/30/05 - No. 9177

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-8600
FAX (702) 362-2597

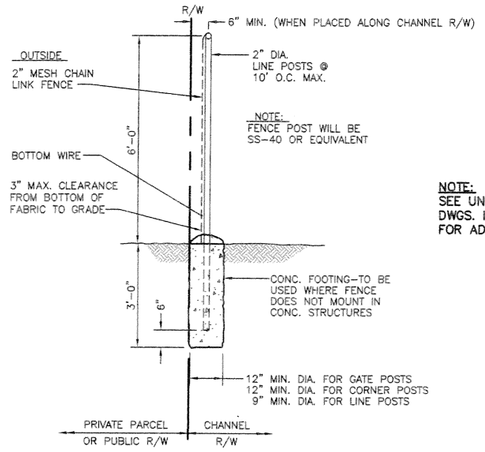
(DRAWING TITLE) CHANNEL LADDER DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

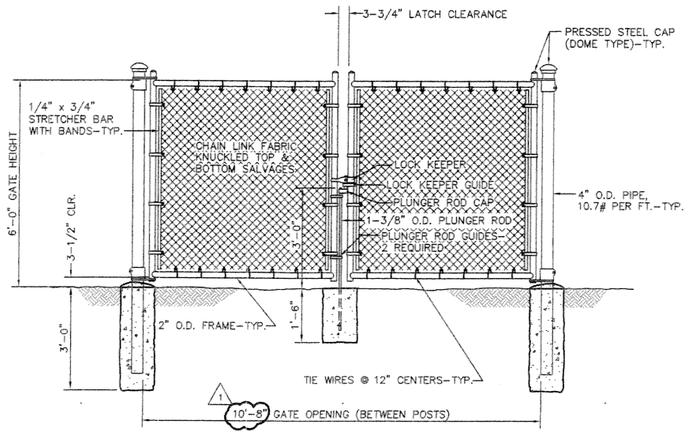
DRAWING NO.
D3
SHT. 119 OF 128

ISSUED FOR CONSTRUCTION

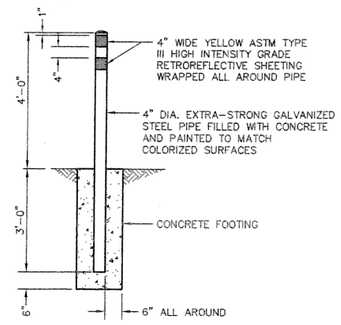


NOTE:
SEE UNIFORM STD. DWGS. NO. 252 & 253 FOR ADDITIONAL INFORMATION

TYPICAL FENCE DETAIL
N.T.S.



TYPICAL DOUBLE SWING GATE DETAIL
N.T.S.



STATIONARY BOLLARD DETAIL
SCALE: 1"=1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	5/11/2004	VTN

SCALE: AS NOTED
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 5/11/2004

PROJECT NO:
FILE NAME:

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

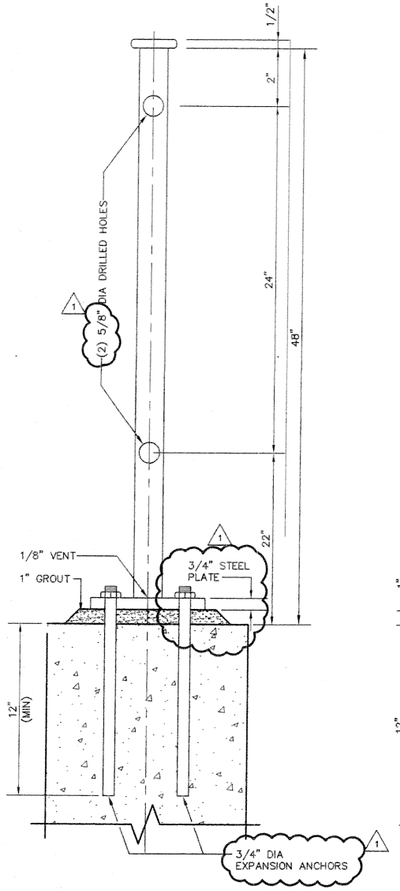
(DRAWING TITLE) GATE AND FENCE DETAILS

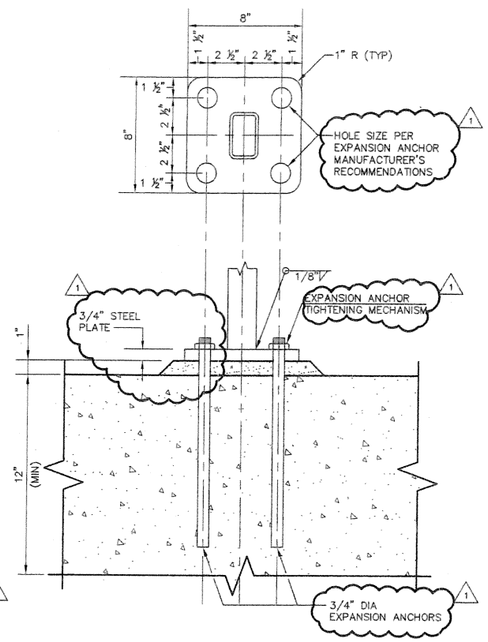
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

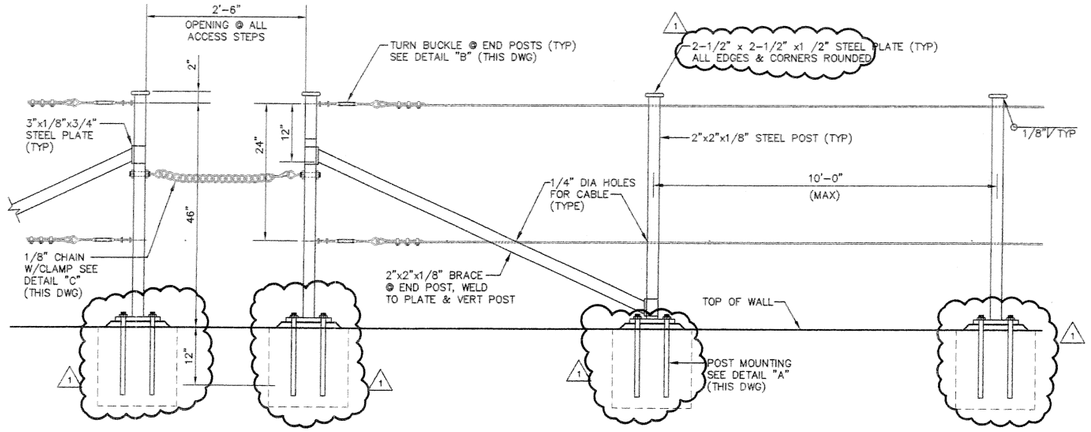
DRAWING NO.
D4
SHT. 120 OF 128

ISSUED FOR CONSTRUCTION





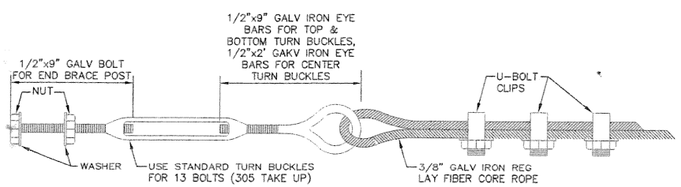
A POST MOUNTING
NOT TO SCALE



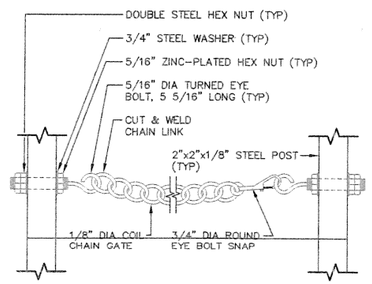
NOTES:

1. ALL POSTS SHALL BE SET PLUMB
2. RAILING POSTS & FITTINGS SHALL BE HOT DIPPED GALVANIZED AFTER FABRICATION.
3. CHAIN SAFETY GATES SHALL BE PROVIDED AT LADDER LOCATIONS SEE DETAIL "C" (THIS DWG) FOR LADDER DETAIL SEE DWG D-3
4. ANGLE POST SEE DETAIL "D" (THIS DWG)
5. CABLE SHALL BE STRETCHED TAUT.

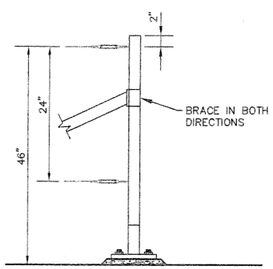
POST AND CABLE RAILING
NOT TO SCALE



B TURN BUCKLE
NOT TO SCALE



C CHAIN SAFETY GATE
NOT TO SCALE



D ANGLE POST
NOT TO SCALE

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
3	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN

SCALE: AS NOTED
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO: 2116.00
FILE NAME:

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2597

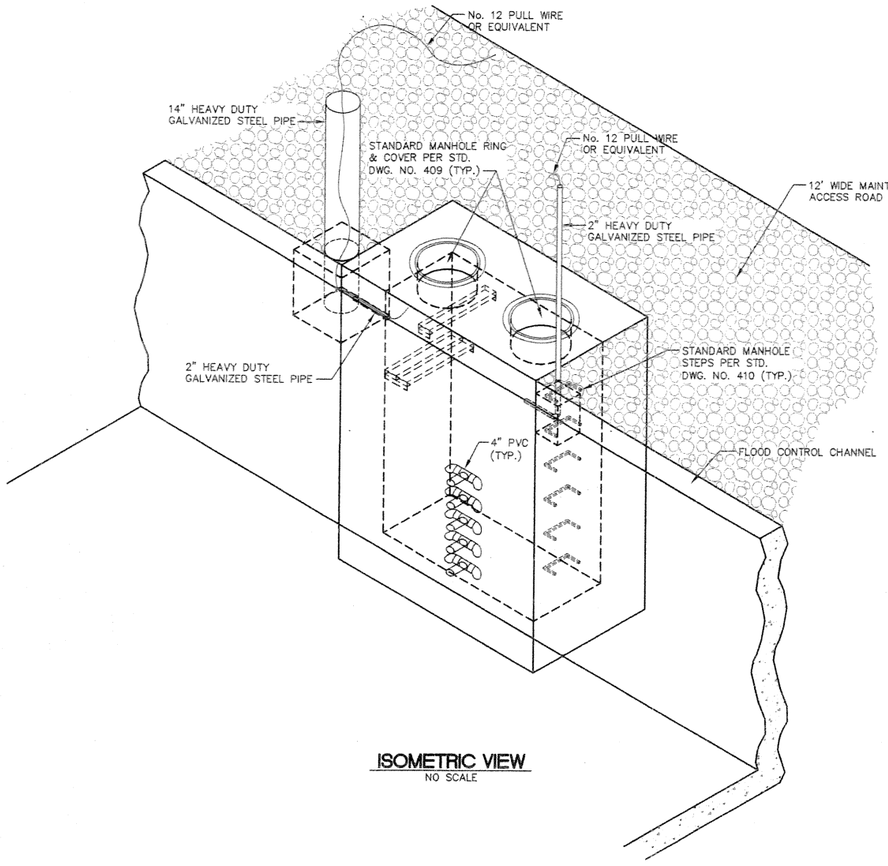
(DRAWING TITLE) POST AND CABLE RAILING DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

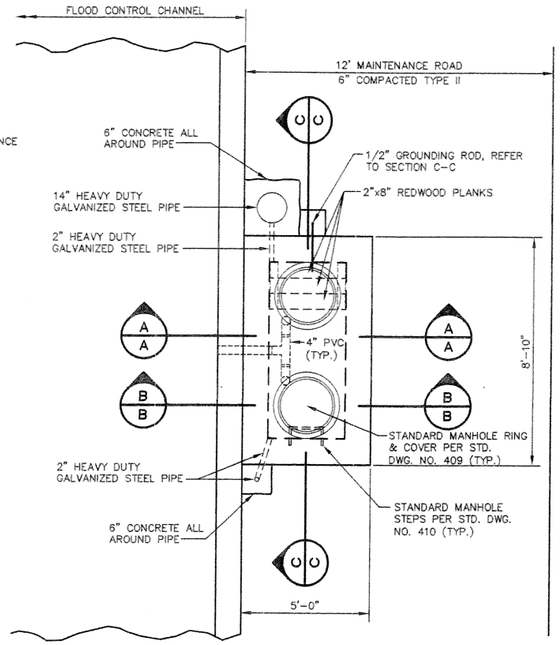
(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
D5
SHT. 121 OF 128

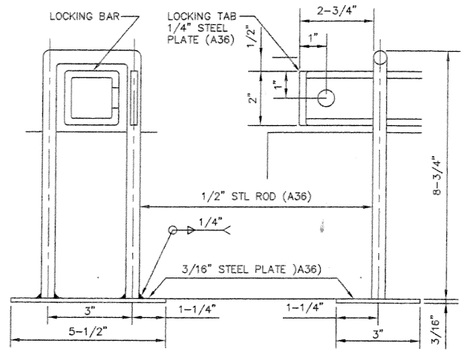
ISSUED FOR CONSTRUCTION



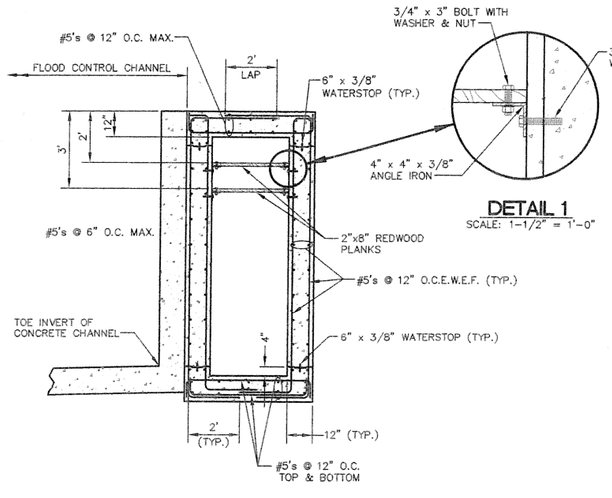
ISOMETRIC VIEW
NO SCALE



PLAN
SCALE: 3/8" = 1'-0"

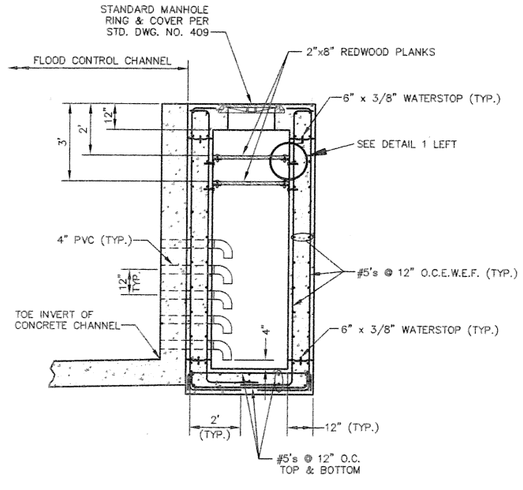


LOCKING BAR GUIDE
NO SCALE

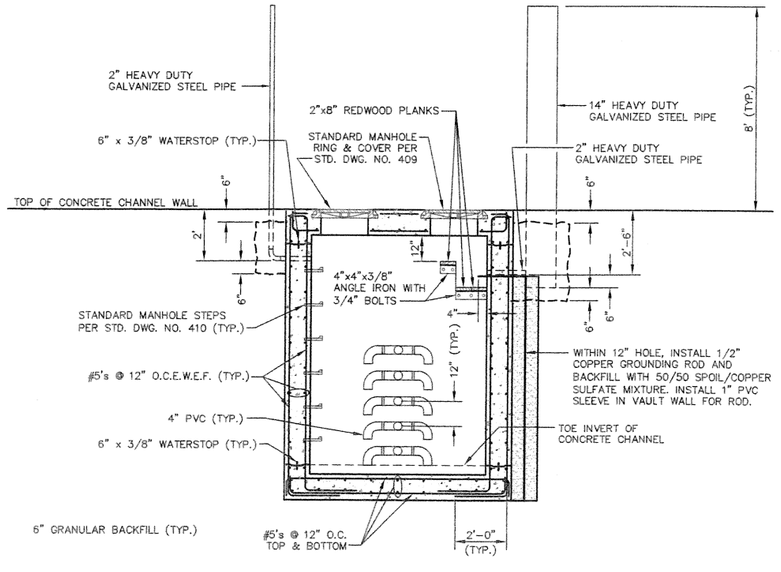


DETAIL 1
SCALE: 1-1/2" = 1'-0"

SECTION A-A
SCALE: 3/8" = 1'-0"



SECTION B-B
SCALE: 3/8" = 1'-0"



SECTION C-C
SCALE: 3/8" = 1'-0"

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

SCALE: AS NOTED
DESIGN: CCRFCD
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

KEITH L. GILBRETH — STATE OF NEVADA — No. 9177 — PROFESSIONAL ENGINEER

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2697

(DRAWING TITLE) FLOOD CONTROL MONITORING STATION DETAILS
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) LAS VEGAS WASH DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
D6
SHT. 122 OF 128

ISSUED FOR CONSTRUCTION

Avoid overhead power line contact.

2 working days **Call before you Overhead**

1-702-593-6111

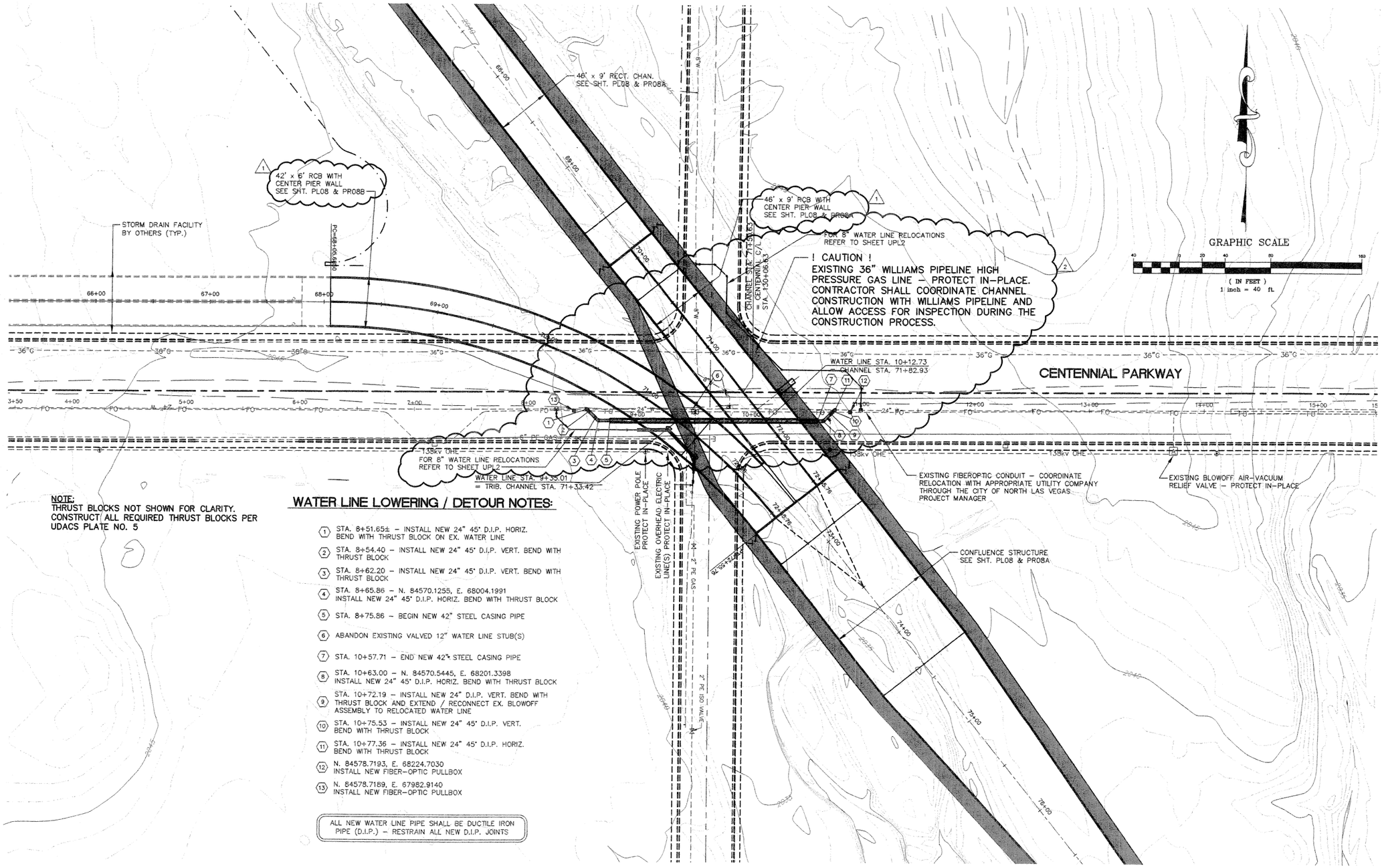
Nevada Power Environment and Safety Services Department

Avoid cutting underground utility lines. It's costly.

2 working days **Call before you Dig**

1-800-227-2600

Underground Service Alert (U.S.A.)



NOTE:
THRUST BLOCKS NOT SHOWN FOR CLARITY. CONSTRUCT ALL REQUIRED THRUST BLOCKS PER UDACS PLATE NO. 5

WATER LINE LOWERING / DETOUR NOTES:

1. STA. 8+51.65± – INSTALL NEW 24" 45° D.I.P. HORIZ. BEND WITH THRUST BLOCK ON EX. WATER LINE
2. STA. 8+54.40 – INSTALL NEW 24" 45° D.I.P. VERT. BEND WITH THRUST BLOCK
3. STA. 8+62.20 – INSTALL NEW 24" 45° D.I.P. VERT. BEND WITH THRUST BLOCK
4. STA. 8+65.86 – N. 84570.1255, E. 68004.1991 INSTALL NEW 24" 45° D.I.P. HORIZ. BEND WITH THRUST BLOCK
5. STA. 8+75.86 – BEGIN NEW 42" STEEL CASING PIPE
6. ABANDON EXISTING VALVED 12" WATER LINE STUB(S)
7. STA. 10+57.71 – END NEW 42" STEEL CASING PIPE
8. STA. 10+63.00 – N. 84570.5445, E. 68201.3398 INSTALL NEW 24" 45° D.I.P. HORIZ. BEND WITH THRUST BLOCK
9. STA. 10+72.19 – INSTALL NEW 24" D.I.P. VERT. BEND WITH THRUST BLOCK AND EXTEND / RECONNECT EX. BLOWOFF ASSEMBLY TO RELOCATED WATER LINE
10. STA. 10+75.53 – INSTALL NEW 24" 45° D.I.P. VERT. BEND WITH THRUST BLOCK
11. STA. 10+77.36 – INSTALL NEW 24" 45° D.I.P. HORIZ. BEND WITH THRUST BLOCK
12. N. 84578.7193, E. 68224.7030 INSTALL NEW FIBER-OPTIC PULLBOX
13. N. 84578.7189, E. 67982.9140 INSTALL NEW FIBER-OPTIC PULLBOX

ALL NEW WATER LINE PIPE SHALL BE DUCTILE IRON PIPE (D.I.P.) – RESTRAIN ALL NEW D.I.P. JOINTS

CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 1	2/12/2004	VTN
2	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
3			
4			
5			

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
EXP. 06/30/05
CIVIL
No. 9177
3/11/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) CENTENNIAL UTILITY RELOCATION - PLAN

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

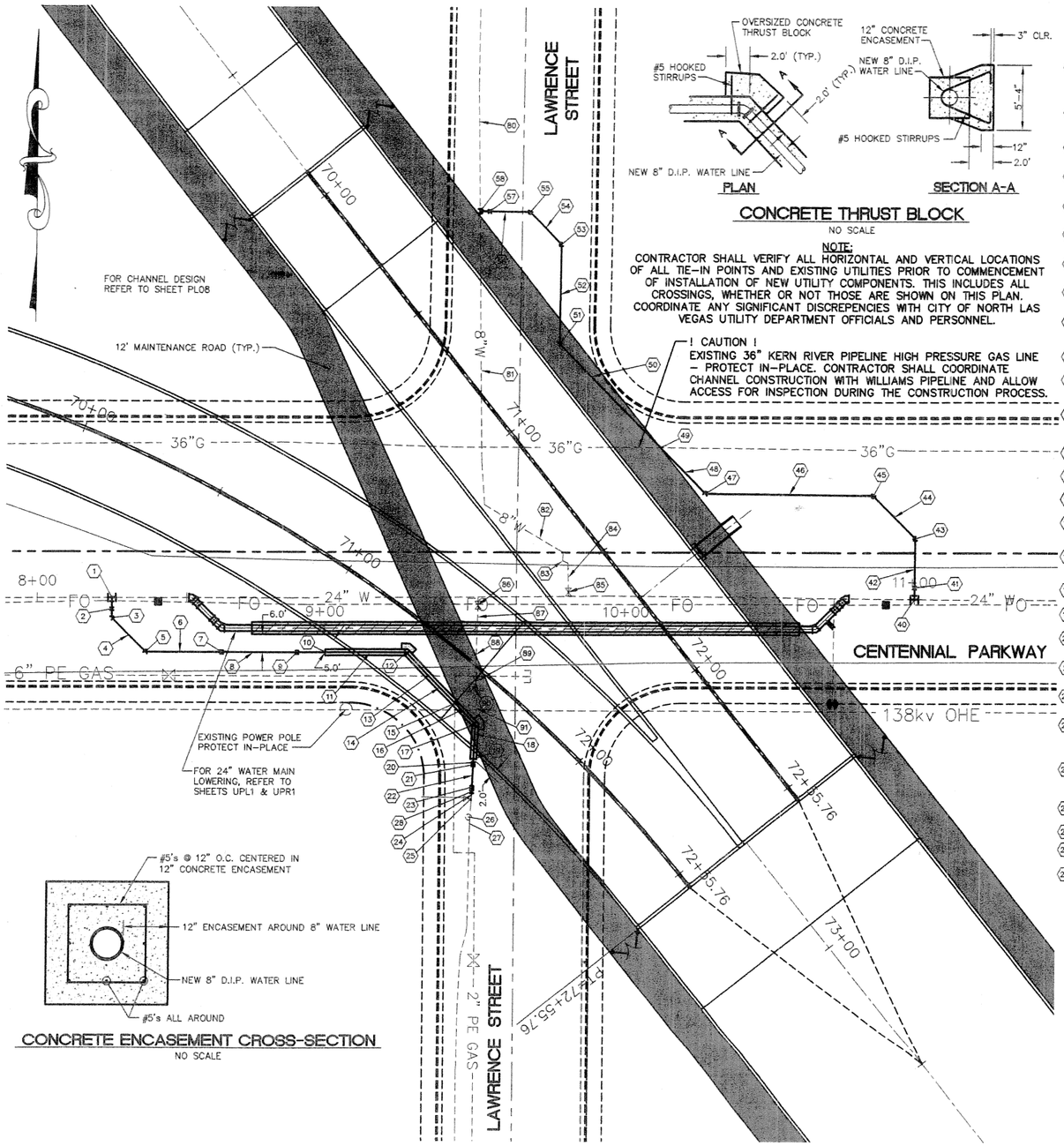
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

UPL1

SHT. 123 OF 128

ISSUED FOR CONSTRUCTION



CONCRETE THRUST BLOCK

NO SCALE

NOTE:

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF ALL TIE-IN POINTS AND EXISTING UTILITIES PRIOR TO COMMENCEMENT OF INSTALLATION OF NEW UTILITY COMPONENTS. THIS INCLUDES ALL CROSSINGS, WHETHER OR NOT THOSE ARE SHOWN ON THIS PLAN. COORDINATE ANY SIGNIFICANT DISCREPENCIES WITH CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT OFFICIALS AND PERSONNEL.

