DS #: 4824

APN: 138-02-713-002

PROJECT: Craig & Rancho Master Drainage Study

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: September 27, 2016
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Craig & Rancho Master Drainage Study**			**COPIES TO:** Lochsa Engineering
Cross Streets:	SEC of Craig Road & Rancho Drive			Pre Rancho Craig LLC
File Number:	F:\Depot\DSMemos\DS4824A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	138-02-713-002			CCRFCD
Zoning Action:	N/A			NDOT
FEMA Flood Zone	YES	NO	**X**	
Proposed Storm Drain	YES	NO	**X**	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	9/7/2016	9/27/2016	See Comments Below	$400.00	457513: $400
			TOTAL FEES (LDDRS):	**$400.00**	**----**

REMARKS:

The Drainage Study for the subject project has been reviewed and:

	is approved subject to conformance to all City standards and the following conditions:
X	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Public Works Department concurrence.

1. The final approval of this master study is for conceptual drainage pattern only. No onsite improvements are being proposed with this master drainage study. No detail site plan had been submitted for site specific drainage analysis. Technical drainage study/studies will be required upon future site specific developments and when final site plans become available.
2. The master study and improvement plans provided in the last submittal, however, proposed mass grading for the overall site. Consult with *City of Las Vegas Land Development Section* and obtain approval prior to the final acceptance of the subject master study and plans.
3. The site is adjacent to or crosses an existing or proposed *Clark County Regional Flood Control District* (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.
4. The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way. The engineer must contact NDOT for encroachment permit for the proposed project.
5. **Sheet DR2**: The 10-yr/25-yr/100-yr flows labeled for Subbasin "ND2" was incorrect. Revise to show 26/34/46 cfs in the next submittal.

6. **Sheet C2.01**: It appears that the curb return at the intersection of *Craig Road* and *Rancho Drive* is to be re-constructed. However, this was not addressed in the master drainage study. Review and address in the next submittal.

7. **Sheet C2.02**: It also appears that a driveway cut and curb & gutter and sidewalk are proposed in *Rancho Drive*. Review and address in the next submittal.

8. **Sheet C2.04** and **Sheet C2.06**: Provide erosion control measures downstream of each of the *Rancho* culverts. Provide hydraulic and sizing of riprap calculations in the next submittal.

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see http://ndep.nv.gov/bwpc/storm01.htm or call (775) 687-9429.

END OF REMARKS

ays

T/R/S: T20S/R60E/02
AREA L-02

****
*** FAX TX REPORT ***
****

TRANSMISSION OK

JOB NO.	1494
DESTINATION ADDRESS	7023659317
PSWD/SUBADDRESS	
DESTINATION ID	
ST. TIME	09/28 07:03
USAGE T	00'42
PGS.	2
RESULT	OK

CITY OF LAS VEGAS
INTER-OFFICE MEMORANDUM

DATE: September 27, 2016

TO:
Land Development Services
Department of Building & Safety

FROM:
Albert Sung, P.E.
Flood Control Project Engineer
Department of Public Works

SUBJECT: Drainage Study for:
Craig & Rancho Master Drainage Study

Cross Streets:	SEC of Craig Road & Rancho Drive
File Number:	F:\Depot\DSMemos\DS4824A.doc
Parcel Number:	138-02-713-002
Zoning Action:	N/A

FEMA Flood Zone	YES	NO **X**
Proposed Storm Drain	YES	NO **X**

COPIES TO:
Lochsa Engineering
Pre Rancho Craig LLC
Bart Anderson, P.E., DevCo
CCRFCD
NDOT

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	9/7/2016	9/27/2016	See Comments Below	$400.00	457513: $400
			TOTAL FEES (LDDRS):	**$400.00**	-----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

	is approved subject to conformance to all City standards and the following conditions:
X	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Public Works Department concurrence.

1. The final approval of this master study is for conceptual drainage pattern only. No onsite improvements are being proposed with this master drainage study. No detail site plan had been submitted for site specific drainage analysis. Technical drainage study/studies will be required upon future site specific developments and when final site plans become available.
2. The master study and improvement plans provided in the last submittal, however, proposed mass grading for the overall site. Consult with *City of Las Vegas Land Development Section* and obtain approval prior to the final acceptance of the subject master study and plans.
3. The site is adjacent to or crosses an existing or proposed *Clark County Regional Flood Control District* (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final

Technical Drainage Study
For
Craig & Rancho Master Drainage Study

August 2016

Prepared for:

Pre Rancho Craig, LLC
120 Presidential Way
Woburn, MA 01801

Prepared by:

LOCHSA ENGINEERING
6345 South Jones Boulevard, Suite 100
Las Vegas, Nevada 89118
(702) 365-9312

Lochsa Job # 161051

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Craig & Rancho Master Drainage Study Date: August 31, 2016

Location of Development: a) Descriptive (Cross Streets) North/South: Jones Boulevard

East/West: Craig Road

b) Section: 2 Township: 20 South Range: 60 East

c) APN : 138-02-713-002

Name of Owner: Pre Rancho Craig LLC (C/O William S. Parris)

Telephone No.: (805) 898 - 2023 Fax No.: (805) 898 - 9913 E-Mail Address:

Address: 120 Presidential Way, Woburn, MA 01801

Contact Person-Name: Hani M. Noshi, Ph.D., P.E., CFM **Telephone No.:** (702) 365-9312

* **E-Mail Address:** hani@lochsa.com **Fax No.:** (702) 365-9317

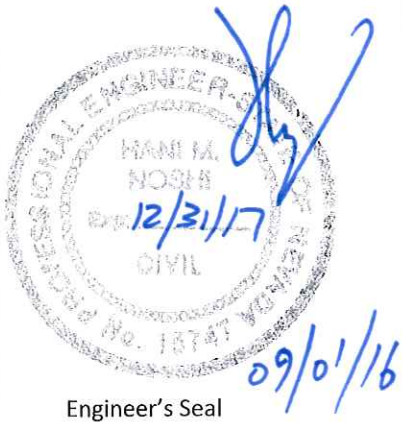
Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 50.14 +/- Acres Being Developed/Disturbed: 0.0 +/- Acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ **Yes**** ☒ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ **Yes**** ☐ **No**
4. Proposed type of development (Residential, Commercial, Etc.): Future Commercial Development
5. Approximate upstream land area which drains to the subject site: 5.0 +/- square miles (mainly conveyed through perimeter streets)
6. Has the site drainage been evaluated in the past? ☐ **YES** ☒ **NO** If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
   Northeasterly towards Craig Road and easterly towards Jones Boulevard, following existing pattern;
8. Briefly describe your proposed schedule for the subject project: ASAP



09/01/16

Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name:	Craig & Rancho Master Drainage Study	Map ID:	
Firm Name:	Lochsa Engineering	Engineer:	Ted Egerton, PE
Address:	6345 South Jones Boulevard Suite 100		
City:	Las Vegas	State: Nevada	Zip: 89118
Phone Number:	(702) 365-9312	Fax Number:	(702) 365-9317
Property Owner:	Pre Rancho Craig LLC		
Address:	120 Presidential Way		
City:	Woburn	State: MA	Zip: 01801

Reviewed By:	Date Received:	Date Accepted for Review:

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. Each study is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT

Yes	No	
✓		Design Manual **Standard Form 1** with the engineer's seal and signature.
✓		Design Manual **Standard Form 4.**
✓		2 copies of the 24" x 36" Drainage Plan
	N/A	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

REFERENCE:	**STANDARD FORM 2**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

Yes	No	
✓		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
✓		A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
✓		Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
✓		On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
✓		Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
✓		Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
✓		Minimum scale: 1" = 60'.
✓		Project name.
✓		Vicinity Map with local and major cross streets.
✓		Revision box.
✓		North arrow and bar scale.
✓		Engineer's/consultant's address and phone number.
✓		Elevation datum and benchmark.
✓		Legend for symbols and abbreviations.
	N/A	Cut/fill scarps, where applicable.
✓		Street names, grades, widths.
✓		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.

REFERENCE:	**STANDARD FORM 2**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
✓		Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
	N/A	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
	N/A	Proposed typical street sections.
	N/A	Streets with off-set crowns.
✓		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
✓		Property lines.
✓		Right-of-way lines with widths, existing and proposed.
✓		Existing improvements and their elevations.
✓		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
✓		Concentration points and drainage flow directions with Q_{100} and V_{100} and D_{100} in streets.
✓		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
✓		Location and cross-section of street capacity calculations.
	N/A	Cross-sectional detail for channels, including cutoff wall locations.
✓		Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
	N/A	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
	N/A	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
	N/A	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.

REFERENCE: | **STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
____	N/A	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
____	N/A	Building and/or lot numbers.
____	N/A	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
____	N/A	Limits of existing floodplain based on current FIRM of best available information; limits of proposed floodplains based on best available information.
____	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table.
____	N/A	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
✓	____	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

Yes	No	
✓	____	Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
✓	____	Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
✓	____	Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
✓	____	Use of correct precipitation values in and around the McCarran Airport rainfall area.
✓	____	A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
✓	____	A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
✓	____	Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
✓	____	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
____	N/A	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
✓	____	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
✓	____	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
____	N/A	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged).
____	N/A	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
____	N/A	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow of depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height of flow depth, which ever is greater.
____	N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data • Input and output information • Plotted cross-sections based on survey with proper encroachments. • A map showing the locations of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
		Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
____	N/A	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
____	N/A	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

REFERENCE: | **STANDARD FORM 2**

CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA
STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

The following checklist is intended as a supplemental guide for the engineer preparing a Technical Drainage Study submittal to the City of Las Vegas. This supplement focuses on requirements specific to the City of Las Vegas. The requirements presented are in addition to the Clark County Regional Flood Control District (CCRFCD) Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCD Standard Form 2 prior to the City accepting a new drainage study for review. The engineer must contact the Flood Control Section at (702) 229-6541 to schedule a submittal appointment.

If items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT		
Yes	No	
	N/A	A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
	N/A	Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.
✓		An electronic copy of the complete submittal is required to be submitted with one original hard copy of the study. Electronic documents should be on a universal computer-readable digital output device replicating your submittal. An Indexed Portable Document Format (PDF) or Print Ready CAD file formats with a minimum of 300dpi are the desired formats. If figures are in color, they must be scanned in color and saved as a separate file. __H.N.__ by initial here, the engineer on record acknowledges that the electronic copy is an identical replicate of the original hard copy submitted to the City of Las Vegas.

II. GRADING PLAN INFORMATION		
Yes	No	
✓		(1) 24" X 36" copy of the Grading Plan, (including all Detail Sheets) sealed by the engineer.
✓		Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. Note: Proposed top of curb elevations must be provided for both sides of roadways even if only half street construction is required.
✓		Label existing topography at a minimum 5 foot elevation interval including adjacent developments, finished floor elevations of existing buildings and top of existing curbs extending 100 feet* around the perimeter of the site. (*Measured from the centerline of the adjacent roadway.)

II. GRADING PLAN INFORMATION		
Yes	No	
	N/A	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
	N/A	All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
✓		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met.
	N/A	Back of lot elevations and lot drainage pattern for all lots including common lots.
	N/A	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
	N/A	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
	N/A	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
	N/A	Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	N/A	Concrete valley gutters are required in parking lots with slopes less than 1 percent. Slopes through cul-de-sac must be at a 1 percent minimum where flow is drained through the cul-de-sac.
	N/A	Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	N/A	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
	N/A	Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
	N/A	Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
	N/A	Lots with "B and C Type Drainage" that drain from one lot to another through a drainage easement shall be required to install an underground nuisance drainage system or a 2-foot valley gutter. 16" x 24" minimum block wall openings are required for both options.
	N/A	Bubblers are required across 80 foot and greater ROW streets. When flows exceed 10 cfs, bubblers larger than 18 inches will be required up to a maximum of 36". Inlets must be sized to match the pipe size provided.

- Contact the Flood Control Section regarding the drainage study review fee. These fees are payable at the time of submittal.
- The Drainage Study must be conditionally approved prior to submitting improvement plans to the Civil and Planning Development of the Department of Building and Safety for review.

This document is intended as an **aid** in preparing Technical Drainage Studies for the City of Las Vegas. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all-inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use.

Craig & Rancho
Master Drainage Study

TABLE OF CONTENTS

1. GENERAL LOCATION AND DEVELOPMENT DESCRIPTION 1
- 1.1 Purpose 1
- 1.2 Location of Property 1
- 1.3 Description of Property 2

2.DRAINAGE DESCRIPTION 3
- 2.1 Existing Drainage Conditions 3
- 2.2 Interim Drainage Condition 14
- 2.3 Future Drainage Condition 18
- 2.4 Master Planning Information 18
- 2.5 Floodplain Information 18
- 2.6 Previous Drainage Studies 19

3.PROPOSED DRAINAGE FACILITIES 19
- 3.1 General Description 19
- 3.2 Compliance with Regulations and Adopted Plans 20
- 3.3 Hydrologic Criteria 20
- 3.4 Facility Design Calculations 21

4.CONCLUSIONS AND RECOMMENDATIONS 22

5. REFERENCES 23

APPENDICES

- A Hydrologic Analysis
- B Hydraulic Calculations
- C Figures
- D Drainage Maps
- E References

1. GENERAL LOCATION AND DEVELOPMENT DESCRIPTION

1.1 Purpose

Lochsa Engineering has been retained by Pre Rancho Craig, LLC to provide a Master Drainage Study for the 50-acre property, located at the southeast corner of Craig Road and Rancho Drive, within the City of Las Vegas, Nevada. This study provides a detailed hydrologic analysis of the flows impacting the existing conditions, as well as provides a conceptual drainage pattern for future improvements. The purpose of the study is to examine the impact for the ultimate development of the subject property, identify any required future mitigation upon ultimate development, and establish an overall ultimate drainage pattern for the property.

This master study will examine the existing, interim, and developed conditions for the site and the upstream watershed. The Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (HCDDM) and the 2008 Las Vegas Valley Flood Control Master Plan Update (MPU) have been compiled and utilized to prepare this study. This report presents summary of the hydrologic and hydraulic analyses, methodology, and results of the study.

1.2 Location of Property

The site represents approximately 50 acres at the southwest corner of Craig Road and Jones Boulevard. The project site is bordered to the west by Rancho Drive. Craig Road and Rancho Drive are Nevada Department of Transportation (NDOT) right-of-way. The site occupies a portion of the Northern Half (N1/2) of the Southeast Quarter (SE1/4) of Section 02 (and a small portion

of the South half (S1/2) of the SE Quarter), Township 20 South, Range 60 East, of the M.D.M., in the City of Las Vegas, Nevada. The site occupies the parcel identified by APN 138-02-702-002. Please refer to the copy of the Assessor's parcel maps provided in Appendix C. The Vicinity Map for the subject site, in relation to the surrounding streets, is also provided in Figure 1 of the Appendix.

1.3 Description of Property

The project site occupies approximately 50 acres and generally slopes to the east and northeast with slopes between 1.0% and 2.0%. Currently, the majority of the site appears to have been cleared, disturbed and graded. The remaining portion of the site is covered with the typical sparse desert shrub land cover. Craig Road, Jones Boulevard and the western half of Rancho Drive along the site are fully improved. The majority of the eastern half of Rancho Drive are also improved, but no curb and sidewalk are constructed. A review of the 2008 MPU's Figure H-20 indicates that the site is located within the hydrologic soil group D, defined as soils with "very low infiltration rate, and high runoff potential". Review of the Natural Resources Conservation Service (NRCS) Web Soil Survey (Reference 3) indicates that the site is located within Soil No. 301 and 305, also identified as within hydrologic soil group D.

2. DRAINAGE DESCRIPTION

In the CCRFCD's 2008 MPU (Reference 2), the valley was hydrologically divided into ten watersheds, and each watershed was further subdivided into sub-basins. The onsite and offsite basins impacting the subject project area fall within the Gowan watershed. As shown in Figure H-20 of the 2008 MPU, the project site is all located within sub-basin PD16A3-C.

2.1 Existing Drainage Conditions

The majority of the offsite flows impacting the subject property are conveyed along Rancho Drive and Craig Road. A large watershed of more than 5.0square miles contribute to the runoff flows impacting the northwest corner of Rancho/Craig intersection. There is an existing 60" Reinforced Concrete Pipe (RCP) storm drain along Craig Road, to the east of the intersection. The existing 60"RCP Craig storm drain was designed to intercept and convey large portion of the flows at the Rancho/Craig intersection. Several studies have provided hydrologic and hydraulic analysis for the offsite flows impacting the Rancho/Craig intersection. As will be discussed in the following sections, flows exceeding the existing Craig storm drain capacity will continue southeasterly along the west side of Rancho Drive.

Offsite flows also impact the subject property through two (2) existing 6ft x 3ft Reinforced Concrete Box Culverts (RCBC) underneath Rancho Drive. As shown in the conceptual grading plans provided with this Master Study, these existing 6' x 3' RCBCs cross underneath Rancho Drive at Stations 21+64 and 31+63cfs. These RCBCs were designed to divert a small portion of the flows along Rancho Drive easterly/southeasterly. Runoff flows conveyed through these RCBCs have also been analyzed in several studies.

The most current discussions for the offsite flows impacting the subject property were provided in the "*Technical Drainage Study for Murphy Express*" (CLV #DS4771, Reference 5) by Lochsa Engineering, approved by the City of Las Vegas (CLV) on February, 2016. As shown in the attached relevant excerpts from Reference 5, the most current and detailed analysis for relevant offsite flows were provided in the "Rancho Drive/US95 Flood Hazard Mapping Restudy, by Louis Berger Group, Inc., approved by FEMA in November 2009 (**will be referred to as the LOMR study**).

Rancho Drive and Craig Road Flows

The Rancho/US95 LOMR study provided detailed hydrologic and hydraulic analysis for the offsite flows at the Craig/Rancho intersection, as well as the flows continuing southeasterly along Rancho Drive. As shown in the attached referenced information, the total surface flows at the Rancho/Craig intersection were determined aa combination point 2C2B3(Q100=199cfs, DARF=0.90). In addition, the LOMR determined 210cfs to be intercepted and conveyed into the existing Craig storm drain during 100-year storm events. Thus, the LOMR study determined the total 100-year flows (i.e. Surface and Craig storm drain) at Rancho/Craig intersection to be approximately 409cfs (i.e. 199cfs + 210cfs). The detailed hydraulic modeling from the LOMR study determined the entire 100-year surface flows from 2C2B3 (199cfs) to continue travelling southeasterly along the west side of Rancho Drive. Thus, the LOMR study determined that no surface flows will continue easterly into Craig Road, to the east of the intersection with Rancho Drive. As shown in the referenced HEC-1 output from the LOMR study, the contributing watershed to the surface and storm drain flows at the Rancho/Craig intersection represents an area

more than runoff flows from approximately 5.20 square miles (=0.40square miles through 2C2B3 + approx. 4.79sqaure miles through D95E).

As shown in referenced Exhibits C6R and C7R from the Rancho/US95 LOMR study, the detailed HEC-RAS model illustrates that southeasterly offsite flows are contained along the western half of Rancho Drive. Thus, the LOMR illustrates that flows travelling within the eastern half of Rancho Drive along the project site will be limited to the local flows.

For the determination of offsite flows through Craig Road, the Murphy Express study (Reference 5) utilized the flows from the "*Northwest Neighborhood Study Area Phase I (1997)*. As shown in Figure F-12, the Northwest Neighborhood Study determined the ultimate flows downstream the intersection of Craig/Jones to be 16/489cfs (10-year/100-year). Reference 5 utilized this most conservative flow value of 16/489cfs for the flood protection of the site. However, in response to CLV and NDOT comments, Reference 5 indicated that these flows are very conservative and do not represent the actual flows along the project site. In response to NDOT comments, Reference 5 illustrated that no flows are expected to be conveyed through Craig Road, east of intersection with Rancho Drive (i.e. following the findings of the Rancho/US95 LOMR). In addition, Reference 5 illustrated that the north half of Craig Road along the subject project site has the capacity to convey more than 324cfs. Thus, Reference 5 illustrated that any flows continuing easterly at the Rancho/Craig intersection will be contained within Craig Road north half. Therefore, Reference 5 illustrated that flows within the southern half of Craig Road along the project site will be limited to the local flows.

As shown in Figure E-12, the Northwest Neighborhood Study determined the flows continuing easterly at Rancho/Craig intersection into Craig Road to be 0/73cfs. As discussed previously, the more detailed and more current hydrologic and hydraulic analysis in Rancho/US95 LOMR determined no flows will continue easterly within Craig Road. However, as discussed in Reference 5, any flows continue easterly will be contained within Craig Road north half (with a flow capacity more than 324cfs). Thus, only local flows will be travelling along the south half of Craig Road along the project site.

Existing 6'x3'RCBCs across Rancho Drive

The LOMR study also provided the most current and detailed analysis for the flows through existing 6'x3'RCBCs across Rancho Drive. The existing RCBC crossing Rancho Drive at Station 21+64 is constructed within the existing UMC Quick Care Center, and will be referred to as the **Northern 6'x3' RCBC**. As shown in the attached copy of the approved plans for the "UMC Quick Care Center", the existing 6'x3' RCBC will divert (easterly) portion of the flows travelling southerly along the west side of Rancho Drive. Within the UMC, these Rancho Drive southerly flows are conveyed through an existing open channel within 90ft public drainage easement. As shown in referenced Exhibit C7R from the LOMR study, the HEC-RAS model along Rancho Drive determined the 100-year water surface elevation (WSE) near the entrance of the Northern 6'x3' RCBC to be 2278.18ft (at HEC-RAS Sta: 53+82).

As shown in the approved UMC Plans and the current topographic information for Rancho Drive, the upstream invert for the Northern 6'x3' RCB is approximately 2275.0ft. Thus, the

available 100-year headwater upstream the entrance of the 6'x3' RCB is approximately 3.0ft. The Rancho/US95 LOMR determined the 100-year flows diverted easterly through the 6'x3'RCB to be 78cfs, utilizing the available 100-year headwater and inlet control nomograph. Since the referenced nomogrph information from the Rancho/US95 LOMR was not available, Reference 5 provided the inlet control nomograph to confirm the diverted 78cfs through the Northern 6'x3' RCB.

The existing 6'x3' RCBC at Station 31+63 crosses Rancho Drive within the existing Pep Boys Auto Center, and will be referred to as **the Southern 6'x3' RCBC**. As shown in the attached copy of the approved plans for the "Rancho Town & Country Shopping Center", the existing 6'x3' RCBC will divert (easterly) portion of the flows travelling southerly along the west side of Rancho Drive. Within the Pep Boys development, these Rancho Drive southerly flows are conveyed through an existing 7' x 3' RCB storm drain. As shown in the attached relevant excerpts from the Rancho/US95 LOMR, the 100-year flows bypassing the existing Northern 6'x3' RCBC towards the existing 7'x3' RCB storm drain is determined to be approximately 121cfs. The Rancho/US95 LOMR determined the 100-year flows diverted easterly through the Southern 6'x3' RCBC to be 35cfs, utilizing the available 100-year headwater through the 7'x3' RCB and inlet control nomograph. Since the referenced nomogrph information from the Rancho/US95 LOMR was not available, Reference 5 provided inlet control nomograph to confirm the diverted 35cfs through the Southern 6'x3'RCBC. Reference 5 also provided a normal depth calculation for the 7'x3' RCB storm drain, to determine the available headwater the existing storm drain near the entrance of the Southern 6'x3' RCBC.

Craig Road Storm Drain

In Response to NDOT comments, the Murphy Express study (Reference 5) provided additional research for a better determination of the hydrologic analysis and hydraulic design for the existing 60"RCP Craig Road storm drain between Rancho Drive and Jones Boulevard. As shown in the attached relevant information from Reference 5, the most relevant information was provided in the 1992 'Hydrologic Study for Craig Road between US 95 and Decatur Boulevard' (will be referred to as Craig Study). **The Craig Study provided hydrologic analysis for the existing and ultimate flows continuing easterly within Craig Road. The Craig Study also established the design flows for the existing Craig Road storm drain and provided hydraulic design for the storm drain system.**

As shown in the attached excerpts, the Craig Study determined the total flows (i.e. Surface & Storm Drain) at the Craig/Rancho intersection as combination point RNHCRG(223/581cfs). The Craig study also determined the flows continuing easterly along Craig Road (just downstream the intersection) as diversion card CRGDIV(223/349cfs, Q10/Q100). The Craig Study also determined that the Craig storm drain is designed to convey 210cfs (for the 10-, 25- and 100-year events) from the combined flows at CRGDIV (also labeled as CRG.RNCH). Utilizing the 25-Year Rainfall Depth Ratio of 0.74 to the 100-year Rainfall Depth, Reference 5 estimated the 25-year flows at CRG.RNCH to be 258cfs (i.e. 0.74 x 349cfs). Thus, the Craig Study determined the bypassed surface flows continuing easterly in Craig Road just east of Rancho Drive to be 13cfs/48cfs/139cfs (Q10/Q25/Q100). **However, since the surface flows are draining onto Craig/Rancho intersection from the north, the Craig Study (similar to other studies in the vicinity) determined these bypassed flows to continue within the north half of Craig Road.**

As shown in the attached referenced HEC-1 from the Craig Study, the watershed area contributing to the flows at Craig/Rancho intersection (combination point RNHCRG) is determined to be more than 60square miles (and will be reduced to approximately 25square miles in the future). The peak time for referenced combination point RNHCRG and diversion card CRG.RNCH is approximately 5.92hours and 7.50hours for the 10-year and 100-year storm events, respectively. As shown in the as-built plans for Craig Road storm drain and the referenced hydraulic model from the Craig Study, the larger drop inlets were constructed within the north half of Craig Road. Minimum size drop inlets (without grates) were constructed along the south half of Craig Road along the project site to intercept any minimal local flows.

Due to the very large difference in the storm drain runoff peak time and the small local flows draining onto the south half of Craig Road, any local flows intercepted and conveyed into the southern laterals are not expected to contribute to the peak flows in the storm drain. As shown in the as-built plans, only contributions from the north laterals incrementally increased the design flow for the 60"RCP storm drain from 210cfs(at Rancho) to 290cfs (at Jones). **Thus, future local flows intercepted from the subject project site will not contribute to (or significantly impact) the design flow for the Craig Road storm drain.**

Jones Boulevard Storm Drain

There is an existing 36"/48"RCP storm drain within Jones Boulevard along the subject property. The storm drain was constructed per the 1998 "Technical Drainage Study for Jones Boulevard-Centennial to Rancho" (DS 2378). As shown in the attached relevant information, the

storm drain was designed to intercept 79cfs and convey the flows northerly to drain into the existing 60"RCP Craig Road storm drain. There is an existing low point within Jones Boulevard at the intersection with Hickam Avenue. The Jones Boulevard storm drain system included 5 drop inlets at the low point to intercept the majority of these flows.

Runoff flows crossing underneath Rancho Drive through the existing 6'x3' RCBCs will drain towards Jones Boulevard low point. In addition, the majority of the flows generated through the subject property will also drain towards Jones low point. The Northwest Neighborhood study assumed the runoff flows exceeding the Jones storm drain capacity to continue northerly towards Craig Road. However, as will be discussed in following sections, the topographic information indicates that runoff flows exceeding the Jones storm drain design capacity will continue easterly into Hickam Avenue.

Hydrologic and Hydraulic analysis for Existing Condition

The HEC-1 Flood Hydrograph Package is utilized in the subject master study to determine the relevant onsite and offsite runoff flows for the project. The HEC-1 model is based on the HEC-1 model from the Rancho/US95 LOMR study. As mentioned before, the hydrologic analysis for the subject watershed represents the most current and detailed analysis. As discussed previously, the LOMR HEC-1 model analyzed the flows continuing southeasterly along Rancho Drive, south of Rancho/Craig intersection, as combination point 2C2B3(Q100=199cfs). The LOMR HEC-1 model also modeled the combined flows diverted through the existing 2:6'x3'RCBCs across Rancho as diversion card D5RCHO(Q100=113cfs, i.e. = 78cfs+35cfs). The subject HEC-1 model

utilizes the entire portion of the LOMR HEC-1 model up to the diversion card D5RCHO.

As shown in the attached figures A-1 and A-2 for NDOT Roadway Functional Classification, Craig Road and Rancho Drive are classified as 'Other Principal Arterial'. As shown in the attached Table 3-1 (Roadway Surface Drainage Facilities) from the 2006 NDOT Drainage Manual, the minimum design return frequency for Craig Road and Rancho Drive is the 25-year storm. Therefore, the subject HEC-1 model analyzes the 25-year storm, in addition to the 10- and 100-year storm events.

The 1-ft topographic map is utilized to delineate the subject property into four basins, labeled as NX1(21/31/46cfs, Q10/Q25/Q100), NX2(16/23/34cfs), NX3(15/21/30cfs) and NX4(3/5/7cfs). The delineation of the onsite basins and immediate offsite basin is depicted in Exhibit DR1, labeled as the 'Onsite Drainage Map, Existing Condition'. Onsite basins NX1 and NX2 represents the portion of the site draining easterly and northeasterly towards Jones Boulevard low point. Onsite NX3 represents the portion of the site draining northeasterly towards Craig Road. Onsite NX4 represents the portion of the site draining onto Jones Boulevard, north of the existing high point.

The eastern half of Rancho Drive along the project site is delineated as offsite basins RNCH1(4/5/7cfs) and RNCH2(3/4/6cfs). Similarly, the eastern and western halves of Jones Boulevard draining onto the low point are delineated as basins JONES1(4/5/7cfs) and JONES2(3/4/6cfs). The eastern half of Jones Boulevard draining northerly towards Craig Road is

delineated as offsite basin JONES3(1/2/2cfs). The southern half of Craig Road along the project site is delineated as offsite basins CRAIG1(3/3/5cfs) and CRAIG2(2/2/3cfs).

As shown in the attached excerpts from Reference 5, the majority of the proposed Murphy Express site was delineated as basin NDA(2/3/4cfs). Since Murphy Express improvements are currently under construction, basin NDA is utilized to represent the existing condition. The subject referenced basin was designed to be intercepted and conveyed into the existing 60"RCP Craig storm drain, through an existing 18"RCP lateral. Thus, referenced basin NDA does not contribute to the surface flows in Craig Road. However, the referenced basin was included in the HEC-1 model.

As shown in the attached output from the HEC-1 model and Exhibit DR1, runoff from RNCH1 is combined with NX1 at CMX1(24/36/53cfs). Similarly, runoff from RNCH2 is combined with NX2 at CMX2(19/27/39cfs). Runoff from CMX1, CMX2 and JONES1 is combined at LOCL-X(45/65/96cfs), which represents the local flows draining towards Jones Boulevard low point from the west. As discussed previously, runoff from the existing 2: 6'x3'RCBCs Rancho culverts is modeled as referenced combination point D5RCHO(20/35/113cfs, DARF= 0.90). Runoff from D5RCHO travels through the site and combine with LOCL-X at combination point TOTL-X(49/81/181cfs), which represents the total flows draining onto Jones Boulevard low point from the west.

The diversion card labeled as JONES-SD(49/79/79cfs) is provided to divert the design flow capacity into the existing 36"/48"RCP Jones storm drain. Thus, the remaining surface flows

exceeding the storm drain capacity is modeled as LOWPNT-X(0/2/102cfs). Runoff from LOWPNT-X is combined with JONES2 at HICKAM-X(3/5/105cfs), which represents the total flows continuing easterly in Hickam Avenue at the intersection with Jones Boulevard.

Runoff from CRAIG1 and CRAIG2 is combined with NX3 at combination point CRG1-X(18/26/36cfs), which represents the total flows conveyed within the southern half of Craig Road along the project site. Runoff from NX4 is combined with JONES3 at combination point JON-X(5/6/9cfs). Runoff from CRG1-X and JON-X is combined at CRG2-X(23/31/44cfs), which represents the total flows conveyed within the southern half of Craig Road at the intersection with Jones Boulevard.

Normal depth calculations are being provided for Rancho Drive eastern half (sections AA and BB), Craig Road southern half (sections CC and DD) and Jones Boulevard western half (section EE). As shown in the attached FlowMaster output, flows within all perimeter streets are well below the maximum allowable velocity x depth (v x d) values of 6.0 and 8.0 during 10- and 100-year storm events, respectively. Flows within Rancho Drive and Craig Road also meets the minimum 12-ft dry lane requirement during the 10-year storm events, whereas Jones Boulevard does not meet the minimum 12-ft dry lane requirement.

As stated previously, Rancho Drive and Craig Road are NDOT right-of-way, which is classified as 'Other Principal Arterial' roadway. As shown in the attached excerpts from the '2006 NDOT Drainage Manual', Rancho and Craig are required to satisfy the ½ lane maximum allowable

spread during the 25-year storm events. Therefore, normal depth calculations for the perimeter streets also utilize the 25-year storm events. As shown in the FlowMaster output, Rancho Drive satisfies the NDOT required maximum allowable 25-year spread, whereas the downstream segment of Craig Road does not satisfy the 25-year allowable spread.

2.2 Interim Drainage Condition

For interim condition, the offsite flows remain as determined and discussed in the existing condition. **No improvements are being proposed with this Master Drainage Study. However, to establish the future drainage pattern for the ultimate development of the site, the entire property is assumed to be developed in this interim condition. A conceptual grading plan is also being provided to illustrate the recommended future pattern for the subject property.**

The conceptual grading contours are utilized to delineate the subject property into five basins, labeled as ND1(45/60/81cfs), ND2(26/34/46cfs), ND3-1(10/13/17cfs), ND3-2(5/6/8cfs) and ND4(4/6/8cfs). The delineation of the onsite basins and immediate offsite basin is depicted in Exhibit DR2, labeled as the 'Onsite Drainage Map, Developed Condition'. Similar to existing pattern, onsite basins ND1 and ND2 represents the future portion of the site draining easterly and northeasterly towards Jones Boulevard low point. Onsite basins ND3-1 and ND3-2 represent the future portion of the site draining northeasterly towards Craig Road. Onsite basin ND4 represents the future portion of the site draining onto Jones Boulevard, north of the existing high point.

The perimeter street offsite basins delineation remains as described in the existing

condition. As shown in the attached output from the HEC-1 model and Exhibit DR2, runoff from RNCH1 is combined with ND1at CMD1(48/63/86cfs). Similarly, runoff from RNCH2 is combined with ND2 at CMD2(28/37/51cfs). Runoff from CMD1, CMD2 and JONES1 is combined at LOCL-D(80/105/144cfs), which represents the future local flows draining towards Jones Boulevard low point from the west. As discussed previously, runoff from the existing 2: 6'x3'RCBCs Rancho culverts is modeled as referenced combination point D5RCHO(20/35/113cfs, DARF= 0.90). Runoff from D5RCHO travels through the site and combine with LOCL-D at combination point TOTL-D(71/100/175cfs), which represents the future total flows draining onto Jones Boulevard low point from the west.

Similar to the existing analysis, the diversion card labeled as JONES-SD(71/79/79cfs) is provided to divert the design flow capacity into the existing 36"/48"RCP Jones storm drain. Thus, the remaining surface flows exceeding the storm drain capacity is modeled as LOWPNT-D(0/21/96cfs). Runoff from LOWPNT-D is combined with JONES2 at HICKAM-D(3/24/99cfs), which represents the total flows continuing easterly in Hickam Avenue at the intersection with Jones Boulevard upon the ultimate development of the subject property. **Comparison between at HICKAM-X(3/5/105cfs) and HICKAM-D(3/24/99cfs) illustrates that the ultimate development of the subject property will not increase the 10-year or 100-year flows continuing easterly through Hickam Avenue.**

As discussed previously, the Jones Boulevard storm drain system included 5 drop inlets at the low point to intercept the majority of these flows. Flow capacity calculation is provided for

these existing drop inlets, for the existing and ultimate conditions. Since the drop inlets are in sump condition, the calculation utilizes the Orifice Equation for the determination of the required ponding depth. Per the CCRFCD Drainage Design Manual, the calculation assumes the grates are 50% clogged during the storm event. In addition, the calculations assume approximately 60% of the grates' area is blocked by the grate's steel.

Runoff from CRAIG1 is combined with ND3-1 at combination point CRG0-D(12/16/22cfs). Runoff from CRG0-D is combined with CRAIG2 and ND3-2 at combination point CRG1-D(18/24/33cfs), which represents the total flows conveyed within the southern half of Craig Road upon the ultimate development of the subject property. **Comparison between at CRG1-X(18/26/36cfs) and CRG1-D(18/24/33cfs) illustrates that the ultimate development of the subject property will not increase the 10-year, 25-year or 100-year flows within the southern half of Craig Road.** However, if ND3-1 is to drain directly onto Craig Road at CRG0-D, it is expected to further increase the 25-year spread within Craig Road, which may not be acceptable for NDOT. Thus, it is expected that the ultimate development of ND3-1 will either utilize the existing 18"RCP lateral to drain directly into the Craig storm drain, or contain the flows onsite before it drains onto Craig Road near CRG1-X.

Runoff from ND4 is combined with JONES3 at combination point JON-D(6/7/10cfs). Runoff from CRG1-D and JON-D is combined at CRG2-D(24/31/43cfs), which represents the total flows conveyed within the southern half of Craig Road at the intersection with Jones Boulevard upon the ultimate development of the subject property.

Normal depth calculations are being provided for Rancho Drive eastern half (sections AA and BB), Craig Road southern half (sections CC and DD) and Jones Boulevard western half (section EE). As shown in the attached FlowMaster output, flows within all perimeter streets are well below the maximum allowable velocity x depth (v x d) values of 6.0 and 8.0 during 10- and 100-year storm events, respectively. Flows within Rancho Drive and Craig Road also meets the minimum 12-ft dry lane requirement during the 10-year storm events. Similar to the existing condition, flows within Jones Boulevard at section EE will not meet the minimum 12-ft dry lane requirement. The calculations determined the maximum 10-year flows along Jones Boulevard that will satisfy the 12ft dry lane requirement to be approximately 18cfs. Thus, it is expected that future drop inlet(s) will be proposed along Jones Boulevard to intercept at least 29cfs (i.e. 47cfs -18cfs) during the 10-year storm events.

As stated previously, Rancho Drive and Craig Road are required to satisfy the ½ lane maximum allowable spread during the 25-year storm events. Therefore, normal depth calculations for the perimeter streets also utilize the 25-year storm events. As shown in the FlowMaster output, upon the construction of curbs, Rancho Drive will satisfy the NDOT required maximum allowable 25-year spread at section AA. However, at section BB, the flows at Rancho Road will not meet the 25-year allowable spread. Thus, future on-grade drop inlet(s) is expected to be required along Rancho Drive near section BB to satisfy the maximum allowable spread during the 25-year storm events. The HY-22 program is utilized to provide preliminary sizing of the future drop inlet along Rancho Drive. As shown in the attached HY-22 output, a future 20ft modified type C drop inlet is anticipated near section BB along Rancho Drive. Similar to the existing condition, Craig Road does not satisfy the 25-year allowable spread at section DD.

2.3 Future Drainage Condition

Since reference flows for perimeter streets and existing Rancho 6' x 3'RCBCs were determined assuming fully developed (worst case) conditions, the future offsite conditions remain as described in the interim conditions.

2.4 Master Planning Information

The "*2008 Las Vegas Valley Flood Control Master Plan Update*" (2008 MPU, Reference 2), dated September 2008, as prepared by Post Buckley Schuh and Jernigan, Inc. (PBS&J), in association with Louis Berger Group and Parsons Brinckerhoff, illustrates the existing and proposed regional master planned facilities. The CCRFCD Flood Control Facility Maps and Inventory Tables have also been updated in 2013. Review of Figure F-20 of the updated 2013 MPU indicates that the future CCRFCD facility labeled as GOAL0111 borders the project site along Rancho Drive. The facility is identified as future 10'x8'RCB storm drain as part of the Gowan Outfall – Alexander Road Facilities.

2.5 Floodplain Information

The project site is covered by Flood Insurance Rate Map (FIRM) for the Clark County, Nevada, and incorporated areas, Community Panel Number: 32003C2155F, Effective Date: November 16, 2011. Review of the FIRM indicates that subject project site falls entirely within Zone "X", described by FEMA as: "*Areas determined to be outside the 0.2% annual chance floodplain.*" Figure 2 in Appendix C illustrates the location of the site on a portion of the referenced FIRM.

2.6 Previous Drainage Studies

The overall area is covered within the CCRFCD "*2008 Las Vegas Valley Flood Control Master Plan Update, Volume I and II*" (Reference 2) and the Natural Resources Conservation Service (NRCS), "*1985 Soil Survey of the Las Vegas Valley*", Issued in July 1985, in conjunction with the Web Soil Survey (Reference 3). The site is also covered in the FIRM for the Clark County, Nevada and incorporated areas, Community Panel Number: 32003C2155F, Effective Date: November 16, 2011.

The most current and relevant discussions for the area was provided in the "*Technical Drainage Study for Murphy Express*" (DS4471, Reference 5) by Lochsa Engineering, approved by the CLV on February 3, 2016. Reference 5 utilized the information from the 2009 Rancho//US95 LOMR, which provided the most detailed and current hydrologic an d hydraulic analysis for the offsite flows impacting the project site and perimeter streets.

Lochsa Engineering generally concurs with all the pertinent referenced analyses utilized in this study.

3. PROPOSED DRAINAGE FACILITIES

3.1 General Description

No improvements are being proposed with this master drainage study. However, to establish the future drainage pattern for the ultimate development of the site, the development of the entire property is being examined. A conceptual grading plan is also being provided to

illustrate the recommended future pattern for the subject property. The proposed ultimate onsite runoff has been designed to follow as much as possible the existing drainage pattern.

3.2 Compliance with Regulations and Adopted Plans

The hydrologic analysis and drainage design of this development is in compliance with local requirements, including the CCRFCD "*Hydrologic Criteria and Drainage Design Manual*" (HCDDM) (Reference 1), and the CCRFCD "*2008 Las Vegas Valley Flood Control Master Plan Update*" (Reference 2). The site design is also in compliance with the Natural Resources Conservation Service (NRCS) Web Soil Survey and the 1995 SCS Soil Survey of Las Vegas Area (Reference 3), as well as FEMA's FIRM with panel number 23003C2155F (Reference 4).

3.3 Hydrologic Criteria

The onsite and offsite basins of the subject project area all fall within the Gowan watershed. The hydrologic and hydraulic analyses presented in this report are carried out in accordance with the CCRFCD's HCDDM (Reference 1). The rainfall values used for the hydrologic analysis of the site represent the 10-year, 25-year and 100-year storm recurrence events, each with six-hour duration. The site is within the boundary for using the McCarran Airport Rainfall Data. Therefore, point precipitation values were determined using Table 505 of the HCDDM. The adjusted point rainfall values for the 6-hour, 10-year, 25-year and 100-year storm events are determined from Table 505 as 1.58, 2.05 and 2.77 inches, respectively.

The rainfall losses due to infiltration, interception, etc. are represented using the SCS curve number (CN) method recommended in the CCRFCD HCDDM (Reference 1). The SCS method divides the soils into four hydrologic groups as A, B, C and D. A review of the 2008 MPU's Figure H-20(Reference 2) indicates that the site and the local upstream watershed is located within the hydrologic soil group D. The NRCS Web Soil Survey and the 1995 SCS Soil Survey of Las Vegas Area (Reference 3) also indicates that the subject site and local watershed is entirely located within the hydrologic soil group D, defined as soils with "very low infiltration rate, high runoff potential". Therefore, the soil group type D is being utilized in this study following the NRCS determination. The CN values for the different land use are determined from Table 602 of the CCRFCD HCDDM. The runoff hydrograph is determined for each sub-basin using the Soil Conservation Service (SCS) unit hydrograph method. Calculations used in the hydrologic analysis for the offsite and onsite basins for existing and proposed conditions are attached in Appendix A.

3.4 Facility Design Calculations

No improvements are being proposed with this master drainage study. However, preliminary sizing of future facilities and analysis of existing facilities have been designed in accordance with the CCRFCD "*Hydrologic Criteria and Drainage Design Manual*" (Reference 1). The onsite drainage plan has been developed to closely resemble existing drainage patterns, and to minimize any impact to the adjacent properties.

4. CONCLUSIONS AND RECOMMENDATIONS

1. This project is in compliance with the applicable drainage laws as recognized by the State of Nevada.
2. This project is in compliance with the CCRFCD "2008 Las Vegas Valley Flood Control Master Plan", as well as the CCRFCD "*Hydrologic Criteria and Drainage Design Manual*".
3. The site is located entirely within areas designated by FEMA as Zone "X", described by FEMA as "*Areas determined to be outside the 0.2% annual chance floodplain.*"
4. No improvements are being proposed with this master drainage study. However, the study establishes the future drainage pattern for the ultimate development of the site. A conceptual grading plan is also being provided to illustrate this recommended future pattern for the subject property.
5. Comparison between the existing and ultimate development of the site illustrates that the established future drainage pattern will not introduce negative impact to the perimeter streets or downstream properties.

5. REFERENCES

1. Clark County Regional Flood Control District, "*Hydrologic Criteria and Drainage Design Manual*", August 1999.

2. Post Buckley, Schuh & Jernigan (PBS&J), Inc., in association with, G. C. Wallace Inc, and Louis Berger Group, "*2008 Las Vegas Valley Flood Control Master Plan Update, Volume 1 and II*", September 2008.

3. Natural Resources Conservation Service (NRCS), "*1985 Soil Survey of the Las Vegas Valley*", Issued July 1985, in conjunction with the Web Soil Survey.

4. Federal Emergency Management Agency, "*Flood Insurance Rate Maps; Community Panel Number 32003C2155F; Clark County, Nevada and Incorporated Areas*", dated November 16, 2011.

5. Lochsa Engineering, "*Technical Drainage Study for Murphy Express*" (DS4471), approved by the City of Las Vegas on February 03, 2016.

Street Flow Summary
(Existing Condition)

10-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [v] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d]	Dry Lane Width (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	38	3.18	0.79	2.51	5.11

Street Flow Summary
(Existing Condition)

100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.96
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	36	5.25	0.58	3.05
Jones Boulevard	100	EE	73	3.91	0.96	3.75

Street Flow Summary
(Future Condition)

10-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [v] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d]	Dry Lane Width (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	47	3.37	0.85	2.86	2.63

Street Flow Summary
(Future Condition)

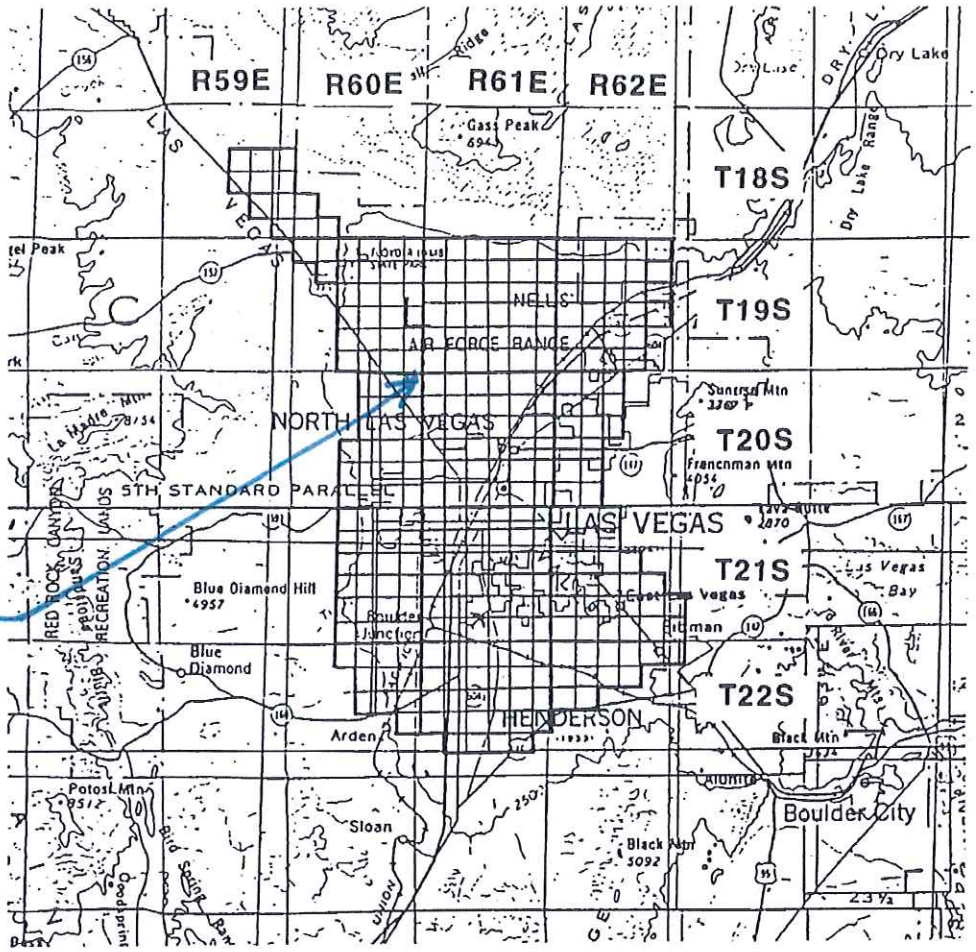
100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.96
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	33	5.17	0.56	2.90
Jones Boulevard	100	EE	85	4.15	1.00	4.15

APPENDIX A

HYDROLOGIC ANALYSIS

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

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

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

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

NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

WRC ENGINEERING	REFERENCE: USACE, Los Angeles District, 1988	TABLE 505

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					

See Table 602A

Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

1 Average runoff condition, and $I_a = 0.2S$.

2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using Figure 603.

3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

4 Composite CN's for natural desert landscaping should be computed using Figure 603 based on the impervious area percentage (CN #98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.

5 Composite CN's to use for the design of temporary measures during grading and construction should be computed using Figure 603 based on the degree of development impervious area percentage) and the CN's for the newly graded pervious areas.

Revision	Date

RUNOFF CURVE NUMBERS
(SEMIARID RANGELANDS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and $I_a = 0.2S$.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

Revision	Date

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

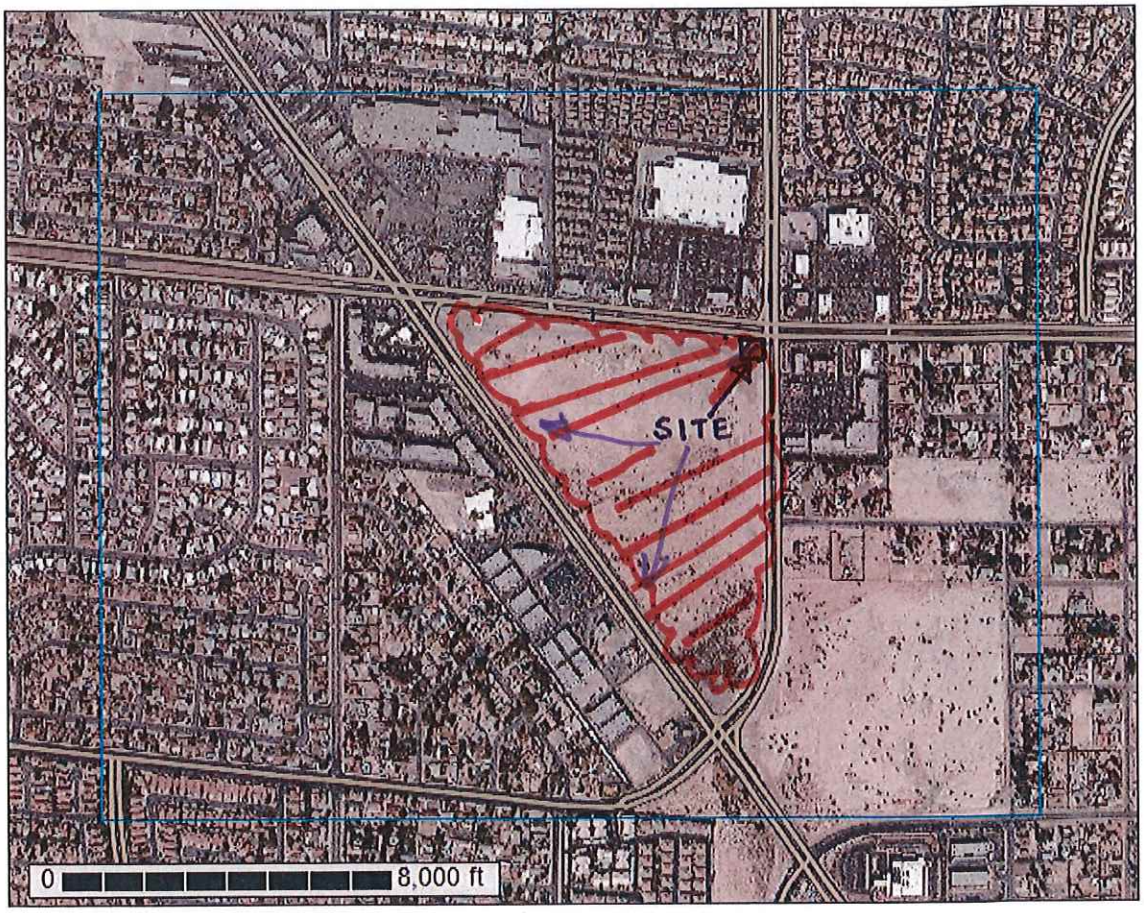
United States Department of Agriculture

NRCS

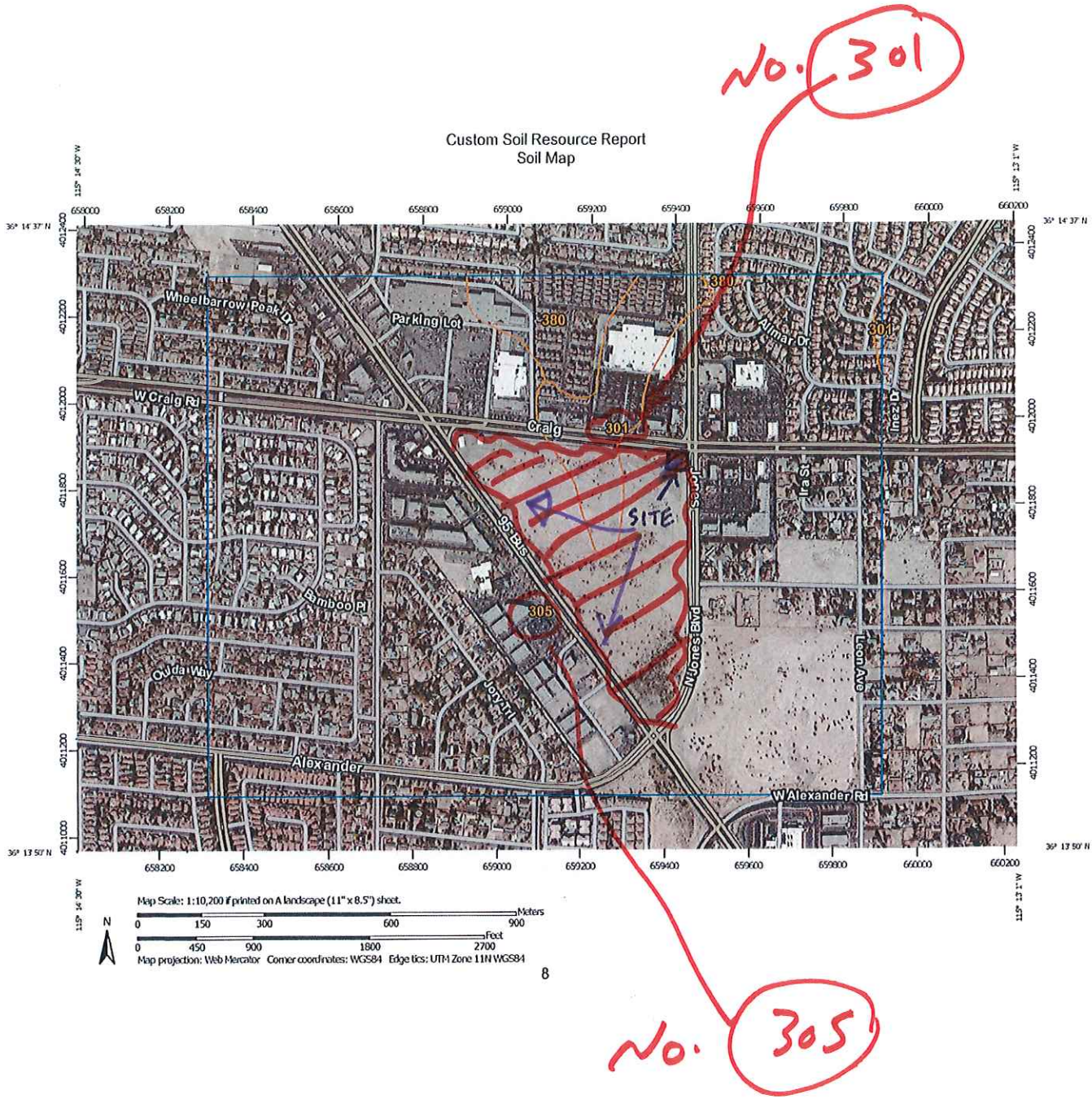
Natural Resources Conservation Service

A product of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local participants

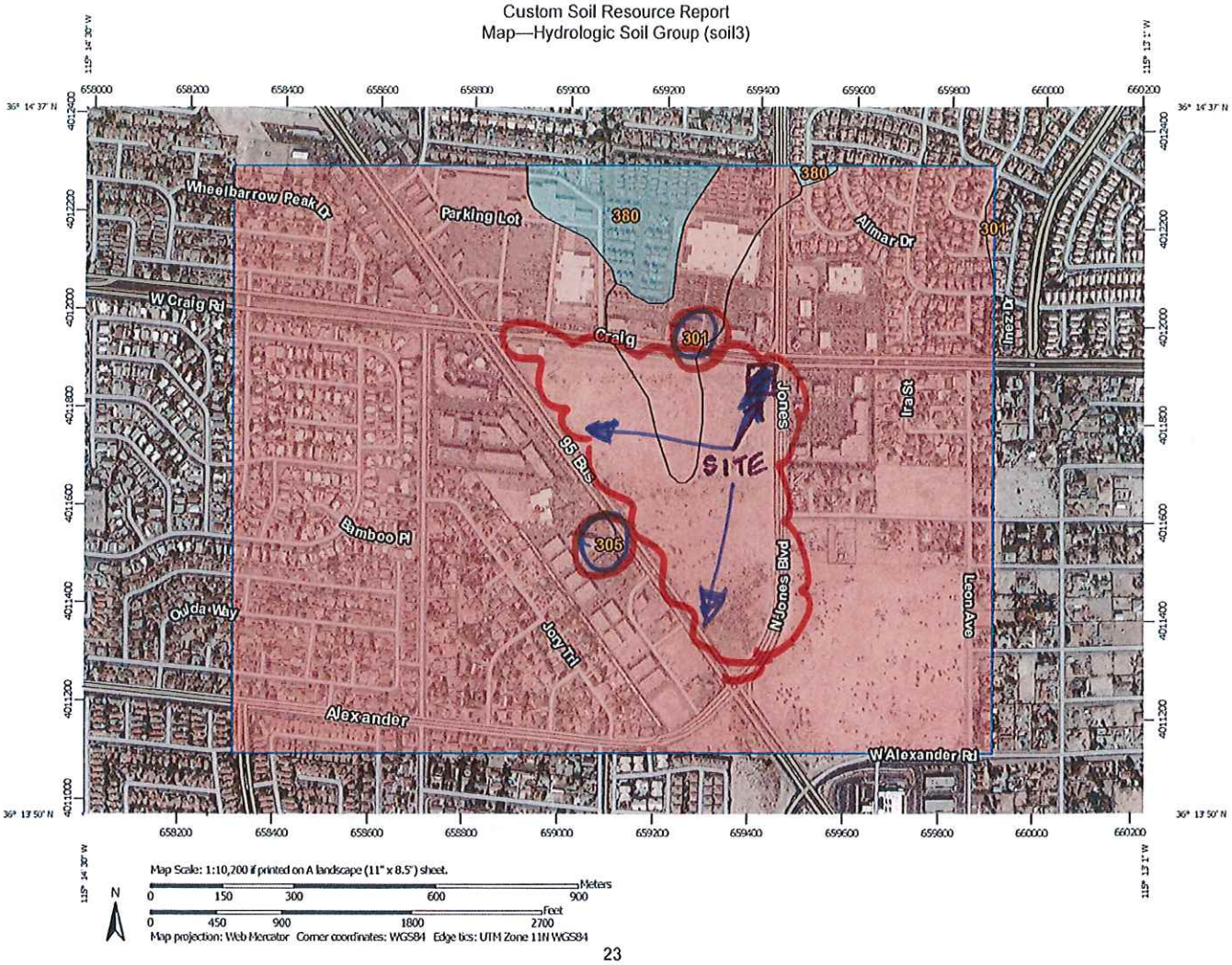
Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County



September 10, 2015


NO. 301
Custom Soil Resource Report
Soil Map
Wheelbarrow Peak Dr
Parking Lot
380
Almar Dr
301
W Craig Rd
Craig
Jones St
SITE
95 Bus
Bamboo Pl
305
W Jones Blvd
Leon Ave
Ojeda Way
Joy Ln
Alexander
W Alexander Rd
Map Scale: 1:10,200 if printed on A landscape (11" x 8.5") sheet.
Meters
Feet
Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84
NO. 305

Custom Soil Resource Report
Map—Hydrologic Soil Group (soil3)



Las Vegas Valley Area, Nevada, Part of Clark County

301—Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrbq
Elevation: 1,800 to 2,600 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 63 to 68 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

Las vegas and similar soils: 100 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Las Vegas

Setting

Landform: Basin-floor remnants
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone

Typical profile

H1 - 0 to 1 inches: gravelly fine sandy loam
H2 - 1 to 7 inches: fine sandy loam
H3 - 7 to 11 inches: gravelly sandy clay loam
H4 - 11 to 15 inches: indurated

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: 3 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 85 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)

305—Las Vegas-DeStazo complex, 0 to 2 percent slopes

Map Unit Setting

National map unit symbol: hrbs
Elevation: 1,400 to 5,200 feet
Mean annual precipitation: 3 to 10 inches
Mean annual air temperature: 55 to 70 degrees F
Frost-free period: 180 to 300 days
Farmland classification: Not prime farmland

Map Unit Composition

Las vegas and similar soils: 60 percent
Destazo and similar soils: 25 percent
Minor components: 15 percent
Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Las Vegas

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone

Typical profile

H1 - 0 to 2 inches: gravelly fine sandy loam
H2 - 2 to 8 inches: fine sandy loam
H3 - 8 to 12 inches: gravelly sandy clay loam
H4 - 12 to 16 inches: indurated

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 3 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 85 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Very low (about 1.6 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)

Description of Destazo

Setting

Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Mixed alluvium

Typical profile

H1 - 0 to 11 inches: fine sandy loam
H2 - 11 to 51 inches: very gravelly sandy clay loam
H3 - 51 to 62 inches: sandy loam

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Well drained
Runoff class: Low
Capacity of the most limiting layer to transmit water (Ksat): Moderately low to moderately high (0.14 to 0.57 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 40 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 4.8 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)

Minor Components

Skyhaven

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: SHALLOW LIMESTONE SLOPE 5-8 P.Z. (030XB030NV_2)

Glencarb

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: LOAMY BOTTOM (030XB020NV)

Bluepoint

Percent of map unit: 5 percent
Landform: Sand sheets, fan piedmonts
Down-slope shape: Linear, convex
Across-slope shape: Linear, convex
Other vegetative classification: LIMY SAND 5-7" P.Z. (030XB037NV_2)

Table—Hydrologic Soil Group (soil2)

Hydrologic Soil Group— Summary by Map Unit — Las Vegas Valley Area, Nevada, Part of Clark County (NV788)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
301	Las Vegas gravelly fine sandy loam, 2 to 4 percent slopes	D	24.8	5.2%
305	Las Vegas-DeStazo complex, 0 to 2 percent slopes	D	434.6	91.2%
380	Skyhaven very fine sandy loam, 0 to 4 percent slopes	C	17.2	3.6%
Totals for Area of Interest			476.5	100.0%

Rating Options—Hydrologic Soil Group (soil2)

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

Hydrologic Soil Group (soil3)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

HYDROLOGIC PARAMETERS

DEVELOPMENT: Craig Rancho Master Study
CALCULATED BY: HN
PROJECT NUMBER: 161051

DATE: August 24, 2016

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)			TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL tc	REMARKS			
DESIGN (1)	K (2)	AREA Ac (3)	AREA Sq. Mile (4)	LENGTH Ft (5)	SLOPE % (6)	ti Min (7)	LENGTH Ft (8)	SLOPE % (9)	VELOCITY FPS (10)	tt Min (11)	TOTAL LENGTH Ft (12)	tc =(L/180)+10 Min (13)	Min (14)	CN (15)	tL Hrs (16)	Urbanized? (17)	Soil Type (18)
NX1	0.8191	22.30	0.034839	200	1.5	6.2	1,760	1.3	1.9	15.8	-	-	22.0	91.6	0.220	NO	D
NX2	0.8189	14.07	0.021982	160	1.3	5.9	930	1.1	1.6	9.5	-	-	15.5	91.6	0.155	NO	D
NX3	0.8508	11.52	0.018005	100	2.5	3.3	1570	2.2	2.0	12.8	-	-	16.1	94.0	0.161	NO	D
NX4	0.8508	2.35	0.00366	100	2.0	3.6	330	2.1	1.2	4.4	-	-	8.0	94.0	0.100	NO	D
RNCH1	0.9036	2.27	0.003554	70	2.0	2.3	1410	0.9	2.3	10.2	1,480	18.2	12.5	98.0	0.125	YES	D
RNCH2	0.9036	1.94	0.003039	70	2.0	2.3	1300	0.6	1.9	11.3	1,370	17.6	13.7	98.0	0.137	YES	D
JONES1	0.9036	2.20	0.003436	55	2.0	2.1	1155	0.8	2.2	8.9	1,210	16.7	10.9	98.0	0.109	YES	D
JONES2	0.9036	2.04	0.003192	90	2.0	2.7	1190	0.8	2.1	9.6	1,280	17.1	12.3	98.0	0.123	YES	D
JONES3	0.9036	0.71	0.00111	55	2.0	2.1	490	0.4	1.2	6.6	545	13.0	8.7	98.0	0.087	YES	D

ti = 1.8 (1.1 - K) L^(0.5) / S^(1/3)

K = 0.0132 CN - 0.39

tt = L / (60 V)

tc = ti + tt

tL= tLAG = 0.6 tc

LOCATION: Onsites and Offsites
HYDROLOGIC CONDITION: Existing and Developed

TRIAL: Final Iteration

AVERAGE VELOCITY

Input Variables	Basin NX1	Basin NX2	Basin NX3	Basin NX4			Basin RNCH1	Basin RNCH2		Basin JONES1	Basin JONES2	Basin JONES3				
Bottom Width, B, (ft):	10.0	10.0	10.0	20.0			2.0	2.0		2.0	2.0	2.0				
Right Side Slope, Zr:	50	50	50	50			50	50		50	0	50				
Left Side Slope, Zl:	50	50	50	50			0	0		0	50	0				
Manning's n:	0.035	0.035	0.035	0.035			0.015	0.015		0.015	0.015	0.015				
Geometric Slope, So (ft/ft):	0.013	0.011	0.022	0.021	0.000	0.000	0.009	0.006	0.000	0.008	0.008	0.004	0.000	0.000	0.000	0.000
Flowrate, Q (cfs) *:	23	17	15	3.5			3.5	3		3.5	3	1				
							Output Variables									
Normal Depth, Yn (ft):	0.41	0.37	0.30	0.11			0.21	0.21		0.22	0.20	0.14				
Area of Flow, A, (sf):	12.38	10.46	7.36	2.80			1.51	1.57		1.61	1.45	0.81				
Velocity, V (fps):	1.86	1.63	2.04	1.25			2.31	1.91		2.17	2.07	1.24				
Wetted Perimeter, p (ft):	50.76	46.82	39.65	30.99			12.67	12.89		13.07	12.42	9.34				
Hydraulic Radius, Rh (ft):	0.24	0.22	0.19	0.09			0.12	0.12		0.12	0.12	0.09				
Free SurfaceTop Width, T (ft):	50.75	46.82	39.64	30.99			12.46	12.68		12.85	12.21	9.20				
Centroid, Y*, (ft):	0.16	0.14	0.12	0.05			0.08	0.08		0.08	0.08	0.06				

*** NOTE : HALF OF THE 100-YEAR STORM RUNOFF FLOWS IS USED TO DETERMINE THE BASIN TRAVEL VELOCITY REQUIRED FOR THE LAG TIME CALCULATIONS**

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **NX1**
Total Area: 22.30 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Newly graded area (pervious area only, no vegetation)	13.38	D	60%	94	56.4
Desert Shrub: Poor Condition	8.92	D	40%	88	35.2
Total:	22.30	-	100%	-	91.6

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **NX2**
Total Area: 14.07 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Newly graded area (pervious area only, no vegetation)	8.41	D	60%	94	56.2
Desert Shrub: Poor Condition	5.66	D	40%	88	35.4
Total:	14.07	-	100%	-	91.6

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **NX3**
Total Area: 11.52 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Newly graded area (pervious area only, no vegetation)	11.52	D	100%	94	94.0
Total:	11.52	-	100%	-	94.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **NX4**
Total Area: 2.35 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Newly graded area (pervious area only, no vegetation)	2.35	D	100%	94	94.0
Total:	2.35	-	100%	-	94.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: RNCH1
Total Area: 2.27 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.27	D	100%	98	98.0
Total:	2.27	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: RNCH2
Total Area: 1.94 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.94	D	100%	98	98.0
Total:	1.94	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: JONES1
Total Area: 2.20 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product (CN x P)
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.20	D	100%	98	98.0
Total:	2.20	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: JONES2
Total Area: 2.04 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product (CN x P)
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.04	D	100%	98	98.0
Total:	2.04	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: JONES3
Total Area: 0.71 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product (CN x P)
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.71	D	100%	98	98.0
Total:	0.71	-	100%	-	98.0

DEVELOPMENT: Craig Rancho Master Study
CALCULATED BY: HN
PROJECT NUMBER: 161051

DATE: August 24, 2016

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)			TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL tc	REMARKS			
DESIGN (1)	K (2)	AREA Ac (3)	AREA Sq. Mile (4)	LENGTH Ft (5)	SLOPE % (6)	ti Min (7)	LENGTH Ft (8)	SLOPE % (9)	VELOCITY FPS (10)	tt Min (11)	TOTAL LENGTH Ft (12)	tc =(L/180)+10 Min (13)	Min (14)	CN (15)	tL Hrs (16)	Urbanized? (17)	Soil Type (18)
ND1	0.9036	26.52	0.041433	200	1.5	4.4	1,760	1.3	4.8	6.1	1,960	20.9	10.5	98.0	0.105	YES	D
ND2	0.9036	14.07	0.021982	160	1.3	4.2	930	1.1	3.9	3.9	1,090	16.1	8.1	98.0	0.081	YES	D
ND3-1	0.9036	4.96	0.007748	80	2.0	2.5	760	1.3	3.3	3.8	840	14.7	6.3	98.0	0.063	YES	D
ND3-2	0.9036	2.33	0.00364	80	2.0	2.5	470	2.1	3.3	2.4	550	13.1	4.9	98.0	0.050	YES	D
ND4	0.9036	2.35	0.003664	100	2.0	2.8	330	2.1	3.4	1.6	430	12.4	4.4	98.0	0.050	YES	D
	0.9036	50.22	0.078465			#####			#N/A	0.0	0	10.0	#####	98.0	#DIV/0!		
CRAIG1	0.9036	1.52	0.002368	60	2.0	2.2	1140	1.2	2.4	8.0	1,200	16.7	10.2	98.0	0.102	YES	D
CRAIG2	0.9036	0.95	0.001477	60	2.0	2.2	700	2.0	2.5	4.7	760	14.2	6.9	98.0	0.069	YES	D
	0.9036	1.52	0.002368			#####				0.0	0	10.0	#####	98.0	#DIV/0!		

ti = 1.8 (1.1 - K) L^(0.5) / S^(1/3)

K = 0.0132 CN - 0.39

tt = L / (60 V)

tc = ti + tt

tL= tLAG = 0.6 tc

LOCATION: Onsites and Offsites
HYDROLOGIC CONDITION: Existing and Developed

TRIAL: Final Iteration

DEVELOPMENT: Craig Rancho Master Study
CALCULATED BY: HN
PROJECT NUMBER: 161051

DATE: August 24, 2016

SUB-BASIN DATA				INITIAL/OVERLAND TIME (ti)			TRAVEL TIME (tt)				tc CHECK (URBANIZED BASINS)		FINAL tc	REMARKS			
DESIGN (1)	K (2)	AREA Ac (3)	AREA Sq. Mile (4)	LENGTH Ft (5)	SLOPE % (6)	ti Min (7)	LENGTH Ft (8)	SLOPE % (9)	VELOCITY FPS (10)	tt Min (11)	TOTAL LENGTH Ft (12)	tc =(L/180)+10 Min (13)	Min (14)	CN (15)	tL Hrs (16)	Urbanized? (17)	Soil Type (18)
ND1	0.9036	26.52	0.041433	200	1.5	4.4	1,760	1.3	4.8	6.1	1,960	20.9	10.5	98.0	0.105	YES	D
ND2	0.9036	14.07	0.021982	160	1.3	4.2	930	1.1	3.9	3.9	1,090	16.1	8.1	98.0	0.081	YES	D
ND3-1	0.9036	4.96	0.007748	80	2.0	2.5	760	1.3	3.3	3.8	840	14.7	6.3	98.0	0.063	YES	D
ND3-2	0.9036	2.33	0.00364	80	2.0	2.5	470	2.1	3.3	2.4	550	13.1	4.9	98.0	0.050	YES	D
ND4	0.9036	2.35	0.003664	100	2.0	2.8	330	2.1	3.4	1.6	430	12.4	4.4	98.0	0.050	YES	D
CRAIG1	0.9036	1.52	0.002368	60	2.0	2.2	1140	1.2	2.4	8.0	1,200	16.7	10.2	98.0	0.102	YES	D
CRAIG2	0.9036	0.95	0.001477	60	2.0	2.2	700	2.0	2.5	4.7	760	14.2	6.9	98.0	0.069	YES	D

ti = 1.8 (1.1 - K) L^(0.5) / S^(1/3)

K = 0.0132 CN - 0.39

tt = L / (60 V)

tc = ti + tt

tL= tLAG = 0.6 tc

LOCATION: Onsites and Offsites
HYDROLOGIC CONDITION: Existing and Developed

TRIAL: Final Iteration

AVERAGE VELOCITY

Input Variables	Basin ND1	Basin ND2	Basin ND3-1	Basin ND3-2			Basin ND4			Basin CRAIG1	Basin CRAIG2					
Bottom Width, B, (ft):	2.0	2.0	2.0	2.0			2.0			2.0	2.0					
Right Side Slope, Zr:	0	0	0	0			0			0	0					
Left Side Slope, Zl:	50	50	50	50			50			50	50					
Manning's n:	0.015	0.015	0.015	0.015			0.015			0.015	0.015					
Geometric Slope, So (ft/ft):	0.013	0.011	0.013	0.021	0.000	0.000	0.021	0.000	0.000	0.012	0.020	0.000	0.000	0.000	0.000	0.000
Flowrate, Q (cfs) *:	40.5	23	8.5	4			4.5			2.5	1.5					
							Output Variables									
Normal Depth, Yn (ft):	0.54	0.44	0.28	0.18			0.19			0.17	0.12					
Area of Flow, A, (sf):	8.43	5.84	2.57	1.22			1.34			1.06	0.60					
Velocity, V (fps):	4.80	3.94	3.31	3.27			3.37			2.36	2.48					
Wetted Perimeter, p (ft):	29.66	24.70	16.44	11.43			11.93			10.65	8.15					
Hydraulic Radius, Rh (ft):	0.28	0.24	0.16	0.11			0.11			0.10	0.07					
Free SurfaceTop Width, T (ft):	29.11	24.25	16.15	11.24			11.73			10.48	8.03					
Centroid, Y*, (ft):	0.19	0.16	0.10	0.07			0.07			0.07	0.05					

*** NOTE : HALF OF THE 100-YEAR STORM RUNOFF FLOWS IS USED TO DETERMINE THE BASIN TRAVEL VELOCITY REQUIRED FOR THE LAG TIME CALCULATIONS**

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **ND1**
Total Area: 26.52 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	26.52	D	100%	98	98.0
Total:	26.52	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **ND2**
Total Area: 14.07 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	14.07	D	100%	98	98.0
Total:	14.07	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **ND3-1**
Total Area: 4.96 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	4.96	D	100%	98	98.0
Total:	4.96	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **ND3-2**
Total Area: 2.33 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.33	D	100%	98	98.0
Total:	2.33	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: **ND4**
Total Area: 2.35 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	2.35	D	100%	98	98.0
Total:	2.35	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: CRAIG1
Total Area: 1.52 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	1.52	D	100%	98	98.0
Total:	1.52	-	100%	-	98.0

Curve Number Calculations
Craig Rancho Master Study

Sub-Basin: CRAIG2
Total Area: 0.95 Acres

Land Use/Cover type	Area [A] (acres)	Soil Type	Percentage, P [P]	Cruve Number [CN]	Product {CN x P}
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)	0.95	D	100%	98	98.0
Total:	0.95	-	100%	-	98.0

HEC-1 MODEL OUTPUT

(EXISTING CONDITION)

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*          VERSION 4.1                 *
*                                      *
*  RUN DATE   31AUG16  TIME  20:24:28  *
*                                      *
****************************************
```

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

```
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


```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            1       ID        CRAIG/RANCHO MASTER DRAINAGE STUDY
            2       ID        EXISTING CONDITION
            3       ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
            4       ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
            5       ID
            6       ID        LOCHSA JOB# 161051
            7       ID
            8       ID
            9       ID        INPUT FILE NAME:  XLOMR.DAT
           10       ID
           11       ID        AUGUST 2016
           12       ID
           13       ID        ************************************************************************
           14       ID        ************************************************************************
           15       ID             INSIDE McCARRAN AIRPORT RAINFALL AREA
           16       ID
           17       ID             10, 25 & 100 YEAR - 6 HOUR STORM EVENT
           18       ID             PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
           19       ID
           20       ID
           21       ID             10-YEAR RAINFALL DEPTH  = 1.58 INCHES
           22       ID             25-YEAR RAINFALL DEPTH  = 2.05 INCHES
           23       ID             100-YEAR RAINFALL DEPTH = 2.77 INCHES
           24       ID
           25       ID             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
           26       ID             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
           27       ID        ************************************************************************
           28       ID
           29       ID
           30       ID   DARF RATIOS FOR AREAS OF 5.20 SQUARE MILES FOR
           31       ID   RANCHO AND JONES BLVD. FLOWS = 0.90
           32       ID
           33       ID             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = (1.58/2.77) X 0.90 = 0.51
           34       ID             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = (2.05/2.77) X 0.90 = 0.67
           35       ID
           36       ID
           37       ID        ************************************************************************
           38       ID
           39       ID        ************************************************************************
                    *
                    *        ******************** AUGUST 2016 ****************************
                    *
                    *                 ----------------------------------------
                    * (1) ***************** BGEGINNING OF REFERENCED HEC-1 MODEL ******************
                    *                 ----------------------------------------
                    *
                    *   ***************** FROM THE "RANCHO/US 95 LOMR **************
                    *        **************ISSUED ON NOVEMBER 30, 2009 ******************
                    *
                    *        ******************** AUSUST 2016 ****************************
                    *
                    *                   **************************
                    *              ********************************************
                    *DIAGRAM
```

*** FREE ***


```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
           40       ID   RANCHO/US95 CLOMR
           41       ID   FOR:  CITY OF LAS VEGAS, NV AND THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTR
           42       ID   THIS IS THE PROPOSED HEC1 MODEL FOR UPPER RANCHO DRIVE (NORTH OF GOWAN ROAD)
           43       ID    FILENAME:UPPRSDN3.DAT
           44       ID
           45       ID    CAM10 DETENTION BASIN AND THE WESTERN BELTWAY CHANNEL ARE INCLUDED IN THE EN
           46       ID    NOT IN THE SDN3 WATERSHED.
           47       ID
           48       ID
           49       ID   MODIFIED BY LBG SEPT 2005
           50       ID   SDN3 CREATED BY REDUCING THE SIZE OF CRAIG SUBBASIN TO 1.434 SQUARE MILES
           51       ID   ADD INTERIM BELTWAY AND GOWAN NORTH PHASE III
```

```
ID   BY MODIFYING THE CRAIG SUBBASIN FROM PBS&J MODEL
ID
ID   LVRA0000 (PEAK CHANNEL AND RANCHO DRIVE IMPROVEMENTS) ADDED BY DIVERTING
ID   FLOW FROM CONCENTRATION POINT CX1X4
ID
ID   TRUVAL FLOW SPLIT, REMOVED FROM CVL MODEL, HAS BEEN PUT BACK IN.
ID
ID   JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
ID
ID   100-YEAR,  6-HOUR STORM,  SDN3
ID   DARF RATIOS FOR AREAS OF 0, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0 AND 10 SQUARE MILES
ID   FOR THE 100-YEAR EVENT.
IT       5       0       0     100
IO       5       0       0
IN       5
*
*      ***************** BEGINNING AUGUST 2016 REVISION ********************
*
* UTILIZED THE RATIOS RELEVANT FOR THE SUBHJECT STUDYJUST SWITCHING 5REMAIN AND
* (CULVERT 27 AND CULVERT 26) CAN BE ROUTED AND COMBINED WITH THE LOCAL
* FLOWS WITHIN THE STUDY
*
*                    ****************************
*              ***********************************************
JR    PREC    1.00    0.74    0.57    0.90    0.67    0.51
*
*
*      ***************** END AUGUST 2016 REVISION ********************
*                    ****************************
*

KK     ANN
PB    2.85
BA   0.259
PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
PC   0.998   0.999   1.000
LS       0    76.8
```



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

UD   0.499
*

KK     RANN
KM  ROUTE TO GD29B
RK     2600   0.015   0.015       0    TRAP     100       2
*

KK    GD29B
PB     2.77
BA    0.138
LS        0     74.3
UD    0.298
*

KK   CGD29B
HC        2
*

KK   RGD29B
KM  ROUTE TO ANN1B
RK     2700   0.015   0.015       0    TRAP     100       2
*

KK    ANN1B
PB     2.77
BA    0.135
LS        0     82.7
UD    0.305
*

KK   CANN1B
HC        2
*

KK   RANN1B
KM  ROUTE TO ANN1C2
RK     2000   0.007   0.015       0    TRAP     100       2
*

KK   ANN1C2
PB     2.77
BA    0.091
LS        0     80.7
UD    0.275
*

KK CANN1C2
HC        2
*
```



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

KK RANN1C2
KM  ROUTE TO PDGCC3
RK     1250  0.0074   0.013       0    TRAP      12       2
*

KK   PDGCC3
PB     2.77
```

```
116          BA   0.047
117          LS       0    84.6
118          UD   0.188
             *

119          KK   CGCC3
120          HC       2
             *

121          KK   RGCC3
122          KM  ROUTE TO PDGCC4
123          RK    1550   0.005   0.013       0    TRAP       8       0
             *

124          KK REMAIN1
125          KM  DIVERT 139 CFS UNDER U.S. 95 BETWEEN ANN ROAD AND THE U.S. 95/RANCHO
126          KM  INTERSECTION IN A 10' X 3' RCB (CULVERT 3).  FLOWS IN EXCESS OF 139 CFS
127          KM  REMAIN ON THE WEST SIDE OF U.S. 95.
128          KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
129          DT    095A
130          DI       0      51     101     118     140     318   10000
131          DQ       0      50     100     117     139     139     139
             *

132          KK   RLBG1
133          KM  ROUTE TO CGCC4 (HECRAS X-11649)
134          KM   ADDED BY LBG
135          RK     278   0.005   0.013       0    TRAP       8       0
             *

136          KK  PDGCC2
137          PB    2.77
138          BA   0.042
139          LS       0    73.2
140          UD   0.286
             *

141          KK   RGCC2
142          KM  ROUTE TO PDGCC4
143          RK    2900  0.0055   0.015       0    TRAP      60       2
             *
```



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

144          KK  PDGCC4
145          PB    2.77
146          BA   0.049
147          LS       0    84.3
148          UD   0.189
             *

149          KK   CGCC4
150          KM   THE FLOW AT THIS NODE CORRESPONDS TO X-11649 OF THE US-95 EFFECTIVE HECRAS.
151          KM   THIS IS THE MOST UPSTREAM NODE IN THE EFFECTIVE MODEL.
152          HC       3
             *

153          KK   RLBG2
154          KM  ROUTE TO CGCB9 (HECRAS X-11287)
155          KM   ADDED BY LBG
156          RK     362   0.005   0.013       0    TRAP       8       0
             *

157          KK  HAMMER
158          PB    2.82
159          BA   0.128
160          LS       0    76.6
161          UD   0.333
             *

162          KK RHAMMER
163          KM  ROUTE TO PDGCD
164          RK    2700   0.015   0.015       0    TRAP      60       2
             *

165          KK   PDGCD
166          PB    2.77
167          BA   0.129
168          LS       0    74.0
169          UD   0.284
             *

170          KK  CPDGCD
171          HC       2
             *

172          KK    RGCD
173          KM  ROUTE TO PDGCB5
174          RK    4060  0.0086   0.015       0    TRAP      40       2
             *

175          KK  PDGCB1
176          PB    2.77
177          BA   0.033
178          LS       0    84.9
179          UD   0.166
             *
```



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

180          KK   RGCB1
181          KM  ROUTE TO PDGCB3
182          RK    2100  0.0086   0.015       0    TRAP      40       2
             *
```

```
183          KK  PDGCB2
184          PB    2.77
185          BA   0.030
186          LS       0    81.3
187          UD   0.190
             *

188          KK   CGCB2
189          HC       2
             *

190          KK   RCGB2
191          KM  ROUTE TO PDGCB3
192          RK     700  0.0029    0.03       0    TRAP       20       2
             *

193          KK  PDGCB3
194          PB    2.77
195          BA   0.066
196          LS       0    73.1
197          UD   0.236
             *

198          KK   CGCB3
199          HC       2
             *

200          KK   RGCB3
201          KM  ROUTE TO PDGCB5
202          RK    1400    0.01   0.025       0    TRAP       20       2
             *

203          KK  PDGCB4
204          PB    2.77
205          BA   0.020
206          LS       0    85.7
207          UD   0.204
             *

208          KK   RGCB4
209          KM  ROUTE TO PDGCB5
210          RK     800    0.01    0.03       0    TRAP       20       2
             *
```



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

211          KK   CGCB4
212          HC       3
             *

213          KK  PDGCC1
214          PB    2.77
215          BA   0.053
216          LS       0    75.4
217          UD   0.263
             *

218          KK  PDGCB5
219          PB    2.77
220          BA   0.110
221          LS       0    76.0
222          UD   0.375
             *

223          KK   CGCB5
224          HC       3
             *

225          KK   RGCB5
226          KM  ROUTE TO PDGCB9
227          RK    3080  0.0065    0.03       0    TRAP       30       2
             *

228          KK  C2GCB5
229          HC       2
             *

230          KK  PDGCB6
231          PB    2.77
232          BA   0.018
233          LS       0    88.2
234          UD   0.177
             *

235          KK   RGCB6
236          KM  ROUTE TO PDGCB9
237          RK    2880  0.0065    0.03       0    TRAP       30       2
             *

238          KK PDGCB10
239          PB    2.77
240          BA   0.074
241          LS       0    83.7
242          UD   0.260
             *
```



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

243          KK  PDGCB9
244          PB    2.77
245          BA   0.031
246          LS       0    76.5
247          UD   0.137
             *
```

```
 248          KK   CGCB9
 249          HC       4
              *

 250          KK   RGCB9
 251          KM  ROUTE TO GCB11 (HECRAS X-10504)
 252          KM   CHANGED FROM 1950 FT TO 783 FEET BY LBG
 253          RK     783  0.0036   0.013       0    TRAP       8       2
              *

 254          KK PDGCB11
 255          PB    2.77
 256          BA   0.033
 257          LS       0    79.3
 258          UD   0.195
              *

 259          KK  CGCB11
 260          HC       2
              *

 261          KK   RLBG3
 262          KM  ROUTE TO REMAIN2 (HECRAS X-9993)
 263          KM   ADDED BY LBG
 264          RK     511  0.0036   0.013       0    TRAP       8       2
              *

 265          KK REMAIN2
 266          KM  DIVERT 192 CFS UNDER U.S. 95 JUST SOUTH OF THE U.S. 95/RANCHO INTERSECTION
 267          KM  IN 2, 6' X 2' RCB'S (CULVERT 5). REMAINING FLOW CONTINUES SOUTH ALONG U.S.
 268          KM  95 TO LONE MOUNTAIN ROAD.
 269          KM   REVISED TO 168 BY LBG
 270          DT    D95B
 271          DI       0     426     591   10000
 272          DQ       0     168     192     192
              *

 273          KK  RMAIN2(HECRAS X-SEC 8237)
 274          KM  ROUTE TO 20BG
 275          RK    1756  0.0029    0.03       0    TRAP      20       2
              *
```



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

 276          KK  LONEMI
 277          PB    2.77
 278          BA   0.411
 279          LS       0    83.1
 280          UD   0.380
              *

 281          KK  GD20BH
 282          PB    2.77
 283          BA   0.047
 284          LS       0    76.6
 285          UD   0.250
              *

 286          KK   CLONE
 287          HC       2
              *

 288          KK   RLONE(HECRAS X-SECTION 8237)
 289          KM  ROUTE TO 20BG
 290          RK    1100  0.0015   0.015       0    TRAP      44       2
              *

 291          KK  GD20BG
 292          PB    2.77
 293          BA   0.113
 294          LS       0    81.4
 295          UD   0.261
              *

 296          KK   C20BG
 297          HC       3
              *

 298          KK   R20BG
 299          KM  ROUTE TO 20BL (HECRAS X-SECTION 6510)
 300          RK    1680  0.0016    0.03       0    TRAP     150       2
              *

 301          KK  CRAIG1
 302          KM   ADDED FOR RANCHO CLOMR - ADD THIS BASIN SUBDIVIDED FROM CRAIG SUBBASIN IN PBS
 303          PB    3.16
 304          BA    2.44
 305          LS       0    82.0
 306          UD   0.700
              *

 307          KK   DBUF1
 308          KM   DIVERT 249 CFS (447 CAPACITY -198 FUTURE INTERCEPTED) TO
 309          KM   GOWAN NORTH BUFFALO BRANCH STORM DRAIN BETWEEN LONE MT AND RED COACH
 310          DT   DGNBB
 311          DI       0     250    2807   10000
 312          DQ       0     249     249     249
              *
```



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

 313          KK   RBUF1
 314          KM  ROUTE TO RED COACH
 315          RK    1295   0.004   0.015       0    TRAP      80       2
              *
```

```
316          KK   DBUF2
317          KM   DIVERT 109 CFS TO GOWAN NORTH BUFFALO BRANCH AT RED COACH
318          DT  DGNBB1
319          DI       0     110    1121   10000
320          DQ       0     109     109     109
             *

321          KK    DRED
322          KM  DIVERT 70.40% FLOW DOWN BUFFALO TOWARDS COBAL CANYON.  TAKE FLOW DOWN RED COAC
323          DT DBUFLO2
324          DI       0     100    1000   10000
325          DQ       0    70.4    704.    7040
             *

326          KK   RDRED
327          KM  ROUTE TO 20BI
328          RK    2700   0.007   0.015       0    TRAP      80       2
             *

329          KK  GD20BI
330          PB    2.77
331          BA   0.115
332          LS       0    80.5
333          UD   0.286
             *

334          KK   C20BI
335          HC       2
             *

336          KK   R20BI
337          KM  ROUTE TO 20BL (HECRAS X-SECTION 6510)
338          RK     910  0.0055   0.015       0    TRAP      40       2
             *

339          KK  GD20BL
340          PB    2.77
341          BA   0.079
342          LS       0    88.7
343          UD   0.230
             *

344          KK   C20BL
345          HC       3
             *
```



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

346          KK   R20BL
347          KM  ROUTE TO C20BJ2 (HECRAS X-SECTION 6109)
348          RK     401  0.0016    0.03       0    TRAP     150       2
             *

349          KKRTBUFAL2
350          KM  RETRIEVE FLOW DIVERTED TO BUFFALO PAST RED COACH
351          DR DBUFLO2
             *

352          KK   RBUF2
353          KM  ROUTE TO COBAL CANYON
354          RK     652   0.004   0.015       0    TRAP      80       2
             *

355          KK  DCOBAL
356          KM  DIVERT 71.46% OF FLOW AT  COBAL CANYON/BUFFALO INTERSECTION SOUTH ON BUFFALO
357          KM  REMAINING FLOW CONTINUES TO US95
358          DT DBUFLO3
359          DI       0    100.    1000   10000
360          DQ       0   71.46   714.6    7146
             *

361          KK RCOBAL1
362          KM  ROUTE TO C20BJ1
363          RK    2700   0.007   0.015       0    TRAP      60       2
             *

364          KK  GD20BJ
365          PB    2.77
366          BA   0.052
367          LS       0    84.3
368          UD   0.257
             *

369          KK  C20BJ1
370          HC       2
             *

371          KK  R20BJ1
372          KM  ROUTE TO C20BJ2
373          RK     900   0.006   0.015       0    TRAP      40       2
             *

374          KK  C20BJ2(US95 HECRAS X-SECTION 59+51)
375          HC       2
             *

376          KK  R20BJ2
377          KM  ROUTE TO C20BM
378          RK     362   0.006   0.015       0    TRAP      40       2
             *
```



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

379          KK  GD20BM
```

```
380          PB    2.77
381          BA   0.048
382          LS       0    89.2
383          UD   0.189
             *

384          KK   C20BM(HECRAS X-SECTION 55+89)
385          KM   GD20BM IS ADDED TO US95 FLOW FROM C20BJ2
386          HC       2
             *

387          KK REMAIN5
388          KM  DIVERSION PER EXISTING INTERCHANGE AT CRAIG ROAD
389          KM  DIVERT FLOW UNDER U.S. 95 JUST NORTH OF THE CRAIG ROAD BRIDGE OVER U.S. 95
390          KM  THROUGH 2, 6' x 2' RCB'S (CULVERT 7).
391          KM  REMAINING FLOW CONTINUES SOUTH ALONG U.S. 95
392          KM  THIS DIVERSION HAS TWO SEPARATE FLOW QUANTITIES, ONE FOR THE SDN3 MODEL
393          KM  AND ONE FOR THE SDN5 MODEL (82 CFS AND 180 CFS RESPECTIVELY).
394          KM   REVISED BY LBG 6-28-05 (RATING CURVE DEVELOPED)
395          DT    D95E
396          DI       0     200     600    1000    1250    2006
397          DQ       0    16.8      82   144.0     170     264
             *

398          KKRREMAINS5
399          KM  ROUTE TO 2C20BK
400          RK     853   0.006   0.015       0    TRAP      40       2
             *

401          KKRTBUFAL3
402          KM  RETRIEVE FLOW DIVERTED TO BUFFALO PAST COBAL CANYON
403          DR DBUFLO3
             *

404          KK   RBUF3
405          KM  ROUTE TO CRAIG ROAD
406          RK     661   0.003   0.015       0    TRAP      80       2
             *

407          KK   DBUF3
408          KM   DIVERT 198 MORE CFS TO GOWAN NORTH BUFFALO BRANCH AT CRAIG
409          DT  DGNBB2
410          DI       0     199    1121   10000
411          DQ       0     198     198     198
             *

412          KK RCRAIG2
413          KM  ROUTE TO GD20BK
414          RK    3400  0.0067   0.015       0    TRAP      80       2
             *
```



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

415          KK  GD20BK
416          PB    2.77
417          BA   0.050
418          LS       0    80.5
419          UD   0.264
             *

420          KK  1C20BK
421          HC       2
             *

422          KK R1C20BK
423          KM  ROUTE TO 2C20BK (X-4736 IN US-95 HECRAS MODEL)
424          RK    1150  0.0039   0.015       0    TRAP      80       2
             *

425          KK  2C20BK
426          HC       2
             *

427          KK R2C20BK
428          KM  ROUTE TO C17BI (X-4241)
429          KM   CHANGE FROM 600 FT TO 495 FT
430          RK     495  0.0039    0.03       0    TRAP      80       2
             *
             * ************************************************
             *
             * KKHICKM3
             * KM RANCHO CLOMR - SUBDIVIDE HICKAM SUBBASIN
             * KM THIS SUBBASIN IS USED WITHOUT THE GOWAN NORTH SYSTEM OR WITH THE GOWAN DETE
             * PB2.89
             * BA0.752
             * LS0          80.3
             * UD0.434
             *
             * KKSDALX
             * KM THIS DIVERSION CAN BE USED WITHOUT THE LONE MOUNTAIN DETENTION BASIN AND
             * KM WITHOUT THE GOWAN NORTH SYSTEM OR WITH THE GOWAN DETENTION BASIN
             * KM DIVERSION INTO ALEXANDER ROAD STORM DRAIN
             * DTDSDALX
             * DI0           763   10000
             * DQ0           732     732
             *
             * KKHICKM2
             * KM RANCHO CLOMR - SUBDIVIDE HICKAM SUBBASIN
             * KM THIS SUBBASIN IS USED WITHOUT THE GOWAN NORTH SYSTEM OR WITH THE GOWAN DETE
             * PB2.89
             * BA0.258
             * LS0          80.3
             * UD0.246
             *
             * KK DUR
             * KM COMBINE HICKM1 AND HICKM2 AT ALEXANDER AND DURANGO
             * HC      2
```

```
*
* KK GNS
* KMDIVERT REMAINING SURFACE FLOW INTO GOWAN NORTH SYSTEM
* DTDGNS
* DI0          763   10000
* DQ0          762    9999
*
```



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

  431         KK HICKAM1
  432         KM   RANCHO CLOMR - THIS REPLACES SUBBASIN HICKAM
  433         PB    2.89
  434         BA   0.477
  435         LS       0    80.3
  436         UD   0.472
              *
              * KKHICKAM
              * PB2.89
              * BA1.487
              * LS0         80.3
              * UD0.437
              *
  437         KK    BUF3
  438         KM  DIVERT ANOTHER 125 CFS TO GOWAN NORTH BUFFALO BRANCH FROM HICKM1 SUBBASIN
  439         KM  REMAINING FLOW CONTINUES EAST ALONG HICKAM AVENUE
  440         DT  DGNBB3
  441         DI       0     126     211   10000
  442         DQ       0     125     125     125
              *
  443         KK RHICKAM
  444         KM  ROUTE TO C17BH
  445         RK    1300   0.008   0.025       0    TRAP      80       2
              *
  446         KK  GD17BH
  447         PB    2.77
  448         BA   0.025
  449         LS       0    82.8
  450         UD   0.178
              *
  451         KK   C17BH
  452         HC       2
              *
  453         KK   R17BH
  454         KM  ROUTE TO GD17BG
  455         RK    1330   0.006   0.025       0    TRAP      80       2
              *
  456         KK  GD17BG
  457         PB    2.77
  458         BA   0.116
  459         LS       0    83.3
  460         UD   0.275
              *
```



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

  461         KK   C17BG
  462         HC       2
              *
  463         KK   R17BG
  464         KM  ROUTE TO C17BI (HECRAS X-SECTION 4241)
  465         RK    1200   0.005   0.025       0    TRAP      80       2
              *
  466         KK  GD17BI
  467         PB    2.77
  468         BA   0.066
  469         LS       0    85.2
  470         UD   0.193
              *
  471         KK   C17BI
  472         HC       3
              *
  473         KK   R17BI
  474         KM  ROUTE TO C17BJ (HECRAS X-SECTION 2740)
  475         RK    1501  0.0023    0.03       0    TRAP     200       2
              *
              * KKREMAIN6a
              * REMOVED BY LBG
              * KMDIVERT FLOW EAST ACROSS U.S. 95 JUST NORTH OF ALEXANDER ROAD.
              * KMDIVERT 522 CFS BETWEEN CROSS-SECTIONS 3614 AND 2810 IN THE
              * KMHEC-RAS MODEL AS WEIR FLOW.
              * DTD95Fa
              * DI0          523   10000   20000
              * DQ0          522     522     522
              *
  476         KK  GD14CH
  477         PB    2.77
  478         BA   0.040
  479         LS       0    83.0
  480         UD   0.181
              *
  481         KK   R14CH
  482         KM  ROUTE TO C17BJ (HECRAS X-SECTION 2740)
```

```
                                                                XLOMR
483          RK    1900   0.005   0.015       0    TRAP      40       2
             *

484          KK  GD17BJ
485          PB    2.77
486          BA   0.063
487          LS       0    88.3
488          UD   0.222
             *
1                                        HEC-1 INPUT                                                    PAGE 16

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

489          KK   C17BJ
490          HC       3
             *

491          KK REMAIN6
492          KM  DIVERT FLOW THROUGH DUAL 6' X 2' RCB'S (CULVERT 10) AT ALEXANDER ROAD BETWEEN
493          KM  CROSS-SECTIONS 2810 AND 2694 IN THE HEC-RAS MODEL.  WEIR FLOW ELIMINATED DUE T
494          KM   SOUND WALL AND BARRIER RAILS
495          DT    D95F
496          DI       0     100     500    1000    1937    2725
497          DQ       0    10.8      72     144     192     264
             *

498          KK   R17BJ
499          KM  ROUTE TO C6MAIN (HECRAS X-SECTION 2514)
500          RK     226   0.005   0.015       0    TRAP      40       2
             *

501          KK  GD14CF
502          KM   JUMP OVER TO THE BASIN NW OF GOWAN & BUFFALO RD INTERSECTION
503          PB    2.78
504          BA   0.130
505          LS       0    77.9
506          UD   0.288
             *

507          KK    BUF4
508          KM  DIVERT 30 CFS TO GOWAN NORTH BUFFALO BRANCH FROM ALEXANDER AND EXCALIBUR
509          KM  REMAINING FLOW CONTINUES EAST ALONG ALEXANDER
510          DT  DGNBB4
511          DI       0      31      60   10000
512          DQ       0      30      30      30
             *

513          KK   R14CF
514          KM  ROUTE TO GD14CG
515          RK    1450   0.006   0.015       0    TRAP     100       2
             *

516          KK  GD14CG
517          PB    2.77
518          BA   0.057
519          LS       0    82.2
520          UD   0.208
             *

521          KK   C14CG
522          HC       2
             *
1                                        HEC-1 INPUT                                                    PAGE 17

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

523          KK   R14CG
524          KM  ROUTE TO GD14CI
525          RK    1650   0.006   0.015       0    TRAP     100       2
             *

526          KK  GD14CI
527          PB    2.77
528          BA   0.054
529          LS       0    79.7
530          UD   0.196
             *

531          KK   C14C1
532          HC       2
             *

533          KK   R14CI
534          KM  ROUTE TO CMAIN6
535          RK     945  0.0106   0.015       0    TRAP     100       2
             *

536          KK  CMAIN6(HECRAS US95 X-SECTION 2514)
537          HC       2
             *

538          KK  RMAIN6
539          KM   ROUTE SOUTH TO US95 HECRAS X-SECTION 1300
540          RK    1214  0.0026    0.03       0    TRAP      80       3
             *

541          KK REMAIN7
542          KM  DIVERT FLOW EAST ACROSS U.S. 95 BETWEEN ALEXANDER ROAD AND GOWAN ROAD.
543          KM  DIVERT FLOW THROUGH 2 - 30" RCP's (CULVERT 12).  FLOW OVER US95 ELIMINATED
544          KM   BTWN CROSS-SECTIONS 1420 AND 1027 DUE TO SOUNDWALLS.
545          KM   REVISED BY LBG 6-28-2005
546          DT    D95G
547          DI       0     100     500    1000    1500    1656    2000
548          DQ       0      60      82      96     102     101     104
             *

549          KK   GD11C
```

```
550          PB    2.77
551          BA   0.132
552          LS       0    86.0
553          UD   0.296
             *

554          KK    C11C
555          HC       2
             *
```



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

556          KK    R11C
557          KM   ROUTE SOUTH TO CULVERT #13 U/S OF GOWAN UNDERPASS (HECRAS 0+17)
558          RK    1283  0.0026    0.03       0    TRAP      80       3
             *

559          KK   GD11B
560          PB    2.77
561          BA   0.196
562          LS       0    87.6
563          UD   0.272
             *

564          KK    C11B
565          HC       2
             *

566          KK  GOWAN1
567          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
568          KM   BY POGGEMEYER DESIGN GROUP, INC
569          KM   DIVERT MAXIMUM OF 422 CFS INTO GOWAN OUTFALL AT US95
570          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
571          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
572          KM   DIVERT NOTHING GOWAN OUTFALL WILL BE FULL!!! LBG
573          DT   GOOF1
574          DI       0      51     101     423    5000
575          DQ       0       1       2       3       4
             *

576          KK    R11B
577          KM  ROUTE TO CPT6B
578          RK    1400  0.0057   0.015       0    TRAP      80       2
             *

579          KK   CY05A
580          PB    2.77
581          BA   0.025
582          LS       0    85.6
583          UD   0.179
             *

584          KK    D95G
585          KM  RETRIEVE FLOW DIVERTED THROUGH OKG 353
586          DR    D95G
             *

587          KK   RD95G
588          KM  ROUTE TO PT6B
589          RK    2300   0.004   0.015       0    TRAP      60       2
             *
```



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

590          KK    PT6B
591          PB    2.77
592          BA   0.107
593          LS       0    89.1
594          UD   0.182
             *

595          KK   CPT6B
596          HC       2
             *

597          KK  2CPT6B
598          KM   RAINBOW & GOWAN
599          HC       3
             *

600          KK  GOWAN2
601          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
602          KM   BY POGGEMEYER DESIGN GROUP, INC
603          KM   DIVERT MAXIMUM OF 52 CFS INTO GOWAN OUTFALL AT RAINBOW
604          KM   FOR A TOTAL OF 474 CFS.
605          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
606          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
607          KM   DIVERT 2 CFS THE GOWAN OUTFALL IS FULL LBG
608          DT   GOOF2
609          DI       0      53     101     423    5000
610          DQ       0       2       2       2       2
             *

611          KK   RPT6B
612          KM  ROUTE TO C5A3
613          RK    2480  0.0067   0.015       0    TRAP      80       2
             *

614          KK   CY05D
615          PB    2.77
616          BA   0.059
617          LS       0    78.6
618          UD   0.254
             *
```

```
619          KK   PT5A3
620          PB    2.77
621          BA   0.089
622          LS       0    87.1
623          UD   0.285
             *

624          KK    C5A3
625          KM   TORREY PINES & GOWAN
626          HC       3
             *
```



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

627          KK  GOWAN3
628          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
629          KM   BY POGGEMEYER DESIGN GROUP, INC
630          KM   DIVERT MAXIMUM OF 21 CFS INTO GOWAN OUTFALL AT TORREY PINES
631          KM   FOR A TOTAL OF 495 CFS.
632          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
633          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
634          KM   DIVERT 2 CFS LBG
635          DT   GOOF3
636          DI       0      22    5000
637          DQ       0       2       2
             *

638          KK    R5A3
639          KM  ROUTE TO C5A8 GOWAN & MAVERICK
640          RK    1236  0.0088   0.015       0    TRAP      80       2
             *

641          KK     MAV
642          KM   DIVERSION TO MAVERICK THEN DUNCAN THEN RANCHO.  DIVERSIONS
643          KM  DETERMINED USING HECRAS
644          DTMAVERICK
645          DI       0     200     400    1050    1300    1550    1800
646          DQ       0       8      14      50     100     150     200
             *

647          KK   R5A3B
648          KM  ROUTE TO C5A8 GOWAN & BRONCO
649          RK     600  0.0088   0.015       0    TRAP      80       2
             *

650          KK   CY06A
651          PB    2.77
652          BA   0.077
653          LS       0    84.0
654          UD   0.246
             *

655          KK   PT5A8
656          PB    2.77
657          BA   0.025
658          LS       0    82.0
659          UD   0.265
             *

660          KK    C5A8
661          KM   GOWAN & BRONCO
662          HC       3
             *
```



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

663          KK   R5A3C
664          KM  ROUTE TO C5A8 GOWAN & JONES
665          RK     620  0.0088   0.015       0    TRAP      80       2
             *

666          KK  GOWAN4
667          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
668          KM   BY POGGEMEYER DESIGN GROUP, INC
669          KM   DIVERT MAXIMUM OF 44 CFS INTO GOWAN OUTFALL AT JONES
670          KM   FOR A TOTAL OF 539 CFS.
671          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
672          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
673          KM   DIVERT 2 CFS LBG
674          DT   GOOF4
675          DI       0      45    5000
676          DQ       0       2       2
             *

677          KK  DPT5A8
678          KM  DIVERT FLOW TO JONES
679          KM  FROM VTN NEVADA SILVER MESA STUDY (1989) AND CVL FISR
680          KM  DIVERTED FLOW DRAINS SOUTH THEN EAST TO SANTA CATALINA.  IT THEN
681          KM  FLOWS UNDER MICHAEL TO RANCHO.  MOST GOES UNDER RANCHO IN A RCB JUST SOUTH
682          KM   OF THE MICHAEL WAY INTERSECTION. REMAINING FLOW CONTINUES SOUTH ON RANCHO.
683          DT  DCY07B
684          DI       0     100     500    1000    2000    3000    4000    5500
685          DQ       0       0     116     253     592     948    1308    1859
             *

686          KK    R5A8
687          KM  ROUTE TO TRUE VALUE
688          RK    1659  0.0097   0.015       0    TRAP      80       2
             *

689          KK   R5A82
690          KM  ROUTE TO CCY07A
691          RK    1220  0.0097   0.015       0    TRAP      80       2
             *
```

```
692          KK   CY07A
693          PB    2.77
694          BA   0.027
695          LS       0    86.2
696          UD   0.237
             *

697          KK  CCY07A
698          HC       2
             *
```



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

699          KK    TRUV
700          KM   DIVERSION BEHIND TRUE VALUE HARDWARE REVISED BY LBG.  DIVERSIONS
701          KM  DETERMINED USING HECRAS LATERAL WEIR. L = 25 FT
702          DT  TRUVAL
703          DI       0     200     400     600    1000    1400    1800
704          DQ       0       8      25      43      78     114     149
             *

705          KK    D95B
706          KM  RETRIEVE FLOW FROM BOX DIVERSION JUST SOUTH OF 95/RANCHO INT. (CULVERT 3)
707          KM  ***NOTE: THIS FLOW CARRIES A DRAINAGE AREA OF 1.49 SQUARE MILES***
708          DR    D95B
             *

709          KK   RD95B
710          KM  ROUTE TO 1REMAIN ON RANCHO DRIVE
711          RK    1200   0.004   0.025       0    TRAP      30       2
             *

712          KK 1REMAIN
713          KM  DIVERT 36 CFS EAST THROUGH 2, 24" CMP'S (CULVERT 14) UNDER RANCHO ROAD JUST
714          KM  NORTHWEST (UPSTREAM) OF THE RANCHO ROAD AND RAINBOW BLVD. INTERSECTION.
715          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO. UPPER RANCHO HECRAS STA. 122+
716          DT  D1RCHO
717          DI       0     191    1000   10000
718          DQ       0      36      36      36
             *

719          KK  PT3AB1
720          PB    2.77
721          BA   0.049
722          LS       0    93.7
723          UD   0.283
             *

724          KK   C3AB1
725          HC       2
             *

726          KK 2REMAIN
727          KM  DIVERT 29 CFS EAST THROUGH A 30" CMP (CULVERT 15) UNDER RANCHO ROAD AT THE
728          KM  RANCHO ROAD AND RAINBOW BLVD. INTERSECTION. (UPPER RANCHO HECRAS STA. 121+00)
729          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
730          DT  D2RCHO
731          DI       0     189    1000   10000
732          DQ       0      29      29      29
             *

733          KK  R2MAIN
734          KM  ROUTE TO PT3AB2
735          RK    1365  0.0022   0.025       0    TRAP      30       2
             *
```



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

736          KK  PT3AB2
737          PB    2.77
738          BA   0.050
739          LS       0    94.5
740          UD   0.197
             *

741          KK   C3AB2
742          HC       2
             *

743          KK 3REMAIN
744          KM  DIVERT 23 CFS EAST THROUGH A 30" CMP (CULVERT 20) UNDER RANCHO ROAD AT THE
745          KM  RANCHO ROAD AND LONE MT. RD. INTERSECTION.  (RANCHO HECRAS 103+99)
746          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
747          DT  D3RCHO
748          DI       0     192    1000   10000
749          DQ       0      23      23      23
             *

750          KK  R3MAIN
751          KM  ROUTE TO CPT2B2 (RANCHO HECRAS 93+76)
752          RK    1023   0.005    0.03       0    TRAP      40       2
             *

753          KK   PT2B2
754          PB    2.77
755          BA   0.078
756          LS       0    87.0
757          UD   0.254
             *

758          KK  CPT2B2
759          HC       2
             *

760          KK 4REMAIN
```

```
761          KM  DIVERT 35 CFS EAST THROUGH A 36" CMP (CULVERT 21) UNDER RANCHO ROAD HALF WAY
762          KM  BETWEEN LONE MT. RD. AND CRAIG ROAD. UPPER RANCHO HECRAS STA. 93+76.
763          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
764          DT  D4RCHO
765          DI      0     214    1000   10000
766          DQ      0      35      35      35
             *

767          KK  R4MAIN
768          KM  ROUTE TO C2B3
769          RK   2323   0.011    0.02       0    TRAP      40       2
             *
1                                        HEC-1 INPUT                                                PAGE 24

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

770          KK   PT2B3
771          PB    2.77
772          BA   0.023
773          LS      0    93.2
774          UD   0.236
             *

775          KK    C2B3(UPPER RANCHO HECRAS STA. 70+16.)
776          HC       2
             *

777          KK    D2B3
778          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN AT RANCHO.  CRAIG STORM DRAIN IS
779          KM  48" RCP, CAPACITY = 210 CFS AT THE 48" LATERAL.  THE INLET TO THE 48"
780          KM  LATERAL IS AT THE DOWNSTREAM END OF THE DRAINAGE EASEMENT BEHIND THE 7-11
781          KM  CONVENIENT STORE.  IMMEDIATELY ABOVE THE 48" INLET ARE 2, 3'X7' RCB'S THAT
782          KM  CROSS UNDER CRAIG ROAD AND DISCHARGE ON THE SOUTHWEST SIDE OF THE CRAIG/
783          KM  RANCHO INTERSECTION.  DIVERT 120 CFS TO THE CRAIG ROAD STORM DRAIN SINCE
784          KM  90 CFS ALREADY EXISTS IN THE PIPE.  REMAINING FLOW TRAVELS UNDER CRAIG ROAD
785          KM  IN THE 2, 3'X7' RCB'S AND DISCHARGES AT THE SOUTHWEST CORNER OF THE
786          KM  CRAIG/RANCHO INTERSECTION AND IS JOINED BY THE STREET FLOW IN CRAIG.
787          KM  ALL STREET FLOW IN CRAIG IS CONTAINED IN THE NORTH HALF STREET BY THE
788          KM  MEDIAN CURB SO THERE IS NO DIVERSION TO TORREY PINES.
789          KM  THE 48" LATERAL TO THE CRAIG ROAD STORM DRAIN IS CULVERT 22.
790          KM  THE 2, 3'X7' RCB'S ARE CULVERT 23. UPPER RANCHO HECRAS STA. 70+00.
791          DT   DCSD2
792          DI      0     121    1000   10000
793          DQ      0     120     120     120
             *

794          KK   PT2A2
795          PB    2.77
796          BA   0.062
797          LS      0    84.7
798          UD   0.222
             *

799          KK    R2A2
800          KM  ROUTE TO C2A1
801          RK   1200   0.004   0.015       0    TRAP     100       2
             *

802          KK   PT2A1
803          PB    2.77
804          BA   0.065
805          LS      0    86.8
806          UD   0.308
             *
1                                        HEC-1 INPUT                                                PAGE 25

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

807          KK    D95E
808          KM  RETRIEVE FLOW FROM BOX DIVERSION AT US95 AND CRAIG (CULVERT 7)
809          KM  ***NOTE: THIS FLOW CARRIES A TOTAL TRIBUTARY AREA OF 18.58 SQUARE MILES.***
810          KM  THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES BROUGHT IN BY D95B, SO
811          KM  THE TOTAL TRIBUTARY AREA TO THE CRAIG/RANCHO INTERSECTION IS 18.98 SQUARE
812          KM  MILES (18.58 + 0.40).
813          DR    D95E
             *

814          KK   RD95E
815          KM  ROUTE TO PT2A2
816          RK   1500   0.004   0.015       0    TRAP      80       2
             *

817          KK    C2A2
818          HC       3
             *

819          KK  DPT2A1
820          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN
821          KM  42" RCP, CAPACITY = 90 CFS
822          KM  REMAINING FLOW CONTINUES EAST IN CRAIG RD.
823          KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
824          DT   DCSD1
825          DI      0      21      51      76      91     200     500    1000
826          DQ      0      20      50      75      90      90      90      90
             *

827          KK    R2A2
828          KM  ROUTE TO C2B1
829          RK   2100   0.007   0.015       0    TRAP      80       2
             *

830          KK   PT2B1
831          PB    2.77
832          BA   0.072
833          LS      0    84.5
834          UD   0.222
             *
```

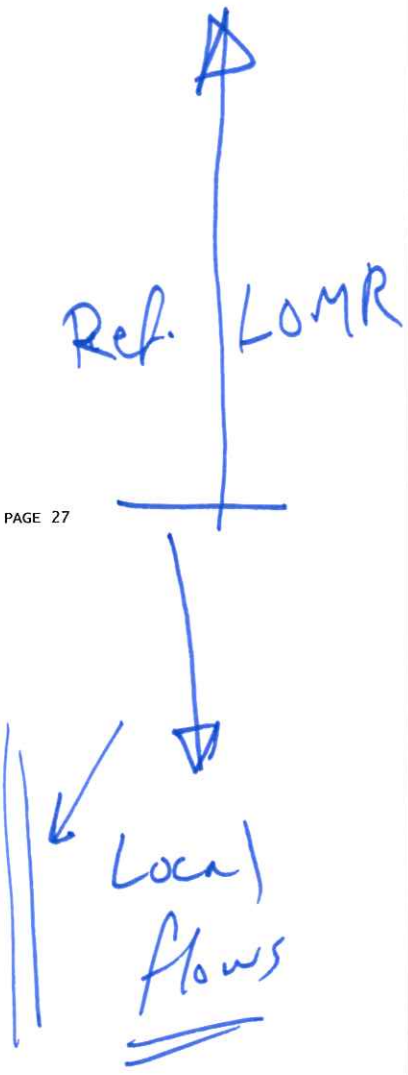
```
835          KK    C2B1
836          HC       2
             *
837          KK    R2B1
838          KM  ROUTE TO C2B3
839          RK     300   0.007   0.015       0    TRAP      80       2
             *
```



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

840          KK   2C2B3
841          HC       2
             *
842          KK   RC2B3
843          KM  ROUTE TO 5REMAIN (UPPER RANCHO HECRAS STA 53+82)
844          RK    1600  0.0076    0.03       0    TRAP      80       2
             *
             *
             *      ***************** BEGINNING AUGUST 2016 REVISION ********************
             *
             * JUST SWITCHING 5REMAIN AND D5RCHO, SO THAT RUNOFF FROM THE RANCHO CULVERTS
             * (CULVERT 27 AND CULVERT 26) CAN BE ROUTED AND COMBINED WITH THE LOCAL
             * FLOWS WITHIN THE STUDY
             *
             *                  ***************************
             *            ********************************************
             *
845          KK  D5RCHO
846          KM   DIVERT FLOW EAST ACROSS RANCHO IN TWO 6' X 3' RCB's. THE FIRST RCB IS JUST
847          KM   UPSTREAM OF THE 7' X 3' RCB (CULVERT 27) THAT PARALLELS RANCHO ON THE WEST
848          KM   SIDE.  DIVERT 78 CFS OF 185 CFS TO THE FIRST 6' X 3' RCB (CULVERT 26). THE
849          KM   REMAINING 107 CFS ENTERS THE 7' X 3' RCB.  THE SECOND 6' X 3' RCB
850          KM   CULVERT 28) IS CONNECTED INTO THE SIDE OF THE 7' X 3' RCB. DIVERT 35 CFS OF
851          KM   THE 107 CFS TO THE SECOND 6' X 3' RCB.  THE REMAINING 72 CFS CONTINUES
852          KM   TO THE SOUTH SIDE OF ALEXANDER IN THE 7' X 3' RCB. UPPER RANCHO HECRAS
853          KM   HAS CULVERT 27 IN IT BETWEEN STA. 52+64 AND 38+36.
854          DT 5REMAIN
855          DI       0     113     155     197     308
856          DQ       0       0      42      84     195
             *
             *     ********************END AUSUST 2016 REVISION*****************************
             *
             *
             *        ********************* AUGUST 2016 ******************************
             *
             *                  ----------------------------------------
             * (1) ***************** END OF REFERENCED HEC-1 MODEL ******************* (1)
             *                  ----------------------------------------
             *
             *   ***************** FROM THE "RANCHO/US 95 LOMR **************
             *        **************ISSUED ON NOVEMBER 30, 2009 *******************
             *
             *        ********************* AUSUST 2016 ******************************
             *
             *                  ***************************
             *            ********************************************
             *
```



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

857          KK   RNCH1
858          KM   NORTHERN PORTION OF EXISTING RANCHO DRIVE ALONG THE PROJECT SITE
859          PB    2.77
860          BA  .00355
861          LS       0    98.0
862          UD    .125
             *
863          KK  RRNCH1
864          KM   ROUTE RUNOFF FROM RNCHO1 THROUGH NX1 TO JONES LOW POINT
865          RK    1660   0.013   0.035       0    TRAP      10      50
             *
866          KK     NX1
867          KM   EXISTING ONSITE BASIN NX1 DRAINING SOUTHEASTERLY TOWARD JONES BLVD LOW POINT
868          BA  .03484
869          LS       0    91.6
870          UD    .220
             *
871          KK    CMX1
872          KM   COMBINE RRNCH1 AND NX1
873          HC       2
             *
874          KK   RNCH2
875          KM   SOUTHERN PORTION OF EXISTING RANCHO DRIVE ALONG THE PROJECT SITE
876          BA  .00304
877          LS       0    98.0
878          UD    .137
             *
879          KK  RRNCH2
880          KM   ROUTE RUNOFF FROM RNCHO1 THROUGH NX2 TO JONES LOW POINT
881          RK     600   0.011   0.035       0    TRAP      10      50
             *
882          KK     NX2
883          KM   EXISTING ONSITE BASIN NX2 DRAINING EASTERLY AND SOUTHEASTERLY TOWARDS
884          KM   JONES BLVD LOW POINT
885          BA  .02198
886          LS       0    91.6
```

```
887          UD    .155
             *

888          KK    CMX2
889          KM    COMBINE RRNCH2 AND NX2
890          HC       2
             *
             *
```



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

891          KK  JONES1
892          KM   WESTERN HALF OF JONES BOULEVARD DRAINING DIRECTLY TOWARDS EXISTING DROP INLET
893          KM   AT THE LAS VEGAS BOULEVARD LOW POINT
894          BA  .00344
895          LS       0    98.0
896          UD    .109
             *

897          KK  LOCL-X
898          KM   COMBINE CMX1, CMX2 AND JONES1
899          KM   LOCAL FLOWS DRAINING ONTO THE EXISTING DROP INLETS AT
900          KM   JONES BLVD. LOW POINT
901          HC       3
             *
             *

902          KK  TOTL-X
903          KM   COMBINE LOCL-X AND D5RCHO
904          KM   TOTAL FLOWS DRAINING ONTO THE EXISTING DROP INLETS AT
905          KM   JONES BLVD. LOW POINT
906          HC       2
             *

907          KKLOWPNT-X
908          KM   DIVERT FLOWS INTO EXISTING JONES BOULEVARD STORM DRAIN
909          KM   REMAINING FLOWS WILL CONTINUE EASTERLY INTO HICKAM AVENUE
910          DTJONES-SD
911          DI       0      79     100     200     300
912          DQ       0      79      79      79      79
             *

913          KK  JONES2
914          KM   EASTERN HALF OF JONES BOULEVARD TOWARDS HICKAM AVE. AT THE INTERSECTION
915          BA  .00319
916          LS       0    98.0
917          UD    .123
             *
             *

918          KKHICKAM-X
919          KM   COMBINE HICKAM-X AND JONES2
920          KM   TOTAL FLOWS CONTINUING INTO HICKAM AVENUE
921          KM   AT INTERSECTION WITH JONES BLVD. LOW POINT
922          HC       2
             *
             * KKR5REMN
             * KMROUTE TO CPT51 (UPPER RANCHO HECRAS STA 38+36)
             * RK1428     0.006    0.03       0   TRAP        7       0
             *
             * KKPT51
             * PB2.77
             * BA0.070
             * LS0          90.4
             * UD0.262
             *
             * KKCPT51
             * HC2
             *
             * KKD95Fa
             * KMRETRIEVE FLOW FROM WIER DIVERSION AT US95 AND ALEXANDER
             * DRD95Fa
             *
             * THESE TWO DIVERSIONS CARRY A TOTAL TRIBUTARY AREA OF 18.68.
             * THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES AND 2.35
             * SQUARE MILES BROUGHT IN BY D95B AND D95E RESPECTIVELY, SO THE TOTAL
             * TRIBUTARY AREA AT THE ALEXANDER/RANCHO INTERSECTION IS 19.69 SQUARE MILES.
             * (18.68 + 1.01)
             *
             * KKDCSD2
             * KM RETRIEVE FLOWS CONVEYED THROUGH THE CRAIG ROAD STORM DRAIN
             * DRDCSD2
             *
             *
             * KKDCSD1
             * KM RETRIEVE FLOWS CONVEYED THROUGH THE CRAIG ROAD STORM DRAIN
             * DRDCSD1
             *
             * KK CRGSD
             * HC     2
             *
             *
             *
```

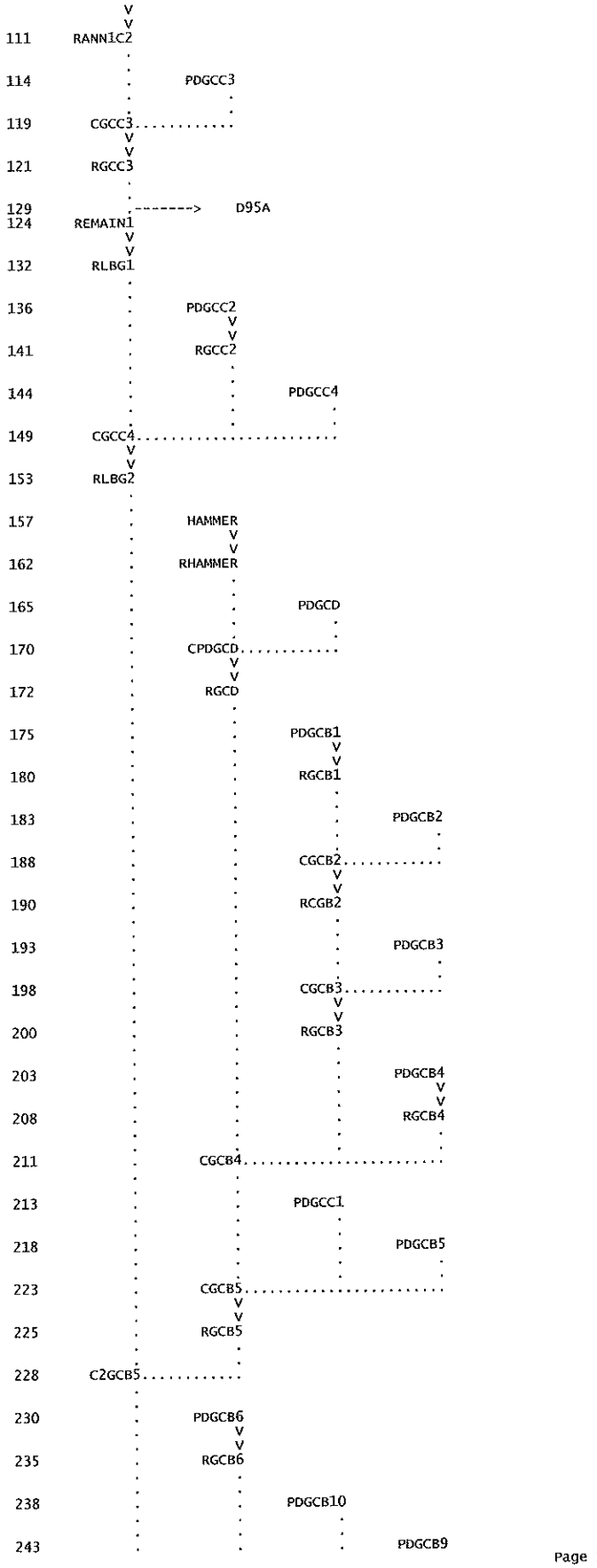


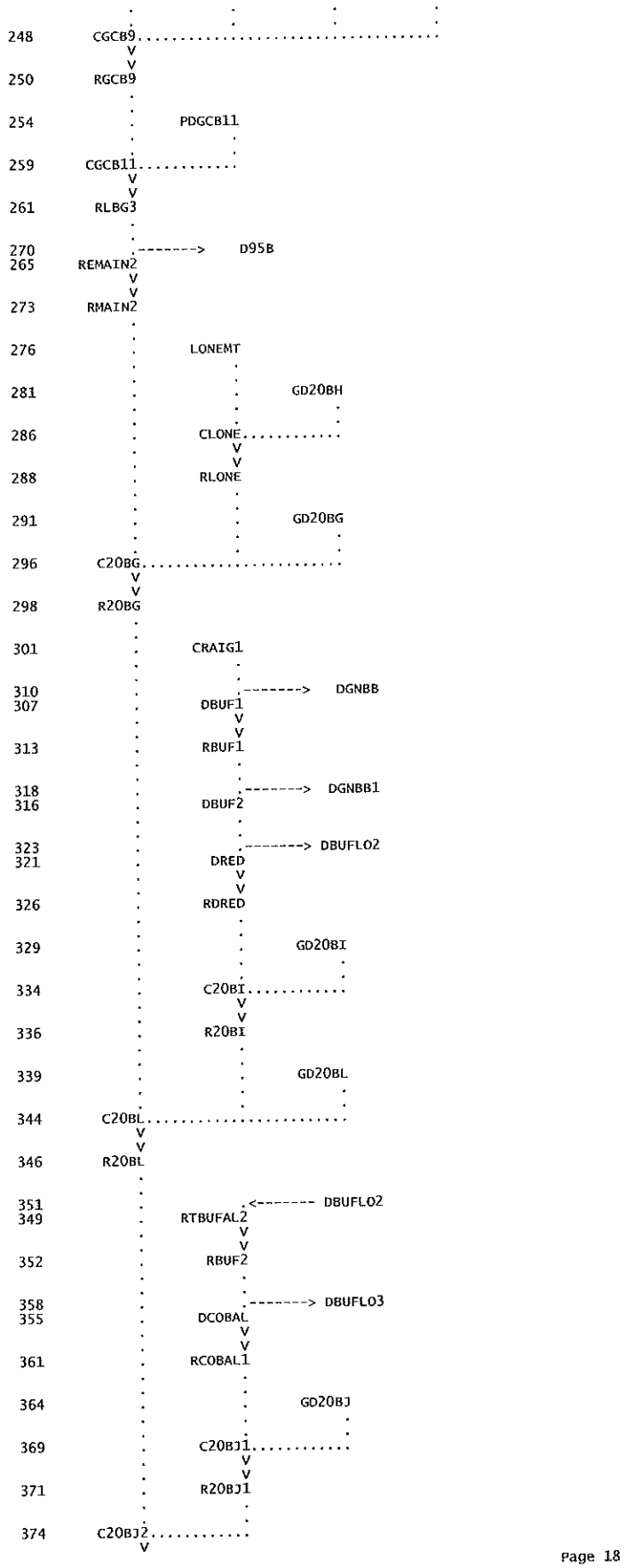
```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

923          KK  CRAIG1
924          KM   WESTERN PORTION OF EXISTING SOUTH-HALF OF CRAIG ROAD ALONG THE PROJECT SITE
925          BA  .00237
926          LS       0    98.0
927          UD    .098
             *

928          KK RCRAIG1
929          KM   ROUTE RUNOFF FROM CRAIG1 TO INTERSECTION WITH JONES BLVD.
```

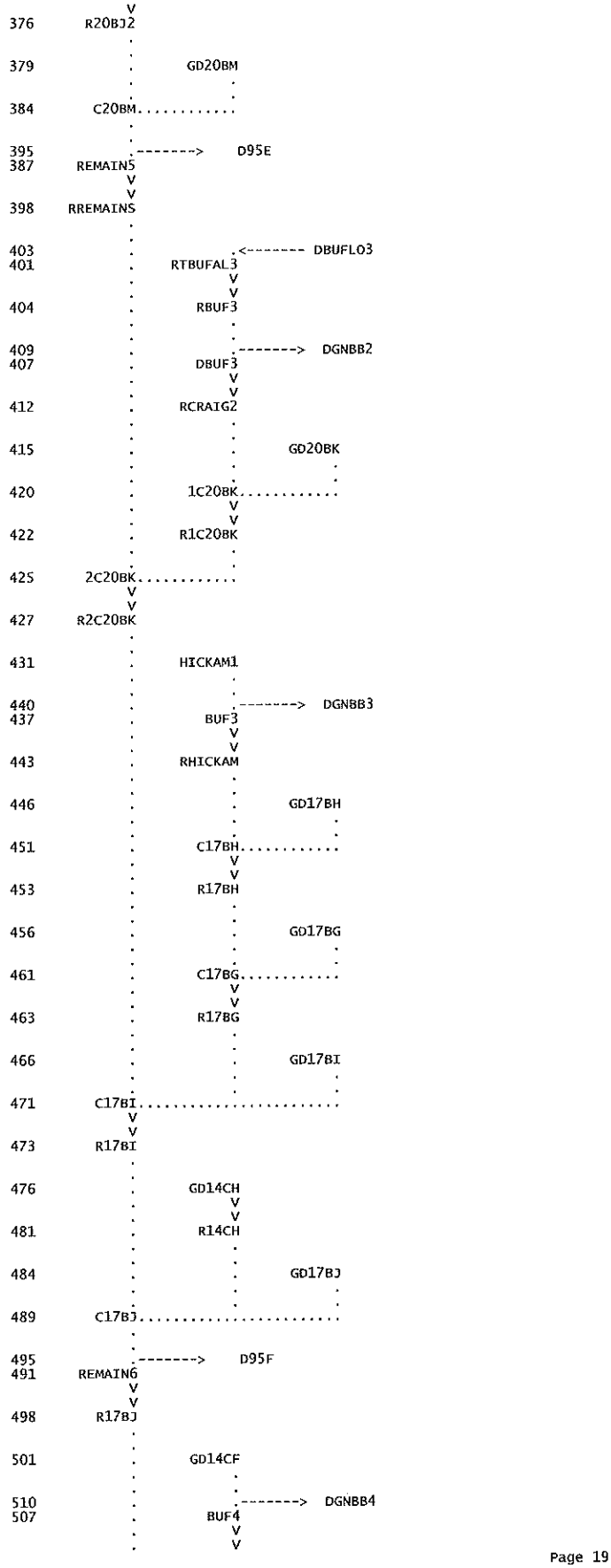
```
                                                                XLOMR
930          RK     700   0.020   0.015       0    TRAP       2      50
             *
931          KK      NX3
932          KM   EXISTING ONSITE BASIN NX3 DRAINING EASTERLY AND NORTHEASTERLY TOWARDS
933          KM   CRAIG ROAD
934          BA  .01801
935          LS        0    94.0
936          UD     .161
             *
             *
937          KK  CRAIG2
938          KM   EASTERN PORTION OF EXISTING SOUTH-HALF OF CRAIG ROAD ALONG THE PROJECT SITE
939          BA  .00148
940          LS        0    98.0
941          UD     .065
             *
             *
942          KK  CRG1-X
943          KM   COMBINE RCRAIG1, NX3 AMD CRAIG2
944          KM   TOTAL SURFACE FLOWS CONVEYED WITHIN CRAIG ROAD SOUTH HALF
945          KM   JUST UPSTREAM THE INTERSECTION WITH JONES BLVD.
946          HC        3
             *
947          KK      NX4
948          KM   EXISTING ONSITE BASIN NX4 DRAINING EASTERLY AND NORTHEASTERLY TOWARDS
949          KM   JONES BOULEVARD, NORTH OF THE HIGHPOINT
950          BA  .00366
951          LS        0    94.0
952          UD     .100
             *
             *
953          KK  JONES3
954          KM   WESTERN HALF OF JONES BOULEVARD, NORTH OF THE HIGHPOINT
955          KM   DRAINING NORTHERLY TOWARDS CRIAG ROAD
956          BA  .00111
957          LS        0    98.0
958          UD     .087
             *
             *
1                                        HEC-1 INPUT                                        PAGE 30

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

959          KK    JON-X
960          KM    COMBINE NX4 AND JONES3
961          KM    TOTAL NORTHERLY FLOWS WITHIN WEST HALF OF JONES BOULEVARD
962          KM    AT INTERSECTION WITH CRAIG ROAD
963          HC        2
             *
             *
964          KK  CRG2-X
965          KM    COMBINE CRG1-X AND JON-X
966          KM    TOTAL FLOWS CONVEYED WITHIN CRAIG ROAD SOUTH HALF,
967          KM    AT THE INTERSECTION WITH JONES BLVD.
968          HC        2
             *
             *
969          KK     NDA^
970          KM    REFERENCED ONSITE BASIN NDA FOR THE PORTION OF THE MURPHY EXPRESS DRAINING IN
971          KM    EXISTING CRAIG ROAD STORM DRAIN, AS REFERENCED FROM
972          KM    "TDS FOR MURPHY EXPRESS (CRAIG RD & JONES BLVD.)", DS 4771
973          BA  .00153
974          LS        0    98.0
975          UD     .050
             *
976          ZZ
```

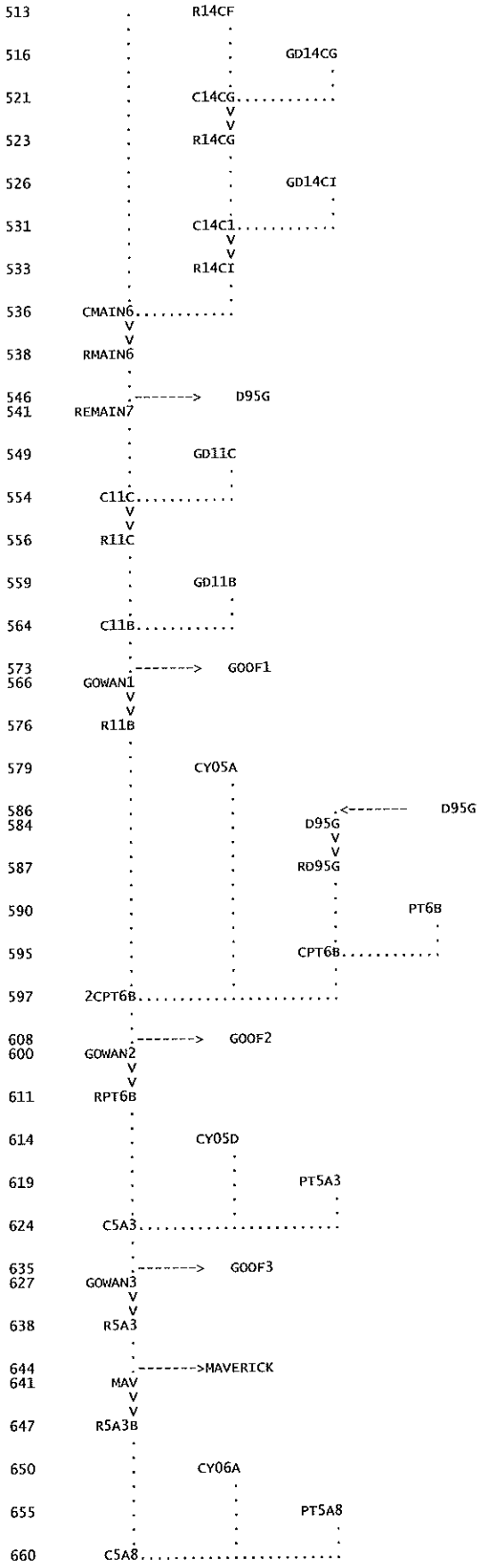
Ref. 5

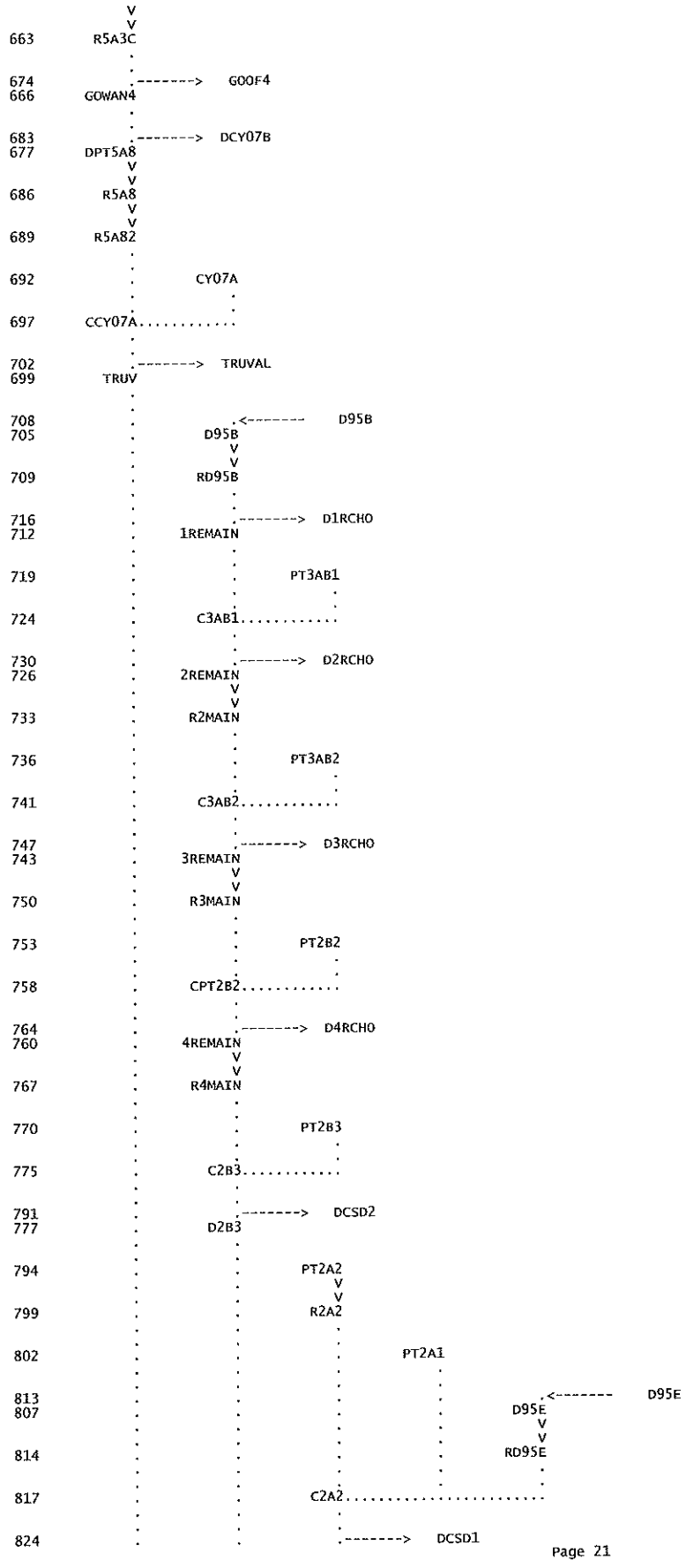
```
1
          SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

   68        ANN
               V
               V
   81        RANN
               .
               .
   84          .       GD29B
               .           .
               .           .
   89      CGD29B.............
               V
               V
   91      RGD29B
               .
               .
   94          .       ANN1B
               .           .
               .           .
   99      CANN1B.............
               V
               V
  101      RANN1B
               .
               .
  104          .      ANN1C2
               .           .
               .           .
  109      CANN1C2.............
```

