

DS #: 5194

APN: 140.30.803.013

PROJECT: Pipers Tracks Training Facility

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		September 27, 2019
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	COPIES TO:	
Drainage Study for:	McCay Engineering	
Pipe Trades Training Facility	Plumbers and Pipefitters Local Union 525	
Cross Streets:	NEQ of Bonanza Drive & Leigon Way	Bart Anderson, P.E., DevCo
File Number:	F:\Depot\DSMemos\DS5194A.doc	
Parcel Number:	140-30-803-013	
Zoning Action:	SDR-77184	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	9/23/2019	9/27/2019	See Comments Below	\$400.00	3577243: \$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.

- In an effort to increase administrative efficiency, for all original and re-submittal packages including updates and the addenda, the City of Las Vegas Public Works Department requires both a hardcopy and a digital copy (PDF) on CD for the drainage study.
A CD was missing in the last submittal. Supplement a CD for the last package in the next submittal.
- A letter sealed and signed by a Nevada registered civil engineer must be included in every submittal certifying documents on the electronic CD matches 100% of the hardcopy submittal. The new submittal requirement is effective on May 1, 2019. If there are any questions regarding these new requirements, please contact Albert Sung in the City Flood Control Section at (702) 229-6541.
- Provide a copy of the zoning/planning conditions associated with this site (**SDR-77184**) 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.
- Figure 7 (Future Onsite Basin Map):** The *Study* discussed about a *Basin ON3* but which is to be found nowhere on the map Figure 7. Identify *Basin ON3* in the next submittal.

5. **Section D/C3.01:** It appears that an offsite swale is proposed behind the south property wall. Obtain a notarized letter of permission for grading from the adjacent property owner to the south prior to the final approval of the drainage study.
6. Identify the proposed swale in the adjacent property with flow line elevations at regular intervals on the grading plan.

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/R62E/30
AREA N-30



**LAS VEGAS
CITY COUNCIL**

CAROLYN G. GOODMAN
Mayor

MICHELE FIORE
Mayor Pro Tem

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SCOTT D. ADAMS
City Manager

DEPARTMENT OF PLANNING
ROBERT SUMMERFIELD
DIRECTOR

**DEVELOPMENT
SERVICES CENTER**

333 N. RANCHO DRIVE
3RD FLOOR
LAS VEGAS, NV 89106
702.229.6301 | VOICE
702.474.7463 | FAX
711 | TTY



cityoflasvegas
lasvegasnevada.gov

September 25, 2019

Mr. Dale Stubblefield
Union Local 525 Training TR NV
750 Legion Way
Las Vegas, Nevada 89110

**RE: SDR-77184 [PRJ-77152] - SITE DEVELOPMENT PLAN REVIEW
PLANNING COMMISSION MEETING OF SEPTEMBER 24, 2019**

Dear Applicant:

The Planning Commission at a regular meeting held on September 24, 2019 voted to **APPROVE** a request for a Site Development Plan Review FOR A PROPOSED 15,000 SQUARE-FOOT TRADE SCHOOL WITH A 3,000 SQUARE-FOOT MEZZANINE, A 2,000 SQUARE-FOOT ATTACHED SHADE CANOPY AND WAIVERS OF THE PERIMETER LANDSCAPE BUFFER STANDARDS on 4.41 acres at 750 Leigon Way (APN 140-30-803-013), C-1 (Limited Commercial) Zone, Ward 3 (Diaz) [PRJ-77152].

This approval is subject to the following conditions:

Planning

1. Conformance to the Conditions of Approval for Variance (VAR-33025) and Site Development Plan Review (SDR-33023) shall be required, except as amended herein.
2. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.
3. All development shall be in conformance with the site plan, landscape plan, and building elevations, date stamped 08/06/19, except as amended by conditions herein.
4. A Waiver from Title 19.08 is hereby approved, to allow a zero-foot wide landscape buffer adjacent to the east property line where eight feet is required.

5. An Exception from Title 19.08 is hereby approved, to allow three parking lot landscape islands where six are required and eight parking lot trees where eleven are required.
6. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.
7. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
8. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, and shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device.
9. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.
10. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

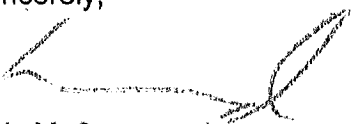
Public Works

11. Correct all American's with Disabilities Act (ADA) deficiencies on the sidewalks adjacent to this site in accordance with code requirements of Title 13.56.040, if any, to the satisfaction of the City Engineer concurrent with development of this site. All existing paving damaged or removed by this development shall be restored at its original location and to its original width concurrent with development of this site.
12. All landscaping and private improvements installed with this project shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.

13. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits or submittal of any construction drawings, whichever may occur first. Provide and improve all drainageways recommended in the approved drainage plan/study. The developer of this site shall be responsible to construct such neighborhood or local drainage facility improvements as are recommended by the City of Las Vegas Neighborhood Drainage Studies and approved Drainage Plan/Study concurrent with development of this site.

This action by the Planning Commission on **September 24, 2019** is final unless a written appeal is filed with the City Clerk within ten days of the date of the Planning Commission's decision as allowed by code or there is a review action filed by the City Council within the same time period. For additional information on appeals or review requests submitted please access <http://www.lasvegasnevada.gov/CheckStatus/DevelopmentApp.htm>, or contact the Department of Planning and Development at 702.229.6301 after **October 7, 2019**. No building permits or business licenses related to these items shall be issued prior to the expiration of the required ten day waiting period, or until any filed appeal is resolved pursuant to LVMC Title 19.18.

Sincerely,



Eric McCammond
Sr. Management Analyst
Case Planning Division

EM:nl

cc:

Gemie Kinsely
GK3 Architecture
2111 Edgewood Avenue
Las Vegas, Nevada 89102

McCAY ENGINEERING

11700 W. CHARLESTON BLVD., SUITE 170-298
LAS VEGAS, NV 89135
702-860-3897

TECHNICAL DRAINAGE STUDY FOR PIPE TRADES TRAINING FACILITY 750 LEIGON WAY

LAS VEGAS

September 20, 2019



McCAY ENGINEERING

PREPARED FOR:

PLUMBERS AND PIPEFITTERS
LOCAL UNION 525
APPRENTICE AND JOURNEYMAN TRAINING
TRUST FOR SOUTHERN NEVADA
760 N. LAMB BLVD.
LAS VEGAS, NV 89110
(702) 224-3032

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Pipe Trades Training Facility 750 Leigon Way Date: 9/20/19

Location of Development: a) Descriptive (Cross Streets) North/South: Leigon Way

East/West: Harris Ave

b) Section: 30 Township: T20S Range: R62E

c) APN : 140-30-803-013

Name of Owner: Plumbers and Pipefitters Local Union 525 Apprentice and Journeyman Training Trust for Southern Nevada

Telephone No.: 702-224-3032 Fax No.: NA E-Mail Address: NA

Address: 760 N. Lamb Blvd., Las Vegas, NV 89110

Contact Person-Name: Jeremy McCay, P.E. Telephone No.: 702-860-3897

E-Mail Address: jmccay@centurylink.net Fax No.: NA

Firm: McCay Engineering

Address: 11700 W. Charleston Blvd., Suite 170-298, Las Vegas, NV 89135

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: 4.41 +/- Acres Being Developed/Disturbed: 1.34 +/- 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

5. Approximate upstream land area which drains to the subject site: None

6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: City of Las Vegas: DS3210

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: The site is discharged to Leigon Way.

8. Briefly describe your proposed schedule for the subject project: ASAP



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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Pipe Trades Training Facility 750 Leigon Way	Map ID:
Firm Name: Blue Diamond Civil Engineering	Engineer: Philip D. Wakefield, P.E.
Address: 452 E. Silverado Ranch Blvd., #186	
City: Las Vegas	State: NV Zip: 89183
Phone Number: 702-287-8914	Fax Number: NA
Property Owner: Plumbers & Pipefitter Local Union 525 Apprentice & Journeyman Training Trust for Sounthern Nevada	
Address: 760 N. Lamb Blvd	
City: Las Vegas	State: NV Zip: 89110
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 (CCRFCDD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

This document is intended as an aid in preparing Technical Drainage Studies. 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 property evaluate the intended land use.

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

I. GENERAL REQUIREMENTS

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.

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 CCRFCDD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

YES NO

- | | | |
|-------------------------------------|--------------------------|--|
| ☒ | ☐ | 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 interim and future 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"x36" sealed by a registered engineer in the State of Nevada. |
| ☒ | ☐ | Minimum scale: 1"=50'. |
| ☒ | ☐ | 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 crown at lot lines, grade breaks, and along curb returns on both sides of the street. |
| ☒ | ☐ | Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate. |
| ☒ | ☐ | Minimum finish floor elevations with top-of-curb elevations at upstream end of lot. |
| ☒ | ☐ | Proposed typical street sections. |

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

YES NO

- 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 and 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 direction 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., sidewalks, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, materials, 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"X48". Wrought iron gate is required for flows > 10 cfs.
- N/A** ☐ Location and detail of floodwalls illustrating depth of flow, proposed grouting height, etc.
- 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.
- ☒ ☐ 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 or best available information; limits of proposed floodplains based on best available information.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

YES NO

- 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. Finish floor elevations must be a minimum of 18 inches above BFE.
- ☒ ☐ Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from Q_{100} flows.
- ☒ ☐ Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
- ☒ ☐ Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

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.
- ☒ ☐ Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2

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 “dxv” products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 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.)

☒ ☐ 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.

☒ ☐ Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirements 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 or flow depth, which ever is greater.

A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones.

N/A ☐

- Field survey data.
- Input and output information.
- Plotted cross-sections based on survey with proper encroachments.
- A map showing the location 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.

N/A ☐ 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 right-of-way, including headwater pool inundation.

☒ ☐ The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed

☒ ☐ Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2



MCCAY ENGINEERING

11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NV 89135
JMCCAY@CENTURYLINK.NET
(702) 860-3897

September 20, 2019

Albert Sung
City of Las Vegas Flood Control
333 N. Rancho Drive
Las Vegas, Nevada 89106

**RE: TECHNICAL DRAINAGE STUDY FOR PIPE TRADES TRAINING FACILITY 750 LEIGON WAY
Job No. 19333**

Mr. Sung:

McCay Engineering is pleased to submit two copies of the Technical Drainage Study and Grading Plan for your review and approval for the above-mentioned project. The proposed 1.34-acre commercial development is located on the east side of Leigon Way approximately 500 feet south of Harris Ave, in a portion of Las Vegas, Nevada.

If you have any questions or comments regarding this project, please do not hesitate to contact this office at (702) 860-3897.

Sincerely,
MCCAY ENGINEERING



Jeremy S. McCay, P.E.
Principal

TABLE OF CONTENTS

I.	INTRODUCTION	1
A.	Study Overview and Purpose	1
B.	Location	1
C.	Existing Site Description	1
D.	FEMA Flood Plain Information	1
E.	CCRFGD Master Plan Information	1
F.	Previous Drainage Studies	2
II.	METHODOLOGY	2
A.	Compliance with Regulations	2
B.	Hydrologic Criteria	2
1.	Rainfall Criteria	2
2.	Runoff Computations	2
III.	DRAINAGE BASIN DESCRIPTIONS	3
A.	Existing Onsite Drainage Description	3
B.	Existing Offsite Drainage Description	3
C.	Future Onsite Drainage Description	3
E.	Facility Design Calculations	4
IV.	CONCLUSIONS	5
V.	REFERENCES	5

TABLES

Table 1	Drainage Basin Parameters	3
Table 2	Future Runoff Amounts	4
Table 3	Offsite Street Flow Calculations	4
Table 4	Onsite Street Flow Calculations	4

FIGURES

Figure 1	Vicinity Map
Figure 1A	Assessor's Parcel Map
Figure 2	Site Description Map
Figure 3	FIRM Map
Figure 4	2018 Master Plan Update Flood Control Facilities Map
Figure 5	2018 Master Plan Update Flood Control Facilities Inventory
Figure 6	2018 Master Plan Update Hydrologic Subareas, Land Use, and Soils
Figure 7	Future Onsite Basin Map

APPENDICES

Figures
Hydrologic Parameters
Future HEC-1 Model
Hydraulic Calculations
Excerpts from the TDS for Joint Apprenticeship Training Center
Project Plans

I. INTRODUCTION

A. Study Overview and Purpose

This study is intended to serve as the technical hydrology study for the proposed development. The site comprises of approximately 1.34 acres of proposed commercial development. This study is a stand-alone document that presents the findings of a hydrologic analysis of the site and contributing watershed area.

This report will identify any natural washes as well as any existing/proposed drainage facilities that contribute stormwater runoff to the site during a 100- and 10-year, 6-hour storm event. This study has been conducted in accordance with the criteria set forth by the Clark County Regional Flood Control District's (CCRFC) *Hydrologic Criteria and Drainage Design Manual* (Reference #1).

B. Location

The project area is within the Southeast Quarter (SE 1/4) of Section 30, Township 20 South, Range 62 East, Mount Diablo Meridian, Las Vegas, Nevada. The site is located at the southeast corner of the intersection at Harris Avenue and Leigon Way (APN 140-30-803-013). See Figures 1 and 1A, *Vicinity Map* and *APN Map*.

C. Existing Site Description

The project site is currently developed as a commercial development. The site consists of approximately 1.34 acres in good hydrologic condition. The general area slopes to the southwest at approximately 0.5 percent. The properties adjacent to the site are generally a patchwork of residential developments and commercial properties. See Figure 2, *Site Description Map*.

D. FEMA Flood Plain Information

A review of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps (FIRM) Community-Panel Number 32003C2187F, effective date November 16, 2011 (Reference #5), indicates the site is not located within a FEMA Zone 'X'. A Zone 'X' is described by FEMA as areas outside of the 0.2% annual chance floodplain. A map depicting the FEMA flood zones in the vicinity of the site is included in the appendix of this study. (Figure 3- FIRM Map)

E. CCRFCD Master Plan Information

As shown on Figure F-25 from the *Flood Control Master Plan Update of the Las Vegas Valley* (see Figures 4 and 5 in the Appendix), prepared by Atkins, et al. (Reference #4), the subject site is not adjacent to a proposed Master Plan Flood Control Facility. Figure W-5 has also been provided (see Figure 6 in the appendix) and the site is a part of basin BN12-C.

F. Previous Drainage Studies

A drainage study done for northern half of the parcel was reviewed for this study. Excerpts from the Technical Drainage Study for the Joint Apprenticeship Training Center (DS3210) that have been deemed appropriate have been placed in the appendices.

II. METHODOLOGY**A. Compliance with Regulations**

This study complies with the standards set forth within Reference #1 and City of Las Vegas drainage requirements.