! CAUTION !
EXISTING 36" KERN RIVER PIPELINE HIGH PRESSURE GAS LINE – PROTECT IN-PLACE. CONTRACTOR SHALL COORDINATE CHANNEL CONSTRUCTION WITH WILLIAMS PIPELINE AND ALLOW ACCESS FOR INSPECTION DURING THE CONSTRUCTION PROCESS.

CONCRETE ENCASEMENT CROSS-SECTION

NO SCALE

SOUTHWEST WATER LINE RELOCATION KEY

(1) EX. 24" WATER LINE STA. 8+25.00
N. 84580.0± E. 67967.5±, ELEV. 2030.86±
INSTALL NEW 24" x 8" D.I.P. TEE WITH THRUST BLOCK ON EXISTING 24" D.I.P. WATER LINE. CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION

(2) N. 84576.2523 E. 67967.4843
INSTALL NEW 8" D.I.P. GATE VALVE

(3) N. 84573.3150 E. 67967.5049
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2030.73

(4) INSTALL NEW 8" D.I.P. WATER LINE AT S=2.0%

(5) N. 84562.0716 E. 67978.8387
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2030.41

(6) INSTALL NEW 8" D.I.P. WATER LINE AT S=3.18%

(7) N. 84562.1256 E. 68004.2753
INSTALL NEW 8" D.I.P. 22-1/2° VERT. BEND WITH THRUST BLOCK
INV. = 2029.60

(8) INSTALL NEW 8" D.I.P. WATER LINE AT S=50.0%

(9) N. 84562.1788 E. 8029.2752
INSTALL NEW 8" D.I.P. 22-1/2° VERT. BEND WITH THRUST BLOCK
INV. = 2023.35

(10) N. 84562.1986 E. 68038.5898
BEGIN 12" CONCRETE ENCASEMENT

(11) INSTALL NEW 8" D.I.P. WATER LINE AT S=0.60%

(12) N. 84562.2559 E. 68065.5320
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND IN CONC. ENCASEMENT WITH TIED-IN OVERSIZED THRUST BLOCK
INV. = 2023.13

(13) EXISTING 6" PE GAS LINE CROSSING – TO BE RELOCATED BY SOUTHWEST GAS CORPORATION

(14) INSTALL NEW CONCRETE ENCASED 8" D.I.P. WATER LINE AT S=0.60%

(15) EXISTING 2" PE GAS LINE CROSSING – TO BE RELOCATED BY SOUTHWEST GAS CORPORATION

(16) EXISTING 138kv OHE LINE – PROTECT IN-PLACE

(17) N. 84538.4592 E. 68088.5486
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND IN CONC. ENCASEMENT WITH TIED-IN OVERSIZED THRUST BLOCK
INV. = 2022.93

(18) INSTALL NEW CONCRETE ENCASED 8" D.I.P. WATER LINE AT S=0.60%

(19) N. 84526.8665 E. 68088.0517
END 12" CONCRETE ENCASEMENT

(20) INSTALL 2" BLOWOFF ASSEMBLY

(21) N. 84524.9676 E. 8087.9703
INSTALL NEW 8" D.I.P. 45° VERT. BEND WITH THRUST BLOCK
INV. = 2022.85

(22) INSTALL NEW 8" D.I.P. WATER LINE AT S=100.0%

(23) N. 84526.8665 E. 68088.0517
INSTALL NEW 8" D.I.P. 45° VERT. BEND WITH THRUST BLOCK
INV. = 2030.34

(24) N. 84515.2±, E. 68087.6±
TIE NEW 8" D.I.P. TO EXISTING 8" D.I.P.
INV. = 2030.61±
CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION

(25) EXISTING 8" x 6" TEE FOR FIRE HYDRANT LATERAL PROTECT IN-PLACE

(26) EXISTING BLOW-OFF ASSEMBLY – PROTECT IN-PLACE

(27) EXISTING 8" END CAP – PROTECT IN-PLACE

(28) N. 84516.2091, E. 68087.5948
INSTALL NEW 8" D.I.P. GATE VALVE

1 NEW SHEET PER ADDENDUM NO. 3

NORTHEAST WATER LINE RELOCATION KEY

(40) EX. 24" WATER LINE STA. 11+00.00
N. 84580.6±, E. 68234.1±, ELEV. 2026.04±
INSTALL NEW 24" x 8" D.I.P. TEE WITH THRUST BLOCK ON EXISTING 24" D.I.P. WATER LINE. CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION

(41) N. 84584.3462, E. 68234.1136
INSTALL NEW 8" D.I.P. GATE VALVE

(42) INSTALL NEW 8" D.I.P. WATER LINE AT S=2.29%

(43) N. 84600.5506, E. 8234.2558
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2026.50

(44) INSTALL NEW 8" D.I.P. WATER LINE AT S=2.29%

(45) N. 84614.7966, E. 68220.2182
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2026.96

(46) INSTALL NEW 8" D.I.P. WATER LINE AT S=2.29%

(47) N. 84615.2077, E. 68164.4099
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2028.23

(48) INSTALL NEW 8" D.I.P. WATER LINE AT S=2.29%

(49) 8" D.I.P. WATER LINE GRADE BREAK OVER EXISTING 36" GAS LINE
TOP EX. 36" GAS LINE = 2025.82±
NEW 8" WATER LINE INV. = 2028.73
CONTRACTOR SHALL VERIFY LOCATION OF EXISTING 36" GAS LINE PRIOR TO WATER LINE CONSTRUCTION AND COORDINATE ANY SIGNIFICANT DISCREPENCY WITH CITY OF NORTH LAS VEGAS UTILITY DEPARTMENT OFFICIALS AND PERSONNEL.

(50) INSTALL NEW 8" D.I.P. WATER LINE AT S=0.50%

(51) N. 84664.8377, E. 68115.5058
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2028.97

(52) INSTALL NEW 8" D.I.P. WATER LINE AT S=0.50%

(53) N. 84697.5961, E. 68115.7471
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2029.13

(54) INSTALL NEW 8" D.I.P. WATER LINE AT S=0.50%

(55) N. 84708.2805, E. 68105.2189
INSTALL NEW 8" D.I.P. 45° HORIZ. BEND WITH THRUST BLOCK
INV. = 2029.21

(56) N. 84708.4±, E. 68088.5±, ELEV. 2029.29±
INSTALL NEW 8" x 8" D.I.P. TEE WITH THRUST BLOCK ON EXISTING 8" D.I.P. WATER LINE. CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION

(57) N. 84708.3796, E. 68091.7704
INSTALL NEW 8" D.I.P. GATE VALVE

(58) N. 84708.4±, E. 68088.5±, ELEV. 2029.29±
INSTALL NEW 8" x 8" D.I.P. TEE WITH THRUST BLOCK ON EXISTING 8" D.I.P. WATER LINE. CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION

EXISTING UTILITY REMOVALS KEY

(80) EX. 8" WATER LINE – PROTECT IN-PLACE OUTSIDE OF WORK ZONE

(81) EX. 8" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE

(82) EX. 8" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE

(83) EX. VALVE – REMOVE AND SALVAGE FOR THE CITY OF NORTH LAS VEGAS

(84) EX. 12" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE

(85) EX. VALVE – REMOVE AND SALVAGE FOR THE CITY OF NORTH LAS VEGAS

(86) EX. VALVE – REMOVE AND SALVAGE FOR THE CITY OF NORTH LAS VEGAS

(87) EX. 12" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE

(88) EX. 12" WATER LINE TEE – REMOVE

(89) EX. 12" x 8" REDUCER – REMOVE

(90) EX. VALVE – REMOVE AND SALVAGE FOR THE CITY OF NORTH LAS VEGAS

(91) EX. 8" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE

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Underground Service Alert (U.S.A.)

Avoid overhead power line contact.
2 working days Call before you Overhead
1-702-593-6111
Nevada Power Environment and Safety Services Department

CITY OF NORTH LAS VEGAS – DEPARTMENT OF PUBLIC WORKS – ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN
△			
△			
△			

SCALE: 1" = 20'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO:
FILE NAME:

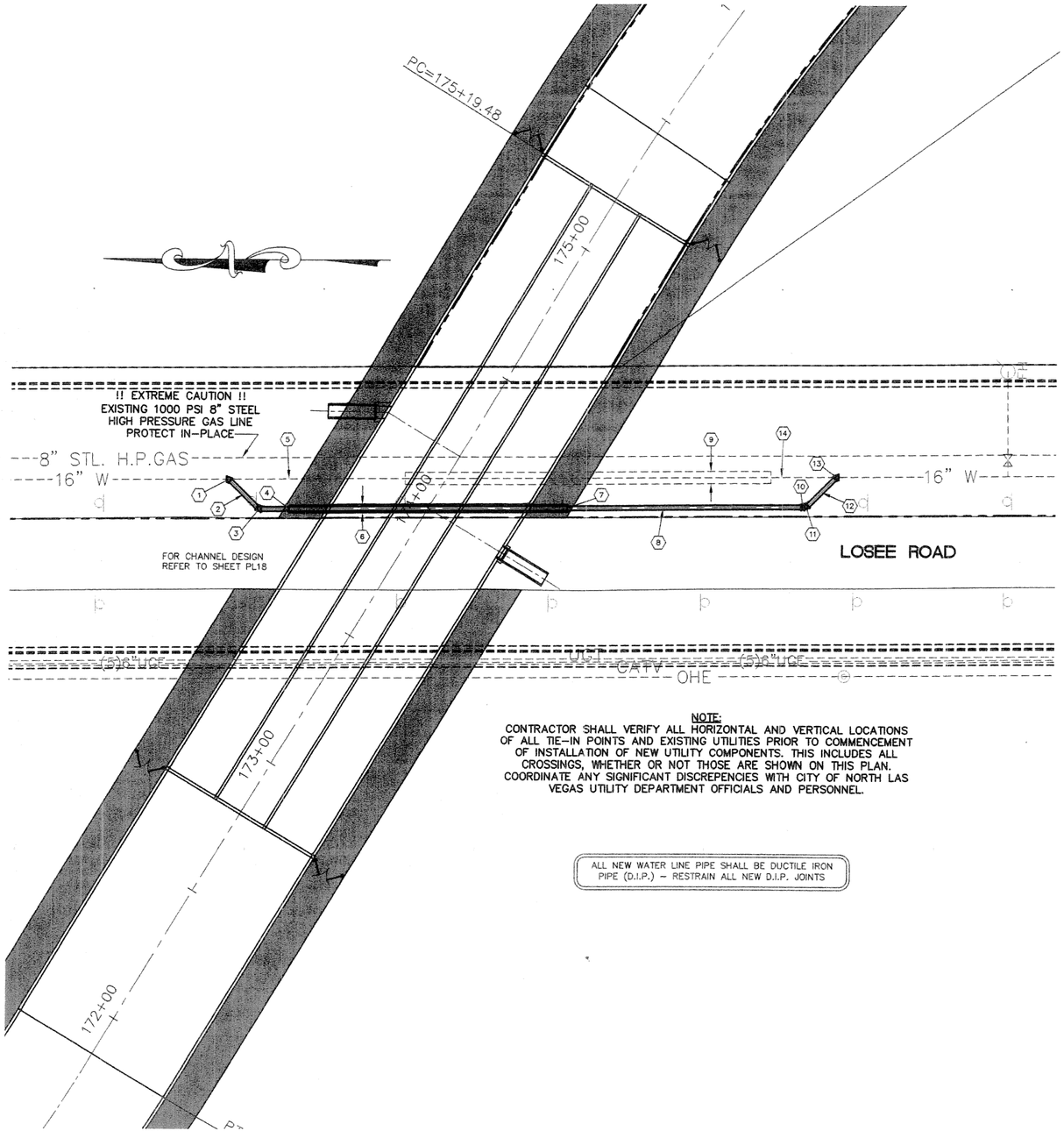
PROFESSIONAL ENGINEER STATE OF NEVADA KERN D. GILBRETH No. 9177 ACTIVE

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2697

(DRAWING TITLE) CENTENNIAL/LAWRENCE WATER LINE RELOCATIONS PLAN
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
UPL2
SHT. 124 OF 128

ISSUED FOR CONSTRUCTION



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ALL NEW WATER LINE PIPE SHALL BE DUCTILE IRON PIPE (D.I.P.) – RESTRAIN ALL NEW D.I.P. JOINTS

1 NEW SHEET PER ADDENDUM NO. 3

WATER LINE RELOCATION KEY

1. N. 74863.5± E. 69448.0±, EX. 16" D.I.P. INV. ELEV. 2034.84± INSTALL NEW 16" D.I.P. 45° BEND WITH THRUST BLOCK ON EXISTING 16" D.I.P. WATER LINE. CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION
2. INSTALL NEW 16" D.I.P. WATER LINE AT 4.15%
3. N. 74853.4175, E. 69438.0609 INSTALL NEW 16" D.I.P. 45° BEND WITH THRUST BLOCK INV. = 1934.23
4. N. 74843.4179, E. 69438.1464, 16" D.I.P. INV. ELEV.= BEGIN 30" STEEL CASING PER DETAILS ON SHEET W1.
5. EXISTING 16" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE
6. NEW 16" D.I.P. WATER LINE IN 30" STEEL CASING AT 0.25% PER DETAILS ON SHEET W1
7. N. 74750.2576, E. 69438.9430 END 30" STEEL CASING PER DETAILS ON SHEET W1.
8. NEW 16" D.I.P. WATER LINE AT 0.25%
9. EXISTING 16" WATER LINE IN STEEL CASING – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE
10. INSTALL NEW 2" BLOWOFF ASSEMBLY
11. N. 74670.2606, E. 69439.6270 INSTALL NEW 16" D.I.P. 45° BEND WITH THRUST BLOCK INV. = 1933.77
12. INSTALL NEW 16" D.I.P. WATER LINE AT 5.59%
13. N. 74660.3± E. 69449.7±, EX. 16" D.I.P. INV. ELEV. 2034.56± INSTALL NEW 16" D.I.P. 45° BEND WITH THRUST BLOCK ON EXISTING 16" D.I.P. WATER LINE. CONTRACTOR SHALL VERIFY TIE-IN LOCATION PRIOR TO CONSTRUCTION
14. EXISTING 16" WATER LINE – REMOVE OR ABANDON AS NECESSARY WITHIN WORK ZONE

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Underground Service Alert (U.S.A.)

Avoid overhead power line contact.
2 working days Call before you Overhead
1-702-593-6111
Nevada Power Environment and Safety Services Department

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 3	3/11/2004	VTN

SCALE: 1" = 20'
DESIGN: VTN
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 3/11/2004
PROJECT NO:
FILE NAME:

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146
PHONE (702) 873-7550
FAX (702) 362-2697

(DRAWING TITLE) LOSEE WATER LINE RELOCATION PLAN
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
UPL3
SHT. 125 OF 128

ISSUED FOR CONSTRUCTION

Avoid overhead power line contact.

2 working days **Call before you Overhead**

1-702-593-6111

Nevada Power Environment and Safety Services Department

Avoid cutting underground utility lines. It's costly.

2 working days **Call before you Dig**

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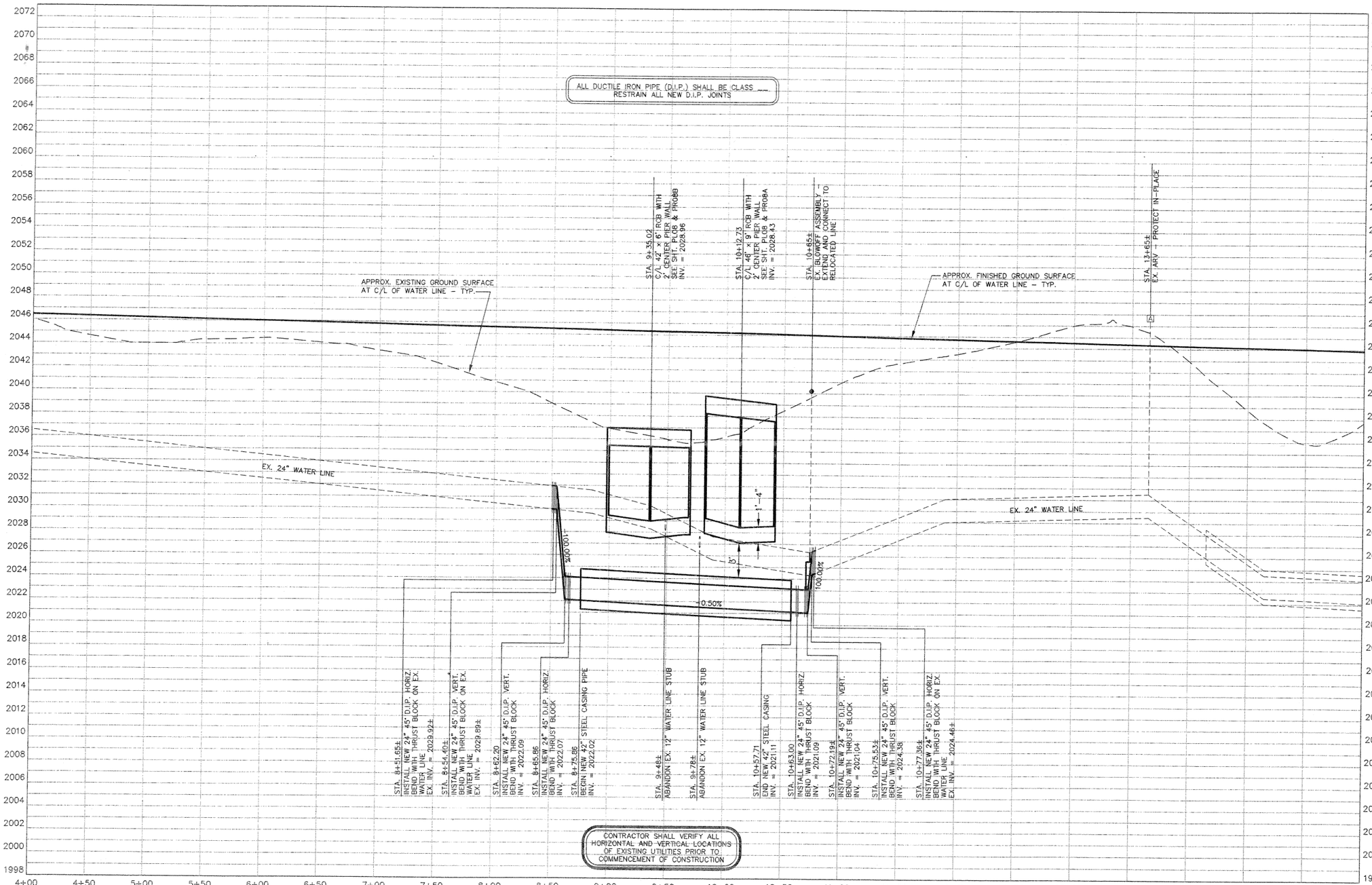
Underground Service Alert (U.S.A.)



CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
△	REVISED PER ADDENDUM NO. 1	1/21/2004	VTN
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△			

PROJECT NO: FILE NAME:

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004

PROFESSIONAL ENGINEER - STATE OF NEVADA
KEN D. GILBRETH
Exp. 06/30/05
CIVIL
No. 9177
1/21/04

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2597

(DRAWING TITLE) CENTENNIAL WATER LINE RELOCATION - PROFILE

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

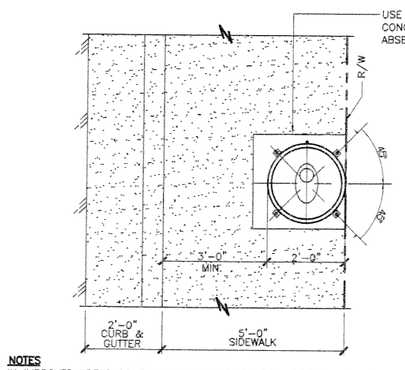
(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.

UPR1

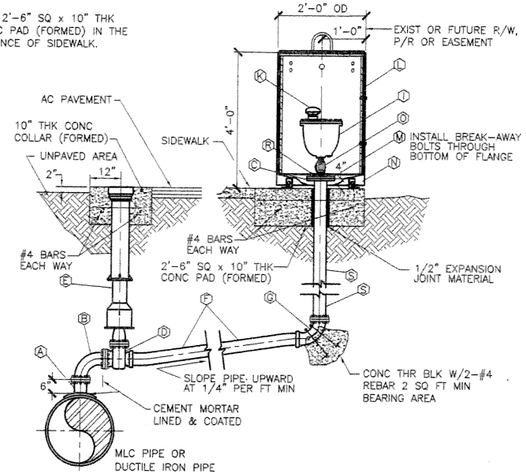
SHT. 126 OF 128

ISSUED FOR CONSTRUCTION



NOTES
IN IMPROVED AREAS CONTRACTOR TO REPLACE FULL SIDEWALK PANEL. IN UNIMPROVED AREAS CONTRACTOR TO CONSTRUCT FORMED 2'-6" SQ x 10" THICK CONCRETE SLAB.

2" COMB AIR VALVE PLAN VIEW



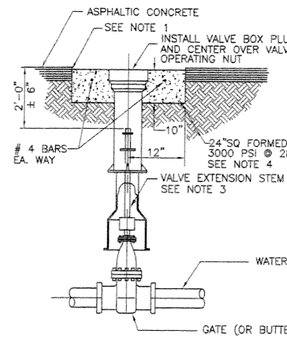
2" COMB AIR VALVE PROFILE

LEGEND

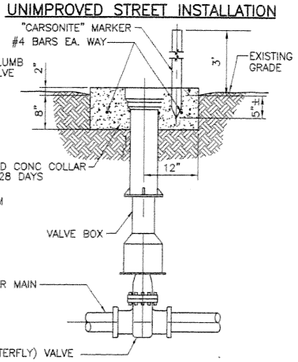
- (A) 4" FLG TEE BOLTED ON TO TAPPING VALVE FOR DIP
- (B) 4"- 90° FLG DUCTILE IRON BEND
- (C) 4" DUCTILE IRON FLANGE ADAPTOR
- (D) 4" FLG x PO OR FLG x MJ GATE VALVE W/2" OPERATING NUT
- (E) VALVE BOX & COVER - SEE DETAIL 2/D-100
- (F) 4" DUCTILE IRON CL50 PIPE OR 4" PVC CL150 DR18 PIPE
- (G) 4" - 90° FLG x PO OR FLG x MJ CI BEND
- (H) 1" OR 2" COMBINATION AIR VALVE, THREADED INLET
- (K) 2" MUSHROOM FOR 2" COMBINATION AIR VALVE ASSY
- (L) 2'-0" OD x 4'-0" HIGH STEEL COVER
- (M) 5/8"-11NC BREAK-AWAY ZINC PLATED HEX HD BOLT, HEX NUT AND LOCKWASHER
- (N) 1/2"-13NC x 2-1/2" LG "RED HEAD" ANCHOR BOLT INSTALLED INSIDE
- (Q) 1" OR 2" CORP STOP, THREADED BOTH ENDS
- (R) 4" x 2" THREADED STL REDUCING FLANGE
- (S) 4" DUCTILE IRON CL50 PIPE

NOTE SEE SPECIFICATIONS FOR ALL APPROVED PRODUCTS

IMPROVED STREET INSTALLATION



UNIMPROVED STREET INSTALLATION

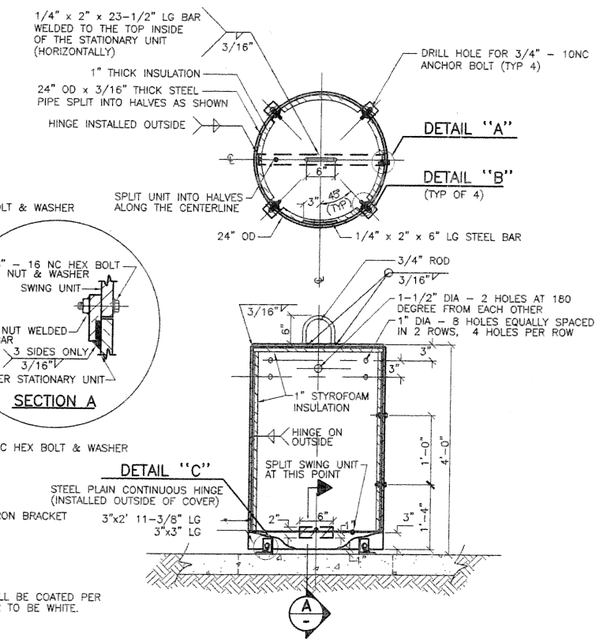


NOTES

1. FINAL RIM ELEVATION TO BE 1/8" TO 1/4" BELOW FINAL STREET GRADE.
2. MORE STRINGENT INSTALLATION REQUIREMENTS MAY BE IMPOSED BY THE ENTITY HAVING THE JURISDICTION OVER THE VALVE BOX INSTALLATION LOCATION.
3. A VALVE EXTENSION STEM SHALL BE PROVIDED WHERE THE DEPTH TO THE OPERATING NUT EXCEEDS FIVE (5) FEET.
4. ALL CONCRETE COLLARS TO BE FORMED 10" THICK.

VALVE BOX INSTALLATION AND ADJUSTMENT (2)

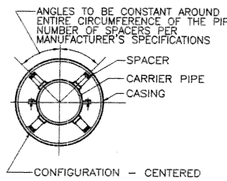
NOT TO SCALE



NOTE
ALL EXPOSED FERROUS METAL SHALL BE COATED PER SPECS SEC 1504. EXTERIOR COLOR TO BE WHITE.

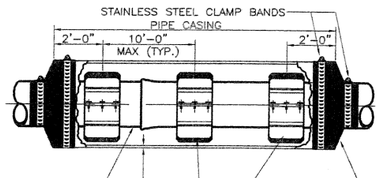
COMBINATION AIR VALVE ASSEMBLY FOR 2" VALVES (1)

NOT TO SCALE



CROSS-SECTION

DI CARRIER PIPE	
8" SPACER WIDTH	
PIPE SIZE	CASING ID
12"	24"
16"	30"
18"	30"
20"	36"
24"	42"
30"	48"
36"	54"



PLACEMENT OF SPACERS ON CARRIER PIPE PER MANUFACTURER'S SPECIFICATIONS

NOTES:

1. D.I. PIPE JOINTS INSIDE CASING TO BE RESTRAINED.
2. STEEL PIPE CASING SYMMETRICAL ABOUT WATER MAIN CENTERLINE.
3. PRE-APPROVED CASING SPACERS AND PRE-APPROVED END SEALS INSTALLED PER MANUFACTURER'S SPECIFICATIONS (REDWOOD SKIDS NOT ALLOWED, UDACS SECTION 3.26 NOT APPLICABLE). USE A "CENTERED" CONFIGURATION AND PROVIDE THE MANUFACTURER WITH THE FOLLOWING:
   - PIPE O.D.
   - CASING I.D.
   - CASING LENGTH
4. STEEL PIPE CASING SHALL BE FABRICATED FROM A MINIMUM OF 1/4" THICK STEEL PLATES. CONFORMING TO THE REQUIREMENTS OF ASTM A283, GRADE B, C OR D. ALL JOINTS SHALL BE GROUND TO A SMOOTH FINISH. ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH C208, "STANDARD FOR FABRICATED ELECTRICALLY WELDED STEEL WATER PIPE". COATINGS FOR STEEL CASING ARE NOT REQUIRED.
5. PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO BENDS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
6. THE PIPE SHALL BE SUPPORTED AT EACH END JOINT WITH SPACERS. AFTER INSTALLATION OF THE PIPE, THE CASING SHALL BE SEALED AT BOTH ENDS WITH CASING END SEALS. DUCTILE IRON PIPE JOINTS INSIDE CASING ARE TO BE RESTRAINED.

