

DS #:

4947

APN:

163.03.101.014

PROJECT:

Towne Storage at Charleston

SUBMITTAL:

1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		January 24, 2018
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	
	Towne Storage at Charleston	
Cross Streets:	SWQ of Charleston Blvd. & Tenaya Way	
File Number:	F:\Depot\DSMemos\DS4947A.doc	
Parcel Number:	163-03-101-014	
Zoning Action:	SDR-71406	
FEMA Flood Zone	YES	NO X
Proposed Storm Drain	YES	NO X
		COPIES TO: Rietz Consulting Inc. Towne Storage, Inc. Bart Anderson, P.E., DevCo

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	1/8/2018	1/24/2018	See Comments Below	\$400.00	492539: \$400
TOTAL FEES (LDDRS):				\$400.00	----

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**SDR-71406**) 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.
2. Identify the project site location on Figure 513 (McCarran Airport Rainfall Area Map) in Appendix A.
3. The 100-year flow in *Charleston Boulevard* is 0.8' deep, ie, beyond the sidewalk and into the onsite landscaping area. The flow is erosive at 6.39 ft/s. Provide erosion protection measures in the landscaping area behind the sidewalk. Review and revise the grading plan and pertinent detail (1/C4) accordingly.
4. The contour lines presented along the existing *Holmby Channel* do not reflect a channel at all, rather looks like a sloped surface. Revise the contours and label the invert elevations in the channel as well as the base flood elevation (BFE) at two locations minimum, one at the west end of the project and one at the east end. Revise all pertinent plans and maps accordingly.

5. Flowmaster calculations were provided for the 12" and 15" storm drains but not for the 10" pipe. Provide as such in the next submittal.
6. Provide inlet calculations for the proposed drop inlets in the grading plan.
7. **Detail D/C4** (Block Wall Opening) appears to show that the invert of the opening is a block height above the ground which is not acceptable. Review and revise accordingly.
8. Extend the proposed onsite storm drain to daylight to the existing *Holmby Channel* directly. Provide a connection detail which must have a concrete collar in the next submittal.
9. Provide a note on the grading plan: "All Onsite Storm Drains and the Associated Facilities are Privately Owned and to be Privately Maintained by the Property Owner".

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: T21S/R60E/03
AREA Q-03

TECHNICAL DRAINAGE STUDY
for
TOWNE STORAGE AT CHARLESTON

Clark County, Nevada

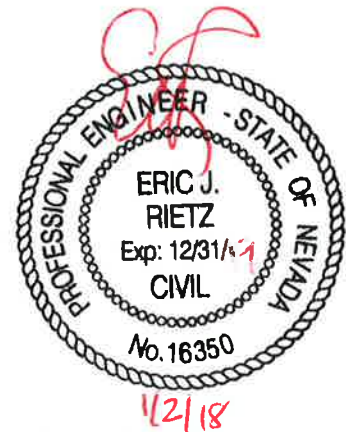
Date: DECEMBER 2017

Prepared By:

Rietz Consulting, Inc.
3060 E. Post Road, Suite #110
Las Vegas, Nevada 89120
Phone: (702) 521-3355
Fax: (702) 891-5397

Prepared For:

Towne Storage, Inc.
1100 East 6600 South, Suite 201
Salt Lake City, Utah 84121
Phone: (801) 262-3388



HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: CHARLESTON & TENAYA MINI STORAGE Date: 11-27-2017

Location of Development: a) Descriptive (Cross Streets) North/South: TENAYA WAY
East/West: CHARLESTON

b) Section: 3 Township: 21S Range: 60E

c) APN : 163-03-101-014

Name of Owner: ALVERSON J B EMP PFT SHR PL & TR AND ALVERSON J BRUCE TRS(Owner) Towne Storage, Inc. (Developer)

Telephone No.: (801) 262-3388 Fax No.: _____ E-Mail Address: B@townestorage.com

Address: 1100 East 6600 South, Suite 201, Salt Lake City, Utah 84121

Contact Person-Name: Eric Rietz Telephone No.: 702-521-3355

* E-Mail Address: eric.rietz@gmail.com Fax No.: _____

Firm: Rietz Consulting, Inc.

Address: 3060 E. Post Rd., Suite 110 Las Vegas, NV 89120

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: 2.22 ac. Being Developed/Disturbed: 2.22 ac.

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: 0 ac.

6. Has the site drainage been evaluated in the past? ☐ YES ☒ NO If yes, please identify documentation: _____

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Charleston Blvd. & ex. drainage flume

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: TOWNE STORAGE	Map ID:																									
Firm Name: RIETZ CONSULTING INC.	Engineer: ERIC RIETZ																									
Address: 3060 E POST ROAD, #110																										
City: LAS VEGAS	State: NV	Zip: 89120																								
Phone Number: (702) 521-3355	Fax Number:																									
Property Owner: ALVERSON J B EMP PFT SHR PL & TR AND ALVERSON J BRUCE																										
Address: 1100 East 6600 South, Suite 201																										
City: Salt Lake City	State: UT	Zip: 84121																								
Reviewed By:	Date Received:	Date Accepted for Review:																								
The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL). This document is intended as an aid in preparing Technical Drainage Studies. Each study submitted is reviewed for compliance with local and regional criteria. This form is not intended to be all inclusive and does not limit the extent of the information, calculations or exhibits which may be necessary to properly evaluate the intended land use. If items are not applicable for the subject site, provide N/A. I. GENERAL REQUIREMENT <table style="width: 100%; border: none;"> <tr> <td style="width: 10%; text-align: center;">Yes</td> <td style="width: 10%; text-align: center;">No</td> <td></td> </tr> <tr> <td style="text-align: center;"><u>X</u></td> <td style="text-align: center;">_____</td> <td>Design Manual Standard Form 1 with the engineer's seal and signature.</td> </tr> <tr> <td style="text-align: center;"><u>X</u></td> <td style="text-align: center;">_____</td> <td>Design Manual Standard Form 4.</td> </tr> <tr> <td style="text-align: center;"><u>X</u></td> <td style="text-align: center;">_____</td> <td>2 copies of the 24" x 36" Drainage Plan.</td> </tr> <tr> <td style="text-align: center;"><u>N/A</u></td> <td style="text-align: center;">_____</td> <td>A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.</td> </tr> </table> II. MAPS AND EXHIBITS <table style="width: 100%; border: none;"> <tr> <td style="width: 10%; text-align: center;">Yes</td> <td style="width: 10%; text-align: center;">No</td> <td></td> </tr> <tr> <td style="text-align: center;"><u>X</u></td> <td style="text-align: center;">_____</td> <td>A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.</td> </tr> <tr> <td style="text-align: center;"><u>X</u></td> <td style="text-align: center;">_____</td> <td>A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.</td> </tr> </table>			Yes	No		<u>X</u>	_____	Design Manual Standard Form 1 with the engineer's seal and signature.	<u>X</u>	_____	Design Manual Standard Form 4 .	<u>X</u>	_____	2 copies of the 24" x 36" Drainage Plan.	<u>N/A</u>	_____	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.	Yes	No		<u>X</u>	_____	A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.	<u>X</u>	_____	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.
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REFERENCE:		STANDARD FORM 2																								

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

Yes	No	
<u>X</u>	<u> </u>	Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs.
<u>X</u>	<u> </u>	On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs.
<u>X</u>	<u> </u>	Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

Yes	No	
<u>X</u>	<u> </u>	Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada.
<u>X</u>	<u> </u>	Minimum scale: 1" = 60'.
<u>X</u>	<u> </u>	Project name.
<u>X</u>	<u> </u>	Vicinity Map with local and major cross streets.
<u>X</u>	<u> </u>	Revision box.
<u>X</u>	<u> </u>	North arrow and bar scale.
<u>X</u>	<u> </u>	Engineer's/consultant's address and phone number.
<u>X</u>	<u> </u>	Elevation datum and benchmark.
<u>X</u>	<u> </u>	Legend for symbols and abbreviations.
<u>X</u>	<u> </u>	Cut/fill scarps, where applicable.
<u>X</u>	<u> </u>	Street names, grades, widths.
<u>X</u>	<u> </u>	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
<u>X</u>	<u> </u>	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where appropriate.
<u>X</u>	<u> </u>	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
<u>X</u>	<u> </u>	Proposed typical street sections.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
<u>N/A</u>	_____	Streets with off-set crowns.
<u>X</u>	_____	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
<u>X</u>	_____	Property lines.
<u>X</u>	_____	Right-of-way lines and widths, existing and proposed.
<u>X</u>	_____	Existing improvements and their elevations.
<u>X</u>	_____	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
<u>X</u>	_____	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
<u>X</u>	_____	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<u>X</u>	_____	Location and cross-section of street capacity calculations.
<u>N/A</u>	_____	Cross-sectional detail for channels, including cutoff wall locations.
<u>X</u>	_____	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) stating size, material, shape, and slope with plan and profile and HGL calculations.
<u>X</u>	_____	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
<u>X</u>	_____	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
<u>N/A</u>	_____	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
<u>N/A</u>	_____	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.
<u>X</u>	_____	Building and/or lot numbers.
<u>N/A</u>	_____	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
<u>N/A</u>	_____	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	
<u>N/A</u>	<u> </u>	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.
<u>X</u>	<u> </u>	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
<u>X</u>	<u> </u>	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
<u>X</u>	<u> </u>	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes	No	
<u>X</u>	<u> </u>	Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
<u>X</u>	<u> </u>	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.
<u>X</u>	<u> </u>	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.
<u>X</u>	<u> </u>	Use of correct precipitation values in and around the McCarran Airport rainfall area.
<u>X</u>	<u> </u>	A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
<u>X</u>	<u> </u>	A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
<u>X</u>	<u> </u>	Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
<u>X</u>	<u> </u>	On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
<u>N/A</u>	<u> </u>	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	
<u>N/A</u>	☐	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
<u>X</u>	☐	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
<u>X</u>	☐	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.
<u>X</u>	☐	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
<u>N/A</u>	☐	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.
<u>X</u>	☐	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 requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
<u>N/A</u>	☐	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the 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.
<u>N/A</u>	☐	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
<u>N/A</u>	☐	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
<u>X</u>	☐	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
<u>X</u>	☐	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

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

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Figure 2 – FEMA FIRM Map

Figure 3 – Soils Map

Figure 4 – 2013 MPU CCRFCD Facilities Map (Figure F-30)

Figure 5 – CLV Central Neighborhood Flood Control Plans

Figure 6 – Offsite Drainage Map

Figure 7 – Existing Drainage Map

Figure 8 – Developed Drainage Map

Figure 9 – BMP Map

LIST OF APENDICES

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Supporting Excerpts from HCDDM

Precipitation, Curve Numbers & Standard Form 4

Existing Condition HEC-1 Analysis

Developed Condition HEC-1 Analysis

Appendix B Hydraulics

Street and Flow Section Calculations

Appendix C Plans and Details

1. INTRODUCTION

1.1 Project Overview & Study Purpose

This study is intended to demonstrate design conformance with City of Las Vegas flood control and drainage criteria for a 2.22-acre mini-storage site located near the intersection of Charleston Boulevard and Tenaya Way.

The proposed site is located on undeveloped property just west of the intersection of Charleston Boulevard and Tenaya Way on the south side of Charleston Boulevard. Proposed site is bounded by existing residential property to the west and an existing commercial office building to the east. Charleston Boulevard bounds the site on the north and an existing storm runoff flume and residential properties bound the site on the south. The existing site does not have positive drainage over the entire site. Based on existing topography and a site visit, about half of the existing site drains to its southeast corner, where no facilities exist to convey storm flow off of the property. The other half of the existing site drains along the eastern block wall to the north into Charleston Boulevard.

Proposed improvements include one and two story mini storage facility, parking and associated access drives. A block wall opening will be constructed at the southeast corner of the site to allow for positive drainage into the existing storm water conveyance facility to the south of the existing site. Proposed grading will direct the majority of the site's storm runoff to the southeast corner of the site, while the lesser part of the storm runoff is directed towards Charleston Boulevard. Proposed finished floor elevations are adequate to protect buildings from 100-year storm flows in Charleston Boulevard and meet requirements for flood protection as indicated in the HCDDM.

This Technical Drainage Study was prepared in accordance with criteria specified in the *Clark County Regional Flood Control District (CCRFC) Hydrologic Criteria and Drainage Design Manual* (latest update), which is referred to in this document as the "*Drainage Manual*". All pertinent reference material and calculations is presented in the Appendix of this report.

1.2 Site Description

The subject site is located in the Northeast Quarter (NE 1/4) of the Northeast Quarter (NE 1/4) of the Northwest Quarter (NW 1/4) of Section 3, Township 21 South (T21S) Range 60 East (R60E), on the south side of Charleston Boulevard just west of Tenaya Way. See *Figure 1, Vicinity Map* in the Appendix of this report.

The existing site is covered with slightly disturbed earth and desert brush. About half of the site drains to Charleston Boulevard. The other half drains to the southeast corner of the site; no outlet exists for storm flow generated on the south side of the existing site. Existing residential properties bound the site on the west; and existing commercial office building bounds the site on the east; a drainage flume and residential properties bound the site on the south; Charleston Boulevard bounds the site on the north.

1.3 FEMA Flood Zone Designation

The subject site is not located within a Federal Emergency Management Association Special Flood Hazard Zone. According to FEMA FIRM Panel 32003C2145F, dated November 16, 2011, the

subject site located within "Zone X" which applies to "areas determined to be outside the 0.2% annual chance floodplain. The associated FEMA map panel has been annotated and included in the appendix of this report.

1.4 CCRFCD Facility Information

Figure F-30, from the 2013 CCRFCD Las Vegas Valley Flood Control Master Plan Update (MPU) shows that the site is not located adjacent to any existing or proposed CCRFCD regional facilities.

1.5 Soils Data

The USDA NRCS Web Soil Survey site was referenced to determine the Hydrologic Soils Group (HSG) for the soils of the sub-basins studied in this report. Curve numbers were selected from the *Drainage Manual* as directed, using the land usage and hydrologic condition of each basin studied, for input to the HEC1 hydrologic model. The site consists of type "D" soils.

1.6 Reference Studies

City of Las Vegas Central Neighborhood Flood Control Plan is used to determine storm flows in Charleston Boulevard adjacent to the proposed site.

2. METHODOLOGY

2.1 Compliance

The methodologies utilized in the preparation of this study are in compliance with the *Drainage Manual* (latest update).

2.2 Hydrologic Modeling

Modeling: The SCS Unit Hydrograph Method (SCS Method) was utilized to determine peak flow rates. The SCS Method utilizes precipitation, drainage area, curve number and lag time parameters to determine peak flow rates. The SCS Method routine within the U.S. Army Corp of Engineers *HEC1* was utilized to model the drainage sub-basins analyzed by this study.