B. Hydrologic Criteria**1. Rainfall Criteria**

The project site is located within the McCarran Airport Rainfall Area. The depth-duration-frequency values for the 6-hour, 10-year and 100-year storm events were obtained from Table 505 and Figure 513 of Reference #1. Since the site encompasses less than 8-square miles a Storm Distribution Number three (SDN #3) was used in the HEC-1 model. The precipitation values are outlined in Table 1.

2. Runoff Computations

The U. S. Army Corps of Engineers HEC-1 flood hydrograph package was used to determine the peak runoff generated during the 100- and 10-year, 6-hour storm event. The HEC-1 computer model simulates the surface runoff response of a given watershed to rainfall. The HEC-1 program represents the watershed as an interconnected system of hydraulic components. Each component represents an aspect of the rainfall runoff process within a portion of the watershed. The smaller portion is referred to as a sub-basin. The computed hydrographs from each sub-basin are then combined at appropriate locations to obtain the final discharge hydrograph. The HEC-1 parameter calculations are located in appendix of this study.

The SCS curve number method was used to determine the infiltration rates for the drainage basins. The soil groups for the project site were determined using the SCS Soil Survey of the Las Vegas Valley. Curve numbers for the developed onsite and offsite were determined using Table 602 (1 of 4) for areas shown to be commercial and pavement. Soil information has been included in the appendix.

Basin areas for the offsite and onsite drainage basins were determined using a scaled plan.

Lag Time T_L is defined as the time measured from the centroid of effective rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time, and is a coherent property to basin length, slope, roughness characteristics, and land use. The lag-times for this study were estimated by calculating the drainage basins' time of concentration, T_C . The time of concentration consists of two components; the initial overland flow time, t_i , and the gutter or channel flow time, t_c . The equation for the time of concentration is $T_C = t_i + t_c$. The equation for lag time is $T_L = 0.6T_C$.

Precipitation in the Las Vegas Valley is characterized typically by long-duration, low-intensity winter storms and by short-duration, high-intensity summer storms. The winter storms, in general, do not produce major flooding events. The summer storms however can and do produce major flash flooding hazards in the Las Vegas Valley Area.

**TABLE 1
DRAINAGE BASIN PARAMETERS**

BASIN	AREA (acres)	CN	POINT PRECIP. (10 yr/100 yr)	DARF (10 yr/100 yr)	LAG (hr)
FUTON1	1.34	94.0	1.58/2.77	0.57/1.00	0.064
FUTOF1	0.14	98.0	1.58/2.77	0.57/1.00	0.050

III. DRAINAGE BASIN DESCRIPTIONS

A. Existing Onsite Drainage Description

The existing onsite condition was analyzed in the approved Technical Drainage Study for the Joint Apprenticeship Training Center (DS3210). Excerpts from the reference material have been placed in the appendix.

B. Existing Offsite Drainage Description

The existing offsite condition was analyzed in the approved Technical Drainage Study for the Joint Apprenticeship Training Center (DS3210). Excerpts from the reference material have been placed in the appendix. The site does not accept runoff from any direction in the existing condition, per the reference material.

C. Future Onsite Drainage Description

The future onsite basin analyzes the proposed development. The onsite basins were delineated using the proposed onsite grading. Basin FUTON1 is discharged in to Leigon Street through a swale placed at the southwest corner of the property. A portion of basin ON3 (25%) from the existing northern portion of the site is now conveyed south along the eastern portion of the proposed building. The portion of the flows has been quantified as 0 cfs and 1 cfs in the 10-year and 100-year conditions, respectively. The delineation of the proposed onsite basin is shown on Figure 7 and included in the appendix. Table 2 shows a summary of the runoff amounts determined in the future condition.

D. Future Offsite Drainage Description

The future offsite basin analyzes the section of Leigon Way that runs along the western frontage of the site. Basin FUTOF1 conveys flows south along the street eventually combining with the flows generated from our site at point COM1. The flows from Technical Drainage Study (DS3210) were referenced and added to FUTOF1 as base flows. The 10-year and 100-year conditions were determined to be 3 cfs and 7 cfs, respectively. The appropriate reference material has been included in the appendices.

TABLE 2
10-YEAR / 100-YEAR, 6-HOUR STORM EVENT
FUTURE RUNOFF AMOUNTS

BASIN NAME/ CONCENTRATION POINT	AREA (acres)	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
FUTON1	1.34	2	4
FUTOF1*	014	3	7
COM1*	--	5	12

*Includes offsite flows from approved TDS (Q10=3cfs, Q100=7cfs)

E. Facility Design Calculations

Offsite street flow calculations for the 10-year and 100-year, 6-hour storm events are summarized in the following tables:

TABLE 3
OFFSITE STREET FLOW CALCULATIONS

STREET	Q ₁₀ /Q ₁₀₀ (cfs)	D ₁₀ /D ₁₀₀ (ft)	V ₁₀ /V ₁₀₀ (ft/s)	V x D
Leigon Way (Section 1) COM1	5/12	0.50/0.64	1.51/1.77	0.76/1.13

Onsite street flow calculations for the 10-year and 100-year, 6-hour storm events are summarized in the following tables:

TABLE 4
ONSITE STREET FLOW CALCULATIONS

STREET	Q ₁₀ /Q ₁₀₀ (cfs)	D ₁₀ /D ₁₀₀ (ft)	V ₁₀ /V ₁₀₀ (ft/s)	V x D
Section 2 FUTON1 + 25% ON3	2/5	0.37/0.49	1.55/1.91	0.57/0.94

The street calculations show that the *CCRFCD Hydrologic Criteria & Drainage Design Manual* velocity/depth products criteria are met in the future. The velocity/depth products are below 6 and 8 for the 10- and 100-year storms, respectively. Driveway entrances have been elevated to at least 6 inches above the 100-year water surface elevation in Leigon Way.

Onsite BMPs have been included for this proposed development. A landscape swale has been provided for the control of surface water quality and the velocities are mitigated by erosion protection for the 100-year condition for basin FUTON1 (see calculations in the appendix). The 100-year flowrate was used and is conservative since it is considered to be more than what is required to be mitigated in the BMP

design. The total mitigated impervious area within this project is more than 75%. The proposed design satisfies BMP requirements.

IV. CONCLUSIONS

The following recommendations are provided to facilitate safety, both public and private, for the proposed commercial development.

1. Elevate the onsite entrances to prevent offsite runoff from entering the site and to maintain conveyance of offsite flow.
2. Construct all proposed street and gutter improvements to allow proper conveyance of storm water.
3. Nuisance water shall be captured onsite so adjacent properties are not affected during construction.

V. REFERENCES

1. *CCRFCD Hydrologic Criteria and Drainage Design Manual*, WRC Engineering, 1999.
2. *Contours*, Clark County.
3. *Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County*, Soil Conservation Service, 1985.
4. *2018 CCRFCD Flood Control Master Plan*, Atkins, et al., 2018.
5. *Flood Insurance Rate Map, Community Panel Number 32003C2187F, Clark County, Nevada*, Federal Emergency Management Agency, effective November 16, 2011.
6. *HEC-1 Flood Hydrograph Package Version 4.0*, U.S. Army Corps of Engineers Hydrologic Engineering Center, 1990.
7. *FlowMaster User's Manual Version 8.0*, Haestad Methods, Inc., 2005.
8. *Technical Drainage Study for Joint Apprentice Training Center*, WRG, 2002.



**McCay
ENGINEERING**

APPENDIX A

FIGURES

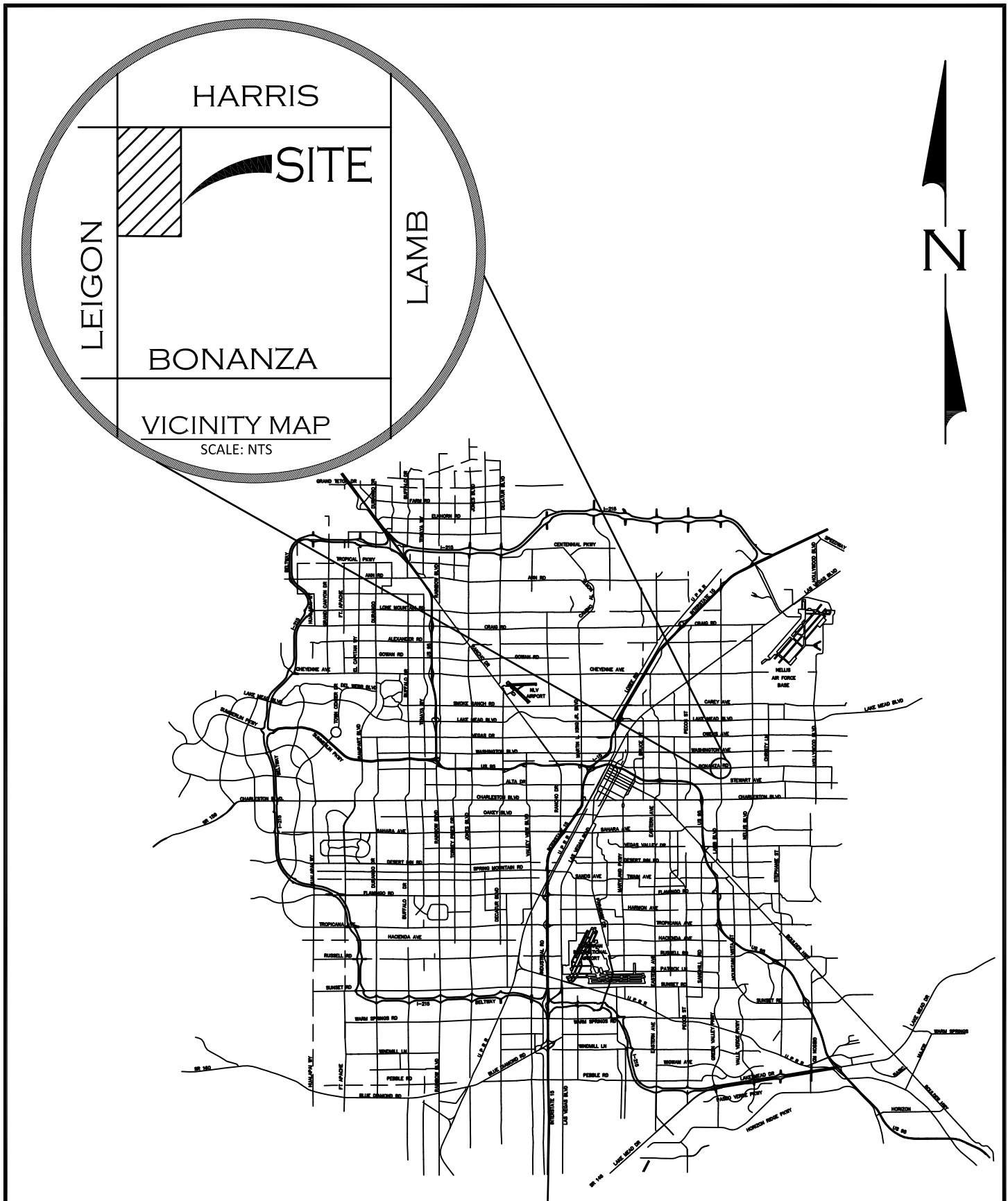


FIGURE 1
VICINITY MAP



McCay Engineering

11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702-860-3897

JOB NUMBER: 19333

DRAWN BY: JSM

DATED: 9/20/2019

This map is for assessment use only and does NOT represent a survey.

No liability is assumed for the accuracy of the data delineated 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

NOTES

ASSESSOR'S PARCELS - CLARK COUNTY, NV.

Briana Johnson - Assessor

PARCEL BOUNDARY
SUB BOUNDARY
PM/LD BOUNDARY
ROAD EASEMENT
MATCH / LEADER 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 NUMBER
1.00 ACREAGE
202 PARCEL SUB/SEQ NUMBER
PB 24-45 PLAT RECORDING NUMBER
5 BLOCK NUMBER
LOT NUMBER
GLS GOV. LOT NUMBER

T20S R62E

30

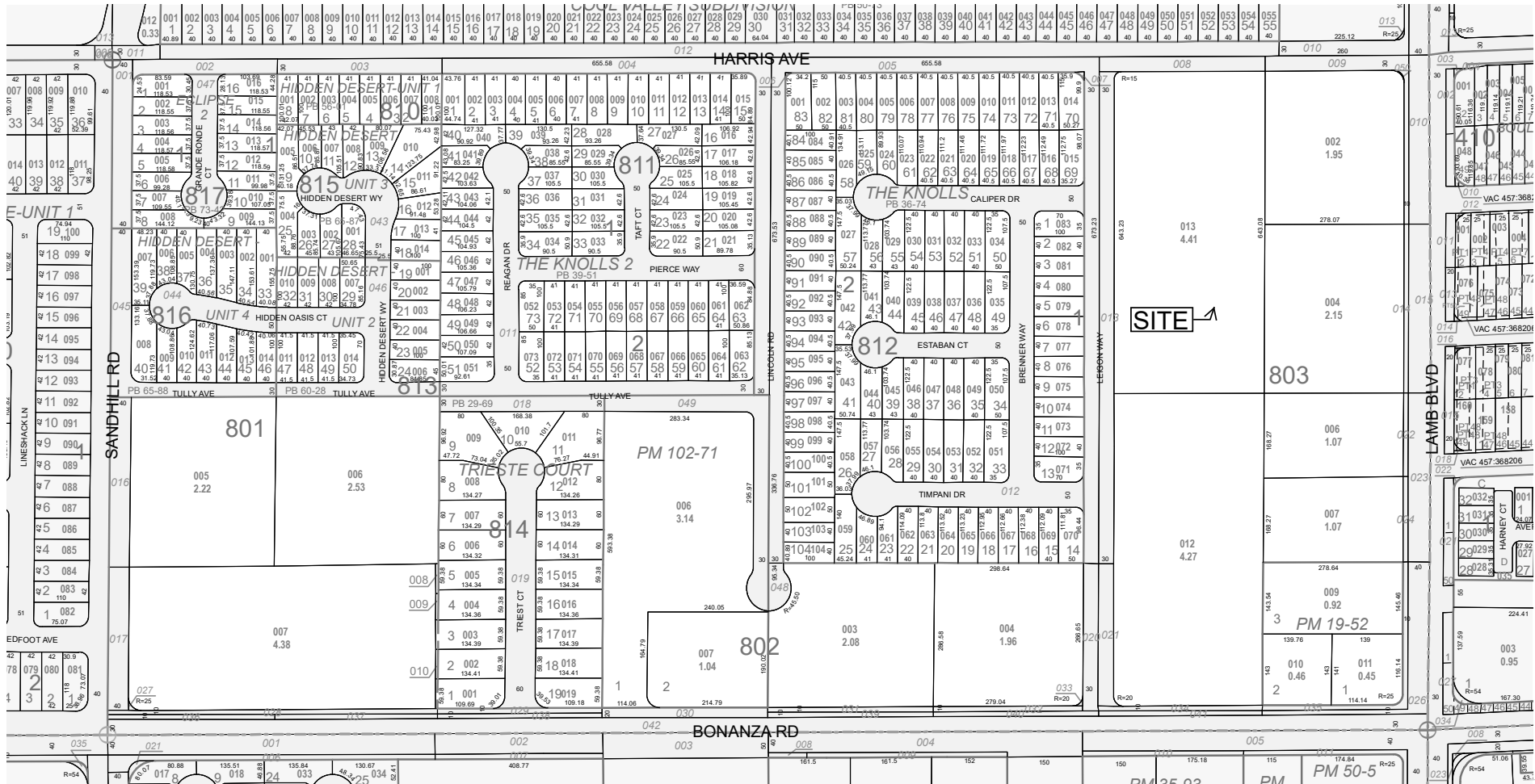
S 2 SE 4

140-30-8

CLARK COUNTY
NEVADA

Scale: 1" = 200'