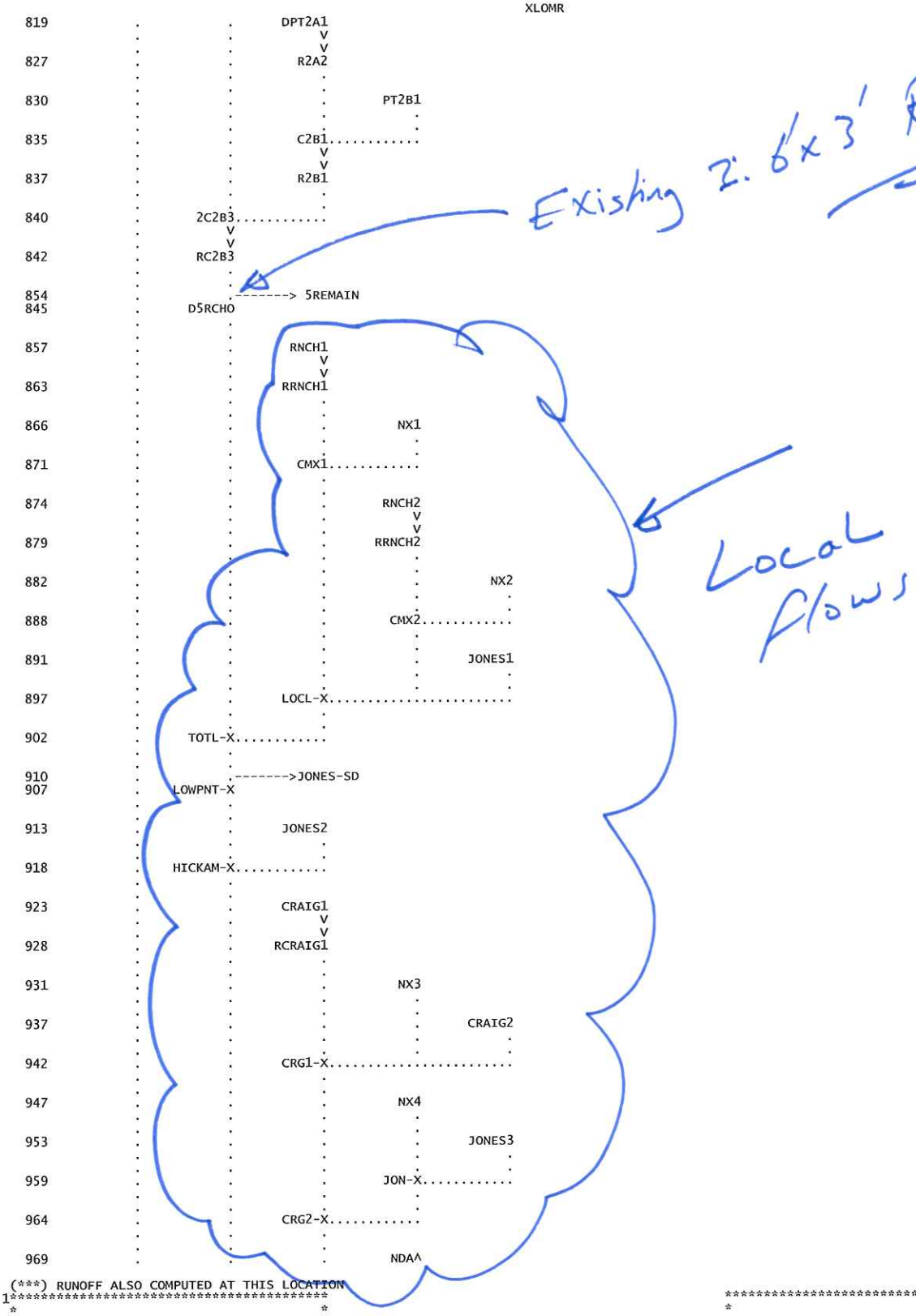

RANN1C2
PDGCC3
CGCC3
RGCC3
D95A
REMAIN1
RLBG1
PDGCC2
RGCC2
PDGCC4
CGCC4
RLBG2
HAMMER
RHAMMER
PDGCD
CPDGCD
RGCD
PDGCB1
RGCB1
PDGCB2
CGCB2
RCGB2
PDGCB3
CGCB3
RGCB3
PDGCB4
RGCB4
CGCB4
PDGCC1
PDGCB5
CGCB5
RGCB5
C2GCB5
PDGCB6
RGCB6
PDGCB10
PDGCB9


248 CGCB9
250 RGCB9
254 PDGCB11
259 CGCB11
261 RLBG3
270
265 REMAIN2
273 RMAIN2
276 LONEMT
281 GD20BH
286 CLONE
288 RLONE
291 GD20BG
296 C20BG
298 R20BG
301 CRAIG1
310
307 DBUF1
313 RBUF1
318
316 DBUF2
323
321 DRED
326 RDRED
329 GD20BI
334 C20BI
336 R20BI
339 GD20BL
344 C20BL
346 R20BL
351
349 RTBUFAL2
352 RBUF2
358
355 DCOBAL
361 RCOBAL1
364 GD20BJ
369 C20BJ1
371 R20BJ1
374 C20BJ2
DGNBB
DGNBB1
DBUFLO2
DBUFLO2
DBUFLO3


R20BJ2
GD20BM
C20BM
D95E
REMAIN5
RREMAINS
DBUFLO3
RTBUFAL3
RBUF3
DGNBB2
DBUF3
RCRAIG2
GD20BK
1C20BK
R1C20BK
2C20BK
R2C20BK
HICKAM1
DGNBB3
BUF3
RHICKAM
GD17BH
C17BH
R17BH
GD17BG
C17BG
R17BG
GD17BI
C17BI
R17BI
GD14CH
R14CH
GD17BJ
C17BJ
D95F
REMAIN6
R17BJ
GD14CF
DGNBB4
BUF4


513 R14CF
516 GD14CG
521 C14CG
523 R14CG
526 GD14CI
531 C14C1
533 R14CI
536 CMAIN6
538 RMAIN6
546 D95G
541 REMAIN7
549 GD11C
554 C11C
556 R11C
559 GD11B
564 C11B
573 GOOF1
566 GOWAN1
576 R11B
579 CY05A
586 D95G
584 D95G
587 RD95G
590 PT6B
595 CPT6B
597 2CPT6B
608 GOOF2
600 GOWAN2
611 RPT6B
614 CY05D
619 PT5A3
624 C5A3
635 GOOF3
627 GOWAN3
638 R5A3
644 MAVERICK
641 MAV
647 R5A3B
650 CY06A
655 PT5A8
660 C5A8


663 R5A3C
674
666 GOWAN4
683
677 DPT5A8
686 R5A8
689 R5A82
692 CY07A
697 CCY07A
702
699 TRUV
708
705 D95B
709 RD95B
716
712 1REMAIN
719 PT3AB1
724 C3AB1
730
726 2REMAIN
733 R2MAIN
736 PT3AB2
741 C3AB2
747
743 3REMAIN
750 R3MAIN
753 PT2B2
758 CPT2B2
764
760 4REMAIN
767 R4MAIN
770 PT2B3
775 C2B3
791
777 D2B3
794 PT2A2
799 R2A2
802 PT2A1
813
807 D95E
814 RD95E
817 C2A2
824
GOOF4
DCY07B
TRUVAL
D95B
D1RCHO
D2RCHO
D3RCHO
D4RCHO
DCSD2
D95E
DCSD1



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1**********

```
*                                        *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*              JUN  1998                 *
*            VERSION 4.1                 *
*                                        *
*  RUN DATE   31AUG16  TIME  20:24:28    *
*                                        *
******************************************
```

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

```
                    CRAIG/RANCHO MASTER DRAINAGE STUDY
                    EXISTING CONDITION
                    USING SCS METHODS AND KINEMATIC WAVE ROUTING
                    MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

                    LOCHSA JOB# 161051


                    INPUT FILE NAME:  XLOMR.DAT

                    AUGUST 2016

                    ********************************************************************************
                    ********************************************************************************
                         INSIDE McCARRAN AIRPORT RAINFALL AREA

                         10, 25 & 100 YEAR - 6 HOUR STORM EVENT
                         PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM


                         10-YEAR RAINFALL DEPTH  = 1.58 INCHES
                         25-YEAR RAINFALL DEPTH  = 2.05 INCHES
                         100-YEAR RAINFALL DEPTH = 2.77 INCHES

                         10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
                         25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
                    ********************************************************************************


                  DARF RATIOS FOR AREAS OF 5.20 SQUARE MILES FOR
                  RANCHO AND JONES BLVD. FLOWS = 0.90

                         10-YEAR RAINFALL DEPTH RATIO (JR CARD) = (1.58/2.77) X 0.90 = 0.51
                         25-YEAR RAINFALL DEPTH RATIO (JR CARD) = (2.05/2.77) X 0.90 = 0.67


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

                    ********************************************************************************
                  RANCHO/US95 CLOMR
                  FOR:  CITY OF LAS VEGAS, NV AND THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTR
                  THIS IS THE PROPOSED HEC1 MODEL FOR UPPER RANCHO DRIVE (NORTH OF GOWAN ROAD)
                   FILENAME:UPPRSDN3.DAT

                   CAM10 DETENTION BASIN AND THE WESTERN BELTWAY CHANNEL ARE INCLUDED IN THE EN
                   NOT IN THE SDN3 WATERSHED.


                  MODIFIED BY LBG SEPT 2005
                  SDN3 CREATED BY REDUCING THE SIZE OF CRAIG SUBBASIN TO 1.434 SQUARE MILES
                  ADD INTERIM BELTWAY AND GOWAN NORTH PHASE III
                  BY MODIFYING THE CRAIG SUBBASIN FROM PBS&J MODEL

                  LVRA0000 (PEAK CHANNEL AND RANCHO DRIVE IMPROVEMENTS) ADDED BY DIVERTING
                  FLOW FROM CONCENTRATION POINT CX1X4

                  TRUVAL FLOW SPLIT, REMOVED FROM CVL MODEL, HAS BEEN PUT BACK IN.

                  JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

                  100-YEAR,  6-HOUR STORM,  SDN3
                  DARF RATIOS FOR AREAS OF 0, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0 AND 10 SQUARE MILES
                  FOR THE 100-YEAR EVENT.

65 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           100  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1   0  ENDING DATE
                     NDTIME       0815  ENDING TIME
                     ICENT          19  CENTURY MARK

                   COMPUTATION INTERVAL      .08 HOURS
                        TOTAL TIME BASE     8.25 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
                1.00       .74       .57       .90       .67       .51

      *** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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 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

*** 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

*** 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

*** 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

*** 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

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

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

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

DARF = 0.9

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00	RATIO 2 .74	RATIO 3 .57	RATIO 4 .90	RATIO 5 .67	RATIO 6 .51
HYDROGRAPH AT	ANN	.26	1	FLOW	123.	62.	30.	99.	48.	21.
+				TIME	4.00	4.00	4.08	4.00	4.00	4.08
ROUTED TO	RANN	.26	1	FLOW	122.	62.	30.	98.	48.	20.
+				TIME	4.08	4.08	4.17	4.08	4.08	4.17
HYDROGRAPH AT	GD29B	.14	1	FLOW	69.	32.	14.	54.	24.	9.
+				TIME	3.75	3.83	3.83	3.75	3.83	3.92
2 COMBINED AT	CGD29B	.40	1	FLOW	174.	85.	39.	137.	64.	27.
+				TIME	3.92	4.00	4.08	3.92	4.00	4.17
ROUTED TO	RGD29B	.40	1	FLOW	173.	84.	39.	137.	64.	26.
+				TIME	4.00	4.08	4.17	4.00	4.08	4.25
HYDROGRAPH AT	ANN1B	.14	1	FLOW	108.	62.	35.	90.	51.	27.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.83
2 COMBINED AT	CANN1B	.53	1	FLOW	258.	128.	59.	206.	98.	40.
+				TIME	3.92	3.92	4.08	3.92	4.00	4.17

ROUTED TO										
+	RANN1B	.53	1	FLOW	256.	127.	59.	203.	97.	40.
				TIME	3.92	4.00	4.17	4.00	4.08	4.25
HYDROGRAPH AT										
+	ANN1C2	.09	1	FLOW	69.	38.	21.	56.	31.	15.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT										
+	CANN1C2	.62	1	FLOW	308.	152.	69.	246.	116.	46.
				TIME	3.92	4.00	4.17	3.92	4.00	4.25
ROUTED TO										
+	RANN1C2	.62	1	FLOW	307.	152.	69.	244.	114.	45.
				TIME	3.92	4.00	4.17	3.92	4.08	4.25
HYDROGRAPH AT										
+	PDGCC3	.05	1	FLOW	50.	30.	18.	42.	24.	14.
				TIME	3.58	3.58	3.67	3.58	3.67	3.67
2 COMBINED AT										
+	CGCC3	.67	1	FLOW	332.	163.	73.	265.	124.	49.
				TIME	3.92	4.00	4.17	3.92	4.00	3.83
ROUTED TO										
+	RGCC3	.67	1	FLOW	331.	163.	73.	264.	122.	48.
				TIME	3.92	4.00	4.17	3.92	4.08	3.92
DIVERSION TO										
+	D95A	.67	1	FLOW	139.	139.	72.	139.	121.	48.
				TIME	3.58	3.83	4.17	3.67	4.08	3.92
HYDROGRAPH AT										
+	REMAIN1	.67	1	FLOW	192.	24.	1.	125.	1.	1.
				TIME	3.92	4.00	3.75	3.92	3.67	3.92
ROUTED TO										
+	RLBG1	.67	1	FLOW	192.	24.	1.	125.	1.	1.
				TIME	3.92	4.00	3.83	3.92	3.75	3.92
HYDROGRAPH AT										
+	PDGCC2	.04	1	FLOW	20.	9.	4.	15.	7.	2.
				TIME	3.75	3.83	3.83	3.75	3.83	3.92
ROUTED TO										
+	RGCC2	.04	1	FLOW	20.	9.	3.	15.	6.	2.
				TIME	3.92	4.00	4.25	3.92	4.08	4.33
HYDROGRAPH AT										
+	PDGCC4	.05	1	FLOW	51.	30.	18.	43.	25.	14.
				TIME	3.58	3.58	3.67	3.58	3.67	3.67
3 COMBINED AT										
+	CGCC4	.76	1	FLOW	237.	45.	19.	161.	26.	15.
				TIME	3.92	4.00	3.67	3.92	3.67	3.67
ROUTED TO										
+	RLBG2	.76	1	FLOW	237.	44.	19.	161.	26.	14.
				TIME	3.92	4.00	3.67	3.92	3.67	3.67
HYDROGRAPH AT										
+	HAMMER	.13	1	FLOW	73.	37.	17.	58.	28.	12.
				TIME	3.83	3.83	3.83	3.83	3.83	3.92
ROUTED TO										
+	RHAMMER	.13	1	FLOW	72.	37.	17.	57.	28.	12.
				TIME	3.83	3.92	4.00	3.83	3.92	4.00
HYDROGRAPH AT										
+	PDGCD	.13	1	FLOW	65.	30.	13.	51.	22.	8.
				TIME	3.75	3.75	3.83	3.75	3.83	3.83
2 COMBINED AT										
+	CPDGCD	.26	1	FLOW	134.	65.	29.	106.	48.	19.
				TIME	3.83	3.83	3.92	3.83	3.92	4.00
ROUTED TO										
+	RGCD	.26	1	FLOW	133.	63.	28.	106.	48.	19.
				TIME	3.92	4.00	4.08	3.92	4.00	4.17
HYDROGRAPH AT										
+	PDGCB1	.03	1	FLOW	38.	23.	14.	32.	19.	11.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO										
+	RGCB1	.03	1	FLOW	37.	22.	13.	31.	18.	10.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT										
+	PDGCB2	.03	1	FLOW	27.	15.	8.	22.	12.	6.
				TIME	3.58	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	CGCB2	.06	1	FLOW	64.	37.	21.	53.	31.	16.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
ROUTED TO										
+	RCGB2	.06	1	FLOW	62.	36.	21.	51.	30.	16.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
HYDROGRAPH AT										
+	PDGCB3	.07	1	FLOW	34.	15.	6.	26.	11.	4.
				TIME	3.67	3.75	3.75	3.67	3.75	3.83
2 COMBINED AT										
+	CGCB3	.13	1	FLOW	96.	51.	27.	77.	41.	19.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
ROUTED TO										

XLOMR

+	RGCB3	.13	1	FLOW	94.	50.	26.	76.	39.	19.
				TIME	3.75	3.75	3.83	3.75	3.75	3.83
HYDROGRAPH AT										
+	PDGCB4	.02	1	FLOW	21.	13.	8.	18.	11.	6.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO										
+	RGCB4	.02	1	FLOW	21.	13.	8.	18.	11.	6.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
3 COMBINED AT										
+	CGCB4	.41	1	FLOW	231.	113.	52.	184.	86.	33.
				TIME	3.83	3.92	4.00	3.83	3.92	4.08
HYDROGRAPH AT										
+	PDGCC1	.05	1	FLOW	30.	15.	6.	24.	11.	4.
				TIME	3.75	3.75	3.83	3.75	3.75	3.83
HYDROGRAPH AT										
+	PDGCB5	.11	1	FLOW	55.	27.	12.	44.	20.	8.
				TIME	3.83	3.92	3.92	3.83	3.92	3.92
3 COMBINED AT										
+	CGCB5	.57	1	FLOW	314.	152.	69.	250.	116.	43.
				TIME	3.83	3.92	4.00	3.83	3.92	4.08
ROUTED TO										
+	RGCB5	.57	1	FLOW	311.	150.	66.	247.	113.	42.
				TIME	3.92	4.00	4.17	3.92	4.00	4.25
2 COMBINED AT										
+	C2GCB5	1.33	1	FLOW	549.	195.	73.	407.	128.	48.
				TIME	3.92	4.00	4.17	3.92	4.00	4.25
HYDROGRAPH AT										
+	PDGCB6	.02	1	FLOW	23.	15.	9.	20.	12.	8.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO										
+	RGCB6	.02	1	FLOW	23.	14.	9.	18.	12.	7.
				TIME	3.75	3.83	3.83	3.83	3.83	3.92
HYDROGRAPH AT										
+	PDGCB10	.07	1	FLOW	67.	39.	23.	56.	32.	18.
				TIME	3.67	3.67	3.75	3.67	3.75	3.75
HYDROGRAPH AT										
+	PDGCB9	.03	1	FLOW	25.	12.	6.	20.	9.	4.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
4 COMBINED AT										
+	CGCB9	1.45	1	FLOW	628.	233.	93.	470.	160.	63.
				TIME	3.83	4.00	4.08	3.92	4.00	4.00
ROUTED TO										
+	RGCB9	1.45	1	FLOW	623.	232.	93.	469.	159.	62.
				TIME	3.92	4.00	4.08	3.92	4.00	4.00
HYDROGRAPH AT										
+	PDGCB11	.03	1	FLOW	26.	14.	7.	22.	11.	5.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	CGCB11	1.49	1	FLOW	638.	238.	96.	481.	164.	64.
				TIME	3.83	4.00	4.08	3.92	4.00	4.00
ROUTED TO										
+	RLBG3	1.49	1	FLOW	638.	238.	95.	479.	163.	64.
				TIME	3.92	4.00	4.08	3.92	4.00	4.08
DIVERSION TO										
+	D95B	1.49	1	FLOW	192.	94.	38.	176.	64.	25.
				TIME	3.83	4.00	4.08	3.92	4.00	4.08
HYDROGRAPH AT										
+	REMAIN2	1.49	1	FLOW	446.	144.	58.	303.	99.	39.
				TIME	3.92	4.00	4.08	3.92	4.00	4.08
ROUTED TO										
+	RMAIN2	1.49	1	FLOW	443.	142.	58.	295.	99.	39.
				TIME	3.92	4.08	4.17	4.00	4.08	4.17
HYDROGRAPH AT										
+	LONEMT	.41	1	FLOW	302.	174.	100.	251.	143.	76.
				TIME	3.83	3.83	3.83	3.83	3.83	3.92
HYDROGRAPH AT										
+	GD20BH	.05	1	FLOW	29.	15.	7.	23.	11.	5.
				TIME	3.67	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT										
+	CLONE	.46	1	FLOW	328.	188.	106.	272.	153.	80.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83
ROUTED TO										
+	RLONE	.46	1	FLOW	325.	185.	105.	269.	150.	80.
				TIME	3.83	3.83	3.92	3.83	3.92	3.92
HYDROGRAPH AT										
+	GD20BG	.11	1	FLOW	90.	51.	28.	74.	41.	21.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
3 COMBINED AT										
+	C20BG	2.06	1	FLOW	824.	344.	172.	609.	266.	124.
				TIME	3.92	3.92	4.00	3.92	3.92	3.92
ROUTED TO										
+	R20BG	2.06	1	FLOW	812.	341.	172.	602.	263.	123.

XLOMR

				TIME	4.00	4.00	4.08	4.00	4.00	4.08
HYDROGRAPH AT										
+	CRAIG1	2.44	1	FLOW	1475.	862.	502.	1233.	708.	388.
				TIME	4.17	4.17	4.25	4.17	4.17	4.25
DIVERSION TO										
+	DGNBB	2.44	1	FLOW	249.	249.	249.	249.	249.	249.
				TIME	3.50	3.67	3.83	3.58	3.67	3.92
HYDROGRAPH AT										
+	DBUF1	2.44	1	FLOW	1226.	613.	253.	984.	459.	139.
				TIME	4.17	4.17	4.25	4.17	4.17	4.25
ROUTED TO										
+	RBUF1	2.44	1	FLOW	1221.	609.	252.	979.	457.	137.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
DIVERSION TO										
+	DGNBB1	2.44	1	FLOW	109.	109.	109.	109.	109.	109.
				TIME	3.58	3.75	4.00	3.67	3.83	4.17
HYDROGRAPH AT										
+	DBUF2	2.44	1	FLOW	1112.	500.	143.	870.	348.	28.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
DIVERSION TO										
+	DBUFLO2	2.44	1	FLOW	783.	352.	101.	612.	245.	20.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
HYDROGRAPH AT										
+	DRED	2.44	1	FLOW	329.	148.	42.	257.	103.	8.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
ROUTED TO										
+	RDRED	2.44	1	FLOW	328.	147.	41.	257.	102.	8.
				TIME	4.25	4.25	4.33	4.25	4.33	4.58
HYDROGRAPH AT										
+	GD20BI	.12	1	FLOW	85.	47.	25.	70.	37.	18.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT										
+	C20BI	2.56	1	FLOW	359.	164.	50.	281.	115.	18.
				TIME	4.17	4.25	4.33	4.25	4.25	3.75
ROUTED TO										
+	R20BI	2.56	1	FLOW	357.	164.	49.	281.	114.	18.
				TIME	4.25	4.25	4.42	4.25	4.33	3.83
HYDROGRAPH AT										
+	GD20BL	.08	1	FLOW	94.	60.	39.	81.	51.	32.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT										
+	C20BL	4.69	1	FLOW	1163.	501.	207.	869.	368.	153.
				TIME	4.00	4.08	4.00	4.00	4.17	4.00
ROUTED TO										
+	R20BL	4.69	1	FLOW	1155.	497.	205.	865.	365.	151.
				TIME	4.00	4.17	4.08	4.08	4.17	4.08
HYDROGRAPH AT										
+	RTBUFAL2	.00	1	FLOW	783.	352.	101.	612.	245.	20.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
ROUTED TO										
+	RBUF2	.00	1	FLOW	780.	352.	99.	609.	245.	19.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
DIVERSION TO										
+	DBUFLO3	.00	1	FLOW	557.	251.	71.	435.	175.	13.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
HYDROGRAPH AT										
+	DC0BAL	.00	1	FLOW	223.	100.	28.	174.	70.	5.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
ROUTED TO										
+	RC0BAL1	.00	1	FLOW	222.	100.	28.	174.	69.	5.
				TIME	4.25	4.33	4.42	4.25	4.33	4.67
HYDROGRAPH AT										
+	GD20BJ	.05	1	FLOW	49.	29.	17.	41.	24.	13.
				TIME	3.67	3.67	3.75	3.67	3.67	3.75
2 COMBINED AT										
+	C20BJ1	.05	1	FLOW	235.	107.	32.	185.	75.	13.
				TIME	4.25	4.25	4.42	4.25	4.33	3.75
ROUTED TO										
+	R20BJ1	.05	1	FLOW	235.	107.	31.	185.	75.	13.
				TIME	4.25	4.33	4.42	4.25	4.33	3.75
2 COMBINED AT										
+	C20BJ2	4.74	1	FLOW	1345.	596.	223.	1030.	429.	158.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08
ROUTED TO										
+	R20BJ2	4.74	1	FLOW	1344.	595.	222.	1028.	429.	158.
				TIME	4.08	4.17	4.33	4.08	4.25	4.08
HYDROGRAPH AT										
+	GD20BM	.05	1	FLOW	62.	40.	26.	54.	34.	21.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT										
+	C20BM	4.79	1	FLOW	1362.	604.	226.	1043.	435.	165.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08

4.79 sq. Miles

XLOMR

DIVERSION TO	D95E	4.79	1	FLOW	184.	83.	21.	148.	55.	14.
+				TIME	4.00	4.17	4.33	4.08	4.25	4.08
HYDROGRAPH AT	REMAIN5	4.79	1	FLOW	1178.	521.	205.	895.	380.	151.
+				TIME	4.00	4.17	4.33	4.08	4.25	4.08
ROUTED TO	RREMAINS	4.79	1	FLOW	1177.	519.	203.	891.	380.	150.
+				TIME	4.08	4.17	4.33	4.08	4.25	4.08
HYDROGRAPH AT	RTBUFAL3	.00	1	FLOW	557.	251.	71.	435.	175.	13.
+				TIME	4.17	4.25	4.25	4.17	4.25	4.33
ROUTED TO	RBUF3	.00	1	FLOW	555.	251.	70.	435.	174.	12.
+				TIME	4.25	4.25	4.33	4.25	4.25	4.42
DIVERSION TO	DGNBB2	.00	1	FLOW	198.	198.	69.	198.	173.	12.
+				TIME	3.83	4.08	4.33	3.92	4.25	4.42
HYDROGRAPH AT	DBUF3	.00	1	FLOW	357.	53.	0.	237.	1.	0.
+				TIME	4.25	4.25	4.33	4.25	4.25	4.42
ROUTED TO	RCRAIG2	.00	1	FLOW	356.	52.	0.	235.	1.	0.
+				TIME	4.25	4.42	5.58	4.33	5.08	7.00
HYDROGRAPH AT	GD20BK	.05	1	FLOW	38.	21.	11.	31.	17.	8.
+				TIME	3.67	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT	1C20BK	.05	1	FLOW	367.	56.	11.	243.	17.	8.
+				TIME	4.25	4.42	3.75	4.33	3.75	3.75
ROUTED TO	R1C20BK	.05	1	FLOW	363.	54.	11.	243.	17.	8.
+				TIME	4.33	4.50	3.83	4.33	3.83	3.83
2 COMBINED AT	2C20BK	4.84	1	FLOW	1460.	530.	211.	1060.	387.	156.
+				TIME	4.17	4.17	4.08	4.17	4.25	4.08
ROUTED TO	R2C20BK	4.84	1	FLOW	1457.	526.	211.	1056.	386.	154.
+				TIME	4.17	4.17	4.08	4.25	4.25	4.08
HYDROGRAPH AT	HICKAM1	.48	1	FLOW	290.	160.	87.	238.	129.	65.
+				TIME	3.92	4.00	4.00	3.92	4.00	4.00
DIVERSION TO	DGNBB3	.48	1	FLOW	125.	125.	86.	125.	125.	64.
+				TIME	3.58	3.75	4.00	3.67	3.92	4.00
HYDROGRAPH AT	BUF3	.48	1	FLOW	165.	35.	1.	113.	4.	1.
+				TIME	3.92	4.00	4.00	3.92	4.00	4.00
ROUTED TO	RHICKAM	.48	1	FLOW	163.	34.	1.	112.	4.	1.
+				TIME	4.00	4.00	4.42	4.00	4.17	4.50
HYDROGRAPH AT	GD17BH	.03	1	FLOW	25.	14.	8.	21.	12.	6.
+				TIME	3.58	3.58	3.67	3.58	3.58	3.67
2 COMBINED AT	C17BH	.50	1	FLOW	172.	40.	8.	120.	12.	6.
+				TIME	4.00	4.00	3.67	4.00	3.58	3.67
ROUTED TO	R17BH	.50	1	FLOW	171.	38.	8.	117.	12.	6.
+				TIME	4.00	4.17	3.83	4.00	3.75	3.83
HYDROGRAPH AT	GD17BG	.12	1	FLOW	99.	58.	34.	83.	48.	26.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT	C17BG	.62	1	FLOW	234.	72.	42.	169.	59.	31.
+				TIME	3.92	3.75	3.75	4.00	3.75	3.83
ROUTED TO	R17BG	.62	1	FLOW	233.	71.	41.	167.	58.	31.
+				TIME	4.00	3.83	3.83	4.00	3.83	3.92
HYDROGRAPH AT	GD17BI	.07	1	FLOW	71.	43.	26.	60.	36.	21.
+				TIME	3.58	3.67	3.67	3.58	3.67	3.67
3 COMBINED AT	C17BI	5.53	1	FLOW	1675.	602.	251.	1212.	419.	184.
+				TIME	4.17	4.17	4.00	4.17	4.25	4.08
ROUTED TO	R17BI	5.53	1	FLOW	1668.	597.	247.	1205.	417.	181.
+				TIME	4.17	4.25	4.17	4.25	4.33	4.17
HYDROGRAPH AT	GD14CH	.04	1	FLOW	40.	23.	13.	33.	19.	10.
+				TIME	3.58	3.58	3.67	3.58	3.58	3.67

+ ROUTED TO	R14CH	.04	1	FLOW	40.	23.	13.	33.	19.	10.
				TIME	3.67	3.67	3.75	3.67	3.75	3.75
+ HYDROGRAPH AT	GD17BJ	.06	1	FLOW	74.	47.	31.	64.	40.	25.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
+ 3 COMBINED AT	C17BJ	5.63	1	FLOW	1700.	614.	265.	1227.	430.	193.
				TIME	4.17	4.25	4.08	4.25	4.25	4.17
+ DIVERSION TO	D95F	5.63	1	FLOW	180.	88.	36.	156.	61.	25.
				TIME	4.17	4.25	4.08	4.25	4.25	4.17
+ HYDROGRAPH AT	REMAIN6	5.63	1	FLOW	1521.	526.	229.	1071.	368.	168.
				TIME	4.17	4.25	4.08	4.25	4.25	4.17
+ ROUTED TO	R17BJ	5.63	1	FLOW	1518.	525.	228.	1070.	368.	168.
				TIME	4.17	4.25	4.08	4.25	4.25	4.17
+ HYDROGRAPH AT	GD14CF	.13	1	FLOW	83.	43.	21.	67.	33.	15.
				TIME	3.75	3.75	3.83	3.75	3.75	3.83
+ DIVERSION TO	DGNBB4	.13	1	FLOW	30.	30.	20.	30.	30.	14.
				TIME	3.50	3.67	3.83	3.50	3.75	3.83
+ HYDROGRAPH AT	BUF4	.13	1	FLOW	53.	13.	1.	37.	3.	0.
				TIME	3.75	3.75	3.83	3.75	3.75	3.83
+ ROUTED TO	R14CF	.13	1	FLOW	52.	12.	1.	37.	3.	0.
				TIME	3.83	3.92	4.25	3.83	4.00	4.33
+ HYDROGRAPH AT	GD14CG	.06	1	FLOW	52.	30.	17.	43.	24.	13.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
+ 2 COMBINED AT	C14CG	.19	1	FLOW	97.	30.	17.	71.	24.	13.
				TIME	3.75	3.92	3.67	3.75	3.67	3.67
+ ROUTED TO	R14CG	.19	1	FLOW	94.	30.	16.	70.	24.	12.
				TIME	3.83	4.00	3.75	3.83	3.75	3.83
+ HYDROGRAPH AT	GD14CI	.05	1	FLOW	44.	24.	13.	36.	19.	9.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
+ 2 COMBINED AT	C14C1	.24	1	FLOW	127.	51.	28.	96.	41.	20.
				TIME	3.75	3.75	3.75	3.83	3.75	3.75
+ ROUTED TO	R14CI	.24	1	FLOW	126.	51.	27.	94.	41.	20.
				TIME	3.83	3.75	3.83	3.83	3.75	3.83
+ 2 COMBINED AT	CMAIN6	5.87	1	FLOW	1580.	548.	245.	1107.	385.	179.
				TIME	4.17	4.25	4.08	4.25	4.25	4.17
+ ROUTED TO	RMAIN6	5.87	1	FLOW	1560.	543.	244.	1100.	383.	178.
				TIME	4.17	4.25	4.17	4.25	4.33	4.25
+ DIVERSION TO	D95G	5.87	1	FLOW	102.	83.	68.	97.	76.	64.
				TIME	4.08	4.25	4.17	4.25	4.33	4.25
+ HYDROGRAPH AT	REMAIN7	5.87	1	FLOW	1459.	460.	176.	1003.	308.	113.
				TIME	4.17	4.25	4.17	4.25	4.33	4.25
+ HYDROGRAPH AT	GD11C	.13	1	FLOW	125.	77.	47.	106.	64.	37.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
+ 2 COMBINED AT	C11C	6.00	1	FLOW	1512.	487.	198.	1039.	330.	128.
				TIME	4.17	4.25	4.17	4.25	4.08	4.17
+ ROUTED TO	R11C	6.00	1	FLOW	1497.	482.	198.	1029.	329.	128.
				TIME	4.25	4.33	4.17	4.25	4.17	4.25
+ HYDROGRAPH AT	GD11B	.20	1	FLOW	206.	129.	82.	176.	109.	66.
				TIME	3.67	3.67	3.75	3.67	3.75	3.75
+ 2 COMBINED AT	C11B	6.20	1	FLOW	1561.	519.	231.	1081.	382.	149.
				TIME	4.17	4.25	4.17	4.25	4.08	4.25
+ DIVERSION TO	GOOF1	6.20	1	FLOW	3.	3.	2.	3.	3.	2.
				TIME	4.17	4.25	4.17	4.25	4.08	4.25
+ HYDROGRAPH AT	GOWAN1	6.20	1	FLOW	1558.	516.	228.	1077.	379.	147.
				TIME	4.17	4.25	4.17	4.25	4.08	4.25
ROUTED TO										

						XLOMR				
+	R11B	6.20	1	FLOW	1555.	514.	227.	1072.	378.	147.
				TIME	4.25	4.25	4.17	4.25	4.08	4.25
HYDROGRAPH AT										
+	CY05A	.03	1	FLOW	29.	17.	10.	24.	14.	8.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT										
+	D95G	.00	1	FLOW	102.	83.	68.	97.	76.	64.
				TIME	4.08	4.25	4.17	4.25	4.33	4.25
ROUTED TO										
+	RD95G	.00	1	FLOW	102.	83.	68.	97.	75.	64.
				TIME	4.17	4.33	4.25	4.33	4.42	4.33
HYDROGRAPH AT										
+	PT6B	.11	1	FLOW	141.	91.	59.	122.	78.	48.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT										
+	CPT6B	.11	1	FLOW	203.	132.	88.	177.	112.	78.
				TIME	3.67	3.75	3.92	3.67	3.83	4.00
3 COMBINED AT										
+	2CPT6B	6.33	1	FLOW	1682.	616.	311.	1191.	478.	221.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
DIVERSION TO										
+	GOOF2	6.33	1	FLOW	2.	2.	2.	2.	2.	2.
				TIME	3.17	3.33	3.50	3.25	3.42	3.50
HYDROGRAPH AT										
+	GOWAN2	6.33	1	FLOW	1680.	614.	309.	1189.	476.	219.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	RPT6B	6.33	1	FLOW	1679.	613.	307.	1181.	474.	219.
				TIME	4.25	4.08	4.17	4.33	4.08	4.25
HYDROGRAPH AT										
+	CY05D	.06	1	FLOW	41.	22.	11.	33.	17.	8.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
HYDROGRAPH AT										
+	PT5A3	.09	1	FLOW	89.	56.	35.	76.	47.	28.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
3 COMBINED AT										
+	C5A3	6.48	1	FLOW	1719.	653.	328.	1214.	507.	234.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
DIVERSION TO										
+	GOOF3	6.48	1	FLOW	2.	2.	2.	2.	2.	2.
				TIME	2.50	3.25	3.42	2.75	3.33	3.50
HYDROGRAPH AT										
+	GOWAN3	6.48	1	FLOW	1717.	651.	326.	1212.	505.	232.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	R5A3	6.48	1	FLOW	1715.	650.	324.	1208.	503.	231.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
DIVERSION TO										
+	MAVERICK	6.48	1	FLOW	183.	28.	12.	82.	20.	9.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
HYDROGRAPH AT										
+	MAV	6.48	1	FLOW	1532.	622.	313.	1127.	483.	222.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	R5A3B	6.48	1	FLOW	1530.	621.	311.	1126.	482.	222.
				TIME	4.25	4.08	4.17	4.33	4.08	4.25
HYDROGRAPH AT										
+	CY06A	.08	1	FLOW	72.	43.	25.	61.	35.	19.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT										
+	PT5A8	.03	1	FLOW	20.	12.	7.	17.	9.	5.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
3 COMBINED AT										
+	C5A8	6.58	1	FLOW	1555.	646.	324.	1146.	503.	231.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	R5A3C	6.58	1	FLOW	1554.	645.	323.	1144.	501.	230.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
DIVERSION TO										
+	GOOF4	6.58	1	FLOW	2.	2.	2.	2.	2.	2.
				TIME	3.17	3.42	3.58	3.33	3.50	3.58
HYDROGRAPH AT										
+	GOWAN4	6.58	1	FLOW	1552.	643.	321.	1142.	499.	228.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
DIVERSION TO										
+	DCY07B	6.58	1	FLOW	440.	155.	64.	301.	116.	37.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
HYDROGRAPH AT										
+	DPT5A8	6.58	1	FLOW	1112.	488.	257.	841.	383.	191.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
ROUTED TO										
+	R5A8	6.58	1	FLOW	1109.	486.	256.	840.	381.	191.

XLOMR

				TIME	4.25	4.08	4.25	4.33	4.17	4.25
ROUTED TO	R5A82	6.58	1	FLOW	1105.	485.	255.	840.	381.	190.
+				TIME	4.25	4.17	4.25	4.33	4.17	4.33
HYDROGRAPH AT	CY07A	.03	1	FLOW	29.	18.	11.	24.	15.	9.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	CCY07A	6.61	1	FLOW	1112.	491.	258.	844.	385.	192.
+				TIME	4.25	4.08	4.25	4.33	4.17	4.25
DIVERSION TO	TRUVAL	6.61	1	FLOW	88.	33.	13.	64.	24.	8.
+				TIME	4.25	4.08	4.25	4.33	4.17	4.25
HYDROGRAPH AT	TRUV	6.61	1	FLOW	1024.	457.	245.	780.	362.	184.
+				TIME	4.25	4.08	4.25	4.33	4.17	4.25
HYDROGRAPH AT	D95B	.00	1	FLOW	192.	94.	38.	176.	64.	25.
+				TIME	3.83	4.00	4.08	3.92	4.00	4.08
ROUTED TO	RD95B	.00	1	FLOW	192.	92.	37.	174.	64.	25.
+				TIME	3.92	4.00	4.17	3.92	4.08	4.08
DIVERSION TO	D1RCHO	.00	1	FLOW	36.	17.	7.	33.	12.	5.
+				TIME	3.92	4.00	4.17	3.92	4.08	4.08
HYDROGRAPH AT	1REMAIN	.00	1	FLOW	156.	74.	30.	141.	52.	20.
+				TIME	3.92	4.00	4.17	3.92	4.08	4.08
HYDROGRAPH AT	PT3AB1	.05	1	FLOW	64.	44.	31.	56.	39.	26.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	C3AB1	.05	1	FLOW	209.	100.	48.	182.	75.	38.
+				TIME	3.83	4.00	3.92	3.92	3.92	3.75
DIVERSION TO	D2RCHO	.05	1	FLOW	29.	15.	7.	28.	12.	6.
+				TIME	3.75	4.00	3.92	3.92	3.92	3.75
HYDROGRAPH AT	2REMAIN	.05	1	FLOW	180.	85.	41.	154.	64.	33.
+				TIME	3.83	4.00	3.92	3.92	3.92	3.75
ROUTED TO	R2MAIN	.05	1	FLOW	177.	84.	41.	152.	63.	32.
+				TIME	3.92	4.00	4.00	3.92	4.00	3.83
HYDROGRAPH AT	PT3AB2	.05	1	FLOW	77.	54.	39.	68.	48.	33.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	C3AB2	.10	1	FLOW	223.	108.	68.	184.	90.	55.
+				TIME	3.83	3.75	3.75	3.92	3.75	3.75
DIVERSION TO	D3RCHO	.10	1	FLOW	23.	13.	8.	22.	11.	7.
+				TIME	3.75	3.75	3.75	3.92	3.75	3.75
HYDROGRAPH AT	3REMAIN	.10	1	FLOW	200.	95.	60.	162.	80.	49.
+				TIME	3.83	3.75	3.75	3.92	3.75	3.75
ROUTED TO	R3MAIN	.10	1	FLOW	195.	95.	59.	160.	78.	48.
+				TIME	3.83	3.83	3.83	3.92	3.83	3.83
HYDROGRAPH AT	PT2B2	.08	1	FLOW	83.	51.	32.	71.	43.	26.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	CPT2B2	.18	1	FLOW	264.	142.	89.	211.	119.	72.
+				TIME	3.83	3.75	3.75	3.83	3.75	3.75
DIVERSION TO	D4RCHO	.18	1	FLOW	35.	23.	15.	34.	20.	12.
+				TIME	3.67	3.75	3.75	3.83	3.75	3.75
HYDROGRAPH AT	4REMAIN	.18	1	FLOW	229.	119.	74.	176.	100.	60.
+				TIME	3.83	3.75	3.75	3.83	3.75	3.75
ROUTED TO	R4MAIN	.18	1	FLOW	224.	118.	74.	175.	99.	60.
+				TIME	3.83	3.83	3.83	3.92	3.83	3.83
HYDROGRAPH AT	PT2B3	.02	1	FLOW	32.	22.	15.	28.	19.	13.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	C2B3	.20	1	FLOW	248.	134.	86.	194.	114.	70.
+				TIME	3.83	3.83	3.83	3.83	3.83	3.83
DIVERSION TO	DCSD2	.20	1	FLOW	120.	120.	85.	120.	113.	69.
+				TIME	3.58	3.75	3.83	3.58	3.83	3.83

HYDROGRAPH AT	D2B3	.20	1	FLOW	128.	14.	1.	74.	1.	1.
+				TIME	3.83	3.83	3.83	3.83	3.83	3.83
HYDROGRAPH AT	PT2A2	.06	1	FLOW	63.	37.	22.	53.	31.	18.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO	R2A2	.06	1	FLOW	61.	37.	22.	51.	31.	17.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT	PT2A1	.06	1	FLOW	63.	39.	24.	53.	33.	19.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT	D95E	.00	1	FLOW	184.	83.	21.	148.	55.	14.
+				TIME	4.00	4.17	4.33	4.08	4.25	4.08
ROUTED TO	RD95E	.00	1	FLOW	184.	82.	21.	147.	55.	14.
+				TIME	4.08	4.25	4.42	4.17	4.25	4.17
3 COMBINED AT	C2A2	.13	1	FLOW	255.	113.	53.	202.	83.	41.
+				TIME	4.00	4.17	3.83	4.00	3.92	3.83
DIVERSION TO	DCSD1	.13	1	FLOW	90.	90.	52.	90.	82.	40.
+				TIME	3.58	3.75	3.83	3.58	3.92	3.83
HYDROGRAPH AT	DPT2A1	.13	1	FLOW	165.	23.	1.	112.	1.	1.
+				TIME	4.00	4.17	3.58	4.00	3.50	3.58
ROUTED TO	R2A2	.13	1	FLOW	164.	22.	1.	111.	1.	1.
+				TIME	4.00	4.25	4.17	4.08	4.00	4.17
HYDROGRAPH AT	PT2B1	.07	1	FLOW	72.	43.	26.	61.	36.	20.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	C2B1	.20	1	FLOW	197.	43.	26.	133.	36.	20.
+				TIME	4.00	3.67	3.67	4.08	3.67	3.67
ROUTED TO	R2B1	.20	1	FLOW	197.	43.	25.	133.	35.	19.
+				TIME	4.00	3.67	3.67	4.08	3.67	3.67
2 COMBINED AT	2C2B3	.40	1	FLOW	312.	54.	26.	199.	36.	20.
+				TIME	3.92	3.75	3.67	3.92	3.67	3.67
ROUTED TO	RC2B3	.40	1	FLOW	308.	52.	25.	197.	35.	20.
+				TIME	3.92	3.83	3.83	4.00	3.83	3.83
DIVERSION TO	5REMAIN	.40	1	FLOW	195.	0.	0.	84.	0.	0.
+				TIME	3.92	.00	.00	4.00	.00	.00
HYDROGRAPH AT	D5RCHO	.40	1	FLOW	113.	52.	25.	113.	35.	20.
+				TIME	3.75	3.83	3.83	3.75	3.83	3.83
HYDROGRAPH AT	RNCH1	.00	1	FLOW	7.	5.	4.	6.	4.	3.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RRNCH1	.00	1	FLOW	7.	5.	4.	6.	4.	3.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT	NX1	.03	1	FLOW	46.	31.	21.	41.	27.	18.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	CMX1	.04	1	FLOW	53.	36.	24.	46.	31.	20.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	RNCH2	.00	1	FLOW	6.	4.	3.	5.	4.	3.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RRNCH2	.00	1	FLOW	5.	4.	3.	5.	4.	3.
+				TIME	3.58	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT	NX2	.02	1	FLOW	34.	23.	16.	30.	20.	13.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	CMX2	.03	1	FLOW	39.	27.	19.	34.	23.	16.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	JONES1	.00	1	FLOW	7.	5.	4.	6.	4.	3.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
3 COMBINED AT	LOCL-X	.07	1	FLOW	96.	65.	45.	84.	56.	37.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58

Ref. LOMR

5q. miles + 4.79 miles from D95E ≃ 5.19 5q. Miles

Local flows

XLOMR

2 COMBINED AT	TOTL-X	.47	1	FLOW	203.	97.	61.	181.	81.	49.
+				TIME	3.67	3.67	3.75	3.75	3.75	3.75
DIVERSION TO	JONES-SD	.47	1	FLOW	79.	79.	61.	79.	79.	49.
+				TIME	3.50	3.58	3.75	3.50	3.67	3.75
HYDROGRAPH AT	LOWPNT-X	.47	1	FLOW	124.	18.	0.	102.	2.	0.
+				TIME	3.67	3.67	.00	3.75	3.75	.00
HYDROGRAPH AT	JONES2	.00	1	FLOW	6.	4.	3.	5.	4.	3.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	HICKAM-X	.47	1	FLOW	129.	22.	3.	105.	5.	3.
+				TIME	3.67	3.67	3.58	3.75	3.67	3.58
HYDROGRAPH AT	CRAIG1	.00	1	FLOW	5.	3.	3.	4.	3.	2.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
ROUTED TO	RCRAIG1	.00	1	FLOW	4.	3.	2.	4.	3.	2.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	NX3	.02	1	FLOW	30.	21.	15.	26.	18.	13.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	CRAIG2	.00	1	FLOW	3.	2.	2.	3.	2.	2.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
3 COMBINED AT	CRG1-X	.02	1	FLOW	36.	26.	18.	32.	23.	16.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	NX4	.00	1	FLOW	7.	5.	3.	6.	4.	3.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	JONES3	.00	1	FLOW	2.	2.	1.	2.	2.	1.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	JON-X	.00	1	FLOW	9.	6.	5.	8.	6.	4.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	CRG2-X	.03	1	FLOW	44.	31.	23.	39.	28.	20.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	NDA^	.00	1	FLOW	4.	3.	2.	3.	2.	2.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50

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= 1.00									
	RANN MANE	1.82	122.44	242.51	.96	5.00	121.58	245.00	.96
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1323E+02 EXCESS= .0000E+00 OUTFLOW= .1322E+02 BASIN STORAGE= .1053E-01 PERCENT ERROR= .0									
FOR PLAN = 1 RATIO= .74									
	RANN MANE	2.49	61.90	246.24	.50	5.00	61.81	245.00	.50
CONTINUITY SUMMARY (AC-FT) - INFLOW= .6912E+01 EXCESS= .0000E+00 OUTFLOW= .6899E+01 BASIN STORAGE= .9157E-02 PERCENT ERROR= .0									
FOR PLAN = 1 RATIO= .57									
	RANN MANE	3.17	29.76	249.97	.26	5.00	29.76	250.00	.26
CONTINUITY SUMMARY (AC-FT) - INFLOW= .3559E+01 EXCESS= .0000E+00 OUTFLOW= .3553E+01 BASIN STORAGE= .7950E-02 PERCENT ERROR= -.1									
FOR PLAN = 1 RATIO= .90									
	RANN MANE	2.03	98.09	244.58	.77	5.00	97.80	245.00	.77
CONTINUITY SUMMARY (AC-FT) - INFLOW= .1066E+02 EXCESS= .0000E+00 OUTFLOW= .1065E+02 BASIN STORAGE= .9697E-02 PERCENT ERROR= .0									
FOR PLAN = 1 RATIO= .67									
	RANN MANE	2.62	47.85	246.09	.39	5.00	47.53	245.00	.39
CONTINUITY SUMMARY (AC-FT) - INFLOW= .5440E+01 EXCESS= .0000E+00 OUTFLOW= .5432E+01 BASIN STORAGE= .1171E-01 PERCENT ERROR= -.1									
FOR PLAN = 1 RATIO= .51									
	RANN MANE	3.73	20.50	250.72	.19	5.00	20.41	250.00	.19
CONTINUITY SUMMARY (AC-FT) - INFLOW= .2575E+01 EXCESS= .0000E+00 OUTFLOW= .2571E+01 BASIN STORAGE= .7596E-02 PERCENT ERROR= -.2									

FOR PLAN = 1 RATIO= .67
RRNCH1 MANE 5.00 4.30 222.37 1.66 5.00 4.15 225.00 1.66

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3089E+00 EXCESS= .0000E+00 OUTFLOW= .3147E+00 BASIN STORAGE= .1650E-03 PERCENT ERROR= -1.9

FOR PLAN = 1 RATIO= .51
RRNCH1 MANE 4.51 3.29 228.63 1.22 5.00 3.22 225.00 1.22

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2261E+00 EXCESS= .0000E+00 OUTFLOW= .2311E+00 BASIN STORAGE= .1215E-03 PERCENT ERROR= -2.3

FOR PLAN = 1 RATIO= 1.00
RRNCH2 MANE 2.15 5.53 218.18 2.55 5.00 5.37 215.00 2.55

CONTINUITY SUMMARY (AC-FT) - INFLOW= .4117E+00 EXCESS= .0000E+00 OUTFLOW= .4130E+00 BASIN STORAGE= .8236E-05 PERCENT ERROR= -.3

FOR PLAN = 1 RATIO= .74
RRNCH2 MANE 2.25 4.07 218.93 1.83 5.00 3.95 220.00 1.83

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2957E+00 EXCESS= .0000E+00 OUTFLOW= .2968E+00 BASIN STORAGE= .7398E-05 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .57
RRNCH2 MANE 2.45 3.07 218.78 1.36 5.00 3.00 220.00 1.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2202E+00 EXCESS= .0000E+00 OUTFLOW= .2211E+00 BASIN STORAGE= .6283E-05 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .90
RRNCH2 MANE 2.11 4.96 219.57 2.27 5.00 4.86 220.00 2.27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3670E+00 EXCESS= .0000E+00 OUTFLOW= .3684E+00 BASIN STORAGE= .6775E-05 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .67
RRNCH2 MANE 2.26 3.68 218.97 1.64 5.00 3.57 220.00 1.64

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2645E+00 EXCESS= .0000E+00 OUTFLOW= .2656E+00 BASIN STORAGE= .6297E-05 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= .51
RRNCH2 MANE 2.42 2.73 218.41 1.20 5.00 2.68 220.00 1.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1936E+00 EXCESS= .0000E+00 OUTFLOW= .1944E+00 BASIN STORAGE= .6956E-05 PERCENT ERROR= -.4

FOR PLAN = 1 RATIO= 1.00
RCRAIG1 MANE 1.05 4.68 211.83 2.54 5.00 4.45 215.00 2.54

CONTINUITY SUMMARY (AC-FT) - INFLOW= .3210E+00 EXCESS= .0000E+00 OUTFLOW= .3216E+00 BASIN STORAGE= .5152E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .74
RCRAIG1 MANE 1.13 3.42 212.82 1.83 5.00 3.27 215.00 1.83

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2305E+00 EXCESS= .0000E+00 OUTFLOW= .2310E+00 BASIN STORAGE= .3699E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .57
RCRAIG1 MANE 1.24 2.61 212.37 1.36 5.00 2.49 215.00 1.36

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1716E+00 EXCESS= .0000E+00 OUTFLOW= .1721E+00 BASIN STORAGE= .3890E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .90
RCRAIG1 MANE 1.15 4.18 212.82 2.27 5.00 4.00 215.00 2.27

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2861E+00 EXCESS= .0000E+00 OUTFLOW= .2867E+00 BASIN STORAGE= .5355E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .67
RCRAIG1 MANE 1.26 3.09 212.40 1.64 5.00 2.95 215.00 1.63

CONTINUITY SUMMARY (AC-FT) - INFLOW= .2062E+00 EXCESS= .0000E+00 OUTFLOW= .2067E+00 BASIN STORAGE= .3544E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .51
RCRAIG1 MANE 1.37 2.29 213.27 1.20 5.00 2.22 215.00 1.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1510E+00 EXCESS= .0000E+00 OUTFLOW= .1512E+00 BASIN STORAGE= .3429E-06 PERCENT ERROR= -.2

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

HEC-1 MODEL OUTPUT

(FUTURE CONDITION)

DLOMR

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   31AUG16  TIME  20:25:02   *
*                                       *
*****************************************
```

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

```
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


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

        1           ID        CRAIG/RANCHO MASTER DRAINAGE STUDY
        2           ID        DEVELOPED (INTERIM/FUTURE) CONDITION
        3           ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
        4           ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
        5           ID
        6           ID        LOCHSA JOB# 161051
        7           ID
        8           ID
        9           ID        INPUT FILE NAME:  DLOMR.DAT
       10           ID
       11           ID        AUGUST 2016
       12           ID        ********************************************************************************
       13           ID        ********************************************************************************
       14           ID             INSIDE McCARRAN AIRPORT RAINFALL AREA
       15           ID
       16           ID             10, 25 & 100 YEAR - 6 HOUR STORM EVENT
       17           ID             PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
       18           ID
       19           ID
       20           ID             10-YEAR RAINFALL DEPTH  = 1.58 INCHES
       21           ID             25-YEAR RAINFALL DEPTH  = 2.05 INCHES
       22           ID             100-YEAR RAINFALL DEPTH = 2.77 INCHES
       23           ID
       24           ID             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
       25           ID             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
       26           ID        ********************************************************************
       27           ID
       28           ID
       29           ID
       30           ID   DARF RATIOS FOR AREAS OF 5.20 SQUARE MILES FOR
       31           ID   RANCHO AND JONES BLVD. FLOWS = 0.90
       32           ID
       33           ID             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = (1.58/2.77) X 0.90 = 0.51
       34           ID             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = (2.05/2.77) X 0.90 = 0.67
       35           ID
       36           ID
       37           ID        ********************************************************************
       38           ID
       39           ID        ********************************************************************
                    *
                    *        ********************* AUGUST 2016 ****************************
                    *
                    *                  ----------------------------------------
                    * (1) ***************** BGEGINNING OF REFERENCED HEC-1 MODEL ********************
                    *                  ----------------------------------------
                    *
                    *   ***************** FROM THE "RANCHO/US 95 LOMR **************
                    *        **************ISSUED ON NOVEMBER 30, 2009 *******************
                    *
                    *        ********************* AUSUST 2016 ****************************
                    *
                    *                  ***************************
                    *              ********************************************
                    *DIAGRAM
```

*** FREE ***


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

       40           ID   RANCHO/US95 CLOMR
       41           ID   FOR:  CITY OF LAS VEGAS, NV AND THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTR
       42           ID   THIS IS THE PROPOSED HEC1 MODEL FOR UPPER RANCHO DRIVE (NORTH OF GOWAN ROAD)
       43           ID    FILENAME:UPPRSDN3.DAT
       44           ID
       45           ID    CAM10 DETENTION BASIN AND THE WESTERN BELTWAY CHANNEL ARE INCLUDED IN THE EN
       46           ID    NOT IN THE SDN3 WATERSHED.
       47           ID
       48           ID
       49           ID   MODIFIED BY LBG SEPT 2005
       50           ID   SDN3 CREATED BY REDUCING THE SIZE OF CRAIG SUBBASIN TO 1.434 SQUARE MILES
       51           ID   ADD INTERIM BELTWAY AND GOWAN NORTH PHASE III
```

```
ID   BY MODIFYING THE CRAIG SUBBASIN FROM PBS&J MODEL
ID
ID   LVRA0000 (PEAK CHANNEL AND RANCHO DRIVE IMPROVEMENTS) ADDED BY DIVERTING
ID   FLOW FROM CONCENTRATION POINT CX1X4
ID
ID   TRUVAL FLOW SPLIT, REMOVED FROM CVL MODEL, HAS BEEN PUT BACK IN.
ID
ID   JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
ID
ID   100-YEAR,  6-HOUR STORM,  SDN3
ID   DARF RATIOS FOR AREAS OF 0, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0 AND 10 SQUARE MILES
ID   FOR THE 100-YEAR EVENT.
IT       5       0       0     100
IO       5       0       0
IN       5
*
*      ***************** BEGINNING AUGUST 2016 REVISION ********************
*
* UTILIZED THE RATIOS RELEVANT FOR THE SUBHJECT STUDYJUST SWITCHING 5REMAIN AND
* (CULVERT 27 AND CULVERT 26) CAN BE ROUTED AND COMBINED WITH THE LOCAL
* FLOWS WITHIN THE STUDY
*
*                    ***************************
*          ***********************************************
JR    PREC     1.00     0.74     0.57     0.90     0.67     0.51
*
*      ***************** END AUGUST 2016 REVISION ********************
*                    ***************************
*
KK     ANN
PB    2.85
BA   0.259
PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
PC   0.998   0.999   1.000
LS       0    76.8
UD   0.499
*
```

1 HEC-1 INPUT PAGE 3

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

KK     RANN
KM   ROUTE TO GD29B
RK     2600   0.015   0.015       0    TRAP     100       2
*

KK    GD29B
PB     2.77
BA    0.138
LS        0    74.3
UD    0.298
*

KK   CGD29B
HC        2
*

KK   RGD29B
KM   ROUTE TO ANN1B
RK     2700   0.015   0.015       0    TRAP     100       2
*

KK    ANN1B
PB     2.77
BA    0.135
LS        0    82.7
UD    0.305
*

KK   CANN1B
HC        2
*

KK   RANN1B
KM   ROUTE TO ANN1C2
RK     2000   0.007   0.015       0    TRAP     100       2
*

KK   ANN1C2
PB     2.77
BA    0.091
LS        0    80.7
UD    0.275
*

KK CANN1C2
HC        2
*

KK RANN1C2
KM   ROUTE TO PDGCC3
RK     1250  0.0074   0.013       0    TRAP      12       2
*
```

1 HEC-1 INPUT PAGE 4

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

KK   PDGCC3
PB     2.77
BA    0.047
```


Ref. LOMR

```
117          LS       0    84.6
118          UD   0.188
             *

119          KK   CGCC3
120          HC       2
             *

121          KK   RGCC3
122          KM  ROUTE TO PDGCC4
123          RK    1550   0.005   0.013       0    TRAP       8       0
             *

124          KK REMAIN1
125          KM  DIVERT 139 CFS UNDER U.S. 95 BETWEEN ANN ROAD AND THE U.S. 95/RANCHO
126          KM  INTERSECTION IN A 10' X 3' RCB (CULVERT 3).  FLOWS IN EXCESS OF 139 CFS
127          KM  REMAIN ON THE WEST SIDE OF U.S. 95.
128          KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
129          DT    D95A
130          DI       0      51     101     118     140     318   10000
131          DQ       0      50     100     117     139     139     139
             *

132          KK   RLBG1
133          KM  ROUTE TO CGCC4 (HECRAS X-11649)
134          KM   ADDED BY LBG
135          RK     278   0.005   0.013       0    TRAP       8       0
             *

136          KK  PDGCC2
137          PB    2.77
138          BA   0.042
139          LS       0    73.2
140          UD   0.286
             *

141          KK   RGCC2
142          KM  ROUTE TO PDGCC4
143          RK    2900  0.0055   0.015       0    TRAP      60       2
             *

144          KK  PDGCC4
145          PB    2.77
146          BA   0.049
147          LS       0    84.3
148          UD   0.189
             *
```



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

149          KK   CGCC4
150          KM   THE FLOW AT THIS NODE CORRESPONDS TO X-11649 OF THE US-95 EFFECTIVE HECRAS.
151          KM   THIS IS THE MOST UPSTREAM NODE IN THE EFFECTIVE MODEL.
152          HC       3
             *

153          KK   RLBG2
154          KM  ROUTE TO CGCB9 (HECRAS X-11287)
155          KM   ADDED BY LBG
156          RK     362   0.005   0.013       0    TRAP       8       0
             *

157          KK  HAMMER
158          PB    2.82
159          BA   0.128
160          LS       0    76.6
161          UD   0.333
             *

162          KK RHAMMER
163          KM  ROUTE TO PDGCD
164          RK    2700   0.015   0.015       0    TRAP      60       2
             *

165          KK   PDGCD
166          PB    2.77
167          BA   0.129
168          LS       0    74.0
169          UD   0.284
             *

170          KK  CPDGCD
171          HC       2
             *

172          KK    RGCD
173          KM  ROUTE TO PDGCB5
174          RK    4060  0.0086   0.015       0    TRAP      40       2
             *

175          KK  PDGCB1
176          PB    2.77
177          BA   0.033
178          LS       0    84.9
179          UD   0.166
             *

180          KK   RGCB1
181          KM  ROUTE TO PDGCB3
182          RK    2100  0.0086   0.015       0    TRAP      40       2
             *
```



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

183          KK  PDGCB2
```

```
184          PB    2.77
185          BA   0.030
186          LS       0    81.3
187          UD   0.190
             *

188          KK    CGCB2
189          HC        2
             *

190          KK    RCGB2
191          KM  ROUTE TO PDGCB3
192          RK      700  0.0029    0.03        0    TRAP       20        2
             *

193          KK  PDGCB3
194          PB    2.77
195          BA   0.066
196          LS       0    73.1
197          UD   0.236
             *

198          KK    CGCB3
199          HC        2
             *

200          KK    RGCB3
201          KM  ROUTE TO PDGCB5
202          RK     1400    0.01   0.025        0    TRAP       20        2
             *

203          KK  PDGCB4
204          PB    2.77
205          BA   0.020
206          LS       0    85.7
207          UD   0.204
             *

208          KK    RGCB4
209          KM  ROUTE TO PDGCB5
210          RK      800    0.01    0.03        0    TRAP       20        2
             *

211          KK    CGCB4
212          HC        3
             *

213          KK  PDGCC1
214          PB    2.77
215          BA   0.053
216          LS       0    75.4
217          UD   0.263
             *
```



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

218          KK  PDGCB5
219          PB    2.77
220          BA   0.110
221          LS       0    76.0
222          UD   0.375
             *

223          KK    CGCB5
224          HC        3
             *

225          KK    RGCB5
226          KM  ROUTE TO PDGCB9
227          RK     3080  0.0065    0.03        0    TRAP       30        2
             *

228          KK  C2GCB5
229          HC        2
             *

230          KK  PDGCB6
231          PB    2.77
232          BA   0.018
233          LS       0    88.2
234          UD   0.177
             *

235          KK    RGCB6
236          KM  ROUTE TO PDGCB9
237          RK     2880  0.0065    0.03        0    TRAP       30        2
             *

238          KK PDGCB10
239          PB    2.77
240          BA   0.074
241          LS       0    83.7
242          UD   0.260
             *

243          KK  PDGCB9
244          PB    2.77
245          BA   0.031
246          LS       0    76.5
247          UD   0.137
             *

248          KK    CGCB9
249          HC        4
             *
```

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

  250         KK   RGCB9
  251         KM  ROUTE TO GCB11 (HECRAS X-10504)
  252         KM   CHANGED FROM 1950 FT TO 783 FEET BY LBG
  253         RK     783  0.0036   0.013       0    TRAP       8       2
              *

  254         KK PDGCB11
  255         PB    2.77
  256         BA   0.033
  257         LS       0    79.3
  258         UD   0.195
              *

  259         KK  CGCB11
  260         HC       2
              *

  261         KK   RLBG3
  262         KM  ROUTE TO REMAIN2 (HECRAS X-9993)
  263         KM   ADDED BY LBG
  264         RK     511  0.0036   0.013       0    TRAP       8       2
              *

  265         KK REMAIN2
  266         KM  DIVERT 192 CFS UNDER U.S. 95 JUST SOUTH OF THE U.S. 95/RANCHO INTERSECTION
  267         KM  IN 2, 6' X 2' RCB'S (CULVERT 5). REMAINING FLOW CONTINUES SOUTH ALONG U.S.
  268         KM  95 TO LONE MOUNTAIN ROAD.
  269         KM   REVISED TO 168 BY LBG
  270         DT    D95B
  271         DI       0     426     591   10000
  272         DQ       0     168     192     192
              *

  273         KK  RMAIN2(HECRAS X-SEC 8237)
  274         KM  ROUTE TO 20BG
  275         RK    1756  0.0029    0.03       0    TRAP      20       2
              *

  276         KK  LONEMT
  277         PB    2.77
  278         BA   0.411
  279         LS       0    83.1
  280         UD   0.380
              *

  281         KK  GD20BH
  282         PB    2.77
  283         BA   0.047
  284         LS       0    76.6
  285         UD   0.250
              *
```



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

  286         KK   CLONE
  287         HC       2
              *

  288         KK   RLONE(HECRAS X-SECTION 8237)
  289         KM  ROUTE TO 20BG
  290         RK    1100  0.0015   0.015       0    TRAP      44       2
              *

  291         KK  GD20BG
  292         PB    2.77
  293         BA   0.113
  294         LS       0    81.4
  295         UD   0.261
              *

  296         KK   C20BG
  297         HC       3
              *

  298         KK   R20BG
  299         KM  ROUTE TO 20BL (HECRAS X-SECTION 6510)
  300         RK    1680  0.0016    0.03       0    TRAP     150       2
              *

  301         KK  CRAIG1
  302         KM   ADDED FOR RANCHO CLOMR - ADD THIS BASIN SUBDIVIDED FROM CRAIG SUBBASIN IN PBS
  303         PB    3.16
  304         BA    2.44
  305         LS       0    82.0
  306         UD   0.700
              *

  307         KK   DBUF1
  308         KM   DIVERT 249 CFS (447 CAPACITY -198 FUTURE INTERCEPTED) TO
  309         KM   GOWAN NORTH BUFFALO BRANCH STORM DRAIN BETWEEN LONE MT AND RED COACH
  310         DT   DGNBB
  311         DI       0     250    2807   10000
  312         DQ       0     249     249     249
              *

  313         KK   RBUF1
  314         KM  ROUTE TO RED COACH
  315         RK    1295   0.004   0.015       0    TRAP      80       2
              *

  316         KK   DBUF2
  317         KM   DIVERT 109 CFS TO GOWAN NORTH BUFFALO BRANCH AT RED COACH
  318         DT  DGNBB1
  319         DI       0     110    1121   10000
```

```
320          DQ       0     109      109      109
             *
```



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

321          KK    DRED
322          KM  DIVERT 70.40% FLOW DOWN BUFFALO TOWARDS COBAL CANYON.  TAKE FLOW DOWN RED COAC
323          DT DBUFLO2
324          DI       0      100     1000    10000
325          DQ       0     70.4     704.     7040
             *

326          KK   RDRED
327          KM  ROUTE TO 20BI
328          RK    2700   0.007   0.015       0    TRAP      80       2
             *

329          KK  GD20BI
330          PB    2.77
331          BA   0.115
332          LS       0     80.5
333          UD   0.286
             *

334          KK   C20BI
335          HC       2
             *

336          KK   R20BI
337          KM  ROUTE TO 20BL (HECRAS X-SECTION 6510)
338          RK     910  0.0055   0.015       0    TRAP      40       2
             *

339          KK  GD20BL
340          PB    2.77
341          BA   0.079
342          LS       0     88.7
343          UD   0.230
             *

344          KK   C20BL
345          HC       3
             *

346          KK   R20BL
347          KM  ROUTE TO C20BJ2 (HECRAS X-SECTION 6109)
348          RK     401  0.0016    0.03       0    TRAP     150       2
             *

349          KKRTBUFAL2
350          KM  RETRIEVE FLOW DIVERTED TO BUFFALO PAST RED COACH
351          DR DBUFLO2
             *
```



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

352          KK   RBUF2
353          KM  ROUTE TO COBAL CANYON
354          RK     652   0.004   0.015       0    TRAP      80       2
             *

355          KK  DCOBAL
356          KM  DIVERT 71.46% OF FLOW AT  COBAL CANYON/BUFFALO INTERSECTION SOUTH ON BUFFALO
357          KM  REMAINING FLOW CONTINUES TO US95
358          DT DBUFLO3
359          DI       0     100.     1000    10000
360          DQ       0   71.46    714.6     7146
             *

361          KK RCOBAL1
362          KM  ROUTE TO C20BJ1
363          RK    2700   0.007   0.015       0    TRAP      60       2
             *

364          KK  GD20BJ
365          PB    2.77
366          BA   0.052
367          LS       0     84.3
368          UD   0.257
             *

369          KK  C20BJ1
370          HC       2
             *

371          KK  R20BJ1
372          KM  ROUTE TO C20BJ2
373          RK     900   0.006   0.015       0    TRAP      40       2
             *

374          KK  C20BJ2(US95 HECRAS X-SECTION 59+51)
375          HC       2
             *

376          KK  R20BJ2
377          KM  ROUTE TO C20BM
378          RK     362   0.006   0.015       0    TRAP      40       2
             *

379          KK  GD20BM
380          PB    2.77
381          BA   0.048
382          LS       0     89.2
383          UD   0.189
             *
```

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

  384     KK   C20BM(HECRAS X-SECTION 55+89)
  385     KM   GD20BM IS ADDED TO US95 FLOW FROM C20BJ2
  386     HC       2
          *

  387     KK REMAIN5
  388     KM  DIVERSION PER EXISTING INTERCHANGE AT CRAIG ROAD
  389     KM  DIVERT FLOW UNDER U.S. 95 JUST NORTH OF THE CRAIG ROAD BRIDGE OVER U.S. 95
  390     KM  THROUGH 2, 6' x 2' RCB'S (CULVERT 7).
  391     KM  REMAINING FLOW CONTINUES SOUTH ALONG U.S. 95
  392     KM  THIS DIVERSION HAS TWO SEPARATE FLOW QUANTITIES, ONE FOR THE SDN3 MODEL
  393     KM  AND ONE FOR THE SDN5 MODEL (82 CFS AND 180 CFS RESPECTIVELY).
  394     KM   REVISED BY LBG 6-28-05 (RATING CURVE DEVELOPED)
  395     DT    D95E
  396     DI       0     200     600    1000    1250    2006
  397     DQ       0    16.8      82   144.0     170     264
          *

  398     KKRREMAINS5
  399     KM  ROUTE TO 2C20BK
  400     RK     853   0.006   0.015       0    TRAP      40       2
          *

  401     KKRTBUFAL3
  402     KM  RETRIEVE FLOW DIVERTED TO BUFFALO PAST COBAL CANYON
  403     DR DBUFLO3
          *

  404     KK   RBUF3
  405     KM  ROUTE TO CRAIG ROAD
  406     RK     661   0.003   0.015       0    TRAP      80       2
          *

  407     KK   DBUF3
  408     KM   DIVERT 198 MORE CFS TO GOWAN NORTH BUFFALO BRANCH AT CRAIG
  409     DT  DGNBB2
  410     DI       0     199    1121   10000
  411     DQ       0     198     198     198
          *

  412     KK RCRAIG2
  413     KM  ROUTE TO GD20BK
  414     RK    3400  0.0067   0.015       0    TRAP      80       2
          *

  415     KK  GD20BK
  416     PB    2.77
  417     BA   0.050
  418     LS       0    80.5
  419     UD   0.264
          *
```



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

  420     KK  1C20BK
  421     HC       2
          *

  422     KK R1C20BK
  423     KM  ROUTE TO 2C20BK (X-4736 IN US-95 HECRAS MODEL)
  424     RK    1150  0.0039   0.015       0    TRAP      80       2
          *

  425     KK  2C20BK
  426     HC       2
          *

  427     KK R2C20BK
  428     KM  ROUTE TO C17BI (X-4241)
  429     KM   CHANGE FROM 600 FT TO 495 FT
  430     RK     495  0.0039    0.03       0    TRAP      80       2
          *
          * ***********************************************
          *
          * KKHICKM3
          * KM RANCHO CLOMR - SUBDIVIDE HICKAM SUBBASIN
          * KM THIS SUBBASIN IS USED WITHOUT THE GOWAN NORTH SYSTEM OR WITH THE GOWAN DETE
          * PB2.89
          * BA0.752
          * LS0         80.3
          * UD0.434
          *
          * KKSDALX
          * KM THIS DIVERSION CAN BE USED WITHOUT THE LONE MOUNTAIN DETENTION BASIN AND
          * KM WITHOUT THE GOWAN NORTH SYSTEM OR WITH THE GOWAN DETENTION BASIN
          * KM DIVERSION INTO ALEXANDER ROAD STORM DRAIN
          * DTDSDALX
          * DI0          763   10000
          * DQ0          732     732
          *
          * KKHICKM2
          * KM RANCHO CLOMR - SUBDIVIDE HICKAM SUBBASIN
          * KM THIS SUBBASIN IS USED WITHOUT THE GOWAN NORTH SYSTEM OR WITH THE GOWAN DETE
          * PB2.89
          * BA0.258
          * LS0         80.3
          * UD0.246
          *
          * KK DUR
          * KM COMBINE HICKM1 AND HICKM2 AT ALEXANDER AND DURANGO
          * HC     2
          *
```

```
* KK GNS
* KMDIVERT REMAINING SURFACE FLOW INTO GOWAN NORTH SYSTEM
* DTDGNS
* DI0          763   10000
* DQ0          762    9999
*
```



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

  431         KK HICKAM1
  432         KM   RANCHO CLOMR - THIS REPLACES SUBBASIN HICKAM
  433         PB    2.89
  434         BA   0.477
  435         LS       0    80.3
  436         UD   0.472
              *
              * KKHICKAM
              * PB2.89
              * BA1.487
              * LS0          80.3
              * UD0.437
              *

  437         KK    BUF3
  438         KM  DIVERT ANOTHER 125 CFS TO GOWAN NORTH BUFFALO BRANCH FROM HICKM1 SUBBASIN
  439         KM  REMAINING FLOW CONTINUES EAST ALONG HICKAM AVENUE
  440         DT  DGNBB3
  441         DI       0     126     211   10000
  442         DQ       0     125     125     125
              *

  443         KK RHICKAM
  444         KM  ROUTE TO C17BH
  445         RK    1300   0.008   0.025       0    TRAP      80       2
              *

  446         KK  GD17BH
  447         PB    2.77
  448         BA   0.025
  449         LS       0    82.8
  450         UD   0.178
              *

  451         KK   C17BH
  452         HC       2
              *

  453         KK   R17BH
  454         KM  ROUTE TO GD17BG
  455         RK    1330   0.006   0.025       0    TRAP      80       2
              *

  456         KK  GD17BG
  457         PB    2.77
  458         BA   0.116
  459         LS       0    83.3
  460         UD   0.275
              *
```



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

  461         KK   C17BG
  462         HC       2
              *

  463         KK   R17BG
  464         KM  ROUTE TO C17BI (HECRAS X-SECTION 4241)
  465         RK    1200   0.005   0.025       0    TRAP      80       2
              *

  466         KK  GD17BI
  467         PB    2.77
  468         BA   0.066
  469         LS       0    85.2
  470         UD   0.193
              *

  471         KK   C17BI
  472         HC       3
              *

  473         KK   R17BI
  474         KM  ROUTE TO C17BJ (HECRAS X-SECTION 2740)
  475         RK    1501  0.0023    0.03       0    TRAP     200       2
              *
              * KKREMAIN6a
              * REMOVED BY LBG
              * KMDIVERT FLOW EAST ACROSS U.S. 95 JUST NORTH OF ALEXANDER ROAD.
              * KMDIVERT 522 CFS BETWEEN CROSS-SECTIONS 3614 AND 2810 IN THE
              * KMHEC-RAS MODEL AS WEIR FLOW.
              * DTD95Fa
              * DI0          523   10000   20000
              * DQ0          522     522     522
              *

  476         KK  GD14CH
  477         PB    2.77
  478         BA   0.040
  479         LS       0    83.0
  480         UD   0.181
              *

  481         KK   R14CH
  482         KM  ROUTE TO C17BJ (HECRAS X-SECTION 2740)
  483         RK    1900   0.005   0.015       0    TRAP      40       2
```

```
*

KK  GD17BJ
PB    2.77
BA   0.063
LS       0    88.3
UD   0.222
*
```



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

KK   C17BJ
HC       3
*

KK REMAIN6
KM  DIVERT FLOW THROUGH DUAL 6' X 2' RCB'S (CULVERT 10) AT ALEXANDER ROAD BETWEEN
KM  CROSS-SECTIONS 2810 AND 2694 IN THE HEC-RAS MODEL.  WEIR FLOW ELIMINATED DUE T
KM   SOUND WALL AND BARRIER RAILS
DT    D95F
DI       0     100     500    1000    1937    2725
DQ       0    10.8      72     144     192     264
*

KK   R17BJ
KM  ROUTE TO C6MAIN (HECRAS X-SECTION 2514)
RK     226   0.005   0.015       0    TRAP      40       2
*

KK  GD14CF
KM   JUMP OVER TO THE BASIN NW OF GOWAN & BUFFALO RD INTERSECTION
PB    2.78
BA   0.130
LS       0    77.9
UD   0.288
*

KK    BUF4
KM  DIVERT 30 CFS TO GOWAN NORTH BUFFALO BRANCH FROM ALEXANDER AND EXCALIBUR
KM  REMAINING FLOW CONTINUES EAST ALONG ALEXANDER
DT  DGNBB4
DI       0      31      60   10000
DQ       0      30      30      30
*

KK   R14CF
KM  ROUTE TO GD14CG
RK    1450   0.006   0.015       0    TRAP     100       2
*

KK  GD14CG
PB    2.77
BA   0.057
LS       0    82.2
UD   0.208
*

KK   C14CG
HC       2
*
```



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

KK   R14CG
KM  ROUTE TO GD14CI
RK    1650   0.006   0.015       0    TRAP     100       2
*

KK  GD14CI
PB    2.77
BA   0.054
LS       0    79.7
UD   0.196
*

KK   C14C1
HC       2
*

KK   R14CI
KM  ROUTE TO CMAIN6
RK     945  0.0106   0.015       0    TRAP     100       2
*

KK  CMAIN6(HECRAS US95 X-SECTION 2514)
HC       2
*

KK  RMAIN6
KM   ROUTE SOUTH TO US95 HECRAS X-SECTION 1300
RK    1214  0.0026    0.03       0    TRAP      80       3
*

KK REMAIN7
KM  DIVERT FLOW EAST ACROSS U.S. 95 BETWEEN ALEXANDER ROAD AND GOWAN ROAD.
KM  DIVERT FLOW THROUGH 2 - 30" RCP's (CULVERT 12).  FLOW OVER US95 ELIMINATED
KM   BTWN CROSS-SECTIONS 1420 AND 1027 DUE TO SOUNDWALLS.
KM   REVISED BY LBG 6-28-2005
DT    D95G
DI       0     100     500    1000    1500    1656    2000
DQ       0      60      82      96     102     101     104
*

KK   GD11C
PB    2.77
```

```
551          BA   0.132
552          LS      0    86.0
553          UD   0.296
             *

554          KK    C11C
555          HC       2
             *
```



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

556          KK    R11C
557          KM   ROUTE SOUTH TO CULVERT #13 U/S OF GOWAN UNDERPASS (HECRAS 0+17)
558          RK    1283  0.0026    0.03       0    TRAP      80       3
             *

559          KK   GD11B
560          PB    2.77
561          BA   0.196
562          LS      0    87.6
563          UD   0.272
             *

564          KK    C11B
565          HC       2
             *

566          KK  GOWAN1
567          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
568          KM   BY POGGEMEYER DESIGN GROUP, INC
569          KM   DIVERT MAXIMUM OF 422 CFS INTO GOWAN OUTFALL AT US95
570          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
571          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
572          KM   DIVERT NOTHING GOWAN OUTFALL WILL BE FULL!!! LBG
573          DT   GOOF1
574          DI      0      51     101     423    5000
575          DQ      0       1       2       3       4
             *

576          KK    R11B
577          KM  ROUTE TO CPT6B
578          RK    1400  0.0057   0.015       0    TRAP      80       2
             *

579          KK   CY05A
580          PB    2.77
581          BA   0.025
582          LS      0    85.6
583          UD   0.179
             *

584          KK    D95G
585          KM  RETRIEVE FLOW DIVERTED THROUGH OKG 353
586          DR    D95G
             *

587          KK   RD95G
588          KM  ROUTE TO PT6B
589          RK    2300   0.004   0.015       0    TRAP      60       2
             *
```



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

590          KK    PT6B
591          PB    2.77
592          BA   0.107
593          LS      0    89.1
594          UD   0.182
             *

595          KK   CPT6B
596          HC       2
             *

597          KK  2CPT6B
598          KM   RAINBOW & GOWAN
599          HC       3
             *

600          KK  GOWAN2
601          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
602          KM   BY POGGEMEYER DESIGN GROUP, INC
603          KM   DIVERT MAXIMUM OF 52 CFS INTO GOWAN OUTFALL AT RAINBOW
604          KM   FOR A TOTAL OF 474 CFS.
605          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
606          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
607          KM   DIVERT 2 CFS THE GOWAN OUTFALL IS FULL LBG
608          DT   GOOF2
609          DI      0      53     101     423    5000
610          DQ      0       2       2       2       2
             *

611          KK   RPT6B
612          KM  ROUTE TO C5A3
613          RK    2480  0.0067   0.015       0    TRAP      80       2
             *

614          KK   CY05D
615          PB    2.77
616          BA   0.059
617          LS      0    78.6
618          UD   0.254
             *

619          KK   PT5A3
```

```
620          PB    2.77
621          BA   0.089
622          LS       0    87.1
623          UD   0.285
             *

624          KK    C5A3
625          KM   TORREY PINES & GOWAN
626          HC       3
             *
```



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

627          KK  GOWAN3
628          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
629          KM   BY POGGEMEYER DESIGN GROUP, INC
630          KM   DIVERT MAXIMUM OF 21 CFS INTO GOWAN OUTFALL AT TORREY PINES
631          KM   FOR A TOTAL OF 495 CFS.
632          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
633          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
634          KM   DIVERT 2 CFS LBG
635          DT   GOOF3
636          DI       0      22    5000
637          DQ       0       2       2
             *

638          KK    R5A3
639          KM  ROUTE TO C5A8 GOWAN & MAVERICK
640          RK    1236  0.0088   0.015       0    TRAP      80       2
             *

641          KK     MAV
642          KM   DIVERSION TO MAVERICK THEN DUNCAN THEN RANCHO.  DIVERSIONS
643          KM  DETERMINED USING HECRAS
644          DTMAVERICK
645          DI       0     200     400    1050    1300    1550    1800
646          DQ       0       8      14      50     100     150     200
             *

647          KK   R5A3B
648          KM  ROUTE TO C5A8 GOWAN & BRONCO
649          RK     600  0.0088   0.015       0    TRAP      80       2
             *

650          KK   CY06A
651          PB    2.77
652          BA   0.077
653          LS       0    84.0
654          UD   0.246
             *

655          KK   PT5A8
656          PB    2.77
657          BA   0.025
658          LS       0    82.0
659          UD   0.265
             *

660          KK    C5A8
661          KM   GOWAN & BRONCO
662          HC       3
             *
```



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

663          KK   R5A3C
664          KM  ROUTE TO C5A8 GOWAN & JONES
665          RK     620  0.0088   0.015       0    TRAP      80       2
             *

666          KK  GOWAN4
667          KM   FROM 90% SUBMITTAL DRAINAGE STUDY ADDENDA I [SIC]
668          KM   BY POGGEMEYER DESIGN GROUP, INC
669          KM   DIVERT MAXIMUM OF 44 CFS INTO GOWAN OUTFALL AT JONES
670          KM   FOR A TOTAL OF 539 CFS.
671          KM   REMAINING FLOW TRAVELS EASTWARD ON GOWAN ROAD
672          KM   MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
673          KM   DIVERT 2 CFS LBG
674          DT   GOOF4
675          DI       0      45    5000
676          DQ       0       2       2
             *

677          KK  DPT5A8
678          KM  DIVERT FLOW TO JONES
679          KM  FROM VTN NEVADA SILVER MESA STUDY (1989) AND CVL FISR
680          KM  DIVERTED FLOW DRAINS SOUTH THEN EAST TO SANTA CATALINA.  IT THEN
681          KM  FLOWS UNDER MICHAEL TO RANCHO.  MOST GOES UNDER RANCHO IN A RCB JUST SOUTH
682          KM   OF THE MICHAEL WAY INTERSECTION. REMAINING FLOW CONTINUES SOUTH ON RANCHO.
683          DT  DCY07B
684          DI       0     100     500    1000    2000    3000    4000    5500
685          DQ       0       0     116     253     592     948    1308    1859
             *

686          KK    R5A8
687          KM  ROUTE TO TRUE VALUE
688          RK    1659  0.0097   0.015       0    TRAP      80       2
             *

689          KK   R5A82
690          KM  ROUTE TO CCY07A
691          RK    1220  0.0097   0.015       0    TRAP      80       2
             *

692          KK   CY07A
```

```
693          PB    2.77
694          BA   0.027
695          LS       0    86.2
696          UD   0.237
             *

697          KK  CCY07A
698          HC       2
             *
```



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

699          KK    TRUV
700          KM   DIVERSION BEHIND TRUE VALUE HARDWARE REVISED BY LBG.  DIVERSIONS
701          KM  DETERMINED USING HECRAS LATERAL WEIR. L = 25 FT
702          DT  TRUVAL
703          DI       0     200     400     600    1000    1400    1800
704          DQ       0       8      25      43      78     114     149
             *

705          KK    D95B
706          KM  RETRIEVE FLOW FROM BOX DIVERSION JUST SOUTH OF 95/RANCHO INT. (CULVERT 3)
707          KM  ***NOTE: THIS FLOW CARRIES A DRAINAGE AREA OF 1.49 SQUARE MILES***
708          DR    D95B
             *

709          KK   RD95B
710          KM  ROUTE TO 1REMAIN ON RANCHO DRIVE
711          RK    1200   0.004   0.025       0    TRAP      30       2
             *

712          KK 1REMAIN
713          KM  DIVERT 36 CFS EAST THROUGH 2, 24" CMP'S (CULVERT 14) UNDER RANCHO ROAD JUST
714          KM  NORTHWEST (UPSTREAM) OF THE RANCHO ROAD AND RAINBOW BLVD. INTERSECTION.
715          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO. UPPER RANCHO HECRAS STA. 122+
716          DT  D1RCHO
717          DI       0     191    1000   10000
718          DQ       0      36      36      36
             *

719          KK  PT3AB1
720          PB    2.77
721          BA   0.049
722          LS       0    93.7
723          UD   0.283
             *

724          KK   C3AB1
725          HC       2
             *

726          KK 2REMAIN
727          KM  DIVERT 29 CFS EAST THROUGH A 30" CMP (CULVERT 15) UNDER RANCHO ROAD AT THE
728          KM  RANCHO ROAD AND RAINBOW BLVD. INTERSECTION. (UPPER RANCHO HECRAS STA. 121+00)
729          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
730          DT  D2RCHO
731          DI       0     189    1000   10000
732          DQ       0      29      29      29
             *

733          KK  R2MAIN
734          KM  ROUTE TO PT3AB2
735          RK    1365  0.0022   0.025       0    TRAP      30       2
             *
```



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

736          KK  PT3AB2
737          PB    2.77
738          BA   0.050
739          LS       0    94.5
740          UD   0.197
             *

741          KK   C3AB2
742          HC       2
             *

743          KK 3REMAIN
744          KM  DIVERT 23 CFS EAST THROUGH A 30" CMP (CULVERT 20) UNDER RANCHO ROAD AT THE
745          KM  RANCHO ROAD AND LONE MT. RD. INTERSECTION.  (RANCHO HECRAS 103+99)
746          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
747          DT  D3RCHO
748          DI       0     192    1000   10000
749          DQ       0      23      23      23
             *

750          KK  R3MAIN
751          KM  ROUTE TO CPT2B2 (RANCHO HECRAS 93+76)
752          RK    1023   0.005    0.03       0    TRAP      40       2
             *

753          KK   PT2B2
754          PB    2.77
755          BA   0.078
756          LS       0    87.0
757          UD   0.254
             *

758          KK  CPT2B2
759          HC       2
             *

760          KK 4REMAIN
761          KM  DIVERT 35 CFS EAST THROUGH A 36" CMP (CULVERT 21) UNDER RANCHO ROAD HALF WAY
```

```
762          KM  BETWEEN LONE MT. RD. AND CRAIG ROAD. UPPER RANCHO HECRAS STA. 93+76.
763          KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
764          DT  D4RCHO
765          DI       0     214    1000   10000
766          DQ       0      35      35      35
             *

767          KK  R4MAIN
768          KM  ROUTE TO C2B3
769          RK    2323   0.011    0.02       0    TRAP      40       2
             *
```



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

770          KK   PT2B3
771          PB    2.77
772          BA   0.023
773          LS       0    93.2
774          UD   0.236
             *

775          KK    C2B3(UPPER RANCHO HECRAS STA. 70+16.)
776          HC       2
             *

777          KK    D2B3
778          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN AT RANCHO.  CRAIG STORM DRAIN IS
779          KM  48" RCP, CAPACITY = 210 CFS AT THE 48" LATERAL.  THE INLET TO THE 48"
780          KM  LATERAL IS AT THE DOWNSTREAM END OF THE DRAINAGE EASEMENT BEHIND THE 7-11
781          KM  CONVENIENT STORE.  IMMEDIATELY ABOVE THE 48" INLET ARE 2, 3'X7' RCB'S THAT
782          KM  CROSS UNDER CRAIG ROAD AND DISCHARGE ON THE SOUTHWEST SIDE OF THE CRAIG/
783          KM  RANCHO INTERSECTION.  DIVERT 120 CFS TO THE CRAIG ROAD STORM DRAIN SINCE
784          KM  90 CFS ALREADY EXISTS IN THE PIPE.  REMAINING FLOW TRAVELS UNDER CRAIG ROAD
785          KM  IN THE 2, 3'X7' RCB'S AND DISCHARGES AT THE SOUTHWEST CORNER OF THE
786          KM  CRAIG/RANCHO INTERSECTION AND IS JOINED BY THE STREET FLOW IN CRAIG.
787          KM  ALL STREET FLOW IN CRAIG IS CONTAINED IN THE NORTH HALF STREET BY THE
788          KM  MEDIAN CURB SO THERE IS NO DIVERSION TO TORREY PINES.
789          KM  THE 48" LATERAL TO THE CRAIG ROAD STORM DRAIN IS CULVERT 22.
790          KM  THE 2, 3'X7' RCB'S ARE CULVERT 23. UPPER RANCHO HECRAS STA. 70+00.
791          DT   DCSD2
792          DI       0     121    1000   10000
793          DQ       0     120     120     120
             *

794          KK   PT2A2
795          PB    2.77
796          BA   0.062
797          LS       0    84.7
798          UD   0.222
             *

799          KK    R2A2
800          KM  ROUTE TO C2A1
801          RK    1200   0.004   0.015       0    TRAP     100       2
             *

802          KK   PT2A1
803          PB    2.77
804          BA   0.065
805          LS       0    86.8
806          UD   0.308
             *
```



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

807          KK    D95E
808          KM  RETRIEVE FLOW FROM BOX DIVERSION AT US95 AND CRAIG (CULVERT 7)
809          KM  ***NOTE: THIS FLOW CARRIES A TOTAL TRIBUTARY AREA OF 18.58 SQUARE MILES.***
810          KM  THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES BROUGHT IN BY D95B, SO
811          KM  THE TOTAL TRIBUTARY AREA TO THE CRAIG/RANCHO INTERSECTION IS 18.98 SQUARE
812          KM  MILES (18.58 + 0.40).
813          DR    D95E
             *

814          KK   RD95E
815          KM  ROUTE TO PT2A2
816          RK    1500   0.004   0.015       0    TRAP      80       2
             *

817          KK    C2A2
818          HC       3
             *

819          KK  DPT2A1
820          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN
821          KM  42" RCP, CAPACITY = 90 CFS
822          KM  REMAINING FLOW CONTINUES EAST IN CRAIG RD.
823          KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
824          DT   DCSD1
825          DI       0      21      51      76      91     200     500    1000
826          DQ       0      20      50      75      90      90      90      90
             *

827          KK    R2A2
828          KM  ROUTE TO C2B1
829          RK    2100   0.007   0.015       0    TRAP      80       2
             *

830          KK   PT2B1
831          PB    2.77
832          BA   0.072
833          LS       0    84.5
834          UD   0.222
             *
```

2: 6'x3' RCBs

```
                                                                                                                    PAGE 26
1                                                HEC-1 INPUT

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

  835         KK    C2B1
  836         HC       2
              *
  837         KK    R2B1
  838         KM  ROUTE TO C2B3
  839         RK     300   0.007   0.015       0    TRAP       80       2
              *
  840         KK   2C2B3
  841         HC       2
              *
  842         KK   RC2B3
  843         KM  ROUTE TO 5REMAIN (UPPER RANCHO HECRAS STA 53+82)
  844         RK    1600  0.0076    0.03       0    TRAP       80       2
              *
              *
              *      ***************** BEGINNING AUGUST 2016 REVISION ********************
              *
              * JUST SWITCHING 5REMAIN AND D5RCHO, SO THAT RUNOFF FROM THE RANCHO CULVERTS
              * (CULVERT 27 AND CULVERT 26) CAN BE ROUTED AND COMBINED WITH THE LOCAL
              * FLOWS WITHIN THE STUDY
              *
              *                    ***************************
              *              ***********************************************

  845         KK  D5RCHO
  846         KM   DIVERT FLOW EAST ACROSS RANCHO IN TWO 6' X 3' RCB's. THE FIRST RCB IS JUST
  847         KM   UPSTREAM OF THE 7' X 3' RCB (CULVERT 27) THAT PARALLELS RANCHO ON THE WEST
  848         KM   SIDE.  DIVERT 78 CFS OF 185 CFS TO THE FIRST 6' X 3' RCB (CULVERT 26). THE
  849         KM   REMAINING 107 CFS ENTERS THE 7' X 3' RCB.  THE SECOND 6' X 3' RCB
  850         KM   CULVERT 28) IS CONNECTED INTO THE SIDE OF THE 7' X 3' RCB. DIVERT 35 CFS OF
  851         KM   THE 107 CFS TO THE SECOND 6' X 3' RCB.  THE REMAINING 72 CFS CONTINUES
  852         KM   TO THE SOUTH SIDE OF ALEXANDER IN THE 7' X 3' RCB. UPPER RANCHO HECRAS
  853         KM   HAS CULVERT 27 IN IT BETWEEN STA. 52+64 AND 38+36.
  854         DT 5REMAIN
  855         DI       0     113     155     197     308
  856         DQ       0       0      42      84     195
              *
              *     ********************END AUSUST 2016 REVISION*****************************
              *
              *
              *        ******************** AUGUST 2016 ******************************
              *
              *                    ----------------------------------------
              * (1) ***************** END OF REFERENCED HEC-1 MODEL ******************** (1)
              *                    ----------------------------------------
              *
              *   ***************** FROM THE "RANCHO/US 95 LOMR **************
              *         **************ISSUED ON NOVEMBER 30, 2009 ******************
              *
              *         ******************** AUSUST 2016 ******************************
              *
              *                    ***************************
              *               ***********************************************
              *
                                                 HEC-1 INPUT                                                        PAGE 27
1

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

  857         KK   RNCH1
  858         KM   NORTHERN PORTION OF EXISTING RANCHO DRIVE ALONG THE PROJECT SITE
  859         BA  .00355
  860         LS       0    98.0
  861         UD    .125
              *
  862         KK  RRNCH1
  863         KM   ROUTE RUNOFF FROM RNCHO1 THROUGH ND1 TO JONES LOW POINT
  864         RK    1660   0.013   0.015       0    TRAP       2      50
              *
  865         KK     ND1
  866         KM   FUTURE ONSITE BASIN ND1 DRAINING SOUTHEASTERLY TOWARD JONES BLVD LOW POINT
  867         BA  .04176
  868         LS       0    98.0
  869         UD    .105
              *
  870         KK    CMD1
  871         KM   COMBINE RRNCH1 AND ND1
  872         HC       2
              *
  873         KK   RNCH2
  874         KM   SOUTHERN PORTION OF EXISTING RANCHO DRIVE ALONG THE PROJECT SITE
  875         BA  .00304
  876         LS       0    98.0
  877         UD    .137
              *
  878         KK  RRNCH2
  879         KM   ROUTE RUNOFF FROM RNCHO1 THROUGH ND2 TO JONES LOW POINT
  880         RK     600   0.011   0.015       0    TRAP       2      50
              *
  881         KK     ND2
  882         KM   FUTURE ONSITE BASIN ND2 DRAINING EASTERLY AND SOUTHEASTERLY TOWARDS
  883         KM   JONES BLVD LOW POINT
  884         BA  .02198
  885         LS       0    98.0
  886         UD    .081
              *
```

Ref. LOMR

```
887          KK    CMD2
888          KM   COMBINE RRNCH2 AND ND2
889          HC       2
             *
             *
1                                        HEC-1 INPUT                                                    PAGE 28

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

890          KK  JONES1
891          KM   WESTERN HALF OF JONES BOULEVARD DRAINING DIRECTLY TOWARDS EXISTING DROP INLET
892          KM   AT THE LAS VEGAS BOULEVARD LOW POINT
893          BA  .00344
894          LS       0    98.0
895          UD    .109
             *

896          KK  LOCL-D
897          KM   COMBINE CMD1, CMD2 AND JONES1
898          KM   FUTURE LOCAL FLOWS DRAINING ONTO THE EXISTING DROP INLETS AT
899          KM   JONES BLVD. LOW POINT
900          HC       3
             *
             *

901          KK  TOTL-D
902          KM   COMBINE LOCL-D AND D5RCHO
903          KM   FUTURE TOTAL FLOWS DRAINING ONTO THE EXISTING DROP INLETS AT
904          KM   JONES BLVD. LOW POINT
905          HC       2
             *

906          KKLOWPNT-D
907          KM   DIVERT FLOWS INTO EXISTING JONES BOULEVARD STORM DRAIN
908          KM   REMAINING FLOWS WILL CONTINUE EASTERLY INTO HICKAM AVENUE
909          DTJONES-SD
910          DI       0      79     100     200     300
911          DQ       0      79      79      79      79
             *

912          KK  JONES2
913          KM   EASTERN HALF OF JONES BOULEVARD TOWARDS HICKAM AVE. AT THE INTERSECTION
914          BA  .00319
915          LS       0    98.0
916          UD    .123
             *
             *

917          KKHICKAM-D
918          KM   COMBINE LOWPNT-D AND JONES2
919          KM   FUTURE TOTAL FLOWS CONTINUING INTO HICKAM AVENUE
920          KM   AT INTERSECTION WITH JONES BLVD. LOW POINT
921          HC       2
             *
             * KKR5REMN
             * KMROUTE TO CPT51 (UPPER RANCHO HECRAS STA 38+36)
             * RK1428     0.006    0.03       0   TRAP        7       0
             *
             * KKPT51
             * PB2.77
             * BA0.070
             * LS0          90.4
             * UD0.262
             *
             * KKCPT51
             * HC2
             *
             * KKD95Fa
             * KMRETRIEVE FLOW FROM WIER DIVERSION AT US95 AND ALEXANDER
             * DRD95Fa
             *
             * THESE TWO DIVERSIONS CARRY A TOTAL TRIBUTARY AREA OF 18.68.
             * THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES AND 2.35
             * SQUARE MILES BROUGHT IN BY D95B AND D95E RESPECTIVELY, SO THE TOTAL
             * TRIBUTARY AREA AT THE ALEXANDER/RANCHO INTERSECTION IS 19.69 SQUARE MILES.
             * (18.68 + 1.01)
             *
             *
             * KKDCSD2
             * KM RETRIEVE FLOWS CONVEYED THROUGH THE CRAIG ROAD STORM DRAIN
             * DRDCSD2
             *
             *
             * KKDCSD1
             * KM RETRIEVE FLOWS CONVEYED THROUGH THE CRAIG ROAD STORM DRAIN
             * DRDCSD1
             *
             * KK CRGSD
             * HC     2
             *
             *
             *
1                                        HEC-1 INPUT                                                    PAGE 29

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

922          KK  CRAIG1
923          KM   WESTERN PORTION OF EXISTING SOUTH-HALF OF CRAIG ROAD ALONG THE PROJECT SITE
924          BA  .00237
925          LS       0    98.0
926          UD    .098
             *

927          KK   ND3-1
928          KM   FUTURE ONSITE BASIN ND3-1 DRAINING NORTHEASTERLY TOWARDS
929          KM   CRAIG ROAD
```

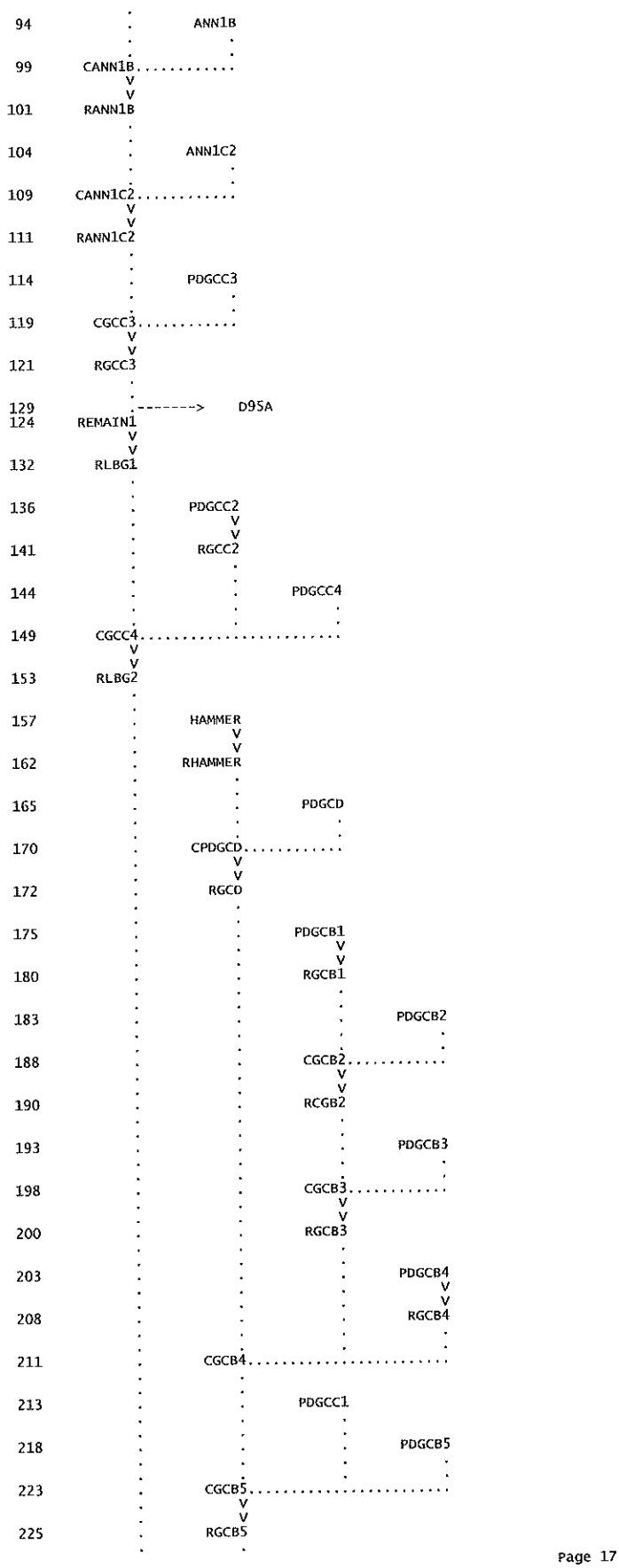
```
930           BA  .00775
931           LS        0    98.0
932           UD     .063
              *
              *

933           KK  CRG0-D
934           KM   COMBINE CRAIG1 AND ND3-1
935           HC        2
              *
              *

936           KK RCRG0-D
937           KM   ROUTE RUNOFF FROM CRG0-D TO INTERSECTION WITH JONES BOULEVARD
938           RK     700   0.020   0.015       0    TRAP       2       50
              *

939           KK  CRAIG2
940           KM   EASTERN PORTION OF EXISTING SOUTH-HALF OF CRAIG ROAD ALONG THE PROJECT SITE
941           BA  .00148
942           LS        0    98.0
943           UD     .065
              *
              *

944           KK   ND3-2
945           KM   FUTURE ONSITE BASIN ND3-2 DRAINING NORTHEASTERLY TOWARDS
946           KM   CRAIG ROAD
947           BA  .00364
948           LS        0    98.0
949           UD     .050
              *
              *

950           KK  CRG1-D
951           KM   COMBINE RCRG0-D, CRAIG2 AND ND3-2
952           KM   TOTAL SURFACE FLOWS CONVEYED WITHIN CRAIG ROAD SOUTH HALF
953           KM   JUST UPSTREAM THE INTERSECTION WITH JONES BLVD.
954           HC        3
              *
```

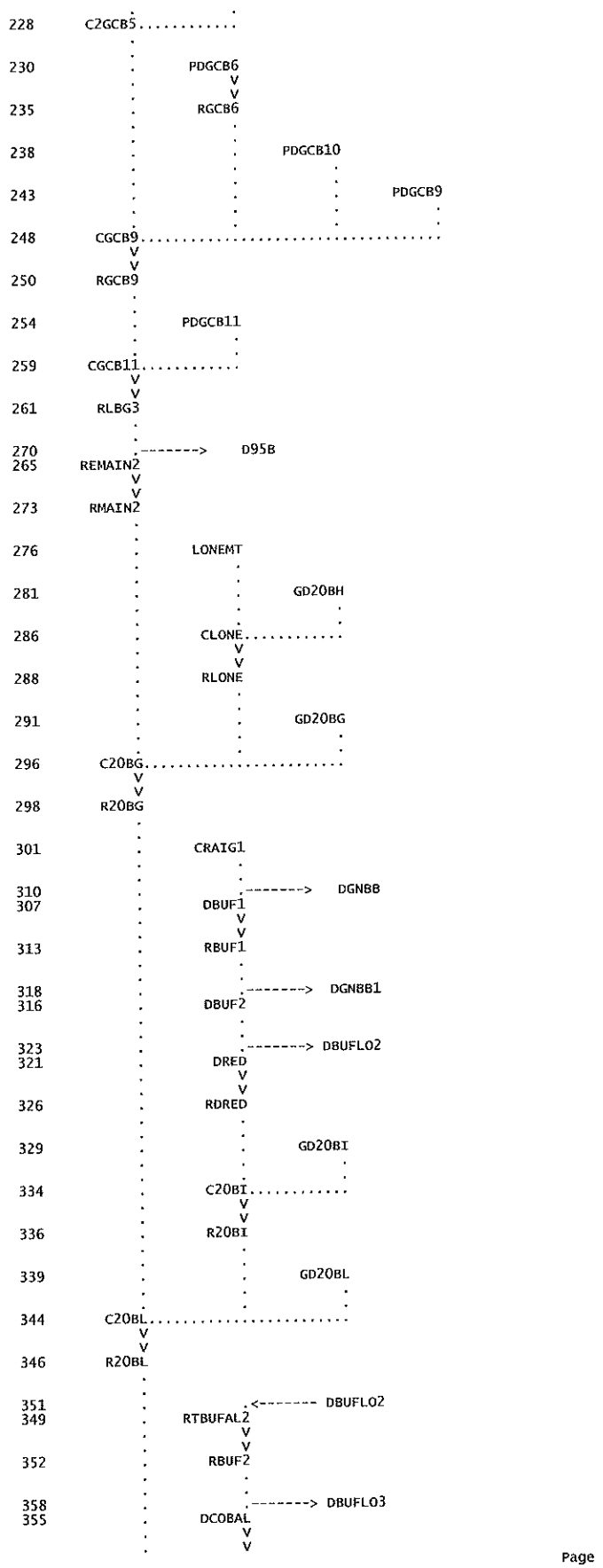


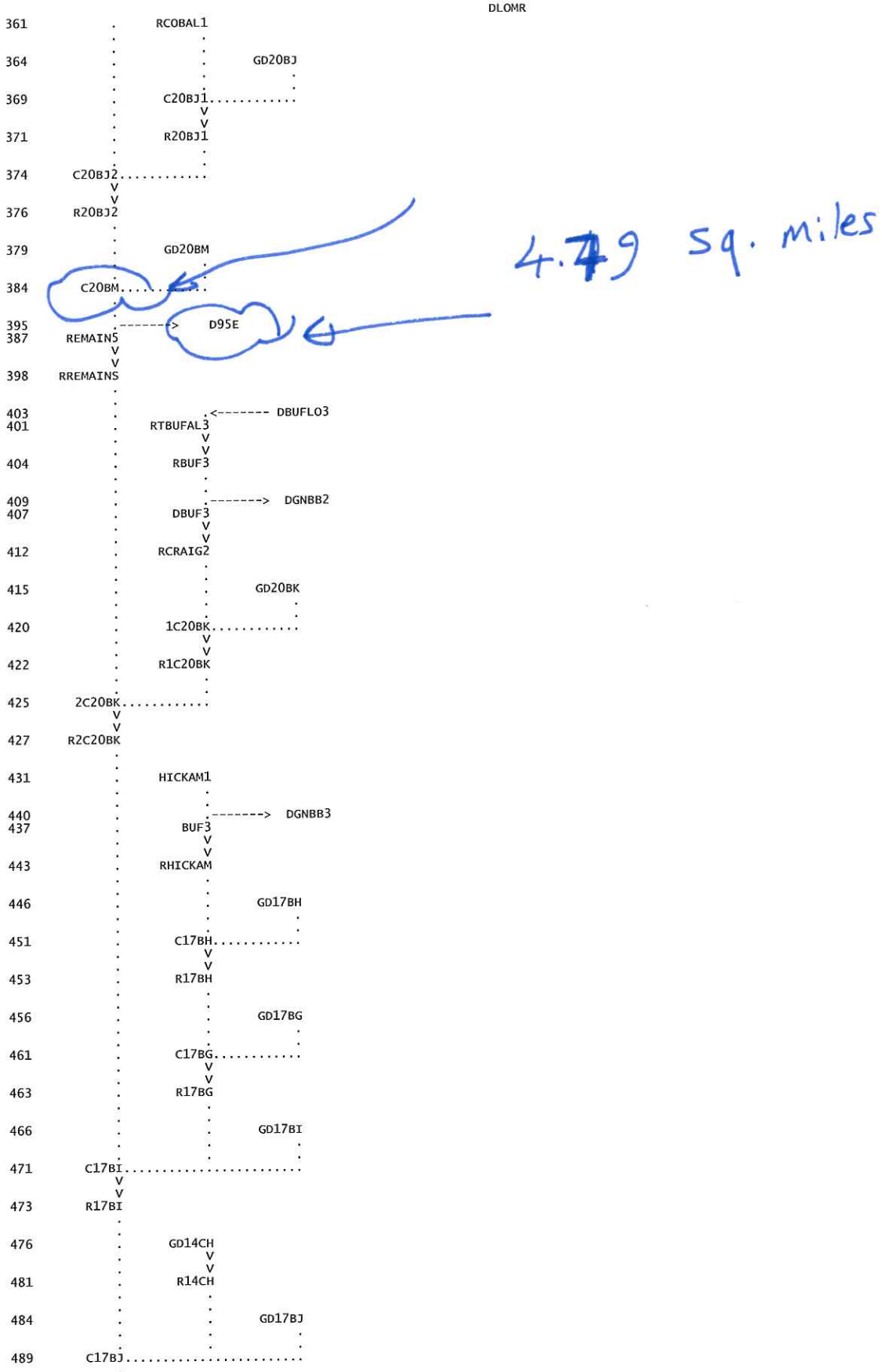
```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

955           KK     ND4
956           KM   FUTURE ONSITE BASIN NX4 DRAINING EASTERLY AND NORTHEASTERLY TOWARDS
957           KM   JONES BOULEVARD, NORTH OF THE HIGHPOINT
958           BA  .00335
959           LS        0    98.0
960           UD     .050
              *
              *

961           KK  JONES3
962           KM   WESTERN HALF OF JONES BOULEVARD, NORTH OF THE HIGHPOINT
963           KM   DRAINING NORTHERLY TOWARDS CRIAG ROAD
964           BA  .00111
965           LS        0    98.0
966           UD     .087
              *
              *

967           KK   JON-D
968           KM   COMBINE ND4 AND JONES3
969           KM   TOTAL NORTHERLY FLOWS WITHIN WEST HALF OF JONES BOULEVARD
970           KM   AT INTERSECTION WITH CRAIG ROAD
971           HC        2
              *
              *

972           KK  CRG2-D
973           KM   COMBINE CRG1-D AND JON-D
974           KM   TOTAL FLOWS CONVEYED WITHIN CRAIG ROAD SOUTH HALF,
975           KM   AT THE INTERSECTION WITH JONES BLVD.
976           HC        2
              *
              *

977           KK    NDA^
978           KM   REFERENCED ONSITE BASIN NDA FOR THE PORTION OF THE MURPHY EXPRESS DRAINING IN
979           KM   EXISTING CRAIG ROAD STORM DRAIN, AS REFERENCED FROM
980           KM   "TDS FOR MURPHY EXPRESS (CRAIG RD & JONES BLVD.)", DS 4771
981           BA  .00153
982           LS        0    98.0
983           UD     .050
              *

984           ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

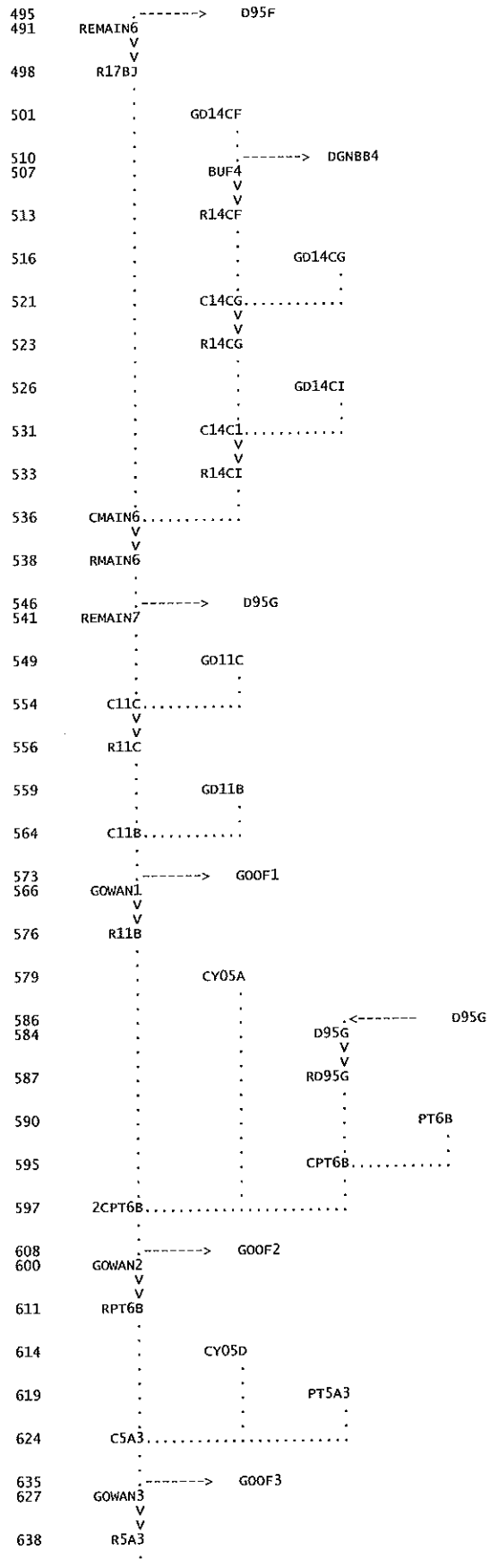
```
INPUT
 LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

   68         ANN
               V
               V
   81        RANN
               .
               .
   84          .       GD29B
               .          .
               .          .
   89       CGD29B.............
               V
               V
   91       RGD29B
               .
```

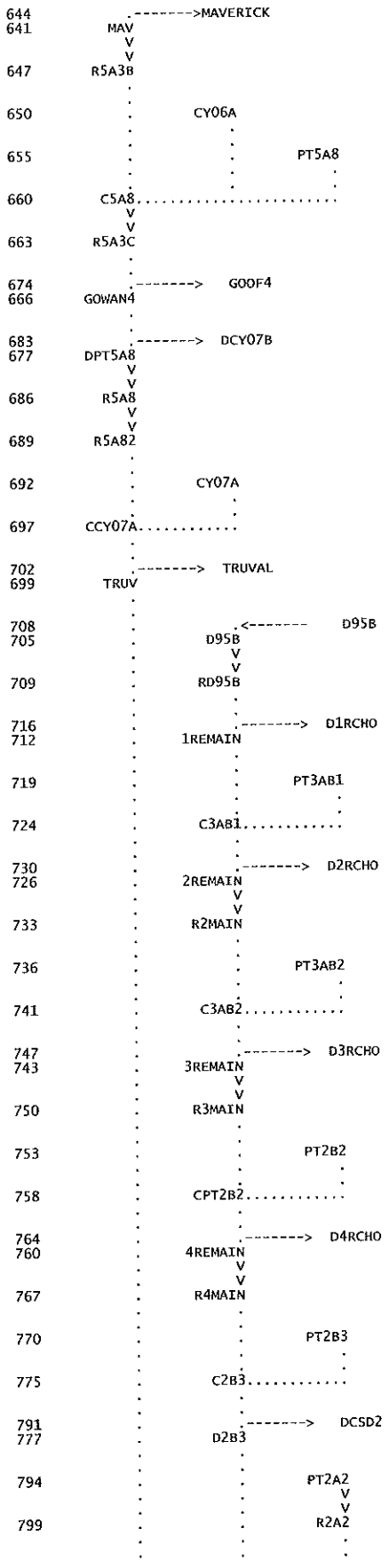

94 ANN1B
99 CANN1B
101 RANN1B
104 ANN1C2
109 CANN1C2
111 RANN1C2
114 PDGCC3
119 CGCC3
121 RGCC3
129 D95A
124 REMAIN1
132 RLBG1
136 PDGCC2
141 RGCC2
144 PDGCC4
149 CGCC4
153 RLBG2
157 HAMMER
162 RHAMMER
165 PDGCD
170 CPDGCD
172 RGCD
175 PDGCB1
180 RGCB1
183 PDGCB2
188 CGCB2
190 RCGB2
193 PDGCB3
198 CGCB3
200 RGCB3
203 PDGCB4
208 RGCB4
211 CGCB4
213 PDGCC1
218 PDGCB5
223 CGCB5
225 RGCB5

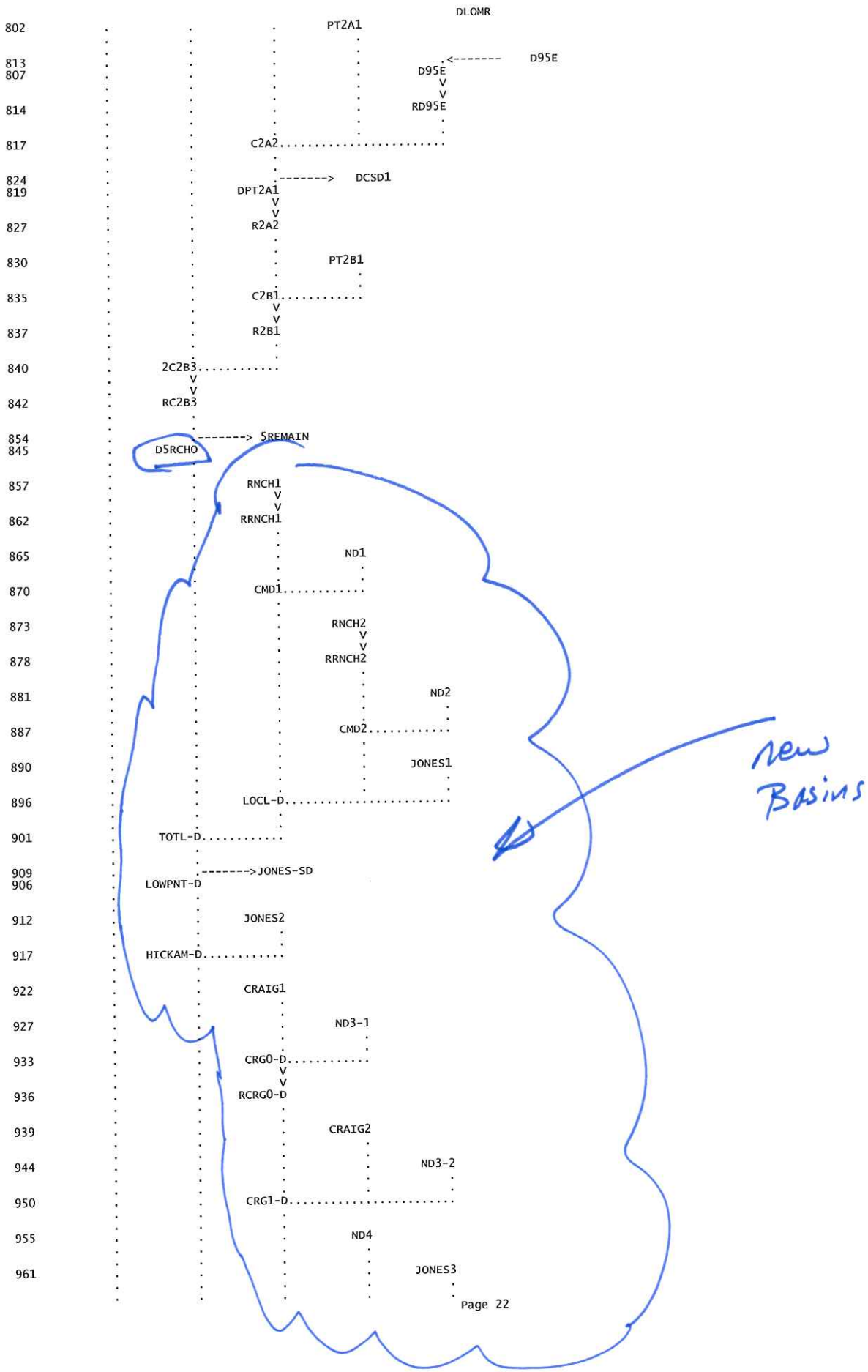

228 C2GCB5
230 PDGCB6
235 RGCB6
238 PDGCB10
243 PDGCB9
248 CGCB9
250 RGCB9
254 PDGCB11
259 CGCB11
261 RLBG3
270
265 REMAIN2
273 RMAIN2
276 LONEMT
281 GD20BH
286 CLONE
288 RLONE
291 GD20BG
296 C20BG
298 R20BG
301 CRAIG1
310 DGN8B
307 DBUF1
313 RBUF1
318 DGN8B1
316 DBUF2
323 DBUFLO2
321 DRED
326 RDRED
329 GD20BI
334 C20BI
336 R20BI
339 GD20BL
344 C20BL
346 R20BL
351 DBUFLO2
349 RTBUFAL2
352 RBUF2
358 DBUFLO3
355 DCOBAL

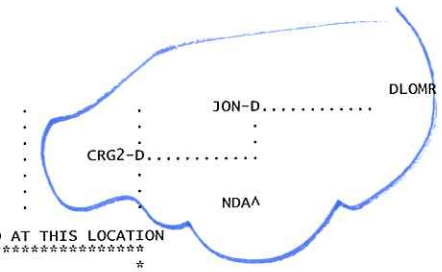

RCOBAL1
GD20BJ
C20BJ1
R20BJ1
C20BJ2
R20BJ2
GD20BM
C20BM
D95E
REMAIN5
RREMAINS
DBUFLO3
RTBUFAL3
RBUF3
DGNBB2
DBUF3
RCRAIG2
GD20BK
1C20BK
R1C20BK
2C20BK
R2C20BK
HICKAM1
DGNBB3
BUF3
RHICKAM
GD17BH
C17BH
R17BH
GD17BG
C17BG
R17BG
GD17BI
C17BI
R17BI
GD14CH
R14CH
GD17BJ
C17BJ

4.79 sq. miles


495
D95F
491
REMAIN6
498
R17BJ
501
GD14CF
510
DGNBB4
507
BUF4
513
R14CF
516
GD14CG
521
C14CG
523
R14CG
526
GD14CI
531
C14CI
533
R14CI
536
CMAIN6
538
RMAIN6
546
D95G
541
REMAIN7
549
GD11C
554
C11C
556
R11C
559
GD11B
564
C11B
573
GOOF1
566
GOWAN1
576
R11B
579
CY05A
586
D95G
584
D95G
587
RD95G
590
PT6B
595
CPT6B
597
2CPT6B
608
GOOF2
600
GOWAN2
611
RPT6B
614
CY05D
619
PT5A3
624
C5A3
635
GOOF3
627
GOWAN3
638
R5A3


644
641 MAV
647 R5A3B
650 CY06A
655 PT5A8
660 C5A8
663 R5A3C
674
666 GOWAN4
GOOF4
683
677 DPT5A8
DCY07B
686 R5A8
689 R5A82
692 CY07A
697 CCY07A
702
699 TRUV
TRUVAL
708
705 D95B
D95B
709 RD95B
716
712 1REMAIN
D1RCHO
719 PT3AB1
724 C3AB1
730
726 2REMAIN
D2RCHO
733 R2MAIN
736 PT3AB2
741 C3AB2
747
743 3REMAIN
D3RCHO
750 R3MAIN
753 PT2B2
758 CPT2B2
764
760 4REMAIN
D4RCHO
767 R4MAIN
770 PT2B3
775 C2B3
791
777 D2B3
DCSD2
794 PT2A2
799 R2A2


DLOMR
802 PT2A1
813 <------- D95E
807 D95E
V
V
814 RD95E
817 C2A2
824 -------> DCSD1
819 DPT2A1
V
V
827 R2A2
830 PT2B1
835 C2B1
V
V
837 R2B1
840 2C2B3
V
V
842 RC2B3
854 -------> SREMAIN
845 D5RCHO
857 RNCH1
V
V
862 RRNCH1
865 ND1
870 CMD1
873 RNCH2
V
V
878 RRNCH2
881 ND2
887 CMD2
890 JONES1
896 LOCL-D
901 TOTL-D
909 -------> JONES-SD
906 LOWPNT-D
912 JONES2
917 HICKAM-D
922 CRAIG1
927 ND3-1
933 CRG0-D
V
V
936 RCRG0-D
939 CRAIG2
944 ND3-2
950 CRG1-D
955 ND4
961 JONES3
New Basins



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*    FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*                JUN  1998              *
*             VERSION 4.1               *
*                                       *
*   RUN DATE   31AUG16  TIME  20:25:02  *
*                                       *
*****************************************
```

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

CRAIG/RANCHO MASTER DRAINAGE STUDY
DEVELOPED (INTERIM/FUTURE) CONDITION
USING SCS METHODS AND KINEMATIC WAVE ROUTING
MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

LOCHSA JOB# 161051

INPUT FILE NAME: DLOMR.DAT

AUGUST 2016

****
****

INSIDE McCARRAN AIRPORT RAINFALL AREA

10, 25 & 100 YEAR - 6 HOUR STORM EVENT
PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM

10-YEAR RAINFALL DEPTH = 1.58 INCHES
25-YEAR RAINFALL DEPTH = 2.05 INCHES
100-YEAR RAINFALL DEPTH = 2.77 INCHES

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74

****

DARF RATIOS FOR AREAS OF 5.20 SQUARE MILES FOR
RANCHO AND JONES BLVD. FLOWS = 0.90

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = (1.58/2.77) X 0.90 = 0.51
25-YEAR RAINFALL DEPTH RATIO (JR CARD) = (2.05/2.77) X 0.90 = 0.67

****

****

RANCHO/US95 CLOMR
FOR: CITY OF LAS VEGAS, NV AND THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTR
THIS IS THE PROPOSED HEC1 MODEL FOR UPPER RANCHO DRIVE (NORTH OF GOWAN ROAD)
FILENAME:UPPRSDN3.DAT

CAM10 DETENTION BASIN AND THE WESTERN BELTWAY CHANNEL ARE INCLUDED IN THE EN
NOT IN THE SDN3 WATERSHED.

MODIFIED BY LBG SEPT 2005
SDN3 CREATED BY REDUCING THE SIZE OF CRAIG SUBBASIN TO 1.434 SQUARE MILES
ADD INTERIM BELTWAY AND GOWAN NORTH PHASE III
BY MODIFYING THE CRAIG SUBBASIN FROM PBS&J MODEL

LVRA0000 (PEAK CHANNEL AND RANCHO DRIVE IMPROVEMENTS) ADDED BY DIVERTING
FLOW FROM CONCENTRATION POINT CX1X4

TRUVAL FLOW SPLIT, REMOVED FROM CVL MODEL, HAS BEEN PUT BACK IN.

JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)

100-YEAR, 6-HOUR STORM, SDN3
DARF RATIOS FOR AREAS OF 0, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0 AND 10 SQUARE MILES
FOR THE 100-YEAR EVENT.

```
 65 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          100  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE      1   0  ENDING DATE
                    NDTIME       0815  ENDING TIME
                     ICENT         19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE     8.25 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
1.00 .74 .57 .90 .67 .51

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

*** 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

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

DARF=0.90

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6
					1.00	.74	.57	.90	.67	.51
HYDROGRAPH AT	ANN	.26	1	FLOW	123.	62.	30.	99.	48.	21.
+				TIME	4.00	4.00	4.08	4.00	4.00	4.08
ROUTED TO	RANN	.26	1	FLOW	122.	62.	30.	98.	48.	20.
+				TIME	4.08	4.08	4.17	4.08	4.08	4.17

HYDROGRAPH AT	GD29B	.14	1	FLOW	69.	32.	14.	54.	24.	9.
+				TIME	3.75	3.83	3.83	3.75	3.83	3.92
2 COMBINED AT	CGD29B	.40	1	FLOW	174.	85.	39.	137.	64.	27.
+				TIME	3.92	4.00	4.08	3.92	4.00	4.17
ROUTED TO	RGD29B	.40	1	FLOW	173.	84.	39.	137.	64.	26.
+				TIME	4.00	4.08	4.17	4.00	4.08	4.25
HYDROGRAPH AT	ANN1B	.14	1	FLOW	108.	62.	35.	90.	51.	27.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.83
2 COMBINED AT	CANN1B	.53	1	FLOW	258.	128.	59.	206.	98.	40.
+				TIME	3.92	3.92	4.08	3.92	4.00	4.17
ROUTED TO	RANN1B	.53	1	FLOW	256.	127.	59.	203.	97.	40.
+				TIME	3.92	4.00	4.17	4.00	4.08	4.25
HYDROGRAPH AT	ANN1C2	.09	1	FLOW	69.	38.	21.	56.	31.	15.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT	CANN1C2	.62	1	FLOW	308.	152.	69.	246.	116.	46.
+				TIME	3.92	4.00	4.17	3.92	4.00	4.25
ROUTED TO	RANN1C2	.62	1	FLOW	307.	152.	69.	244.	114.	45.
+				TIME	3.92	4.00	4.17	3.92	4.08	4.25
HYDROGRAPH AT	PDGCC3	.05	1	FLOW	50.	30.	18.	42.	24.	14.
+				TIME	3.58	3.58	3.67	3.58	3.67	3.67
2 COMBINED AT	CGCC3	.67	1	FLOW	332.	163.	73.	265.	124.	49.
+				TIME	3.92	4.00	4.17	3.92	4.00	3.83
ROUTED TO	RGCC3	.67	1	FLOW	331.	163.	73.	264.	122.	48.
+				TIME	3.92	4.00	4.17	3.92	4.08	3.92
DIVERSION TO	D95A	.67	1	FLOW	139.	139.	72.	139.	121.	48.
+				TIME	3.58	3.83	4.17	3.67	4.08	3.92
HYDROGRAPH AT	REMAIN1	.67	1	FLOW	192.	24.	1.	125.	1.	1.
+				TIME	3.92	4.00	3.75	3.92	3.67	3.92
ROUTED TO	RLBG1	.67	1	FLOW	192.	24.	1.	125.	1.	1.
+				TIME	3.92	4.00	3.83	3.92	3.75	3.92
HYDROGRAPH AT	PDGCC2	.04	1	FLOW	20.	9.	4.	15.	7.	2.
+				TIME	3.75	3.83	3.83	3.75	3.83	3.92
ROUTED TO	RGCC2	.04	1	FLOW	20.	9.	3.	15.	6.	2.
+				TIME	3.92	4.00	4.25	3.92	4.08	4.33
HYDROGRAPH AT	PDGCC4	.05	1	FLOW	51.	30.	18.	43.	25.	14.
+				TIME	3.58	3.58	3.67	3.58	3.67	3.67
3 COMBINED AT	CGCC4	.76	1	FLOW	237.	45.	19.	161.	26.	15.
+				TIME	3.92	4.00	3.67	3.92	3.67	3.67
ROUTED TO	RLBG2	.76	1	FLOW	237.	44.	19.	161.	26.	14.
+				TIME	3.92	4.00	3.67	3.92	3.67	3.67
HYDROGRAPH AT	HAMMER	.13	1	FLOW	73.	37.	17.	58.	28.	12.
+				TIME	3.83	3.83	3.83	3.83	3.83	3.92
ROUTED TO	RHAMMER	.13	1	FLOW	72.	37.	17.	57.	28.	12.
+				TIME	3.83	3.92	4.00	3.83	3.92	4.00
HYDROGRAPH AT	PDGCD	.13	1	FLOW	65.	30.	13.	51.	22.	8.
+				TIME	3.75	3.75	3.83	3.75	3.83	3.83
2 COMBINED AT	CPDGCD	.26	1	FLOW	134.	65.	29.	106.	48.	19.
+				TIME	3.83	3.83	3.92	3.83	3.92	4.00
ROUTED TO	RGCD	.26	1	FLOW	133.	63.	28.	106.	48.	19.
+				TIME	3.92	4.00	4.08	3.92	4.00	4.17
HYDROGRAPH AT	PDGCB1	.03	1	FLOW	38.	23.	14.	32.	19.	11.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO	RGCB1	.03	1	FLOW	37.	22.	13.	31.	18.	10.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT										

							DLOMR			
+	PDGCB2	.03	1	FLOW	27.	15.	8.	22.	12.	6.
				TIME	3.58	3.67	3.67	3.67	3.67	3.67
+ 2 COMBINED AT	CGCB2	.06	1	FLOW	64.	37.	21.	53.	31.	16.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
+ ROUTED TO	RCGB2	.06	1	FLOW	62.	36.	21.	51.	30.	16.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
+ HYDROGRAPH AT	PDGCB3	.07	1	FLOW	34.	15.	6.	26.	11.	4.
				TIME	3.67	3.75	3.75	3.67	3.75	3.83
+ 2 COMBINED AT	CGCB3	.13	1	FLOW	96.	51.	27.	77.	41.	19.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
+ ROUTED TO	RGCB3	.13	1	FLOW	94.	50.	26.	76.	39.	19.
				TIME	3.75	3.75	3.83	3.75	3.75	3.83
+ HYDROGRAPH AT	PDGCB4	.02	1	FLOW	21.	13.	8.	18.	11.	6.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
+ ROUTED TO	RGCB4	.02	1	FLOW	21.	13.	8.	18.	11.	6.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
+ 3 COMBINED AT	CGCB4	.41	1	FLOW	231.	113.	52.	184.	86.	33.
				TIME	3.83	3.92	4.00	3.83	3.92	4.08
+ HYDROGRAPH AT	PDGCC1	.05	1	FLOW	30.	15.	6.	24.	11.	4.
				TIME	3.75	3.75	3.83	3.75	3.75	3.83
+ HYDROGRAPH AT	PDGCB5	.11	1	FLOW	55.	27.	12.	44.	20.	8.
				TIME	3.83	3.92	3.92	3.83	3.92	3.92
+ 3 COMBINED AT	CGCB5	.57	1	FLOW	314.	152.	69.	250.	116.	43.
				TIME	3.83	3.92	4.00	3.83	3.92	4.08
+ ROUTED TO	RGCB5	.57	1	FLOW	311.	150.	66.	247.	113.	42.
				TIME	3.92	4.00	4.17	3.92	4.00	4.25
+ 2 COMBINED AT	C2GCB5	1.33	1	FLOW	549.	195.	73.	407.	128.	48.
				TIME	3.92	4.00	4.17	3.92	4.00	4.25
+ HYDROGRAPH AT	PDGCB6	.02	1	FLOW	23.	15.	9.	20.	12.	8.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
+ ROUTED TO	RGCB6	.02	1	FLOW	23.	14.	9.	18.	12.	7.
				TIME	3.75	3.83	3.83	3.83	3.83	3.92
+ HYDROGRAPH AT	PDGCB10	.07	1	FLOW	67.	39.	23.	56.	32.	18.
				TIME	3.67	3.67	3.75	3.67	3.75	3.75
+ HYDROGRAPH AT	PDGCB9	.03	1	FLOW	25.	12.	6.	20.	9.	4.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
+ 4 COMBINED AT	CGCB9	1.45	1	FLOW	628.	233.	93.	470.	160.	63.
				TIME	3.83	4.00	4.08	3.92	4.00	4.00
+ ROUTED TO	RGCB9	1.45	1	FLOW	623.	232.	93.	469.	159.	62.
				TIME	3.92	4.00	4.08	3.92	4.00	4.00
+ HYDROGRAPH AT	PDGCB11	.03	1	FLOW	26.	14.	7.	22.	11.	5.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
+ 2 COMBINED AT	CGCB11	1.49	1	FLOW	638.	238.	96.	481.	164.	64.
				TIME	3.83	4.00	4.08	3.92	4.00	4.00
+ ROUTED TO	RLBG3	1.49	1	FLOW	638.	238.	95.	479.	163.	64.
				TIME	3.92	4.00	4.08	3.92	4.00	4.08
+ DIVERSION TO	D95B	1.49	1	FLOW	192.	94.	38.	176.	64.	25.
				TIME	3.83	4.00	4.08	3.92	4.00	4.08
+ HYDROGRAPH AT	REMAIN2	1.49	1	FLOW	446.	144.	58.	303.	99.	39.
				TIME	3.92	4.00	4.08	3.92	4.00	4.08
+ ROUTED TO	RMAIN2	1.49	1	FLOW	443.	142.	58.	295.	99.	39.
				TIME	3.92	4.08	4.17	4.00	4.08	4.17
+ HYDROGRAPH AT	LONEMT	.41	1	FLOW	302.	174.	100.	251.	143.	76.
				TIME	3.83	3.83	3.83	3.83	3.83	3.92
+ HYDROGRAPH AT	GD20BH	.05	1	FLOW	29.	15.	7.	23.	11.	5.

				TIME	3.67	DLOMR 3.75	3.75	3.75	3.75	3.75
2 COMBINED AT +	CLONE	.46	1	FLOW	328.	188.	106.	272.	153.	80.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83
ROUTED TO +	RLONE	.46	1	FLOW	325.	185.	105.	269.	150.	80.
				TIME	3.83	3.83	3.92	3.83	3.92	3.92
HYDROGRAPH AT +	GD20BG	.11	1	FLOW	90.	51.	28.	74.	41.	21.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
3 COMBINED AT +	C20BG	2.06	1	FLOW	824.	344.	172.	609.	266.	124.
				TIME	3.92	3.92	4.00	3.92	3.92	3.92
ROUTED TO +	R20BG	2.06	1	FLOW	812.	341.	172.	602.	263.	123.
				TIME	4.00	4.00	4.08	4.00	4.00	4.08
HYDROGRAPH AT +	CRAIG1	2.44	1	FLOW	1475.	862.	502.	1233.	708.	388.
				TIME	4.17	4.17	4.25	4.17	4.17	4.25
DIVERSION TO +	DGNBB	2.44	1	FLOW	249.	249.	249.	249.	249.	249.
				TIME	3.50	3.67	3.83	3.58	3.67	3.92
HYDROGRAPH AT +	DBUF1	2.44	1	FLOW	1226.	613.	253.	984.	459.	139.
				TIME	4.17	4.17	4.25	4.17	4.17	4.25
ROUTED TO +	RBUF1	2.44	1	FLOW	1221.	609.	252.	979.	457.	137.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
DIVERSION TO +	DGNBB1	2.44	1	FLOW	109.	109.	109.	109.	109.	109.
				TIME	3.58	3.75	4.00	3.67	3.83	4.17
HYDROGRAPH AT +	DBUF2	2.44	1	FLOW	1112.	500.	143.	870.	348.	28.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
DIVERSION TO +	DBUFLO2	2.44	1	FLOW	783.	352.	101.	612.	245.	20.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
HYDROGRAPH AT +	DRED	2.44	1	FLOW	329.	148.	42.	257.	103.	8.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
ROUTED TO +	RDRED	2.44	1	FLOW	328.	147.	41.	257.	102.	8.
				TIME	4.25	4.25	4.33	4.25	4.33	4.58
HYDROGRAPH AT +	GD20BI	.12	1	FLOW	85.	47.	25.	70.	37.	18.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT +	C20BI	2.56	1	FLOW	359.	164.	50.	281.	115.	18.
				TIME	4.17	4.25	4.33	4.25	4.25	3.75
ROUTED TO +	R20BI	2.56	1	FLOW	357.	164.	49.	281.	114.	18.
				TIME	4.25	4.25	4.42	4.25	4.33	3.83
HYDROGRAPH AT +	GD20BL	.08	1	FLOW	94.	60.	39.	81.	51.	32.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT +	C20BL	4.69	1	FLOW	1163.	501.	207.	869.	368.	153.
				TIME	4.00	4.08	4.00	4.00	4.17	4.00
ROUTED TO +	R20BL	4.69	1	FLOW	1155.	497.	205.	865.	365.	151.
				TIME	4.00	4.17	4.08	4.08	4.17	4.08
HYDROGRAPH AT +	RTBUFAL2	.00	1	FLOW	783.	352.	101.	612.	245.	20.
				TIME	4.17	4.25	4.25	4.17	4.25	4.25
ROUTED TO +	RBUF2	.00	1	FLOW	780.	352.	99.	609.	245.	19.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
DIVERSION TO +	DBUFLO3	.00	1	FLOW	557.	251.	71.	435.	175.	13.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
HYDROGRAPH AT +	DCOBAL	.00	1	FLOW	223.	100.	28.	174.	70.	5.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
ROUTED TO +	RCOBAL1	.00	1	FLOW	222.	100.	28.	174.	69.	5.
				TIME	4.25	4.33	4.42	4.25	4.33	4.67
HYDROGRAPH AT +	GD20BJ	.05	1	FLOW	49.	29.	17.	41.	24.	13.
				TIME	3.67	3.67	3.75	3.67	3.67	3.75
2 COMBINED AT +	C20BJ1	.05	1	FLOW	235.	107.	32.	185.	75.	13.
				TIME	4.25	4.25	4.42	4.25	4.33	3.75

+ ROUTED TO	R20BJ1	.05	1	FLOW	235.	107.	31.	185.	75.	13.
				TIME	4.25	4.33	4.42	4.25	4.33	3.75
+ 2 COMBINED AT	C20BJ2	4.74	1	FLOW	1345.	596.	223.	1030.	429.	158.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08
+ ROUTED TO	R20BJ2	4.74	1	FLOW	1344.	595.	222.	1028.	429.	158.
				TIME	4.08	4.17	4.33	4.08	4.25	4.08
+ HYDROGRAPH AT	GD20BM	.05	1	FLOW	62.	40.	26.	54.	34.	21.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
+ 2 COMBINED AT	C20BM	4.79	1	FLOW	1362.	604.	226.	1043.	435.	165.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08
+ DIVERSION TO	D95E	4.79	1	FLOW	184.	83.	21.	148.	55.	14.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08
+ HYDROGRAPH AT	REMAIN5	4.79	1	FLOW	1178.	521.	205.	895.	380.	151.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08
+ ROUTED TO	RREMAIN5	4.79	1	FLOW	1177.	519.	203.	891.	380.	150.
				TIME	4.08	4.17	4.33	4.08	4.25	4.08
+ HYDROGRAPH AT	RTBUFAL3	.00	1	FLOW	557.	251.	71.	435.	175.	13.
				TIME	4.17	4.25	4.25	4.17	4.25	4.33
+ ROUTED TO	RBUF3	.00	1	FLOW	555.	251.	70.	435.	174.	12.
				TIME	4.25	4.25	4.33	4.25	4.25	4.42
+ DIVERSION TO	DGNBB2	.00	1	FLOW	198.	198.	69.	198.	173.	12.
				TIME	3.83	4.08	4.33	3.92	4.25	4.42
+ HYDROGRAPH AT	DBUF3	.00	1	FLOW	357.	53.	0.	237.	1.	0.
				TIME	4.25	4.25	4.33	4.25	4.25	4.42
+ ROUTED TO	RCRAIG2	.00	1	FLOW	356.	52.	0.	235.	1.	0.
				TIME	4.25	4.42	5.58	4.33	5.08	7.00
+ HYDROGRAPH AT	GD20BK	.05	1	FLOW	38.	21.	11.	31.	17.	8.
				TIME	3.67	3.75	3.75	3.75	3.75	3.75
+ 2 COMBINED AT	1C20BK	.05	1	FLOW	367.	56.	11.	243.	17.	8.
				TIME	4.25	4.42	3.75	4.33	3.75	3.75
+ ROUTED TO	R1C20BK	.05	1	FLOW	363.	54.	11.	243.	17.	8.
				TIME	4.33	4.50	3.83	4.33	3.83	3.83
+ 2 COMBINED AT	2C20BK	4.84	1	FLOW	1460.	530.	211.	1060.	387.	156.
				TIME	4.17	4.17	4.08	4.17	4.25	4.08
+ ROUTED TO	R2C20BK	4.84	1	FLOW	1457.	526.	211.	1056.	386.	154.
				TIME	4.17	4.17	4.08	4.25	4.25	4.08
+ HYDROGRAPH AT	HICKAM1	.48	1	FLOW	290.	160.	87.	238.	129.	65.
				TIME	3.92	4.00	4.00	3.92	4.00	4.00
+ DIVERSION TO	DGNBB3	.48	1	FLOW	125.	125.	86.	125.	125.	64.
				TIME	3.58	3.75	4.00	3.67	3.92	4.00
+ HYDROGRAPH AT	BUF3	.48	1	FLOW	165.	35.	1.	113.	4.	1.
				TIME	3.92	4.00	4.00	3.92	4.00	4.00
+ ROUTED TO	RHICKAM	.48	1	FLOW	163.	34.	1.	112.	4.	1.
				TIME	4.00	4.00	4.42	4.00	4.17	4.50
+ HYDROGRAPH AT	GD17BH	.03	1	FLOW	25.	14.	8.	21.	12.	6.
				TIME	3.58	3.58	3.67	3.58	3.58	3.67
+ 2 COMBINED AT	C17BH	.50	1	FLOW	172.	40.	8.	120.	12.	6.
				TIME	4.00	4.00	3.67	4.00	3.58	3.67
+ ROUTED TO	R17BH	.50	1	FLOW	171.	38.	8.	117.	12.	6.
				TIME	4.00	4.17	3.83	4.00	3.75	3.83
+ HYDROGRAPH AT	GD17BG	.12	1	FLOW	99.	58.	34.	83.	48.	26.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
+ 2 COMBINED AT	C17BG	.62	1	FLOW	234.	72.	42.	169.	59.	31.
				TIME	3.92	3.75	3.75	4.00	3.75	3.83

ROUTED TO	R17BG	.62	1	FLOW	233.	71.	41.	167.	58.	31.
+				TIME	4.00	3.83	3.83	4.00	3.83	3.92
HYDROGRAPH AT	GD17BI	.07	1	FLOW	71.	43.	26.	60.	36.	21.
+				TIME	3.58	3.67	3.67	3.58	3.67	3.67
3 COMBINED AT	C17BI	5.53	1	FLOW	1675.	602.	251.	1212.	419.	184.
+				TIME	4.17	4.17	4.00	4.17	4.25	4.08
ROUTED TO	R17BI	5.53	1	FLOW	1668.	597.	247.	1205.	417.	181.
+				TIME	4.17	4.25	4.17	4.25	4.33	4.17
HYDROGRAPH AT	GD14CH	.04	1	FLOW	40.	23.	13.	33.	19.	10.
+				TIME	3.58	3.58	3.67	3.58	3.58	3.67
ROUTED TO	R14CH	.04	1	FLOW	40.	23.	13.	33.	19.	10.
+				TIME	3.67	3.67	3.75	3.67	3.75	3.75
HYDROGRAPH AT	GD17BJ	.06	1	FLOW	74.	47.	31.	64.	40.	25.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT	C17BJ	5.63	1	FLOW	1700.	614.	265.	1227.	430.	193.
+				TIME	4.17	4.25	4.08	4.25	4.25	4.17
DIVERSION TO	D95F	5.63	1	FLOW	180.	88.	36.	156.	61.	25.
+				TIME	4.17	4.25	4.08	4.25	4.25	4.17
HYDROGRAPH AT	REMAIN6	5.63	1	FLOW	1521.	526.	229.	1071.	368.	168.
+				TIME	4.17	4.25	4.08	4.25	4.25	4.17
ROUTED TO	R17BJ	5.63	1	FLOW	1518.	525.	228.	1070.	368.	168.
+				TIME	4.17	4.25	4.08	4.25	4.25	4.17
HYDROGRAPH AT	GD14CF	.13	1	FLOW	83.	43.	21.	67.	33.	15.
+				TIME	3.75	3.75	3.83	3.75	3.75	3.83
DIVERSION TO	DGNBB4	.13	1	FLOW	30.	30.	20.	30.	30.	14.
+				TIME	3.50	3.67	3.83	3.50	3.75	3.83
HYDROGRAPH AT	BUF4	.13	1	FLOW	53.	13.	1.	37.	3.	0.
+				TIME	3.75	3.75	3.83	3.75	3.75	3.83
ROUTED TO	R14CF	.13	1	FLOW	52.	12.	1.	37.	3.	0.
+				TIME	3.83	3.92	4.25	3.83	4.00	4.33
HYDROGRAPH AT	GD14CG	.06	1	FLOW	52.	30.	17.	43.	24.	13.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	C14CG	.19	1	FLOW	97.	30.	17.	71.	24.	13.
+				TIME	3.75	3.92	3.67	3.75	3.67	3.67
ROUTED TO	R14CG	.19	1	FLOW	94.	30.	16.	70.	24.	12.
+				TIME	3.83	4.00	3.75	3.83	3.75	3.83
HYDROGRAPH AT	GD14CI	.05	1	FLOW	44.	24.	13.	36.	19.	9.
+				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT	C14C1	.24	1	FLOW	127.	51.	28.	96.	41.	20.
+				TIME	3.75	3.75	3.75	3.83	3.75	3.75
ROUTED TO	R14CI	.24	1	FLOW	126.	51.	27.	94.	41.	20.
+				TIME	3.83	3.75	3.83	3.83	3.75	3.83
2 COMBINED AT	CMAIN6	5.87	1	FLOW	1580.	548.	245.	1107.	385.	179.
+				TIME	4.17	4.25	4.08	4.25	4.25	4.17
ROUTED TO	RMAIN6	5.87	1	FLOW	1560.	543.	244.	1100.	383.	178.
+				TIME	4.17	4.25	4.17	4.25	4.33	4.25
DIVERSION TO	D95G	5.87	1	FLOW	102.	83.	68.	97.	76.	64.
+				TIME	4.08	4.25	4.17	4.25	4.33	4.25
HYDROGRAPH AT	REMAIN7	5.87	1	FLOW	1459.	460.	176.	1003.	308.	113.
+				TIME	4.17	4.25	4.17	4.25	4.33	4.25
HYDROGRAPH AT	GD11C	.13	1	FLOW	125.	77.	47.	106.	64.	37.
+				TIME	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT	C11C	6.00	1	FLOW	1512.	487.	198.	1039.	330.	128.
+				TIME	4.17	4.25	4.17	4.25	4.08	4.17
ROUTED TO										

DLOMR

+	R11C	6.00	1	FLOW	1497.	482.	198.	1029.	329.	128.
				TIME	4.25	4.33	4.17	4.25	4.17	4.25
HYDROGRAPH AT										
+	GD11B	.20	1	FLOW	206.	129.	82.	176.	109.	66.
				TIME	3.67	3.67	3.75	3.67	3.75	3.75
2 COMBINED AT										
+	C11B	6.20	1	FLOW	1561.	519.	231.	1081.	382.	149.
				TIME	4.17	4.25	4.17	4.25	4.08	4.25
DIVERSION TO										
+	GOOF1	6.20	1	FLOW	3.	3.	2.	3.	3.	2.
				TIME	4.17	4.25	4.17	4.25	4.08	4.25
HYDROGRAPH AT										
+	GOWAN1	6.20	1	FLOW	1558.	516.	228.	1077.	379.	147.
				TIME	4.17	4.25	4.17	4.25	4.08	4.25
ROUTED TO										
+	R11B	6.20	1	FLOW	1555.	514.	227.	1072.	378.	147.
				TIME	4.25	4.25	4.17	4.25	4.08	4.25
HYDROGRAPH AT										
+	CY05A	.03	1	FLOW	29.	17.	10.	24.	14.	8.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT										
+	D95G	.00	1	FLOW	102.	83.	68.	97.	76.	64.
				TIME	4.08	4.25	4.17	4.25	4.33	4.25
ROUTED TO										
+	RD95G	.00	1	FLOW	102.	83.	68.	97.	75.	64.
				TIME	4.17	4.33	4.25	4.33	4.42	4.33
HYDROGRAPH AT										
+	PT6B	.11	1	FLOW	141.	91.	59.	122.	78.	48.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT										
+	CPT6B	.11	1	FLOW	203.	132.	88.	177.	112.	78.
				TIME	3.67	3.75	3.92	3.67	3.83	4.00
3 COMBINED AT										
+	2CPT6B	6.33	1	FLOW	1682.	616.	311.	1191.	478.	221.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
DIVERSION TO										
+	GOOF2	6.33	1	FLOW	2.	2.	2.	2.	2.	2.
				TIME	3.17	3.33	3.50	3.25	3.42	3.50
HYDROGRAPH AT										
+	GOWAN2	6.33	1	FLOW	1680.	614.	309.	1189.	476.	219.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	RPT6B	6.33	1	FLOW	1679.	613.	307.	1181.	474.	219.
				TIME	4.25	4.08	4.17	4.33	4.08	4.25
HYDROGRAPH AT										
+	CY05D	.06	1	FLOW	41.	22.	11.	33.	17.	8.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
HYDROGRAPH AT										
+	PT5A3	.09	1	FLOW	89.	56.	35.	76.	47.	28.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
3 COMBINED AT										
+	C5A3	6.48	1	FLOW	1719.	653.	328.	1214.	507.	234.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
DIVERSION TO										
+	GOOF3	6.48	1	FLOW	2.	2.	2.	2.	2.	2.
				TIME	2.50	3.25	3.42	2.75	3.33	3.50
HYDROGRAPH AT										
+	GOWAN3	6.48	1	FLOW	1717.	651.	326.	1212.	505.	232.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	R5A3	6.48	1	FLOW	1715.	650.	324.	1208.	503.	231.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
DIVERSION TO										
+	MAVERICK	6.48	1	FLOW	183.	28.	12.	82.	20.	9.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
HYDROGRAPH AT										
+	MAV	6.48	1	FLOW	1532.	622.	313.	1127.	483.	222.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	R5A3B	6.48	1	FLOW	1530.	621.	311.	1126.	482.	222.
				TIME	4.25	4.08	4.17	4.33	4.08	4.25
HYDROGRAPH AT										
+	CY06A	.08	1	FLOW	72.	43.	25.	61.	35.	19.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT										
+	PT5A8	.03	1	FLOW	20.	12.	7.	17.	9.	5.
				TIME	3.67	3.75	3.75	3.67	3.75	3.75
3 COMBINED AT										
+	C5A8	6.58	1	FLOW	1555.	646.	324.	1146.	503.	231.
				TIME	4.25	4.08	4.17	4.25	4.08	4.17
ROUTED TO										
+	R5A3C	6.58	1	FLOW	1554.	645.	323.	1144.	501.	230.

						DLOMR				
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
DIVERSION TO										
+	GOOF4	6.58	1	FLOW	2.	2.	2.	2.	2.	2.
				TIME	3.17	3.42	3.58	3.33	3.50	3.58
HYDROGRAPH AT										
+	GOWAN4	6.58	1	FLOW	1552.	643.	321.	1142.	499.	228.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
DIVERSION TO										
+	DCY07B	6.58	1	FLOW	440.	155.	64.	301.	116.	37.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
HYDROGRAPH AT										
+	DPT5A8	6.58	1	FLOW	1112.	488.	257.	841.	383.	191.
				TIME	4.25	4.08	4.17	4.25	4.08	4.25
ROUTED TO										
+	R5A8	6.58	1	FLOW	1109.	486.	256.	840.	381.	191.
				TIME	4.25	4.08	4.25	4.33	4.17	4.25
ROUTED TO										
+	R5A82	6.58	1	FLOW	1105.	485.	255.	840.	381.	190.
				TIME	4.25	4.17	4.25	4.33	4.17	4.33
HYDROGRAPH AT										
+	CY07A	.03	1	FLOW	29.	18.	11.	24.	15.	9.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	CCY07A	6.61	1	FLOW	1112.	491.	258.	844.	385.	192.
				TIME	4.25	4.08	4.25	4.33	4.17	4.25
DIVERSION TO										
+	TRUVAL	6.61	1	FLOW	88.	33.	13.	64.	24.	8.
				TIME	4.25	4.08	4.25	4.33	4.17	4.25
HYDROGRAPH AT										
+	TRUV	6.61	1	FLOW	1024.	457.	245.	780.	362.	184.
				TIME	4.25	4.08	4.25	4.33	4.17	4.25
HYDROGRAPH AT										
+	D95B	.00	1	FLOW	192.	94.	38.	176.	64.	25.
				TIME	3.83	4.00	4.08	3.92	4.00	4.08
ROUTED TO										
+	RD95B	.00	1	FLOW	192.	92.	37.	174.	64.	25.
				TIME	3.92	4.00	4.17	3.92	4.08	4.08
DIVERSION TO										
+	D1RCHO	.00	1	FLOW	36.	17.	7.	33.	12.	5.
				TIME	3.92	4.00	4.17	3.92	4.08	4.08
HYDROGRAPH AT										
+	1REMAIN	.00	1	FLOW	156.	74.	30.	141.	52.	20.
				TIME	3.92	4.00	4.17	3.92	4.08	4.08
HYDROGRAPH AT										
+	PT3AB1	.05	1	FLOW	64.	44.	31.	56.	39.	26.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	C3AB1	.05	1	FLOW	209.	100.	48.	182.	75.	38.
				TIME	3.83	4.00	3.92	3.92	3.92	3.75
DIVERSION TO										
+	D2RCHO	.05	1	FLOW	29.	15.	7.	28.	12.	6.
				TIME	3.75	4.00	3.92	3.92	3.92	3.75
HYDROGRAPH AT										
+	2REMAIN	.05	1	FLOW	180.	85.	41.	154.	64.	33.
				TIME	3.83	4.00	3.92	3.92	3.92	3.75
ROUTED TO										
+	R2MAIN	.05	1	FLOW	177.	84.	41.	152.	63.	32.
				TIME	3.92	4.00	4.00	3.92	4.00	3.83
HYDROGRAPH AT										
+	PT3AB2	.05	1	FLOW	77.	54.	39.	68.	48.	33.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT										
+	C3AB2	.10	1	FLOW	223.	108.	68.	184.	90.	55.
				TIME	3.83	3.75	3.75	3.92	3.75	3.75
DIVERSION TO										
+	D3RCHO	.10	1	FLOW	23.	13.	8.	22.	11.	7.
				TIME	3.75	3.75	3.75	3.92	3.75	3.75
HYDROGRAPH AT										
+	3REMAIN	.10	1	FLOW	200.	95.	60.	162.	80.	49.
				TIME	3.83	3.75	3.75	3.92	3.75	3.75
ROUTED TO										
+	R3MAIN	.10	1	FLOW	195.	95.	59.	160.	78.	48.
				TIME	3.83	3.83	3.83	3.92	3.83	3.83
HYDROGRAPH AT										
+	PT2B2	.08	1	FLOW	83.	51.	32.	71.	43.	26.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	CPT2B2	.18	1	FLOW	264.	142.	89.	211.	119.	72.
				TIME	3.83	3.75	3.75	3.83	3.75	3.75
DIVERSION TO										
+	D4RCHO	.18	1	FLOW	35.	23.	15.	34.	20.	12.
				TIME	3.67	3.75	3.75	3.83	3.75	3.75

HYDROGRAPH AT										
+	4REMAIN	.18	1	FLOW	229.	119.	74.	176.	100.	60.
				TIME	3.83	3.75	3.75	3.83	3.75	3.75
ROUTED TO										
+	R4MAIN	.18	1	FLOW	224.	118.	74.	175.	99.	60.
				TIME	3.83	3.83	3.83	3.92	3.83	3.83
HYDROGRAPH AT										
+	PT2B3	.02	1	FLOW	32.	22.	15.	28.	19.	13.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	C2B3	.20	1	FLOW	248.	134.	86.	194.	114.	70.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83
DIVERSION TO										
+	DCSD2	.20	1	FLOW	120.	120.	85.	120.	113.	69.
				TIME	3.58	3.75	3.83	3.58	3.83	3.83
HYDROGRAPH AT										
+	D2B3	.20	1	FLOW	128.	14.	1.	74.	1.	1.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83
HYDROGRAPH AT										
+	PT2A2	.06	1	FLOW	63.	37.	22.	53.	31.	18.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO										
+	R2A2	.06	1	FLOW	61.	37.	22.	51.	31.	17.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT										
+	PT2A1	.06	1	FLOW	63.	39.	24.	53.	33.	19.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT										
+	D95E	.00	1	FLOW	184.	83.	21.	148.	55.	14.
				TIME	4.00	4.17	4.33	4.08	4.25	4.08
ROUTED TO										
+	RD95E	.00	1	FLOW	184.	82.	21.	147.	55.	14.
				TIME	4.08	4.25	4.42	4.17	4.25	4.17
3 COMBINED AT										
+	C2A2	.13	1	FLOW	255.	113.	53.	202.	83.	41.
				TIME	4.00	4.17	3.83	4.00	3.92	3.83
DIVERSION TO										
+	DCSD1	.13	1	FLOW	90.	90.	52.	90.	82.	40.
				TIME	3.58	3.75	3.83	3.58	3.92	3.83
HYDROGRAPH AT										
+	DPT2A1	.13	1	FLOW	165.	23.	1.	112.	1.	1.
				TIME	4.00	4.17	3.58	4.00	3.50	3.58
ROUTED TO										
+	R2A2	.13	1	FLOW	164.	22.	1.	111.	1.	1.
				TIME	4.00	4.25	4.17	4.08	4.00	4.17
HYDROGRAPH AT										
+	PT2B1	.07	1	FLOW	72.	43.	26.	61.	36.	20.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT										
+	C2B1	.20	1	FLOW	197.	43.	26.	133.	36.	20.
				TIME	4.00	3.67	3.67	4.08	3.67	3.67
ROUTED TO										
+	R2B1	.20	1	FLOW	197.	43.	25.	133.	35.	19.
				TIME	4.00	3.67	3.67	4.08	3.67	3.67
2 COMBINED AT										
+	2C2B3	.40	1	FLOW	312.	54.	26.	199.	36.	20.
				TIME	3.92	3.75	3.67	3.92	3.67	3.67
ROUTED TO										
+	RC2B3	.40	1	FLOW	308.	52.	25.	197.	35.	20.
				TIME	3.92	3.83	3.83	4.00	3.83	3.83
DIVERSION TO										
+	5REMAIN	.40	1	FLOW	195.	0.	0.	84.	0.	0.
				TIME	3.92	.00	.00	4.00	.00	.00
HYDROGRAPH AT										
+	D5RCHO	.40	1	FLOW	113.	52.	25.	113.	35.	20.
				TIME	3.75	3.83	3.83	3.75	3.83	3.83
HYDROGRAPH AT										
+	RNCH1	.00	1	FLOW	7.	5.	4.	6.	4.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58
ROUTED TO										
+	RRNCH1	.00	1	FLOW	7.	5.	4.	6.	4.	3.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT										
+	ND1	.04	1	FLOW	81.	60.	45.	73.	54.	40.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT										
+	CMD1	.05	1	FLOW	86.	63.	48.	77.	57.	42.
				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT										
+	RNCH2	.00	1	FLOW	6.	4.	3.	5.	4.	3.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58

					DLOMR					
ROUTED TO	RRNCH2	.00	1	FLOW	6.	4.	3.	5.	4.	3.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
HYDROGRAPH AT	ND2	.02	1	FLOW	46.	34.	26.	41.	31.	23.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	CMD2	.03	1	FLOW	51.	37.	28.	46.	34.	25.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	JONES1	.00	1	FLOW	7.	5.	4.	6.	4.	3.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
3 COMBINED AT	LOCL-D	.07	1	FLOW	144.	105.	80.	129.	95.	71.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	TOTL-D	.47	1	FLOW	203.	116.	81.	175.	100.	71.
+				TIME	3.67	3.58	3.50	3.75	3.58	3.50
DIVERSION TO	JONES-SD	.47	1	FLOW	79.	79.	79.	79.	79.	71.
+				TIME	3.33	3.42	3.50	3.33	3.50	3.50
HYDROGRAPH AT	LOWPNT-D	.47	1	FLOW	124.	37.	2.	96.	21.	0.
+				TIME	3.67	3.58	3.50	3.75	3.58	.00
HYDROGRAPH AT	JONES2	.00	1	FLOW	6.	4.	3.	5.	4.	3.
+				TIME	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT	HICKAM-D	.48	1	FLOW	128.	41.	5.	99.	24.	3.
+				TIME	3.67	3.58	3.50	3.75	3.58	3.58
HYDROGRAPH AT	CRAIG1	.00	1	FLOW	5.	3.	3.	4.	3.	2.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	ND3-1	.01	1	FLOW	17.	13.	10.	16.	11.	9.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	CRG0-D	.01	1	FLOW	22.	16.	12.	20.	15.	11.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
ROUTED TO	RCRG0-D	.01	1	FLOW	21.	15.	11.	19.	14.	10.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	CRAIG2	.00	1	FLOW	3.	2.	2.	3.	2.	2.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	ND3-2	.00	1	FLOW	8.	6.	5.	8.	6.	4.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
3 COMBINED AT	CRG1-D	.02	1	FLOW	33.	24.	18.	29.	21.	16.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	ND4	.00	1	FLOW	8.	6.	4.	7.	5.	4.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	JONES3	.00	1	FLOW	2.	2.	1.	2.	2.	1.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	JON-D	.00	1	FLOW	10.	7.	6.	9.	7.	5.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
2 COMBINED AT	CRG2-D	.02	1	FLOW	43.	31.	24.	38.	28.	21.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50
HYDROGRAPH AT	NDA^	.00	1	FLOW	4.	3.	2.	3.	2.	2.
+				TIME	3.50	3.50	3.50	3.50	3.50	3.50

1

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

ISTAQ	ELEMENT	DT	PEAK	TIME TO PEAK	VOLUME	DT	INTERPOLATED TO COMPUTATION INTERVAL PEAK	TIME TO PEAK	VOLUME
		(MIN)	(CFS)	(MIN)	(IN)	(MIN)	(CFS)	(MIN)	(IN)
FOR PLAN = 1 RATIO= 1.00									
	RANN MANE	1.82	122.44	242.51	.96	5.00	121.58	245.00	.96

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1323E+02 EXCESS= .0000E+00 OUTFLOW= .1322E+02 BASIN STORAGE= .1053E-01 PERCENT ERROR= .0

FOR PLAN = 1 RATIO= .74									
	RANN MANE	2.49	61.90	246.24	.50	5.00	61.81	245.00	.50

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6912E+01 EXCESS= .0000E+00 OUTFLOW= .6899E+01 BASIN STORAGE= .9157E-02 PERCENT ERROR= .0

CONTINUITY SUMMARY (AC-FT) - INFLOW= .1222E+01 EXCESS= .0000E+00 OUTFLOW= .1224E+01 BASIN STORAGE= .4467E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .67

RCRGO-D	MANE	.86	14.30	211.36	1.63	5.00	13.66	210.00	1.63

CONTINUITY SUMMARY (AC-FT) - INFLOW= .8806E+00 EXCESS= .0000E+00 OUTFLOW= .8824E+00 BASIN STORAGE= .3506E-06 PERCENT ERROR= -.2

FOR PLAN = 1 RATIO= .51

RCRGO-D	MANE	.98	10.64	211.45	1.20	5.00	10.15	210.00	1.20

CONTINUITY SUMMARY (AC-FT) - INFLOW= .6446E+00 EXCESS= .0000E+00 OUTFLOW= .6456E+00 BASIN STORAGE= .3618E-06 PERCENT ERROR= -.2

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

APPENDIX B

HYDRAULIC ANALYSIS

HYDRAULIC CALCULATIONS

Normal Flow Depth Calculations for Rancho Drive

(Existing and Future Conditions)

Section AA - Rancho - Q25 Allowable Flow Spread
Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho - Q25 Allowable I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	010000	ft/ft
Discharg	10.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	81.47	ft
Elevation Range	.00 to 82.53	
Flow Area	3.4	ft²
Wetted Perimeter	20.45	ft
Top Width	19.93	ft
Actual Depth	0.47	ft
Critical Elevation	81.51	ft
Critical Slope	0.005990	ft/ft
Velocity	2.97	ft/s
Velocity Head	0.14	ft
Specific Energy	81.61	ft
Froude Number	1.28	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

Notes: * Maximum allowed 25-year flow spread is determined as gutter width (1.5') + Buss Lane (12.5ft from gutter) + 1/2 travel lane (6.0') = a total top width of 20.0ft.

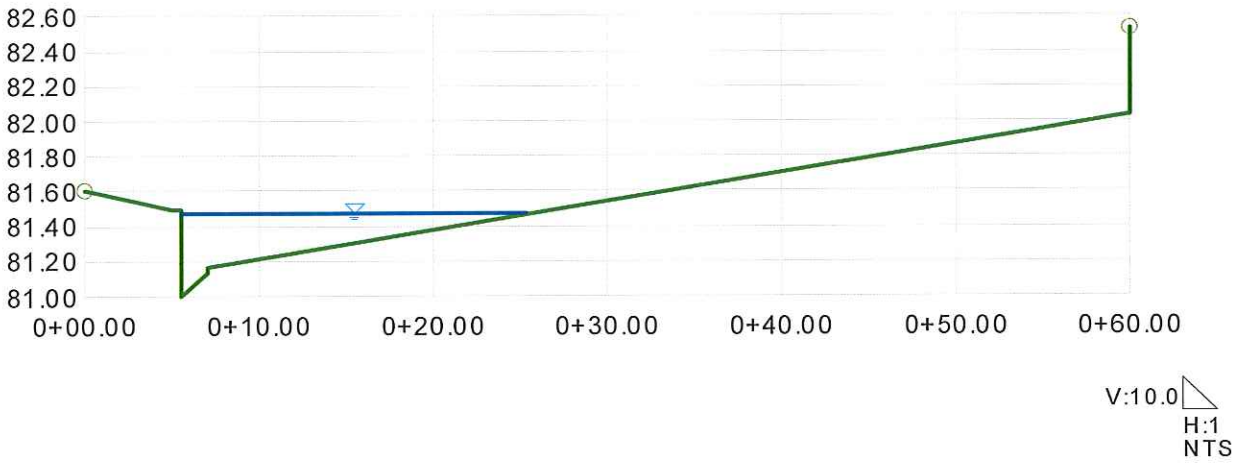
* Allowable 25-year surface discharge is determined as the flows resulting in the maximum allowed flow spread

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section AA - Rancho - Q25 Allowable Flow Spread
Cross Section for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho - Q25 Allowable I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.010000	ft/ft
Water Surface Elev	81.47	ft
Elevation Range	.00 to 82.53	
Discharge	10.00	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section AA - Rancho (10-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (10-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	010000	ft/ft
Discharg	4.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	81.37	ft
Elevation Range	.00 to 82.53	
Flow Area	1.7	ft²
Wetted Perimeter	14.18	ft
Top Width	13.76	ft
Actual Depth	0.37	ft
Critical Elevation	81.39	ft
Critical Slope	0.006715	ft/ft
Velocity	2.39	ft/s
Velocity Head	0.09	ft
Specific Energy	81.46	ft
Froude Number	1.21	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

Notes: * Q10/Q25/Q100 = 4/5/7cfs = runoff generated through offsite basin RNCH1(4/5/7cfs).

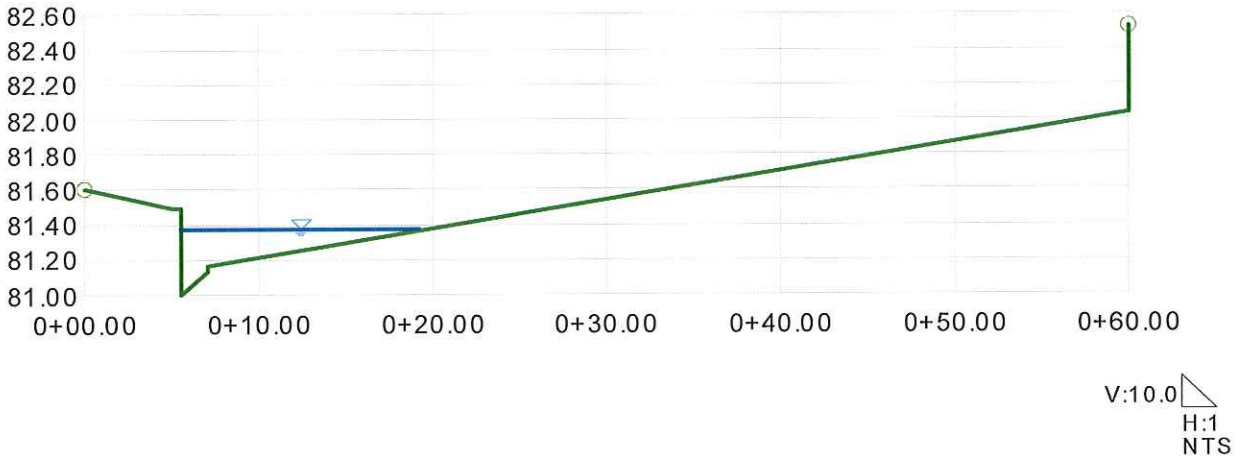
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section AA - Rancho (10-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (10-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.010000	ft/ft
Water Surface Elev	81.37	ft
Elevation Range	.00 to 82.53	
Discharge	4.00	cfs

→ Dry Lane ≈ 40.74' ✱ 12' O.K ←



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section AA - Rancho (25-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (25-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	010000	ft/ft
Discharg	5.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	81.39	ft
Elevation Range	.00 to 82.53	
Flow Area	2.0	ft²
Wetted Perimeter	15.53	ft
Top Width	15.09	ft
Actual Depth	0.39	ft
Critical Elevation	81.41	ft
Critical Slope	0.006519	ft/ft
Velocity	2.52	ft/s
Velocity Head	0.10	ft
Specific Energy	81.49	ft
Froude Number	1.22	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

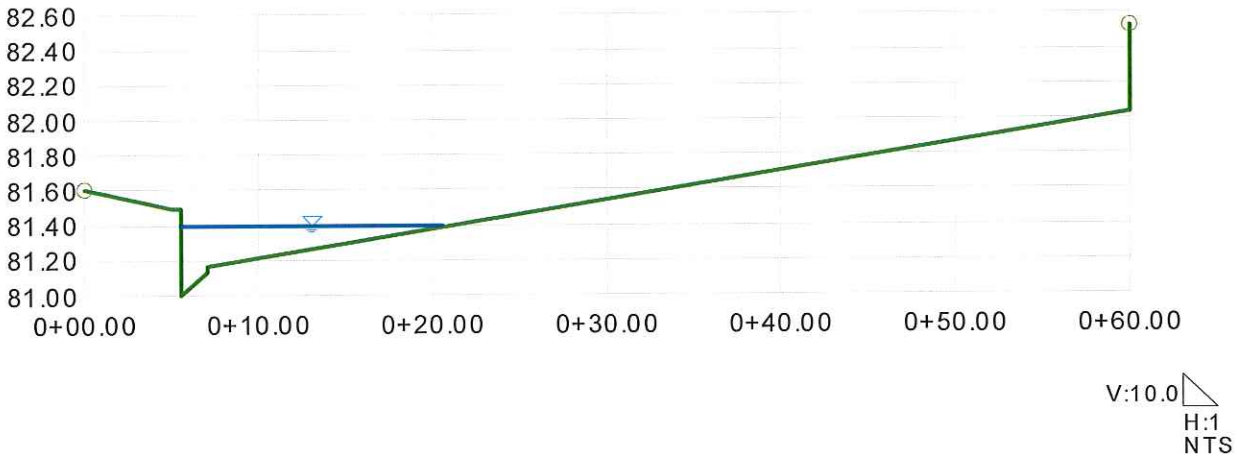
Notes: * Q10/Q25/Q100 = 4/5/7cfs = runoff generated through offsite basin RNCH1(4/5/7cfs).

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section AA - Rancho (25-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (25-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.010000	ft/ft
Water Surface Elev	81.39	ft
Elevation Range	.00 to 82.53	
Discharge	5.00	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section AA - Rancho (100-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (100-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	010000	ft/ft
Discharg	7.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	81.43	ft
Elevation Range	.00 to 82.53	
Flow Area	2.6	ft²
Wetted Perimeter	17.77	ft
Top Width	17.30	ft
Actual Depth	0.43	ft
Critical Elevation	81.45	ft
Critical Slope	0.006233	ft/ft
Velocity	2.73	ft/s
Velocity Head	0.12	ft
Specific Energy	81.54	ft
Froude Number	1.25	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

Notes: * Q10/Q25/Q100 = 4/5/7cfs = runoff generated through offsite basin RNCH1(4/5/7cfs).

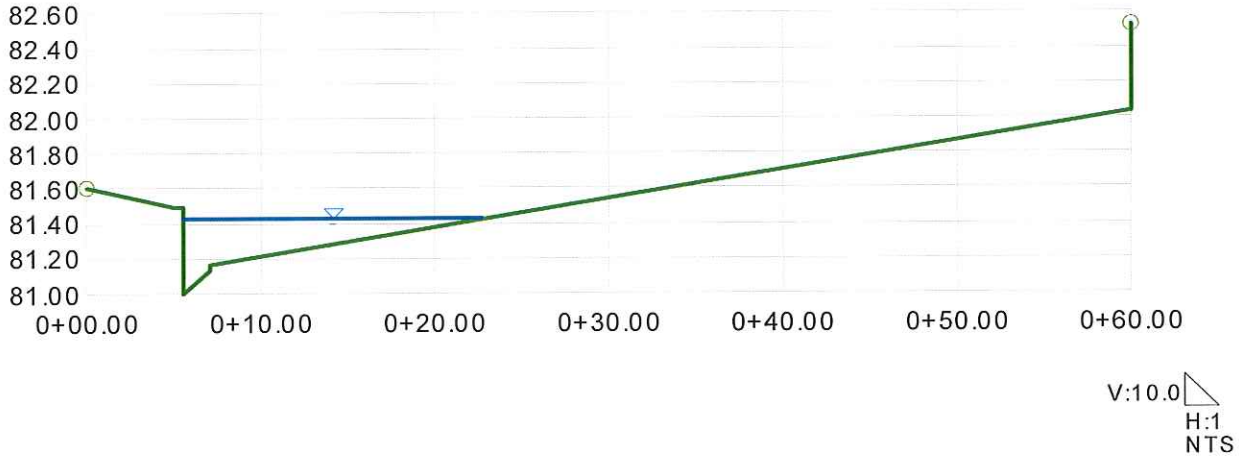
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

© Haestad Methods, Inc.

Section AA - Rancho (100-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (100-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.010000	ft/ft
Water Surface Elev	81.43	ft
Elevation Range	.00 to 82.53	
Discharge	7.00	cfs



© Haestad Methods, Inc.

Section BB - Rancho - Q25 Allowable Flow Spread
Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho - Q25 Allowable I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Dischargı	2.40	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin(	Horton's Method

Results		
Mannings Coefficiel	0.015	
Water Surface Elev	72.95	ft
Elevation Range	.63 to 73.73	
Flow Area	1.8	ft²
Wetted Perimeter	20.24	ft
Top Width	19.88	ft
Actual Depth	0.32	ft
Critical Elevation	72.93	ft
Critical Slope	0.007752	ft/ft
Velocity	1.37	ft/s
Velocity Head	0.03	ft
Specific Energy	72.98	ft
Froude Number	0.81	
Flow Type	Subcritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

Notes: * Maximum allowed 25-year flow spread is determined as gutter width (1.5') + Buss Lane (12.5ft from gutter) + 1/2 travel lane (6.0') = a total top width of 20.0ft.

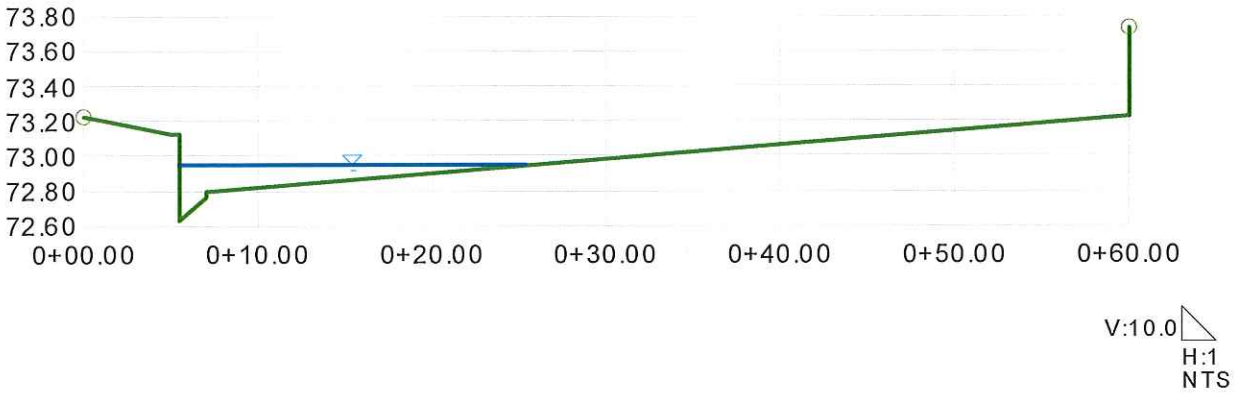
* Allowable 25-year surface discharge is determined as the flows resulting in the maximum allowed flow spread

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section BB - Rancho - Q25 Allowable Flow Spread
Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho - Q25 Allowable I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	72.95	ft
Elevation Range	!.63 to 73.73	
Discharge	2.40	cfs



© Haestad Methods, Inc.

Section BB - Rancho (10-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (10-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	7.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	73.04	ft
Elevation Range	.63 to 73.73	
Flow Area	4.0	ft²
Wetted Perimeter	31.07	ft
Top Width	30.62	ft
Actual Depth	0.41	ft
Critical Elevation	73.02	ft
Critical Slope	0.006740	ft/ft
Velocity	1.77	ft/s
Velocity Head	0.05	ft
Specific Energy	73.09	ft
Froude Number	0.87	
Flow Type	Subcritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

Notes: * Q10/Q25/Q100 = 7/9/13cfs = conservtively assumed as runoff generated through offsite basins RNCH1(4/5/7cfs) + RNCH2(3/4/6cfs)

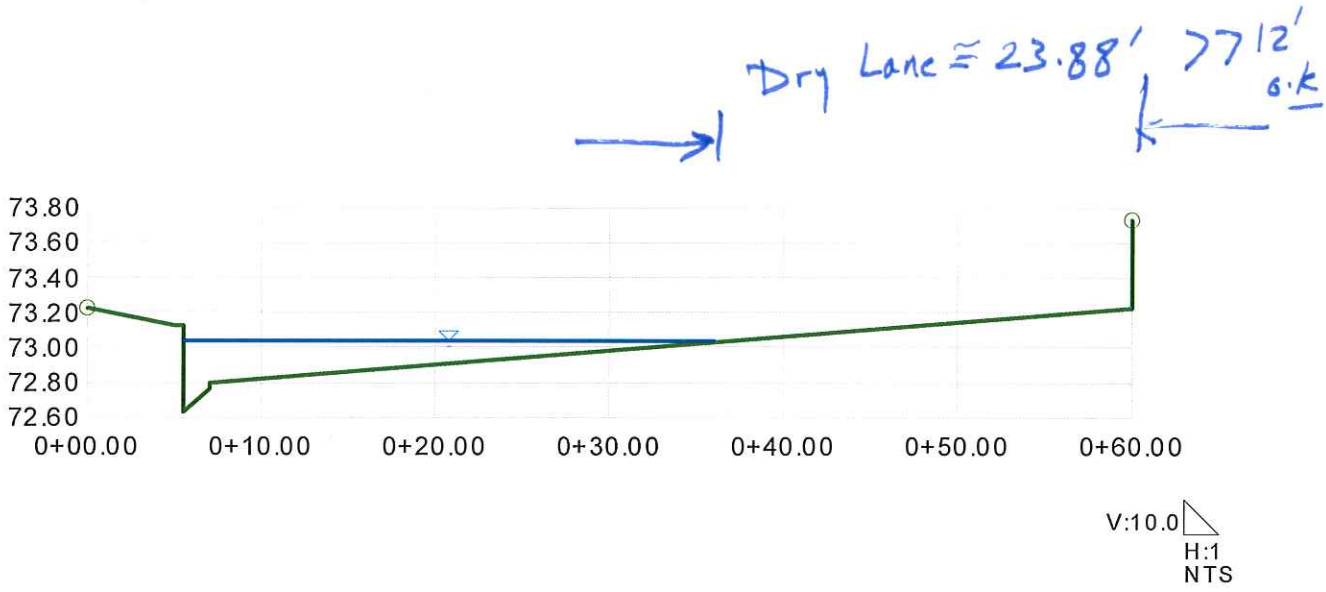
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

© Haestad Methods, Inc.

Section BB - Rancho (10-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (10-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficier	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	73.04	ft
Elevation Range	!.63 to 73.73	
Discharge	7.00	cfs



Section BB - Rancho (25-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (25-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	9.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	73.06	ft
Elevation Range	.63 to 73.73	
Flow Area	4.8	ft²
Wetted Perimeter	34.26	ft
Top Width	33.78	ft
Actual Depth	0.43	ft
Critical Elevation	73.05	ft
Critical Slope	0.006519	ft/ft
Velocity	1.88	ft/s
Velocity Head	0.06	ft
Specific Energy	73.12	ft
Froude Number	0.88	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

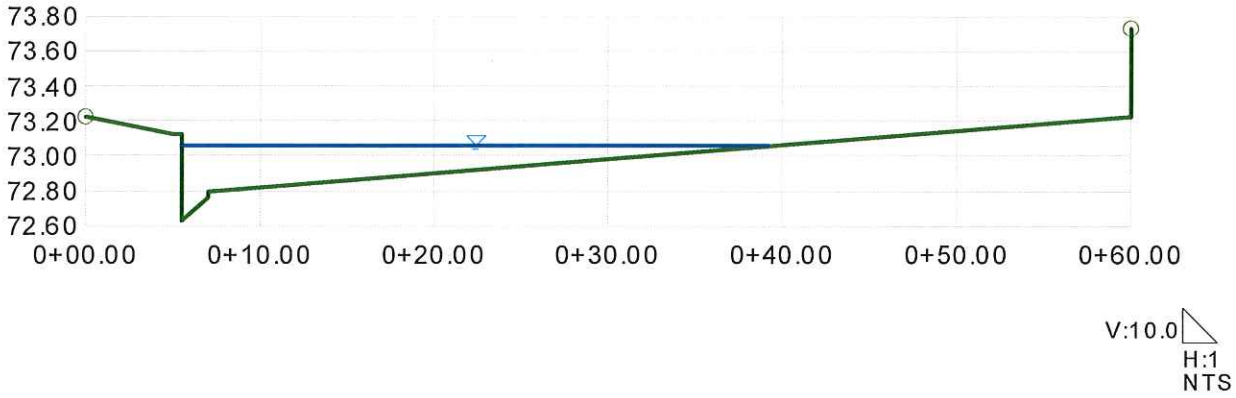
Notes: * Q10/Q25/Q100 = 7/9/13cfs = conservtively assumed as runoff generated through offsite basins RNCH1(4/5/7cfs) + RNCH2(3/4/6cfs)

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section BB - Rancho (25-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (25-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	73.06	ft
Elevation Range	!.63 to 73.73	
Discharge	9.00	cfs



Section BB - Rancho (100-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (100-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	13.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	73.10	ft
Elevation Range	.63 to 73.73	
Flow Area	6.3	ft²
Wetted Perimeter	39.48	ft
Top Width	38.96	ft
Actual Depth	0.47	ft
Critical Elevation	73.09	ft
Critical Slope	0.006207	ft/ft
Velocity	2.06	ft/s
Velocity Head	0.07	ft
Specific Energy	73.17	ft
Froude Number	0.90	
Flow Type	Subcritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	73.23
0+05.00	73.13
0+05.50	73.13
0+05.50	72.63
0+07.00	72.76
0+07.00	72.80
0+60.00	73.23
0+60.00	73.73

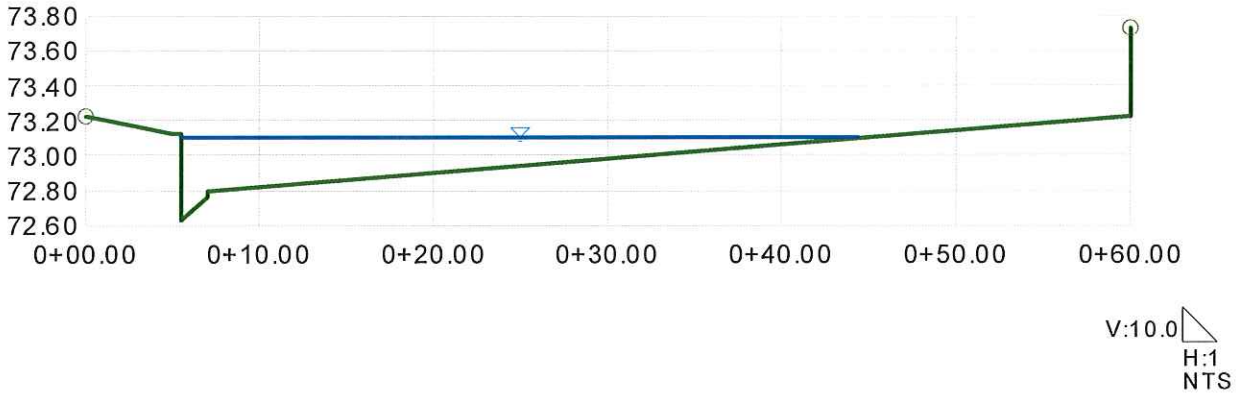
Notes: * Q10/Q25/Q100 = 7/9/13cfs = conservtively assumed as runoff generated through offsite basins RNCH1(4/5/7cfs) + RNCH2(3/4/6cfs)

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section BB - Rancho (100-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section BB - Rancho (100-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	73.10	ft
Elevation Range	!.63 to 73.73	
Discharge	13.00	cfs



HYDRAULIC CALCULATIONS

Normal Flow Depth Calculations for Craig Road

(Existing and Future Conditions)

Section CC - Craig - Q25 Allowable Flow Spread
Worksheet for Irregular Channel

Project Description	
Worksheet	Section CC - Craig - Q25 Allowable Fl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	008000	ft/ft
Discharg	1.50	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	85.83	ft
Elevation Range	.52 to 87.00	
Flow Area	0.8	ft²
Wetted Perimeter	8.47	ft
Top Width	8.12	ft
Actual Depth	0.31	ft
Critical Elevation	85.83	ft
Critical Slope	0.007450	ft/ft
Velocity	1.85	ft/s
Velocity Head	0.05	ft
Specific Energy	85.88	ft
Froude Number	1.03	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+47.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	87.00
0+00.00	86.50
0+39.50	85.69
0+39.50	85.65
0+41.00	85.52
0+41.00	86.02
0+41.50	86.02
0+47.00	86.12

Notes: * Maximum allowed 25-year flow spread is determined as gutter width (1.5') + 1/2 travel lane (= 7.0') = a total top width of 8.50ft.

* Allowable 25-year surface discharge is determined as the flows resulting in the maximum allowed flow spread

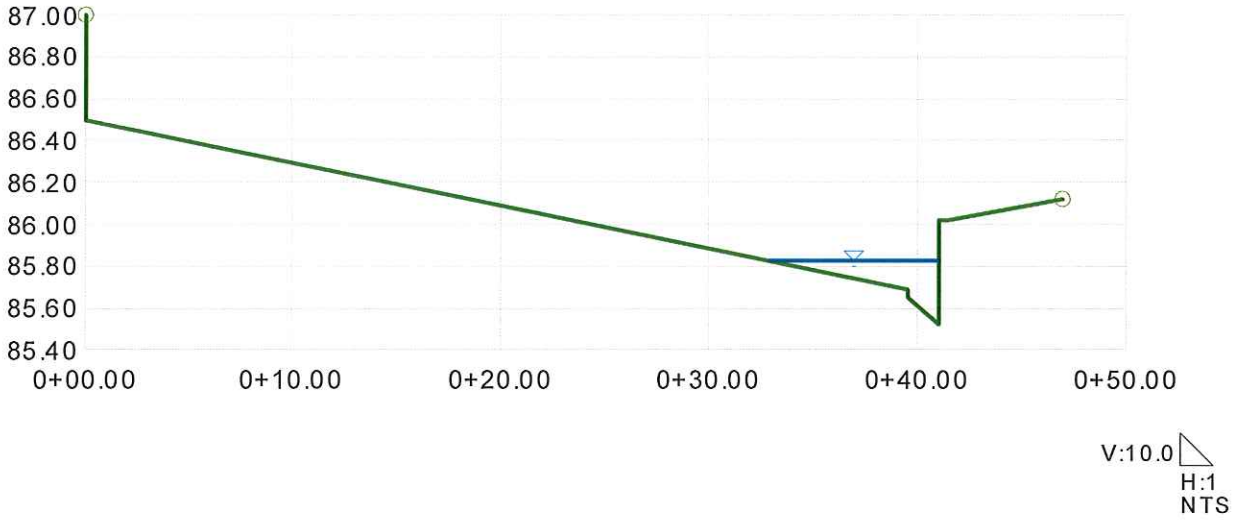
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

© Haestad Methods, Inc.

Section CC - Craig - Q25 Allowable Flow Spread
Cross Section for Irregular Channel

Project Description	
Worksheet	Section CC - Craig - Q25 Allowable Fl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.008000	ft/ft
Water Surface Elev	85.83	ft
Elevation Range	.52 to 87.00	
Discharge	1.50	cfs



Section CC - Craig - (10-Year and 25-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section CC - Craig - (10-Year and 25-Year, Existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	008000	ft/ft
Discharg	1.50	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	85.83	ft
Elevation Range	.52 to 87.00	
Flow Area	0.8	ft²
Wetted Perimeter	8.47	ft
Top Width	8.12	ft
Actual Depth	0.31	ft
Critical Elevation	85.83	ft
Critical Slope	0.007450	ft/ft
Velocity	1.85	ft/s
Velocity Head	0.05	ft
Specific Energy	85.88	ft
Froude Number	1.03	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+47.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	87.00
0+00.00	86.50
0+39.50	85.69
0+39.50	85.65
0+41.00	85.52
0+41.00	86.02
0+41.50	86.02
0+47.00	86.12

Notes: * Q10/Q25/Q100 = 1.5/1.5/2.5cfs = approximatley 1/2 (half) of runoff generated through offsite basin CRAIG1(3/3/5cfs).

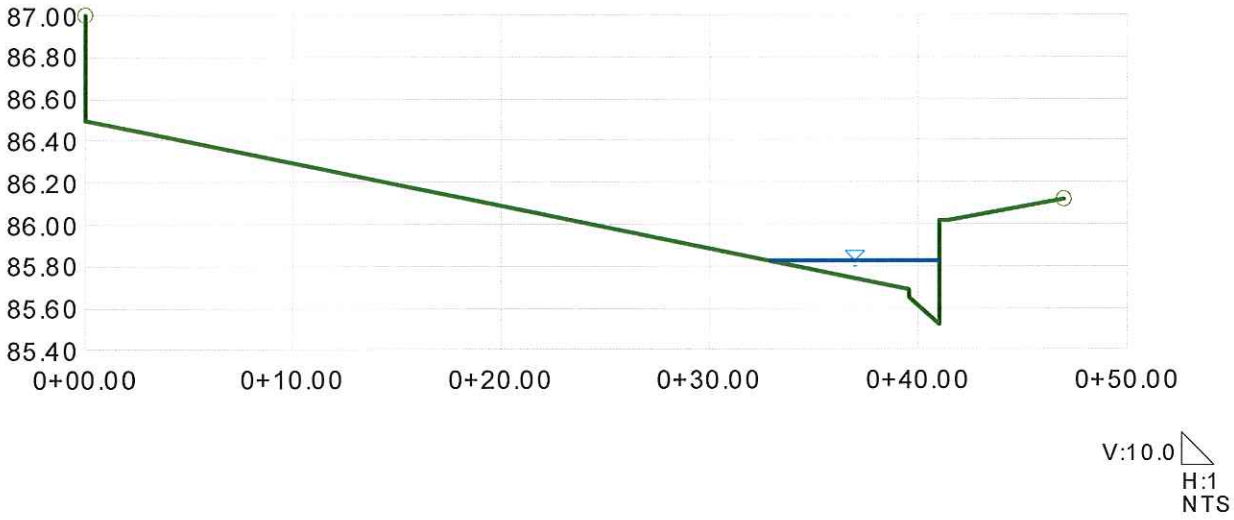
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section CC - Craig - (10-Year and 25-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section CC - Craig - (10-Year and 25-Year, Existing
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.008000	ft/ft
Water Surface Elev	85.83	ft
Elevation Range	.52 to 87.00	
Discharge	1.50	cfs

→ Dry Lane = 32.88' > 12' O.K



Section CC - Craig - (100-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section CC - Craig - (100-Year, Existing ar
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	008000	ft/ft
Discharg	2.50	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	85.87	ft
Elevation Range	.52 to 87.00	
Flow Area	1.2	ft²
Wetted Perimeter	10.61	ft
Top Width	10.21	ft
Actual Depth	0.35	ft
Critical Elevation	85.87	ft
Critical Slope	0.006976	ft/ft
Velocity	2.08	ft/s
Velocity Head	0.07	ft
Specific Energy	85.94	ft
Froude Number	1.07	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+47.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	87.00
0+00.00	86.50
0+39.50	85.69
0+39.50	85.65
0+41.00	85.52
0+41.00	86.02
0+41.50	86.02
0+47.00	86.12

Notes: * Q10/Q25/Q100 = 1.5/1.5/2.5cfs = approximatley 1/2 (half) of runoff generated through offsite basin CRAIG1(3/3/5cfs).

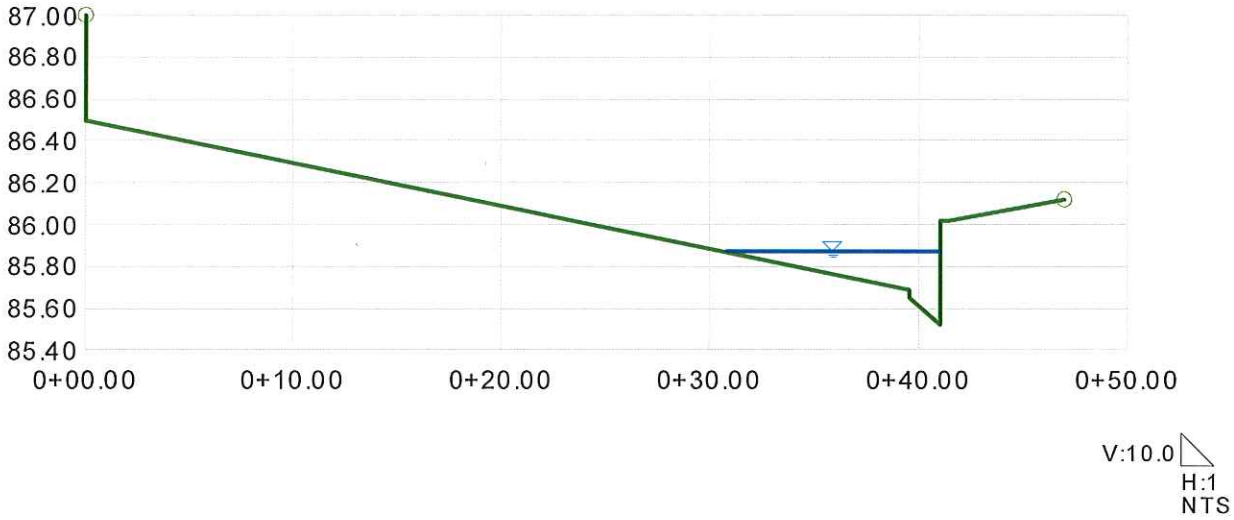
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

© Haestad Methods, Inc.

Section CC - Craig - (100-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section CC - Craig - (100-Year, Existing ar
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.008000	ft/ft
Water Surface Elev	85.87	ft
Elevation Range	).52 to 87.00	
Discharge	2.50	cfs



Section DD - Craig - Q25 Allowable Flow Spread
Worksheet for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - Q25 Allowable Fl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	025000	ft/ft
Discharg	1.80	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	66.34	ft
Elevation Range	.07 to 67.30	
Flow Area	0.7	ft²
Wetted Perimeter	8.80	ft
Top Width	8.48	ft
Actual Depth	0.27	ft
Critical Elevation	66.38	ft
Critical Slope	0.007556	ft/ft
Velocity	2.76	ft/s
Velocity Head	0.12	ft
Specific Energy	66.46	ft
Froude Number	1.76	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+46.50	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.30
0+00.00	66.80
0+39.50	66.24
0+39.50	66.20
0+41.00	66.07
0+41.00	66.57
0+41.50	66.57
0+46.50	66.67

Notes: * Maximum allowed 25-year flow spread is determined as gutter width (1.5') + 1/2 travel lane (= 7.0') = a total top width of 8.50ft.

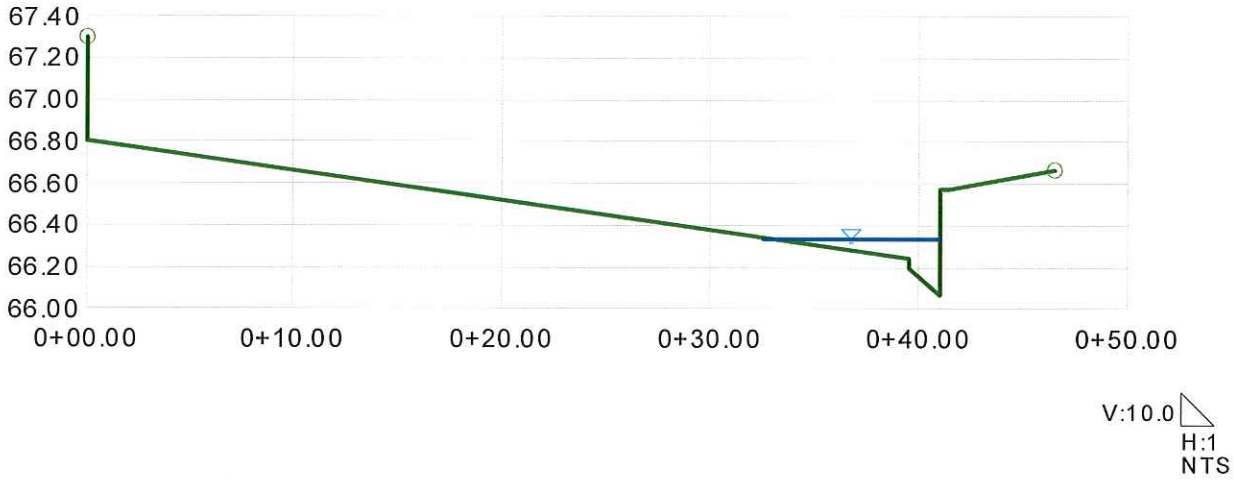
* Allowable 25-year surface discharge is determined as the flows resulting in the maximum allowed flow spread

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section DD - Craig - Q25 Allowable Flow Spread
Cross Section for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - Q25 Allowable Fl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.025000	ft/ft
Water Surface Elev	66.34	ft
Elevation Range	.07 to 67.30	
Discharge	1.80	cfs



© Haestad Methods, Inc.

Section DD - Craig - (10-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (10-Year, Existing an
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	025000	ft/ft
Dischargı	18.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficiel	0.015	
Water Surface Elev	66.54	ft
Elevation Range	).07 to 67.30	
Flow Area	3.8	ft²
Wetted Perimeter	23.34	ft
Top Width	22.82	ft
Actual Depth	0.47	ft
Critical Elevation	66.66	ft
Critical Slope	0.005727	ft/ft
Velocity	4.70	ft/s
Velocity Head	0.34	ft
Specific Energy	66.89	ft
Froude Number	2.02	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+46.50	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.30
0+00.00	66.80
0+39.50	66.24
0+39.50	66.20
0+41.00	66.07
0+41.00	66.57
0+41.50	66.57
0+46.50	66.67

Notes: * Q10/Q25/Q100 = 18/26/36cfs = combined runoff from CRG1-X(18/26/36cfs). Conservatively assuming the entire runoff is conveyed as surface flows through Craig Road.

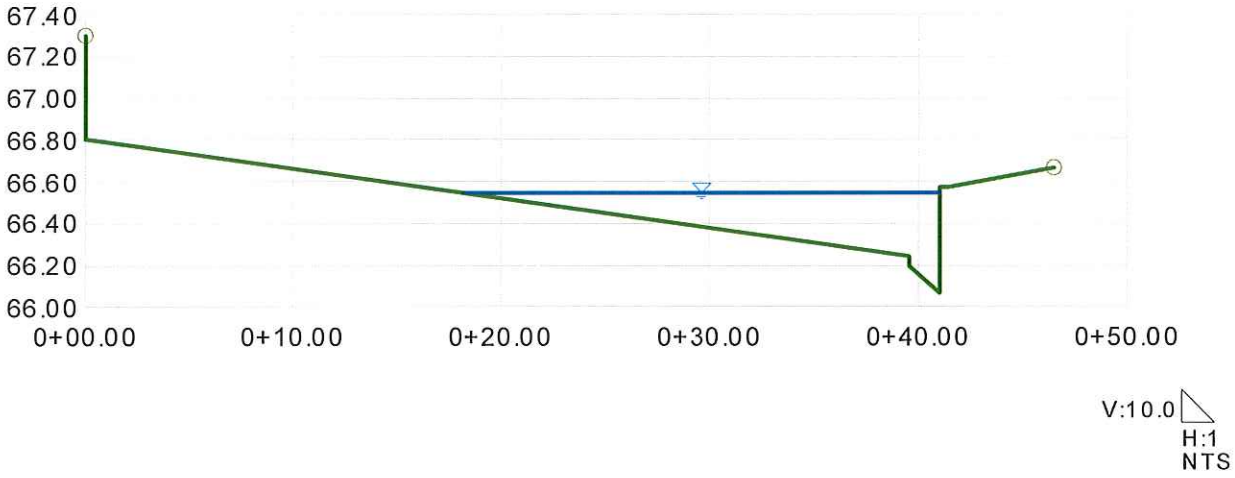
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section DD - Craig - (10-Year, Existing and Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (10-Year, Existing an
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.025000	ft/ft
Water Surface Elev	66.54	ft
Elevation Range	.07 to 67.30	
Discharge	18.00	cfs

Dry Lane
18.18' > 12.0' o.k



© Haestad Methods, Inc.

Section DD - Craig - (25-Year, Existing)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (25-Year, Ex
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	025000	ft/ft
Dischargı	26.00	cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin(	Horton's Method

Results		
Mannings Coefficiei	0.015	
Water Surface Elev	66.60	ft
Elevation Range	i.07 to 67.30	
Flow Area	5.2	ft²
Wetted Perimeter	29.07	ft
Top Width	28.52	ft
Actual Depth	0.53	ft
Critical Elevation	66.72	ft
Critical Slope	0.005431	ft/ft
Velocity	4.98	ft/s
Velocity Head	0.39	ft
Specific Energy	66.98	ft
Froude Number	2.05	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+46.50	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	67.30
0+00.00	66.80
0+39.50	66.24
0+39.50	66.20
0+41.00	66.07
0+41.00	66.57
0+41.50	66.57
0+46.50	66.67

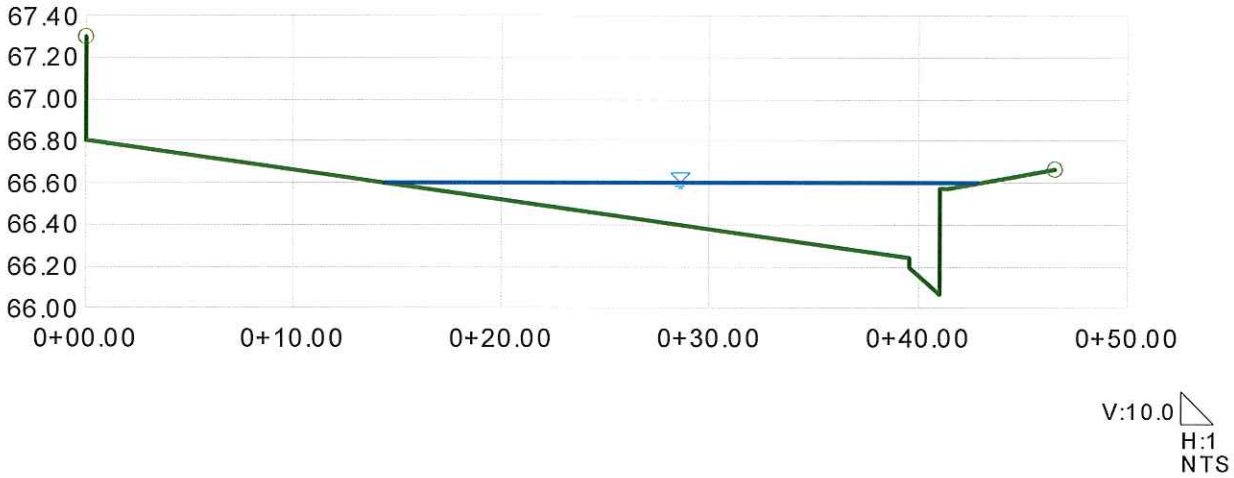
Notes: * Q10/Q25/Q100 = 18/26/36cfs = combined runoff from CRG1-X(18/26/36cfs). Conservatively assuming the entire runoff is conveyed as surface flows through Craig Road.

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section DD - Craig - (25-Year, Existing)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (25-Year, Ex
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.025000	ft/ft
Water Surface Elev	66.60	ft
Elevation Range	.07 to 67.30	
Discharge	26.00	cfs



Section DD - Craig - (100-Year, Existing)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (100-Year, E:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	025000	ft/ft
Discharg	36.00	cfs

Options	
Current Roughness Meth	oved Lotter's Method
Open Channel Weighting	oved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	66.65	ft
Elevation Range	.07 to 67.30	
Flow Area	6.9	ft²
Wetted Perimeter	35.31	ft
Top Width	34.76	ft
Actual Depth	0.58	ft
Critical Elevation	66.78	ft
Critical Slope	0.005170	ft/ft
Velocity	5.25	ft/s
Velocity Head	0.43	ft
Specific Energy	67.08	ft
Froude Number	2.08	
Flow Type	Supercritical	

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+46.50	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	67.30
0+00.00	66.80
0+39.50	66.24
0+39.50	66.20
0+41.00	66.07
0+41.00	66.57
0+41.50	66.57
0+46.50	66.67

Notes: * Q10/Q25/Q100 = 18/26/36cfs = combined runoff from CRG1-X(18/26/36cfs). Conservatively assuming the entire runoff is conveyed as surface flows through Craig Road.

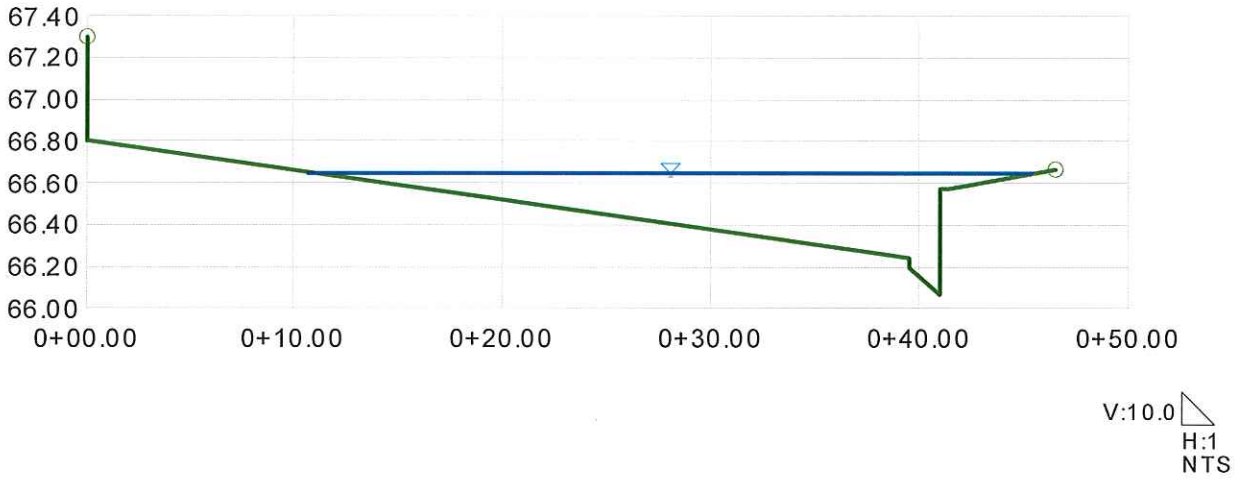
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

© Haestad Methods, Inc.

Section DD - Craig - (100-Year, Existing)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (100-Year, E:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.025000	ft/ft
Water Surface Elev	66.65	ft
Elevation Range	.07 to 67.30	
Discharge	36.00	cfs



Section DD - Craig - (25-Year, Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (25-Year, F
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	025000	ft/ft
Discharg	24.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	66.58	ft
Elevation Range	.07 to 67.30	
Flow Area	4.9	ft²
Wetted Perimeter	27.55	ft
Top Width	27.00	ft
Actual Depth	0.51	ft
Critical Elevation	66.70	ft
Critical Slope	0.005499	ft/ft
Velocity	4.93	ft/s
Velocity Head	0.38	ft
Specific Energy	66.96	ft
Froude Number	2.05	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+46.50	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.30
0+00.00	66.80
0+39.50	66.24
0+39.50	66.20
0+41.00	66.07
0+41.00	66.57
0+41.50	66.57
0+46.50	66.67

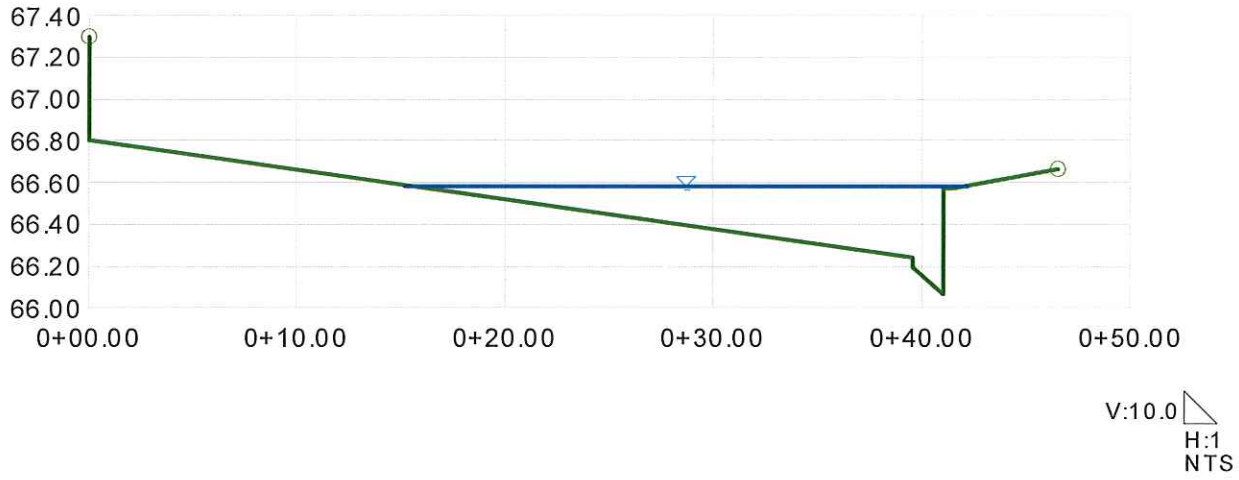
Notes: * Q10/Q25/Q100 = 18/24/33cfs = combined runoff from CRG1-D(18/24/33cfs). Conservatively assuming the entire runoff is conveyed as surface flows through Craig Road.

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section DD - Craig - (25-Year, Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (25-Year, F
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.025000	ft/ft
Water Surface Elev	66.58	ft
Elevation Range	.07 to 67.30	
Discharge	24.00	cfs



Section DD - Craig - (100-Year, Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (100-Year, I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	025000	ft/ft
Discharg	33.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	66.63	ft
Elevation Range	.07 to 67.30	
Flow Area	6.4	ft²
Wetted Perimeter	33.62	ft
Top Width	33.07	ft
Actual Depth	0.56	ft
Critical Elevation	66.76	ft
Critical Slope	0.005238	ft/ft
Velocity	5.17	ft/s
Velocity Head	0.42	ft
Specific Energy	67.05	ft
Froude Number	2.08	
Flow Type	Supercritical	

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+46.50	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	67.30
0+00.00	66.80
0+39.50	66.24
0+39.50	66.20
0+41.00	66.07
0+41.00	66.57
0+41.50	66.57
0+46.50	66.67

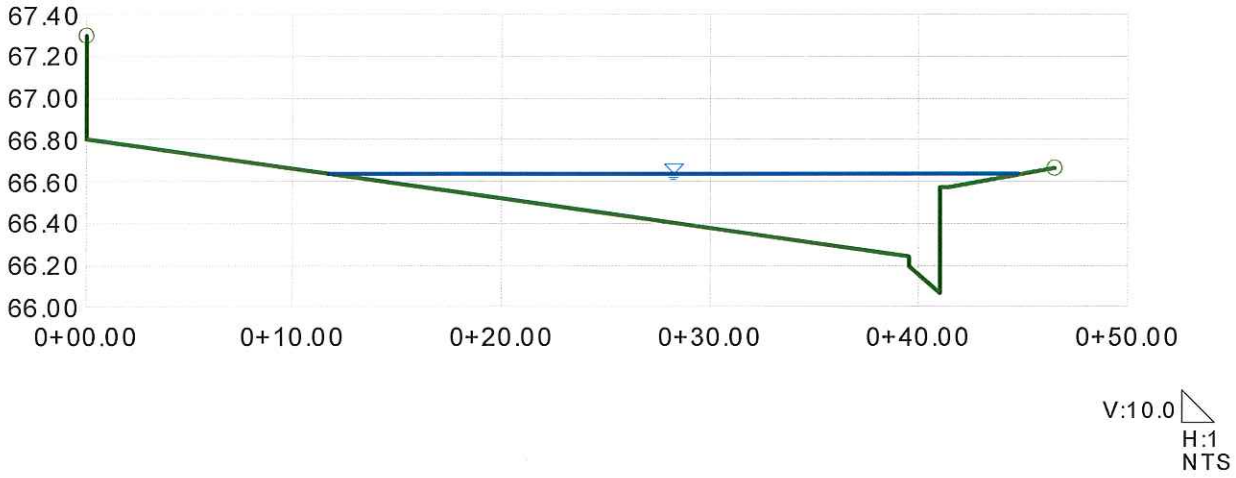
Notes: * Q10/Q25/Q100 = 18/24/33cfs = combined runoff from CRG1-D(18/24/33cfs). Conservatively assuming the entire runoff is conveyed as surface flows through Craig Road.

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section DD - Craig - (100-Year, Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section DD - Craig - (100-Year, I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.025000	ft/ft
Water Surface Elev	66.63	ft
Elevation Range	.07 to 67.30	
Discharge	33.00	cfs



HYDRAULIC CALCULATIONS

Normal Flow Depth Calculations for Jones Boulevard

(Existing and Future Conditions)

Section EE - Jones - 10-Year Allowable Dry Lane
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones - 10-Year Allowabl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Dischargı	18.00	cfs

18 cfs

Options	
Current Roughness Methc	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficiel	0.015	
Water Surface Elev	62.95	ft
Elevation Range	!.30 to 63.70	
Flow Area	7.0	ft²
Wetted Perimeter	30.90	ft
Top Width	30.30	ft
Actual Depth	0.65	ft
Critical Elevation	62.94	ft
Critical Slope	0.005744	ft/ft
Velocity	2.56	ft/s
Velocity Head	0.10	ft
Specific Energy	63.05	ft
Froude Number	0.94	
Flow Type	Subcritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.49067466e-1 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

Section EE - Jones - 10-Year Allowable Dry Lane
Worksheet for Irregular Channel

Notes:
* Allowable 10-year surface discharge is determined as the maximum flows resulting in the minimum required 12ft Dry Lane

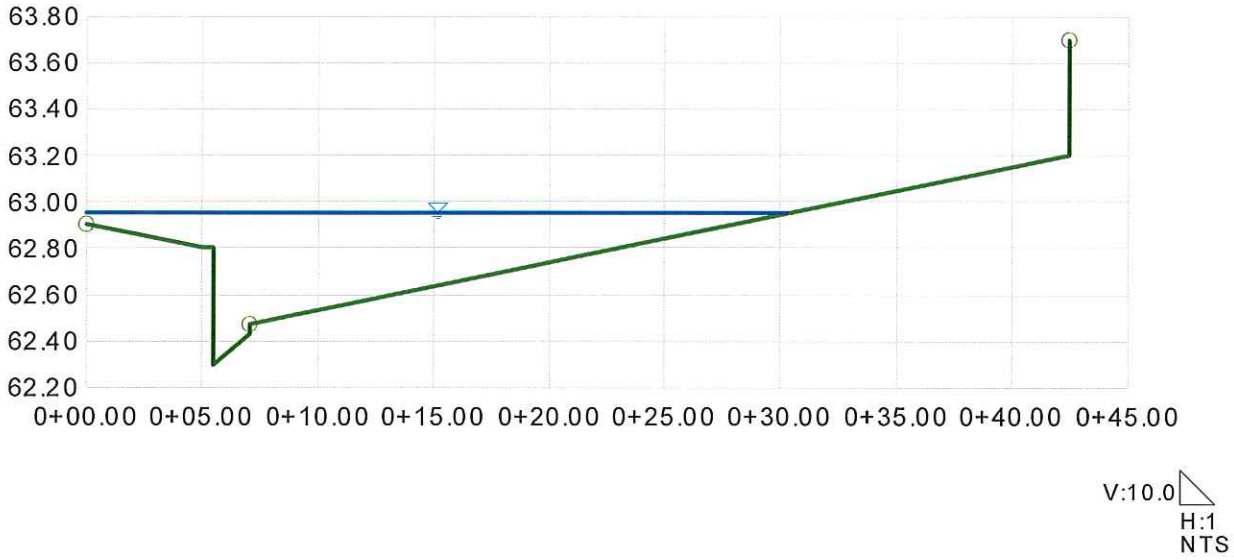
© Haestad Methods, Inc.

Section EE - Jones - 10-Year Allowable Dry Lane
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones - 10-Year Allowabl
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	62.95	ft
Elevation Range	:.30 to 63.70	
Discharge	18.00	cfs

≈ 12.20 ft (min. Dry Lane)



Section EE - Jones (10-Year, Existing)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (10-Year, E:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	38.00	cfs

Larger than 18 cfs.

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	63.09	ft
Elevation Range	.30 to 63.70	
Flow Area	12.0	ft²
Wetted Perimeter	38.13	ft
Top Width	37.39	ft
Actual Depth	0.79	ft
Critical Elevation	63.09	ft
Critical Slope	0.005105	ft/ft
Velocity	3.18	ft/s
Velocity Head	0.16	ft
Specific Energy	63.25	ft
Froude Number	0.99	
Flow Type	Subcritical	

D

V

Calculation Messages:
Water elevation exceeds lowest end station by 0.19485056 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

Section EE - Jones (10-Year, Existing)
Worksheet for Irregular Channel

Notes: * Q10/Q25/Q100 = 38/52/73cfs = runoff from CMP2(16/23/34cfs, for DARF=0.90) + 20/26/35cfs (Q10=0.57x 35cfs / Q25= 0.74 x 35cfs / Q100 = 35cfs from existing southern 6ft x 3ft RCB) + 2/3/4cfs (approximately 1/2 (half) of runoff generated through offsite basin JONES1(4/5/7cfs)).

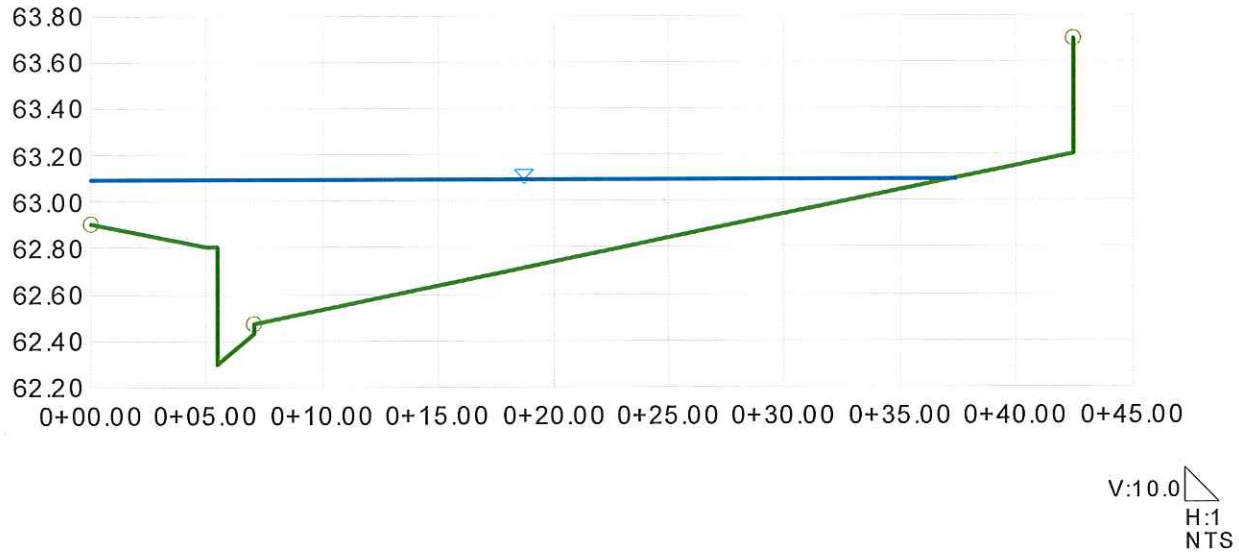
* The calculations conservatively assumes no flows are being convyed yet through the 36"RCP storm drain along Jones Boulevard.

Section EE - Jones (10-Year, Existing)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (10-Year, E:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	63.09	ft
Elevation Range	:.30 to 63.70	
Discharge	38.00	cfs

≈ 5.11' < 12ft min.



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (25-Year, Existing)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (25-Year, E:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	52.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	63.17	ft
Elevation Range	.30 to 63.70	
Flow Area	15.0	ft²
Wetted Perimeter	41.96	ft
Top Width	41.14	ft
Actual Depth	0.87	ft
Critical Elevation	63.18	ft
Critical Slope	0.004861	ft/ft
Velocity	3.47	ft/s
Velocity Head	0.19	ft
Specific Energy	63.36	ft
Froude Number	1.01	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.272008 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (25-Year, Existing)
Worksheet for Irregular Channel

Notes: * Q10/Q25/Q100 = 38/52/73cfs = runoff from CM2(16/23/34cfs, for DARF=0.90) + 20/26/35cfs (Q10=0.57x 35cfs / Q25= 0.74 x 35cfs / Q100 = 35cfs from existing southern 6ft x 3ft RCB) + 2/3/4cfs (approximately 1/2 (half) of runoff generated through offsite basin JONES1(4/5/7cfs)).

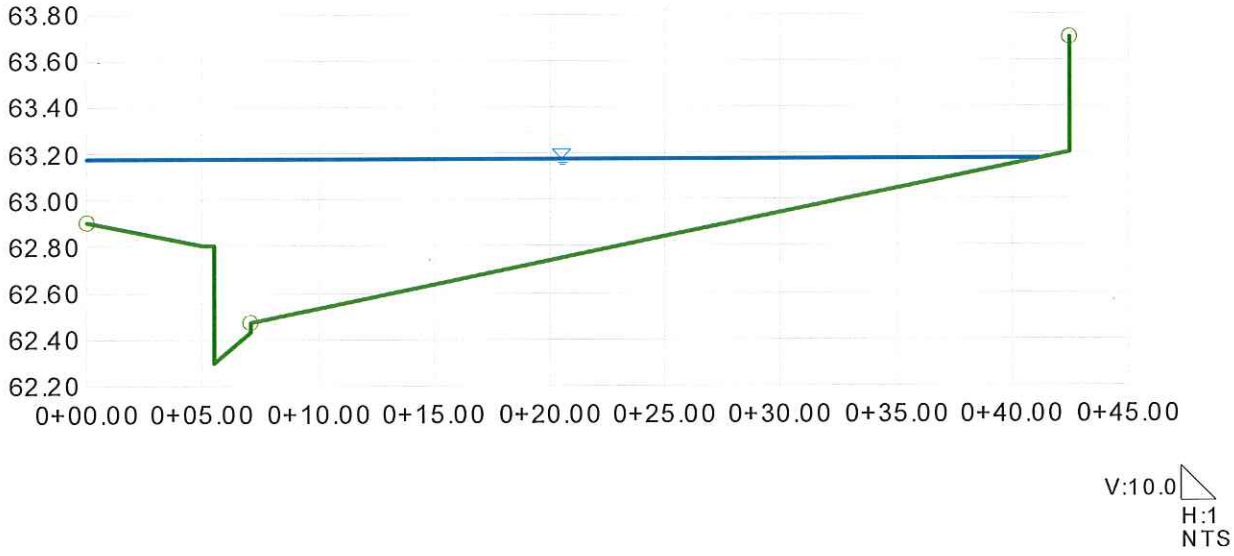
* The calculations conservatively assumes no flows are being convyed yet through the 36"RCP storm drain along Jones Boulevard.

© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (25-Year, Existing)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (25-Year, E:
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	63.17	ft
Elevation Range	!.30 to 63.70	
Discharge	52.00	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (100-Year, Existing)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (100-Year, E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	73.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	63.26	ft
Elevation Range	.30 to 63.70	
Flow Area	18.7	ft²
Wetted Perimeter	43.47	ft
Top Width	42.50	ft
Actual Depth	0.96	ft
Critical Elevation	63.27	ft
Critical Slope	0.004576	ft/ft
Velocity	3.91	ft/s
Velocity Head	0.24	ft
Specific Energy	63.50	ft
Froude Number	1.04	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.35876871 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

© Haestad Methods, Inc.

Section EE - Jones (100-Year, Existing)
Worksheet for Irregular Channel

Notes: * Q10/Q25/Q100 = 38/52/73cfs = runoff from CMX2(16/23/34cfs, for DARF=0.90) + 20/26/35cfs (Q10=0.57x 35cfs / Q25= 0.74 x 35cfs / Q100 = 35cfs from existing southern 6ft x 3ft RCB) + 2/3/4cfs (approximately 1/2 (half) of runoff generated through offsite basin JONES1(4/5/7cfs)).

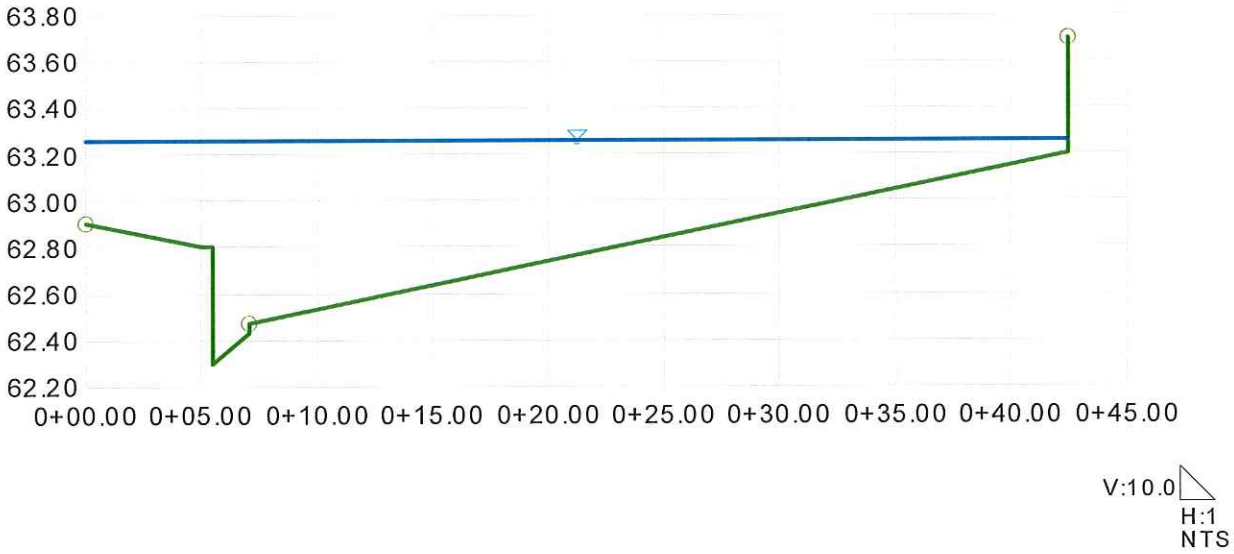
* The calculations conservatively assumes no flows are being convyed yet through the 36"RCP storm drain along Jones Boulevard.

© Haestad Methods, Inc.

Section EE - Jones (100-Year, Existing)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (100-Year, E
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	63.26	ft
Elevation Range	.30 to 63.70	
Discharge	73.00	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (10-Year, Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (10-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharge	47.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	63.15	ft
Elevation Range	.30 to 63.70	
Flow Area	13.9	ft²
Wetted Perimeter	40.67	ft
Top Width	39.87	ft
Actual Depth	0.85	ft
Critical Elevation	63.15	ft
Critical Slope	0.004938	ft/ft
Velocity	3.37	ft/s
Velocity Head	0.18	ft
Specific Energy	63.32	ft
Froude Number	1.01	
Flow Type	Supercritical	

Thus, approx. 30 cfs will have to be intercepted during 10-yr events (i.e 47 - 18 cfs ≈ 29 cfs) to meet 12'-Dry Lane

Calculation Messages:
Water elevation exceeds lowest end station by 0.24596851 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (10-Year, Future)
Worksheet for Irregular Channel

Notes: * Q10/Q25/Q100 = 47/63/85cfs = runoff from CMD2(25/34/46cfs, for DARF=0.90) + 20/26/35cfs (Q10=0.57x 35cfs / Q25= 0.74 x 35cfs / Q100 = 35cfs from existing southern 6ft x 3ft RCB) + 2/3/4cfs (approximately 1/2 (half) of runoff generated through offsite basin JONES1(4/5/7cfs)).

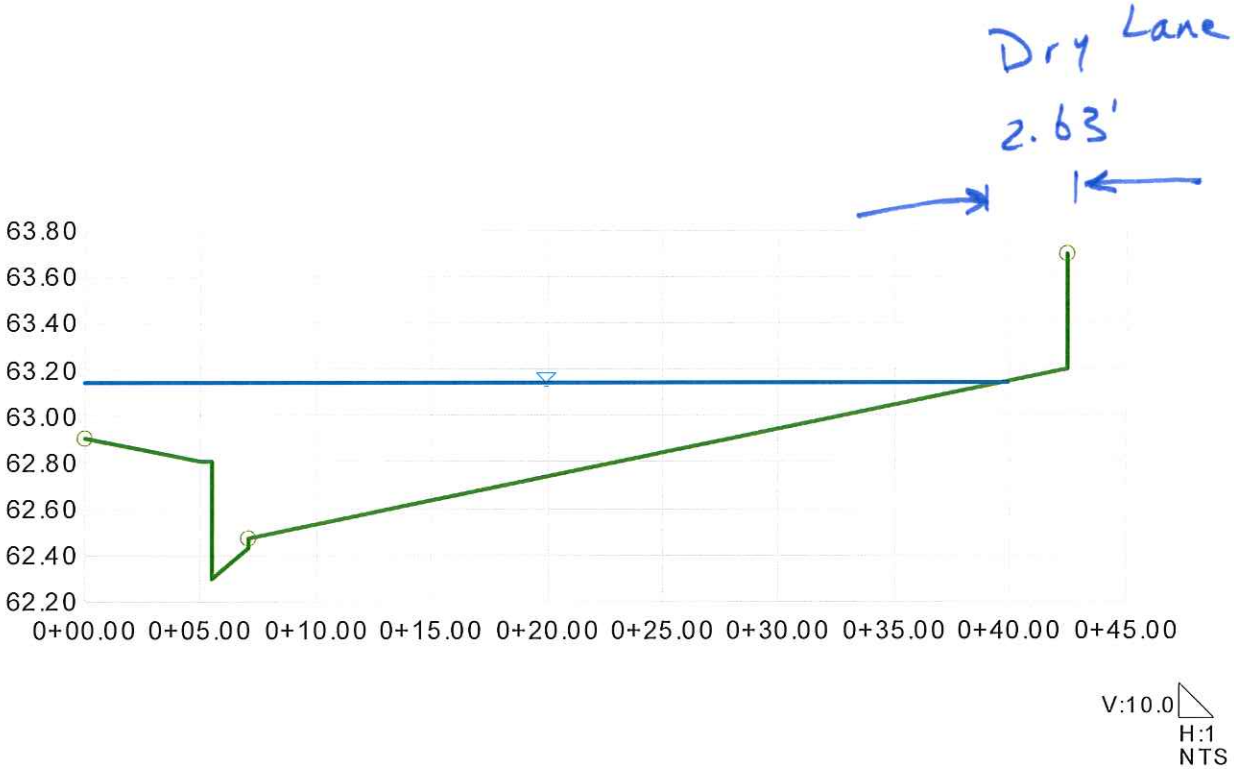
* The calculations conservatively assumes no flows are being convyed yet through the 36"RCP storm drain along Jones Boulevard.

© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (10-Year, Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (10-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	63.15	ft
Elevation Range	:.30 to 63.70	
Discharge	47.00	cfs



Section EE - Jones (25-Year, Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (25-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	63.00	cfs

Options	
Current Roughness Meth	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	63.22	ft
Elevation Range	.30 to 63.70	
Flow Area	17.1	ft²
Wetted Perimeter	43.40	ft
Top Width	42.50	ft
Actual Depth	0.92	ft
Critical Elevation	63.23	ft
Critical Slope	0.004702	ft/ft
Velocity	3.69	ft/s
Velocity Head	0.21	ft
Specific Energy	63.43	ft
Froude Number	1.03	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.32099841 ft.

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

© Haestad Methods, Inc.

Section EE - Jones (25-Year, Future)
Worksheet for Irregular Channel

Notes: * Q10/Q25/Q100 = 47/63/85cfs = runoff from CMD2(25/34/46cfs, for DARF=0.90) + 20/26/35cfs (Q10=0.57x 35cfs / Q25= 0.74 x 35cfs / Q100 = 35cfs from existing southern 6ft x 3ft RCB) + 2/3/4cfs (approximately 1/2 (half) of runoff generated through offsite basin JONES1(4/5/7cfs)).

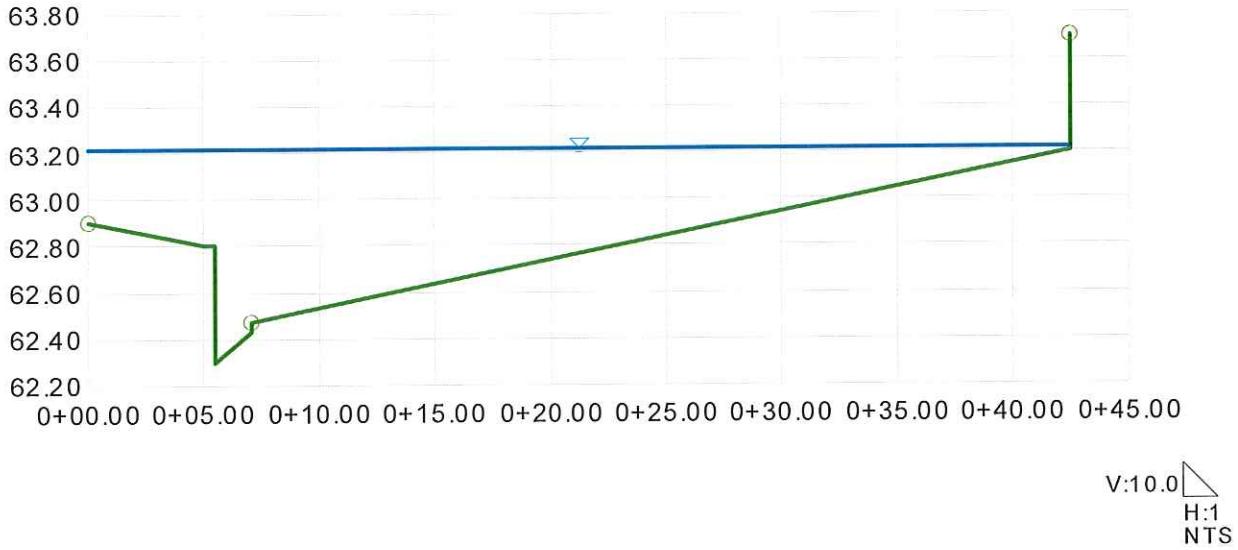
* The calculations conservatively assumes no flows are being convyed yet through the 36"RCP storm drain along Jones Boulevard.

© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (25-Year, Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (25-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	63.22	ft
Elevation Range	!.30 to 63.70	
Discharge	63.00	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (100-Year, Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Slope	005000	ft/ft
Discharg	85.00	cfs

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coefficie	0.015	
Water Surface Elev	63.30	ft
Elevation Range	.30 to 63.70	
Flow Area	20.5	ft²
Wetted Perimeter	43.56	ft
Top Width	42.50	ft
Actual Depth	1.00	ft
Critical Elevation	63.32	ft
Critical Slope	0.004448	ft/ft
Velocity	4.15	ft/s
Velocity Head	0.27	ft
Specific Energy	63.57	ft
Froude Number	1.05	
Flow Type	Supercritical	

Calculation Messages:
Water elevation exceeds lowest end station by 0.40150122 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+42.50	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	62.90
0+05.00	62.80
0+05.50	62.80
0+05.50	62.30
0+07.00	62.43
0+07.00	62.47
0+42.50	63.20
0+42.50	63.70

© Haestad Methods, Inc.

Section EE - Jones (100-Year, Future)
Worksheet for Irregular Channel

Notes: * Q10/Q25/Q100 = 47/63/85cfs = runoff from CMD2(25/34/46cfs, for DARF=0.90) + 20/26/35cfs (Q10=0.57x 35cfs / Q25= 0.74 x 35cfs / Q100 = 35cfs from existing southern 6ft x 3ft RCB) + 2/3/4cfs (approximately 1/2 (half) of runoff generated through offsite basin JONES1(4/5/7cfs)).

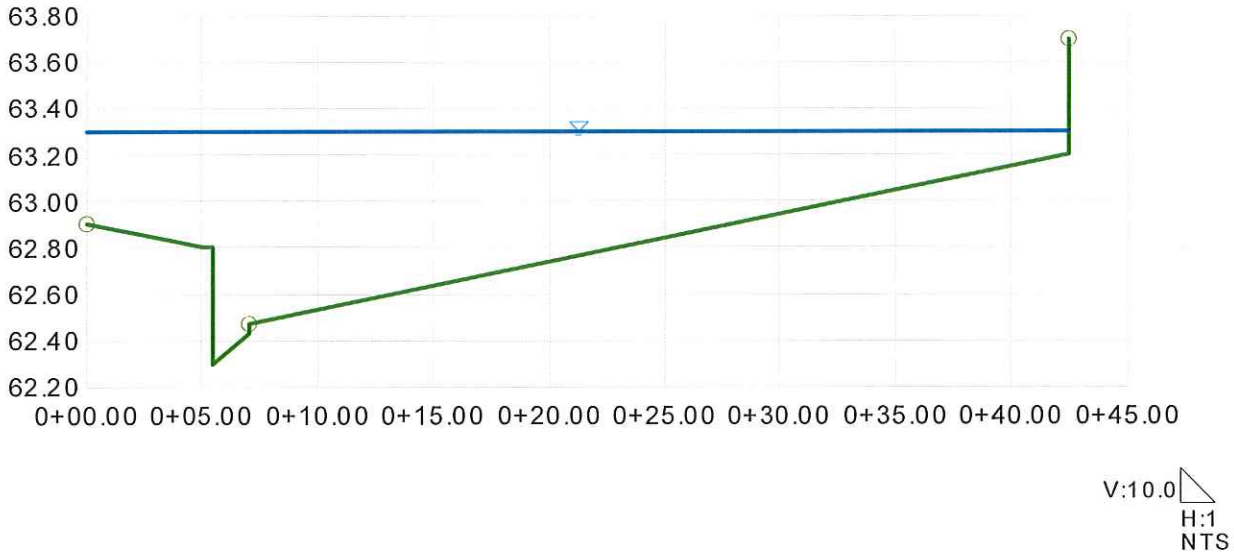
* The calculations conservatively assumes no flows are being convyed yet through the 36"RCP storm drain along Jones Boulevard.

© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Section EE - Jones (100-Year, Future)
Cross Section for Irregular Channel

Project Description	
Worksheet	Section EE - Jones (100-Year,
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coefficie	0.015	
Slope	0.005000	ft/ft
Water Surface Elev	63.30	ft
Elevation Range	:.30 to 63.70	
Discharge	85.00	cfs



Hydraulic Calculations (HY-22) Preliminary Sizing of Future On-Grade Drop Inlet

along Rancho Drive

(Future Condition)

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 08/29/2016

Project No. :161051
Project Name.:Rancho/Craig Master Drainage Study
Computed by :HN

Project Description
Future Drop Inlet along Rancho
Near Section BB

Inlets on Grade: Curb Opening, Grate Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
Sx	Pavement Cross Slope (ft/ft)	0.0080
Sw	Gutter Cross Slope (ft/ft)	0.0830
n	Manning's Coefficient	0.016
W	Gutter Width (ft)	1.50
a	Gutter Depression (inch)	2.00
Q	Discharge (cfs)	7.000
T	Width of Spread (ft)	29.67

Q_{10}

Gutter Flow

Eo	Gutter Flow Ratio	0.177
d	Depth of Flow (ft)	0.35
V	Average Velocity (ft/sec)	1.94

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Curb Opening	22.54	10.00	0.10	0.683	6.317
Parallel Bar P-1-7/8	1.50	8.75	0.76	4.824	1.493
Combination			0.79	5.507	1.493

Note: The curb opening length in the input screen is the total length of the curb opening including its length along the grate.

Future 20 Ft Type 'C' or equivalent

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 08/29/2016

Project No. :161051
Project Name.:Rancho/Craig Master Drainage Study
Computed by :HN

Project Description
Future Drop Inlet along Rancho
Near Section BB

Inlets on Grade: Curb Opening, Grate Inlet

Roadway and Discharge Data

	Cross Slope		Composite
S	Longitudinal Slope	(ft/ft)	0.0050
Sx	Pavement Cross Slope	(ft/ft)	0.0080
Sw	Gutter Cross Slope	(ft/ft)	0.0830
n	Manning's Coefficient		0.016
W	Gutter Width (ft)		1.50
a	Gutter Depression (inch)		2.00
Q	Discharge (cfs)		9.000
T	Width of Spread (ft)		32.70

Q_{25}

Gutter Flow

Eo	Gutter Flow Ratio	0.158
d	Depth of Flow (ft)	0.37
V	Average Velocity (ft/sec)	2.06

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Curb Opening	26.47	10.00	0.08	0.750	8.250
Parallel Bar P-1-7/8	1.50	8.75	0.74	6.099	2.150
Combination			0.76	6.850	2.150

Note: The curb opening length in the input screen is the total length of the curb opening including its length along the grate.

By Pass

Future 20ft D.I
w/ 17.50ft grate.

FHWA Urban Drainage Design Program, HY-22
Drainage of Highway Pavements

Inlets on Grade
Date: 08/29/2016

Project No. :161051
Project Name.:Rancho/Craig Master Drainage Study
Computed by :HN

Project Description
Future Drop Inlet along Rancho
Near Section BB

Inlets on Grade: Curb Opening, Grate Inlet

Roadway and Discharge Data

		Composite
	Cross Slope	
S	Longitudinal Slope (ft/ft)	0.0050
Sx	Pavement Cross Slope (ft/ft)	0.0080
Sw	Gutter Cross Slope (ft/ft)	0.0830
n	Manning's Coefficient	0.016
W	Gutter Width (ft)	1.50
a	Gutter Depression (inch)	2.00
Q	Discharge (cfs)	13.000
T	Width of Spread (ft)	37.66

Q100

Gutter Flow

Eo	Gutter Flow Ratio	0.133
d	Depth of Flow (ft)	0.41
V	Average Velocity (ft/sec)	2.26

Inlet Interception

INLET INTERCEPTION	LT or WGR (ft)	L (ft)	E	Qi (cfs)	Qb (cfs)
Curb Opening	33.38	10.00	0.07	0.863	12.137
Parallel Bar P-1-7/8	1.50	8.75	0.70	8.481	3.656
Combination			0.72	9.344	3.656

Note: The curb opening length in the input screen is the total length of the curb opening including its length along the grate.

HYDRAULIC CALCULATIONS

Hydraulic Capacity for the Existing Drop Inlets (Sump Conditions) at Jones Boulevard Low Point

(Existing and Future Conditions)

Project: Craig & Rancho Master Drainage Study
Project Number: 161051

Date: August, 2016

Rating Table for Existing Drop Inlets (Sump Condition) at Jones Blvd. Low Point
Existing 3:5ft D.I + 2: 2.5ft D.I.

Orifice Equation: $Q = K_g \times C_g \times A_s \times (2g \times H_g)^{0.5}$

D.I Flowline = 0.00

Side Opening

Length of Opening (Ls)(ft)	:	20.0
Orifice Coefficient (Cs)	:	0.65
Clogging Factor (Ks)	:	0.50
Side Opening Height	:	0.50

Grate

Length of Opening (Lg)(ft):		20.0	
Orifice Coefficient (Cg)	:	0.65	
Clogging Factor (Kg)	:	0.50	<--- 50% Clogging is assumed
Effective Area Coeficient :		0.60	<--- 60% of Grate area is assumed covered with Steel
Grate Width (W) (ft)	:	1.50	

* As = 0.60 x Lg x W

	WSE (ft)	Depth of Flow (ft)	Head Above Side Opening (Hs) (ft)	Area of Side Opening (As) (sf)	Flow into Side Opening (Qs) (cfs)	Head Above Grate (Hg) (ft)	Area of Grate (As)* (sf)	Flow into Grate (Qs) (cfs)	Total Flow (Qt) (cfs)	
	0.00	0.00	0.00	0.0	0.00	0.00	18.0	0.00	0.0	
	0.10	0.10	0.05	2.0	1.17	0.10	18.0	14.85	16.0	
	0.20	0.20	0.10	4.0	3.30	0.20	18.0	20.99	24.3	
	0.30	0.30	0.15	6.0	6.06	0.30	18.0	25.71	31.8	
	0.40	0.40	0.20	8.0	9.33	0.40	18.0	29.69	39.0	
	0.50	0.50	0.25	10.0	13.04	0.50	18.0	33.20	46.2	
*	**0.55**	**0.55**	**0.30**	**10.0**	**14.29**	**0.55**	**18.0**	**34.82**	**49.1**	<--- Q100 = 59cfs = 79cfs (Jones SD Capcity)
	0.60	0.60	0.35	10.0	15.43	0.60	18.0	36.36	51.8	- 30cfs (future, into upstream 36"RCP)
	0.70	0.70	0.45	10.0	17.50	0.70	18.0	39.28	56.8	
	0.80	0.80	0.55	10.0	19.34	0.80	18.0	41.99	61.3	
	0.90	0.90	0.65	10.0	21.03	0.90	18.0	44.54	65.6	
	1.00	1.00	0.75	10.0	22.59	1.00	18.0	46.95	69.5	
	1.10	1.10	0.85	10.0	24.05	1.10	18.0	49.24	73.3	
	1.20	1.20	0.95	10.0	25.42	1.20	18.0	51.43	76.8	
*	**1.27**	**1.27**	**1.02**	**10.0**	**26.34**	**1.27**	**18.0**	**52.91**	**79.2**	<--- Q100 = 79cfs = Design Flow for existing SD
	1.30	1.30	1.05	10.0	26.73	1.30	18.0	53.53	80.3	
	1.40	1.40	1.15	10.0	27.97	1.40	18.0	55.55	83.5	
	1.50	1.50	1.25	10.0	29.16	1.50	18.0	57.50	86.7	
	1.60	1.60	1.35	10.0	30.30	1.60	18.0	59.38	89.7	
	1.70	1.70	1.45	10.0	31.41	1.70	18.0	61.21	92.6	
	1.75	1.75	1.50	10.0	31.94	1.75	18.0	62.10	94.0	

*** Note : review of the grades at Jones low point, illustrates that at ponding depth of more than 1.0ft, flows will spillover and continue easterly towards Hickam. However, in the future, large portion of the runoff from CMD2(28/37/51cfs) is expected to be intercepted and convyed directly into the exisitng storm drain**

APPENDIX C

FIGURES

NOTES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data deliniated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

0 100 200 400 600 800

MAP LEGEND

PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE
CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL
001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GL5 GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

BOOK T20S R60E

099	100	101
126	125	124
137	138	139
164	163	162

SEC. 2

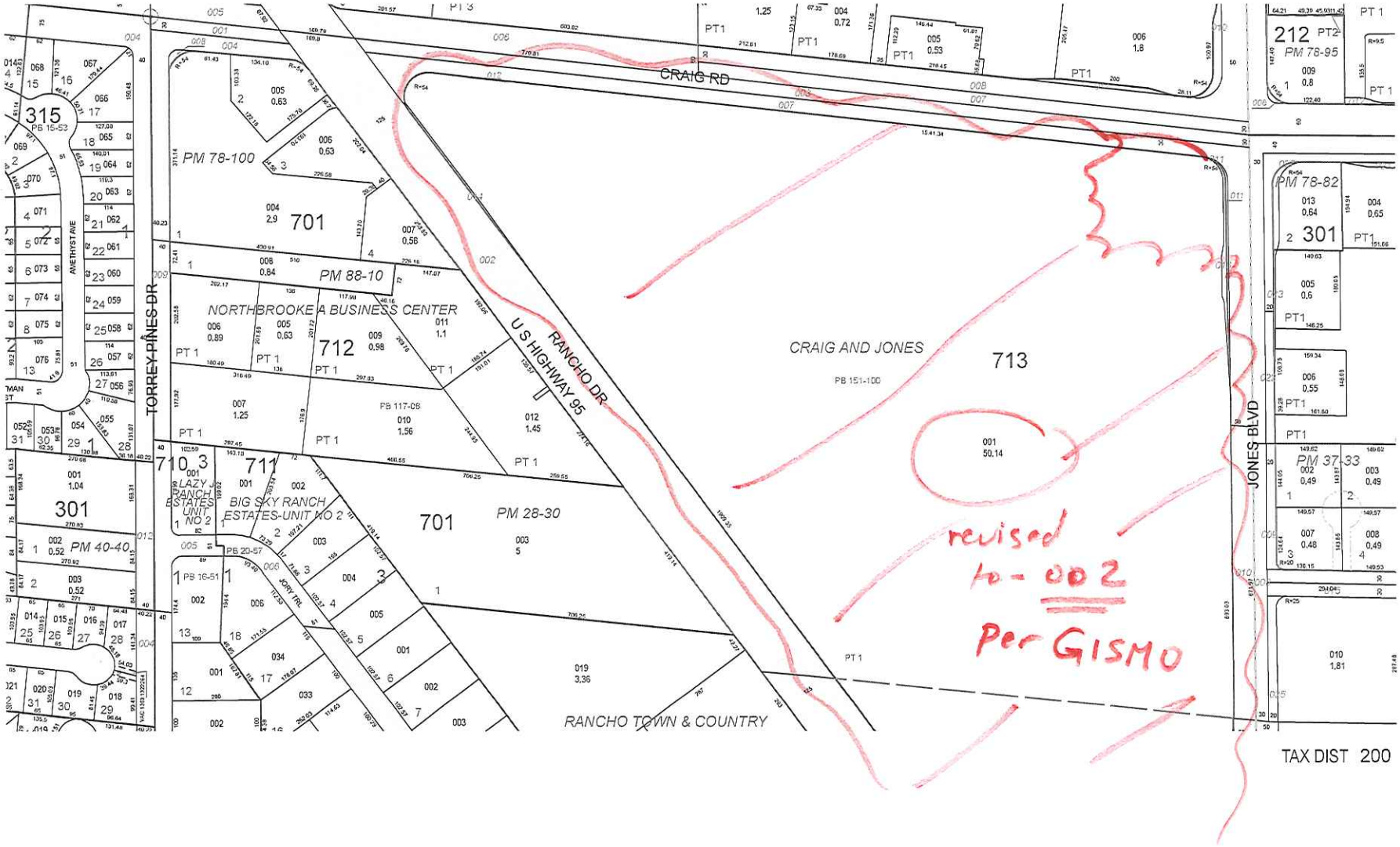
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

MAP N 2 SE 4

8	4	8	4
5	1	5	1
6	2	6	2
7	3	7	3
8	4	8	4
5	1	5	1

138-02-7

Scale: 1" = 200' Rev: 7/6/2016



NOTES

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data deliniated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

0 100 200 400 600 800

MAP LEGEND

PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER LINE
HISTORIC LOT LINE
HISTORIC SUB BOUNDARY
HISTORIC PM/LD BOUNDARY
SECTION LINE
CONDOMINIUM UNIT
AIR SPACE PCL
RIGHT OF WAY PCL
SUB-SURFACE PCL

001 ROAD PARCEL NUMBER
001 PARCEL NUMER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
5 LOT NUMBER
GLS GOV. LOT NUMBER

ASSESSOR'S PARCELS - CLARK CO., NV.

Michele W. Shafe - Assessor

BOOK T20S R60E

099	100	101
126	125	12412
137	138	13914
164	163	16216

SEC. 2

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

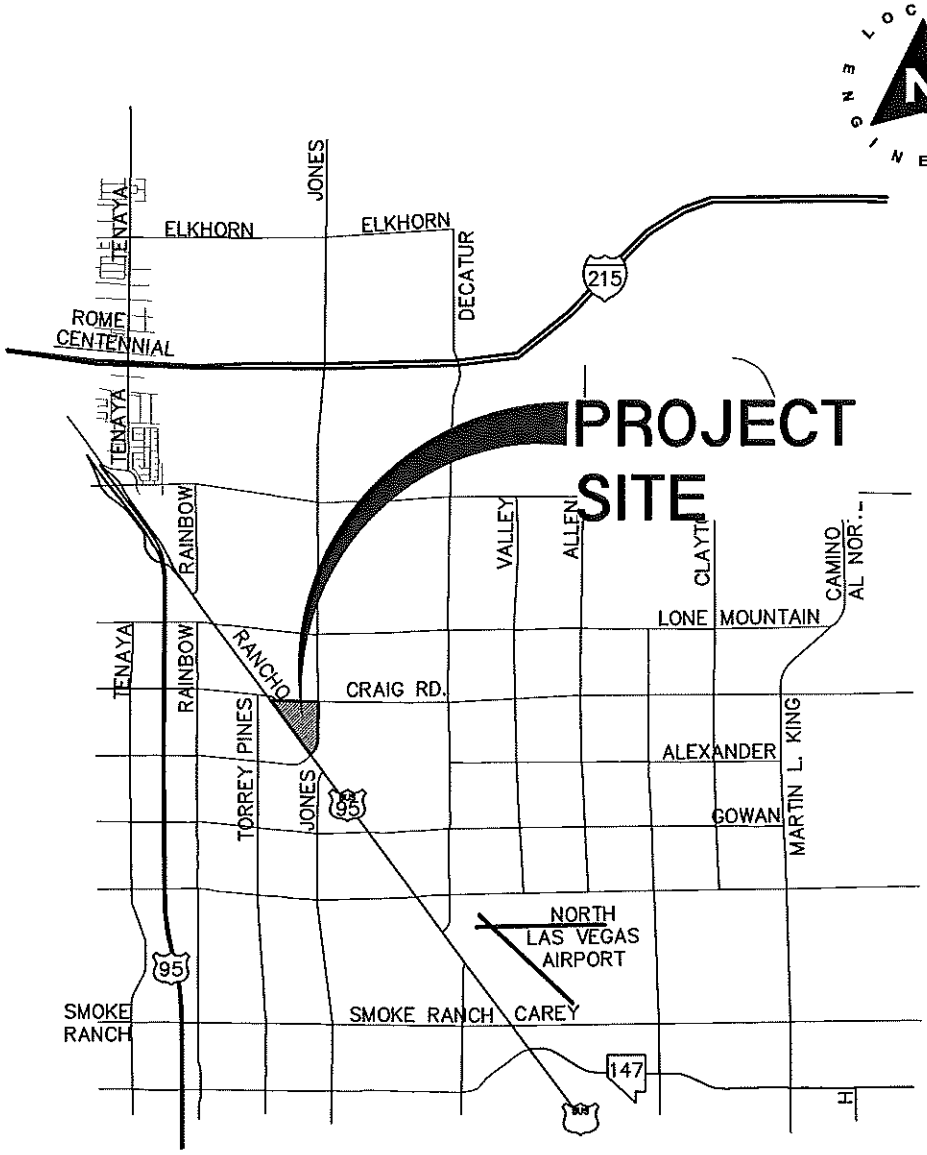
MAP S 2 SE 4

8	4	8	4
5	1	5	1
6	2	6	2
7	3	7	3
8	4	8	4
5	1	5	1

138-02-8

Scale: 1" = 200' Rev: 7/6/2016

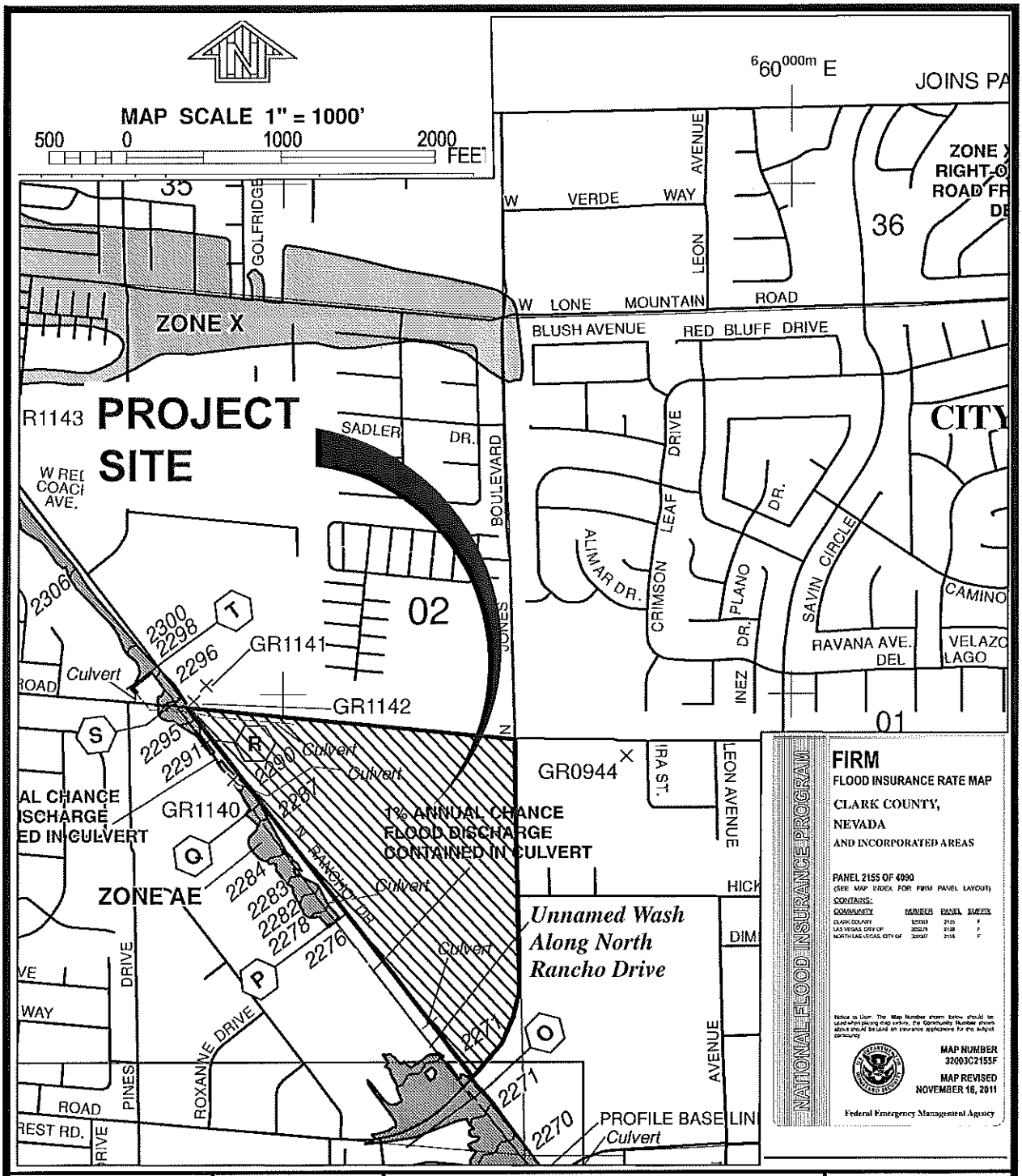
TAX DIST 200



VICINITY MAP

NOT TO SCALE

DRAWN BY: CWB	SCALE: N.T.S.	**VICINITY MAP (FIGURE 1)**	PROJECT No.: 161051
CHECKED BY: HMN	DATE: 07/25/16		SHEET No. **V-M**
Lochsa engineering 6345 South Jones Blvd. Suite 100 Las Vegas, NV 89118 Phone (702) 365-9312 - Fax (702) 365-9317		**CRAIG AND RANCHO MASTER GRADING**	SHEET 1 OF 1



DRAWN BY: CWB	SCALE:1"=1000'	**FLOOD INSURANCE RATE MAP (FIGURE 2)**	PROJECT No.: 161051
CHECKED BY: HMN	DATE:07/25/16		SHEET No. **F-M**
Lochsa engineering 6345 South Jones Blvd. Suite 100 Las Vegas, NV 89118 Phone (702) 365-9312 - Fax (702) 365-9317		**CRAIG AND RANCHO MASTER GRADING**	SHEET 1 OF 1

REGIONAL FLOOD CONTROL DISTRICT

2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F- 20
FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain

N

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

Scale: 1 inch = 2,000 feet

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

US95 I-15 I-215

PROJECT SITE (FACILITY GOAL 0111 ADJACENT TO SITE)

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANWE		ANN ROAD CHANNEL WEST						
0000	E	12' X 12' RCB	1400	2214	CNN043-C	CWEST3	3.41	0.66
0027	E	14' X 9' RCB	203	2214	CNN043-C	CWEST3	3.41	0.77
0031	E	12' X 10' RCB	2362	2214	CNN043-C	CWEST3	3.41	1.40
0076	E	16' X 8' RCB	350	2214	CNN043-C	CWEST3	3.41	0.93
0082	E	12' X 11' RCB	2217	1947	CNW3B2-C	CWEST3	2.99	0.71
0122	E	12' X 10' RCB	260	1947	CNW3B2-C	CWEST3	2.99	0.71
0127	E	10' X 8' RCB	1450	1947	CNW3B2-C	CWEST3	2.99	2.55
0157	E	10' X 9' RCB	1112	1257	CNW2D2-C	CWEST3	1.95	1.13
0177	E	12' X 10' RCB	2797	1257	CNW2D2-C	CWEST3	1.95	0.39
0232	E	12 'X 8' RCB	714	1257	CNW2D2-C	CWEST3	1.95	0.43
0245	E	10' X 9' RCB	1721	993	CNW2D1-C	WEST3	6.84	0.80
0279	E	10' X 9' RCB	553	743	2CNW2B5C	WEST3	6.37	0.80
0290	E	8' X 8' RCB	2050	743	2CNW2B5C	WEST3	6.37	0.70
CNEA		CENTENNIAL PKWY CHANNEL EAST						
0123	E	14' X 6' RCB	1585	1457	CNN093-C	WEST3	1.67	0.92
0153	E	14' X 6' RCB	1125	1457	CNN093-C	WEST3	1.67	1.34
0175	E	15' X 6' RCB	125	1174	CNN078-C	WEST3	1.35	5.66
0176	E	Conc Chnl 15'W 6.5'D 0:1 SS	540	1174	CNN078-C	WEST3	1.35	0.70
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0000	E	2: 27' X 10' RCB	309	4465	CNW3D3-C	WEST3	6.41	1.38
0005	E	4: 13.5' X 10' RCB	762	4465	CNW3D3-C	WEST3	6.41	1.10
0020	E	4: 13' X 10' RCB	310	4465	CNW3D3-C	WEST3	6.41	2.57
0026	E	4: 13.5' X 9' RCB	750	4465	CNW3D3-C	WEST3	6.41	0.61
0045	E	Conc Chnl 56'W 8'D 0:1 SS	1575	4465	CNW3D3-C	WEST3	6.41	0.61
0071	E	3: 18' X 8' RCBC @ Bradley	300	4465	CNW3D3-C	WEST3	6.41	0.61
0075	E	Conc Chnl 54'W 8'D 0:1 SS	775	4465	CNW3D3-C	WEST3	6.41	0.42
0110	E	Conc Chnl 54'W 9'D 0:1 SS	620	4382	2CW3B4-C	WEST3	6.15	0.42
0129	E	3: 18' X 8' RCB	2451	4382	2CW3B4-C	WEST3	6.15	0.40
0150	E	Conc Chnl 40'W 9.5'D 0:1 SS	2279	4233	CNW3B3-C	WEST3	5.64	0.42
0173	E	3: 18' X 8' RCBC @ Torrey Pines	200	4233	CNW3B3-C	WEST3	5.64	0.42
0176	E	Conc Chnl 40'W 9'D 0:1 SS	150	4233	CNW3B3-C	WEST3	5.64	0.41
0189	E	Conc Chnl 36'W 10'D 0:1 SS	1200	4067	CNW2D4-C	WEST3	5.15	0.42
GOA2		GOWAN OUTFALL - ALEXANDER BRANCH						
0000	P1	8' X 5' RCB	2281	523	CPT41-C	ALLGOW3	0.61	0.90
GOAL		GOWAN OUTFALL - ALEXANDER ROAD FACILITIES						
0000	P1	10' X 9' RCB	5280	1461	CPT5A2-C	ALLGOW3	3.23	1.00
0100	P1	10' X 8' RCB	540	1297	CCPT41-C	ALLGOW3	2.89	1.00
0111	P1	10' X 8' RCB	3000	880	CPT2B2	ALLGOW3	2.28	0.83
0168	P1	10' X 8' RCB	4200	880	CPT2B2	ALLGOW3	2.28	0.50
GOCL		GOWAN OUTFALL - CLAYTON BRANCH						
0000	P1	9' X 8' RCB	6785	814	CPT2B-1	ALLGOW3	1.11	0.61
GOCR		GOWAN OUTFALL - CRAIG ROAD						
0000	E	Conc Chnl 20'W 7'D 2:1 SS	1380	3101	CPT3D-3	ALLGOW3	5.78	1.06
0022	E	2: 8' X 8' RCB	3000	1120	CPT4C-2	ALLGOW3	1.75	0.50
0080	E	120" RCP	5850	995	CPT4C-1	ALLGOW3	1.50	0.50
0180	E	114" RCP	350	238	PT4B3-C	ALLGOW3	0.28	0.30
0201	E	96" RCP	1090	238	PT4B3-C	ALLGOW3	0.28	0.35
GOLO		GOWAN OUTFALL - LONE MTN. ROAD BRANCH						
0000	E	72" RCP	1370	308^	CPT2AD-1^	ALLGOW3	3.28	0.53
0001	E	13' X 8' RCB	1370	1433^	CPT2AD-1^	ALLGOW3	3.28	0.45
0025	E	16' X 8' RCB	1464	1741	CPT2AD-1	ALLGOW3	3.28	0.39
0052	E	16' X 8' RCB	2564	1741	CPT2AD-1	ALLGOW3	3.28	0.42
0100	E	16' X 8' RCB	2732	1605	C2AC2-C	ALLGOW3	2.96	0.37
0152	E	10' X 10' RCB	700	1605	C2AC2-C	ALLGOW3	2.96	0.71
0165	E	10' X 8' RCB	3300	1415	CPT2AB2	ALLGOW3	2.59	1.21
0228	E	10' X 8' RCB	1300	1244	C2AB1C	ALLGOW3	2.31	1.00
0253	E	10' X 6' RCB	1200	986	CPT3AC1	ALLGOW3	2.10	1.25
0275	E	8' X 6' RCB	3000	590	CPT3AA2	ALLGOW3	1.16	0.77

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOOF		GOWAN OUTFALL FACILITIES						
0000	E	Conc Chnl 20'W 7'D 2:1 SS	2500	5233	CPT-2B-3	GW5SC	14.66	1.25
0040	E	Conc Chnl 20'W 7'D 2:1 SS	1900	5058	CCPT2C1*	GW4SC	11.84	0.60
0074	E	2: 16' X 7' RCBC @ Camino Al Norte	131	5058	CCPT2C1*	GW4SC	11.84	1.30
0077	E	Conc Chnl 20'W 7'D 2:1 SS	3157	5058	CCPT2C1*	GW4SC	11.84	1.40
0146	E	3: 12' X 5' RCBC @ Clayton	150	4014^	CCPT2C1*^	GW4SC	11.84	1.33
0147	P1	Add 1: 12' X 7' RCBC @ Clayton	150	1044^	CCPT2C1*^	GW4SC	11.84	1.33
0149	E	Conc Chnl 20'W 7'D 2:1 SS	1228	5058	CCPT2C1	GW4SC	11.84	1.13
0150	E	Conc Chnl 20'W 7'D 2:1 SS	612	4772	CCPT3D-3	GW4SC	10.86	1.13
0162	E	Confluence Structure	678	4772	CCPT3D-3	GW4SC	10.86	0.90
0196	E	37.66' X 5.66' Bridge @ Simmons	112	3101	CPT3D-3	ALLGOW3	5.78	0.90
0198	E	14' X 6' RCB	1344	1164^	CPT4C-3^	GW3SC	5.85	0.41
0199	P1	Add 1: 24' X 6' RCB	1171	1581^	CPT4C-3^	GW3SC	5.85	0.40
0200	E	24' X 6' RCB	173	1581^	CPT4C-3^	GW3SC	5.85	0.89
0224	P1	1: 20' X 6' RCB and 1: 14' X 6' RCB	2700	2745	CPT4C-3	GW3SC	5.85	0.40
0275	P1	1: 16' X 8' RCB and 1: 14' X 6' RCB	515	2582	CPT5C-3	GW3SC	5.59	0.40
0285	P1	2: 14' X 8' RCB	2650	2582	CPT5C-3	GW3SC	5.59	0.45
0325	P1	2: 14' X 8' RCB	2650	2458	CPT5C-2	GW3SC	5.36	0.37
0375	P1	2: 12' X 8' RCB	2700	2375	CPT5C-1	GW3SC	5.17	0.56
0427	E	96" RCP	1510	630	DGOW2A	GW3SC	1.38	0.47
0485	E	90" RCP	1080	630	DGOW2A	GW3SC	1.38	0.47
0486	E	8' X 5' RCB	3300	630	DGOW2A	GW3SC	1.38	0.60
0511	E	8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50
LV03		CLAYTON STREET CHANNEL						
0000	E	33' X 16' RCBC @ Hammer	400	1044	CNN057-C	WEST3	1.22	0.42
0006	E	Conc Chnl 9'W 9.4'D 1.5:1 SS	1300	1044	CNN057-C	WEST3	1.22	0.42
0030	E	2: 9' X 7' RCBC @ Ann	120	1044	CNN057-C	WEST3	1.22	0.42
0031	E	Conc Chnl 8'W 8.1'D 1.5:1 SS	2600	757	CNN054-C	WEST3	0.81	0.40
0081	E	2: 10' X 7' RCBC @ Tropical	100	757	CNN054-C	WEST3	0.81	0.42
0082	E	Conc Chnl 7'W 7.1'D 1.5:1 SS	2444	757	CNN054-C	WEST3	0.81	2.80
0128	E	Conc Chnl 7'W 7.1'D 1.5:1 SS	167	257	1/2NN052-C	WEST3	0.55	2.80
0129	E	2: 10' X 6' RCB	801	257	1/2NN052-C	WEST3	0.55	1.60
0131	E	10' X 6' RCB	665	257	1/2NN052-C	WEST3	0.55	1.28
LV05		WESTERN TRIBUTARY AT ALEXANDER RD						
0131	E	Conc Chnl 28'W 3'D 3:1 SS	1300	567	CLV99B-3	WEST3	0.64	0.76
LV06		WESTERN TRIBUTARY AT CRAIG RD						
0053	E	16' X 6' RCAP	782	1080	CLV99A-3	WEST3	1.31	1.56
0063	E	14' X 6' RCAP	526	1080	CLV99A-3	WEST3	1.31	1.88
0075	E	12' X 6' RCB	1608	1080	CLV99A-3	WEST3	1.31	0.72
0105	E	2: 8' X 6' RCBC @ Revere	158	1080	CLV99A-3	WEST3	1.31	1.71
0107	E	Conc Chnl 17.3'W 6'D 0:1 SS	140	1080	CLV99A-3	WEST3	1.31	3.79
0110	E	Conc Chnl 12'W 5.5'D 2:1 SS	2451	1080	CLV99A-3	WEST3	1.31	0.87
0147	E	12' X 6' RCBC @ Alexander	150	629	CLV99A-2	WEST3	0.74	1.16
LVMD		LAS VEGAS WASH - MIDDLE						
1877	E	Conc Chnl 30'W 10'D 1:1 SS	1570	6423	CNN104-C	WEST5	44.33	1.10
1905	E	Conc Chnl 12'W 10'D 1.65:1 SS	2440	3245	CNN086-C	WEST5	29.30	1.00
1953	E	2: 24' X 10' RCBC @ Camino Al Norte	145	3245	CNN086-C	WEST5	29.30	0.94
1954	E	Conc Chnl 32'W 7'D 2:1 SS	1587	3245	CNN086-C	WEST5	29.30	0.99
1984	E	Transition Structure	550	3221	LOWERDB	CWEST5	19.67	0.99
2048	E	68,000 cfs PMF Spillway		68000	LOWERIN	CWEST5	19.67	
2049	E	4: 7' X 7' RCB Outlet	200	3221	LOWERDB	CWEST5	19.67	
2050	E	700 ac-ft Lower Las Vegas Wash Detention Basin		6729	LOWERIN	CWEST5	19.67	
2052	P1	Conc Chnl 50'W 6'D 0:1 SS	240	6636	2C057-C	CWEST5	19.28	3.11
2053	P1	Conc Chnl 60'W 12'D 0:1 SS	690	6636	2C057-C	CWEST5	19.28	0.15
2054	P1	Conc Chnl 60'W 12'D 0:1 SS	260	6636	2C057-C	CWEST5	19.28	3.80
2055	P1	Conc Chnl 60'W 12'D 0:1 SS	165	6636	2C057-C	CWEST5	19.28	9.10
2060	E	4: 12.75' X 16' RCBC @ Clayton	144	6171	2C044-C	CWEST5	18.06	0.15
2061	E	Conc Chnl 54'W 16'D 0:1 SS	425	6171	2C044-C	CWEST5	18.06	0.15
2062	E	Conc Chnl 54'W 9'D 0:1 SS	1200	6171	2C044-C	CWEST5	18.06	1.35
2089	E	Conc Chnl 54'W 9'-9.5'D 0:1 SS	908	6171	2C044-C	CWEST5	18.06	0.50
2124	E	2: 26.5' X 10' RCBC @ Simmons	110	6046	2C043-C	CLVMD5	15.94	0.50

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVMD		LAS VEGAS WASH - MIDDLE						
2125	E	Conc Chnl 54'W 9'D 0:1 SS	1571	6046	2C043-C	CLVMD5	15.94	0.77
2170	E	4: 12' X 10' RCBC @ Ann Road	500	6046	2C043-C	CLVMD5	15.94	1.42
2172	E	Conc Chnl 50'W 10'D 0:1 SS	1289	5734	2C3D4-C*	CLVMD4	11.98	1.15
2192	E	2: 24.5' X 10' RCBC @ Allen	110	5734	2C3D4-C*	CLVMD4	11.98	1.15
2197	E	Conc Chnl 50'W 10'D 0:1 SS	1385	5734	2C3D4-C*	CLVMD4	11.98	1.37
2223	E	50' X 10' RCBC @ El Campo Grande	275	5734	2C3D4-C*	CLVMD4	11.98	1.60
2228	E	Conc Chnl 50'W 10'D 0:1 SS	1600	5734	2C3D4-C*	CLVMD4	11.98	1.83
2266	E	2: 24.5' X 10' RCBC @ Tropical	575	5734	2C3D4-C*	CLVMD4	11.98	0.80
2276	E	Conc Chnl 50'D 10'D 0:1 SS	985	5734	2C3D4-C*	CLVMD4	11.98	0.80
2294	E	2: 24.5' X 10' RCBC @ Ranchhouse	292	5734	2C3D4-C	CLVMD4	11.98	1.04
2300	E	Transition Structure	200	5734	2C3D4-C	CLVMD4	11.98	1.50
2304	E	Conc Chnl 70'W 10'D 0:1 SS	220	5734	2C3D4-C	CLVMD4	11.98	1.50
2308	E	Confluence Structure	480	5734	2C3D4-C	CLVMD4	11.98	0.90
2322	E	2: 15' X 9' RCB	1200	3317	CNW3D4-C	CWEST3	6.88	1.50
2324	E	2: 14' X 8' RCB	5485	3317	CNW3D4-C	CWEST3	6.88	0.40
LVSM		LAS VEGAS WASH-SIMMONS						
0000	E	12' X 8' RCB	195	790	CNN044-C	WEST3	0.81	0.63
0006	E	11' X 6' RCB	1005	790	CNN044-C	WEST3	0.81	0.30
0025	E	10' X 6' RCB	1310	790	CNN044-C	WEST3	0.81	0.44
0050	E	9' X 6' RCB	387	530	CNN040-C	WEST3	0.53	0.50
0057	E	8' X 6' RCB	1113	530	CNN040-C	WEST3	0.53	0.54
0084	E	72" RCP	252	530	CNN040-C	WEST3	0.53	1.49
0089	E	60" RCP	1068	235	NN038-C	WEST3	0.24	2.04
0109	E	48" RCP	2003	235	NN038-C	WEST3	0.24	1.91
TREA		TROPICAL ROAD CHANNEL EAST						
0134	E	66" RCP	2700	447	CNN095-C	WEST3	0.57	2.10

** 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.*

^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).

REGIONAL FLOOD CONTROL DISTRICT

2013 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F - 20

LEGEND

ID (Facility Identifier) AABB
- Parent Stream Name
- Stream Name

River Mile 0000
- Distance Above Confluence with Parent Stream (Miles)
- Miles in Hundredths

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

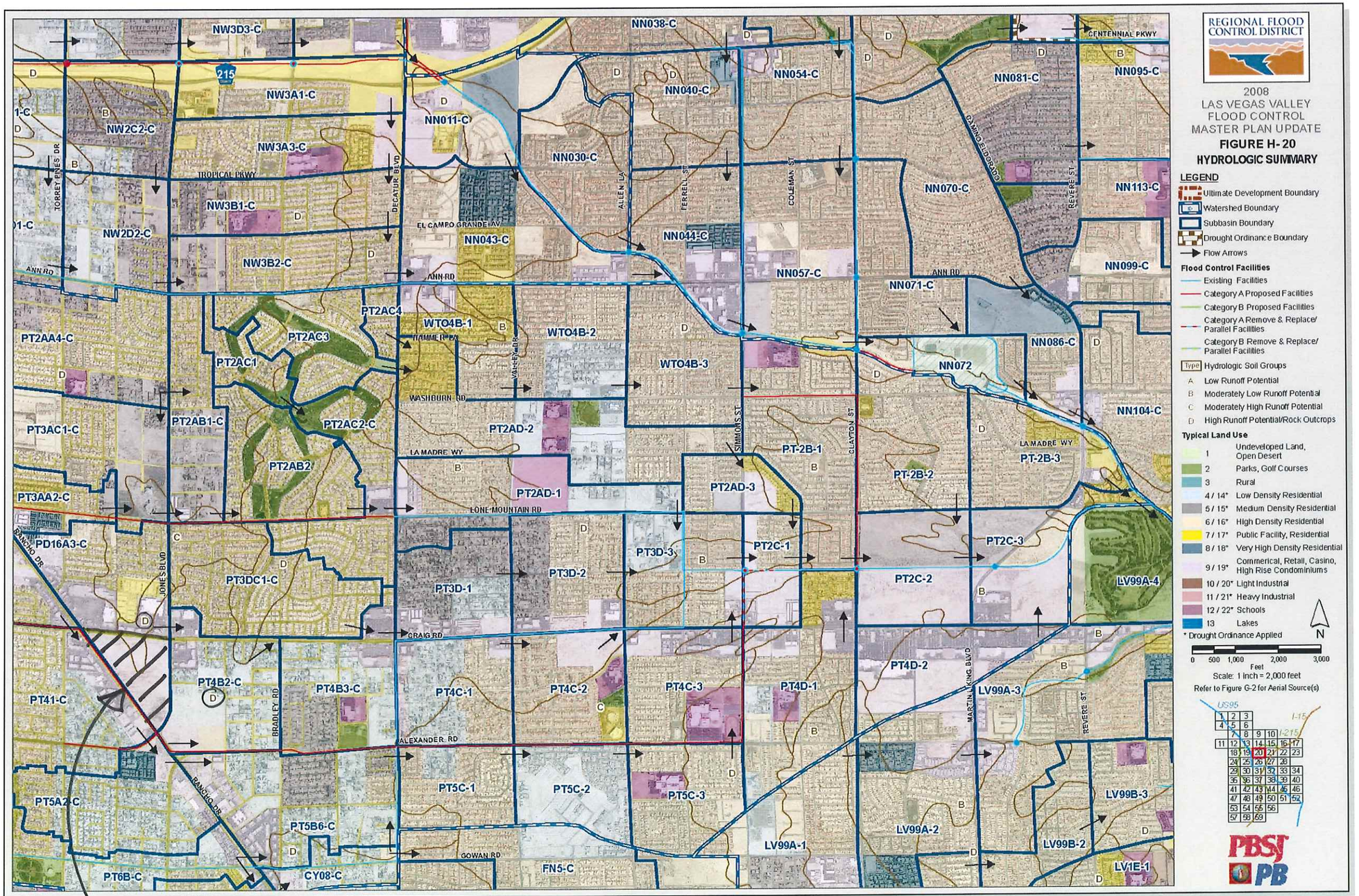
Bottom Width.....W

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.....CMPC
- High Density Polyethylene.....HDPE
- Horizontal Elliptical Reinforced Concrete Pipe.....HERCP
- Reinforced Concrete Arch Pipe.....RCAP
- Reinforced Concrete Arch Culvert.....RCAC
- Reinforced Concrete Box.....RCB
- Reinforced Concrete Box Culvert.....RCBC
- Reinforced Concrete Pipe.....RCP
- Reinforced Concrete Pipe Culvert.....RCPC
- Storm Sewer Pipe.....SSP



PROJECT SITE ('D' SOIL)

CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

SUB-BASIN BOUNDARY

FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
300	10-YEAR FACILITY FLOW
800	100-YEAR FACILITY FLOW

(FLOWS IN CFS)

BWJS ←→ Basin-ID

(13 / 59) ←→ Contributing flow (10-Year / 100-Year) from the basin (cfs)

PHOTO DATE: APRIL 1996

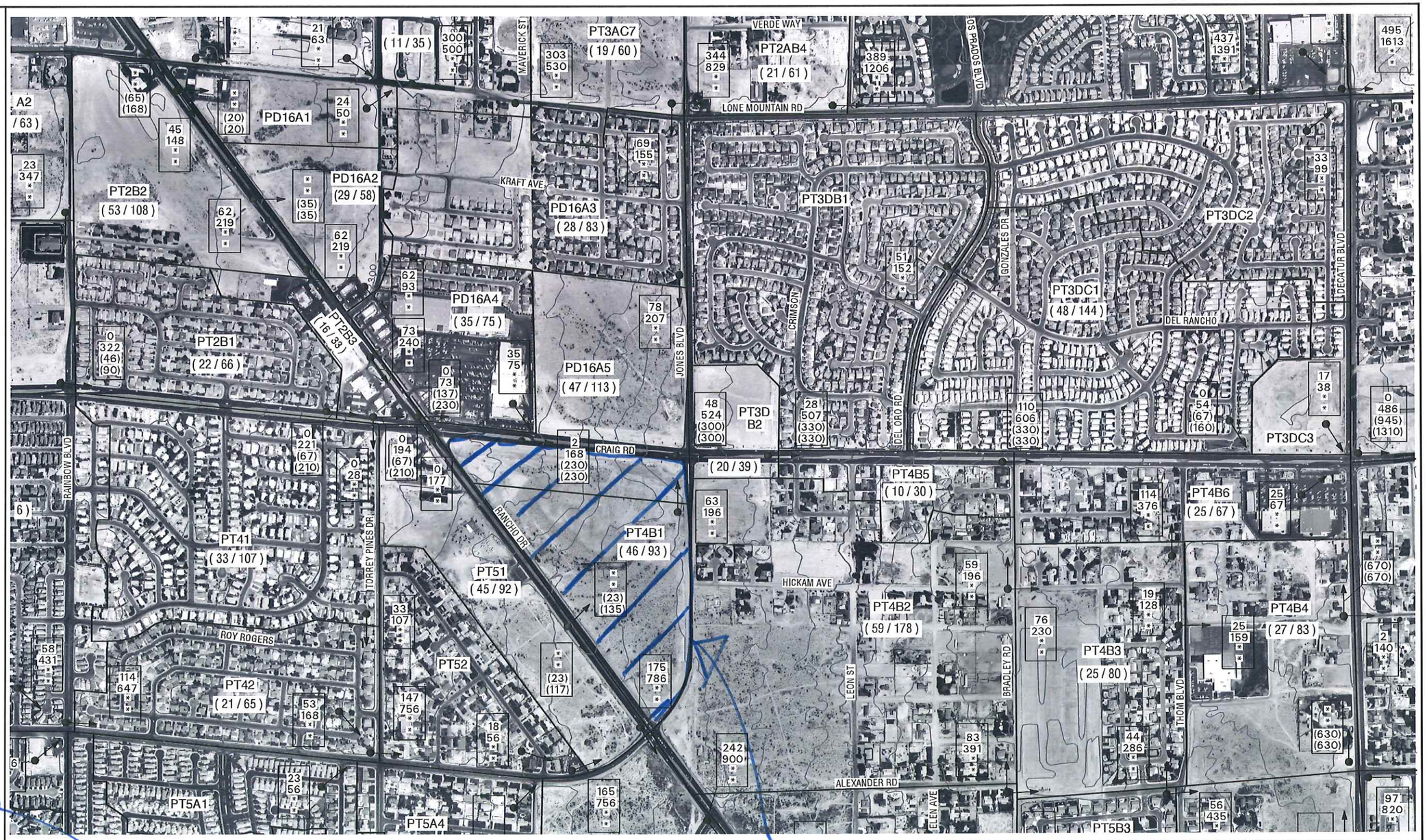


FIGURE E-12

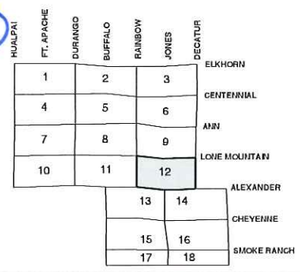
EXISTING DRAINAGE CONDITIONS

PROJECT SITE

PBS&J POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING PLANNING SURVEYING GIS

901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200



NOTE:

Existing conditions are based on future CN values with only existinig local and CCRFCD facilities in place

N W E S

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

NORTHWEST NEIGHBORHOOD STUDY

CITY OF LAS VEGAS NEVADA

LEGEND

- EXISTING REGIONAL DETENTION BASINS
- PROPOSED REGIONAL DETENTION BASINS
- EXISTING LOCAL DETENTION BASINS
- EXISTING REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES
- EXISTING LOCAL BRIDGES
- EXISTING REGIONAL CULVERT
- PROPOSED REGIONAL CULVERT
- EXISTING LOCAL CULVERT
- EXISTING REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE
- EXISTING LOCAL PIPELINE
- PROPOSED LOCAL PIPLINE
- EXISTING REGIONAL CHANNEL
- PROPOSED REGIONAL CHANNEL
- EXISTING LOCAL CHANNEL
- PROPOSED REGIONAL PIPELINE (Notincluded in 1996 MPU)
- PROPOSED REGIONAL CHANNEL (Notincluded in 1996 MPU)
- EXISTING REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE
- EXISTING LOCAL DIKE/LEVEE
- EXISTING STORM WATER PUMPING STATION
- PROPOSED BELTWAY ALIGNMENT

FIGURE F-12

FUTURE DRAINAGE CONDITIONS

PROJECT SITE

N W E S

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
(300)	10-YEAR FACILITY FLOW
(800)	100-YEAR FACILITY FLOW

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place

* The capacity of the proposed regional facility is based on the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley." The facility may need to be enlarged in final design.

HUALPAI	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	
1		2		3			ELKHORN
4		5		6			CENTENNIAL
7		8		9			ANN
10		11		12			LONE MOUNTAIN
			13	14			ALEXANDER
			15	16			CHEYENNE
			17	18			SMOKE RANCH

PBS&J

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING PLANNING SURVEYING GIS

901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014

Phone: (702) 263-7275 Fax: (702) 263-7200

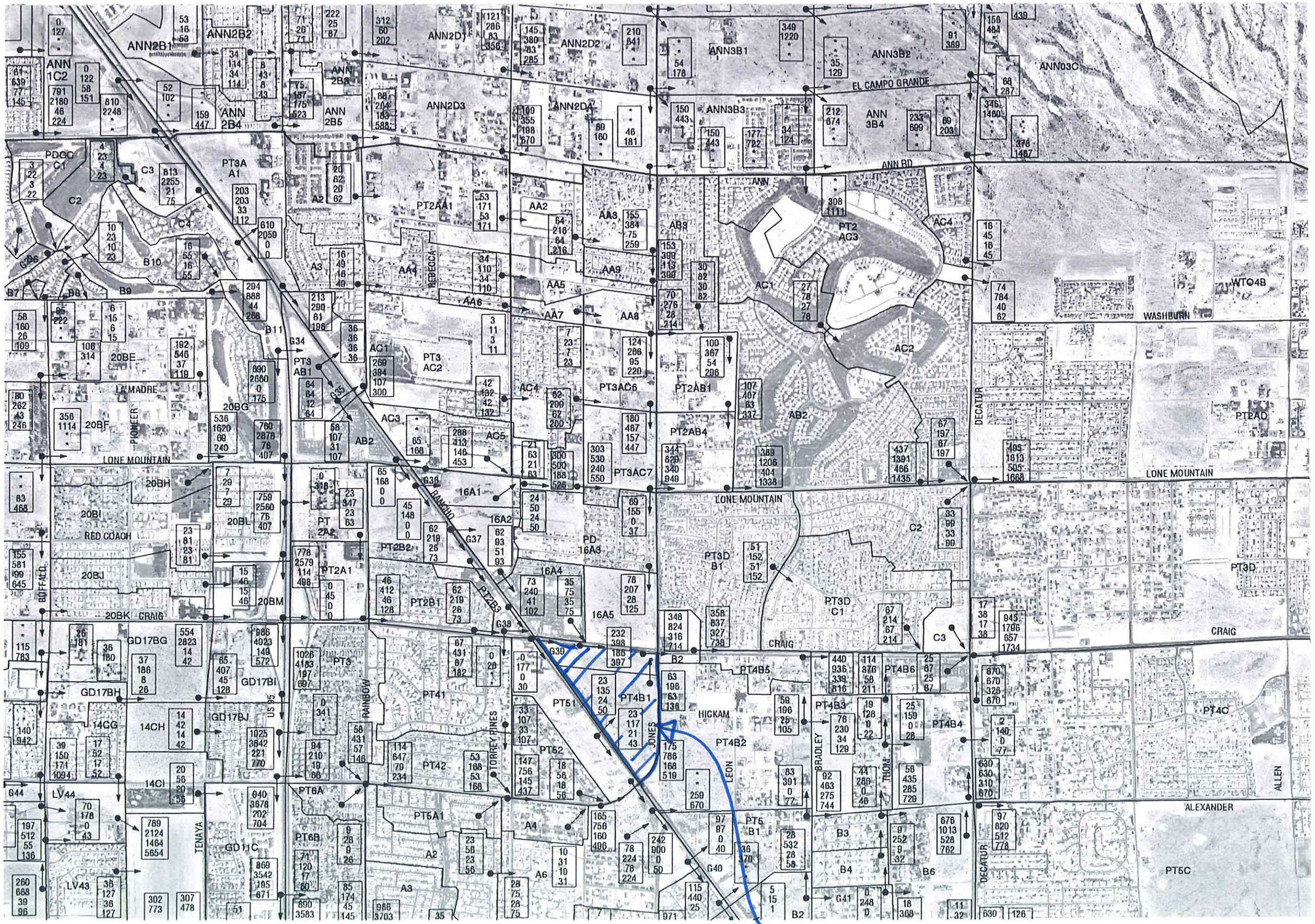


PHOTO DATE: APRIL 1996

CITY OF LAS VEGAS NEVADA

CITY WIDE HYDROLOGY STUDY UPDATE - 1997

LEGEND

- SUB-BASIN BOUNDARY
- FLOW ARROW

250	10-YEAR EXISTING FLOW
500	100-YEAR EXISTING FLOW
300	10-YEAR ULTIMATE FLOW
800	100-YEAR ULTIMATE FLOW

(FLOWS IN CFS)

NOTE:
Facility flows must be subtracted from flows shown to determine surface flows. (See "F" sheets for facility flows)

N
W E
S

1 INCH = 1600 FEET

FIGURE H-6

1	2			
3	4			
5	6			
7	8	9	10	
11	12	13	14	15
	16	17	18	19

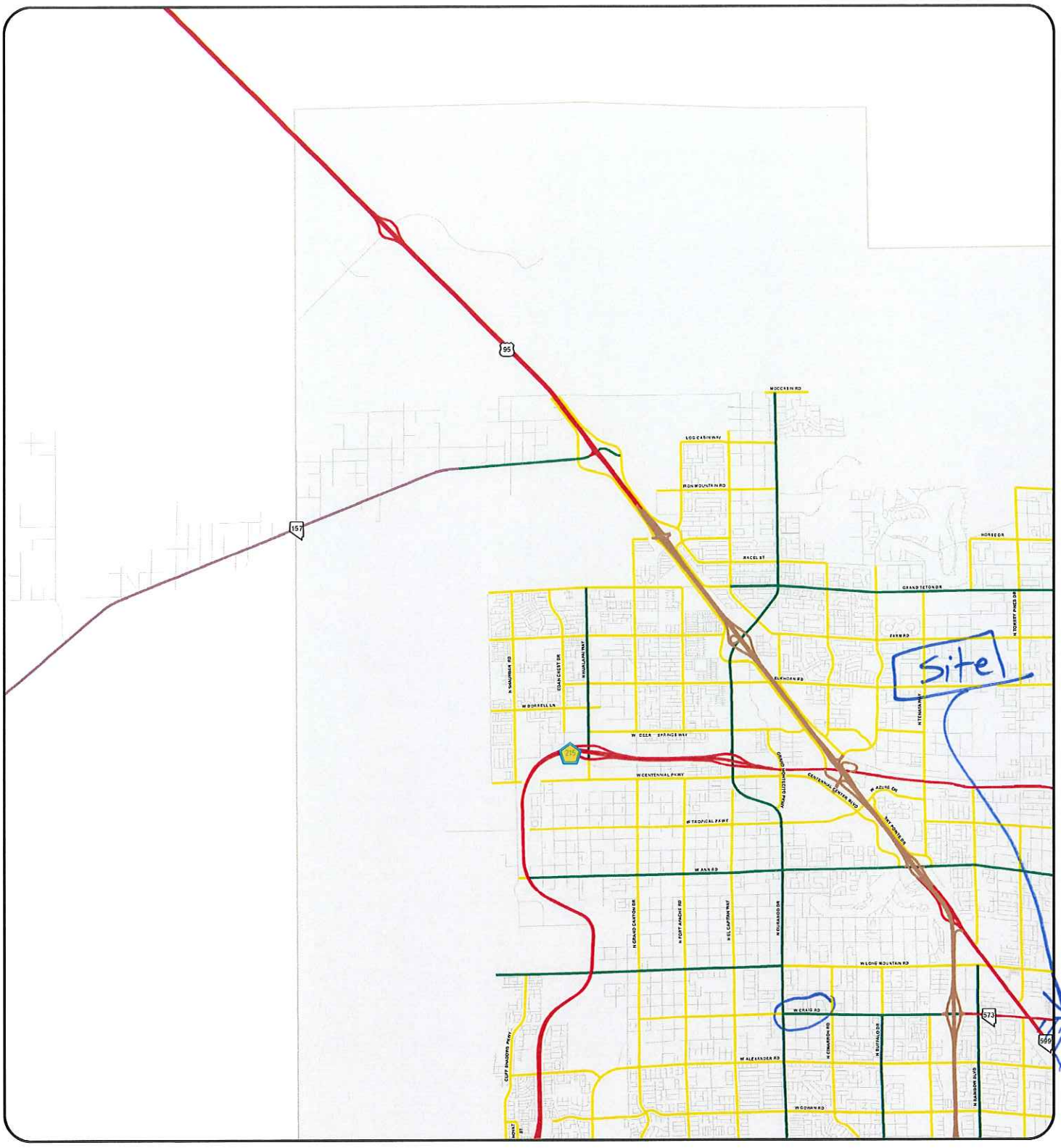
PBSJ POST, BUCKLEY, SCHUH & JERNIGAN, INC.

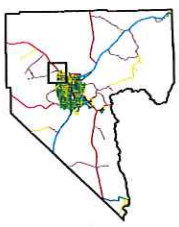
APPENDIX D

REFERENCES

Relevant Excerpts from NDOT Roadway Functional Classifications and

the 2006 "NDOT Drainage Manual", Second Edition





2015

PREPARED BY
THE NEVADA DEPARTMENT OF TRANSPORTATION

Existing	Proposed Unbuilt	
		1 Interstates
		2 Other Freeways and Expressways
		3 Other Principal Arterials
		4 Minor Arterials
		5 Major Collectors
		6 Minor Collectors
		7 Local Roads
		Urban Limits
		State Line
		County Lines

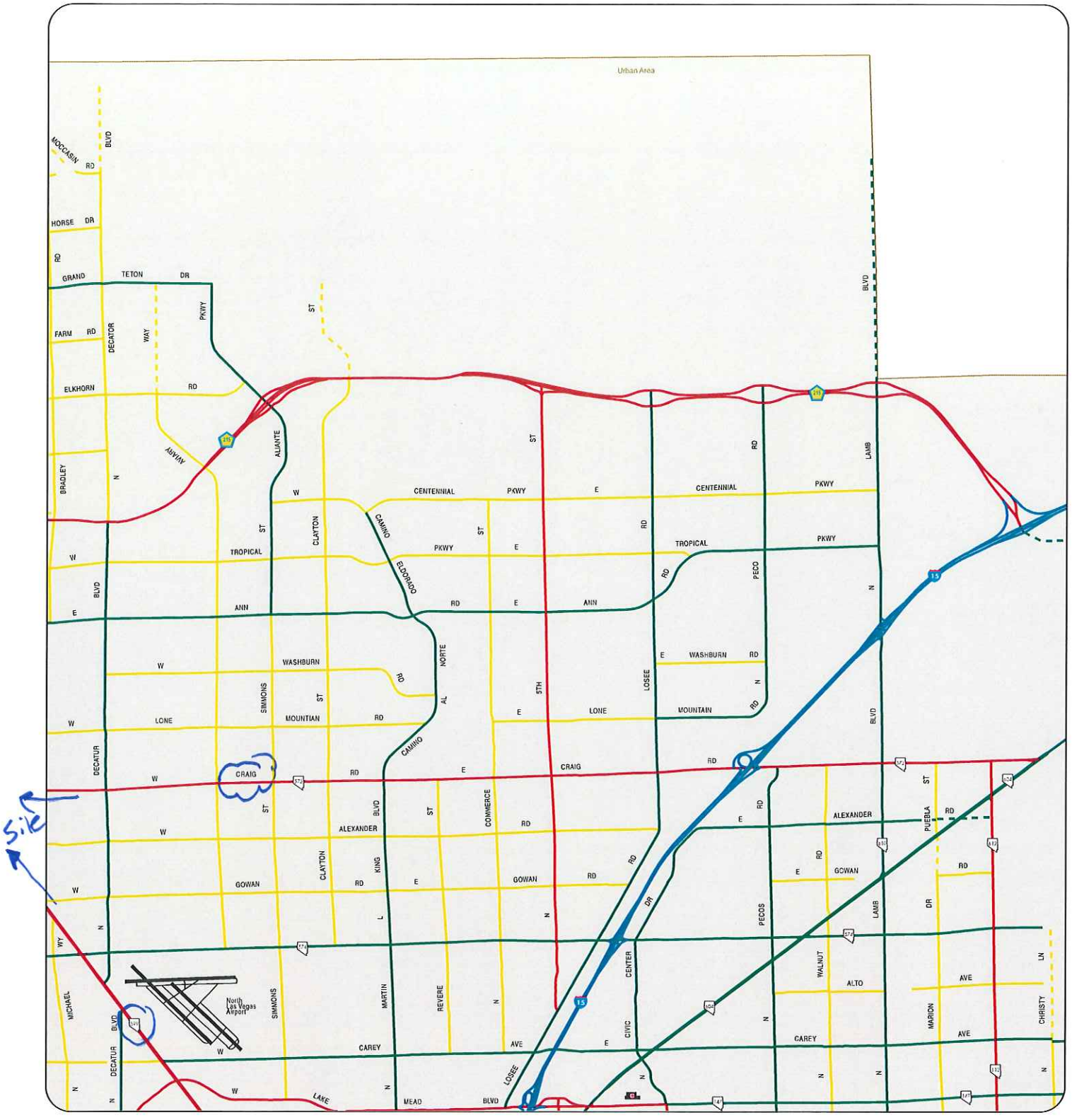
Miles
0 0.35 0.7 1.4 2.1 2.8

Craig (SR 573) & Rancho (SR 599)

ROADWAY FUNCTIONAL CLASSIFICATION

LAS VEGAS URBANIZED A-1

CLARK COUNTY, NEVADA



ROADWAY FUNCTIONAL CLASSIFICATION

LAS VEGAS A2 URBANIZED AREA

CLARK COUNTY, NEVADA

NEVADA DEPARTMENT OF TRANSPORTATION

NEVADA DOT

Jeff Fontaine, P.E.
Director

DRAINAGE MANUAL

Kenny Guinn
Governor

NDOT HYDRAULICS

Prepared By: Hydraulics Section
2nd Edition
December 2006

Section 3

3. Design Guidelines

3.1 Introduction

This section is intended to provide technical guidance and criteria for use in developing drainage designs, including a brief overview of available methods, and NDOT's interpretation of their applicability and limitations. The following are general hydraulic design guidelines:

- The level of design studies should be commensurate with the risk associated with the improvement and with other economic, engineering, social, or environmental concerns.
- Established drainage patterns within NDOT right-of-way shall be perpetuated and/or improved through the roadway prism to the extent practicable, up to the 100-year event.
- The design must be assessed to verify no adverse drainage effects have been created up to the 100-year event.
- Design of local regional flood control facilities within NDOT right-of-way shall conform to established local policies, criteria, and standards to the extent practicable.
- For impoundments and diversions, consideration should be given to water rights impacts.
- Consideration should be given to public safety when designing hydraulic facilities.
- The use of drainage systems (channels, detention basins, etc.) as multi-use facilities (parks, bike paths, etc) is not supported, unless all liability, maintenance, and ownership are assumed by a local entity. The CHE must be notified of any proposed multi-use facility.

3.2 Hydrology

3.2.1 General

For a complete discussion of hydrologic analysis, the reader is referred to Hydraulic Design Series No. 2 (HDS 2): Highway Hydrology, by FHWA, and Guidelines for Hydrology – Volume II, Highway Drainage Guidelines, prepared by AASHTO.

A design storm frequency shall be selected based on the facility to be designed and the roadway classification. Design storm frequency tables for various facilities are as follows:

Table 3-1
Roadway Surface Drainage Facilities

Roadway Classification (1)	Minimum Design Return Frequency (Years)	Maximum Allowable Spread Into Adjacent Travel Lane (3)
Interstate Highways (2)	25	0
Principal Arterials & Other Freeways and Expressways (2)	25	0
Other Principal Arterial	25	½ lane
Minor Arterial	10	½ lane
Rural Major Collector	10	½ lane
Urban or Rural Minor Collector	10	½ lane
Frontage Roads (if not classified)	10	½ lane

(1) Contact the NDOT Planning Division for the latest roadway functional classification maps.
(2) Including ramps
(3) Spread limits specified are as measured into the traveled lane beyond any available parking lanes, bike lanes, and shoulder widths. Turn pockets and bus turnouts are not considered as the travel lane. Auxiliary lanes are considered as travel lane.

Table 3-2
Design Storm Selection Guidelines for Off-Site Flow Facilities (Culverts, Channels, Bridges)

Roadway Classification (1)	Minimum Design Return Frequency (years) (2)
Interstate Highways (3)	50
Principal Arterials & Other Freeways and Expressways (3)	50
Other Principal Arterial	25
Minor Arterial	25
Rural Major Collector	25
Urban or Rural Minor Collector	10
Frontage Roads (if not classified)	10

(1) Contact the NDOT Planning Division for the latest roadway functional classification maps.
(2) If an existing roadway is known to have been designed for a higher return frequency than indicated in the above table, the higher return frequency shall be used for design.
(3) Including ramps.

The hydrologic analysis shall consider the existing and future 20-year development or ultimate build-out condition in the contributing watershed. Verify assumptions with the Principal Hydraulic Engineer (PHE). The existing conditions shall be evaluated based on current development and current flood control facilities in place. If proposed flood control

facilities are imminent or will be constructed within the same time frame as the project, they can be considered as existing (discuss with local agencies and PHE). The developed or future conditions of the watershed shall be modeled by assuming the upstream area has been developed in accordance with available land use planning information, judgment, and the assumption that all proposed master planned flood control facilities are in place. Typically the larger flow condition will be used for design.

3.2.2 Acceptable Methods

Several available hydrologic methods acceptable to NDOT and the circumstances and limitations of their use are listed below. Upon approval by the PHE, other appropriate methods may be used. Where possible, the hydrologic method used should be calibrated to local conditions and tested for accuracy and reliability. It is good practice to compare the results of other hydrologic methods to the chosen method. The hydraulic engineer must select the most appropriate hydrologic method for the watershed to be analyzed. The appropriate method is typically dependent on considerations such as available data, project complexity, required level of effort and accuracy, etc., and must be approved by the PHE. All hydrologic analyses shall include research of the flood history of the area (including maintenance records), available storm run-off data, and the effect these historical flows have had on existing structures.

The following provides a guide to hydrologic methods and their appropriate applications and limitations:

3.2.2.1 Rational Method

- The Rational Method shall be used only for drainage areas up to 200 acres.
- The Rational Method is typically used to determine design discharge rates for all storm drain system elements. However, for complex storm drain systems or where a hydrograph is needed (for peak timing or run-off volume), it is preferred to design the inlets and laterals using peak flows estimated by the Rational Method, and design the storm drain mainline, and/or detention basin using a synthetic hydrograph model, such as HEC-1. The two methods will often produce varied results, and therefore should be adjusted to produce reasonably consistent peak flows.
- For Clark County, rainfall intensities shall be developed in accordance with the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (HCDDM). Rainfall intensities for the remainder of the state shall be developed using the procedure outlined in National Oceanic and Atmospheric Administration (NOAA) Atlas 14, Precipitation-Frequency Atlas of the Western United States, Nevada.
- A minimum time of concentration (T_c) of 5 minutes is used for directly connected impervious drainage basins, such as on-site roadway surface basins. A minimum T_c of 10 minutes is used for basins including pervious areas. Subdivide basins into areas of similar hydrologic characteristics in order to develop an appropriate T_c.

- The hydrograph produced by the Rational Method is not appropriate for detention basin design due to the hydrograph time base. NDOT requires detention basins to be based on the 6 or 24-hour storm as appropriate.
- NDOT does not accept the use of the "Modified Rational Method" as defined in the CCRFD Manual in which a reduction factor is applied to the calculated flow rate.
- Depending on the terrain, the sheet flow component of the T_c generally occurs over distances much less than 300 feet (flat terrain), and typically less than 100 feet (steep terrain).

3.2.2.2 Regression Equations

- Regression equations are generally used to estimate peak flows for watersheds with limited data for which other hydrologic methods are impractical or infeasible.
- Regression equations may be used at sites within the limitations of the equations, and where the required accuracy of the analysis is commensurate with the equations.

3.2.2.3 Statistical Analysis

- Statistical analyses are used to estimate peak flows using recorded data. Where stream flow gage data is available, the Log Pearson III analysis shall be used provided there are at least 10 years of continuous or synthesized gage data for 10-year or more frequent discharge estimates and 25 years for 100-year discharge estimates (Reference WRC Bulletin 17b). Consider drought periods, watershed development and condition, facility construction or removal, type of run-off event, and other factors that may affect the statistical distribution.
- Statistical analysis results from hydrologically similar basins may be transferred to adjacent basins.
- For NDOT projects, statistical analysis of gage data is available from the USGS upon request. Real time and historical data is available online from USGS. Gage data may also be available from local entities.

3.2.2.4 Synthetic Modeling

- Synthetic modeling is used to develop peak flows or where a run-off hydrograph is required.
- Synthetic models using a unit hydrograph should not be used for watersheds over 100 square miles.
- The SCS (NRCS) unit hydrograph method shall be used to develop a unit hydrograph.
- Within Clark County, rainfall distribution shall be developed in accordance with the CCRFCD manual. Rainfall distribution for the remainder of the state shall be developed using the procedure outlined in NOAA Atlas 14, Precipitation-Frequency Atlas of the Western United States, Nevada, referred to as the "Balanced Storm." With sufficient justification, alternate storm distributions may be used with approval of the PHE.

- Watershed T_c and Lag Time shall be computed using SCS TR-55 (1986), United States Bureau of Reclamation (USBR) Flood Hydrology Manual, (1989), of Federal Aviation Administration (FAA) equations (1970). Refer to the CCRFCD manual and the Washoe County manual for usage guidelines and limitations.
- Additional information regarding land use (Clark County, Washoe County) and soil types (Natural Resources Conservation Service) can be found online.
- Within Clark County, routing methods shall be developed in accordance with the CCRFCD Manual. Use the Muskingum, Muskingum-Cunge or Kinematic Wave channel routing for the remainder of the state. The Modified-Puls method shall be used for reservoir routing.

3.2.2.5 Other Methods

- Local published hydrologic methods may be used with prior written approval by the PHE.
- The 100-year discharges specified in FEMA Flood Insurance Studies shall be used to analyze impacts of proposed projects in regulatory floodways and floodplains. If the published flows appear to be outdated, values based on current hydrologic methods may be used subject to approval from necessary regulatory agencies. Verification that the published discharges are reasonable must be completed prior to using the flow values for design.
- Locally accepted flows presented in local flood control master plans may be used with concurrence of the PHE.

3.3 Hydraulic Design Guidelines

3.3.1 General

Following are hydraulic design guidelines and criteria. For more detailed information, refer to the appropriate references listed in Section 3.3.12 (Design References).

3.3.2 Roadway Surface Systems

3.3.2.1 General

Roadway surface drainage facilities collect storm water run-off from the pavement and contributing adjacent area and convey it through the roadway right-of-way to an appropriate outlet. Roadway surface drainage facilities, a.k.a. on-site systems, consist of curbs, gutters, drop inlets, storm drains, median ditches, and roadside ditches.

For more design and engineering guidance, refer to the Federal Highway Administration publication, "Urban Drainage Design Manual" (HEC 22). On-site systems should be evaluated for unanticipated impacts (areas of ponding, flow diversion, etc.) resulting from 100-year rainfall. Consult with PHE to assess the level of effort needed for evaluation and mitigation.

3.3.2.2 Design Criteria and Guidelines

- The on-site system design frequency shall be based on Table 3-1 (Roadway Surface Drainage Facilities).
- For all roadway surface flow spread calculations use a Manning's "n" value of 0.015.
- When practicable, roadway surface drainage facilities shall be designed to collect all flows reaching the roadway surface. This would include run-off generated both on the roadway itself, and flows reaching the roadway prism from upstream and adjacent basins such as parking lots or cross streets that direct flows onto the roadway surface. If significant off-site flows are directed into the on-site system, that system must be designed to accommodate those flows. Consult with the PHE for these cases.
- The outlets of storm drains shall be designed considering the potential for flow diversion, outlet erosion, safety, etc.
- Where roadway widening is expected in the future, the onsite system shall be designed to be compatible with the ultimate roadway configuration to the extent possible. At a minimum, consideration shall be given to drop inlet and manhole location, storm drain trunk line capacity and location, and impacts of increased peak flow at storm drain outlet.
- The 100-year event (developed conditions flows) must be evaluated to the extent necessary to ensure no adverse impacts are created. For example, at sag locations or where a long system is bordered by barrier rail and cumulative bypass flow could become significant, or where storm drain outlets discharge to detention structures or other facilities susceptible to failure.
- Gutter grades should not be less than 0.3 percent for curbed pavements (not less than 0.2 percent in very flat terrain). Minimum grades can be maintained in very flat terrain by use of a "saw tooth" profile. Special care must be taken when roadway surfaces are created from vertical curves and/or super elevations that reduce the available gutter slopes.
- A minimum two (2%) percent typical cross slope is desirable for all roadway surfaces. The typical roadway cross slope shall not be less than 1.5 percent without CHE approval.
- The on-site system shall be designed to minimize flows across the traveled way, such as at reverse super elevations and gore locations. Flows directed onto bridges should also be minimized, especially in areas where freezing temperatures are expected. Concentrated flows across the traveled way or onto bridges shall be limited to a maximum of 0.25 cfs (this is measured as the bypass at the last inlet, which is usually at the point of 1% cross slope).
- Bituminous shoulder dike heights greater than three inches require the approval of the CHE. Use of six inch high dike requires approval of the Chief Road Design Engineer.

3.3.2.2.1 Inlets (Roadway Surface and Infield)

- Inlets shall be placed to intercept flows to meet the spread criteria as shown in Table 3-1 (Roadway Surface Drainage Facilities), and designed in accordance with HEC-22, Urban Drainage Design Manual, FHWA. Larger inlets, i.e., inlets collecting off-site flows, may require additional design consideration. Coordinate these instances with the PHE.
- Bicycle/Pedestrian safe grates shall be used for all areas where bicycle/pedestrian traffic is expected.
- Infield grates, such as the NDOT Standard Type 2A, can be used where debris is expected or high efficiency is required, however, this type of grate shall not be used where pedestrian traffic is expected.
- At super elevation reversals, place inlets where the cross-slope reduces to approximately 1% and limit design flow bypass to 0.25 cfs. On a case-by-case basis and in long transitions, especially where the distance between the last inlet and the reverse super elevation exceeds 100 ft, the hydraulic engineer and the roadway designer shall work closely to minimize risks associated with bypass flow. Placing an additional drop inlet at approximately 0.5% and minimizing the bypass flow to 0.1 cfs should be considered.
- Coordinate with Roadway Design to avoid cross slope reversals near vertical curve high or low points. This creates flat areas on the roadway surface that accumulate water and cannot efficiently be drained.
- Sag locations are determined by the roadway profile, super elevation, and gore details. Super elevation transitions in sag locations should be avoided, however, if unavoidable, ensure the true low point is accurately located by considering both the profile grade and cross slope.
- If special details are provided in the plans, i.e., gore details, intersection grading, etc., the elevation information included in these details will generally supersede the plan and profile sheets (coordinate with Roadway Design team).
- For capacity calculations, longitudinal and transverse slopes at inlets must be consistent with the roadway profile and super elevation plans. If a Digital Terrain Model (DTM) is used, the hydraulic engineer must verify the DTM accurately portrays the profile information.
- For inlets in a vertical curve and/or a super elevation transition, determine the instantaneous longitudinal slope at the grate by determining the elevation at the grate, and at 10 feet upstream. The slope between these two points will be considered the instantaneous slope at the grate.
- It is not necessary to include a clogging factor for inlets on grade, unless debris is known to be a problem. Use a minimum 25% clogging factor for inlets on grade that are expected to be subject to debris. Use of a larger clogging factor requires the approval of the PHE. Apply a clogging factor by reducing the actual grate front and side dimensions by 25% in capacity calculations.

- In sag locations, a 50% clogging factor shall be applied by providing double the required inlet capacity (If in orifice flow, assume half of the open area is clogged, if in weir condition, assume half of the weir length is ineffective).
- For sag locations where a clogged inlet could result in ponding depths greater than one foot, design the sag inlet as described above and provide two (2) additional flanker inlets. Each flanker inlet shall have the same effective perimeter as required for the sag inlet prior to application of the 50% clogging factor. The flanker inlets should be placed at an elevation of 0.37 times the allowable ponding depth (as determined by the allowable spread) above the sag inlet. This design approach will provide the required inlet capacity at the allowable ponding depth if the sag inlet should become fully clogged and assumes that the sag and flanker inlets operate as weirs. The same general design philosophy shall be used for the rare cases in which the sag inlet operates as an orifice at the allowable ponding depth. Orifice situations shall be designed on a case-by-case basis. The design must also be checked for 100-year flows.

3.3.2.2.2 Suggested inlet spacing procedure

Optimizing the placement of roadway surface inlets in terms of function and cost is an iterative process. Any reasonable, logical approach is acceptable, as long as the design is easily followed and the resulting system is optimized. The following is a brief summary of the preferred approach:

1. Place inlets at all necessary locations (sags, reverse super elevations, ends of barrier rail, major intersection, etc.)
2. Determine allowable spread widths.
3. Determine approximate spacing needed to meet spread widths, and tentatively locate inlets.
4. The next steps are iterative. Connect the system with a preliminary storm drain layout. Optimize the layout considering manhole spacing, inlet interception and bypass, lateral locations, outfall locations, etc. Use of trench drains or larger inlets may help optimize spacing.

3.3.2.2.3 Storm Drains

- Storm drain systems shall be analyzed using hydraulic grade line computations. Refer to HEC-22 for design guidance. Grade line computations are not required for a single inlet down drain.
- Storm drains should normally be sized on the assumption that they will flow full or partially full under the design discharge but will not be placed under pressure head. If pressure flow is unavoidable, the hydraulic gradient shall remain at least one (1) foot below the ground surface for the design flow. The intent is to ensure trunk line flows do not exit the system through inlets or manholes.

- Maintain a minimum flow velocity in storm drain trunk lines (more than 2 upstream inlets) of 3 feet per second at the design flow, modeled with standard hydraulic grade line computations. For laterals (2 or less upstream inlets), a minimum of 3 feet per second shall be maintained at the design flow under normal depth conditions.
- Design pipes with a minimum slope of 0.3 percent. Where necessary, this slope can be less, but in no cases less than 0.2 percent.
- Minimum pipe diameters for storm drains are 18 inches for trunk lines, 15 inches for lateral connectors, and 12 inches for down drains.
- Conduit cross section shall not decrease in the downstream direction.
- Select appropriate conduit "n" values according to HEC-22 guidance.
- Debris blockage potential, maintenance issues, cost implications, and physical constraints influence the number of inlets that can be connected in series.
- Alignments of storm drains should be set using tangent sections and angle points as opposed to radii, for constructability reasons.

3.3.2.2.4 Manholes

Manholes are utilized to provide access to continuous underground storm drains for inspection and cleanout.

- Manholes are required where two (2) or more storm drains converge, at a maximum spacing along tangent sections, where pipe size changes, where vertical or horizontal alignment changes more than 10 degrees, and at the intersection of laterals to trunk lines. Exceptions to the above are allowed based on site conditions and maintenance accessibility. For example, a manhole may not be required at the junction of a short, shallow lateral and a storm drain trunk line.
- Manholes should not be located in traffic lanes. However, when it is impossible to avoid locating a manhole in a traffic lane, care should be taken to ensure it is not in the normal vehicle wheel path. Locating manholes in intersections is to be specifically avoided.
- A minimum difference of 0.1'shall be provided between the inlet and outlet pipe invert elevations in a manhole or drop inlet.
- Allow a minimum of six inches separation between pipe penetrations in manholes.
- For storm drains with diameters 24" or less, the maximum spacing for manholes is 300'. For pipes over 24" in diameter, a 400' maximum is required for manhole spacing.

3.3.2.2.5 Roadside and Median Ditches

- For ditches that collect significant off-site flows, refer to Section 3.3.3 (Channels - off-site flow).
- Roadside and median ditches shall be designed to the recurrence interval specified in Table 3.1 (Roadway Surface Drainage Facilities).
- Judgment must be applied to determine appropriate freeboard. Consider freeboard requirements based on depth, velocity and amount of flow, maintenance, constructability, and consequence of flow breakout. Generally, appropriate freeboard will be between 0 and 1 foot.
- All ditches must be designed to be stable (non-erosive) during the design event (refer to HEC-15 for design guidance).
- For ditches within clear zone limits, refer to AASHTO Roadside Design Guide and consult with Roadway Design personnel for traversable geometry guidance.

3.3.2.2.6 Bridge Deck Drainage

- Attempt to collect 100% of the roadway surface water prior to flowing onto the bridge deck. If this is not feasible, flow onto the bridge shall be limited to 0.25 cfs. Avoid placing inlets in the approach slab.
- Longitudinal drainage on long bridges should be provided by scuppers or inlets sufficient in size and number to meet the spread criteria refer to Table 3-1 (Roadway Surface Drainage Facilities).
- Downspouts, where required, should be made of rigid corrosion-resistant material not less than six inches in diameter and should be provided with cleanouts.
- Deck drains and downspouts shall be designed to prevent the discharge of drainage water against any portion of the structure, embankments, slope pavement, slope protection, onto moving traffic below, railroad tracks, onto private property or into environmentally sensitive areas. Prevent erosion at the outlet of the downspout.
- Zero gradients and sag vertical curves should be avoided on bridges. The minimum typical bridge deck cross slope and longitudinal slope shall be 1.5 percent and 0.5 percent, respectively. Use of lesser typical slopes requires CHE approval.

- Channel design incorporating curves must account for flow super elevation.
- For channels within clear zone limits, refer to AASHTO Roadside Design Guide for traversable geometry guidance.

3.3.3.2.2 Natural Channels

- Environmental impacts of channel modifications, including disturbance of fish habitat, wetlands, riparian vegetation, and stream bank stability shall be assessed. The channel design shall minimize these impacts, and mitigation shall be provided as appropriate.
- If relocation of a stream channel is unavoidable, the cross-sectional shape, meander, pattern, roughness, sediment transport, and slope shall conform to the existing conditions insofar as practicable.

3.3.4 Culverts

3.3.4.1 General

In-depth culvert design guidance can be found in the FHWA publication Hydraulic Design Series Number 5 (HDS 5), "Hydraulic Design of Highway Culverts".

3.3.4.2 Design Criteria & Guidelines

- The design flow selected shall be consistent with the class of highway and commensurate with the risk at the site. Table 3-2 (Design Storm Selection Guidelines for Off-Site Flow Facilities) shall be used to establish the minimum design event for all culverts.
- Flow conditions for culverts must be analyzed for the existing and future conditions 100-year event. Mitigation must be provided if the 100-year flow conditions within or outside of NDOT right-of-way are unreasonably aggravated.
- When necessary culverts shall be designed to accommodate debris or proper provisions shall be made for debris maintenance, i.e., debris rack (refer to Section 3.3.4.3 and HEC-9 for guidance).
- Culvert plan and profile layout shall be designed to avoid sediment accumulation in culvert barrels. Detailed sediment transport analysis may be required where significant sedimentation issues are anticipated. When determining which sediment transport analysis method should be used, consideration should be given to the final channel geometry, channel bed stability (aggradation, degradation) debris potential, design stage, backwater magnitude resulting from the structure, median sediment size and overall watershed condition.
- Depending on District maintenance requirements, access for personnel and equipment shall be provided to facilitate culvert maintenance.

- The minimum culvert diameters shall be 24" on interstate systems and 18" elsewhere.
- Follow manhole placement guidelines as described in Section 3.3.2.2.4 (Manholes).
- Use arch or oval shapes only if required by hydraulic limitations, site characteristics, structural criteria, or environmental criteria.
- The culvert skew shall not exceed 45 degrees as measured from a line perpendicular to the roadway centerline without the approval of the PHE.
- Outlet protection shall be considered for all culverts with erosive outlet velocities (see HEC-11, HEC-14). Judgment must be applied in all cases, considering site conditions (soils, slope, existing conditions velocity, existing conditions erosion, etc.), when evaluating the need for outlet protection.
- Flotation potential of flexible culverts shall be evaluated by comparing the vertical hydrostatic uplift force with the combined weight of the culvert and soil overburden. Anchorage and other methods shall be used to prevent flotation.
- Select appropriate conduit "n" values according to HDS-5 guidance.
- The maximum allowable ponding elevation for the design flow is the edge of the roadway pavement. Additional consideration (seepage / piping, buoyancy, etc.) should be given if the headwater is over 1.5 times the diameter of the culvert.

3.3.4.3 Debris Racks and Grates

- Racks and grates should be considered as part of design in areas with high debris load, where the culvert is long, and for culverts that present an "attractive nuisance". Provide a minimum net open area of two times the culvert entrance.
- In urban areas, consider using access control grates for culverts with smallest dimension of 4 ft and longer than 1000 ft. Use of access control grates must be based on an economic analysis that considers flooding impacts, cost of grate, right of way impacts, and long term maintenance costs (20 - years).
- Selection of rack or grate type must be based on cost and available maintenance equipment.

3.3.4.4 Traffic and Safety Considerations

- The AASHTO Roadside Design Guide establishes a "clear zone" in which obstructions to the traveling public should be avoided or mitigated. Coordinate drainage design clear zone issues with the Roadway Design Engineer. Refer to the AASHTO Roadside Design Guide for roadside safety considerations relative to drainage facilities.
- Consider fencing where drainage facilities present an "attractive nuisance," or safety hazard.

- Typically, infield grates can be used in areas within NDOT control of access, and locations where a minimum of 10 feet is maintained away from expected pedestrian traffic areas.

3.3.5 Bridges

3.3.5.1 General

Bridges are hydraulically defined as structures that operate in a free water surface condition for the design flow rate. Bridges ordinarily lack an integrated floor and typically span drainage ways as well as manmade structures. Structures designed as described above are treated in this section.

3.3.5.2 Design Criteria & Guidelines

Table 3-2 (Design Storm Selection Guidelines for Off-Site Flow Facilities) shall be used to establish the minimum design flood. See Section 3.3.2.2.6 (Bridge Deck Drainage) and Table 3-1 (Roadway Surface Drainage Facilities) for bridge surface drainage considerations. Table 3-2 (Design Storm Selection Guidelines for Off-Site Flow Facilities) relates the minimum required flood design frequency to functional classifications of roadways. Deviations from this Table may be warranted based on local site conditions, economic consideration, and/or risk analysis. Revisions will require prior (written) approval of the Chief Bridge Engineer and Chief Hydraulic Engineer.

- The 100-year event must be checked in all cases to ensure that no adverse flooding impacts are created to adjacent properties.

- Backwater increases over existing conditions shall conform to FEMA regulations for sites covered by the National Flood Insurance Program (NFIP). In general, a backwater increase of no more than 1 foot is allowed during the passage of the 100-year flood, if practicable, for sites not covered by NFIP. All increases in backwater must be assessed for upstream impacts. Mitigation must be provided if the 100-year flow conditions within or outside of NDOT right-of-way are unreasonably aggravated.

- Where feasible, a minimum freeboard of two (2) feet shall be provided between the design water surface elevation and the low chord of the bridge to allow for passage of debris. Where this is not feasible (depending on type of structure, site conditions and economic considerations), the freeboard should be based on the type of stream and level of protection desired as approved by the PHE.

- The proposed facility shall not cause unreasonable change in the existing flow distribution.

- When needed, channel and abutment protection measures through bridge crossings shall be designed for the lesser of the 100-year or overtopping event. Additional

REFERENCE 5

"Technical Drainage Study for Murphy Express"
(DS 4771)

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: February 3, 2016
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Murphy Express**			**COPIES TO:** Lochsa Engineering
Cross Streets:	SWC of Craig Road & Jones Boulevard			Eastern Real Estate, LLC
File Number:	F:\Depot\DSMemos\DS4771B.doc			Bart Anderson, P.E., DevCo
Parcel Number:	138-02-702-001			NDOT
Zoning Action:	TMP-60902; SUP-61781 & SDR-61785			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	12/16/2015	1/6/2016	Not Approved	$400.00	426560: $400
2nd Submittal	1/19/2016	2/3/2016	See Comments Below	$400.00	429810: $400
			TOTAL FEES (LDDRS):	**$800.00**	-----

REMARKS:

The Drainage Study for the subject project has been reviewed and:

X	is approved subject to conformance to all City standards and the following conditions:
	must be resubmitted or supplemented including the following:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
	is conditionally approved subject to Clark County Public Works Department concurrence.

1. The project proposes to construct facilities (driveway cut) within *Nevada Department of Transportation* (NDOT) right-of-way (***Craig Road***). The engineer must contact NDOT for encroachment permit for the proposed project.

2. The proposed temporary asphalt sidewalk in ***Rancho Drive*** is within the jurisdiction of the *State of Nevada*. Obtain approval and all necessary permits from *Nevada Department of Transportation* (NDOT) prior to the final acceptance of the subject improvement plans by the ***City of Las Vegas***.

3. On **Sheet C3.0** (Overall Grading Plan), remove "FUTURE" in the 5'-AC sidewalk construction notation for this is to be constructed concurrently with the subject "***Murphy Express***" development.

4. For the subject development of ***Murphy Express Gas Station***, the offsite flows from the two existing culverts in ***Rancho Drive*** do not present any apparent impact to the proposed improvements. However, in the future when an overall master site plan becomes available, a master technical drainage study will be required to address and to dedicate a public drainage easement (privately maintained) from each of the culverts across the whole site. The public drainage easements must be recorded by separate document prior to the final approval of the master technical drainage study and the improvement plans.

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Update and accepted by the *City of Las Vegas Flood Control Section.* Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the *City of Las Vegas* reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

NOTE: Please be advised that all land surface area disturbances over 1 acre or any area adjacent to a water way must submit to the *Nevada Division of Environmental Protection* a "Notice of Intent" to discharge that certifies a stormwater pollution prevention plan has been developed and is maintained on site; for inclusion in the Stormwater General Permit No. NVR100000. A phased construction unit in a contiguous subdivision is considered under construction until all stripped or disturbed surface areas have been covered by paving, building construction or planting. For more information, including forms and applications see http://ndep.nv.gov/bwpc/storm01.htm or call (775) 687-9429.

END OF REMARKS
ays

T/R/S: T20S/R60E/02
AREA L-02

STATE OF NEVADA
DEPARTMENT OF TRANSPORTATION

P. O. Box 170
Las Vegas, Nevada 89125-0170
January 27, 2016

BRIAN SANDOVAL, *Governor*

RUDY MALFABON, P.E., *Director*

Mr. William S. Parris, Managing Member
Parris Robinson Eastern LLC
510 Castillo Street
Santa Barbara CA 93101

SUBJECT: District Permit No. 204470-2016

To Whom It May Concern:

You are hereby advised to read and abide by the "Terms and Conditions Relating to Right-of-Way Occupancy Permits" booklet attached and any additional conditions which have been added to and listed on page 2 of your permit.

If you have any questions or desire further information on this matter, please feel free to contact me at 671-6610.

Sincerely,

Thaddeus V. Stephenson

(FOR) Rudye D. Lucero
District I Permit Coordinator

725-1

Fee $1000.00 Permit No.
Milepost SR573, CL, 1.192-1.256 District ONE
District No.: 20470-2016
Applicant: PARRIS ROBINSON EASTERN LLC
Type of Work: INSTALL 22 LF OF 18" RCP & (1) 84988 COMMERCIAL APPROACH RT.
Work Order # 2015/1.51

FOR DEPARTMENT USE ONLY

APPLICATION AND PERMIT FOR OCCUPANCY OF
NEVADA DEPARTMENT OF TRANSPORTATION RIGHT-OF-WAY
(Under the provisions of NRS 408.423, 408.210 and NAC 408)

1. Location where excavation, construction, installation and/or occupancy is proposed

CRAIG ROAD (SR 573) — Local name of highway
JONES BLVD — Street address or nearest cross street

2. Describe in detail the type and scope of work; capacity or size of facility; stages and time frame for development; scheduled dates for start and completion. Attach 4 sets of detailed plans or drawings.

PROJECT IS PROPOSING TO REMOVE APPROXIAMTELY 76.0 LF OF EXISTING C & G AND SIDEWALK ON BEHALF OF PARRIS ROBINSON EASTERN LLC.
THESE IMPROVEMENTS ARE TO ENHANCE INGRESS / EGRESS MOVEMENT INTO PROPERTY NEAR S/W CRNR OF CRAIG ROAD @ JONES BLVD. CONSTRUCT ONE RADIUS STYLE DRIVE APPROACH, TWO HANDICAP RAMPS, INSTALL ONE (1) 'ONE WAY SIGN' AND ~ 22 LF OF 18" RCP FOR CONNECTION INTO EXISTING DRAINAGE FACILITIES.

CLV # TBD APN 138-02-702-001
CONSTRUCTION COMMENCES ASAP FROM NDOT PERMIT RELEASE
CONSTRUCTION DURATION IS NOT TO EXCEED TWELVE MONTHS

3. PERMITTEE hereby acknowledges that he has read and received a copy of the specific Terms and Conditions Relating to Right-of-Way Occupancy Permits issued by the State of Nevada Department of Transportation, and accepts said terms and conditions and any additional terms and conditions stated in this permit.

4. **SPECIFIC TERMS AND CONDITIONS APPURTENANT TO THIS PERMIT ARE LISTED ON PAGE 2.**

5. THE PERMIT SHALL BE SIGNED AND RETURNED TO THE DISTRICT OFFICE.

PARRIS ROBINSON EASTERN LLC
Name of PERMITTEE (Type or Print)

WSParris
Signature of PERMITTEE — WILLIAM S. PARRIS

510 CASTILLO STREET
Address

MANANGING MEMBER
Title

SANTA BARBARA CA 93101
City, State, Zip

January 13, 2016
Date of Application

(805) 898-2023 — Phone No.
(805) 898-9913 — Fax No.

CLV # TBD / APN 138-02-702-001
Permittee's I.D. No. or Parcel No.

Addendum to Technical Drainage Study For Murphy Express (SWC Craig Rd. & Jones Blvd.)

January 2016

Prepared for:

Eastern Real Estate, LLC
120 Presidential Way, Suite 300
Woburn, MA 01801
(708) 717-6211

Prepared by:

LOCHSA ENGINEERING
6345 South Jones Boulevard
Suite 100
Las Vegas, Nevada 89118
(702) 365-9312

Lochsa Job # 151068

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Murphy Express at Craig Rd. and Jones Blvd. Date: January 14, 2016

Location of Development: a) Descriptive (Cross Streets) North/South: Jones Blvd.

East/West: Craig Rd.

b) Section: 02 Township: 20 South Range: 60 East

c) APN : 138-02-702-001

Name of Owner: Dan Sullivan

Telephone No.: (708) 717-6211 Fax No.: E-Mail Address:

Address: 120 Presidential Way Woburn, MA 01801

Contact Person-Name: Chris Blake, EI **Telephone No.:** (702) 365-9312

*** E-Mail Address:** chris.blake@lochsa.com **Fax No.:** (702) 365-9317

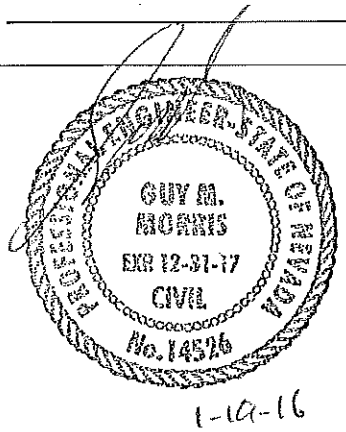
Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 24.06 +/- Acres Being Developed/Disturbed: 1.03 +/- Acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No
4. Proposed type of development (Residential, Commercial, Etc.): Commercial (Retail)
5. Approximate upstream land area which drains to the subject site: N/A
6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation:
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site:
   To an onsite sump grate inlet where the onsite flow ultimately discharges into the existing 60" RCP facility that runs along the south side of Craig Road. If there is clogging, there is an emergency overflow path that will direct flow to Craig Rd
8. Briefly describe your proposed schedule for the subject project: ASAP



1-12-16

Engineer's Seal

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

***New Required Field**

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

T 702-365-9312 | F 702-365-9317
6345 S Jones Blvd, Suite 100
Las Vegas, NV 89118

Lochsa engineering

January 19, 2016

Albert Sung, P.E.
Public Works – Development and Flood Control
333 North Rancho Drive
Las Vegas, Nevada 89106

Subject: Addendum to Technical Drainage Study for Murphy Express – Craig Rd. & Jones Blvd.
CLV Number DS4771A
Lochsa Engineering Project Number: 151068

Dear Mr. Sung,

Lochsa Engineering is in receipt of your comment letter dated January 6, 2016 for the above referenced project. In response to your comments, the following responses are being offered:

1. Provide a copy of the zoning/planning conditions associated with this site (**TMP-60902; SUP-61781 & SDR-61785**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.

Response 1: Noted. A copy of the zoning/planning conditions (**TMP-60902; SUP-61781; SDR-61785**) for this site has been provided with this submittal in Appendix A.

2. The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way (***Craig Road***). The engineer must contact NDOT for encroachment permit for the proposed project.

Response 2: In existing conditions, the flow from large portion of the Rancho/Craig parcel (the northern 24.06-acre parcel) and the subject Murphy Express site discharge northeasterly onto Craig Road. This flow (analyzed as developed) is a portion of the referenced Craig Road flows from the ***CLV Northwest Neighborhood Stud***. As shown in Figure E—12 of ***CLV Northwest Neighborhood Study***, the entire north portion of the Rancho/Craig parcel is portion of basin PD16A5(47/113cfs). Thus, large portion of the Rancho/Craig parcel is expected to ultimately drain onto Craig Road. Please note that the referenced flow (489cfs-100yr) from the ***CLV Northwest Neighborhood Study*** is actually downstream of our site and assumes major flows from Jones Boulevard (north and south of the intersection with Craig Road. However, this more conservative flows were conservatively used to represent the flows along the project site. We have included

reference material from the hydrology model of the ***CLV Northwest Neighborhood Study*** to clearly show our site was included as a portion of the flows running along Craig Road discharging east toward the intersection of Jones Blvd. and Craig Road.

The Murphy Express (portion of the Rancho/Craig parcel) the site was delineated as basin NXA(1/3cfs) and NDA(2/3cfs) for the existing and developed conditions, respectively. Thus, the only increase is approximately 1cfs during 10-year storm events. However, the entire runoff form NDA is designed to drain into a proposed 18" RCP lateral (into the back of the existing drop inlet), which drains into the existing 60-inch RCP storm drain facility (300cfs capacity) along the south side of Craig Road. Therefore, the improvement will not result in any increase to the Craig Road (NDOT right-of-way) flows in the interim/developed conditions.

In addition, due to the large watershed draining onto Craig Road, any increase in the onsite local flows is not expected to affect the Peak flow value along Craig Road. As shown in the attached relevant HEC-1 model from the CLV Neighborhood Study, the combination point C16A4(2/168cfs) represents Craig Road flows along the project site. The HEC-1 model illustrates that the hydrograph peak for C16A4 is approximately 3.67hours (i.e. 3(hours): 40(minutes), which is actually much less than expected peak time, due to the use of several diversion/retrieval cards). The previously submitted HEC-1 model for the existing and developed (ultimate) conditions is revised to include the full hydrograph for basins NXA and NDA. As sown in the attached output, at 3hr:40min the developed basin NDA results in equal(or less) contribution to Craig Road peak flows for the 10- and 100-year events.

Similarly, the remaining portion of the Rancho/Craig parcel was delineated as basin OFX2(11/23cfs) and OFD2(15/28cfs) for the existing and developed conditions, respectively. As shown in the revised HEC-1 output, at 3hr:40min the developed basin OFD2 results in less contribution to Craig Road peak flows for the 10- and 100-year events.

From all of the above, it is expected that the improvement of the subject Murphy Express and the northern portion of the Rancho/Craig parcel will not result in any increase to the Craig Road (NDOT right-of-way) flows in the interim or developed conditions.

3. The proposed temporary asphalt sidewalk in ***Rancho Drive*** is within the jurisdiction of the *State of Nevada*. Obtain approval and all necessary permits from *Nevada Department of Transportation* (NDOT) prior to the final acceptance of the subject improvement plans by the ***City of Las Vegas***.

Response 3: Noted.

4. In the proposed Tentative Map, provide the following note in the 1-Lot Commercial Plat: "**ALL SUBDIVIDED PARCELS COMPRISING THIS COMMERCIAL SUBDIVISION SHALL PROVIDE PERPETUAL INTER-SITE COMMON DRAINAGE RIGHTS ACROSS ALL EXISTING AND FUTURE PARCEL LIMITS**".

Response 4: Noted. The note has been added on the proposed Tentative Map in the 1-Lot Commercial Plat.

5. For the subject development of ***Murphy Express Gas Station***, the offsite flows from the two existing culverts in ***Rancho Drive*** do not present any apparent impact to the proposed improvements. However, in the future when an overall master site plan becomes available, a master technical drainage study will be required to address and to dedicate a public drainage easement (privately maintained) from each of the culverts across the whole site. The public drainage easements must be recorded by separate document prior to the final approval of the master technical drainage study and the improvement plans.

Master Study

Response 5: Noted.

6. It appears that a berm is proposed around the subject improvements for flood protection. Address in the next submittal whether this is a temporary facility and will be replaced with screen/flood wall when the remaining portion of the site is developed.

Response 6: The proposed berm surrounding the subject improvements for flood protection is a temporary facility. The berm will be replaced with a screen/flood wall when the remaining portion of the site is developed in the future. It is anticipated that future development will provide curb/gutter to convey flows following the historical drainage pattern.

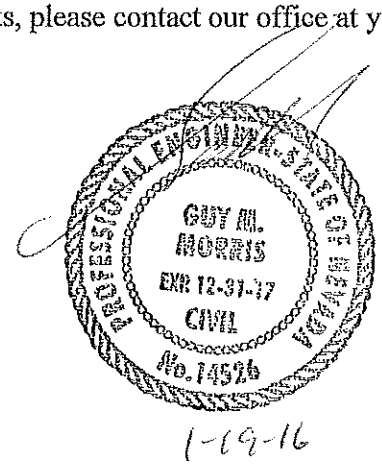
7. It appears that the proposed driveway off of ***Craig Road*** does not provide the adequate six inches of freeboard for onsite protection from a 100-year major storm event. The proposed 2.4% may need to be increased and the proposed flood wall in ***Craig Road*** may also need to be extended into the site at the driveway throat. Review and revise accordingly in the next submittal.

Response 7: As discussed in the response to Comment No. 2, runoff from combination point C16A4(2/168cfs) (from the CLV Neighborhood Study) is more representative of Craig Road flows along the project. However, the more conservative 100-year flow value of 489cfs was utilized, similar to the approved studies in the vicinity.
The flow line elevation (2263.50ft) at the proposed driveway entrance and the 100-year flow depth of 1.41 feet in Craig Road (for 489cfs). Thus, we have revised our grading plan at the proposed driveway entrance to provide a minimum 6-inches of freeboard for onsite protection from a 100-year major storm event. We have revised the driveway by raising the high point to a flow line elevation of 2265.49ft at the top of the driveway throat, which gives us more than 6-inches of freeboard for onsite protection (2263.50FL + 1.41ft (100yr depth) + 0.50ft (freeboard) = 2265.41ft Minimum). The slope of the driveway entrance at the throat has been revised to be 4.30% along the east side of the driveway. The west side of the driveway was also raised to help the situation but we are not providing a hump as the flow will continue discharging to Craig Road at this location.

If you have any questions or further comments, please contact our office at your convenience.

Sincerely,
LOCHSA ENGINEERING

Guy Morris, PE
Principal



1-19-16

Response to Comment No. 2 and No. 7

Relevant Excerpts from the "Northwest Neighborhood Study"

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             SEPTEMBER 1990            *
*              VERSION 4.0              *
*                                       *
*  RUN DATE  01/09/1998  TIME  10:01:39 *
*                                       *
*****************************************
```