CASING ASSEMBLY DETAIL (3)

NOT TO SCALE

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	REVISIONS DESCRIPTION	DATE	BY

SCALE: AS NOTED
DESIGN: VTN
DRAWN: VTN
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA KEIN D. GILBRETH EXP. 6/30/2005 No 9177

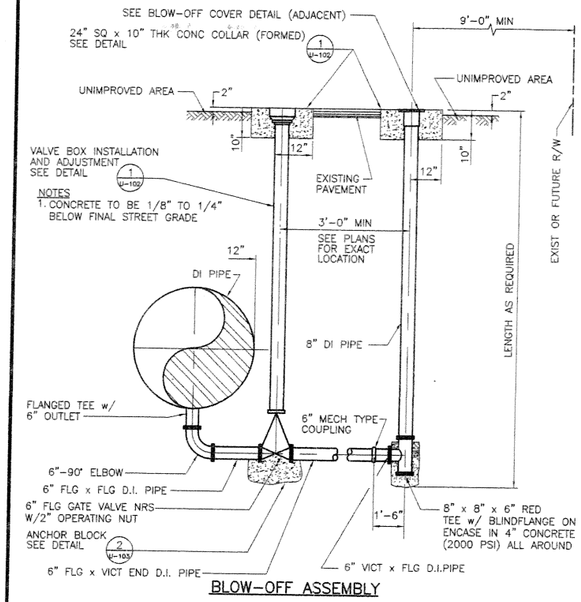
vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2500
FAX (702) 362-2597

(DRAWING TITLE) WATER LINE DETAILS

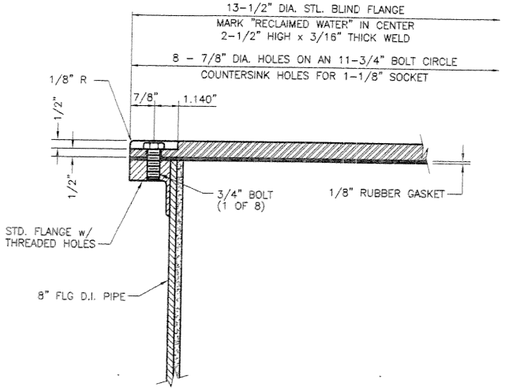
(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
W1
SHT. 27 OF 28



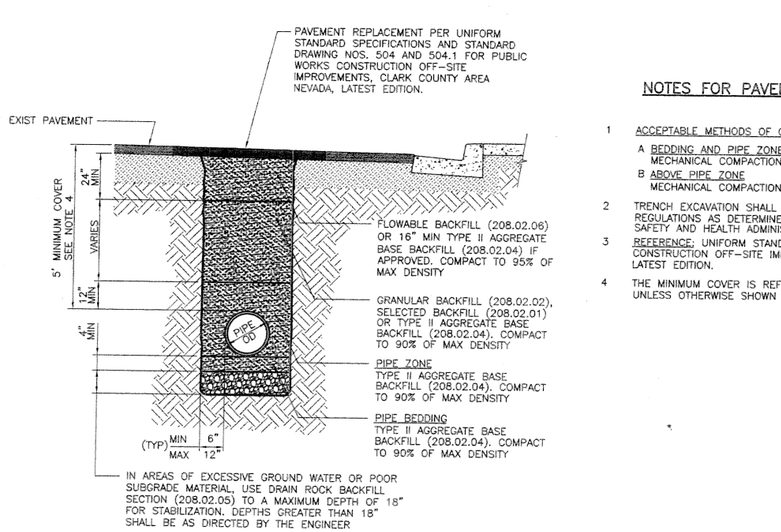
BLOW-OFF ASSEMBLY



BLOW-OFF COVER

BLOW-OFF ASSEMBLY AND COVER DETAIL (1)

NOT TO SCALE



TRENCH BACKFILL - PAVED AND UNPAVED AREAS (STREETS GREATER THAN 60' R/W) (2)

NOT TO SCALE

NOTES FOR PAVED AND UNPAVED AREAS

1 ACCEPTABLE METHODS OF COMPACTION

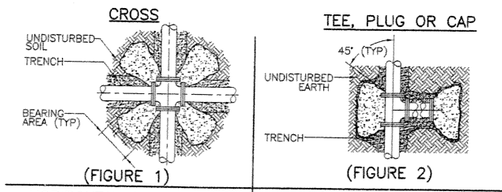
A BEDDING AND PIPE ZONE AREAS
MECHANICAL COMPACTION ONLY

B ABOVE PIPE ZONE
MECHANICAL COMPACTION ONLY

2 TRENCH EXCAVATION SHALL COMPLY WITH THE CURRENT REGULATIONS AS DETERMINED BY NEVADA OCCUPATIONAL SAFETY AND HEALTH ADMINISTRATION.

3 REFERENCE: UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS CLARK COUNTY AREA NEVADA, LATEST EDITION.

4 THE MINIMUM COVER IS REFERENCED TO FUTURE FINISHED FINAL GRADES UNLESS OTHERWISE SHOWN ON PROFILE DRAWINGS.



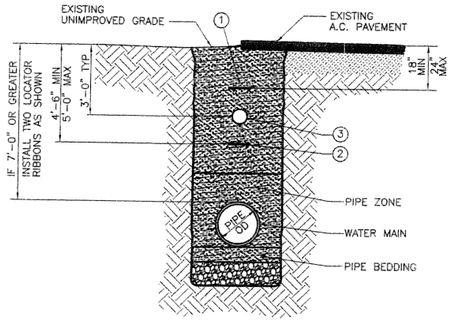
GENERAL NOTES

COAT AND WRAP ALL METAL SURFACES IN ACCORDANCE WITH DIVISION 15 OF THE LVVWD SPECS, PROTECTIVE COATINGS. ALL CONCRETE SHALL BE 3000 PSI MINIMUM, 28 DAYS COMPRESSIVE STRENGTH. CONCRETE IS TO BE PLACED IN UNDISTURBED EARTH. TABLE BELOW DENOTES MINIMUM BEARING AREA OR VOLUME OF THRUST BLOCK. SPECIAL DESIGN CALCULATIONS ARE TO BE SUBMITTED TO LVVWD FOR APPROVAL IF ALLOWABLE SOIL BEARING CAPACITY IS LESS THAN 3000 PSF. ALL VERTICAL SURFACES NOT BEARING AGAINST UNDISTURBED EARTH SHALL BE FORMED.

PIPE ID	BEARING AREA IN SQ FT						CONC/CU YDS		
	FIGURE 1	FIGURE 2	FIGURE 3, Δ				FIGURE 4, Δ		
			90°	45°	22½°	11¼°	45°	22½°	11¼°
4"	2	2	2	1	1	1	1.0	0.5	0.5
6"	2	3	4	2	1	1	1.5	1.0	0.5
8"	3	5	7	4	2	1	3.0	1.5	1.0
10"	4	8	10	6	3	2	4.5	2.5	1.5
12"	5	11	16	8	4	2	6.5	3.0	1.5

THRUST BLOCK INSTALLATION (3)

NOT TO SCALE



1 PIPE LOCATOR RIBBON – 3" WIDTH

2 PIPE LOCATOR RIBBON – 6" WIDTH

3 MARKER BALL (DISTRICT PROVIDED)

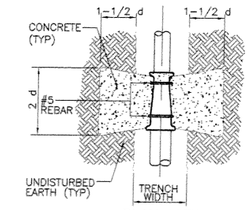
NOTES

1. CENTER PIPE LOCATOR RIBBON IN TRENCH AND PLACE OVER ENTIRE LENGTH OF ALL TYPES, SIZES AND LOCATIONS OF WATER MAINS
2. RIBBON SHALL BE IN ACCORDANCE WITH SECTION 3316 OF THE SPECIFICATIONS.
3. MARKER BALLS REQUIRED FOR NON-METALLIC PIPE OR WHEN SPECIFIED BY THE ENGINEER. INSTALL AT ALL HORIZONTAL BENDS OR DEFLECTIONS, CASING ENDS AND EVERY 400 FEET OF PIPELINE.
4. MARKER BALLS SHALL BE IN ACCORDANCE WITH SECTION 3326 OF THE SPECIFICATIONS.

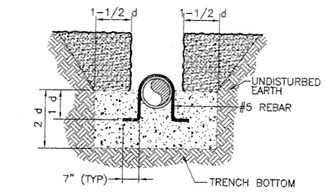
PIPE LOCATOR RIBBON AND MARKER BALL INSTALLATION (4)

NOT TO SCALE

LEGEND: d = LARGER DIAMETER PIPE SIZE

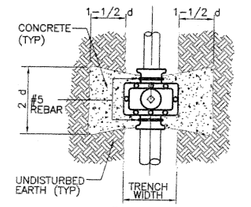


PLAN VIEW

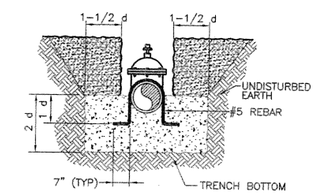


ELEVATION

REDUCERS



PLAN VIEW



ELEVATION

GATE VALVES

NOTES

1.) ALL CONCRETE SHALL BE 3000 PSI MINIMUM 28 DAYS COMPRESSIVE STRENGTH

2.) ALL VALVES AND EXPOSED REBAR TO BE COATED AND WRAPPED IN ACCORDANCE WITH DIVISION 15 OF THE LVVWD SPECS, PROTECTIVE COATINGS.

ANCHOR BLOCK DETAILS FOR IN-LINE REDUCERS AND GATE VALVES (5)

NOT TO SCALE

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

NO.	DESCRIPTION	DATE	BY
	REVISIONS		

SCALE: AS NOTED
DESIGN: VTN
DRAWN: VTN
CHECKED: JNG
APPROVED: KDG
DATE: 1/21/2004
PROJECT NO:
FILE NAME:

PROFESSIONAL ENGINEER STATE OF NEVADA KEN D. GILBRETH EXP: 09/30/05 No 9171 CIVIL

vtn nevada
• CONSULTING ENGINEERS
• PLANNERS
• LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 362-2600
FAX (702) 362-2597

(DRAWING TITLE) WATER LINE DETAILS

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
W2
SHT 128 OF 128

ISSUED FOR CONSTRUCTION

RESPONSE TO COMMENTS
UPPER LAS VEGAS WASH CHANNEL
REQUEST FOR
CONDITIONAL LETTER OF MAP REVISION

Case No.: 05-09-1009R
Community: City of North Las Vegas, Nevada
Community No.: 320007

Prepared for:

Clark County Regional Flood Control District
500 South Grand Central Parkway
Las Vegas, Nevada 89155

Prepared by:

PBS&J
2270 Corporate Circle, Suite 100
Henderson, Nevada 89074

Reference Number: 511606.00
December, 2005

PBS&J

ENGINEERING · PLANNING
CONSTRUCTION SERVICES
SURVEYING

December 15, 2005

Ms. Sheila M. Norlin
National LOMC Manager
Michael Baker Jr., Inc.
3601 Eisenhower Avenue
Alexandria, Virginia 22304-6425

RE: CASE NO.: 05-09-1009R
COMMUNITY: CITY OF NORTH LAS VEGAS, NEVADA
COMMUNITY NO.: 320007

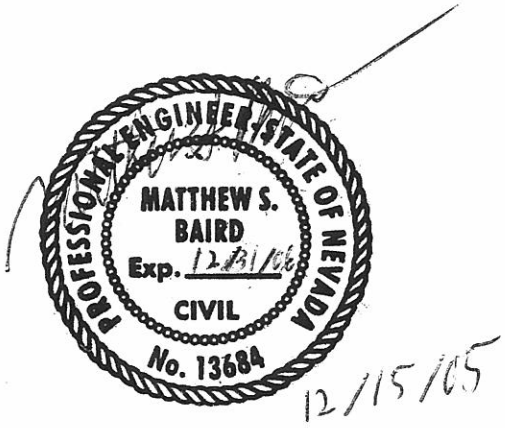
Dear Ms. Norlin:

Submitted for your review is the Response to Comments for the Upper Las Vegas Wash Channel Request for Conditional Letter of Map Revision.

If you have any questions regarding this report, please contact our office at (702) 263-7275.

Sincerely,

PBS&J



12/15/05

Brian K. Loffman, CFM
Hydrologist

Matt Baird, P.E., CFM
Sr. Program Manager

2270 Corporate Circle · Suite 100 · Henderson, Nevada 89074-6382 · Telephone 702/263-7275 · Fax 702/263-7200

The response to comments in a letter dated November 23, 2005 from Michael Baker Jr., Inc. (MBJ) are included below, see Appendix A for a copy of the comment letter.

Comment 1: **In our telephone conversation on November 16, 2005, it was established that the proposed discharge used in the submitted proposed hydraulic model, and based on a fully developed watershed, was not appropriate. Furthermore, it was agreed that the use of the effective discharge is suitable. Please submit a proposed hydraulic model for the Las Vegas Wash which uses the effective discharge.**

Response 1: The proposed hydraulic model for the Upper Las Vegas Wash Channel was run using the effective discharge of 2,833 cfs. As noted in our telephone discussion on November 16, 2005 the channel shows containment with the effective discharge with the exception of a breakout that occurs at WSPG Station 308+34.34 (Channel Station 1+65.65). The proposed channel section at this location consists of a 25' x 9' rectangular channel. The 100-year WSE at WSPG station 308+34.34 is 9.24' or approximately 2.88 inches above the proposed channel wall. The flow in the WSPG model was reduced until containment at this section was established (2,725 cfs). Please refer to Appendix B for the WSPG models. Thus, 108 cfs (2,833 – 2,725) would breakout of the proposed channel. The WSPG models have been provided on a CD, see Appendix F. The 1-foot contours on the design plans were reviewed to determine the flow path of the breakout. The plans show the existing ground is higher than the top of channel on the north side and lower on the south side (see Sheet PL01 & PR01A in Appendix D). Therefore, the 108 cfs would breakout of the proposed channel on the south side and follow the natural wash as shown on Figure 1, see Appendix D. Cross-section A-A represents the natural wash in which the breakout flow would be conveyed (see Figure 1 for the location of the cross-section). The slope used in Section A-A is 1.2% and was obtained from the 1-foot contours on the design plans. The cross-section was cut along the flow path to determine if a new flood zone delineation was warranted. The normal depth of Section A-A is 0.90 feet and the hydraulic depth is 0.49-feet; thus, no new flood zone is proposed. Please refer to Appendix C for the Flowmaster calculation worksheet. Also, refer to Appendix E for an email correspondence that shows the City of North Las Vegas has been contacted regarding the breakout section of the channel.

Comment 2: **The submitted work map entitled "Upper Las Vegas Wash Channel CLOMR, Proposed Shaded Zone X Flood Zone Delineation Map", prepared by PBS&J, dated April 2005, contains a proposed Special Flood Hazard Area (SFHA) designated Zone A, with no Base Flood Elevations determined, from approximately 600**

feet upstream of the 215 Beltway to the confluence with proposed channel, but no hydraulic analysis has been provided along this reach. Please submit a hydraulic analysis for the proposed SFHA designated Zone A from approximately 600 feet upstream of the I-215 Beltway to the confluence with the proposed channel.

The effective flood zone that is the subject of item 2 is the result of backwater from the main branch at an elevation somewhere between 2100 and 2105 per the effective FIRM, rather than tributary flow. The flood control improvements that are the subject of this CLOMR request eliminate this backwater condition and do not affect the tributary area to this point. Therefore it is recommended that this flood zone AE be changed to Shaded Zone X. Thus, no additional technical analysis will be submitted in response to this item. Please refer to Appendix D for revised Figures 4 and 4A that show the proposed Shaded Zone X delineation. The electronic flood zone delineation for the proposed Shaded Zone X has been provided on a CD, see Appendix F.

Appendix A: Comment Letter

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

November 23, 2005

Mr. Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood
Control District
600 South Grand Central Parkway, Suite 300
Las Vegas, NV 89106-4511

IN REPLY REFER TO:
Case No.: 05-09-1009R
Community: City of North Las Vegas, NV
Community No.: 320007

316-AD

Dear Mr. Eubanks:

This responds to your request dated May 5, 2005, that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a conditional revision to the Flood Insurance Rate Map (FIRM) for Clark County, Nevada and Incorporated Areas. Pertinent information about the request is listed below.

Identifier:	Upper Las Vegas Wash Channel
Flooding Source:	Las Vegas Wash
FIRM Panel(s) Affected:	32003C1767 E, 1769 E, 1788 E, and 2176 E

The data required to complete our review, which must be submitted within 90 days of the date of this letter, are listed on the enclosed summary.

If we do not receive the required data within 90 days, we will suspend our processing of your request. Any data submitted after 90 days will be treated as an original submittal and will be subject to all submittal/payment procedures, including the flat review and processing fee for requests of this type established by the current fee schedule. A copy of the notice summarizing the current fee schedule, which was published in the *Federal Register,* is enclosed for your information.

FEMA receives a very large volume of requests and cannot maintain inactive requests for an indefinite period of time. In addition, as a result of the aftermath of recent hurricanes, many FEMA employees have been deployed to assist in disaster relief efforts. Therefore, we are unable to grant extensions for the submission of required data/fee for revision requests. If a requester is informed by letter that additional data are required to complete our review of a request, the data/fee **must** be submitted within 90 days of the date of the letter. Any fees already paid will be forfeited for any request for which the requested data are not received within 90 days.

We will continue to work expeditiously to review all submittals in accordance with National Flood Insurance Program (NFIP) regulations, and will aim to meet the regulatory timeframe for the review of all requests. However, requesters should be aware that delays may occur in the review process because of the current emergency situation. We appreciate the patience and cooperation of all requesters as FEMA assists in hurricane relief efforts.

If you have general questions about your request, FEMA policy, or the NFIP, please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning your request, please call the Revisions Coordinator for your State, Mr. Sacha Tohme, CFM, who may be reached at (703) 960-8800, ext. 3028.

Sincerely,

Sheila M. Norlin, CFM
National LOMC Manager
Michael Baker Jr., Inc.

Enclosures

cc: Mr. Lenny Badger, P.E., CFM
Manager, Development and Flood Control
Department of Public Works
City of North Las Vegas

Mr. Matthew S. Baird, P.E., CFM
Senior Program Manager
PBS&J

NATIONAL FLOOD INSURANCE PROGRAM

FEMA NATIONAL SERVICE PROVIDER

Summary of Additional Data Required to Support a
Conditional Letter of Map Revision

Case No.: 05-09-1009R

Requester: Mr. Kevin Eubanks, P.E., CFM

Community: City of North Las Vegas, NV

Community No.: 320007

The issues listed below must be addressed before we can continue the review of your request.

1. In our telephone conversation on November 16, 2005, it was established that the proposed discharge used in the submitted proposed hydraulic model, and based on a fully developed watershed, was not appropriate. Furthermore, it was agreed that the use of the effective discharge is suitable. Please submit a proposed hydraulic model for Las Vegas Wash which uses the effective discharge.

2. The submitted work map entitled "Upper Las Vegas Wash Channel CLOMR, Proposed Shaded Zone X Flood Zone Delineation Map", prepared by PBS&J, dated April 2005, contains a proposed Special Flood Hazard Area (SFHA) designated Zone A, with no Base Flood Elevations determined, from approximately 600 feet upstream of the I-215 Beltway to the confluence with the proposed channel, but no hydraulic analysis has been provided along this reach. Please submit a hydraulic analysis for the proposed SFHA designated Zone A from approximately 600 feet upstream of the I-215 Beltway to the confluence with the proposed channel.

Please send the required data directly to us at the address shown at the bottom of this page. For identification purposes, please include the case number referenced above on all correspondence.

Appendix B: WSPG Model

Proposed Hydraulic Model
Effective Flow (2,833 cfs)

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
Portions Copyrighted by CIVILSOFT, 1986, 1987, 1989

Version
Serial Number

Nov 29, 2005 11:24:33

Input file : ulvw.dat
Output file: ulvw.out

INPUT FILE LISTING

```
T1 Upper Las Vegas Wash Channel
T2 Q = 2,690cfs @ NLVDB Outfall
T3 WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004
SO  8979.87 1911.41  1
R   9029.40 1911.79  1      .015
R   9080.11 1912.15  1      .015
R   9129.15 1912.46  1      .015
R   9179.15 1912.99  1      .015
R   9229.63 1913.25  1      .015
R   9279.17 1913.67  1      .015
R   9329.42 1914.02  1      .015
R   9379.72 1914.25  1      .015
R   9429.66 1914.44  1      .015
R   9479.77 1914.54  1      .015
R   9528.52 1914.92  1      .015
R   9577.24 1915.31  1      .015
BX  9577.24 1915.31  2
R   9696.65 1915.60  2      .015
BE  9696.65 1915.60  1      .015
TS  9920.85 1917.87  3      .015
R   9971.16 1918.38  3      .015
R  10209.69 1919.94  3      .015                          1019.00 13.41
R  10316.37 1920.63  3      .015
R  10539.15 1922.08  3      .015                          1000.00 12.76
R  10904.69 1923.89  4      .015
R  11338.37 1926.04  5      .015                           500.00 49.70
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R  12418.62 1931.23  5      .015                           500.00 51.16
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R  19364.08 1979.99 14      .015                          1000.00 16.13
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R  24499.99 2034.00 18      .015
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BE 30177.26 2096.93 25
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BX 30303.07 2098.25 27
R  30482.62 2100.03 27      .013                         575.00 17.89
BE 30482.62 2100.03 25
R  30694.06 2102.13 25      .013                         575.00 21.07
BX 30694.06 2102.13 27
R  30834.34 2103.47 27      .013                         575.00 13.98
BE 30834.34 2103.47 25
R  30874.16 2103.72 25      .013
TS 31161.12 2105.64 28      .013
R  31186.87 2105.82 28      .013
SH 31186.87 2105.82 28
1                                                    SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR   INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH              DROP

  CD      1    2      0       .00       9.50   62.00                .00
  CD      2    3      6      1.00       8.00   62.00    .00   .00   .00
  CD      3    2      0       .00      10.00   56.00                .00
  CD      4    2      0       .00       9.00   56.00                .00
  CD      5    2      0       .00       9.50   56.00                .00
  CD      6    3      2       .85       7.00   56.00    .00   .00   .00
  CD      7    3      2       .85       8.00   56.00    .00   .00   .00
  CD      8    2      0       .00      11.00   56.00                .00
  CD      9    3      2       .85       9.00   56.00    .00   .00   .00
  CD     10    2      0       .00       9.00   62.00                .00
  CD     11    2      0       .00      11.00   50.00                .00
  CD     12    2      0       .00       7.00   10.00                .00
  CD     13    3      1       .83       9.00   50.00    .00   .00   .00
  CD     14    2      0       .00       9.00   50.00                .00
  CD     15    2      0       .00       9.50   50.00                .00
  CD     16    3      1       .83       8.00   50.00    .00   .00   .00
  CD     17    2      0       .00      11.00   90.00                .00
  CD     18    2      0       .00       8.00   46.00                .00
  CD     19    3      1       .83       6.00   42.00    .00   .00   .00
  CD     20    3      1       .83       9.00   46.00    .00   .00   .00
  CD     21    2      0       .00       8.00   42.00                .00
  CD     22    2      0       .00       8.00   20.00                .00
  CD     23    3      1       .83       8.00   42.00    .00   .00   .00
  CD     24    2      0       .00       8.00   49.67                .00
  CD     25    2      0       .00       9.00   25.00                .00
  CD     26    3      1       .67       9.00   20.67    .00   .00   .00
  CD     27    3      1      1.00       9.00   25.00    .00   .00   .00
  CD     28    2      0       .00      12.00   53.40                .00
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                Upper Las Vegas Wash Channel
0HEADING LINE NO 2 IS -
0                                Q = 2,690cfs @ NLVDB Outfall
0HEADING LINE NO 3 IS -
0                                WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004
1                                                                                                          PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET          *          *                                    W S ELEV
                      U/S DATA   STATION     INVERT  SECT                                     .00
                                   8979.87 1911.41    1
0 ELEMENT NO   2 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9029.40 1911.79    1             .015                    .00    .00     .00      0
0 ELEMENT NO   3 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9080.11 1912.15    1             .015                    .00    .00     .00      0
0 ELEMENT NO   4 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9129.15 1912.46    1             .015                    .00    .00     .00      0
0 ELEMENT NO   5 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9179.15 1912.99    1             .015                    .00    .00     .00      0
0 ELEMENT NO   6 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9229.63 1913.25    1             .015                    .00    .00     .00      0
0 ELEMENT NO   7 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9279.17 1913.67    1             .015                    .00    .00     .00      0
0 ELEMENT NO   8 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9329.42 1914.02    1             .015                    .00    .00     .00      0
0 ELEMENT NO   9 IS A REACH                  *          *       *
                      U/S DATA   STATION     INVERT  SECT              N                  RADIUS  ANGLE  ANG PT  MAN H
                                   9379.72 1914.25    1             .015                    .00    .00     .00      0
```

```
0 ELEMENT NO  10 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9429.66 1914.44     1            .015
0 ELEMENT NO  11 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9479.77 1914.54     1            .015
0 ELEMENT NO  12 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9528.52 1914.92     1            .015
0 ELEMENT NO  13 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9577.24 1915.31     1            .015
0 ELEMENT NO  14 IS A BRIDGE EXIT                                 *
                  U/S DATA   STATION    INVERT  SECT
                               9577.24 1915.31     2
```

RADIUS	ANGLE	ANG PT	MAN H
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0


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1
0                        WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  15 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9696.65 1915.60     2            .015
0 ELEMENT NO  16 IS A BRIDGE ENTRANCE                             *
                  U/S DATA   STATION    INVERT  SECT             FP
                               9696.65 1915.60     1            .015
0 ELEMENT NO  17 IS A TRANSITION           *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9920.85 1917.87     3            .015
0 ELEMENT NO  18 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                               9971.16 1918.38     3            .015
0 ELEMENT NO  19 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              10209.69 1919.94     3            .015
0 ELEMENT NO  20 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              10316.37 1920.63     3            .015
0 ELEMENT NO  21 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              10539.15 1922.08     3            .015
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  22 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              10904.69 1923.89     4            .015
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  23 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              11338.37 1926.04     5            .015
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  24 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              11972.15 1929.18     4            .015
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  25 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              12418.62 1931.23     5            .015
0 ELEMENT NO  26 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              12459.99 1931.42     5            .015
0 ELEMENT NO  27 IS A BRIDGE EXIT                                 *
                  U/S DATA   STATION    INVERT  SECT
                              12459.99 1931.42     6
```

RADIUS	ANGLE	ANG PT	MAN H
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0
1019.00	13.41	.00	0
.00	.00	.00	0
1000.00	12.76	.00	0
.00	.00	.00	0
500.00	49.70	.00	0
.00	.00	.00	0
500.00	51.16	.00	0
.00	.00	.00	0


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1
0                        WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  28 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              12604.99 1932.15     6            .015
0 ELEMENT NO  29 IS A BRIDGE ENTRANCE                             *
                  U/S DATA   STATION    INVERT  SECT             FP
                              12604.99 1932.15     4           1.000
0 ELEMENT NO  30 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              12759.72 1933.58     4            .015
0 ELEMENT NO  31 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              12999.99 1935.80     4            .015
0 ELEMENT NO  32 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              13480.51 1939.20     4            .015
0 ELEMENT NO  33 IS A BRIDGE EXIT                                 *
                  U/S DATA   STATION    INVERT  SECT
                              13480.51 1939.20     7
0 ELEMENT NO  34 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              13719.99 1940.35     7            .015
0 ELEMENT NO  35 IS A BRIDGE ENTRANCE                             *
                  U/S DATA   STATION    INVERT  SECT             FP
                              13719.99 1940.35     8           1.000
0 ELEMENT NO  36 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              13813.88 1941.42     8            .015
0 ELEMENT NO  37 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              14414.99 1948.27     8            .015
0 ELEMENT NO  38 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              14834.08 1950.37     8            .015
0 ELEMENT NO  39 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              15554.99 1953.97     8            .015
0 ELEMENT NO  40 IS A BRIDGE EXIT                                 *
                  U/S DATA   STATION    INVERT  SECT
                              15554.99 1953.97     9
```