Rev: 1/8/2019



TAX DIST 200

FIGURE 1A

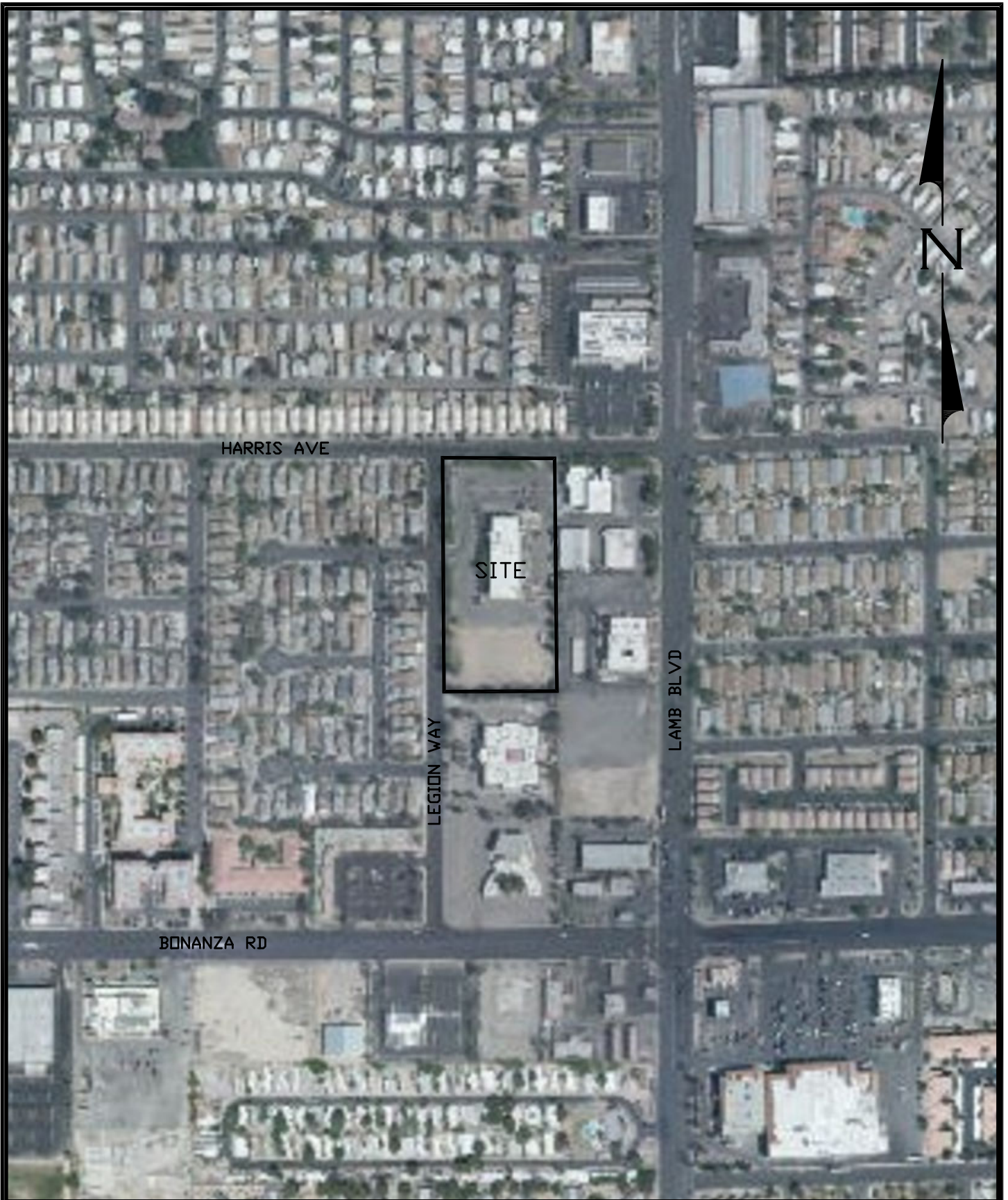


FIGURE 2
SITE DESCRIPTION MAP



McCAY ENGINEERING

11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702-860-3897

JOB NUMBER: 19333

DRAWN BY: JSM

DATED: 9/20/2019

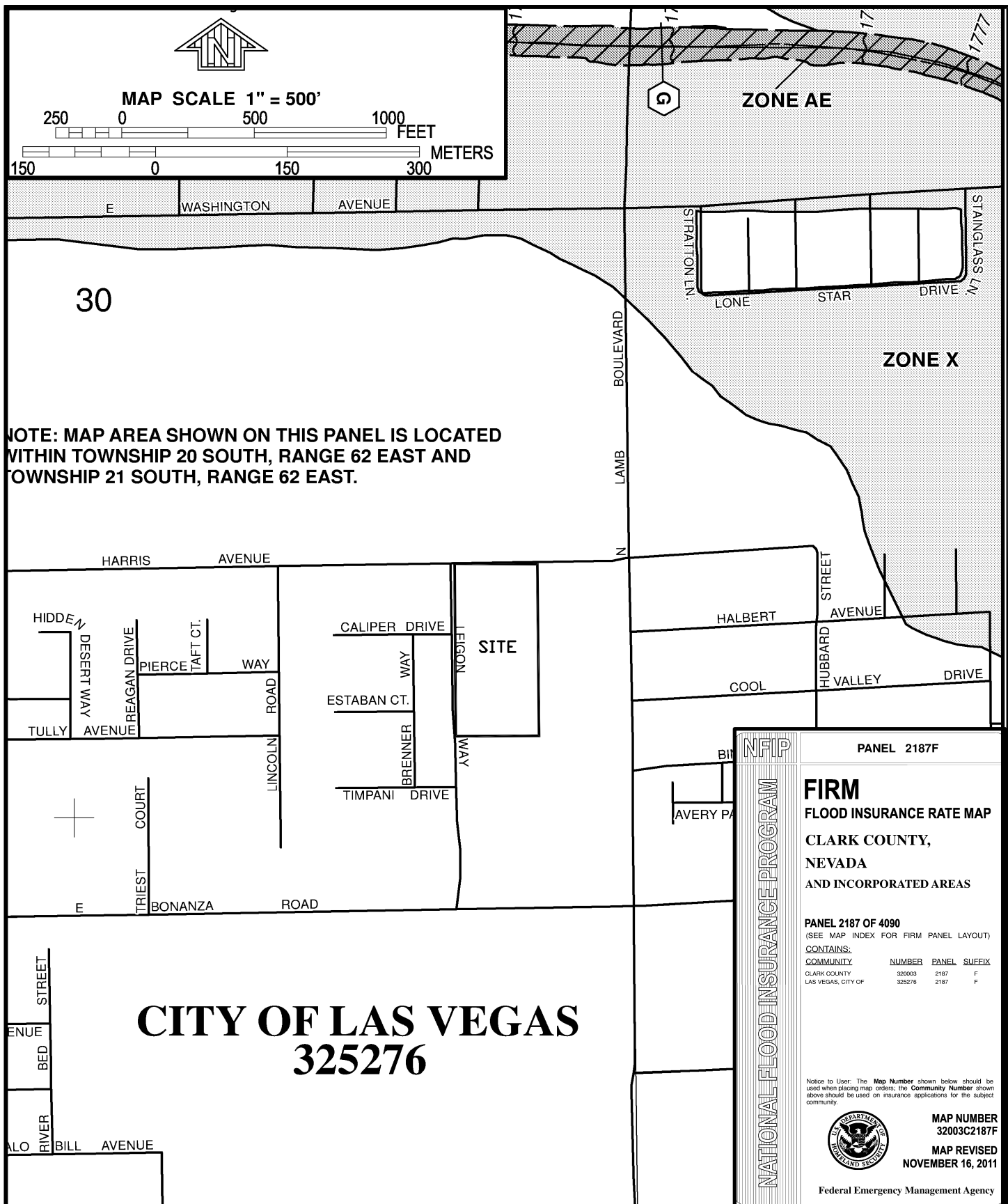


FIGURE 3
FIRM



McCay Engineering

11700 W. CHARLESTON BLVD.
SUITE #170-298
LAS VEGAS, NEVADA 89135
P 702-860-3897

JOB NUMBER: 19333
DRAWN BY: JSM DATED: 9/20/2019

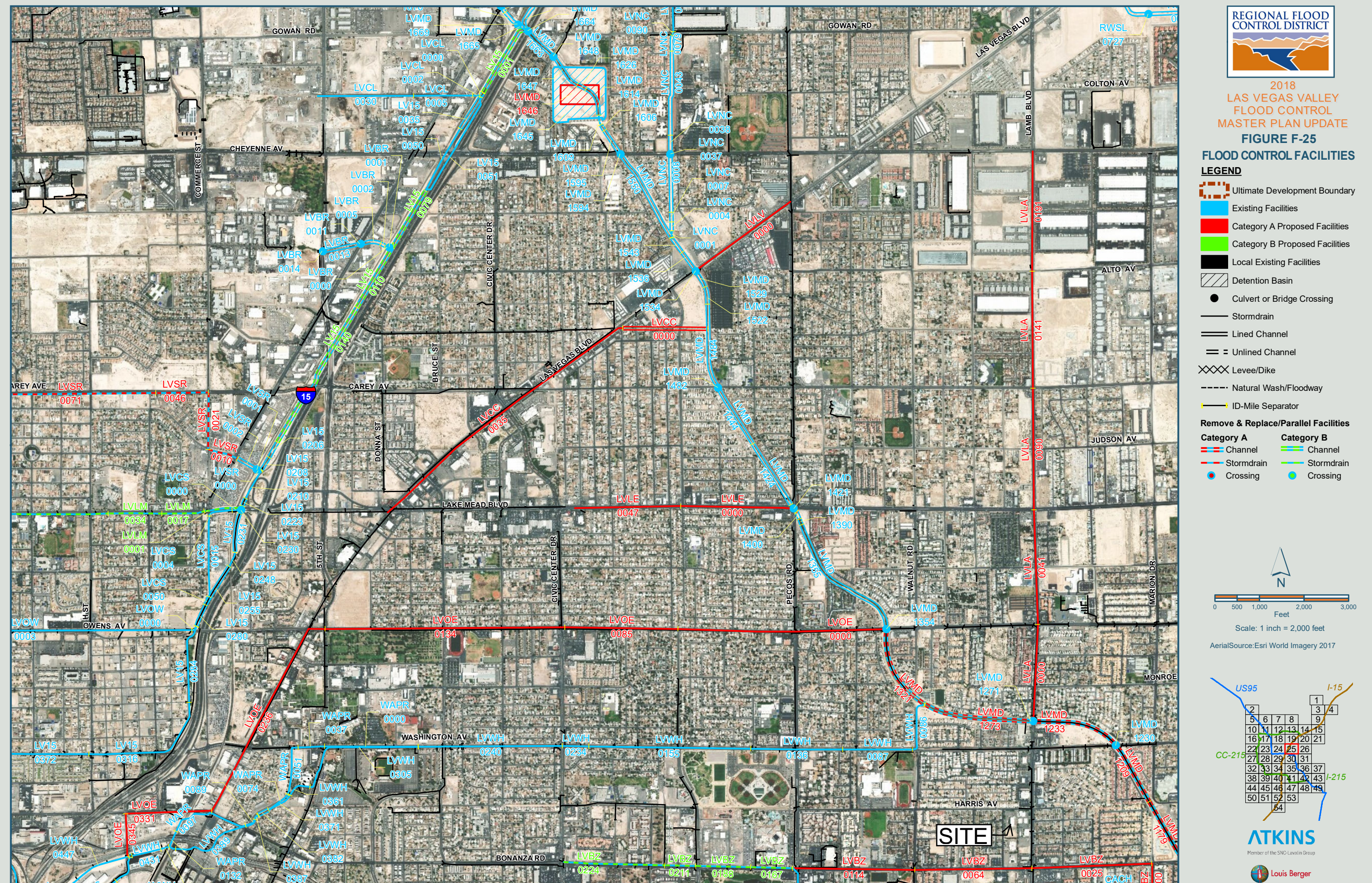
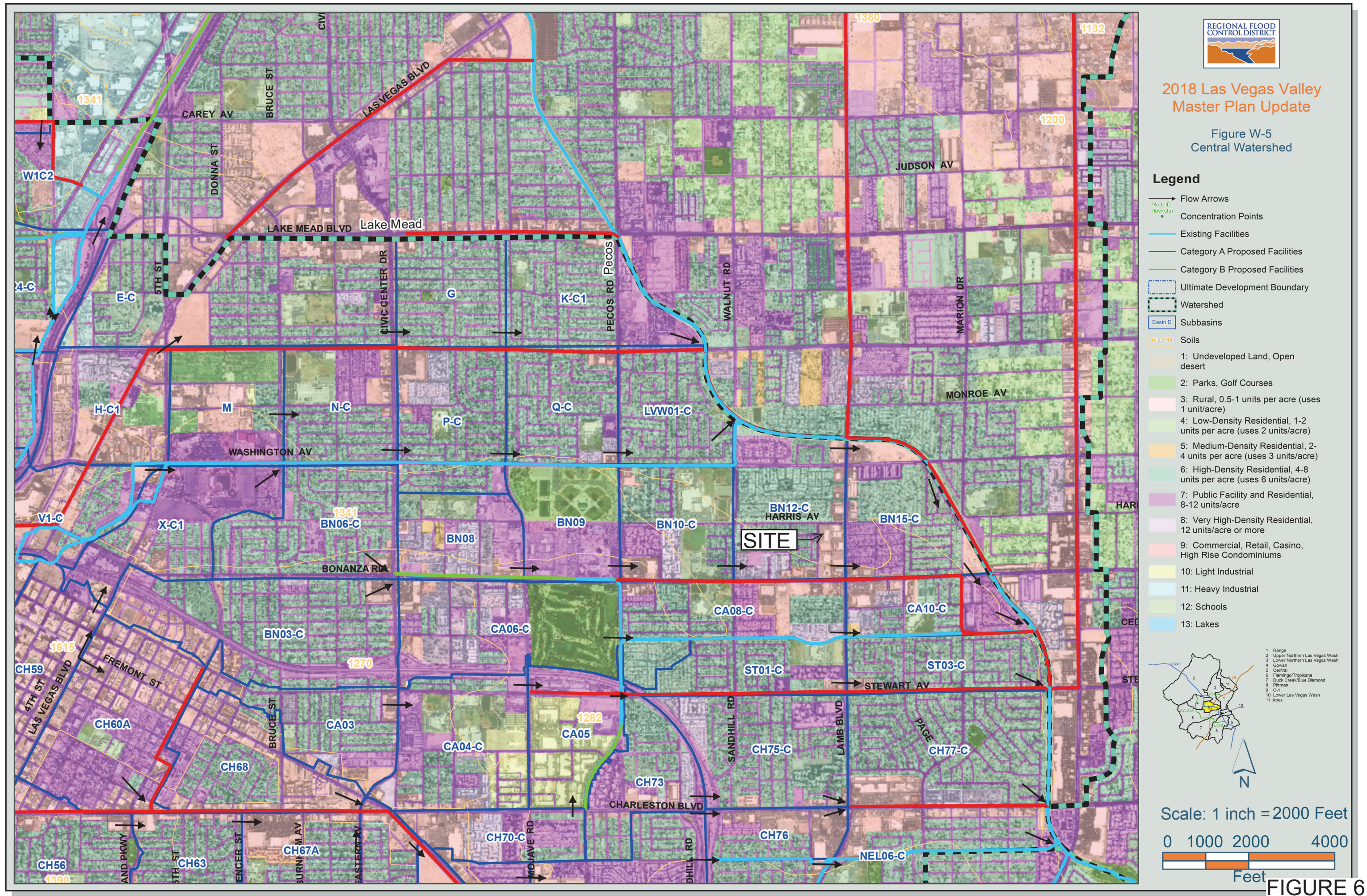