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

```
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


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

                    *DIAGRAM
*** FREE ***
               1    ID   NORTHWEST NEIGHBORHOOD STUDY AND CITY-WIDE HYDROLOGY STUDY UPDATE
               2    ID   FOR:  THE CITY OF LAS VEGAS
               3    ID
               4    ID   AUGUST 1997
               5    ID   REFERENCE NUMBER: 51300
               6    ID
               7    ID   HEC1 FILE: EXNGOW3.DAT
               8    ID   GOWAN WATERSHED
               9    ID   MODEL FOR AREAS DOWNSTREAM OR NOT TRIBUTARY TO THE GOWAN NORTH OR SOUTH
              10    ID   DETENTION BASINS.  IN THE EXISTING CONDITION THIS INCLUDES CAM-10 AND THE
              11    ID   GOWAN NORTH CHANNEL AREAS, SINCE THOSE FACILITIES DO NOT EXIST.  THIS
              12    ID   MODEL ALSO INCLUDES THE RANCHO DETENTION BASIN AND ALL AREAS TRIBUTARY TO
              13    ID   IT IN THE EXISTING CONDITION.
              14    ID
              15    ID   EXISTING CONDITIONS, EXISTING FACILITIES, ULTIMATE LAND USE
              16    ID
              17    ID  1.  INTERPOLATION BETWEEN FLOWS WAS COMPLETED TO OBTAIN THE MOST ACCURATE
              18    ID      FLOW FOR EACH TRIBUTARY AREA AT EACH CONCENTRATION POINT.
              19    ID  2.  THERE ARE TWO DISCHARGE POINTS FROM THIS HEC-1 MODEL TO THE NORTHWEST
              20    ID      CENTRAL HEC-1 MODEL (EXNWCEN3.DAT AND EXNWCEN5.DAT).  HYDROGRAPHS WERE
              21    ID      IMPORTED TO THE NORTHWEST CENTRAL HEC-1 TO REPRESENT THOSE INCOMMING
              22    ID      FLOWS.  THE LOCATIONS OF THESE DISCHARGE POINTS ARE RANCHO AND
              23    ID      CHEYENNE AND DECATUR AND GOWAN.  EACH HYDROGRAPH FOR BOTH THE SDN3 AND
              24    ID      SDN5 MODELS WERE "DARFED" ACCORDING TO THEIR TRIBUTARY AREA AND THEN
              25    ID      IMPORTED INTO THE NORTHWEST CENTRAL HEC-1 MODELS.
              26    ID  3.  IT SHOULD BE NOTED THAT THE EAST BOUNDARY OF THE STUDY AREA AND OF
              27    ID      THIS HEC-1 MODEL IS DECATUR, ANY COMBINATION OF FLOWS EAST OF DECATUR
              28    ID      IS FOR THE PURPOSE OF REDUCING THE HYDROGRAPH STACK AND SHOULD NOT BE
              29    ID      USED AS THE ACTUAL FLOW IN THAT AREA.
              30    ID  4.  IN SOME AREAS SURFACE FLOW IS SEPARATED FROM FACILITY FLOW TO
              31    ID      ACCOMMODATE SURFACE FLOW SPLITS.  THEREFORE, AT SOME CONCENTRATION
              32    ID      POINTS THE FACILITY FLOW THAT HAS BEEN TEMPROARILY DIVERTED OUT OF THE
              33    ID      MODEL MUST BE ADDED TO THE SURFACE FLOW TO OBTAIN THE TOTAL FLOW AT
              34    ID      THE CONCENTRATION POINT.
              35    ID  5.  THIS HEC-1 MODEL COVERS ALL OF THE GOWAN WATERSHED NORTH OF ALEXANDER
              36    ID      AND WEST OF DECATUR (APPROXIMATELY).  IT ALSO COVERS THAT PORTION OF
              37    ID      THE WEST TRIBUTARY THAT DRAINS TO THE RANCHO DETENTION BASIN AND THE
              38    ID      AREA THAT IS EAST OF U.S. 95 AND SOUTH OF TROPICAL (APPROXIMATELY).
              39    ID      THE HEC-1 MODEL COVERS THESE AREAS TO REDUCE THE NUMBER OF HYDROGRAPHS
              40    ID      THAT MUST BE IMPORTED FROM THE WEST TRIBUTARY WATERSHED, SINCE UNDER
              41    ID      EXISTING CONDITIONS THERE IS SIGNIFICANT INTER-WATERSHED TRANSPORT OF
              42    ID      FLOW.  TWO HYDROGRAPHS ARE IMPORTED FROM THE WEST TRIBUTARY HEC-1, ONE
              43    ID      AT TROPICAL AND U.S 95 AND ONE AT TROPICAL AND RAINBOW.  EACH
              44    ID      HYDROGRAPH FOR BOTH THE SDN3 AND SDN5 MODELS WERE "DARFED" ACCORDING
              45    ID      TO THEIR TRIBUTARY AREA AND THEN IMPORTED INTO THIS HEC-1 MODEL.
              46    ID  6.  DUE TO THE NUMBER OF DIVERSIONS AND THE FACT THAT TRIBUTARY AREA IS
              47    ID      NOT CARRIED WITH A DIVERTED FLOW, IT MAY BE DIFFICULT TO DETERMINE THE
              48    ID      CORRECT DARF TO USE FOR CERTAIN CONCENTRATION POINTS, HOWEVER, AS A
              49    ID      GENERAL RULE TRIBUTARY AREA WAS NOT MANUALLY CARRIED WITH A DIVERTED
              50    ID      FLOW UNLESS THE AREA WAS GREATER THAT 1 SQUARE MILE.  ADDITIONALLY,
              51    ID      IN SOME AREAS THE TRIBUTARY AREA FOR A DIVERTED FLOW WAS ESTIMATED
              52    ID      BASED ON THE AMOUNT OF THE TOTAL FLOW DIVERTED.
              53    ID  7.  IN SOME AREAS (DUE TO DIVERSIONS ACROSS U.S. 95 AND RANCHO) THE SDN3
```



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

              54    ID      MODEL SHOULD BE USED FOR THE 10-YEAR EVENT AND THE SDN5 USED FOR THE
              55    ID      100-YEAR EVENT.  THIS IS ESPECIALLY TRUE IN THE AREA BOUNDED BY
              56    ID      RANCHO, LONE MT., DECATUR AND GOWAN.
              57    ID  8.  IT SHOULD BE NOTED THAT AT THE INTERSECTION OF GOWAN AND RANCHO THERE
              58    ID      IS APPROXIMATELY 600 CFS IN THE GOWAN OUTFALL, 500 CFS TRAVELING
              59    ID      SOUTHEAST ALONG RANCHO AND 1600 CFS THAT IS DIVERTED ACROSS RANCHO TO
              60    ID      GOWAN ROAD AS SURFACE FLOW FOR THE 100-YEAR EVENT.  HOWEVER, FOR THE
              61    ID      10-YEAR EVENT NO FLOW IS DIVERTED ACROSS RANCHO AS SURFACE FLOW.
              62    ID      THEREFORE, THE SDN5 MODEL IS USED FOR THE 100-YEAR FLOWS AND THE SDN3
              63    ID      MODEL IS USED FOR THE 10-YEAR FLOWS ON THE EAST SIDE OF RANCHO.  IT
              64    ID      SHOULD ALSO BE NOTED THAT THE 1600 CFS IS FURTHER SUBDIVIDED BY FLOW
              65    ID      SPLITS, AS THE 1600 CFS DECREASED FROM THE FLOW SPLITS IT BECOMES
              66    ID      INCREASINGLY DIFFICULT TO DETERMINE WHETHER OR NOT THE CONTROLING OR
              67    ID      HIGHEST PEAK FLOW COMES FROM THE 1600 CFS OR "LOCAL FLOWS".  IT SHOULD
              68    ID      SUFFICE TO SAY THAT DUE TO THE LIMITAIONS OF THE HEC-1 PROGRAM IT IS
```

```
   69          ID      UP TO THE USER TO DETERMING THE CORRECT TRIBUTARY AREA, CORRECT DARF,
   70          ID      AND CORRECT STROM DISTRIBUTION TO USE TO OBTAIN THE MOST ACCURATE AND
   71          ID      HIGHEST PEAK FLOW POSSIBLE FOR BOTH THE 10-YEAR AND 100-YEAR EVENTS
   72          ID      WHICH MAY OR MAY NOT BE OBTAINED FROM THE HEC-1 MODEL.  THE FLOWS
   73          ID      PRESENTED IN VOLUME 2 OF THIS DOCUMENT REFLECT THIS EXCERSIZE.
   74          ID
   75          ID
   76          ID   JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
   77          ID
   78          ID   100-YEAR,  6-HOUR STORM,  SDN3
   79          ID   DARF RATIOS FOR AREAS OF 0, 1, 2, 6 AND 10 SQUARE MILES FOR 100-YEAR
   80          ID   DARF RATIOS FOR AREAS OF 0, 2, 6 AND 10 SQUARE MILES FOR 10-YEAR
   81          ID
   82          JP       2
   83          IT       5       0       0     200
   84          IO       5       0       0
   85          IN       5
   86          JR    PREC       1    0.97    0.93     0.9    0.86    0.57    0.53   0.513    0.49
               *
   87          KK    BWJS                                                                  0.1
   88          PB    2.98                                                                   1
   89          BA   0.106                                                                   2
   90          PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
   91          PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
   92          PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
   93          PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
   94          PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
   95          PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
   96          PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
   97          PC   0.998   0.999   1.000
   98          LS       0    74.1
   99          UD   0.317
               *
1                                        HEC-1 INPUT                                    PAGE  3

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

  100               KK    RBWJS
  101               KM   ROUTE TO CPFR
  102               RK     3000   0.026    0.03       0    TRAP     100       2
                    *

  103               KK     CPFR
  104               PB     2.91
  105               BA    0.126
  106               LS        0    76.0
  107               UD    0.302
                    *

  108               KK    CCPFR
  109               HC        2
                    *

  110               KK    RCPFR
  111               KM   ROUTE TO GD28BE3
  112               RK      500   0.023    0.03       0    TRAP     100       2
                    *

  113               KK GD28BE3
  114               PB     2.86
  115               BA    0.010
  116               LS        0    78.3
  117               UD    0.133
                    *

  118               KK   C28BE3
  119               HC        2
                    *

  120               KK   R28BE3
  121               KM   ROUTE TO GD28BE4
  122               RK     2100   0.023    0.03       0    TRAP     100       2
                    *

  123               KK GD28BE4
  124               PB     2.80
  125               BA    0.020
  126               LS        0    94.0
  127               UD    0.162
                    *

  128               KK   C28BE4
  129               HC        2
                    *

  130               KK   R28BE4
  131               KM   ROUTE TO ANN1A2
  132               RK     3500   0.017    0.03       0    TRAP     300       2
                    *
1                                        HEC-1 INPUT                                    PAGE  4

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

  133               KK   ANN1A2
  134               PB     2.77
  135               BA    0.174
  136               LS        0    93.8
  137               UD    0.250
                    *

  138               KK CANN1A2
  139               HC        2
                    *

  140               KK     R1A2
  141               KM   ROUTE TO RANCHO DETENTION BASIN
  142               RK     1000   0.015    0.03       0    TRAP     100       2
                    *
```

```
2060          KK 2REMAIN
2061          KM  DIVERT FLOW EAST THROUGH CULVERT (RAN 353) AT INTERSECTION OF
2062          KM  SANTA FE AND RANCHO, REMAINING FLOW CONTINUES SOUTHEAST ALONG
2063          KM  THE WEST SIDE OF RANCHO IN RAN 352
2064          KM  MINIMUM OF 1 CFS WILL BE DIVERTED TO AVOID ZERO FLOW
2065          DT  D2RCHO
2066          DI       0       5      20      54     156    1000    2000
2067          DQ       0       1       1      11      29      29      29
              *

2068          KK  R2MAIN
2069          KM  ROUTE TO PT3AB2
2070          RK    1365  0.0022    0.02       0    TRAP      20       2
              *
1                                        HEC-1 INPUT                                        PAGE 61

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

2071          KK  PT3AB2
2072          PB   2.77
2073          BA  0.050
2074          LS       0    93.4
2075          UD  0.220
              *

2076          KK   C3AB2
2077          HC       2
              *
              * PROPOSED REGIONAL FACILITY, NO DIVERSION EXISTING CONDITION
              *
              * KK    DSTAY
              * KM    DIVERT FLOW EAST IN GOLO 0331, 72" RCP, CAPACITY = 420 CFS
              * KM    CAPACITY BASED ON 1996 MPU
              * KM    LONE MT. AND RANCHO INTERSECTION
              * KM    REMAINING FLOW CONTINUES SOUTHEAST
              * DT    DGOLO1
              * DI    0              50     150     420     500    1000    5000
              * DQ    0              50     150     420     420     420     420
              *
              * THE FOLLOWING RETRIEVAL WAS REMOVED DUE TO ZERO FLOW.
              *
              * KK    D95C
              * KM    RETRIEVE FLOW FROM BOX DIVERSION AT LOME MT/95 INT.
              * DR    D95C
              *
              * KK    RD95C
              * KM    ROUTE TO PT3AB2
              * RK    1800       0.003    0.02       0   TRAP      70       2
              *
              * KK    COSTAY
              * HC    2
              *

2078          KK 3REMAIN
2079          KM  DIVERT FLOW EAST THROUGH CULVERT RAN 340 AT THE
2080          KM  LONE MT. AND RANCHO INTERSECTION, RAN 340 IS 50% CLOGGED AT
2081          KM  THE DOWNSTREAM END.  REMAINING FLOW CONTINUES SOUTHEAST
2082          KM  ALONG THE WEST SIDE OF RANCHO.
2083          KM  CLOGGING IGNORED PER CLV
2084          DT  D3RCHO
2085          DI       0      40     500    1000    2000
2086          DQ       0      20      20      20      20
              *

2087          KK   PT2B2
2088          PB   2.77
2089          BA  0.078
2090          LS       0    93.3
2091          UD  0.236
              *
1                                        HEC-1 INPUT                                        PAGE 62

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

2092          KK  COSTAY
2093          HC       2
              *

2094          KK 4REMAIN
2095          KM  DIVERT FLOW EAST THROUGH CULVERT RAN 330 BETWEEN
2096          KM  LONE MT. AND CRAIG.  REMAINING FLOW CONTINUES
2097          KM  SOUTHEAST ALONG THE WEST SIDE OF RANCHO
2098          DT  D4RCHO
2099          DI       0       7      70     500    1000    2000
2100          DQ       0     3.5      35      35      35      35
              *

2101          KK  R4MAIN
2102          KM  ROUTE TO PT2B3
2103          RK    1400   0.011   0.025       0    TRAP      40       2
              *

2104          KK   PT2B3
2105          PB   2.77
2106          BA  0.023
2107          LS       0    93.3
2108          UD  0.211
              *

2109          KK    C2B3
2110          HC       2
              *

2111          KK    D2B3
2112          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN AT RANCHO.  CRAIG STORM DRAIN IS
2113          KM  48" RCP, CAPACITY = 210 CFS (PER CLV) AT 48" LATERAL BEHIND 7-11: DIVERT
2114          KM  120 CFS TO STORM DRAIN SINCE 90 CFS ALREADY EXISTS IN PIPE.
2115          KM  REMAINING FLOW TRAVELS UNDER CRAIG ROAD IN 2, 3'X7' RCB'S BEHIND 7-11
2116          KM  20 CFS IS THEN DIVERTED TO RAN 300 (2'X6' RCB) WHICH ENTERS CRAIG STORM
```

← D4RCHO flows diverted across Rancho culvert, North of intersection with Craig.

```
2191          DR   DCSD1
              *

2192          KK    R2B1
2193          KM  ROUTE TO PT2B3
2194          RK    3000   0.007   0.015       0    CIRC       4
              *

2195          KK   DCSD2
2196          KM  RETRIEVE FLOW DIVERTED TO CRAIG STORM DRAIN AT CRAIG AND RANCHO
2197          DR   DCSD2
              *

2198          KK   CDCSD
2199          HC       3
              *
```



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

2200          KK  DCSD2A
2201          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN
2202          KM  60" RCP, CAPACITY = 230 CFS
2203          KM  REMAINING FLOW TRAVELS SOUTH ALONG RANCHO
2204          KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
2205          DT   DCSD1
2206          DI       0      21      51     101     201     231     300    1000
2207          DQ       0      20      50     100     200     230     230     230
              *

2208          KK  DCRAIG
2209          KM  FLOW SPLIT AT RANCHO AND CRAIG, DIVERT FLOW TO CRAIG.
2210          KM  CAPACITY OF WEST HALF STREET OF RANCHO IS APPROX. 100 CFS.
2211          KM  WEST HALF STREET OF RANCHO WILL FILL TO CAPACITY BEFORE FLOW SPLITS TO
2212          KM  THE EAST SIDE OF RANCHO, 50% OF FLOW IN EXCESS OF 100 CFS IS ASSUMED TO
2213          KM  SPLIT TO CRAIG ROAD EAST OF RANCHO
2214          KM  REMAINING FLOW CONTINUES SOUTHEAST ON THE WEST SIDE OF RANCHO AND JOINS
2215          KM  FLOW CROSSING CRAIG IN BOX CULVERTS.
2216          KM  MINIMUM OF 1 CFS WILL BE DIVERTED TO AVOID ZERO FLOW
2217          DT DPD16A4
2218          DI       0      11     101     200     300     400     500    1000    5000
2219          DQ       0       1       1      50     100     150     200     450    2400
              *

2220          KK    R2B1
2221          KM  ROUTE TO PT2B3
2222          RK     300   0.007    0.02       0    TRAP      70       2
              *

2223          KK   CD2B3
2224          HC       2
              *

2225          KK   RD2B3
2226          KM  ROUTE TO PT51
2227          RK    3010  0.0076    0.03       0    TRAP      50       2
              *

2228          KK    PT51
2229          PB    2.77
2230          BA   0.070
2231          LS       0    93.5
2232          UD   0.273
              *

2233          KK   CPT51
2234          HC       2
              *
```



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

2235          KK SREMAIN
2236          KM  DIVERT FLOW EAST IN RAN 270 AND RAN 260
2237          KM  PER RANCHO TOWN AND COUNTRY DRAINAGE STUDY 156 CFS IS DIVERTED
2238          KM  THROUGH RAN 270 (56 CFS) AND RAN 260 (100 CFS), WHEN THE TOTAL FLOW
2239          KM  IS 291 CFS AT RAN 270.  DEVELOPED LINEAR RATING CURVE BASED ON
2240          KM  100-YEAR FLOWS.  NOTE THAT A 7' X 3' RCB IS PROPOSED TO BE CONSTRUCTED
2241          KM  PARALLEL TO RANCHO ROAD ON THE WEST SIDE (RAN 265).
2242          KM  REMAINING FLOW CONTINUES SOUTH ALONG THE WEST SIDE OF RANCHO
2243          DT  D5RCHO
2244          DI       0   145.5     291     582    1164
2245          DQ       0      78     156     312     624
              *

2246          KK    D95F
2247          KM  RETRIEVE FLOW FROM BOX DIVERSION AT US95 AND ALEXANDER
2248          DR    D95F
              *

2249          KK   RD95F
2250          KM  ROUTE TO PT3
2251          RK    1500   0.004    0.02       0    TRAP      40       2
              *

2252          KK    DPT3
2253          KM  RETRIEVE WEIR FLOW ACROSS U.S. 95 NORTH OF ALEXANDER
2254          DR    DPT3
              *

2255          KK   RDPT3
2256          KM  ROUTE TO PT3
2257          RK    2000   0.004    0.02       0    TRAP      40       2
              *

2258          KK     PT3
2259          PB    2.77
2260          BA   0.148
2261          LS       0    86.7
2262          UD   0.283
```


Conservative flows at Rancho/Craig intersection -

DPD16A4

flows splitting easterly into Craig Rd. at intersection with Rancho.

```
*
2974    KK  D4RCHO
2975    KM  RETRIEVE FLOW FROM RAN 330
2976    DR  D4RCHO
*
2977    KK RD4RCHO
2978    KM  ROUTE TO PD16A2
2979    RK    1900   0.008   0.025       0    TRAP      40       2
*
2980    KK  PD16A2
2981    PB    2.77
2982    BA   0.038
2983    LS       0    93.9
2984    UD   0.192
*
2985    KK   C16A2
2986    HC       2
*
2987    KK   R16A2
2988    KM  ROUTE TO PD16A4
2989    RK    1820  0.0082    0.02       0    TRAP      40       2
*
2990    KK DPD16A4
2991    KM  RETRIEVE FLOW DIVERTED AT CRAIG AND RANCHO
2992    DR DPD16A4
*
2993    KK  RD16A4
2994    KM  ROUTE TO PD16A4
2995    RK     900    0.01    0.02       0    TRAP      70       2
*
1                                    HEC-1 INPUT                                    PAGE 89

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

2996    KK  PD16A4
2997    PB    2.77
2998    BA   0.056
2999    LS       0    91.9
3000    UD   0.222
*
3001    KK   C16A4
3002    HC       3
*
3003    KK   R16A4
3004    KM  ROUTE TO PT4B1
3005    RK    1225   0.019    0.02       0    TRAP      70       2
*
3006    KK DPD16A3
3007    KM  RETRIEVE FLOW DIVERTED AT LONE MT. AND JONES
3008    DR DPD16A3
*
3009    KK  RD16A3
3010    KM  ROUTE TO PD16A3
3011    RK    1300   0.006    0.02       0    TRAP      90       2
*
3012    KK  PD16A3
3013    PB    2.77
3014    BA   0.100
3015    LS       0    82.7
3016    UD   0.273
*
3017    KK   C16A3
3018    HC       2
*
3019    KK   R16A3
3020    KM  ROUTE TO PD16A5
3021    RK    1330   0.006   0.025       0    TRAP      40       2
*
3022    KK  PD16A5
3023    PB    2.77
3024    BA   0.087
3025    LS       0    89.5
3026    UD   0.196
*
1                                    HEC-1 INPUT                                    PAGE 90

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

3027    KK   C16A5
3028    HC       2
*
3029    KK  D5RCHO
3030    KM  RETRIEVE FLOW FROM RAN 260 AND 270
3031    DR  D5RCHO
*
3032    KK RD5RCHO
3033    KM  ROUTE TO PT4B1
3034    RK    1800  0.0056    0.03       0    TRAP      40       2
*
3035    KK   PT4B1
3036    PB    2.77
3037    BA   0.065
```

Basin

Basin PD16A4 upstream the subject site

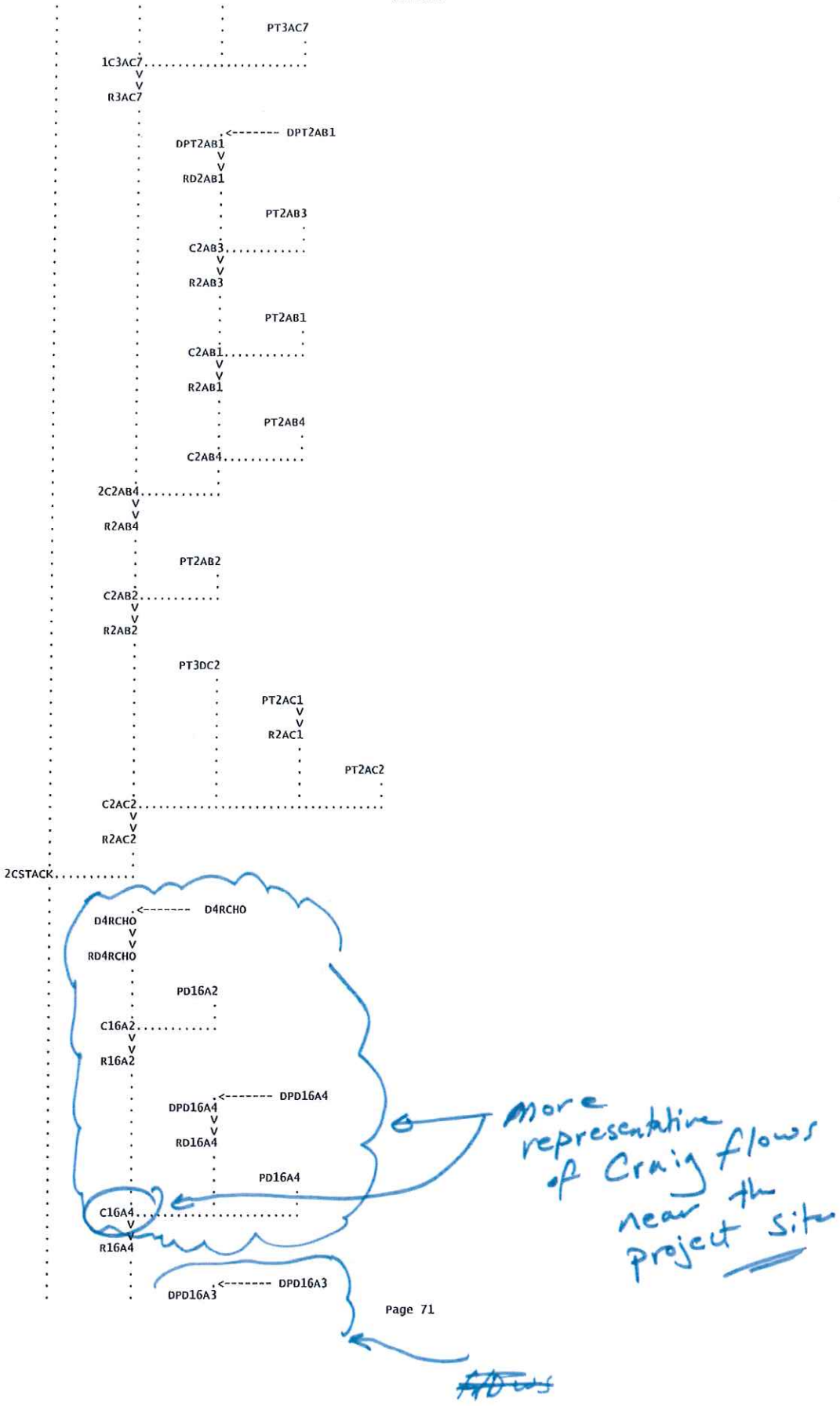
```
3038          LS       0    93.8
3039          UD   0.219
              *

3040          KK    C4B1
3041          HC       2
              *

3042          KK   2C4B1
3043          HC       3
              *

3044          KK  DPT4B1
3045          KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN AT JONES AND CRAIG
3046          KM  CRAIG STORM DRAIN IS 60" RCP CAPACITY = 330 CFS, DIVERT 100 CFS TO
3047          KM  STORM DRAIN SINCE 230 CFS ALREADY EXISTS IN PIPE.
3048          KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
3049          DT   DCSD3
3050          DI       0      51     101     300     500    1000
3051          DQ       0      50     100     100     100     100
              *

3052          KK RDPT4B1
3053          KM  ROUTE TO PT3DB2
3054          RK     700  0.0086    0.02       0    TRAP      70       2
              *

3055          KK  PT3DB2
3056          PB    2.77
3057          BA   0.023
3058          LS       0    94.7
3059          UD   0.144
              *
```



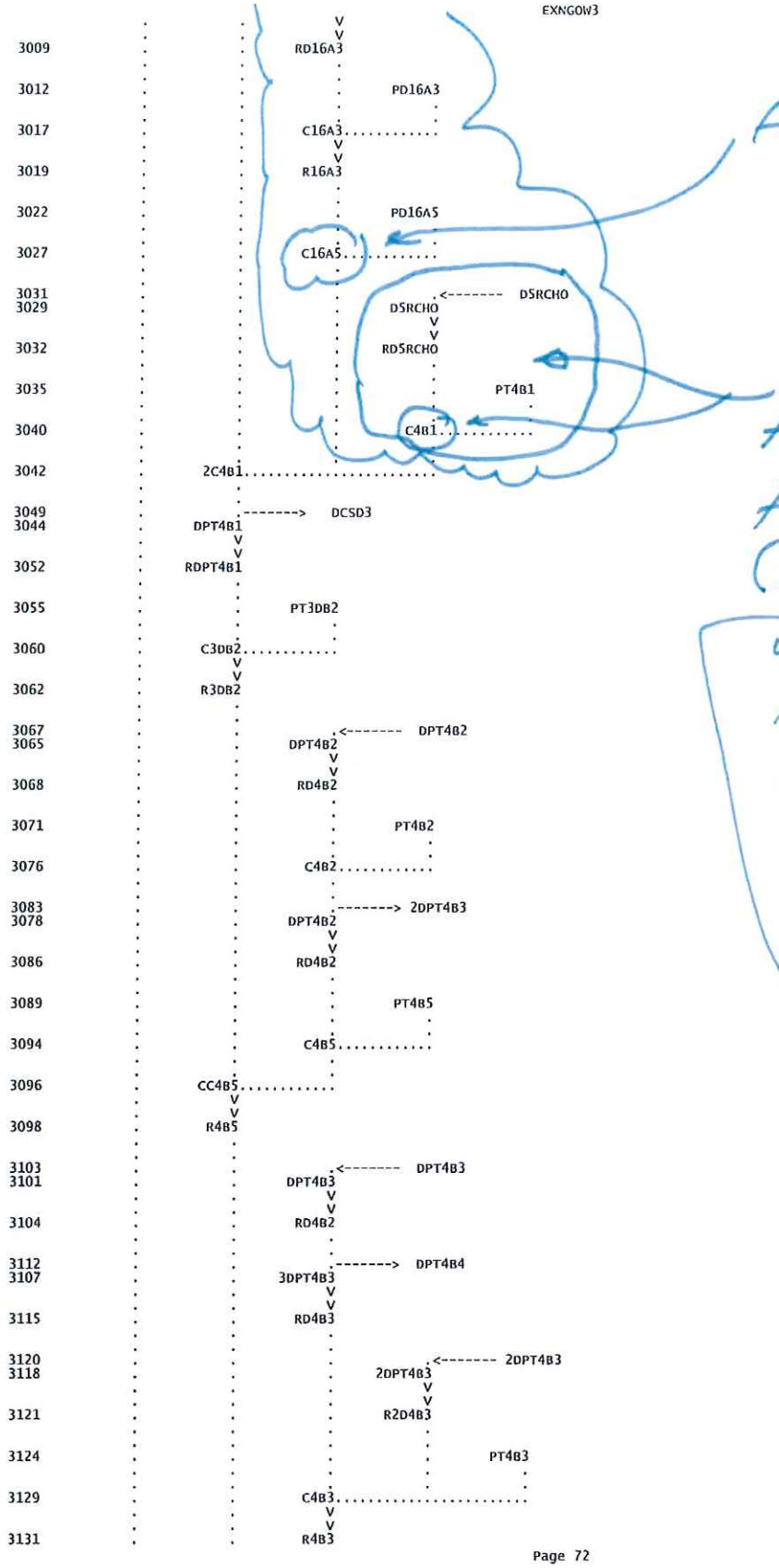
```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

3060          KK   C3DB2
3061          HC       2
              *

3062          KK   R3DB2
3063          KM  ROUTE TO PT4B5
3064          RK    1890   0.017    0.02       0    TRAP      70       2
              *

3065          KK  DPT4B2
3066          KM  RETRIEVE FLOW DIVERTED AT ALEXANDER AND BRADLEY
3067          DR  DPT4B2
              *

3068          KK   RD4B2
3069          KM  ROUTE TO HICKAM
3070          RK    1600  0.0076    0.02       0    TRAP      50       2
              *

3071          KK   PT4B2
3072          PB    2.77
3073          BA   0.217
3074          LS       0    83.1
3075          UD   0.303
              *

3076          KK    C4B2
3077          HC       2
              *

3078          KK  DPT4B2
3079          KM  FLOW SPLIT AT BRADLEY AND HICKAM
3080          KM  DIVERT FLOW TO HICKAM
3081          KM  REMAINING FLOW CONTINUES NORTH IN BRADLEY
3082          KM  CROWN NOT HELD IN EITHER STREET
3083          DT 2DPT4B3
3084          DI       0      10     100     500    1000    5000
3085          DQ       0     5.8      58     269     523    2507
              *

3086          KK   RD4B2
3087          KM  ROUTE TO PT4B5
3088          RK     420  0.0048    0.02       0    TRAP      50       2
              *

3089          KK   PT4B5
3090          PB    2.77
3091          BA   0.031
3092          LS       0    83.5
3093          UD   0.206
              *
```



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

3094          KK    C4B5
3095          HC       2
              *

3096          KK   CC4B5
3097          HC       2
              *

3098          KK    R4B5
3099          KM  ROUTE TO PT4B6
3100          RK    2660  0.0049    0.02       0    TRAP      70       2
              *

3101          KK  DPT4B3
3102          KM  RETRIEVE FLOW DIVERTED AT ALEXANDER AND THOM
3103          DR  DPT4B3
              *
```



More representative of Craig flows near the project site



flows through Jones (north of Craig) & it includes north portion of Craig/Rancho parcel

flows from Jones (south of Craig)

which includes flows crossing Rancho's culverts (Q_{100}=135 cfs)

+

flows from PT4B1 (93cfs)

That was determined from the Topography to continue easterly towards Hickam Av.

HYDROGRAPH AT STATION LOSPRAD
FOR PLAN 2, RATIO = .57

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	16.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 111.	5.25		60.	22.	22.	22.
		(INCHES)	.841	.868	.868	.868
		(AC-FT)	30.	31.	31.	31.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (AC-FT)	(HR)				
10.	5.25	5.	2.	2.	2.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (FEET)	(HR)				
25.29	5.25	23.73	21.54	21.54	21.54

CUMULATIVE AREA = .66 SQ MI

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

HYDROGRAPH AT STATION LOSPRAD
FOR PLAN 2, RATIO = .53

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	16.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 74.	5.67		52.	19.	19.	19.
		(INCHES)	.732	.758	.758	.758
		(AC-FT)	26.	27.	27.	27.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (AC-FT)	(HR)				
9.	5.67	5.	2.	2.	2.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (FEET)	(HR)				
25.19	5.67	23.54	21.47	21.47	21.47

CUMULATIVE AREA = .66 SQ MI

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

HYDROGRAPH AT STATION LOSPRAD
FOR PLAN 2, RATIO = .51

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	16.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 66.	5.83		49.	18.	18.	18.
		(INCHES)	.687	.713	.713	.713
		(AC-FT)	24.	25.	25.	25.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (AC-FT)	(HR)				
8.	5.83	4.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (FEET)	(HR)				
25.10	5.83	23.31	21.38	21.38	21.38

CUMULATIVE AREA = .66 SQ MI

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

HYDROGRAPH AT STATION LOSPRAD
FOR PLAN 2, RATIO = .49

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	16.58-HR
+ (CFS)	(HR)					
		(CFS)				
+ 66.	5.83		46.	17.	17.	17.
		(INCHES)	.644	.670	.670	.670
		(AC-FT)	23.	24.	24.	24.

PEAK STORAGE	TIME	MAXIMUM AVERAGE STORAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (AC-FT)	(HR)				
7.	5.83	3.	1.	1.	1.

PEAK STAGE	TIME	MAXIMUM AVERAGE STAGE			
		6-HR	24-HR	72-HR	16.58-HR
+ (FEET)	(HR)				
25.01	5.83	23.04	21.29	21.29	21.29

CUMULATIVE AREA = .66 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	RATIO 2	RATIO 3	RATIO 4	RATIO 5	RATIO 6	RATIO 7	RATIO 8	RATIO 9
				1.00	.97	.93	.90	.86	.57	.53	.51	.49

				TIME	3.83	3.83	3.83	3.92	3.92	4.00	4.08	4.08	4.92
ROUTED TO													
+	R2AC2	2.62	1	FLOW	1837.	1749.	1623.	1527.	1400.	601.	503.	462.	438.
				TIME	3.92	3.92	3.92	3.92	3.92	4.08	4.17	4.17	5.08
			2	FLOW	1837.	1749.	1623.	1527.	1399.	595.	494.	453.	407.
				TIME	3.92	3.92	3.92	3.92	3.92	4.08	4.17	4.17	5.00
2 COMBINED AT													
+	2CSTACK	24.98	1	FLOW	5001.	4675.	4167.	3904.	3483.	1678.	1429.	1314.	1209.
				TIME	4.33	4.33	4.33	4.42	4.42	5.08	5.17	5.25	5.17
			2	FLOW	4979.	4652.	4149.	3888.	3467.	1660.	1397.	1279.	1173.
				TIME	4.33	4.33	4.42	4.42	4.42	5.00	5.17	5.25	5.17
HYDROGRAPH AT													
+	D4RCHO	.00	1	FLOW	35.	35.	35.	35.	35.	35.	35.	35.	35.
				TIME	3.42	3.42	3.42	3.42	3.42	3.58	3.58	3.58	3.67
			2	FLOW	35.	35.	35.	35.	35.	35.	35.	35.	35.
				TIME	3.42	3.42	3.42	3.42	3.42	3.58	3.58	3.58	3.67
ROUTED TO													
+	RD4RCHO	.00	1	FLOW	35.	35.	35.	35.	35.	35.	35.	35.	35.
				TIME	3.58	3.58	3.58	3.58	3.58	3.75	3.75	3.75	3.75
			2	FLOW	35.	35.	35.	35.	35.	35.	35.	35.	35.
				TIME	3.58	3.58	3.58	3.58	3.58	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	PD16A2	.04	1	FLOW	58.	56.	53.	51.	49.	29.	26.	25.	23.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
			2	FLOW	58.	56.	53.	51.	49.	29.	26.	25.	23.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	C16A2	.04	1	FLOW	93.	91.	88.	86.	84.	62.	59.	57.	55.
				TIME	3.58	3.58	3.58	3.58	3.58	3.67	3.67	3.67	3.67
			2	FLOW	93.	91.	88.	86.	84.	62.	59.	57.	55.
				TIME	3.58	3.58	3.58	3.58	3.58	3.67	3.67	3.67	3.67
ROUTED TO													
+	R16A2	.04	1	FLOW	92.	90.	87.	85.	83.	61.	58.	57.	55.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
			2	FLOW	92.	90.	87.	85.	83.	61.	58.	57.	55.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	DPD16A4	.00	1	FLOW	73.	57.	54.	48.	45.	0.	0.	0.	0.
				TIME	4.17	4.25	4.25	4.83	4.83	3.42	3.42	3.42	3.42
			2	FLOW	73.	57.	54.	48.	45.	0.	0.	0.	0.
				TIME	4.17	4.25	4.25	4.83	4.83	3.42	3.42	3.42	3.42
ROUTED TO													
+	RD16A4	.00	1	FLOW	65.	51.	49.	47.	45.	0.	0.	0.	0.
				TIME	4.25	4.92	4.92	4.83	4.83	4.00	4.00	4.00	3.92
			2	FLOW	64.	51.	49.	47.	45.	0.	0.	0.	0.
				TIME	4.25	4.92	4.33	4.83	4.83	4.00	4.00	4.00	3.92
HYDROGRAPH AT													
+	PD16A4	.06	1	FLOW	75.	73.	69.	66.	62.	35.	31.	30.	28.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
			2	FLOW	75.	73.	69.	66.	62.	35.	31.	30.	28.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT													
+	C16A4	.09	1	FLOW	168.	163.	156.	151.	145.	95.	87.	84.	80.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75
			2	FLOW	168.	163.	156.	151.	145.	95.	87.	84.	80.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75
ROUTED TO													
+	R16A4	.09	1	FLOW	165.	161.	154.	149.	143.	94.	86.	82.	78.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
			2	FLOW	165.	161.	154.	149.	143.	94.	86.	82.	78.
				TIME	3.67	3.67	3.67	3.67	3.67	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	DPD16A3	.00	1	FLOW	156.	150.	139.	130.	119.	69.	67.	67.	66.
				TIME	3.75	3.83	3.83	3.92	3.92	5.00	5.00	5.00	5.00
			2	FLOW	156.	150.	139.	130.	119.	69.	67.	67.	66.
				TIME	3.75	3.83	3.83	3.92	3.92	5.00	5.00	5.00	5.00
ROUTED TO													
+	RD16A3	.00	1	FLOW	156.	148.	138.	128.	118.	69.	67.	67.	66.
				TIME	3.83	3.83	3.92	3.92	4.00	5.00	5.00	5.00	5.00
			2	FLOW	156.	148.	138.	128.	118.	69.	67.	67.	66.
				TIME	3.83	3.83	3.92	3.92	4.00	5.00	5.00	5.00	5.00
HYDROGRAPH AT													
+	PD16A3	.10	1	FLOW	83.	79.	74.	69.	64.	28.	23.	21.	19.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
			2	FLOW	83.	79.	74.	69.	64.	28.	23.	21.	19.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	C16A3	.10	1	FLOW	231.	220.	196.	181.	161.	78.	75.	74.	73.
				TIME	3.83	3.83	3.83	3.92	3.92	5.00	5.00	5.00	5.00
			2	FLOW	231.	220.	196.	181.	161.	78.	75.	74.	73.
				TIME	3.83	3.83	3.83	3.92	3.92	5.00	5.00	5.00	5.00
ROUTED TO													
+	R16A3	.10	1	FLOW	229.	214.	195.	178.	159.	78.	75.	74.	73.
				TIME	3.83	3.83	3.92	3.92	4.00	5.00	5.00	5.00	5.00
			2	FLOW	230.	214.	195.	178.	159.	78.	75.	74.	73.
				TIME	3.83	3.83	3.92	3.92	4.00	5.00	5.00	5.00	5.00
HYDROGRAPH AT													
+	PD16A5	.09	1	FLOW	113.	108.	102.	97.	91.	47.	42.	40.	37.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.67	3.67	3.67
			2	FLOW	113.	108.	102.	97.	91.	47.	42.	40.	37.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	C16A5	.19	1	FLOW	302.	284.	249.	226.	200.	89.	85.	84.	82.

Q10 majority in storm drain

Q100

more representation of flows along project site.

			2	TIME	3.83	3.83	3.83	3.92	3.92	4.92	4.92	4.92	4.92
				FLOW	302.	284.	249.	226.	200.	89.	85.	84.	82.
				TIME	3.83	3.83	3.83	3.92	3.92	4.92	4.92	4.92	4.92
HYDROGRAPH AT													
+	DSRCHO	.00	1	FLOW	142.	131.	114.	97.	87.	24.	22.	21.	19.
				TIME	3.83	3.83	3.83	3.83	4.92	3.67	3.67	3.67	3.67
			2	FLOW	142.	131.	116.	97.	87.	24.	22.	21.	19.
				TIME	3.83	3.83	3.83	3.83	4.92	3.67	3.67	3.67	3.67
ROUTED TO													
+	RDSRCHO	.00	1	FLOW	136.	127.	112.	93.	86.	24.	21.	20.	19.
				TIME	3.92	3.92	3.92	3.92	4.92	3.83	3.83	3.83	3.83
			2	FLOW	137.	127.	111.	93.	86.	24.	21.	20.	19.
				TIME	3.92	3.92	3.92	3.92	4.92	3.83	3.83	3.83	3.83
HYDROGRAPH AT													
+	PT4B1	.06	1	FLOW	93.	90.	85.	82.	78.	46.	42.	40.	37.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
			2	FLOW	93.	90.	85.	82.	78.	46.	42.	40.	37.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	C4B1	.06	1	FLOW	196.	176.	158.	138.	119.	63.	57.	54.	51.
				TIME	3.83	3.92	3.92	3.92	3.92	3.75	3.75	3.75	3.75
			2	FLOW	198.	176.	157.	138.	119.	63.	57.	54.	51.
				TIME	3.83	3.92	3.92	3.92	3.92	3.75	3.75	3.75	3.75
3 COMBINED AT													
+	2C4B1	.35	1	FLOW	638.	593.	514.	472.	428.	233.	206.	195.	180.
				TIME	3.83	3.83	3.92	3.92	3.75	3.75	3.75	3.75	3.75
			2	FLOW	640.	593.	522.	472.	428.	233.	206.	195.	180.
				TIME	3.83	3.83	3.83	3.92	3.75	3.75	3.75	3.75	3.75
DIVERSION TO													
+	DCSD3	.35	1	FLOW	100.	100.	100.	100.	100.	100.	100.	100.	100.
				TIME	3.33	3.33	3.33	3.33	3.33	3.50	3.50	3.58	3.58
			2	FLOW	100.	100.	100.	100.	100.	100.	100.	100.	100.
				TIME	3.33	3.33	3.33	3.33	3.33	3.50	3.50	3.58	3.58
HYDROGRAPH AT													
+	DPT4B1	.35	1	FLOW	538.	493.	414.	372.	328.	133.	106.	95.	80.
				TIME	3.83	3.83	3.92	3.92	3.75	3.75	3.75	3.75	3.75
			2	FLOW	540.	493.	422.	372.	328.	133.	106.	95.	80.
				TIME	3.83	3.83	3.83	3.92	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	RDPT4B1	.35	1	FLOW	533.	488.	412.	372.	328.	131.	103.	91.	76.
				TIME	3.83	3.83	3.92	3.92	3.75	3.75	3.75	3.75	3.75
			2	FLOW	535.	488.	419.	372.	328.	131.	103.	91.	76.
				TIME	3.83	3.83	3.83	3.92	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	PT3DB2	.02	1	FLOW	39.	38.	36.	35.	33.	20.	18.	18.	17.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
			2	FLOW	39.	38.	36.	35.	33.	20.	18.	18.	17.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT													
+	C3DB2	.37	1	FLOW	551.	506.	423.	384.	348.	143.	114.	102.	86.
				TIME	3.83	3.83	3.92	3.75	3.75	3.75	3.75	3.75	3.75
			2	FLOW	553.	506.	435.	384.	348.	143.	114.	102.	86.
				TIME	3.83	3.83	3.83	3.83	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	R3DB2	.37	1	FLOW	543.	496.	421.	384.	346.	137.	111.	100.	85.
				TIME	3.83	3.83	3.92	3.83	3.75	3.83	3.83	3.83	3.83
			2	FLOW	544.	496.	429.	384.	346.	137.	111.	100.	85.
				TIME	3.83	3.83	3.83	3.83	3.75	3.83	3.83	3.83	3.83
HYDROGRAPH AT													
+	DPT4B2	.00	1	FLOW	277.	263.	243.	226.	220.	83.	74.	71.	66.
				TIME	3.83	3.83	3.92	3.92	4.83	3.92	4.00	4.00	4.00
			2	FLOW	278.	263.	244.	226.	220.	83.	74.	71.	66.
				TIME	3.83	3.83	3.92	3.92	4.83	3.92	4.00	4.00	4.00
ROUTED TO													
+	RD4B2	.00	1	FLOW	274.	262.	241.	225.	219.	82.	74.	70.	66.
				TIME	3.92	3.92	3.92	3.92	4.83	4.00	4.08	4.08	4.08
			2	FLOW	275.	262.	243.	225.	219.	82.	74.	70.	66.
				TIME	3.92	3.92	3.92	3.92	4.83	4.00	4.08	4.08	4.08
HYDROGRAPH AT													
+	PT4B2	.22	1	FLOW	178.	169.	157.	149.	137.	59.	50.	46.	40.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
			2	FLOW	178.	169.	157.	149.	137.	59.	50.	46.	40.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	C4B2	.22	1	FLOW	435.	412.	374.	350.	316.	135.	116.	108.	97.
				TIME	3.83	3.83	3.83	3.83	3.92	3.83	3.92	3.92	3.92
			2	FLOW	435.	412.	377.	350.	316.	135.	116.	108.	97.
				TIME	3.83	3.83	3.83	3.83	3.92	3.83	3.92	3.92	3.92
DIVERSION TO													
+	2DPT4B3	.22	1	FLOW	235.	222.	203.	190.	172.	76.	66.	62.	56.
				TIME	3.83	3.83	3.83	3.83	3.92	3.83	3.92	3.92	3.92
			2	FLOW	235.	222.	204.	190.	172.	76.	66.	62.	56.
				TIME	3.83	3.83	3.83	3.83	3.92	3.83	3.92	3.92	3.92
HYDROGRAPH AT													
+	DPT4B2	.22	1	FLOW	200.	189.	172.	160.	144.	59.	49.	46.	41.
				TIME	3.83	3.83	3.83	3.83	3.92	3.83	3.92	3.92	3.92
			2	FLOW	200.	189.	173.	160.	144.	59.	49.	46.	41.
				TIME	3.83	3.83	3.83	3.83	3.92	3.83	3.92	3.92	3.92
ROUTED TO													
+	RD4B2	.22	1	FLOW	198.	187.	170.	159.	144.	57.	49.	45.	41.
				TIME	3.83	3.83	3.92	3.92	3.92	3.92	3.92	3.92	4.00
			2	FLOW	198.	187.	171.	159.	144.	57.	49.	45.	41.
				TIME	3.83	3.83	3.92	3.92	3.92	3.92	3.92	3.92	4.00

north flows from Jones (south of Craig) ↑ not really, except for storm drain flows =

T 702-365-9312 | F 702-365-9317
6345 S Jones Blvd, Suite 100
Las Vegas, NV 89118

Lochsa engineering

March 29, 2016

Response to NDOT Comments

Mr. Thaddeus V. Stephenson, ET IV
District I Permit Department
Nevada Department of Transportation
123 E. Washington Avenue
Las Vegas, NV 89107

Subject: District Permit No. 204470-2016 for Murphy Express at Craig Road and Jones Boulevard
Lochsa Engineering Project No. 151068.51

Dear Mr. Stephenson,

Lochsa Engineering is in receipt of the comment letter from the Department's Committee Review for the above referenced project. **Please note that the response to the following comments did not result in any revision to the previously submitted Murphy Express grading plans (Sheets C-3.0, C-3.1 and C-5.0). Thus, no revised grading plan sheets are being resubmitted for the Murphy Express improvements. Please also note that the revised Rancho Drive temporary sidewalk plans in response to Comment No. 3 were submitted with a separate NDOT permit # 204370-2015 for Rancho Drive (SR 599).**

In response to your comments, the following information is presented:

Comment 1: Provide design flows for the NDOT functional classification of adjacent roadways as appropriate.

Response 1: Noted. As shown in the attached figures A-1 and A-2 for NDOT Roadway Functional Classification, Craig Road and Rancho Drive are classified as 'Other Principal Arterial'. As shown in the attached Table 3-1 (Roadway Surface Drainage Facilities) from the 2006 NDOT Drainage Manual, the minimum design return frequency for Craig Road and Rancho Drive is the 25-year storm. Therefore, the previously submitted HEC-1 model has been revised to model the 25-year storm, in addition to the previous 10- and 100-year storm events. Previous drainage exhibits DR1(Existing), DR2(Interim), DR3(Developed) and OF1(Offsite) have also been revised to include the 25-year runoff flow values.

In response to Comment No. 2, runoff flows conveyed within the south half of Craig Road have been revised to reflect only the local flows. Therefore, normal depth calculation is being provided for Craig Road along the project site to reflect the revised existing, interim and developed conditions.

Comment 2: Provide a display similar to the "Developed Drainage Plan" (Sheet DR3) for the existing conditions to show in a side-by-side comparison that the increase in peak flow leaving the development is negligible. For the drop inlet that in Construction Note #12 on Sheet C-3.1, please show/discuss its impact to the downstream system.

Response 2: Noted. The response to this comment will be provided in four different sections to ensure that the different concerns are being properly addressed. As will be shown, the proposed interim improvements (Murphy Express) will not increase surface flows within Craig Road for the 10-, 25- or the 100-year storm events. In addition, it will be shown that the local flows generated through the project site will not contribute/impact the design flow for the existing Craig Road storm drain. Thus, the future development of the Rancho/Jones property (basins OFD1 and OFD2) may be required to utilize the capacity of the existing Craig Road storm drain, to avoid any increase to the surface flows in Craig Road.

Existing/Developed Surface Runoff Comparison

The "Existing Drainage Plan" (Sheet DR1) is provided for comparison with Sheet DR3. Sheets DR1, DR2 and DR3 are also revised to label the 25-year storm runoff values. The previously submitted HEC-1 models for the Existing, Interim and Developed conditions have also been revised to provide additional combination points CMX3/CMI3/CMD3 to provide comparison for the total surface flows draining onto Craig Road through the subject Rancho/Craig property. Runoff from CMX3(15/22/31cfs, Q10/Q25/Q100) represents the existing condition, whereas CMI3(14/20/29cfs) represents the interim condition (i.e. upon the construction of only the proposed Murphy Express improvements). The comparison between CMX3 and CMI3 illustrates that the proposed Murphy Express improvements will actually result in a minor reduction to the surface flows within the southern half of Craig Road. This is due to the draining the runoff from basin NDA(2/2/3cfs) into the existing Craig Road storm drain.

The combined runoff at CMD3(19/26/36cfs) represents the total surface flows draining onto Craig Road upon the full development of the northern portion of the Rancho/Jones property (i.e. offsite basins OFD1 and OFD2). The comparison between CMX3 and CMD3 illustrates an increase in the surface flows in Craig Road by 4cfs, 4cfs and 5cfs for the 10-year, 25-year and 100-year storm events, respectively. **As will be discussed in the following paragraph, the existing Craig Road storm drain along the site provides sufficient capacity to convey this increase in Craig Road flows. Therefore, the future development of OFD1 and OFD2 is expected to utilize the existing storm drain in Craig Road and Jones Boulevard to convey this ultimate increase of runoff flows.**

Craig Road Storm Drain

Additional research is carried out to provide a better determination of the hydrologic analysis and hydraulic design for Craig Road and the existing Craig Road storm drain, between Rancho Drive and Jones Boulevard. The most relevant information was provided in the 1992 'Hydrologic Study for Craig Road between US 95 and Decatur Boulevard' (will be referred to as Craig Study). **The Craig Study provided hydrologic analysis for the existing and ultimate flows continuing easterly within Craig Road. The Craig Study also established the design flows for the existing Craig Road storm drain and provided hydraulic design for the storm drain system.**

As shown in the attached excerpts, the Craig Study determined the total flows (i.e. Surface & Storm Drain) at the Craig/Rancho intersection as combination point RNHCRG(223/581cfs). The Craig study also determined the flows continuing easterly along Craig Road (just downstream the intersection) as diversion card CRGDIV(223/349cfs,

Q10/Q100). The Craig Study also determined that the Craig storm drain is designed to convey 210cfs (for the 10-, 25- and 100-year events) from the combined flows at CRGDIV (also labeled as CRG.RNCH). Utilizing the 25-Year Rainfall Depth Ratio of 0.74 to the 100-year Rainfall Depth, the 25-year flows at CRG.RNCH is estimated to be 258cfs (i.e. 0.74 x 349cfs). **Thus, the bypassed surface flows continuing easterly in Craig Road just east of Rancho Drive was determined to be 13cfs/48cfs/139cfs (Q10/Q25/Q100).**

Since the surface flows are draining onto Craig/Rancho intersection from the north, the Craig Study (and other studies in the vicinity) determined these bypassed flows to continue within the north half of Craig Road. Normal depth calculation is also being provided to illustrate the large capacity of Craig Road north half that will contain the entire 100-year bypassed flows. Thus, flows within the south half of Craig Road along the project site are limited to the runoff generated through the south half of Craig Road, in addition to the runoff generated through the subject site (i.e. CMX2, CMI2 and CMD2).

As shown in the attached referenced HEC-1 from the Craig Study, the watershed area contributing to the flows at Craig/Rancho intersection (combination point RNHCRG) is determined to be more than 60square miles (and will be reduced to approximately 25square miles in the future). The peak time for referenced combination point RNHCRG and diversion card CRG.RNCH is approximately 5.92hours and 7.50hours for the 10-year and 100-year storm events, respectively. As shown in the as-built plans for Craig Road storm drain and the referenced hydraulic model from the Craig Study, the larger drop inlets were constructed within the north half of Craig Road. Minimum size (4ft) drop inlets were constructed along the south half of Craig Road along the project site. **As described previously, the flows within the north half of Craig Road represent the large watershed flows, whereas the flows within the south half represent the local flows. Due to the very large runoff peak time for the large watershed (more than 6hours), only the flows intercepted from the northern drop inlets/laterals may contribute to the storm drain design flow. As shown in the as-built plans, with these contributions from the north laterals, the design flow for the 60"RCP segment is increased from 210cfs(at Rancho) to 290cfs (at Jones).**

As shown in the referenced information from the Craig Study, Future flows conveyed through north half of Craig Road and the existing storm drain will be much less than the Existing flows. This is due to the anticipated construction of the Gowan North Buffalo Branch (between Lone Mountain and Washburn), between Lone Mountain Road and Craig Road. Please also note that since the approval of the Craig Study, the Gowan Outfall CCRFCD facility along Lone Mountain has been constructed (between Rancho Drive and Decatur Boulevard). As shown in the attached referenced as-built plans and "Final Design Report for Gowan Outfall – Lone Mountain Branch, Rancho to Decatur", runoff from the entire area northwest of the Jones/Lone Mountain intersection will no longer drain towards the Craig/Jones intersection. Thus, the previously referenced diversion card labeled as LMTN.DIV no longer drains towards the Craig/Jones intersection. Therefore, the Existing and Future flows at Craig/Jones intersection are significantly less than previously determined in the Craig Study.

It is worth mentioning that the most current and detailed hydrologic analysis for the flows at the Rancho/Craig intersection were provided in the "Rancho Drive/US95 Flood Hazard Mapping Restudy, by Louis Berger Group, Inc., approved by FEMA in November 2009

(will be referred to as the Rancho/US95 LOMR). As shown in the attached referenced information, the total surface flows at the Rancho/Craig intersection were determined aa combination point 2C2B3(Q100=199cfs), in addition to 210cfs intercepted and conveyed into the existing Craig storm drain. Thus, the LOMR study determined the total 100-year flows (i.e. Surface and Craig storm drain) at Rancho/Craig intersection to be approximately 409cfs (i.e. 199cfs + 210cfs). **The Rancho/US95 LOMR Study determined the entire 100-year surface flows of 199cfs to continue southerly along Rancho Drive.** Thus, the As discussed previously, the Craig Study determined the total flows (i.e. Surface and Craig storm drain) at the Craig/Rancho intersection as combination point RNHCRG(Q100=581cfs). **Thus, the Craig Study represents a more conservative estimate of the surface flows along the north half of Craig Road. On the other hand, the design flow for the existing Craig storm drain remains unchanged from the LOMR and Craig studies.**

Existing Drop Inlet and Lateral

As shown in the attached as-built plans, the existing 4ft Type 'A' drop inlet (no grate) is labeled as drop inlet #16. The inlet drains into the 60"RCP through the existing 18"RCP lateral. The inlet and lateral are located in STA: 62+40, approximately 83ft downstream the 36"RCP lateral at STA: 61+57. As shown in the referenced hydraulic model from the Craig Study, the Energy Grade Line (EGL) and Hydraulic Grade Line (HGL) at STA: 61+57 are determined to be 2255.92ft and 2252.53ft, respectively.

From the as-built plans, the Craig Road storm drain HGL value near the subject drop inlet #16 is estimated to be approximately 2251.0ft, which is approximately 10ft below Craig Road flowline elevation. **As shown in the referenced hydraulic calculations from the Craig Study, the subject drop inlet #16 was determined to intercept approximately 2.20cfs. The existing 18"RCP lateral was constructed with 10% slope, and the Craig Study illustrated that the 18"RCP lateral has the capacity to convey more than 10cfs** (at a conservative slope of 1.0%). However, since the local flows intercepted through the existing drop inlet #16 do not contribute to the 60"RCP design flow, the referenced hydraulic design did not model any additional flows from the 18"RCP lateral at STA: 62+40.

Proposed Drop Inlet and Lateral

The subject proposed 3'x3' onsite drop inlet in Construction Note #12 (Sheet C-3.1) is designed to intercept the runoff from onsite basin NDA(2/2/3cfs). Runoff intercepted from the proposed drop inlet will be conveyed into a proposed 18"RCP(at 1.0% slope), which drains into the back of the existing 4ft drop inlet #16 and into the existing 18"RCP lateral. As discussed in the previous section, the existing drop inlet #16 was designed to intercept approximately 2.20cfs. Thus, the total 100-year flows being proposed to drain through the existing 18"RCP lateral is estimated to be 5.20cfs (i.e. 2.20 + Q100 from NDA). The Craig Study illustrated that the flow capacity of the existing 18"RCP (at 1.0%) is more than 10cfs. **Thus, the existing 18" RCP lateral has the capacity to convey the entire flows from the proposed drop inlet, in addition to the existing drop inlet #16. Inlet-control nomograph is also being provided for the 18"RCP to illustrate its sufficient capacity to convey the entire flows.**

As discussed previously, the design flows for the Craig Road storm drain system was determined as the peak flows from a large watershed shed of more than 60square miles and with hydrograph peak time of more than 6.0 hours. Only bypassed flows conveyed along the north half of Craig Road may contribute/impact to the Craig Storm drain design flow. Flows within the south half of Craig Road represent only local flows draining onto Craig Road from the south. Due to the very large peak time of the large watershed (more than 6hours), any intercepted local flows will not contribute to the peak flows in the storm drain. **Thus, the intercepted flows from onsite basin NDA (or future basins OFD1 and OFD2) will not contribute to (or impact) the design flow for the Craig Road storm drain.**

Comment 3: The proposed temporary sidewalk has a slope that would create a V-Ditch along Rancho Drive. Either flip the slope so that the flow will continue to sheet flow, or do the hydrology for the Functional Classification of this roadway section and show that flow will not be diverted and spread will not be violated on Rancho Drive.

Response 3: The plans have been revised to flip the previously proposed cross slope for the temporary sidewalk, to allow for the Rancho Drive flows to continue to sheet flow. Please note that the revised Rancho Drive temporary sidewalk plans were submitted with a separate NDOT permit # 204370-2015 for Rancho Drive (SR 599).

Comment 4: Concerning the culverts that will be extended on Rancho Drive at Station 21+64 and Station 31+63, please do an existing versus proposed culvert analysis to show that the capacity will not be impacted for the design event (per the Functional Classification of the roadway).

Response 4: The subject existing 6' x 3' RCBCs across Rancho Drive at Stations 21+64 and 31+63cfs, have been analyzed in several studies. As shown in the attached Table 3-2 'Design Storm Selection for Off-site Flow Facilities (Culverts, Channels, Bridges)' from the 2006 NDOT Drainage Manual, the minimum design return frequency for the Culverts crossing Rancho Drive is the 25-year storm. **However, as indicated in Note (2) in Table 3-2, since the existing Rancho Drive culverts were originally designed for higher return frequency than the 25-year, the 100-year return frequency is being utilized in the response to the comments.**

The existing RCBC at Station 21+64 crosses Rancho Drive within the existing UMC Quick Care Center, and will be and **will be referred to as the UMC 6'x3' RCBC**. As shown in the attached copy of the approved plans for the "UMC Quick Care Center", the existing UMC 6'x3' RCBC will divert (easterly) portion of the flows travelling southerly along the west side of Rancho Drive. Within the UMC, these Rancho Drive southerly flows are conveyed through an existing open channel within 90ft public drainage easement. The southerly flows along Rancho Drive and the diverted flows through the UMC 6'x3' RCBC were previously analyzed in several drainage studies. The most current and detailed analysis for these flows are provided in the "Rancho Drive/US95 Flood Hazard Mapping Restudy, by Louis Berger Group, Inc., approved by FEMA in November 2009 (**will be referred to as the Rancho/US95 LOMR**).

As shown in the attached relevant excerpts from the Rancho/US95 LOMR, the 100-year flows traveling southerly along Rancho Drive (upstream the existing UMC 6'x3' RCBC) was determined to be 199cfs. As shown in referenced Exhibit C7R, the HEC-RAS model along Rancho Drive determined the 100-year water surface elevation (WSE) near the entrance of the UMC 6'x3' RCB to be 2278.18ft (at HEC-RAS Sta: 53+82). As shown in the approved UMC Plans and the current topographic information for Rancho Drive, the upstream invert for the UMC 6'x3' RCB is approximately 2275.0ft. Thus, the available 100-year headwater upstream the entrance of the UMC 6'x3' RCB is approximately 3.0ft. The Rancho/US95 LOMR determined the 100-year flows diverted easterly through the UMC 6'x3'RCB to be 78cfs, utilizing the available 100-year headwater and inlet control nomograph. Since the referenced nomogrph information from the Rancho/US95 LOMR was not available, the inlet control nomograph is utilized in this response to confirm the diverted 78cfs through the UMC 6'x3' RCB.

The existing 6'x3' RCBC at Station 31+63 crosses Rancho Drive within the existing Pep Boys Auto Center, and will be and **will be referred to as the Pep Boys 6'x3' RCBC**. As shown in the attached copy of the approved plans for the "Rancho Town & Country Shopping Center", the existing Pep Boys 6'x3' RCBC will divert (easterly) portion of the flows travelling southerly along the west side of Rancho Drive. Within the Pep Boys development, these Rancho Drive southerly flows are conveyed through an existing 7' x 3' RCB storm drain. As shown in the attached relevant excerpts from the Rancho/US95 LOMR, the 100-year flows bypassing the existing UMC 6'x3' RCBC towards the existing 7'x3' RCB is determined to be approximately 121cfs. The Rancho/US95 LOMR determined the 100-year flows diverted easterly through the Pep Boys 6'x3' RCBC to be 35cfs, utilizing the available 100-year headwater through the 7'x3' RCB and inlet control nomograph. Since the referenced nomogrph information from the Rancho/US95 LOMR was not available, the inlet control nomograph is utilized in this response to confirm the diverted 35cfs through the Pep Boys 6'x3'RCBC. To determine the available headwater at the through the existing 7'x3' RCB storm drain (near the entrance of the Pep Boys 6'x3' RCBC), a normal depth calculation is provided for the 7'x3' RCB. As shown in the FlowMaster output, the 100-year flow depth within the 7'x3' RBC storm drain is estimated to be 1.76ft.

Thus, the 1000-year design flows for the UMC(Station 21+64) and Pep Boys(Station 31+63) is determined to be 78cfs and 35cfs, respectively. To illustrate that the proposed 10-ft extension will not impact the capacity of the existing 6'x3' RCBC, normal depth calculation is provided for each RCBC. The normal depth calculation illustrates that the design flow through each RCBC is partially-full and Supercritical flow regime. Thus, any downstream disturbance will not propagate upstream to impact the headwater at the entrance. In addition, outlet control nomograph is provided for each RCBC to illustrate that the required outlet-control headwater at the entrance will remain lower than the available headwater near the entrance of the RCBCs.

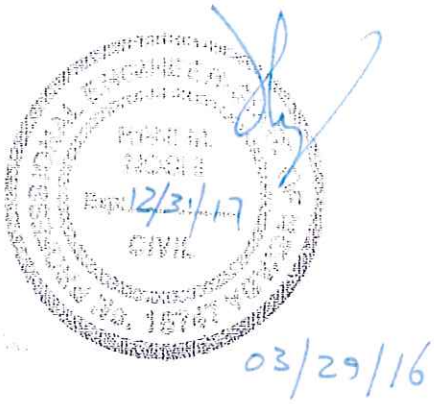
Comment 5: Due to they will be extended outside of ROW. Please verify with NDOT Maintenance as to whether they will require a maintenance agreement to access the end of the facility

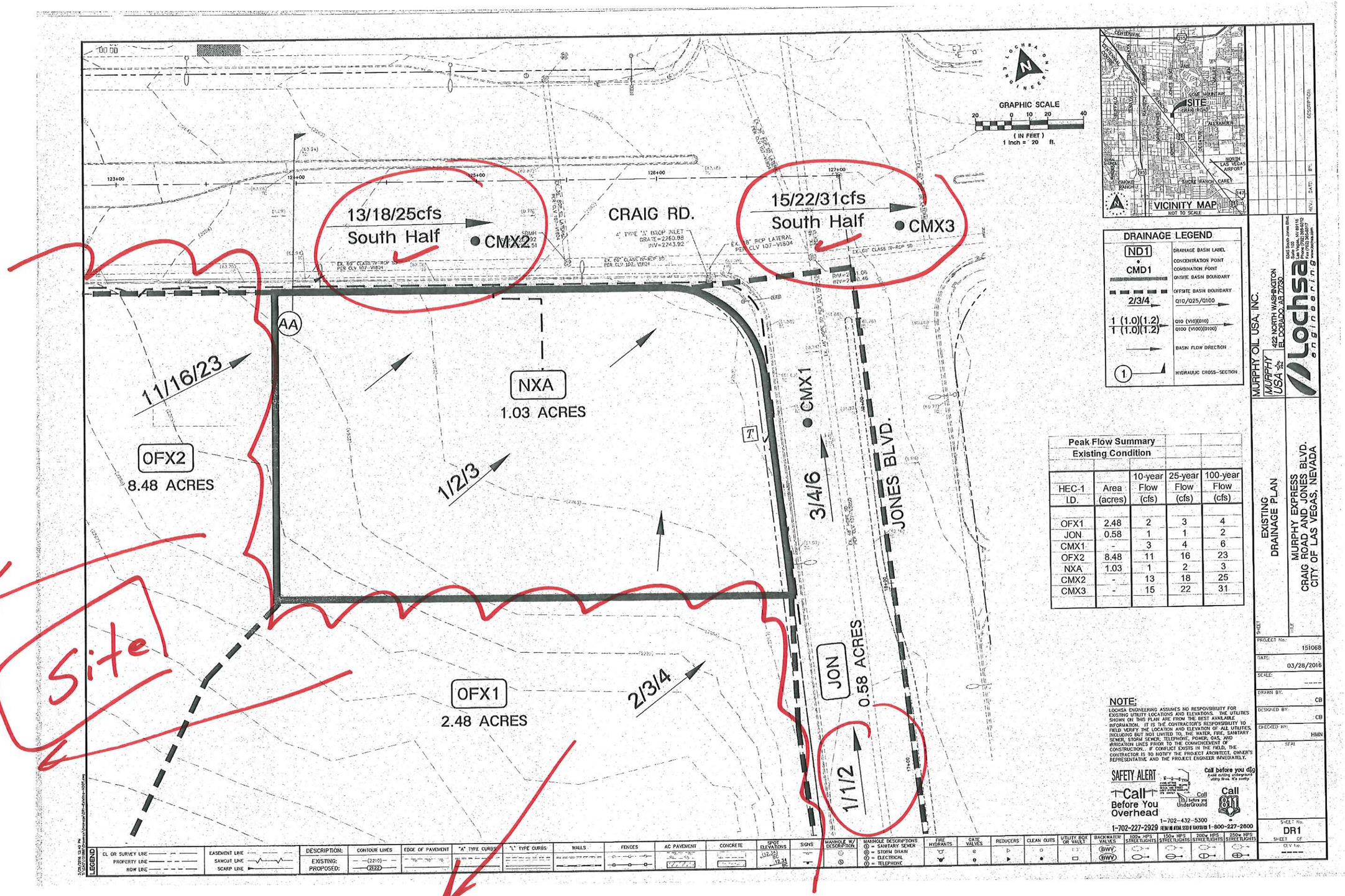
Response 5: Lochsa Engineering has verified with NDOT on the maintenance agreement to access end of each facility. Per Mr. Mohamed Rouas, NDOT Asst. District Engineer, additional T & C has been created and will be shown in the permit upon release. <u>The additional condition will state that "The Permittee shall give the Department maintenance access for the drainage facilities that extend onto the Permittee's Property".</u>

If you have any questions or further comments, please contact our office at your convenience.