Precipitation: The site is located within the McCarran Rainfall Area, per *Drainage Manual* Figure 513. Precipitation depths for the 10 and 100-year storm events are taken from table 505; 10-year=1.58", 100-year=2.77". SDN 3 design storm from Table 503 in the *Drainage Manual* has been used for the less than 1-mile square drainage area. Reference tables and figures from the *Drainage Manual* are included in the Appendix.

Curve Number: The SCS curve number loss rate methodology was utilized to approximate infiltration for the drainage sub-basins.

Lag Time: The lag time is defined as the time measured from the center of mass of effective rainfall to the time to peak of the outflow hydrograph. The lag time is related to the time of concentration as 0.6 times the t-basins modeled. A copy of lag time computations is included in the appendix.

2.3 Hydraulic Modeling

Street Flow: Normal depth street flows are analyzed utilizing Flowmaster by Haestad Methods.

Hydraulic Sections: Minor hydraulic sections are analyzed by calculating normal depth with Flowmaster by Haestad Methods.

3. EXISTING CONDITIONS DRAINAGE

3.1 On-site Existing Conditions

The existing site is covered with slightly disturbed earth and desert brush. About half of the site drains to Charleston Boulevard. The other half drains to the southeast corner of the site; no outlet exists for storm flow generated on the south side of the existing site

3.2 Offsite Existing Conditions

Charleston Boulevard drains from the west to the east adjacent to the north boundary of the site. Flow within Charleston Boulevard is referenced from the City of Las Vegas Central Neighborhood Flood Control Plan. A single offsite basin is used to estimate the flow impacting the Homlby Channel on the southern boundary of the proposed site. The basin extends west to Buffalo Drive generally following the basin lines of 3-HOLM-C (as shown in CLV Central Neighborhood study). Proposed site is located upstream of the center of 3-HOLM-C. Total flow from 3-HOLM-C is shown as 119/284 cfs in the 10/100-year storm events; calculated storm runoff at proposed site is less than half of the total master planned storm flow as would be expected from the proposed site's location within 3-HOLM-C.

Table 1, Existing Flow Summary

Basin ID/Concentration Point	Area (ac)	Q10 (cfs)	Q100 (cfs)
EON1	0.94	1	2
EON2	1.28	1	3
EOFF1	32.78	48	114
CP1	---	49	117

4. DEVELOPED CONDITION DRAINAGE

4.1 Onsite Developed Conditions

The proposed site is graded to drain to Charleston Boulevard and the existing drainage flume on the south side of the site. Storm runoff discharged to Charleston Boulevard does not exceed existing discharge flow rate. Flows to the south will pass through a block wall opening to existing drainage flume on the south side of the site.

4.2 Offsite Developed Conditions

The majority of the offsite area is developed in existing conditions. Developed curve numbers are used in the existing offsite and developed offsite analyses. See existing offsite conditions section for detailed explanation.

Table 2, Developed Flow Summary

Basin ID/Concentration Point	Area (ac)	Q10 (cfs)	Q100 (cfs)
DON1	0.30	1	1
DON2	1.92	3	6
EOFF1	32.78	48	114
CP1	---	51	119

4.3 Developed Hydraulics

Street flow calculations have been performed for Charleston Boulevard adjacent to the site. Two onsite sections have been analyzed to show conformance with HCDDM criteria. Holmby Channel along the south boundary of the site is analyzed to show adequate capacity and flood protection for the site.

Table 3, Developed Hydraulic Sections

Section	Q10	Q100	D10	D100	V10	V100	D*V10	D*V100
A – Charleston Blvd	74	147	0.67	0.80	5.4	6.39	3.62	5.11
B – Onsite Section	-	1	-	0.24	-	1.32	-	0.32
C – Onsite Section	-	3	-	0.42	-	1.67	-	0.70
D – Holmby Channel EX	-	117	-	0.75	-	16.37	-	N/A
D – Holmby Channel DEV	-	119	-	0.76	-	16.48	-	N/A

Flow through section B is estimated as 1 cfs; this is about 1/6TH of the flow from DON2. Onsite storm drain and inlets are proposed in the east drive aisle; three inlets are evenly spaced within the drive aisle. Flow through section C is estimated as 3-cfs; this is about half of the flow from DON2. Flow for Charleston Boulevard is taken from the City of Las Vegas Central Flood Control Plan; Q10/Q100 for Charleston Boulevard adjacent to the site is 74/147-cfs. Flow in Holmby Channel is estimated as the flow from CP1.

An onsite storm drain is proposed to reduce the depth of storm runoff in the east drive aisle of the proposed site. Four 2'x2' inlets are proposed to capture surface runoff between the central and eastern buildings. Inlets are connected by varying pipe sizes from 10" to 15". Total estimated storm flow conveyed in the facility varies from 1-cfs to 3-cfs. Inlets can capture about 1-cfs each, providing more capture capacity than the estimated total flow for the facility. Pipe sizing calculations and inlet sizing calculation are contained in the appendix of this report.

Finished floor elevation of the proposed buildings adjacent to Charleston Boulevard are elevated to above twice the 100-year depth of flow in Charleston Boulevard. Top of curb elevation at the upstream end of the building is 2471.86; flow line is 2471.36; 100-yr depth of flow is 0.8'; two times the depth of flow is 1.60'; 1.60' plus 2471.36 is 2472.96. The finished floor elevation of the buildings adjacent to Charleston Boulevard is 2473. The buildings are adequately flood protected from storm flow in Charleston Boulevard.

Holmby Channel runs adjacent to the southern boundary of the site. Contributing areas to the channel lie west of the project site. Holmby Channel is approximately 9.5' wide and approximately 2' feet deep; the channel section is lined with concrete. The estimated storm flow is fully contained within the channel section. At the upstream end of the site the invert elevation of the channel is above the proposed finished floor elevation of the south most buildings; the existing channel lining depth is adequate to provide flood protection for the proposed structures. The addition of 2-cfs to the 100-year flow in the Holmby Channel during the developed condition is considered negligible. Pre-development depth is shown to be 0.75' and post development depth is shown to be 0.76'. Pre-development velocity is 16.37 fps and

post-development velocity is 16.48 fps. The change in flow depth and velocity are very small and should produce no downstream impacts.

Proposed block wall opening has been analyzed to show proper sizing and conformance with criteria. 6 cfs of storm flow discharge through the proposed opening. A weir section has been analyzed to show conformance with criteria. For 6-cfs the headwater depth is 0.6' above the crest; assuming 50% clogging, the headwater depth will be within the 16" opening. The outlet invert is 2467.00, with 50% clogging the invert is 2467.67; the max headwater elevation is 2468.27. Finished floor elevation of adjacent building is 2470.00; finished floor elevation is 1.73' above worst case storm flow depth at site outlet. Block wall opening will adequately perform during 100-yr storm event.

4.4 Lower Impact Development

Proposed grading design incorporates features intended to conform to section 1500 of the HCDDM. Impervious areas, pavement and roofs, drain through landscape areas and BMP swales prior to discharge.

One BMP swale is proposed with development of the proposed site. The north side of the site will discharge through landscape areas, but no specific treatment is proposed. The southern half of the site flows through one treatment swale prior to offsite discharge.

Total Treated Pavement Area	Total Untreated Pavement area	Total Pavement Area	Percentage of Parking Area Treated
0.69-acres	0.19-acres	0.88	78%

BMP Swale lining uses the standard 3"-D50 landscape rock as directed in Section 1500 of the HCDDM.

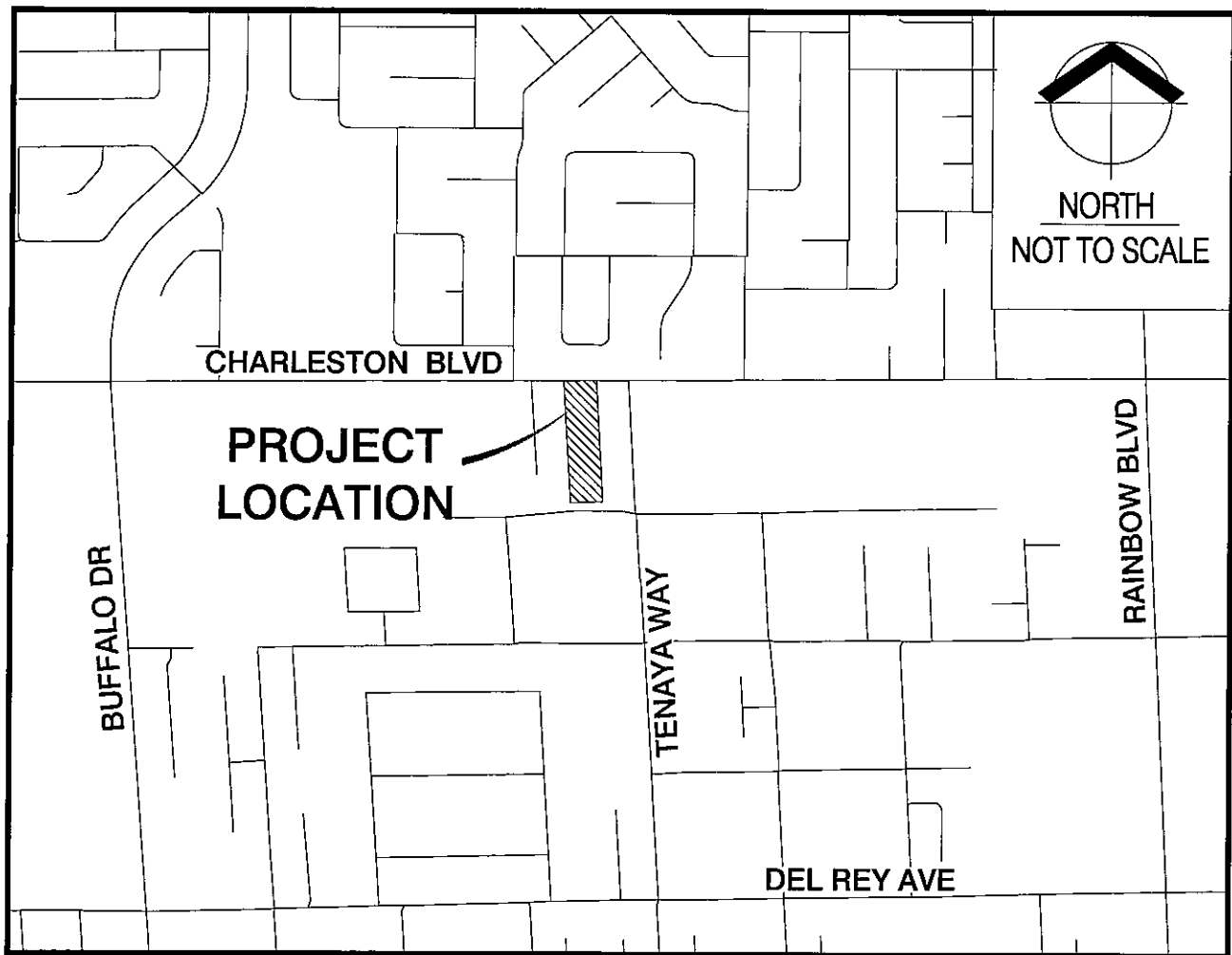
5. CONCLUSIONS & RECOMMENDATIONS

The site meets criteria set forth in the Hydrologic Criteria and Drainage Design Manual. The design is well prepared and analyses are competently completed; the project should be approved and built based on the information provided.

6. REFERENCES

1. Hydrologic Criteria and Drainage Design Manual. Clark County Regional Flood Control District, 1990.
2. Soil Survey of Las Vegas Valley Area, Nevada. U.S. Department of Agriculture, Soil Conservation Service, July 1985.
3. FlowMaster Version 8.i, dated 2009. Prepared by Bentley Systems Inc.
4. HEC1, Hydrologic Engineering Core, ACE
5. Flood Insurance Rate Map #32003C2535F, Clark County Unincorporated Areas, printed November 26, 2011, revised to reflect LOMR December 3, 2012
6. City of Las Vegas Central Neighborhood Flood Control Master Plan, prepared by PBS&J.

FIGURES



VICINITY MAP

RIETZ
CONSULTING INC.

3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

CHARLESTON & TENAYA
MINI STORAGE

VICINITY MAP

DATE: 11/20/2017

DRAFTER: JG

CHECKED: JG

CHECKED: EJ

FIGURE

1

NOTES TO USERS

This map is for use in administering the National Flood Insurance Program. It does not necessarily identify all areas subject to flooding, particularly from local drainage sources of small size. The community map repository should be consulted for possible updated or additional flood hazard information.

To obtain more detailed information in areas where **Base Flood Elevations (BFEs)** and/or **floodways** have been determined, users are encouraged to consult the **Flood Profiles and Floodway Data** and/or **Summary of Stillwater Elevations** tables contained within the **Flood Insurance Study (FIS)** report that accompanies this FIRM. Users should be aware that BFEs shown on the FIRM represent rounded whole-foot elevations. These BFEs are intended for flood insurance rating purposes only and should not be used as the sole source of flood elevation information. Accordingly, flood elevation data presented in the FIS report should be utilized in conjunction with the FIRM for purposes of construction and/or floodplain management.

Coastal Base Flood Elevations shown on this map apply only landward of 0.0' North American Vertical Datum of 1988 (NAVD 88). Users of this FIRM should be aware that coastal flood elevations are also provided in the **Summary of Stillwater Elevations** table in the **Flood Insurance Study** report for this jurisdiction. Elevations shown in the **Summary of Stillwater Elevations** table should be used for construction and/or floodplain management purposes when they are higher than the elevations shown on this FIRM.

Boundaries of the **floodways** were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the National Flood Insurance Program. Floodway widths and other pertinent floodway data are provided in the **Flood Insurance Study** report for this jurisdiction.

Certain areas not in Special Flood Hazard Areas may be protected by **flood control structures**. Refer to Section 2.4 "Flood Protection Measures" of the **Flood Insurance Study** report for information on flood control structures for this jurisdiction.

The **projection** used in the preparation of this map was Universal Transverse Mercator (UTM) zone 11. The **horizontal datum** was NAD83, GRS1980 spheroid. Differences in datum, spheroid, projection or UTM zones used in the production of FIRM for adjacent jurisdictions may result in slight positional differences in map features across jurisdiction boundaries. These differences do not affect the accuracy of this FIRM.

Flood elevations on this map are referenced to the North American Vertical Datum of 1988. These flood elevations must be compared to structure and ground elevations referenced to the same vertical datum. For information regarding conversion between the National Geodetic Vertical Datum of 1929 and the North American Vertical Datum of 1988, visit the National Geodetic Survey website at <http://www.ngs.noaa.gov/> or contact the National Geodetic Survey at the following address:

NGS Information Services
NCA, NING12
National Geodetic Survey
SSMC-3, #9202
1315 East-West Highway
Silver Spring, MD 20910-3282

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at (201) 713-3242, or visit its website at <http://www.ngs.noaa.gov/>.

Base map information shown on this FIRM was provided in digital format by the Clark County GIS Management Office (GISMO).