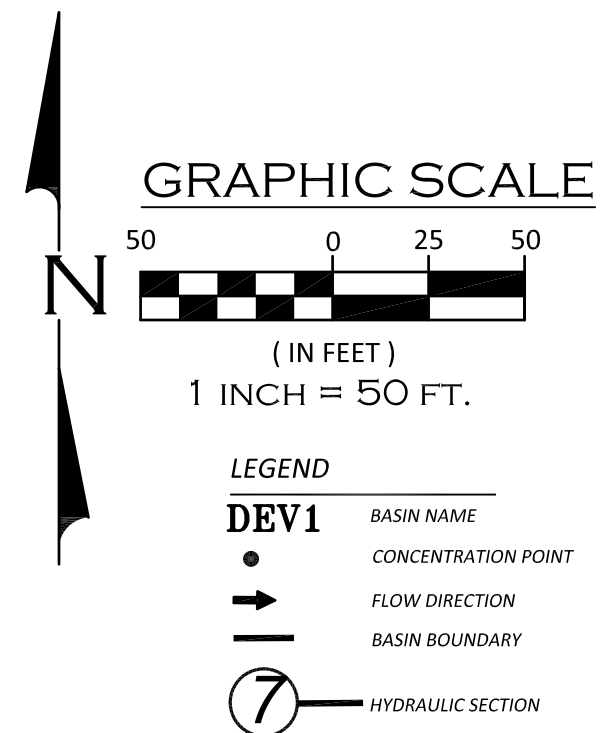
FIGURE 4

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
CABZ 0010	E	CEDAR AVENUE - BONANZA 60" RCP	1450					0.30
LCCH 0013	E	LAS VEGAS CREEK CHANNEL 2: 12' X 6' RCB	2035	3050	CLC20-C	MEADOWS4	9.60	0.82
LV15		FREEWAY CHANNEL						
0000	E	CONC CHNL 20"W 10'D 1.5:1 SS (REPLACE W/ LV150001)	1759	5012	2CLV1E-3	CWEST4	11.19	0.12
0001	P0	CONC CHNL 55"W 11'D 0:1 SS (REPLACES LV150000)	1759	5012	2CLV1E-3	CWEST4	11.19	0.12
0035	E	CONC CHNL 20"W 10'D 1.5: SS	899	1404 [^]	2CLV1D-5 [^]	CWEST4	10.29	0.16
0050	E	2: 8' X 10' RCB	1504	1404 [^]	2CLV1D-5 [^]	CLVMD4	10.29	0.75
0051	E	12' X 10' RCB	2524	3275 [^]	2CLV1D-5 [^]	CLVMD4	10.29	5.20
0078	E	CONC CHNL 20"W 10'D 1.5:1 SS (REPLACE W/ LV150079)	1608	4679	2CLV1D-5	CWEST4	10.29	0.14
0079	P0	CONC CHNL 50"W 11'D 0:1 SS (REPLACES LV150078)	1608	4679	2CLV1D-5	CWEST4	10.29	0.14
0109	E	CONC CHNL 15-20"W 10'D 1.5:1 SS (REPLACE W/ LV150110)	1576	4353	CLV1D-4	CWEST4	9.49	0.11
0110	P0	CONC CHNL 45"W 11:5D 0:1 SS (REPLACES LV150109)	1576	4353	CLV1D-4	CWEST4	9.49	0.11
0139	E	CONC CHNL 15"W 10'D 1.5:1 SS (REPLACE W/ LV150140)	3665	4353	CLV1D-4	CWEST4	9.49	0.18
0140	P0	CONC CHNL 45"W 11'D 0:1 SS (REPLACES LV150139)	3665	4353	CLV1D-4	CWEST4	9.49	0.18
0206	E	CONC CHNL 48"W 13'D 0:1 SS	329	4081	OW1C2	NW4SC	8.92	0.46
0208	E	CONFLUENCE STRUCTURE 64" 48"W 10-13'D 0:1 SS	298	4081	OW1C2	NW4SC	8.92	0.42
0210	E	3: 12' X 9' RCB	725	3689	CCVG24	NW3SC	7.14	0.25
0223	E	CONFLUENCE STRUCTURE 40"W 9'D 0:1 S:1	185	3689	CCVG24	NW3SC	7.14	0.25
0230	E	12' X 4.5' RCB @ LAKE MEAD	177	1265	DRAILRD	NW3	5.30	1.16
0231	E	CONC CHNL 8"W 8'D 0:1 SS	900	1265	DRAILRD	NW3	5.30	2.50
0248	E	8' X 8' RCB @ UPRR	300	1265	DRAILRD	NW3	5.30	1.34
0255	E	CONC CHNL 8"W 8'D 0:1 SS	1330	1265	DRAILRD	NW3	5.30	2.00
0280	E	CONC CHNL 21"W 8'D 0:1 SS	550	2530	CCVG10	NW3	5.30	2.00
0284	E	14' X 6' RCB	1790	1444	CVG10-C	NW3	4.91	0.50
0316	E	11' X 6' RCB	3010	1152	CWA20-C	NW3	4.52	0.59
0372	E	8' X 6' RCB	1970	1152	CWA20-C	NW3	4.52	0.66
LVBR		LAS VEGAS - BROOK						
0000	E	96" CMPC @ UPRR	107	346 [^]	CLV1D-5 [^]	WEST3	0.80	0.35
0001	E	8' X 4' RCB @ UPRR	107	530 [^]	CLV1D-5 [^]	WEST3	0.80	0.93
0002	E	CONC CHNL 27"W 9'D 0:1 SS	125	876	CLV1D-5	WEST3	0.80	1.57
0005	E	CONC CHNL 18"W 4:75D 0:1 SS	367	876	CLV1D-5	WEST3	0.80	2.43
0011	E	2: 9' X 3' RCB @ LOSEE	135	876	CLV1D-5	WEST3	0.80	0.71
0013	E	CONC CHNL 12"W 4:5D 2:1 SS	750	876	CLV1D-5	WEST3	0.80	1.50
0014	E	12' X 4' RCB @ N. 5TH ST	100	876	CLV1D-5	WEST3	0.80	2.60
LVBZ		LAS VEGAS WASH - BONANZA						
0000	P	2: 12' X 7' RCB	1760	1753	CBN15-C	SW3	2.15	0.40
0025	P	2: 12' X 7' RCB	2700	1753	CBN15-C	SW3	2.15	0.40
0064	P	2: 12' X 7' RCB	2630	1603	CBN12-C	SW3	1.87	0.40
0114	P	2: 12' X 6' RCB	2740	1311	CBN10-C	SW3	1.54	0.40
0166	E	54" RCP (REPLACE W/ LVB20167)	930	1106	CBN09	SW3	1.29	0.45
0167	P0	10' X 9' RCB (REPLACES LVB20166)	930	1106	CBN09	SW3	1.29	0.45
0187	E	48" RCP (REPLACE W/ LVB20188)	1235	1106	CBN09	SW3	1.29	0.71
0188	P0	9' X 9' RCB (REPLACES LVB20187)	1235	1106	CBN09	SW3	1.29	0.71
0210	E	42" RCP (REPLACE W/ LVB20211)	704	1004	CBN08	SW3	1.05	1.37
0211	P0	8' X 8' RCB (REPLACES LVB20210)	704	1004	CBN08	SW3	1.05	1.37
0223	E	36" RCP (REPLACE W/ LVB20224)	2275	856	CBN03	SW3	0.84	0.72
0224	P0	8' X 8' RCB (REPLACES LVB20223)	2275	856	CBN03	SW3	0.84	0.72
LVCC		LAS VEGAS WASH CARTIER CHANNEL						
0000	P	CONC CHNL 12"W 9:5D 0:1 SS	1900	995	CLW1A-3	CCWEST3	1.00	0.40
0035	P	10' X 5' RCB	6750	417	A-C	WEST3	0.40	0.32
LVCL		LAS VEGAS WASH - COLTON						
0000	E	CONC CHNL 9"W 13'D 0:1 SS	102	1071	QLV1E-3	WEST3	0.90	0.63
0002	E	102" RCP	157	1071	QLV1E-3	WEST3	0.90	0.62
0005	E	9' X 8' RCB	1320	1071	QLV1E-3	WEST3	0.90	0.94
0030	E	7' X 6' RCB	2148	1071	QLV1E-3	WEST3	0.90	2.22
LVCS		LAS VEGAS WASH - COMMERCE STREET						
0000	E	12' X 5' RCB	290	1590	CVG24	NW3	5.78	1.64
0004	E	10' X 6' RCB	100	1590	CVG24	NW3	5.78	4.84
0015	E	10' X 8' RCB	1700	1590	CVG24	NW3	5.78	0.97
0050	E	CONC CHNL 10"W 8'D 0:1 SS	200	1265	DDCVG10	NW3	5.30	2.27

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVCK		LAS VEGAS WASH - KING CHARLES CHANNEL						
0000	E	CONC CHNL 35"W 10'D 0:1 SS	592	5518	CLV99B-7	CWEST5	14.74	0.40
0009	E	CONC CHNL 21.8"W 10'D 1.5:1 SS	3280	5518	CLV99B-7	CWEST5	14.74	0.40
LVLA		LAS VEGAS WASH - LAMB						
0000	P	2: 13' X 9' RCB	2200	2461	CLW03	WEST3	3.30	0.30
0041	P	13' X 11' RCB	2600	2320	COA02	WEST3	3.07	0.58
0090	P	13' X 11' RCB	2700	2047	CLW64-3	WEST3	2.65	0.44
0141	P	13' X 10' RCB	2650	1693	CLW64-2	WEST3	2.12	0.38
0191	P	12' X 9' RCB	2700	1452	CLW64-1	WEST3	1.61	0.56
LVLE		LAKE MEAD DRAIN TO LAS VEGAS WASH						
0000	P	12' X 6' RCB	2600	660	CLV1B-2	WEST3	0.78	0.40
0047	P	12' X 4' RCB	2400	458	LV1B-1	WEST3	0.49	0.50
LVLM		LAS VEGAS WASH - LAKE MEAD						
0000	E	43"X 68" HERCP (REPLACE W/ LVLM0001)	847	1159	CLM20-C	NW3SC	1.36	4.60
0001	P0	12' X 4' RCB (REPLACES LVLM0000)	847	1159	CLM20-C	NW3SC	1.36	4.60
0016	E	54" RCP (REPLACE W/ LVLM0017)	965	1159	CLM20-C	NW3SC	1.36	4.38
0017	P0	12' X 4' RCB (REPLACES LVLM0016)	965	1159	CLM20-C	NW3SC	1.36	4.38
0033	E	60" RCP (REPLACE W/ LVLM0034)	1186	1159	CLM20-C	NW3SC	1.36	1.62
0034	P0	12' X 5' RCB (REPLACES LVLM0033)	1186	1159	CLM20-C	NW3SC	1.36	1.62
0059	E	72" RCP (REPLACE W/ LVLM0060)	5952	1159	CLM20-C	NW3SC	1.36	0.66
0060	P0	12' X 7' RCB (REPLACES LVLM0059)	5952	1159	CLM20-C	NW3SC	1.36	0.66
LVLV		LAS VEGAS BLVD DRAIN						
0000	P	2: 10' X 8' RCB	2600	823	CLW075-4	WEST3	1.03	0.10
LVMD		LAS VEGAS WASH - MIDDLE						
1178	E	EARTH CHNL 30"W 18-20'D 2:1 SS (REPLACE W/ LVMD1179)	1500	13206	CLVW04-C	CLVWASH5	109.77	0.57
1179	P	CONC CHNL 60"W 9:5D 2:1 SS (REPLACES LVMD1178)	1500	13206	CLVW04-C	CLVWASH5	109.77	0.57
1208	E	BANK-STAB. CHNL 65"W 15D 2:1 SS (REPLACE W/ LVMD1209)	1420	13206	CLVW04-C	CLVWASH5	109.77	0.32
1209	P	CONC CHNL 60"W 11'D 2:1 SS (REPLACES LVMD1208)	1420	13206	CLVW04-C	CLVWASH5	109.77	0.32
1230	E	4 SPAN BRIDGE 162"W 13'D @ WASHINGTON	105	13172	CCLVW03	CLVWASH5	109.50	0.73
1232	E	BANK-STAB. CHNL 48"W 8'D 2:1 SS (REPLACE W/ LVMD1233)	1900	13172	CCLVW03	CLVWASH5	109.50	0.73
1233	P	CONC CHNL 90"W 8'D 0:1 SS (REPLACES LVMD1232)	1900	13172	CCLVW03	CLVWASH5	109.50	0.73
1271	E	4 SPAN BRIDGE 94"W 10'-12'D 2:1 SS @ LAMB	120	12412	OCLVW01C	CLVWASH5	106.21	0.38
1272	E	EARTH CHNL 80"W 10'D 2:1 SS (REPLACE W/ LVMD1273)	2400	12412	OCLVW01C	CLVWASH5	106.21	0.38
1273	P	CONC CHNL 80"W 9'D 2:1 SS (REPLACES LVMD1272)	2400	12412	OCLVW01C	CLVWASH5	106.21	0.38
1230	E	GABION CHNL 100"W 10'D 2:1 SS (REPLACE W/ LVMD1321)	1950	9070	OCK-C1	CLVWASH5	103.98	0.38
1321	P	CONC CHNL 80"W 8:5D 2:1 SS (REPLACES LVMD1320)	1950	9070	OCK-C1	CLVWASH5	103.98	0.38
1354	E	5 SPAN BRIDGE 110"W 7-8'D 2:1 SS @ OWENS	120	7810	2CLV1B-2	CLVWASH5	169.06	0.58
1355	E	GABION CHNL 100"W 10'D 2:1 SS	3122	7810	2CLV1B-2	CLVWASH5	169.06	0.58
1390	E	ENERGY DISSIPATOR	137	7692	CLW64-4	CLVWASH5	168.27	0.10
1400	E	CONC CHNL 90' W 12D 0:1	173	7692	CLW64-4	CLVWASH5	168.27	5.00
1421	E	2 SPAN BRIDGE 84"W 8'D @ LAKE MEAD	200	8906	CLW64-4	CCWEST5	80.53	0.60
1424	E	CONC CHNL 78"W 8:5D 0:1 SS	1615	8906	CLW64-4	CCWEST5	80.53	0.34
1444	E	CONC CHNL 84"W 8'D 0:1 SS	1450	8906	CLW64-4	CCWEST5	80.53	0.34
1482	E	1 SPAN BRIDGE 84"W 7'D @ CAREY	72	8906	CLW64-4	CCWEST5	80.53	1.00
1484	E	CONC CHNL 84"W 8-9'D 0:1 SS	1880	8906	CLW64-4	CCWEST5	80.53	0.37
1522	E	CONC CHNL 90"W 10'D 0:1 SS	376	8866	2CLW1A-3	CCWEST5	80.16	0.53
1529	E	CONC CHNL 90"W 9:8'D 0:1 SS	360	8866	2CLW1A-3	CCWEST5	80.16	0.53
1534	E	1 SPAN BRIDGE 72.5"W 7.5D @ LAS VEGAS BLVD	120	8742	CLW1A-4	CCWEST5	78.13	0.88
1536	E	CONC CHNL 70"W 8'D 0:1 SS	455	8742	CLW1A-4	CCWEST5	78.13	0.49
1543	E	CONFLUENCE STRUCTURE	393	8742	CLW1A-4	CCWEST5	78.13	1.44
1550	E	CONC CHNL 90"W 7.5-9'D 0:1 SS	2150	8260	CHYPKOT	CCWEST5	77.19	0.45
1594	E	1 SPAN BRIDGE 90"W 5'D @ CHEYENNE	124	8260	CHYPKOT	CCWEST5	77.19	0.71
1595	E	CONC CHNL 90"W 7'D 0:1 SS	580	8260	CHYPKOT	CCWEST5	77.19	0.40
1606	E	TRANSITION STRUCTURE	144	8260	CHYPKOT	CCWEST5	77.19	0.40
1609	E	60' X 7.25' RCB WITH 2" CENTER PIER	221	8260	CHYPKOT	CCWEST5	77.19	0.40
1614	E	CONC CHNL 60"W 9'-11'D 0:1 SS	703	13796	CHYPKIN	CCWEST5	77.19	0.15
1626	E	TRANSITION STRUCTURE	227	13796	CHYPKIN	CCWEST5	77.19	2.46
1643	E	64,000 CFS PMF SPILLWAY (REPLACE W/ LVMD1644)		64000	CHYPKIN	CCWEST5	77.19	
1644	P	MODIFY 64,000 CFS PMF SPILLWAY, RAISE BY 1" (REPL LVMD1643)		64000	CHYPKIN	CCWEST5	77.19	
1645	E	456 AC-FT CHEYENNE PEAKING BASIN		13796	CHYPKIN	CCWEST5	77.19	
1646	P	UPGRADE TO 590 AC-FT CHEYENNE PEAKING BASIN		13796	CHYPKIN	CCWEST5	77.19	
1647	E	CONC CHNL 120"D 10"W 0:1 SS	800	13796	CHYPKIN	CCWEST5	77.19	0.40