RADIUS	ANGLE	ANG PT	MAN H
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0
.00	.00	.00	0
700.00	39.33	.00	0
700.00	19.67	.00	0
.00	.00	.00	0
1000.00	34.44	.00	0
1000.00	24.01	.00	0
.00	.00	.00	0


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1
0                        WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  41 IS A REACH                *         *      *
                  U/S DATA   STATION    INVERT  SECT              N
                              15704.99 1954.72     9            .015
```

RADIUS	ANGLE	ANG PT	MAN H
.00	.00	.00	0

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0 ELEMENT NO  42 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                              15704.99 1954.72    4             1.000
0 ELEMENT NO  43 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              16249.99 1960.92    4             .015                                    .00    .00     .00     0
0 ELEMENT NO  44 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              17894.90 1971.90    4             .015                                    .00    .00     .00     0
0 ELEMENT NO  45 IS A TRANSITION             *       *       *
                  U/S DATA   STATION    INVERT  SECT              N
                              18074.90 1973.10   10             .015
0 ELEMENT NO  46 IS A JUNCTION               *       *       *       *               *                       *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                              18199.90 1973.93   11     0    12    .015      .0       .1      .00  1973.93    .00     .10
0 ELEMENT NO  47 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                              18199.90 1973.93   13
0 ELEMENT NO  48 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              18489.99 1975.55   13             .015                                    .00    .00     .00     0
0 ELEMENT NO  49 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                              18489.99 1975.55   14             1.000
0 ELEMENT NO  50 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              19082.52 1978.56   14             .015                                    .00    .00     .00     0
0 ELEMENT NO  51 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              19364.08 1979.99   14             .015                                   1000.00 16.13     .00     0
0 ELEMENT NO  52 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              19633.21 1981.36   14             .015                                   1000.00 15.42     .00     0
1                                                                                                                    PAGE NO   6
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  53 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              20417.93 1987.77   14             .015                                    .00    .00     .00     0
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  54 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              20542.23 1988.79   15             .015                                   500.00  14.24     .00     0
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  55 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              20600.27 1989.26   14             .015                                    .00    .00     .00     0
0 ELEMENT NO  56 IS A TRANSITION             *       *       *
                  U/S DATA   STATION    INVERT  SECT              N
                              20780.27 1992.50   10             .015
0 ELEMENT NO  57 IS A JUNCTION               *       *       *       *               *                       *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                              20905.27 1994.75   11     0    12    .015      .0       .1      .00  1994.75    .00     .10
0 ELEMENT NO  58 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                              20905.27 1994.75   16
0 ELEMENT NO  59 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              20962.78 1995.89   16             .015                                    .00    .00     .00     0
0 ELEMENT NO  60 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21078.04 1998.17   16             .015                                   500.00  13.21     .00     0
0 ELEMENT NO  61 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                              21078.04 1998.17   11             1.000
0 ELEMENT NO  62 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21238.18 2001.35   11             .015                                    .00    .00     .00     0
0 ELEMENT NO  63 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21354.36 2003.65   11             .015                                   963.00   6.91     .00     0
0 ELEMENT NO  64 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21412.24 2004.80   11             .015                                    .00    .00     .00     0
1                                                                                                                    PAGE NO   7
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  65 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                              21412.24 2004.80   13
0 ELEMENT NO  66 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21462.24 2005.79   13             .015                                    .00    .00     .00     0
0 ELEMENT NO  67 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                              21462.24 2005.79   11             1.000
0 ELEMENT NO  68 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21580.88 2008.14   11             .015                                    .00    .00     .00     0
0 ELEMENT NO  69 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21713.69 2009.16   11             .015                                   1037.00  7.34     .00     0
0 ELEMENT NO  70 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21830.99 2010.07   11             .015                                    .00    .00     .00     0
0 ELEMENT NO  71 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                              21830.99 2010.07   13
0 ELEMENT NO  72 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21880.99 2010.45   13             .015                                    .00    .00     .00     0
0 ELEMENT NO  73 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                              21880.99 2010.45   11             1.000
0 ELEMENT NO  74 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT              N                                    RADIUS  ANGLE  ANG PT  MAN H
                              21924.99 2010.79   11             .015                                    .00    .00     .00     0
0 ELEMENT NO  75 IS A REACH                  *       *       *
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                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               22739.34 2014.86   11             .015                                   .00    .00     .00      0
0 ELEMENT NO  76 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               22824.99 2015.29   11             .015                                 785.00   6.25     .00      0
0 ELEMENT NO  77 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               23263.37 2021.09   11             .015                                 785.00  32.00     .00      0
0 ELEMENT NO  78 IS A TRANSITION
                    U/S DATA   STATION    INVERT  SECT            N
                               23564.23 2025.80   17             .015
1                                                                                                                  PAGE NO   8
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  79 IS A JUNCTION
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               23744.23 2027.09   18     0    19    .015      .0       .1       .00  2027.09    .00     .10
0 ELEMENT NO  80 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               23744.23 2027.09   20
0 ELEMENT NO  81 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               23969.99 2031.22   20             .015                                   .00    .00     .00      0
0 ELEMENT NO  82 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               24009.99 2031.43   20             .015                                   .00    .00     .00      0
0 ELEMENT NO  83 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               24009.99 2031.43   18          1.000
0 ELEMENT NO  84 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               24499.99 2034.00   18             .015                                   .00    .00     .00      0
0 ELEMENT NO  85 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               24799.99 2037.10   18             .015                                   .00    .00     .00      0
0 ELEMENT NO  86 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               26069.99 2046.00   18             .015                                   .00    .00     .00      0
0 ELEMENT NO  87 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               26979.99 2057.63   18             .015                                   .00    .00     .00      0
0 ELEMENT NO  88 IS A JUNCTION
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               27079.99 2058.91   21     0    22    .015      .0       .1       .00  2058.91    .00     .10
0 ELEMENT NO  89 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               27128.00 2059.53   21             .015                                   .00    .00     .00      0
0 ELEMENT NO  90 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               27128.00 2059.53   23
1                                                                                                                  PAGE NO   9
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  91 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               27399.99 2063.00   23             .015                                 1500.00  10.39     .00      0
0 ELEMENT NO  92 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               27399.99 2063.00   21          1.000
0 ELEMENT NO  93 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               27689.98 2066.71   21             .015                                 1500.00  11.08     .00      0
0 ELEMENT NO  94 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               27913.07 2070.06   21             .015                                   .00    .00     .00      0
0 ELEMENT NO  95 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               28537.03 2078.04   21             .015                                 2000.00  17.88     .00      0
0 ELEMENT NO  96 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               28664.99 2078.68   21             .015                                   .00    .00     .00      0
0 ELEMENT NO  97 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               28664.99 2078.68   23
0 ELEMENT NO  98 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               28824.99 2079.48   23             .015                                   .00    .00     .00      0
0 ELEMENT NO  99 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               28824.99 2079.48   21          1.000
0 ELEMENT NO 100 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               29449.99 2082.60   21             .015                                   .00    .00     .00      0
0 ELEMENT NO 101 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               29796.43 2090.59   21             .015                                   .00    .00     .00      0
0 ELEMENT NO 102 IS A TRANSITION
                    U/S DATA   STATION    INVERT  SECT            N
                               29896.43 2092.89   24             .015
0 ELEMENT NO 103 IS A JUNCTION
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               29996.43 2095.20   25     0    26    .015      .0       .1       .00  2095.20    .00     .10
1                                                                                                                  PAGE NO  10
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO 104 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               29996.43 2095.20   27
0 ELEMENT NO 105 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               30023.40 2095.41   27             .013                                 575.00   2.68     .00      0
0 ELEMENT NO 106 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
                               30177.26 2096.93   27             .013                                 575.00  15.33     .00      0
0 ELEMENT NO 107 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               30177.26 2096.93   25          1.000
0 ELEMENT NO 108 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                                  RADIUS  ANGLE  ANG PT  MAN H
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                         30303.07 2098.25   25                   .013                                575.00  12.54     .00     0
0 ELEMENT NO 109 IS A BRIDGE EXIT                   *
                 U/S DATA   STATION    INVERT  SECT
                         30303.07 2098.25   27
0 ELEMENT NO 110 IS A REACH         *         *     *
                 U/S DATA   STATION    INVERT  SECT                 N                                RADIUS  ANGLE  ANG PT  MAN H
                         30482.62 2100.03   27                   .013                                575.00  17.89     .00     0
0 ELEMENT NO 111 IS A BRIDGE ENTRANCE               *
                 U/S DATA   STATION    INVERT  SECT                FP
                         30482.62 2100.03   25                  1.000
0 ELEMENT NO 112 IS A REACH         *         *     *
                 U/S DATA   STATION    INVERT  SECT                 N                                RADIUS  ANGLE  ANG PT  MAN H
                         30694.06 2102.13   25                   .013                                575.00  21.07     .00     0
0 ELEMENT NO 113 IS A BRIDGE EXIT                   *
                 U/S DATA   STATION    INVERT  SECT
                         30694.06 2102.13   27
0 ELEMENT NO 114 IS A REACH         *         *     *
                 U/S DATA   STATION    INVERT  SECT                 N                                RADIUS  ANGLE  ANG PT  MAN H
                         30834.34 2103.47   27                   .013                                575.00  13.98     .00     0
0 ELEMENT NO 115 IS A BRIDGE ENTRANCE               *
                 U/S DATA   STATION    INVERT  SECT                FP
                         30834.34 2103.47   25                  1.000
0 ELEMENT NO 116 IS A REACH         *         *     *
                 U/S DATA   STATION    INVERT  SECT                 N                                RADIUS  ANGLE  ANG PT  MAN H
                         30874.16 2103.72   25                   .013                                   .00    .00     .00     0
0 ELEMENT NO 117 IS A TRANSITION    *         *     *
                 U/S DATA   STATION    INVERT  SECT                 N
                         31161.12 2105.64   28                   .013
1                                                                                                                  PAGE NO  11
0                  WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO 118 IS A REACH         *         *     *
                 U/S DATA   STATION    INVERT  SECT                 N                                RADIUS  ANGLE  ANG PT  MAN H
                         31186.87 2105.82   28                   .013                                   .00    .00     .00     0
0 ELEMENT NO 119 IS A SYSTEM HEADWORKS              *                   *
                 U/S DATA   STATION    INVERT  SECT                                    W S ELEV
                         31186.87 2105.82   28                                              .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
1                                                                                                                   PAGE    1
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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	8979.87	1911.41	2.89	1914.30	2833.5	15.84	3.90	1918.19	.00	4.02		9.50	62.00	.00	0	.00
0	49.53	.00767					.00692	.34			2.81			.00		
0	9029.40	1911.79	2.91	1914.70	2833.5	15.72	3.84	1918.54	.00	4.02		9.50	62.00	.00	0	.00
0	50.71	.00710					.00680	.34			2.87			.00		
0	9080.11	1912.15	2.92	1915.07	2833.5	15.67	3.81	1918.88	.00	4.02		9.50	62.00	.00	0	.00
0	49.04	.00632					.00682	.33			2.98			.00		
0	9129.15	1912.46	2.90	1915.36	2833.5	15.75	3.86	1919.22	.00	4.02		9.50	62.00	.00	0	.00
0	.55	.01060					.00688	.00			2.54			.00		
0	9129.70	1912.47	2.90	1915.37	2833.5	15.74	3.85	1919.22	.00	4.02		9.50	62.00	.00	0	.00
0	49.45	.01060					.00638	.32			2.54			.00		
0	9179.15	1912.99	3.04	1916.03	2833.5	15.01	3.50	1919.54	.00	4.02		9.50	62.00	.00	0	.00
0	.00	.01060					.00590	.00			2.54			.00		
0	9179.15	1912.99	3.04	1916.03	2833.5	15.01	3.50	1919.54	.00	4.02		9.50	62.00	.00	0	.00
0	50.48	.00515					.00600	.30			3.17			.00		
0	9229.63	1913.25	3.01	1916.26	2833.5	15.17	3.58	1919.84	.00	4.02		9.50	62.00	.00	0	.00
0	49.54	.00848					.00578	.29			2.72			.00		
0	9279.17	1913.67	3.12	1916.79	2833.5	14.65	3.34	1920.13	.00	4.02		9.50	62.00	.00	0	.00
0	50.25	.00697					.00524	.26			2.89			.00		
0	9329.42	1914.02	3.20	1917.22	2833.5	14.28	3.17	1920.39	.00	4.02		9.50	62.00	.00	0	.00
0	50.30	.00457					.00509	.26			3.30			.00		
0	9379.72	1914.25	3.17	1917.42	2833.5	14.40	3.22	1920.65	.00	4.02		9.50	62.00	.00	0	.00
0	49.94	.00380					.00535	.27			3.49			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	9429.66	1914.44	3.10	1917.54	2833.5	14.72	3.37	1920.91	.00	4.02		9.50	62.00	.00	0	.00
0	2.06	.00200					.00556	.01			4.27			.00		
0	9431.72	1914.44	3.10	1917.54	2833.5	14.75	3.38	1920.92	.00	4.02		9.50	62.00	.00	0	.00
0	48.04	.00200					.00604	.29			4.27			.00		
0	9479.77	1914.54	2.95	1917.49	2833.5	15.47	3.72	1921.21	.00	4.02		9.50	62.00	.00	0	.00
0	48.75	.00779					.00633	.31			2.79			.00		
0	9528.52	1914.92	3.00	1917.92	2833.5	15.22	3.60	1921.52	.00	4.02		9.50	62.00	.00	0	.00
0	.00	.00779					.00616	.00			2.79			.00		
0	9528.52	1914.92	3.00	1917.92	2833.5	15.22	3.60	1921.52	.00	4.02		9.50	62.00	.00	0	.00
0	48.72	.00800					.00592	.29			2.77			.00		
0	9577.24	1915.31	3.08	1918.39	2833.5	14.84	3.42	1921.81	.00	4.02		9.50	62.00	.00	0	.00
0	BRIDGE EXIT													.00		
0	9577.24	1915.31	3.85	1919.16	2833.5	13.14	2.68	1921.84	.00	4.30		8.00	62.00	.00	6	1.00
0	BRIDGE EXIT													.00		
0	9577.24	1915.31	3.85	1919.16	2833.5	13.14	2.68	1921.84	.00	4.30		8.00	62.00	.00	6	1.00
0	10.06	.00243					.00746	.08			5.83			.00		
0	9587.30	1915.33	3.74	1919.07	2833.5	13.53	2.85	1921.92	.00	4.30		8.00	62.00	.00	6	1.00
0	18.89	.00243					.00829	.16			5.83			.00		
0	9606.19	1915.38	3.56	1918.95	2833.5	14.19	3.13	1922.08	.00	4.30		8.00	62.00	.00	6	1.00
0	21.04	.00243					.00943	.20			5.83			.00		
0	9627.23	1915.43	3.40	1918.83	2833.5	14.89	3.44	1922.27	.00	4.30		8.00	62.00	.00	6	1.00
0	22.43	.00243					.01073	.24			5.83			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

ULVW.OUT

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 9649.66	1915.49	3.24	1918.73	2833.5	15.61	3.79	1922.52	.00	4.30		8.00	62.00	.00	6	1.00
0 23.28	.00243					.01223	.28			5.83			.00		
0 9672.94	1915.54	3.09	1918.63	2833.5	16.38	4.17	1922.80	.00	4.30		8.00	62.00	.00	6	1.00
0 23.71	.00243					.01394	.33			5.83			.00		
0 9696.65	1915.60	2.95	1918.55	2833.5	17.18	4.58	1923.13	.00	4.30		8.00	62.00	.00	6	1.00
0BRIDGE ENTRANCE													.00		
0 9696.65	1915.60	2.56	1918.16	2833.5	17.88	4.97	1923.13	.00	4.02		9.50	62.00	.00	0	.00
0TRANS STR	.01013					.00875	1.96						.00		
0 9920.85	1917.87	3.07	1920.94	2833.5	16.49	4.23	1925.16	.00	4.30		10.00	56.00	.00	0	.00
0TRANS STR	.01013					.00714	.00						.00		
0 9920.85	1917.87	3.07	1920.94	2833.5	16.49	4.23	1925.16	.00	4.30		10.00	56.00	.00	0	.00
0 50.31	.01014					.00678	.34			2.75			.00		
0 9971.16	1918.38	3.17	1921.55	2833.5	15.95	3.95	1925.51	.43	4.30		10.00	56.00	.00	0	.00
0 238.53	.00654					.00629	1.50			3.15			.00		
0 10209.69	1919.94	3.21	1923.15	2833.5	15.74	3.85	1927.01	.00	4.30		10.00	56.00	.00	0	.00
0 106.68	.00647					.00606	.65			3.16			.00		
0 10316.37	1920.63	3.25	1923.88	2833.5	15.59	3.78	1927.65	.42	4.30		10.00	56.00	.00	0	.00
0 69.21	.00651					.00587	.41			3.16			.00		
0 10385.58	1921.08	3.28	1924.36	2833.5	15.43	3.70	1928.06	.41	4.30		10.00	56.00	.00	0	.00
0 153.57	.00651					.00536	.82			3.16			.00		
0 10539.15	1922.08	3.44	1925.52	2833.5	14.71	3.36	1928.88	.00	4.30		9.00	56.00	.00	0	.00
0 159.80	.00495					.00495	.79			3.44			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 10698.95	1922.87	3.44	1926.31	2833.5	14.71	3.36	1929.67	.00	4.30		9.00	56.00	.00	0	.00
0 205.74	.00495					.00496	1.02			3.44			.00		
0 10904.69	1923.89	3.44	1927.33	2833.5	14.71	3.36	1930.69	.75	4.30		9.50	56.00	.00	0	.00
0 433.68	.00496					.00496	2.15			3.44			.00		
0 11338.37	1926.04	3.44	1929.48	2833.5	14.71	3.36	1932.84	.00	4.30		9.00	56.00	.00	0	.00
0 209.47	.00495					.00496	1.04			3.44			.00		
0 11547.84	1927.08	3.44	1930.52	2833.5	14.71	3.36	1933.88	.00	4.30		9.00	56.00	.00	0	.00
0 424.31	.00495					.00482	2.05			3.44			.00		
0 11972.15	1929.18	3.50	1932.68	2833.5	14.46	3.25	1935.93	.00	4.30		9.00	56.00	.00	0	.00
0 .00	.00495					.00469	.00			3.44			.00		
0 11972.15	1929.18	3.50	1932.68	2833.5	14.46	3.25	1935.93	.73	4.30		9.50	56.00	.00	0	.00
0 188.71	.00459					.00477	.90			3.52			.00		
0 12160.86	1930.05	3.46	1933.51	2833.5	14.62	3.32	1936.83	.74	4.30		9.50	56.00	.00	0	.00
0 257.76	.00459					.00525	1.35			3.52			.00		
0 12418.62	1931.23	3.30	1934.53	2833.5	15.33	3.65	1938.18	.00	4.30		9.50	56.00	.00	0	.00
0 41.37	.00459					.00576	.24			3.52			.00		
0 12459.99	1931.42	3.26	1934.68	2833.5	15.51	3.74	1938.42	.00	4.30		9.50	56.00	.00	0	.00
0BRIDGE EXIT													.00		
0 12459.99	1931.42	3.45	1934.87	2833.5	15.12	3.55	1938.42	.00	4.39		7.00	56.00	.00	2	.85
0 75.91	.00503					.00735	.56			3.83			.00		
0 12535.90	1931.80	3.30	1935.11	2833.5	15.79	3.88	1938.98	.00	4.39		7.00	56.00	.00	2	.85
0 69.09	.00503					.00842	.58			3.83			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 12604.99	1932.15	3.15	1935.30	2833.5	16.57	4.26	1939.56	.00	4.39		7.00	56.00	.00	2	.85
0BRIDGE ENTRANCE													.00		
0 12604.99	1932.15	2.87	1935.02	2833.5	17.61	4.82	1939.84	.00	4.30		9.00	56.00	.00	0	.00
0BRIDGE ENTRANCE													.00		
0 12604.99	1932.15	2.87	1935.02	2833.5	17.61	4.82	1939.84	.00	4.30		9.00	56.00	.00	0	.00
0 154.73	.00924					.00862	1.33			2.83			.00		
0 12759.72	1933.58	2.91	1936.49	2833.5	17.37	4.69	1941.18	.75	4.30		9.00	56.00	.00	0	.00
0 83.02	.00924					.00826	.69			2.83			.00		
0 12842.74	1934.35	2.95	1937.30	2833.5	17.15	4.57	1941.87	.73	4.30		9.00	56.00	.00	0	.00
0 157.25	.00924					.00751	1.18			2.83			.00		
0 12999.99	1935.80	3.10	1938.90	2833.5	16.35	4.15	1943.05	.66	4.30		9.00	56.00	.00	0	.00
0 224.23	.00708					.00682	1.53			3.08			.00		
0 13224.22	1937.39	3.13	1940.52	2833.5	16.17	4.06	1944.58	.65	4.30		9.00	56.00	.00	0	.00
0 256.29	.00708					.00623	1.60			3.08			.00		
0 13480.51	1939.20	3.28	1942.48	2833.5	15.42	3.69	1946.18	.00	4.30		9.00	56.00	.00	0	.00
0BRIDGE EXIT													.00		
0 13480.51	1939.20	3.48	1942.68	2833.5	15.01	3.50	1946.18	.00	4.39		8.00	56.00	.00	2	.85
0 59.52	.00480					.00711	.42			3.90			.00		
0 13540.03	1939.49	3.35	1942.84	2833.5	15.56	3.76	1946.60	.00	4.39		8.00	56.00	.00	2	.85
0 67.75	.00480					.00805	.55			3.90			.00		
0 13607.78	1939.81	3.20	1943.01	2833.5	16.32	4.14	1947.15	.00	4.39		8.00	56.00	.00	2	.85
0 59.15	.00480					.00928	.55			3.90			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 13666.93	1940.10	3.05	1943.14	2833.5	17.12	4.55	1947.70	.00	4.39		8.00	56.00	.00	2	.85
0 53.06	.00480					.01071	.57			3.90			.00		
0 13719.99	1940.35	2.91	1943.26	2833.5	17.95	5.01	1948.26	.00	4.39		8.00	56.00	.00	2	.85
0BRIDGE ENTRANCE													.00		
0 13719.99	1940.35	2.67	1943.02	2833.5	18.92	5.56	1948.59	.00	4.30		11.00	56.00	.00	0	.00
0 93.89	.01140					.01103	1.04			2.65			.00		
0 13813.88	1941.42	2.68	1944.10	2833.5	18.85	5.52	1949.62	.00	4.30		11.00	56.00	.00	0	.00
0 .00	.01140					.01096	.00			2.65			.00		
0 13813.88	1941.42	2.68	1944.10	2833.5	18.85	5.52	1949.62	.62	4.30		11.00	56.00	.00	0	.00

23988.74	.	IWC X	R
24039.79	.	I X X	R
24090.84	.	I WCEH	R
24141.89	.	I WCEH	R
24192.94	.	IWCEH	R
24243.99	.	IBXEH	BE
24295.04	.	IWC X	R
24346.09	.	I X X	R
24397.14	.	I WCX	R
24448.19	.	IWCHE	R
24499.24	.		
24550.29	.	IWC X	R
24601.35	.		
24652.40	.		
24703.45	.	IWC X	R
24754.50	.		
24805.55	.	I WCX	R
24856.60	.	I WCX	R
24907.65	.		
24958.70	.		
25009.75	.		
25060.80	.		
25111.85	.	I WCX	R
25162.90	.		
25213.95	.		
25265.00	.		
25316.05	.		
25367.10	.		
25418.15	.		
25469.21	.		
25520.26	.		
25571.31	.		
25622.36	.		
25673.41	.	I WCX	R
25724.46	.		
25775.51	.		
25826.56	.		
25877.61	.	IWC X	R
25928.66	.		
25979.71	.	I WCHE	R
26030.76	.		
26081.81	.	IWC X	R
26132.86	.		
26183.91	.		
26234.96	.		
26286.01	.		
26337.06	.		
26388.12	.		
26439.17	.		
26490.22	.	IWC HE	R
26541.27	.		
26592.32	.		
26643.37	.		
26694.42	.		
26745.47	.		
26796.52	.		
26847.57	.		
26898.62	.		
26949.67	.		
27000.72	.	I WCHE	JX
27051.77	.		
27102.82	.	I X HE	R
27153.87	.	IBWCHE	BX
27204.92	.	I WCHE	R
27255.97	.		
27307.03	.		
27358.08	.		
27409.13	.	IBXBHE	BE
27460.18	.	IWC HE	R
27511.23	.		
27562.28	.		
27613.33	.		
27664.38	.		
27715.43	.	IWC HE	R
27766.48	.		
27817.53	.		
27868.58	.		
27919.63	.	I WCHE	R
27970.68	.	I WCHE	R
28021.73	.		
28072.78	.		
28123.83	.		
28174.88	.	IWC HE	R
28225.94	.		
28276.99	.		
28328.04	.	IWC X	R
28379.09	.		
28430.14	.	I WCHE	R
28481.19	.	I X X	R
28532.24	.	I WCX	R
28583.29	.	I WCX	R
28634.34	.		
28685.39	.	IBXHE	BX
28736.44	.	I XHE	R
28787.49	.	I XHE	R
28838.54	.	IBXBX	BE
28889.59	.	IBXBX	BE
28940.64	.	I X X	R
28991.69	.	I WCHE	R
29042.74	.		
29093.79	.	I WCHE	R
29144.85	.	IWC X	R
29195.90	.		
29246.95	.	IWC HE	R
29298.00	.	IW CHE	R
29349.05	.	I WCH E	R