This map reflects more detailed and up-to-date **stream channel configurations** than those shown on the previous FIRM for this jurisdiction. The floodplains and floodways that were transferred from the previous FIRM may have been adjusted to conform to these new stream channel configurations. As a result, the **Flood Profiles and Floodway Data** tables in the **Flood Insurance Study** report (which contains authoritative hydraulic data) may reflect stream channel distances that differ from what is shown on this map.

Corporate limits shown on this map are based on the best data available at the time of publication. Because changes due to annexations or de-annexations may have occurred after this map was published, map users should contact appropriate community officials to verify current corporate limit locations.

Please refer to the separately printed **Map Index** for an overview map of the county showing the layout of map panels; community map repository addresses; and a Listing of Communities table containing National Flood Insurance Program dates for each community as well as a listing of the panels on which each community is located.

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1-877-FEMA-MAP (1-877-336-2627) or visit the FEMA Map Service Center website at <http://msc.fema.gov>. Available products may include previously issued Letters of Map Change, a Flood Insurance Study Report, and/or digital versions of this map. Many of these products can be ordered or obtained directly from the website. Users may determine the current map date for each FIRM panel by visiting the FEMA Map Service Center website or by calling the FEMA Map Information eXchange.

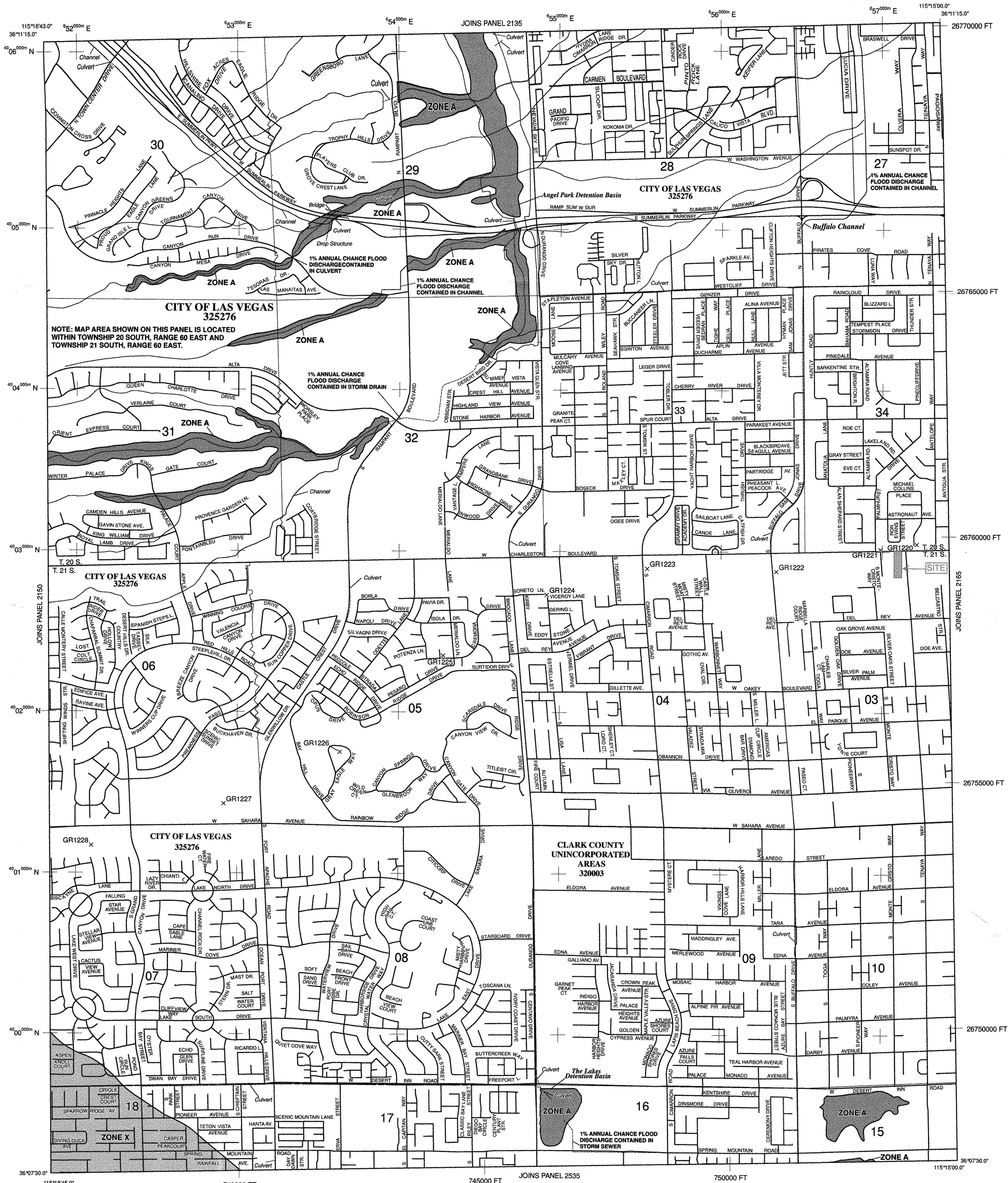
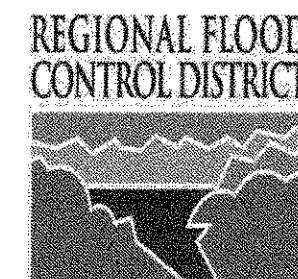
The Digital Flood Insurance Rate Map (DFIRM) was produced through a unique partnership between Clark County and the Federal Emergency Management Agency (FEMA). Clark County has developed a long-term approach of floodplain management to decrease the costs associated with flooding. This is demonstrated by the Clark County commitment to share and maintain floodplain layers within their Geographic Information System Management Office (GISMO).

This DFIRM reflects several innovative features. These include:

- Southern Nevada GIS-Cooperation among local government agencies throughout Clark County. The foundation of cooperation is the GIS Interlocal Agreements formed between fourteen regional participants. In part, the agreements specify that the Clark County GIS Management Office (GISMO) will be responsible for maintaining a GIS data warehouse and associated Southern Nevada GIS metadata.

- The GISMO's responsibilities go beyond maintaining the GIS data warehouse. GISMO also maintains the Street Centerline Database used by 911 dispatch services. This centerline database serves as the base map for this DFIRM.

DIGITAL DATA AVAILABILITY: <http://www.co.clark.nv.us/celt/gismo/gismo.htm>



LEGEND

SPECIAL FLOOD HAZARD AREAS (SFHAs) SUBJECT TO INUNDATION BY THE 1% ANNUAL CHANCE FLOOD

The 1% annual chance flood (100-year flood), also known as the base flood, is the flood that has a 1% chance of being equaled or exceeded in any given year. The Special Flood Hazard Area is the area subject to flooding by the 1% annual chance flood. Areas of Special Flood Hazard include Zones A, AE, AH, AO, AR, A99, V and VE. The Base Flood Elevation is the water-surface elevation of the 1% annual chance flood.

ZONE A No Base Flood Elevations determined.

ZONE AE Base Flood Elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); Base Flood Elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR Special Flood Hazard Area formerly protected from the 1% annual chance flood by a flood control system that was subsequently identified. Zone AR indicates that the former flood control system is being restored to provide protection from the 1% annual chance or greater flood.

ZONE A99 Area to be protected from 1% annual chance flood by a Federal flood protection system under construction; no Base Flood Elevations determined.

ZONE V Coastal flood zone with velocity hazard (wave action); no Base Flood Elevations determined.

ZONE VE Coastal flood zone with velocity hazard (wave action); Base Flood Elevations determined.

FLOODWAY AREAS IN ZONE AE

The floodway is the channel of a stream plus any adjacent floodplain areas that must be kept free of encroachment so that the 1% annual chance flood can be carried without substantial increases in flood heights.

OTHER FLOOD AREAS

ZONE X Areas of 0.2% annual chance flood; areas of 1% annual chance flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 1% annual chance flood.

OTHER AREAS

ZONE X Areas determined to be outside the 0.2% annual chance floodplain.

ZONE D Areas in which flood hazards are undetermined, but possible.

COASTAL BARRIER RESOURCES SYSTEM (CBRS) AREAS

OTHERWISE PROTECTED AREAS (OPAs)

CBRS areas and OPAs are normally located within or adjacent to Special Flood Hazard Areas.

— Floodplain boundary

— Floodway boundary

— Zone D boundary

— CBRS and OPA boundary

— Boundary dividing Special Flood Hazard Areas of different Base Flood Elevations, flood depths or flood velocities.

— Base Flood Elevation line and value; elevation in feet*

— Base Flood Elevation value where uniform within zone; elevation in feet*

* Referenced to the North American Vertical Datum of 1988 (NAVD 88)

— Cross section line

— Transsect line

Geographic coordinates referenced to the North American Datum of 1983 (NAD 83)

1000-meter Universal Transverse Mercator grid ticks, zone 11

5000-foot grid ticks: Nevada State Plane coordinate system, east zone (FIPSZONE 2701), Transverse Mercator

DX5510

Bench mark (see explanation in Notes to Users section of this FIRM panel)

• M1.5

River Mile

MAP REPOSITORIES

Refer to Map Repositories list on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP

August 16, 1991

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL

September 27, 2002

November 16, 2011 - to reflect updated topographic information, to change floodway, to add Base Flood Elevations, to update corporate limits, to change Base Flood Elevations, to add Special Flood Hazard Areas, to change Special Flood Hazard Areas, to delete Special Flood Hazard Areas, to change zone designations, to add roads and road names, and to incorporate previously issued Letters of Map Revision.

For community map revision history prior to countywide mapping, refer to the Community Map History table located in the Flood Insurance Study report for this jurisdiction.

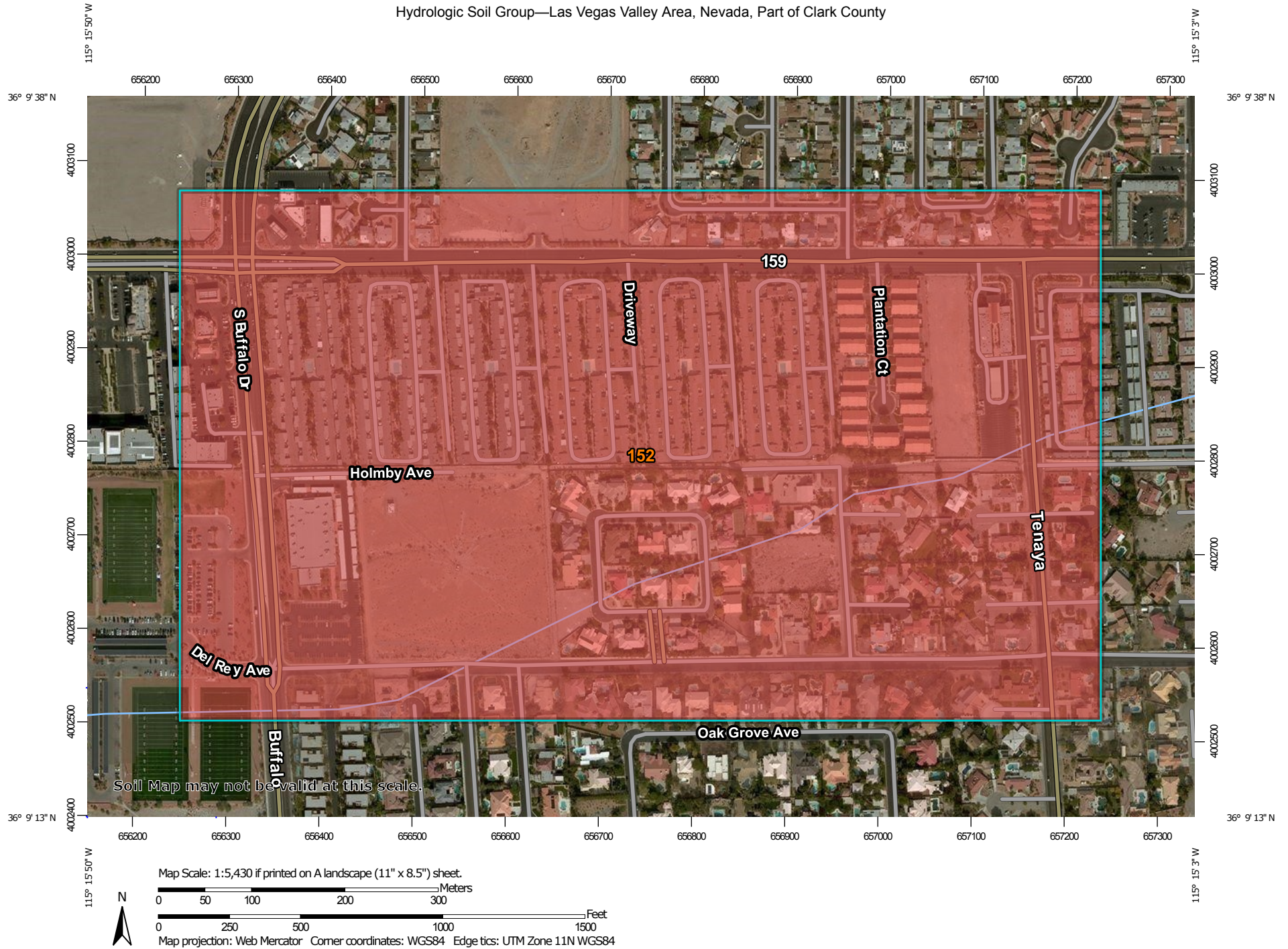
To determine if flood insurance is available in this community, contact your insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

MAP SCALE 1" = 1000'

500 0 1000 2000 FEET

300 0 300 600 METERS

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



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

11/30/2017
Page 1 of 4

FIGURE 3

MAP LEGEND

Area of Interest (AOI)	
	Area of Interest (AOI)
Soils	
Soil Rating Polygons	
	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available
Soil Rating Lines	
	A
	A/D
	B
	B/D
	C
	C/D
	D
	Not rated or not available
Background	
	A
	A/D
	B
	B/D
Water Features	
	Streams and Canals
Transportation	
	Rails
	Interstate Highways
	US Routes
	Major Roads
	Local Roads
Aerial Photography	
	Aerial Photography

MAP INFORMATION

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

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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 12, Sep 15, 2017

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—Feb 25, 2014

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.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
152	Cave gravelly fine sandy loam, 0 to 4 percent slopes	D	139.0	100.0%
Totals for Area of Interest			139.0	100.0%

Description

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

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

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

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

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

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.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition



Component Percent Cutoff: None Specified

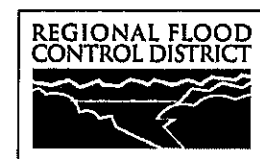
Tie-break Rule: Higher

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
APDG 0000	E	ANGEL PARK - DURANGO	2600	842	C38B	ALLGOW3	0.79	0.70
0050	E	72" RCP	1901	374	38A	ALLGOW3	0.35	0.96
APMD 0027	E	ANGEL PARK - MIDDLE BRANCH	170	6048	C11A-3*	ALLGOW4	11.31	3.00
0030	E	1: 12' X 10' and 2: 12' X 2' RCBC @ Canyon Run	7000	6048	C11A-3*	ALLGOW4	11.31	3.00
0132	E	Natural Wash	120	6048	C11A-3*	ALLGOW4	11.31	1.00
0133	E	2: 12x10' RCBC @ Hualapai	3015	6048	C11A-3*	ALLGOW4	11.31	3.00
APNO 0001	E	ANGEL PARK NORTH		9199	ANGLPKIN	ALLGOW5	21.99	
	E	1,512 ac-ft Angel Park Detention Basin						
APP1 0000	E	ANGEL PARK - PECCOLE 1	2982	442	PIC-B	ALLGOW3	0.44	2.40
0056	E	72" RCP	1385	442	PIC-B	ALLGOW3	0.44	2.40
APP2 0000	E	ANGEL PARK - PECCOLE 2	4793	2004	C57B-1	ALLGOW3	1.93	2.10
	E	Grass Chnl 10'W 5'D 2:1 SS						
APSO 0000	E	ANGEL PARK - SOUTH BRANCH	2506	4628	CC57B-4	ALLGOW3	5.24	1.62
0020	E	2: 12' X 12' RCBC	350	4628	CC57B-4	ALLGOW3	5.24	1.80
0050	E	2: 12' X 12' RCBC @ Rampart	209	4628	CC57B-4	ALLGOW3	5.24	1.84
0067	E	Natural Wash	8300	2384	C57B-2	ALLGOW3	2.67	2.10
0204	E	Natural Wash	326	2056	C12B	ALLGOW3	2.00	2.66
0205	E	2: 8' X 8' RCBC @ Hualapai	2380	2056	C12B	ALLGOW3	2.00	3.48
0254	E	Natural Wash	190	1932	C12A	ALLGOW3	1.74	3.00
0255	E	2: 8' X 8' RCBC @ Town Center Dr.	140	1932	C12A	ALLGOW3	1.74	3.00
FLBF 0152	E	FLAMINGO WASH - BUFFALO	3480	814	CLF11	FLAM3A	4.29	0.32
0228	E	10' X 7' RCB	1330	746	CLF9	FLAM3A	0.94	1.00
0252	E	96" RCP	170	746	CLF9	FLAM3A	0.94	1.00
0258	E	9' X 6' RCB	1140	748	CLF9	FLAM3A	0.94	0.50
0278	E	96" RCP	2840	508	LF8	FLAM3A	0.51	0.50
0328	E	90" RCP	680	508	LF8	FLAM3A	0.51	0.30
FLDI 0000	E	DESERT INN DRAIN	190	1145	CLF4	FLAM3A	1.38	2.71
0004	E	9' X 6' RCB	2670	1145	CLF4	FLAM3A	1.38	1.00
0050	E	96" RCP	1390	1145	CLF4	FLAM3A	1.38	1.65
0075	E	90" RCP	1010	874	CLF3	FLAM3A	0.94	1.87
0095	E	84" RCP	200	874	CLF3	FLAM3A	0.94	1.87
0100	E	96" RCP	190	277	LF1	FLAM3A	0.37	1.86
0105	E	72" RCP	2510	277	LF1	FLAM3A	0.37	1.85
FLDR 0179	E	DURANGO COLLECTOR	1810	260	CUFS23	FLAM3A	0.45	1.21
FLDY 0000	E	FLAMINGO WASH - DARBY STORM DRAIN	100	558	CLF24	FLAM3A	0.76	0.25
0002	E	84" RCP	50	558	CLF24	FLAM3A	0.76	0.25
0004	E	10' X 3' RCB	680	558	CLF24	FLAM3A	0.76	2.80
0013	E	60" RCP	580	558	CLF24	FLAM3A	0.76	1.79
FLLA 0227	E	FLAMINGO WASH - LATERAL (FLAMINGO/RAINBOW)	1360	640	CLF28	FLAM3B	1.03	0.40
0254	E	93" RCP	2730	403	CLF27	FLAM3A	1.54	0.40
0305	E	90" RCP		1556	CLF25	FLAM3A	1.03	
0306	E	1,556 cfs PMF Spillway	160	29	DIDB	FLAM3A	1.03	0.43
0308	E	30" RCP with 18" Orifice Outlet		744	CLF25	FLAM3A	1.03	
0308	E	62 ac-ft Desert Inn Detention Basin						
0322	E	81" RCP	1370	224	LF25	FLAM3A	0.27	0.50
0345	E	81" RCP	1340	224	LF25	FLAM3A	0.27	0.50
0369	E	72" RCP	670					0.50
0379	E	66" RCP	1320					0.50

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
FLMN 0000	E	FLAMINGO WASH - MONTESSOURI NORTH STORM DRAIN	1340	558	CLF24	FLAM3A	0.76	0.50
0025	E	78" RCP	1330	558	CLF24	FLAM3A	0.76	0.50
0050	E	72" RCP	500	372	LF23	FLAM3A	0.38	0.50
0060	E	66" RCP	800	372	LF23	FLAM3A	0.38	0.50
0075	E	54" RCP	30	372	LF23	FLAM3A	0.38	0.50
FLMS 0000	E	FLAMINGO WASH - MONTESSOURI SOUTH STORM DRAIN	630					0.52
	E	54" RCP						
FLSM 0000	E	SPRING MOUNTAIN DRAIN	4590	116	CLF10W	FLAM3A	2.84	2.50
0083	E	60" RCP	570	86	LAKEDB	FLAM3A	2.62	1.90
0088	E	36" RCP	90	86	LAKEDB	FLAM3A	2.62	
0087	E	38" RCP Outlet		1978	CLF7	FLAM3A	2.62	
0088	P1	143 ac-ft Lakes Detention Basin		1976	CLF7	FLAM3A	2.62	
0100	E	Upgrade to 165 ac-ft Lakes Detention Basin		1976	CLF7	FLAM3A	2.62	1.25
0125	E	12' X 6' RCB	310	1976	CLF7	FLAM3A	2.62	0.80
0180	E	96" RCP	3040	750	CLF6N	FLAM3A	0.87	0.50
	E	90" RCP	2350	528	LF5	FLAM3A	0.49	
GOSO 0297	E	GOWAN SOUTH FACILITIES	2124	1825	CW1BB-C	ALLGOW3	2.14	1.60
0336	E	12' X 7' RCB	602	1593	12' WESTC	ALLGOW3	1.84	3.40
0352	E	2: 8' X 5' RCB	2740	1374	C1-DUCHC	ALLGOW3	1.60	0.73
0404	E	2: 8' X 4' RCB	2680	1125	C1-ALTAC	ALLGOW3	1.32	0.80
0455	E	2: 12' X 4' RCB	350	665	C1-HOLMC	ALLGOW3	0.81	0.30
0462	E	12' X 4' RCB	1330	665	C1-HOLMC	ALLGOW3	0.81	0.30
GOWC 0000	E	GOWAN SOUTH FACILITIES - WEST CLIFF	5400	257	1-WEST-C	ALLGOW3	0.24	1.67
	E	24" RCP						
LCCH 0438	E	LAS VEGAS CREEK CHANNEL	1090	182	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1080	162	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
0499	E	42" RCP Outlet	680	85	RAINBOWB	SW3	1.11	1.88
0513	E	102 ac-ft Rainbow Detention Basin		970	RAINBWIN	SW3	1.11	
0518	E	60" RCP Connector Pipe Under Rainbow Blvd	670	970	RAINBWIN	SW3	1.11	1.85
LCLO 0000	E	LAS VEGAS CREEK - LORENZI	445	265	DAL00A	SW3	0.41	3.37
0008	E	7' X 6' RCB	2415	265	DAL00A	SW3	0.41	0.40
0054	E	7' X 5' RCB	169	265	DAL00A	SW3	0.41	1.00
MEAL 0160	E	MEADOWS ALTA	2600	331	CUS	SW3	0.56	1.25
0209	E	36" RCP	2500	150	DCR2	SW3	0.41	1.70
0258	E	48" RCP	81	150	DCR2	SW3	0.41	1.48
0258	E	38" X 60" HERCP	275	150	DCR2	SW3	0.41	4.07
MECH 0310	E	EXTENSION OF MEADOWS / CHARLESTON	1000	32	OAKEYOT	SW3	1.88	1.43
0323	E	24" RCP	200	32	OAKEYDB	SW3	1.88	
0324	E	15" RCP Outlet		1652	OAKEYIN	SW3	1.88	
0334	E	201 ac-ft Oakley Detention Basin						
0334	E	11' X 6' RCB	200	573	C5-OAK-C	SW3	0.56	0.50
0337	E	8' X 6' RCB	520	573	C5-OAK-C	SW3	0.56	0.50
0338	E	10' X 8' RCB	2080	1131	C3A-OAKC	SW3	1.32	1.62
0351	E	90" RCP	1350	573	C5-OAK-C	SW3	0.56	0.50
0378	E	10' X 8' RCB	745	1131	C3A-OAKC	SW3	1.32	2.00
0380	E	66" RCP	385	352	3-HOLM-C	SW3	0.33	2.00
0387	E	66" RCP	300	403	3A-OAK-C	SW3	0.43	3.08
0390	E	83" X 53" RCP	50	352	3-HOLM-C	SW3	0.33	2.00
0400	E	10' X 6' RCB	1890	823	C3-ELP-C	SW3	0.88	1.43
0405	E	66" RCP	1390	403	3A-OAK-C	SW3	0.43	1.00
0410	E	66" RCP	182	352	3-HOLM-C	SW3	0.33	2.00
0420	E	66" RCP	1410	352	3-HOLM-C	SW3	0.33	2.00

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
MECN 0123	P1	MEADOWS - CHARLESTON	5200	821	CCH09-C	SW3	0.72	1.64
0223	P1	8' X 6' RCB	2700	422	CCH05-C	SW3	0.34	2.04
RRFA 0105	E	RED ROCK - FORT APACHE COLLECTOR	1330	463	CUFR22	FLAM3A	0.77	0.94
0130	E	78" RCP	690	331	UFR21	FLAM3A	0.51	0.93
0143	E	66" RCP	1330	331	UFR21	FLAM3A	0.51	2.54
RRHU 0015	E	RED ROCK - HUALAPAI COLLECTOR	560	1199	CUFR13N	FLAM3A	1.52	1.30
0025	E	10' X 10' RCB	3310	1199	CUFR13N	FLAM3A	1.52	1.30
0079	E	11' X 5.5' RCAP	2650	981	CUFR11	FLAM3A	1.09	1.30
0129	E	8' X 6' RCB	2630	842	CUFR10	FLAM3A	0.82	1.20

* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.
** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.
^ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).