ID / 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						
1648	E	3 SPAN BRIDGE 95'W 8-10'D 2:1 SS @ CIVIC CENTER	120	13796	CHYPKIN	CCWEST5	77.19	0.70
1663	E	CONC CHNL 80'W 10'D 2:1 SS	700	13715	3C99B-7	CCWEST5	76.87	0.70
1664	E	3 SPAN BRIDGE 75'W 10'D 2:1 SS @ I-15	120	13715	3C99B-7	CCWEST5	76.87	0.70
1665	E	TRANSITION STRUCTURE	200	8157	CLV99B-5	WEST5	48.36	0.36
1669	E	FREE SPAN BRIDGE 55'W 12'D @ UPRR	40	8157	CLV99B-5	WEST5	48.36	0.36
1670	E	CONC CHNL 82'W 10'D 0:1 SS	370	8157	CLV99B-5	WEST5	48.36	1.69
1677	E	CONC CHNL 80'W 10'D 2:1 SS	119	8157	CLV99B-5	WEST5	48.36	0.37
1679	E	4 SPAN BRIDGE 100'W 12'D 2:1 SS @ LOSEE	120	8157	CLV99B-5	WEST5	48.36	0.37
LVNC		LAS VEGAS WASH - N CHANNEL						
0001	E	18' X 7' RCB	150	1059	CLW100	CWEST5	14.59	0.33
0004	E	CONC CHNL 18'W 8.5'D 0:1 SS	200	1059	CLW100	CWEST5	14.59	0.33
0007	E	DROP STRUCTURE 18'W 2.8'D 3:1 SS	200	1059	CLW100	CWEST5	14.59	0.70
0008	E	CONC CHNL 18'W 10'D 2:1 SS	1250	1059	CLW100	CWEST5	14.59	0.70
0037	E	2. 14' X 7'-6" CMAP @ CHEYENNE	120	1059	CLW100	CWEST5	14.59	0.70
0038	E	CONC CHNL 32'W 8.5'D 2:1 SS	363	1059	CLW100	CWEST5	14.59	0.30
0043	E	CONC CHNL 12'W 6'-8"D 2:1 SS	1930	1059	CLW100	CWEST5	14.59	0.50
0079	E	TRANSITION CONC CHNL	350	1059	CLW100	CWEST5	14.59	1.00
0090	E	3. 12' X 6' RCB	120	1059	CLW100	CWEST5	14.59	0.70
0091	E	14' X 6' RCAP	1324	1059	CLW100	CWEST5	14.59	0.52
LVOE		OWENS AVENUE - EAST						
0000	P	15' X 12' RCB	4700	3018	OK-C1	SW5	24.06	0.47
0085	P	14' X 12' RCB	2540	2908	CG	SW5	23.74	0.62
0134	P	12' X 11' RCB	5380	2833	CE-C	SW5	23.51	1.00
0236	P	13' X 9' RCB	5000	2643	CH-C1	SW5	22.90	1.50
0331	P	13' X 12' RCB	1940	2576	DLVOE	SW5	22.61	0.60
0345	P	13' X 12' RCB	990	2576	DLVOE	SW5	22.61	0.60
LVOW		OWENS AVENUE SYSTEM						
0000	E	10' X 6' RCB	145	1219	CLM16B-C	NW3	2.43	0.76
0003	E	96" RCP	7500	1219	CLM16B-C	NW3	2.43	0.70
LVSR		LAS VEGAS WASH - SMOKE RANCH						
0000	E	CONC CHNL 22'W 8'D 0:1 SS	79	1086	CS1-C	NW3SC	1.42	2.32
0001	E	FREE SPAN BRIDGE 22'W 10'D	50	1086	CS1-C	NW3SC	1.42	2.32
0002	E	CONC CHNL 22'W 8'D 0:1 SS	468	1086	CS1-C	NW3SC	1.42	2.32
0009	E	72" RCP (REPLACE W/ LVSR00010)	702	1086	CS1-C	NW3SC	1.42	2.32
0010	P	10' X 5' RCB (REPLACES LVSR0009)	702	1086	CS1-C	NW3SC	1.42	2.32
0020	E	60" RCP (REPLACE W/ LVSR00021)	1320	1086	CS1-C	NW3SC	1.42	3.03
0021	P	10' X 5' RCB (REPLACES LVSR00020)	1320	1086	CS1-C	NW3SC	1.42	3.03
0045	E	54" RCP (REPLACE W/ LVSR00046)	1180	1086	CS1-C	NW3SC	1.42	3.41
0046	P	10' X 5' RCB (REPLACES LVSR00045)	1180	1086	CS1-C	NW3SC	1.42	3.41
0070	E	66" RCP (REPLACE W/ LVSR00071)	4118	1086	CS1-C	NW3SC	1.42	0.73
0071	P	10' X 8' RCB (REPLACES LVSR00070)	4118	1086	CS1-C	NW3SC	1.42	0.73
LVWH		WASHINGTON AVENUE CHANNEL						
0086	E	3. 12' X 8' RCB	1210	3825	CLVW01-C	SW5SC	16.58	0.35
0087	E	3. 12' X 8' RCB	1560	3825	CLVW01-C	SW5SC	16.58	0.33
0136	E	3. 12' X 8' RCB	2063	3728	QQ-C	SW5SC	16.35	0.33
0155	E	3. 10' X 8' RCB	3630	3618	CP-C	SW5SC	16.09	0.68
0234	E	2. 12' X 8' RCB	600	3502	CN-C	SW5SC	15.78	0.71
0240	E	2. 12' X 8' RCB	3240	3502	CN-C	SW5SC	15.78	1.50
0305	E	12' X 8' RCB	2950	1562 ¹	CV1-C ¹	SW5SC	14.95	2.93
0361	E	12' X 8' RCB	548	1562 ¹	CV1-C ¹	SW5SC	14.95	0.90
0371	E	12' X 8' RCB	590	1562 ¹	CV1-C ¹	SW5SC	14.95	2.62
0382	E	CONC CHNL 50'W 10'D 0:1 SS	260	3124	CV1-C	SW5SC	14.95	0.80
0387	E	12' X 8' RCB	125	1562 ¹	CV1-C ¹	SW5SC	14.95	7.43
0389	E	12' X 8' RCB	2110	1562 ¹	CV1-C ¹	SW5SC	14.95	0.90
0426	E	16' X 8' RCB	150	1562 ¹	CV1-C ¹	SW5SC	14.95	1.08
0429	E	SPLITTER STRUCTURE (2. 12' X 8' RCB)	190	2870	DCLC21	SW5	22.61	1.90
0431	E	3. 14.33' X 10' RCB	665	2870	DCLC21	SW5	22.61	0.15
0446	E	JUNCTION STRUCTURE	69	2870	DCLC21	SW5	22.61	0.15
0447	E	3. 14.33' X 10' RCB	1955	5193	CCAL93	SW5	22.05	0.15
RWSL		RANGE WASH - SLOAN						
0694	E	CONC CHNL 10'W 8'D 1.5:1 SS	1500	1686	C4T4	RW3SC	2.40	0.56





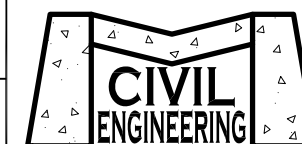
BASIN NAME/ CONCENTRATION POINT	AREA (acres)	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
FUTON1	1.34	2	4
FUTOF1*	014	3	7
COM1*	--	5	12

*Includes offsite flows from approved TDS (Q10=3cfs, Q100=7cfs)

STREET	Q ₁₀ /Q ₁₀₀ (cfs)	D ₁₀ /D ₁₀₀ (ft)	V ₁₀ /V ₁₀₀ (ft/s)	V x D
Leigon Way (Section 1) COM1	5/12	0.50/0.64	1.51/1.77	0.76/1.13

STREET	Q ₁₀ /Q ₁₀₀ (cfs)	D ₁₀ /D ₁₀₀ (ft)	V ₁₀ /V ₁₀₀ (ft\ s)	V x D
Section 2 FUTON1 + 25% ON3	2/5	0.37/0.49	1.55/1.91	0.57/0.94

FIGURE 7 FUTURE ONSITE BASIN MAP



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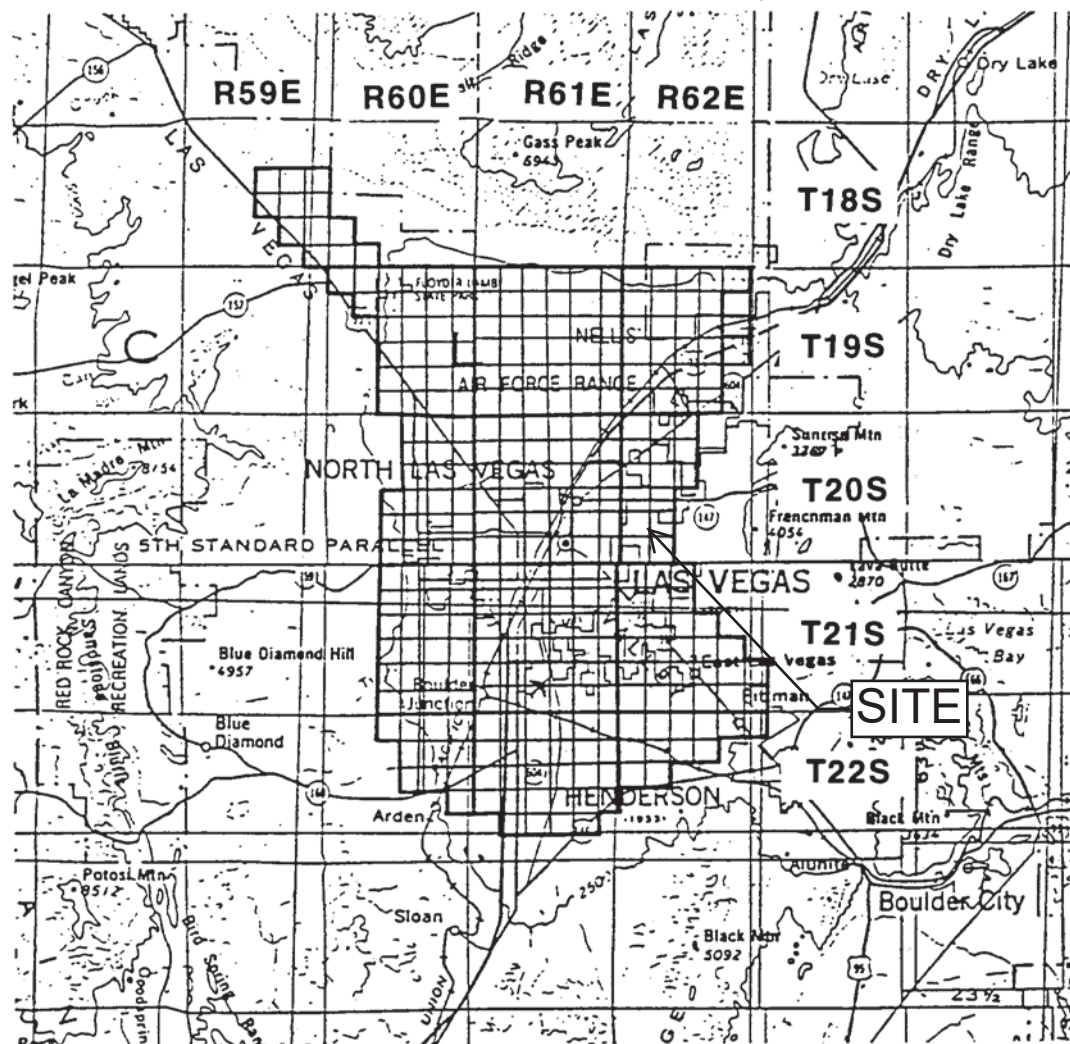
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ENGINEERING**

APPENDIX B

HYDROLOGIC PARAMETERS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

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

TOWNSHIP RANGE SECTIONS

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

Notes:

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

Revision	Date

WRC
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REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

SIX HOUR DEPTH-AREA REDUCTION FACTORS

<u>Drainage Area (Square Miles)</u>	<u>Six-Hour Depth-Area Reduction Factor</u>
---	---

0.0	1.00
0.5	0.98
1.0	0.97
2.0	0.93
4.0	0.91
6.0	0.90
8.0	0.88
10.0	0.86
20.0	0.79
30.0	0.74
50.0	0.68
100.0	0.60
150.0	0.55
200.0	0.51
300.0	0.46
400.0	0.42
500.0	0.39

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

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area ²	A	B	C	D
<i>Fully developed urban areas (vegetation established)</i>					
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.