Sincerely,
LOCHSA ENGINEERING

Hani M. Noshi, Ph.D., P.E., CFM
Principal





Peak Flow Summary
Existing Condition

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
OFX1	2.48	2	3	4
JON	0.58	1	1	2
CMX1	-	3	4	6
OFX2	8.48	11	16	23
NXA	1.03	1	2	3
CMX2	-	13	18	25
CMX3	-	15	22	31

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

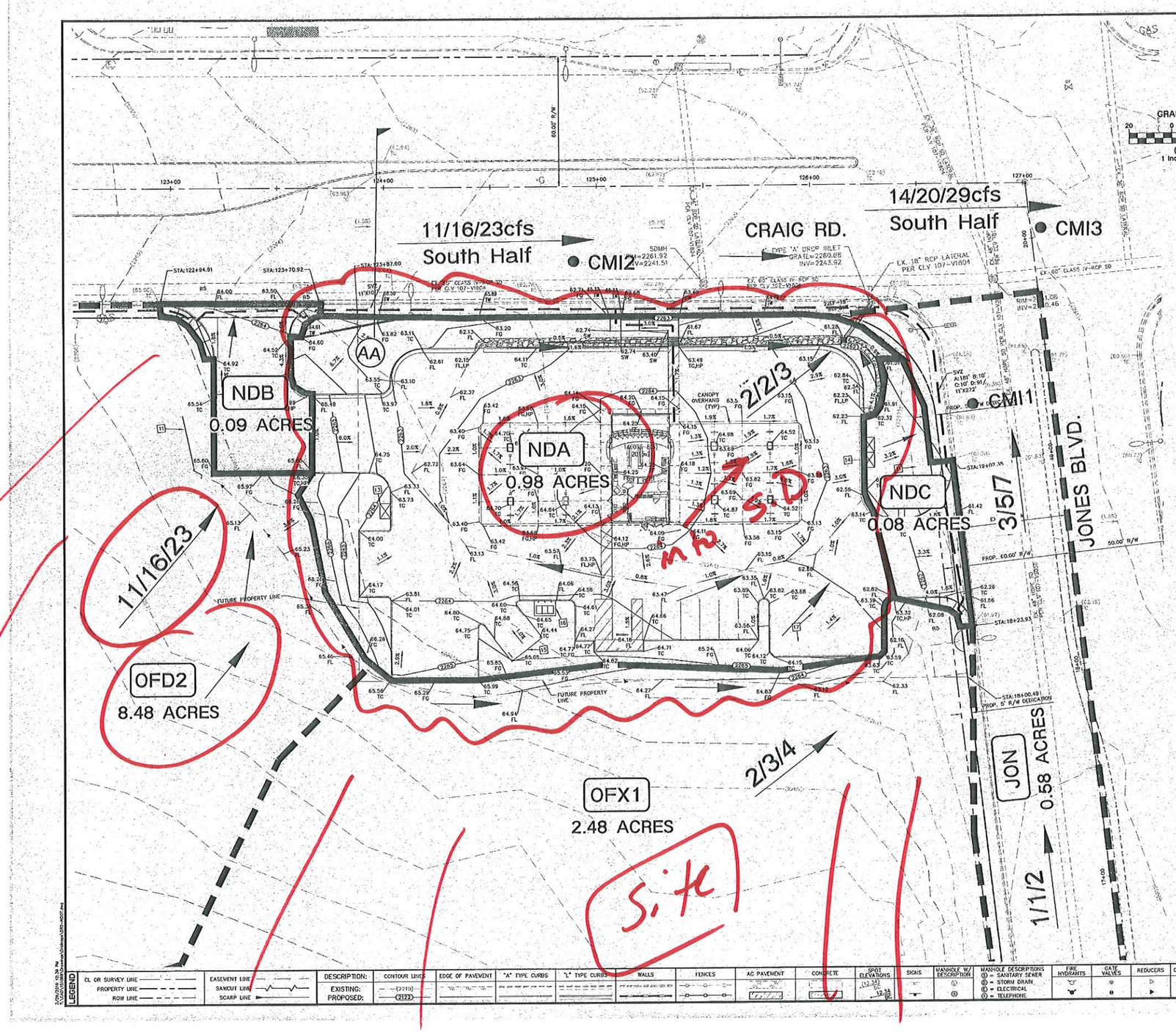
SAFETY ALERT
Call Before You Overhead
1-702-432-5300
Call before you dig
Avoid hitting underground utility lines. It's easy.
Call 811
1-702-227-2929 1-800-227-2600

MURPHY OIL USA, INC.
MURPHY USA
420 NORTH WASHINGTON
EL DORADO, AR 71730

Lochsa engineering
6345 South Jones Blvd.
Las Vegas, NV 89118
Phone: (702) 365-1372
Fax: (702) 365-1377
www.lochsa.com

EXISTING DRAINAGE PLAN
MURPHY EXPRESS
CRAIG ROAD AND JONES BLVD.
CITY OF LAS VEGAS, NEVADA

PROJECT No.: 15106B
DATE: 03/28/2016
SCALE: ---
DRAWN BY: CB
DESIGNED BY: CB
CHECKED BY: HMN
SEAL
SHEET No. DR1
SHEET OF
CLV file:



DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
CMD1	CONCENTRATION POINT / COMBINATION POINT
	ONSITE BASIN BOUNDARY
	OFFSITE BASIN BOUNDARY
2/3/4	Q10/Q25/Q100
1 (1.0)(1.2) / 1 (1.0)(1.2)	Q10 (V10)(D10) / Q100 (V100)(D100)
	BASIN FLOW DIRECTION
1	HYDRAULIC CROSS-SECTION

Peak Flow Summary
Interim Condition

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
OFX1	2.48	2	3	4
JON	0.58	1	1	2
NDC	0.08	<1	<1	<1
CMI1	-	3	5	7
OFX2	8.48	11	16	23
NDB	0.09	<1	<1	<1
CMI2	-	11	16	23
CMI3	-	14	20	29
NDA	0.98	2	2	3

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

SAFETY ALERT
Call Before You Overhead
Call before you Underground
Call before you dig
Avoid hitting underground utility lines. It's easy.
Call 811
1-702-432-5300
1-702-227-2929
1-800-227-2600

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKFLOW VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34)			S = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34			D = STORM DRAIN						BWV				
														E = ELECTRICAL										
														T = TELEPHONE										

MURPHY OIL USA, INC.	
MURPHY USA	
422 NORTH WASHINGTON EL DORADO, AR 71730	
Lochsa engineering	6345 South Jones Blvd. Suite 100 Las Vegas, NV 89118 Phone (702) 365-6312 Fax (702) 365-6377 www.lochsa.com
DESCRIPTION:	
NO.: DATE: BY:	
INTERIM DRAINAGE PLAN	
MURPHY EXPRESS CRAIG ROAD AND JONES BLVD. CITY OF LAS VEGAS, NEVADA	
SHEET TITLE	
PROJECT No.: 151068	
DATE: 03/28/2016	
SCALE:	
DRAWN BY: CB	
DESIGNED BY: CB	
CHECKED BY: HMN	
SEAL:	
SHEET No. DR2	
SHEET OF	CLV No.

15/20/28cfs
South Half
CMD2

CRAIG RD.

19/26/36cfs
South Half
CMD3

NDB
0.09 ACRES

AA

NDA
0.98 ACRES

2/2/3

CMD1

NDC
0.08 ACRES

4/6/8

JONES BLVD.

15/20/28

OFD2
8.48 ACRES

FUTURE PROPERTY LINE

FUTURE PROPERTY LINE

OFD1
2.48 ACRES

3/4/5

JON
0.58 ACRES

1/1/2

Site

GRAPHIC SCALE
20 0 10 20 40
(IN FEET)
1 Inch = 20 ft.

VICINITY MAP
NOT TO SCALE

DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
CMD1	CONCENTRATION POINT / CONFLUENCE POINT
	ONSITE BASIN BOUNDARY
	OFFSITE BASIN BOUNDARY
2/3/4	Q10/Q25/Q100
1 (1.0)(1.2) / 1 (1.0)(1.2)	Q10 (V10)(D10) / Q100 (V100)(D100)
	BASIN FLOW DIRECTION
1	HYDRAULIC CROSS-SECTION

Peak Flow Summary
Developed Condition

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)	
OFD1	2.48	3	4	5	
JON	0.58	1	1	2	
NDC	0.08	<1	<1	<1	
CMD1	-	4	6	8	<—Note (1)
OFD2	8.48	15	20	28	
NDB	0.09	<1	<1	<1	
CMD2	-	15	20	28	<—Note (1)
CMD3	-	19	26	36	<—Note (1)
NDA	0.98	2	2	3	

* Note (1) : Future development of OFD1/OFD2 may drain portion of their flows into existing Craig Road or Jones Blvd. storm drains

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

SAFETY ALERT
Call Before You Overhead
Call Before You Underground
Call before you dig
Call 811
1-702-432-5300
1-702-227-2929 1-800-227-2600

LEGEND
CL OR SURVEY LINE
PROPERTY LINE
ROW LINE
EASEMENT LINE
SAWCUT LINE
SCARP LINE
DESCRIPTION: EXISTING: PROPOSED:
CONTOUR LINES (2210) 2222
EDGE OF PAVEMENT
"A" TYPE CURBS
"L" TYPE CURBS
WALLS
FENCES
AC PAVEMENT
CONCRETE
SPOT ELEVATIONS
SIGNS
MANHOLE W/ DESCRIPTION
MANHOLE DESCRIPTIONS
(S) = SANITARY SEWER
(D) = STORM DRAIN
(E) = ELECTRICAL
(T) = TELEPHONE
FIRE HYDRANTS
GATE VALVES
REDUCERS
CLEAN OUTS
UTILITY BOX OR VAULT
BACKWATER VALVES
100w HPS STREETLIGHTS
150w HPS STREETLIGHTS
200w HPS STREETLIGHTS
250w HPS STREETLIGHTS

NO.	DESCRIPTION	BY:	DATE:

MURPHY OIL USA, INC.
MURPHY USA
422 NORTH WASHINGTON
EL DORADO, AR 71730

Lochsa engineering
5345 South Jones Blvd.
Las Vegas, NV 89118
Phone (702) 362-2672
Fax (702) 362-2687
www.lochsa.com

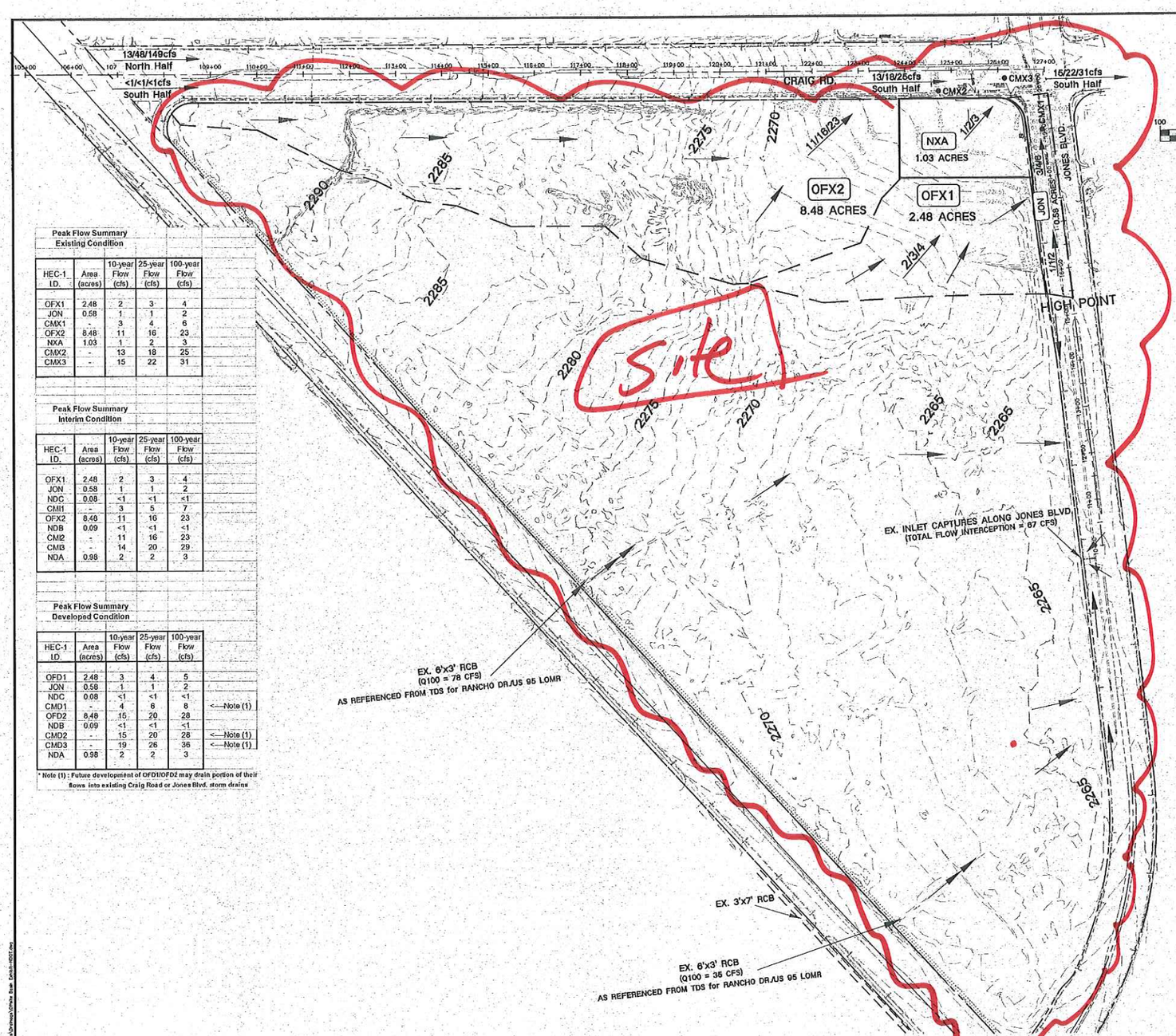
DEVELOPED DRAINAGE PLAN

MURPHY EXPRESS
CRAIG ROAD AND JONES BLVD.
CITY OF LAS VEGAS, NEVADA

PROJECT No.: 151068
DATE: 03/28/2016
SCALE: —
DRAWN BY: CB
DESIGNED BY: CB
CHECKED BY: HMN
SEAL

SHEET No. DR3
SHEET OF
C.V. No. —

3/25/2016 10:35 PM
C:\Users\Chris\Documents\Murphy\DR3-DEVELOPED.dwg



Peak Flow Summary
Existing Condition

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
OFX1	2.48	2	3	4
JON	0.58	1	1	2
CMX1	-	3	4	6
OFX2	8.48	11	16	23
NXA	1.03	1	2	3
CMX2	-	13	18	25
CMX3	-	15	22	31

Peak Flow Summary
Interim Condition

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)
OFX1	2.48	2	3	4
JON	0.58	1	1	2
NDC	0.08	<1	<1	<1
CMI1	-	3	5	7
OFX2	8.48	11	16	23
NDB	0.09	<1	<1	<1
CMI2	-	11	16	23
CMI3	-	14	20	29
NDA	0.98	2	2	3

Peak Flow Summary
Developed Condition

HEC-1 I.D.	Area (acres)	10-year Flow (cfs)	25-year Flow (cfs)	100-year Flow (cfs)	
OFD1	2.48	3	4	5	
JON	0.58	1	1	2	
NDC	0.08	<1	<1	<1	
CMD1	-	4	6	8	<—Note (1)
OFD2	8.48	15	20	28	
NDB	0.09	<1	<1	<1	
CMD2	-	15	20	28	<—Note (1)
CMD3	-	19	26	36	<—Note (1)
NDA	0.98	2	2	3	

* Note (1) : Future development of OFD1/OFD2 may drain portion of their flows into existing Craig Road or Jones Blvd. storm drains

GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 inch = 100 ft.

DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
	ONSITE BASIN BOUNDARY
	OFFSITE BASIN BOUNDARY
2/3/4	Q10/Q25/Q100
1 (1.0)(1.2) / 1 (1.0)(1.2)	Q10 (V10)(D10) / Q100 (V100)(D100)
	BASIN FLOW DIRECTION

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

SAFETY ALERT
Call Before You Overhead
Call before you dig
Avoid cutting underground utility lines. It's easy.
Call
Call (1) before you Undercrank
1-702-432-5300
1-702-227-2929 1-800-227-2600

LEGEND

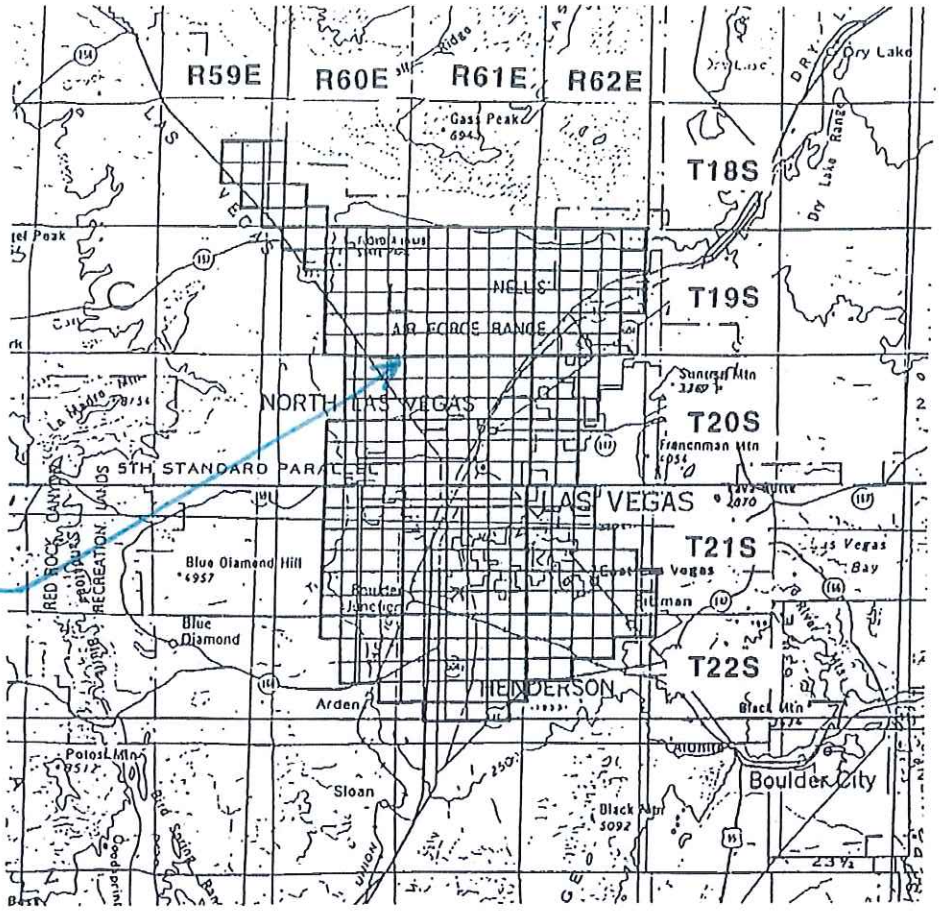
| | | |

Response to Comments No. 1 and 2

Revised HEC-1 Output to Include the 25-Year Storm Runoff

(Existing and Developed Conditions)

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP	RANGE	SECTIONS	TOWNSHIP	RANGE	SECTIONS
18 South	59 East	13-15,22-26,36	20 South	62 East	4-9,16-20,29-32
18 South	60 East	30-32	21 South	60 East	1-4,9-16,21-28,33-36
19 South	60 East	1-6,8-16,21-28,33-36	21 South	61 East	ALL SECTIONS
19 South	61 East	ALL SECTIONS	21 South	62 East	4-9,15-23, 25-36
19 South	62 East	2-11,14-23,27-34	22 South	60 East	1-4,10-15,24
20 South	60 East	1-3,10-15,21-28,33-36	22 South	61 East	1-24,26-29
20 South	61 East	ALL SECTIONS	22 South	62 East	1-10,17-18

Notes:

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

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

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

NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.

2. The 24 hour values presented above are for use with TR-55 only.

3. Table 501 adjustments not required.

Revision	Date

WRC ENGINEERING	REFERENCE: USACE, Los Angeles District, 1988	TABLE 505

```
1****************************************
*                                      *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
*             JUN  1998                *
*           VERSION 4.1                *
*                                      *
*  RUN DATE   25MAR16  TIME  16:04:14  *
*                                      *
****************************************
```

X

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

```
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


```
LINE          ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
    1         ID       MURPHY EXPRESS - CRAIG AND JONES
    2         ID       TECHNICAL DRAINAGE STUDY
    3         ID       EXISTING CONDITION
    4         ID       USING SCS METHODS AND KINEMATIC WAVE ROUTING
    5         ID       MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
    6         ID
    7         ID       LOCHSA JOB# 151068
    8         ID
    9         ID
   10         ID       INPUT FILE NAME:  X.DAT
   11         ID
   12         ID       MARCH 2016
   13         ID
   14         ID       ***************************************************************************
   15         ID       ***************************************************************************
   16         ID            INSIDE McCARRAN AIRPORT RAINFALL AREA
   17         ID
   18         ID            10, 25 & 100 YEAR - 6 HOUR STORM EVENT
   19         ID            PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
   20         ID
   21         ID
   22         ID            10-YEAR RAINFALL DEPTH  = 1.58 INCHES
   23         ID            25-YEAR RAINFALL DEPTH  = 2.05 INCHES
   24         ID            100-YEAR RAINFALL DEPTH = 2.77 INCHES
   25         ID
   26         ID            10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
   27         ID            25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
   28         ID
   29         ID       ***************************************************************************
   30         ID
   31         ID       ***************************************************************************
              *DIAGRAM
   32         IT         5                  73
   33         IO         5        0
   34         IN         5
   35         JR      PREC    .5700    0.74    1.00

   36         KK      OFX1
   37         KM     EXISTING OFFSITE BASIN DRAINING NORTHEASTERLY TOWARD SITE
   38         PB      2.77
   39         PC       0.0      .02     .057     .07     .087     .108     .124     .13      .13      .13
   40         PC       .13      .13      .13     .133      .14     .142     .148     .158     .172     .181
   41         PC       .19     .197     .199       .2     .201     .204     .214     .229     .241     .249
   42         PC      .251     .256      .27     .278     .281     .283     .295     .322     .352     .409
   43         PC      .499      .59      .71     .744     .781     .812     .819     .835     .851     .856
   44         PC       .86     .868     .876     .888      .91     .926     .937      .95      .97     .976
   45         PC      .982     .985     .987     .989      .99     .993     .993     .994     .995     .998
   46         PC      .998     .999      1.0
   47         BA    .00241
   48         LS        0     94.0
   49         UD     .100
```



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

   50         KK      JON
   51         KM     EXISTING STREET BASIN JON
   52         KM     DRAINING NORTH TOWARD CRAIG RD.
   53         BA    .00091
   54         LS        0     98.0
   55         UD      .070

   56         KK      CMX1
   57         KM     COMBINE BASINS OFX1 AND JON THAT COMBINE JUST SOUTH OF CRAIG RD. ON JONES BLV
   58         HC        2

   59         KK      OFX2
   60         KM     EXISTING OFFSITE BASIN OFX2
   61         KM     EXISTING OFFSITE BASIN DRAINING EAST TOWARD SITE
   62         BA    .01325
   63         LS        0     94.0
   64         UD      .130
   65         KO        1
```

```
          66          KK     NXA
          67          KM   EXISTING ONSITE BASIN DRAINING NORTHEASTERLY TOWARD CRAIG RD AND JONES BLVD I
          68          BA  .00161
          69          LS       0    94.0
          70          UD    .100

          71          KK    CMX2
          72          KM   COMBINE BASINS OFX2 AND NXA
          73          HC       2

          74          KK    CMX3
          75          KM   COMBINE CMX1 AND CMX2
          76          KM   TOTAL SURFACE FLOWS FROM THE RANCHO/JONES PROPERTIES DRAINING ONTO CRAIG ROAD
          77          KO       1
          78          HC       2
          79          ZZ
1
              SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    36        OFX1
              .
              .
    50        .         JON
              .          .
              .          .
    56        CMX1.....
              .
              .
    59        .        OFX2
              .          .
              .          .
    66        .          .         NXA
              .          .          .
              .          .          .
    71        .        CMX2.....
              .          .
              .          .
    74        CMX3.....

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   25MAR16  TIME  16:04:14   *
*                                       *
*****************************************

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

                        MURPHY EXPRESS - CRAIG AND JONES
                        TECHNICAL DRAINAGE STUDY
                        EXISTING CONDITION
                        USING SCS METHODS AND KINEMATIC WAVE ROUTING
                        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

                        LOCHSA JOB# 151068


                        INPUT FILE NAME:  X.DAT

                        MARCH 2016

                        ************************************************************************
                        ************************************************************************
                             INSIDE McCARRAN AIRPORT RAINFALL AREA

                             10, 25 & 100 YEAR - 6 HOUR STORM EVENT
                             PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM


                             10-YEAR RAINFALL DEPTH  = 1.58 INCHES
                             25-YEAR RAINFALL DEPTH  = 2.05 INCHES
                             100-YEAR RAINFALL DEPTH = 2.77 INCHES

                             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
                             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
                        ************************************************************************

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

  33 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           73  NUMBER OF HYDROGRAPH ORDINATES
                     NDDATE     1    0  ENDING DATE
                     NDTIME        0600  ENDING TIME
                     ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL      .08 HOURS
                       TOTAL TIME BASE     6.00 HOURS

               ENGLISH UNITS
                    DRAINAGE AREA         SQUARE MILES
                    PRECIPITATION DEPTH   INCHES
                    LENGTH, ELEVATION     FEET
```

X

FLOW CUBIC FEET PER SECOND
STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 .74 1.00

*** ***

59 KK
*
* OFX2 *
*

65 KO OUTPUT CONTROL VARIABLES
IPRNT 1 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

SUBBASIN RUNOFF DATA

62 BA SUBBASIN CHARACTERISTICS
TAREA .01 SUBBASIN AREA

PRECIPITATION DATA

38 PB STORM 2.77 BASIN TOTAL PRECIPITATION

39 PI INCREMENTAL PRECIPITATION PATTERN

.02	.04	.01	.02	.02	.02	.01	.00	.00	.00
.00	.00	.00	.01	.00	.01	.01	.01	.01	.01
.01	.00	.00	.00	.00	.01	.02	.01	.01	.00
.01	.01	.01	.00	.00	.01	.03	.03	.06	.09
.09	.12	.03	.04	.03	.01	.02	.02	.00	.00
.01	.01	.01	.02	.02	.01	.01	.02	.01	.01
.00	.00	.00	.00	.00	.00	.00	.00	.00	.00
.00	.00								

63 LS SCS LOSS RATE
STRTL .13 INITIAL ABSTRACTION
CRVNBR 94.00 CURVE NUMBER
RTIMP .00 PERCENT IMPERVIOUS AREA

64 UD SCS DIMENSIONLESS UNITGRAPH
TLAG .13 LAG

***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

UNIT HYDROGRAPH
10 END-OF-PERIOD ORDINATES

17.	37.	27.	12.	5.	2.	1.	1.	0.	0.

HYDROGRAPH AT STATION OFX2

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	1		0305	38	.07	.02	.06	2.
1		0005	2	.06	.06	.00	0.	1		0310	39	.08	.02	.07	4.
1		0010	3	.10	.10	.00	0.	1		0315	40	.16	.03	.13	7.
1		0015	4	.04	.03	.00	0.	1		0320	41	.25	.03	.22	11.
1		0020	5	.05	.04	.01	0.	1		0325	42	.25	.03	.23	17.
1		0025	6	.06	.04	.02	1.	1		0330	43	.33	.03	.31	22.
1		0030	7	.04	.03	.02	1.	1		0335	44	.09	.01	.09	23.
1		0035	8	.02	.01	.01	1.	1		0340	45	.10	.01	.10	17.
1		0040	9	.00	.00	.00	1.	1		0345	46	.09	.00	.08	13.
1		0045	10	.00	.00	.00	1.	1		0350	47	.02	.00	.02	9.
1		0050	11	.00	.00	.00	0.	1		0355	48	.04	.00	.04	6.
1		0055	12	.00	.00	.00	0.	1		0400	49	.04	.00	.04	5.
1		0100	13	.00	.00	.00	0.	1		0405	50	.01	.00	.01	4.
1		0105	14	.01	.00	.00	0.	1		0410	51	.01	.00	.01	3.
1		0110	15	.02	.01	.01	0.	1		0415	52	.02	.00	.02	2.
1		0115	16	.01	.00	.00	1.	1		0420	53	.02	.00	.02	2.
1		0120	17	.02	.01	.01	1.	1		0425	54	.03	.00	.03	2.
1		0125	18	.03	.01	.01	1.	1		0430	55	.06	.00	.06	3.
1		0130	19	.04	.02	.02	1.	1		0435	56	.04	.00	.04	4.
1		0135	20	.02	.01	.01	2.	1		0440	57	.03	.00	.03	4.
1		0140	21	.02	.01	.02	2.	1		0445	58	.04	.00	.03	4.
1		0145	22	.02	.01	.01	2.	1		0450	59	.06	.00	.05	4.
1		0150	23	.01	.00	.00	1.	1		0455	60	.02	.00	.02	4.
1		0155	24	.00	.00	.00	1.	1		0500	61	.02	.00	.02	3.
1		0200	25	.00	.00	.00	0.	1		0505	62	.01	.00	.01	2.
1		0205	26	.01	.00	.01	0.	1		0510	63	.01	.00	.01	1.
1		0210	27	.03	.01	.02	1.	1		0515	64	.01	.00	.01	1.
1		0215	28	.04	.01	.03	1.	1		0520	65	.00	.00	.00	1.
1		0220	29	.03	.01	.02	2.	1		0525	66	.01	.00	.01	1.
1		0225	30	.02	.01	.02	2.	1		0530	67	.00	.00	.00	1.
1		0230	31	.01	.00	.00	2.	1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.01	1.	1		0540	69	.00	.00	.00	0.
1		0240	33	.04	.01	.03	1.	1		0545	70	.01	.00	.01	0.
1		0245	34	.02	.01	.02	2.	1		0550	71	.00	.00	.00	0.
1		0250	35	.01	.00	.01	2.	1		0555	72	.00	.00	.00	0.
1		0255	36	.01	.00	.00	1.	1		0600	73	.00	.00	.00	0.
1		0300	37	.03	.01	.03	1.								

TOTAL RAINFALL = 2.77, TOTAL LOSS = .64, TOTAL EXCESS = 2.13

X

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
23.	3.58	(CFS)	3.	3.	3.	3.
		(INCHES)	2.123	2.123	2.123	2.123
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .01 SQ MI

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH AT STATION OFX2
PLAN 1, RATIO = .57

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	1		0305	38	.04	.02	.03	1.
1		0005	2	.03	.03	.00	0.	1		0310	39	.05	.02	.03	2.
1		0010	3	.06	.06	.00	0.	1		0315	40	.09	.03	.06	3.
1		0015	4	.02	.02	.00	0.	1		0320	41	.14	.04	.10	5.
1		0020	5	.03	.03	.00	0.	1		0325	42	.14	.03	.11	8.
1		0025	6	.03	.03	.00	0.	1		0330	43	.19	.03	.16	11.
1		0030	7	.03	.02	.00	0.	1		0335	44	.05	.01	.05	11.
1		0035	8	.01	.01	.00	0.	1		0340	45	.06	.01	.05	9.
1		0040	9	.00	.00	.00	0.	1		0345	46	.05	.01	.04	7.
1		0045	10	.00	.00	.00	0.	1		0350	47	.01	.00	.01	5.
1		0050	11	.00	.00	.00	0.	1		0355	48	.03	.00	.02	3.
1		0055	12	.00	.00	.00	0.	1		0400	49	.03	.00	.02	3.
1		0100	13	.00	.00	.00	0.	1		0405	50	.01	.00	.01	2.
1		0105	14	.00	.00	.00	0.	1		0410	51	.01	.00	.01	1.
1		0110	15	.01	.01	.00	0.	1		0415	52	.01	.00	.01	1.
1		0115	16	.00	.00	.00	0.	1		0420	53	.01	.00	.01	1.
1		0120	17	.01	.01	.00	0.	1		0425	54	.02	.00	.02	1.
1		0125	18	.02	.01	.00	0.	1		0430	55	.03	.00	.03	2.
1		0130	19	.02	.02	.01	0.	1		0435	56	.03	.00	.02	2.
1		0135	20	.01	.01	.00	1.	1		0440	57	.02	.00	.02	2.
1		0140	21	.01	.01	.01	1.	1		0445	58	.02	.00	.02	2.
1		0145	22	.01	.01	.00	1.	1		0450	59	.03	.00	.03	2.
1		0150	23	.00	.00	.00	0.	1		0455	60	.01	.00	.01	2.
1		0155	24	.00	.00	.00	0.	1		0500	61	.01	.00	.01	2.
1		0200	25	.00	.00	.00	0.	1		0505	62	.00	.00	.00	1.
1		0205	26	.00	.00	.00	0.	1		0510	63	.00	.00	.00	1.
1		0210	27	.02	.01	.01	0.	1		0515	64	.00	.00	.00	1.
1		0215	28	.02	.01	.01	1.	1		0520	65	.00	.00	.00	0.
1		0220	29	.02	.01	.01	1.	1		0525	66	.00	.00	.00	0.
1		0225	30	.01	.01	.01	1.	1		0530	67	.00	.00	.00	0.
1		0230	31	.00	.00	.00	1.	1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.00	0.	1		0540	69	.00	.00	.00	0.
1		0240	33	.02	.01	.01	1.	1		0545	70	.00	.00	.00	0.
1		0245	34	.01	.01	.01	1.	1		0550	71	.00	.00	.00	0.
1		0250	35	.00	.00	.00	1.	1		0555	72	.00	.00	.00	0.
1		0255	36	.00	.00	.00	0.	1		0600	73	.00	.00	.00	0.
1		0300	37	.02	.01	.01	0.								

TOTAL RAINFALL = 1.58, TOTAL LOSS = .57, TOTAL EXCESS = 1.01

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
11.	3.58	(CFS)	1.	1.	1.	1.
		(INCHES)	1.005	1.005	1.005	1.005
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .01 SQ MI

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH AT STATION OFX2
PLAN 1, RATIO = .74

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	1		0305	38	.06	.02	.04	1.
1		0005	2	.04	.04	.00	0.	1		0310	39	.06	.02	.04	3.
1		0010	3	.08	.08	.00	0.	1		0315	40	.12	.03	.09	4.
1		0015	4	.03	.03	.00	0.	1		0320	41	.18	.04	.15	8.
1		0020	5	.03	.03	.00	0.	1		0325	42	.19	.03	.16	11.
1		0025	6	.04	.03	.01	0.	1		0330	43	.25	.03	.22	15.
1		0030	7	.03	.02	.01	1.	1		0335	44	.07	.01	.06	16.
1		0035	8	.01	.01	.00	1.	1		0340	45	.08	.01	.07	12.
1		0040	9	.00	.00	.00	1.	1		0345	46	.06	.01	.06	9.
1		0045	10	.00	.00	.00	0.	1		0350	47	.01	.00	.01	7.
1		0050	11	.00	.00	.00	0.	1		0355	48	.03	.00	.03	4.
1		0055	12	.00	.00	.00	0.	1		0400	49	.03	.00	.03	4.
1		0100	13	.00	.00	.00	0.	1		0405	50	.01	.00	.01	3.
1		0105	14	.01	.00	.00	0.	1		0410	51	.01	.00	.01	2.
1		0110	15	.01	.01	.00	0.	1		0415	52	.02	.00	.02	1.
1		0115	16	.00	.00	.00	0.	1		0420	53	.02	.00	.02	1.
1		0120	17	.01	.01	.00	0.	1		0425	54	.02	.00	.02	2.
1		0125	18	.02	.01	.01	0.	1		0430	55	.05	.00	.04	2.
1		0130	19	.03	.02	.01	1.	1		0435	56	.03	.00	.03	3.
1		0135	20	.02	.01	.01	1.	1		0440	57	.02	.00	.02	3.
1		0140	21	.02	.01	.01	1.	1		0445	58	.03	.00	.02	3.
1		0145	22	.01	.01	.01	1.	1		0450	59	.04	.00	.04	3.
1		0150	23	.00	.00	.00	1.	1		0455	60	.01	.00	.01	3.
1		0155	24	.00	.00	.00	0.	1		0500	61	.01	.00	.01	2.
1		0200	25	.00	.00	.00	0.	1		0505	62	.01	.00	.01	2.

1	0205	26	.01	.00	.00	0.		1	0510	63	.00	.00	.00	1.
1	0210	27	.02	.01	.01	0.		1	0515	64	.00	.00	.00	1.
1	0215	28	.03	.01	.02	1.		1	0520	65	.00	.00	.00	0.
1	0220	29	.02	.01	.01	1.		1	0525	66	.01	.00	.01	0.
1	0225	30	.02	.01	.01	1.		1	0530	67	.00	.00	.00	0.
1	0230	31	.00	.00	.00	1.		1	0535	68	.00	.00	.00	0.
1	0235	32	.01	.00	.01	1.		1	0540	69	.00	.00	.00	0.
1	0240	33	.03	.01	.02	1.		1	0545	70	.01	.00	.01	0.
1	0245	34	.02	.01	.01	1.		1	0550	71	.00	.00	.00	0.
1	0250	35	.01	.00	.00	1.		1	0555	72	.00	.00	.00	0.
1	0255	36	.00	.00	.00	1.		1	0600	73	.00	.00	.00	0.
1	0300	37	.02	.01	.02	1.								

TOTAL RAINFALL = 2.05, TOTAL LOSS = .61, TOTAL EXCESS = 1.44

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
16.	3.58	(CFS)	2.	2.	2.	2.
		(INCHES)	1.439	1.439	1.439	1.439
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .01 SQ MI

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH AT STATION OFX2
PLAN 1, RATIO = 1.00

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.		1		0305	38	.07	.02	.06	2.
1		0005	2	.06	.06	.00	0.		1		0310	39	.08	.02	.07	4.
1		0010	3	.10	.10	.00	0.		1		0315	40	.16	.03	.13	7.
1		0015	4	.04	.03	.00	0.		1		0320	41	.25	.03	.22	11.
1		0020	5	.05	.04	.01	0.		1		0325	42	.25	.03	.23	17.
1		0025	6	.06	.04	.02	1.		1		0330	43	.33	.03	.31	22.
1		0030	7	.04	.03	.02	1.		1		0335	44	.09	.01	.09	23.
1		0035	8	.02	.01	.01	1.		1		0340	45	.10	.01	.10	17.
1		0040	9	.00	.00	.00	1.		1		0345	46	.09	.00	.08	13.
1		0045	10	.00	.00	.00	1.		1		0350	47	.02	.00	.02	9.
1		0050	11	.00	.00	.00	0.		1		0355	48	.04	.00	.04	6.
1		0055	12	.00	.00	.00	0.		1		0400	49	.04	.00	.04	5.
1		0100	13	.00	.00	.00	0.		1		0405	50	.01	.00	.01	4.
1		0105	14	.01	.00	.00	0.		1		0410	51	.01	.00	.01	3.
1		0110	15	.02	.01	.01	0.		1		0415	52	.02	.00	.02	2.
1		0115	16	.01	.00	.00	1.		1		0420	53	.02	.00	.02	2.
1		0120	17	.02	.01	.01	1.		1		0425	54	.03	.00	.03	2.
1		0125	18	.03	.01	.01	1.		1		0430	55	.06	.00	.06	3.
1		0130	19	.04	.02	.02	1.		1		0435	56	.04	.00	.04	4.
1		0135	20	.02	.01	.01	2.		1		0440	57	.03	.00	.03	4.
1		0140	21	.02	.01	.02	2.		1		0445	58	.04	.00	.03	4.
1		0145	22	.02	.01	.01	2.		1		0450	59	.06	.00	.05	4.
1		0150	23	.01	.00	.00	1.		1		0455	60	.02	.00	.02	4.
1		0155	24	.00	.00	.00	1.		1		0500	61	.02	.00	.02	3.
1		0200	25	.00	.00	.00	0.		1		0505	62	.01	.00	.01	2.
1		0205	26	.01	.00	.01	0.		1		0510	63	.01	.00	.01	1.
1		0210	27	.03	.01	.02	1.		1		0515	64	.01	.00	.01	1.
1		0215	28	.04	.01	.03	1.		1		0520	65	.00	.00	.00	1.
1		0220	29	.03	.01	.02	2.		1		0525	66	.01	.00	.01	1.
1		0225	30	.02	.01	.02	2.		1		0530	67	.00	.00	.00	1.
1		0230	31	.01	.00	.00	2.		1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.01	1.		1		0540	69	.00	.00	.00	0.
1		0240	33	.04	.01	.03	1.		1		0545	70	.01	.00	.01	0.
1		0245	34	.02	.01	.02	2.		1		0550	71	.00	.00	.00	0.
1		0250	35	.01	.00	.01	2.		1		0555	72	.00	.00	.00	0.
1		0255	36	.01	.00	.00	1.		1		0600	73	.00	.00	.00	0.
1		0300	37	.03	.01	.03	1.									

TOTAL RAINFALL = 2.77, TOTAL LOSS = .64, TOTAL EXCESS = 2.13

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
23.	3.58	(CFS)	3.	3.	3.	3.
		(INCHES)	2.123	2.123	2.123	2.123
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .01 SQ MI

*** ***

```
***************
*             *
*     CMX3    *
*             *
***************
```

```
77 KO          OUTPUT CONTROL VARIABLES
                    IPRNT         1  PRINT CONTROL
                    IPLOT         0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE

78 HC          HYDROGRAPH COMBINATION
                    ICOMP         2  NUMBER OF HYDROGRAPHS TO COMBINE
```

***

HYDROGRAPH AT STATION CMX3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = .57

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		0135	20	1.	1		0310	39	3.	1		0445	58	3.
1		0005	2	0.	1		0140	21	1.	1		0315	40	4.	1		0450	59	3.
1		0010	3	0.	1		0145	22	1.	1		0320	41	8.	1		0455	60	3.
1		0015	4	0.	1		0150	23	1.	1		0325	42	12.	1		0500	61	2.
1		0020	5	0.	1		0155	24	0.	1		0330	43	15.	1		0505	62	1.
1		0025	6	0.	1		0200	25	0.	1		0335	44	15.	1		0510	63	1.
1		0030	7	0.	1		0205	26	0.	1		0340	45	12.	1		0515	64	1.
1		0035	8	0.	1		0210	27	0.	1		0345	46	9.	1		0520	65	0.
1		0040	9	0.	1		0215	28	1.	1		0350	47	6.	1		0525	66	0.
1		0045	10	0.	1		0220	29	1.	1		0355	48	4.	1		0530	67	0.
1		0050	11	0.	1		0225	30	1.	1		0400	49	3.	1		0535	68	0.
1		0055	12	0.	1		0230	31	1.	1		0405	50	3.	1		0540	69	0.
1		0100	13	0.	1		0235	32	1.	1		0410	51	2.	1		0545	70	0.
1		0105	14	0.	1		0240	33	1.	1		0415	52	1.	1		0550	71	0.
1		0110	15	0.	1		0245	34	1.	1		0420	53	1.	1		0555	72	0.
1		0115	16	0.	1		0250	35	1.	1		0425	54	2.	1		0600	73	0.
1		0120	17	0.	1		0255	36	1.	1		0430	55	2.					
1		0125	18	0.	1		0300	37	1.	1		0435	56	3.					
1		0130	19	1.	1		0305	38	2.	1		0440	57	3.					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
		(CFS)	2.	2.	2.	2.
15.	3.58	(INCHES)	1.023	1.023	1.023	1.023
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .02 SQ MI

HYDROGRAPH AT STATION CMX3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = .74

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		0135	20	1.	1		0310	39	4.	1		0445	58	4.
1		0005	2	0.	1		0140	21	1.	1		0315	40	7.	1		0450	59	4.
1		0010	3	0.	1		0145	22	1.	1		0320	41	11.	1		0455	60	4.
1		0015	4	0.	1		0150	23	1.	1		0325	42	16.	1		0500	61	3.
1		0020	5	0.	1		0155	24	1.	1		0330	43	21.	1		0505	62	2.
1		0025	6	1.	1		0200	25	0.	1		0335	44	22.	1		0510	63	1.
1		0030	7	1.	1		0205	26	0.	1		0340	45	16.	1		0515	64	1.
1		0035	8	1.	1		0210	27	1.	1		0345	46	12.	1		0520	65	1.
1		0040	9	1.	1		0215	28	1.	1		0350	47	9.	1		0525	66	1.
1		0045	10	0.	1		0220	29	2.	1		0355	48	6.	1		0530	67	0.
1		0050	11	0.	1		0225	30	2.	1		0400	49	5.	1		0535	68	0.
1		0055	12	0.	1		0230	31	1.	1		0405	50	4.	1		0540	69	0.
1		0100	13	0.	1		0235	32	1.	1		0410	51	3.	1		0545	70	0.
1		0105	14	0.	1		0240	33	1.	1		0415	52	2.	1		0550	71	0.
1		0110	15	0.	1		0245	34	2.	1		0420	53	2.	1		0555	72	0.
1		0115	16	0.	1		0250	35	1.	1		0425	54	2.	1		0600	73	0.
1		0120	17	0.	1		0255	36	1.	1		0430	55	3.					
1		0125	18	1.	1		0300	37	1.	1		0435	56	4.					
1		0130	19	1.	1		0305	38	2.	1		0440	57	4.					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
		(CFS)	3.	3.	3.	3.
22.	3.58	(INCHES)	1.458	1.458	1.458	1.458
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .02 SQ MI

HYDROGRAPH AT STATION CMX3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = 1.00

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		0135	20	2.	1		0310	39	6.	1		0445	58	5.
1		0005	2	0.	1		0140	21	2.	1		0315	40	10.	1		0450	59	5.
1		0010	3	0.	1		0145	22	2.	1		0320	41	17.	1		0455	60	5.
1		0015	4	0.	1		0150	23	2.	1		0325	42	24.	1		0500	61	4.
1		0020	5	1.	1		0155	24	1.	1		0330	43	31.	1		0505	62	3.
1		0025	6	1.	1		0200	25	1.	1		0335	44	31.	1		0510	63	2.
1		0030	7	2.	1		0205	26	1.	1		0340	45	23.	1		0515	64	1.
1		0035	8	2.	1		0210	27	1.	1		0345	46	17.	1		0520	65	1.
1		0040	9	1.	1		0215	28	2.	1		0350	47	12.	1		0525	66	1.
1		0045	10	1.	1		0220	29	3.	1		0355	48	8.	1		0530	67	1.
1		0050	11	0.	1		0225	30	3.	1		0400	49	7.	1		0535	68	0.
1		0055	12	0.	1		0230	31	2.	1		0405	50	5.	1		0540	69	0.
1		0100	13	0.	1		0235	32	2.	1		0410	51	4.	1		0545	70	1.
1		0105	14	0.	1		0240	33	2.	1		0415	52	3.	1		0550	71	1.
1		0110	15	1.	1		0245	34	3.	1		0420	53	3.	1		0555	72	0.

```
                                                
```

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   25MAR16  TIME  17:57:38   *
*                                       *
*****************************************
```

I

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

```
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

   1          ID        MURPHY EXPRESS - CRAIG AND JONES
   2          ID        TECHNICAL DRAINAGE STUDY
   3          ID        INTERIM CONDITION
   4          ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
   5          ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
   6          ID
   7          ID        LOCHSA JOB# 151068
   8          ID
   9          ID
  10          ID        INPUT FILE NAME:  I.DAT
  11          ID
  12          ID        MARCH 2016
  13          ID        ********************************************************************************
  14          ID        ********************************************************************************
  15          ID             INSIDE McCARRAN AIRPORT RAINFALL AREA
  16          ID
  17          ID             10, 25 & 100 YEAR - 6 HOUR STORM EVENT
  18          ID             PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
  19          ID
  20          ID
  21          ID             10-YEAR RAINFALL DEPTH  = 1.58 INCHES
  22          ID             25-YEAR RAINFALL DEPTH  = 2.05 INCHES
  23          ID             100-YEAR RAINFALL DEPTH = 2.77 INCHES
  24          ID
  25          ID             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
  26          ID             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
  27          ID
  28          ID        ********************************************************************************
  29          ID        ********************************************************************************
  30          ID
  31          *DIAGRAM
  32          IT      5                   73
  33          IO      5       0
  34          IN      5
  35          JR    PREC   .5700    0.74    1.00

  36          KK   OFX1
  37          KM   EXISTING OFFSITE BASIN DRAINING NORTHEASTERLY TOWARD SITE
  38          PB    2.77
  39          PC     0.0     .02     .057     .07     .087     .108     .124     .13     .13     .13
  40          PC     .13     .13      .13     .133     .14     .142     .148     .158     .172     .181
  41          PC     .19     .197     .199     .2     .201     .204     .214     .229     .241     .249
  42          PC    .251     .256     .27     .278     .281     .283     .295     .322     .352     .409
  43          PC    .499     .59      .71     .744     .781     .812     .819     .835     .851     .856
  44          PC     .86     .868     .876     .888     .91     .926     .937     .95     .97     .976
  45          PC    .982     .985     .987     .989     .99     .993     .993     .994     .995     .998
  46          PC    .998     .999     1.0
  47          BA  .00241
  48          LS       0     94.0
  49          UD    .100
```

1 HEC-1 INPUT PAGE 2

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

  50          KK     JON
  51          KM   EXISTING STREET BASIN JON
  52          KM   DRAINING NORTH TOWARD CRAIG RD.
  53          BA  .00091
  54          LS       0     98.0
  55          UD    .070

  56          KK     NDC
  57          KM   DEVELOPED ONSITE BASIN DRAINING EASTERLY TOWARD JONES BLVD.
  58          BA  .00013
  59          LS       0     96.8
  60          UD    .050

  61          KK    CMI1
  62          KM   COMBINE BASINS OFX1 AND JON THAT COMBINE JUST SOUTH OF CRAIG RD. ON JONES BLV
  63          HC       3

  64          KK    OFX2
```

```
65          KM   EXISTING OFFSITE BASIN OFX2
66          KM   EXISTING OFFSITE BASIN DRAINING EAST TOWARD SITE
67          BA  .01325
68          LS       0    94.0
69          UD    .128

70          KK     NDB
71          KM   DEVELOPED ONSITE BASIN DRAINING NORTH TOWARD CRAIG RD.
72          BA  .00014
73          LS       0    98.0
74          UD    .050

75          KK    CMI2
76          KM   COMBINE BASINS OFX2 AND NDB
77          HC       2

78          KK    CMI3
79          KM   COMBINE CMI1 AND CMI2
80          KM   TOTAL SURFACE FLOWS FROM THE RANCHO/JONES PROPERTIES DRAINING ONTO CRAIG ROAD
81          KO       1
82          HC       2

83          KK     NDA
84          KM   DEVELOPED ONSITE BASIN DRAINING SOUTHEASTERLY TOWARD GRATE INLET AT NEC OF SI
85          BA  .00141
86          LS       0    98.0
87          UD    .050
88          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    36      OFX1
              .
              .
    50        .          JON
              .            .
              .            .
    56        .            .          NDC
              .            .            .
              .            .            .
    61        CMI1.........................
              .
              .
    64        .          OFX2
              .            .
              .            .
    70        .            .          NDB
              .            .            .
              .            .            .
    75        .          CMI2............
              .            .
              .            .
    78        CMI3............
              .
              .
    83        .          NDA
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   25MAR16  TIME  17:57:38   *
*                                       *
*****************************************
```

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

MURPHY EXPRESS - CRAIG AND JONES
TECHNICAL DRAINAGE STUDY
INTERIM CONDITION
USING SCS METHODS AND KINEMATIC WAVE ROUTING
MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

LOCHSA JOB# 151068

INPUT FILE NAME: I.DAT

MARCH 2016

****
****

INSIDE McCARRAN AIRPORT RAINFALL AREA

10, 25 & 100 YEAR - 6 HOUR STORM EVENT
PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM

10-YEAR RAINFALL DEPTH = 1.58 INCHES
25-YEAR RAINFALL DEPTH = 2.05 INCHES
100-YEAR RAINFALL DEPTH = 2.77 INCHES

10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74

****

****

```
 33 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           73  NUMBER OF HYDROGRAPH ORDINATES
                  NDDATE      1    0  ENDING DATE
                  NDTIME         0600  ENDING TIME
                  ICENT           19  CENTURY MARK

                COMPUTATION INTERVAL      .08 HOURS
                    TOTAL TIME BASE     6.00 HOURS

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

  JP          MULTI-PLAN OPTION
                   NPLAN           1  NUMBER OF PLANS

  JR          MULTI-RATIO OPTION
                  RATIOS OF PRECIPITATION
                  .57       .74       1.00

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

          ***************
          *             *
 78 KK    *      CMI3   *
          *             *
          ***************

 81 KO          OUTPUT CONTROL VARIABLES
                   IPRNT           1  PRINT CONTROL
                   IPLOT           0  PLOT CONTROL
                   QSCAL          0.  HYDROGRAPH PLOT SCALE

 82 HC          HYDROGRAPH COMBINATION
                   ICOMP           2  NUMBER OF HYDROGRAPHS TO COMBINE
                                                
```

DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW	DA	MON	HRMN	ORD	FLOW
1	0045	10	0.	*	1	0220	29	2.	*	1	0355	48	5.	*	1	0530	67	0.	
1	0050	11	0.	*	1	0225	30	2.	*	1	0400	49	4.	*	1	0535	68	0.	
1	0055	12	0.	*	1	0230	31	1.	*	1	0405	50	4.	*	1	0540	69	0.	
1	0100	13	0.	*	1	0235	32	1.	*	1	0410	51	2.	*	1	0545	70	0.	
1	0105	14	0.	*	1	0240	33	1.	*	1	0415	52	2.	*	1	0550	71	0.	
1	0110	15	0.	*	1	0245	34	2.	*	1	0420	53	2.	*	1	0555	72	0.	
1	0115	16	0.	*	1	0250	35	1.	*	1	0425	54	2.	*	1	0600	73	0.	
1	0120	17	0.	*	1	0255	36	1.	*	1	0430	55	3.	*					
1	0125	18	1.	*	1	0300	37	1.	*	1	0435	56	4.	*					
1	0130	19	1.	*	1	0305	38	2.	*	1	0440	57	4.	*					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
20.	3.50	(CFS)	3.	3.	3.	3.
		(INCHES)	1.465	1.465	1.465	1.465
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .02 SQ MI

HYDROGRAPH AT STATION CMI3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = 1.00

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	0135	20	2.	*	1	0310	39	6.	*	1	0445	58	5.	
1	0005	2	0.	*	1	0140	21	2.	*	1	0315	40	9.	*	1	0450	59	5.	
1	0010	3	0.	*	1	0145	22	2.	*	1	0320	41	16.	*	1	0455	60	5.	
1	0015	4	0.	*	1	0150	23	2.	*	1	0325	42	22.	*	1	0500	61	4.	
1	0020	5	1.	*	1	0155	24	1.	*	1	0330	43	29.	*	1	0505	62	3.	
1	0025	6	1.	*	1	0200	25	1.	*	1	0335	44	28.	*	1	0510	63	2.	
1	0030	7	2.	*	1	0205	26	0.	*	1	0340	45	21.	*	1	0515	64	1.	
1	0035	8	2.	*	1	0210	27	1.	*	1	0345	46	16.	*	1	0520	65	1.	
1	0040	9	1.	*	1	0215	28	2.	*	1	0350	47	11.	*	1	0525	66	1.	
1	0045	10	1.	*	1	0220	29	3.	*	1	0355	48	8.	*	1	0530	67	1.	
1	0050	11	0.	*	1	0225	30	3.	*	1	0400	49	6.	*	1	0535	68	0.	
1	0055	12	0.	*	1	0230	31	2.	*	1	0405	50	5.	*	1	0540	69	0.	
1	0100	13	0.	*	1	0235	32	1.	*	1	0410	51	3.	*	1	0545	70	0.	
1	0105	14	0.	*	1	0240	33	2.	*	1	0415	52	3.	*	1	0550	71	1.	
1	0110	15	0.	*	1	0245	34	2.	*	1	0420	53	3.	*	1	0555	72	0.	
1	0115	16	1.	*	1	0250	35	2.	*	1	0425	54	3.	*	1	0600	73	0.	
1	0120	17	1.	*	1	0255	36	1.	*	1	0430	55	4.	*					
1	0125	18	1.	*	1	0300	37	2.	*	1	0435	56	5.	*					
1	0130	19	2.	*	1	0305	38	3.	*	1	0440	57	5.	*					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
29.	3.50	(CFS)	4.	4.	4.	4.
		(INCHES)	2.151	2.151	2.151	2.151
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .02 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 .57	RATIO 2 .74	RATIO 3 1.00
HYDROGRAPH AT	OFX1	.00	1	FLOW	2.	3.	4.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	JON	.00	1	FLOW	1.	1.	2.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	NDC	.00	1	FLOW	0.	0.	0.
				TIME	3.50	3.50	3.50
3 COMBINED AT	CMI1	.00	1	FLOW	3.	5.	7.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	OFX2	.01	1	FLOW	11.	16.	23.
				TIME	3.58	3.58	3.58
HYDROGRAPH AT	NDB	.00	1	FLOW	0.	0.	0.
				TIME	3.50	3.50	3.50
2 COMBINED AT	CMI2	.01	1	FLOW	11.	16.	23.
				TIME	3.58	3.58	3.58
2 COMBINED AT	CMI3	.02	1	FLOW	14.	20.	29.
				TIME	3.58	3.50	3.50
HYDROGRAPH AT	NDA	.00	1	FLOW	2.	2.	3.
				TIME	3.50	3.50	3.50

D

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*             JUN  1998                 *
*           VERSION 4.1                 *
*                                       *
*  RUN DATE   25MAR16  TIME  15:53:23   *
*                                       *
*****************************************
```

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

```
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

    1         ID        MURPHY EXPRESS - CRAIG AND JONES
    2         ID        TECHNICAL DRAINAGE STUDY
    3         ID        DEVELOPED CONDITION
    4         ID        USING SCS METHODS AND KINEMATIC WAVE ROUTING
    5         ID        MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION
    6         ID
    7         ID        LOCHSA JOB# 151068
    8         ID
    9         ID
   10         ID        INPUT FILE NAME:  D.DAT
   11         ID
   12         ID        MARCH 2016
   13         ID
   14         ID        ********************************************************************************
   15         ID        ********************************************************************************
   16         ID             INSIDE McCARRAN AIRPORT RAINFALL AREA
   17         ID
   18         ID             10, 25 & 100 YEAR - 6 HOUR STORM EVENT
   19         ID             PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM
   20         ID
   21         ID
   22         ID             10-YEAR RAINFALL DEPTH  = 1.58 INCHES
   23         ID             25-YEAR RAINFALL DEPTH  = 2.05 INCHES
   24         ID             100-YEAR RAINFALL DEPTH = 2.77 INCHES
   25         ID
   26         ID             10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
   27         ID             25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74
   28         ID
   29         ID        ********************************************************************************
   30         ID
   31         ID        ********************************************************************************
              *DIAGRAM
   32         IT      5                   73
   33         IO      5       0
   34         IN      5
   35         JR    PREC   .5700    0.74    1.00

   36         KK    OFD1
   37         KM   DEVELOPED OFFSITE BASIN DRAINING EASTERLY TOWARD SITE
   38         PB    2.77
   39         PC     0.0     .02     .057     .07     .087     .108     .124     .13     .13     .13
   40         PC     .13     .13      .13     .133     .14     .142     .148     .158     .172     .181
   41         PC     .19     .197     .199      .2     .201     .204     .214     .229     .241     .249
   42         PC    .251     .256     .27     .278     .281     .283     .295     .322     .352     .409
   43         PC    .499      .59     .71     .744     .781     .812     .819     .835     .851     .856
   44         PC     .86     .868     .876     .888      .91     .926     .937      .95      .97     .976
   45         PC    .982     .985     .987     .989      .99     .993     .993     .994     .995     .998
   46         PC    .998     .999      1.0
   47         BA  .00241
   48         LS      0     96.8
   49         UD    .059
```

1 HEC-1 INPUT PAGE 2

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

   50         KK     JON
   51         KM   EXISTING STREET BASIN JON
   52         KM   DRAINING NORTH TOWARD CRAIG RD.
   53         BA  .00091
   54         LS      0     98.0
   55         UD    .070

   56         KK     NDC
   57         KM   DEVELOPED ONSITE BASIN DRAINING EASTERLY TOWARD JONES BLVD.
   58         BA  .00013
   59         LS      0     96.8
   60         UD    .050

   61         KK    CMD1
   62         KM   COMBINE BASINS OFD1, JON AND NDC THAT COMBINE JUST SOUTH OF CRAIG RD. ON JONE
   63         HC      3

   64         KK    OFD2
```

D

```
65          KM   DEVELOPEDG OFFSITE BASIN DRAINING EAST TOWARD JONES BLVD.
66          BA  .01325
67          LS       0    96.8
68          UD    .078
69          KO       1

70          KK     NDB
71          KM   DEVELOPED ONSITE BASIN DRAINING NORTH TOWARD CRAIG RD.
72          BA  .00014
73          LS       0    98.0
74          UD    .050

75          KK    CMD2
76          KM   COMBINE BASINS OFD2 AND NDB
77          HC       2

78          KK    CMD3
79          KM   COMBINE CMD1 AND CMD2
80          KM   TOTAL SURFACE FLOWS FROM THE RANCHO/JONES PROPERTIES DRAINING ONTO CRAIG ROAD
81          KO       1
82          HC       2

83          KK     NDA
84          KM   DEVELOPED ONSITE BASIN DRAINING SOUTHEASTERLY TOWARD GRATE INLET AT NEC OF SI
85          BA  .00141
86          LS       0    98.0
87          UD    .050
88          ZZ
```

NDA

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    36       OFD1
               .
               .
    50         .         JON
               .          .
               .          .
    56         .          .         NDC
               .          .          .
               .          .          .
    61       CMD1.....................
               .
               .
    64         .       OFD2
               .          .
               .          .
    70         .          .         NDB
               .          .          .
               .          .          .
    75         .       CMD2.........
               .          .
               .          .
    78       CMD3.........
               .
               .
    83         .         NDA

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
```

1

```
**********************************************
*                                            *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)        *
*             JUN  1998                      *
*           VERSION 4.1                      *
*                                            *
*  RUN DATE   25MAR16  TIME  15:53:23        *
*                                            *
**********************************************
```

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

MURPHY EXPRESS - CRAIG AND JONES
TECHNICAL DRAINAGE STUDY
DEVELOPED CONDITION
USING SCS METHODS AND KINEMATIC WAVE ROUTING
MASTER PLAN ADJUSTED 6-HOUR RAINFALL AND STORM DISTRIBUTION

LOCHSA JOB# 151068

INPUT FILE NAME: D.DAT

MARCH 2016

```
********************************************************************************
********************************************************************************
     INSIDE McCARRAN AIRPORT RAINFALL AREA

     10, 25 & 100 YEAR - 6 HOUR STORM EVENT
     PRECIPITATION BASED ON FIGURES 503 AND 506 OF THE HCDDM


     10-YEAR RAINFALL DEPTH  = 1.58 INCHES
     25-YEAR RAINFALL DEPTH  = 2.05 INCHES
     100-YEAR RAINFALL DEPTH = 2.77 INCHES

     10-YEAR RAINFALL DEPTH RATIO (JR CARD) = 1.58/2.77 = 0.57
     25-YEAR RAINFALL DEPTH RATIO (JR CARD) = 2.05/2.77 = 0.74

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

********************************************************************************
```

```
 33 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           73  NUMBER OF HYDROGRAPH ORDINATES
                 NODATE      1    0  ENDING DATE
                 NOTIME         0600  ENDING TIME
                  ICENT           19  CENTURY MARK

               COMPUTATION INTERVAL      .08 HOURS
                   TOTAL TIME BASE     6.00 HOURS

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

 JP          MULTI-PLAN OPTION
                  NPLAN            1  NUMBER OF PLANS

 JR          MULTI-RATIO OPTION
                RATIOS OF PRECIPITATION
               .57       .74      1.00


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


          ***************
          *             *
 64 KK    *     OFD2    *
          *             *
          ***************

 69 KO          OUTPUT CONTROL VARIABLES
                     IPRNT           1  PRINT CONTROL
                     IPLOT           0  PLOT CONTROL
                     QSCAL          0.  HYDROGRAPH PLOT SCALE

             SUBBASIN RUNOFF DATA

 66 BA          SUBBASIN CHARACTERISTICS
                     TAREA         .01  SUBBASIN AREA

               PRECIPITATION DATA

 38 PB               STORM        2.77  BASIN TOTAL PRECIPITATION

 39 PI           INCREMENTAL PRECIPITATION PATTERN
                    .02       .04       .01       .02       .02       .02       .01       .00       .00       .00
                    .00       .00       .00       .01       .00       .01       .01       .01       .01       .01
                    .01       .00       .00       .00       .00       .01       .02       .01       .01       .00
                    .01       .01       .01       .00       .00       .01       .03       .03       .06       .09
                    .09       .12       .03       .04       .03       .01       .02       .02       .00       .00
                    .01       .01       .01       .02       .02       .01       .01       .02       .01       .01
                    .00       .00       .00       .00       .00       .00       .00       .00       .00       .00
                    .00       .00

 67 LS          SCS LOSS RATE
                     STRTL         .07  INITIAL ABSTRACTION
                    CRVNBR       96.80  CURVE NUMBER
                     RTIMP         .00  PERCENT IMPERVIOUS AREA

 68 UD          SCS DIMENSIONLESS UNITGRAPH
                     TLAG         .08  LAG

                                                    ***

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

                                                UNIT HYDROGRAPH
                                            7 END-OF-PERIOD ORDINATES
                43.       41.       13.        4.        1.        0.        0.
```

****

HYDROGRAPH AT STATION OFD2

****

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q	DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	1		0305	38	.07	.01	.07	4.
1		0005	2	.06	.06	.00	0.	1		0310	39	.08	.01	.08	7.
1		0010	3	.10	.08	.02	1.	1		0315	40	.16	.01	.15	10.
1		0015	4	.04	.02	.02	1.	1		0320	41	.25	.01	.24	18.
1		0020	5	.05	.02	.02	2.	1		0325	42	.25	.01	.24	22.
1		0025	6	.06	.02	.04	3.	1		0330	43	.33	.01	.32	28.
1		0030	7	.04	.01	.03	3.	1		0335	44	.09	.00	.09	22.
1		0035	8	.02	.00	.01	2.	1		0340	45	.10	.00	.10	14.
1		0040	9	.00	.00	.00	1.	1		0345	46	.09	.00	.08	11.
1		0045	10	.00	.00	.00	0.	1		0350	47	.02	.00	.02	7.
1		0050	11	.00	.00	.00	0.	1		0355	48	.04	.00	.04	4.
1		0055	12	.00	.00	.00	0.	1		0400	49	.04	.00	.04	4.
1		0100	13	.00	.00	.00	0.	1		0405	50	.01	.00	.01	3.
1		0105	14	.01	.00	.01	0.	1		0410	51	.01	.00	.01	2.
1		0110	15	.02	.01	.01	1.	1		0415	52	.02	.00	.02	2.
1		0115	16	.01	.00	.00	1.	1		0420	53	.02	.00	.02	2.
1		0120	17	.02	.00	.01	1.	1		0425	54	.03	.00	.03	3.
1		0125	18	.03	.01	.02	2.	1		0430	55	.06	.00	.06	4.
1		0130	19	.04	.01	.03	2.	1		0435	56	.04	.00	.04	5.
1		0135	20	.02	.00	.02	2.	1		0440	57	.03	.00	.03	4.
1		0140	21	.02	.00	.02	2.	1		0445	58	.04	.00	.04	4.
1		0145	22	.02	.00	.02	2.	1		0450	59	.06	.00	.05	4.
1		0150	23	.01	.00	.00	1.	1		0455	60	.02	.00	.02	4.
1		0155	24	.00	.00	.00	1.	1		0500	61	.02	.00	.02	2.

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
								D								
1		0200	25	.00	.00	.00	0.	*	1		0505	62	.01	.00	.01	2.
1		0205	26	.01	.00	.01	0.	*	1		0510	63	.01	.00	.01	1.
1		0210	27	.03	.00	.02	1.	*	1		0515	64	.01	.00	.01	1.
1		0215	28	.04	.01	.04	3.	*	1		0520	65	.00	.00	.00	0.
1		0220	29	.03	.00	.03	3.	*	1		0525	66	.01	.00	.01	1.
1		0225	30	.02	.00	.02	3.	*	1		0530	67	.00	.00	.00	0.
1		0230	31	.01	.00	.00	2.	*	1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.01	1.	*	1		0540	69	.00	.00	.00	0.
1		0240	33	.04	.00	.03	2.	*	1		0545	70	.01	.00	.01	1.
1		0245	34	.02	.00	.02	2.	*	1		0550	71	.00	.00	.00	0.
1		0250	35	.01	.00	.01	2.	*	1		0555	72	.00	.00	.00	0.
1		0255	36	.01	.00	.00	1.	*	1		0600	73	.00	.00	.00	0.
1		0300	37	.03	.00	.03	2.	*								

TOTAL RAINFALL = 2.77, TOTAL LOSS = .36, TOTAL EXCESS = 2.41

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.00-HR
(CFS)	(HR)	(CFS)				
28.	3.50		3.	3.	3.	3.
		(INCHES)	2.406	2.406	2.406	2.406
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .01 SQ MI

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH AT STATION OFD2
PLAN 1, RATIO = .57

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	*	1		0305	38	.04	.01	.03	2.
1		0005	2	.03	.03	.00	0.	*	1		0310	39	.05	.01	.04	3.
1		0010	3	.06	.06	.00	0.	*	1		0315	40	.09	.01	.08	5.
1		0015	4	.02	.02	.00	0.	*	1		0320	41	.14	.02	.13	9.
1		0020	5	.03	.02	.01	0.	*	1		0325	42	.14	.01	.13	12.
1		0025	6	.03	.02	.01	1.	*	1		0330	43	.19	.01	.18	15.
1		0030	7	.03	.01	.01	1.	*	1		0335	44	.05	.00	.05	12.
1		0035	8	.01	.00	.00	1.	*	1		0340	45	.06	.00	.06	7.
1		0040	9	.00	.00	.00	0.	*	1		0345	46	.05	.00	.05	6.
1		0045	10	.00	.00	.00	0.	*	1		0350	47	.01	.00	.01	4.
1		0050	11	.00	.00	.00	0.	*	1		0355	48	.03	.00	.02	2.
1		0055	12	.00	.00	.00	0.	*	1		0400	49	.03	.00	.02	2.
1		0100	13	.00	.00	.00	0.	*	1		0405	50	.01	.00	.01	2.
1		0105	14	.00	.00	.00	0.	*	1		0410	51	.01	.00	.01	1.
1		0110	15	.01	.01	.01	0.	*	1		0415	52	.01	.00	.01	1.
1		0115	16	.00	.00	.00	0.	*	1		0420	53	.01	.00	.01	1.
1		0120	17	.01	.00	.01	0.	*	1		0425	54	.02	.00	.02	1.
1		0125	18	.02	.01	.01	1.	*	1		0430	55	.03	.00	.03	2.
1		0130	19	.02	.01	.01	1.	*	1		0435	56	.03	.00	.02	3.
1		0135	20	.01	.01	.01	1.	*	1		0440	57	.02	.00	.02	2.
1		0140	21	.01	.00	.01	1.	*	1		0445	58	.02	.00	.02	2.
1		0145	22	.01	.00	.01	1.	*	1		0450	59	.03	.00	.03	2.
1		0150	23	.00	.00	.00	1.	*	1		0455	60	.01	.00	.01	2.
1		0155	24	.00	.00	.00	0.	*	1		0500	61	.01	.00	.01	1.
1		0200	25	.00	.00	.00	0.	*	1		0505	62	.00	.00	.00	1.
1		0205	26	.00	.00	.00	0.	*	1		0510	63	.00	.00	.00	1.
1		0210	27	.02	.00	.01	1.	*	1		0515	64	.00	.00	.00	0.
1		0215	28	.02	.01	.02	1.	*	1		0520	65	.00	.00	.00	0.
1		0220	29	.02	.01	.01	1.	*	1		0525	66	.00	.00	.00	0.
1		0225	30	.01	.00	.01	1.	*	1		0530	67	.00	.00	.00	0.
1		0230	31	.00	.00	.00	1.	*	1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.01	1.	*	1		0540	69	.00	.00	.00	0.
1		0240	33	.02	.01	.02	1.	*	1		0545	70	.00	.00	.00	0.
1		0245	34	.01	.00	.01	1.	*	1		0550	71	.00	.00	.00	0.
1		0250	35	.00	.00	.00	1.	*	1		0555	72	.00	.00	.00	0.
1		0255	36	.00	.00	.00	0.	*	1		0600	73	.00	.00	.00	0.
1		0300	37	.02	.00	.01	1.	*								

TOTAL RAINFALL = 1.58, TOTAL LOSS = .34, TOTAL EXCESS = 1.24

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.00-HR
(CFS)	(HR)	(CFS)				
15.	3.50		2.	2.	2.	2.
		(INCHES)	1.239	1.239	1.239	1.239
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .01 SQ MI

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH AT STATION OFD2
PLAN 1, RATIO = .74

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	*	1		0305	38	.06	.01	.05	3.
1		0005	2	.04	.04	.00	0.	*	1		0310	39	.06	.01	.05	5.
1		0010	3	.08	.07	.01	0.	*	1		0315	40	.12	.01	.11	7.
1		0015	4	.03	.02	.01	1.	*	1		0320	41	.18	.01	.17	12.
1		0020	5	.03	.02	.01	1.	*	1		0325	42	.19	.01	.18	16.
1		0025	6	.04	.02	.02	2.	*	1		0330	43	.25	.01	.24	20.
1		0030	7	.03	.01	.02	2.	*	1		0335	44	.07	.00	.07	16.
1		0035	8	.01	.00	.01	1.	*	1		0340	45	.08	.00	.07	10.

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0040	9	.00	.00	.00	1.	*	1		0345	46	.06	.00	.06	8.
1		0045	10	.00	.00	.00	0.	*	1		0350	47	.01	.00	.01	5.
1		0050	11	.00	.00	.00	0.	*	1		0355	48	.03	.00	.03	3.
1		0055	12	.00	.00	.00	0.	*	1		0400	49	.03	.00	.03	3.
1		0100	13	.00	.00	.00	0.	*	1		0405	50	.01	.00	.01	2.
1		0105	14	.01	.00	.00	0.	*	1		0410	51	.01	.00	.01	1.
1		0110	15	.01	.01	.01	1.	*	1		0415	52	.02	.00	.02	1.
1		0115	16	.00	.00	.00	1.	*	1		0420	53	.02	.00	.02	2.
1		0120	17	.01	.00	.01	1.	*	1		0425	54	.02	.00	.02	2.
1		0125	18	.02	.01	.01	1.	*	1		0430	55	.05	.00	.04	3.
1		0130	19	.03	.01	.02	2.	*	1		0435	56	.03	.00	.03	4.
1		0135	20	.02	.01	.01	2.	*	1		0440	57	.02	.00	.02	3.
1		0140	21	.02	.00	.01	1.	*	1		0445	58	.03	.00	.03	3.
1		0145	22	.01	.00	.01	1.	*	1		0450	59	.04	.00	.04	3.
1		0150	23	.00	.00	.00	1.	*	1		0455	60	.01	.00	.01	3.
1		0155	24	.00	.00	.00	0.	*	1		0500	61	.01	.00	.01	2.
1		0200	25	.00	.00	.00	0.	*	1		0505	62	.01	.00	.01	1.
1		0205	26	.01	.00	.00	0.	*	1		0510	63	.00	.00	.00	1.
1		0210	27	.02	.00	.02	1.	*	1		0515	64	.00	.00	.00	0.
1		0215	28	.03	.01	.02	2.	*	1		0520	65	.00	.00	.00	0.
1		0220	29	.02	.00	.02	2.	*	1		0525	66	.01	.00	.01	0.
1		0225	30	.02	.00	.01	2.	*	1		0530	67	.00	.00	.00	0.
1		0230	31	.00	.00	.00	1.	*	1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.01	1.	*	1		0540	69	.00	.00	.00	0.
1		0240	33	.03	.00	.02	1.	*	1		0545	70	.01	.00	.01	0.
1		0245	34	.02	.00	.01	2.	*	1		0550	71	.00	.00	.00	0.
1		0250	35	.01	.00	.01	1.	*	1		0555	72	.00	.00	.00	0.
1		0255	36	.00	.00	.00	1.	*	1		0600	73	.00	.00	.00	0.
1		0300	37	.02	.00	.02	1.	*								

TOTAL RAINFALL = 2.05, TOTAL LOSS = .35, TOTAL EXCESS = 1.70

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.00-HR
(CFS)	(HR)	(CFS)				
20.	3.50		2.	2.	2.	2.
		(INCHES)	1.698	1.698	1.698	1.698
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .01 SQ MI

WARNING *** TIME INTERVAL IS GREATER THAN .29*LAG

HYDROGRAPH AT STATION OFD2
PLAN 1, RATIO = 1.00

DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q		DA	MON	HRMN	ORD	RAIN	LOSS	EXCESS	COMP Q
1		0000	1	.00	.00	.00	0.	*	1		0305	38	.07	.01	.07	4.
1		0005	2	.06	.06	.00	0.	*	1		0310	39	.08	.01	.08	7.
1		0010	3	.10	.08	.02	1.	*	1		0315	40	.16	.01	.15	10.
1		0015	4	.04	.02	.02	1.	*	1		0320	41	.25	.01	.24	18.
1		0020	5	.05	.02	.02	2.	*	1		0325	42	.25	.01	.24	22.
1		0025	6	.06	.02	.04	3.	*	1		0330	43	.33	.01	.32	28.
1		0030	7	.04	.01	.03	3.	*	1		0335	44	.09	.00	.09	22.
1		0035	8	.02	.00	.01	2.	*	1		0340	45	.10	.00	.10	14.
1		0040	9	.00	.00	.00	1.	*	1		0345	46	.09	.00	.08	11.
1		0045	10	.00	.00	.00	0.	*	1		0350	47	.02	.00	.02	7.
1		0050	11	.00	.00	.00	0.	*	1		0355	48	.04	.00	.04	4.
1		0055	12	.00	.00	.00	0.	*	1		0400	49	.04	.00	.04	4.
1		0100	13	.00	.00	.00	0.	*	1		0405	50	.01	.00	.01	3.
1		0105	14	.01	.00	.01	0.	*	1		0410	51	.01	.00	.01	2.
1		0110	15	.02	.01	.01	1.	*	1		0415	52	.02	.00	.02	2.
1		0115	16	.01	.00	.00	1.	*	1		0420	53	.02	.00	.02	2.
1		0120	17	.02	.00	.01	1.	*	1		0425	54	.03	.00	.03	3.
1		0125	18	.03	.01	.02	2.	*	1		0430	55	.06	.00	.06	4.
1		0130	19	.04	.01	.03	2.	*	1		0435	56	.04	.00	.04	5.
1		0135	20	.02	.00	.02	2.	*	1		0440	57	.03	.00	.03	4.
1		0140	21	.02	.00	.02	2.	*	1		0445	58	.04	.00	.04	4.
1		0145	22	.02	.00	.02	2.	*	1		0450	59	.06	.00	.05	4.
1		0150	23	.01	.00	.00	1.	*	1		0455	60	.02	.00	.02	4.
1		0155	24	.00	.00	.00	1.	*	1		0500	61	.02	.00	.02	2.
1		0200	25	.00	.00	.00	0.	*	1		0505	62	.01	.00	.01	2.
1		0205	26	.01	.00	.01	0.	*	1		0510	63	.01	.00	.01	1.
1		0210	27	.03	.00	.02	1.	*	1		0515	64	.01	.00	.01	1.
1		0215	28	.04	.01	.04	3.	*	1		0520	65	.00	.00	.00	0.
1		0220	29	.03	.00	.03	3.	*	1		0525	66	.01	.00	.01	1.
1		0225	30	.02	.00	.02	3.	*	1		0530	67	.00	.00	.00	0.
1		0230	31	.01	.00	.00	2.	*	1		0535	68	.00	.00	.00	0.
1		0235	32	.01	.00	.01	1.	*	1		0540	69	.00	.00	.00	0.
1		0240	33	.04	.00	.03	2.	*	1		0545	70	.01	.00	.01	1.
1		0245	34	.02	.00	.02	2.	*	1		0550	71	.00	.00	.00	0.
1		0250	35	.01	.00	.01	2.	*	1		0555	72	.00	.00	.00	0.
1		0255	36	.01	.00	.00	1.	*	1		0600	73	.00	.00	.00	0.
1		0300	37	.03	.00	.03	2.	*								

TOTAL RAINFALL = 2.77, TOTAL LOSS = .36, TOTAL EXCESS = 2.41

PEAK FLOW	TIME		MAXIMUM AVERAGE FLOW			
			6-HR	24-HR	72-HR	6.00-HR
(CFS)	(HR)	(CFS)				
28.	3.50		3.	3.	3.	3.
		(INCHES)	2.406	2.406	2.406	2.406
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .01 SQ MI

*** *** *** *

```
          ***************
          *             *
78 KK     *     CMD3    *
          *             *
          ***************

81 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          1  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL          0.  HYDROGRAPH PLOT SCALE

82 HC          HYDROGRAPH COMBINATION
                    ICOMP          2  NUMBER OF HYDROGRAPHS TO COMBINE

                                                ***
```

HYDROGRAPH AT STATION CMD3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = .57

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		0135	20	1.	1		0310	39	4.	1		0445	58	3.
1		0005	2	0.	1		0140	21	1.	1		0315	40	7.	1		0450	59	3.
1		0010	3	0.	1		0145	22	1.	1		0320	41	12.	1		0455	60	2.
1		0015	4	0.	1		0150	23	1.	1		0325	42	15.	1		0500	61	2.
1		0020	5	1.	1		0155	24	0.	1		0330	43	19.	1		0505	62	1.
1		0025	6	1.	1		0200	25	0.	1		0335	44	15.	1		0510	63	1.
1		0030	7	1.	1		0205	26	0.	1		0340	45	9.	1		0515	64	0.
1		0035	8	1.	1		0210	27	1.	1		0345	46	7.	1		0520	65	0.
1		0040	9	0.	1		0215	28	2.	1		0350	47	4.	1		0525	66	0.
1		0045	10	0.	1		0220	29	2.	1		0355	48	3.	1		0530	67	0.
1		0050	11	0.	1		0225	30	2.	1		0400	49	3.	1		0535	68	0.
1		0055	12	0.	1		0230	31	1.	1		0405	50	2.	1		0540	69	0.
1		0100	13	0.	1		0235	32	1.	1		0410	51	1.	1		0545	70	0.
1		0105	14	0.	1		0240	33	1.	1		0415	52	1.	1		0550	71	0.
1		0110	15	0.	1		0245	34	2.	1		0420	53	1.	1		0555	72	0.
1		0115	16	0.	1		0250	35	1.	1		0425	54	2.	1		0600	73	0.
1		0120	17	0.	1		0255	36	1.	1		0430	55	3.					
1		0125	18	1.	1		0300	37	1.	1		0435	56	3.					
1		0130	19	1.	1		0305	38	3.	1		0440	57	3.					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
		(CFS)				
19.	3.50		2.	2.	2.	2.
		(INCHES)	1.247	1.247	1.247	1.247
		(AC-FT)	1.	1.	1.	1.

CUMULATIVE AREA = .02 SQ MI

HYDROGRAPH AT STATION CMD3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = .74

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		0135	20	2.	1		0310	39	6.	1		0445	58	3.
1		0005	2	0.	1		0140	21	2.	1		0315	40	10.	1		0450	59	4.
1		0010	3	0.	1		0145	22	2.	1		0320	41	16.	1		0455	60	3.
1		0015	4	1.	1		0150	23	1.	1		0325	42	21.	1		0500	61	2.
1		0020	5	1.	1		0155	24	1.	1		0330	43	26.	1		0505	62	1.
1		0025	6	2.	1		0200	25	0.	1		0335	44	19.	1		0510	63	1.
1		0030	7	2.	1		0205	26	0.	1		0340	45	12.	1		0515	64	1.
1		0035	8	2.	1		0210	27	1.	1		0345	46	10.	1		0520	65	0.
1		0040	9	1.	1		0215	28	2.	1		0350	47	6.	1		0525	66	1.
1		0045	10	0.	1		0220	29	3.	1		0355	48	4.	1		0530	67	0.
1		0050	11	0.	1		0225	30	2.	1		0400	49	4.	1		0535	68	0.
1		0055	12	0.	1		0230	31	1.	1		0405	50	3.	1		0540	69	0.
1		0100	13	0.	1		0235	32	1.	1		0410	51	2.	1		0545	70	0.
1		0105	14	0.	1		0240	33	2.	1		0415	52	2.	1		0550	71	0.
1		0110	15	1.	1		0245	34	2.	1		0420	53	2.	1		0555	72	0.
1		0115	16	1.	1		0250	35	1.	1		0425	54	3.	1		0600	73	0.
1		0120	17	1.	1		0255	36	1.	1		0430	55	4.					
1		0125	18	1.	1		0300	37	2.	1		0435	56	5.					
1		0130	19	2.	1		0305	38	4.	1		0440	57	4.					

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
		(CFS)				
26.	3.50		3.	3.	3.	3.
		(INCHES)	1.706	1.706	1.706	1.706
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .02 SQ MI

HYDROGRAPH AT STATION CMD3
SUM OF 2 HYDROGRAPHS
PLAN 1, RATIO = 1.00

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		0135	20	3.	1		0310	39	8.	1		0445	58	5.
1		0005	2	0.	1		0140	21	3.	1		0315	40	14.	1		0450	59	6.
1		0010	3	1.	1		0145	22	2.	1		0320	41	23.	1		0455	60	4.
1		0015	4	2.	1		0150	23	2.	1		0325	42	29.	1		0500	61	3.
1		0020	5	3.	1		0155	24	1.	1		0330	43	36.	1		0505	62	2.
1		0025	6	4.	1		0200	25	0.	1		0335	44	27.	1		0510	63	1.
1		0030	7	4.	1		0205	26	1.	1		0340	45	17.	1		0515	64	1.
1		0035	8	3.	1		0210	27	2.	1		0345	46	13.	1		0520	65	1.
1		0040	9	1.	1		0215	28	3.	1		0350	47	8.	1		0525	66	1.
1		0045	10	0.	1		0220	29	4.	1		0355	48	6.	1		0530	67	0.
1		0050	11	0.	1		0225	30	3.	1		0400	49	6.	1		0535	68	0.
1		0055	12	0.	1		0230	31	2.	1		0405	50	4.	1		0540	69	0.
1		0100	13	0.	1		0235	32	1.	1		0410	51	2.	1		0545	70	1.
1		0105	14	0.	1		0240	33	3.	1		0415	52	2.	1		0550	71	0.
1		0110	15	1.	1		0245	34	3.	1		0420	53	3.	1		0555	72	0.
1		0115	16	1.	1		0250	35	2.	1		0425	54	3.	1		0600	73	0.
1		0120	17	1.	1		0255	36	1.	1		0430	55	6.					
1		0125	18	2.	1		0300	37	2.	1		0435	56	6.					
1		0130	19	3.	1		0305	38	6.	1		0440	57	5.					

****

PEAK FLOW (CFS)	TIME (HR)		MAXIMUM AVERAGE FLOW 6-HR	24-HR	72-HR	6.00-HR
36.	3.50	(CFS)	4.	4.	4.	4.
		(INCHES)	2.414	2.414	2.414	2.414
		(AC-FT)	2.	2.	2.	2.

CUMULATIVE AREA = .02 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 .57	RATIO 2 .74	RATIO 3 1.00
HYDROGRAPH AT	OFD1	.00	1	FLOW	3.	4.	5.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	JON	.00	1	FLOW	1.	1.	2.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	NDC	.00	1	FLOW	0.	0.	0.
				TIME	3.50	3.50	3.50
3 COMBINED AT	CMD1	.00	1	FLOW	4.	6.	8.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	OFD2	.01	1	FLOW	15.	20.	28.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	NDB	.00	1	FLOW	0.	0.	0.
				TIME	3.50	3.50	3.50
2 COMBINED AT	CMD2	.01	1	FLOW	15.	20.	28.
				TIME	3.50	3.50	3.50
2 COMBINED AT	CMD3	.02	1	FLOW	19.	26.	36.
				TIME	3.50	3.50	3.50
HYDROGRAPH AT	NDA	.00	1	FLOW	2.	2.	3.
				TIME	3.50	3.50	3.50

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

Response to Comment No. 2

Flow Capacity (Normal Depth) Calculation for Craig Road North Half

&

Inlet Control Nomograph for 18" RCP Lateral into Existing Craig Road Storm Drain

Craig Rd. North Half Capacity
Worksheet for Irregular Channel

Project Description	
Worksheet	Craig Rd. North Half Cap
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Slope	010000	ft/ft
Water Surface Elev	1.30	ft

Options	
Current Roughness Metho	ved Lotter's Method
Open Channel Weighting	ved Lotter's Method
Closed Channel Weightin	Horton's Method

Results		
Mannings Coeffic	0.015	
Elevation Range	.00 to 1.30	
Discharge	324.08	cfs
Flow Area	39.4	ft²
Wetted Perimeter	49.75	ft
Top Width	48.00	ft
Actual Depth	1.30	ft
Critical Elevation	1.60	ft
Critical Slope	0.003578	ft/ft
Velocity	8.22	ft/s
Velocity Head	1.05	ft
Specific Energy	2.35	ft
Froude Number	1.60	
Flow Type	Supercritical	

North half Craig Rd. flow capacity is well above the available flows by passing the 60" RCP storm Drain.

Calculation Messages:
Water elevation exceeds lowest end station by 0.7 ft.

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+07.00	0.013
0+07.00	0+48.00	0.016

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+48.00	0.80
0+48.00	1.30

Craig Rd. North Half Capacity
Worksheet for Irregular Channel

Notes: * Total flows (i.e. Surface & Storm Drain) continuing easterly along Craig Rd. just downstream the intersection with Rancho Av. is estimated to be 223/349cfs, as determined in the referenced diversion card CRG.RNCH from the 'Hydrologic Study for Craig Road between US 95 and Decatur Blvd.'.

* Utilizing the 25-Year Rainfall Depth Ratio of 0.74 to the 100-year Rainfall Depth, the Total Craig Road flows at CRG.RNCH is estimated to be 258cfs (i.e. 0.74 x 349cfs).

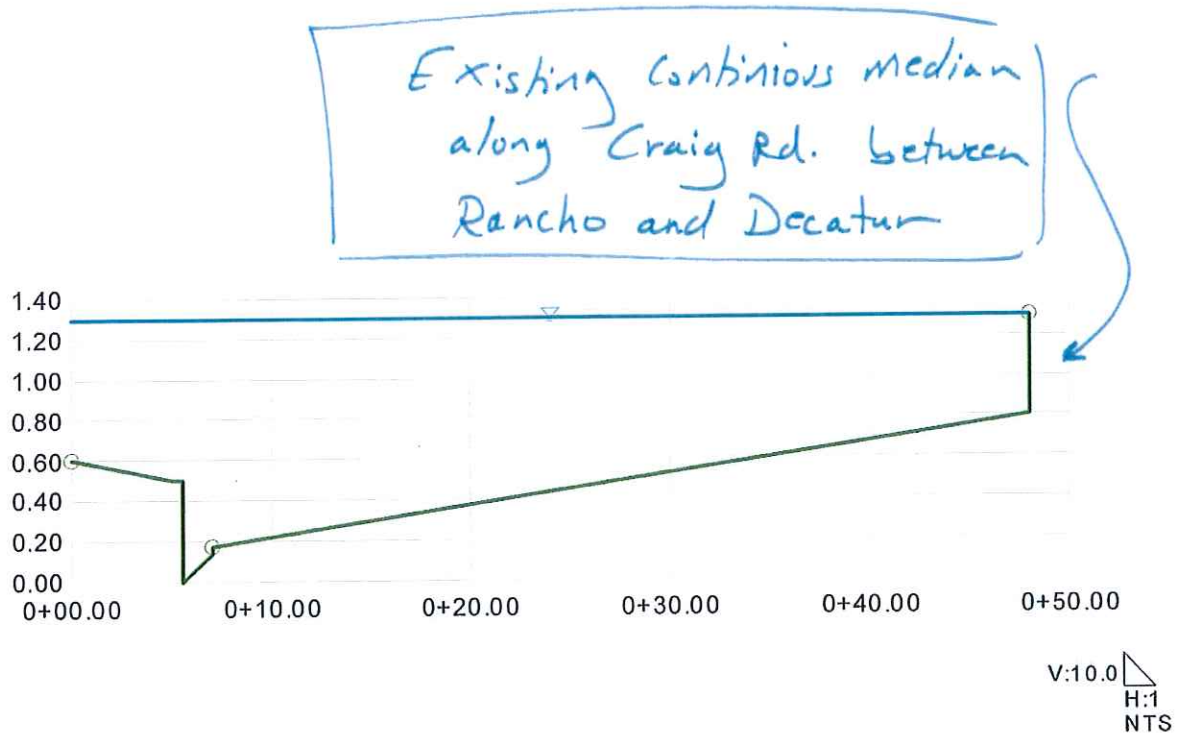
* As shown in the attached referenced information, the Craig Rd. Storm Drain will convey approximately 210cfs for the 10-, 25- and 100-year events from referenced CRG.RNCH. Thus, the Surface flows continuing easterly in Craig Rd at Rancho is determined to be 13cfs/48cfs/139cfs (Q10/Q25/Q100).

* This analysis is provided to illustrate that the entire Surface flows within Craig Road will continue within the north half. Thus, flows within the south half of Craig Rd. along the project site are limited to the runoff generated through the south half of Craig Rd. and CMX2/CMD2.

Craig Rd. North Half Capacity
Cross Section for Irregular Channel

Project Description	
Worksheet	Craig Rd. North Half Ca
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Mannings Coefficie	0.015	
Slope	0.010000	ft/ft
Water Surface Elev	1.30	ft
Elevation Range	.00 to 1.30	
Discharge	324.08	cfs



© Haestad Methods, Inc.

Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

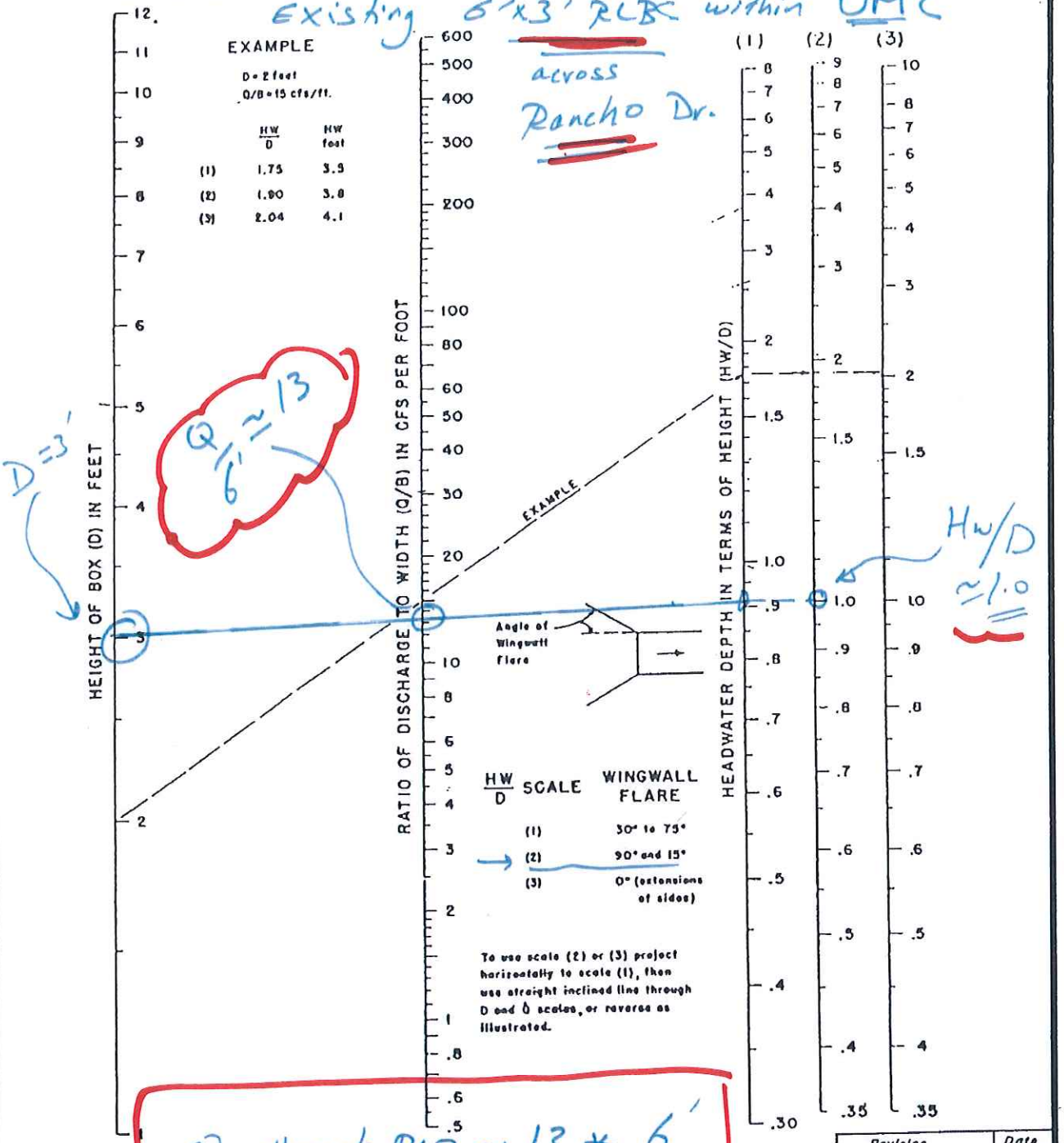
Response to Comment No. 4

Inlet-Control Nomograph, Outlet-Control Nomograph and Normal Depth Calculation for the Existing UMC 6'x3' RCBC across Rancho Drive

↑ Northern 6'x3' RCBC

NOMOGRAPH – INLET CONTROL BOX CULVERT

Existing 6'x3' RCB within UMC across Rancho Dr.



Revision	Date

WRC ENGINEERING

REFERENCE: USDOT, FHWA, HDS No.5, 1985

FIGURE 1004

Existing 6' x 3' RCB through UMC(100-Year)
Worksheet for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through UMC(
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.013	
Slope	005000	ft/ft
Bottom Width	6.00	ft
Discharge	78.00	cfs

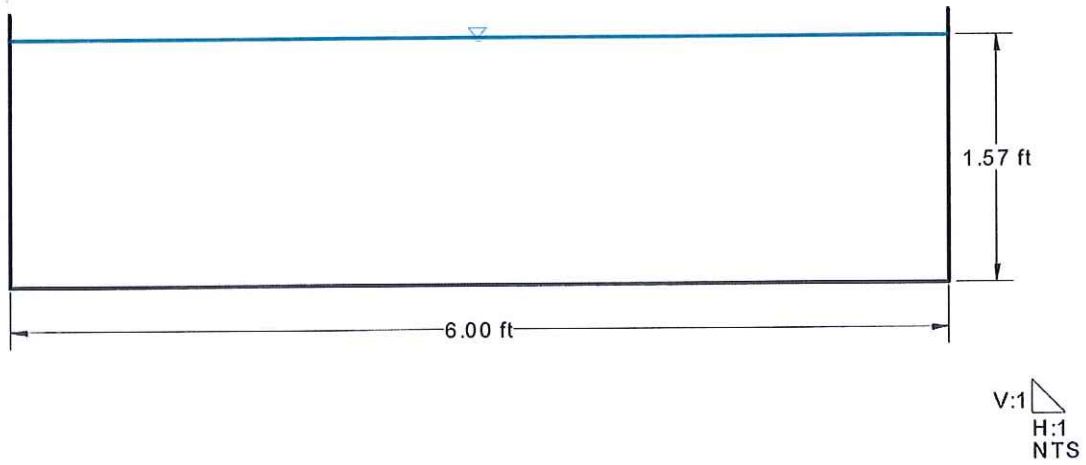
Results		
Depth	1.57	ft
Flow Area	9.4	ft²
Wetted Perim	9.15	ft
Top Width	6.00	ft
Critical Depth	1.74	ft
Critical Slope	0.003767	ft/ft
Velocity	8.26	ft/s
Velocity Head	1.06	ft
Specific Ener	2.63	ft
Froude Numb	1.16	
Flow Type	Supercritical	

Notes: * Q100 = approximately 78cfs = 100-year flows as determined from the attached inlet nomograph analysis, assuming 3ft of available headwater at the entrance. as adopted from the Rancho/US95 LOMR (i.e. headwater = 2278.18ft (WSE at HEC-RAS Sta:53+82) - 2275.0ft RCBC invert)

Existing 6' x 3' RCB through UMC(100-Year)
Cross Section for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through UMC(
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.013	
Slope	005000	ft/ft
Depth	1.57	ft
Bottom Width	6.00	ft
Discharge	78.00	cfs



© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

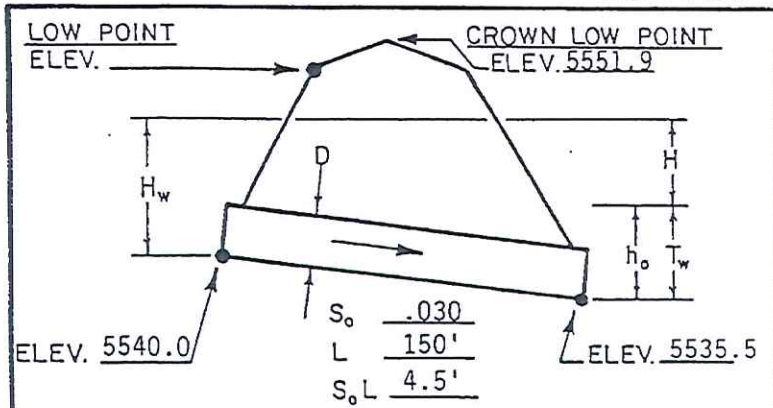
CULVERT RATING FOR EXAMPLE IN SECTION 1006.1

WRC ENGINEERING

REFERENCE:

TABLE 1002

PROJECT: EXAMPLE LOCATION: CLARK COUNTY STATION: 1 + 00



CULVERT DATA

TYPE: 48" CMP n: .024
INLET: F.E.S. Q_{FULL}: 135
K_e: 0.5 V_{FULL}: 10.7

OUTLET CONTROL EQUATIONS

(1) $H_w = H + h_o - LS_o$

(2) For $T_w < D$; $h_o = \frac{d_c + D}{2}$ or T_w (whichever is greater)

$T_w \geq D$; $h_o = T_w$

(3) For Box Culvert: $d_c = 0.315(Q/B)^{2/3} \leq D$

	Q	STORM EVENT	INLET CONTROL $\frac{H_w}{D}$	INLET CONTROL H_w	OUTLET CONTROL H	OUTLET CONTROL T_w	OUTLET CONTROL $T_w < D$ d_c	OUTLET CONTROL $T_w < D$ $\frac{d_c + D}{2} = h$	OUTLET CONTROL $T_w \geq D$ h_o	OUTLET CONTROL H_w	TYPE OF CONTROL	CONTROL HEADWATER ELEVATION	OUTLET VELOCITY
	1	2	3	4	5	6	7	8	9	10	11	12	13
	70		1.0	4	1.9	1.5	2.5	3.3		0.7	Inlet	5544.0	10.8
	115		1.5	6	5.5	2.0	3.0	3.5		4.5	Inlet	5546.0	12.0
	145		2.0	8	8.9	2.5	3.4	3.7		8.1	Outlet	5548.0	11.5
(1)	170		2.5	10	12.5	3.0	3.7	3.9		11.9	Outlet	5551.9	13.5
(2)	195		3.0	12	16.0	3.5	4.0	4.0		15.5	Outlet	5555.5	15.5

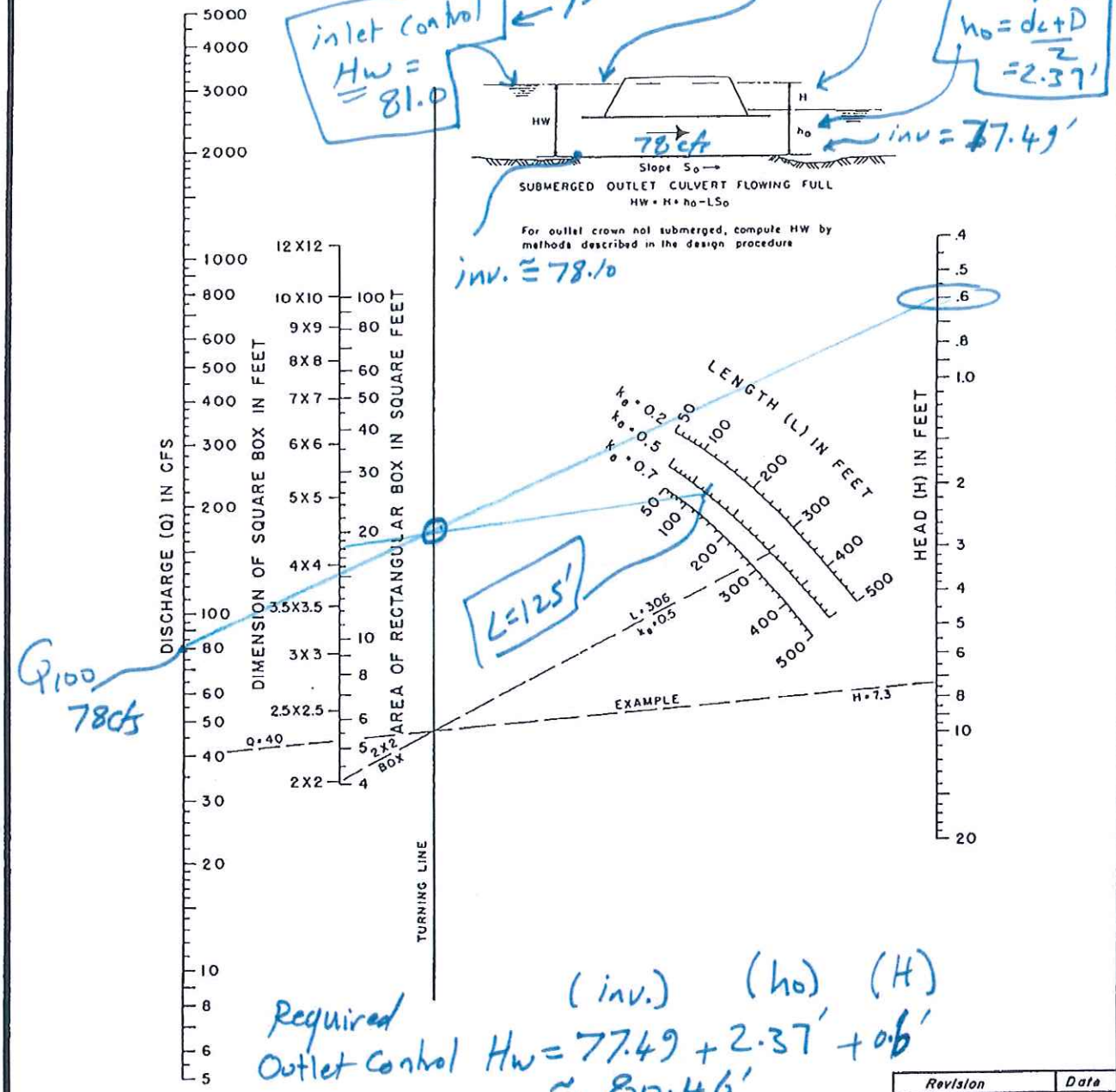
NOTES: (1) Culvert capacity without road overtopping.
(2) Excessive road overtopping depth (3.6').

Revision	Date

Existing 6'x3' RCBC through UMC

NOMOGRAPH – OUTLET CONTROL BOX CULVERT

(n=0.012)



Required Outlet Control Hw = (inv.) 77.49 + (ho) 2.37' + (H) 0.6'
≈ 80.46'

(i.e Still less than 81.0 required for Inlet Control)

Revision	Date

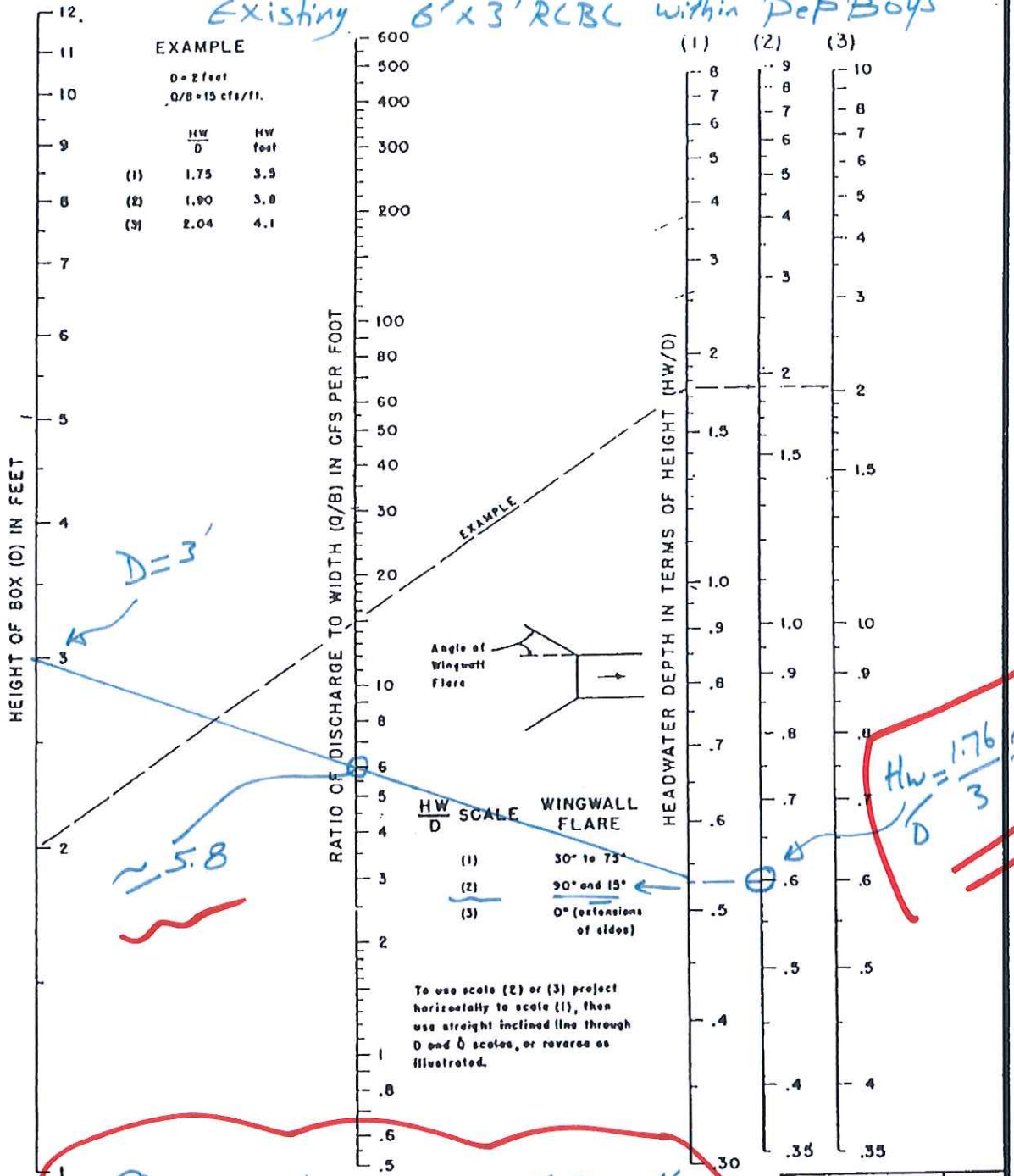
Response to Comment No. 4

Inlet-Control Nomograph, Outlet-Control Nomograph and Normal Depth Calculations for the Existing 7'x3' RBC Storm Drain and the Existing Pep Boys 6'x3' RCBC across Rancho Drive

Southern 6'x3' RCBCs

NOMOGRAPH – INLET CONTROL BOX CULVERT

Existing 6'x3' RCBC within DeP Boys



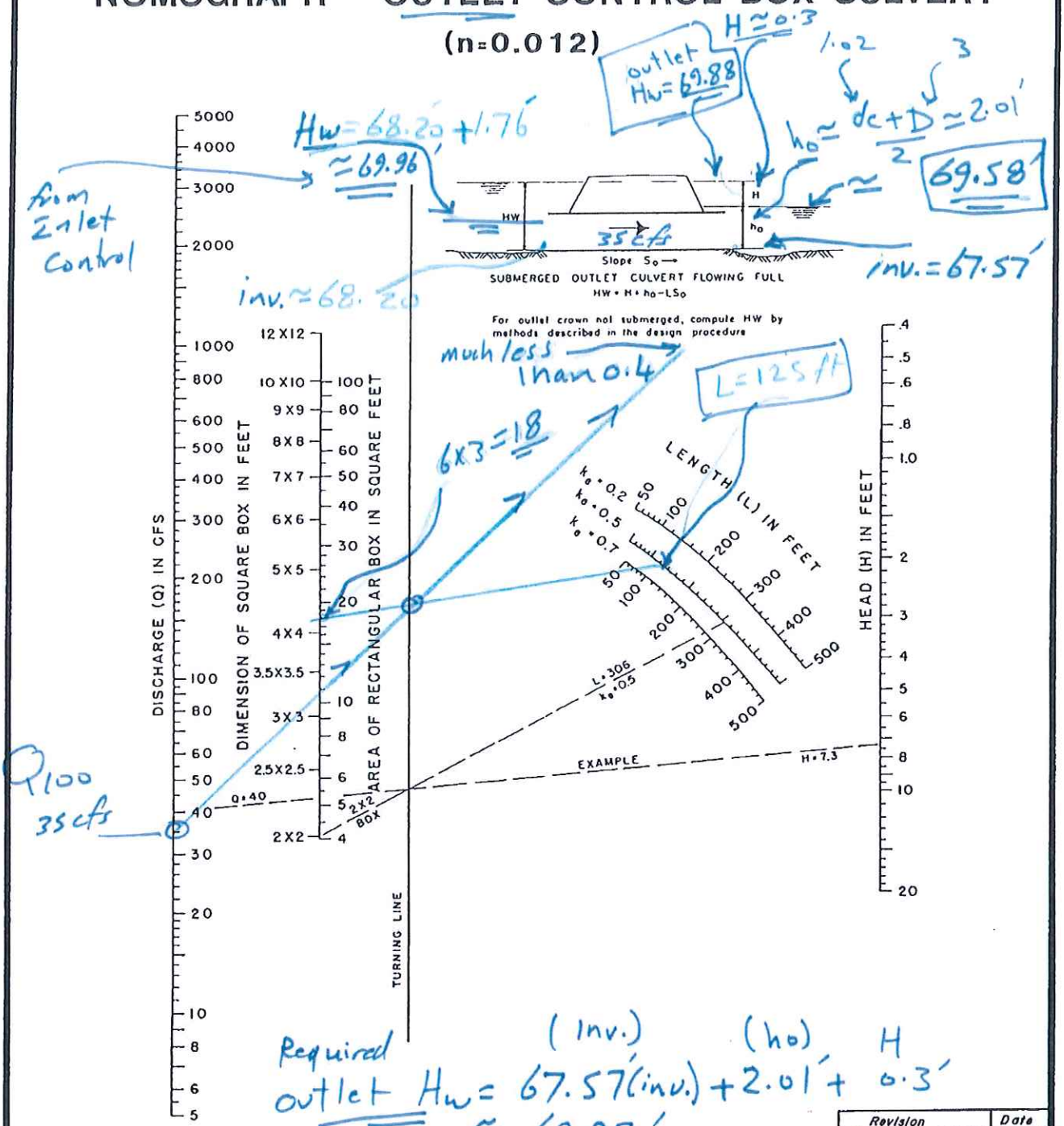
Revision	Date

WRC ENGINEERING	REFERENCE: USDOT, FHWA, HDS No.5, 1985	FIGURE 1004

Existing 6'x3' RCBC through Pep Boys

NOMOGRAPH – OUTLET CONTROL BOX CULVERT

(n=0.012)



Required outlet Hw = 67.57 (inv.) + 2.01 (hₒ) + 0.3 H

≈ 69.88'

(i.e. still less than 69.96 required for Inlet Control)

Revision	Date

WRC ENGINEERING

REFERENCE: USDOT, FHWA, HDS No. 5, 1985

FIGURE 1008

Existing 7' x 3' RCB Storm Drain through Pep Boy 100-Year)
Worksheet for Rectangular Channel

Project Description	
Worksheet	Existing 7' x 3' RCB Storm Drain through Pep B
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.013	
Slope	006000	ft/ft
Bottom Width	7.00	ft
Discharge	121.00	cfs

Results		
Depth	1.76	ft
Flow Area	12.3	ft²
Wetted Perim	10.52	ft
Top Width	7.00	ft
Critical Depth	2.10	ft
Critical Slope	0.003599	ft/ft
Velocity	9.83	ft/s
Velocity Head	1.50	ft
Specific Energ	3.26	ft
Froude Numb	1.31	
Flow Type	Supercritical	

Notes: * Q100 = 121cfs cfs = 100-year flows bypassing the existing UMC 6'x3' RCBC and continuing through the 7'x3' RCB through Pep Boys, as determined from the Rancho/US95 LOMR (i.e. = 121cfs = 199*cfs along west side of Rancho - 78cfs diverted easterly through the UMC 6'x3'RCBC across Rancho)

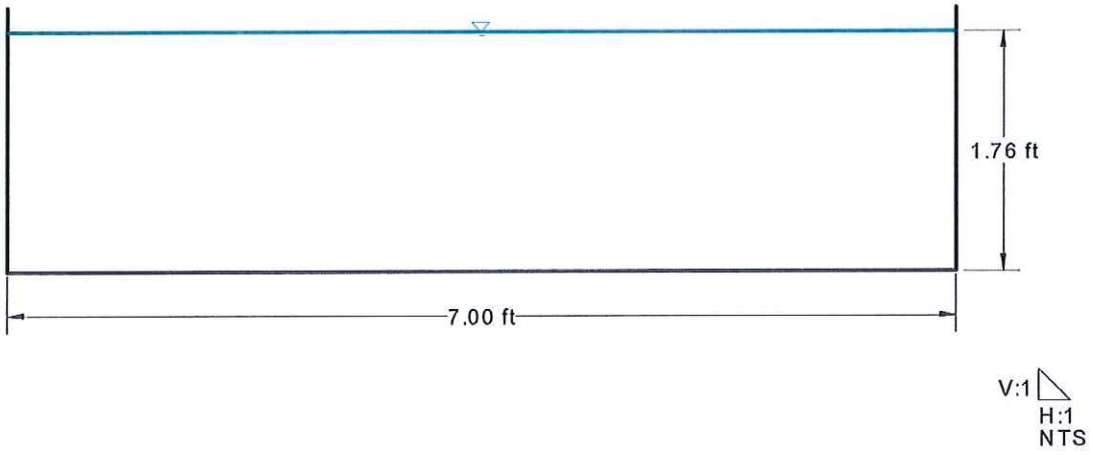
* The analysis is provided to estimate the available 100-year headwater at the entrance of the existing Pep Boys 6'x3' RCBC

* The 0.60% slope is utilized per the approved plans for the "Rancho Town & Country Shopping Center"

Existing 7' x 3' RCB Storm Drain through Pep Boy 100-Year)
Cross Section for Rectangular Channel

Project Description	
Worksheet	Existing 7' x 3' RCB Storm Drain through Pep B
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.013	
Slope	006000	ft/ft
Depth	1.76	ft
Bottom Width	7.00	ft
Discharge	121.00	cfs



Existing 6' x 3' RCB through Pep Boys (100-Year)
Worksheet for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through Pep Boys (
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data		
Mannings Coeffic	0.013	
Slope	005000	ft/ft
Bottom Width	6.00	ft
Discharge	35.00	cfs

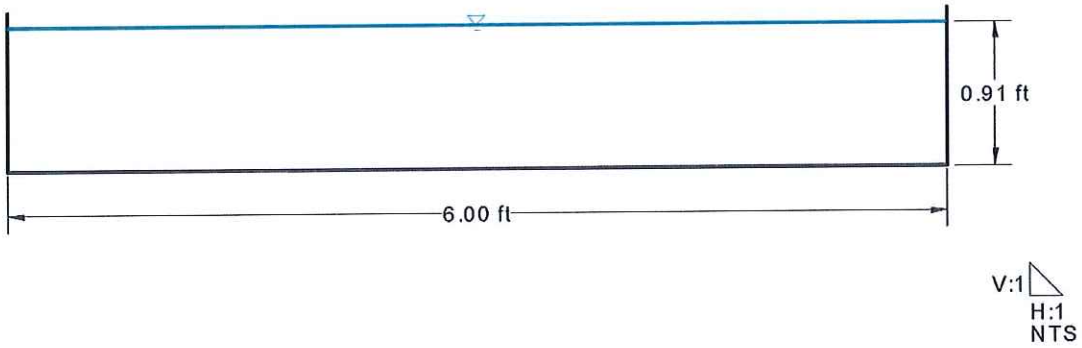
Results		
Depth	0.91	ft
Flow Area	5.5	ft²
Wetted Perim	7.83	ft
Top Width	6.00	ft
Critical Depth	1.02	ft
Critical Slope	0.003614	ft/ft
Velocity	6.38	ft/s
Velocity Head	0.63	ft
Specific Energ	1.55	ft
Froude Numb	1.18	
Flow Type	Supercritical	

Notes: * Q100 = approximately 35cfs = as determined from the attached inlet control nomograph analysis, assuming 1.76ft of available headwater at the entrance through the 7'x3' RCB storm drain, as analyzed in the Rancho/US95 LOMR

Existing 6' x 3' RCB through Pep Boys (100-Year)
Cross Section for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through Pep Boys (
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data		
Mannings Coeffic	0.013	
Slope	005000	ft/ft
Depth	0.91	ft
Bottom Width	6.00	ft
Discharge	35.00	cfs



© Haestad Methods, Inc.
Lochsa Engineering
37 Brookside Road Waterbury, CT 06708 USA (203) 755-1666

Response to Comments No. 2 and 4

Relevant Excerpts from the "Rancho/US95 Flood Hazard Mapping Restudy"

NATIONAL FLOOD INSURANCE PROGRAM

FEMA PRODUCTION AND TECHNICAL SERVICES CONTRACTOR

2009 DEC -7 PM 2:10

RECD

November 30, 2009

The Honorable Sheri L. Buck
Mayor, City of North Las Vegas
2200 Civic Center Drive
North Las Vegas, NV 89030

IN REPLY REFER TO:
Case No.: 09-09-1685P
Community: City of North Las Vegas, NV
Community No.: 320007

316-PMR

Dear Mayor Buck:

This is in reference to a May 12, 2009, request that the Department of Homeland Security's Federal Emergency Management Agency (FEMA) issue a revision to the effective Flood Insurance Rate Map (FIRM) and Flood Insurance Study (FIS) for Clark County, Nevada and Incorporated Areas. Information pertinent to this revision request is listed below.

Requester:	Syndi Flippin-Dudley, Ph.D., P.E.
Identifier:	Rancho Drive / U.S. 95
Flooding Sources:	Unnamed Wash along U.S. Highway 95, Unnamed Wash along North Rancho Drive, Unnamed Wash along Gowan Road, and Unnamed Wash along Maverick Street and Duncan Drive
FIRM Panels Affected:	32003C2155 E and 32003C2160 E

At the request of FEMA, we reviewed the information submitted in support of this request and determined that the FIRM and FIS report should be revised as a Physical Map Revision (PMR). As a result of this PMR, the flood hazard information along the following areas will be revised: the Unnamed Wash along U.S. Highway 95, from approximately 1,480 feet upstream of Craig Road to just upstream of Gowan Road; the Unnamed Wash along North Rancho Drive, from approximately 260 feet upstream of Craig Road to approximately 100 feet upstream of Riverside Drive; the Unnamed Wash along Gowan Road, from just upstream of U.S. Highway 95 to just upstream of North Rancho Drive; and the Unnamed Wash along Maverick Street and Duncan Drive, from just upstream of North Rancho Drive to Gowan Road. However, because another PMR for Clark County, Nevada and Incorporated Areas is currently being processed, this PMR could not be processed at this time. At the request of your community, FEMA will incorporate this PMR into the ongoing PMR for Clark County, Nevada and Incorporated Areas.

Because this revision request also affects the City of Las Vegas and unincorporated areas of Clark County, separate letters for those communities will issued on the same date as this letter.

The revision area described above is known collectively as the Unnamed Washes along U.S. 95 and North Rancho Drive and Gowan Road in the City of Las Vegas, Nevada. The property is approximately bounded on the west by North Tenaya Way, on the south by Riverside Drive, on the east by a line parallel to and approximately 1,000 feet east of Rancho Drive, and on the north by a line parallel to and approximately 350 feet north of West Craig Road.

So that we may provide your community with the most up-to-date information possible, we request that your community review the affected FIRM panels and revised FIS report to determine if any additional changes are warranted. Examples of possible changes include updates to corporate limits or new streets. To assist us in processing the revised FIRM and FIS report in a timely manner, we request that your community submit such changes within 30 days of the date of this letter. Please submit any requested changes, along with supporting documentation (e.g., annotated copies of FIRM panels, corporate limits map, topographic mapping), to the address shown at the bottom of this page.

Before we initiate the revision and republication process, we will review and incorporate, as appropriate, any requested changes to the affected FIRM panel or revised FIS report that are received during this 30-day period. We will send preliminary copies of the revised FIRM and FIS report to your community for review. At that time, your community will have an additional 30 days to provide information to support other changes to the affected portions of the FIS report and map. We will review all information submitted during that 30-day period and incorporate it, as appropriate, before the FIS report and map are republished and distributed.

Your submittal of requested changes during the initial 30-day period will facilitate the revision and republication process. While it may be possible to incorporate requested changes later, it will likely cause significant delays in the revision and republication process. Therefore, if the data to support additional changes are not immediately available, or if additional time is needed, please inform us immediately.

If you have general questions about this case, the review and revision process, FEMA policy, or the National Flood Insurance Program, please call the FEMA Map Assistance Center, toll free, at 1-877-FEMA MAP (1-877-336-2627). If you have specific questions concerning this case, please contact your Revisions Coordinator for this request, Mr. Joseph Kuechenmeister, CFM, by e-mail at jkuechenmeister@mbakercorp.com or by telephone at (720) 479-3181.

Sincerely,

Syed Qayum

Syed Qayum, CFM
LOMR Technical Manager
BakerAECOM, LCC.

cc: Mr. Randy Fultz, P.E., CFM
Assistant City Engineer
City of Las Vegas

Mr. Kevin Eubanks, P.E., CFM
Assistant General Manager
Clark County Regional Flood Control District

RANCHO DRIVE / US 95
Flood Hazard Mapping Restudy

Additional Documents

Prepared For:

CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS
731 S. FOURTH STREET
LAS VEGAS, NV 89101

Prepared By:

THE LOUIS BERGER GROUP, INC.
500 E. AMIGO COURT, SUITE 100
LAS VEGAS, NV 89119

July 24, 2009

```
1*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*              JUN  1998                *
*            VERSION 4.1                *
*                                       *
*  RUN DATE   23FEB06  TIME  13:53:48   *
*                                       *
*****************************************
```

UPPRSDN3 - for Rancho

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

```
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
*** FREE ***
             1      ID   RANCHO/US95 CLOMR
             2      ID   FOR:  CITY OF LAS VEGAS, NV AND THE CLARK COUNTY REGIONAL FLOOD CONTROL DISTR
             3      ID   THIS IS THE PROPOSED HEC1 MODEL FOR UPPER RANCHO DRIVE (NORTH OF GOWAN ROAD)
             4      ID    FILENAME:UPPRSDN3.DAT
             5      ID
             6      ID
             7      ID   MODIFIED BY LBG SEPT 2005
             8      ID   SDN3 CREATED BY REDUCING THE SIZE OF CRAIG SUBBASIN TO 1.434 SQUARE MILES
             9      ID   ADD INTERIM BELTWAY AND GOWAN NORTH PHASE III
            10      ID   BY MODIFYING THE CRAIG SUBBASIN FROM PBS&J MODEL
            11      ID
            12      ID   LVRA0000 (PEAK CHANNEL AND RANCHO DRIVE IMPROVEMENTS) ADDED BY DIVERTING
            13      ID   FLOW FROM CONCENTRATION POINT CX1X4
            14      ID
            15      ID   TRUVAL FLOW SPLIT, REMOVED FROM CVL MODEL, HAS BEEN PUT BACK IN.
            16      ID
            17      ID   JR CARD RATIOS REPRESENT DEPTH-AREA REDUCTION FACTORS (DARF'S)
            18      ID
            19      ID   100-YEAR,  6-HOUR STORM,  SDN3
            20      ID   DARF RATIOS FOR AREAS OF 0, 0.5, 1.0, 2.0, 4.0, 6.0, 8.0 AND 10 SQUARE MILES
            21      ID   FOR THE 100-YEAR EVENT.
            22      IT       5       0       0     300
            23      IO       5       0       0
            24      IN       5
            25      JR    PREC    1.00    0.98    0.97    0.93    0.91    0.90    0.88    0.86
                    *
            26      KK     ANN
            27      PB    2.85
            28      BA   0.259
            29      PC   0.000   0.020   0.057   0.070   0.087   0.108   0.124   0.130   0.130   0.130
            30      PC   0.130   0.130   0.130   0.133   0.140   0.142   0.148   0.158   0.172   0.181
            31      PC   0.190   0.197   0.199   0.200   0.201   0.204   0.214   0.229   0.241   0.249
            32      PC   0.251   0.256   0.270   0.278   0.281   0.283   0.295   0.322   0.352   0.409
            33      PC   0.499   0.590   0.710   0.744   0.781   0.812   0.819   0.835   0.851   0.856
            34      PC   0.860   0.868   0.876   0.888   0.910   0.926   0.937   0.950   0.970   0.976
            35      PC   0.982   0.985   0.987   0.989   0.990   0.993   0.993   0.994   0.995   0.998
            36      PC   0.998   0.999   1.000
            37      LS       0    76.8
            38      UD   0.499
                    *
            39      KK    RANN
            40      KM  ROUTE TO GD29B
            41      RK    2600   0.015   0.015       0    TRAP     100       2
                    *
            42      KK   GD29B
            43      PB    2.77
            44      BA   0.138
            45      LS       0    74.3
            46      UD   0.298
                    *
```

1 HEC-1 INPUT PAGE 2

```
          LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
            47      KK  CGD29B
            48      HC       2
                    *
            49      KK  RGD29B
            50      KM  ROUTE TO ANN1B
            51      RK    2700   0.015   0.015       0    TRAP     100       2
                    *
            52      KK   ANN1B
            53      PB    2.77
            54      BA   0.135
            55      LS       0    82.7
            56      UD   0.305
```

```
                *
  718           KK 4REMAIN
  719           KM  DIVERT 35 CFS EAST THROUGH A 36" CMP (CULVERT 21) UNDER RANCHO ROAD HALF WAY
  720           KM  BETWEEN LONE MT. RD. AND CRAIG ROAD. UPPER RANCHO HECRAS STA. 93+76.
  721           KM  REMAINING FLOW CONTINUES SOUTHEAST ALONG RANCHO.
  722           DT  D4RCHO
  723           DI       0     214    1000   10000
  724           DQ       0      35      35      35
                *

  725           KK  R4MAIN
  726           KM  ROUTE TO C2B3
  727           RK    2323   0.011    0.02       0    TRAP      40       2
                *
1                                        HEC-1 INPUT                                        PAGE 23

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

  728           KK   PT2B3
  729           PB    2.77
  730           BA   0.023
  731           LS       0    93.2
  732           UD   0.236
                *

  733           KK    C2B3(UPPER RANCHO HECRAS STA. 70+16.)
  734           HC       2
                *

  735           KK    D2B3
  736           KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN AT RANCHO.  CRAIG STORM DRAIN IS
  737           KM  48" RCP, CAPACITY = 210 CFS AT THE 48" LATERAL.  THE INLET TO THE 48"
  738           KM  LATERAL IS AT THE DOWNSTREAM END OF THE DRAINAGE EASEMENT BEHIND THE 7-11
  739           KM  CONVENIENT STORE.  IMMEDIATELY ABOVE THE 48" INLET ARE 2, 3'X7' RCB'S THAT
  740           KM  CROSS UNDER CRAIG ROAD AND DISCHARGE ON THE SOUTHWEST SIDE OF THE CRAIG/
  741           KM  RANCHO INTERSECTION.  DIVERT 120 CFS TO THE CRAIG ROAD STORM DRAIN SINCE
  742           KM  90 CFS ALREADY EXISTS IN THE PIPE.  REMAINING FLOW TRAVELS UNDER CRAIG ROAD
  743           KM  IN THE 2, 3'X7' RCB'S AND DISCHARGES AT THE SOUTHWEST CORNER OF THE
  744           KM  CRAIG/RANCHO INTERSECTION AND IS JOINED BY THE STREET FLOW IN CRAIG.
  745           KM  ALL STREET FLOW IN CRAIG IS CONTAINED IN THE NORTH HALF STREET BY THE
  746           KM  MEDIAN CURB SO THERE IS NO DIVERSION TO TORREY PINES.
  747           KM  THE 48" LATERAL TO THE CRAIG ROAD STORM DRAIN IS CULVERT 22.
  748           KM  THE 2, 3'X7' RCB'S ARE CULVERT 23. UPPER RANCHO HECRAS STA. 70+00.
  749           DT   DCSD2
  750           DI       0     121    1000   10000
  751           DQ       0     120     120     120
                *

  752           KK   PT2A2
  753           PB    2.77
  754           BA   0.062
  755           LS       0    84.7
  756           UD   0.222
                *

  757           KK    R2A2
  758           KM  ROUTE TO C2A1
  759           RK    1200   0.004   0.015       0    TRAP     100       2
                *

  760           KK   PT2A1
  761           PB    2.77
  762           BA   0.065
  763           LS       0    86.8
  764           UD   0.308
                *
1                                        HEC-1 INPUT                                        PAGE 24

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

  765           KK    D95E
  766           KM  RETRIEVE FLOW FROM BOX DIVERSION AT US95 AND CRAIG (CULVERT 7)
  767           KM  ***NOTE: THIS FLOW CARRIES A TOTAL TRIBUTARY AREA OF 18.58 SQUARE MILES.***
  768           KM  THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES BROUGHT IN BY D95B, SO
  769           KM  THE TOTAL TRIBUTARY AREA TO THE CRAIG/RANCHO INTERSECTION IS 18.98 SQUARE
  770           KM  MILES (18.58 + 0.40).
  771           DR    D95E
                *

  772           KK   RD95E
  773           KM  ROUTE TO PT2A2
  774           RK    1500   0.004   0.015       0    TRAP      80       2
                *

  775           KK    C2A2
  776           HC       3
                *

  777           KK  DPT2A1
  778           KM  DIVERT FLOW TO CRAIG RD. STORM DRAIN
  779           KM  42" RCP, CAPACITY = 90 CFS
  780           KM  REMAINING FLOW CONTINUES EAST IN CRAIG RD.
  781           KM  MINIMUM OF 1 CFS WILL REMAIN TO AVOID ZERO FLOW
  782           DT   DCSD1
  783           DI       0      21      51      76      91     200     500    1000
  784           DQ       0      20      50      75      90      90      90      90
                *

  785           KK    R2A2
  786           KM  ROUTE TO C2B1
  787           RK    2100   0.007   0.015       0    TRAP      80       2
                *

  788           KK   PT2B1
  789           PB    2.77
  790           BA   0.072
  791           LS       0    84.5
  792           UD   0.222
                *
```

Diverting 120 cfs into existing Craig Rd. Storm Drain (in addition to a previous 90cfs) i.e total of 210 cfs. at Rancho/Craig

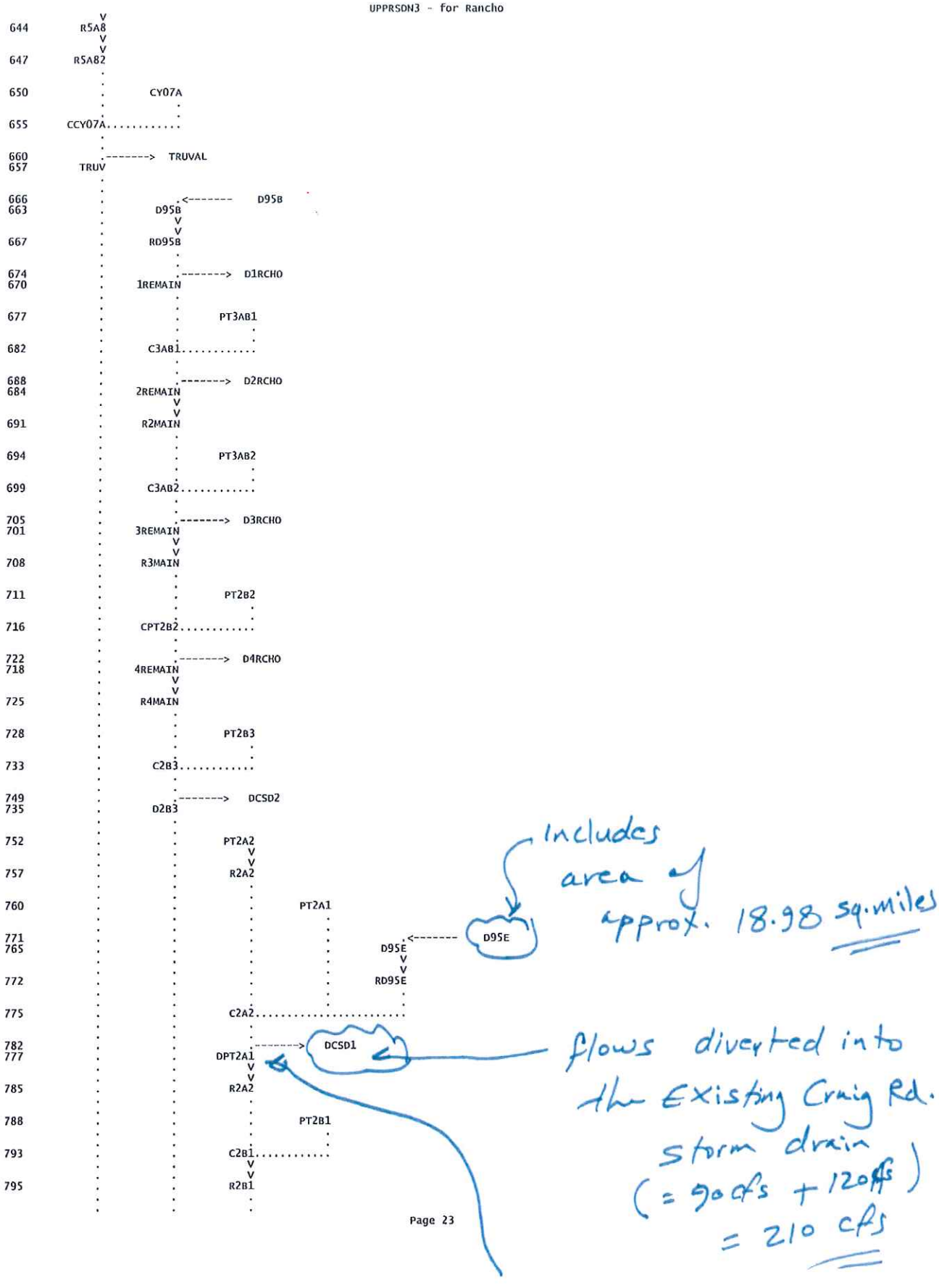
```
793          KK    C2B1
794          HC       2
             *

795          KK    R2B1
796          KM  ROUTE TO C2B3
797          RK     300   0.007   0.015       0    TRAP      80       2
             *
```

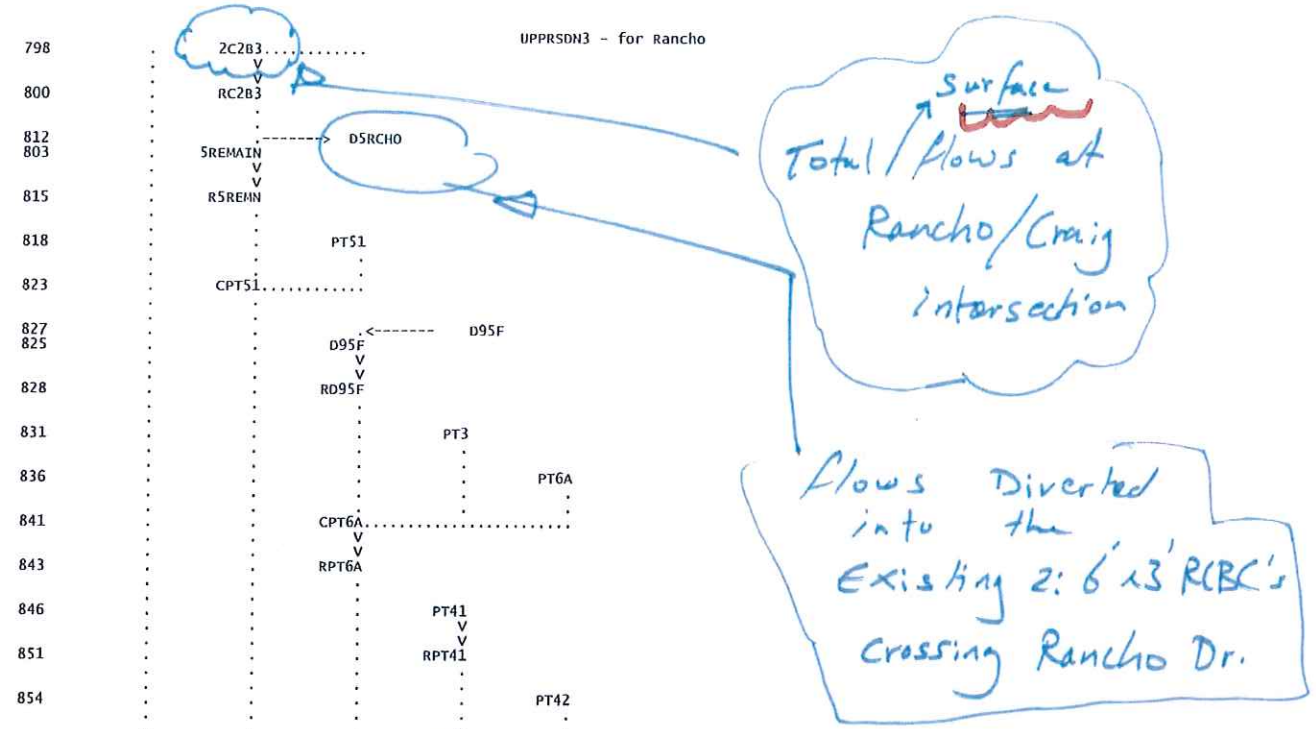


```
LINE         ID.......1.......2.......3.......4.......5.......6.......7.......8.......9.....10

798          KK   2C2B3
799          HC       2
             *

800          KK   RC2B3
801          KM  ROUTE TO 5REMAIN (UPPER RANCHO HECRAS STA 53+82)
802          RK    1600  0.0076    0.03       0    TRAP      80       2
             *

803          KK 5REMAIN
804          KM  DIVERT FLOW EAST ACROSS RANCHO IN TWO 6' X 3' RCB's. THE FIRST RCB IS JUST
805          KM  UPSTREAM OF THE 7' X 3' RCB (CULVERT 27) THAT PARALLELS RANCHO ON THE WEST
806          KM  SIDE.  DIVERT 78 CFS OF 185 CFS TO THE FIRST 6' X 3' RCB (CULVERT 26). THE
807          KM  REMAINING 107 CFS ENTERS THE 7' X 3' RCB.  THE SECOND 6' X 3' RCB
808          KM  CULVERT 28) IS CONNECTED INTO THE SIDE OF THE 7' X 3' RCB. DIVERT 35 CFS OF
809          KM  THE 107 CFS TO THE SECOND 6' X 3' RCB.  THE REMAINING 72 CFS CONTINUES
810          KM  TO THE SOUTH SIDE OF ALEXANDER IN THE 7' X 3' RCB. UPPER RANCHO HECRAS
811          KM  HAS CULVERT 27 IN IT BETWEEN STA. 52+64 AND 38+36.
812          DT  D5RCHO
813          DI        0     185    1000   10000
814          DQ        0     113     113     113
             *

815          KK  R5REMN
816          KM  ROUTE TO CPT51 (UPPER RANCHO HECRAS STA 38+36)
817          RK    1428   0.006    0.03       0    TRAP       7       0
             *

818          KK    PT51
819          PB    2.77
820          BA   0.070
821          LS       0    90.4
822          UD   0.262
             *

823          KK   CPT51
824          HC       2
             *
             * KKD95Fa
             * KMRETRIEVE FLOW FROM WIER DIVERSION AT US95 AND ALEXANDER
             * DRD95Fa
             *
             * THESE TWO DIVERSIONS CARRY A TOTAL TRIBUTARY AREA OF 18.68.
             * THIS IS NOT IN ADDITION TO THE 1.49 SQUARE MILES AND 2.35
             * SQUARE MILES BROUGHT IN BY D95B AND D95E RESPECTIVELY, SO THE TOTAL
             * TRIBUTARY AREA AT THE ALEXANDER/RANCHO INTERSECTION IS 19.69 SQUARE MILES.
             * (18.68 + 1.01)
             *
```



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

825          KK    D95F
826          KM  RETRIEVE FLOW FROM BOX (CULVERT 10) AND WIER DIVERSION AT US95 AND ALEXANDER
827          DR    D95F
             *

828          KK   RD95F
829          KM  ROUTE TO CPT6A
830          RK    1500   0.004   0.015       0    TRAP     100       2
             *

831          KK     PT3
832          PB    2.77
833          BA   0.148
834          LS       0    86.9
835          UD   0.211
             *

836          KK    PT6A
837          PB    2.77
838          BA   0.024
839          LS       0    90.3
840          UD   0.231
             *

841          KK   CPT6A
842          HC       3
             *

843          KK   RPT6A
844          KM  ROUTE TO PT42
845          RK    2450   0.007   0.015       0    TRAP     100       2
             *

846          KK    PT41
847          PB    2.77
848          BA   0.137
849          LS       0    82.0
850          UD   0.220
             *

851          KK   RPT41
852          KM  ROUTE TO CPT42
853          RK    1050  0.0038   0.015       0    TRAP      80       2
             *
```


R5A8
R5A82
CY07A
CCY07A
TRUVAL
TRUV
D95B
RD95B
D1RCHO
1REMAIN
PT3AB1
C3AB1
D2RCHO
2REMAIN
R2MAIN
PT3AB2
C3AB2
D3RCHO
3REMAIN
R3MAIN
PT2B2
CPT2B2
D4RCHO
4REMAIN
R4MAIN
PT2B3
C2B3
DCSD2
D2B3
PT2A2
R2A2
PT2A1
D95E
RD95E
C2A2
DCSD1
DPT2A1
R2A2
PT2B1
C2B1
R2B1
Includes area of approx. 18.98 sq.miles
flows diverted into the Existing Craig Rd. storm drain (= 90 cfs + 120 cfs) = 210 cfs


2C2B3
RC2B3
D5RCHO
5REMAIN
R5REMN
PT51
CPT51
D95F
D95F
RD95F
PT3
PT6A
CPT6A
RPT6A
PT41
RPT41
PT42
CPT42
PT5A1
C5A1
R5A1
PT5A4
PT52
CPT52
RPT52
2CPT51
R2CPT51
D6RCHO
6REMAIN
R6MAIN
PT5A2
R5A2
PT5A6
C5A6
D7RCHO
7REMAIN
R7MAIN
MAVERICK
DMAV
RMAV
CMAV
Surface
Total flows at Rancho/Craig intersection
Flows Diverted into the Existing 2: 6'x3' RCBC's Crossing Rancho Dr.

```
                    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
               1.00      .98       .97       .93       .91       .90       .88       .86

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

            ***************
            *             *
1146 KK     *  DETCAM10   *
            *             *
            ***************

1151 KO          OUTPUT CONTROL VARIABLES
                    IPRNT          5  PRINT CONTROL
                    IPLOT          0  PLOT CONTROL
                    QSCAL         0.  HYDROGRAPH PLOT SCALE
1
```

DARF =0.9

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 1.00	RATIO 2 .98	RATIO 3 .97	RATIO 4 .93	RATIO 5 .91	RATIO 6 .90	RATIO 7 .88	RATIO 8 .86
HYDROGRAPH AT												
+	ANN	.26	1	FLOW	123.	118.	115.	106.	101.	99.	94.	89.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
ROUTED TO												
+	RANN	.26	1	FLOW	122.	117.	114.	105.	100.	98.	93.	88.
				TIME	4.08	4.08	4.08	4.08	4.08	4.08	4.08	4.08
HYDROGRAPH AT												
+	GD29B	.14	1	FLOW	69.	66.	65.	58.	55.	54.	51.	48.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT												
+	CGD29B	.40	1	FLOW	174.	166.	163.	148.	141.	137.	130.	123.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00	4.00
ROUTED TO												
+	RGD29B	.40	1	FLOW	173.	166.	162.	148.	140.	137.	130.	123.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HYDROGRAPH AT												
+	ANN1B	.14	1	FLOW	108.	105.	103.	96.	92.	90.	87.	83.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT												
+	CANN1B	.53	1	FLOW	258.	247.	242.	222.	211.	206.	196.	186.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO												
+	RANN1B	.53	1	FLOW	256.	245.	239.	218.	208.	203.	193.	184.
				TIME	3.92	3.92	3.92	3.92	4.00	4.00	4.00	4.00
HYDROGRAPH AT												
+	ANN1C2	.09	1	FLOW	69.	66.	65.	60.	58.	56.	54.	52.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT												
+	CANN1C2	.62	1	FLOW	308.	296.	289.	265.	252.	246.	234.	222.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO												
+	RANN1C2	.62	1	FLOW	307.	294.	288.	263.	251.	244.	232.	220.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT												
+	PDGCC3	.05	1	FLOW	50.	48.	48.	44.	43.	42.	40.	39.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT												
+	CGCC3	.67	1	FLOW	332.	318.	311.	285.	272.	265.	252.	239.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO												
+	RGCC3	.67	1	FLOW	331.	318.	311.	284.	271.	264.	250.	238.