2013 LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
FACILITY INVENTORY
FIGURE F - 30

LEGE N D

ID (Facility Identifier) _____ AAB

Parent Stream Name _____

Stream Name _____

River Mile _____ 0000

Distance Above Confluence with Parent Stream (Miles) _____

Miles in Hundredths _____

Existing Facility.....E

Proposed or Modified Facility.....P

Contingency Level

Category B.....P0

Master Plan.....P1

Preliminary Design.....P2

Design.....P3

Bottom Width.....W

Depth.....D

Side Slope, H:V.....SS

Construction Features

Cast in Place Concrete Pipe.....CIPCP

Corrugated Metal Arch Pipe Culvert.....CMAP

Corrugated Metal Pipe Culvert.....CMPC

High Density Polyethylene.....HDPE

Horizontal Elliptical Reinforced Concrete Pipe.....HERCP

Reinforced Concrete Arch Pipe.....RCAP

Reinforced Concrete Arch Culvert.....RCAC

Reinforced Concrete Box.....RCB

Reinforced Concrete Box Culvert.....RCBC

Reinforced Concrete Pipe.....RCP

Reinforced Concrete Pipe Culvert.....RCPC

Storm Sewer Pipe.....SSP

FIGURE 4

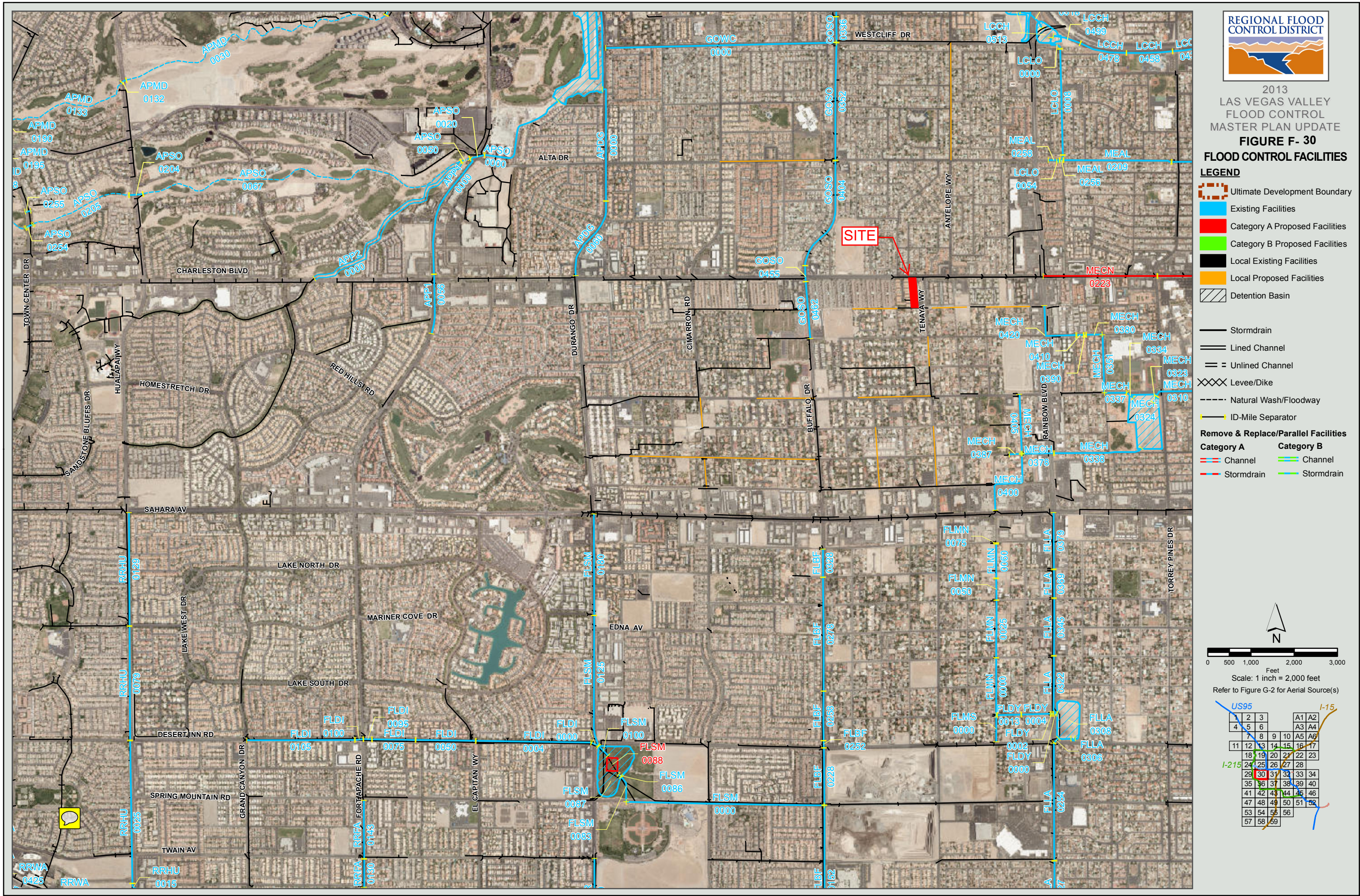


FIGURE 4



2004 CITY OF LAS VEGAS
CENTRAL NEIGHBORHOOD
FLOOD CONTROL MASTER PLAN

LEGEND

REGIONAL STREAM NAME DESIGNATOR	AABB
REGIONAL MILE	0000
LOCAL STREAM NAME DESIGNATOR	AAB
LOCAL ID NUMBER	000
EXISTING FACILITY	E
PROPOSED OR MODIFIED FACILITY	P
CONTINGENCY LEVEL:	
CATEGORY B	P0
MASTER PLAN	P1
PRELIMINARY DESIGN	P2
DESIGN	P3
BOTTOM WIDTH	W
DEPTH	D
SIDE SLOPE, H:V	SS
LEFT SIDE SLOPE H:V	LSS
RIGHT SIDE SLOPE H:V	RSS
CORRUGATED METAL ARCH PIPE CULVERT	CMAAP
CORRUGATED METAL PIPE CULVERT	CMP
DUCTILE IRON PIPE	DIP
HIGH DENSITY POLYETHYLENE PIPE	HDPE
HELICAL ELLIPTICAL REINFORCED CONCRETE PIPE	HERCP
PUBLIC DRAINAGE EASEMENT	PDE
POLYVINYL CHLORIDE PIPE	PVC
REINFORCED CONCRETE BOX	RCB
REINFORCED CONCRETE BOX CULVERT	RCBC
REINFORCED CONCRETE ELLIPTICAL PIPE	RCEP
REINFORCED CONCRETE PIPE	RCP
REINFORCED CONCRETE PIPE ARCH	RCPA
REINFORCED CONCRETE PIPE CULVERT	RCPC
STORM SEWER PIPE	SSP
VITRIFIED CLAY PIPE	VCP

NOTES:
FLOW = 100 YEAR HEC-1 FLOW (REGIONAL FACILITIES)
FLOW = FACILITY CAPACITY (LOCAL FACILITIES)

FLOOD CONTROL FACILITIES INVENTORY

SHEET I - 4



ID	MILE	Status	Plan No.	Facility Description	Facility Length L (ft)	Channel Slope S (%)	Flow (cfs)
F-6 REGIONAL FACILITIES							
LAS VEGAS WASH - MIDDLE							
LVMD	1178	E	2002 Master Plan Update	Earth Chnl 30"W 18"-20"D 2:1 SS	2900	0.57	12415
LVMD	1178	P1	2002 Master Plan Update	Conc Chnl 60"W 9.5"D 2:1 SS	2900	0.57	12415
LVMD	1232	E	2002 Master Plan Update	Earth Chnl 48"W 8"D 1.5:1 SS	2059	0.73	12415
LVMD	1232	P1	2002 Master Plan Update	Conc Chnl 90"W 8"D	2059	0.73	12415
LVMD	1271	E	2002 Master Plan Update	4 Span Bndge 94"W 10'-12"D 2:1 SS @ Lamb	120	0.38	12372
LVMD	1272	E	2002 Master Plan Update	Earth Chnl 80"W 10"D 2:1 SS	2400	0.38	11776
LVMD	1272	P1	2002 Master Plan Update	Conc Chnl 80"W 8.5"D 2:1 SS	2400	0.38	11776
LVMD	1321	P1	2002 Master Plan Update	Conc Chnl 80"W 7.5"D 2:1 SS	2200	0.38	8911
LVNB	0035	E	107-V1789	10' X 5' RCB	75		465
LVNB	0037	E	107-V1789	96" RCP	2042		465
LVNB	0076	E	107-V1789	90" RCP	3376		465
WASHINGTON AVENUE CHANNEL							
LVWH	0086	E	731-54	3: 12' X 8' RCB	1111	0.33	4027
LVWH	0087	E	731-54A	3: 12' X 8' RCB	1466	0.33	4027
LOCAL FACILITIES							
BNZ	010	E	107-V349	Conc Chnl 3'D 7"W 1.5:1 SS	225		533
LMB	180	E	HWY-BK L7	38" X 24" HERCP	1465		
LMB	190	E	HWY-BK L7	24" RCP	425	0.17	9
LMB	200	E	HWY-BK L7	18" RCP	325	0.25	5
LMB	210	E	HWY-BK L7	18" RCP	155	0.80	9
MAR	000	E	327-V136	21" ARCPA	696		10
MAR	020	E	327-V136	18" RCPA	381		5
MAR	030	E	327-V136	18" RCPA	617		5
MAR	040	E	327-V136	130' X 8' Pedestrian Bndge	130		
NEL	011	E	107-V989	60" RCP	475		116
NEL	021	E	327-V194	18" RCP	450		6
OVS	010	E	107-V858	24" RCP	373		14
OVS	020	E	107-V858	30" RCP	937		20
OVS	030	E	107-V858	36" RCP	950		42
OVS	040	E	107-V858	42" RCP	1677		56
OVS	050	E	107-V858	24" RCP	670		12
OVS	060	E	107-V858	36" RCP	1050		45
OVS	070	E	107-V858	30" RCP	235		30
OVS	071	E	107-V858	24" RCP	750		16
OVS	080	E	107-V858	24" RCP	528		14
SHL	130	E	107-V849B	53" X 34" SSP	52	0.30	
SHL	140	E	107-V849B	36" SSP	85	0.35	
SHL	160	E	715-105	12" PVC	99	0.40	3
WAS	010	E	107-V1982	36" RCP	1281		47
WAS	020	E	107-V1982	29" X 45" RCPA	85		39
WAS	090	E	107-V1982	12" RCP	147		
WAS	100	E	107-V1982	36" RCP	628		47
WAS	110	E	107-V1982	48" RCP	58		110
WAS	120	E	107-V1982	30" RCP	2930		42
WAS	131	E	107-V833	12" RCP	36		2
WAS	140	E	107-V1982	24" RCP	905		14
WAS	160	E	715-105	18" PVC	767		

ID	MILE	Status	Plan No.	Facility Description	Facility Length L (ft)	Channel Slope S (%)	Flow (cfs)
F-7 REGIONAL FACILITIES							
ANGEL PARK - DURANGO							
APDG	0000	E	107-V1649 / V1660	84" RCP	2600	0.70	839
APDG	0080	E	107-V1649 / V1660	72" RCP	1901	0.96	374
ANGEL PARK NORTH							
APNO	0000	E	731-49A	1400 ac-ft Angel Park Detention Basin			8623
ANGEL PARK - SOUTH BRANCH							
APSO	0000	E	2002 Master Plan Update	Natural Wash	2500	2.00	4425
GOWAN SOUTH FACILITIES							
GOSO	0336	E	107-V1753	1: 12' X 7' RCB	700	3.40	1624
GOSO	0352	E	107-V2140	2: 8' X 5' RCB	2740	0.73	1403
GOSO	0404	E	107-V2140	2: 8' X 4' RCB	2391	0.80	1146
GOSO	0455	E	107-V1648	2: 12' X 4' RCBC @ Charleston Blvd	350	0.30	685
GOSO	0462	E	107-V2140	1: 12' X 4' RCB u/s of Charleston Blvd	1375	0.30	685
LAS VEGAS CREEK CHANNEL							
LCCH	0582	E	650.14-7	24" RCP	6440	1.67	257
LCCH	0502	E	2002 Master Plan Update	36" RCP	792	1.10	70
LCCH	0517	E	2002 Master Plan Update	30" RCP	264	1.10	43
LCCH	0522	E	2002 Master Plan Update	24" RCP	1350	1.90	31
LAS VEGAS CREEK CHANNEL - PARALLEL SYSTEM							
LCCP	0452	P2	NDOT U.S. 95 Widening	Spitway			8280
LCCP	0454	P2	NDOT U.S. 95 Widening	55 ac-ft Rainbow Detention Basin			826
EXTENSION OF MEADOWS / CHARLESTON COLLECTION SYSTEM							
MECH	0420	E	731-55	66" RCP	1168	2.00	284
MEADOWS - CHARLESTON							
MECN	0223	P1	2002 Master Plan Update	7' X 6' RCB	2700	2.04	676
LOCAL FACILITIES							
APD	100	E	107-Y4289-3	18" RCP	116		14
CHN	370	E	107V-853	18" RCP	12796		15
CHN	390	E	107-V1648	18" RCP	1233	1.50	144
CHN	400	E	107-V2486	3: 24" X 36" HERCP	96		320
CHN	410	E	107-V1648	54" RCP	634		223
CHN	420	E	107-V1648	48" RCP	1185		159
CHN	430	E	107-V1648	42" RCP	1179		105
CHN	440	E	107-V1648	36" RCP	527		10
CHN	445	E	107-V2251	19" X 30" HERCP	108	0.25	18
CHN	446	E	107-V2251	30" RCP	249	0.25	68
CHN	450	E	107-V1648	30" RCP	250		37
CHN	460	E	107-V1648	24" RCP	430		26
CHN	470	E	107-V1648	21" RCP	587		415
CHN	474	E	107-1660	72" RCP	850	0.96	17
CHN	475	E	107-V1697	18" RCP	2800		8
CHN	100	E	327Y-4199	18" PVC	825		
CHN	100	E	107-V1989	18" RCP	10		
DLR	050	E	107-Y4404	Riprap Chnl 20"W 2.67'D 3.56:1 SS	343		11
DLR	110	E	107Y-4429	18" RCP	295	1.35	91
HLM	030	E	107-V2830	48" RCP	252	0.40	293
RNB	025	E	650.14-7	24" RCP	3558		7
RNB	030	E	327-V191	18" RCP	100		250
RNB	040	E	327-V191	24" RCP	545		42
RNB	050	E	Hwy Bk R-3	30" RCP	630	1.37	37
RNB	055	E	Hwy Bk R-6	36" RCP	666	0.40	31
RNB	060	E	Hwy Bk R-6	33" RCP	360	0.45	21
RNB	070	E	Hwy Bk R-6	27" RCP	100	0.50	14
RNB	080	E	Hwy Bk R-6	24" RCP	202	0.47	6
RNB	100	E	Hwy Bk R-6	18" RCP	700	0.79	8
RNB	110	E	Hwy Bk R-6	18" RCP	504		522
RNB	120	E	Hwy Bk R-6	60" RCP	230	5.30	94
RNB	130	E	107-V1683	36" RCP	260		4
RNB	150	E	107-2158-2	24" RCP	180	0.02	35
RNB	160	E	107Y-2159	24" RCP	122	2.40	
RNB	170	E	107Y-2159	24" RCP			
RNB	180	E	107Y-4057	12" PVC	878		
RNB	190	E	Hwy Bk R-6	30" RCP	90		6
RNB	200	E	Hwy Bk R-6	18" RCP	325	0.30	
RNB	210	E	107-V1989	30" RCP			
RNB	220	E	107Y-2159-3	5" PDE	30		
VVW	000	E	565-304	12" LVVWD Discharge Pipe 2 Bk DI	744	0.21	2
WTC	016	E	107Y-4307	21" RCP	343	2.38	21
WTC	017	E	107Y-4307-2	30" RCP	736	1.20	39

WESTCOTT silver sky
THES Assisted Living

TWIN LAKES BAPTIST CHURCH (PAVING ONLY)



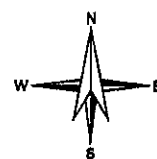
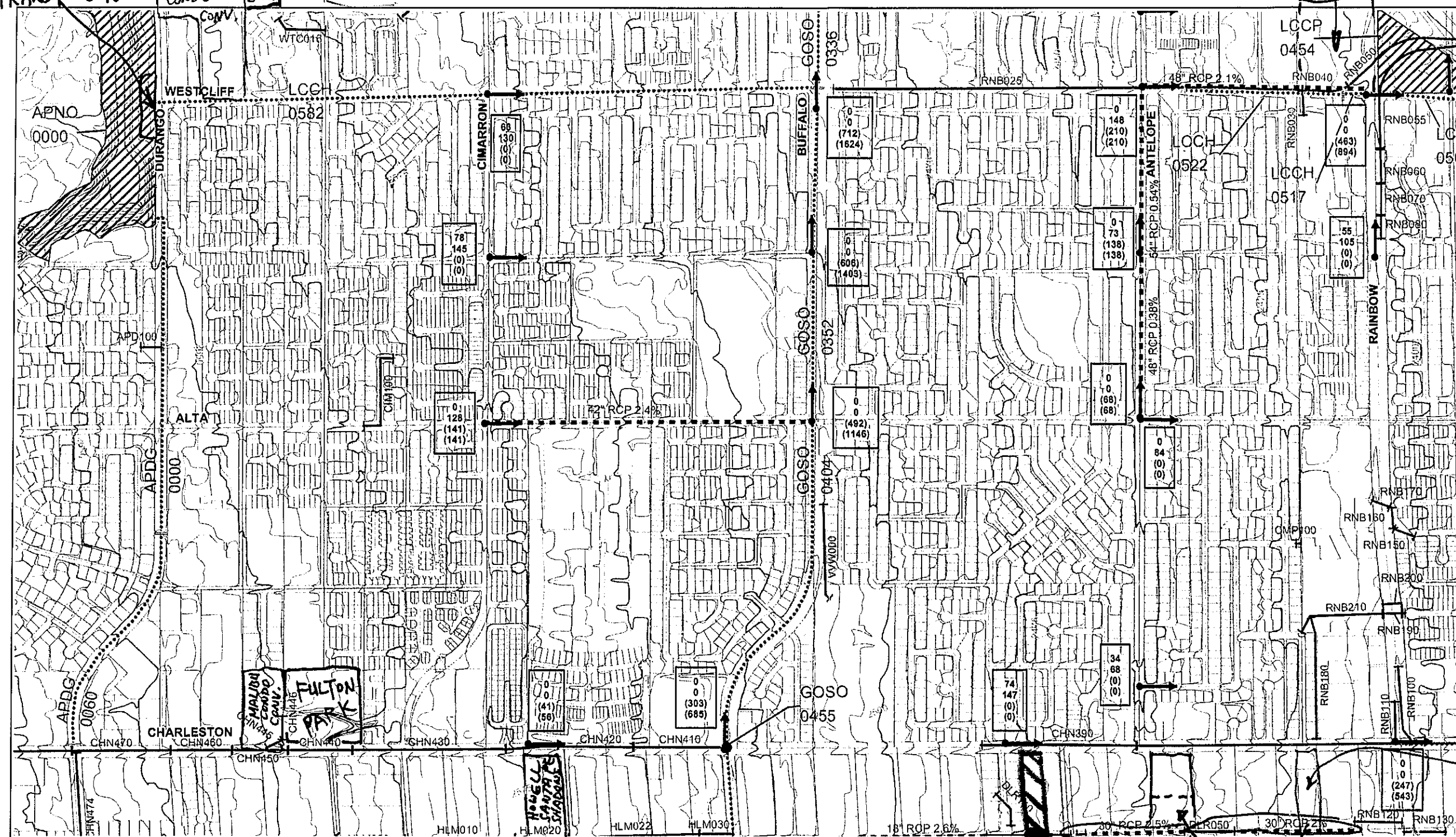
City of Las Vegas
**CENTRAL
NEIGHBORHOOD
FLOOD CONTROL
MASTER PLAN**