```
29400.10  .                                                                I WCH E             .    R
29451.15  .                                                                I WCH  E            .    R
29502.20  .                                                                                    .
29553.25  .                                                                                    .
29604.30  .                                                                                    .
29655.35  .                                                                                    .
29706.40  .                                                                                    .
29757.45  .                                                                                    .
29808.50  .                                                                    I WCH E         .    TX
29859.55  .                                                                                    .
29910.60  .                                                                     IW CH  E       .    JX
29961.65  .                                                                                    .
30012.71  .                                                                       IBWCH E      .    BX
30063.76  .                                                                       I WCH E      .    R
30114.81  .                                                                       I WCH E      .    R
30165.86  .                                                                                    .
30216.91  .                                                                       IBBWCHE      .    BE
30267.96  .                                                                       I  WCH E     .    R
30319.01  .                                                                        IBBWX E     .    BX
30370.06  .                                                                        I  WX E     .    R
30421.11  .                                                                        I  WX E     .    R
30472.16  .                                                                                    .
30523.21  .                                                                         IBBWX E    .    BE
30574.26  .                                                                         I WCH E    .    R
30625.31  .                                                                         I W X E    .    R
30676.36  .                                                                          I WCHE    .    R
30727.41  .                                                                          IBBXH E   .    BX
30778.46  .                                                                          I  WX E   .    R
30829.52  .                                                                          I  WX E   .    R
30880.56  .                                                                          I  WCHE   .    R
30931.62  .                                                                          I    XHE  .    R
30982.67  .                                                                           I  XHE   .    R
31033.72  .                                                                           IBBXHE   .    BE
31084.77  .                                                                           I  CXE   .    R
31135.82  .                                                                           I  CXE   .    R
31186.87  .                                                                           I  CXE   .    TX
          .         .         .         .         .         .         .         .         .         .
0         1911.41   1932.05   1952.69   1973.33   1993.97   2014.61   2035.26   2055.90   2076.54   2097.18   2117.82
1
```

N O T E S

1. GLOSSARY

   I = INVERT ELEVATION
   C = CRITICAL DEPTH
   W = WATER SURFACE ELEVATION
   H = HEIGHT OF CHANNEL
   E = ENERGY GRADE LINE
   X = CURVES CROSSING OVER
   B = BRIDGE ENTRANCE OR EXIT
   Y = WALL ENTRANCE OR EXIT

2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY
1

Proposed Hydraulic Model
Channel Containment Flow (2,725 cfs)

STORM DRAIN ANALYSIS PLUS

Original version by Los Angeles County Public Works
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Version
Serial Number

Nov 29, 2005 16:56:54

Input file : ulvwa.dat
Output file: ulvwa.out

INPUT FILE LISTING

```
T1 Upper Las Vegas Wash Channel
T2 Q = 2,690cfs @ NLVDB Outfall
T3 WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004
SO  8979.87 1911.41  1
R   9029.40 1911.79  1      .015
R   9080.11 1912.15  1      .015
R   9129.15 1912.46  1      .015
R   9179.15 1912.99  1      .015
R   9229.63 1913.25  1      .015
R   9279.17 1913.67  1      .015
R   9329.42 1914.02  1      .015
R   9379.72 1914.25  1      .015
R   9429.66 1914.44  1      .015
R   9479.77 1914.54  1      .015
R   9528.52 1914.92  1      .015
R   9577.24 1915.31  1      .015
BX  9577.24 1915.31  2
R   9696.65 1915.60  2      .015
BE  9696.65 1915.60  1      .015
TS  9920.85 1917.87  3      .015
R   9971.16 1918.38  3      .015
R  10209.69 1919.94  3      .015                          1019.00 13.41
R  10316.37 1920.63  3      .015
R  10539.15 1922.08  3      .015                          1000.00 12.76
R  10904.69 1923.89  4      .015
R  11338.37 1926.04  5      .015                           500.00 49.70
R  11972.15 1929.18  4      .015
R  12418.62 1931.23  5      .015                           500.00 51.16
R  12459.99 1931.42  5      .015
BX 12459.99 1931.42  6
R  12604.99 1932.15  6      .015
BE 12604.99 1932.15  4
R  12759.72 1933.58  4      .015
R  12999.99 1935.80  4      .015                           700.00 39.33
R  13480.51 1939.20  4      .015                           700.00 19.67
BX 13480.51 1939.20  7
R  13719.99 1940.35  7      .015
BE 13719.99 1940.35  8
R  13813.88 1941.42  8      .015
R  14414.99 1948.27  8      .015                          1000.00 34.44
R  14834.08 1950.37  8      .015                          1000.00 24.01
R  15554.99 1953.97  8      .015
BX 15554.99 1953.97  9
R  15704.99 1954.72  9      .015
BE 15704.99 1954.72  4
R  16249.99 1960.92  4      .015
R  17894.90 1971.90  4      .015
TS 18074.90 1973.10 10      .015
JX 18199.90 1973.93 11    12.015     0.01                 1973.93         0.1
BX 18199.90 1973.93 13
R  18489.99 1975.55 13      .015
BE 18489.99 1975.55 14
R  19082.52 1978.56 14      .015
R  19364.08 1979.99 14      .015                          1000.00 16.13
R  19633.21 1981.36 14      .015                          1000.00 15.42
R  20417.93 1987.77 14      .015
R  20542.23 1988.79 15      .015                           500.00 14.24
R  20600.27 1989.26 14      .015
TS 20780.27 1992.50 10      .015
JX 20905.27 1994.75 11    12.015     0.01                 1994.75         0.1
BX 20905.27 1994.75 16
R  20962.78 1995.89 16      .015
R  21078.04 1998.17 16      .015                           500.00 13.21
BE 21078.04 1998.17 11
R  21238.18 2001.35 11      .015
R  21354.36 2003.65 11      .015                           963.00  6.91
R  21412.24 2004.80 11      .015
BX 21412.24 2004.80 13
R  21462.24 2005.79 13      .015
BE 21462.24 2005.79 11
R  21580.88 2008.14 11      .015
R  21713.69 2009.16 11      .015                          1037.00  7.34
R  21830.99 2010.07 11      .015
BX 21830.99 2010.07 13
R  21880.99 2010.45 13      .015
BE 21880.99 2010.45 11
R  21924.99 2010.79 11      .015
R  22739.34 2014.86 11      .015
R  22824.99 2015.29 11      .015                           785.00  6.25
R  23263.37 2021.09 11      .015                           785.00 32.00
TS 23564.23 2025.80 17      .015
JX 23744.23 2027.09 18    19.015     0.01                 2027.09         0.1
BX 23744.23 2027.09 20
R  23969.99 2031.22 20      .015
R  24009.99 2031.43 20      .015
BE 24009.99 2031.43 18
R  24499.99 2034.00 18      .015
R  24799.99 2037.10 18      .015
```

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R  26069.99 2046.00 18      .015
R  26979.99 2057.63 18      .015
JX 27079.99 2058.91 21    22.015     0.01              2058.91         0.1
R  27128.00 2059.53 21      .015     ~
BX 27128.00 2059.53 23
R  27399.99 2063.00 23      .015                       1500.00 10.39
BE 27399.99 2063.00 21
R  27689.98 2066.71 21      .015                       1500.00 11.08
R  27913.07 2070.06 21      .015
R  28537.03 2078.04 21      .015                       2000.00 17.88
R  28664.99 2078.68 21      .015
BX 28664.99 2078.68 23
R  28824.99 2079.48 23      .015
BE 28824.99 2079.48 21
R  29449.99 2082.60 21      .015
R  29796.43 2090.59 21      .015
TS 29896.43 2092.89 24      .015
JX 29996.43 2095.20 25    26.015     0.01              2095.20         0.1
BX 29996.43 2095.20 27
R  30023.40 2095.41 27      .013                        575.00  2.68
R  30177.26 2096.93 27      .013                        575.00 15.33
BE 30177.26 2096.93 25
R  30303.07 2098.25 25      .013                        575.00 12.54
BX 30303.07 2098.25 27
R  30482.62 2100.03 27      .013                        575.00 17.89
BE 30482.62 2100.03 25
R  30694.06 2102.13 25      .013                        575.00 21.07
BX 30694.06 2102.13 27
R  30834.34 2103.47 27      .013                        575.00 13.98
BE 30834.34 2103.47 25
R  30874.16 2103.72 25      .013
TS 31161.12 2105.64 28      .013
R  31186.87 2105.82 28      .013
SH 31186.87 2105.82 28
1                                                    SP
                                  WATER SURFACE PROFILE - CHANNEL DEFINITION LISTING                                  PAGE    1
0 CARD  SECT  CHN   NO OF  AVE PIER  HEIGHT 1  BASE    ZL    ZR    INV   Y(1)  Y(2)  Y(3)  Y(4)  Y(5)  Y(6)  Y(7)  Y(8)  Y(9)  Y(10)
  CODE   NO   TYPE  PIERS   WIDTH    DIAMETER  WIDTH                DROP

  CD      1    2      0       .00       9.50   62.00                .00
  CD      2    3      6      1.00       8.00   62.00    .00   .00   .00
  CD      3    2      0       .00      10.00   56.00                .00
  CD      4    2      0       .00       9.00   56.00                .00
  CD      5    2      0       .00       9.50   56.00                .00
  CD      6    3      2       .85       7.00   56.00    .00   .00   .00
  CD      7    3      2       .85       8.00   56.00    .00   .00   .00
  CD      8    2      0       .00      11.00   56.00                .00
  CD      9    3      2       .85       9.00   56.00    .00   .00   .00
  CD     10    2      0       .00       9.00   62.00                .00
  CD     11    2      0       .00      11.00   50.00                .00
  CD     12    2      0       .00       7.00   10.00                .00
  CD     13    3      1       .83       9.00   50.00    .00   .00   .00
  CD     14    2      0       .00       9.00   50.00                .00
  CD     15    2      0       .00       9.50   50.00                .00
  CD     16    3      1       .83       8.00   50.00    .00   .00   .00
  CD     17    2      0       .00      11.00   90.00                .00
  CD     18    2      0       .00       8.00   46.00                .00
  CD     19    3      1       .83       6.00   42.00    .00   .00   .00
  CD     20    3      1       .83       9.00   46.00    .00   .00   .00
  CD     21    2      0       .00       8.00   42.00                .00
  CD     22    2      0       .00       8.00   20.00                .00
  CD     23    3      1       .83       8.00   42.00    .00   .00   .00
  CD     24    2      0       .00       8.00   49.67                .00
  CD     25    2      0       .00       9.00   25.00                .00
  CD     26    3      1       .67       9.00   20.67    .00   .00   .00
  CD     27    3      1      1.00       9.00   25.00    .00   .00   .00
  CD     28    2      0       .00      12.00   53.40                .00
 ERROR MESSAGE NUMBER  7 IN SEQUENCE CHECKING THRU CHANNEL DEFINITION DATA
 INVALID CARD CODE ENCOUNTERED WHILE PROCESSING CD AND PTS CARDS - CODE =
1                                                                                                          PAGE NO   1
0                              WATER SURFACE PROFILE - TITLE CARD LISTING
0HEADING LINE NO 1 IS -
0                                Upper Las Vegas Wash Channel
0HEADING LINE NO 2 IS -
0                                Q = 2,690cfs @ NLVDB Outfall
0HEADING LINE NO 3 IS -
0                                WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004
1                                                                                                          PAGE NO   2
0                              WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO   1 IS A SYSTEM OUTLET      *          *          *                                  W S ELEV
                    U/S DATA    STATION    INVERT  SECT                                          .00
                                 8979.87 1911.41    1
0 ELEMENT NO   2 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9029.40 1911.79    1              .015                  .00    .00    .00      0
0 ELEMENT NO   3 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9080.11 1912.15    1              .015                  .00    .00    .00      0
0 ELEMENT NO   4 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9129.15 1912.46    1              .015                  .00    .00    .00      0
0 ELEMENT NO   5 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9179.15 1912.99    1              .015                  .00    .00    .00      0
0 ELEMENT NO   6 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9229.63 1913.25    1              .015                  .00    .00    .00      0
0 ELEMENT NO   7 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9279.17 1913.67    1              .015                  .00    .00    .00      0
0 ELEMENT NO   8 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9329.42 1914.02    1              .015                  .00    .00    .00      0
0 ELEMENT NO   9 IS A REACH             *          *          *
                    U/S DATA    STATION    INVERT  SECT              N                RADIUS  ANGLE  ANG PT  MAN H
                                 9379.72 1914.25    1              .015                  .00    .00    .00      0
```

0 ELEMENT NO 10 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9429.66	1914.44	1	.015	.00	.00	.00	0

0 ELEMENT NO 11 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9479.77	1914.54	1	.015	.00	.00	.00	0

0 ELEMENT NO 12 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9528.52	1914.92	1	.015	.00	.00	.00	0

0 ELEMENT NO 13 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9577.24	1915.31	1	.015	.00	.00	.00	0

0 ELEMENT NO 14 IS A BRIDGE EXIT

U/S DATA	STATION	INVERT	SECT
	9577.24	1915.31	2

1

0

WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO 15 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9696.65	1915.60	2	.015	.00	.00	.00	0

0 ELEMENT NO 16 IS A BRIDGE ENTRANCE

U/S DATA	STATION	INVERT	SECT	FP
	9696.65	1915.60	1	.015

0 ELEMENT NO 17 IS A TRANSITION

U/S DATA	STATION	INVERT	SECT	N
	9920.85	1917.87	3	.015

0 ELEMENT NO 18 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	9971.16	1918.38	3	.015	.00	.00	.00	0

0 ELEMENT NO 19 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10209.69	1919.94	3	.015	1019.00	13.41	.00	0

0 ELEMENT NO 20 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10316.37	1920.63	3	.015	.00	.00	.00	0

0 ELEMENT NO 21 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10539.15	1922.08	3	.015	1000.00	12.76	.00	0

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

0 ELEMENT NO 22 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	10904.69	1923.89	4	.015	.00	.00	.00	0

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

0 ELEMENT NO 23 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	11338.37	1926.04	5	.015	500.00	49.70	.00	0

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

0 ELEMENT NO 24 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	11972.15	1929.18	4	.015	.00	.00	.00	0

WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS

0 ELEMENT NO 25 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12418.62	1931.23	5	.015	500.00	51.16	.00	0

0 ELEMENT NO 26 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12459.99	1931.42	5	.015	.00	.00	.00	0

0 ELEMENT NO 27 IS A BRIDGE EXIT

U/S DATA	STATION	INVERT	SECT
	12459.99	1931.42	6

1

0

WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO 28 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12604.99	1932.15	6	.015	.00	.00	.00	0

0 ELEMENT NO 29 IS A BRIDGE ENTRANCE

U/S DATA	STATION	INVERT	SECT	FP
	12604.99	1932.15	4	1.000

0 ELEMENT NO 30 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12759.72	1933.58	4	.015	.00	.00	.00	0

0 ELEMENT NO 31 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	12999.99	1935.80	4	.015	700.00	39.33	.00	0

0 ELEMENT NO 32 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	13480.51	1939.20	4	.015	700.00	19.67	.00	0

0 ELEMENT NO 33 IS A BRIDGE EXIT

U/S DATA	STATION	INVERT	SECT
	13480.51	1939.20	7

0 ELEMENT NO 34 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	13719.99	1940.35	7	.015	.00	.00	.00	0

0 ELEMENT NO 35 IS A BRIDGE ENTRANCE

U/S DATA	STATION	INVERT	SECT	FP
	13719.99	1940.35	8	1.000

0 ELEMENT NO 36 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	13813.88	1941.42	8	.015	.00	.00	.00	0

0 ELEMENT NO 37 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	14414.99	1948.27	8	.015	1000.00	34.44	.00	0

0 ELEMENT NO 38 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	14834.08	1950.37	8	.015	1000.00	24.01	.00	0

0 ELEMENT NO 39 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	15554.99	1953.97	8	.015	.00	.00	.00	0

0 ELEMENT NO 40 IS A BRIDGE EXIT

U/S DATA	STATION	INVERT	SECT
	15554.99	1953.97	9

1

0

WATER SURFACE PROFILE - ELEMENT CARD LISTING

0 ELEMENT NO 41 IS A REACH

U/S DATA	STATION	INVERT	SECT	N	RADIUS	ANGLE	ANG PT	MAN H
	15704.99	1954.72	9	.015	.00	.00	.00	0

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0 ELEMENT NO  42 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                             15704.99 1954.72    4              1.000
0 ELEMENT NO  43 IS A REACH                  *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             16249.99 1960.92    4              .015                                    .00    .00     .00      0
0 ELEMENT NO  44 IS A REACH                  *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             17894.90 1971.90    4              .015                                    .00    .00     .00      0
0 ELEMENT NO  45 IS A TRANSITION             *       *
                  U/S DATA   STATION    INVERT  SECT               N
                             18074.90 1973.10   10              .015
0 ELEMENT NO  46 IS A JUNCTION               *       *       *       *                   *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4     INVERT-3 INVERT-4  PHI 3   PHI 4
                             18199.90 1973.93   11     0    12   .015       .0       .1       .00  1973.93    .00     .10
0 ELEMENT NO  47 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                             18199.90 1973.93   13
0 ELEMENT NO  48 IS A REACH                  *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             18489.99 1975.55   13              .015                                    .00    .00     .00      0
0 ELEMENT NO  49 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                             18489.99 1975.55   14             1.000
0 ELEMENT NO  50 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             19082.52 1978.56   14              .015                                    .00    .00     .00      0
0 ELEMENT NO  51 IS A REACH                  *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             19364.08 1979.99   14              .015                                   1000.00  16.13     .00      0
0 ELEMENT NO  52 IS A REACH                  *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             19633.21 1981.36   14              .015                                   1000.00  15.42     .00      0
1                                                                                                                    PAGE NO   6
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  53 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             20417.93 1987.77   14              .015                                    .00    .00     .00      0
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  54 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             20542.23 1988.79   15              .015                                   500.00  14.24     .00      0
 WARNING - ADJACENT SECTIONS ARE NOT IDENTICAL - SEE SECTION NUMBERS AND CHANNEL DEFINITIONS
0 ELEMENT NO  55 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             20600.27 1989.26   14              .015                                    .00    .00     .00      0
0 ELEMENT NO  56 IS A TRANSITION             *       *       *
                  U/S DATA   STATION    INVERT  SECT               N
                             20780.27 1992.50   10              .015
0 ELEMENT NO  57 IS A JUNCTION               *       *       *       *                   *                  *
                  U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4     INVERT-3 INVERT-4  PHI 3   PHI 4
                             20905.27 1994.75   11     0    12   .015       .0       .1       .00  1994.75    .00     .10
0 ELEMENT NO  58 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                             20905.27 1994.75   16
0 ELEMENT NO  59 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             20962.78 1995.89   16              .015                                    .00    .00     .00      0
0 ELEMENT NO  60 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21078.04 1998.17   16              .015                                   500.00  13.21     .00      0
0 ELEMENT NO  61 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                             21078.04 1998.17   11             1.000
0 ELEMENT NO  62 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21238.18 2001.35   11              .015                                    .00    .00     .00      0
0 ELEMENT NO  63 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21354.36 2003.65   11              .015                                   963.00   6.91     .00      0
0 ELEMENT NO  64 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21412.24 2004.80   11              .015                                    .00    .00     .00      0
1                                                                                                                    PAGE NO   7
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  65 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                             21412.24 2004.80   13
0 ELEMENT NO  66 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21462.24 2005.79   13              .015                                    .00    .00     .00      0
0 ELEMENT NO  67 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                             21462.24 2005.79   11             1.000
0 ELEMENT NO  68 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21580.88 2008.14   11              .015                                    .00    .00     .00      0
0 ELEMENT NO  69 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21713.69 2009.16   11              .015                                   1037.00   7.34     .00      0
0 ELEMENT NO  70 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21830.99 2010.07   11              .015                                    .00    .00     .00      0
0 ELEMENT NO  71 IS A BRIDGE EXIT                        *
                  U/S DATA   STATION    INVERT  SECT
                             21830.99 2010.07   13
0 ELEMENT NO  72 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21880.99 2010.45   13              .015                                    .00    .00     .00      0
0 ELEMENT NO  73 IS A BRIDGE ENTRANCE                    *
                  U/S DATA   STATION    INVERT  SECT              FP
                             21880.99 2010.45   11             1.000
0 ELEMENT NO  74 IS A REACH                  *       *       *
                  U/S DATA   STATION    INVERT  SECT               N                                  RADIUS  ANGLE  ANG PT  MAN H
                             21924.99 2010.79   11              .015                                    .00    .00     .00      0
0 ELEMENT NO  75 IS A REACH                  *       *       *
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                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               22739.34 2014.86   11            .015                            .00    .00     .00      0
0 ELEMENT NO  76 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               22824.99 2015.29   11            .015                          785.00   6.25     .00      0
0 ELEMENT NO  77 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               23263.37 2021.09   11            .015                          785.00  32.00     .00      0
0 ELEMENT NO  78 IS A TRANSITION
                    U/S DATA   STATION    INVERT  SECT            N
                               23564.23 2025.80   17            .015
1                                                                                                                PAGE NO   8
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  79 IS A JUNCTION
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               23744.23 2027.09   18     0    19    .015      .0       .1      .00  2027.09    .00     .10
0 ELEMENT NO  80 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               23744.23 2027.09   20
0 ELEMENT NO  81 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               23969.99 2031.22   20            .015                            .00    .00     .00      0
0 ELEMENT NO  82 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               24009.99 2031.43   20            .015                            .00    .00     .00      0
0 ELEMENT NO  83 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               24009.99 2031.43   18         1.000
0 ELEMENT NO  84 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               24499.99 2034.00   18            .015                            .00    .00     .00      0
0 ELEMENT NO  85 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               24799.99 2037.10   18            .015                            .00    .00     .00      0
0 ELEMENT NO  86 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               26069.99 2046.00   18            .015                            .00    .00     .00      0
0 ELEMENT NO  87 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               26979.99 2057.63   18            .015                            .00    .00     .00      0
0 ELEMENT NO  88 IS A JUNCTION
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               27079.99 2058.91   21     0    22    .015      .0       .1      .00  2058.91    .00     .10
0 ELEMENT NO  89 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               27128.00 2059.53   21            .015                            .00    .00     .00      0
0 ELEMENT NO  90 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               27128.00 2059.53   23
1                                                                                                                PAGE NO   9
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO  91 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               27399.99 2063.00   23            .015                         1500.00  10.39     .00      0
0 ELEMENT NO  92 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               27399.99 2063.00   21         1.000
0 ELEMENT NO  93 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               27689.98 2066.71   21            .015                         1500.00  11.08     .00      0
0 ELEMENT NO  94 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               27913.07 2070.06   21            .015                            .00    .00     .00      0
0 ELEMENT NO  95 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               28537.03 2078.04   21            .015                         2000.00  17.88     .00      0
0 ELEMENT NO  96 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               28664.99 2078.68   21            .015                            .00    .00     .00      0
0 ELEMENT NO  97 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               28664.99 2078.68   23
0 ELEMENT NO  98 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               28824.99 2079.48   23            .015                            .00    .00     .00      0
0 ELEMENT NO  99 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               28824.99 2079.48   21         1.000
0 ELEMENT NO 100 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               29449.99 2082.60   21            .015                            .00    .00     .00      0
0 ELEMENT NO 101 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               29796.43 2090.59   21            .015                            .00    .00     .00      0
0 ELEMENT NO 102 IS A TRANSITION
                    U/S DATA   STATION    INVERT  SECT            N
                               29896.43 2092.89   24            .015
0 ELEMENT NO 103 IS A JUNCTION
                    U/S DATA   STATION    INVERT  SECT LAT-1 LAT-2   N      Q3       Q4    INVERT-3 INVERT-4  PHI 3   PHI 4
                               29996.43 2095.20   25     0    26    .015      .0       .1      .00  2095.20    .00     .10
1                                                                                                                PAGE NO  10
0                          WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO 104 IS A BRIDGE EXIT
                    U/S DATA   STATION    INVERT  SECT
                               29996.43 2095.20   27
0 ELEMENT NO 105 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               30023.40 2095.41   27            .013                          575.00   2.68     .00      0
0 ELEMENT NO 106 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
                               30177.26 2096.93   27            .013                          575.00  15.33     .00      0
0 ELEMENT NO 107 IS A BRIDGE ENTRANCE
                    U/S DATA   STATION    INVERT  SECT           FP
                               30177.26 2096.93   25         1.000
0 ELEMENT NO 108 IS A REACH
                    U/S DATA   STATION    INVERT  SECT            N                          RADIUS  ANGLE  ANG PT  MAN H
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                                30303.07 2098.25   25                   .013                      575.00  12.54     .00      0
0 ELEMENT NO 109 IS A BRIDGE EXIT                   *
                      U/S DATA    STATION    INVERT  SECT
                                30303.07 2098.25   27
0 ELEMENT NO 110 IS A REACH            *          *     *
                      U/S DATA    STATION    INVERT  SECT                N                        RADIUS  ANGLE  ANG PT  MAN H
                                30482.62 2100.03   27                   .013                      575.00  17.89     .00      0
0 ELEMENT NO 111 IS A BRIDGE ENTRANCE               *
                      U/S DATA    STATION    INVERT  SECT               FP
                                30482.62 2100.03   25                  1.000
0 ELEMENT NO 112 IS A REACH            *          *     *
                      U/S DATA    STATION    INVERT  SECT                N                        RADIUS  ANGLE  ANG PT  MAN H
                                30694.06 2102.13   25                   .013                      575.00  21.07     .00      0
0 ELEMENT NO 113 IS A BRIDGE EXIT                   *
                      U/S DATA    STATION    INVERT  SECT
                                30694.06 2102.13   27
0 ELEMENT NO 114 IS A REACH            *          *     *
                      U/S DATA    STATION    INVERT  SECT                N                        RADIUS  ANGLE  ANG PT  MAN H
                                30834.34 2103.47   27                   .013                      575.00  13.98     .00      0
0 ELEMENT NO 115 IS A BRIDGE ENTRANCE               *
                      U/S DATA    STATION    INVERT  SECT               FP
                                30834.34 2103.47   25                  1.000
0 ELEMENT NO 116 IS A REACH            *          *     *
                      U/S DATA    STATION    INVERT  SECT                N                        RADIUS  ANGLE  ANG PT  MAN H
                                30874.16 2103.72   25                   .013                        .00     .00     .00      0
0 ELEMENT NO 117 IS A TRANSITION       *          *     *
                      U/S DATA    STATION    INVERT  SECT                N
                                31161.12 2105.64   28                   .013
                                                                                                         PAGE NO  11
1
0                         WATER SURFACE PROFILE - ELEMENT CARD LISTING
0 ELEMENT NO 118 IS A REACH            *          *     *
                      U/S DATA    STATION    INVERT  SECT                N                        RADIUS  ANGLE  ANG PT  MAN H
                                31186.87 2105.82   28                   .013                        .00     .00     .00      0
0 ELEMENT NO 119 IS A SYSTEM HEADWORKS              *                         *
                      U/S DATA    STATION    INVERT  SECT                               W S ELEV
                                31186.87 2105.82   28                                        .00
 NO EDIT ERRORS ENCOUNTERED-COMPUTATION IS NOW BEGINNING