				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.75
HYDROGRAPH AT												
+	PT5A3	.09	1	FLOW	89.	87.	85.	80.	78.	76.	74.	71.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
3 COMBINED AT												
+	C5A3	6.48	1	FLOW	1719.	1618.	1568.	1366.	1262.	1214.	1123.	1038.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
DIVERSION TO												
+	GOOF3	6.48	1	FLOW	2.	2.	2.	2.	2.	2.	2.	2.
				TIME	2.50	2.50	2.58	2.58	2.67	2.75	2.83	2.92
HYDROGRAPH AT												
+	GOWAN3	6.48	1	FLOW	1717.	1616.	1566.	1364.	1260.	1212.	1121.	1036.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
ROUTED TO												
+	R5A3	6.48	1	FLOW	1715.	1613.	1562.	1359.	1256.	1208.	1120.	1034.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.33
DIVERSION TO												
+	MAVERICK	6.48	1	FLOW	183.	163.	152.	112.	91.	82.	64.	49.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.33
HYDROGRAPH AT												
+	MAV	6.48	1	FLOW	1532.	1450.	1410.	1247.	1165.	1127.	1056.	985.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.33
ROUTED TO												
+	R5A3B	6.48	1	FLOW	1530.	1448.	1407.	1245.	1163.	1126.	1056.	985.
				TIME	4.25	4.25	4.25	4.25	4.25	4.33	4.33	4.33
HYDROGRAPH AT												
+	CY06A	.08	1	FLOW	72.	70.	69.	64.	62.	61.	58.	56.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT												
+	PT5A8	.03	1	FLOW	20.	20.	19.	18.	17.	17.	16.	16.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.75	3.75
3 COMBINED AT												
+	C5A8	6.58	1	FLOW	1555.	1472.	1431.	1267.	1184.	1146.	1073.	1003.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.25	4.25
ROUTED TO												
+	R5A3C	6.58	1	FLOW	1554.	1470.	1429.	1265.	1182.	1144.	1072.	1002.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.25
DIVERSION TO												
+	GOOF4	6.58	1	FLOW	2.	2.	2.	2.	2.	2.	2.	2.
				TIME	3.17	3.17	3.25	3.25	3.33	3.33	3.33	3.33
HYDROGRAPH AT												
+	GOWAN4	6.58	1	FLOW	1552.	1468.	1427.	1263.	1180.	1142.	1070.	1000.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.25
DIVERSION TO												
+	DCY07B	6.58	1	FLOW	440.	412.	398.	342.	314.	301.	277.	253.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.25
HYDROGRAPH AT												
+	DPT5A8	6.58	1	FLOW	1112.	1057.	1029.	921.	866.	841.	793.	747.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.25
ROUTED TO												
+	R5A8	6.58	1	FLOW	1109.	1053.	1025.	917.	865.	840.	793.	746.
				TIME	4.25	4.25	4.25	4.33	4.33	4.33	4.33	4.33
ROUTED TO												
+	R5A82	6.58	1	FLOW	1105.	1049.	1022.	917.	864.	840.	793.	746.
				TIME	4.25	4.25	4.25	4.33	4.33	4.33	4.33	4.33
HYDROGRAPH AT												
+	CY07A	.03	1	FLOW	29.	28.	27.	26.	25.	24.	23.	23.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT												
+	CCY07A	6.61	1	FLOW	1112.	1056.	1028.	922.	869.	844.	797.	750.
				TIME	4.25	4.25	4.25	4.33	4.33	4.33	4.33	4.33
DIVERSION TO												
+	TRUVAL	6.61	1	FLOW	88.	83.	81.	71.	67.	64.	60.	56.
				TIME	4.25	4.25	4.25	4.33	4.33	4.33	4.33	4.33
HYDROGRAPH AT												
+	TRUV	6.61	1	FLOW	1024.	973.	948.	851.	803.	780.	737.	694.
				TIME	4.25	4.25	4.25	4.33	4.33	4.33	4.33	4.33
HYDROGRAPH AT												
+	D95B	.00	1	FLOW	192.	192.	192.	183.	178.	176.	171.	165.
				TIME	3.83	3.83	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO												
+	RD95B	.00	1	FLOW	192.	192.	191.	182.	177.	174.	170.	161.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	4.00
DIVERSION TO												
+	DIRCHO	.00	1	FLOW	36.	36.	36.	34.	33.	33.	32.	30.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT												
+	1REMAIN	.00	1	FLOW	156.	156.	155.	148.	144.	141.	138.	130.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT												
+	PT3AB1	.05	1	FLOW	64.	62.	61.	58.	57.	56.	55.	53.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT												
+	C3AB1	.05	1	FLOW	209.	206.	204.	192.	185.	182.	177.	168.

				TIME	3.83	3.83	3.83	3.83	3.92	3.92	3.92	3.92
DIVERSION TO												
+	D2RCHO	.05	1	FLOW	29.	29.	29.	29.	28.	28.	27.	26.
				TIME	3.75	3.75	3.83	3.83	3.92	3.92	3.92	3.92
HYDROGRAPH AT												
+	2REMAIN	.05	1	FLOW	180.	177.	175.	163.	157.	154.	150.	142.
				TIME	3.83	3.83	3.83	3.83	3.92	3.92	3.92	3.92
ROUTED TO												
+	R2MAIN	.05	1	FLOW	177.	175.	173.	162.	156.	152.	148.	140.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	4.00	4.00
HYDROGRAPH AT												
+	PT3AB2	.05	1	FLOW	77.	75.	74.	71.	69.	68.	66.	65.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.58
2 COMBINED AT												
+	C3AB2	.10	1	FLOW	223.	215.	211.	196.	188.	184.	177.	167.
				TIME	3.83	3.83	3.83	3.83	3.92	3.92	3.92	3.92
DIVERSION TO												
+	D3RCHO	.10	1	FLOW	23.	23.	23.	23.	23.	22.	21.	20.
				TIME	3.75	3.75	3.75	3.83	3.92	3.92	3.92	3.92
HYDROGRAPH AT												
+	3REMAIN	.10	1	FLOW	200.	192.	188.	173.	166.	162.	156.	147.
				TIME	3.83	3.83	3.83	3.83	3.92	3.92	3.92	3.92
ROUTED TO												
+	R3MAIN	.10	1	FLOW	195.	189.	186.	173.	165.	160.	153.	145.
				TIME	3.83	3.92	3.92	3.92	3.92	3.92	3.92	4.00
HYDROGRAPH AT												
+	PT2B2	.08	1	FLOW	83.	80.	79.	74.	72.	71.	68.	66.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT												
+	CPT2B2	.18	1	FLOW	264.	254.	248.	228.	216.	211.	201.	190.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
DIVERSION TO												
+	D4RCHO	.18	1	FLOW	35.	35.	35.	35.	35.	35.	33.	31.
				TIME	3.67	3.67	3.75	3.75	3.83	3.83	3.83	3.83
HYDROGRAPH AT												
+	4REMAIN	.18	1	FLOW	229.	219.	213.	193.	181.	176.	168.	159.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
ROUTED TO												
+	R4MAIN	.18	1	FLOW	224.	214.	209.	191.	180.	175.	167.	158.
				TIME	3.83	3.83	3.92	3.92	3.92	3.92	3.92	3.92
HYDROGRAPH AT												
+	PT2B3	.02	1	FLOW	32.	31.	31.	29.	28.	28.	27.	27.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT												
+	C2B3	.20	1	FLOW	248.	237.	231.	210.	199.	195.	186.	177.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
DIVERSION TO												
+	DCSD2	.20	1	FLOW	120.	120.	120.	120.	120.	120.	120.	120.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.58	3.67
HYDROGRAPH AT												
+	D2B3	.20	1	FLOW	128.	117.	111.	90.	79.	75.	66.	57.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
HYDROGRAPH AT												
+	PT2A2	.06	1	FLOW	63.	61.	60.	56.	54.	53.	51.	49.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO												
+	R2A2	.06	1	FLOW	61.	59.	58.	54.	52.	51.	50.	48.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT												
+	PT2A1	.06	1	FLOW	63.	61.	60.	56.	54.	53.	52.	50.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT												
+	D95E	.00	1	FLOW	184.	176.	172.	158.	152.	148.	142.	132.
				TIME	4.00	4.08	4.08	4.08	4.08	4.08	4.08	4.08
ROUTED TO												
+	RD95E	.00	1	FLOW	184.	175.	171.	157.	150.	147.	140.	131.
				TIME	4.08	4.08	4.08	4.08	4.17	4.17	4.17	4.17
3 COMBINED AT												
+	C2A2	.13	1	FLOW	255.	244.	239.	219.	207.	202.	190.	179.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.08	4.08
DIVERSION TO												
+	DCSD1	.13	1	FLOW	90.	90.	90.	90.	90.	90.	90.	90.
				TIME	3.58	3.58	3.58	3.58	3.58	3.58	3.67	3.67
HYDROGRAPH AT												
+	DPT2A1	.13	1	FLOW	165.	154.	149.	129.	117.	112.	100.	89.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.08	4.08
ROUTED TO												
+	R2A2	.13	1	FLOW	164.	152.	146.	127.	117.	111.	99.	87.
				TIME	4.00	4.00	4.00	4.08	4.08	4.08	4.08	4.17
HYDROGRAPH AT												
+	PT2B1	.07	1	FLOW	72.	70.	69.	64.	62.	61.	58.	56.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT												
+	C2B1	.20	1	FLOW	197.	184.	178.	153.	139.	133.	121.	107.

+ 90 cfs = 210 cfs in Craig Storm Drain at Rancho.

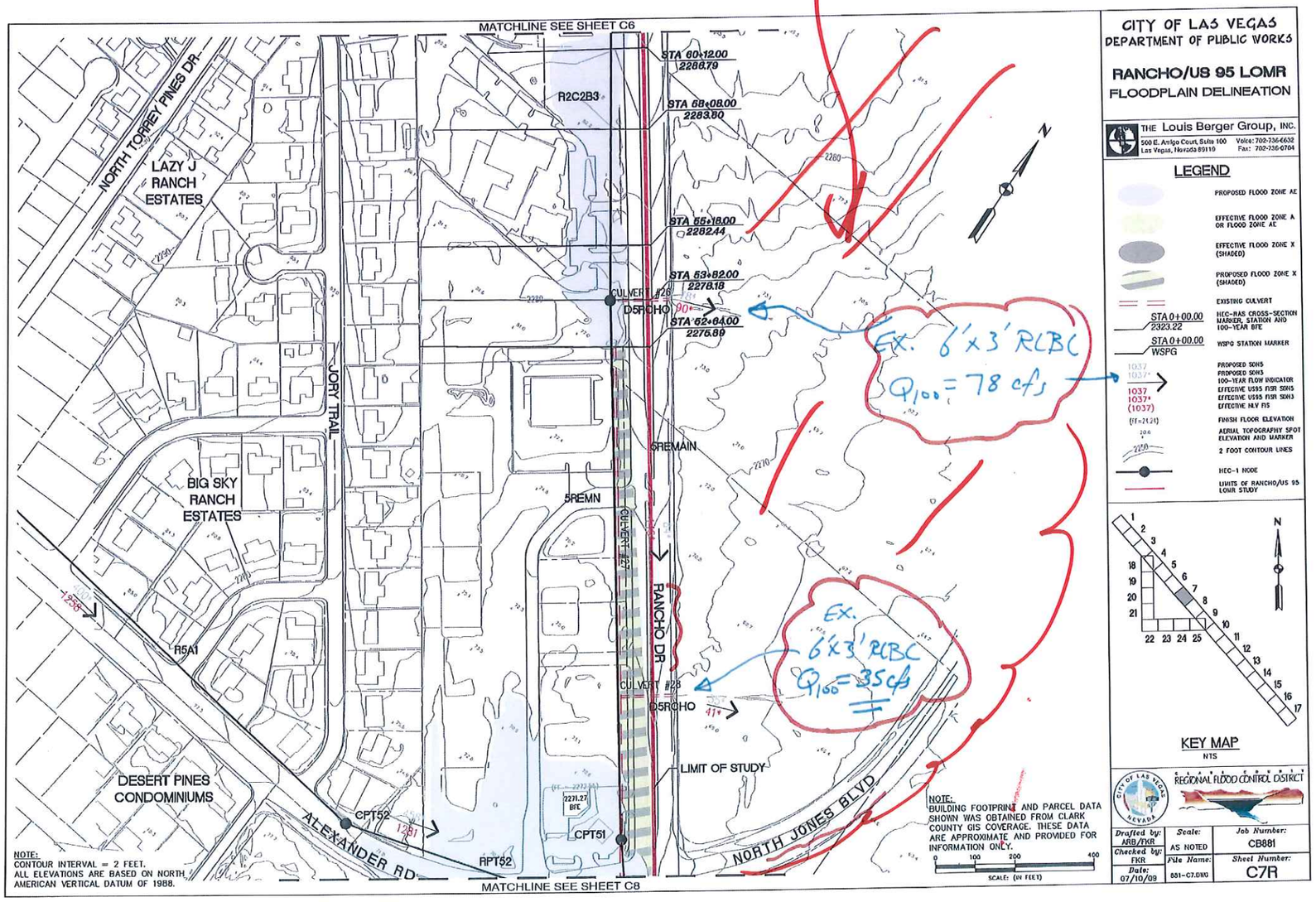
DARF = 0.9

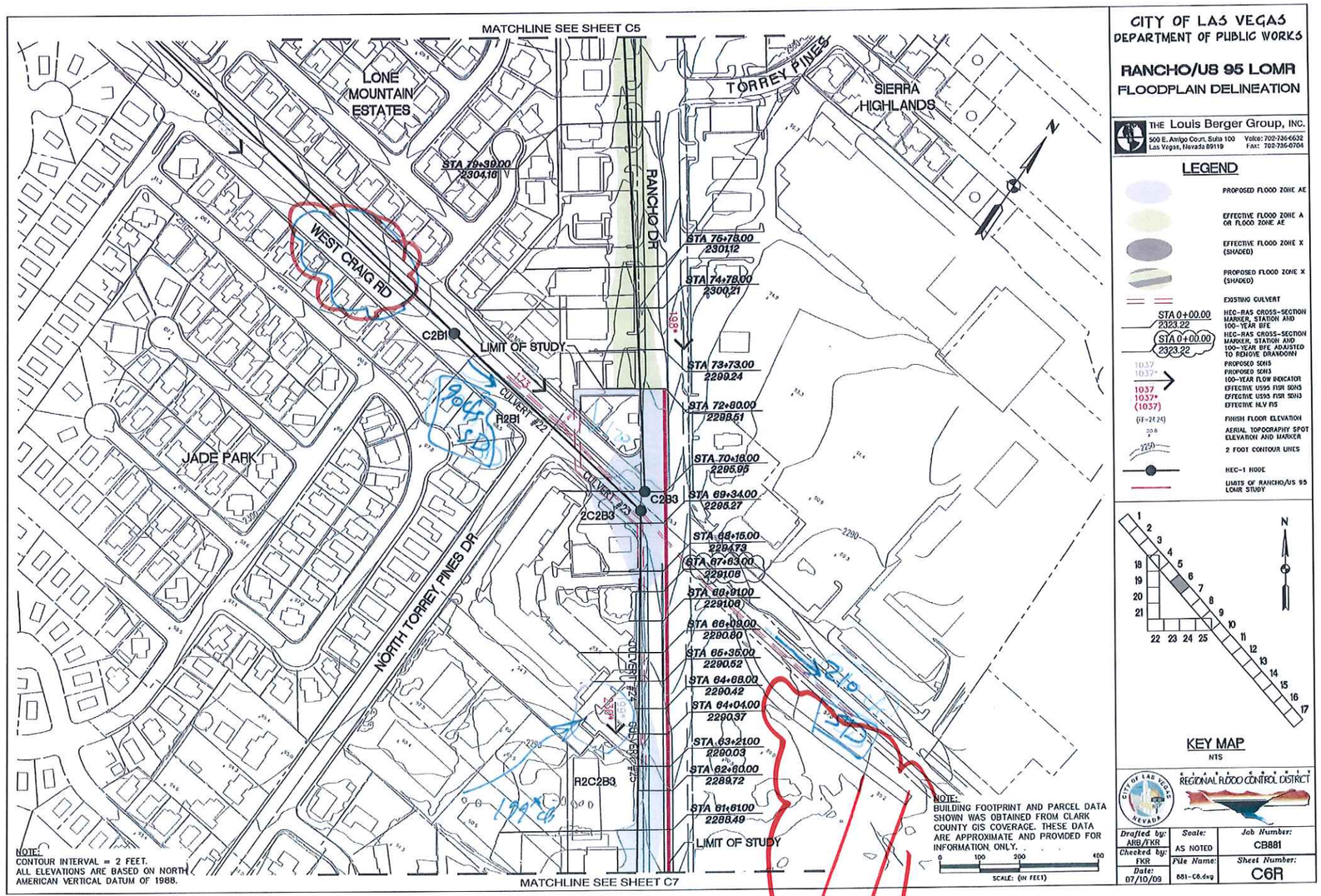
				TIME	4.00	4.00	4.00	4.00	4.08	4.08	4.08	4.08
ROUTED TO													
+	R2B1	.20	1	FLOW	197.	184.	177.	152.	139.	133.	120.	107.
				TIME	4.00	4.00	4.00	4.00	4.08	4.08	4.08	4.08
2 COMBINED AT													
+	2C2B3	.40	1	FLOW	312.	291.	278.	233.	209.	199.	177.	156.
				TIME	3.92	3.92	3.92	3.92	3.92	3.92	3.92	3.92
ROUTED TO													
+	RC2B3	.40	1	FLOW	308.	285.	273.	230.	208.	197.	176.	155.
				TIME	3.92	3.92	4.00	4.00	4.00	4.00	4.00	4.00
DIVERSION TO													
+	D5RCHO	.40	1	FLOW	113.	113.	113.	113.	113.	113.	108.	94.
				TIME	3.75	3.83	3.83	3.83	3.92	3.92	4.00	4.00
HYDROGRAPH AT													
+	5REMAIN	.40	1	FLOW	195.	172.	160.	117.	95.	84.	69.	60.
				TIME	3.92	3.92	4.00	4.00	4.00	4.00	4.00	4.00
ROUTED TO													
+	R5REMN	.40	1	FLOW	192.	171.	160.	116.	93.	82.	68.	59.
				TIME	4.00	4.00	4.00	4.00	4.00	4.00	4.00	4.00
HYDROGRAPH AT													
+	PT51	.07	1	FLOW	84.	82.	81.	77.	74.	73.	71.	69.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
2 COMBINED AT													
+	CPT51	.47	1	FLOW	244.	219.	205.	157.	133.	122.	109.	100.
				TIME	3.92	3.92	3.92	4.00	4.00	3.92	3.92	3.92
HYDROGRAPH AT													
+	D95F	.00	1	FLOW	180.	175.	172.	163.	158.	156.	151.	147.
				TIME	4.17	4.17	4.17	4.25	4.25	4.25	4.25	4.25
ROUTED TO													
+	RD95F	.00	1	FLOW	179.	174.	172.	162.	157.	155.	151.	146.
				TIME	4.25	4.25	4.25	4.25	4.25	4.25	4.33	4.33
HYDROGRAPH AT													
+	PT3	.15	1	FLOW	166.	161.	159.	149.	144.	142.	137.	132.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	PT6A	.02	1	FLOW	30.	29.	29.	27.	27.	26.	25.	25.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT													
+	CPT6A	.17	1	FLOW	266.	255.	250.	230.	220.	216.	205.	196.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	RPT6A	.17	1	FLOW	265.	255.	249.	229.	219.	215.	205.	195.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
HYDROGRAPH AT													
+	PT41	.14	1	FLOW	122.	118.	116.	107.	103.	101.	97.	93.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
ROUTED TO													
+	RPT41	.14	1	FLOW	119.	115.	112.	104.	100.	98.	94.	90.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
HYDROGRAPH AT													
+	PT42	.08	1	FLOW	61.	59.	58.	54.	52.	51.	49.	47.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
2 COMBINED AT													
+	CPT42	.22	1	FLOW	177.	171.	168.	156.	150.	148.	142.	136.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	PT5A1	.05	1	FLOW	59.	57.	56.	53.	51.	51.	49.	47.
				TIME	3.67	3.67	3.67	3.67	3.67	3.67	3.67	3.67
3 COMBINED AT													
+	C5A1	.44	1	FLOW	489.	470.	461.	426.	409.	400.	382.	365.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	R5A1	.44	1	FLOW	480.	461.	453.	418.	401.	392.	375.	359.
				TIME	3.75	3.75	3.75	3.75	3.75	3.83	3.83	3.83
HYDROGRAPH AT													
+	PT5A4	.03	1	FLOW	27.	26.	26.	24.	23.	22.	22.	21.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
HYDROGRAPH AT													
+	PT52	.06	1	FLOW	52.	51.	50.	46.	44.	43.	42.	40.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
3 COMBINED AT													
+	CPT52	.54	1	FLOW	560.	538.	528.	488.	468.	458.	438.	418.
				TIME	3.75	3.75	3.75	3.75	3.75	3.75	3.75	3.75
ROUTED TO													
+	RPT52	.54	1	FLOW	553.	532.	522.	482.	463.	453.	434.	415.
				TIME	3.75	3.75	3.75	3.83	3.83	3.83	3.83	3.83
2 COMBINED AT													
+	2CPT51	1.01	1	FLOW	762.	717.	694.	614.	582.	569.	541.	515.
				TIME	3.83	3.83	3.83	3.83	3.83	3.83	3.83	3.83
ROUTED TO													
+	R2CPT51	1.01	1	FLOW	756.	713.	690.	611.	580.	567.	539.	513.
				TIME	3.92	3.92	3.92	3.83	3.83	3.83	3.83	3.83
DIVERSION TO													
+	D6RCHO	1.01	1	FLOW	184.	168.	159.	130.	121.	118.	110.	104.

surface flows travelling southerly along Rancho

78 cfs + 35 cfs = 113 cfs flows diverted through the Existing 2: 6'x3' RCBC underneath Rancho

Subject Site





CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS

RANCHO/US 95 LOMR
FLOODPLAIN DELINEATION

THE Louis Berger Group, INC.
500 E. Amigo Court, Suite 100 Las Vegas, Nevada 89119
Voice: 702-736-6632 Fax: 702-736-0704

LEGEND

- PROPOSED FLOOD ZONE AE
- EFFECTIVE FLOOD ZONE A OR FLOOD ZONE AE
- EFFECTIVE FLOOD ZONE X (SHADED)
- PROPOSED FLOOD ZONE X (SHADED)
- EXISTING CULVERT
- STA 0+00.00 / 2323.22 — HEC-RAS CROSS-SECTION MARKER, STATION AND 100-YEAR BFE
- STA 0+00.00 / 2323.22 — HEC-RAS CROSS-SECTION MARKER, STATION AND 100-YEAR BFE ADJUSTED TO REMOVE DRAWDOWN
- 1037 / 1037* — PROPOSED SDI5 / PROPOSED SDI3 100-YEAR FLOW INDICATOR
- 1037 / 1037* / (1037) — EFFECTIVE US95 FISR SDI5 / EFFECTIVE US95 FISR SDI3 / EFFECTIVE NLV FIS
- (FF=2424) — FINISH FLOOR ELEVATION
- AERIAL TOPOGRAPHY SPOT ELEVATION AND MARKER
- 2 FOOT CONTOUR LINES
- HEC-1 NODE
- LIMITS OF RANCHO/US 95 LOMR STUDY

KEY MAP
NTS

REGIONAL FLOOD CONTROL DISTRICT

Drafted by: ARB/FKR	Scale: AS NOTED	Job Number: CB881
Checked by: FKR	File Name: 881-C6.dwg	Sheet Number: C6R
Date: 07/10/09		

subject site

Response to Comment No. 2

Relevant Excerpts from the "Hydrology Study for Craig Road between U.S. 95 and Decatur Boulevard"

DS #: 4496

APN: _____

PROJECT: Hydrology Study for Craig Road between U.S. 95 and Decatur Blv.

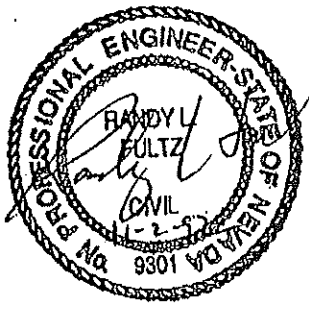
SUBMITTAL: 1st Submittal

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____

CLV
Mark Sorensen

HYDROLOGY STUDY
FOR
CRAIG ROAD BETWEEN U.S.95 AND DECATUR BOULEVARD



PREPARED BY:

CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS
FLOOD CONTROL SECTION
LAS VEGAS, NV 89128
229-6276

November 2, 1992

Since the contours in the undeveloped area were originally west to east, it is believed most of the flow would have been conveyed across Rancho Drive prior to construction. It is believed a similar portion of the 100-year flow (Q100) should be conveyed across Rancho Drive with a underground piping system into the Gowan Outfall at Decatur Boulevard. The proposed design will convey the 10-year flow (Q10) across Rancho Drive.

This would relieve the flooding problems south of Craig Road at the two intersections of (1) Rancho Drive and Alexander Road and (2) Jones Boulevard and Rancho Drive. Both of these intersections will need significant future RTC funds for flood control improvements to alleviate flooding if the Craig Road Project does not convey a portion of the flow east.

Previous studies in the project area include the following:

- August 1988 G.C. Wallace Inc., Gowan Detention Basin Predesign Report.
- December 1988 G.C. Wallace Inc., Decatur Boulevard Street Improvement Project Design Report.
- 1989 G.C. Wallace Inc., Drainage Study for U.S.95 Interchanges Between Smoke Ranch and Lone Mountain.
- May 1990 VTN-Nevada, Design Report for Gowan Detention Basin Outfall Structure.
- November 1990 Hefner Engineering, Design Report for Craig Road Between Decatur and U.S. 95.

The November 1990 Hefner Engineering Report used information presented in the above studies to design the storm sewer system for Craig Road from U.S.95 to Decatur Boulevard. The RTC criteria allows for funding drainage improvements for the 10-year flow with a 12-foot dry lane in each direction and 6-inch depth (curb height) at major intersections.

OBJECTIVES

This study will prepare hydrology and hydraulic calculations for design whcih convey the 10-year flow in Craig easterly across Rancho Drive. A hydrologic analysis for the 10 and 100-year frequency events for existing and future conditions will be prepared. The hydraulic characteristics through culverts along U.S.95 and Rancho Drive were modified to reflect lower backwater elevations for a 10-year frequency. The results of this analysis will be compared to the Hefner Engineering Design Report.

HYDROLOGIC ANALYSIS

This section presents the criteria, methodology and results of the hydrologic analysis of the study. The hydrologic analysis was divided into two alternatives: (1) Existing Conditions and (2) Future Conditions With the Gowan North Channel In-place. The drainage areas west of U.S. 95 are shown of Figure 2 and east of U.S.95 on Figure 3.

The basis for the HEC-1 Model was the G.C. Wallace Decatur Drainage Study with the following changes:

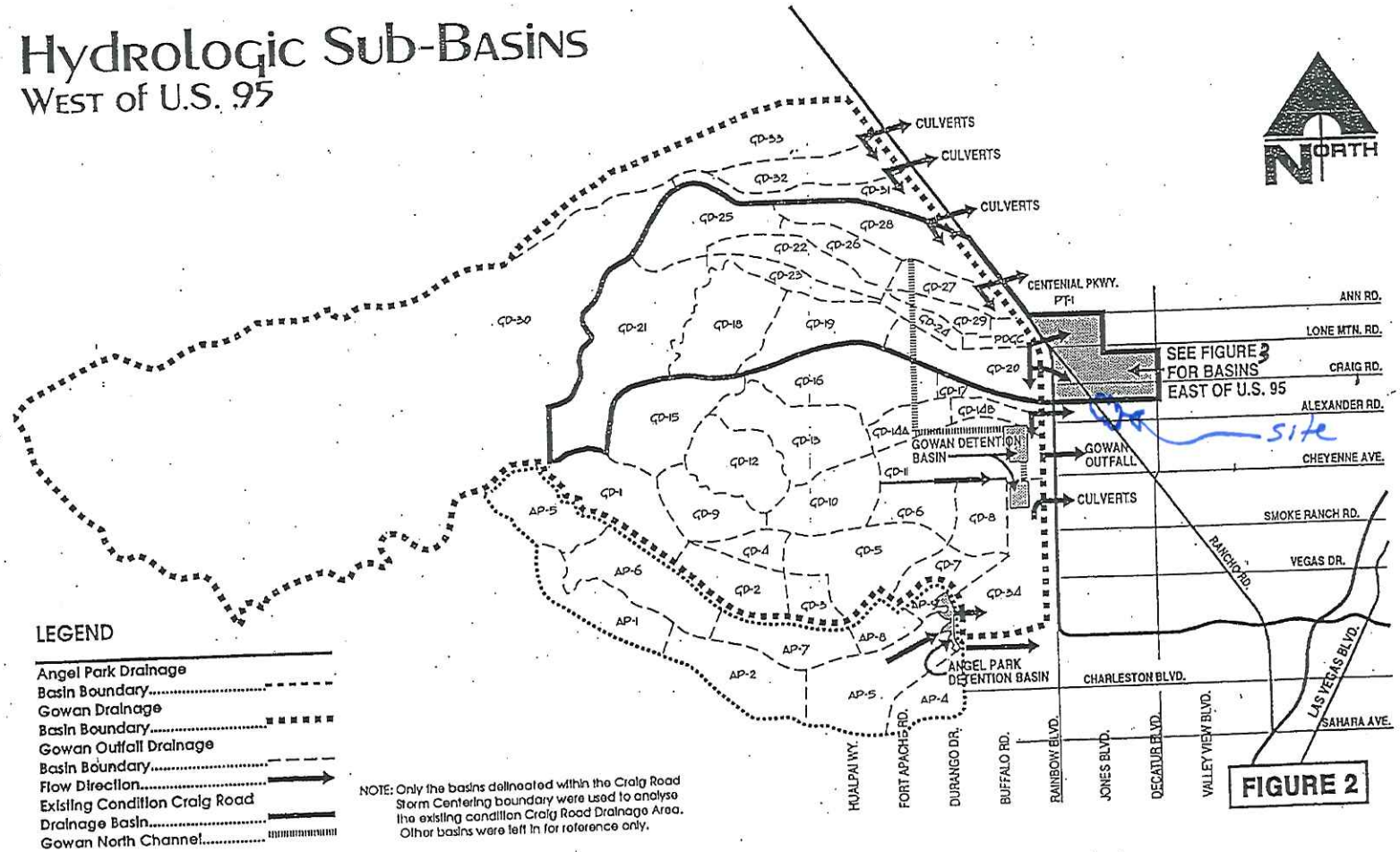
- Culvert analysis modified to allow for the lower backwater elevations.
- The storm centering was modified for the smaller drainage areas and is dicsussed below.
- Future value CN values were modified to allow for greater percentage of drought tolerant landscaping.

Existing Conditions

Both the 10 and 100 year 6-hour storms were analyzed for the Existing Condition Alternative. This alternative assumed the Q10 portion of the Q100 was conveyed east across Rancho Drive. This assumption would allow for the reduction in flooding problems at (1) Alexander Road and Rancho Drive and (2) Jones Boulevard and Rancho Drive. The remainder of the Q100 flow would be directed across Craig Road and south along Rancho Drive through two 3'x7' RCB's similar to the design originally proposed by the Hefner Design. Hydraulic calculations are contained in Appendix D.

The VTN Gowan Outfall Report provided a more refined storm centering analysis to the terminus of this project at Craig Road and Decatur Boulevard and this was incorporated into the HEC-1 Model. The VTN Gowan Outfall Report evaluated several storm centering alternatives for the Gowan Outfall. Storm Centering 3 for a 66 square mile area (see Figure 2 for storm centering delineation) yielded the highest Q100 stormwater runoff at the Craig Road and Decatur Boulevard intersection of 1020 cfs. This same storm centering using a DARF of 0.67 was used for the existing condition analysis. For future conditions with the Gowan Outfall the DARF was reduced to 0.765.

Hydrologic Sub-Basins
West of U.S. 95



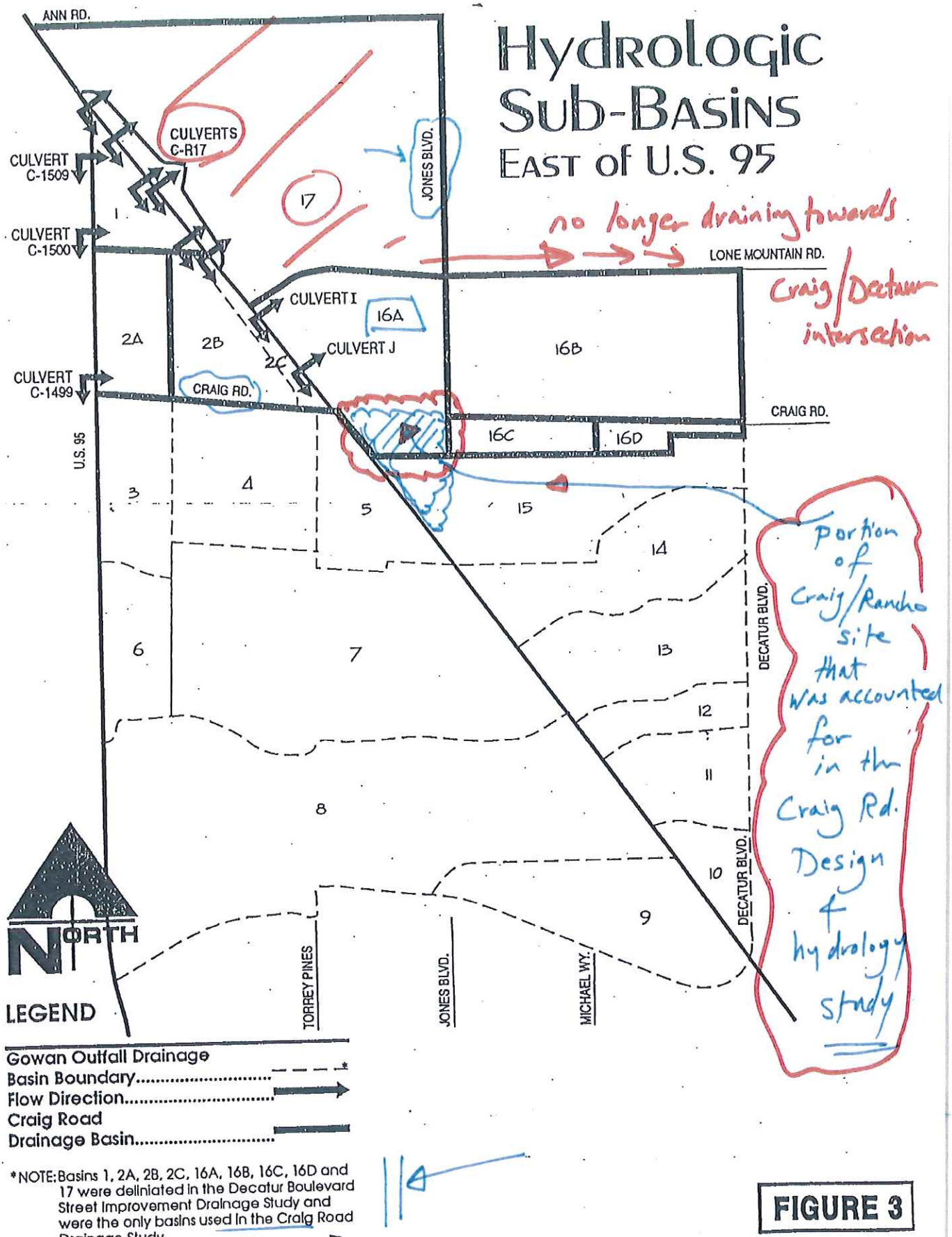
LEGEND

- Angel Park Drainage Basin Boundary.....
- Gowan Drainage Basin Boundary.....
- Gowan Outfall Drainage Basin Boundary.....
- Flow Direction.....
- Existing Condition Craig Road Drainage Basin.....
- Gowan North Channel.....

NOTE: Only the basins delineated within the Craig Road Storm Centering boundary were used to analyse the existing condition Craig Road Drainage Area. Other basins were left in for reference only.

FIGURE 2

Hydrologic Sub-Basins East of U.S. 95



LEGEND

Gowan Outfall Drainage Basin Boundary.....

Flow Direction.....

Craig Road Drainage Basin.....

*NOTE: Basins 1, 2A, 2B, 2C, 16A, 16B, 16C, 16D and 17 were delinlated in the Decatur Boulevard Street Improvement Drainage Study and were the only basins used in the Craig Road Drainage Study.

FIGURE 3

The stormsewer system for the Existing Condition Alternative was analyzed taking the Q10 flow of 223 cfs across Rancho Drive and conveying the Q100 cross flow from Rancho Drive across Craig Road and south along Rancho Drive as shown on Figure 4. It is necessary to convey the Q100 Rancho Drive cross flow of 359 cfs because the adjacent property to the 7-11 Store is in a FEMA A zone and the Craig Road project is raising the street grade approximately 2-feet. Thus, a backwater condition on the property would be caused on the FEMA A zone property if not properly conveyed.

The Q100 flow of 359 cfs is collected behind the 7-11 Store. The Q10 portion of 140 cfs will be directed into the Craig Road 10-year storm drainage system. The remaining 219 cfs (359 cfs minus 140 cfs) not collected in the Q10 system will be conveyed in a concrete lined channel into 2-3'x7' concrete boxes that extend across Craig Road into the drainageway along the west side of Rancho Drive. This is similar to the Hefner Design. However, since a 54-inch pipe extends across Craig Road, one less 3'x7' box will be required. Hydraulic calculations for the two 3'x7' culverts are contained in Appendix D.

A flow split north of Craig Road at Lone Mountain and Jones Boulevard occurs and diverts a Q10 of 120 cfs and Q100 of 240 cfs into the Craig Road system. This diversion area was part of the VTN design for the Gowan Outfall Project and must be intercepted.

Approximately 800 LF west of Decatur Boulevard, the Rancho Alta Mira Development has a 66-inch storm sewer that discharges approximately 160 cfs into the Craig Road storm sewer system. This is a reduced Q100 peak flow following detention in Rancho Alta Mira. This flow was added directly to the peak flow in Craig Road for both the 10 and 100-year frequency analyses.

Future Conditions With Gowan North Channel

The design flows with the Gowan North Channel are shown on Figure 6. This Regional Flood Control Facility is not on the City of Las Vegas 10-Year Plan and it is not known when it will be scheduled for construction. The HEC-1 Model was modified to allow for the reduction in area from 66 square miles to 26 square miles. The DARF was increased from 0.67 to 0.765.

DARF

Hydrologic Analysis Summary

A summary of the results of the flow analyses and pipe sizes is presented on Table 1 and is graphically shown on Figures 4 and 5 along with the Hefner Engineering design information on Figure 6 for comparison.

TABLE 1
STORMWATER FLOW SUMMARY

LOCATION	Existing 10-yr (cfs)	Existing 100-yr (cfs)	Future 10-yr (cfs)	Future 100-yr (cfs)	Hefner Design (cfs)
Craig and US 95	103	212	5	13	61
Craig and Torrey Pines	140	359	34	356	366
Craig and Rancho	223	581	55	366	468
Craig and Jones	338	478	213	358	232
Craig and Rancho Alta Mira	498	638	373	518	392
Craig and Decatur	498	638	373	518	392

Upon the construction of the upstream Gowan facility along US-95 between Craig & Ann Rd.

This has been reduced by the construction of the Lone Mountain facility between Rancho/Decatur

Following this hydrologic analysis it is believed weaknesses in the Hefner Engineering design existed in the following areas:

- Allowing only 78 cfs to cross Rancho Drive in a pipe during a 100-year event. The historical flow path was predominately west to east in Craig Road.

- The input for the diversions across Rancho Drive north of Craig Road were taken from the Decatur Drainage Study for a 100-year event. For a 10-year event the backwater conditions in the culverts would be significantly lower. With lower backwater conditions, less stormwater would be passed through the culverts and more stormwater would be conveyed south on the west side of Rancho Drive to the intersection of Craig Road and Rancho Drive.

- The Hefner Engineering report assumed the Gowan North Channel was in place. Since this project is not on the CLV 10-Year Regional Flood Control Plan, it is believed the stormwater system should be designed as though it was not in place. Also, the Hefner Design Report used the 50-year frequency flow crossing U.S. 95 rather than a 10-year frequency.

- A flow diversion occurs at Lone Mountain and Jones Boulevard that presently diverts a Q10 of 120 cfs and Q100 of 240 cfs into the Craig Road system.

COST SUMMARY

Pipe sizes were determined based on normal depth calculations using Manning's Equation and are presented in Table 2. A cost comparison was prepared using the Q10 flow for the existing and future condition alternatives and comparing the relative pipe conveyance cost differences to the Hefner Design. This cost estimate is not a detailed construction cost estimate since it does not include the inlet and lateral collection system costs. The inlet and lateral system cost differences were considered significant to the cost of the storm sewer system.

These costs provide a relative idea as to the cost-effectiveness of the alternatives. The Cost Summary of the Existing Condition 10-Year Design, Hefner Design and Future Conditions with the Gowan North Channel is shown on Table 3. The Existing Condition 10-Year Design Alternative is approximately $144,100 or 5.5 percent more expensive than the original Hefner Design. This represents about 2.4 percent of the total cost for the Craig Road project estimated at $6,000,000. The Future Condition Alternative is about $410,000 or 16 percent less than the Hefner Design.

TABLE 2
Craig Road Stormwater
Normal Depth Pipe Analysis

Pipe Segment	Station	Flow (cfs)	Slope (%)	Pipe Size (in) *
	166+39 (Decatur Blvd.)	485	0.37 %	
1				102
	114+72	485	0.25 %	
2				102
	106+71	325	0.42 %	
3				78
	97+65 (Lake Tahoe)	325	0.58 %	
4				72
	88+30	325	0.63 %	
5				72
	84+00	325	1.60 %	
6				60
	79+41	325	1.92 %	
7				60
	70+97	325	0.41 %	
8				78
	67+00	325	0.57 %	
9				78
	61+57 (Jones Blvd.)	297	1.79 %	
10				60
	55+46	230	2.75 %	
11				54
	50+83	230	1.91 %	
12				54
	47+23	230	1.67 %	
13				54
	43+63 (Rancho Road)	210	2.26 %	
14				54 **
	38+75	210	0.56 %	
15				54 **
	38+32 (Torrey Pines)	94	0.56 %	
16				54 **
	32+84.38	94	0.68 %	
17				48
	29+01.30	94	0.56 %	
18				48
	25+18.22	92	0.56 %	
19				48
	13+00 (Rainbow Blvd.)	90	0.56 %	
20				48
	06+65 (U.S. 95)	90	1.23 %	
21				48

* – Pipes sized based on normal depth calculations
Manning's equation (n=0.013)
** – or equivalent low head pipe

was constructed as 60" instead of 54"

File No. \home\tomv\3data\vfcd\craig1.wk3

During final design cost reductions will be pursued south of Craig Road on the west side of Rancho Drive. The original concrete lined channel section into the 2'x6' RCB will be replaced with less expensive rip-rap and gabion berm for Q10 flow to direct the flow into the culvert.

CONCLUSIONS AND RECOMMENDATIONS

It is recommended that the Craig Road storm drainage system be sized to convey the existing 10-year flow as shown in Figure 4 of this design report.

The following advantages of this design outweigh the 6.5 percent additional cost for drainage improvements relative to the Hefner Design:

- Flooding south of Craig Road at: 1) Alexander Road and Rancho Drive and 2) Jones and Rancho Drive will be greatly reduced. Both of these RTC intersections would benefit from this project and will require less flood control improvements should Rancho Drive ever be fully improved.

- Emergency vehicle access to and from Rancho Drive at Craig Road and the above intersections will be improved during a 10-year storm.

- Provide a more direct route for stormwater conveyance to the Gowan Outfall and the Las Vegas Wash.

- Collect the Q10 stormwater diversion at Lone Mountain Road and Jones Boulevard of 120 cfs.

HYDRAULIC ANALYSIS FOR RECOMMENDED ALTERNATIVE

A detailed pressure flow hydraulic analysis was performed for the Existing Condition 10-Year Alternative. An allowable 6-inch (top-of curb) street flow of 13 cfs was subtracted from the projected 10-year flow shown on Table 1. This flow was based on a typical street section taken at the upstream end of the intersection. This curb height in the intersection criterion was more restrictive than the allowable 12-foot dry lane criteria.

The hydraulic grade line was analysed assuming a 10-year flow in the Gowan Outfall. This flow was approximated usinged 57 percent of 1078 cfs or 614 cfs. The 57 percent value was arrived at based on precipitation ratios within the McCarran Airport rainfall area for a 10-year storm (1.58 inches) versus a 100-year storm (2.77 inches).

This assumption was less conservative than the original assumptions used by Hefner Engineering. It resulted in significant reductions in storm sewer requirements in the lower reaches. The largest pipe is now 84-inch in diameter. It will not be necessary to connect to the existing 84-inch stub out at Decatur Boulevard with a large pipe to maintain the hydraulic grade line below the ground surface. Appendix E contains supporting information for the hydraulic grade line analysis.

Table 4 shows recommended pressure flow design pipe sizes for this project and Table 5 presents a corresponding pipe summary. The final pressure flow pipe size revisions indicate a cost savings of approximately $87,000 with the more efficient system.

TABLE 4
Craig Road Stormwater
Recommended Pipe Sizes

Pipe Segment	Station	Flow (cfs)	Slope (%)	Pipe Size (in) *
	166+39 (Decatur Blvd.)	485		
1	Existing Pipe		0.37 %	84
	114+72	485		
2			0.50 %	84
	107+67	325		
3			0.37%	72
	97+65 (Lake Tahoe)	325		
4			0.35%	72
	92+98	325		
5			0.75%	66 **
	84+00	325		
6			1.86 %	60
	70+97	325		
7			0.41 %	60
	67+00	325		
8			0.57 %	60
	61+57 (Jones Blvd.)	297		
9			1.79 %	60
	55+46	230		
10			3.19%	60
	50+83	230		
11			0.87%	60
	47+23	230		
12			0.87%	60
	43+63 (Rancho Road)	210		
13			0.56 %	60
	38+75 (Torrey Pines)	210		
14			0.55 %	48
	20+18	92		
15			0.55 %	42
	13+00 (Rainbow Blvd.)	90		
16			0.55 %	42
	06+65 (U.S. 95)	90		
17				42

As Constructed

* – Pipes sized based on normal depth calculations
Manning's equation (n=0.013)
** – or equivalent low head pipe

File No. \home\tom\r3data\rfcd\crg1fin.wk3

PROJECT: CRAIG ROAD – WEST REACH
File No.: s:\home\tom\r3data\dncgwst.rtc
DATE : 10/28/92

Manning's Roughness 0.013

	STATION DESCRIPTION	FINISH GRADE	INV. ELEV.	PIPE DIA (IN)	LENGTH (FT)	Q (CFS)	friction head loss	MINOR LOSSES bend Hb	manhole Hmh	transtn Ht	junction Hj	ELEV. HGL	ELEV. EGL	pressure velocity
	51+06	2282.60	2265.09									2268.63	2275.44	
1		2285.90	2268.44	60	383.00	230	2.97					2272.24	2275.44	11.7
	47+23	2285.90	2268.44					0.00	0.11	0.00	0.09	2272.44	2275.64	11.5
2		2288.20	2270.83	60	273.00	225	2.03					2274.53	2277.77	11.5
	44+50	2288.20	2270.83					0.00	0.10	0.00	0.09	2274.72	2277.96	11.2
3		2289.50	2271.59	60	87.00	220	0.62					2275.29	2278.39	11.2
	43+63	2289.50	2271.59					0.00	0.10	0.00	0.17	2275.56	2278.37	10.7
4		2291.70	2273.66	60	369.00	210	2.39					2278.98	2280.75	10.7
	39+94	2291.70	2273.66					0.00	0.09	0.00	0.00	2279.06	2280.84	10.7
5		2292.90	2274.32	60	119.00	210	0.77					2279.83	2281.61	10.7
	38+75	2292.90	2274.32					0.00	0.09	0.09	0.91	2280.92	2282.70	7.5
6		2293.90	2274.93	48	108.20	94	0.46					2282.29	2283.16	7.5
	37+66.80	2293.90	2274.93					0.00	0.04	0.00	0.00	2282.33	2283.20	7.5
7		2300.00	2291.20	48	372.80	94	1.59					2292.60	2301.53	7.5
	33+94	2300.00	2291.20					0.10	0.04	0.00	0.00	2292.74	2301.67	7.5
8		2299.80	2293.58	48	110.00	94	0.47					2295.38	2299.94	7.5
	32+84.38	2299.80	2293.58					0.10	0.04	0.00	0.00	2295.52	2300.09	7.5
9		2307.10	2296.28	48	383.00	94	1.63					2298.92	2300.69	7.5
	29+01.03	2307.10	2296.28					0.00	0.04	0.00	0.00	2298.96	2300.74	7.5
10		2310.60	2298.41	48	383.08	94	1.63					2301.29	2302.75	7.5
	25+18.22	2310.60	2298.41					0.00	0.04	0.00	0.04	2301.37	2302.83	7.3
11		2313.70	2301.19	48	500.22	92	2.04					2303.99	2305.48	7.3
	20+18	2313.73	2301.19					0.00	0.04	0.06	0.59	2304.68	2306.11	9.6
12		2314.50	2302.69	42	272.00	92	2.26					2306.95	2308.37	9.6
	17+46	2314.50	2302.69					0.00	0.00	0.00	0.00	2306.95	2308.37	9.6
13		2314.70	2302.94	42	45.00	92	0.37					2307.33	2308.75	9.6
	17+01	2314.70	2302.94					0.00	0.00	0.00	0.00	2307.33	2308.75	9.6
14		2315.40	2303.67	42	183.00	92	1.52					2308.85	2310.27	9.6
	15+17.76	2315.40	2303.67					0.07	0.07	0.00	0.00	2308.99	2310.41	9.4
15		2315.80	2304.35	42	123.00	90	0.98					2310.03	2311.39	9.4
	13+95	2315.80	2304.35					0.00	0.00	0.00	0.00	2310.03	2311.39	9.4
16		2316.10	2304.76	42	75.00	90	0.60					2310.62	2311.98	9.4
	13+20	2316.10	2304.76					0.00	0.00	0.00	0.00	2310.62	2311.98	9.4
17		2316.20	2305.05	42	52.00	90	0.41					2311.04	2312.40	9.4
	12+68	2316.20	2305.05					0.00	0.00	0.00	0.00	2311.04	2312.40	9.4
18		2316.70	2306.29	42	170.00	90	1.35					2312.39	2313.75	9.4
	10+98	2316.70	2306.29					0.00	0.07	0.00	0.00	2312.46	2313.82	9.4
19		2318.10	2308.68	42	433.00	90	3.45					2315.90	2317.26	9.4
	6+65	2318.10	2308.68					0.19	0.07	0.00	0.00	2316.16	2317.52	9.4
20		2318.70	2308.85	42	21.00	90	0.17					2316.33	2317.69	9.4

201C Monroe St NE, Albuquerque, NM

DATE : 11-2-92
PROJECT: CRAIG ROAD – EAST REACH
FILE NAME: h:\home\tom\r3data\craigestrtc

Manning's Roughness 0.013

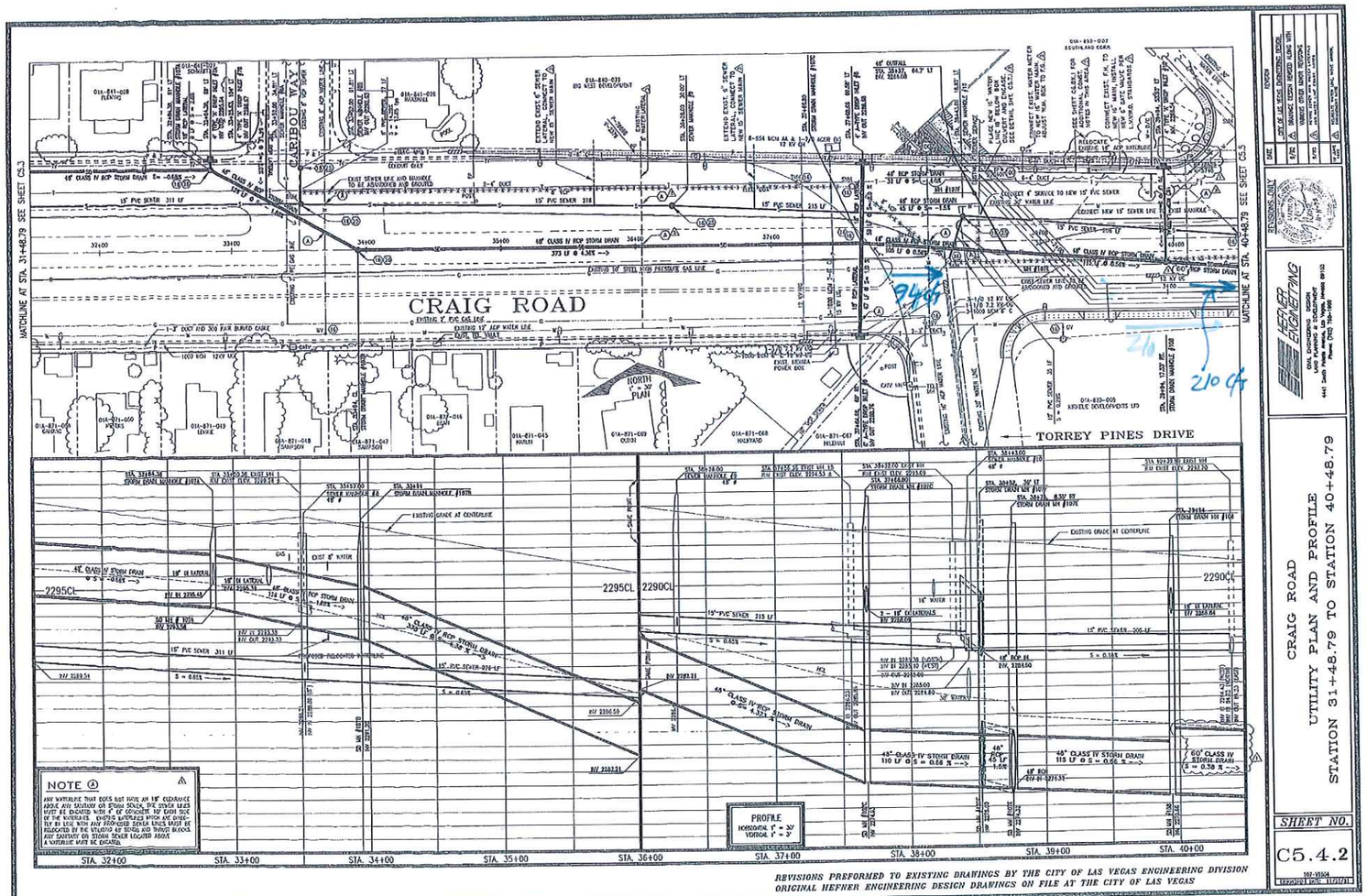
STATION DESCRIPTION	FINISH GRADE	INV. ELEV.	PIPE DIA (IN)	LENGTH (FT)	Q (CFS)	friction head loss	MINOR LOSSES bend Hb	manhole Hmh	transtn Ht	junction Hj	ELEV. HGL	ELEV. EGL	pressure velocity
117+39	2208.90	2191.10	(GOWAN OUTFALL)								2196.30	2199.93	
1	2209.00	2191.60	120	100.00	617	0.14	0.00	0.05	0.15	1.63	2196.60	2200.43	7.9
116+39	2209.00	2192.70									2198.43	2202.17	12.6
2	2208.80	2192.80	84	167.00	485	0.96	0.00	0.12	0.00	0.05	2200.66	2203.12	12.6
114+72	2208.80	2192.80									2200.83	2203.30	12.5
3	2209.00	2196.29	84	705.00	480	3.96	0.00	0.12	0.04	0.21	2202.59	2205.28	12.5
107+67	2209.00	2197.29									2202.96	2205.34	11.5
4	2209.00	2197.64	72	96.00	325	0.56	0.00	0.10	0.00	0.06	2203.85	2205.90	11.5
106+71	2209.00	2197.64									2204.02	2206.07	11.3
5	2209.00	2198.26	72	169.00	320	0.96	0.00	0.10	0.00	0.06	2205.04	2207.03	11.3
105+02	2209.00	2198.26									2205.20	2207.19	11.1
6	2209.70	2198.96	72	190.00	315	1.05	0.00	0.00	0.00	0.06	2206.31	2208.24	11.1
103+12	2209.70	2198.96									2206.37	2208.30	11.0
7	2213.00	2200.67	72	462.00	310	2.46	0.00	0.00	0.00	0.06	2208.89	2210.76	11.0
98+50	2213.00	2200.67									2208.95	2210.82	10.8
8	2213.40	2201.03	72	85.00	305	0.44	0.00	0.09	0.00	0.00	2209.45	2211.26	10.8
97+65	2213.40	2201.03									2209.54	2211.35	10.8
9	2216.70	2202.64	72	467.00	305	2.41	0.00	0.09	0.08	0.00	2211.95	2213.75	10.8
92+98	2216.70	2202.74									2212.11	2213.92	12.8
10	2219.30	2203.79	66	328.00	305	2.69	0.00	0.13	0.00	0.00	2214.05	2216.61	12.8
89+70	2219.30	2203.79									2214.18	2216.74	12.8
11	2220.30	2204.28	66	140.00	305	1.15	0.00	0.13	0.00	0.07	2215.33	2217.89	12.8
88+30	2220.30	2204.28									2215.52	2218.08	12.7
12	2224.10	2207.50	66	430.00	301	3.44	0.00	0.12	0.12	0.00	2219.03	2221.52	12.7
84+00	2224.10	2208.00									2219.27	2221.76	15.3
13	2237.30	2218.97	60	438.00	301	5.82	0.00	0.18	0.00	0.14	2222.07	2230.67	15.3
79+61	2237.30	2218.97									2222.40	2231.00	15.0
14	2246.80	2226.61	60	411.00	295	5.24	0.00	0.18	0.00	0.00	2230.01	2236.69	15.0
75+50	2246.80	2226.61									2230.19	2236.87	15.0
15	2251.60	2235.27	60	453.00	295	5.78	0.00	0.18	0.00	0.12	2238.67	2245.35	15.0
70+97	2251.60	2235.37									2238.96	2243.76	14.8
16	2255.50	2237.00	60	397.00	290	4.90	0.00	0.17	0.00	0.00	2245.27	2248.65	14.8
67+00	2255.50	2237.00									2245.44	2248.82	14.8
17	2261.00	2240.10	60	543.00	290	6.70	0.00	0.17	0.00	0.23	2252.13	2255.52	14.8
61+57	2261.00	2240.10									2252.53	2255.92	14.3
18	2273.80	2251.05	60	611.00	280	7.02	0.00	0.16	0.00	0.33	2254.35	2260.79	14.3
55+46	2273.80	2251.05									2254.84	2261.28	13.5
19	2282.60	2265.09	60	440.00	265	4.53	0.00	0.14	0.00	0.70	2267.79	2277.11	13.5
51+06	2282.60	2265.09									2268.63	2277.95	11.7
20	2285.90	2268.44	60	383.00	230	2.97					2272.24	2275.44	11.7

at 36" RCP Latural

Latural = 4' D.T. existing

80 Prot. 83 Ft upstream the subject

HGL is more than 10 ft below existing finished Grades


CRAIG ROAD
TORREY PINES DRIVE
NORTH
PLAN
PROFILE
HORIZONTAL 1" = 30'
VERTICAL 1" = 3'
NOTE ①
ANY WATERLINE THAT DOES NOT HAVE AN 18" CLEARANCE ABOVE ANY SANITARY OR STORM SEWER, BYE SEWER LINES MUST BE ENCASED WITH 6" OF CONCRETE 10' EACH SIDE OF THE WATER-LINE. EXISTING WATERLINES WHICH ARE DIRECTLY IN LINE WITH ANY PROPOSED SEWER LINES MUST BE RELOCATED BY THE UTILITIES AT BENDS AND THRUST BLOCKS JUST EASTERLY OF STORM SEWER LOCATED ABOUT A WATERLINE MAIN BE ENCASED.
STA. 32+00
STA. 33+00
STA. 34+00
STA. 35+00
STA. 36+00
STA. 37+00
STA. 38+00
STA. 39+00
STA. 40+00
MATCHLINE AT STA. 31+48.79 SEE SHEET C5.3
MATCHLINE AT STA. 40+48.79 SEE SHEET C5.5
2295CL
2290CL
946
210.04
REVISIONS PREFORMED TO EXISTING DRAWINGS BY THE CITY OF LAS VEGAS ENGINEERING DIVISION
ORIGINAL HEFNER ENGINEERING DESIGN DRAWINGS ON FILE AT THE CITY OF LAS VEGAS
HEFNER ENGINEERING
CIVIL ENGINEERING DEVELOPMENT
1445 South Pavilion Center Dr., Las Vegas, Nevada 89135
Phone (702) 562-1600
CRAIG ROAD
UTILITY PLAN AND PROFILE
STATION 31+48.79 TO STATION 40+48.79
SHEET NO.
C5.4.2
SHT. 43/66

CULVERT INLET SECTION

OPEN CHANNEL SECTION

CRAIG ROAD

RANCHO DRIVE - SOUTH

TORREY PINES

NOTE A

ANY WATERLINE THAT DOES NOT HAVE AN 18" CLEARANCE ABOVE ANY SANITARY OR STORM SEWER, THE SEWER LINES MUST BE ENCASED WITH 6" OF CONCRETE 12" BOX SIDE OF THE WATERLINE. EXISTING WATERLINES WHICH ARE DIRECTLY IN LINE WITH ANY PROPOSED SEWER LINES MUST BE RELOCATED BY THE UTILIZING AT ROAD AND THRUST BLOCKS. ANY SANITARY OR STORM SEWER LOCATED ABOVE A WATERLINE MUST BE ENCASED.

NOTE B

RETAINING WALL TO BE CONSTRUCTED WITH A LEVEL TOP-OF-WALL ELEVATION. CONTRACTOR TO CONNECT RETAINING WALL TO EXISTING BLOCK WALL.

NOTE C

REFER TO SHEETS C5.4 & C5.5 FOR ADDITIONAL STORM DRAINAGE INFORMATION

BOX CULVERT OUTLET SECTION

HEAVY RIPRAP

GABIONS SEE SHEET C7.2 - DETAIL # 3

NORTH
1" = 30'
PLAN

CONSTRUCTION NOTES

1. INSTALL 3'x 7' PRECAST BOX CULVERT AS PER DETAIL ON SHEET C7.1.
2. RELOCATE EXISTING UTILITY LINES WHICH CONFLICT WITH NEW BOX CULVERT.
3. CONTRACTOR TO CLEAN AND CLEAR ALL DEBRIS IN EXISTING BOX CULVERT.
4. LIMIT OF CONSTRUCTION.
5. CONSTRUCT TYPE 1 HEADWALL AS PER RDOT STD. SHEET NO. R-25.1.5 (MOD).

NOTE

PROFILE A-A
HORIZONTAL 1" = 30'
VERTICAL 1" = 3'

STA 0+00 STA 1+00 STA 2+00 STA 3+00 STA 4+00 STA 5+00

CRA. STA. 36+15.00

CRA. STA. 45+20.00

REVISIONS PREFORMED TO EXISTING DRAWINGS BY THE CITY OF LAS VEGAS ENGINEERING DIVISION
ORIGINAL HEFNER ENGINEERING DESIGN DRAWINGS ON FILE AT THE CITY OF LAS VEGAS

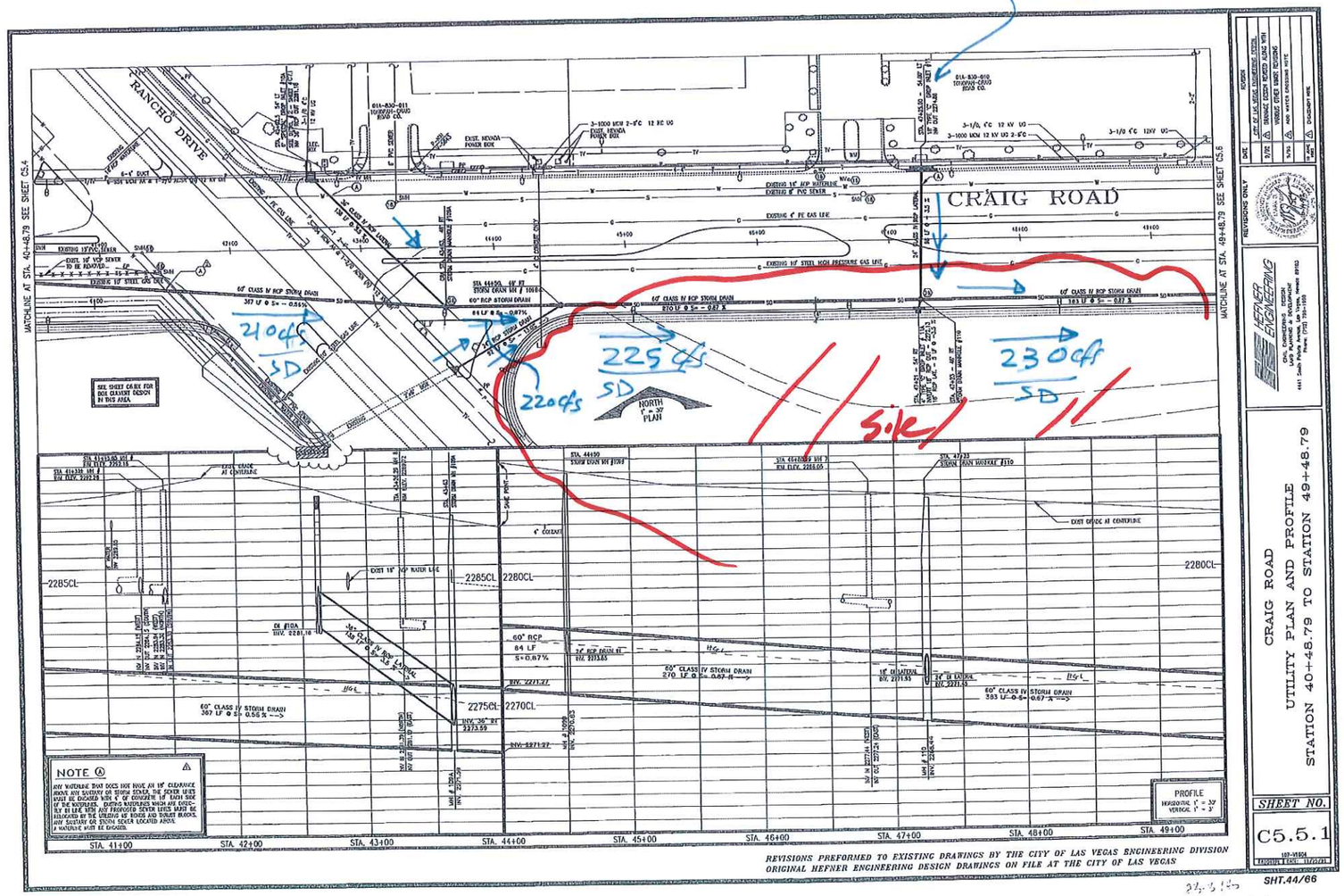
REVISIONS ONLY

HEFNER ENGINEERING
CIVIL ENGINEERING DESIGN
LAND PLANNING & DEVELOPMENT
441 South Pecos Road, Las Vegas, Nevada 89101
Phone: (702) 759-1010

CRAIG ROAD
UTILITY PLAN AND PROFILE
STATION 31+48.79 TO STATION 40+48.79

SHEET NO.
C6.BX.1

SHT.53/66



REVISIONS

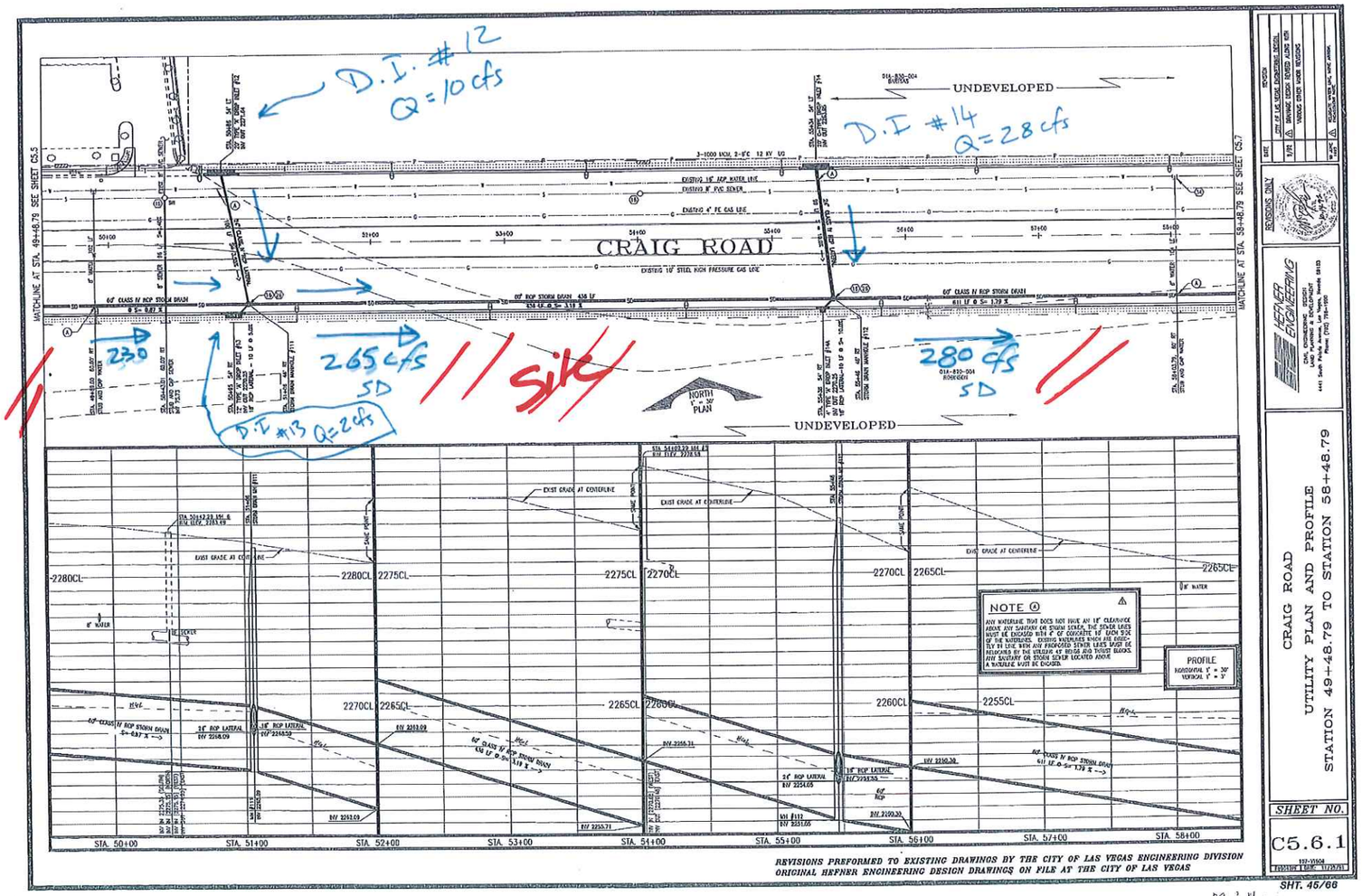
NO.	DATE	DESCRIPTION
1	9/05	STORMCE DESIGN REVISED ALONG 100YR/100 YEAR FLOOD ZONE
2	9/06	ADD WATER & SEWER NOTE
3	4/07	DISCHARGE MIN.

HEFNER ENGINEERING
CIVIL ENGINEERING DESIGN
LAND PLANNING & DEVELOPMENT
6411 South Rainbow Boulevard 89163
Phone (702) 795-1000

CRAIG ROAD
UTILITY PLAN AND PROFILE
STATION 40+48.79 TO STATION 49+48.79

SHEET NO.
C5.5.1

SHT.44/66



MATCHLINE AT STA. 49+48.79 SEE SHEET C5.5

MATCHLINE AT STA. 58+48.79 SEE SHEET C5.7

REVISIONS ONLY

HEFNER ENGINEERING
CIVIL ENGINEERING DESIGN
LAND PLANNING & DEVELOPMENT
4411 South Pecos Road, Las Vegas, Nevada 89121
Phone (702) 794-1000

CRAIG ROAD
UTILITY PLAN AND PROFILE
STATION 49+48.79 TO STATION 58+48.79

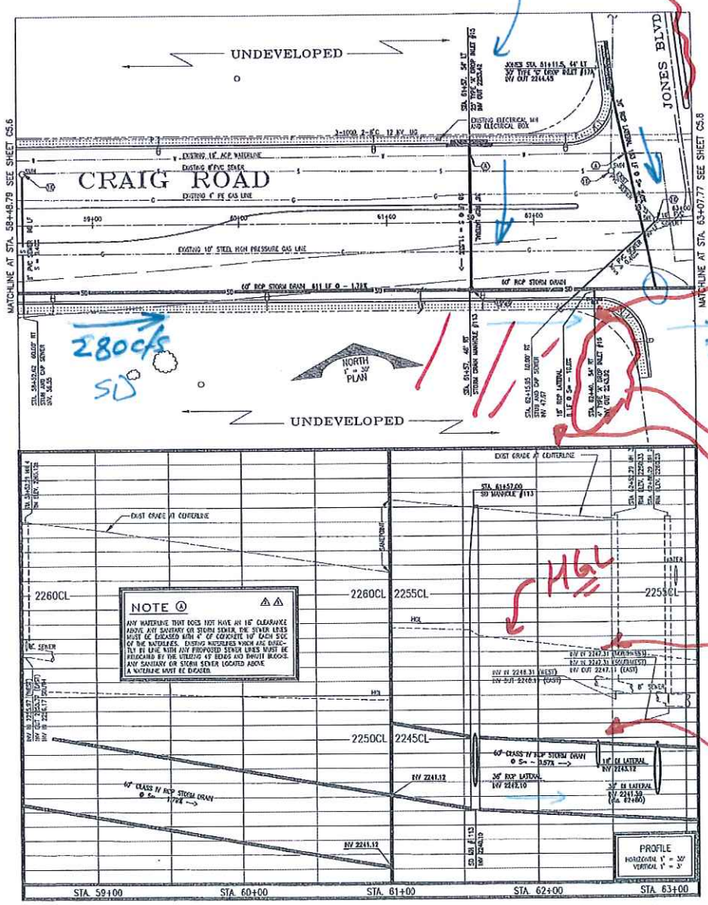
SHEET NO.
C5.6.1

SHT. 45/66

233 LF

D.I # 15
Q = 51.5 cfs

Murphy Express Site



280cfs
50

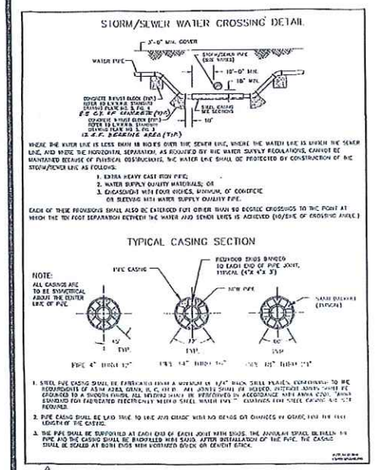
290cfs
50

Drop inlet #16

HGL

Lateral
18"
10 % slope

HGL at 18" lateral = 2251



WHERE THE WATER LINE IS LESS THAN 18 INCHES OVER THE SEWER LINE, WHERE THE WATER LINE IS UNDER THE SEWER LINE, AND WHERE THE HORIZONTAL SEPARATION, AS REQUIRED BY THE WATER SUPPLY REGULATIONS, CANNOT BE MAINTAINED BECAUSE OF PHYSICAL OBSTRUCTIONS, THE WATER LINE SHALL BE PROTECTED BY CONSTRUCTION OF THE STORM/SEWER LINE AS FOLLOWS:

1. EXTRA HEAVY CAST IRON PIPE;
2. WATER SUPPLY QUALITY MATERIALS; OR
3. ENCASEMENT WITH FOUR INCHES, MINIMUM, OF CONCRETE OR SLEEVING WITH WATER SUPPLY QUALITY PIPE.

EACH OF THESE PROVISIONS SHALL ALSO BE EXTENDED FOR OTHER THAN 90 DEGREE CROSSINGS TO THE POINT AT WHICH THE TEN FOOT SEPARATION BETWEEN THE WATER AND SEWER LINES IS ACHIEVED (DEPENDENT OF CROSSING ANGLE.)

1. STEEL PIPE CASING SHALL BE FABRICATED FROM A MINIMUM OF 1/4" THICK STEEL PLATES, CONFORMING TO THE REQUIREMENTS OF ASTM A283, GRADE D, C, OR D. ALL JOINTS SHALL BE WELDED, BUTTWELD JOINTS MUST BE USED FOR A SMOOTH INSIDE, ALL WELDING SHALL BE PERFORMED IN ACCORDANCE WITH AWWA C206. ALL WELDS EXPOSED OR FABRICATED INSIDE OR OUTSIDE SHALL RECEIVE SHELL WATER PAINT. COATINGS FOR STEEL CASING ARE NOT REQUIRED.
2. PIPE CASING SHALL BE LAID TRUE TO LINE AND GRADE WITH NO ERRORS OR CHANGES IN GRADE FOR THE FULL LENGTH OF THE CASING.
3. THE PIPE SHALL BE SUPPORTED AT EACH END OF EACH JOINT WITH SKIDS. THE ANNULAR SPACE BETWEEN THE PIPE AND THE CASING SHALL BE BACKFILLED WITH SAND. AFTER INSTALLATION OF THE PIPE, THE CASING SHALL BE SEALED AT BOTH ENDS WITH WATERTIGHT BRICK OR CEMENT STACK.

REVISION	DATE
1 ⚠ PER AT&T, VERIZON, CENTURYLINK, & NV ENERGY COMMENTS	8/19/21
2 ⚠ DRAINAGE DESIGN REVISED ALONG WEST	1/21/22
3 ⚠ VARIOUS STREET SEWER REVISIONS	3/2/22
4 ⚠ ADD WATER CROSSING DETAIL	10 JAN 2023
5 ⚠ REVISED PER CITY OF LAS VEGAS COMMENTS	23 JAN 2023

REVISIONS ONLY

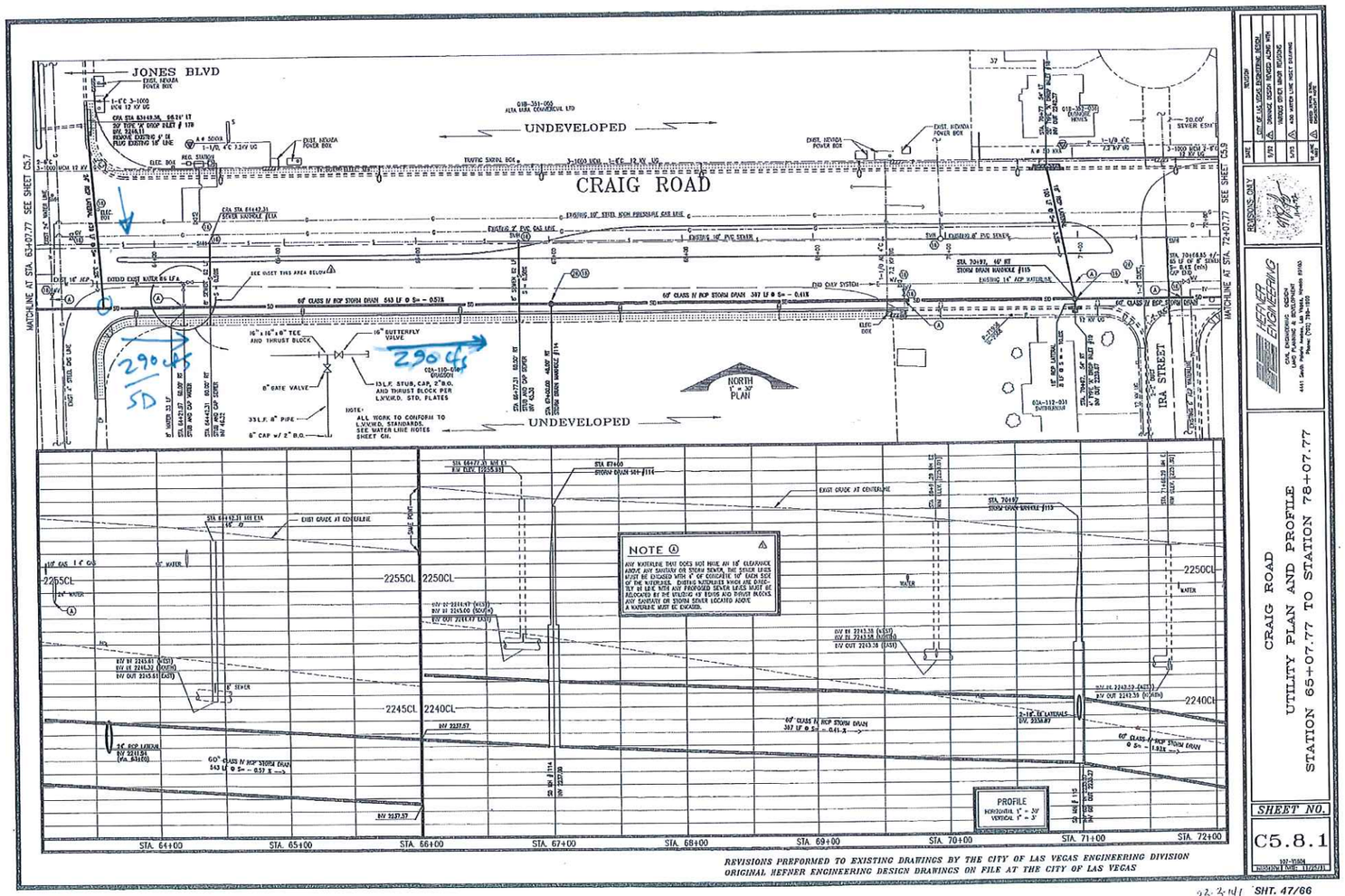
HEPNER ENGINEERING
CIVIL ENGINEERING DESIGN
LAND PLANNING & DEVELOPMENT
6441 South Pecos Road, Suite 200, Las Vegas, Nevada 89120
Phone: (702) 736-1100

CRAIG ROAD
UTILITY PLAN AND PROFILE
STATION 58+48.79 TO STATION 63+07.77

SHEET NO.
C5.7.1

REVISIONS PREFORMED TO EXISTING DRAWINGS BY THE CITY OF LAS VEGAS ENGINEERING DIVISION
ORIGINAL HEPNER ENGINEERING DESIGN DRAWINGS ON FILE AT THE CITY OF LAS VEGAS

23 2 10 SHT. 46/66



REVISIONS PREFORMED TO EXISTING DRAWINGS BY THE CITY OF LAS VEGAS ENGINEERING DIVISION
ORIGINAL HEFNER ENGINEERING DESIGN DRAWINGS ON FILE AT THE CITY OF LAS VEGAS

BUSINESS ONLY

HEFNER ENGINEERING
CIVIL ENGINEERING DESIGN
LAND DEVELOPMENT CONSULTANTS
4411 South Pecos Road, Las Vegas, Nevada 89121
Phone: (702) 384-4012

CRAIG ROAD
UTILITY PLAN AND PROFILE
STATION 65+07.77 TO STATION 78+07.77

SHEET NO.
C5.8.1

93-141 SHT. 47/66

APPENDIX A

HEC-1 MODEL EXISTING CONDITIONS

HEC1 S/N: HMVersion: 6.20 Data File: i:\hecpack\rfcd\exis10a.h1a

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*        SEPTEMBER 1990                 *
*         VERSION 4.0                   *
*                                       *
*  RUN DATE  09/18/1992  TIME  20:40:38 *
*                                       *
*****************************************
```


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


```
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
```

```
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
:::                                      :::
:::  Full Microcomputer Implementation   :::
:::                 by                   :::
:::        Haestad Methods, Inc.         :::
:::                                      :::
::::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::::
```


37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

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

```
*DIAGRAM
ID  ************************************************************************
ID  *                          EXISTING CONDITIONS                         *
ID  *                      DECATUR BOULEVARD DRAINAGE                      *
ID  *                                                                      *
ID  *                    100-Year, 6-Hour USACOE STORM                     *
ID  * FILE = EXISTING.M1                                 OCTOBER 9, 1988 *
ID  ************************************************************************
*FREE*
IT 5 0 0 300
IQ 5 0 0
IN 5 0 0
ID ************************************************************************
ID *       10-YEAR STORM PROGRAM ADJUSTMENT  by CLV 8/13/92               *
ID *                                                                      *
ID *     o Use rating curve for Craig Road/US 95 culverts which           *
ID *       reflect newly constructed interchange (C-1499).  The           *
ID *       rating curve is from Drainage Study for U.S. 95                *
ID *       Interchanges and Overpasses between Smoke Ranch Road           *
ID *       and Lone Mountain Road, Las Vegas, Nevada, Nevada              *
ID *       Department of Transportation by G.C. Wallace, Inc.             *
ID *       Our copy of the above study is not dated by material           *
ID *       inside is dated 1/89.                                          *
ID *     o Remove Drainage Basins which flow into the Gowan               *
ID *       Detention Basins and those North of Elkhorn.  This             *
ID *       increases flows.  We are modeling unregulated basins           *
ID *       downstream of the Gowan Detention Basins because they          *
ID *       most stress the Gowan Outfall Basin at Craig & Decatur         *
ID *       in the VTN Gowan Detention Basin Outfall Structure             *
ID *       report, May 1990 for (CNLV).  See related note on              *
ID *       CLV 8/13/92 changes above.                                     *
ID * 8/20/92 changes by CLV                                               *
ID *     o New PB cards were placed through out the run to reflect        *
ID *       the changes in the rainfall and the changes in the             *
ID *       Depth Area Reduction Factor of each subbasin.                  *
ID ************************************************************************
ID *                 8/21/92 - RAINFALL CHANGES - CLV                     *
ID *      The PB cards for the following areas were revised to            *
ID *      reflect the McCarren rainfall of 2.77 * A.R.F.                  *
ID *                                                                      *
ID *      AREA          FROM          TO          A.R.F.                 *
ID *      GD.29         1.9           2.69        0.9724                 *
ID *      GD.28         1.76          2.57        0.9282                 *
```

C-1499

Gowan D.B.

DARF

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  54      ID  *     GD.27          1.9            2.70           0.9752     *
  55      ID  *     GD.26          1.95           2.64           0.9536     *
  56      ID  *     PDGC           1.9            2.71           0.980      *
  57      ID  *     GD.24          1.9            2.57           0.9265     *
  58      ID  *     GD.20          1.9            2.57           0.9265     *
  59      ID  *     GD.17          1.9            2.71           0.980      *
  60      ID  *     GD.14B         1.9            2.71           0.980      *
  61      ID  *                                                            *
  62      ID  *                    REVISED RATIOS                          *
  63      ID  *                                                            *
  64      ID  *     Ratio 1 = 1.0 - 100 Year rainfall                      *
  65      ID  *     Ratio 2 = 0.570 - 10 Year rainfall                     *
  66      ID  ************************************************************
  67      ID  *                 8/21/92 - CHANGES - CLV                    *
  68      ID  *           CURVE NUMBER CHANGES TO SHOW THE                 *
  69      ID  *             ULTIMATE DEVELOPED CONDITION                   *
  70      ID  *                                                            *
  71      ID  *   GROUP          FROM           TO                         *
  72      ID  *                                                            *
  73      ID  *   AREA.1         81             94                         *
  74      ID  *   AREA.2         82             90                         *
  75      ID  *   AREA.16        82             90                         *
  76      ID  *   AREA.17        82             88                         *
  77      ID  *   GD.28          76             80                         *
  78      ID  *   GD.26          77             80                         *
  79      ID  *   GD.27          77             85                         *
  80      ID  *   GD.29          76             85                         *
  81      ID  *   PDGC           79             83                         *
  82      ID  *   AREA.24        76             76                         *
  83      ID  *   AREA.20        81             85                         *
  84      ID  *   AREA.27        79             85                         *
  85      ID  *   AREA.14B       82             85                         *
  86      ID  ************************************************************
  87      ID  *                        NOTE                                *
  88      ID  *   NO CURVE NUMBERS WERE CHANGED SOUTH OF CRAIG EAST OF       *
  89      ID  *   THE EXPRESSWAY (US95)                                    *
  90      ID  ************************************************************
  91      JR   prec   1.000   0.570

  92      KK   GD.1
  93      BA   2.98
  94      KM   LAS VEGAS STANDARD PROJECT SUMMER THUNDERSTORM
  95      PB   2.23
  96      PC   .000   .020   .059   .080   .110   .144   .150   .160   .168   .171
  97      PC   .180   .182   .187   .190   .197   .202   .210   .220   .230   .241
  98      PC   .250   .259   .265   .280   .290   .300   .305   .309   .310   .317
  99      PC   .321   .327   .333   .346   .361   .381   .408   .430   .477   .514
 100      PC   .561   .630   .710   .720   .731   .752   .779   .790   .795   .804
 101      PC   .810   .820   .826   .840   .859   .889   .910   .938   .966   .970
 102      PC   .974   .979   .981   .983   .985   .989   .990   .992   .993   .996
 103      PC   .997   .999   1.00
 104      LS     0     86
 105      UD    .62
```

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

  106         KK      V
  107         RK   12500   0.057    .065       0    TRAP     150       0

  108         KK    GD.2
  109         BA    3.11
  110         PB     2.1
  111         LS       0      88
  112         UD     .83

  113         KK       .
  114         HC       2

  115         KK       V
  116         KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  117         RK    4000    0.05   0.065       0    TRAP     700       0

  118         KK    GD.3
  119         BA     .80
  120         PB    1.97
  121         LS       0      86
  122         UD     .32

  123         KK       .
  124         HC       2

  125         KK       V
  126         KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  127         RK   12500    0.04    .065       0    TRAP     700       0

  128         KK    GD.4
  129         BA      .8
  130         PB     2.1
  131         LS       0      87
  132         UD     .62

  133         KK       V
  134         KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  135         RK   16000    0.04   0.065       0    TRAP     300       0

  136         KK    GD.5
  137         BA    3.31
  138         PB    1.95
  139         LS       0      85
  140         UD    1.38

  141         KK       .
  142         KM   INTERSECTION OF RAMPART AND LAKE MEAD
  143         HC       3
```

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

  144     KK      V
  145     KM   ROUTE NORTH ALONG RAMPART
  146     RK    6500    0.02   0.065       0    TRAP     250       0

  147     KK    GD.6
  148     KM   DEL WEBB - SUN CITY SUMMERLIN
  149     BA     1.6
  150     PB    1.91
  151     LS       0      85
  152     UD     .96

  153     KK       .
  154     KM   INTERSECTION OF RAMPART AND CHEYENNE
  155     HC       2

  156     KK       V
  157     KM   ROUTE WEST TO BUFFALO
  158     RK    5500   0.015   0.015       0    TRAP      20       2

  159     KK    GD.7
  160     KM   INTERSECTION OF LAKE MEAD AND BUFFALO
  161     BA    1.13
  162     PB    1.95
  163     LS       0      88
  164     UD    1.38

  165     KK       V
  166     KM   ROUTE NORTH ALONG BUFFALO DRIVE
  167     RK    8000    0.02   0.065       0    TRAP     100       0

  168     KK    GD.8
  169     KM   R.A. HOMES - DESERT SHORES
  170     BA    1.53
  171     PB     1.9
  172     LS       0      84
  173     UD    1.11

  174     KK       .
  175     KM   INTERSECTION OF CHEYENNE AND BUFFALO
  176     HC       3

  177     KK       V
  178     KM   ROUTE NORTH TO GOWAN ROAD UNDERPASS
  179     RK    4000     .01    .065       0    TRAP     330       0

  180     KK   GD.34
  181     KM   AREA BETWEEN BUFFALO DRIVE AND OK GRAGSON HWY.
  182     BA    3.84
  183     PB     1.9
  184     LS       0      83
  185     UD    1.72
```

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

  186     KK  HWY.95
  187     KM   DIVERT CULVERT CAPACITIES WEST UNDER ORAN GRAGSON HWY
  188     DTCULVERTS
  189     DI       0     100     200     300    1000    2000
  190     DQ       0    99.9   199.9   299.9   999.9    1840

  191     KK       V
  192     KM   ROUTE NORTH TO GOWAN UNDERPASS
  193     RK    4000     .02    .065       0    TRAP     200       0

  194     KK       .
  195     KM   GOWAN ROAD UNDERPASS - FLOWS FROM THE SOUTH
  196     HC       2

  197     KK    GD.9
  198     BA     2.0
  199     PB    2.13
  200     LS       0      88
  201     UD      .3

  202     KK       V
  203     RK   12500    0.05    .065       0    TRAP     150       0

  204     KK   GD.10
  205     BA    2.27
  206     PB    1.98
  207     LS       0      87
  208     UD      .9

  209     KK       .
  210     HC       2

  211     KK       V
  212     KM   ROUTE EAST TO GOWAN ROAD UNDERPASS
  213     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  214     RK   10000    .023    .065       0    TRAP     600       0

  215     KK       V
  216     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  217     RK    8000     .01    .065       0    TRAP     600       0

  218     KK   GD.11
  219     BA    3.17
  220     PB     1.9
  221     LS       0      84
  222     UD    2.44

  223     KK       .
  224     KM   GOWAN ROAD UNDERPASS FLOWS FROM SOUTH AND WEST
  225     HC       3
```

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

  226     KK  GD.33
  227     BA   4.85
  228     PB   1.85
  229     LS      0      88
  230     UD    3.5

  231     KK  RANCHO
  232     KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
  233     DTCULVERTS
  234     DI      0    1545    3129    4000    8000
  235     DQ      0  1544.9    1545    2416    6416

  236     KK      V
  237     KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
  238     RK   4300     .01    .025       0    TRAP      10       4

  239     KK  GD.32
  240     BA   2.35
  241     PB   1.78
  242     LS      0      85
  243     UD   1.74

  244     KK
  245     HC      2

  246     KK  RANCHO
  247     KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
  248     DTCULVERTS
  249     DI      0     900    2484    4000    8000
  250     DQ      0   899.9     900    2416    6416

  251     KK      V
  252     KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
  253     RK   4000     .01    .025       0    TRAP      10       4

  254     KK  GD.30
  255     KM   LARGE, FORESTED AREA EXTENDING TO MOUNT CHARLESTON
  256     BA  48.75
  257     PB   2.19
  258     LS      0      79
  259     UD   2.69

  260     KK      V
  261     KM   ROUTE WEST TO RANCHO (HWY 95)
  262     RK  25500    .037    .065       0    TRAP     320       0

  263     KK  GD.31
  264     BA   1.77
  265     PB   1.77
  266     LS      0      80
  267     UD   2.59
```

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

  268     KK      .
  269     HC      3

  270     KK  RANCHO
  271     KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
  272     DTCULVERTS
  273     DI       0     520    1889    4000    8000
  274     DQ       0   519.9     520    2631    6631

  275     KK       V
  276     KM   ROUTE SOUTH ALONG WEST SIDE OF RANCHO (HWY 95)
  277     RK    4000     .01    .025       0    TRAP      10       4

  278     KK   GD.28
  279     BA    2.88
  280     KM   LAS VEGAS STANDARD PROJECT SUMMER THUNDERSTORM
  281     PB    1.76
          * PC .000 .020 .059 .080 .110 .144 .150 .160 .168 .171
          * PC .180 .182 .187 .190 .197 .202 .210 .220 .230 .241
          * PC .250 .259 .265 .280 .290 .300 .305 .309 .310 .317
          * PC .321 .327 .333 .346 .361 .381 .408 .430 .477 .514
          * PC .561 .630 .710 .720 .731 .752 .779 .790 .795 .804
          * 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
  282     LS       0      80
  283     UD    2.52

  284     KK       .
  285     HC       2

  286     KK       .
  287     KM   DIVERT CHANNEL EXCESS AND CULVERT CAPACITIES WEST
  288     DTCENTNIAL
  289     DI       0    1040    5456    8000
  290     DQ       0  1039.9    1040    3585

  291     KK   RK.28
  292     KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95
  293     RK    2000     .01    .025       0    TRAP      10       4

  294     KK   GD.25
  295     BA    2.78
  296     PB    1.92
  297     LS       0      88
  298     UD    1.09

  299     KK       V
  300     RK   14000    .035    .065       0    TRAP     130       0
```

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

  301     KK  GD.26
  302     BA   1.41
  303     PB   1.95
  304     LS      0      80
  305     UD   1.23

  306     KK      .
  307     HC      2

  308     KK R1.GD26
  309     KM  ROUTE WEST TO ANN ROAD AND HWY 95
  310     KM  ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  311     RK   7000    .023    .065       0   TRAP     500       0

  312     KK  R2.26
  313     KM  ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  314     RK   6000    .013    .065       0   TRAP     500       0

  315     KK  GD.27
  316     BA   1.13
  317     PB   1.90
  318     LS      0      85
  319     UD   1.61

  320     KK  95@ANN
  321     KM  INTERSECTION OF ANN ROAD AND HWY 95
  322     HC      3

  323     KKR1.26-28
  324     KM  ROUTE SOUTH ALONG WEST SIDE OF HWY 95
  325     RK   3000    .009    .025       0   TRAP      50       3

  326     KKR2.26-28
  327     RK   3000    .004    .022       0   TRAP      25       8

  328     KK  GD.29
  329     BA    .76
  330     PB   1.90
  331     LS      0      85
  332     UD   1.49

  333     KK  RK.29
  334     RK   8000   0.01    .025       0   TRAP      20       8

  335     KK  PDGC
  336     KM  PAINTED DESERT GOLF COURSE
  337     BA    .53
  338     PB   1.90
  339     LS      0      83
  340     UD    1.2
```

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

  341     KK 95-RNCH
  342     KM   SOUTH SIDE OF PAINTED DESERT AT HWY 95
  343     HC     3

  344     KK 95+RNCH    PAINTED DESERT
  345     KM   ****************************************
  346     KM   * RANCHO - HIGHWAY 95 INTERSECTION      *
  347     KM   * DOUBLE 6'X2' RCB, HWo=4', Q=196 cfs   *
  348     KM   ****************************************
  349     DT  C-1509
  350     DI       0     288    1000   10000
  351     DQ       0   287.9     288     288

  352     KK 95-LONE
  353     KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95 TO LONE MOUNTAIN ROAD
  354     RK    1685   .0008    .025       0    TRAP      10       4

  355     KK 95+LONE
  356     KM   ****************************************
  357     KM   * LONE MOUNTAIN - HIGHWAY 95 INTERSECTION *
  358     KM   * DOUBLE 6'X2' RCB, HWo=5', Q=235 cfs     *
  359     KM   ****************************************
  360     DT  C-1500
  361     DI       0     294    1000   10000
  362     DQ       0   293.9     294     294

  363     KKR.PDGC-28
  364     KM   ROUTE SOUTH ALONG WEST SIDE OF HWY 95 TO CRAIG ROAD
  365     RK    2630   .0014    .025       0    TRAP      10       4

  366     KK   GD.21
  367     BA    6.04
  368     PB    2.21
  369     LS       0      88
  370     UD     .72

  371     KK       V
  372     RK   19500    .049    .065       0    TRAP     100       0

  373     KK   GD.22
  374     BA    1.65
  375     PB    1.99
  376     LS       0      85
  377     UD     1.5

  378     KK   GD.23
  379     BA    1.01
  380     PB    2.02
  381     LS       0      85
  382     UD    1.41
```

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

  383     KK      .
  384     HC      3

  385     KK      V
  386     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  387     RK   10500    .022    .065       0    TRAP     750       0

  388     KK   GD.24
  389     KM   ************************** MODIFY & LABEL "24B" IN FINAL RUN *******
  390     BA     .64
  391     PB    1.90
  392     LS       0      76
  393     UD     1.2

  394     KK      .
  395     HC      2

  396     KK RK.GD24
  397     KM   ROUTE WEST TO HWY 95
  398     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  399     RK   10000     .02    .065       0    TRAP     750       0

  400     KK   GD.18
  401     BA    3.42
  402     PB     2.1
  403     LS       0      88
  404     UD     .31

  405     KK      V
  406     RK   13000    .038    .065       0    TRAP     200       0

  407     KK   GD.19
  408     BA    2.41
  409     PB    1.96
  410     LS       0      81
  411     UD    1.24

  412     KK      .
  413     HC      2

  414     KK      V
  415     KM   ROUTE WEST TO HWY 95 AT CRAIG ROAD
  416     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  417     RK   13500     .02    .065       0    TRAP     650       0

  418     KK   GD.20
  419     KM   ************************** MODIFY & LABEL "20B" IN FINAL RUN-*******
  420     BA    2.35
  421     PB    1.90
  422     LS       0      85
  423     UD    2.51
```

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

  424     KK95-CRAIG
  425     KM   INTERSECTION OF CRAIG ROAD AND HWY 95
  426     HC    4

  427     KK95+CRAIG
  428     KM   ****************************************
  429     KM   * MODIFY TO INCLUDE RATING CURVE FOR   *
  430     KM   * NEW NDOT OVERPASS INCLUDING EXISTING *
  431     KM   * DOUBLE 6'X2' RCB, per GCW 1/89 STUDY *
  432     KM   ****************************************
  433     DT  C-1499
  434     DI     0    201    401    602    802   1003   1203   1404   1604   1805
  435     DI  2005   5000  10000
  436     DQ     0    .01      6     22     40     72     96    115    124    134
  437     DQ   144    233    233

  438     KK R.20-28
  439     KM   ROUTE SOUTH ALONG WEST SIDE OF ORAN GRAGSON HWY TO ALEXANDER ROAD
  440     RK  2000    .01   .025     0   TRAP     10      4

  441     KK   GD.15
  442     BA    3.28
  443     PB    2.19
  444     LS       0     87
  445     UD     .48

  446     KK       V
  447     RK  18000    .05   .065     0   TRAP    190      0

  448     KK   GD.16
  449     BA    3.76
  450     PB    1.99
  451     LS       0     81
  452     UD    1.63

  453     KK
  454     HC       2

  455     KK       V
  456     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  457     RK  15500    .02   .065     0   TRAP    600      0

  458     KK   GD.17
  459     KM   ************************** MODIFY & LABEL "17B" IN FINAL RUN *******
  460     BA     .56
  461     PB    1.90
  462     LS       0     85
  463     UD     2.0
```

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

  464     KK 95-ALEX
  465     HC      3

  466     KK 95+ALEX
  467     KM   ****************************************
  468     KM   * ALEXANDER - HIGHWAY 95 INTERSECTION   *
  469     KM   * DOUBLE 6'X2' RCB, HWo=5.5', Q=256 cfs *
  470     KM   ****************************************
  471     DT  C-1497
  472     DI       0     256    1000   10000
  473     DQ       0   255.9     256     256

  474     KKRK.17-28
  475     KM   ROUTE SOUTH ALONG WEST SIDE OF HIGHWAY 95
  476     KM   ************************************************
  477     KM   * APPROXIMATELY 1940 CFS OVERTOPS HIGHWAY 95  *
  478     KM   * BETWEEN ALEXANDER ROAD AND GOWAN ROAD FOR A  *
  479     KM   * WIDTH OF ABOUT 2000 FEET AND A MAXIMUM DEPTH *
  480     KM   * OF ABOUT 2.4 FEET APPROXIMATELY 1500 FEET    *
  481     KM   * SOUTH OF ALEXANDER ROAD.                     *
  482     KM   ************************************************
  483     RK     1500   .0022'   .025       0    TRAP      10       4

  484     KK95+OVR.T
  485     DT OVERTOP
  486     DI       0     100    1000    2450    3000    4000    5000    6000    8000   10000
  487     DQ       0       0       0       0     550    1550    2550    3550    5550    7550

  488     KKGOWAN->N
  489     KM   ROUTE SOUTH TO GOWAN UNDERPASS
  490     RK     1300   .0022    .025       0    TRAP      10       4

  491     KK   GD.12
  492     BA    2.27
  493     PB     2.1
  494     LS       0      88
  495     UD      .3

  496     KK       V
  497     RK    9000     .04    .065       0    TRAP     160       0

  498     KK   GD.13
  499     BA    3.15
  500     PB    2.03
  501     LS       0      85
  502     UD    1.10

  503     KK       ,
  504     HC       2
```

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

  505     KK      V
  506     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  507     RK    8000    .03    .065       0    TRAP    650       0

  508     KK      V
  509     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  510     RK   11500    .01    .065       0    TRAP    650       0

  511     KK  GD.14A
  512     BA    1.71
  513     PB     1.9
  514     LS       0      80
  515     UD    0.88

  516     KK       .
  517     HC       2

  518     KK      V
  519     KM   ALLUVIAL FAN BRAIDED CHANNEL ROUTING (FEMA)
  520     RK    9000    .025    .065       0    TRAP    600       0

  521     KK  GD.14B
  522     BA     .68
  523     PB    1.90
  524     LS       0      85
  525     UD    1.67

  526     KK       .
  527     HC       3

  528     KK GOWAN-N
  529     KM   ROUTE TO GOWAN ROAD UNDERPASS
  530     RK    2000    .005    .025       0    TRAP      10       4
  531     KM    ************************* ADD K GD.34B & GD.14C IN FINALRUN**********
  532     KM    ************************* GET THEM FROM GOWAN III, PART 2 OF 2 APENDICIES

  533     KKT.GWN095
  534     KM   TOTAL PEAK AT GOWAN ROAD UNDERPASS EXCLUDING FLOWS FROM DET. BASINS
  535     HC       2

  536     KK     NOTUSED
  537     KM   ***************************************************************************
  538     KM   ***************************************************************************
  539     KM   ******* G O W A N  U N D E R P A S S - E X I S T I N G  *******
  540     KM   ***************************************************************************
  541     KM   ***************************************************************************
  542     DT   GOWAN
  543     DI       0      10     100    1000   10000
  544     DQ       0      10     100    1000   10000
```

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

  545     KK  C-1509
  546     DR  C-1509  RANCHO       -     HWY      95 CULVERT

  547     KK R.C1509
  548     KM   ROUTE TO RANCHO ROAD AT LONE MOUNTAIN
  549     RK    4000     .02     .03       0    TRAP       0       4

  550     KK  C-1500
  551     DR  C-1500    LONEMOUNTAIN       -     HWY      95 CULVERT

  552     KK R.C1500
  553     KM   ROUTE TO RANCHO ROAD AT LONE MOUNTAIN
  554     RK    2000     .02     .03       0    TRAP       0       4

  555     KK  AREA.1
  556     KM   UNDEVELOPED
  557     KM   AREA.........68 AC
  558     KM   LENGTH......3000 FT
  559     KM   SLOPE.....0.006 FT/FT
  560     KM   VELOCITY.....1.0 FPS
  561     BA   .1067
  562     LS       0      94
  563     UD      .5

  564     KKR-LON.MT
  565     KM  RANCHO AND LONE MOUNTAIN
  566     HC       4

  567     KK   C-R17
  568     KM   ************************************************************************
  569     KM   * CULVERTS ON RANCHO ARE DESIGNATED BY THE DRAINAGE AREA THAT THEY *
  570     KM   * DRAIN INTO.  ALL CAPACITIES OF CULVERTS DRAINING INTO THE SAME   *
  571     KM   * AREA ARE COMBINED IN A SINGLE DIVERSION STATEMENT.                *
  572     KM   ************************************************************************
  573     KM   ********************************************************************
  574     KM   * C-R17 CULVERTS ARE LOCATED NEAR OR NORTH OF LONE MOUNTAIN ROAD *
  575     KM   *       NO.1....1-36" CMP, HWo=7', Q= 78 CFS                       *
  576     KM   *       NO.2....2-24" CMP, HWo=7', Q= 74 CFS                       *
  577     KM   *       NO.3....1-30" CMP, HWo=7', Q= 56 CFS                       *
  578     KM   *       NO.4....2-24" CMP, HWo=7', Q= 74 CFS                       *
  579     KM   *       NO.5....1-24" CMP, HWo=7', Q= 37 CFS                       *
  580     KM   ********************************************************************
  581     KM   ********************************************************************
  582     KM   *       8/24/92 - CLV CULVERT REVISION TO ACCOUNT FOR              *
  583     KM   *         TEN YEAR LOWFLOW HEAD RATES                              *
  584     KM   * C-R17 CULVERTS ARE LOCATED NEAR OR NORTH OF LONE MOUNTAIN ROAD *
  585     KM   *       NO.1....1-36" CMP, HWo=2', Q= 20 CFS                       *
  586     KM   *       NO.2....2-24" CMP, HWo=2', Q= 27 CFS                       *
  587     KM   *       NO.3....1-30" CMP, HWo=2', Q= 16 CFS                       *
  588     KM   *       NO.4....2-24" CMP, HWo=2', Q= 27 CFS                       *
  589     KM   *       NO.5....1-24" CMP, HWo=2', Q= 13 CFS                       *
  590     KM   ********************************************************************
  591     KM   ********************************************************************
  592     KM   *       9/01/92 - CLV CULVERT REVISION TO ACCOUNT FOR              *
```

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

  593     KM   *         TEN YEAR LOWFLOW HEAD RATES                        *
  594     KM   * C-R17 CULVERTS ARE LOCATED NEAR OR NORTH OF LONE MOUNTAIN ROAD *
  595     KM   ************************************************************
  596     DT   C-R17
  597     DI       0     150     350     500     700     850    1000   10000
  598     DQ       0      50     111     145     181     192     220     220

  599     KK       V
  600     KM   ROUTE CULVERT EXCESS SOUTH ALONG RANCHO TO CRAIG ROAD
  601     RK    3600     .02     .03       0    TRAP       0       4

  602     KK AREA.2C
  603     KM   ************************************************************
  604     KM   *              8/25/92 - CLV CHANGES                         *
  605     KM   *  AREA.2 DIVIDED INTO 3 SUBBASINS. AREA.2A, AREA.2B AND AREA.2C *
  606     KM   ************************************************************
  607     KM   DENSITY.....2 AC
  608     KM   AREA.....31.9 AC
  609     KM   LENGTH.....3700 FT
  610     KM   SLOPE.....0.005 FT/FT
  611     KM   VELOCITY.....1.0 FPS
  612     BA   .0498
  613     LS       0      90
  614     UD   0.617

  615     KK       .
  616     HC       2

  617     KKRNCH--CRG
  618     KM   ******************************************************
  619     KM   * C-R16 CULVERTS ARE LOCATED ON RANCHO NORTH OF CRAIG *
  620     KM   *   8/17/92 RENAMED----------------------------v    *
  621     KM   *       NO.6....1-36" CMP, HWo=7', Q= 78 CFS     C-I  *
  622     KM   *       NO.7....1-36" CMP, HWo=7', Q= 78 CFS     C-J  *
  623     KM   ******************************************************
  624     DT     C-I
  625     DI       0      50     150     350     500     700     850    1000   10000
  626     DQ       0    49.9      50      50      50      50      50      50      50      50

  627     KK       V
  628     KM   ************************* REVISE ROUTING FOR FINAL RUN*************
  629     KM   ROUTE SOUTH TO ALEXANDER ALONG WEST SIDE OF RANCHO
  630     RK    4000    .008     .03       0    TRAP       0       4

  631     KKRNCH-CRG
  632     DT     C-J
  633     DI       0      20     150     350     500     700     850    1000   10000
  634     DQ       0    19.9      20      20      30      40      45      50      50

  635     KK  C-1499    CRAIG ROAD - HIGHWAY 95 CULVERT
  636     DR  C-1499
```

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

  637     KK  RAMP-S
  638     KM  ****************************************************************
  639     KM  *                 8/25/92 - CLV CHANGE                         *
  640     KM  * SOUTH OFF RAMP EAST OF US.95 AT CRAIG ROAD                    *
  641     KM  * AREA.........7.2 AC                                           *
  642     KM  * LENGTH.......1300 FT                                         *
  643     KM  ****************************************************************
  644     BA   0.011
  645     LS       0      88
  646     UD   0.217

  647     KK  RAMP-N
  648     KM  ****************************************************************
  649     KM  *                 8/25/92 - CLV CHANGE                         *
  650     KM  * NORTH OFF RAMP EAST OF US.95 AT CRAIG ROAD                    *
  651     KM  * AREA.........7.2 AC                                           *
  652     KM  * LENGTH.......1300 FT                                         *
  653     KM  ****************************************************************
  654     BA   0.011
  655     LS       0      88
  656     UD   0.217

  657     KK C-1499A
  658     KM   COMBINED FLOW FROM US.95 AND NORTH AND SOUTH OFF RAMP AREAS
  659     HC       3

  660     KK   ROUT1
  661     KM   ROUTE EAST TO RANCHO-CRAIG INTERSECTION
  662     RK    1300     .02     .03       0    TRAP       0       4

  663     KK AREA.2A
  664     KM  ****************************************************************
  665     KM  *              8/25/92 - CLV CHANGES                           *
  666     KM  *  AREA.2 DIVIDED INTO 3 SUBBASINS. AREA.2A, AREA.2B AND AREA.2C *
  667     KM  ****************************************************************
  668     KM   DENSITY........2 AC
  669     KM   AREA.........76.3 AC
  670     KM   LENGTH......3090 FT
  671     KM   SLOPE......0.005 FT/FT
  672     KM   VELOCITY.....1.0 FPS
  673     BA   .1192
  674     LS       0      90
  675     UD   0.515

  676     KK   COMBA
  677     KM   COMBINED FLOW FROM C-1499A AND AREA.2A
  678     HC       2

  679     KK   ROUT2
  680     KM   ROUTE EAST TO RANCHO-CRAIG INTERSECTION
  681     RK    2200     .02     .03       0    TRAP       0       4
```

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

  682     KK AREA.2B
  683     KM  ************************************************************************
  684     KM  *              8/25/92 - CLV CHANGES                                   *
  685     KM  *  AREA.2 DIVIDED INTO 3 SUBBASINS. AREA.2A, AREA.2B AND AREA.2C *
  686     KM  ************************************************************************
  687     KM  DENSITY.....2 AC
  688     KM  AREA.....82.6 AC
  689     KM  LENGTH.....4100 FT
  690     KM  SLOPE.....0.005 FT/FT
  691     KM  VELOCITY.....1.0 FPS
  692     BA  .1291
  693     LS       0      90
  694     UD  0.683

  695     KK  COMBB
  696     KM  COMBINED FLOW FROM AREA.2A AND AREA.2B
  697     HC       2

  698     KK  ROUT3
  699     KM  ROUTE EAST TO RANCHO-CRAIG INTERSECTION
  700     RK     500     .02     .03       0    TRAP       0       4

  701     KK  RNHCRG
  702     KM  COMBINED FLOW FROM AREA.2A AND AREA.2B WITH FLOWS ON WEST SIDE OF RANCHO
  703     HC       2

  704     KKRNCH@-CRG
  705     KM  ********************************************************
  706     KM  * DIVERSION OF TEN YEAR STORM DOWN CRAIG STORM DRAIN  *
  707     KM  *   8/27/92 - 100 YEAR STORM WILL CONTINUE ON DOWN     *
  708     KM  *     RANCHO ROAD AS IT PRESENTLY DOWS.                *
  709     KM  ********************************************************
  710     DT  CRGDIV
  711     DI       0      40     100     156     200     349     500    1000   10000
  712     DQ       0    39.9    99.9   155.9   199.9   348.9     349     349     349

  713     KK       V
  714     KM  ************************ REVISE ROUTING FOR FINAL RUN ************
  715     KM  ROUTE SOUTH TO ALEXANDER ALONG WEST SIDE OF RANCHO
  716     RK    4000    .008     .03       0    TRAP       0       4

  717     KK  C-1497    ALEXANDER - HIGHWAY 95 CULVERT
  718     DR  C-1497

  719     KK       V
  720     KM  ROUTE CULVERT FLOW TO ALEXANDER AND RAINBOW INTERSECTION
  721     RK    1500    .005    .025       0    TRAP       0       4

  722     KK  AREA.3
  723     KM  DENSITY.....2 AC
  724     KM  AREA.....104 AC
  725     KM  LENGTH.....4000 FT
  726     KM  SLOPE.....0.004 FT/FT
  727     KM  VELOCITY.....1.0 FPS
```

flow diverted within Craig storm drain & Craig North half capacity

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  728     BA   0.163
  729     LS      0      82
  730     UD   0.667

  731     KK       .
  732     HC       2

  733     KK       V
  734     KM   ROUTE FLOW TO ALEXANDER AND TORREY PINES INTERSECTION
  735     RK    2500    .005    .025       0    TRAP       0       4

  736     KK  AREA.4
  737     KM   DENSITY......1/2 AC
  738     KM   AREA.........159 AC
  739     KM   LENGTH......5000 FT
  740     KM   SLOPE......0.006 FT/FT
  741     KM   VELOCITY.....1.0 FPS
  742     BA   0.248
  743     LS      0      85
  744     UD   0.833

  745     KK       .
  746     HC       2

  747     KK       V
  748     KM   ROUTE FLOW TO ALEXANDER AND RANCHO INTERSECTION
  749     RK    2500    .005    .025       0    TRAP       0       4

  750     KK  AREA.5
  751     KM   DENSITY.........2 AC
  752     KM   AREA...........97 AC
  753     KM   LENGTH.......4700 FT
  754     KM   SLOPE......0.0064 FT/FT
  755     KM   VELOCITY......1.0 FPS
  756     BA   0.152
  757     LS      0      82
  758     UD   0.783

  759     KK  R-ALEX
  760     HC       3

  761     KKRNCH++CRG
  762     DT   C-R15
  763     DI       0     100     200     300     400     500   505.1    1000   10000
  764     DQ       0    99.9   199.9   299.9   399.9   499.9     505     505     505

  765     KKRNCH+GWN
  766     KM   ************************ REVISE ROUTING FOR FINAL RUN*************
  767     KM   ROUTE CULVERT EXCESS SOUTH ALONG RANCHO TO GOWAN
  768     RK    3500    .004    .03        0    TRAP       0       4
```

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

  769     KK OVERTOP
  770     DR OVERTOP

  771     KK  GOWAN
  772     DR  GOWAN

  773     KK  AREA.6
  774     KM  DENSITY.....1/2 AC
  775     KM  AREA.........81 AC
  776     KM  LENGTH.....3500 FT
  777     KM  SLOPE.....0.0046 FT/FT
  778     KM  VELOCITY.....1.0 FPS
  779     BA  0.127
  780     LS      0      85
  781     UD  0.583

  782     KK      .
  783     HC      3

  784     KK      V
  785     KM  ROUTE FLOW EAST TO RANCHO-GOWAN INTERSECTION
  786     RK   7000    .005    .025       0    TRAP      40       4

  787     KK  AREA.7
  788     KM  DENSITY.....1/2 AC
  789     KM  AREA.........460 AC
  790     KM  LENGTH.....9600 FT
  791     KM  SLOPE.....0.0055 FT/FT
  792     KM  VELOCITY.....1.0 FPS
  793     BA  0.719
  794     LS      0      85
  795     UD    1.6

  796     KK R-GOWAN
  797     HC      3

  798     KK  C-R14
  799     KM  ************************************************************
  800     KM  * C-R14 CULVERTS ARE LOCATED ON RANCHO SOUTH OF ALEXANDER *
  801     KM  *       NO.12...1-36" CMP, HWo=5', Q= 60 CFS              *
  802     KM  *       NO.13...6'X2' RCB, HWo=5', Q= 123 CFS             *
  803     KM  ************************************************************
  804     DT  C-R14
  805     DI      0     100     183     500    1000   10000
  806     DQ      0      99     181     183     183     183

  807     KK  C-R13
  808     KM  ********************************************************
  809     KM  * C-R13 CULVERTS ARE LOCATED ON RANCHO NORTH OF GOWAN *
  810     KM  *      NO.14...1-24" CMP, HWo=5', Q= 30 CFS           *
  811     KM  *      NO.15...1-24" CMP, HWo=5', Q= 30 CFS           *
  812     KM  ********************************************************
  813     DT  C-R13
  814     DI      0      60     100    1000   10000
```

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

  815     DQ       0      59      60      60      60

  816     KK  BREACH
  817     KM  ****************************************************************
  818     KM  * AT GOWAN ROAD, HEC-2 RESULTS INDICATE THAT THE WEST SIDE OF *
  819     KM  * RANCHO HAS ONLY ABOUT 1000 CFS CAPACITY BEFORE OVERTOPPING  *
  820     KM  * THE ROAD AND CONTINUING EAST INTO AREA.13.                   *
  821     KM  ****************************************************************
  822     DT  BREACH
  823     DI       0     500    1000    1500    2000    3000    5000   10000
  824     DQ       0       1       2     500    1000    2000    4000    9000

  825     KK       V
  826     KM  ROUTE FLOWS SOUTH TO RANCHO-CHEYENNE INTERSECTION
  827     RK    3200    .005     .03       0    TRAP       0       4

  828     KK  AREA.8
  829     KM  DENSITY......1/4 AC
  830     KM  AREA.........636 AC
  831     KM  LENGTH.....12000 FT
  832     KM  SLOPE......0.006 FT/FT
  833     KM  VELOCITY.....1.0 FPS
  834     BA  0.994
  835     LS       0      87
  836     UD     2.0

  837     KK  R-CHYN
  838     HC       2

  839     KK       V
  840     KM  ROUTE FLOWS SOUTH TO RANCHO-DECATUR INTERSECTION
  841     RK    2500    .005     .03       0    TRAP       0       4

  842     KK  AREA.9
  843     KM  DENSITY.......1/2 AC
  844     KM  AREA..........172 AC
  845     KM  LENGTH.......6000 FT
  846     KM  SLOPE......0.0083 FT/FT
  847     KM  VELOCITY......1.0 FPS
  848     BA  0.269
  849     LS       0      85
  850     UD     1.0

  851     KK R-DCTUR
  852     HC       2

  853     KK  RANCHO
  854     KM  ************************************************************
  855     KM  * C-R10 CULVERTS ARE LOCATED ON RANCHO SOUTH OF CHEYENNE *
  856     KM  *       NO.16...1-24" CMP, HWo=7', Q= 37 CFS              *
  857     KM  *       NO.17...6'X3' RCB, HWo=7', Q= 215 CFS             *
  858     KM  ************************************************************
  859     DT  C-R10
  860     DI       0     100     200     252     300     500    1000    5000
  861     DQ       0    99.9   199.9   251.9     252     252     252     252
```

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

  862     KK      .
  863     DR   C-R10

  864     KK AREA.10
  865     KM   UNDEVELOPED
  866     KM   AREA.....50 AC
  867     KM   LENGTH.....2000 FT
  868     KM   SLOPE......0.01 FT/FT
  869     KM   VELOCITY....1.0 FPS
  870     BA   0.078
  871     LS      0      81
  872     UD   0.333

  873     KKD-AIRPRT
  874     KM   DECATUR ROAD - FLOW TO CNLV AIRPORT
  875     HC      2

  876     KK  D-CHYN    AREA.11
  877     KM   DENSITY.....2 AC
  878     KM   AREA.....85 AC
  879     KM   LENGTH.....3300 FT
  880     KM   SLOPE......0.006 FT/FT
  881     KM   VELOCITY.....1.0 FPS
  882     BA   0.133
  883     LS      0     82
  884     UD    0.55

  885     KK D-GOWAN    AREA.12
  886     KM   DENSITY.....2 AC
  887     KM   AREA.....71 AC
  888     KM   LENGTH.....4000 FT
  889     KM   SLOPE......0.006 FT/FT
  890     KM   VELOCITY.....1.0 FPS
  891     BA   0.111
  892     LS      0      82
  893     UD   0.667

  894     KK   C-R13
  895     DR   C-R13

  896     KK      V
  897     KM   ROUTE CULVERT FLOWS TO ALEXANDER AND DECATUR INTERSECTION
  898     RK    3000    .005    .025       0    TRAP      20       4

  899     KK  BREACH
  900     DR  BREACH

  901     KK      V
  902     KM   ROUTE RANCHO-GOWAN OVERFLOW RUNOFF EAST TO ALEXANDER-DECATUR INTERSECTION
  903     RK    3000    .005    .025       0    TRAP      20       4
```

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

  904     KK      .
  905     KM   ************************************************************************
  906     KM   ****  THESE HYDROGRAPHS ARE ADDED TO MAKE ROOM ON THE ROUTING      *
  907     KM   ****  DIAGRAM ONLY.  THE NUMBER DOES NOT HAVE ANY PHYSICAL MEANING *
  908     KM   ************************************************************************
  909     HC       4

  910     KK AREA.13
  911     KM   DENSITY.....2 AC
  912     KM   AREA.....125 AC
  913     KM   LENGTH.....5500 FT
  914     KM   SLOPE.....0.0064 FT/FT
  915     KM   VELOCITY.....1.0 FPS
  916     BA   0.195
  917     LS       0      82
  918     UD   0.917

  919     KK  D-ALEX
  920     HC       3

  921     KK   C-R14
  922     DR   C-R14

  923     KK       V
  924     KM   ROUTE CULVERT FLOWS EAST TO DECATUR-SAN MIGUEL INTERSECTION
  925     RK    6000    .007    .025       0    TRAP      20  ,    4

  926     KK AREA.14
  927     KM   DENSITY.....2 AC
  928     KM   AREA.....176 AC
  929     KM   LENGTH.....6000 FT
  930     KM   SLOPE.....0.007 FT/FT
  931     KM   VELOCITY.....1.0 FPS
  932     BA   0.275
  933     LS       0      82
  934     UD     1.0

  935     KKD-SANMGL
  936     KM   DECATUR ROAD - SAN MIGUEL ROAD INTERSECTION
  937     HC       2

  938     KK   C-R15
  939     DR   C-R15

  940     KK       V
  941     KM   ROUTE CULVERT FLOWS EAST TO DECATUR-CRAIG INTERSECTION
  942     RK    7000      .01    .025       0    TRAP      20       4

  943     KK AREA.15
  944     KM   DENSITY.....2 AC
  945     KM   AREA.....228 AC
  946     KM   LENGTH.....6800 FT
  947     KM   SLOPE.....0.011 FT/FT
  948     KM   VELOCITY.....1.5 FPS
```

```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
  949     BA   0.356
  950     LS      0      82
  951     UD   0.756

  952     KK D.CRG.S
  953     KM   DECATUR-CRAIG FLOWS FROM THE SOUTH
  954     HC      2

  955     KKCRG.RNCH.E1
  956     DR  CRGDIV

  957     KKCRG.RNCH.E2
  958     DR     C-J

  959     KKCRG.RNCH.E
  960     KM   CRAIG FLOWS AND CULVERT J FLOWS COMBINED
  961     HC      2

  962     KK      V
  963     KM   ROUTE CULVERT FLOWS EAST TO JONES-CRAIG INTERSECTION
  964     KM   ************************REVISE ROUTING TO E. CRG-RNCH FOR FINAL RUN*****
  965     RK    2150     .01    .025       0    TRAP      20       4

  966     KK   C-R17
  967     DR   C-R17

  968     KK      V
  969     KM   ROUTE CULVERT FLOWS EAST TO JONES AND LONE MOUNTAIN INTERSECTION
  970     RK    4300     .01    .025       0    TRAP      20       4

  971     KK AREA.17
  972     KM   DENSITY........2 AC
  973     KM   AREA.........688 AC
  974     KM   LENGTH......11300 FT
  975     KM   SLOPE......0.010 FT/FT
  976     KM   VELOCITY.....1.5 FPS
  977     BA   1.068
  978     LS      0      88
  979     UD   1.256

  980     KKLMT.JONES
  981     KM   LONE MOUNTIAN/JONES BOULEVARD FLOWS FROM THE WEST
  982     HC      2

  983     KKLMTN.DIV
  984     KM   ****************************************************************
  985     KM   *     AT LONE MOUNTIAN AND JONES A FLOW SPLIT OCCURES.  THE    *
  986     KM   *     FOLLOWING DIVERT CARD DIVERTES THE 10 YEAR AND THE 100   *
  987     KM   *     YEAR FLOWS.                                              *
  988     KM   ****************************************************************
  989     DT  LMTN.D
  990     DI      0      50     100     150     200     300     500    1000
  991     DQ      0      29      58      87     116     174     290     580
```

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

 992      KK   C-I
 993      DR   C-I

 994      KK     V
 995      KM   ROUTE CULVERT FLOWS EAST TO DECATUR-CRAIG INTERSECTION
 996      KM   ************************ REVISE ROUTING TO E. CRG-JONES FOR FINAL RUN*****
 997      RK    7000     .01    .025      0    TRAP     20      4

 998      KKAREA.16A
 999      KM   DENSITY........2 AC
1000      KM   AREA.........193 AC
1001      KM   LENGTH......5850 FT
1002      KM   SLOPE......0.011 FT/FT
1003      KM   VELOCITY.....1.5 FPS
1004      BA   0.302
1005      LS      0      90
1006      UD   0.650

1007      KKCRG1.JONES
1008      KM   CRAIG/JONES BOULEVARD FLOWS FROM THE NORTH
1009      HC      3

1010      KKCRG.JONES
1011      KM   CRAIG/JONES BOULEVARD FLOWS FROM THE WEST
1012      HC      2

1013      KK     V
1014      KM   ROUTE CULVERT FLOWS EAST TO DECATUR-CRAIG INTERSECTION
1015      KM   ************************ REVISE ROUTING TO 1/2 WAY BETWEEN *******
1016      KM   ************************JONES & DECATUR @ CRAIG FOR FINAL RUN*****
1017      RK    4800     .01    .025      0    TRAP     20      4

1018      KKAREA.16C
1019      KM   DENSITY........2 AC
1020      KM   AREA...........6 AC
1021      KM   LENGTH......5850 FT
1022      KM   SLOPE......0.011 FT/FT
1023      KM   VELOCITY.....1.5 FPS
1024      BA  0.0094
1025      LS      0      90
1026      UD    0.30

1027      KK      .
1028      HC      2

1029      KKAREA.16B
1030      KM   DENSITY........2 AC
1031      KM   AREA.........335 AC
1032      KM   LENGTH....14,580 FT
1033      KM   SLOPE......0.011 FT/FT
1034      KM   VELOCITY.....1.5 FPS
1035      BA  0.5234
1036      LS      0      90
1037      UD    1.62
```

assumed Residential

includes approx. 1/3 of the entire Craig/Rancho Property.

CN=90

approximately 240 acres identified as APN 138-02-702-001

Jones Blvd. flows from the North onto Craig.

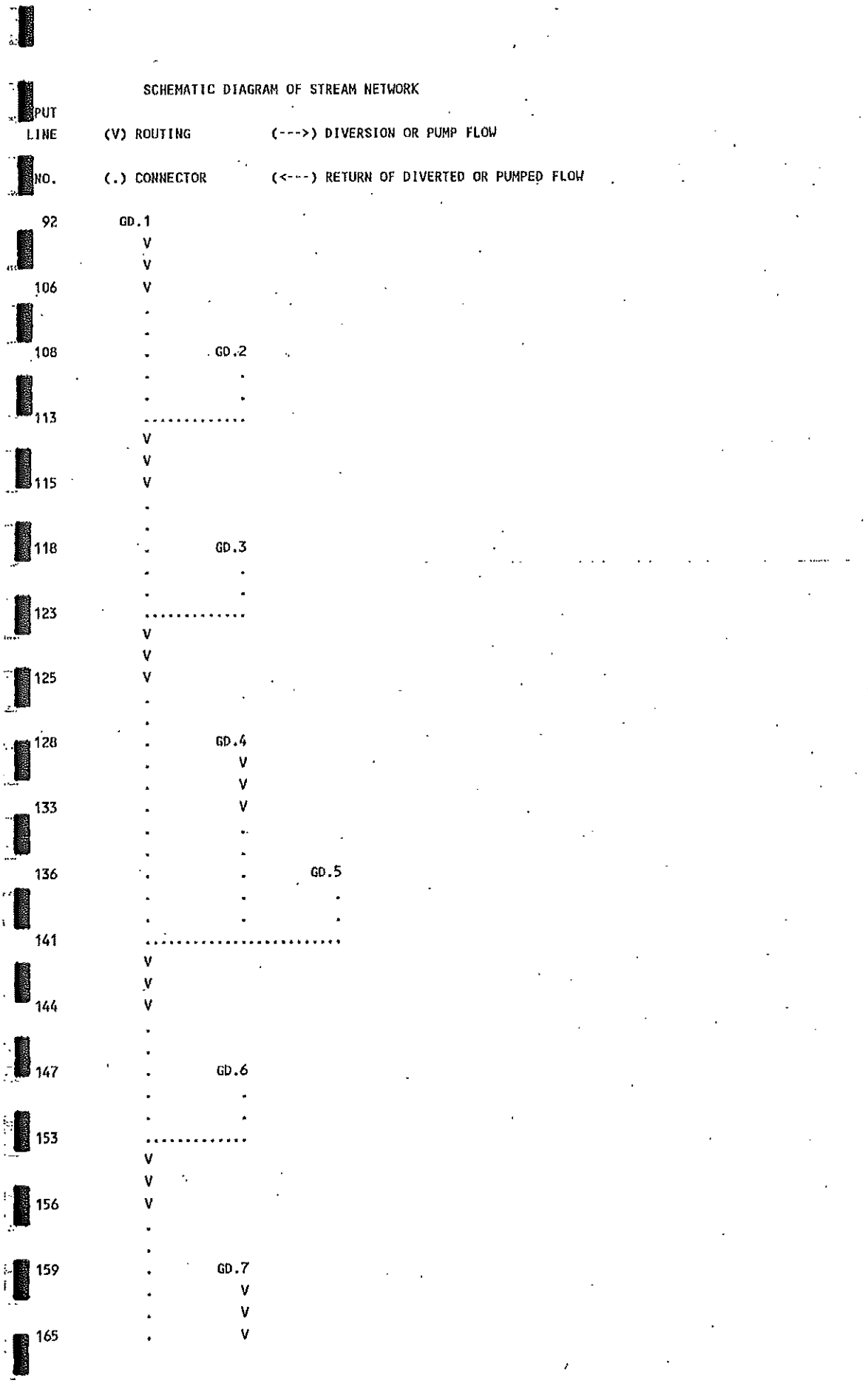
Total flows in Craig East of intersection with Jones Blvd. (surface + storm Drain)

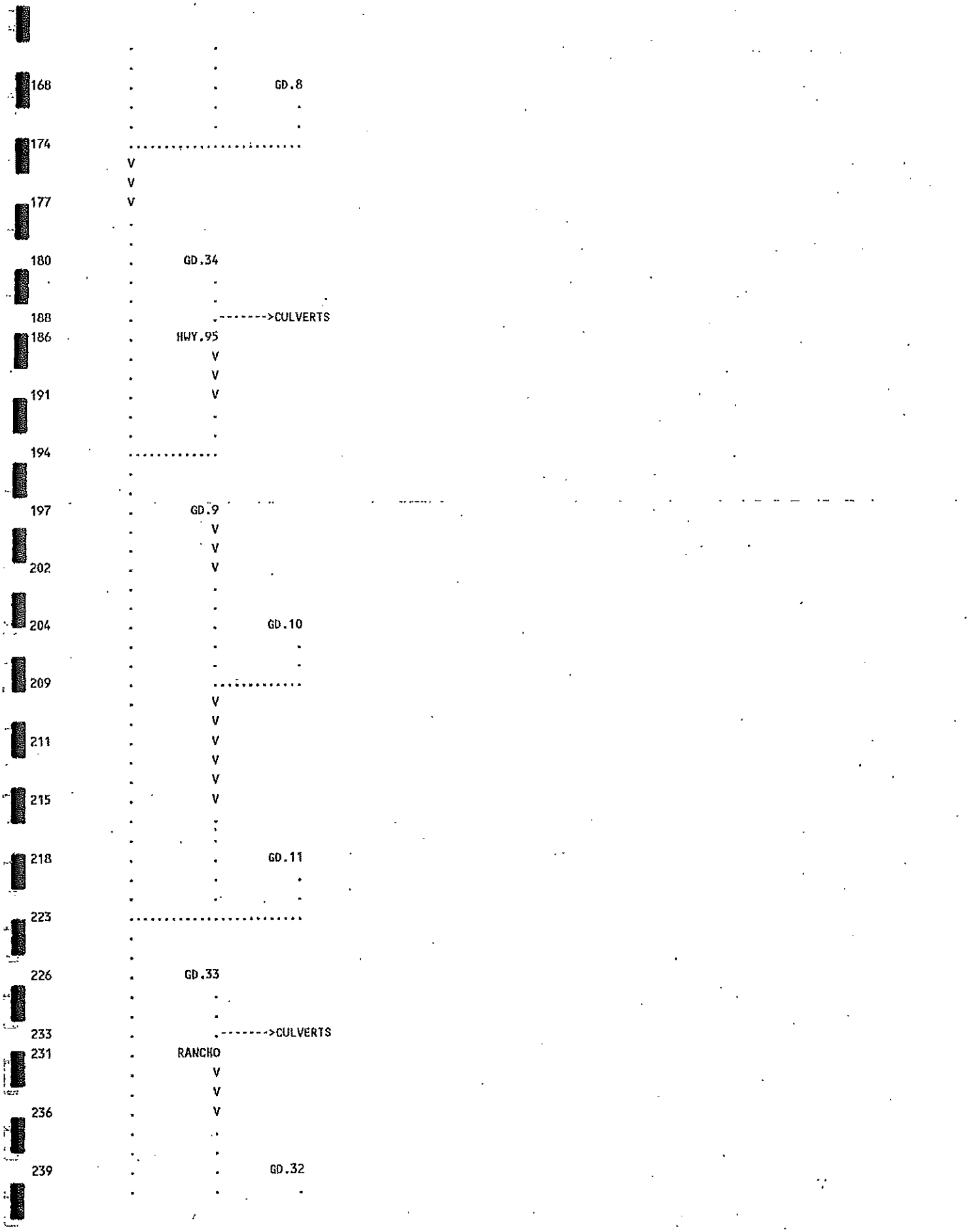
```
LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10