LEGEND

- | | |
|---|---|
|  | Existing Regional Facility |
|  | Category A Proposed Regional Facility (2002 MPU) |
|  | Category B Proposed Regional Facility (2002 MPU) |
|  | Category A Proposed Regional Facility (2004 CNFCMP) |
|  | Existing Local Facility |
|  | Proposed Local Facility |
|  | Regional Culvert |
|  | Regional Bridge |
|  | Regional Pipeline |
|  | Regional Channel |
|  | Regional Levee |
|  | Regional Detention Basin |
|  | Local Storm Drain |
|  | Local Culvert |
|  | Proposed Local Storm Drain |
|  | Regional ID-Mile Separator |
|  | Local Facility Separator |

CHARLES TOWN
BUSINESS
PARK
(TMP-
22257)

FIGURE F-7



0 200 400 600 800 1,000 1,200 1,400 1,600

Exon 1 Exon 2 Exon 3 Exon 4 Exon 5 Exon 6 Exon 7 Exon 8 Exon 9 Exon 10

Intron 1 Intron 2 Intron 3 Intron 4 Intron 5 Intron 6 Intron 7 Intron 8 Intron 9

5' UTR

hTERT

SCALE: 1 inch = 800 feet

●→ Flow Arrow

250	10-Year Street Flow
500	100-Year Street Flow
(300)	10-Year Facility Flow
(800)	100-Year Facility Flow

(Flows in CFS)

NOTE:

NOTE:
Ultimate drainage conditions are based on
future Curve Number values with all flood control
facilities in place.

100-Year flows at locations where a 100-Year subbasin concentration point does not exist in the hydrology model were based on an area-weighted ratio of the 100-Year flows from concentration points upstream and downstream of the location. See Volume I for a more detailed explanation.

Charleston
& Tenaya
Mini Storage

Lake Mead
Washington
Charleston
Sahara
Desert Inn

		1	2	
		3	4	5
7	8	9	10	11
13	14	15	16	17
	18	19		

12
CONC. 1
CHANNEL

PBS

2270 Corporate Circle, Suite 100
Henderson, NV 89074
(702) 263-7275
Fax: (702) 263-7200



City of Las Vegas

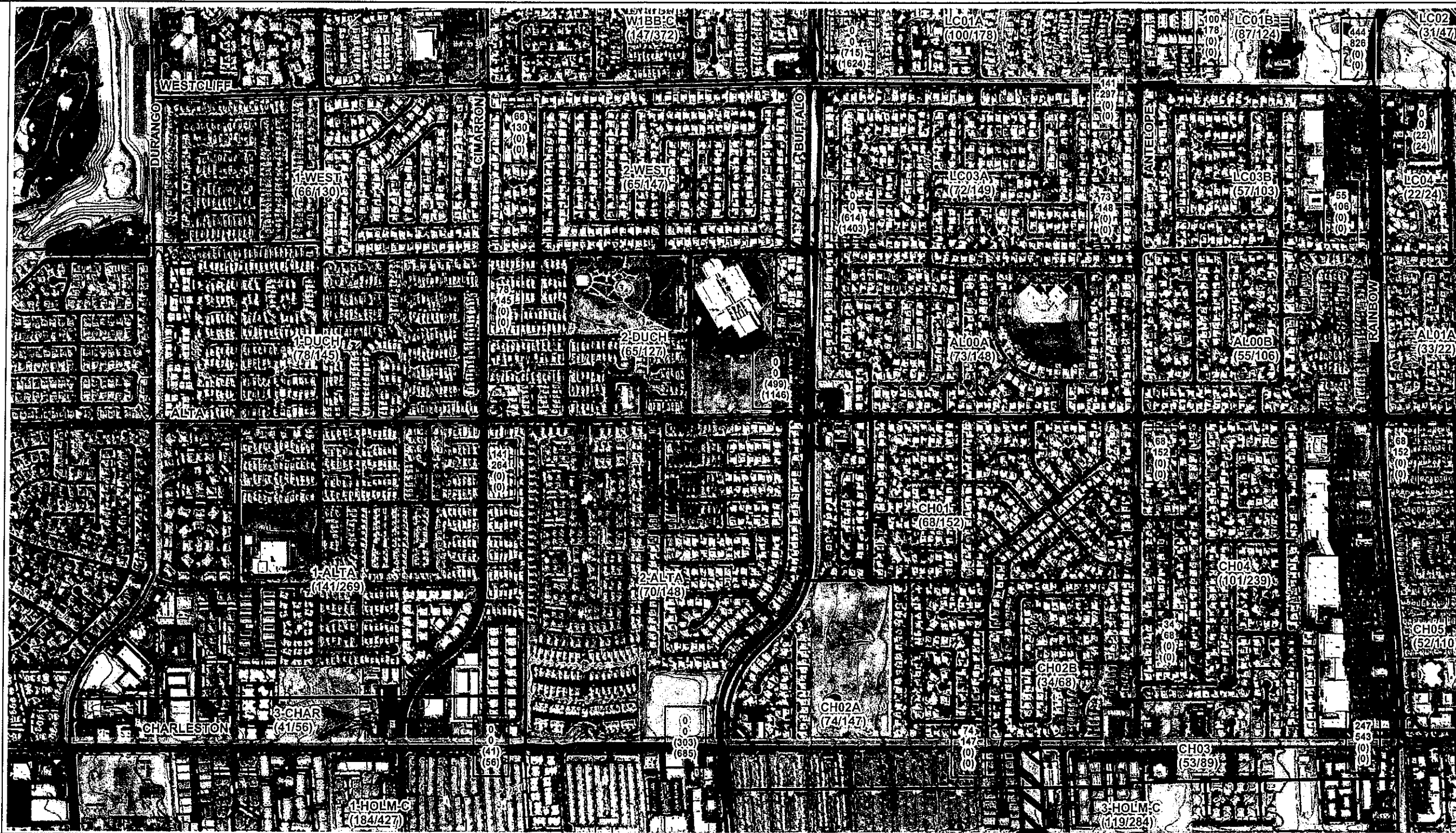
CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

- Sub-basin Boundary
- LV12 Basin ID
- (10yr./100yr.) Contributing flow from the basin (cfs)
- Flow Arrow
- 250 10-Year Street Flow
- 500 100-Year Street Flow
- (300) 10-Year Facility Flow
- (800) 100-Year Facility Flow
- (Flows in CFS)
- Study Area Limit

PHOTO DATE: SPRING 2004

FIGURE E-7



EXISTING DRAINAGE CONDITIONS

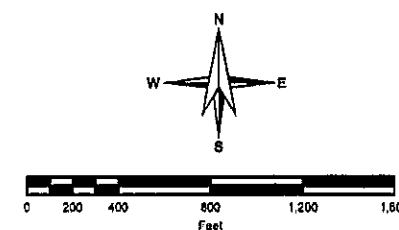


2270 Corporate Circle, Suite 100
Henderson, NV 89074
(702) 263-7275
Fax: (702) 263-7200

	Durango	Rainbow	Decatur	Tonopah	5th	Pecos	Nellis
Lake Mead				1	2		
Washington				3	4	5	6
Charleston	7	8	9	10	11	12	
Sahara	13	14	15	16	17		
Desert Inn		18	19				

NOTE:
Existing conditions are based on future
Curve Number values with only existing local and
CCRFD facilities in place.

100-Year flows at locations where a 100-Year
subbasin concentration point does not exist in the
hydrology model were based on an area-weighted
ratio of the 100-Year flows from concentration points
upstream and downstream of the location. See
Volume I for a more detailed explanation.



SCALE: 1 inch = 800 feet

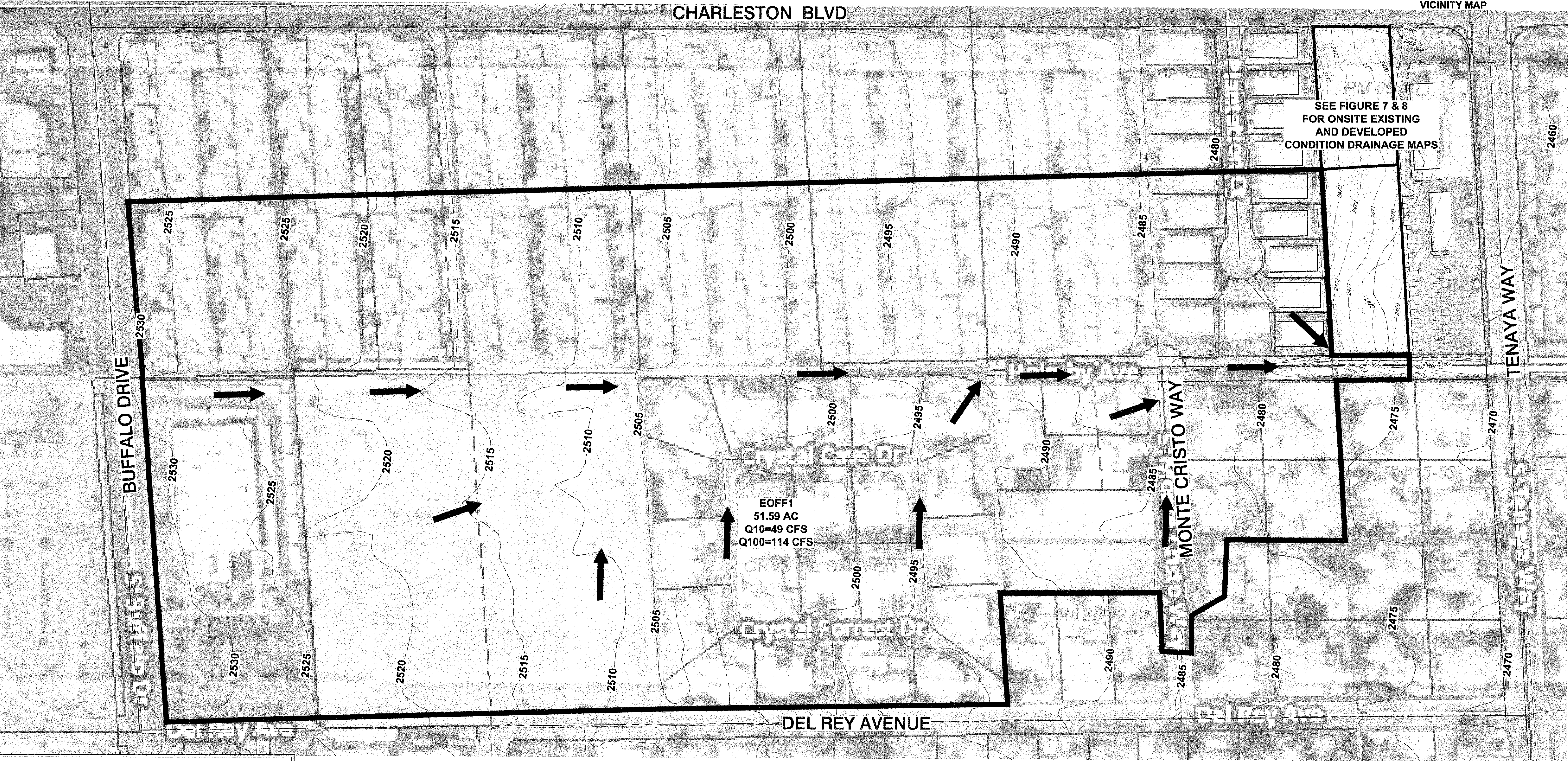
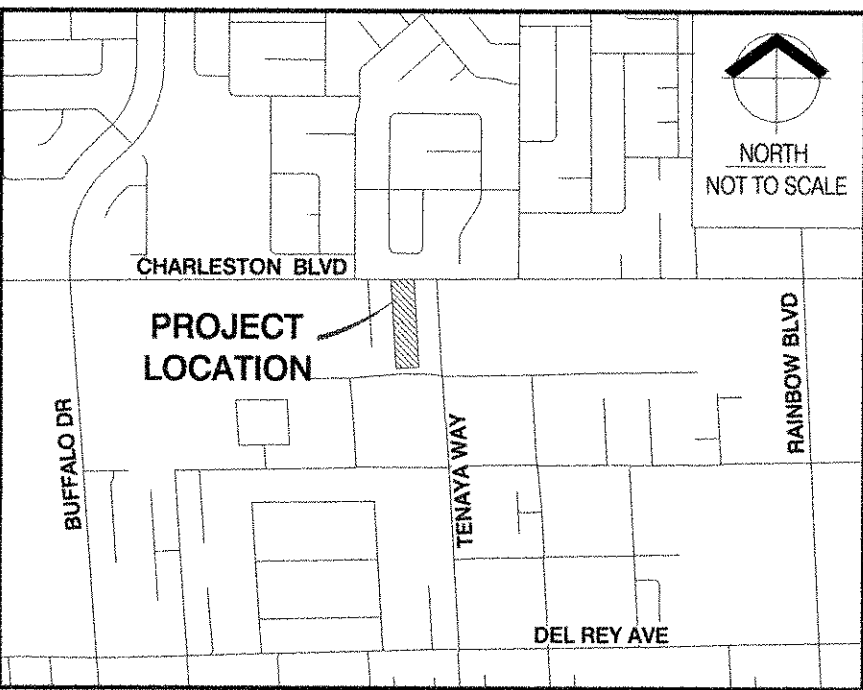
Charleston &
Tenaya Mini Storage

Existing Flow Summary

Basin ID/Concentration Point	Area (ac)	Q10 (cfs)	Q100 (cfs)
EON1	0.94	1	2
EON2	1.28	1	3
EOFF1	32.78	48	114
CP1	---	49	117

Developed Flow Summary

Basin ID/Concentration Point	Area (ac)	Q10 (cfs)	Q100 (cfs)
DON1	0.30	1	1
DON2	1.92	3	6
EOFF1	32.78	48	114
CP1	---	51	119



SEE FIGURE 7 & 8
FOR ONSITE EXISTING
AND DEVELOPED
CONDITION DRAINAGE MAPS

DISCLAIMER NOTE:
EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT VERTICAL AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

FAST
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Underground
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FREEWAY AND ARTERIAL SYSTEM
OF TRANSPORTATION

Call before you Dig
1-800-227-2600

FLOOD ZONE
THIS SITE IS LOCATED IN ZONE "X". AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C2145F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

BENCHMARK
CLARK COUNTY VERTICAL CONTROL
RIVET AND SQUARE ALUMINUM PLATE IN TOP OF CURB, NORTHEAST CORNER OF SAHARA AVENUE AND BUFFALO DRIVE NEAR THE PC OF SAHARA AVENUE
ELEVATION: 767.569 METERS = 2516.355 FEET
NAVD88

BASIS OF BEARING
S 89°20'31" W THE SOUTH LINE OF THE NORTH HALF (N 1/2) OF THE NORTHWEST QUARTER OF SECTION 3, TOWNSHIP 21 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SEEN IN FILE 85, PAGE 59 OF PARCEL MAPS RECORDED IN THE CLARK COUNTY NEVADA'S RECORDERS OFFICE.