 ** WARNING NO. 2 ** - WATER SURFACE ELEVATION GIVEN IS LESS THAN OR EQUALS INVERT ELEVATION IN HDWKDS, W.S.ELEV = INV + DC
                                                                                                              PAGE    1
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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	8979.87	1911.41	2.81	1914.22	2725.5	15.62	3.79	1918.01	.00	3.92		9.50	62.00	.00	0	.00
0	49.53	.00767					.00693	.34			2.74			.00		
0	9029.40	1911.79	2.84	1914.63	2725.5	15.50	3.73	1918.36	.00	3.92		9.50	62.00	.00	0	.00
0	50.71	.00710					.00682	.35			2.81			.00		
0	9080.11	1912.15	2.85	1915.00	2725.5	15.45	3.71	1918.71	.00	3.92		9.50	62.00	.00	0	.00
0	49.04	.00632					.00685	.34			2.91			.00		
0	9129.15	1912.46	2.83	1915.29	2725.5	15.54	3.75	1919.04	.00	3.92		9.50	62.00	.00	0	.00
0	2.03	.01060					.00690	.01			2.48			.00		
0	9131.18	1912.48	2.83	1915.31	2725.5	15.52	3.74	1919.06	.00	3.92		9.50	62.00	.00	0	.00
0	47.97	.01060					.00639	.31			2.48			.00		
0	9179.15	1912.99	2.97	1915.96	2725.5	14.80	3.40	1919.36	.00	3.92		9.50	62.00	.00	0	.00
0	.00	.01060					.00590	.00			2.48			.00		
0	9179.15	1912.99	2.97	1915.96	2725.5	14.80	3.40	1919.36	.00	3.92		9.50	62.00	.00	0	.00
0	50.48	.00515					.00601	.30			3.10			.00		
0	9229.63	1913.25	2.94	1916.19	2725.5	14.96	3.48	1919.67	.00	3.92		9.50	62.00	.00	0	.00
0	49.54	.00848					.00578	.29			2.65			.00		
0	9279.17	1913.67	3.05	1916.72	2725.5	14.43	3.24	1919.95	.00	3.92		9.50	62.00	.00	0	.00
0	50.25	.00697					.00522	.26			2.82			.00		
0	9329.42	1914.02	3.13	1917.15	2725.5	14.05	3.07	1920.22	.00	3.92		9.50	62.00	.00	0	.00
0	50.30	.00457					.00506	.25			3.22			.00		
0	9379.72	1914.25	3.10	1917.35	2725.5	14.16	3.12	1920.47	.00	3.92		9.50	62.00	.00	0	.00
0	49.94	.00380					.00532	.27			3.41			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION / L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH	NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0	9429.66	1914.44	3.03	1917.47	2725.5	14.49	3.26	1920.74	.00	3.92		9.50	62.00	.00	0	.00
0	.00	.00380					.00551	.00			3.41			.00		
0	9429.66	1914.44	3.03	1917.47	2725.5	14.49	3.26	1920.74	.00	3.92		9.50	62.00	.00	0	.00
0	3.65	.00200					.00555	.02			4.17			.00		
0	9433.31	1914.45	3.02	1917.47	2725.5	14.54	3.29	1920.76	.00	3.92		9.50	62.00	.00	0	.00
0	46.46	.00200					.00604	.28			4.17			.00		
0	9479.77	1914.54	2.88	1917.42	2725.5	15.25	3.62	1921.04	.00	3.92		9.50	62.00	.00	0	.00
0	48.75	.00779					.00633	.31			2.72			.00		
0	9528.52	1914.92	2.93	1917.85	2725.5	15.00	3.50	1921.35	.00	3.92		9.50	62.00	.00	0	.00
0	.00	.00779					.00616	.00			2.72			.00		
0	9528.52	1914.92	2.93	1917.85	2725.5	15.00	3.50	1921.35	.00	3.92		9.50	62.00	.00	0	.00
0	48.72	.00800					.00591	.29			2.70			.00		
0	9577.24	1915.31	3.01	1918.32	2725.5	14.60	3.31	1921.63	.00	3.92		9.50	62.00	.00	0	.00
0BRIDGE EXIT														.00		
0	9577.24	1915.31	3.78	1919.09	2725.5	12.89	2.58	1921.67	.00	4.19		8.00	62.00	.00	6	1.00
0BRIDGE EXIT														.00		
0	9577.24	1915.31	3.78	1919.09	2725.5	12.89	2.58	1921.67	.00	4.19		8.00	62.00	.00	6	1.00
0	11.91	.00243					.00734	.09			5.65			.00		
0	9589.15	1915.34	3.64	1918.98	2725.5	13.36	2.77	1921.76	.00	4.19		8.00	62.00	.00	6	1.00
0	18.61	.00243					.00822	.15			5.65			.00		
0	9607.76	1915.38	3.47	1918.86	2725.5	14.01	3.05	1921.91	.00	4.19		8.00	62.00	.00	6	1.00
0	20.70	.00243					.00935	.19			5.65			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 9628.46	1915.43	3.31	1918.75	2725.5	14.69	3.36	1922.10	.00	4.19	8.00	62.00	.00	6	1.00
0 22.05	.00243					.01065	.23		5.65			.00		
0 9650.51	1915.49	3.16	1918.65	2725.5	15.41	3.69	1922.34	.00	4.19	8.00	62.00	.00	6	1.00
0 22.86	.00243					.01214	.28		5.65			.00		
0 9673.37	1915.54	3.01	1918.55	2725.5	16.16	4.06	1922.61	.00	4.19	8.00	62.00	.00	6	1.00
0 23.28	.00243					.01385	.32		5.65			.00		
0 9696.65	1915.60	2.87	1918.47	2725.5	16.95	4.47	1922.94	.00	4.19	8.00	62.00	.00	6	1.00
0BRIDGE ENTRANCE												.00		
0 9696.65	1915.60	2.49	1918.09	2725.5	17.65	4.84	1922.93	.00	3.92	9.50	62.00	.00	0	.00
0TRANS STR	.01013					.00879	1.97					.00		
0 9920.85	1917.87	2.99	1920.86	2725.5	16.27	4.12	1924.98	.00	4.19	10.00	56.00	.00	0	.00
0TRANS STR	.01013					.00717	.00					.00		
0 9920.85	1917.87	2.99	1920.86	2725.5	16.27	4.12	1924.98	.00	4.19	10.00	56.00	.00	0	.00
0 50.31	.01014					.00680	.34		2.68			.00		
0 9971.16	1918.38	3.09	1921.47	2725.5	15.73	3.84	1925.32	.42	4.19	10.00	56.00	.00	0	.00
0 238.53	.00654					.00630	1.50		3.08			.00		
0 10209.69	1919.94	3.13	1923.07	2725.5	15.53	3.75	1926.82	.00	4.19	10.00	56.00	.00	0	.00
0 106.68	.00647					.00608	.65		3.09			.00		
0 10316.37	1920.63	3.16	1923.79	2725.5	15.38	3.68	1927.47	.41	4.19	10.00	56.00	.00	0	.00
0 74.01	.00651					.00588	.43		3.08			.00		
0 10390.38	1921.11	3.20	1924.31	2725.5	15.21	3.59	1927.91	.40	4.19	10.00	56.00	.00	0	.00
0 148.77	.00651					.00536	.80		3.08			.00		

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0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 10539.15	1922.08	3.36	1925.44	2725.5	14.50	3.27	1928.70	.00	4.19	9.00	56.00	.00	0	.00
0 241.74	.00495					.00496	1.20		3.36			.00		
0 10780.89	1923.28	3.36	1926.63	2725.5	14.50	3.27	1929.90	.00	4.19	9.00	56.00	.00	0	.00
0 123.80	.00495					.00496	.61		3.36			.00		
0 10904.69	1923.89	3.36	1927.25	2725.5	14.50	3.27	1930.51	.73	4.19	9.50	56.00	.00	0	.00
0 433.68	.00496					.00496	2.15		3.36			.00		
0 11338.37	1926.04	3.36	1929.40	2725.5	14.50	3.27	1932.66	.00	4.19	9.00	56.00	.00	0	.00
0 236.06	.00495					.00496	1.17		3.36			.00		
0 11574.43	1927.21	3.36	1930.57	2725.5	14.50	3.27	1933.83	.00	4.19	9.00	56.00	.00	0	.00
0 397.72	.00495					.00482	1.92		3.36			.00		
0 11972.15	1929.18	3.42	1932.60	2725.5	14.24	3.15	1935.75	.71	4.19	9.50	56.00	.00	0	.00
0 193.19	.00459					.00476	.92		3.44			.00		
0 12165.34	1930.07	3.38	1933.45	2725.5	14.39	3.22	1936.67	.72	4.19	9.50	56.00	.00	0	.00
0 253.28	.00459					.00524	1.33		3.44			.00		
0 12418.62	1931.23	3.22	1934.45	2725.5	15.10	3.54	1938.00	.00	4.19	9.50	56.00	.00	0	.00
0 41.37	.00459					.00575	.24		3.44			.00		
0 12459.99	1931.42	3.19	1934.61	2725.5	15.28	3.63	1938.23	.00	4.19	9.50	56.00	.00	0	.00
0BRIDGE EXIT												.00		
0 12459.99	1931.42	3.37	1934.79	2725.5	14.89	3.45	1938.24	.00	4.28	7.00	56.00	.00	2	.85
0 77.43	.00503					.00731	.57		3.73			.00		
0 12537.42	1931.81	3.22	1935.03	2725.5	15.58	3.77	1938.80	.00	4.28	7.00	56.00	.00	2	.85
0 67.57	.00503					.00840	.57		3.73			.00		

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0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 12604.99	1932.15	3.07	1935.22	2725.5	16.34	4.15	1939.37	.00	4.28	7.00	56.00	.00	2	.85
0BRIDGE ENTRANCE												.00		
0 12604.99	1932.15	2.80	1934.95	2725.5	17.38	4.69	1939.64	.00	4.19	9.00	56.00	.00	0	.00
0BRIDGE ENTRANCE												.00		
0 12604.99	1932.15	2.80	1934.95	2725.5	17.38	4.69	1939.64	.00	4.19	9.00	56.00	.00	0	.00
0 154.73	.00924					.00865	1.34		2.76			.00		
0 12759.72	1933.58	2.84	1936.42	2725.5	17.13	4.56	1940.98	.73	4.19	9.00	56.00	.00	0	.00
0 86.79	.00924					.00828	.72		2.76			.00		
0 12846.51	1934.38	2.88	1937.26	2725.5	16.90	4.44	1941.70	.71	4.19	9.00	56.00	.00	0	.00
0 153.48	.00924					.00753	1.16		2.76			.00		
0 12999.99	1935.80	3.02	1938.82	2725.5	16.12	4.04	1942.86	.65	4.19	9.00	56.00	.00	0	.00
0 246.28	.00708					.00680	1.68		3.00			.00		
0 13246.27	1937.54	3.06	1940.60	2725.5	15.90	3.93	1944.53	.63	4.19	9.00	56.00	.00	0	.00
0 234.24	.00708					.00619	1.45		3.00			.00		
0 13480.51	1939.20	3.21	1942.41	2725.5	15.16	3.57	1945.98	.00	4.19	9.00	56.00	.00	0	.00
0BRIDGE EXIT												.00		
0 13480.51	1939.20	3.40	1942.60	2725.5	14.76	3.39	1945.99	.00	4.28	8.00	56.00	.00	2	.85
0 63.50	.00480					.00705	.45		3.80			.00		
0 13544.00	1939.50	3.27	1942.78	2725.5	15.34	3.66	1946.43	.00	4.28	8.00	56.00	.00	2	.85
0 66.35	.00480					.00802	.53		3.80			.00		
0 13610.35	1939.82	3.12	1942.94	2725.5	16.09	4.02	1946.97	.00	4.28	8.00	56.00	.00	2	.85
0 57.83	.00480					.00925	.53		3.80			.00		

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0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 13668.18	1940.10	2.97	1943.08	2725.5	16.87	4.43	1947.50	.00	4.28	8.00	56.00	.00	2	.85
0 51.81	.00480					.01067	.55		3.80			.00		
0 13719.99	1940.35	2.84	1943.19	2725.5	17.70	4.87	1948.05	.00	4.28	8.00	56.00	.00	2	.85
0BRIDGE ENTRANCE												.00		
0 13719.99	1940.35	2.61	1942.96	2725.5	18.66	5.41	1948.37	.00	4.19	11.00	56.00	.00	0	.00
0 93.89	.01140					.01107	1.04		2.59			.00		
0 13813.88	1941.42	2.62	1944.04	2725.5	18.59	5.37	1949.41	.00	4.19	11.00	56.00	.00	0	.00
0 .00	.01140					.01100	.00		2.59			.00		
0 13813.88	1941.42	2.62	1944.04	2725.5	18.59	5.37	1949.41	.60	4.19	11.00	56.00	.00	0	.00

0	108.32	.01140					.01088	1.18			2.59			.00		
0	13922.20	1942.65	2.64	1945.29	2725.5	18.46	5.30	1950.59	.59	4.19		11.00	56.00	.00	0	.00
0	251.06	.01140					.00999	2.51			2.59			.00		
0	14173.26	1945.52	2.76	1948.28	2725.5	17.60	4.82	1953.10	.54	4.19		11.00	56.00	.00	0	.00
0	107.24	.01140					.00857	.92			2.59			.00		
0	14280.50	1946.74	2.90	1949.64	2725.5	16.78	4.38	1954.02	.49	4.19		11.00	56.00	.00	0	.00
0	63.49	.01140					.00736	.47			2.59			.00		
0	14343.99	1947.46	3.04	1950.50	2725.5	16.00	3.98	1954.48	.45	4.19		11.00	56.00	.00	0	.00
0	42.00	.01140					.00632	.27			2.59			.00		
0	14385.99	1947.94	3.19	1951.13	2725.5	15.26	3.62	1954.75	.41	4.19		11.00	56.00	.00	0	.00
0	29.00	.01140					.00542	.16			2.59			.00		
0	14414.99	1948.27	3.35	1951.62	2725.5	14.55	3.29	1954.90	.37	4.19		11.00	56.00	.00	0	.00
0	419.09	.00501					.00500	2.10			3.35			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	14834.08	1950.37	3.35	1953.72	2725.5	14.54	3.28	1957.00	.00	4.19		11.00	56.00	.00	0	.00
0	138.46	.00499					.00500	.69			3.35			.00		
0	14972.54	1951.06	3.35	1954.41	2725.5	14.54	3.28	1957.69	.00	4.19		11.00	56.00	.00	0	.00
0	415.46	.00499					.00539	2.24			3.35			.00		
0	15388.00	1953.14	3.20	1956.33	2725.5	15.21	3.60	1959.93	.00	4.19		11.00	56.00	.00	0	.00
0	166.99	.00499					.00626	1.04			3.35			.00		
0	15554.99	1953.97	3.05	1957.02	2725.5	15.96	3.96	1960.98	.00	4.19		11.00	56.00	.00	0	.00
0	BRIDGE EXIT													.00		
0	15554.99	1953.97	3.21	1957.18	2725.5	15.64	3.80	1960.98	.00	4.28		9.00	56.00	.00	2	.85
0	34.49	.00500					.00818	.28			3.74			.00		
0	15589.48	1954.14	3.13	1957.28	2725.5	16.02	3.99	1961.26	.00	4.28		9.00	56.00	.00	2	.85
0	61.32	.00500					.00912	.56			3.74			.00		
0	15650.80	1954.45	2.99	1957.44	2725.5	16.80	4.39	1961.82	.00	4.28		9.00	56.00	.00	2	.85
0	54.19	.00500					.01053	.57			3.74			.00		
0	15704.99	1954.72	2.85	1957.57	2725.5	17.62	4.82	1962.39	.00	4.28		9.00	56.00	.00	2	.85
0	BRIDGE ENTRANCE													.00		
0	15704.99	1954.72	2.62	1957.34	2725.5	18.58	5.37	1962.71	.00	4.19		9.00	56.00	.00	0	.00
0	161.59	.01138					.01077	1.74			2.59			.00		
0	15866.58	1956.56	2.65	1959.21	2725.5	18.36	5.24	1964.45	.00	4.19		9.00	56.00	.00	0	.00
0	222.20	.01138					.00981	2.18			2.59			.00		
0	16088.78	1959.09	2.78	1961.87	2725.5	17.51	4.76	1966.63	.00	4.19		9.00	56.00	.00	0	.00
0	100.62	.01138					.00842	.85			2.59			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	16189.41	1960.23	2.92	1963.15	2725.5	16.69	4.33	1967.48	.00	4.19		9.00	56.00	.00	0	.00
0	60.58	.01138					.00723	.44			2.59			.00		
0	16249.99	1960.92	3.06	1963.98	2725.5	15.92	3.94	1967.91	.00	4.19		9.00	56.00	.00	0	.00
0	.00	.01138					.00668	.00			2.59			.00		
0	16249.99	1960.92	3.06	1963.98	2725.5	15.92	3.94	1967.91	.00	4.19		9.00	56.00	.00	0	.00
0	870.36	.00667					.00668	5.81			3.06			.00		
0	17120.35	1966.73	3.06	1969.79	2725.5	15.92	3.94	1973.72	.00	4.19		9.00	56.00	.00	0	.00
0	457.50	.00667					.00659	3.01			3.06			.00		
0	17577.85	1969.78	3.08	1972.87	2725.5	15.78	3.87	1976.74	.00	4.19		9.00	56.00	.00	0	.00
0	317.05	.00667					.00604	1.91			3.06			.00		
0	17894.90	1971.90	3.23	1975.13	2725.5	15.05	3.52	1978.65	.00	4.19		9.00	56.00	.00	0	.00
0	TRANS STR	.00667					.00744	1.34						.00		
0	18074.90	1973.10	2.58	1975.68	2725.5	17.04	4.51	1980.19	.00	3.92		9.00	62.00	.00	0	.00
0	JUNCT STR	.00664					.00717	.90						.00		
0	18199.90	1973.93	3.61	1977.54	2725.4	15.12	3.55	1981.09	.00	4.52		11.00	50.00	.00	0	.00
0	BRIDGE EXIT													.00		
0	18199.90	1973.93	3.73	1977.66	2725.4	14.84	3.42	1981.09	.00	4.57		9.00	50.00	.00	1	.83
0	290.09	.00558					.00523	1.52			3.72			.00		
0	18489.99	1975.55	3.88	1979.43	2725.4	14.30	3.18	1982.60	.00	4.57		9.00	50.00	.00	1	.83
0	BRIDGE ENTRANCE													.00		
0	18489.99	1975.55	3.60	1979.15	2725.4	15.16	3.57	1982.72	.00	4.52		9.00	50.00	.00	0	.00
0	BRIDGE ENTRANCE													.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0	STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0	L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0	18489.99	1975.55	3.60	1979.15	2725.4	15.16	3.57	1982.72	.00	4.52		9.00	50.00	.00	0	.00
0	157.98	.00508					.00508	.80			3.60			.00		
0	18647.97	1976.35	3.60	1979.95	2725.4	15.16	3.57	1983.52	.00	4.52		9.00	50.00	.00	0	.00
0	434.55	.00508					.00521	2.26			3.60			.00		
0	19082.52	1978.56	3.54	1982.10	2725.4	15.39	3.68	1985.78	.37	4.52		9.00	50.00	.00	0	.00
0	281.56	.00508					.00572	1.61			3.60			.00		
0	19364.08	1979.99	3.39	1983.38	2725.4	16.06	4.01	1987.39	.40	4.52		9.00	50.00	.00	0	.00
0	156.09	.00509					.00658	1.03			3.59			.00		
0	19520.17	1980.78	3.24	1984.03	2725.4	16.81	4.39	1988.42	.44	4.52		9.00	50.00	.00	0	.00
0	113.04	.00509					.00764	.86			3.59			.00		
0	19633.21	1981.36	3.09	1984.45	2725.4	17.63	4.83	1989.28	.48	4.52		9.00	50.00	.00	0	.00
0	-.00	.00509					.00822	.00			3.59			.00		
0	19633.21	1981.36	3.09	1984.45	2725.4	17.63	4.83	1989.28	.00	4.52		9.00	50.00	.00	0	.00
0	175.30	.00817					.00825	1.45			3.10			.00		
0	19808.51	1982.79	3.08	1985.88	2725.4	17.67	4.85	1990.73	.00	4.52		9.00	50.00	.00	0	.00
0	433.75	.00817					.00896	3.89			3.10			.00		
0	20242.27	1986.34	2.94	1989.28	2725.4	18.54	5.34	1994.61	.00	4.52		9.00	50.00	.00	0	.00
0	175.66	.00817					.01043	1.83			3.10			.00		
0	20417.93	1987.77	2.80	1990.57	2725.4	19.44	5.87	1996.45	.00	4.52		9.00	50.00	.00	0	.00
0	.00	.00817					.01122	.00			3.10			.00		
0	20417.93	1987.77	2.80	1990.57	2725.4	19.44	5.87	1996.45	1.17	4.52		9.50	50.00	.00	0	.00
0	11.50	.00821					.01129	.13			3.09			.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 20429.43	1987.86	2.79	1990.66	2725.4	19.52	5.92	1996.58	1.18	4.52	9.50	50.00	.00	0	.00
0 112.80	.00821					.01230	1.39		3.09			.00		
0 20542.23	1988.79	2.66	1991.45	2725.4	20.47	6.51	1997.96	.00	4.52	9.00	50.00	.00	0	.00
0 58.04	.00810					.01394	.81		3.11			.00		
0 20600.27	1989.26	2.58	1991.84	2725.4	21.12	6.93	1998.77	.00	4.52	9.00	50.00	.00	0	.00
0TRANS STR	.01800					.01900	3.42					.00		
0 20780.27	1992.50	1.94	1994.44	2725.4	22.63	7.96	2002.40	.00	3.92	9.00	62.00	.00	0	.00
0JUNCT STR	.01800					.02048	2.56					.00		
0 20905.27	1994.75	2.44	1997.19	2725.3	22.37	7.77	2004.96	.00	4.52	11.00	50.00	.00	0	.00
0BRIDGE EXIT												.00		
0 20905.27	1994.75	2.49	1997.24	2725.3	22.30	7.73	2004.96	.00	4.57	8.00	50.00	.00	1	.83
0 57.51	.01982					.01916	1.10		2.46			.00		
0 20962.78	1995.89	2.49	1998.38	2725.3	22.24	7.68	2006.07	.00	4.57	8.00	50.00	.00	1	.83
0 115.26	.01978					.01882	2.17		2.46			.00		
0 21078.04	1998.17	2.51	2000.68	2725.3	22.05	7.55	2008.24	.00	4.57	8.00	50.00	.00	1	.83
0BRIDGE ENTRANCE												.00		
0 21078.04	1998.17	2.42	2000.59	2725.3	22.56	7.91	2008.50	.00	4.52	11.00	50.00	.00	0	.00
0 160.14	.01986					.01717	2.75		2.35			.00		
0 21238.18	2001.35	2.50	2003.85	2725.3	21.82	7.40	2011.25	.77	4.52	11.00	50.00	.00	0	.00
0 116.18	.01980					.01511	1.76		2.35			.00		
0 21354.36	2003.65	2.62	2006.27	2725.3	20.82	6.73	2013.00	.00	4.52	11.00	50.00	.00	0	.00
0 57.88	.01987					.01319	.76		2.35			.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 21412.24	2004.80	2.72	2007.52	2725.3	20.05	6.25	2013.77	.00	4.52	11.00	50.00	.00	0	.00
0BRIDGE EXIT												.00		
0 21412.24	2004.80	2.78	2007.58	2725.3	19.96	6.19	2013.77	.00	4.57	9.00	50.00	.00	1	.83
0 50.00	.01980					.01289	.64		2.46			.00		
0 21462.24	2005.79	2.88	2008.67	2725.3	19.22	5.74	2014.41	.00	4.57	9.00	50.00	.00	1	.83
0BRIDGE ENTRANCE												.00		
0 21462.24	2005.79	2.76	2008.55	2725.3	19.75	6.06	2014.61	.00	4.52	11.00	50.00	.00	0	.00
0 25.57	.01981					.01136	.29		2.35			.00		
0 21487.81	2006.30	2.83	2009.12	2725.3	19.28	5.78	2014.90	.00	4.52	11.00	50.00	.00	0	.00
0 40.12	.01981					.01016	.41		2.35			.00		
0 21527.94	2007.09	2.97	2010.06	2725.3	18.38	5.25	2015.31	.00	4.52	11.00	50.00	.00	0	.00
0 30.02	.01981					.00872	.26		2.35			.00		
0 21557.96	2007.69	3.11	2010.80	2725.3	17.53	4.77	2015.57	.00	4.52	11.00	50.00	.00	0	.00
0 22.92	.01981					.00750	.17		2.35			.00		
0 21580.88	2008.14	3.26	2011.40	2725.3	16.71	4.34	2015.74	.00	4.52	11.00	50.00	.00	0	.00
0 -.00	.01981					.00693	.00		2.35			.00		
0 21580.88	2008.14	3.26	2011.40	2725.3	16.71	4.34	2015.74	.42	4.52	11.00	50.00	.00	0	.00
0 132.81	.00768					.00665	.88		3.16			.00		
0 21713.69	2009.16	3.35	2012.51	2725.3	16.27	4.12	2016.62	.40	4.52	11.00	50.00	.00	0	.00
0 .00	.00768					.00637	.00		3.16			.00		
0 21713.69	2009.16	3.35	2012.51	2725.3	16.27	4.12	2016.62	.00	4.52	11.00	50.00	.00	0	.00
0 4.99	.00776					.00635	.03		3.15			.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 21718.68	2009.20	3.35	2012.55	2725.3	16.25	4.10	2016.66	.00	4.52	11.00	50.00	.00	0	.00
0 112.31	.00776					.00589	.66		3.15			.00		
0 21830.99	2010.07	3.52	2013.59	2725.3	15.49	3.73	2017.32	.00	4.52	11.00	50.00	.00	0	.00
0BRIDGE EXIT												.00		
0 21830.99	2010.07	3.63	2013.70	2725.3	15.26	3.62	2017.32	.00	4.57	9.00	50.00	.00	1	.83
0 50.00	.00760					.00576	.29		3.36			.00		
0 21880.99	2010.45	3.73	2014.18	2725.3	14.84	3.42	2017.61	.00	4.57	9.00	50.00	.00	1	.83
0BRIDGE ENTRANCE												.00		
0 21880.99	2010.45	3.49	2013.94	2725.3	15.61	3.79	2017.73	.00	4.52	11.00	50.00	.00	0	.00
0 44.00	.00773					.00535	.24		3.15			.00		
0 21924.99	2010.79	3.59	2014.38	2725.3	15.19	3.59	2017.96	.00	4.52	11.00	50.00	.00	0	.00
0 262.70	.00500					.00529	1.39		3.62			.00		
0 22187.69	2012.10	3.52	2015.62	2725.3	15.50	3.73	2019.35	.00	4.52	11.00	50.00	.00	0	.00
0 231.71	.00500					.00590	1.37		3.62			.00		
0 22419.40	2013.26	3.35	2016.61	2725.3	16.26	4.11	2020.72	.00	4.52	11.00	50.00	.00	0	.00
0 136.24	.00500					.00687	.94		3.62			.00		
0 22555.64	2013.94	3.20	2017.14	2725.3	17.05	4.52	2021.66	.00	4.52	11.00	50.00	.00	0	.00
0 101.21	.00500					.00799	.81		3.62			.00		
0 22656.85	2014.45	3.05	2017.50	2725.3	17.88	4.97	2022.47	.00	4.52	11.00	50.00	.00	0	.00
0 82.49	.00500					.00930	.77		3.62			.00		
0 22739.34	2014.86	2.91	2017.77	2725.3	18.76	5.47	2023.23	.70	4.52	11.00	50.00	.00	0	.00
0 17.08	.00502					.01019	.17		3.61			.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION / 0 L/ELEM	INVERT ELEV / SO	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD / SF AVE	ENERGY GRD.EL. / HF	SUPER ELEV	CRITICAL DEPTH / NORM DEPTH	HGT/ DIA	BASE/ ID NO.	ZL / ZR	NO PIER	AVBPR
0 22756.42	2014.95	2.87	2017.82	2725.3	18.96	5.59	2023.41	.71	4.52	11.00	50.00	.00	0	.00
0 68.57	.00502					.01122	.77		3.61			.00		
0 22824.99	2015.29	2.74	2018.03	2725.3	19.89	6.15	2024.18	.78	4.52	11.00	50.00	.00	0	.00
0 90.56	.01323					.01182	1.07		2.66			.00		