1038      KKAREA.16D
1039      KM   DENSITY.....2 AC
1040      KM   AREA.....4.6 AC
1041      KM   LENGTH.....2850 FT
1042      KM   SLOPE.....0.011 FT/FT
1043      KM   VELOCITY.....1.5 FPS
1044      BA  0.0072
1045      LS       0      90
1046      UD   0.317

1047      KK       .
1048      KM   CRAIG/DECATUR FLOWS FROM THE NORTH
1049      HC       3

1050      KK D-CRAIG
1051      KM   DECATUR-CRAIG TOTAL INFLOW
1052      HC       2
1053      ZZ
```

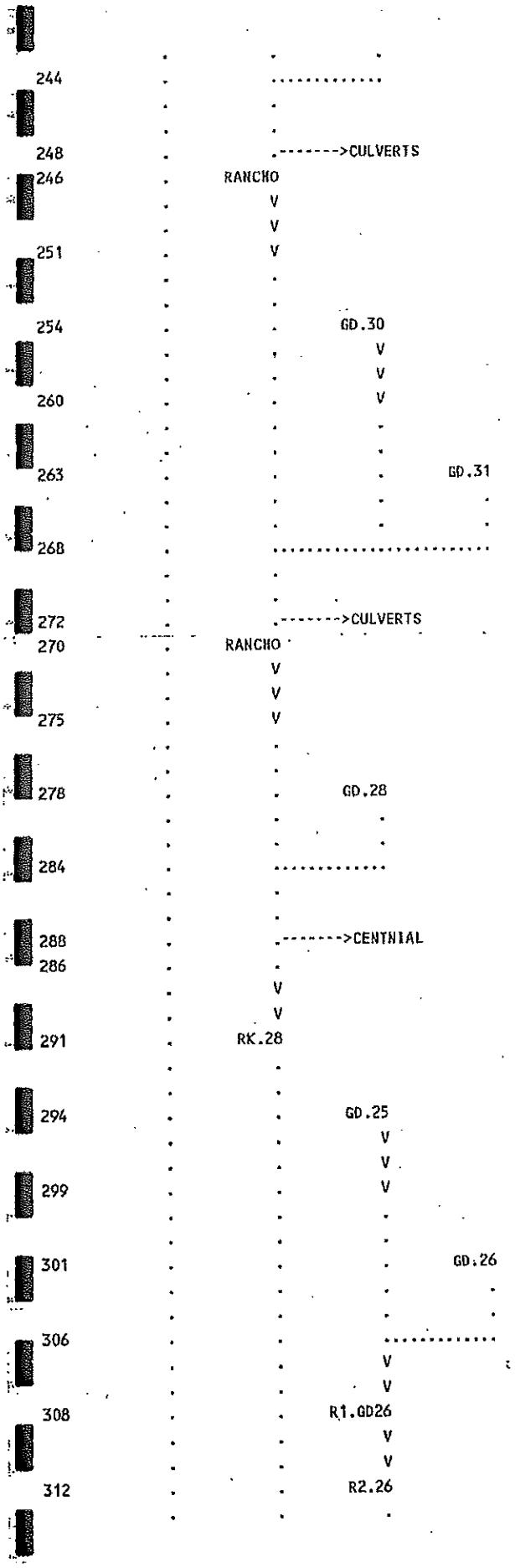
SCHEMATIC DIAGRAM OF STREAM NETWORK

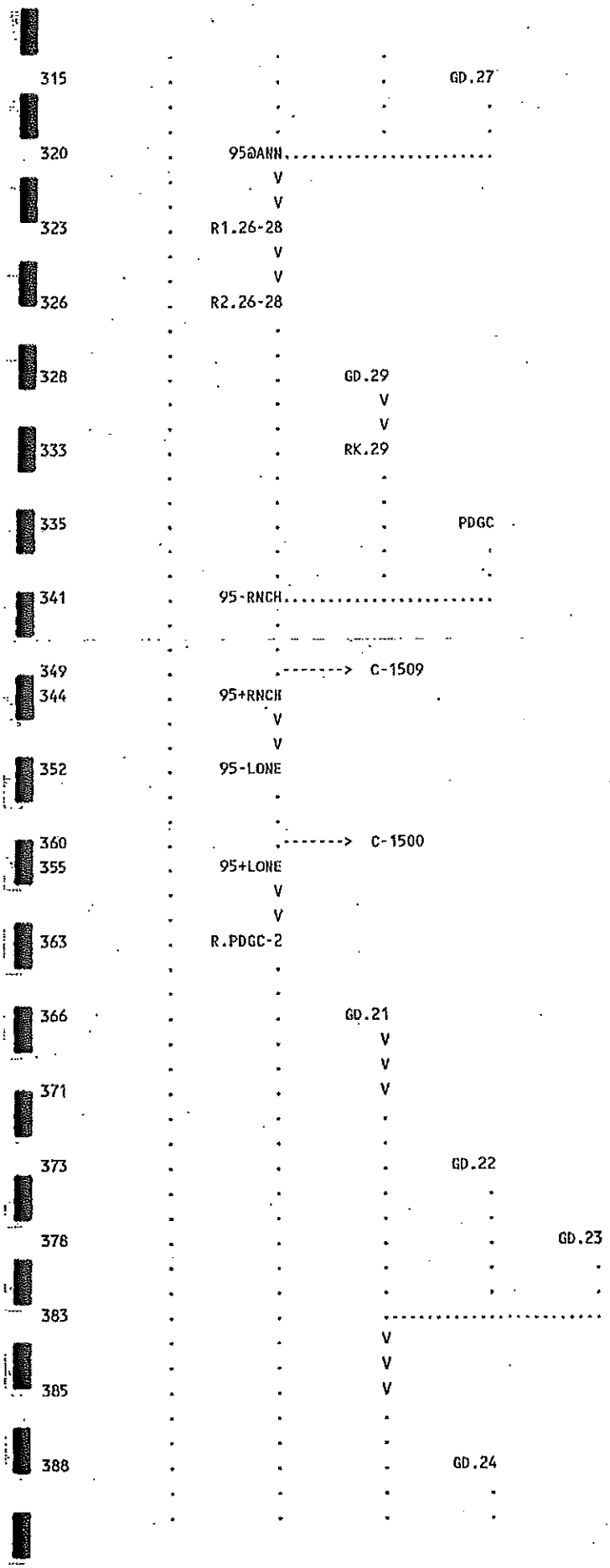
PUT LINE NO.

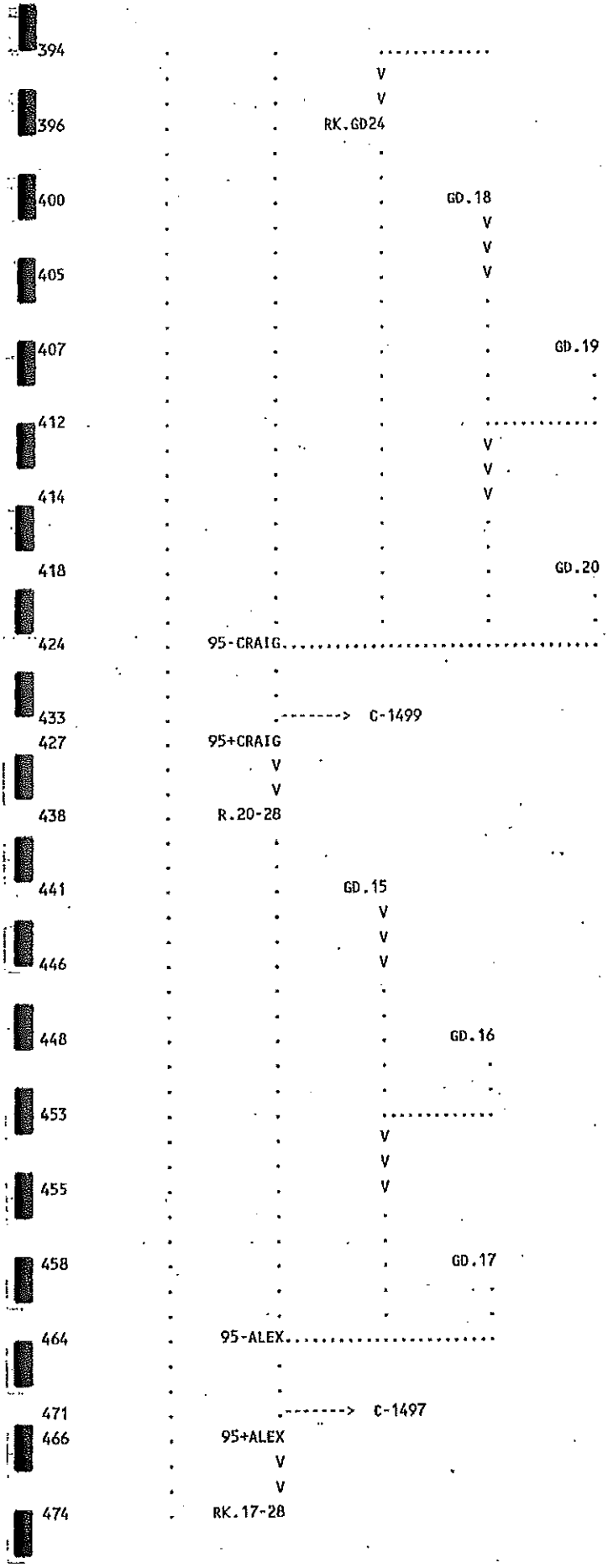
(V) ROUTING
(.) CONNECTOR
(---->) DIVERSION OR PUMP FLOW
(<----) RETURN OF DIVERTED OR PUMPED FLOW

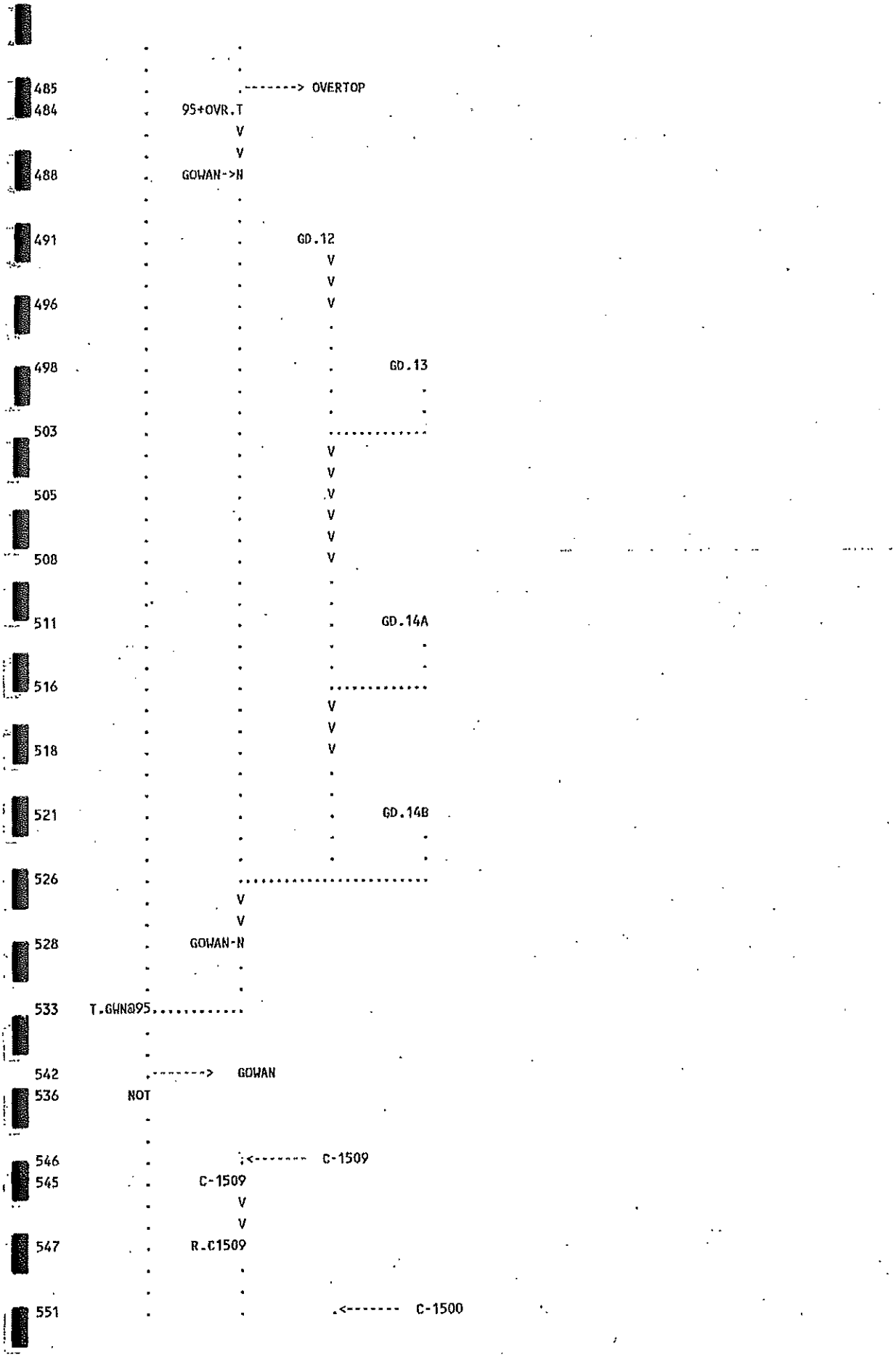


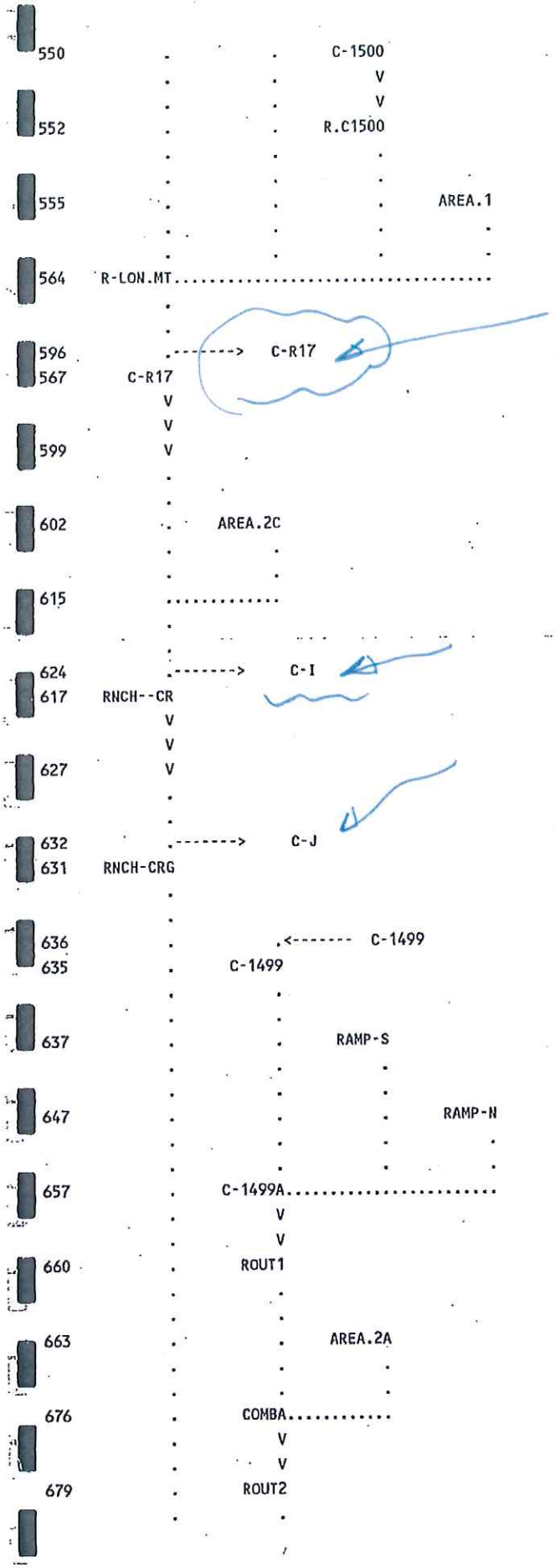

168
GD.8
174
177
180
GD.34
188
CULVERTS
186
HWY.95
191
194
197
GD.9
202
204
GD.10
209
211
215
218
GD.11
223
226
GD.33
233
CULVERTS
231
RANCHO
236
239
GD.32

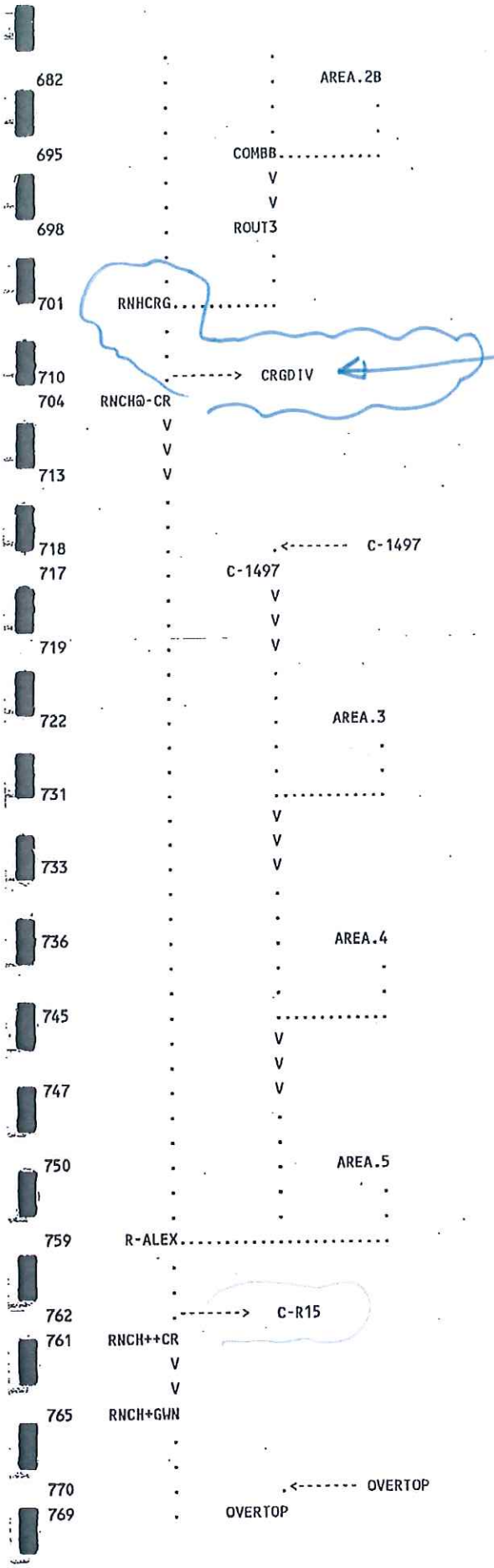

244
248
->CULVERTS
246
RANCHO
251
254
GD.30
260
263
GD.31
268
272
->CULVERTS
270
RANCHO
275
278
GD.28
284
288
->CENTNIAL
286
291
RK.28
294
GD.25
299
301
GD.26
306
308
R1.GD26
312
R2.26


315
GD.27
320
95@ANN
323
R1.26-28
326
R2.26-28
328
GD.29
333
RK.29
335
PDGC
341
95-RNCH
349
C-1509
344
95+RNCH
352
95-LONE
360
C-1500
355
95+LONE
363
R.PDGC-2
366
GD.21
371
373
GD.22
378
GD.23
383
385
388
GD.24


394
396
RK.GD24
400
GD.18
405
407
GD.19
412
414
418
GD.20
424
95-CRAIG
433
C-1499
427
95+CRAIG
438
R.20-28
441
GD.15
446
448
GD.16
453
455
458
GD.17
464
95-ALEX
471
C-1497
466
95+ALEX
474
RK.17-28


485
OVERTOP
484
95+OVR.T
488
GOWAN->N
491
GD.12
496
498
GD.13
503
505
508
511
GD.14A
516
518
521
GD.14B
526
528
GOWAN-N
533
T.GHN@95
542
GOWAN
536
NOT
546
C-1509
545
C-1509
547
R.C1509
551
C-1500

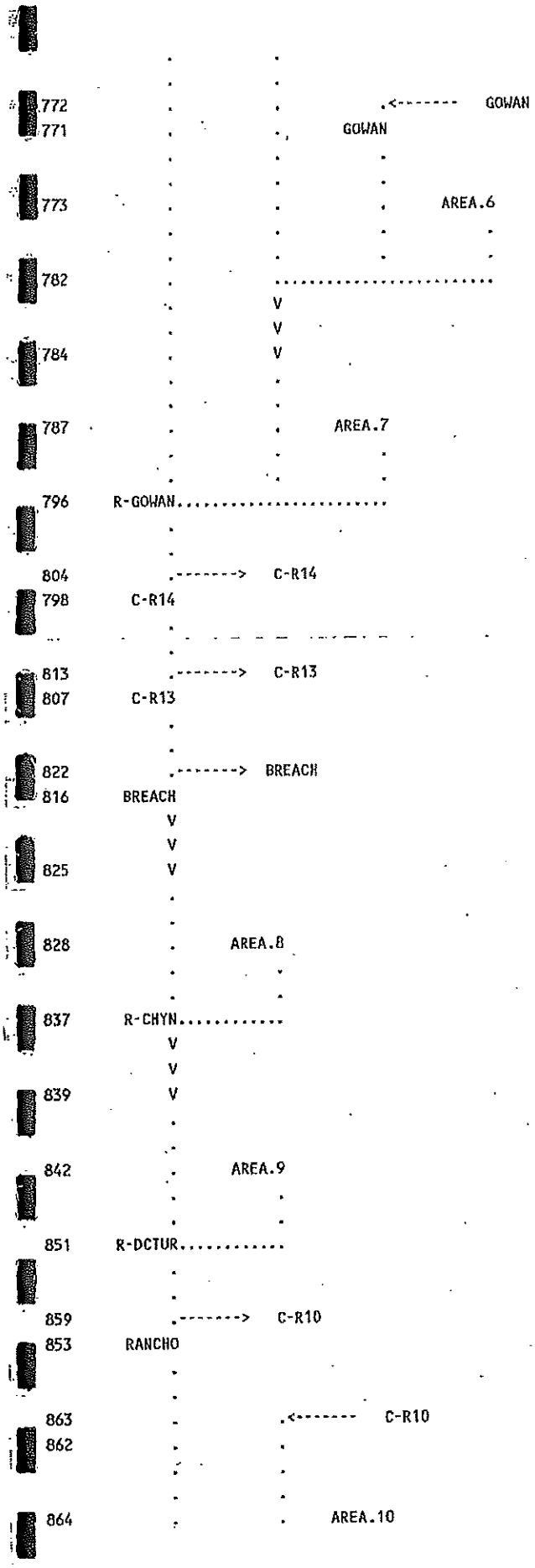

550
C-1500
552
R.C1500
555
AREA.1
564
R-LON.MT
596
C-R17
567
C-R17
599
602
AREA.2C
615
624
C-I
617
RNCH--CR
627
632
C-J
631
RNCH-CRG
636
C-1499
635
C-1499
637
RAMP-S
647
RAMP-N
657
C-1499A
660
ROUT1
663
AREA.2A
676
COMBA
679
ROUT2

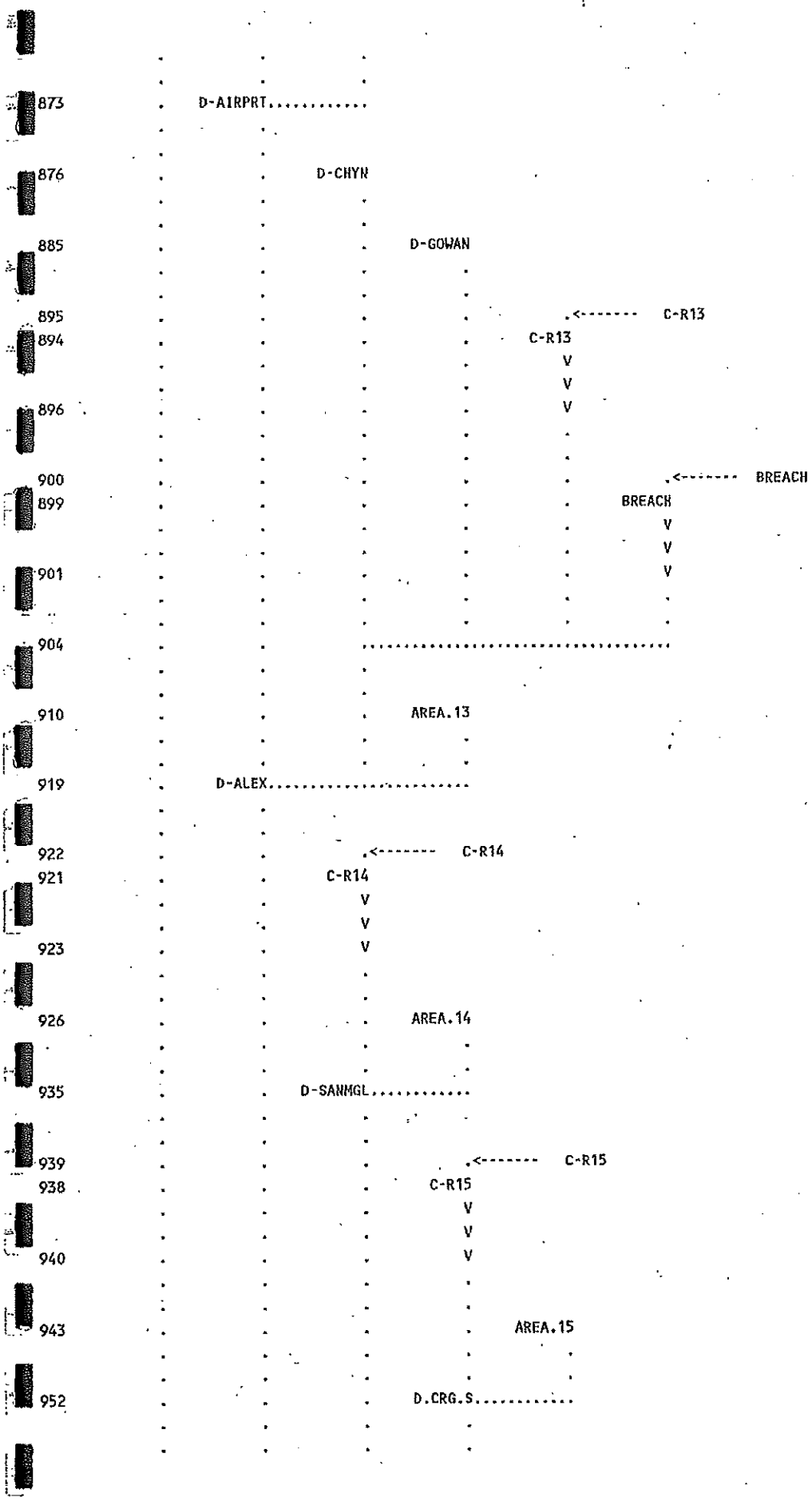


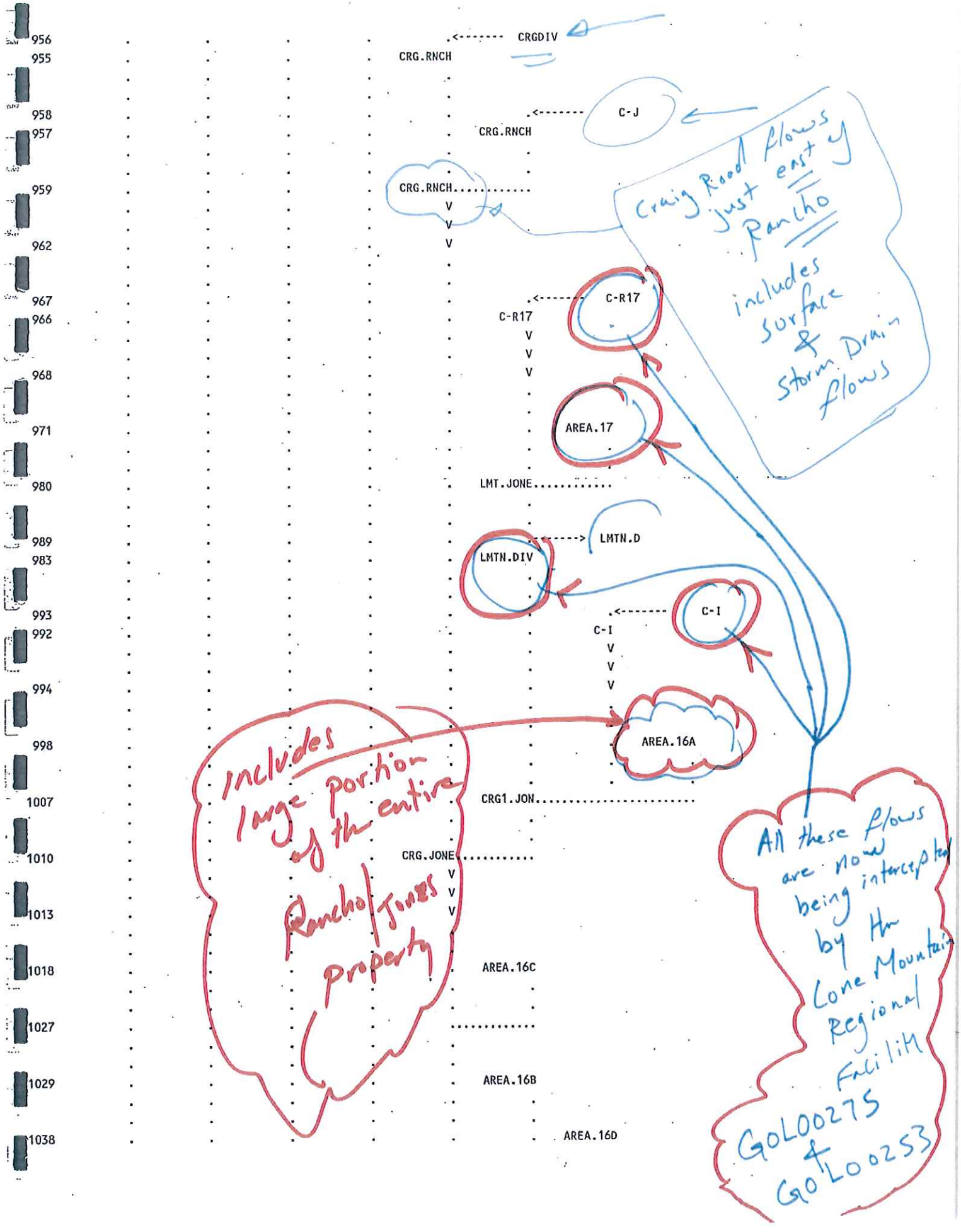
CRGDIV

flows Diverted easterly into Craig Rd. at intersection with Rancho either into Storm Drain (210 cfs)

or as surface within the north half of Craig Rd.


772
771
GOWAN
<-------
GOWAN
773
AREA.6
782
784
787
AREA.7
796
R-GOWAN
804
------->
C-R14
798
C-R14
813
------->
C-R13
807
C-R13
822
------->
BREACH
816
BREACH
825
828
AREA.8
837
R-CHYN
839
842
AREA.9
851
R-DCTUR
859
------->
C-R10
853
RANCHO
863
<-------
C-R10
862
864
AREA.10


873
D-AIRPRT
876
D-CHYN
885
D-GOWAN
895
C-R13
894
C-R13
896
900
BREACH
899
BREACH
901
904
910
AREA.13
919
D-ALEX
922
C-R14
921
C-R14
923
926
AREA.14
935
D-SANMGL
939
C-R15
938
C-R15
940
943
AREA.15
952
D.CRG.S


956
955
958
957
959
962
967
966
968
971
980
989
983
993
992
994
998
1007
1010
1013
1018
1027
1029
1038
CRGDIV
CRG.RNCH
C-J
CRG.RNCH
CRG.RNCH
C-R17
C-R17
AREA.17
LMT.JONE
LMTN.D
LMTN.DIV
C-I
C-I
AREA.16A
CRG1.JON
CRG.JONE
AREA.16C
AREA.16B
AREA.16D
Craig Road flows just east of Rancho
includes surface & storm drain flows
Includes large portion of the entire Rancho/Jones Property
All these flows are now being intercepted by the Lone Mountain Regional Facility
G0L00275 & G0L00253

```
                                                                    .
                                                                    .
1047                                                                .
                                                                    .
                                                                    .
1050                                    D-CRAIG.....                .
```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

HEC1 S/N: HMVersion: 6.20 Data File: i:\hecpack\rfcd\exis10a.h1a

```
*****************************************
*                                       *
*  FLOOD HYDROGRAPH PACKAGE  (HEC-1)    *
*        SEPTEMBER 1990                 *
*         VERSION 4.0                   *
*                                       *
* RUN DATE  09/18/1992  TIME  20:40:38  *
*                                       *
*****************************************
```

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

```
**********************************************************************
*                      EXISTING CONDITIONS                           *
*                   DECATUR BOULEVARD DRAINAGE                       *
*                                                                    *
*                  100-Year, 6-Hour USACOE STORM                     *
* FILE = EXISTING.H1                              OCTOBER 9, 1988    *
**********************************************************************
```

9 IO OUTPUT CONTROL VARIABLES

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

```
**********************************************************************
*      10-YEAR STORM PROGRAM ADJUSTMENT  by CLV 8/13/92              *
*                                                                    *
*   The depth area reduction factor was adjusted to reflect a        *
*   26 square mile area and to provide for a 10-year storm           *
*   event.  Twenty-six mile area equivilant to "Storm Centering      *
*   C" in Design Report for the Gowan Detention Basin Outfall        *
*   Structure by VTN, May 1990 (for CNLV).                           *
*                                                                    *
*   Ratio 1 = 1.0  * (0.765/0.67) = 1.143                            *
*   Ratio 2 = 0.570 * (0.765/0.67) = 0.651                           *
*                  ********************                              *
*                  8/17/92 CHANGES by CLV                            *
*                                                                    *
*    o Remove Drainage Basins West of Gowan North Channels           *
*    o Use rating curve for Craig Road/US 95 culverts which          *
*      reflect newly constructed interchange (C-1499).  The          *
*      rating curve is from Drainage Study for U.S. 95               *
*      Interchanges and Overpasses between Smoke Ranch Road          *
*      and Lone Mountain Road, Las Vegas, Nevada, Nevada             *
*      Department of Transportation by G.C. Wallace, Inc.            *
*      Our copy of the above study is not dated by material          *
*      inside is dated 1/89.                                         *
*    o Remove Drainage Basins which flow into the Gowan              *
*      Detention Basins and those North of Elkhorn.  This            *
*      increases flows.  We are modeling unregulated basins          *
*      downstream of the Gowan Detention Basins because they         *
*      most stress the Gowan Outfall Basin at Craig & Decatur        *
*      in the VTN Gowan Detention Basin Outfall Structure            *
*      report, May 1990 for (CNLV).  See related note on             *
```

```
*       CLV 8/13/92 changes above.                                    *
* 8/20/92 changes by CLV                                              *
*     o New PB cards were placed through out the run to reflect       *
*       the changes in the rainfall and the changes in the            *
*       Depth Area Reduction Factor of each subbasin.                 *
**********************************************************************
*                 8/21/92 - RAINFALL CHANGES - CLV                    *
*      The PB cards for the following areas were revised to           *
*      reflect the McCarren rainfall of 2.77 * A.R.F.                 *
*                                                                     *
*      AREA          FROM          TO          A.R.F.                 *
*      GD.29         1.9           2.69        0.9724                 *
*      GD.28         1.76          2.57        0.9282                 *
*      GD.27         1.9           2.70        0.9752                 *
*      GD.26         1.95          2.64        0.9536                 *
*      PDGC          1.9           2.71        0.980                  *
*      GD.24         1.9           2.57        0.9265                 *
*      GD.20         1.9           2.57        0.9265                 *
*      GD.17         1.9           2.71        0.980                  *
*      GD.14B        1.9           2.71        0.980                  *
*                                                                     *
*                       REVISED RATIOS                                *
*                                                                     *
*      Ratio 1 = 1.0 - 100 Year rainfall                              *
*      Ratio 2 = 0.570 - 10 Year rainfall                             *
**********************************************************************
*                   8/21/92 - CHANGES - CLV                           *
*              CURVE NUMBER CHANGES TO SHOW THE                       *
*                ULTIMATE DEVELOPED CONDITION                         *
*                                                                     *
*    GROUP           FROM          TO                                 *
*                                                                     *
*    AREA.1          81            94                                 *
*    AREA.2          82            90                                 *
*    AREA.16         82            90                                 *
*    AREA.17         82            88                                 *
*    GD.28           76            80                                 *
*    GD.26           77            80                                 *
*    GD.27           77            85                                 *
*    GD.29           76            85                                 *
*    PDGC            79            83                                 *
*    AREA.24         76            76                                 *
*    AREA.20         81            85                                 *
*    AREA.27         79            85                                 *
*    AREA.14B        82            85                                 *
**********************************************************************
*                          NOTE                                       *
*    NO CURVE NUMBERS WERE CHANGED SOUTH OF CRAIG EAST OF             *
*    THE EXPRESSWAY (US95)                                            *
**********************************************************************

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
               1.00       .57


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


   *** FLOGRD - MAXIMUM NUMBER OF DX INTERVALS REACHED. MDX=201
    THIS MAY AFFECT ACCURACY OF KW  SOLUTION. TO REDUCE ERRORS SHORTEN CHANNEL ELEMENT = 3

   *** 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
```

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

					RATIOS APPLIED TO PRECIPITATION	
ERATION	STATION	AREA	PLAN		RATIO 1	RATIO 2
					1.00	.57
DROGRAPH AT	GD.1	2.98	1	FLOW	993.	334.
				TIME	4.00	4.08
UTED TO	V	2.98	1	FLOW	984.	331.
				TIME	4.33	4.58
DROGRAPH AT	GD.2	3.11	1	FLOW	898.	321.
				TIME	4.25	4.33
2 COMBINED AT	.	6.09	1	FLOW	1878.	635.
				TIME	4.25	4.50
ROUTED TO	V	6.09	1	FLOW	1874.	631.
				TIME	4.42	4.67
YDROGRAPH AT	GD.3	.80	1	FLOW	294.	92.
				TIME	3.67	3.75
2 COMBINED AT	.	6.89	1	FLOW	1970.	676.
				TIME	4.42	4.75
OUTED TO	V	6.89	1	FLOW	1957.	674.
				TIME	4.83	5.50
HYDROGRAPH AT	GD.4	.80	1	FLOW	255.	87.
				TIME	4.00	4.08
ROUTED TO	V	.80	1	FLOW	253.	87.
				TIME	5.08	5.75
HYDROGRAPH AT	GD.5	3.31	1	FLOW	540.	173.
				TIME	5.25	5.58
3 COMBINED AT	.	11.00	1	FLOW	2697.	895.
				TIME	5.00	5.75

UTED TO						
	V	11.00	1	FLOW	2668.	892.
				TIME	5.17	6.00
HYDROGRAPH AT						
	GD.6	1.60	1	FLOW	298.	88.
				TIME	4.42	5.42
2 COMBINED AT						
	.	12.60	1	FLOW	2924.	956.
				TIME	5.17	6.00
OUTED TO						
	V	12.60	1	FLOW	2907.	956.
				TIME	5.17	6.00
YDROGRAPH AT						
	GD.7	1.13	1	FLOW	220.	80.
				TIME	5.08	5.42
OUTED TO						
	V	1.13	1	FLOW	220.	80.
				TIME	5.50	6.08
HYDROGRAPH AT						
	GD.8	1.53	1	FLOW	242.	72.
				TIME	4.67	5.50
3 COMBINED AT						
	.	15.26	1	FLOW	3351.	1096.
				TIME	5.17	6.00
ROUTED TO						
	V	15.26	1	FLOW	3342.	1086.
				TIME	5.33	6.17
YDROGRAPH AT						
	GD.34	3.84	1	FLOW	486.	137.
				TIME	5.75	5.92
IVERSION TO						
	CULVERTS	3.84	1	FLOW	486.	136.
				TIME	5.75	5.92
HYDROGRAPH AT						
	HWY.95	3.84	1	FLOW	0.	0.
				TIME	3.83	5.08
ROUTED TO						
	V	3.84	1	FLOW	0.	0.
				TIME	10.83	12.08
2 COMBINED AT						
	.	19.10	1	FLOW	3342.	1086.
				TIME	5.33	6.17
YDROGRAPH AT						
	GD.9	2.00	1	FLOW	980.	356.
				TIME	3.67	3.67

[redacted]UTED TO						
	V	2.00	1	FLOW	947.	347.
				TIME	4.00	4.17
[redacted]YDROGRAPH AT						
	GD.10	2.27	1	FLOW	534.	175.
				TIME	4.33	4.42
2 COMBINED AT [redacted]						
		4.27	1	FLOW	1399.	507.
				TIME	4.00	4.17
[redacted]OUTED TO						
	V	4.27	1	FLOW	1387.	470.
				TIME	4.50	5.17
[redacted]OUTED TO						
	V	4.27	1	FLOW	1373.	457.
				TIME	5.08	6.08
[redacted]YDROGRAPH AT						
	GD.11	3.17	1	FLOW	350.	102.
				TIME	6.42	6.58
3 COMBINED AT [redacted]						
		26.54	1	FLOW	4856.	1621.
				TIME	5.25	6.17
HYDROGRAPH AT [redacted]						
	GD.33	4.85	1	FLOW	504.	174.
				TIME	7.33	7.50
DIVERSION TO [redacted]						
	CULVERTS	4.85	1	FLOW	504.	174.
				TIME	7.33	7.50
[redacted]YDROGRAPH AT						
	RANCHO	4.85	1	FLOW	0.	0.
				TIME	7.00	7.08
[redacted]OUTED TO						
	V	4.85	1	FLOW	0.	0.
				TIME	8.50	9.33
[redacted]YDROGRAPH AT						
	GD.32	2.35	1	FLOW	298.	89.
				TIME	5.75	5.92
2 COMBINED AT [redacted]						
		7.20	1	FLOW	298.	89.
				TIME	5.75	5.92
DIVERSION TO [redacted]						
	CULVERTS	7.20	1	FLOW	298.	89.
				TIME	5.75	5.92
[redacted]YDROGRAPH AT						
	RANCHO	7.20	1	FLOW	0.	0.
				TIME	5.58	5.67

[redacted]

ROUTED TO						
	V	7.20	1	FLOW	0.	0.
				TIME	7.00	7.67
HYDROGRAPH AT						
	GD.30	48.75	1	FLOW	4804.	1179.
				TIME	6.67	6.92
ROUTED TO						
	V	48.75	1	FLOW	4799.	1178.
				TIME	7.25	7.92
HYDROGRAPH AT						
	GD.31	1.77	1	FLOW	122.	25.
				TIME	6.67	7.00
COMBINED AT						
		57.72	1	FLOW	4914.	1199.
				TIME	7.17	7.92
DIVERSION TO						
	CULVERTS	57.72	1	FLOW	3545.	520.
				TIME	7.17	7.75
HYDROGRAPH AT						
	RANCHO	57.72	1	FLOW	1369.	679.
				TIME	5.67	7.92
ROUTED TO						
	V	57.72	1	FLOW	1369.	678.
				TIME	5.75	7.92
HYDROGRAPH AT						
	GD.28	2.88	1	FLOW	199.	41.
				TIME	6.58	6.92
COMBINED AT						
		60.60	1	FLOW	1568.	711.
				TIME	6.58	7.92
DIVERSION TO						
	CENTNIAL	60.60	1	FLOW	1040.	711.
				TIME	5.75	7.92
HYDROGRAPH AT						
		60.60	1	FLOW	528.	0.
				TIME	6.58	7.75
ROUTED TO						
	RK.28	60.60	1	FLOW	528.	0.
				TIME	6.67	8.25
HYDROGRAPH AT						
	GD.25	2.78	1	FLOW	591.	202.
				TIME	4.58	4.67
ROUTED TO						
	V	2.78	1	FLOW	590.	202.
				TIME	5.00	5.42

HYDROGRAPH AT	GD.26	1.41	1	FLOW	172.	44.
				TIME	5.25	5.67
2 COMBINED AT		4.19	1	FLOW	759.	245.
				TIME	5.00	5.50
ROUTED TO	R1.GD26	4.19	1	FLOW	759.	245.
				TIME	5.42	6.17
ROUTED TO	R2.26	4.19	1	FLOW	757.	244.
				TIME	5.83	6.92
HYDROGRAPH AT	GD.27	1.13	1	FLOW	167.	52.
				TIME	5.58	5.75
3 COMBINED AT	95@ANN	65.92	1	FLOW	1418.	280.
				TIME	5.83	6.83
ROUTED TO	R1.26-28	65.92	1	FLOW	1418.	280.
				TIME	5.92	6.92
ROUTED TO	R2.26-28	65.92	1	FLOW	1417.	279.
				TIME	6.00	7.00
HYDROGRAPH AT	GD.29	.76	1	FLOW	116.	36.
				TIME	5.42	5.67
ROUTED TO	RK.29	.76	1	FLOW	115.	36.
				TIME	5.67	6.08
HYDROGRAPH AT	PDGC	.53	1	FLOW	75.	22.
				TIME	4.92	5.50
3 COMBINED AT	95-RNCH	67.21	1	FLOW	1589.	314.
				TIME	6.00	7.00
DIVERSION TO	C-1509	67.21	1	FLOW	288.	288.
				TIME	5.75	7.00
HYDROGRAPH AT	95+RNCH	67.21	1	FLOW	1301.	26.
				TIME	6.00	7.00
ROUTED TO	95-LONE	67.21	1	FLOW	1299.	24.
				TIME	6.00	7.25

DIVERSION TO						
	C-1500	67.21	1	FLOW	294.	24.
				TIME	5.83	7.25
HYDROGRAPH AT						
	95+LONE	67.21	1	FLOW	1005.	0.
				TIME	6.00	7.25
ROUTED TO						
	R.PDGC-2	67.21	1	FLOW	1005.	0.
				TIME	6.08	10.33
HYDROGRAPH AT						
	GD.21	6.04	1	FLOW	2041.	752.
				TIME	4.17	4.17
ROUTED TO						
	V	6.04	1	FLOW	2035.	750.
				TIME	4.42	4.67
HYDROGRAPH AT						
	GD.22	1.65	1	FLOW	272.	88.
				TIME	5.42	5.67
HYDROGRAPH AT						
	GD.23	1.01	1	FLOW	174.	57.
				TIME	5.33	5.58
3 COMBINED AT						
		8.70	1	FLOW	2369.	857.
				TIME	4.42	4.67
ROUTED TO						
	V	8.70	1	FLOW	2361.	854.
				TIME	4.92	5.42
HYDROGRAPH AT						
	GD.24	.64	1	FLOW	56.	10.
				TIME	5.50	5.75
2 COMBINED AT						
		9.34	1	FLOW	2413.	863.
				TIME	4.92	5.42
ROUTED TO						
	RK.GD24	9.34	1	FLOW	2405.	852.
				TIME	5.33	6.25
HYDROGRAPH AT						
	GD.18	3.42	1	FLOW	1611.	578.
				TIME	3.67	3.67
ROUTED TO						
	V	3.42	1	FLOW	1559.	570.
				TIME	4.00	4.25
HYDROGRAPH AT						
	GD.19	2.41	1	FLOW	317.	85.
				TIME	5.25	5.58

2 COMBINED AT						
		5.83	1	FLOW	1717.	608.
				TIME	4.00	4.25
ROUTED TO						
	V	5.83	1	FLOW	1707.	470.
				TIME	4.75	6.83
HYDROGRAPH AT						
	GD.20	2.35	1	FLOW	271.	83.
				TIME	6.50	6.67
COMBINED AT						
	95-CRAIG	84.73	1	FLOW	4294.	1281.
				TIME	6.17	6.25
VERSION TO						
	C-1499	84.73	1	FLOW	212.	103.
				TIME	6.17	6.25
HYDROGRAPH AT						
	95+CRAIG	84.73	1	FLOW	4082.	1178.
				TIME	6.17	6.25
ROUTED TO						
	R.20-28	84.73	1	FLOW	4068.	1175.
				TIME	6.17	6.25
HYDROGRAPH AT						
	GD.15	3.28	1	FLOW	1274.	446.
				TIME	3.83	3.92
OUTED TO						
	V	3.28	1	FLOW	1265.	441.
				TIME	4.33	4.67
YDROGRAPH AT						
	GD.16	3.76	1	FLOW	469.	123.
				TIME	5.67	5.92
2 COMBINED AT						
		7.04	1	FLOW	1510.	504.
				TIME	4.33	4.67
ROUTED TO						
	V	7.04	1	FLOW	1503.	500.
				TIME	5.17	6.00
HYDROGRAPH AT						
	GD.17	.56	1	FLOW	74.	23.
				TIME	6.00	6.17
3 COMBINED AT						
	95-ALEX	92.33	1	FLOW	5199.	1656.
				TIME	6.17	6.25
IVERSION TO						
	C-1497	92.33	1	FLOW	256.	256.
				TIME	4.67	5.92

HYDROGRAPH AT						
	95+ALEX	92.33	1	FLOW	4943.	1400.
				TIME	6.17	6.25
ROUTED TO						
	RK.17-28	92.33	1	FLOW	4934.	1377.
				TIME	6.25	6.33
DIVERSION TO						
	OVERTOP	92.33	1	FLOW	2484.	0.
				TIME	6.25	.08
HYDROGRAPH AT						
	95+OVR.T	92.33	1	FLOW	2450.	1377.
				TIME	5.17	6.33
ROUTED TO						
	GOWAN->N	92.33	1	FLOW	2450.	1359.
				TIME	5.25	6.33
HYDROGRAPH AT						
	GD.12	2.27	1	FLOW	1088.	392.
				TIME	3.67	3.67
ROUTED TO						
	V	2.27	1	FLOW	1046.	379.
				TIME	3.92	4.08
HYDROGRAPH AT						
	GD.13	3.15	1	FLOW	607.	191.
				TIME	4.58	5.42
2 COMBINED AT						
		5.42	1	FLOW	1402.	495.
				TIME	3.92	4.08
ROUTED TO						
	V	5.42	1	FLOW	1375.	484.
				TIME	4.33	4.67
ROUTED TO						
	V	5.42	1	FLOW	1347.	473.
				TIME	5.17	6.08
HYDROGRAPH AT						
	GD.14A	1.71	1	FLOW	227.	57.
				TIME	4.42	5.42
2 COMBINED AT						
		7.13	1	FLOW	1552.	508.
				TIME	5.17	6.08
ROUTED TO						
	V	7.13	1	FLOW	1548.	501.
				TIME	5.50	6.75
HYDROGRAPH AT						
	GD.14B	.68	1	FLOW	99.	31.
				TIME	5.67	5.83

3 COMBINED AT						
		100.14	1	FLOW	4096.	1783.
				TIME	5.50	6.83
ROUTED TO						
	GOWAN-N	100.14	1	FLOW	4093.	1775.
				TIME	5.58	6.92
COMBINED AT						
	T.GWN@95	126.68	1	FLOW	8600.	3052.
				TIME	5.58	6.83
DIVERSION TO						
	GOWAN	126.68	1	FLOW	8600.	3052.
				TIME	5.58	6.83
HYDROGRAPH AT						
	NOT	126.68	1	FLOW	0.	0.
				TIME	.08	.08
HYDROGRAPH AT						
	C-1509	.00	1	FLOW	288.	288.
				TIME	5.75	7.00
ROUTED TO						
	R.C1509	.00	1	FLOW	288.	288.
				TIME	5.83	7.08
HYDROGRAPH AT						
	C-1500	.00	1	FLOW	294.	24.
				TIME	5.83	7.25
ROUTED TO						
	R.C1500	.00	1	FLOW	294.	23.
				TIME	5.92	7.33
HYDROGRAPH AT						
	AREA.1	.11	1	FLOW	48.	22.
				TIME	3.83	3.92
4 COMBINED AT						
	R-LON.MT	126.79	1	FLOW	590.	311.
				TIME	5.83	7.33
DIVERSION TO						
	C-R17	126.79	1	FLOW	161.	99.
				TIME	5.83	7.33
HYDROGRAPH AT						
	C-R17	126.79	1	FLOW	429.	212.
				TIME	5.83	7.33
ROUTED TO						
	V	126.79	1	FLOW	428.	211.
				TIME	5.92	7.42
HYDROGRAPH AT						
	AREA.2C	.05	1	FLOW	16.	6.
				TIME	4.00	4.08

2 COMBINED AT		126.84	1	FLOW	432.	211.
				TIME	5.92	7.42
DIVERSION TO	C-I	126.84	1	FLOW	50.	50.
				TIME	4.50	7.08
DROGRAPH AT	RNCH--CR	126.84	1	FLOW	382.	161.
				TIME	5.92	7.42
UTED TO	V	126.84	1	FLOW	381.	160.
				TIME	6.08	7.58
VERSION TO	C-J	126.84	1	FLOW	22.	20.
				TIME	6.08	7.42
HYDROGRAPH AT	RNCH-CRG	126.84	1	FLOW	359.	140.
				TIME	6.08	7.58
HYDROGRAPH AT	C-1499	.00	1	FLOW	212.	103.
				TIME	6.17	6.25
DROGRAPH AT	RAMP-S	.01	1	FLOW	5.	2.
				TIME	3.58	3.58
DROGRAPH AT	RAMP-N	.01	1	FLOW	5.	2.
				TIME	3.58	3.58
COMBINED AT	C-1499A	.02	1	FLOW	212.	103.
				TIME	6.17	6.25
OUTED TO	ROUT1	.02	1	FLOW	212.	103.
				TIME	6.17	6.25
HYDROGRAPH AT	AREA.2A	.12	1	FLOW	42.	16.
				TIME	3.92	3.92
2 COMBINED AT	COMBA	.14	1	FLOW	216.	105.
				TIME	6.17	6.25
UTED TO	ROUT2	.14	1	FLOW	216.	104.
				TIME	6.17	6.33
DROGRAPH AT	AREA.2B	.13	1	FLOW	40.	15.
				TIME	4.08	4.17

[redacted] COMBINED AT						
	COMBB	.27	1	FLOW	234.	107.
[redacted]				TIME	5.42	6.33
ROUTED TO						
	ROUT3	.27	1	FLOW	233.	105.
[redacted]				TIME	5.50	6.33
2 COMBINED AT						
[redacted]	RNHCRG	127.11	1	FLOW	581.	223.
				TIME	6.17	7.50
[redacted]IVERSION TO						
	CRGDIV	127.11	1	FLOW	349.	223.
				TIME	5.92	7.50
[redacted]DROGRAPH AT						
	RNCH@-CR	127.11	1	FLOW	232.	0.
				TIME	6.17	6.25
[redacted]UTED TO						
	V	127.11	1	FLOW	232.	0.
				TIME	6.25	7.33
HYDROGRAPH AT						
	C-1497	.00	1	FLOW	256.	256.
[redacted]				TIME	4.67	5.92
ROUTED TO						
[redacted]	V	.00	1	FLOW	256.	256.
				TIME	4.75	6.00
HYDROGRAPH AT						
[redacted]	AREA.3	.16	1	FLOW	30.	7.
				TIME	4.17	5.25
[redacted] COMBINED AT						
[redacted]	.	.16	1	FLOW	280.	260.
				TIME	5.25	5.92
[redacted]UTED TO						
	V	.16	1	FLOW	279.	259.
				TIME	5.25	6.08
[redacted]YDROGRAPH AT						
	AREA.4	.25	1	FLOW	50.	14.
[redacted]				TIME	4.25	5.33
2 COMBINED AT						
[redacted]	.	.41	1	FLOW	319.	267.
				TIME	5.25	6.00
ROUTED TO						
[redacted]	V	.41	1	FLOW	319.	267.
				TIME	5.33	6.08
[redacted]YDROGRAPH AT						
	AREA.5	.15	1	FLOW	25.	7.
				TIME	4.25	5.33
[redacted]						

Existing

Total flows at Craig / Rancho

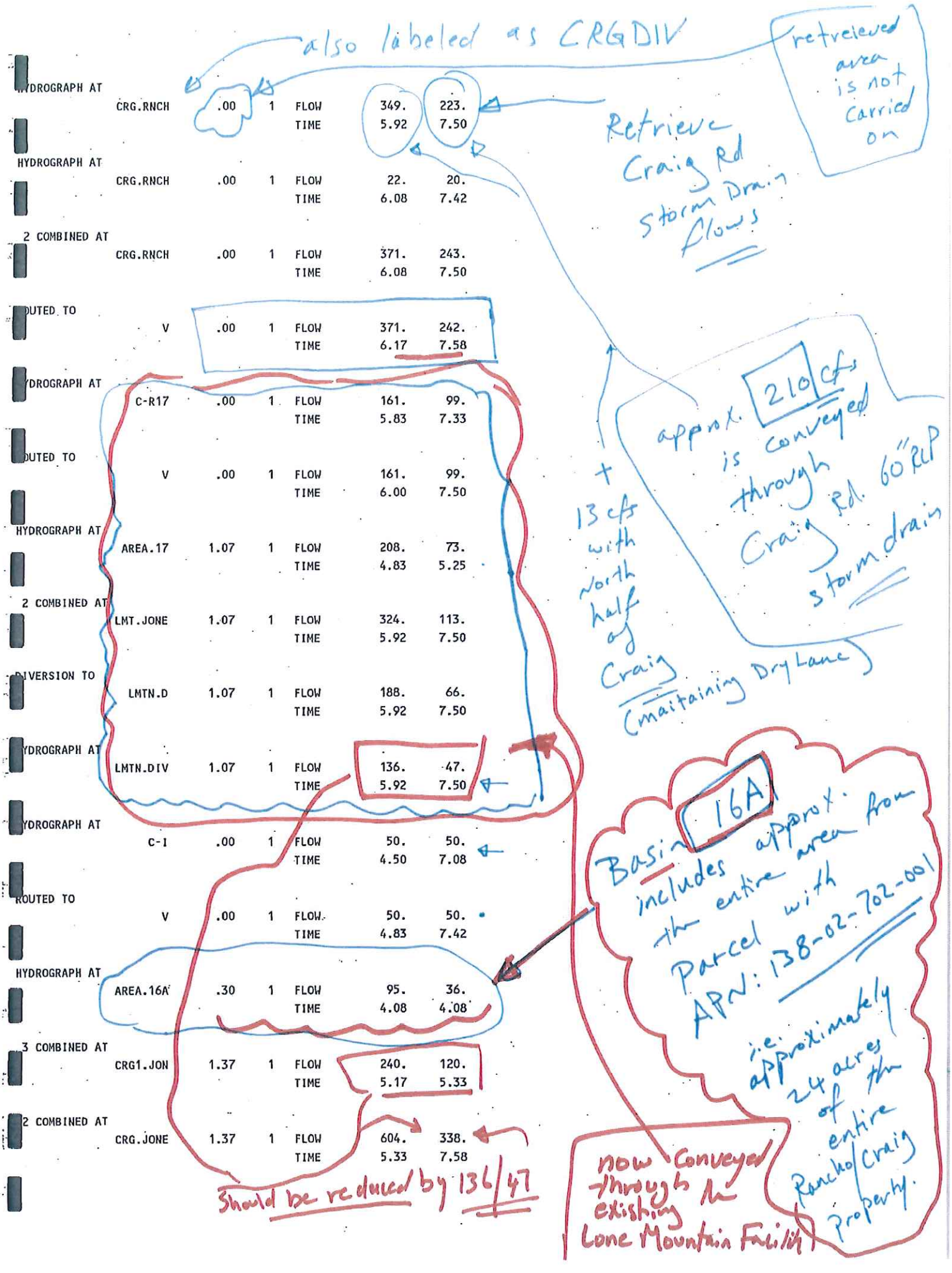
Peak time ranges between 6.17 hrs to 7.50 hrs

Being Diverted into Craig Storm Drain of North Half

3 COMBINED AT						
	R-ALEX	127.67	1	FLOW	521.	270.
				TIME	6.17	6.08
DIVERSION TO						
	C-R15	127.67	1	FLOW	505.	270.
				TIME	6.17	6.08
HYDROGRAPH AT						
	RNCH++CR	127.67	1	FLOW	16.	0.
				TIME	6.17	5.67
ROUTED TO						
	RNCH+GWN	127.67	1	FLOW	16.	0.
				TIME	6.50	6.75
HYDROGRAPH AT						
	OVERTOP	.00	1	FLOW	2484.	0.
				TIME	6.25	.08
HYDROGRAPH AT						
	GOWAN	.00	1	FLOW	8600.	3052.
				TIME	5.58	6.83
HYDROGRAPH AT						
	AREA.6	.13	1	FLOW	31.	9.
				TIME	4.00	4.08
3 COMBINED AT						
		.13	1	FLOW	10569.	3052.
				TIME	5.58	6.83
ROUTED TO						
	V	.13	1	FLOW	10530.	3039.
				TIME	5.58	6.92
HYDROGRAPH AT						
	AREA.7	.72	1	FLOW	107.	33.
				TIME	5.58	5.75
6 COMBINED AT						
	R-GOWAN	128.52	1	FLOW	10637.	3060.
				TIME	5.58	6.92
DIVERSION TO						
	C-R14	128.52	1	FLOW	183.	183.
				TIME	4.33	5.83
HYDROGRAPH AT						
	C-R14	128.52	1	FLOW	10454.	2877.
				TIME	5.58	6.92
DIVERSION TO						
	C-R13	128.52	1	FLOW	60.	60.
				TIME	4.17	5.42
HYDROGRAPH AT						
	C-R13	128.52	1	FLOW	10394.	2817.
				TIME	5.58	6.92

DIVERSION TO						
	BREACH	128.52	1	FLOW	9394.	1817.
				TIME	5.58	6.92
HYDROGRAPH AT						
	BREACH	128.52	1	FLOW	1000.	1000.
				TIME	4.83	6.17
ROUTED TO						
	V	128.52	1	FLOW	1000.	1000.
				TIME	4.92	6.25
HYDROGRAPH AT						
	AREA.8	.99	1	FLOW	149.	51.
				TIME	5.92	6.08
2 COMBINED AT						
	R-CHYN	129.51	1	FLOW	1149.	1051.
				TIME	5.92	6.25
ROUTED TO						
	V	129.51	1	FLOW	1149.	1050.
				TIME	6.00	6.33
HYDROGRAPH AT						
	AREA.9	.27	1	FLOW	48.	14.
				TIME	4.50	5.42
2 COMBINED AT						
	R-DCTUR	129.78	1	FLOW	1184.	1058.
				TIME	5.67	6.33
DIVERSION TO						
	C-R10	129.78	1	FLOW	252.	252.
				TIME	4.50	5.92
HYDROGRAPH AT						
	RANCHO	129.78	1	FLOW	932.	806.
				TIME	5.67	6.33
HYDROGRAPH AT						
		.00	1	FLOW	252.	252.
				TIME	4.50	5.92
HYDROGRAPH AT						
	AREA.10	.08	1	FLOW	19.	4.
				TIME	3.75	5.00
2 COMBINED AT						
	D-AIRPRT	.08	1	FLOW	265.	253.
				TIME	5.00	5.83
HYDROGRAPH AT						
	D-CHYN	.13	1	FLOW	27.	7.
				TIME	4.00	5.17
HYDROGRAPH AT						
	D-GOWAN	.11	1	FLOW	20.	5.
				TIME	4.17	5.25

HYDROGRAPH AT	C-R13	.00	1	FLOW	60.	60.
				TIME	4.17	5.42
ROUTED TO	V	.00	1	FLOW	60.	60.
				TIME	4.33	5.67
HYDROGRAPH AT	BREACH	.00	1	FLOW	9394.	1817.
				TIME	5.58	6.92
ROUTED TO	V	.00	1	FLOW	9346.	1786.
				TIME	5.67	7.00
4 COMBINED AT		.24	1	FLOW	9428.	1846.
				TIME	5.67	7.00
HYDROGRAPH AT	AREA.13	.19	1	FLOW	30.	8.
				TIME	4.42	5.42
3 COMBINED AT	D-ALEX	.52	1	FLOW	9706.	2100.
				TIME	5.67	7.00
HYDROGRAPH AT	C-R14	.00	1	FLOW	183.	183.
				TIME	4.33	5.83
ROUTED TO	V	.00	1	FLOW	183.	183.
				TIME	4.58	6.08
HYDROGRAPH AT	AREA.14	.28	1	FLOW	40.	11.
				TIME	4.50	5.50
2 COMBINED AT	D-SANMGL	.28	1	FLOW	223.	193.
				TIME	4.50	5.67
HYDROGRAPH AT	C-R15	.00	1	FLOW	505.	270.
				TIME	6.17	6.08
ROUTED TO	V	.00	1	FLOW	505.	268.
				TIME	6.33	6.33
HYDROGRAPH AT	AREA.15	.36	1	FLOW	61.	16.
				TIME	4.25	5.33
2 COMBINED AT	D.CRG.S	.36	1	FLOW	522.	274.
				TIME	6.25	6.33


also labeled as CRGDIV
retreieved area is not carried on
Retrieve Craig Rd Storm Drain flows
HYDROGRAPH AT
CRG.RNCH .00 1 FLOW 349. 223.
TIME 5.92 7.50
HYDROGRAPH AT
CRG.RNCH .00 1 FLOW 22. 20.
TIME 6.08 7.42
2 COMBINED AT
CRG.RNCH .00 1 FLOW 371. 243.
TIME 6.08 7.50
ROUTED TO
V .00 1 FLOW 371. 242.
TIME 6.17 7.58
HYDROGRAPH AT
C-R17 .00 1 FLOW 161. 99.
TIME 5.83 7.33
ROUTED TO
V .00 1 FLOW 161. 99.
TIME 6.00 7.50
HYDROGRAPH AT
AREA.17 1.07 1 FLOW 208. 73.
TIME 4.83 5.25
2 COMBINED AT
LMT.JONE 1.07 1 FLOW 324. 113.
TIME 5.92 7.50
DIVERSION TO
LMTN.D 1.07 1 FLOW 188. 66.
TIME 5.92 7.50
HYDROGRAPH AT
LMTN.DIV 1.07 1 FLOW 136. 47.
TIME 5.92 7.50
HYDROGRAPH AT
C-1 .00 1 FLOW 50. 50.
TIME 4.50 7.08
ROUTED TO
V .00 1 FLOW 50. 50.
TIME 4.83 7.42
HYDROGRAPH AT
AREA.16A .30 1 FLOW 95. 36.
TIME 4.08 4.08
3 COMBINED AT
CRG1.JON 1.37 1 FLOW 240. 120.
TIME 5.17 5.33
2 COMBINED AT
CRG.JONE 1.37 1 FLOW 604. 338.
TIME 5.33 7.58
+ 13 cfs with North half of Craig (maintaining Dry Lane)
approx. 210 cfs is conveyed through Craig Rd. 60" RCP storm drain
Basin 16A includes approx. the entire area from Parcel with APN: 138-02-702-001
i.e. approximately 24 acres of the entire Rancho/Craig property.
Should be reduced by 136/47
now Conveyed through the existing Lone Mountain Facility

UTED TO						
	V	1.37	1	FLOW	604.	338.
				TIME	5.42	7.58
HYDROGRAPH AT						
	AREA.16C	.01	1	FLOW	4.	2.
				TIME	3.67	3.67
2 COMBINED AT						
		1.38	1	FLOW	605.	338.
				TIME	5.42	7.58
DROGRAPH AT						
	AREA.16B	.52	1	FLOW	103.	41.
				TIME	5.42	5.58
DROGRAPH AT						
	AREA.16D	.01	1	FLOW	3.	1.
				TIME	3.67	3.67
COMBINED AT						
		1.91	1	FLOW	708.	351.
				TIME	5.42	7.58
2 COMBINED AT						
	D-CRAIG	2.27	1	FLOW	1171.	609.
				TIME	6.25	7.58

REFERENCE

Relevant Excerpts from the "Technical Drainage Study for Jones Boulevard-Centennial to Rancho"
(DS 2378)

DS #: 2378

APN: _____

PROJECT: JONES BOULEVARD – CENTENNIAL TO RANCHO

SUBMITTAL: 1ST SUBMITTAL

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____

TECHNICAL DRAINAGE STUDY

OCT - 5 1998
CLV PUBLIC WORKS
FLOOD CONTROL

JONES BOULEVARD
PDG PROJECT #98009-D

2378

PREPARED FOR:
City of Las Vegas
400 E. Stewart Avenue
Las Vegas, NV 89101

SEPTEMBER 29, 1998
PREPARED BY:

POGGEMEYER DESIGN GROUP, INC.
ENGINEERS – PLANNERS – SURVEYORS – LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY
LAS VEGAS, NEVADA 89128
(702) 255-8100 (702) 255-8375 FAX
PDG-LV@POGGEMEYER.COM

DRAINAGE STUDY INFORMATION FORM

Name of Development: JONES BOULEVARD IMPROVEMENTS Date: 25-Sep-98

Location of Development:
a) Descriptive: NORTH TO SOUTH, FROM CENTENNIAL TO RANCHO
b) Sect. 1, 2 Twn. 20 S Rng. 60 E
c) Sect. 36, 35 Twn. 19 S Rng. 60 E
d) Sect. 25, 26 Twn. 19 S Rng. 60 E

Name of Owner: CITY OF LAS VEGAS Assessors Parcel No: N/A

Contact Person-Name: Stephen L. Weatherman P.E. Telephone No: (702) 255-8100

Firm: POGGEMEYER DESIGN GROUP, INC.

Address: 2601 North Tenaya Way - Las Vegas, Nevada 89128

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 36.4 ACRES Being Developed/Disturbed: 36.4 ACRES

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? (YES*) NO

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? (YES*) NO

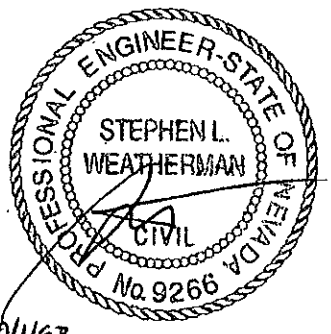
4. Proposed type of development (Residential, Commercial, Etc.)? Warehouse

5. Approximate upstream land area which drains to the subject site? 32.5 SM

6. Has the site drainage been evaluated in the past? (YES) NO If yes, please identify documentation: Canyon Ridge Church Drainage Study, Copperfield Drainage Study, Mirage Drainage Study, and Copper Crest SubDivision

7. If known, please briefly identify the proposed discharge points(s) of runoff from the site: Discharging into Clayton Street and Brooks Avenue

8. Briefly describe your proposed schedule for the subject project: Apr-99



10/1/98 Engineer's Seal

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

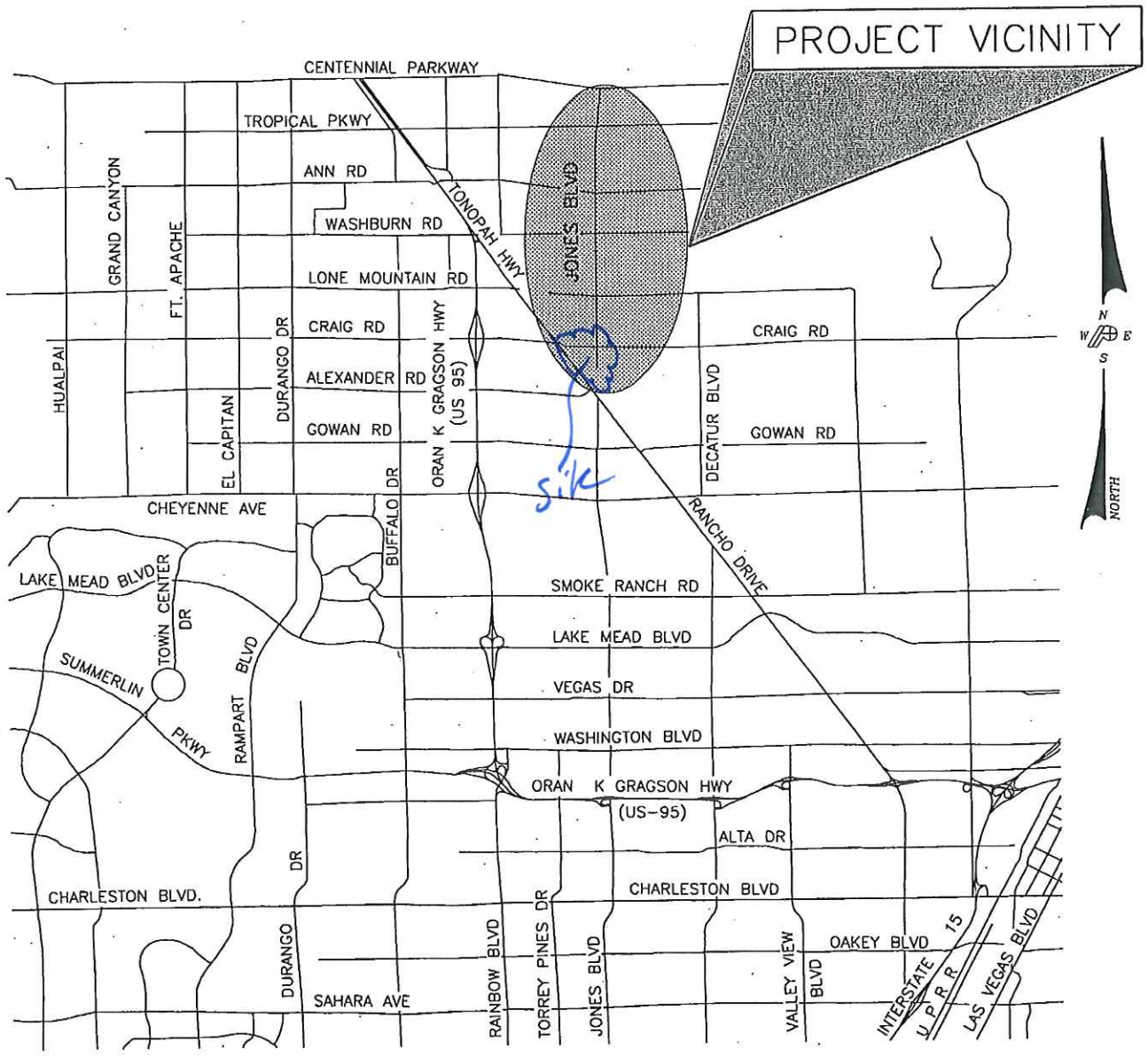
* Review and concurrence of the Clark County Regional flood Control District is required.

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1



JONES BOULEVARD IMPROVEMENT PROJECT

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

FIGURE A VICINITY MAP

INTRODUCTION

The project begins at Jones Boulevard and Rancho and ends at Centennial. The project includes Craig Road, Lone Mountain, and Ann Road intersections, and is impacted by flows from the west. This area includes the southern portion of the West Tributary Watershed and the north portion of the Gowan Watershed. US-95 and Rancho Drive split these watersheds, with the majority of the flows from the west of these highways being diverted south along the west side of the roadways. Some of the flow from the west does cross over or under the highways and continues to Jones Boulevard.

The future conditions, with all planned regional and local facilities in place, limits the future off-site basin to the west. The limits are Rainbow from Centennial to Ann, and Rancho from Ann to Jones for the 100-year event. The 10-year event is limited to the west by Torrey Pines from Centennial to Rancho and Rancho to Jones.

The project is crossed west to east by the existing Craig Road storm drain system, the future regional Ann Road system, and the future regional Lone Mountain system. The Jones Boulevard improvements include a large diameter storm drain system. This system drains to three outfalls:

1. The northern area between Centennial and Ann is planned to discharge into the future regional Ann Road System.
2. The middle area between Ann and Lone Mountain is planned to be drained to the future regional Lone Mountain system.

3. The southern area between Lone Mountain and Rancho drains to the existing Craig Road system.

The drainage system between Lone Mountain and Ann Road will not be fully functional because the Ann Road and Lone Mountain systems will not be in place when Jones Boulevard is constructed. The storm drain pipe and inlets will be constructed, but the pipe outlet from this overall system will not have the capacity needed for the full flow. A minor 18" pipe will connect the northern system to the middle system to provide a positive drain for the northern system. The middle system is connected to the southern system by a 54" line. The portions of the regional system within the Jones improvements at Ann will be constructed with the Jones Boulevard Improvements project to avoid re-constructing this major intersections in the future.

The criteria used to design the storm drain system is the Regional Flood Control Drainage Criteria and Drainage Design Manual requirements for 100-foot Right of Way roadways. The primary reference of the drainage study is the City of Las Vegas Northwest Neighborhood Flood Control Master Plan. This plan provides pipe size, slope, and preliminary flow rates for the full development condition.

DRAINAGE STUDY SCOPE

The purpose of the drainage study is to develop facility drainage design. The first step is to identify and quantify the off-site flow. The evaluation includes both existing, post-Jones construction and future conditions. The basis for this

analysis is the Northwest Neighborhood Study, modified to use current exiting conditions.

The next step is to evaluate the schematic design as presented in the Northwest Neighborhood Study. This includes evaluating the flows identified in the Neighborhood study and comparing them to the off-site flows developed by this study.

The last step is to develop inlet capacity requirements at the intersections and other locations. These capacity requirements are based on the road slope and flows. The capacities provided are for the 10-year future conditions. The report discusses the Northwest Neighborhood Study assumption and makes recommendations for the final storm drain design.

The purpose of the drainage study includes the following items:

1. Determine the flows impacting the project.
2. Determine the flood zones impacting the project.
3. Evaluate the design flows in Jones.
4. Determine the suitability of the Northwest neighborhood Study Facilities Plan.
5. Provide storm drain mainline plan and profile.
6. Determine size and location of storm drain drop inlets as required to collect flow.
7. Evaluate hydraulic grade line of proposed storm drain system.
8. Provide recommendations for changes to the Northwest Neighborhood Study Facilities Plan.

FLOOD HAZARD DESIGNATION

The special flood hazard areas for the portion of North Las Vegas, Nevada are outlined on the Federal Emergency (FEMA) Flood Insurance Rate Maps (FIRM) #32003C1765-D and #32003C1765-D, dated August 16, 1996. Figure 2 is a portion of Community Plan #32003C1765-D and #32003C1765-D, (FIRM) which show the majority of the project site is located in Flood Zone X, an area determined to be outside of the 500-year floodplain. However the roadway is crossed by Flood Zone A south of Craig near Blackmon Circle, and at the Lone Mountain intersection. These Flood Zones have been removed under LOMR's #95-09-842P and #95-09-926P and no longer impact the project.

HYDROLOGIC METHODOLOGY

The Hydrologic methods used are in accordance with adopted Clark County Regional Flood Control District Hydrologic Criteria and the Drainage Design Manual (CCRFCD Manual). Six-hour rainfall duration's and SDN3 design storm distributions were used.

HYDROLOGIC MODEL

The Hydrologic model utilized in this study is the HEC-1 Flood Hydrograph Package developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center. HEC-1 is a rainfall runoff event simulation model utilizing an interconnected system of hydrologic and hydraulic components to simulate the surface runoff response of a drainage area to precipitation. The calculations of

this study were performed using the SCS and Kinematic Wave Hydrograph subroutine of the HEC-1 Flood Hydrograph model. A detailed explanation of the theory and background is presented in Section 4 of SCS National Engineering Handbook and HEC-1 user manual. Computed Hydrographs were routed using the Kinematic wave routing technique.

PRECIPITATION

The point precipitation value for six-hour storm duration was taken directly from Table 505 of CCRFCD Hydrologic Criteria and Drainage Design Manual. Since the drainage area for the project is less than 10 square miles, an **SDN3** design storm distribution with a 5-minute time increment was selected for use in the **HEC-1** computer model.

SOIL AND CURVE NUMBER

The soil and final CN values were taken directly from the Northwest Neighborhood Drainage Study.

LAG TIME

The time between a brief heavy rain and maximum runoff rate is called lag time. Lag time can be estimated from the historical Hydrograph, or it can be estimated from specific watershed characteristics such as watershed length, slope, and flow retardant. Based on studies of many storm events for a range of watershed conditions, the following empirical relationship between Lag Time (L) and time of concentration (Tc) was derived:

L = 0.6 Tc

Tc = (L/3600 V) + Ti

Where L = Hydraulic Length

V = Average Velocity

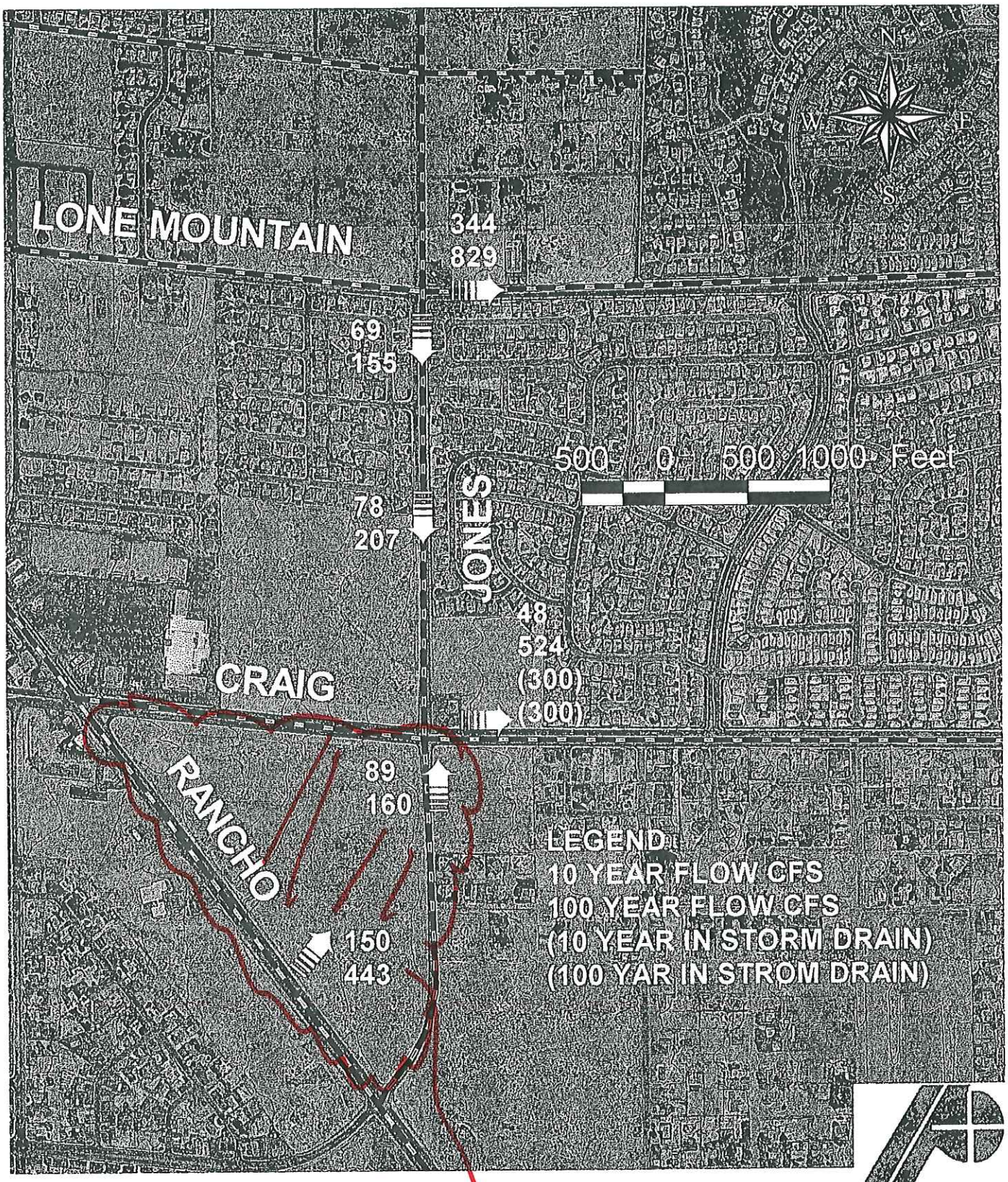
Ti = Initial Flow Time

Average velocities for estimating travel time for surface flow were used to develop a time of concentration. To determine flow times, the equation Ti=1.8(1.1-K) L^1/2 / S^1/3 was used as outlined in Ref. 1. The time of concentration is shown on Standard Form 4 in the technical appendix. The Northwest Neighborhood Drainage Study Lag time was used for all unmodified basins

FACILITY DESIGN

The facilities are designed to meet the Clark County Regional Flood Control District policy noted below:

THE POLICY OF THE CCRFCD SHALL BE TO ALLOW THE USE OF STREETS FOR STORM DRAINAGE WITH SPECIFIC LIMITATIONS. THE ALLOWABLE STREET CAPACITY FOR THE MINOR STORM EVENT FOR DIFFERENT STREET RIGHT-OF-WAY WIDTHS SHALL BE DETERMINED AS FOLLOWS:



CITY OF LAS VEGAS
JONES BOULEVARD
EXISTING CONDITIONS
SOUTH AREA

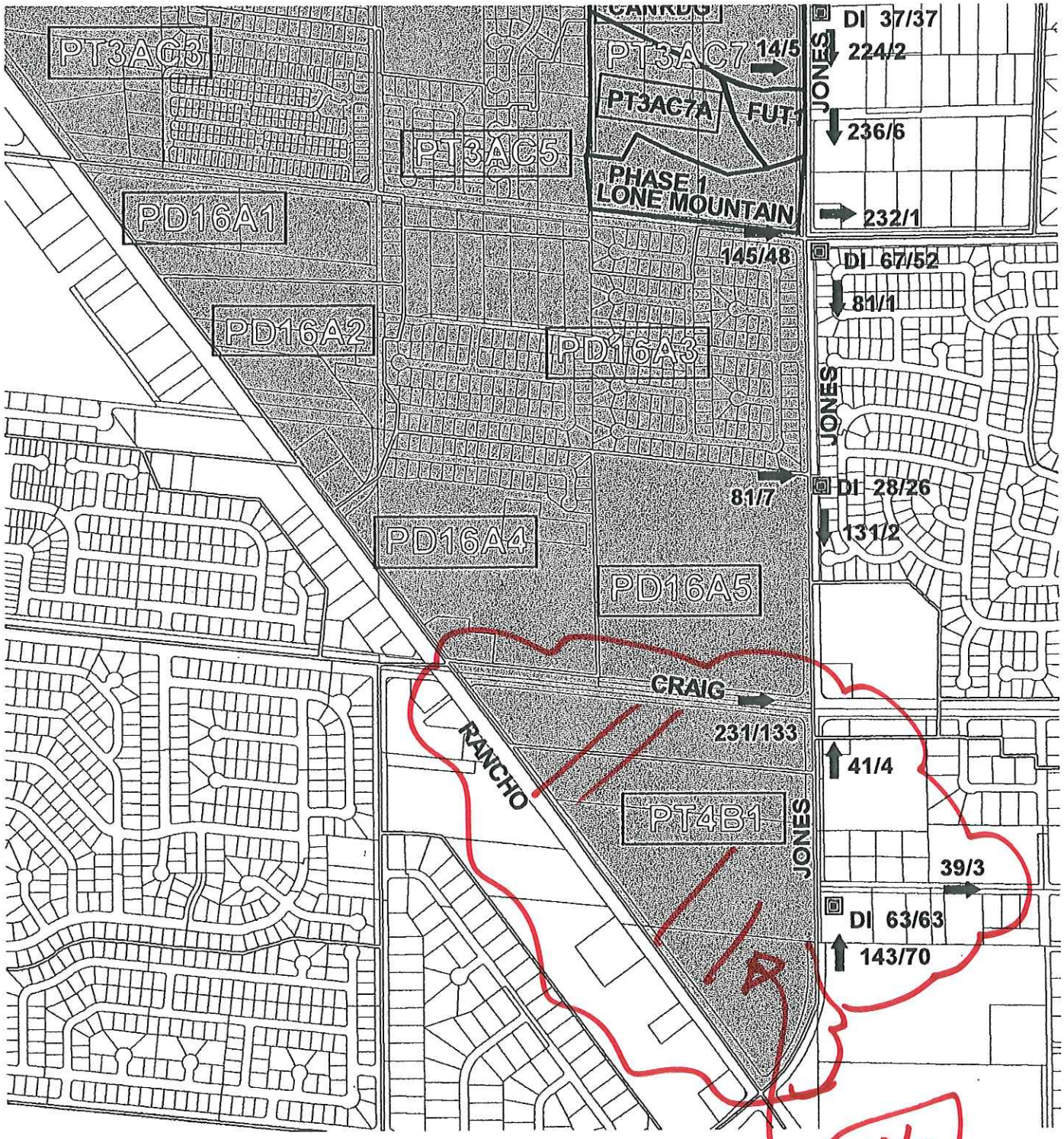
POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS

2601 North Tenaya Way
Las Vegas , Nevada 89128
(702) 255-8100
FAX (702) 255-8375

PDG# 98009-D

Northwest Neighborhood Study
Sheet 12

FIGURE 4c



CITY OF LAS VEGAS
JONES BOULEVARD
PROPOSED CONDITIONS
SOUTH AREA

POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
2601 North Tenaya Way
Las Vegas , Nevada 89128
(702) 255-8100
FAX (702) 255-8375

PDG# 98009-D
Northwest
Neighborhood Study
Sheet 9

FIGURE 5c

the flow from the north, and orifice plates are required at the center system inlets to limit the flow to 120 CFS.

From Lone Mountain, the 54" RCP runs south to station 47+00 at 0.4% and is upsized to a 60" RCP. At this location (46+50), 81/7 flows in from the west. A drop inlet system on the west side is planned to collect 28/26. At this point, 131/2 flows south in Jones to Craig.

This is the end of the north portion of the south system.

The south portion of the south system begins at 19+00 with a 36" HDPE pipe and runs north to a point (26+00) where the pipe changes slope to 1.10%. At this point, a drop inlet system on the west is planned to collect 63/59 and 160/1 flows north in Jones to Craig.

This is the end of the south portion of the south system.

In addition to the drop inlets noted above there will be additional 4-foot drop inlets placed as nuisance drains every 300' where the slope of Jones is less than 0.4% and where a 12' dry lane cannot be maintained.

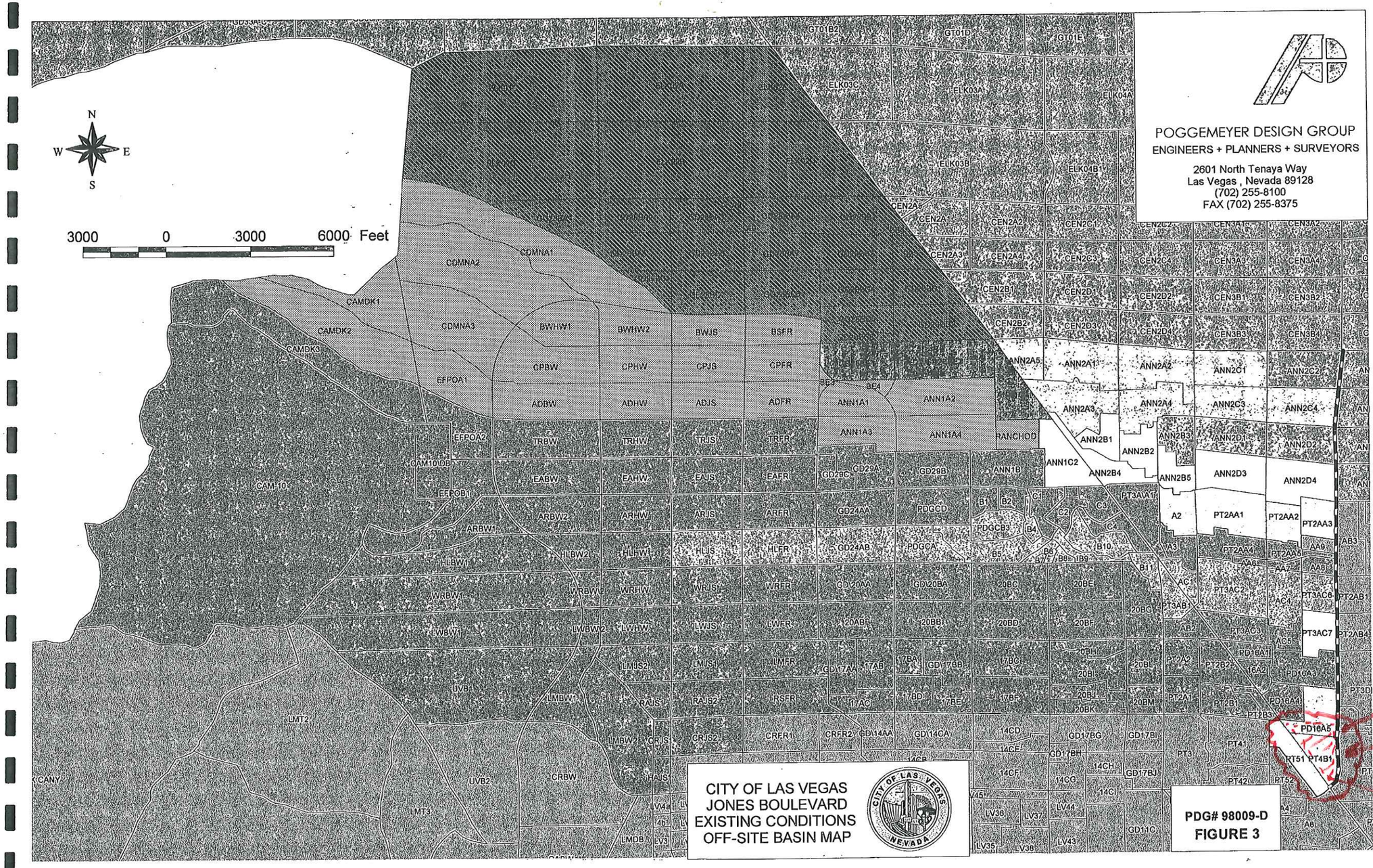
HGL CALCULATIONS

Hydroflow by Intellisolve was used to prepare the HGL calculations for the project. The north and center runs used the top of pipe to begin the calculations. The south runs used the HGL shown on the Craig Road plans by Hefner Engineering. The 30% drainage study indicated that the 54" pipe between stations 126+90 to 134+00 required upsizing to 60". This change has been added to the current plans and HGL.

CONCLUSIONS

1. The Northwest Neighborhood Drainage Study facilities appear to be appropriate, except for the north system. The pipe noted has been upsized.
2. The site was crossed by Flood Zone A at two locations, but LOMR's #95-09-842P and #95-09-926P have removed the Flood Zone.
3. The catch basins for the north and center section must have orifice plates installed to prevent overcharging the storm drain system.
4. The proposed storm drain system will provide little more than nuisance flow collection until the proposed regional facilities are complete.

CITY OF LAS VEGAS
JONES BOULEVARD
EXISTING CONDITION
OFFSITE BASIN MAP



POGGEMEYER DESIGN GROUP
ENGINEERS + PLANNERS + SURVEYORS
2601 North Tenaya Way
Las Vegas , Nevada 89128
(702) 255-8100
FAX (702) 255-8375

HEC-1
JONES BOULEVARD
WITH STORM DRAIN

HEC1 S/N: 1333000222 HMVersion: 6.40 Data File: oscb100a.HC1

```
*****************************************
*                                       *
*   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*          SEPTEMBER 1990               *
*           VERSION 4.0                 *
*                                       *
*  RUN DATE  09/03/1998  TIME  10:56:04 *
*                                       *
*****************************************
```

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

```
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
```

```
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
:::                                    :::
:::  Full Microcomputer Implementation :::
:::                 by                 :::
:::         Haestad Methods, Inc.      :::
:::                                    :::
::::::::::::::::::::::::::::::::::::::::::
::::::::::::::::::::::::::::::::::::::::::
```

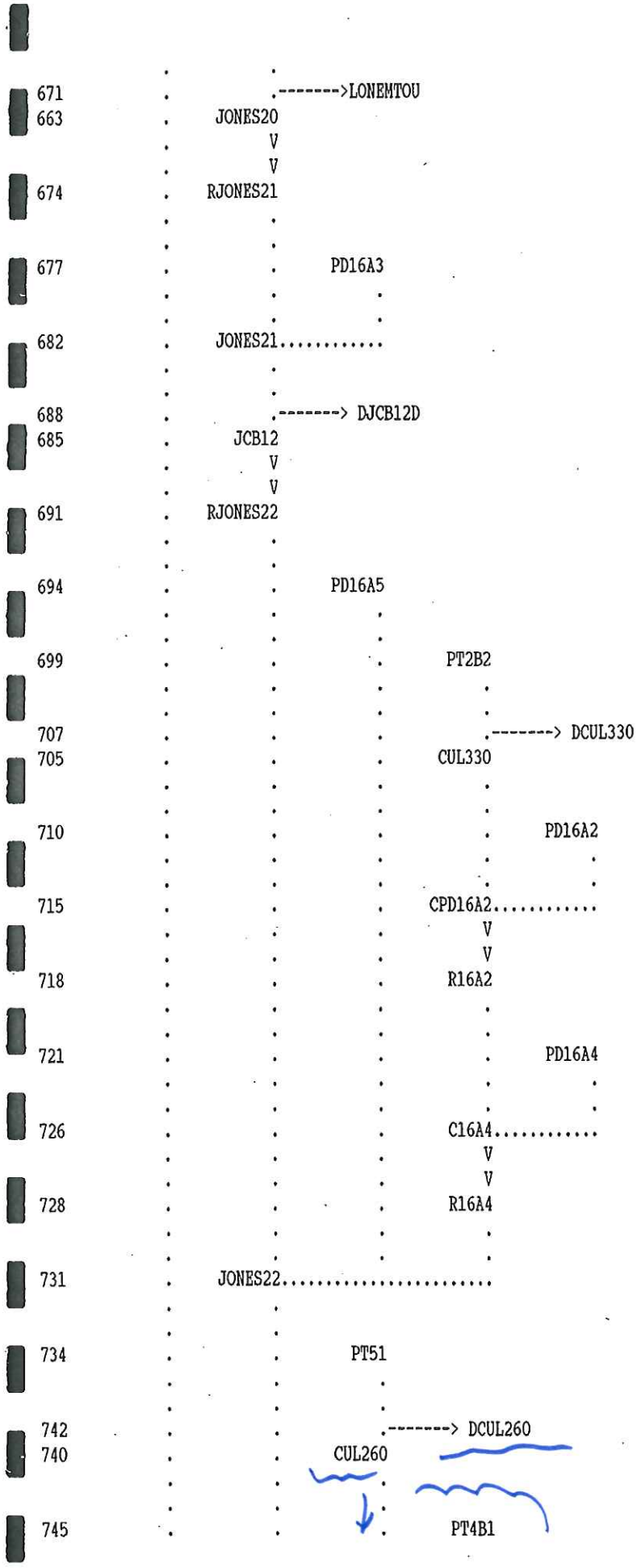
37 Brookside Road * Waterbury, Connecticut 06708 * (203) 755-1666

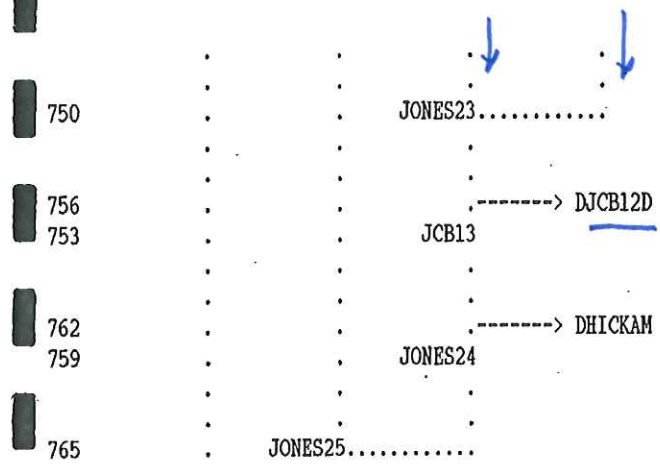
THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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

  728     KK   R16A4
  729     KM  ROUTE TO CRAIG
  730     RK    1225   0.019    0.02       0    TRAP      70       2
          *

  731     KK JONES22
  732     KM   CONCENTRATE ALL FLOWS AT CRAIG
  733     HC       3
          *

  734     KK    PT51
  735     KM  DUMMY BASIN TO PROVIDE FLOW FROM CULVERT 260
  736     PB    2.77
  737     BA    0.07
  738     LS       0    93.8
  739     UD   0.273
          *

  740     KK  CUL260
  741     KM  DIVERT FLOW AT CULVERT CROSSING RANCHO
  742     DT DCUL260
  743     DI       2      45      93     186
  744     DQ       1      21      43      86
          *

  745     KK   PT4B1
  746     PB    2.77
  747     BA   0.065
  748     LS       0    93.8
  749     UD   0.219
          *

  750     KK JONES23
  751     KM   CONCENTRATE ALL FLOWS AT HICKAM
  752     HC       2
          *

  753     KK   JCB13
  754     KM  DIVERT FLOW INTO JONES STORM DRAIN FROM PT4B1
  755     KM  REMAINING FLOW NORTH IN JONES OR EAST IN HICKAM
  756     DT DJCB12D
  757     DI       3      17      26      39      65     100     150     175
  758     DQ       1      15      24      37      63      63      63      63
          *

  759     KK JONES24
  760     KM  DIVERT FLOW EAST IN HICKAM
  761     KM  REMAINING FLOW NORTH IN JONES
  762     DT DHICKAM
  763     DI       3       5      10      25      50      75     100     150
  764     DQ       1       2       4      10      19      38      44      55
          *
```