LEGEND

BASIN AREA
Q10
Q100

BASIN BOUNDARY LINE

SUB-BASIN LABEL

FLOW CROSS SECTION LOCATION

FLOW DIRECTION ARROW

CONCENTRATION POINT LABEL

CP
Q10
Q100

SITE DATA
APN No. 183-03-101-014
ACREAGE: 2.22
ZONING: P-R

DATUM
THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS OTHERWISE NOTED.
ADD 2400.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

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FX: 702.891.5397

OFFSITE DRAINAGE MAP

TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

FIG. 6
SHEET 6 OF 9 SHEETS

DATE: 12/26/2017
DRAFTER: JG
CHECKED: ER
SCALE: 1" = 100'

P:\Charleston and Tenaya Mini Storage\DRAINAGE\CHARLESTON&TENAYA MAP.dwg - 12/26/2017 3:44 PM

FLOOD ZONE

THIS SITE IS LOCATED IN ZONE "X". AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C2145F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

BENCHMARK

CLARK COUNTY VERTICAL CONTROL
RIVET AND SQUARE ALUMINUM PLATE IN TOP OF CURB, NORTHEAST CORNER OF SAHARA AVENUE AND BUFFALO DRIVE NEAR THE PC OF SAHARA AVENUE
ELEVATION: 767.569 METERS = 2518.355 FEET
NAVD88

BASIS OF BEARING

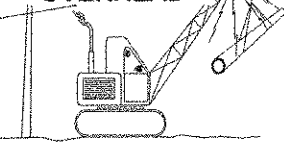
S 89°20'31" W-THE SOUTH LINE OF THE NORTH HALF (N ½) OF THE NORTHWEST QUARTER OF SECTION 3, TOWNSHIP 21 SOUTH, RANGE 90 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SEEN IN FILE 85, PAGE 50 OF PARCEL MAPS RECORDED IN THE CLARK COUNTY NEVADA'S RECORDERS OFFICE.

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AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.

CALL BEFORE YOU DO OVERHEAD



1-702-227-2929

Call before you Dig
Avoid cutting underground utility lines. It's costly.

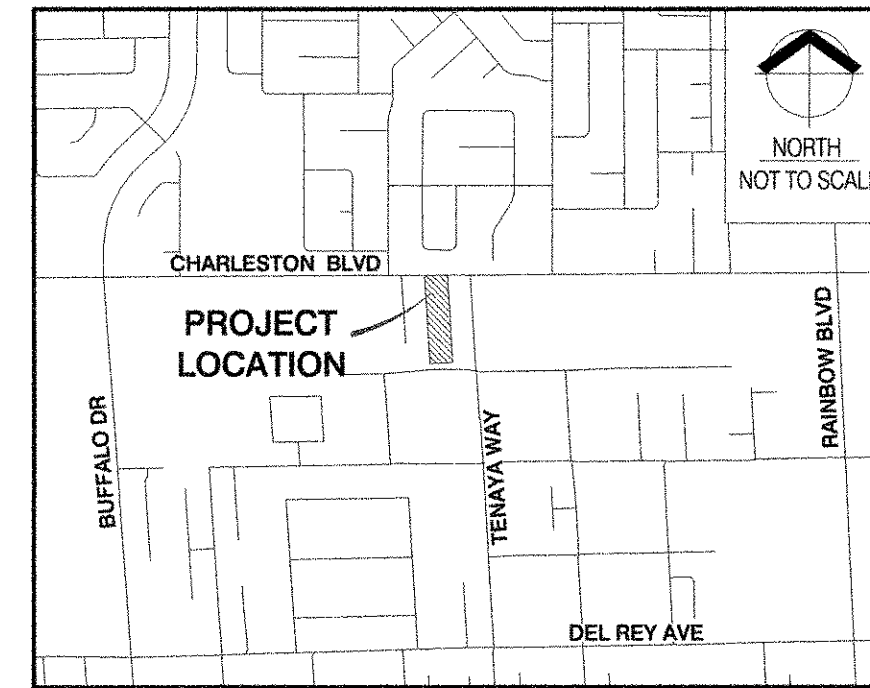
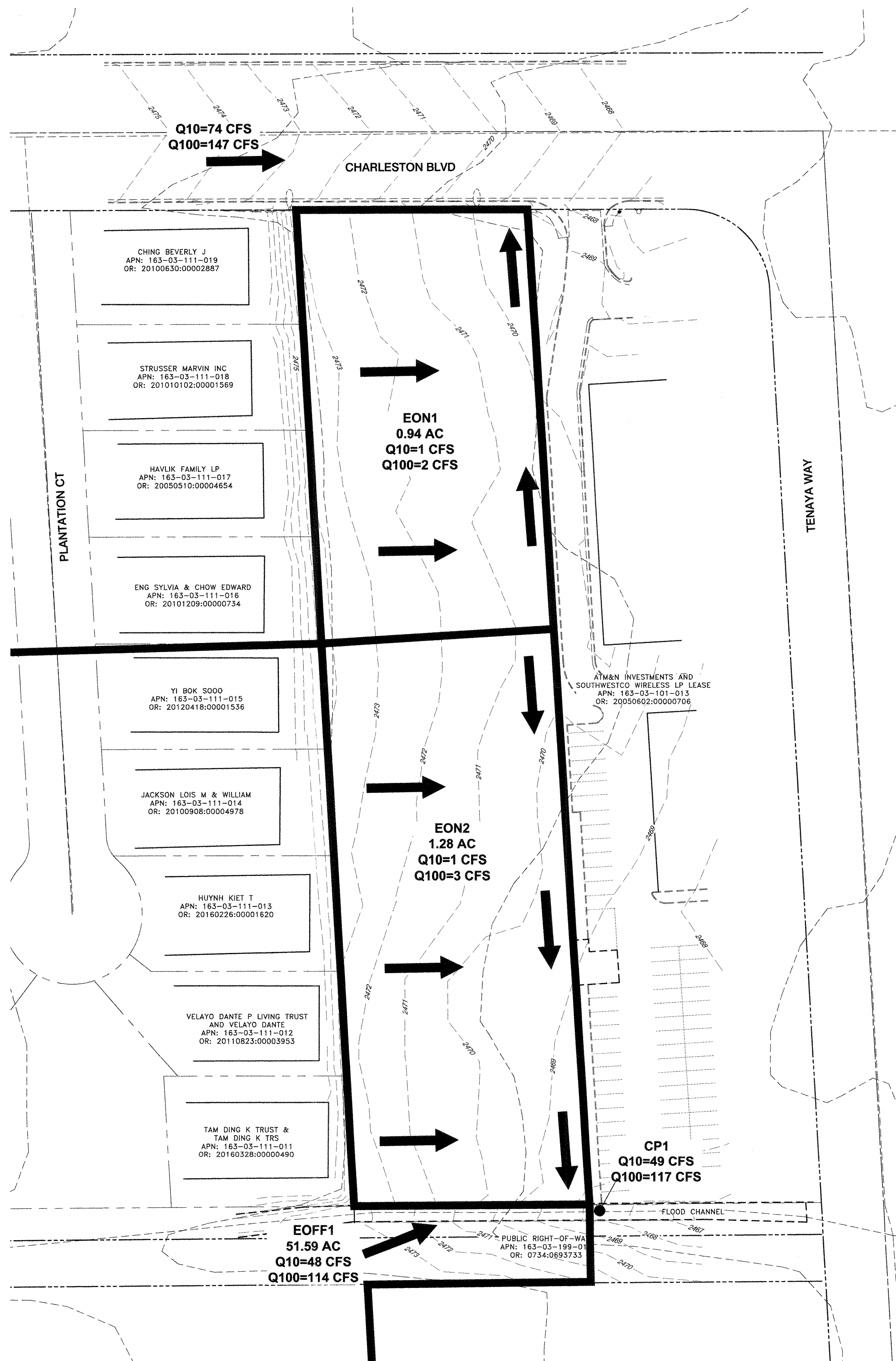


OR
1-800-227-2600

FAST

Call before you UnderGround

1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



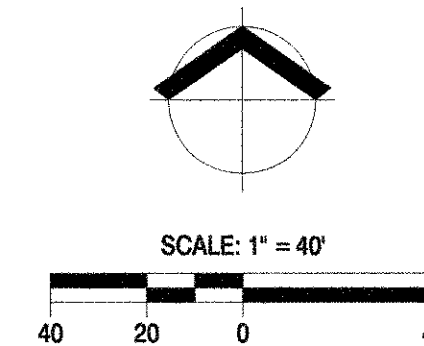
VICINITY MAP

LEGEND

- BASIN BOUNDARY LINE
- SUB-BASIN LABEL
- FLOW CROSS SECTION LOCATION
- FLOW DIRECTION ARROW
- CONCENTRATION POINT LABEL

Existing Flow Summary

Basin ID/Concentration Point	Area (ac)	Q10 (cfs)	Q100 (cfs)
EON1	0.94	1	2
EON2	1.28	1	3
EOFF1	32.78	48	114
CP1	---	49	117



SITE DATA

APN No: 163-03-101-014 ACREAGE: 2.22 ZONING: P-R

DATUM

THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS OTHERWISE NOTED.

ADD 2400.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

EXISTING DRAINAGE MAP

TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

DATE: 12/26/2017

DRAFTER: JG

CHECKED: EJ

SCALE: 1" = 40'

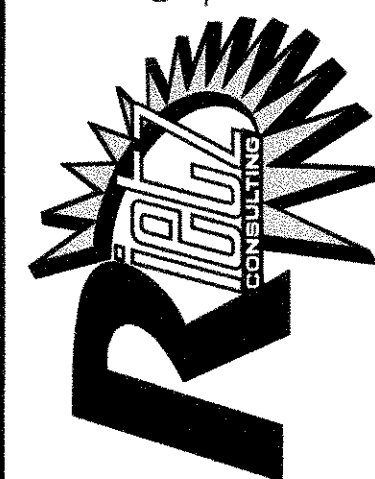
SHEET

FIG. 7

SHEET 7 OF 9 SHEETS

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LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397



P:\Charleston and Tenaya Mini Storage\DRAINAGE\CHARLESTON&TENAYA MAP.dwg - 12/28/2017 3:47 PM

FLOOD ZONE

THIS SITE IS LOCATED IN ZONE "X". AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C2145F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

BENCHMARK

CLARK COUNTY VERTICAL CONTROL
RIVET AND SQUARE ALUMINUM PLATE IN TOP OF CURB, NORTHEAST CORNER OF SAHARA AVENUE AND BUFFALO DRIVE NEAR THE PC OF SAHARA AVENUE
ELEVATION: 767.569 METERS = 2518.355 FEET
NAVD88

BASIS OF BEARING

S 89°20'31" W-THE SOUTH LINE OF THE NORTH HALF (N₁) OF THE NORTHWEST QUARTER OF SECTION 3, TOWNSHIP 21 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SEEN IN FILE 65, PAGE 50 OF PARCEL MAPS RECORDED IN THE CLARK COUNTY NEVADA'S RECORDER'S OFFICE.

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Call before you Dig
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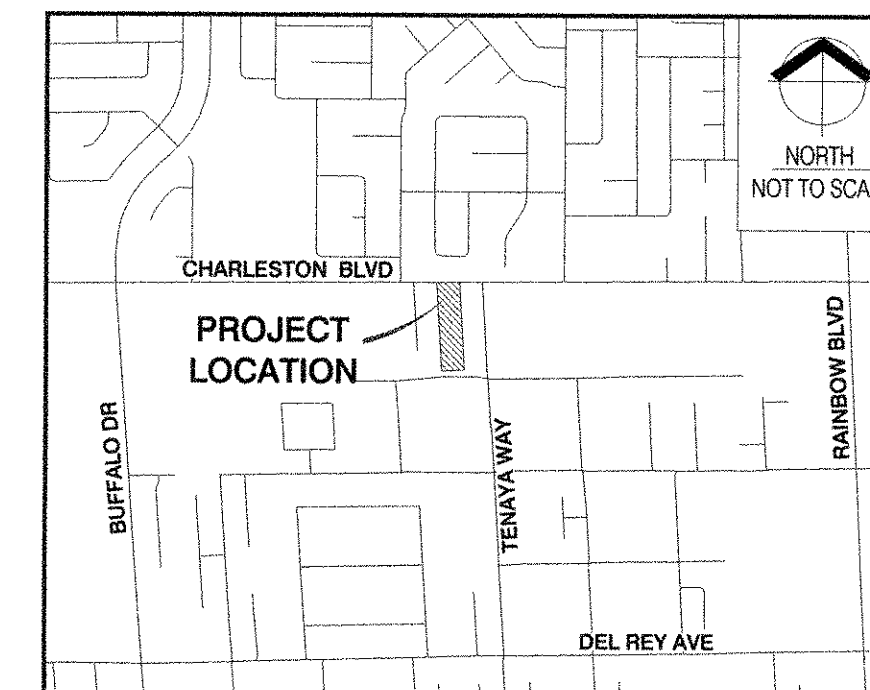
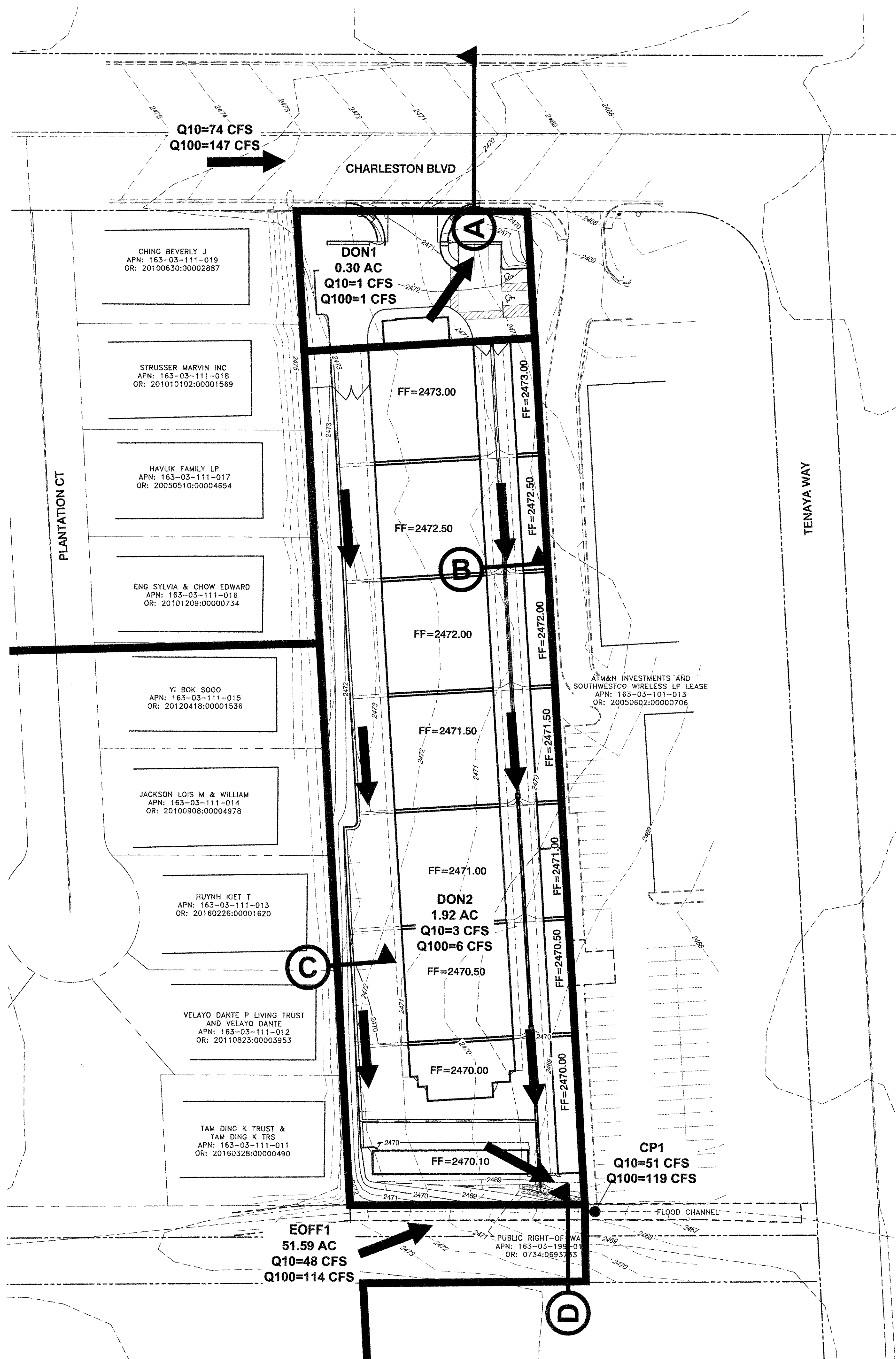