0 22915.55	2016.49	2.78	2019.27	2725.3	19.62	5.98	2025.25	.76	4.52		11.00	50.00	.00	0	.00
0 164.03	.01323					.01074	1.76			2.66			.00		
0 23079.58	2018.66	2.91	2021.57	2725.3	18.71	5.44	2027.01	.69	4.52		11.00	50.00	.00	0	.00
0 87.92	.01323					.00922	.81			2.66			.00		
0 23167.50	2019.82	3.06	2022.88	2725.3	17.84	4.94	2027.82	.63	4.52		11.00	50.00	.00	0	.00
0 56.60	.01323					.00792	.45			2.66			.00		
0 23224.10	2020.57	3.21	2023.78	2725.3	17.01	4.49	2028.27	.57	4.52		11.00	50.00	.00	0	.00
0 39.27	.01323					.00681	.27			2.66			.00		
0 23263.37	2021.09	3.36	2024.45	2725.3	16.21	4.09	2028.54	.00	4.52		11.00	50.00	.00	0	.00
0TRANS STR	.01565					.01465	4.41						.00		
0 23564.23	2025.80	1.54	2027.34	2725.3	19.62	5.98	2033.33	.00	3.05		11.00	90.00	.00	0	.00
0JUNCT STR	.00717					.01754	3.16						.00		
0 23744.23	2027.09	2.90	2029.99	2725.2	20.44	6.49	2036.48	.00	4.78		8.00	46.00	.00	0	.00
0BRIDGE EXIT													.00		
0 23744.23	2027.09	2.97	2030.06	2725.2	20.34	6.43	2036.48	.00	4.84		9.00	46.00	.00	1	.83
0BRIDGE EXIT													.00		
0 23744.23	2027.09	2.97	2030.06	2725.2	20.34	6.43	2036.48	.00	4.84		9.00	46.00	.00	1	.83
0 74.95	.01829					.01261	.95			2.69			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 23819.18	2028.46	3.11	2031.57	2725.2	19.42	5.86	2037.43	.00	4.84		9.00	46.00	.00	1	.83
0 51.83	.01829					.01094	.57			2.69			.00		
0 23871.01	2029.41	3.26	2032.67	2725.2	18.52	5.33	2038.00	.00	4.84		9.00	46.00	.00	1	.83
0 36.86	.01829					.00946	.35			2.69			.00		
0 23907.88	2030.08	3.42	2033.50	2725.2	17.66	4.85	2038.35	.00	4.84		9.00	46.00	.00	1	.83
0 27.10	.01829					.00819	.22			2.69			.00		
0 23934.97	2030.58	3.58	2034.16	2725.2	16.84	4.40	2038.57	.00	4.84		9.00	46.00	.00	1	.83
0 20.14	.01829					.00710	.14			2.69			.00		
0 23955.12	2030.95	3.76	2034.71	2725.2	16.05	4.00	2038.71	.00	4.84		9.00	46.00	.00	1	.83
0 14.87	.01829					.00615	.09			2.69			.00		
0 23969.99	2031.22	3.94	2035.16	2725.2	15.31	3.64	2038.80	.00	4.84		9.00	46.00	.00	1	.83
0 40.00	.00525					.00577	.23			4.05			.00		
0 24009.99	2031.43	3.92	2035.35	2725.2	15.40	3.68	2039.03	.00	4.84		9.00	46.00	.00	1	.83
0BRIDGE ENTRANCE													.00		
0 24009.99	2031.43	3.65	2035.08	2725.2	16.23	4.09	2039.17	.00	4.78		8.00	46.00	.00	0	.00
0BRIDGE ENTRANCE													.00		
0 24009.99	2031.43	3.65	2035.08	2725.2	16.23	4.09	2039.17	.00	4.78		8.00	46.00	.00	0	.00
0 40.73	.00525					.00587	.24			3.77			.00		
0 24050.72	2031.64	3.63	2035.27	2725.2	16.32	4.14	2039.41	.00	4.78		8.00	46.00	.00	0	.00
0 212.81	.00525					.00640	1.36			3.77			.00		
0 24263.53	2032.76	3.46	2036.22	2725.2	17.12	4.55	2040.77	.00	4.78		8.00	46.00	.00	0	.00
0 134.35	.00525					.00744	1.00			3.77			.00		

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WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 24397.88	2033.46	3.30	2036.76	2725.2	17.95	5.01	2041.77	.00	4.78		8.00	46.00	.00	0	.00
0 102.12	.00525					.00865	.88			3.77			.00		
0 24499.99	2034.00	3.15	2037.15	2725.2	18.83	5.51	2042.66	.00	4.78		8.00	46.00	.00	0	.00
0 190.79	.01033					.00872	1.66			3.04			.00		
0 24690.78	2035.97	3.28	2039.25	2725.2	18.06	5.07	2044.32	.00	4.78		8.00	46.00	.00	0	.00
0 109.21	.01033					.00758	.83			3.04			.00		
0 24799.99	2037.10	3.44	2040.54	2725.2	17.22	4.61	2045.15	.00	4.78		8.00	46.00	.00	0	.00
0 318.83	.00701					.00701	2.23			3.44			.00		
0 25118.82	2039.33	3.44	2042.77	2725.2	17.22	4.61	2047.38	.00	4.78		8.00	46.00	.00	0	.00
0 527.31	.00701					.00756	3.99			3.44			.00		
0 25646.13	2043.03	3.28	2046.31	2725.2	18.04	5.06	2051.37	.00	4.78		8.00	46.00	.00	0	.00
0 198.91	.00701					.00878	1.75			3.44			.00		
0 25845.04	2044.42	3.13	2047.55	2725.2	18.92	5.57	2053.12	.00	4.78		8.00	46.00	.00	0	.00
0 128.01	.00701					.01022	1.31			3.44			.00		
0 25973.04	2045.32	2.98	2048.31	2725.2	19.85	6.12	2054.43	.00	4.78		8.00	46.00	.00	0	.00
0 96.95	.00701					.01189	1.15			3.44			.00		
0 26069.99	2046.00	2.85	2048.85	2725.2	20.82	6.73	2055.58	.00	4.78		8.00	46.00	.00	0	.00
0 400.98	.01278					.01279	5.13			2.85			.00		
0 26470.97	2051.12	2.85	2053.97	2725.2	20.82	6.73	2060.70	.00	4.78		8.00	46.00	.00	0	.00
0 509.02	.01278					.01333	6.79			2.85			.00		
0 26979.99	2057.63	2.77	2060.40	2725.2	21.35	7.09	2067.49	.00	4.78		8.00	46.00	.00	0	.00
0JUNCT STR	.01280					.01278	1.28						.00		

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WATER SURFACE PROFILE LISTING

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0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 27079.99	2058.91	3.12	2062.03	2725.1	20.83	6.74	2068.77	.00	5.08		8.00	42.00	.00	0	.00
0 48.01	.01292					.01157	.56			3.02			.00		
0 27128.00	2059.53	3.14	2062.67	2725.1	20.70	6.66	2069.32	.00	5.08		8.00	42.00	.00	0	.00
0BRIDGE EXIT													.00		
0 27128.00	2059.53	3.22	2062.75	2725.1	20.57	6.58	2069.32	.00	5.14		8.00	42.00	.00	1	.83
0 271.99	.01276					.01339	3.64			3.24			.00		
0 27399.99	2063.00	3.16	2066.16	2725.1	20.93	6.81	2072.97	.00	5.14		8.00	42.00	.00	1	.83
0BRIDGE ENTRANCE													.00		
0 27399.99	2063.00	3.01	2066.01	2725.1	21.59	7.24	2073.25	.41	5.08		8.00	42.00	.00	0	.00
0 289.99	.01279					.01341	3.89			3.03			.00		
0 27689.98	2066.71	2.96	2069.67	2725.1	21.92	7.47	2077.14	.00	5.08		8.00	42.00	.00	0	.00
0 223.09	.01502					.01288	2.87			2.88			.00		
0 27913.07	2070.06	3.09	2073.15	2725.1	21.02	6.87	2080.01	.29	5.08		8.00	42.00	.00	0	.00
0 247.70	.01279					.01143	2.83			3.03			.00		
0 28160.77	2073.23	3.19	2076.42	2725.1	20.34	6.43	2082.85	.27	5.08		8.00	42.00	.00	0	.00
0 158.32	.01279					.01008	1.60			3.03			.00		
0 28319.08	2075.25	3.35	2078.60	2725.1	19.39	5.84	2084.44	.25	5.08		8.00	42.00	.00	0	.00

0	89.46	.01279					.00868	.78			3.03			.00		
0	28408.54	2076.40	3.51	2079.91	2725.1	18.49	5.31	2085.22	.22	5.08		8.00	42.00	.00	0	.00
0	58.59	.01279					.00747	.44			3.03			.00		
0	28467.13	2077.15	3.68	2080.83~	2725.1	17.63	4.83	2085.66	.20	5.08		8.00	42.00	.00	0	.00
0	40.81	.01279					.00643	.26			3.03			.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
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0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 28507.95	2077.67	3.86	2081.53	2725.1	16.81	4.39	2085.92	.18	5.08		8.00	42.00	.00	0	.00
0	29.08	.01279				.00554	.16			3.03			.00		
0 28537.03	2078.04	4.05	2082.09	2725.1	16.03	3.99	2086.08	.00	5.08		8.00	42.00	.00	0	.00
0	127.96	.00500				.00518	.66			4.08			.00		
0 28664.99	2078.68	4.02	2082.70	2725.1	16.12	4.04	2086.74	.00	5.08		8.00	42.00	.00	0	.00
0BRIDGE EXIT													.00		
0 28664.99	2078.68	4.19	2082.87	2725.1	15.79	3.87	2086.75	.00	5.14		8.00	42.00	.00	1	.83
0	28.48	.00500				.00599	.17			4.44			.00		
0 28693.47	2078.82	4.16	2082.98	2725.1	15.91	3.93	2086.92	.00	5.14		8.00	42.00	.00	1	.83
0	131.52	.00500				.00652	.86			4.44			.00		
0 28824.99	2079.48	3.97	2083.45	2725.1	16.69	4.33	2087.77	.00	5.14		8.00	42.00	.00	1	.83
0BRIDGE ENTRANCE													.00		
0 28824.99	2079.48	3.70	2083.18	2725.1	17.52	4.77	2087.95	.00	5.08		8.00	42.00	.00	0	.00
0	1.45	.00499				.00679	.01			4.08			.00		
0 28826.44	2079.49	3.70	2083.19	2725.1	17.53	4.78	2087.97	.00	5.08		8.00	42.00	.00	0	.00
0	130.05	.00499				.00734	.95			4.08			.00		
0 28956.49	2080.14	3.53	2083.67	2725.1	18.39	5.25	2088.92	.00	5.08		8.00	42.00	.00	0	.00
0	102.21	.00499				.00853	.87			4.08			.00		
0 29058.70	2080.65	3.36	2084.01	2725.1	19.28	5.78	2089.79	.00	5.08		8.00	42.00	.00	0	.00
0	85.74	.00499				.00991	.85			4.08			.00		
0 29144.44	2081.07	3.21	2084.28	2725.1	20.23	6.36	2090.64	.00	5.08		8.00	42.00	.00	0	.00
0	74.58	.00499				.01152	.86			4.08			.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 29219.02	2081.45	3.06	2084.51	2725.1	21.21	6.99	2091.50	.00	5.08		8.00	42.00	.00	0	.00
0	66.33	.00499				.01339	.89			4.08			.00		
0 29285.35	2081.78	2.92	2084.69	2725.1	22.25	7.69	2092.39	.00	5.08		8.00	42.00	.00	0	.00
0	59.88	.00499				.01557	.93			4.08			.00		
0 29345.22	2082.08	2.78	2084.86	2725.1	23.33	8.46	2093.32	.00	5.08		8.00	42.00	.00	0	.00
0	54.60	.00499				.01812	.99			4.08			.00		
0 29399.83	2082.35	2.65	2085.00	2725.1	24.47	9.31	2094.31	.00	5.08		8.00	42.00	.00	0	.00
0	50.16	.00499				.02109	1.06			4.08			.00		
0 29449.99	2082.60	2.53	2085.13	2725.1	25.67	10.24	2095.37	.00	5.08		8.00	42.00	.00	0	.00
0	346.44	.02306				.02189	7.58			2.51			.00		
0 29796.43	2090.59	2.59	2093.18	2725.1	25.09	9.78	2102.96	.00	5.08		8.00	42.00	.00	0	.00
0TRANS STR	.02300					.02506	2.51						.00		
0 29896.43	2092.89	2.10	2094.99	2725.1	26.18	10.65	2105.64	.00	4.54		8.00	49.67	.00	0	.00
0JUNCT STR	.02310					.01887	1.89						.00		
0 29996.43	2095.20	5.03	2100.23	2725.0	21.67	7.30	2107.53	.00	7.17		9.00	25.00	.00	0	.00
0BRIDGE EXIT													.00		
0 29996.43	2095.20	5.36	2100.56	2725.0	21.19	6.98	2107.54	.00	7.37		9.00	25.00	.00	1	1.00
0	26.97	.00778				.00861	.23			5.55			.00		
0 30023.40	2095.41	5.34	2100.75	2725.0	21.24	7.01	2107.77	.00	7.37		9.00	25.00	.00	1	1.00
0	153.86	.00988				.00831	1.28			5.09			.00		
0 30177.26	2096.93	5.50	2102.43	2725.0	20.63	6.61	2109.05	.00	7.37		9.00	25.00	.00	1	1.00
0BRIDGE ENTRANCE													.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		
0 30177.26	2096.93	4.85	2101.78	2725.0	22.49	7.86	2109.64	.68	7.17		9.00	25.00	.00	0	.00
0	125.81	.01049				.00685	.86			4.29			.00		
0 30303.07	2098.25	5.07	2103.32	2725.0	21.49	7.18	2110.50	.00	7.17		9.00	25.00	.00	0	.00
0BRIDGE EXIT													.00		
0 30303.07	2098.25	5.41	2103.66	2725.0	20.99	6.85	2110.51	.00	7.37		9.00	25.00	.00	1	1.00
0BRIDGE EXIT													.00		
0 30303.07	2098.25	5.41	2103.66	2725.0	20.99	6.85	2110.51	.00	7.37		9.00	25.00	.00	1	1.00
0	8.71	.00991				.00835	.07			5.08			.00		
0 30311.78	2098.34	5.42	2103.75	2725.0	20.96	6.83	2110.58	.00	7.37		9.00	25.00	.00	1	1.00
0	170.84	.00991				.00783	1.34			5.08			.00		
0 30482.62	2100.03	5.68	2105.71	2725.0	19.98	6.21	2111.92	.00	7.37		9.00	25.00	.00	1	1.00
0BRIDGE ENTRANCE													.00		
0 30482.62	2100.03	4.97	2105.00	2725.0	21.94	7.48	2112.48	.65	7.17		9.00	25.00	.00	0	.00
0	15.89	.00993				.00674	.11			4.37			.00		
0 30498.51	2100.19	4.99	2105.18	2725.0	21.82	7.40	2112.58	.64	7.17		9.00	25.00	.00	0	.00
0	116.45	.00993				.00625	.73			4.37			.00		
0 30614.97	2101.34	5.24	2106.58	2725.0	20.81	6.73	2113.31	.59	7.17		9.00	25.00	.00	0	.00
0	79.09	.00993				.00543	.43			4.37			.00		
0 30694.06	2102.13	5.49	2107.62	2725.0	19.84	6.12	2113.74	.00	7.17		9.00	25.00	.00	0	.00
0BRIDGE EXIT													.00		
0 30694.06	2102.13	5.94	2108.07	2725.0	19.12	5.68	2113.75	.00	7.37		9.00	25.00	.00	1	1.00
0BRIDGE EXIT													.00		

WATER SURFACE PROFILE LISTING

Upper Las Vegas Wash Channel
Q = 2,690cfs @ NLVDB Outfall
WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

0 STATION	INVERT ELEV	DEPTH OF FLOW	W.S. ELEV	Q	VEL	VEL HEAD	ENERGY GRD.EL.	SUPER ELEV	CRITICAL DEPTH		HGT/ DIA	BASE/ ID NO.	ZL	NO PIER	AVBPR
0 L/ELEM	SO					SF AVE	HF			NORM DEPTH			ZR		

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0 30694.06  2102.13     5.94   2108.07    2725.0   19.12     5.68   2113.75    .00     7.37              9.00   25.00   .00   1   1.00
0    39.84   .00955                                          .00630      .25                     5.15                      .00
0 30733.90  2102.51     6.09   2108.60~   2725.0   18.64     5.40   2114.00    .00     7.37              9.00   25.00   .00   1   1.00
0    50.57   .00955                                          .00572      .29                     5.15                      .00
0 30784.47  2102.99     6.39   2109.38    2725.0   17.77     4.91   2114.29    .00     7.37              9.00   25.00   .00   1   1.00
0    29.84   .00955                                          .00505      .15                     5.15                      .00
0 30814.31  2103.28     6.70   2109.98    2725.0   16.95     4.46   2114.44    .00     7.37              9.00   25.00   .00   1   1.00
0    15.43   .00955                                          .00445      .07                     5.15                      .00
0 30829.74  2103.43     7.03   2110.45    2725.0   16.16     4.06   2114.51    .00     7.37              9.00   25.00   .00   1   1.00
0     4.60   .00955                                          .00393      .02                     5.15                      .00
0 30834.34  2103.47     7.37   2110.84    2725.0   15.40     3.69   2114.53    .00     7.37              9.00   25.00   .00   1   1.00
0BRIDGE ENTRANCE                                                                                                           .00
0 30834.34  2103.47     9.00   2112.47    2725.0   12.11     2.28   2114.75    .00     7.17              9.00   25.00   .00   0    .00
0    38.51   .00628                                          .00132      .05                     5.10                      .00
0 30872.85  2103.71     8.58   2112.29    2725.0   12.70     2.51   2114.80    .00     7.17              9.00   25.00   .00   0    .00
0     1.31   .00628                                          .00141      .00                     5.10                      .00
0 30874.16  2103.72     8.56   2112.28    2725.0   12.73     2.52   2114.80    .00     7.17              9.00   25.00   .00   0    .00
0TRANS STR   .00669                                          .00080      .23                                               .00
0 31161.12  2105.64     9.11   2114.75    2725.0    5.60      .49   2115.24    .00     4.32             12.00   53.40   .00   0    .00
0    25.75   .00700                                          .00019      .00                     2.84                      .00
0 31186.87  2105.82     8.91   2114.73    2725.0    5.73      .51   2115.24    .00     4.32             12.00   53.40   .00   0    .00
1
                          Upper Las Vegas Wash Channel
                          Q = 2,690cfs @ NLVDB Outfall
                          WSPG file: ULVW.dat, by: JG, VTN, 2/23/2004