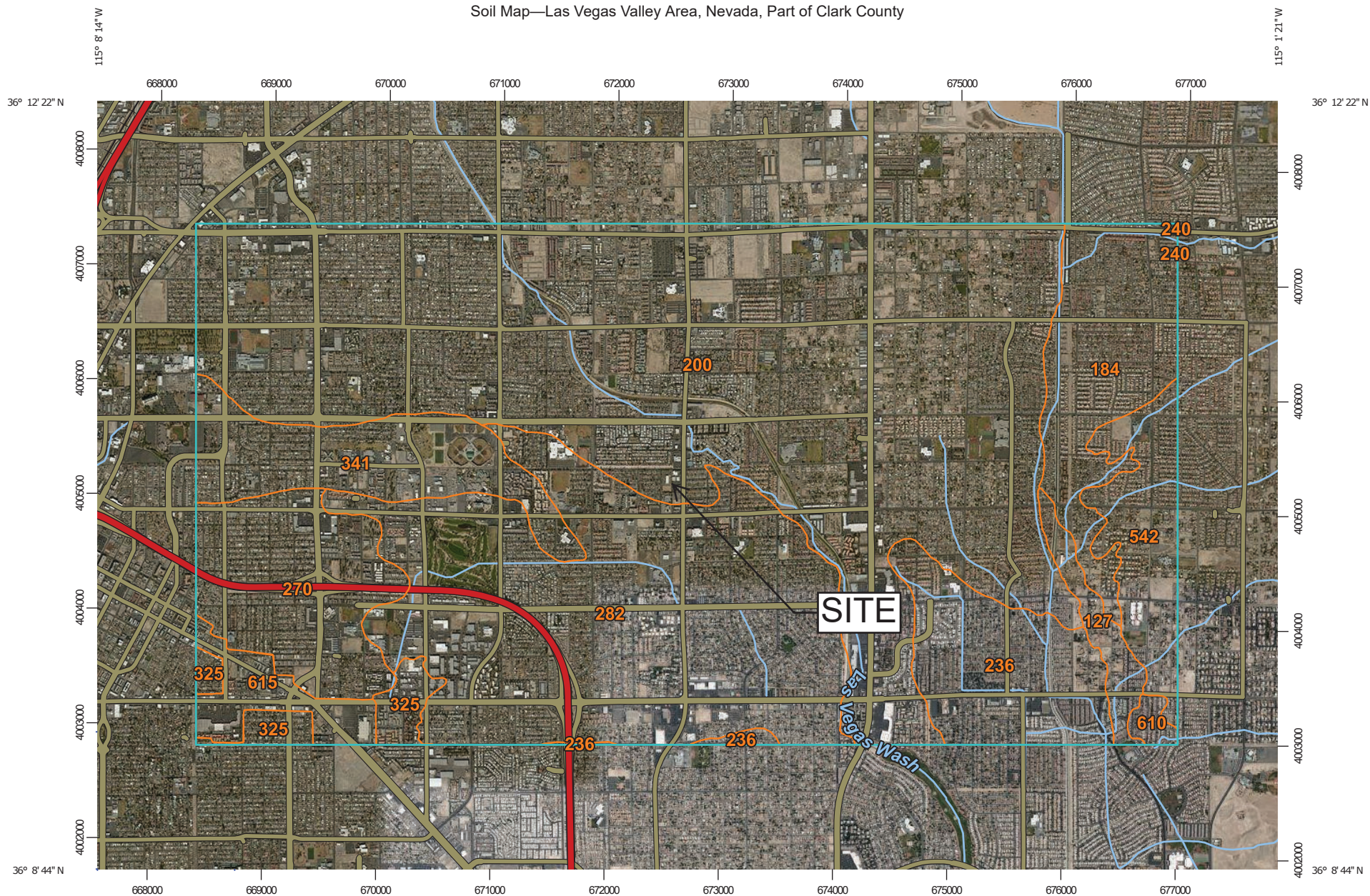
3 CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.

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

Soil Map—Las Vegas Valley Area, Nevada, Part of Clark County



Map Scale: 1:47,200 if printed on A landscape (11" x 8.5") sheet.

0 500 1000 2000 3000 Meters

0 2000 4000 8000 12000 Feet

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 11N WGS84



**Natural Resources
Conservation Service**

Web Soil Survey
National Cooperative Soil Survey

9/6/2019
Page 1 of 3

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County

Survey Area Data: Version 13, Sep 14, 2018

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Sep 26, 2013—Sep 8, 2018

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
127	Bluepoint loamy fine sand, 0 to 2 percent slopes	124.4	1.3%
184	Caliza very gravelly sandy loam, 2 to 8 percent slopes	600.2	6.2%
200	Glencarb silt loam	4,461.3	46.1%
236	Glencarb very fine sandy loam, saline	545.0	5.6%
240	Goodsprings gravelly fine sandy loam, 2 to 4 percent slopes	1.3	0.0%
270	Land silt loam, drained	606.7	6.3%
282	Land silty clay loam	2,095.5	21.6%
325	McCarran fine sandy loam, 0 to 4 percent slopes	138.8	1.4%
341	Paradise silt loam	531.8	5.5%
542	Weiser-Aztec complex, 2 to 8 percent slopes	358.4	3.7%
610	Pits, gravel	33.5	0.3%
615	Urban land	182.9	1.9%
Totals for Area of Interest		9,679.7	100.0%

Engineering Properties

This table gives the engineering classifications and the range of engineering properties for the layers of each soil in the survey area.

Hydrologic soil group is a group of soils having similar runoff potential under similar storm and cover conditions. The criteria for determining Hydrologic soil group is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Listing HSGs by soil map unit component and not by soil series is a new concept for the engineers. Past engineering references contained lists of HSGs by soil series. Soil series are continually being defined and redefined, and the list of soil series names changes so frequently as to make the task of maintaining a single national list virtually impossible. Therefore, the criteria is now used to calculate the HSG using the component soil properties and no such national series lists will be maintained. All such references are obsolete and their use should be discontinued. Soil properties that influence runoff potential are those that influence the minimum rate of infiltration for a bare soil after prolonged wetting and when not frozen. These properties are depth to a seasonal high water table, saturated hydraulic conductivity after prolonged wetting, and depth to a layer with a very slow water transmission rate. Changes in soil properties caused by land management or climate changes also cause the hydrologic soil group to change. The influence of ground cover is treated independently. There are four hydrologic soil groups, A, B, C, and D, and three dual groups, A/D, B/D, and C/D. In the dual groups, the first letter is for drained areas and the second letter is for undrained areas.

The four hydrologic soil groups are described in the following paragraphs:

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.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Depth to the upper and lower boundaries of each layer is indicated.

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is 15 percent or more, an appropriate modifier is added, for example, "gravelly."

Classification of the soils is determined according to the Unified soil classification system (ASTM, 2005) and the system adopted by the American Association of State Highway and Transportation Officials (AASHTO, 2004).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to particle-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, CL-ML.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of particle-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest.

Percentage of rock fragments larger than 10 inches in diameter and 3 to 10 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination. Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

References:

American Association of State Highway and Transportation Officials (AASHTO). 2004. Standard specifications for transportation materials and methods of sampling and testing. 24th edition.

Report—Engineering Properties

Absence of an entry indicates that the data were not estimated. The asterisk "*" denotes the representative texture; other possible textures follow the dash. The criteria for determining the hydrologic soil group for individual soil components is found in the National Engineering Handbook, Chapter 7 issued May 2007(<http://directives.sc.egov.usda.gov/OpenNonWebContent.aspx?content=17757.wba>). Three values are provided to identify the expected Low (L), Representative Value (R), and High (H).

Engineering Properties—Las Vegas Valley Area, Nevada, Part of Clark County														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
127—Bluepoint loamy fine sand, 0 to 2 percent slopes														
Bluepoint	100	A	0-9	Loamy fine sand	SM	A-2, A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	75-80-85	25-35-45	0-16 -20	NP
			9-24	Stratified fine sand to gravelly loamy fine sand	SM	A-2	0- 0- 0	0- 0- 0	70-85-100	60-75-90	55-70-85	10-20-30	0-16 -20	NP
			24-41	Loamy fine sand, loamy sand, fine sand	SM	A-2, A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	65-75-85	25-35-45	0-16 -20	NP
			41-60	Stratified sand to very fine sandy loam	ML, SM	A-2, A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	50-70-90	30-45-60	0-18 -23	NP

Engineering Properties--Las Vegas Valley Area, Nevada, Part of Clark County														
Map unit symbol and soil name	Pct. of map unit	Hydrologic group	Depth	USDA texture	Classification		Pct Fragments		Percentage passing sieve number—				Liquid limit	Plasticity index
					Unified	AASHTO	>10 inches	3-10 inches	4	10	40	200		
			<i>In</i>				<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>	<i>L-R-H</i>
184—Caliza very gravelly sandy loam, 2 to 8 percent slopes														
Caliza	100	A	0-3	Very gravelly sandy loam	GM	A-1	0- 0- 0	0- 3- 5	45-50-55	35-40-45	25-30-35	10-15-20	0-7 -14	NP
			3-16	Very gravelly sandy loam, very cobbly sandy loam	GM, SM	A-1, A-2	0- 0- 0	10-20-30	50-60-70	40-50-60	30-38-45	15-23-30	0-7 -14	NP
			16-60	Stratified very gravelly coarse sand to loamy sand	SM, SP, SP-SM, SW-SM	A-1	0- 0- 0	0- 3- 5	50-58-65	40-48-55	10-18-25	0- 8- 15	0-7 -14	NP
200—Glencarb silt loam														
Glencarb	100	C	0-6	Silt loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	90-95-100	70-80-90	20-25-30	NP-5-10
			6-60	Stratified very fine sandy loam to silty clay loam	CL, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	75-80-85	25-30-35	5-10-15
236—Glencarb very fine sandy loam, saline														
Glencarb	100	C	0-6	Very fine sandy loam	CL-ML, ML	A-4	0- 0- 0	0- 0- 0	100-100-100	100-100-100	85-90-95	55-60-65	20-25-30	NP-5-10
			6-60	Stratified very fine sandy loam to silty clay loam	CL, CL-ML	A-4, A-6	0- 0- 0	0- 0- 0	100-100-100	100-100-100	95-98-100	75-80-85	20-25-30	5-10-15

SOIL TYPE CALCULATED CURVE NUMBER

Soil Type #200 – (Commercial)

Soil	Percent(%)	Soil Type	CN
Glencarb	100	C	94

CN = 94.0

Soil Type #200 – (Paved Road)

Soil	Percent(%)	Soil Type	CN
Glencarb	100	C	98

CN = 98.0

BASIN COMPOSITE CN VALUES

FUTON1

FUTURE

Soil Type	Land Use	Percent of Basin	CN Value
200	Commercial	100	94

CN(Composite) = 1*94.0
CN = 94.0

FUTOF1

FUTURE

Soil Type	Land Use	Percent of Basin	CN Value
200	Pavement	100	98

CN(Composite) = 1*98.0
CN = 98.0

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Project No. : 19333

DEVELOPMENT : Pipe Trades Training Facility
Future Condition
CALCULATED BY : PDW

DATE: September 2019



SUB-BASIN DATA					INITIAL / OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc	Tc CHECK URBANIZED BASINS		FINAL Tc	Min Tc	Tlag	REMARKS
DESIG:	CN	K	AREA (acres)	AREA (mi ²)	LENGTH (ft)	SLOPE (%)	Ti (min)	LENGTH (ft)	SLOPE (%)	LAND COVER k	VELOCITY* (fps)	Tt (min)	Tc = Ti + Tt (min)	TOTAL LENGTH (ft)	Tc = (L/180)+10 (min)	(min)	(min)	Tlag = 0.6Tc/60 (hrs)	
(1)		(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)		(10)	(11)		(12)	(13)	(14)			
Future Onsite Basins																			
FUTON1	94.0	0.8508	1.34	0.0021	50	1.00	3.17	415	0.50	DEV	2.16	3.2	6.4	465.0	12.583	6.37	5.00	0.064	
Future Offsite Basins																			
FUTOF1	98.0	0.9036	0.14	0.0002	25	0.50	2.23	185	0.25	DEV	1.53	2.0	4.2	210.0	11.167	4.24	5.00	0.050	minimum Tc used

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

$$T_c = T_i + T_t$$

$$K = 0.0132 (CN) - 0.39$$

$$T_{lag} = 0.6T_c$$

* The velocity in column 9 was computed using the equation $V = CS^{0.5}$

C is a coefficient and S is the travel slope, as outlined in section 602.1 of the CCRFCD Manual.

*As recommended in the CCRFCD Manual, C = 30.6 under developed conditions and C = 29.4 under undeveloped conditions.