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

  765     KK JONES25
  766     KM   CONCENTRATE ALL FLOWS AT CRAIG
  767     HC       2
  768     ZZ
```


671
663
JONES20
674
RJONES21
677
PD16A3
682
JONES21
688
685
JCB12
691
RJONES22
694
PD16A5
699
PT2B2
707
705
CUL330
710
PD16A2
715
CPD16A2
718
R16A2
721
PD16A4
726
C16A4
728
R16A4
731
JONES22
734
PT51
742
740
CUL260
745
PT4B1
LONEMTOU
DJCB12D
DCUL330
DCUL260



***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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 1.00	RATIO 2 .57
HYDROGRAPH AT	ANN2C1	.12	1	FLOW	103.	34.
				TIME	3.67	3.75
DIVERSION TO	DCB1	.12	1	FLOW	33.	32.
				TIME	3.42	3.75
HYDROGRAPH AT	CB1	.12	1	FLOW	70.	2.
				TIME	3.67	3.75
DIVERSION TO	DANN2C3	.12	1	FLOW	20.	1.
				TIME	3.67	3.33
HYDROGRAPH AT	DANN2C1	.12	1	FLOW	51.	1.
				TIME	3.67	3.75
ROUTED TO	RANN2C1	.12	1	FLOW	50.	1.
				TIME	3.83	4.50
HYDROGRAPH AT	EX-2	.05	1	FLOW	27.	8.
				TIME	4.00	4.08
HYDROGRAPH AT	FUT-1	.03	1	FLOW	29.	11.
				TIME	3.67	3.75
HYDROGRAPH AT	FUT-2	.03	1	FLOW	35.	15.
				TIME	3.67	3.67
HYDROGRAPH AT	FUT-3	.01	1	FLOW	8.	2.
				TIME	3.67	3.75
5 COMBINED AT	CFUT	.24	1	FLOW	131.	32.
				TIME	3.83	3.75
DIVERSION TO	DJCB1D	.24	1	FLOW	31.	30.
				TIME	3.42	3.75
HYDROGRAPH AT	JCB1	.24	1	FLOW	100.	2.
				TIME	3.83	3.25
DIVERSION TO	AZOUT1	.24	1	FLOW	26.	1.
				TIME	3.83	3.25
HYDROGRAPH AT	JONES1	.24	1	FLOW	74.	1.
				TIME	3.83	3.25
ROUTED TO	RJONES2	.24	1	FLOW	72.	1.
				TIME	3.83	3.42
HYDROGRAPH AT	DANN2C3	.00	1	FLOW	20.	1.

				TIME	3.75	3.75
DIVERSION TO	LONEMTOU	1.07	1	FLOW	232.	1.
				TIME	3.75	3.33
HYDROGRAPH AT	JONES20	1.07	1	FLOW	81.	1.
				TIME	3.75	3.75
ROUTED TO	RJONES21	1.07	1	FLOW	81.	1.
				TIME	3.83	4.25
HYDROGRAPH AT	PD16A3	.10	1	FLOW	83.	28.
				TIME	3.75	3.75
2 COMBINED AT	JONES21	1.17	1	FLOW	162.	28.
				TIME	3.75	3.75
DIVERSION TO	DJCB12D	1.17	1	FLOW	28.	26.
				TIME	3.42	3.75
HYDROGRAPH AT	JCB12	1.17	1	FLOW	134.	2.
				TIME	3.75	3.33
ROUTED TO	RJONES22	1.17	1	FLOW	131.	2.
				TIME	3.83	5.67
HYDROGRAPH AT	PD16A5	.09	1	FLOW	113.	47.
				TIME	3.58	3.58
HYDROGRAPH AT	PT2B2	.08	1	FLOW	108.	53.
				TIME	3.67	3.67
DIVERSION TO	DCUL330	.08	1	FLOW	73.	26.
				TIME	3.67	3.67
HYDROGRAPH AT	CUL330	.08	1	FLOW	35.	26.
				TIME	3.67	3.67
HYDROGRAPH AT	PD16A2	.04	1	FLOW	58.	29.
				TIME	3.58	3.58
2 COMBINED AT	CPD16A2	.12	1	FLOW	92.	54.
				TIME	3.58	3.67
ROUTED TO	R16A2	.12	1	FLOW	91.	53.
				TIME	3.67	3.67
HYDROGRAPH AT	PD16A4	.06	1	FLOW	75.	35.
				TIME	3.67	3.67
2 COMBINED AT	C16A4	.17	1	FLOW	167.	88.
				TIME	3.67	3.67
ROUTED TO	R16A4	.17	1	FLOW	165.	85.
				TIME	3.67	3.67
3 COMBINED AT	JONES22	1.43	1	FLOW	362.	135.
				TIME	3.75	3.67
HYDROGRAPH AT	PT51	.07	1	FLOW	93.	46.

				TIME	3.67	3.67
IVERSION TO	DCUL260	.07	1	FLOW	43.	21.
				TIME	3.67	3.67
YDROGRAPH AT	CUL260	.07	1	FLOW	50.	24.
				TIME	3.67	3.67
YDROGRAPH AT	PT4B1	.06	1	FLOW	93.	46.
				TIME	3.67	3.67
2 COMBINED AT	JONES23	.13	1	FLOW	143.	70.
				TIME	3.67	3.67
DIVERSION TO	DJCB12D	.13	1	FLOW	63.	63.
				TIME	3.42	3.58
HYDROGRAPH AT	JCB13	.13	1	FLOW	80.	7.
				TIME	3.67	3.67
DIVERSION TO	DHICKAM	.13	1	FLOW	39.	3.
				TIME	3.67	3.67
YDROGRAPH AT	JONES24	.13	1	FLOW	41.	4.
				TIME	3.67	3.67
2 COMBINED AT	JONES25	1.56	1	FLOW	397.	139.
				TIME	3.75	3.67

Culv. # 260 in NW Neighborhood Study

Jones S.D.

towards Jones Blvd. Low Point at Hickam

surface splitting into Hickam

STREET X-CROSS CALCULATIONS

Worksheet
Worksheet for Irregular Channel

Project Description	
Project File	c:\fmw\project2.fm2
Worksheet	100 FT. ROW WITH MEDIAN .50% SLOPE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Input Data		
Channel Slope	0.005000	ft/ft
Water Surface Elevation	10.16	ft

Elevation range: 9.50 ft to 10.91 ft.

Station (ft)	Elevation (ft)	Start Station	End Station	Roughness
10.00	10.00	10.00	17.00	0.013
15.50	10.00	17.00	54.50	0.016
15.50	9.50	54.50	61.50	0.013
17.00	9.62			
17.00	9.66			
54.50	10.41			
54.50	10.91			
61.50	10.91			

Results		
Wtd. Mannings Coefficient	0.015	
Discharge	21.70	ft³/s
Flow Area	8.03	ft²
Wetted Perimeter	32.71	ft
Top Width	32.00	ft ← top width
Depth	0.66	ft
Critical Water Elev.	10.15	ft
Critical Slope	0.005572	ft/ft
Velocity	2.70	ft/s
Velocity Head	0.11	ft
Specific Energy	10.27	ft
Froude Number	0.95	
Full Flow Capacity	247.34	ft³/s

Flow is subcritical.

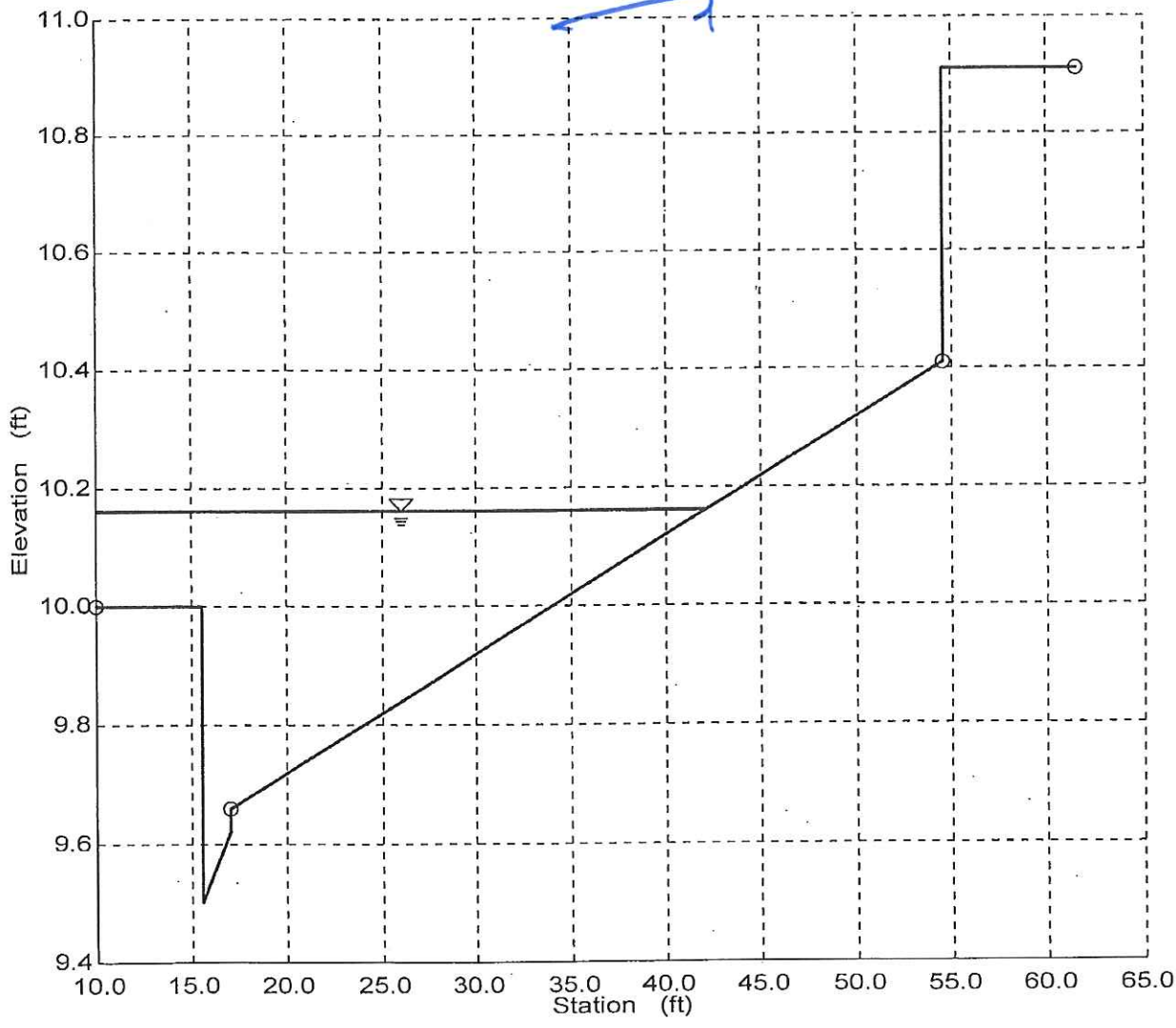
Water elevation exceeds lowest end station by 0.16 ft.

Cross Section
Cross Section for Irregular Channel

Project Description	
Project File	c:\fmw\project2.fm2
Worksheet	100 FT. ROW WITH MEDIAN .50% SLOPE
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Discharge

Section Data		
Wtd. Mannings Coefficient	0.015	
Channel Slope	0.005000	ft/ft
Water Surface Elevation	10.16	ft
Discharge	21.70	ft³/s

12.5' Dry Lane



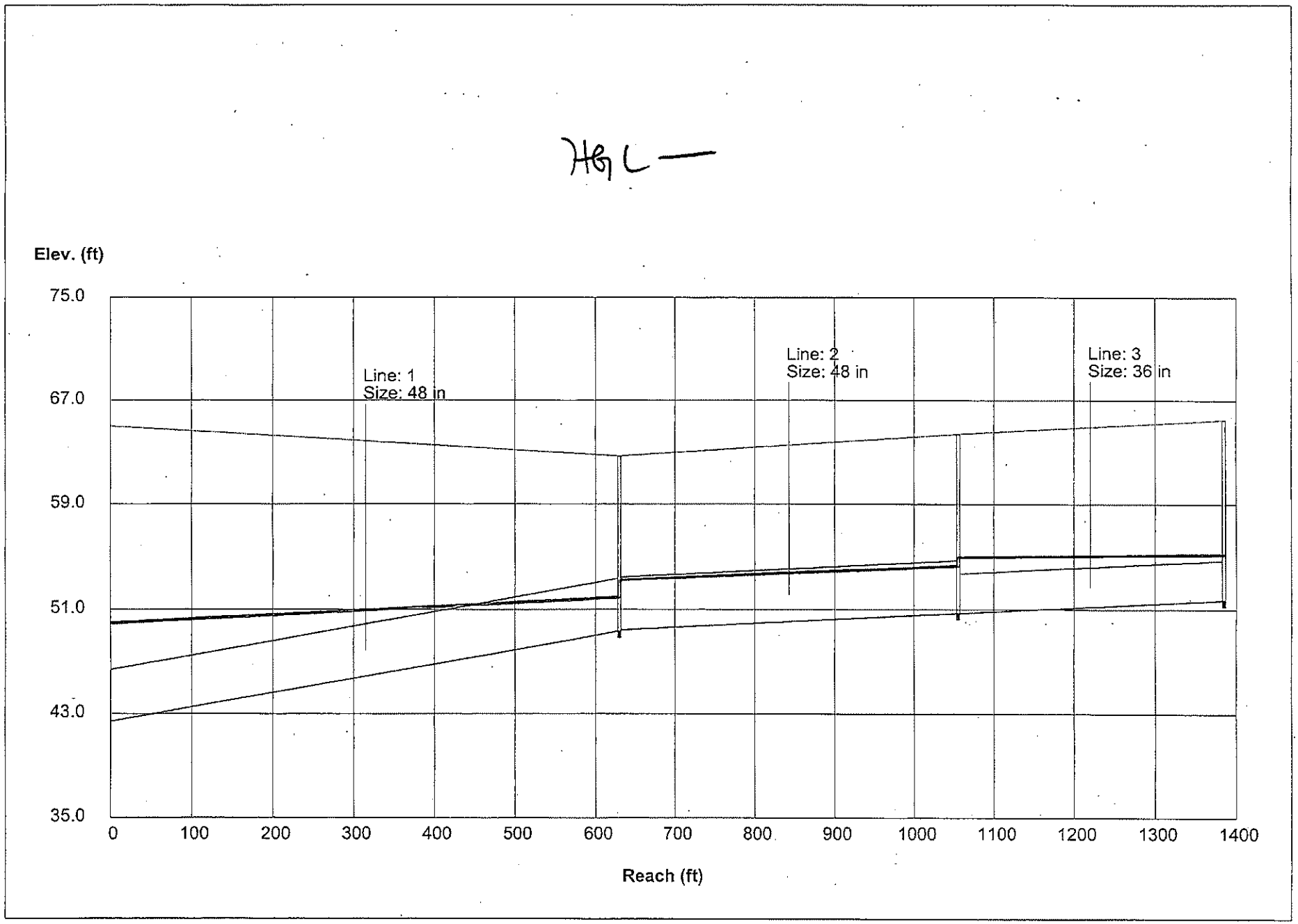
DROP INLET CALCULATIONS

STORM DRAIN CALCULATIONS

HGL PROFILE
STATIONS
18+45 TO 32+30

Storm Sewer Profile

Proj. file: JONS10.STM



Line 1 Q = 79.00 **Size = 48 x 48 (Cir)** **Nv = 0.013** **Len = 630.0** **JLC = 1.00**

32+30 to 26+00 / Outfall

	Invert	Depth	HGL	EGL	Area	Vel	T-Wid	Cover
Dnstrm	42.40	48	50.00	50.61	12.56	6.29	0.00	18.60
Upstrm	49.33	32	51.96	53.22	8.75	9.02	3.80	9.37

Drainage area (ac)	= 0.00	Slope of invert (%)	= 1.100
Runoff coefficient (C)	= 0.00	Slope energy grade line (%)	= 0.414
Time of conc. (min)	= 4.59	Critical depth (in)	= 32
Inlet Time (min)	= 0.00	Natural ground elev. (ft)	= 62.70
Intensity @ 10 yr (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C x A	= 0.00	Additional Q (cfs)	= 0.00
Q = CA x I (cfs)	= 0.00	Full-flow capacity (cfs)	= 150.66
Q Catchment (cfs)	= 0.00	Inlet Type	= MH
Q Carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.00
Q Captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.00
Q Bypassed to offsite	= 0.00	Width of Flow (ft)	= 0.00

48" RCP

Line 2 Q = 79.00 **Size = 48 x 48 (Cir)** **Nv = 0.013** **Len = 425.0** **JLC = 1.00**

26+00 to 21+75 / Downstream line = 1

	Invert	Depth	HGL	EGL	Area	Vel	T-Wid	Cover
Dnstrm	49.43	46	53.22	53.86	12.32	6.41	3.90	9.27
Upstrm	50.71	43	54.31	54.99	11.92	6.63	2.39	9.69

Drainage area (ac)	= 0.00	Slope of invert (%)	= 0.300
Runoff coefficient (C)	= 0.00	Slope energy grade line (%)	= 0.265
Time of conc. (min)	= 3.50	Critical depth (in)	= 32
Inlet Time (min)	= 0.00	Natural ground elev. (ft)	= 64.40
Intensity @ 10 yr (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C x A	= 0.00	Additional Q (cfs)	= 0.00
Q = CA x I (cfs)	= 0.00	Full-flow capacity (cfs)	= 78.68
Q Catchment (cfs)	= 0.00	Inlet Type	= MH
Q Carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.00
Q Captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.00
Q Bypassed to 1 (cfs)	= 0.00	Width of Flow (ft)	= 0.00

Line 3 **Q = 12.00** **Size = 36 x 36 (Cir)** **Nv = 0.013** **Len = 330.0** **JLC = 1.00**

18+45 to 21+75 / Downstream line = 2

	Invert	Depth	HGL	EGL	Area	Vel	T-Wid	Cover
Dnstrm	50.71	36	54.99	55.03	7.07	1.70	0.00	10.69
Upstrm	51.71	36	55.10	55.14	7.07	1.70	0.00	10.79

Drainage area (ac)	= 0.00	Slope of invert (%)	= 0.305
Runoff coefficient (C)	= 0.00	Slope energy grade line (%)	= 0.032
Time of conc. (min)	= 0.26	Critical depth (in)	= 13
Inlet Time (min)	= 0.00	Natural ground elev. (ft)	= 65.50
Intensity @ 10 yr (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.39
Cumulative C x A	= 0.00	Additional Q (cfs)	= 0.00
Q = CA x I (cfs)	= 0.00	Full-flow capacity (cfs)	= 36.81
Q Catchment (cfs)	= 0.00	Inlet Type	= MH
Q Carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.00
Q Captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.00
Q Bypassed to 2 (cfs)	= 0.00	Width of Flow (ft)	= 0.00

Line 4 **Q = 63.00** **Size = 42 x 42 (Cir)** **Nv = 0.013** **Len = 24.0** **JLC = 1.00**

21+75 CB / Downstream line = 2

	Invert	Depth	HGL	EGL	Area	Vel	T-Wid	Cover
Dnstrm	52.21	33	54.99	55.91	8.19	7.69	3.12	8.69
Upstrm	59.00	29	61.43	62.64	7.13	8.84	3.23	1.90

Drainage area (ac)	= 0.00	Slope of invert (%)	= 28.292
Runoff coefficient (C)	= 0.00	Slope energy grade line (%)	= 28.062
Time of conc. (min)	= 0.00	Critical depth (in)	= 29
Inlet Time (min)	= 0.00	Natural ground elev. (ft)	= 64.40
Intensity @ 10 yr (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C x A	= 0.00	Additional Q (cfs)	= 63.00
Q = CA x I (cfs)	= 0.00	Full-flow capacity (cfs)	= 535.13
Q Catchment (cfs)	= 0.00	Inlet Type	= KnCap
Q Carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.01
Q Captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.02
Q Bypassed to 2 (cfs)	= 0.00	Width of Flow (ft)	= 0.00

Line 5 **Q = 4.00** **Size = 18 x 18 (Cir)** **Nv = 0.013** **Len = 64.0** **JLC = 1.00**

26+75 CB / Downstream line = 2

	Invert	Depth	HGL	EGL	Area	Vel	T-Wid	Cover
Dnstrm	53.21	18	54.99	55.07	1.77	2.26	0.00	9.69
Upstrm	59.00	9	59.76	60.07	0.90	4.43	1.50	3.90

Drainage area (ac)	= 0.00	Slope of invert (%)	= 9.047
Runoff coefficient (C)	= 0.00	Slope energy grade line (%)	= 7.810
Time of conc. (min)	= 0.00	Critical depth (in)	= 9
Inlet Time (min)	= 0.00	Natural ground elev. (ft)	= 64.40
Intensity @ 10 yr (in/hr)	= 0.00	Upstream surcharge (ft)	= 0.00
Cumulative C x A	= 0.00	Additional Q (cfs)	= 4.00
Q = CA x I (cfs)	= 0.00	Full-flow capacity (cfs)	= 31.59
Q Catchment (cfs)	= 0.00	Inlet Type	= KnCap
Q Carryover (cfs)	= 0.00	Gutter slope (ft/ft)	= 0.00
Q Captured (cfs)	= 0.00	Cross slope (ft/ft)	= 0.02
Q Bypassed to 2 (cfs)	= 0.00	Width of Flow (ft)	= 0.00

DEPARTMENT OF PUBLIC WORKS

Mayor:
OSCAR B. GOODMAN

Councilmen:
MICHAEL J. McDONALD
GARY REESE
LARRY BROWN
LYNETTE B. McDONALD
LAWRENCE WEEKLY
MICHAEL MACK

City Manager:
VIRGINIA VALENTINE

Director of Public Works:
RICHARD D. GOECKE

City Engineer:
Charles Kajkowski, Jr., P.E.

REVIEWED BY:

5-16-2000
City Engineer Date

5/12/00
Engineering Design Superintendent Date

5/11/00
Regional Transportation Commission of Clark County Date

Nevada Power Company Date

1-27-00
Southwest Gas Corporation Date

1/28/00
Sprint Central Telephone Company Date

Bonnie Aff Apt. 1, 21-36, 39-46, 52, 54, 60, 66-74, 4/04/00
Las Vegas Valley Water District 72, 94 Date

Terry Lompa HFC Conduit 1/28/00
Cox Communication Las Vegas, Inc. Date

JONES BOULEVARD IMPROVEMENT PROJECT

FROM RANCHO DRIVE TO CENTENNIAL PARKWAY

FUNDED BY: CITY OF LAS VEGAS
REGIONAL TRANSPORTATION COMMISSION OF CLARK COUNTY
SPECIAL IMPROVEMENT DISTRICT 1471 CITY OF LAS VEGAS
SPECIAL IMPROVEMENT DISTRICT 120 CLARK COUNTY

BID NUMBER: 00-1730-02

27716

DATE | REVISIONS
DRAWN BY DRF | CHECKED BY TEP
DESIGNED BY SGW | DATE: 01.25.00
JOB NUMBER 99009 | SHEET #1

POGGEMEYER DESIGN GROUP
ENGINEERS SURVEYORS PLANNERS
LANDSCAPE ARCHITECTS
2260 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 233-9700

DEPARTMENT OF PUBLIC WORKS
PROJECT: JONES BOULEVARD IMPROVEMENT PROJECT FROM RANCHO DRIVE TO CENTENNIAL PARKWAY
SHEET: COVER SHEET
DRAWING NO. 1 | 1/94

107-V3050

WATER NOTES

LAS VEGAS VALLEY WATER DISTRICT STANDARD NOTES
LVVWD PROJECT # 21729

1. NO WORK SHALL BEGIN UNTIL THE WATER PLANS HAVE BEEN RELEASED FOR CONSTRUCTION BY THE LVVWD. FOLLOWING WATER PLAN APPROVAL, FORTY-EIGHT (48) HOURS NOTICE SHALL BE GIVEN TO THE LVVWD CUSTOMER SERVICE DEPARTMENT (258-7171) PRIOR TO THE START OF CONSTRUCTION. NOTICE MUST BE GIVEN BY 2:00 PM, THE BUSINESS DAY PRIOR TO A LVVWD INSPECTION. WHEN REQUESTING INSPECTIONS PLEASE REFER TO THE PROJECT # IDENTIFIED ABOVE.
2. ALL WORK SHALL CONFORM TO LVVWD STANDARD PLATES, DRAWINGS, AND SPECIFICATIONS, LATEST EDITION AND THE UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR WATER DISTRIBUTION SYSTEMS (UDACS), LATEST EDITION.
3. ALL WORK, EXCEPT AS MODIFIED BY THESE PLANS OR BY NOTE 2, SHALL BE DONE IN ACCORDANCE WITH THE MOST CURRENT DRAFT OR EDITION OF THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFFSITE IMPROVEMENT, CLARK COUNTY AREA.
4. A SINGLE PIPE MATERIAL SHALL BE USED THROUGHOUT THE PROJECT UNLESS OTHERWISE APPROVED BY THE LVVWD.
5. ALL SERVICE LATERALS TWO (2) INCHES IN DIAMETER AND SMALLER SHALL BE A COPPER TUBING WITH LVVWD APPROVED SERVICE SADDLES.
6. ALL WATER METER BOXES SHALL BE LOCATED OUTSIDE OF DRIVEWAY AREAS.
7. ALL VALVES SHALL BE LOCATED OUTSIDE OF DRIVEWAYS, VALLEY AND CURB GUTTERS.
8. THE FOLLOWING REQUIREMENTS MUST BE MET IN THE EVENT A WATER LINE AND SANITARY OR STORM SEWER LINE CROSS:

   A MINIMUM EIGHTEEN (18) INCH VERTICAL SEPARATION (OUTSIDE TO OUTSIDE) MUST BE MAINTAINED WHEN THE WATER LINE IS INSTALLED OVER THE SANITARY OR STORM SEWER LINE. IF THE VERTICAL SEPARATION CANNOT BE MAINTAINED OR THE WATER LINE MUST BE PLACED UNDER THE SANITARY OR STORM SEWER LINE, THE SANITARY OR STORM SEWER LINE MUST BE CONSTRUCTED WITH ONE OF THE FOLLOWING OR, AS SHOWN ON THESE PLANS:

   A. POTABLE WATER SUPPLY QUALITY MATERIAL.
   B. ENCASEMENT, WITH FOUR (4) INCH CONCRETE (MINIMUM).
   C. SLEEVING WITH POTABLE WATER SUPPLY QUALITY PIPE.

   EACH PROVISION MUST EXTEND ALONG THE SANITARY OR STORM SEWER, ON EITHER SIDE OF THE MAIN, A MINIMUM TEN (10) FOOT DISTANCE PERPENDICULAR TO THE WATER MAIN EXTERIOR.
9. WARNING TAPE SHALL BE REQUIRED OVER ALL MAINS, ALL SIX (6) INCH DIAMETER AND LARGER SERVICE LATERALS, AND ANY SERVICE LATERAL NOT INSTALLED PERPENDICULAR TO THE MAIN IN ACCORDANCE WITH STANDARD PLATE NO. 27.
10. ALL WATER FACILITIES SHALL BE FILLED, DISINFECTED, PRESSURE TESTED, FLUSHED, FILLED AND AN ACCEPTABLE WATER SAMPLE OBTAINED, PRIOR TO CONNECTION TO THE LVVWD'S DISTRIBUTION SYSTEM.
11. THE CONTRACTOR MUST OBTAIN ALL METERS TWO (2) INCHES AND SMALLER FROM LVVWD CENTRAL STORES. TELEPHONE 258-3152 FORTY-EIGHT (48) HOURS PRIOR TO PICK UP.
12. CONSTRUCTION MAY INTERRUPT SERVICE, WITH LVVWD APPROVED AND PROPER NOTIFICATION, BETWEEN THE HOURS OF 10 PM AND 6 AM, SUNDAY THROUGH THURSDAY. CIRCUMSTANCES MAY REQUIRE TEMPORARY SERVICE FEED BE INSTALLED WITHOUT LVVWD REIMBURSEMENT. ANY TEMPORARY SERVICE FEED MUST HAVE PRIOR LVVWD APPROVAL.
13. ALL WATER FACILITY CONSTRUCTION MATERIALS USED MUST BE AS LISTED ON THE LVVWD'S APPROVED MATERIALS AND MANUFACTURERS LISTING FOR NEW FACILITIES, LATEST REVISION, OR SPECIFICALLY APPROVED ON THESE PLANS.

RELOCATION OF FIRE HYDRANTS (EXTENSION OF EXISTING LATERAL)

THE CONTRACTOR SHALL REMOVE AND RELOCATE BOTH THE UPPER AND LOWER BARRELS OF THE EXISTING FIRE HYDRANT(S) WHERE SHOWN, EXTEND THE EXISTING LATERAL AS REQUIRED, AND REINSTALL SUCH HYDRANT(S) AT THE NEW LOCATION'S) INDICATED. RELOCATIONS WHERE THE LATERAL CANNOT BE EXTENDED SHALL BE TREATED AS NEW INSTALLATION.

NOTE:

CONTRACTOR SHALL ABANDON THE OUTLETS AT THE CONNECTION TO THE ACTIVE MAIN IN ACCORDANCE WITH THE DISTRICT'S STANDARDS AND AT THE CONTRACTOR'S EXPENSE.

ABANDONMENT OF EXISTING SERVICE(S)- 2" AND SMALLER

THE CONTRACTOR SHALL NOTIFY THE INSPECTION DIVISION AT THE LVVWD (702-258-3227) 48 HOURS PRIOR TO THE REQUESTED REMOVAL TIME TO ALLOW THE DISTRICT TO TAKE THE FINAL METER READING OF THE METER. AFTER THE FINAL READING, THE EXISTING METER(S) SHALL BE REMOVED AND DELIVERED TO THE DISTRICT. THE CONTRACTOR MAY THEN BEGIN REMOVAL PROCEDURES FOR THE AFFECTED SERVICE AS FOLLOWS:

EXISTING SERVICE LATERALS THAT ARE TO BE ABANDONED FROM THE EXISTING WATER MAIN, SHALL HAVE THE CORPORATION STOP TURNED OFF AT THE MAIN, A MINIMUM OF 12" OF THE LATERAL CUT OUT NEAR THE CORPORATION STOPS AND A BRASS CAP INSTALLED ON THE CORPORATION STOP. IF THE CORPORATION STOP IS DAMAGED BEYOND REPAIR OR PULLED FROM THE EXISTING WATER MAIN, THE MAIN SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, IN A MANNER APPROVED BY THE LVVWD. IF THE CORPORATION STOP IS NOT WATER TIGHT, THE CONTRACTOR SHALL NOTIFY LVVWD COMMUNICATION SUPPORT CENTER (702-258-7171) FOR FURTHER DIRECTION.

THE CONTRACTOR SHALL REMOVE THE EXISTING SERVICE METER BOX AND APPURTENANCES. FILL AND GRADE ANY AND ALL RESULTING VOIDS AND REPLACE OR RESTORE TO ORIGINAL CONDITIONS OR BETTER, ALL LANDSCAPING, IRRIGATION SYSTEMS, CONCRETE, SIDEWALKS, ASPHALT, OR ANY OTHER ITEMS DAMAGED OR REMOVED DURING THE REMOVAL OF THE EXISTING SERVICE METER BOX.

EXTEND SERVICE LATERALS 2" AND SMALLER

WATER METERS IN FINISHED ROADWAYS SHALL BE RELOCATED TO BACK OF CURB AND SHALL BE INSTALLED PER THE UDACS PLATE NO. 1B OR 1D. ALL SERVICE LATERALS 2" AND SMALLER MAY BE EXTENDED, PROVIDED THE FOLLOWING CRITERIA ARE MET:

1. LATERAL CAN ONLY BE EXTENDED IF CONNECTING TO COPPER.
2. LATERAL MUST BE INSTALLED AT 90 DEGREES TO THE MAIN.
3. AN EXISTING SERVICE LATERAL THAT IS NOT COPPER IS TO BE ABANDONED FROM THE EXISTING WATER MAIN, AND REPLACED WITH A COPPER SERVICE LATERAL PER UDACS PLATE NO. 1B OR 1D. IF THE CORPORATION STOP IS DAMAGED BEYOND REPAIR OR PULLED FROM THE EXISTING WATER MAIN, THE MAIN SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, IN A MANNER APPROVED BY THE LVVWD. IF THE CORPORATION STOP IS NOT WATER TIGHT, THE CONTRACTOR SHALL NOTIFY LVVWD COMMUNICATION SUPPORT CENTER (702-258-7171) FOR FURTHER DIRECTION.

   THE CONTRACTOR SHALL INSTALL A NEW SERVICE OF LIKE SIZE ADJACENT TO THE DAMAGED SERVICE IN ACCORDANCE WITH UDACS PLATE NO. 1B OR 1D.

RECONNECT SERVICE LATERALS 2" AND SMALLER

ALL SERVICE LATERALS 2" AND SMALLER THAT ARE CUT OR DAMAGED MAY BE RECONNECTED, PROVIDED THE FOLLOWING CRITERIA ARE MET:

1. IF THE LATERAL IS COPPER, THE LATERAL MAY BE CUT AND SPLICED NOT MORE THAN ONCE IN A MANNER APPROVED BY THE DISTRICT.
2. IF THE LATERAL IS NOT COPPER, THE LATERAL MUST BE ABANDONED FROM THE EXISTING WATER MAIN, AND REPLACED WITH A COPPER SERVICE LATERAL PER UDACS PLATE NO. 1B OR 1D. IF THE CORPORATION STOP IS DAMAGED BEYOND REPAIR OR PULLED FROM THE EXISTING WATER MAIN, THE MAIN SHALL BE REPAIRED AT THE CONTRACTOR'S EXPENSE, IN A MANNER APPROVED BY THE LVVWD. IF THE CORPORATION STOP IS NOT WATER TIGHT, THE CONTRACTOR SHALL NOTIFY LVVWD COMMUNICATION SUPPORT CENTER (702-258-7171) FOR FUTURE DIRECTION.

THE CONTRACTOR SHALL INSTALL A NEW SERVICE OF LIKE SIZE ADJACENT TO THE DAMAGED SERVICE IN ACCORDANCE WITH UDACS PLATE NO. 1B OR 1D.

EXTEND TEST STATIONS

THE FOLLOWING IS REQUIRED IN ORDER TO RELOCATE THE CORROSION TEST STATION.

1. EXPOSE THE TEST STATION AND LABEL ALL LEADS ACCORDING TO THE ENCLOSED DRAWING.
2. THE LEADS THAT ARE CONNECTED TO THE PIPE REQUIRE #6 COPPER WIRE WITH A HMWPE JACKET SUCH AS RAYCHEM PERMARAD.
3. THE LEAD THAT IS CONNECTED TO THE REFERENCE CELL REQUIRES #14 COPPER WIRE WITH A HMWPE JACKET SUCH AS RAYCHEM PERMARAD.
4. CONNECT THE TWO WIRES TO BE SPLICED WITH A COPPER BUTT CONNECTION USING A PROPER CRIMPING TOOL.
5. MAKE EACH SPLICE USING A SCOTCHCAST RESIN SPLICING KIT, DURO-CAST UNIVERSAL SPLICE KIT OR RAYCHEM ANODE SPLICE ENCAPSULATION KIT, SIMILAR TO THE ONES USED BY THE PHONE COMPANY TO SPLICE THEIR CABLES.
6. RECONNECT THE TEST BOARD TO PROPER LEADS AND PLACE THE TEST BOX AT THE NEW SITE.

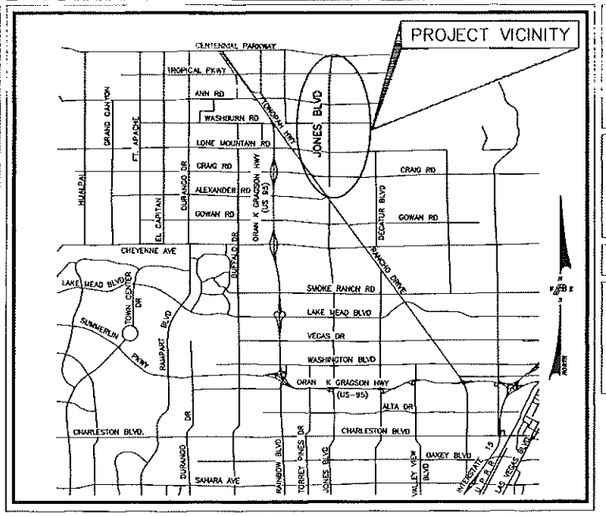
Bonnie Croft — LVVWD
4-4-00 — DATE

DEVIATIONS FROM STANDARDS

ITEM:

MINIMUM LONGITUDINAL CENTERLINE GRADE FOR STREETS SHALL BE 0.4%. BETWEEN STA 22+47.92 THRU STA 28+48.98 = 0.35%, STA 35+90 THRU STA 38+50 = 0.39%, STA 55+00 THRU STA 59+50 = 0.36%, STA 59+50 THRU STA 64+00 = 0.34%, STA 64+00 THRU STA 72+00 = 0.35%, STA 113+00 THRU STA 117+00 = 0.15%, STA 117+00 THRU STA 122+00 = 0.16%, STA 122+00 THRU STA 125+50 = 0.26%, STA 125+50 THRU STA 130+50 = 0.30%, STA 130+50 THRU STA 139+00 = 0.39%, STA 139+00 THRU STA 147+00 = 0.34%, STA 147+50 THRU STA 153+50 = 0.35%, STA 153+50 THRU STA 160+00 = 0.18%, STA 160+00 THRU STA 167+89.91 = 0.11% DEVIATED FROM STANDARD.

VICINITY MAP



CLV GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA", LATEST ISSUE; THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA NEVADA", LATEST REVISED EDITION; THE "SUMMERLIN IMPROVEMENT STANDARDS" FOR WORK IN THE SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON SHEET C2 AS "DEVIATIONS FROM STANDARDS".
2. THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCES WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.
3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER AND OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.
4. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS, ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.
5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3600 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGNS TO BE APPROVED BY THE CITY, PRIOR TO THE USE ON THE PROJECT.
6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.
7. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 300' IN EXTRUDED-TYPE CURB.
8. AC PAVEMENT TO BE ONE-HALF INCH (1/2") ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS AND CROSS GUTTERS.
9. CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY OF LAS VEGAS SHALL BE REMOVED AND REPLACED PER STANDARD DRAWING 216.
10. SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD DRAWING 235. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.
11. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE AS SHOWN ON PLANS.
12. ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY THE SOILS ENGINEER APPROVED BY THE CITY ENGINEER, AND AS SHOWN ON THESE PLANS.
13. EXACT LOCATION OF ALL SAWCUT LINES MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS ENGINEER IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATIONS.
14. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. STATURE NO. 625.550.
15. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC., SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY AND THE CITY ENGINEER.
16. WALL NOTES:
17. ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS; FLOOD CONTROL AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPARATE PERMIT AND INSPECTION BY THE BUILDING DEPARTMENT.
18. ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHT-OF-WAY.
19. CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, AND SEWER CLEAN OUTS ETC. TO FINISH GRADE AS APPLICABLE WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.
20. MATERIALS, HANDLING AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF NDOT OR THE CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND THE PLANS AND DETAILS SHOWN HEREON.

BASIS OF BEARINGS

THE EAST LINE OF NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., HAVING A BEARING OF NORTH 00°38'45" WEST PER PROJECT CONTROL PERFORMED FOR THE CITY OF LAS VEGAS BY CARTER & BURGESS & BURGESS (HAVING AZIMUTH = 359°21'15"), DATED MARCH 19, 1998.

BASIS OF ELEVATION

CITY OF LAS VEGAS BENCHMARK SLV00 2E4, RIVET & PLATE IN TOP OF CURB, NW RETURN JONES BLVD. AND CRAIG ROAD, NAVD 88 (REVISED) 689.3651M, 2261.69 FT.
NOTE: THE ABOVE REFERENCED BENCHMARK IS NOT PUBLISHED. THE CITY OF LAS VEGAS SURVEY DEPARTMENT FURNISHED THE ELEVATION PER A REVISED BENCH RUN DUE TO SUBSIDENCE IN THE AREA OF THIS SURVEY. THE DATA WILL BE PUBLISHED AT A LATER DATE.

UTILITY NOTE:

EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATIONS.
"CALL BEFORE YOU DIG: 1(800)227-2600."

Call before you Dig. 1-800-227-2600

NO.	DATE	REVISION

ANY INFORMATION OR DATA ON THIS DRAWING IS NOT RELIABLE IN CASE IT IS USED BY ANY PERSON OR FOR ANY PURPOSE NOT EXPRESSLY AUTHORIZED IN WRITING BY POGGEMEYER DESIGN GROUP, AND POGGEMEYER DESIGN GROUP ASSUMES NO RESPONSIBILITY WHATSOEVER IN CONNECTION THEREWITH. ANY SUCH USE OR REUSE WITHOUT SUCH AUTHORIZATION SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO POGGEMEYER DESIGN GROUP, AND THE USER SHALL INDEMNIFY AND HOLD HARMLESS POGGEMEYER DESIGN GROUP FROM ALL CLAIMS, DAMAGES, LOSSES AND EXPENSES ARISING OUT OF OR RESULTING THEREFROM.

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2501 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

JONES BLVD. IMPROVEMENT PROJECT
RANCHO DR. TO CENTENNIAL PKWY.

INFORMATION SHEET
JONES BOULEVARD

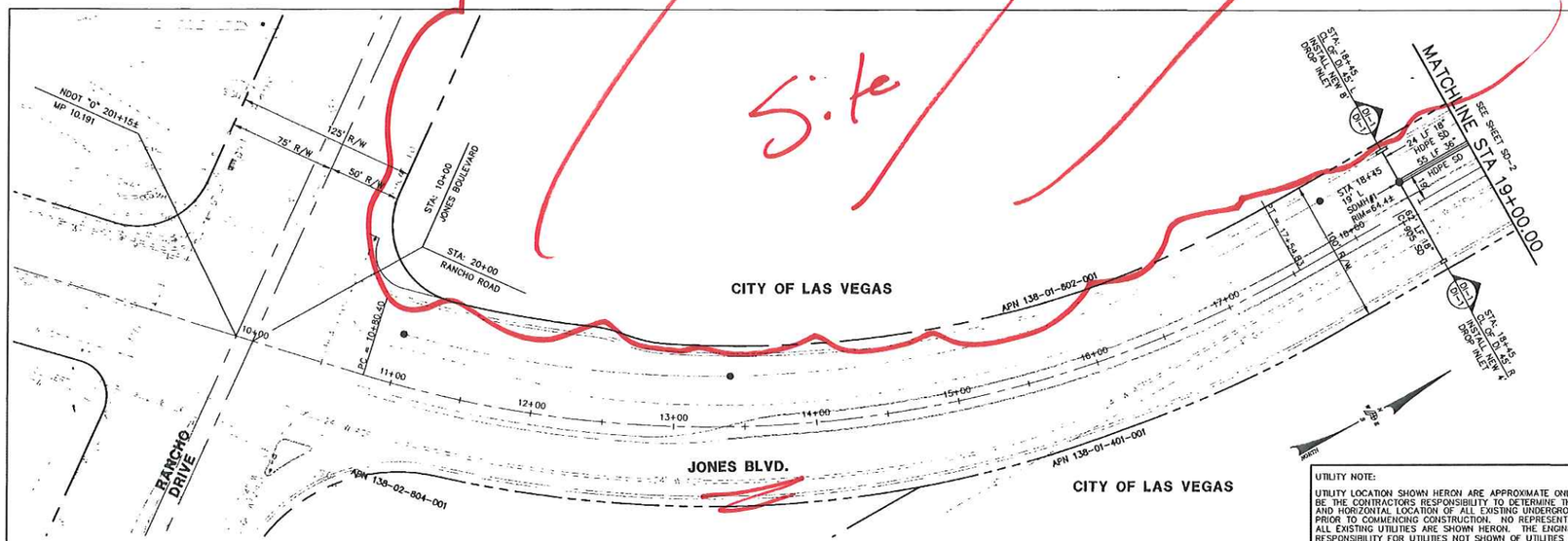
JOB NUMBER	98009
DESIGNED BY	SWG
DRAWN BY	BCK
CHECKED BY	TEP
DATE	03.28.00
SHEET NUMBER	2

2 OF 94

27717

107-V3050

Site



PLAN – JONES BOULEVARD

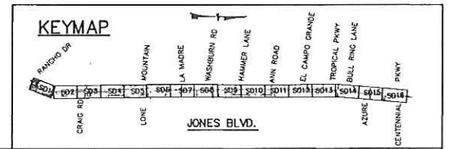
GRAPHIC SCALE

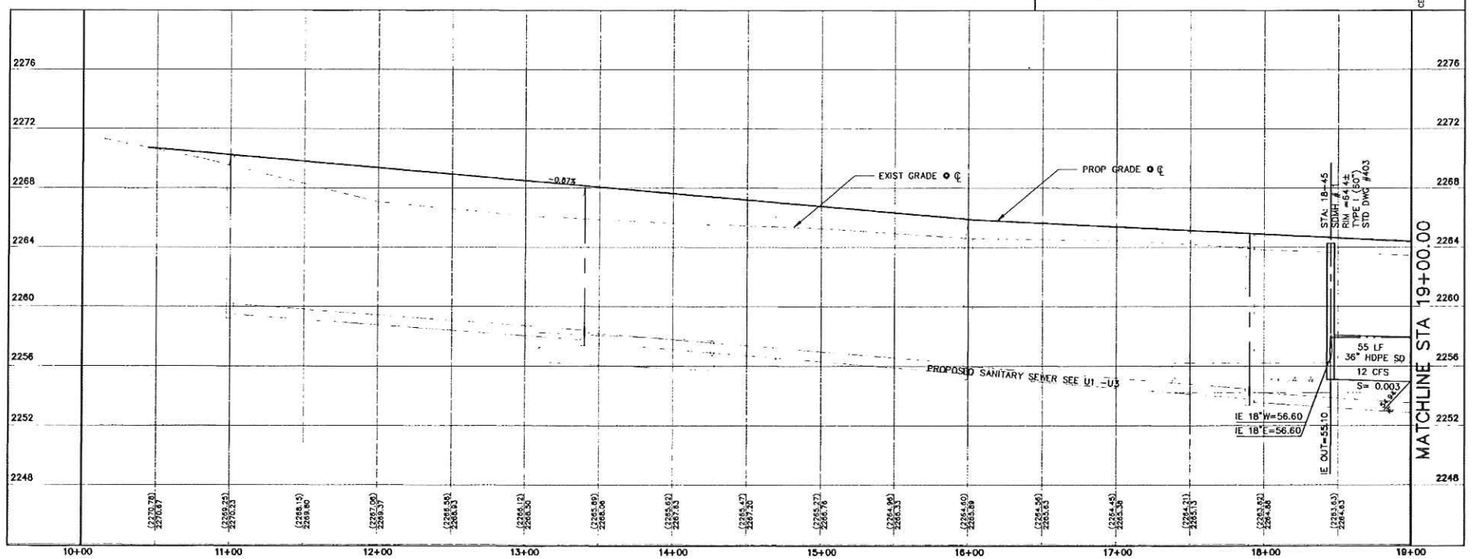
(IN FEET)
1 inch = 40 ft.

UTILITY NOTE:

UTILITY LOCATION SHOWN HERON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OF UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

KEYMAP





PROFILE

1" = 40' H
1" = 4' V

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

ANY INFORMATION OR DATA ON THIS DRAWING IS NOT INTENDED TO BE SUITABLE FOR REUSE BY ANY PARTY ON EXTENSIONS OF THIS PROJECT OR ON ANY OTHER PROJECT. ANY REUSE, WITHOUT WRITTEN VERIFICATION OR ADAPTATION BY THE ENGINEER FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO THE ENGINEER

DATE	REVISION

JONES BLVD. IMPROVEMENT PROJECT
RANCHO DR. TO CENTENNIAL PKWY.

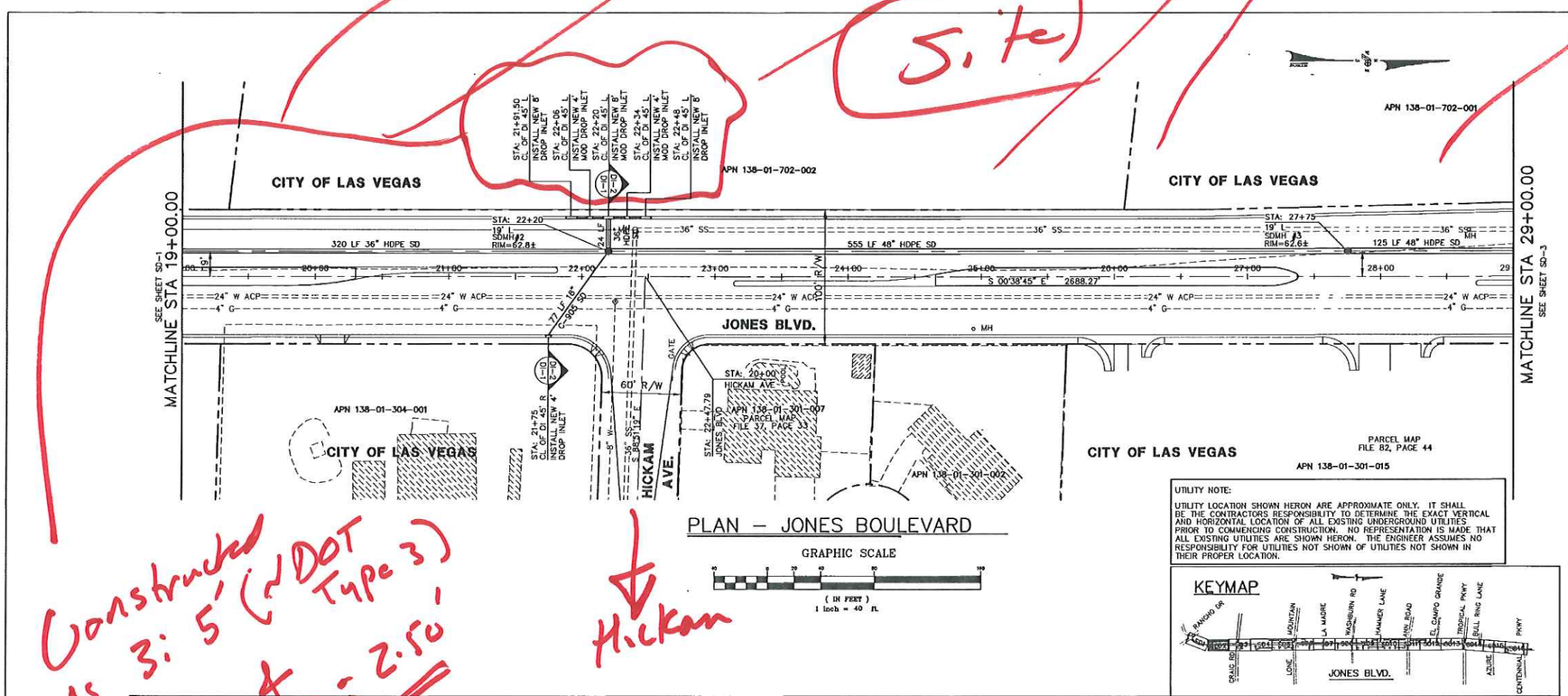
STORM DRAIN PLAN AND PROFILE
JONES BOULEVARD
STA 10+00 TO 19+00

JOB NUMBER	98009
DESIGNED BY	SLW
DRAWN BY	BCK
CHECKED BY	TEP
DATE	1.25.00
SHEET NUMBER	SD-1
	50 of 94

Call before you Dig. 1-800-227-2600

27765

107-V3050

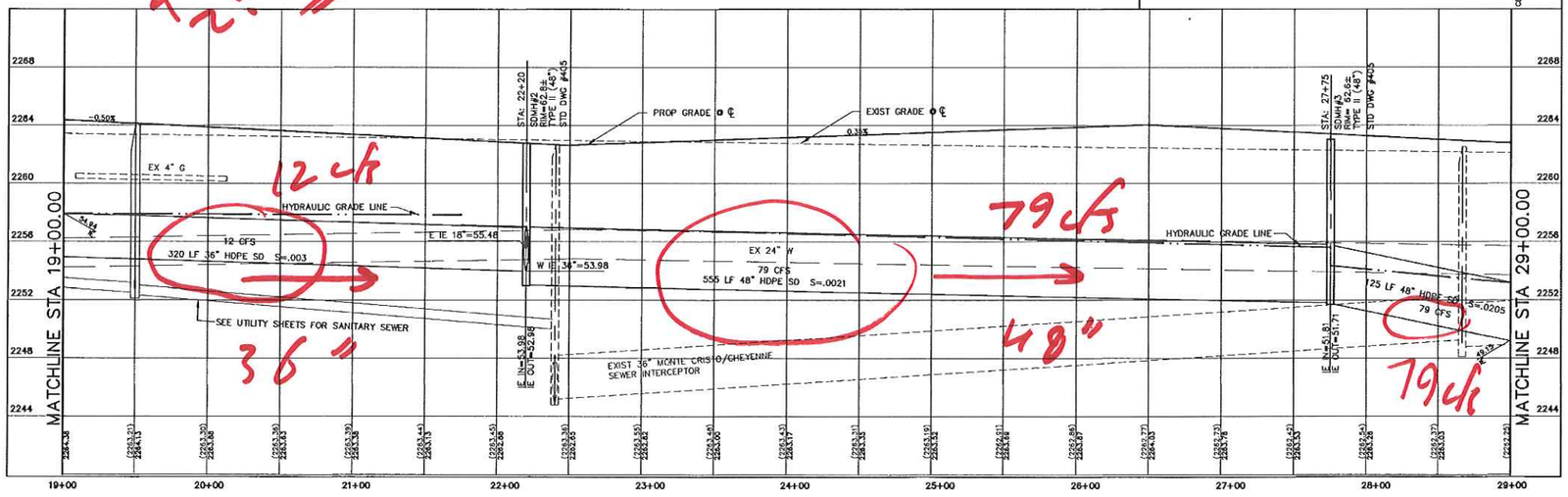


PLAN – JONES BOULEVARD

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

KEYMAP



PROFILE

1" = 40' H
1" = 4' V

Call before you Dig. 1-800-227-2600

Constructed as 3: 5' (nDOT Type 3) 4 2-2.50'

Hickam

27766

UTILITY NOTE:

UTILITY LOCATION SHOWN HERON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OF UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

ANY INFORMATION OR DATA ON THIS DRAWING IS NOT INTENDED TO BE SUITABLE FOR REUSE BY ANY PARTY ON EXTENSIONS OF THIS PROJECT OR ON ANY OTHER PROJECT. FOR ANY REUSE WITHOUT WRITTEN VERIFICATION AND ADAPTATION BY POGGEMEYER DESIGN GROUP, INC. FOR THE SPECIFIC PURPOSE INTENDED WILL BE AT USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO THE ENGINEER.

NO.	DATE	REVISION

POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2501 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

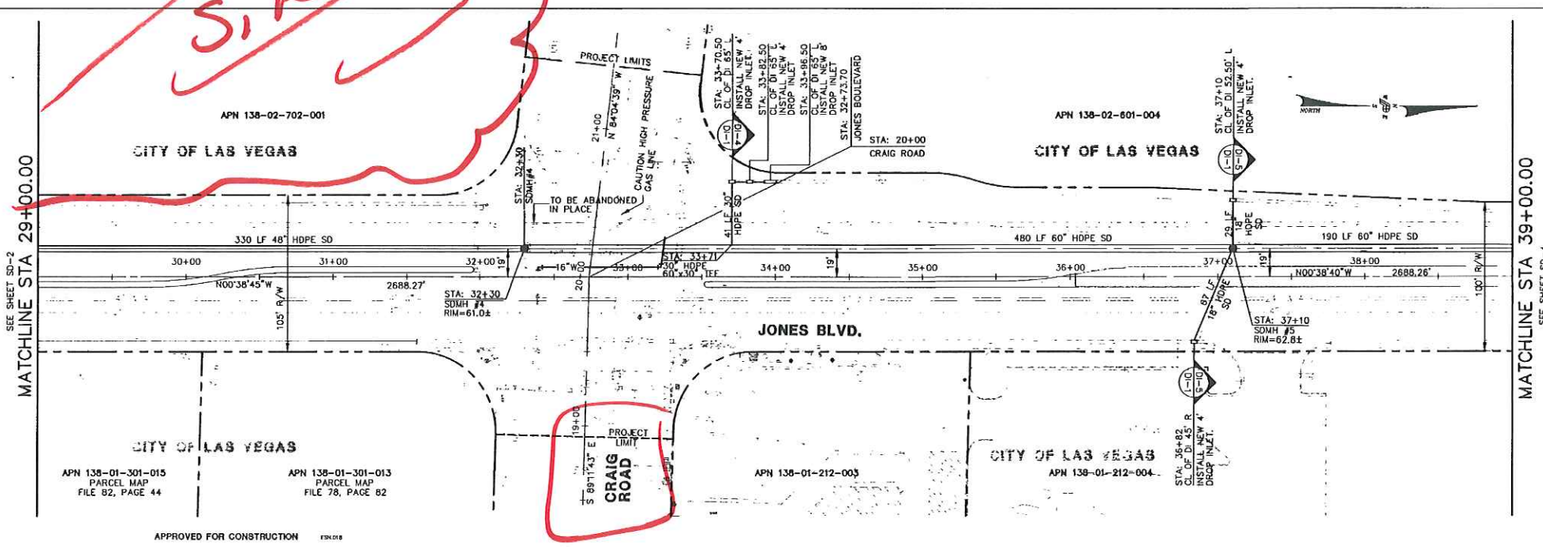
JONES BLVD. IMPROVEMENT PROJECT
RANCHO DR. TO CENTENNIAL PKWY.

STORM DRAIN PLAN AND PROFILE
JONES BOULEVARD
STA 19+00 TO 29+00

JOB NUMBER	98009
DESIGNED BY	SLW
DRAWN BY	BCK
CHECKED BY	TEP
DATE	1.25.00
SHEET NUMBER	SD-2
	51 OF 94

107-V3050

Site



APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT — DATE

UTILITY NOTE:

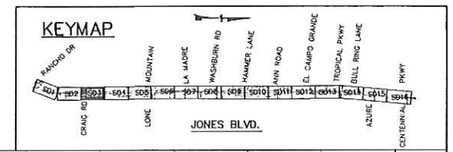
UTILITY LOCATION SHOWN HERON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OF UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

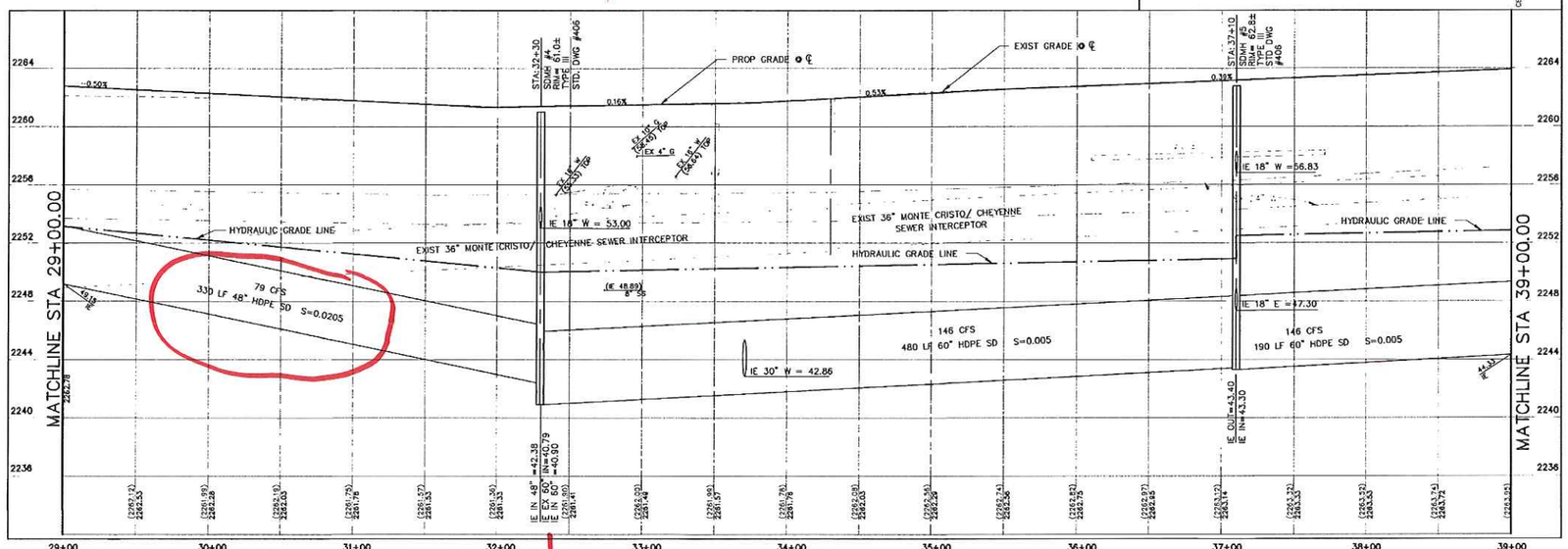
PLAN – JONES BOULEVARD

GRAPHIC SCALE

(IN FEET)
1 inch = 40 ft.

KEYMAP





PROFILE

1" = 40' H
1" = 4' V

27767

107-V3050

ANY INFORMATION OR DATA ON THIS DRAWING IS NOT INTENDED TO BE SUITABLE FOR REUSE BY ANY PERSON, FIRM OR CORPORATION FOR ANY PURPOSE OR EXTENSION OF THE PROJECT OR ANY OTHER PROJECT FOR WHICH IT WAS NOT PREPARED BY POGGEMEYER DESIGN GROUP, INC. ANY SUCH REUSE OR ADAPTATION BY THE ENGINEER FOR THE SPECIFIC PURPOSE INTENDED, SHALL BE AT THE USER'S SOLE RISK AND WITHOUT LIABILITY OR LEGAL EXPOSURE TO THE ENGINEER.

NO.	DATE	REVISION

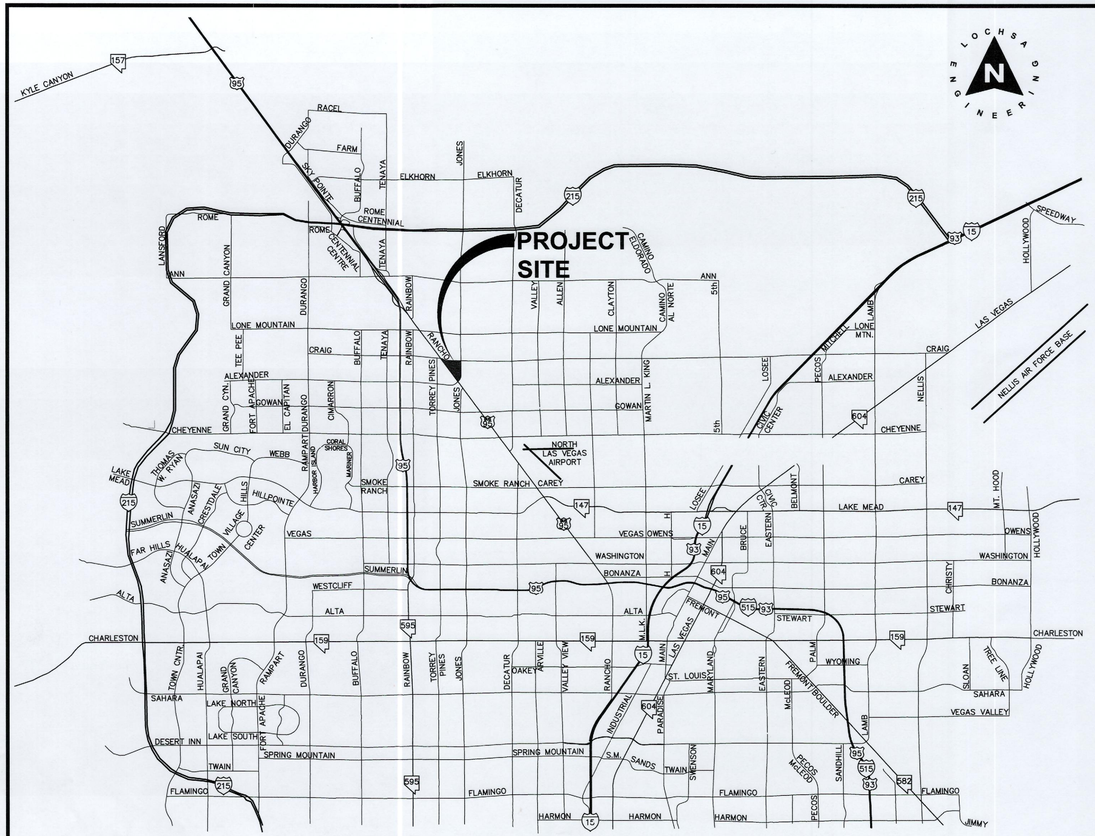
POGGEMEYER DESIGN GROUP
ENGINEERS PLANNERS SURVEYORS
LANDSCAPE ARCHITECTS
2601 NORTH TENAYA WAY LAS VEGAS, NEVADA 89128 (702) 255-8100

JONES BLVD. IMPROVEMENT PROJECT
RANCHO DR. TO CENTENNIAL PKWY

STORM DRAIN PLAN AND PROFILE
JONES BOULEVARD
STA 29+00 TO 39+00

JOB NUMBER	98009
DESIGNED BY	SLW
DRAWN BY	BCK
CHECKED BY	TEP
DATE	03.28.00
SHEET NUMBER	SD-3
	52 of 94

Call before you Dig. 1-800-227-2600



IMPROVEMENT PLANS FOR
CRAIG & RANCHO
MASTER GRADING

A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M, CITY OF LAS VEGAS, NEVADA.
A.P.N.: 138-02-713-002

ABBREVIATIONS

ABAN	ABANDON	INV	INVERT
AIP	ABANDON IN PLACE	ISL	ISLAND
AGG	AGGREGATE	JB	JUNCTION BOX
ALT	ALTERNATE	LOC	LENGTH OF CURB
A	ANODE, GAS	LT	LEFT
ACP	ASBESTOS CEMENT PIPE	LF	LINEAR FEET
ACP	ASPHALTIC CONCRETE	LVVWD	LAS VEGAS VALLEY WATER DISTRICT
AVE	AVENUE	MH	MANHOLE
BC	BACK OF CURB	MAX	MAXIMUM
BCR	BACK OF CURB RADIUS	MIN	MINIMUM
BVC	BEGINNING OF VERTICAL CURVE	MON	MONOLITHIC
BM	BENCHMARK	N/O	NORTH OF
BDRY LINE	BOUNDARY LINE	NTS	NOT TO SCALE
CATV	CABLE TELEVISION	OC	ON CENTER
C-C	CENTER TO CENTER	OG	OPEN-GRADED PAVEMENT, ORIGINAL GROUND
CL	CENTERLINE	PVMT	PAVEMENT
CBC	CITY OF BOULDER CITY	PI	POINT OF INTERSECITON
CLV	CITY OF LAS VEGAS	PRC	POINT OF REVERSE CURVE
COH	CITY OF HENDERSON	PC	POINT OF CURVE
CM	CITY OF MESQUITE	PT	POINT OF TANGENCY
CNLV	CITY OF NORTH LAS VEGAS	PCC	POINT OF COMPOUND CURVE
CC	CLARK COUNTY	PCC, CONC	PORTLAND CEMENT CONCRETE
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT	PP	POWER POLE
CO	CLEAN OUT, SEWER	P	POWER
COMM	COMMERCIAL	PL	PROPERTY LINE
CONC, PCC	CONCRETE	PROP	PROPOSED
CONST	CONSTRUCTION OR CONSTRUCT	PB	PULL BOX
COR	CORNER	RP	RADIUS POINT
CMP	CORRUGATED METAL PIPE	R	RADIUS
CSAP	CORRUGATED STEEL ARCH PIPE	RR	RAILROAD
CSP	CORRUGATED STEEL PIPE	REINF	REINFORCED
C&G	CURB & GUTTER	RC	REINFORCED CONCRETE
CIP	CAST IRON PIPE	RCB	REINFORCED CONCRETE BOX
COL	COLUMN	RCP	REINFORCED CONCRETE PIPE
CU YD, CY	CUBIC YARD	RELOC	RELOCATE
CU FT, CF	CUBIC FOOT	RT	RIGHT
CULV	CULVERT	R/W	RIGHT-OF-WAY
CF	CURB FACE	RD	ROAD
DEPT	DEPARTMENT	SS	SANITARY SEWER
DIA	DIAMETER	SHT	SHEET
DWY	DRIVEWAY	S/O	SOUTH OF
DI	DROP INLET	SW	SIDEWALK
ESMT	EASEMENT	SQ FT, SF	SQUARE FOOT
E/O	EAST OF	SQ YD,SY	SQUARE YARD
EP	EDGE OF PAVEMENT	STA	STATION
EO	EDGE OF OIL	SHP	STEEL HIGHPRESSURE PIPE
E	ELECTRIC	SD	STORM DRAIN
EM	ELECTRIC METER	STD	STANDARD
ELEV	ELEVATION	STRUCT	STRUCTURAL OR STRUCTURE
EMBK	EMBANKMENT	SURV	SURVEY
EOR	END OF CURB RETURN	SLT	STREETLIGHT
EC	END OF CURVE	TL	TELEPHONE
EBS	CATHODE PROTECTION BOND STATION	TEMP	TEMPORARY
ETS	CATHODE PROTECTION TEST STATION	TBA	TO BE ADJUSTED
EVC	END OF VERTICAL CURVE	TBR	TO BE REMOVED
EXIST	EXISTING	TC	TOP OF CURB
FT	FEET/FOOT	TP	TOP OF PIPE
FG	FINISH GRADE	TS	TRAFFIC SIGNAL
FA	FIRE ALARM	TSI	TRAFFIC SIGNAL INTERCONNECT
FH	FIRE HYDRANT	TRANS	TRANSITION
FL	FLOW LINE	TYP	TYPICAL
GALV	GLAVANIZED	UG	UNDERGROUND
GM	GAS METER	VAR	VARIABLE
GR	GAS PRESSURE REGULATOR	VERT	VERTICAL
PL-G	PLASTIC GAS	VC	VERTICAL CURVE
SG	STEEL GAS	VG	VALLEY GUTTER
GB	GRADE BREAK	VCP	VITRIFIED CLAY PIPE
GUT	GUTTER	W	WATER
HDWL	HEADWALL	WM	WATER METER
IN	INCH	W/O	WEST OF
INT	INTERSECTION	YD	YARD

DEVELOPER

PARRIS ROBINSON EASTERN LLC
510 CASTILLO STREET
SUITE 320
CONTACT: WILLIAM S. PARRIS
PHONE: (805) 898-2023
FAX: (805) 898-9913

OWNER

PRE RANCHO CRAIG LLC
120 PRESIDENTIAL WAY
WOBURN, MA 01801
CONTACT: WILLIAM S. PARRIS
PHONE: (805) 898-2023

UTILITY PROVIDERS

WATER: . . . . . LAS VEGAS VALLEY WATER DISTRICT
SEWER: . . . . . CITY OF LAS VEGAS
GAS: . . . . . SOUTHWEST GAS CORPORATION
ELECTRIC: . . . . . NV ENERGY
TELEPHONE: . . . . . CENTURYLINK
CABLE TV: . . . . . COX COMMUNICATIONS LAS VEGAS, INC.
TRASH: . . . . . REPUBLIC SILVER STATE DISPOSAL SERVICE

APPROVALS

ALLEN PAVELKA, P.E., #9029 — DATE
CITY ENGINEER

APPROVAL OF THESE PLANS IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS, EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARD. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARDS IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA, NEVADA.

CHRIS KNIGHT, DIRECTOR-BUILDING AND SAFETY — DATE

NOTE:
THIS PLAN CONFORMS TO THE APPLICABLE STANDARDS OF THE PLANNING DEPARTMENT.

LAS VEGAS FIRE AND RESCUE — DATE

LAS VEGAS VALLEY WATER DISTRICT
APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER — DATE
PROJECT NO.

SOUTHWEST GAS CORPORATION — DATE

NV ENERGY — DATE

NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY 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.

COX COMMUNICATIONS LAS VEGAS, INC. — DATE

CENTRAL TELEPHONE COMPANY D.B.A. CENTURYLINK — DATE

THE AFFIXED CENTURYLINK 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.

SHEET INDEX

Sheet List Table

DRAWING NUMBER	SHEET TITLE	SHEET
General		
1	COVER SHEET	C1.01
2	NOTES SHEET	C1.02
Grading Plans		
3	OVERALL GRADING PLAN	C2.00
4	(SHEET 1 OF 6)	C2.01
5	(SHEET 2 OF 6)	C2.02
6	(SHEET 3 OF 6)	C2.03
7	(SHEET 4 OF 6)	C2.04
8	(SHEET 5 OF 6)	C2.05
9	(SHEET 6 OF 6)	C2.06

GENERAL SITE INFORMATION

A.P.N.:
138-02-713-002

BASIS OF BEARINGS:
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:
BENCHMARK NO SLV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG RCAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2600

FAST Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES; EDGE OF PAVEMENT; "A" TYPE CURBS; "L" TYPE CURBS; WALLS; FENCES; AC PAVEMENT; CONCRETE; SPOT ELEVATIONS; SIGNS; MANHOLE W/ DESCRIPTION; MANHOLE DESCRIPTIONS; FIRE HYDRANTS; GATE VALVES; REDUCERS; CLEAN OUTS; UTILITY BOX OR VAULT; BACKWATER VALVES; 100w HPS STREETLIGHTS; 150w HPS STREETLIGHTS; 200w HPS STREETLIGHTS; 250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)
ROW LINE	SCARP LINE	PROPOSED:	2122

Ⓢ = SANITARY SEWER
Ⓓ = STORM DRAIN
Ⓔ = ELECTRICAL
Ⓣ = TELEPHONE

BVC = BACKWATER VALVE CONCRETE
BVV = BACKWATER VALVE VAULT

8/31/2016 1:33 PM
N:\Work\161051\Drawings\Plot Drawings\C-161051-100-Cover

Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone: (702) 365-9312
Fax: (702) 365-9317
www.lochsa.com

REV.:	DATE:	BY:	DESCRIPTION:

SHEET: GENERAL COVER SHEET
TITLE: CRAIG & RANCHO MASTER GRADING

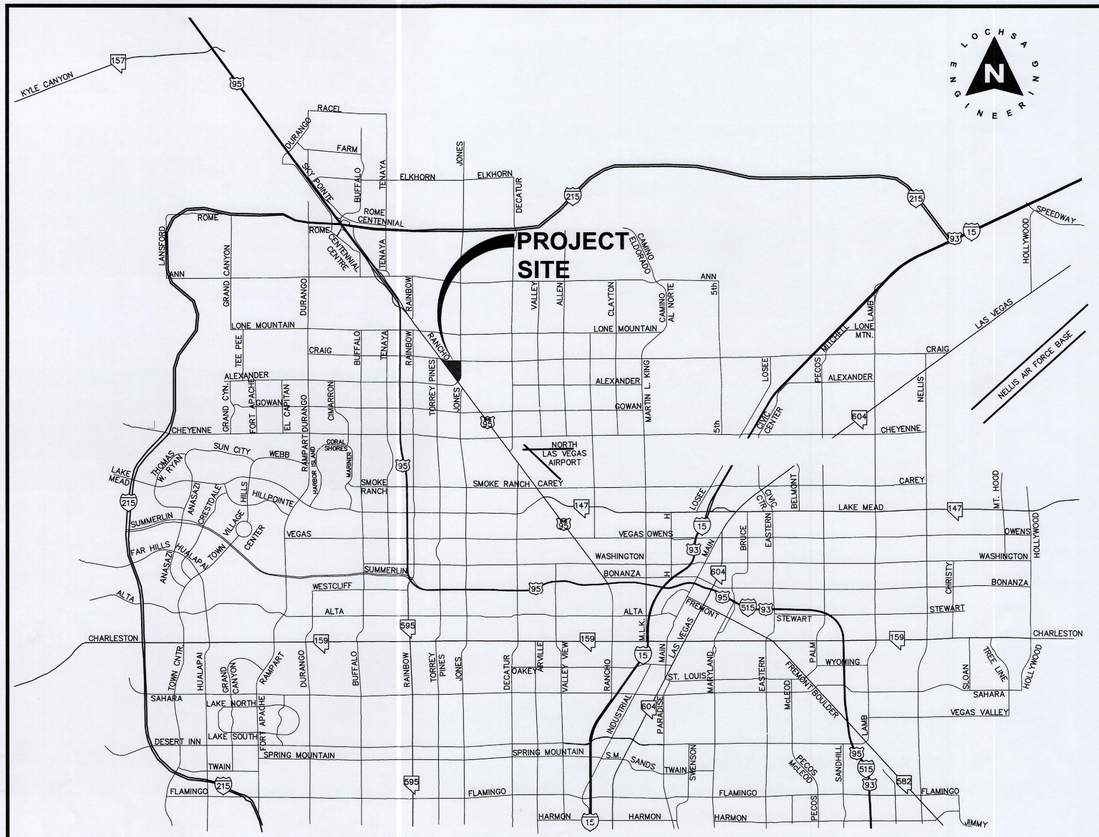
PROJECT No.: 161051
DATE: 4/11/16
SCALE: N/A
DRAWN BY: JLI
DESIGNED BY: JLI
CHECKED BY: TTE

SEAL: PROFESSIONAL ENGINEER - STATE OF NEVADA — TED J. EGERTON — No. 11286 — 12-31-16 — CIVIL

8/31/2016

SHEET No. C1.01
SHEET 1 OF 9

CLV No. 62604



IMPROVEMENT PLANS FOR
CRAIG & RANCHO
MASTER GRADING

A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M, CITY OF LAS VEGAS, NEVADA.
A.P.N.: 138-02-713-002

REV.:	DATE:	BY:	DESCRIPTION:

Lochsa engineering
6345 South Jones Blvd.
Suite 100
Las Vegas, NV 89118
Phone (702) 362-8512
Fax (702) 362-9317
www.lochsa.com

SHEET: GENERAL COVER SHEET
TITLE: CRAIG & RANCHO MASTER GRADING

PROJECT No.: 161051
DATE: 4/11/16
SCALE: N/A
DRAWN BY: JLI
DESIGNED BY: JLI
CHECKED BY: TTE

SEAL
PROFESSIONAL ENGINEER — STATE OF NEVADA
TED EGERTON
Exp. 12-31-16
No. 11286
CIVIL
8/31/2016

SHEET No. C1.01
SHEET 1 OF 9
CLV No. 62604

ABBREVIATIONS

ABAN	ABANDON	INV	INVERT
AIP	ABANDON IN PLACE	ISL	ISLAND
AGG	AGGREGATE	JB	JUNCTION BOX
ALT	ALTERNATE	LOC	LENGTH OF CURB
A	ANODE, GAS	LT	LEFT
ACP	ASBESTOS CEMENT PIPE	LF	LINEAR FEET
ACP	ASPHALTIC CONCRETE	LVVWD	LAS VEGAS VALLEY WATER DISTRICT
AVE	AVENUE	MH	MANHOLE
BC	BACK OF CURB	MAX	MAXIMUM
BCR	BACK OF CURB RADIUS	MIN	MINIMUM
BVC	BEGINNING OF VERTICAL CURVE	MON	MONOLITHIC
BM	BENCHMARK	N/O	NORTH OF
BDRY LINE	BOUNDARY LINE	NTS	NOT TO SCALE
CATV	CABLE TELEVISION	OC	ON CENTER
C-C	CENTER TO CENTER	OG	OPEN--GRADED PAVEMENT, ORIGINAL GROUND
CL	CENTERLINE	PVMT	PAVEMENT
CBC	CITY OF BOULDER CITY	PI	POINT OF INTERSECITON
CLV	CITY OF LAS VEGAS	PRC	POINT OF REVERSE CURVE
COH	CITY OF HENDERSON	PC	POINT OF CURVE
CM	CITY OF MESQUITE	PT	POINT OF TANGENCY
CNLV	CITY OF NORTH LAS VEGAS	PCC	POINT OF COMPOUND CURVE
CC	CLARK COUNTY	PCC, CONC	PORTLAND CEMENT CONCRETE
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT	PP	POWER POLE
CO	CLEAN OUT, SEWER	P	POWER
COMM	COMMERCIAL	PL	PROPERTY LINE
CONC, PCC	CONCRETE	PROP	PROPOSED
CONST	CONSTRUCTION OR CONSTRUCT	PB	PULL BOX
COR	CORNER	RP	RADIUS POINT
CMP	CORRUGATED METAL PIPE	R	RADIUS
CSAP	CORRUGATED STEEL ARCH PIPE	RR	RAILROAD
CSP	CORRUGATED STEEL PIPE	REINF	REINFORCED
C&G	CURB & GUTTER	RC	REINFORCED CONCRETE
CIP	CAST IRON PIPE	RCB	REINFORCED CONCRETE BOX
COL	COLUMN	RCP	REINFORCED CONCRETE PIPE
CU YD, CY	CUBIC YARD	RELOC	RELOCATE
CU FT, CF	CUBIC FOOT	RT	RIGHT
CULV	CULVERT	R/W	RIGHT-OF-WAY
CF	CURB FACE	RD	ROAD
DEPT	DEPARTMENT	SS	SANITARY SEWER
DIA	DIAMETER	SHT	SHEET
DWY	DRIVEWAY	S/O	SOUTH OF
DI	DROP INLET	SW	SIDEWALK
ESMT	EASEMENT	SQ FT, SF	SQUARE FOOT
E/O	EAST OF	SQ YD,SY	SQUARE YARD
EP	EDGE OF PAVEMENT	STA	STATION
EO	EDGE OF OIL	SHP	STEEL HIGHPRESSURE PIPE
E	ELECTRIC	SD	STORM DRAIN
EM	ELECTRIC METER	STD	STANDARD
ELEV	ELEVATION	STRUCT	STRUCTURAL OR STRUCTURE
EMBK	EMBANKMENT	SURV	SURVEY
ECR	END OF CURB RETURN	SLT	STREETLIGHT
EC	END OF CURVE	TL	TELEPHONE
EBS	CATHODE PROTECTION BOND STATION	TEMP	TEMPORARY
ETS	CATHODE PROTECTION TEST STATION	TBA	TO BE ADJUSTED
EVC	END OF VERTICAL CURVE	TBR	TO BE REMOVED
EXIST	EXISTING	TC	TOP OF CURB
FT	FEET/FOOT	TP	TOP OF PIPE
FG	FINISH GRADE	TS	TRAFFIC SIGNAL
FA	FIRE ALARM	TSI	TRAFFIC SIGNAL INTERCONNECT
FH	FIRE HYDRANT	TRANS	TRANSITION
FL	FLOW LINE	TYP	TYPICAL
GALV	GLAVANIZED	UG	UNDERGROUND
GM	GAS METER	VAR	VARIABLE
GR	GAS PRESSURE REGULATOR	VERT	VERTICAL
PL-G	PLASTIC GAS	VC	VERTICAL CURVE
SG	STEEL GAS	VG	VALLEY GUTTER
GB	GRADE BREAK	VCP	VITRIFIED CLAY PIPE
GUT	GUTTER	W	WATER
HDWL	HEADWALL	WM	WATER METER
IN	INCH	W/O	WEST OF
INT	INTERSECTION	YD	YARD

DEVELOPER

PARRIS ROBINSON EASTERN LLC
510 CASTILLO STREET
SUITE 320
CONTACT: WILLIAM S. PARRIS
PHONE: (805) 898-2023
FAX: (805) 898-9913

OWNER

PRE RANCHO CRAIG LLC
120 PRESIDENTIAL WAY
WOBURN, MA 01801
CONTACT: WILLIAM S. PARRIS
PHONE: (805) 898-2023

UTILITY PROVIDERS

WATER: . . . . . LAS VEGAS VALLEY WATER DISTRICT
SEWER: . . . . . CITY OF LAS VEGAS
GAS: . . . . . SOUTHWEST GAS CORPORATION
ELECTRIC: . . . . . NV ENERGY
TELEPHONE: . . . . . CENTURYLINK
CABLE TV: . . . . . COX COMMUNICATIONS LAS VEGAS, INC.
TRASH: . . . . . REPUBLIC SILVER STATE DISPOSAL SERVICE

APPROVALS

ALLEN PAVELKA, P.E., #9029 — DATE
CITY ENGINEER

APPROVAL OF THESE PLANS IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS, EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARD. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARDS IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA, NEVADA.

CHRIS KNIGHT, DIRECTOR-BUILDING AND SAFETY — DATE

NOTE:
THIS PLAN CONFORMS TO THE APPLICABLE STANDARDS OF THE PLANNING DEPARTMENT.

LAS VEGAS FIRE AND RESCUE — DATE

LAS VEGAS VALLEY WATER DISTRICT
APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER — DATE
PROJECT NO.

SOUTHWEST GAS CORPORATION — DATE

NV ENERGY — DATE

NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY 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.

COX COMMUNICATIONS LAS VEGAS, INC. — DATE

CENTRAL TELEPHONE COMPANY D.B.A. CENTURYLINK — DATE

THE AFFIXED CENTURYLINK 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.

SHEET INDEX

Sheet List Table

DRAWING NUMBER	SHEET TITLE	SHEET
General		
1	COVER SHEET	C1.01
2	NOTES SHEET	C1.02
Grading Plans		
3	OVERALL GRADING PLAN	C2.00
4	(SHEET 1 OF 6)	C2.01
5	(SHEET 2 OF 6)	C2.02
6	(SHEET 3 OF 6)	C2.03
7	(SHEET 4 OF 6)	C2.04
8	(SHEET 5 OF 6)	C2.05
9	(SHEET 6 OF 6)	C2.06

GENERAL SITE INFORMATION

A.P.N.:
138-02-713-002

BASIS OF BEARINGS:
THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:
BENCHMARK NO SLV0002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG RCAD AND JONES BOULEVARD. ELEVATION=226'.88 FEET / 689.423 METERS (NAVD 88 DATUM)

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2600

FAST Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU Do OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BC		Ⓢ	Ⓢ = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34 BC			Ⓓ = STORM DRAIN Ⓔ = ELECTRICAL Ⓣ = TELEPHONE						BWV				

8/31/2016 1:32 PM
N:\Jobs\161051\Drawings\Final Drawings\C-161051-100-Cvr.dwg

CITY OF LAS VEGAS STREETLIGHT NOTES

1. ALL STREET LIGHTING INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE STREET LIGHTING PLANS, THE 'UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA', LATEST REVISION, AND THE 'UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA', LATEST REVISION, AND ANY ADOPTED SPECIAL AREA STANDARDS.

2. NO DEVIATION OF STREET LIGHT, PULL BOX, CONDUITS (ETC.) LOCATIONS SHALL BE PERMITTED WITHOUT WRITTEN APPROVAL OF TRAFFIC ENGINEERING AND THE CITY ENGINEER.

3. ALL EXISTING STREET LIGHTING SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.

4. ALL STREET LIGHTING CONDUITS STUB SHALL HAVE AT LEAST ONE GREEN #8 THW WIRE INSTALLED, AS TRACER WIRE. WHEN 'EMPTY' CONDUIT IS COMPLETELY INSTALLED FROM PB TO PB, IT SHALL HAVE MINIMUM OF 2 #4 AND 1 #8 THW WIRE WITH THE ENDS TAPED OR "SAFE OFF" PRIOR TO FINAL INSPECTION.

5. ANY STRUCTURE SUCH AS BLOCK WALLS, CHAIN LINK FENCES, RETAINING WALLS, ETC., SHALL LEAVE A MINIMUM CLEARANCE IN ACCORDANCE WITH THE USD NO. 320A.

6. AS-BUILT DRAWINGS SHALL BE SUPPLIED TO THE TEFO PRIOR TO ANY PRE-FINAL INSPECTION. THE ASBUILT DRAWING NEEDS TO BE STAMPED AS-BUILT AND SIGNED BY THE PREPARER.

7. SERVICE POINT SHALL BE COORDINATED WITH NV ENERGY COMPANY, AND WHEREVER POSSIBLE, BE LOCATED NEAR THE CENTER OF THE CIRCUIT. SERVICE POINTS SHALL BE SHOWN ON THE CIVIL PLANS.

8. IT SHALL BE ASSUMED THAT IN THE ABSENCE OF AN EXISTING, WORKABLE CIRCUIT TO ATTACH TO, ALL INSTALLATIONS SHALL REQUIRE A NEW SERVICE FOR OPERATION OF THE CIRCUIT.

9. WHEREVER THERE IS AN OVERHEAD UTILITY THAT MAY CONFLICT WITH THE INSTALLATION OF STREET LIGHTING CIRCUITS AND/OR POLES, THESE CONFLICTS MUST BE RESOLVED BETWEEN THE DEVELOPER AND THE UTILITIES INVOLVED, AT NO EXPENSE TO THE CITY OF LAS VEGAS, BEFORE STREETLIGHT BASES ARE INSTALLED.

10. THE CONTRACTOR SHALL FURNISH COMPLETE SERVICE TO TRANSFORMERS AND CONTROL SYSTEMS IF REQUIRED ON PLANS.

11. THE DEVELOPER/OWNER WILL BE REQUIRED TO SUPPLY POWER TO ALL NEW PUBLIC STREET LIGHTS INSTALLED UNDER THIS DESIGN PRIOR TO BOND RELEASE OR PROJECT COMPLETION. THE DEVELOPER/OWNER WILL BE RESPONSIBLE FOR ALL ITEMS ASSOCIATED WITH THE INSTALLATION, CONSTRUCTION, ENERGIZING, MAINTENANCE AND OPERATIONAL COST OF SAID STREET LIGHTS PRIOR TO PROJECT COMPLETION. REFER TO THE PLAN FOR ANY NEW SERVICE REQUIREMENTS. THE TRANSFER OF OWNERSHIP FROM THE DEVELOPER/OWNER TO THE CITY OF LAS VEGAS FOR ALL NEW PUBLIC STREET LIGHTS AND/OR SERVICE/S INSTALLED UNDER THIS PLAN DESIGN WILL BE IN CONJUNCTION WITH THIS PROJECT COMPLETION. COORDINATE ALL MAINTENANCE AND OPERATIONAL TRANSFERS WITH THE CITY OF LAS VEGAS TRAFFIC ENGINEERING DEPARTMENT (TEFO) AT (702) 229-6331.

REVISED 04/15/10

CITY OF LAS VEGAS GRADING NOTES

1. IN THE EVENT THAT ANY UNFORESEEN CONDITIONS NOT COVERED BY THESE NOTES ARE ENCOUNTERED DURING GRADING OPERATIONS, THE OWNER/ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTION.

2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL NECESSARY CUTS AND FILLS WITHIN THE LIMITS OF THIS PROJECT AND THE RELATED OFF-SITE WORK, SO AS TO GENERATE THE DESIRED SUBGRADE, FINISH GRADES AND SLOPES SHOWN.

3. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR ALL EXCAVATION. ADEQUATE SHORING SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR TO PREVENT UNDERMINING OF ANY ADJACENT FEATURES OR FACILITIES AND/OR CAVING OF THE EXCAVATION.

4. THE CONTRACTOR IS WARNED THAT AN EARTHWORK BALANCE WAS NOT NECESSARILY THE INTENT OF THIS PROJECT. ANY ADDITIONAL MATERIAL REQUIRED OR LEFTOVER MATERIAL FOLLOWING EARTHWORK OPERATIONS BECOMES THE RESPONSIBILITY OF THE CONTRACTOR.

5. THE GRADING CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE OWNER TO PROVIDE FOR THE REQUIREMENTS OF THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND ASSOCIATED PERMIT.

6. CONTRACTOR SHALL GRADE TO THE LINES AND ELEVATIONS SHOWN ON THE PLANS WITHIN THE FOLLOWING HORIZONTAL AND VERTICAL TOLERANCES AND DEGREES OF COMPACTION, IN THE AREAS INDICATED:

	HORIZONTAL	VERTICAL	COMPACTION
A. PAVEMENT AREA SUBGRADE	0.1'+	+0.0' TO -0.1'	SEE SOILS REPORT
B. ENGINEERED FILL	0.5'+	+0.1' TO -0.1'	SEE SOILS REPORT
COMPACTION TESTING WILL BE PERFORMED BY THE OWNER OR HIS REPRESENTATIVE.			

7. ALL CUT AND FILL SLOPES SHALL BE PROTECTED UNTIL EFFECTIVE EROSION CONTROL HAS BEEN ESTABLISHED.

8. THE USE OF POTABLE WATER WITHOUT A SPECIAL PERMIT FOR BUILDING OR CONSTRUCTION PURPOSES INCLUDING CONSOLIDATION OF BACKFILL OR DUST CONTROL IS PROHIBITED. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FOR CONSTRUCTION WATER.

9. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS AND ALL OTHER PUBLIC RIGHT-OF-WAY IN A CLEAN, SAFE AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK OR CONSTRUCTION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT. ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC SHALL BE MAINTAINED IN A CLEAN, SAFE AND USABLE CONDITION.

10. IN THE EVENT THAT ANY TEMPORARY CONSTRUCTION ITEM IS REQUIRED THAT IS NOT SHOWN ON THESE DRAWINGS, THE OWNER AGREES TO PROVIDE AND INSTALL SUCH ITEM AT HIS OWN EXPENSE AND AT THE DIRECTION OF THE CITY ENGINEER. TEMPORARY CONSTRUCTION INCLUDES DITCHES, BERMS, ROAD SIGNS AND BARRICADES, ETC.

REVISED 04/15/10

CITY OF LAS VEGAS SEWER NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS AND THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, AS AMENDED. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO BE AWARE OF THE CONTENTS OF THE ABOVE SPECIFICATIONS.

2. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PERFORM CONSTRUCTION AS PER PLANS. ANY ADDITIONS, DELETIONS, OR CHANGES SHALL FIRST MEET WITH THE APPROVAL OF THE CITY ENGINEER.

3. CHISEL "S" OR "G" IN CURBS WHERE SEWER OR GAS LATERALS PASS UNDER THE CURB.

4. POLYVINYL (PVC) SEWER PIPE SHALL MEET ASTM D-3034 SDR 35 SPECIFICATIONS, INSTALLED WITH SAND BEDDING AND BACKFILL OF TYPE II AGGREGATE BASE.

5. ALL MANHOLES PAVED IN STREETS EIGHTY (80') FOOT R/W AND LARGER SHALL HAVE CONCRETE COLLARS. STREETS LESS THAN EIGHTY (80') FOOT R/W WILL REQUIRE RETROFIT IF PAVING DOES NOT CONFORM TO CITY STANDARDS AT THE MANHOLE.

6. TEE SADDLES SHALL BE USED TO CONNECT SEWER LATERALS TO EXISTING MAIN LINES UP TO TWELVE INCH (12") DIAMETER. CONNECTIONS TO FIFTEEN INCH (15") OR LARGER MAINS SHALL REQUIRE SPECIAL PROCEDURES. IN LINE "Y"S SHALL BE USED ON LINES TWELVE INCHES (12") OR ABOVE.

7. WATER MAINS SHALL BE PROTECTED IN ACCORDANCE WITH LVVWD STANDARDS WHENEVER A SEWER MAIN CROSSES OVER A WATER MAIN OR THE SEWER IS LESS THAN EIGHTEEN INCH (18") UNDER A WATER MAIN.

8. ALL CONTRACTORS INSTALLING SEWER MAINS THAT WILL BE UNDER THE JURISDICTION OF THE CITY OF LAS VEGAS MUST BE STATE OF NEVADA CLASS "A" CONTRACTORS.

9. THE CITY OF LAS VEGAS WILL NOT ACCEPT ANY SEWER MAINS WHICH HAVE A VERTICAL DEFLECTION OF MORE THAN ONE TENTH (0.1) OF A FOOT FROM THE APPROVED CONSTRUCTION PLANS AT ANY LOCATION. SEWER MAINS FOUND TO EXCEED THIS TOLERANCE WILL HAVE TO BE REPAIRED OR REMOVED OR REPLACED TO THE SATISFACTION OF THE CITY ENGINEER PRIOR TO ACCEPTANCE BY THE CITY OF LAS VEGAS.

10. INSTALLATION OF CURVED SEWER REQUIRES THE USE OF C-900 PIPE WHICH ALLOWS FOR PIPE DEFLECTION AT THE JOINTS.

REVISED 04/15/10

CITY OF LAS VEGAS FIRE DEPARTMENT NOTES

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LAS VEGAS FIRE & RESCUE ADOPTED FIRE CODE ORDINANCE #6325 FOR HYDRANT SPECIFICATIONS AND HYDRANT INSTALLATION SPECIFICATIONS.

2. AUTHORIZED FIRE HYDRANTS ARE AS FOLLOWS:
   A. – KENNEDY – GUARDIAN MODELS K81A AND K81D
   B. – MUELLER – SUPER CENTURION 250 MODEL A-423
   C. – CLOW – MEDALLION MODEL F-2546LVD
   D. – U.S. PIPE – METROFLOW/M-03

3. A PERMIT IS REQUIRED FROM LAS VEGAS FIRE & RESCUE FOR THE INSTALLATION OF ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTORS MATERIAL TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER BEFORE COMMENCEMENT OF WORK. [IFC § 105.7.12]

4. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS, FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED BEFORE COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDER AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW. [IFC § 3310, § 3312]

5. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, THE CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTER LINE OF STREET ADJACENT TO THE FIRE HYDRANTS. [IFC § 507.5.7.3]

6. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED BEFORE COVERING THE LINES. CENTER LOADING IS ACCEPTABLE FOR THE HYDRO TESTS WITH PRIOR FIRE PREVENTION APPROVAL. [IFC § 106.3]

7. ALL ON-SITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE U.L. LISTED A.W.W.A. APPROVED AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE. [IFC § 507.2.1, NFPA 24]

8. PAINTING OF CURBS, FIRE HYDRANTS, PADS, PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, AND ALL OTHER WORK NECESSARY PER PLANS SHALL BE COMPLETED BEFORE APPROVAL BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION. [IFC § 507]

9. PRIVATE HYDRANTS SHALL BE PAINTED RED. [IFC § 507.5.7.1]

10. PRIOR TO THE FINAL OCCUPANCY, A FIRE FLOW TEST SHALL BE WITNESSED BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW. [IFC § 507]

11. FIRE HYDRANT SPACING SHALL BE AS FOLLOWS: [IFC § C102]
    RESIDENTIAL – 500 FEET UNSPRINKLERED; 600 FEET SPRINKLERED.
    COMMERCIAL – 300 FEET UNSPRINKLERED; 400 FEET SPRINKLERED.

12. WHERE THE WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED AND FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT A MAXIMUM OF 1000 FT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR (4) OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FT ON AN ALTERNATING BASIS. [IFC § C102.8]

13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE RADIUS OF A CUL-DE-SAC OR WITHIN 20 FT OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.

14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FT OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION. [IFC § C102.12]

15. A MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FT, AS MEASURED BY AN APPROVED ROUTE. [IFC § C102.4]

16. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FT, AS MEASURED BY AN APPROVED ROUTE. [IFC § C102.7]

17. THE MAXIMUM DISTANCE FROM A HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FT. [IFC § C102.6]

18. TWO (2) SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE IS 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-INS ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN. [IFC § C104]

19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS. [IFC § 503.2.3]

20. THE GRADIENT FOR THE FIRE APPARATUS ROADS SHALL NOT EXCEED 12% ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FT PRIOR TO OR AFTER THE GRADE CHANGE, ADJACENT TO THE STRUCTURES GRADIENT SHALL NOT EXCEED 6%. [IFC § 503.2.7, § 503.2.8]

21. THE TURNING RADIUS OF THE FIRE APPARATUS ACCESS ROADS SHALL BE NO LESS THAN 52 FT OUTSIDE AND 28 FT INSIDE TURNING RADIUS. [IFC § 503.2.4]

22. VERTICAL CLEARANCE OF ALL FIRE APPARATUS ACCESS ROADS SHALL NOT BE LESS THAN 13 FT 6 INS. [IFC § 503.2.1]

23. FIRE DEPARTMENT ACCESS ROADS SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 40 FT FLOW LINE TO FLOW LINE WITH PARALLEL PARKING PERMITTED ON BOTH SIDES. NOT LESS THAN 32 FT WIDE, FLOW-LINE TO FLOW-LINE, WHERE PARKING IS PERMITTED ONLY ON ONE SIDE OF THE FIRE APPARATUS ACCESS ROAD. NOT LESS THAN 24 FT WIDE, FLOW-LINE TO FLOW-LINE, WHERE NO PARKING IS PERMITTED ON EITHER SIDE. FIRE LANES THROUGH PARKING LOTS SHALL NOT BE LESS THAN 24 FT. [IFC § 503.2.1.1]

24. FIRE APPARATUS ACCESS ROAD SHALL BE REQUIRED WHEN ANY PORTION OF AN EXTERIOR WALL OF THE FIRST STORY IS LOCATED MORE THAN 150 FT FROM A FIRE DEPARTMENT VEHICLE ACCESS. THIS DISTANCE COULD BE INCREASED TO 250 FT IF THE BUILDING IS SPRINKLERED. [IFC § 503.1.1]

25. APPROVED SECONDARY FIRE APPARATUS ACCESS SHALL BE PROVIDED FOR 100 OR MORE DWELLING UNITS, ROAD(S) WITH DEAD-ENDS OR WITH A SINGLE POINT OF ACCESS IN EXCESS OF 600 FT. COMMERCIAL AND INDUSTRIAL DEVELOPMENTS WHERE BUILDINGS EXCEED 2 STORIES OR 30 FT IN HEIGHT, OR EXCEEDING 62,000 SQ FT IN AREA. [IFC § 503.1.2]

26. ALL DEAD-END FIRE APPARATUS ROADS AND/OR FIRE LANES, PUBLIC OR PRIVATE, IN EXCESS OF 150 FT IN LENGTH SHALL BE PROVIDED WITH AN APPROVED TURN AROUND HAVING A MINIMUM DIAMETER OF 81 FT. [IFC § 503.2.5]

27. ALL FIRE APPARATUS ACCESS ROADS SHALL BE MARKED BY PLACING APPROVED SIGNS AT THE START OF THE DESIGNATED FIRE LANE, ONE SIGN AT THE END OF THE FIRE LANE AND WITH SIGNS AT INTERVALS OF 100 FT ALONG THE DESIGNATED FIRE LANES. SIGNS TO BE PLACES ON BOTH SIDES OF AN ACCESS ROADWAY IF NEEDED TO PREVENT PARKING ON EITHER SIDE. SIGNS TO BE INSTALLED NO HIGHER THAN 10FT OR LESS THAN 6 FT FROM THE ROADWAY LEVEL. THE CURB ALONG OR ON THE PAVEMENT OR CEMENT (IF NO CURB IS PROVIDED) SHALL BE PAINTED WITH RED WEATHER RESISTANT PAINT IN ADDITION TO THE SIGNS. [IFC § 503.3]

28. ELECTRONICALLY CONTROLLED ACCESS GATES SHALL BE PROVIDED WITH AN APPROVED EMERGENCY VEHICLE DETECTOR/RECEIVER SYSTEM. SAID SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE IFC § 503.6 AND IFC APPENDIX M.

EFFECTIVE DATE 07-01-2014

CITY OF LAS VEGAS GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE 'UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA', LATEST ISSUE; THE 'UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA NEVADA', LATEST REVISED EDITION; THE 'SUMMERLIN IMPROVEMENT STANDARDS' FOR WORK IN THE SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON THIS SHEET AS 'DEVIATIONS FROM STANDARDS'.

2. THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCES WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.

3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER AND OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.

4. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS, ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.

5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGNS TO BE APPROVED BY THE CITY, PRIOR TO THE USE ON THE PROJECT.

6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.

7. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 300' IN EXTRUDED-TYPE CURB.

8. AC PAVEMENT TO BE ONE-HALF INCH (½") ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS AND CROSS GUTTERS.

9. CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY OF LAS VEGAS SHALL BE REMOVED AND REPLACED PER STANDARD DRAWING 216.

10. SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD DRAWING 235. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.

11. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF THE TRANSITIONS TO BE AS SHOWN ON PLANS.

12. ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY THE (COMPANY , _ REPORT #, DATE) APPROVED BY THE CITY ENGINEER, AND AS SHOWN ON THESE PLANS.

13. EXACT LOCATION OF ALL SAWCUT LINES MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS ENGINEER IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATIONS.

14. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. STATUTE NO. 625.380 & CITY OF LAS VEGAS TITLE 18, APPENDIX D.

15. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC., SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY AND THE CITY ENGINEER.

WALL NOTES:
16. ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS; FLOOD CONTROL AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPARATE PERMIT AND INSPECTION BY THE BUILDING DEPARTMENT.

17. ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHT OF WAY.

18. CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, AND SEWER CLEAN OUTS, ETC. TO FINISH GRADE AS APPLICABLE WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.

19. MATERIALS, HANDLING AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF NDOT OR THE CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND DETAILS SHOWN HEREON.

20. WHEN INSTALLING UNDERGROUND FACILITIES THAT REQUIRE UNDERGROUND LOCATING DEVICES SUCH AS MARKER BALLS, LOCATING RIBBON, ETC. THE CONTRACTOR SHALL PROVIDE WRITTEN DOCUMENTATION TO OFFSITE INSPECTION AND TESTING CERTIFYING THAT ALL DEVICES HAVE BEEN PLACED AND VERIFIED TO BE IN GOOD WORKING CONDITION PRIOR TO THE CONSTRUCTION OF ANY ROAD BASE.

21. SANITARY SEWER AND STORM DRAIN FACILITIES SHOWN ON THESE PLANS SHALL BE USED TO MEET THE REQUIREMENTS OF NRS 455 AND SHALL SHOW AT A MINIMUM THE HORIZONTAL AND VERTICAL (INVERT) LOCATION OF PUBLIC SEWER MANHOLES, STORM DRAIN MANHOLES, STORM DRAIN LATERALS AT THE CONNECTION TO THE STORM DRAIN MAIN AND AT THE CONNECTION TO A DROP INLET, AND THE CONNECTION OF SEWER SERVICE LATERALS TO THE SERER MAIN AND WHERE THE SERER SERVICE LATERALS EXIT THE PUBLIC RIGHT-OF-WAT. ANY DEVIATIONS FROM THE INFORMATION SHOWN SHALL BE NOTED AND SUBMITTED AS A REVISION TO THE PLANS AND APPROVER PRIOR TO ACCEPTANCE OF FACILITY VIDEO INSPECTION.

22. CCTV VIDEO INSPECTION IS REQUIRED FOR ALL SEWER AND STORM DRAINS. THE CCTV VIDEO INSPECTIONS NEED TO BE PERFORMED PER THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS LATEST ADDITION.

23. A SEPARATE BORING PERMIT IS REQUIRED FOR ALL BORING ACTIVITIES.

REVISED 04/03/15

DEVIATIONS FROM STANDARDS

NONE.

CITY OF LAS VEGAS TRAFFIC NOTES

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.

2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.

3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.

4. WHEN A DESIGNATED "SAFE ROUTE TO SCHOOL" IS ENCROACHED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING OF THE CONSTRUCTION WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.

5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. ALL NEW TRAFFIC SIGNS SHALL BE FABRICATED WITH DIAMOND GRADE VIP CLASS 6 REFLECTIVE SHEETING OR APPROVED EQUAL. ALL NEW TRAFFIC SIGNS, EXCEPT STREETNAME AND SCHOOL SPEED LIMIT SIGNS, SHALL HAVE 3M SERIES 1160 OR APPROVED EQUIVALENT ANTI-GRAFFITI PROTECTIVE OVERLAY FILM; SCHOOL ZONE SIGNS SHALL HAVE 3M SERIES 1150 ANTI-GRAFFITI PROTECTIVE OVERLAY FILM. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.

7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE (5') FEET OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGNPOST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGNPOST SHALL BE ELIMINATED.

8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HERE UNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.

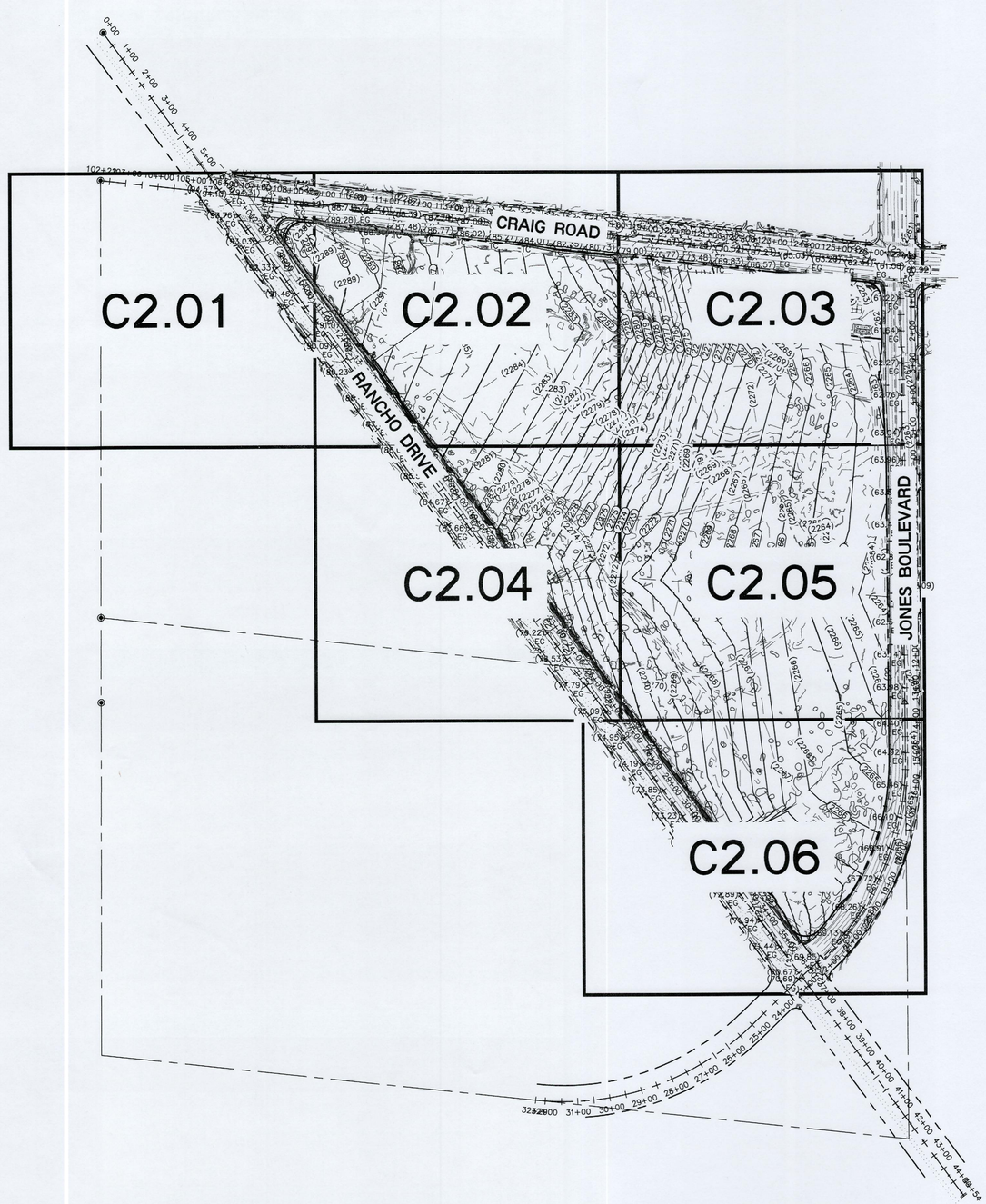
9. STREET SIGNS AND STOPS SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.

10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO INSURE THE SAFETY OF THE PUBLIC IN OR AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIALIST SET UP, MAINTAIN AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHT OF WAY.

11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING CITIZENS AREA TRANSIT (C.A.T.) IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET TO ARRANGE FOR TEMPORARY RELOCATION OF STOP.

13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE # 828-3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONT

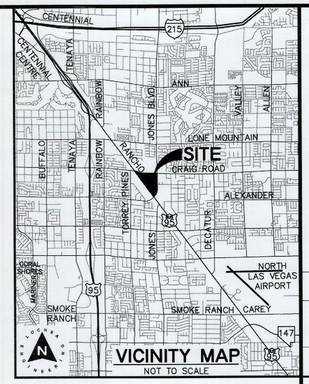


GRAPHIC SCALE

200 0 100 200 400

(IN FEET)

1 inch = 200 ft.



NOTE:

NO ROUCH GRADING IS BEING PROPOSED WITH THESE DRAWINGS. INFORMATION CONTAINED HEREIN IS FOR FUTURE DRAINAGE PURPOSES ONLY.

NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO 5LV002E4 "CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2800

FAST Call before you Underground 1-702-432-5300 FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DIG OVERHEAD 1-702-227-2929

LEGEND

CL OR SURVEY LINE PROPERTY LINE ROW LINE	EASEMENT LINE SAWCUT LINE SCARP LINE	DESCRIPTION: EXISTING: PROPOSED:	CONTOUR LINES (2210) 2122	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS (12.34) BC 12.34 BC	SIGNS	MANHOLE W/ DESCRIPTION S	MANHOLE DESCRIPTIONS (S) = SANITARY SEWER (D) = STORM DRAIN (E) = ELECTRICAL (T) = TELEPHONE	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES BWV BWV	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS

6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 365-9312
Fax (702) 365-9317
www.lochsa.com

Lochsa engineering

REV.:	DATE:	BY:	DESCRIPTION:

SHEET: GRADING PLANS
OVERALL GRADING PLAN

TITLE: CRAIG & RANCHO
MASTER GRADING

PROJECT No.: 161051

DATE: 4/8/16

SCALE: 1"=200'

DRAWN BY: JLI

DESIGNED BY: JLI

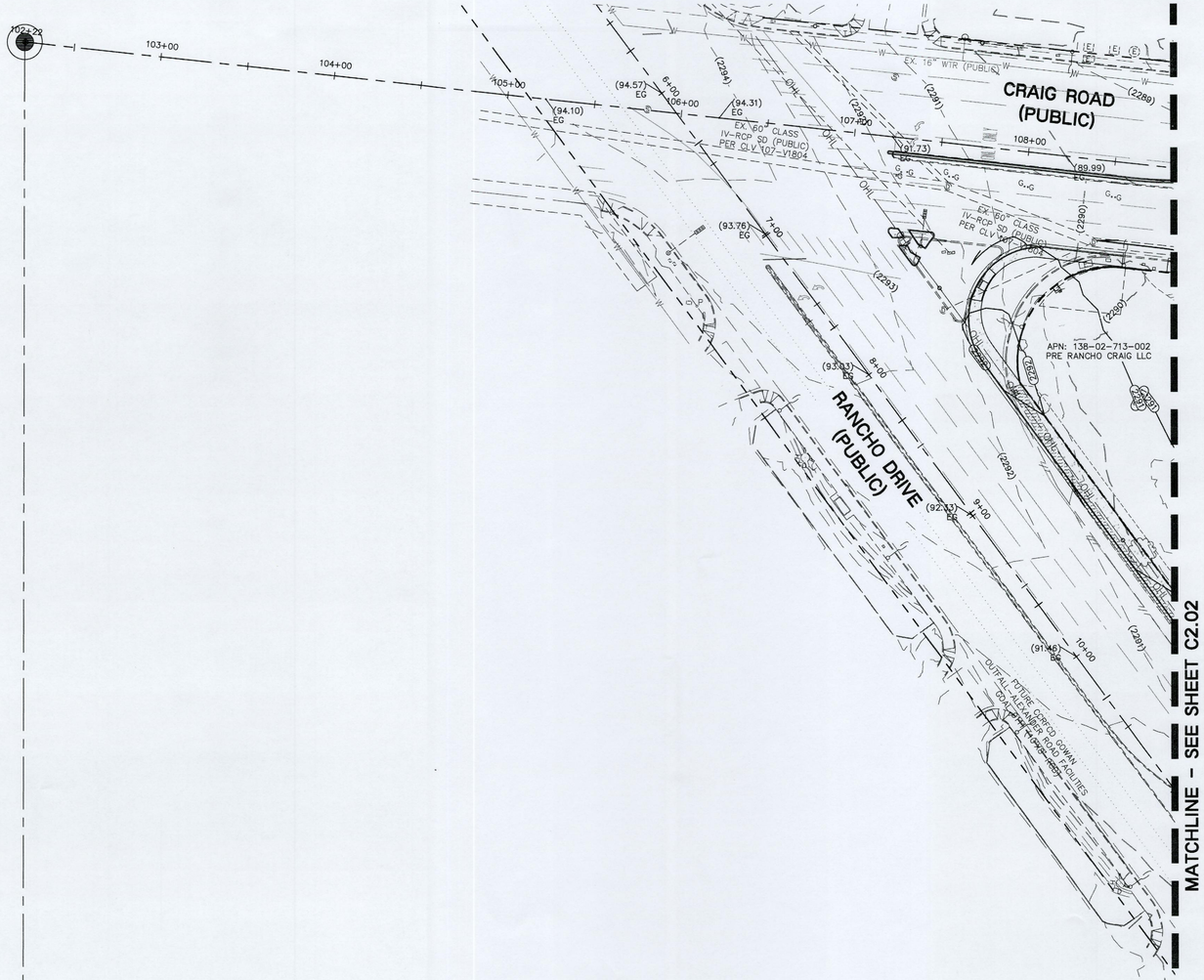
CHECKED BY: TTE

SEAL
PROFESSIONAL ENGINEER-STATE OF NEVADA
TED T. ESCHTON
Exp. 12-31-16
CIVIL
No 11286
03/14/2016

SHEET No. C2.00
SHEET 3 OF 9

CLV No. 62604

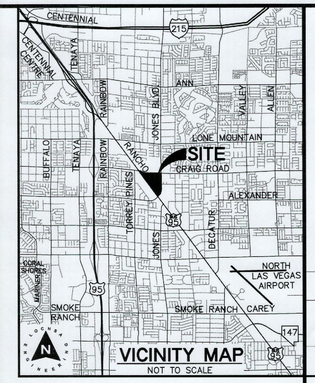
9/21/2016 1:52 PM
N:\Projects\Rancho\Craig-Rancho\Prod. Drawings\C-161051-2001-GP.dwg



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.



NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO SLV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2600

FAST
Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BC		(S)	(S) = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34 BC			(D) = STORM DRAIN (E) = ELECTRICAL (T) = TELEPHONE						BWV				

SHEET:	GRADING PLANS (SHEET 1 OF 6)
TITLE	CRAIG & RANCHO MASTER GRADING

REV.:	DATE:	BY:	DESCRIPTION:

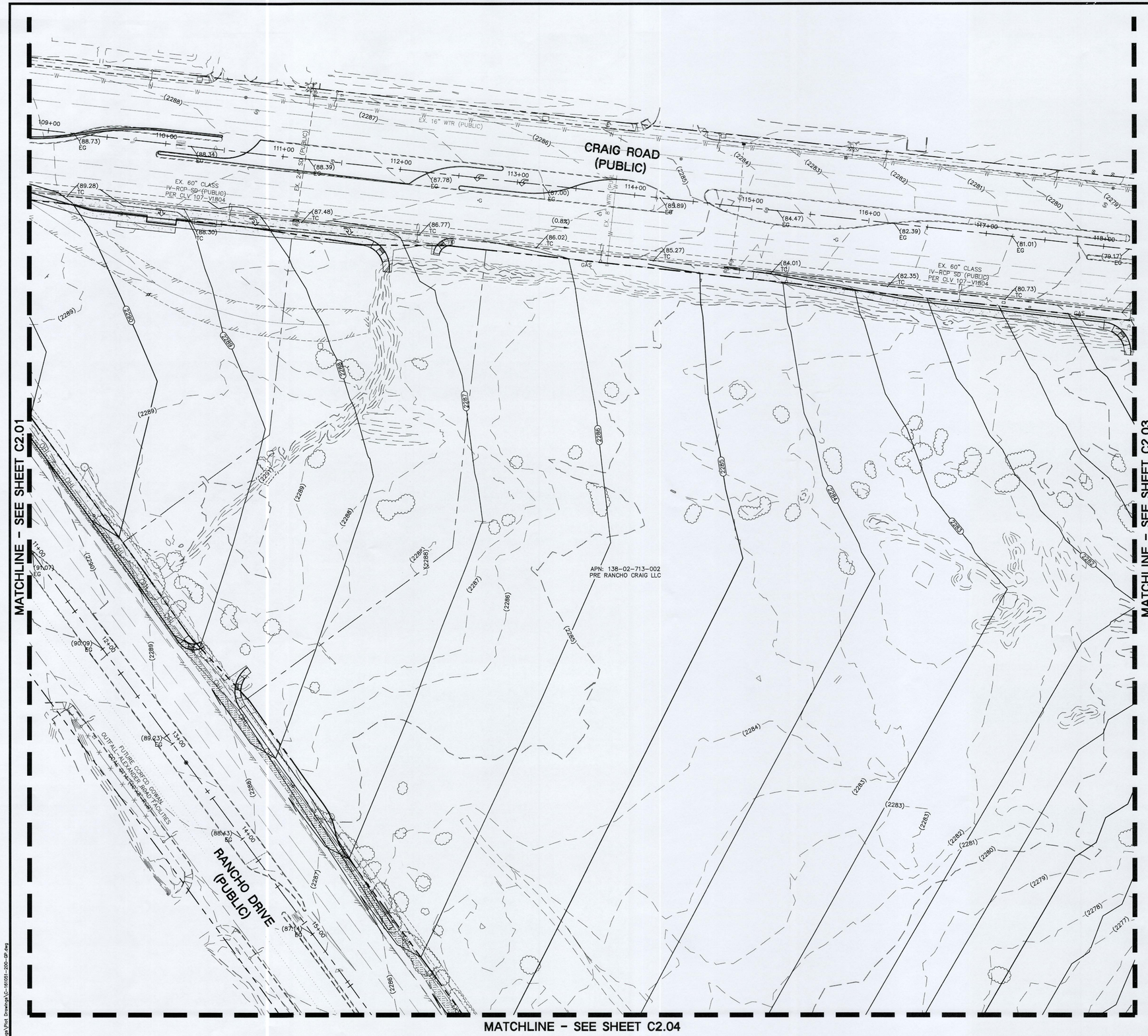
Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 385-9312
Fax (702) 385-9317
www.lochsa.com

PROJECT No.:	161051
DATE:	4/8/16
SCALE:	1"=40'
DRAWN BY:	JLI
DESIGNED BY:	JLI
CHECKED BY:	TTE

SEAL
TED T. EGERTON
EXP. 12-31-16
CIVIL
No. 11286
STATE OF NEVADA
PROFESSIONAL ENGINEER
03/14/2016

SHEET No.	C2.01
SHEET	4 OF 9
CLV No.	62604

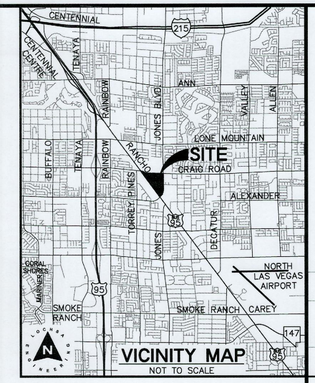
8/31/2016 1:53 PM
N:\Jobs\161051\Drawings\Civil Drawings\C-161051-200-GP.dwg



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 Inch = 40 ft.



NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO SLV0026E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2600

FAST Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34)		(S)	(S) = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34 BC			(D) = STORM DRAIN (E) = ELECTRICAL (T) = TELEPHONE						BWV				

REV.:	
DATE:	
BY:	
DESCRIPTION:	

Lochsa engineering
6345 South Jones Blvd.
Suite 100
Las Vegas, NV 89118
Phone (702) 365-9312
Fax (702) 365-9317
www.lochsa.com

SHEET: GRADING PLANS (SHEET 2 OF 6)

TITLE: CRAIG & RANCHO MASTER GRADING

PROJECT No.: 161051

DATE: 4/8/16

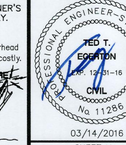
SCALE: 1"=40'

DRAWN BY: JLI

DESIGNED BY: JLI

CHECKED BY: TTE

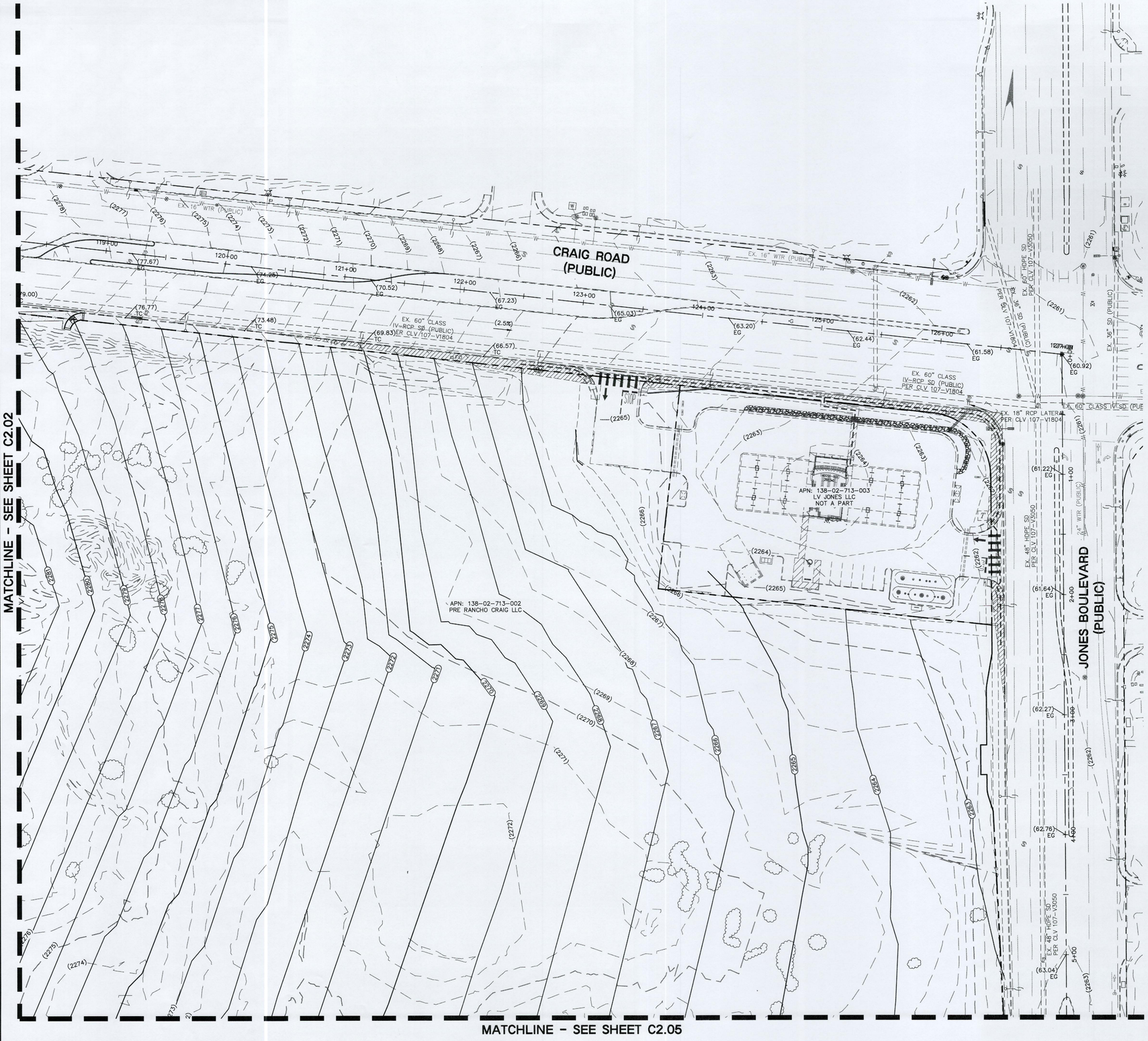
SEAL



SHEET No. C2.02
SHEET 5 OF 9

CLV No. 62604

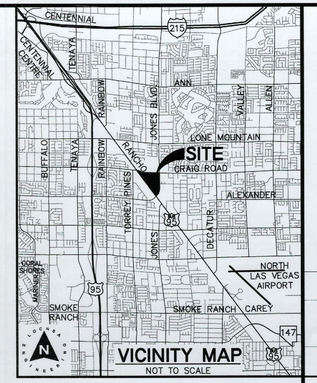
8/25/2016 1:53 PM
R:\CAD\161051\Drawings\Plot Drawings\C2-161051-2D5-3P.dwg



GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.



NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO 5LV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2600

FAST Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) EC		S	S = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34 BC		S	D = STORM DRAIN E = ELECTRICAL T = TELEPHONE						BWV				

5345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 365-3312
Fax (702) 365-3317
www.lochsa.com

Lochsa engineering

REV.:	DATE:	BY:	DESCRIPTION:

SHEET: GRADING PLANS (SHEET 3 OF 6)

TITLE: CRAIG & RANCHO MASTER GRADING

PROJECT No.: 161051

DATE: 4/8/16

SCALE: 1"=40'

DRAWN BY: JLI

DESIGNED BY: JLI

CHECKED BY: TTE

SEAL

PROFESSIONAL ENGINEER - STATE OF NEVADA
TED TEGERDEN
No. 11286
CIVIL
12-31-16

03/14/2016

SHEET No. C2.03
SHEET 6 OF 9

CLV No. 62604

R:\Projects\161051\Drawings\Plot Drawings\C-161051-200-GP.dwg
8/30/2016 1:53 PM

MATCHLINE – SEE SHEET C2.02

MATCHLINE – SEE SHEET C2.05

RANCHO DRIVE (PUBLIC)

APN: 138-02-713-002
PRE RANCHO CRAIG LLC

EX. TYPE II NDOT HEADWALL FL=77.49

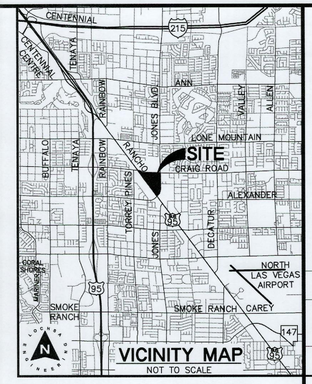
EX. 6'x3'RCB

FUTURE CONCRETE DOWN DRAIN FACILITIES

GRAPHIC SCALE

40 0 20 40 80

(IN FEET)
1 inch = 40 ft.



NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO SLV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811
OR
1-800-227-2600

FAST Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BC 12.34 BC		Ⓢ	Ⓢ = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122										Ⓢ	Ⓓ = STORM DRAIN Ⓔ = ELECTRICAL Ⓣ = TELEPHONE						BWV				

8/31/2016 1:53 PM
S:\LOCHSA\161051\Drawings\Civil Drawings\C-161051-200-GP.dwg

Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 365-9317
Fax (702) 365-9317
www.lochsa.com

REV.:	DATE:	BY:	DESCRIPTION:

SHEET: GRADING PLANS (SHEET 4 OF 6)

TITLE: CRAIG & RANCHO MASTER GRADING

PROJECT No.: 161051

DATE: 4/8/16

SCALE: 1"=40'

DRAWN BY: JLI

DESIGNED BY: JLI

CHECKED BY: TTE

SEAL: PROFESSIONAL ENGINEER – STATE OF NEVADA – TED T. EGERTON – No. 11286 – CIVIL – 03/14/2016

SHEET No. C2.04
SHEET 7 OF 9

CLV No. 62604

MATCHLINE - SEE SHEET C2.03

MATCHLINE - SEE SHEET C2.04

MATCHLINE - SEE SHEET C2.06

APN: 138-02-713-002
PRE RANCHO CRAIG LLC

JONES BOULEVARD (PUBLIC)

EX. 48" HDPE SD PER CLV 107-V3050

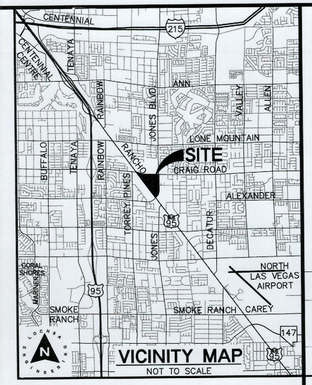
EX. 36" HDPE SD PER CLV 107-V3050

EX. 5' NDOT TYPE 3 DROP INLET
EX. 2.5' NDOT TYPE 3 DROP INLET
EX. 5' NDOT TYPE 3 DROP INLET
EX. 2.5' NDOT TYPE 3 DROP INLET
EX. 36" HDPE SD
EX. 5' NDOT TYPE 3 DROP INLET

(63.96) EG 6+00
(63.82) EG 7+00
(63.48) EG 8+00
(62.81) EG 9+00
(62.09) EG 10+00
(62.54) EG 11+00
(63.14) EG 12+00
(63.98) EG 13+00

(0.5%)

GRAPHIC SCALE
40 0 20 40 80
(IN FEET)
1 inch = 40 ft.



NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO 5LV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2600

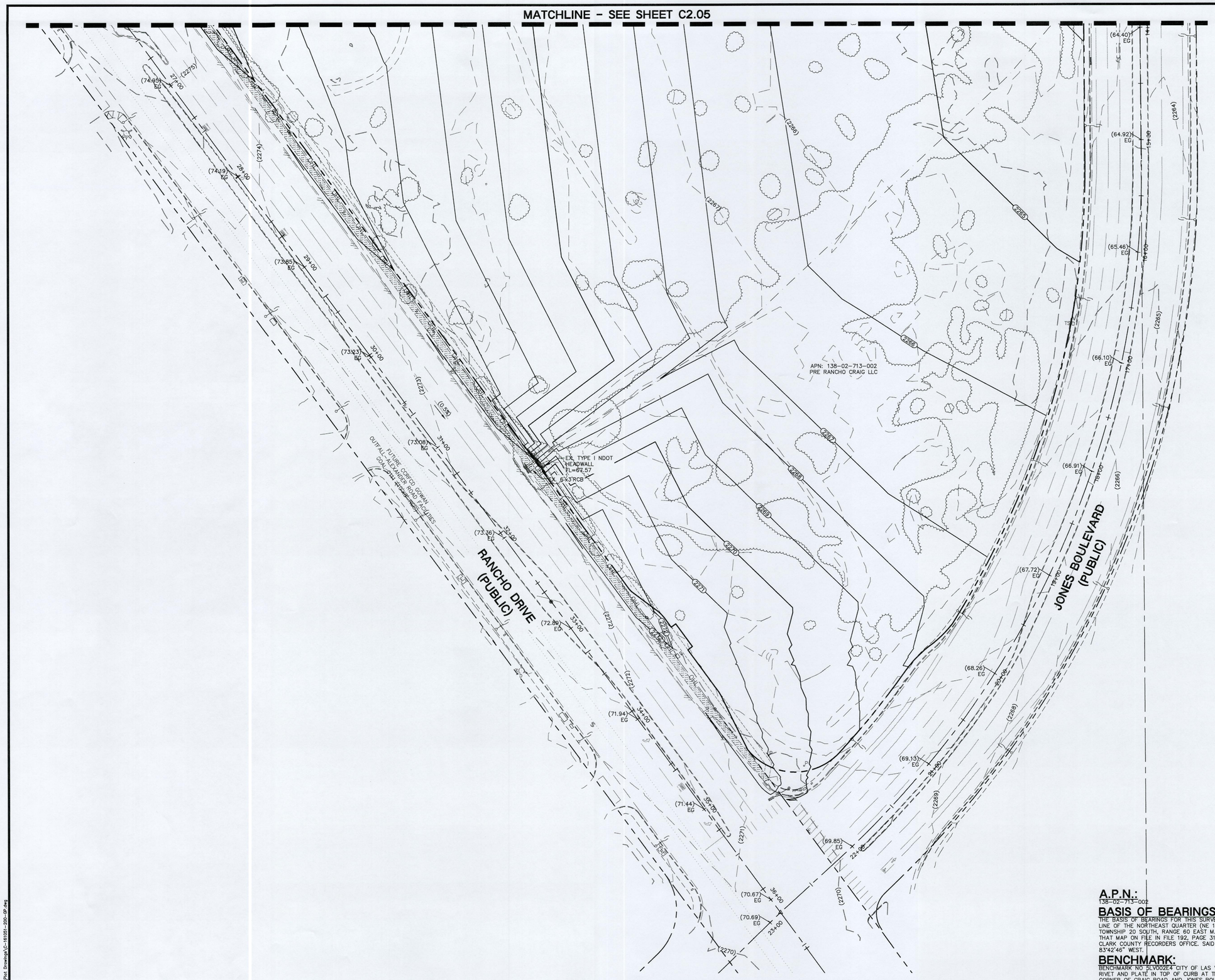
FAST
Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

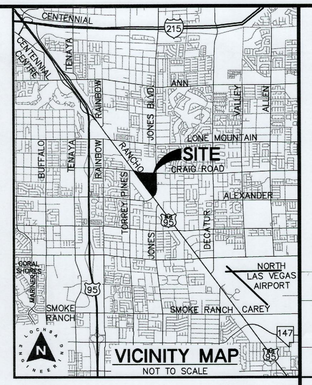
Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

LEGEND

| | | |

MATCHLINE - SEE SHEET C2.05





GRAPHIC SCALE

40 0 20 40 80

(IN FEET)

1 inch = 40 ft.

NOTE:

LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO 5LV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811 OR 1-800-227-2800

FAST Call before you Underground
1-702-432-5300
FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid hitting overhead power lines. It's costly.
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BC		Ⓢ	Ⓢ = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34 BC		Ⓢ	Ⓓ = STORM DRAIN						BWV				
														Ⓔ = ELECTRICAL										
														Ⓣ = TELEPHONE										

Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 360-3312
Fax (702) 360-3377
www.lochsa.com

REV.:	DATE:	BY:	DESCRIPTION:

SHEET: GRADING PLANS (SHEET 6 OF 6)

TITLE: CRAIG & RANCHO MASTER GRADING

PROJECT No.: 161051

DATE: 4/8/16

SCALE: 1"=40'

DRAWN BY: JLI

DESIGNED BY: JLI

CHECKED BY: TTE

SEAL

NEVADA PROFESSIONAL ENGINEER - STATE OF NEVADA
TED T. EGERTON
Exp. 12-31-16
CIVIL
No. 11286

03/14/2016

SHEET No. C2.06
SHEET 9 OF 9

CLV No. 62604

8/31/2016 1:53 PM
T:\CAD\161051\Drawings\Plot Drawings\C-161051-200-GP.dwg

* Includes referenced flows from the 2009 " Rancho/US 95 LOMR"

Peak Flow Summary
Existing Condition

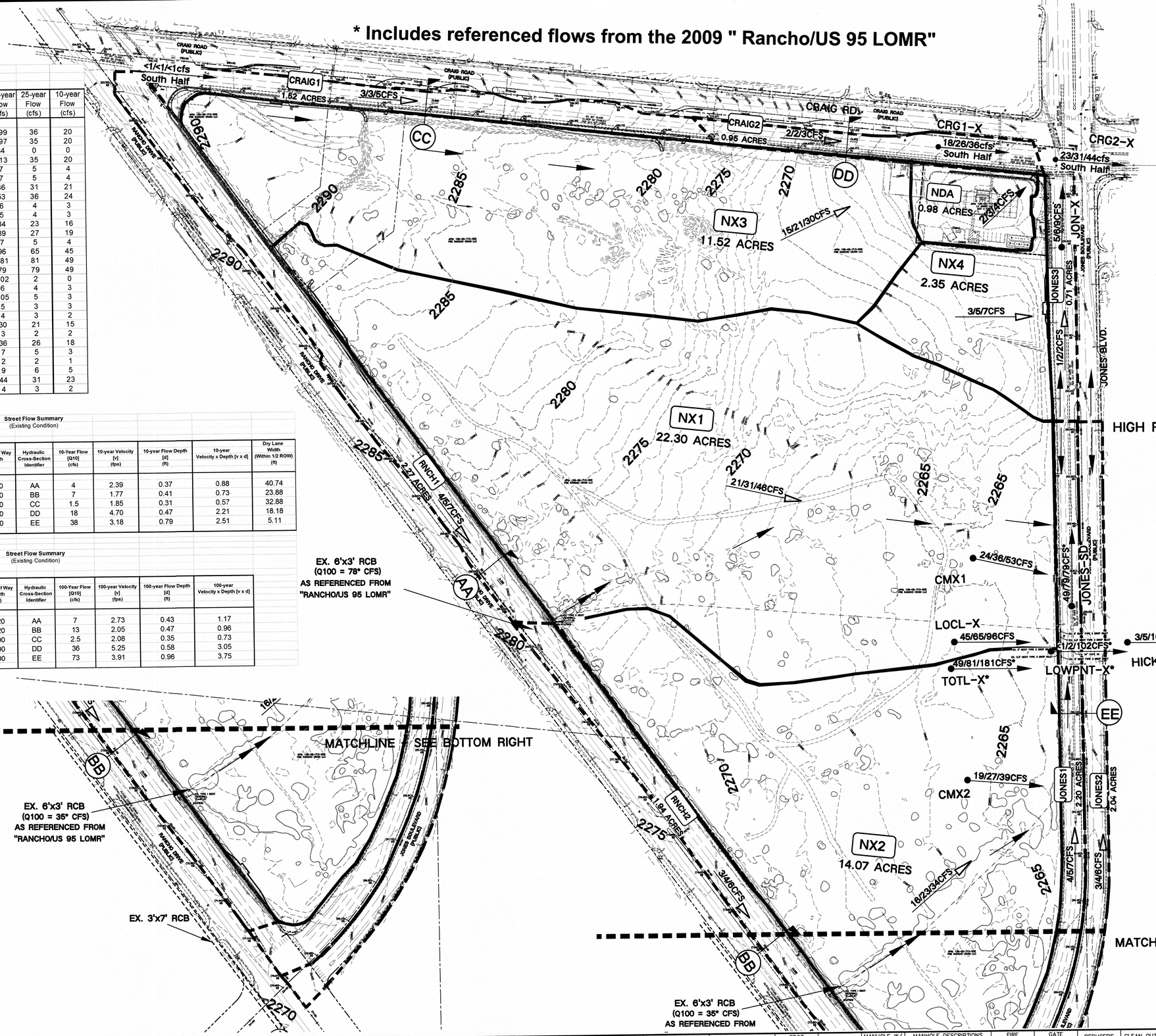
HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
2C2B3	-	199	36	20
RC2B3	-	197	35	20
5REMAIN	-	84	0	0
D5RCHO	-	113	35	20
RNCH1	2.27	7	5	4
RRNCH1	-	7	5	4
NX1	22.3	46	31	21
CMX1	-	53	36	24
RNCH2	1.94	6	4	3
RRNCH2	-	5	4	3
NX2	14.07	34	23	16
CMX2	-	39	27	19
JONES1	2.2	7	5	4
LOCL-X	-	96	65	45
TOTL-X	-	181	81	49
JONES-SD	-	79	79	49
LOWPNT-X	-	102	2	0
JONES2	2.04	6	4	3
HICKAM-X	-	105	5	3
CRAIG1	1.52	5	3	3
RCRAIG1	-	4	3	2
NX3	11.52	30	21	15
CRAIG2	0.95	3	2	2
CRG1-X	-	36	26	18
NX4	2.35	7	5	3
JONES3	0.71	2	2	1
JON-X	-	9	6	5
CRG2-X	-	44	31	23
NDA^	0.98	4	3	2

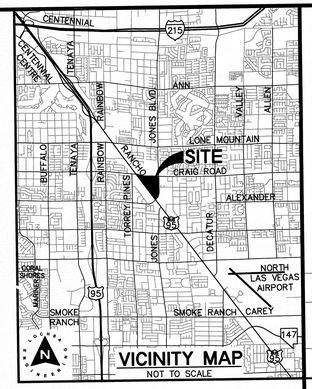
Street Flow Summary
(Existing Condition)
10-year, 6-hour Storm

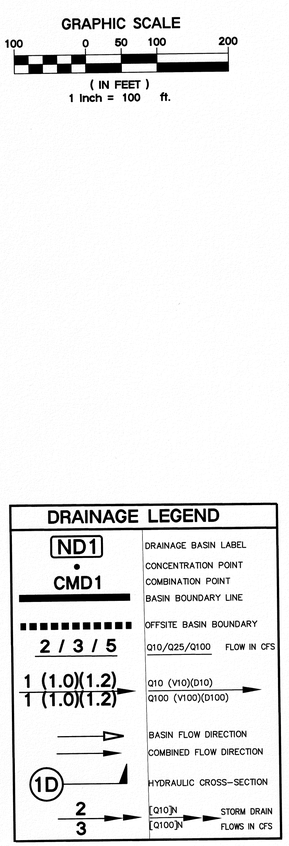
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [v] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d]	Dry Lane Width (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	38	3.18	0.79	2.51	5.11

Street Flow Summary
(Existing Condition)
100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.96
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	36	5.25	0.58	3.05
Jones Boulevard	100	EE	73	3.91	0.96	3.75







Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 365-9312
Fax (702) 365-9317
www.lochsa.com

ONSITE BASIN MAP
(EXISTING CONDITION)

CRAIG & RANCHO
MASTER DRAINAGE STUDY

SHEET	TITLE
PROJECT No.:	161051
DATE:	08/26/16
SCALE:	1"=100'
DRAWN BY:	HMN
DESIGNED BY:	HMN
CHECKED BY:	HMN

SHEET No. DR1
SHEET 1 2
CLV No. --

REV.: DATE: BY: DESCRIPTION:

LEGEND

CL OR SURVEY LINE	PROPERTY LINE	ROW LINE	EASEMENT LINE	SAWCUT LINE	SCARP LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
						EXISTING:	(2210)								(12.34) BC 12.34 PC			Ⓢ = SANITARY SEWER						BWV				
						PROPOSED:	2122										Ⓢ	Ⓓ = STORM DRAIN Ⓔ = ELECTRICAL Ⓣ = TELEPHONE					BWV				

9/1/2016 10:38 AM
N:\2016\161051\Drawings\Drainage\DR1-C-161051-2000-09.dwg

* Includes referenced flows from the " Rancho/US 95 LOMR"

Peak Flow Summary
Future Condition

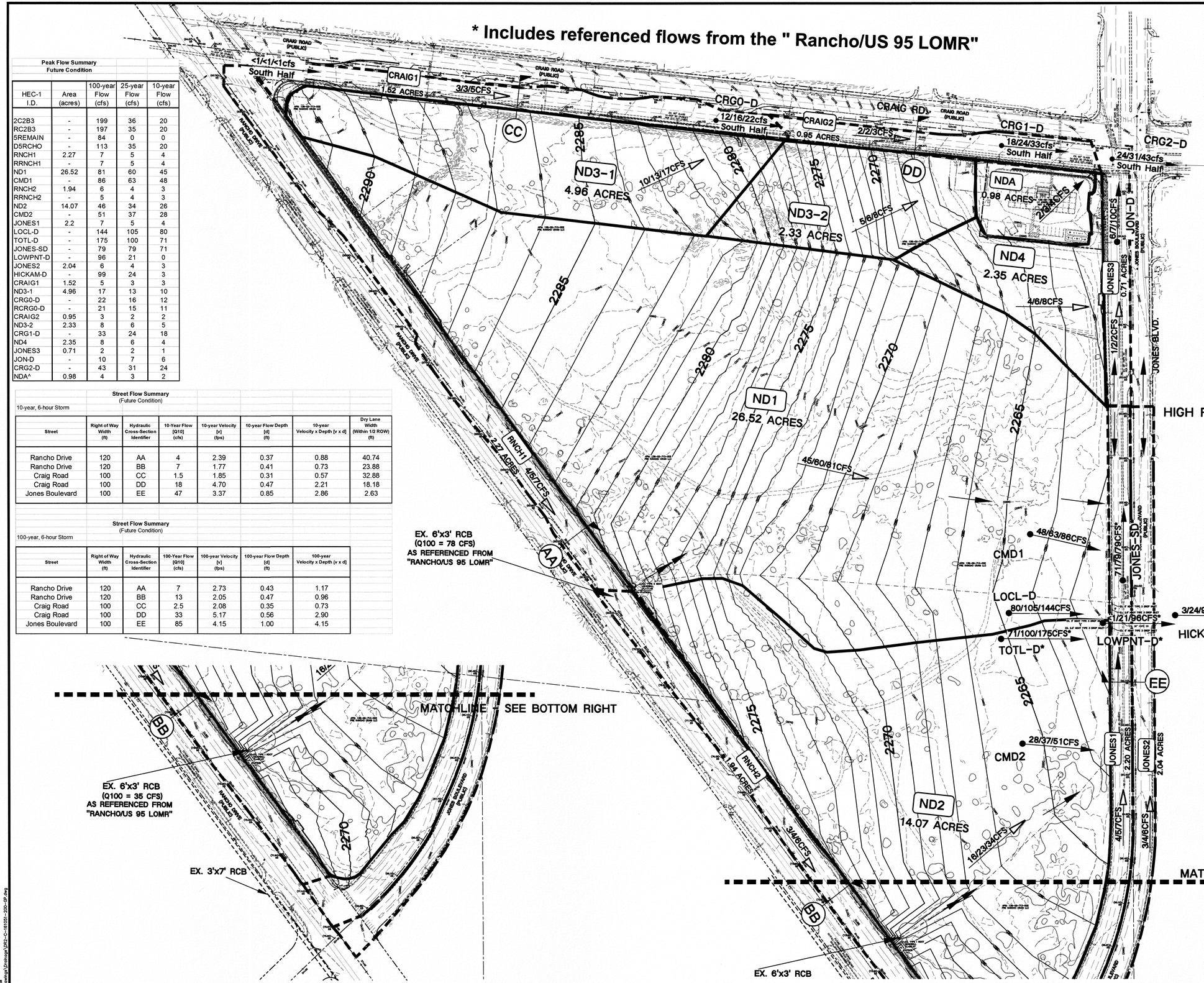
HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
2C2B3	-	199	36	20
RC2B3	-	197	35	20
5REMAIN	-	84	0	0
D5RCHO	-	113	35	20
RNCH1	2.27	7	5	4
RRNCH1	-	7	5	4
ND1	26.52	81	60	45
CMD1	-	86	63	48
RNCH2	1.94	6	4	3
RRNCH2	-	5	4	3
ND2	14.07	46	34	26
CMD2	-	51	37	28
JONES1	2.2	7	5	4
LOCL-D	-	144	105	80
TOTL-D	-	175	100	71
JONES-SD	-	79	79	71
LOWPNT-D	-	96	21	0
JONES2	2.04	6	4	3
HICKAM-D	-	99	24	3
CRAIG1	1.52	5	3	3
ND3-1	4.96	17	13	10
CRG0-D	-	22	16	12
RCRG0-D	-	21	15	11
CRAIG2	0.95	3	2	2
ND3-2	2.33	8	6	5
CRG1-D	-	33	24	18
ND4	2.35	8	6	4
JONES3	0.71	2	2	1
JON-D	-	10	7	6
CRG2-D	-	43	31	24
NDA^	0.98	4	3	2

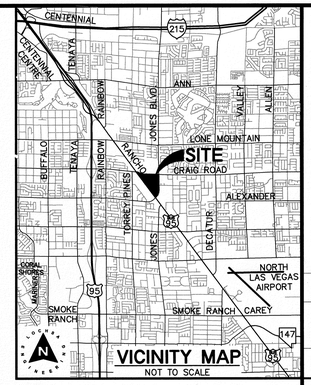
Street Flow Summary
(Future Condition)
10-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [v] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d]	Dry Lane Width (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	47	3.37	0.85	2.86	2.63

Street Flow Summary
(Future Condition)
100-year, 6-hour Storm

Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q10] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.96
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	33	5.17	0.56	2.90
Jones Boulevard	100	EE	85	4.15	1.00	4.15





GRAPHIC SCALE
100 0 50 100 200
(IN FEET)
1 Inch = 100 ft.

DRAINAGE LEGEND

ND1	DRAINAGE BASIN LABEL
•	CONCENTRATION POINT
CMD1	COMBINATION POINT
	BASIN BOUNDARY LINE
	OFFSITE BASIN BOUNDARY
2 / 3 / 5	Q10/Q25/Q100 FLOW IN CFS
1 (1.0)(1.2) / 1 (1.0)(1.2)	Q10 (V10)(D10) / Q100 (V100)(D100)
	BASIN FLOW DIRECTION
	COMBINED FLOW DIRECTION
1D	HYDRAULIC CROSS-SECTION
2 / 3	[Q10]N / [Q100]N STORM DRAIN FLOWS IN CFS

LEGEND

CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100w HPS STREETLIGHTS	150w HPS STREETLIGHTS	200w HPS STREETLIGHTS	250w HPS STREETLIGHTS
PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BC		S	S = SANITARY SEWER						BWV				
ROW LINE	SCARP LINE	PROPOSED:	2122								12.34 BC			D = STORM DRAIN E = ELECTRICAL T = TELEPHONE						BWV				

9/1/2016 10:30 AM
P:\CAD\161051\Drawings\Drainage\DR2-C-161051-200-DP.dwg

Lochsa engineering
6345 South Jones Blvd
Suite 100
Las Vegas, NV 89118
Phone (702) 365-9152
Fax (702) 365-9317
www.lochsa.com

ONSITE BASIN MAP
(FUTURE CONDITON)

CRAIG & RANCHO
MASTER DRAINAGE STUDY

SHEET	TITLE
PROJECT No.:	161051
DATE:	08/26/16
SCALE:	1"=100'
DRAWN BY:	HMN
DESIGNED BY:	HMN
CHECKED BY:	HMN

SHEET No.
DR2
SHEET 2 2
CLV No.
--

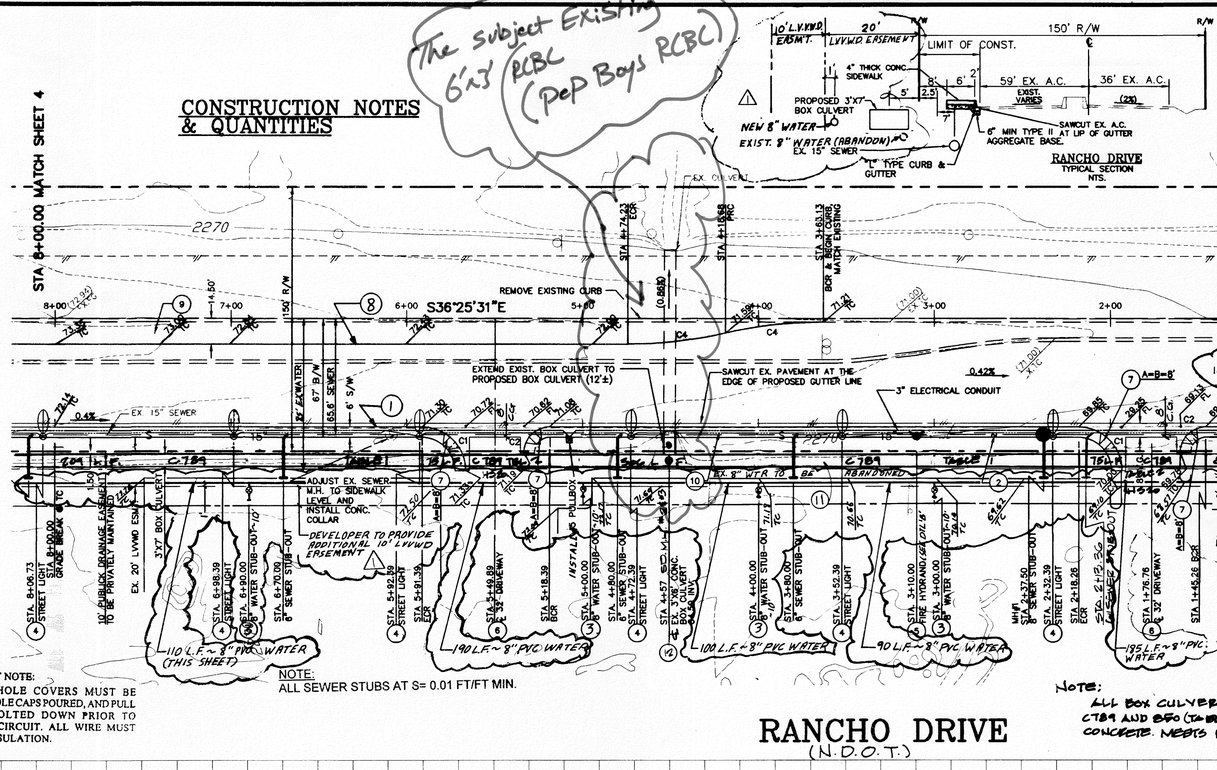
DESCRIPTION:	DATE:	BY:
REV.:		

CONSTRUCTION NOTES & QUANTITIES

1	CONSTRUCT NDOT TYPE 5 CURB & GUTTER (R-5.1.1 (613))	738 LF.
2	CONSTRUCT 4" PCC SIDEWALK PER NDOT R-5.1.1.1 (613)	4226 SF.
3	INSTALL 8"TEE W/ 8" VALVE, STUB & CAP	4 EA.
4	INSTALL 250W HPS STEET LIGHT W/ SAFETY PASE PER CCASD #311, #312, #314, #315, #316, #318	6 EA.
5	INSTALL FIRE HYDRANT ASSY. PER CCASD NO. 518	1 EA.
6	CONSTRUCT DRIVEWAY PER CCASD DWG NO. 225	901 SF.
7	CONSTRUCT SIDEWALK RAMP PER NDOT STD DWG NO. R-5.1.1.1 (613)	4 EA.
8	CONSTRUCT MEDIAN CURB PER NDOT STD DWG NO. R-5.1.1 (613) TYPE A	437 LF.
9	CONSTRUCT PVMT SECTION, MATCH EXISTING	854 SY.
	8" PVC WATER	750 LF
	8" D.I.P. WATER	197 LF.
10	1 1/4" ELECTRICAL CONDUIT	738 LF.
	8" PVC SEWER	25 LF.
	SEWER MAN HOLE	1 EA.
	6" PVC SEWER	100 LF.
11	3'x 7' CONC. BOX CULV.	887 LF
12	STORM DRAIN M.H.	2 EA.
	3'X 6' BOX CULVERT	12 LF.

CONSTRUCTION NOTES & QUANTITIES

The subject Existing 6'x3' RCBC (PepBoys RCBC)



LEGEND

- EXISTING SEWER LINE AND MANHOLE
- EXISTING WATER LINE
- PROPOSED WATER LINE
- PROPOSED SEWER LINE AND MANHOLE
- LOT 1 — LOT NUMER
- BLOCK NUMBER
- RIGHT OF WAY
- GB — GRADE BREAK
- 0.4% — RATE OF GRADE AND DIRECTION OF SLOPE (APPLIES TO BOTH STREET AND SEWER UNLESS OTHERWISE INDICATED)
- EXISTING GROUND CONTOUR LINE
- BLOCK WALL
- FENCE
- PROPOSED / EXISTING STREET LIGHT
- PROPOSED / EXISTING FIRE HYDRANT
- PROPOSED / EXISTING WATER VALVE
- TC — TOP OF CURB
- FL — FLOW LINE
- FG — FINISHED GRADE
- ST. LT. SERVICE POINT & R.C.O.C.

NEVADA DEPARTMENT OF TRANSPORTATION (NDOT) PERMIT REQUIRED

AN APPROVED NDOT OCCUPANCY PERMIT SHALL BE OBTAINED THROUGH THE DISTRICT PRIOR TO ANY CONSTRUCTION WITHIN THE NDOT RIGHT-OF-WAY

NOTE:

APPROVAL OF THESE PLANS FOR THE WATER STUBOUT INSTALLATION WILL NOT BE CONSTRUED AS A COMMITMENT FOR WATER SERVICE TO THIS PROPERTY

CONDITIONAL APPROVAL OF VALVED OUTLET (6" AND LARGER)

THE WATER PLANS SHOW ONE OR MORE VALVED OUTLETS EXTENDING OUT OF PAVED AREAS. INSTALLATION OF THESE OUTLETS IS ACCEPTABLE, HOWEVER, IF THE OUTLETS ARE INCORRECTLY LOCATED OR NOT USED FOR ANY REASON WHEN THE PROPERTY IS ACTUALLY DEVELOPED, THE DEVELOPER SHALL ABANDON THE OUTLETS AT THE CONNECTION TO THE ACTIVE MAIN IN ACCORDANCE WITH THE DISTRICT'S STANDARDS AND AT THE DEVELOPER'S EXPENSE.

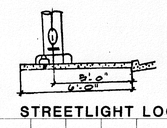
BENCHMARK

#7C0012NES, RIVET & PLATE IN TOP OF HEADWALL NORTH SIDE OF RANCHO ROAD AT JONES BLVD. ELEV. USED WAS 2263.18 ADD 2.30 FEET TO ALL ELEVATIONS SHOWN HERON TO OBTAIN ELEVATION RELATIVE TO CURRENT CITY OF LAS VEGAS DATUM (NAVD 88)

GRAPHIC SCALE

40 0 20 40 80

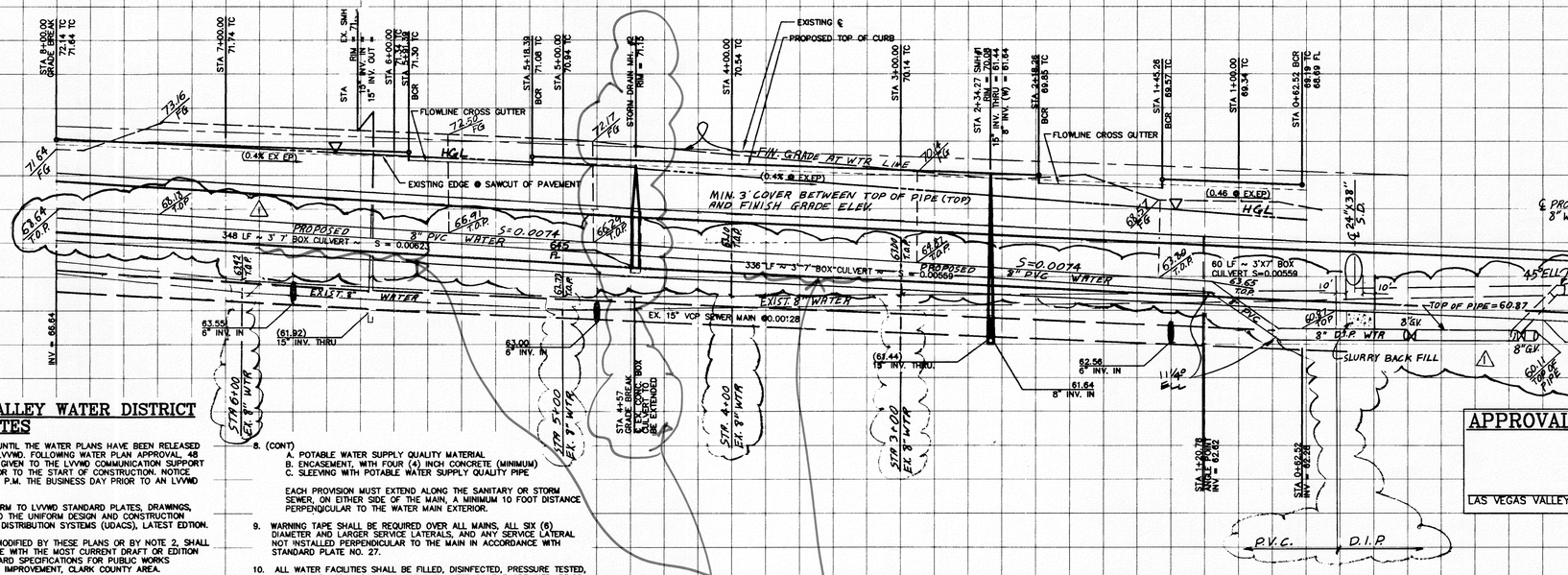
(IN FEET)
1 inch = 40 ft.

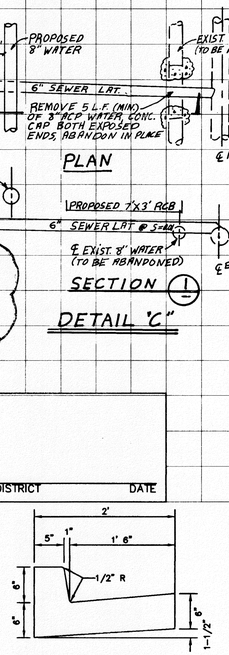


STREETLIGHT LOCATION

STREET LIGHT NOTE: ALL HAND HOLE COVERS MUST BE INSTALLED, POLE CAPS POURED, AND PULL BOX LIDS BOLTED DOWN PRIOR TO ENERGIZING CIRCUIT. ALL WIRE MUST HAVE THW INSULATION.

NOTE: ALL SEWER STUBS AT S= 0.01 FT/FT MIN.





LAS VEGAS VALLEY WATER DISTRICT STANDARD NOTES

1. NO WORK SHALL BEGIN UNTIL THE WATER PLANS HAVE BEEN RELEASED FOR CONSTRUCTION BY LVVWD. FOLLOWING WATER PLAN APPROVAL, 48 HOUR NOTICE SHALL BE GIVEN TO THE LVVWD COMMUNICATION SUPPORT CENTER (258-7171) PRIOR TO THE START OF CONSTRUCTION. NOTICE MUST BE GIVEN BY 2:00 P.M. THE BUSINESS DAY PRIOR TO AN LVVWD INSPECTION.
2. ALL WORK SHALL CONFORM TO LVVWD STANDARD PLATES, DRAWINGS, AND SPECIFICATIONS AND THE UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR WATER DISTRIBUTION SYSTEMS (UDACS), LATEST EDTION.
3. ALL WORK, EXCEPT AS MODIFIED BY THESE PLANS OR BY NOTE 2, SHALL BE DONE IN ACCORDANCE WITH THE MOST CURRENT DRAFT OR EDITION OF THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENT, CLARK COUNTY AREA.
4. A SINGLE PIPE MATERIAL SHALL BE USED THROUGHOUT THE PROJECT UNLESS OTHERWISE APPROVED BY THE LVVWD.
5. ALL SERVICE LATERALS TWO (2) INCHES IN DIAMETER AND SMALLER SHALL BE COPPER TUBING WITH LVVWD APPROVED SERVICE SADDLES.
6. ALL WATER METER BOXES SHALL BE LOCATED OUTSIDE OF DRIVEWAY AREAS.
7. ALL VALVES SHALL BE LOCATED OUTSIDE OF DRIVEWAYS, VALLEY AND CURB GUTTERS.
8. THE FOLLOWING REQUIREMENTS MUST BE MET IN THE EVENT OF A WATERLINE AND SANITARY OR STROM SEWER LINE CROSS:

   A MINIMUM EIGHTEEN (18) INCH VERTICAL SEPARATION (OUTSIDE TO OUTSIDE) MUST BE MAINTAINED WHEN THE WATER LINE IS INSTALLED OVER THE SANITARY OR STORM SEWER SEWER LINE. IF THE VERTICAL SEPRATION CANNOT BE MAINTAINED OR THE WATER LINE MUST BE PLACED UNDER THE SANITARY OR STORM SEWER LINE, THE SANITARY OR STORM SEWER LINE MUST BE CONSTRUCTED WITH ONE OF THE FOLLOWING OR, AS SHOWN ON THESE PLANS:

   A. POTABLE WATER SUPPLY QUALITY MATERIAL
   B. ENCASEMENT, WITH FOUR (4) INCH CONCRETE (MINIMUM)
   C. SLEEVING WITH POTABLE WATER SUPPLY QUALITY PIPE

   EACH PROVISION MUST EXTEND ALONG THE SANITARY OR STORM SEWER, ON EITHER SIDE OF THE MAIN, A MINIMUM 10 FOOT DISTANCE PERPENDICULAR TO THE WATER MAIN EXTERIOR.
9. WARNING TAPE SHALL BE REQUIRED OVER ALL MAINS, ALL SIX (6) DIAMETER AND LARGER SERVICE LATERALS, AND ANY SERVICE LATERAL NOT INSTALLED PERPENDICULAR TO THE MAIN IN ACCORDANCE WITH STANDARD PLATE NO. 27.
10. ALL WATER FACILITIES SHALL BE FILLED, DISINFECTED, PRESSURE TESTED, FLUSHED, FILLED AND AN ACCEPTABLE WATER SAMPLE OBTAINED, PRIOR TO CONNECTION TO THE LVVWD'S DISTRIBUTION SYSTEM.
11. THE CONTRACTOR MUST OBTAIN ALL METERS TWO (2) INCHES AND SMALLER FROM THE LVVWD CENTRAL STORES. TELEPHONE 258-3152 FORTY-EIGHT (48) HOURS PRIOR TO PICKUP.
12. CONSTRUCTION MAY INTERRUPT SERVICE, WITH LVVWD APPROVAL AND PROPER NOTIFICATION, BETWEEN THE HOURS OF 10 P.M. AND 6 A.M., SUNDAY THROUGH THURSDAY. CIRCUMSTANCES MAY REQUIRE TEMPORARY SERVICE FEEDS BE INSTALLED, WITHOUT LVVWD REIMBURSEMENT. ANY TEMPORARY SERVICE FEED MUST HAVE PRIOR LVVWD APPROVAL.
13. ALL WATER FACILITY CONSTRUCTION MATERIALS USED MUST BE AS LISTED ON THE LVVWD'S PRE-APPROVED MATERIALS AND MANUFACTURERS LISTING FOR NEW FACILITIES, LATEST REVISION, OR SPECIFICALLY APPROVED ON THESE PLANS.

Existing 7'x3' RCB storm drain along Rancho Dr.

B.C. CURVE DATA

CURVE	RADIUS	DELTA	LENGTH	TANGENT
C1	25.00'	90°00'00"	39.27'	25.00'
C2	15.00'	90°00'00"	23.57'	15.00'
C3	15.00'	90°00'00"	23.57'	15.00'
C4	250.00'	12°50'19"	56.02'	28.13'
* C5	54.00'	82°24'11"	77.68'	47.28'
C9	30.00'	82°24'11"	43.15'	26.26'

* PROPERTY LINE CURVE DATA

NDOT TYPE 5 CURB & GUTTER R-5.1.1 (613) NTS

APPROVALS

LAS VEGAS VALLEY WATER DISTRICT DATE

PROFILE SCALE: HORIZ: 1" = 40' VERT: 1" = 4'

Call before you dig — It's a Law. 1-800-227-2600

REVISIONS: DEV PRE LVVWD Comm #4

Standage & Truitt Engineering, Ltd.
CIVIL ENGINEERING AND SURVEYING
6855 W. CHARLESTON BOULEVARD
LAS VEGAS, NEVADA 89117
PHONE: (702) 255-2950
FAX: (702) 255-3090

RANCHO DRIVE

STA 0+62.00 - 8+00.00

RANCHO TOWN & COUNTY SHOPPING CENTER

CITY OF LAS VEGAS NEVADA

MICHAEL J. OREHAM — CIVIL — No. 10684 — STATE OF NEVADA — 8/26/96

JOB NO.:	960208.03
FILE:	6208PP1
DESIGNER:	PDS
DRAWN BY:	ANR
CHECKED BY:	MJC
DATE:	8/19/96

SHEET NO. 5 OF 7

107-V2598

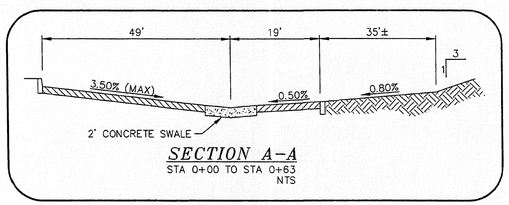
P:\JOBS\960208\6208PP1 Fri Aug 23 08:46:04 1996 MXS5

LEGEND

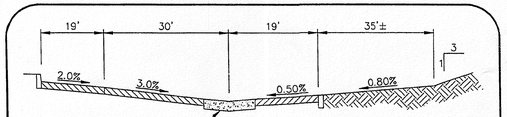
PROPERTY BOUNDARY	
RETAINING WALL	
1820	EXISTING CONTOUR
20	FINISH CONTOUR
	EXISTING STREET LIGHT
FF	FINISH FLOOR
FG	FINISH GRADE
TC	TOP OF CURB
TSW	TOP OF SIDEWALK
EP	EDGE OF PAVEMENT
BFE	BASE FLOOD ELEV.
FL	FLOWLINE
HP	HIGH POINT
39.35	FINISH ELEVATION
(39.35)	EXIST. ELEVATION

CONSTRUCTION NOTE

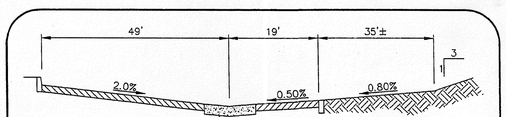
1. CONSTRUCT "L" TYPE CURB AND GUTTER PER UNIFORM STD. DWG. No. 216
2. CONSTRUCT "A" TYPE CURB PER UNIFORM STD. DWG. No. 219. (TYP. UNLESS NOTED OTHERWISE.)
4. CONSTRUCT 2" ASPHALT CONCRETE W/ FOG SEAL ON 4" TYPE II AGGREGATE BASE W/ PRIME COAT ON 6" TYPE I AGGREGATE BASE. SEE DETAIL THIS SHEET
5. CONSTURCT R1-1 SIGN (STOP)
6. CONSTRUCT 6" WIDE CURB OPENING.
7. CONSTRUCT SW RAMP (CASE 1) PER STD.DWG. NO 235.
8. CONSTRUCT CROSS GUTTER PER STD. DWG. NO. 228.
9. CONSTRUCT TYPE 5 CURB & GUTTER PER NDOTS STANDARDS
10. CONSTRUCT DEPRESSED CURB, SEE DETAIL THIS SHEET.
11. SAWCUT AND REMOVE
12. CONSTRUCT RIP RAP (d50=1.0', d=2.0')



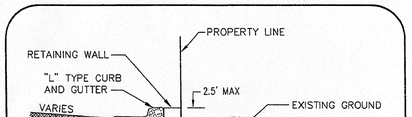
SECTION A-A
STA 0+00 TO STA 0+63
NTS



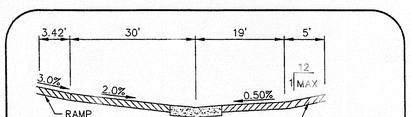
SECTION B-B
STA 0+90 TO STA 1+08
NTS



SECTION C-C
STA 1+89 TO STA 2+05
NTS



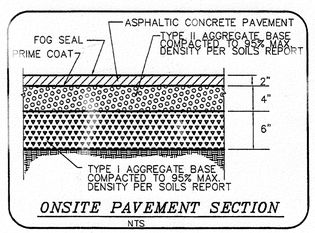
SECTION D-D
NTS



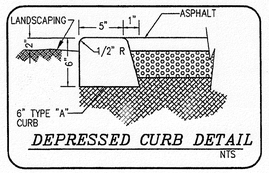
SECTION E-E
STA 2+00 TO STA 2+09
NTS

NOTE:
I CERTIFY THAT THIS GRADING PLAN IS IN COMFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT.

Dennis R. Wilbel 5/30/96
DATE



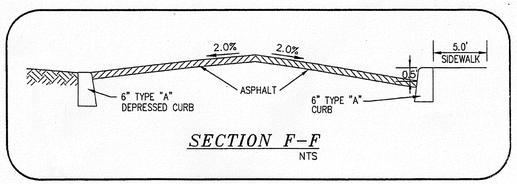
ONSITE PAVEMENT SECTION
NTS



DEPRESSED CURB DETAIL
NTS

SIDEWALK RAMP TABLE

RAMP	"A" (FT)	"B" (FT)
W1	9.5	4.5
W2	4.5	21.5
W3	9.5	4.5
W4	8.0	8.0



SECTION F-F
NTS

LEGAL DESCRIPTION

THAT PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M., CLARK COUNTY, NEVADA, DESCRIBED AS FOLLOWED:
LOT ONE (1) ACCORDING TO PARCEL MAP RECORDED SEPTEMBER 28, 1979 AS DOCUMENT NO. 1084241 IN FILE 28 OF PARCEL MAPS, PAGE 30, OFFICAL RECORDS OF CLARK COUNTY, NEVADA.

BENCHMARK

CITY OF LAS VEGAS BENCHMARK NO. 7C00-2S4, BEING A RIVET & PLATE IN TOP OF CURB, NNE RETURN OF ALEXANDER ROAD AND TORREY PINES DRIVE.

ELEVATION: 696.7123 METERS OR 2285.797 FEET, NAVD 1988.

BASIS OF BEARING

N 84°00'00" W BEING THE SOUTH LINE OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.B. & M., CITY OF LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN IN FILE 28, PAGE 30 OF PARCEL MAPS IN THE RECORDER'S OFFICE OF CLARK COUNTY, NEVADA.

PROPOSED LIDO PLAZA SOUTH

N 83°47'49" W 706.25'

S 83°47'49" E 706.25'

N 36°25'31" W 419.14'

S 36°25'31" E 419.14'

BIG SKY RANCH ESTATES UNIT II

TRASH ENCLOSURE

UTILITY AREA

EXISTING BUILDING FF = 2285

PROPOSED BUILDING 7,200 S.F. FF = 84.00 BFE = 81.95

RETAINING WALL 184.00'

UNDEVELOPED

STA 1+31.02 END CURB, GUTTER & SIDEWALK REMOVAL

STA 1+17.00 BEGIN CURB, GUTTER & SIDEWALK REMOVAL

STA 2+53.02 END CURB, GUTTER & SIDEWALK REMOVAL

STA 1+89.02 BEGIN CURB, GUTTER & SIDEWALK REMOVAL

RANCHO DRIVE

90.00' PUBLIC DRAINAGE EASEMENT TO BE PRIVATELY MAINTAINED NO BUILDINGS IN THIS AREA

EXISTING 3'x6' RCBC

STA 0+00.00

R=2280' (NO.0.1')

125.00'

Existing 6'x3' RCBC (UMC RCBC)

GRAPHIC SCALE
40 0 20 40 80 160
(IN FEET)
1 inch = 40 ft

1" = 40'

PROJECT SITE

VICINITY MAP

NOTE:
OFFSITE IMPROVEMENTS PER N.D.O.T. PERMIT NO. 1-0120, APPROVED 7-23-80.
ALL NEW WORK ON RANCHO DR. WITHIN NDOT R/W, AS SHOWN ON THESE PLANS REQUIRES NDOT PERMIT & APPROVAL.

FOUND BRASS DISK P.L.S. #7008

S 1/4 33

N 84°00'00" W 2459.09' 2500.97' (BASIS OF BEARING)

ALEXANDER ROAD

N 36°25'31" W 1915.04'

41.88'

FOUND P.K. NAIL SE CORNER SECTION 2

2 1 11 12

SAFETY ALERT
Call before you Overhead
593-6111
OVERHEAD SERVICE ALERT

Avoid cutting underground utility lines. It's costly.
Call before you Dig.
1-800-227-2600
UNDERGROUND SERVICE ALERT (USA)

REVISIONS

No.	Date	CHKD	APP'D

DESIGNED: WSW JC
DRAWN: DRW
CHECKED:
JOB NO: 712-96
SCALE: 1"=40'
HORIZ: NONE
VERT:

Carter::Burgess
Consultants in Engineering, Architecture, Planning and the Environment
2350 East Sunset Road, Suite 105
Las Vegas, Nevada 89120
(702) 798-1007 Fax (702) 798-7056

PROJECT: UMC QUICK CARE CENTER

DESCRIPTION: GRADING PLAN

SHEET 3
3 OF 4

107-V2529

L:\712-96\TABSURF Wed May 29 16:15:26 1996