                  .         .         .         .         .         .         .         .         .         .         .
     8979.87    .IX EH                                                                                                .   R
     9030.46    .IWCEH                                                                                                .   R
     9081.04    .IWCEH                                                                                                .   R
     9131.63    .IWCE H                                                                                               .   R
     9182.21    .IWCE H                                                                                               .   R
     9232.80    .I XE H                                                                                               .   R
     9283.38    .I XE H                                                                                               .   R
     9333.97    .I X EH                                                                                               .   R
     9384.55    . IX EH                                                                                               .   R
     9435.14    . IWCEH                                                                                               .   R
     9485.72    . IWCEH                                                                                               .   R
     9536.31    . IWCE H                                                                                              .   R
     9586.90    . IWCE H                                                                                              .   R
     9637.48    . IWCE H                                                                                              .   R
     9688.07    . IWCE H                                                                                              .   R
     9738.65    . I XE H                                                                                              .   R
     9789.24    . I XE H                                                                                              .   R
     9839.82    . IBXEBH                                                                                              .   BX
     9890.41    . IBXEH                                                                                               .   BX
     9940.99    . I XEH                                                                                               .   R
     9991.58    . I X X                                                                                               .   R
    10042.16    . I X X                                                                                               .   R
    10092.75    . I X X                                                                                               .   R
    10143.33    . I WCX                                                                                               .   R
    10193.92    .  IWCX                                                                                               .   R
    10244.51    .  IWCX                                                                                               .   BE
    10295.09    .  IX EH                                                                                              .   TX
    10345.68    .   IWCEH                                                                                             .   TX
    10396.26    .   IWCEH                                                                                             .   R
    10446.85    .   IWCE H                                                                                            .   R
    10497.43    .    IWCEH                                                                                            .   R
    10548.02    .    IWCE H                                                                                           .   R
    10598.60    .    I XE H                                                                                           .   R
    10649.19    .     IWCEH                                                                                           .   R
    10699.77    .                                                                                                     .
    10750.36    .                                                                                                     .
    10800.95    .     I XE H                                                                                          .   R
    10851.53    .                                                                                                     .
    10902.12    .                                                                                                     .
    10952.70    .      IWCEH                                                                                          .   R
    11003.29    .                                                                                                     .
    11053.87    .                                                                                                     .
    11104.46    .                                                                                                     .
    11155.04    .                                                                                                     .
    11205.63    .                                                                                                     .
    11256.21    .                                                                                                     .
    11306.80    .                                                                                                     .
    11357.38    .       IWCEH                                                                                         .   R
    11407.97    .                                                                                                     .
    11458.56    .                                                                                                     .
    11509.14    .                                                                                                     .
    11559.73    .                                                                                                     .
    11610.31    .       I XE H                                                                                        .   R
    11660.90    .                                                                                                     .
    11711.48    .                                                                                                     .
    11762.07    .                                                                                                     .
    11812.65    .                                                                                                     .
    11863.24    .                                                                                                     .
    11913.82    .                                                                                                     .
    11964.41    .                                                                                                     .
    12015.00    .        I XE H                                                                                       .   R
    12065.58    .                                                                                                     .
    12116.17    .                                                                                                     .
    12166.75    .         IWCEH                                                                                       .   R
    12217.34    .                                                                                                     .
    12267.92    .                                                                                                     .
    12318.51    .                                                                                                     .
    12369.09    .                                                                                                     .
    12419.68    .         I XE H                                                                                      .   R
    12470.26    .         IBXEBH                                                                                      .   BX
    12520.85    .         I XEH                                                                                       .   R
    12571.43    .         I X X                                                                                       .   R
    12622.02    .          IWCX                                                                                       .   BE
    12672.61    .          IWCEH                                                                                      .   BE
    12723.19    .          IWCEH                                                                                      .   R
    12773.78    .          I X EH                                                                                     .   R
    12824.36    .                                                                                                     .
    12874.95    .           IWCEH                                                                                     .   R
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12925.53   .                                                                  .
12976.12   .                                                                  .
13026.70   .          I X EH                                                  .   R
13077.29   .                                                                  .
13127.87   .                                                                  .
13178.46   .                                                                  .
13229.04   .                                                                  .
13279.63   .           I X EH                                                 .   R
13330.22   .                                                                  .
13380.80   .                                                                  .
13431.39   .                                                                  .
13481.97   .            IBXEH                                                 .   BX
13532.56   .            I XEH                                                 .   R
13583.14   .            I XEH                                                 .   R
13633.73   .            I X X                                                 .   R
13684.31   .            I X X                                                 .   R
13734.90   .             IWCX                                                 .   BE
13785.49   .             IWCE H                                               .   R
13836.07   .             IWC EH                                               .   R
13886.66   .             IWC EH                                               .   R
13937.24   .              IWCE H                                              .   R
13987.83   .                                                                  .
14038.41   .                                                                  .
14089.00   .                                                                  .
14139.58   .                                                                  .
14190.17   .                IWC EH                                            .   R
14240.75   .                                                                  .
14291.34   .                 IWCE H                                           .   R
14341.92   .                                                                  .
14392.51   .                 IWCE H                                           .   R
14443.10   .                 I XE  H                                          .   R
14493.68   .                 I X E H                                          .   R
14544.27   .                                                                  .
14594.85   .                                                                  .
14645.44   .                                                                  .
14696.02   .                                                                  .
14746.61   .                                                                  .
14797.19   .                                                                  .
14847.78   .                  I X E H                                         .   R
14898.36   .                                                                  .
14948.95   .                                                                  .
14999.54   .                   IWCE H                                         .   R
15050.12   .                                                                  .
15100.71   .                                                                  .
15151.29   .                                                                  .
15201.88   .                                                                  .
15252.46   .                                                                  .
15303.05   .                                                                  .
15353.63   .                                                                  .
15404.22   .                    IWCE H                                        .   R
15454.80   .                                                                  .
15505.39   .                                                                  .
15555.97   .                    IBXBEH                                        .   BX
15606.56   .                    I X X                                         .   R
15657.15   .                    I X EH                                        .   R
15707.73   .                    I X EH                                        .   R
15758.32   .                    IBWCEH                                        .   BE
15808.90   .                    I WCEH                                        .   R
15859.49   .                                                                  .
15910.07   .                     I X EH                                       .   R
15960.66   .                                                                  .
16011.24   .                                                                  .
16061.83   .                                                                  .
16112.41   .                       IWCEH                                      .   R
16163.00   .                                                                  .
16213.58   .                       I X EH                                     .   R
16264.17   .                       I WCEH                                     .   R
16314.76   .                       I WCEH                                     .   R
16365.34   .                                                                  .
16415.93   .                                                                  .
16466.51   .                                                                  .
16517.10   .                                                                  .
16567.68   .                                                                  .
16618.27   .                                                                  .
16668.85   .                                                                  .
16719.44   .                                                                  .
16770.03   .                                                                  .
16820.61   .                                                                  .
16871.20   .                                                                  .
16921.78   .                                                                  .
16972.37   .                                                                  .
17022.95   .                                                                  .
17073.54   .                                                                  .
17124.12   .                          I X EH                                  .   R
17174.71   .                                                                  .
17225.29   .                                                                  .
17275.88   .                                                                  .
17326.46   .                                                                  .
17377.05   .                                                                  .
17427.63   .                                                                  .
17478.22   .                                                                  .
17528.81   .                                                                  .
17579.39   .                            IWCEH                                 .   R
17629.98   .                                                                  .
17680.56   .                                                                  .
17731.15   .                                                                  .
17781.73   .                                                                  .
17832.32   .                                                                  .
17882.90   .                                                                  .
17933.49   .                             IWCEH                                .   TX
17984.07   .                                                                  .
18034.66   .                                                                  .
18085.25   .                             I X EH                               .   JX
18135.83   .                                                                  .
18186.42   .                                                                  .
18237.00   .                              IBXEBH                              .   BX
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18287.59    .                I XEH                                                .    R
18338.17    .                                                                     .
18388.76    .                                                                     .
18439.34    .                                                                     .
18489.93    .                                                                     .
18540.51    .                IWCEH                                                .    BE
18591.10    .                IWCEH                                                .    BE
18641.69    .                IWCEH                                                .    R
18692.27    .                I XEH                                                .    R
18742.86    .                                                                     .
18793.44    .                                                                     .
18844.03    .                                                                     .
18894.61    .                                                                     .
18945.20    .                                                                     .
18995.78    .                                                                     .
19046.37    .                                                                     .
19096.95    .                 I X X                                               .    R
19147.54    .                                                                     .
19198.13    .                                                                     .
19248.71    .                                                                     .
19299.29    .                                                                     .
19349.88    .                                                                     .
19400.47    .                  IWCEH                                              .    R
19451.05    .                                                                     .
19501.64    .                                                                     .
19552.22    .                  I X X                                              .    R
19602.81    .                                                                     .
19653.39    .                  I WCEH                                             .    R
19703.98    .                  I WCEH                                             .    R
19754.56    .                                                                     .
19805.15    .                                                                     .
19855.73    .                   I X X                                             .    R
19906.32    .                                                                     .
19956.91    .                                                                     .
20007.49    .                                                                     .
20058.08    .                                                                     .
20108.66    .                                                                     .
20159.25    .                                                                     .
20209.83    .                                                                     .
20260.42    .                     IWC X                                           .    R
20311.00    .                                                                     .
20361.59    .                                                                     .
20412.17    .                                                                     .
20462.76    .                     I WC X                                          .    R
20513.35    .                     I WC X                                          .    R
20563.93    .                      IWC X                                          .    R
20614.52    .                      IWC X                                          .    R
20665.10    .                      IWC  X                                         .    TX
20715.69    .                                                                     .
20766.27    .                                                                     .
20816.86    .                        IWC HE                                       .    JX
20867.44    .                                                                     .
20918.03    .                         IWCBBX                                      .    BX
20968.62    .                         IWC HE                                      .    R
21019.20    .                         I WCHE                                      .    R
21069.79    .                                                                     .
21120.37    .                           IWCHE                                     .    BE
21170.96    .                           IWC  X                                    .    R
21221.54    .                                                                     .
21272.13    .                            IWC  X                                   .    R
21322.71    .                                                                     .
21373.30    .                            IWC  EH                                  .    R
21423.88    .                             IWCBEH                                  .    BX
21474.47    .                             IWC X                                   .    R
21525.05    .                             IBXBEH                                  .    BE
21575.64    .                             I X E H                                 .    R
21626.22    .                             I WC EH                                 .    R
21676.81    .                              IWC EH                                 .    R
21727.40    .                              I X EH                                 .    R
21777.98    .                              I WCE H                                .    R
21828.57    .                              I WCE H                                .    R
21879.15    .                               IWCE H                                .    R
21929.74    .                               IWCE H                                .    R
21980.32    .                               I XE H                                .    R
22030.91    .                               IBXBEBH                               .    BX
22081.49    .                               I WCEH                                .    R
22132.08    .                               IBWCEH                                .    BE
22182.66    .                               I WCE H                               .    R
22233.25    .                                IWCE H                               .    R
22283.84    .                                I X E H                              .    R
22334.42    .                                                                     .
22385.01    .                                                                     .
22435.59    .                                  IWCE H                             .    R
22486.18    .                                                                     .
22536.76    .                                                                     .
22587.35    .                                  I X E H                            .    R
22637.93    .                                                                     .
22688.52    .                                  I WCE H                            .    R
22739.10    .                                                                     .
22789.69    .                                   IWC EH                            .    R
22840.28    .                                   IWC EH                            .    R
22890.86    .                                   IWC EH                            .    R
22941.45    .                                   I WC EH                           .    R
22992.03    .                                                                     .
23042.62    .                                                                     .
23093.20    .                                    I WC EH                          .    R
23143.79    .                                                                     .
23194.37    .                                     I X EH                          .    R
23244.96    .                                     I WCE H                         .    R
23295.54    .                                      IWCE H                         .    TX
23346.13    .                                                                     .
23396.71    .                                                                     .
23447.30    .                                                                     .
23497.88    .                                                                     .
23548.47    .                                                                     .
23599.06    .                                        IX  EH                       .    JX
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23649.64   .                                                    .
23700.23   .                                                    .
23750.81   .                    IWCHE                           .   BX
23801.40   .                    IWCBX                           .   BX
23851.98   .                    IWC X                           .   R
23902.57   .                    I WC X                          .   R
23953.15   .                     IWC X                          .   R
24003.74   .                     I X X                          .   R
24054.32   .                     I WCEH                         .   R
24104.91   .                     I WCEH                         .   R
24155.50   .                      IWCEH                         .   R
24206.08   .                      IBXEH                         .   BE
24256.67   .                      IWCEH                         .   BE
24307.25   .                      IWCEH                         .   R
24357.84   .                      I X X                         .   R
24408.42   .                      I WCX                         .   R
24459.01   .                       IWC X                        .   R
24509.59   .                       IWC X                        .   R
24560.18   .                                                    .
24610.76   .                                                    .
24661.35   .                                                    .
24711.94   .                        IWC X                       .   R
24762.52   .                                                    .
24813.11   .                        I WCX                       .   R
24863.69   .                                                    .
24914.28   .                                                    .
24964.86   .                                                    .
25015.45   .                                                    .
25066.03   .                                                    .
25116.62   .                                                    .
25167.20   .                         I WCX                      .   R
25217.79   .                                                    .
25268.38   .                                                    .
25318.96   .                                                    .
25369.54   .                                                    .
25420.13   .                                                    .
25470.72   .                                                    .
25521.30   .                                                    .
25571.89   .                                                    .
25622.47   .                                                    .
25673.06   .                           I WCX                    .   R
25723.64   .                                                    .
25774.23   .                                                    .
25824.81   .                                                    .
25875.40   .                            IWC X                   .   R
25925.99   .                                                    .
25976.57   .                            I WCHE                  .   R
26027.16   .                                                    .
26077.74   .                             IWC X                  .   R
26128.33   .                                                    .
26178.91   .                                                    .
26229.50   .                                                    .
26280.08   .                                                    .
26330.67   .                                                    .
26381.25   .                                                    .
26431.84   .                                                    .
26482.43   .                              I WCHE                .   R
26533.01   .                                                    .
26583.60   .                                                    .
26634.18   .                                                    .
26684.77   .                                                    .
26735.35   .                                                    .
26785.94   .                                                    .
26836.52   .                                                    .
26887.11   .                                                    .
26937.69   .                                                    .
26988.28   .                                I WCHE              .   JX
27038.87   .                                                    .
27089.45   .                                 IWC HE             .   R
27140.04   .                                 IBWCHE             .   BX
27190.62   .                                 I WCHE             .   R
27241.21   .                                                    .
27291.79   .                                                    .
27342.38   .                                                    .
27392.96   .                                                    .
27443.55   .                                   IWCBHE           .   BE
27494.13   .                                   IWC HE           .   R
27544.72   .                                                    .
27595.30   .                                                    .
27645.89   .                                                    .
27696.47   .                                     IWC HE         .   R
27747.06   .                                                    .
27797.65   .                                                    .
27848.23   .                                                    .
27898.82   .                                                    .
27949.40   .                                      I WCHE        .   R
27999.99   .                                                    .
28050.57   .                                                    .
28101.16   .                                                    .
28151.74   .                                                    .
28202.33   .                                       IWC HE       .   R
28252.91   .                                                    .
28303.50   .                                                    .
28354.09   .                                        IWC X       .   R
28404.67   .                                                    .
28455.26   .                                        I WCHE      .   R
28505.84   .                                         I X X      .   R
28556.43   .                                         I WCX      .   R
28607.01   .                                         I WCX      .   R
28657.60   .                                                    .
28708.18   .                                          IWCX      .   BX
28758.77   .                                          I XX      .   R
28809.35   .                                          I XHE     .   R
28859.94   .                                          IBXBX     .   BE
28910.53   .                                          I X X     .   R
28961.11   .                                          I X X     .   R
```

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   29011.70   .                                                                I WCX              .    R
   29062.28   .                                                                I WCHE             .    R
   29112.87   .                                                                                   .
   29163.45   .                                                                 IWC X             .    R
   29214.04   .                                                                                   .
   29264.62   .                                                                 IWC HE            .    R
   29315.21   .                                                                 IWC HE            .    R
   29365.79   .                                                                 I WCH E           .    R
   29416.38   .                                                                 I WCH E           .    R
   29466.96   .                                                                 I WCH  E          .    R
   29517.55   .                                                                                   .
   29568.13   .                                                                                   .
   29618.72   .                                                                                   .
   29669.31   .                                                                                   .
   29719.89   .                                                                                   .
   29770.48   .                                                                     I WCH E       .    TX
   29821.06   .                                                                                   .
   29871.65   .                                                                      IW CH  E     .    JX
   29922.23   .                                                                                   .
   29972.82   .                                                                        IBWCH E    .    BX
   30023.40   .                                                                        I WCH E    .    R
   30073.99   .                                                                        I WCH E    .    R
   30124.57   .                                                                                   .
   30175.16   .                                                                        IBBWCHE    .    BE
   30225.75   .                                                                        I  WCH E   .    R
   30276.33   .                                                                         IBWCH E   .    BX
   30326.92   .                                                                         IBBWX E   .    BX
   30377.50   .                                                                         I  WX E   .    R
   30428.09   .                                                                         I  WX E   .    R
   30478.67   .                                                                          IBBXH E  .    BE
   30529.26   .                                                                          I WCH E  .    R
   30579.84   .                                                                          I WCH E  .    R
   30630.43   .                                                                           I WCHE  .    R
   30681.02   .                                                                           IBBXH E .    BX
   30731.60   .                                                                           IBBXH E .    BX
   30782.19   .                                                                           I  XH E .    R
   30832.77   .                                                                           I  WX E .    R
   30883.36   .                                                                           I  WCHE .    R
   30933.94   .                                                                           I   XHE .    R
   30984.53   .                                                                            I  XHE .    R
   31035.11   .                                                                            IBBXHE .    BE
   31085.70   .                                                                            I  CXE .    R
   31136.28   .                                                                            I  CXE .    R
   31186.87   .                                                                                   .
0             1911.41   1932.05   1952.69   1973.33   1993.97   2014.61   2035.26   2055.90   2076.54   2097.18   2117.82
1
```

N O T E S

1. GLOSSARY

   I = INVERT ELEVATION
   C = CRITICAL DEPTH
   W = WATER SURFACE ELEVATION
   H = HEIGHT OF CHANNEL
   E = ENERGY GRADE LINE
   X = CURVES CROSSING OVER
   B = BRIDGE ENTRANCE OR EXIT
   Y = WALL ENTRANCE OR EXIT

2. STATIONS FOR POINTS AT A JUMP MAY NOT BE PLOTTED EXACTLY
1

Appendix C: Normal Depth Calculation

Worksheet for Cross-Section A-A

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

Input Data		
Channel Slope:	1.20000	%
Discharge:	108.00	ft³/s

Options	
Current Roughness Weighted Meth	ImprovedLotters
Open Channel Weighted Roughnes	ImprovedLotters
Closed Channel Weighted Roughne	Hortons

Results		
Roughness Coefficient:	0.035	
Water Surface Elevation:	2111.40	ft
Elevation Range:	2110.50 to 2114.00 ft	
Flow Area:	37.22	ft²
Wetted Perimeter:	75.51	ft
Top Width:	75.48	ft
Normal Depth:	0.90	ft
Critical Depth:	0.79	ft
Critical Slope:	0.02370	ft/ft
Velocity:	2.90	ft/s
Velocity Head:	0.13	ft
Specific Energy:	1.03	ft
Froude Number:	0.73	
Flow Type:	Subcritical	

hydraulic depth

$\frac{A}{TW} = \frac{37.22}{75.48} = 0.49'$

Segment Roughness		
Start Station	End Station	Roughness Coefficient
(0+00, 2112.00)	(1+32, 2114.00)	0.035

Section Geometry	
Station	Elevation
0+00	2112.00
0+53	2111.00

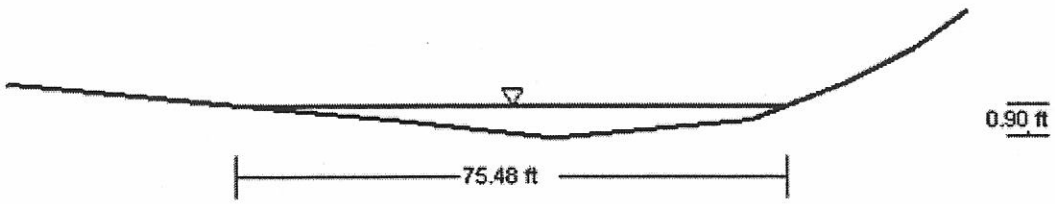
Worksheet for Cross-Section A-A

Station	Elevation
0+75	2110.50
1+02	2111.00
1+15	2112.00
1+25	2113.00
1+32	2114.00

Cross-Section A-A
Cross Section for Cross-Section A-A

Project Description		
Flow Element:	Irregular Section	
Friction Method:	Manning Formula	
Solve For:	Normal Depth	

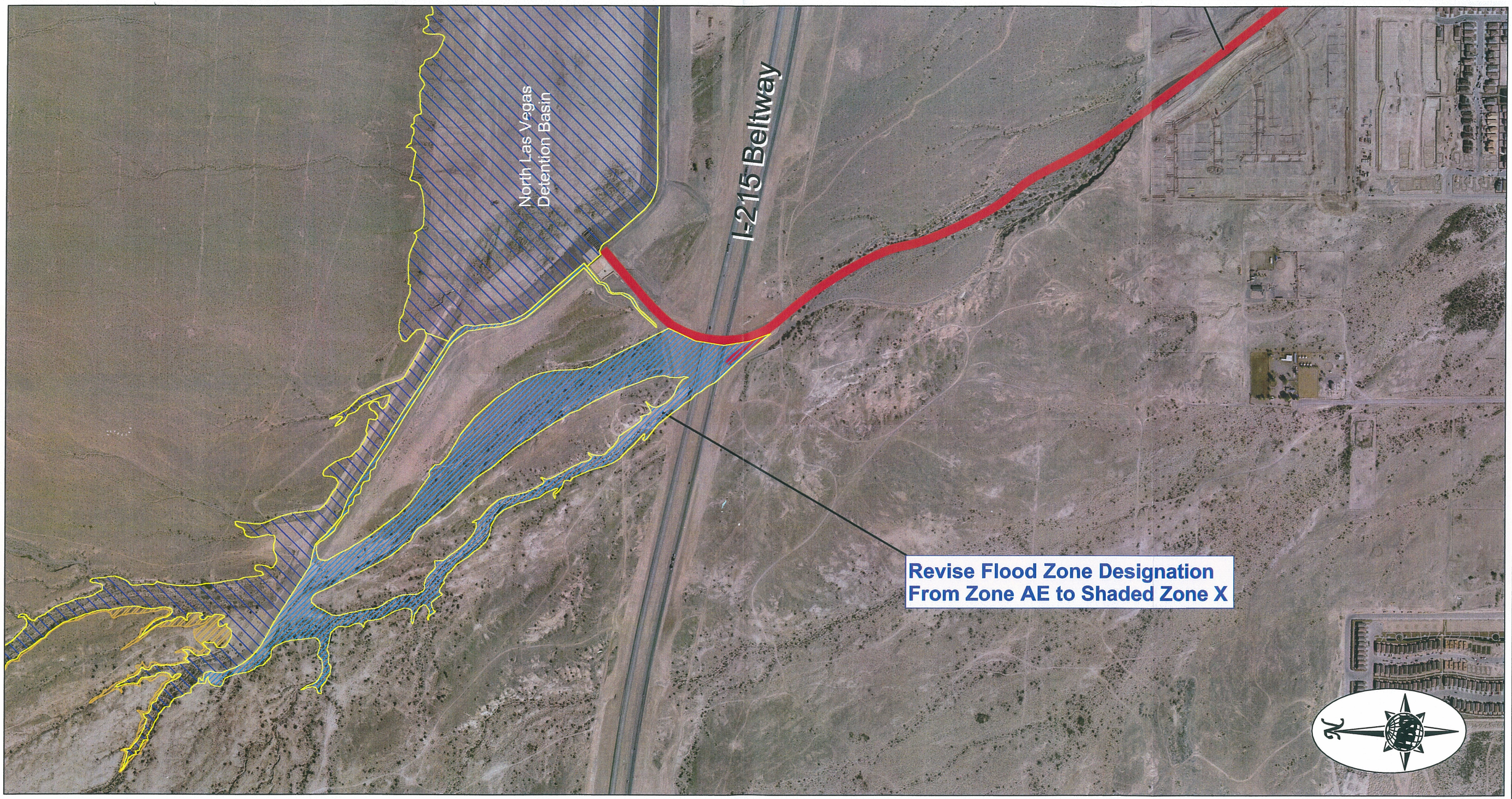
Section Data		
Roughness Coefficient:	0.035	
Channel Slope:	1.20000	%
Normal Depth:	0.90	ft
Elevation Range:	2110.50 to 2114.00 ft	
Discharge:	108.00	ft^3/s



V: 5
H: 1

Appendix D

VTN Design Plan Sheets & Figures



GRAPHIC SCALE

600 0 300 600 1200 2400

(IN FEET)

1 inch = 600 ft.

FIGURE 4A: PROPOSED FLOOD ZONE DELINEATION MAP

Upper Las Vegas Wash Channel CLOMR

Zone AE Flood Zone

Shaded ZoneX Flood Zone

Upper Las Vegas Wash Facility Alignment/100-Year Flood Zone

Note: Aerial Photo as of April 2004

PBSJ
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Suite 100
Henderson, Nevada 89074
Tele: 702-263-7275
Fax: 702-263-7200
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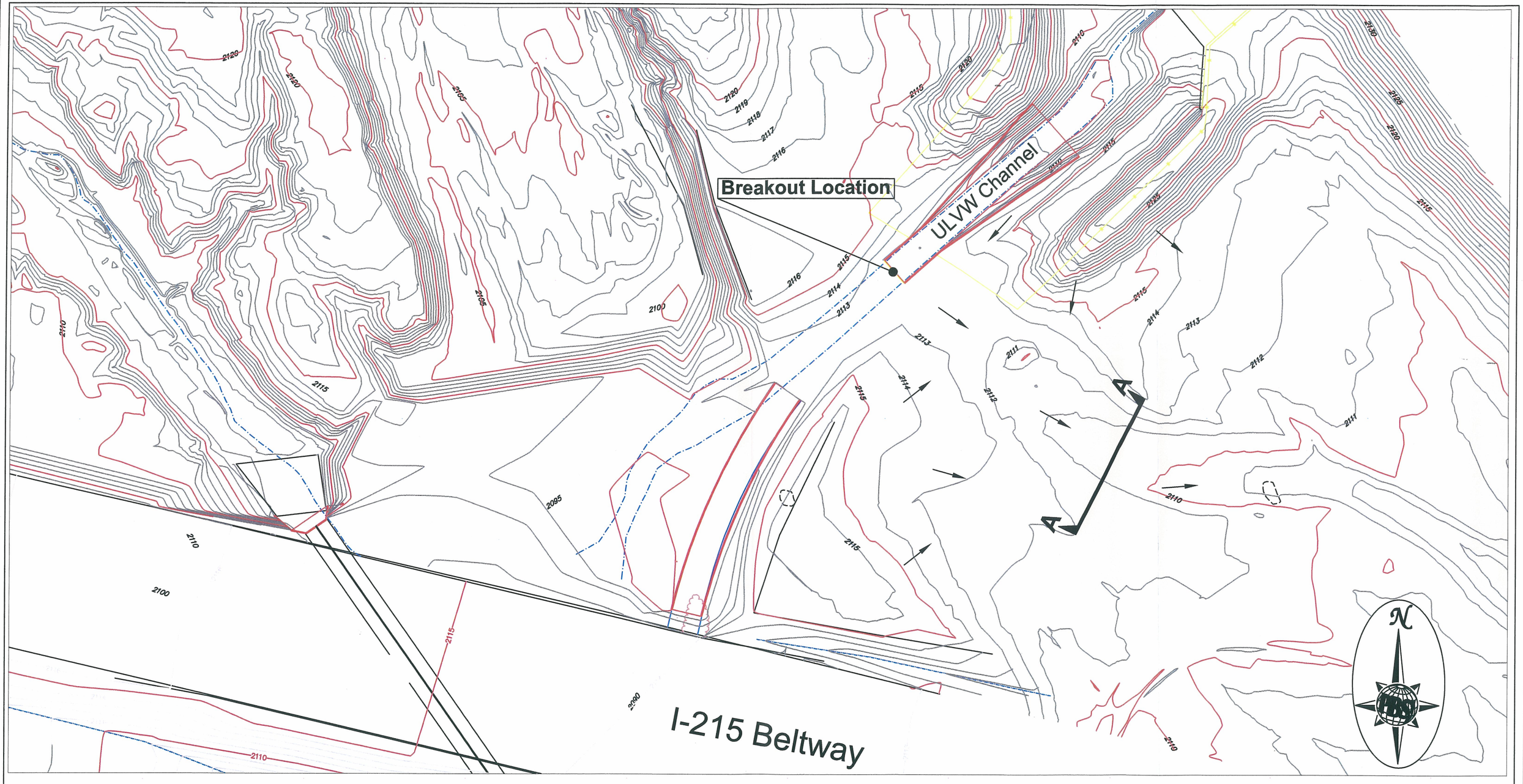
FIGURE 4A



GRAPHIC SCALE

80 0 40 80 160 320

(IN FEET)

1 inch = 80 ft.

The hydraulic analysis and proposed flood zone delineation completed for this CLOMR are based on topographic information shown on this map and the channel plans provided in Appendix D.

I hereby certify that the information presented herewith substantially conforms with current conditions.

Matthew S. Baird, NV 13684

12/15/05
Date

FIGURE 1: CROSS-SECTION MAP UPPER LAS VEGAS WASH CHANNEL

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FIGURE 1

ADDITIVE ALTERNATE #2

SEE SHEET PR01B MATCH LINE

CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION

STA. -1+61.13
BEGIN NEW LEFT WALL FOR 83'-4" x 11'6" REBOT CHAN MATCH WITH TYPICAL OUTLET STRUC. WINGWALL ANGLE POINT BEGIN WIDTH TRANS. STRUC.

EXISTING NORTHERN BELTWAY
NORTH 5th STREET TO PECOS ROAD
INTERIM IMPROVEMENTS AS DESIGNED BY PARSON BRINKERHOFF (P/B)

141.87± EX. TRANS. STRUC. TO BE REMOVED

140.28± EX. DOUBLE 12' x 9' RCB

211.44± EX. 25' x 9' RECT. CHAN.

179.55± EX. DOUBLE 12' x 9' RCB

125.81± EX. 25' x 9' RECT. CHAN.

59.82± EX. 25' x 9' RECT. CHAN.

EXISTING GROUND SURFACE PROFILE 45' LEFT OF CHANNEL CENTERLINE -TYP.

HGL

-0.67%

± -0.67%

± -0.96%

± -0.99%

± -0.99%

± -1.05%

STA. -1+71.64
BEGIN NEW 53.4± x 12' RECT. MATCH WITH TYPICAL FOR ENERGY DISSIPATOR WALL CONSTRUCT CUTOFF WALL EX. INV. ± 2105.70±

STA. -1+86.88
BEGIN NEW RIGHT WALL FOR 83'-4" x 11'2" RECT. CHAN MATCH WITH TYPICAL OUTLET STRUC. STEM WALL END

STA. -0+46.04±
BEGIN REMOVAL OF EXISTING TRANS. STRUC.
EX. INV. = 2104.66±

STA. 1+25.63
END REMOVAL OF EX. TRANS. STRUC.
END NEW WIDTH TRANS. STRUC.
MATCH EX. P/B 25' x 9' RECT. CHAN.
EX. INV. = 2103.72±

CONTRACTOR SHALL CONFIRM EXISTING STRUCTURE ELEVATIONS AND COORDINATE ANY SIGNIFICANT DISCREPENCIES WITH THE ENGINEER

EXISTING GROUND SURFACE PROFILE 45' RIGHT OF CHANNEL CENTERLINE -TYP.

EXISTING GROUND SURFACE PROFILE AT CENTERLINE OF CHANNEL -TYP.

REFER TO STRUCTURAL DRAWINGS FOR CUTOFF WALL LOCATIONS

Q = 2690 CFS

SEE SHEET PR01B MATCH LINE

2148 2146 2144 2142 2140 2138 2136 2134 2132 2130 2128 2126 2124 2122 2120 2118 2116 2114 2112 2110 2108 2106 2104 2102 2100 2098 2096 2094 2092 2090 2088 2086 2084 2082 2080 2078 2076 2074

-3+00 -2+00 -1+00 0+00 1+00 2+00 3+00 4+00 5+00 6+00 7+00 8+00

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER ADDENDUM NO. 2	5/24/2004	YTH
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED:
APPROVED:
DATE: 1/21/2004

PROJECT NO:
FILE NAME:

KENNETH D. GILBRETH — EXPIRES 12/31/2005 — STATE OF NEVADA — No. 9177 — CIVIL — REGISTERED PROFESSIONAL ENGINEER

vtn nevada
CONSULTING ENGINEERS
PLANNERS
LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7450
FAX (702) 362-2597

(DRAWING TITLE) BASIN OUTLET PROFILE - STA. -3+00 TO STA. 8+25

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO. PR01A

SHT. 9 OF 128

CENTERLINE / MAINTENANCE ROAD CONTROL POINT DATA

POINT NO.	NORTHING	EASTING	DESCRIPTION
(1.1)	90415.8871	64783.8472	BEGIN CONST.
(1.2)	90389.5288	64754.0052	P.C.
(1.3)	89651.5804	64648.4634	P.C.C.
(1.4)	89629.1976	64663.3388	P.T.

CITY OF NORTH LAS VEGAS - DEPARTMENT OF PUBLIC WORKS - ENGINEERING SERVICES DIVISION

REVISIONS			
NO.	DESCRIPTION	DATE	BY
1	REVISED PER CHANGE ORDER NO. 1	6/09/2004	VIN
2			
3			
4			
5			

SCALE: 1"=40'
DESIGN: DJB
DRAWN: DJB
CHECKED: JNG
APPROVED: KDC
DATE: 5/24/2004
PROJECT NO:
FILE NAME:

KEN D. GILBRETH — CIVIL — No. 9717 — EXP. 06/30/06 — PROFESSIONAL ENGINEER STATE OF NEVADA

vtn nevada
CONSULTING ENGINEERS
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2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PHONE (702) 873-7550
FAX (702) 362-2592

(DRAWING TITLE) PLAN VIEW - BASIN OUTFALL

(PROJECT TITLE) UPPER LAS VEGAS WASH CHANNEL

(LOCATION) NORTH LAS VEGAS DETENTION BASIN TO CRAIG ROAD

DRAWING NO.
PL01
SHT. X OF X

Appendix E: E-mail Correspondence

Loffman, Brian

From: Loffman, Brian
Sent: Thursday, December 15, 2005 2:34 PM
To: Loffman, Brian
Subject: FW: Upper LV Wash Channel

-----Original Message-----
From: Bill Marshall [mailto:BILLM@ci.north-las-vegas.nv.us]
Sent: Wednesday, December 14, 2005 7:53 AM
To: Kevin Eubanks
Cc: jeffg@vtnnv.com
Subject: Re: Upper LV Wash Channel

Kevin
We will issue a change order to connect the top of wall at the end of the new transition to the top of the culvert.
Bill

>>> "Kevin Eubanks" <KevinEubanks@ccrfcd.org> 12/02/05 11:19 AM >>>
Jeff/Bill,

I have you guys down in my records at the ones most knowledgeable on this project. We are preparing a CLOMR for this project. FEMA has brought to our attention that a portion of the channel is not deep enough to contain the flow. It is a very short reach at the upstream most end of the project. Looking at Sheets PL01 and PR01A between Sta.
1+25.83 and 1+65.65. This is the existing section of channel that is
to
remain just downstream of a new transition. The HGL is actually shown above the top of channel. It is not a significant amount of flow escaping, but if it is not too late to make a revision, we may want to consider doing so. Raising the existing channel wall a few feet or extending the transition all the way to the existing culvert or connecting the top of wall at the end of the new transition to the top of the culvert would do the trick.

Let me know if questions or how you want to proceed.

Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood Control District 600 Grand Central Parkway Las Vegas, Nevada 89106-4511
702.455.3139
KEubanks@ccrfcd.org
Website: www.ccrfcd.org

Appendix F: Data CD