REFERENCE :

STANDARD FORM 4



**McCay
ENGINEERING**

APPENDIX C

FUTURE HEC-1 MODEL

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
* RUN DATE 13SEP19 TIME 11:49:47
*
*****

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*****
*
* 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 XXXXXXX XXXXX XXX

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

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

1 HEC-1 INPUT PAGE 1

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

```

1 ID
2 ID TECHNICAL DRAINAGE STUDY FOR UNION LOCAL 525
3 ID LAS VEGAS, NEVADA
4 ID
5 ID PREPARED FOR:
6 ID
7 ID PREPARED BY:
8 ID MCCAY ENGINEERING
9 ID 11700 W. CHARLESTON BLVD, SUITE 170-298
10 ID LAS VEGAS, NV 89135
11 ID
12 ID
13 ID FUTURE 10 YEAR
14 ID FILENAME:UL525-futa10.dat
15 ID JOB#19333
16 ID
17 ID
18 ID
19 *DIAGRAM
20 IT 5 0 0 300
21 IO 5
22 IN 5
23 JR PREC 0.57
24 *
25 KK FUTON1
26 KM FUTURE ONSITE BASIN FUTON1
27 BA 0.0021
28 PB 2.77
29 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
30 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
31 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
32 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
33 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
34 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
35 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
36 PC .998 .999 1.00
37 LS 0 94.0
38 UD 0.064
39 *
40 KK FUTOF1
41 KM FUTURE OFFSITE BASIN FUTOF1
42 BF 3
43 BA 0.0002
44 LS 0 98.0
45 UD 0.050
46 *
47 KK COM1
48 KM COMBINE FUTON1 AND FUTOF1
49 HC 2
50 *
51 ZZ

```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT

LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
 23 FUTON1
 .
 37 . FUTOF1
 .
 43 COM1.....

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 * RUN DATE 13SEP19 TIME 11:49:47 *

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

TECHNICAL DRAINAGE STUDY FOR UNION LOCAL 525 LAS VEGAS, NEVADA

PREPARED FOR:

PREPARED BY:

MCCAY ENGINEERING
 11700 W. CHARLESTON BLVD, SUITE 170-298
 LAS VEGAS, NV 89135

FUTURE 10 YEAR
 FILENAME:UL525-futa10.dat
 JOB#19333

20 IO OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE
 IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57

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
HYDROGRAPH AT				
+	FUTON1	.00	1 FLOW	2.
			TIME	3.50
HYDROGRAPH AT				
+	FUTOF1	.00	1 FLOW	3.

				TIME	3.50
2	COMBINED AT				
+		COM1	.00	1	FLOW
					5.
				TIME	3.50

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

```

1*****
*
*   FLOOD HYDROGRAPH PACKAGE (HEC-1)
*       JUN 1998
*       VERSION 4.1
*
*   RUN DATE 13SEP19 TIME 11:50:12
*
*****

```

```

*****
*
*   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   X   XX
X   X   X   X   X   X   X
XXXXXXX   XXXX   X   XXXXX   X
X   X   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
2      ID          TECHNICAL DRAINAGE STUDY FOR UNION LOCAL 525
3      ID          LAS VEGAS, NEVADA
4      ID
5      ID          PREPARED FOR:
6      ID
7      ID          PREPARED BY:
8      ID          MCCAY ENGINEERING
9      ID          11700 W. CHARLESTON BLVD, SUITE 170-298
10     ID          LAS VEGAS, NV 89135
11     ID
12     ID
13     ID          FUTURE 100-YEAR
14     ID          FILENAME:UL525-futa100.dat
15     ID          JOB#19333
16     ID
17     ID
18     ID
19     *DIAGRAM
20     IT          5      0      0      300
21     IO          5
22     IN          5
23     JR          PREC      1.00
24     *
25     KK          FUTON1
26     KM          FUTURE ONSITE BASIN FUTON1
27     BA          0.0021
28     PB          2.77
29     PC          .000      .020      .057      .070      .087      .108      .124      .130      .130      .130
30     PC          .130      .130      .130      .133      .140      .142      .148      .158      .172      .181
31     PC          .190      .197      .199      .200      .201      .204      .214      .229      .241      .249
32     PC          .251      .256      .270      .278      .281      .283      .295      .322      .352      .409
33     PC          .499      .590      .710      .744      .781      .812      .819      .835      .851      .856
34     PC          .860      .868      .876      .888      .910      .926      .937      .950      .970      .976
35     PC          .982      .985      .987      .989      .990      .993      .993      .994      .995      .998
36     PC          .998      .999      1.00
37     LS          0      94.0
38     UD          0.064
39     *
40     KK          FUTOF1
41     KM          FUTURE OFFSITE BASIN FUTOF1
42     BF          7
43     BA          0.0002
44     LS          0      98.0
45     UD          0.050
46     *
47     KK          COM1
48     KM          COMBINE FUTON1 AND FUTOF1
49     HC          2
50     *
51     ZZ

```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK
INPUT

LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
 NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW
 23 FUTON1
 .
 37 . FUTOF1
 .
 43 COM1.....

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
 *
 * FLOOD HYDROGRAPH PACKAGE (HEC-1) *
 * JUN 1998 *
 * VERSION 4.1 *
 *
 * RUN DATE 13SEP19 TIME 11:50:12 *
 *

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

TECHNICAL DRAINAGE STUDY FOR UNION LOCAL 525
 LAS VEGAS, NEVADA

PREPARED FOR:

PREPARED BY:

MCCAY ENGINEERING
 11700 W. CHARLESTON BLVD, SUITE 170-298
 LAS VEGAS, NV 89135

FUTURE 100-YEAR
 FILENAME:UL525-futa100.dat
 JOB#19333

20 IO OUTPUT CONTROL VARIABLES
 IPRNT 5 PRINT CONTROL
 IPLOT 0 PLOT CONTROL
 QSCAL 0. HYDROGRAPH PLOT SCALE

IT HYDROGRAPH TIME DATA
 NMIN 5 MINUTES IN COMPUTATION INTERVAL
 IDATE 1 0 STARTING DATE
 ITIME 0000 STARTING TIME
 NQ 300 NUMBER OF HYDROGRAPH ORDINATES
 NDDATE 2 0 ENDING DATE
 NDTIME 0055 ENDING TIME
 ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
 TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 1.00

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
				1.00
HYDROGRAPH AT				
+	FUTON1	.00	1 FLOW	4.
			TIME	3.50
HYDROGRAPH AT				
+	FUTOF1	.00	1 FLOW	7.

				TIME	3.50
2	COMBINED AT				
+		COM1	.00	1	FLOW
					12.
				TIME	3.50

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



**McCay
ENGINEERING**

APPENDIX D

HYDRAULIC CALCULATIONS

Worksheet for FUT 10 YR - LEIGON SCT 1

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	0.003 ft/ft
Discharge	5.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.60
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+30.0	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.60)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+30.0, 0.63)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

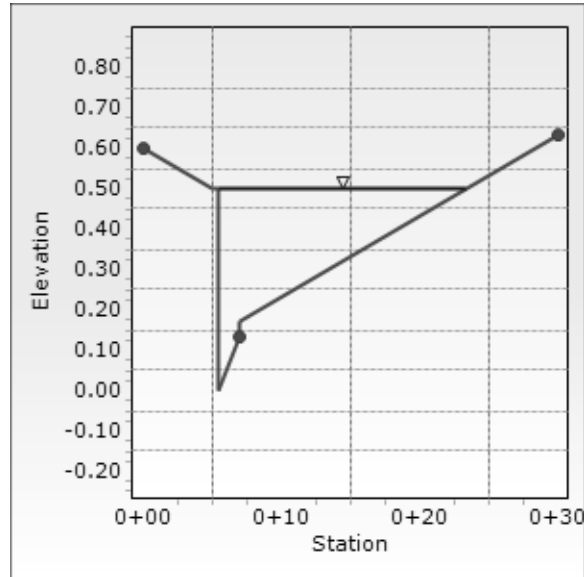
Results	
Normal Depth	0.50 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	3.3 ft ²
Wetted Perimeter	18.37 ft
Hydraulic Radius	0.18 ft
Top Width	17.82 ft
Normal Depth	0.50 ft
Critical Depth	0.43 ft
Critical Slope	0.007 ft/ft
Velocity	1.51 ft/s
Velocity Head	0.04 ft
Specific Energy	0.53 ft
Froude Number	0.618

Worksheet for FUT 10 YR - LEIGON SCT 1

Results	
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.50 ft
Critical Depth	0.43 ft
Channel Slope	0.003 ft/ft
Critical Slope	0.007 ft/ft

Cross Section for FUT 10 YR - LEIGON SCT 1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.003 ft/ft
Normal Depth	0.50 ft
Discharge	5.00 cfs



Worksheet for FUT 100 YR - LEIGON SCT 1

Project Description	
Friction Method	Manning
Solve For	Formula
	Normal Depth
Input Data	
Channel Slope	0.003 ft/ft
Discharge	12.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.0	0.60
0+05.0	0.50
0+05.5	0.50
0+05.5	0.00
0+07.0	0.13
0+07.0	0.17
0+30.0	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 0.60)	(0+07.0, 0.13)	0.013
(0+07.0, 0.13)	(0+30.0, 0.63)	0.016

Options	
Current Roughness Weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

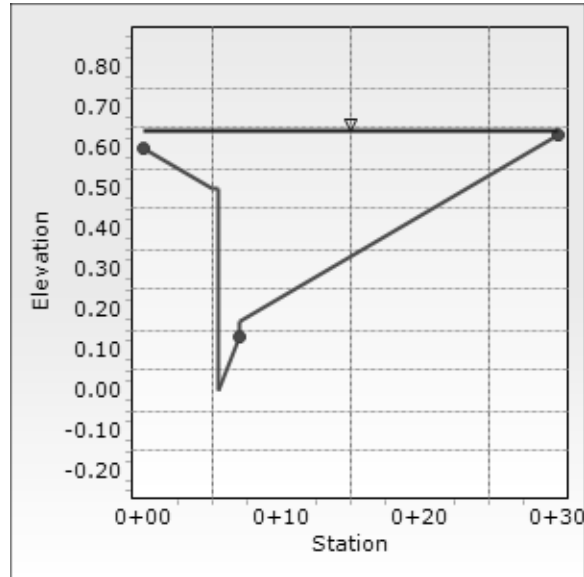
Results	
Normal Depth	0.64 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	6.8 ft ²
Wetted Perimeter	30.59 ft
Hydraulic Radius	0.22 ft
Top Width	30.00 ft
Normal Depth	0.64 ft
Critical Depth	0.57 ft
Critical Slope	0.006 ft/ft
Velocity	1.77 ft/s
Velocity Head	0.05 ft
Specific Energy	0.68 ft
Froude Number	0.659

Worksheet for FUT 100 YR - LEIGON SCT 1

Results	
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	0.00 ft/s
Upstream Velocity	0.00 ft/s
Normal Depth	0.64 ft
Critical Depth	0.57 ft
Channel Slope	0.003 ft/ft
Critical Slope	0.006 ft/ft
Messages	
Messages	Water Surface Elevation exceeds lowest end station by 0.035396375 3505253ft.

Cross Section for FUT 100 YR - LEIGON SCT 1

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.003 ft/ft
Normal Depth	0.64 ft
Discharge	12.00 cfs



Worksheet for 10 Yr Section 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Discharge	2.00	ft ³ /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00	0.50
0+01	0.50
0+01	0.00
0+02	0.13
0+02	0.17
0+47	1.30

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+02, 0.13)	0.013
(0+02, 0.13)	(0+47, 1.30)	0.016

Options

Current Roughness weighted Method	Pavlovskii's Method
Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth	0.37	ft
Elevation Range	0.00 to 1.30 ft	
Flow Area	1.29	ft²
Wetted Perimeter	10.05	ft
Hydraulic Radius	0.13	ft
Top Width	9.63	ft

Worksheet for 10 Yr Section 2

Results

Normal Depth	0.37	ft
Critical Depth	0.34	ft
Critical Slope	0.00751	ft/ft
Velocity	1.55	ft/s
Velocity Head	0.04	ft
Specific Energy	0.41	ft
Froude Number	0.74	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.37	ft
Critical Depth	0.34	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00751	ft/ft

Cross Section for 10 Yr Section 2

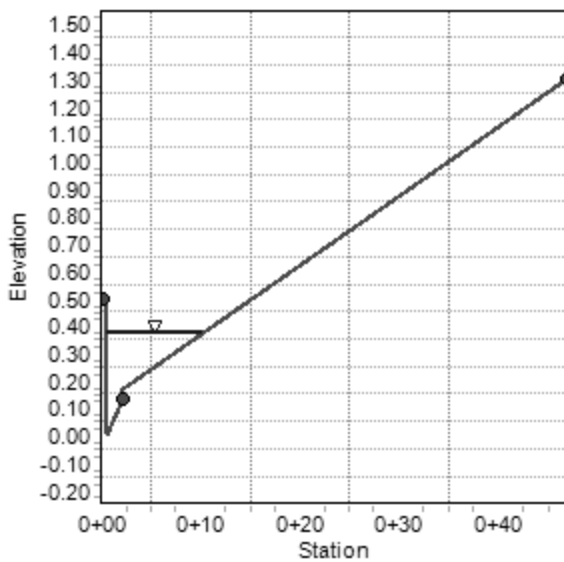
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.37	ft
Discharge	2.00	ft ³ /s

Cross Section Image



Worksheet for 100 Yr Section 2

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00400 ft/ft
Discharge 5.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00	0.50
0+01	0.50
0+01	0.00
0+02	0.13
0+02	0.17
0+47	1.30

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.50)	(0+02, 0.13)	0.013
(0+02, 0.13)	(0+47, 1.30)	0.016

Options

Current Roughness Weighted Method Pavlovskii's Method
Open Channel Weighting Method Pavlovskii's Method
Closed Channel Weighting Method Pavlovskii's Method

Results

Normal Depth 0.49 ft
Elevation Range 0.00 to 1.30 ft
Flow Area 2.61 ft²
Wetted Perimeter 14.60 ft
Hydraulic Radius 0.18 ft
Top Width 14.07 ft

Worksheet for 100 Yr Section 2

Results

Normal Depth	0.49	ft
Critical Depth	0.45	ft
Critical Slope	0.00677	ft/ft
Velocity	1.91	ft/s
Velocity Head	0.06	ft
Specific Energy	0.54	ft
Froude Number	0.78	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.49	ft
Critical Depth	0.45	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00677	ft/ft

Cross Section for 100 Yr Section 2

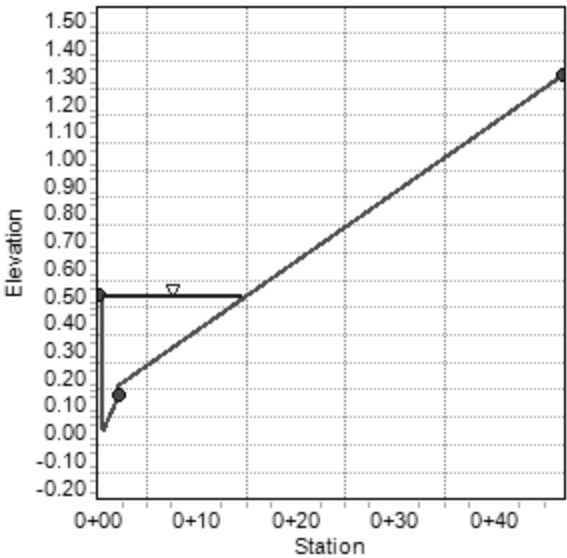
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.49	ft
Discharge	5.00	ft³/s

Cross Section Image



Worksheet for BMP for FUTON1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.02640	ft/ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	5.00	ft ³ /s

Results

Normal Depth	0.63	ft
Flow Area	1.60	ft ²
Wetted Perimeter	5.21	ft
Hydraulic Radius	0.31	ft
Top Width	5.05	ft
Critical Depth	0.63	ft
Critical Slope	0.02736	ft/ft
Velocity	3.13	ft/s
Velocity Head	0.15	ft
Specific Energy	0.78	ft
Froude Number	0.98	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.63	ft
Critical Depth	0.63	ft
Channel Slope	0.02640	ft/ft
Critical Slope	0.02736	ft/ft

Cross Section for BMP for FUTON1

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.035	
Channel Slope	0.02640	ft/ft
Normal Depth	0.63	ft
Left Side Slope	4.00	ft/ft (H:V)
Right Side Slope	4.00	ft/ft (H:V)
Discharge	5.00	ft ³ /s

Cross Section Image



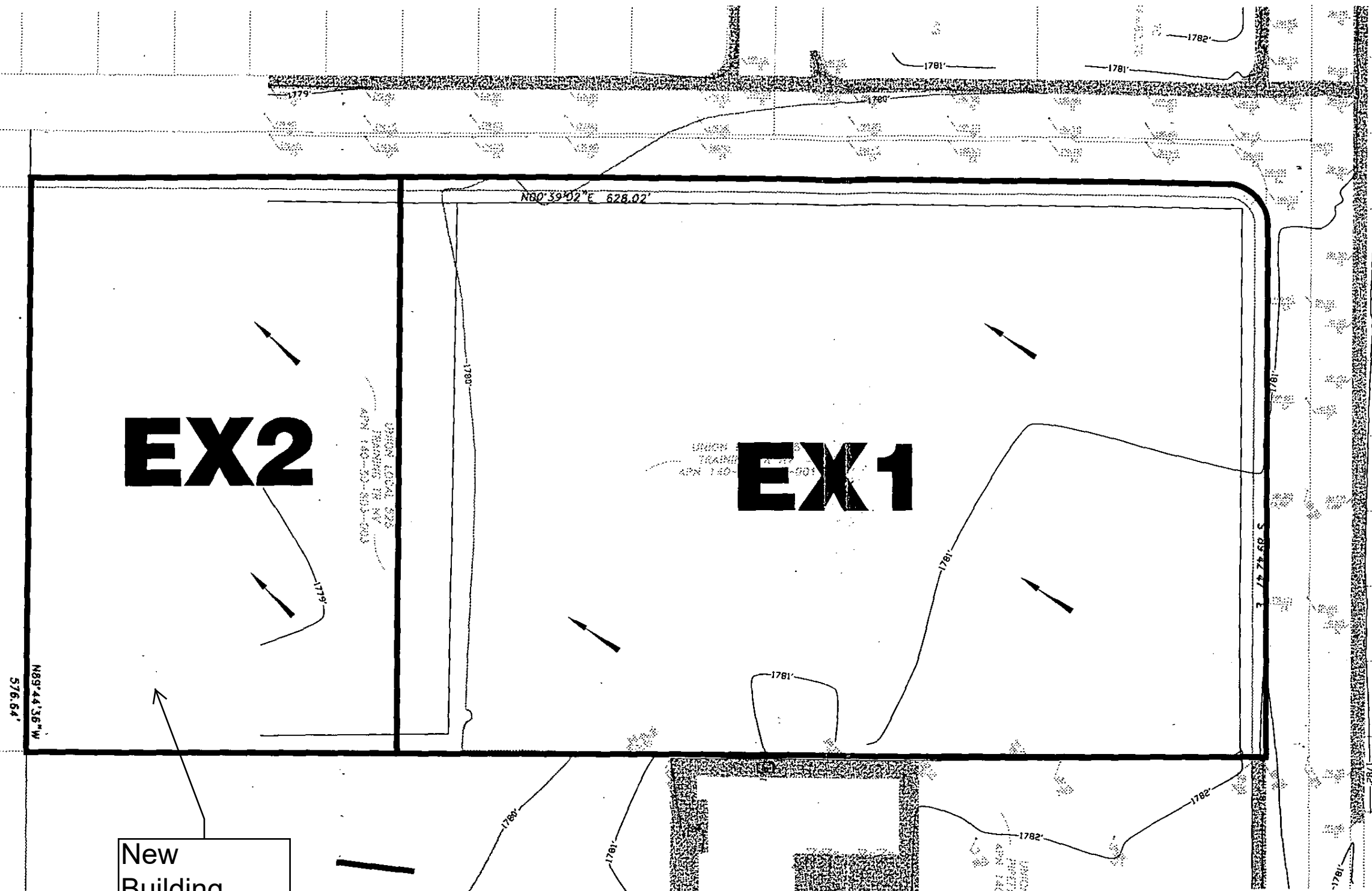


**McCay
ENGINEERING**

APPENDIX E

EXCERPTS FROM
TECHNICAL DRAINAGE STUDY FOR THE
JOINT APPRENTICESHIP TRAINING CENTER
DS3210

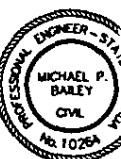
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EXISTING ONSITE HEC-1 ANALYSIS

BASIN ID/ CONCENTRATION POINT	AREA (acres)	Q10 (cfs)	Q100 (cfs)
EX1	3.18	1	4
EX2	1.36	0	2

DATE: 4/16/02
DESIGNED: R. SCHAEFER
C. BAROULL
ENGINEER: M. BAILEY
SCALE: 1"=200' HORIZ VERT



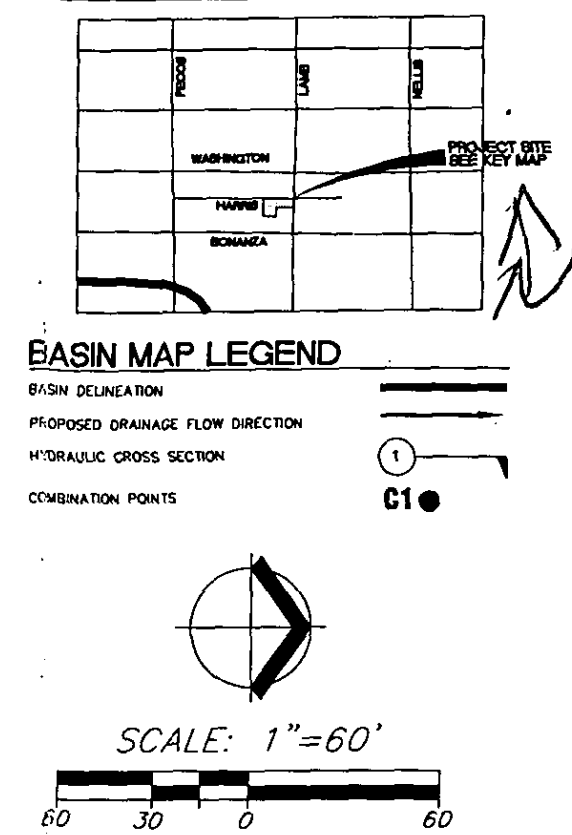
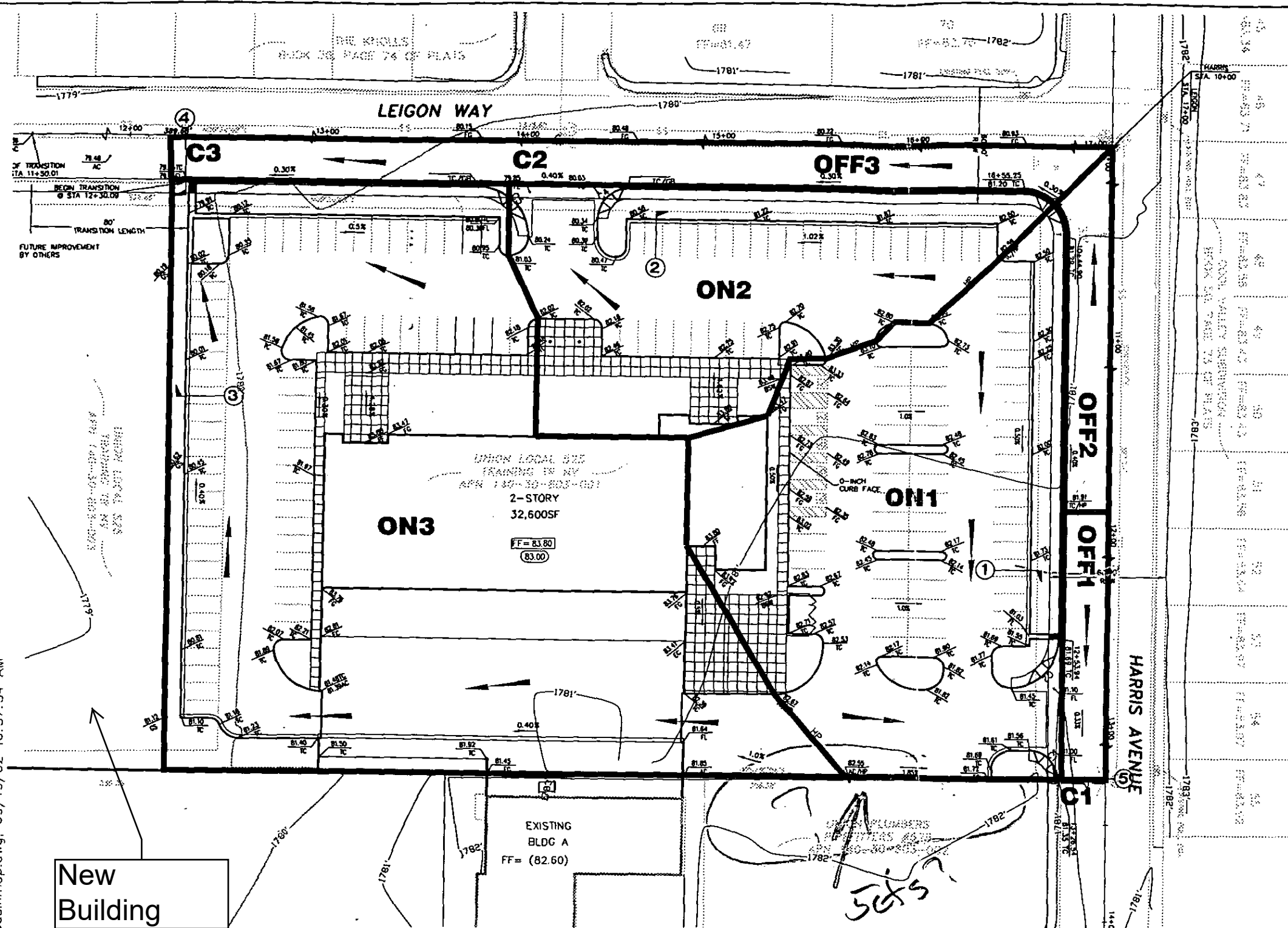
SHEET TITLE
EXISTING BASIN

SHEET NUMBER
FIGURE 5
CLV DRAWING

SUN COLONY, LLC
TERRAGONA ESTATES
CITY OF LAS VEGAS

RICHARDSON PARTNERS-PC
6372 Melrose Drive, Suite 3
LAS VEGAS, NEVADA 89120
(702) 738-8822

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DEVELOPED ONSITE HEC-1 ANALYSIS

BASIN ID/ CONCENTRATION POINT	AREA (acres)	Q10 (cfs)	Q100 (cfs)
ON1	1.02	1	3
OFF1	0.07	0	0
C1	--	1	3
OFF2	0.09	0	0
ON2	0.57	1	2
OFF3	0.24	1	1
C2	--	1	3
ON3	1.58	2	5
C3	--	3	7

STREET FLOW CALCULATIONS

HYDRAULIC SECTION	Q ₁₀ / Q ₁₀₀ (CFS)	D ₁₀ / D ₁₀₀ (FT)	V ₁₀ / V ₁₀₀ (FPS)	D X V PRODUCT
SECTION 1	1/3	0.27/0.34	1.15/1.64	0.31/0.56
SECTION 2	1/2	0.25/0.29	1.53/1.76	0.38/0.52
SECTION 3	2/5	0.31/0.37	1.45/1.91	0.45/0.71
SECTION 4	3/7	0.41/0.53	1.63/1.84	0.67/0.97
SECTION 5	1/3	0.30/0.39	1.29/1.84	0.39/0.72

JOINT APPRENTICESHIP TRAINING CENTER
TERRAGONA ESTATES

CITY OF LAS VEGAS
A PORTION OF THE SE 1/4 OF SECTION 30, TOWNSHIP 20 SOUTH, RANGE 02 EAST
MDM, CLARK COUNTY, NEVADA

DATE: 4/16/02
DESIGNED: R. SCHAEFFER
ENGINEER: G. BANGILL
SCALE: 1"=60'
VERT: HORIZ
PROJECT NO: TRP2848

PROFESSIONAL ENGINEER - STATE OF NEVADA
MICHAEL P. BAILEY
CIVIL
No. 10264

SHEET TITLE: DEVELOPED BASIN
SHEET NUMBER: **FIGURE 6**
CLV DRAWING NO.

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION			
				RATIO 1 0.57	RATIO 2 1.00		
HYDROGRAPH AT		ON1	0.00 TIME	1	FLOW 3.50	1.	3.
HYDROGRAPH AT		OFF1	0.00 TIME	1	FLOW 3.50	0.	0.
2 COMBINED AT		C1	0.00 TIME	1	FLOW 3.50	1.	3.
HYDROGRAPH AT		OFF2	0.00 TIME	1	FLOW 3.50	0.	0.
ROUTED TO	R1		0.00 TIME	1	FLOW 3.58	0.	0.
HYDROGRAPH AT		ON2	0.00 TIME	1	FLOW 3.50	1.	2.
ROUTED TO	R2		0.00 TIME	1	FLOW 3.50	1.	2.
HYDROGRAPH AT		OFF3	0.00 TIME	1	FLOW 3.50	1.	1.
3 COMBINED AT		C2	0.00 TIME	1	FLOW 3.50	1.	3.
HYDROGRAPH AT		ON3	0.00 TIME	1	FLOW 3.50	2.	5.
2 COMBINED AT		C3	0.00 TIME	1	FLOW 3.50	3.	7.

Referenced
flows



**McCay
ENGINEERING**

APPENDIX F

PROJECT PLANS