OR
1-800-227-2600



Call before you UnderGround

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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



LEGEND

- BASIN BOUNDARY LINE
- SUB-BASIN LABEL
- FLOW CROSS SECTION LOCATION
- FLOW DIRECTION ARROW
- CONCENTRATION POINT LABEL

Developed Flow Summary

Basin ID/Concentration Point	Area (ac)	Q10 (cfs)	Q100 (cfs)
DON1	0.30	1	1
DON2	1.92	3	6
EOFF1	32.78	48	114
CP1	---	51	119

Developed Hydraulic Sections

Section	Q10	Q100	D10	D100	V10	V100	D*V10	D*V100
A - Charleston Blvd	74	147	0.67	0.80	5.4	6.39	3.62	5.11
B - Onsite Section	-	1	-	0.24	-	1.32	-	0.32
C - Onsite Section	-	3	-	0.42	-	1.67	-	0.70
D - Holmby Channel EX	-	117	-	0.75	-	16.37	-	N/A
D - Holmby Channel DEV	-	119	-	0.76	-	16.48	-	N/A

SITE DATA

APN No. 163-03-101-014 ACREAGE: 2.22 ZONING: P-R

DATUM

THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS OTHERWISE NOTED.

ADD 3400.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

DEVELOPED DRAINAGE MAP

TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

DATE: 12/28/2017

JG

DRAFTER:

ELR

CHECKED:

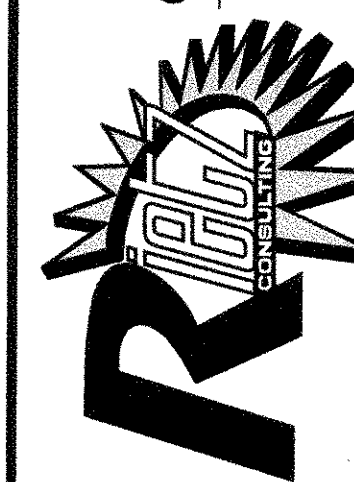
SCALE: 1" = 40'

SHEET

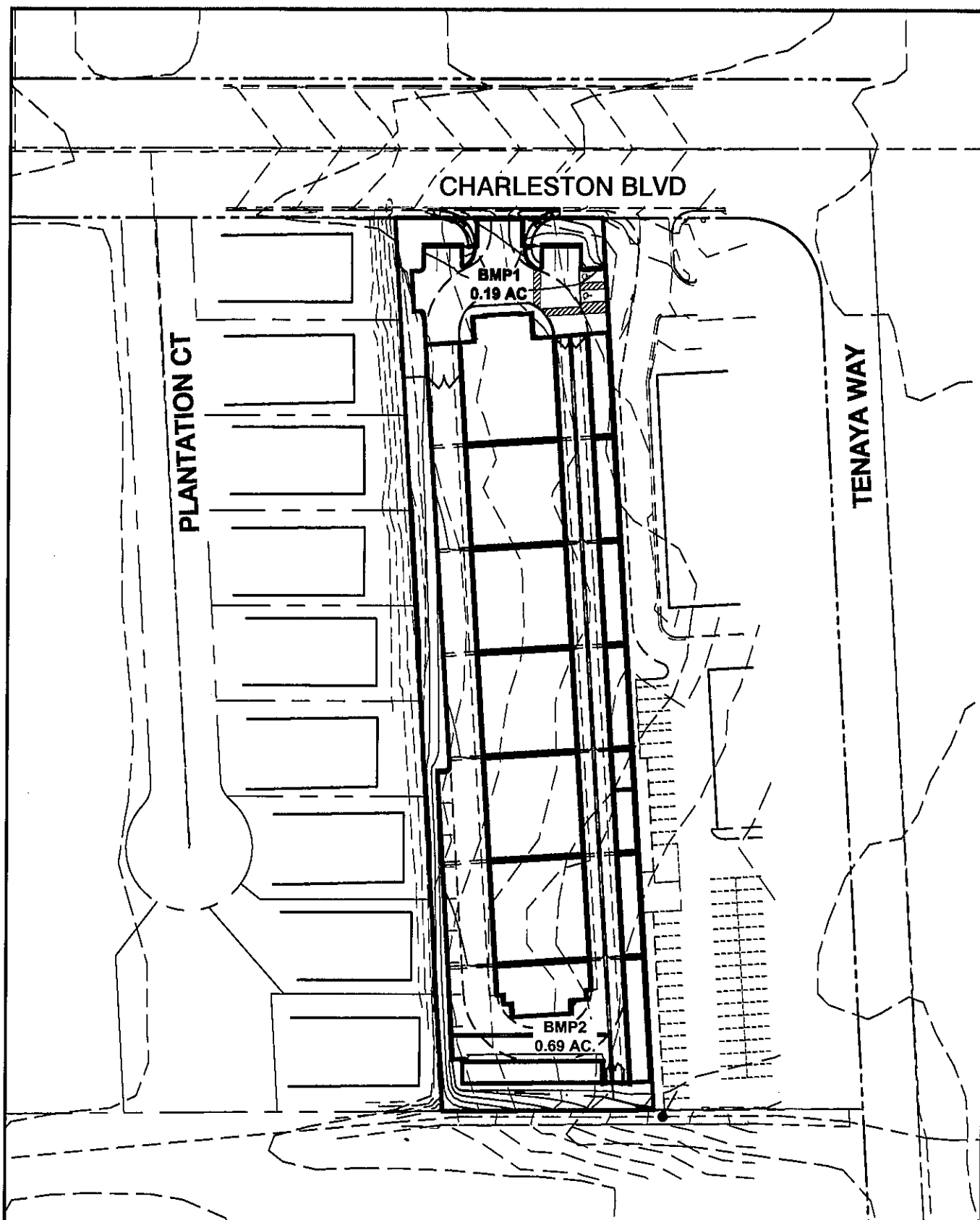
FIG. 8

SHEET 8 OF 9 SHEETS

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FX: 702.891.5397



REV: DATE DESCRIPTION:



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FX: 702.891.5397

CHARLESTON & TENAYA
MINI STORAGE

BMP MAP

DATE: 11/20/2017

DRAFTER: JG

CHECKED: JG

CHECKED: EJ

FIGURE

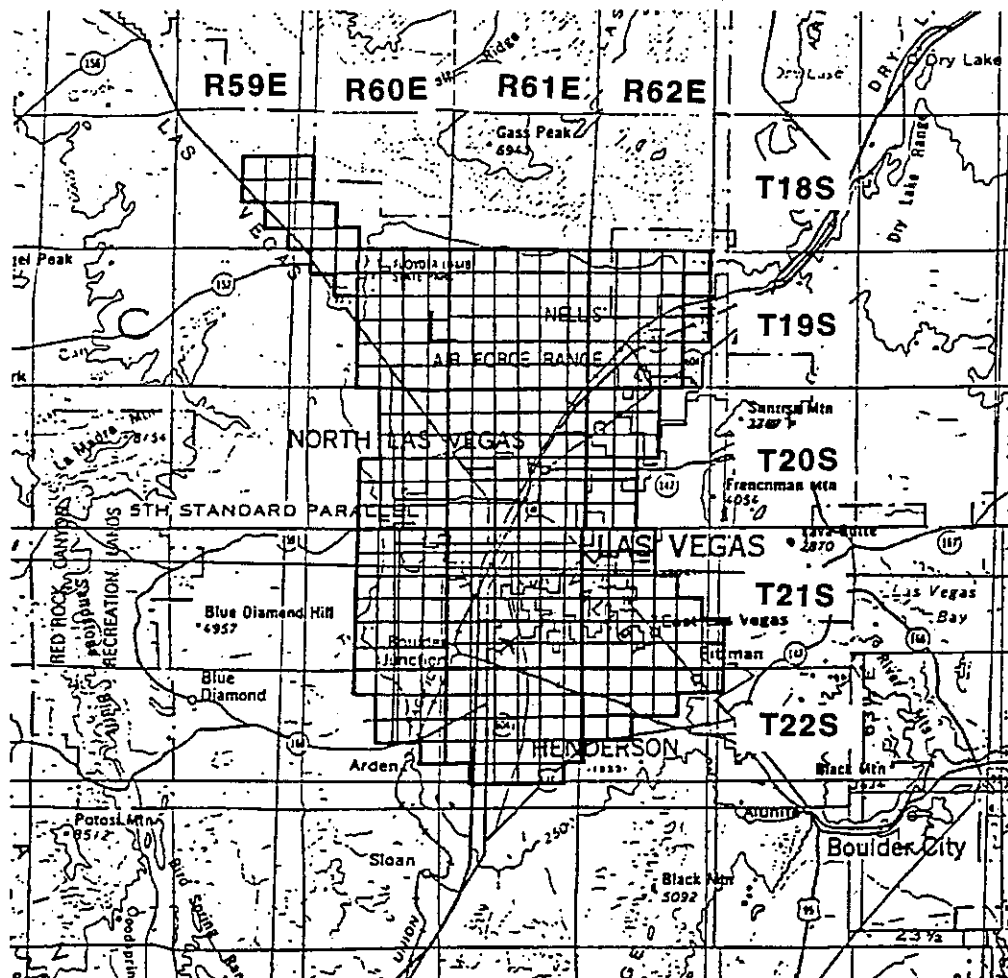
9

APPENDIX A: HYDROLOGY

HCDDM EXCERPTS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

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

TOWNSHIP RANGE SECTIONS

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

Notes:

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

Revision	Date

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

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

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

Revision	Date

**WRC
ENGINEERING**

REFERENCE:
USACE, Los Angeles District, 1988

TABLE 505

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

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

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

**WRC
ENGINEERING**

REFERENCE:
USACE, Los Angeles District, 1988

TABLE 502

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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 $I_p = 0.2S$.
- 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

**WRC
ENGINEERING**

REFERENCE:
SCS TR-55, USDA, June 1986.

**TABLE 602
1 of 4**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

Average Lot Size or Usage ¹	Percent Impervious ²	Curve Number for Hydrologic Soil Groups			
		A	B	C	D
Apartments/Condos	72	81	88	91	93
Townhouses/6,000 sq ft lots or less ³	69	80	87	90	92
7,000 sq ft lots	63	76	84	89	91
8,000 sq ft lots	58	73	82	88	90
10,000 sq ft lots	38	61	75	83	87
14,000 sq ft lots	30	57	72	81	86
20,000 sq ft lots	25	54	70	80	85
40,000 sq ft lots	20	51	68	79	84
80,000 sq ft lots	12	46	65	77	82

1 Lot size should represent the size of the average lot and not the gross acreage divided by the number of lots.

2 Actual percent impervious value should be compared to selected land use type.

3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Revision	Date

REFERENCE:

TABLE 602A

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS (SEMIARID RANGELANDS¹)

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

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

²Poor: <30% ground cover (litter, grass, and brush overstory).

Fair: 30 to 70% ground cover.

Good: >70% ground cover.

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

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

SCS TR-55, USDA, June 1986.

**TABLE 602
4 of 4**

RAINFALL-SOILS-STANDARD

FORM 4

Rainfall and Precipitation Computations

Project Name: CHARLESTON & TENAYA MINI STORAGE

By: jg



3060 E. Post Rd. Suite 110
Las Vegas NV 89120 Ph. 702-521-3355

DATA:

Project is located in: Township: 21S Range: 60E

Site is located in McCarren Airport Rainfall Area

Figure 513*

Six Hour Depth Reduction Factors (DARF):

Table 502*

Area (gross acres): 2.22 = 0.003 square miles
DARF = 1.00

Calculations:

$P_{10} =$ 1.58 10-Year Precipitation (in)

$P_{100} =$ 2.77 100-Year Precipitation (in)

$P_{10}/P_{100} =$ 0.57 HEC-1 Multiple Ratio Value

Equations:

$P = (\text{Rainfall}) * (\text{Precipitation Adjustment Ratio}) * (\text{Depth Area Reduction Factor})$

* Clark County Regional Flood Control District - Hydrologic Criteria and Drainage Design Manual

Soil & Curve Number Computations

Project Name: CHARLESTON & TENAYA MINI STORAGE

Date: Nov-17

By: JG



3060 E. Post Rd. Suite 110
Las Vegas NV 89120 Ph. 702-521-3355

DATA:

Hydrologic Soils Group	Commercial CN	DESERT SHRUB	RESIDENTIAL 20,000 SF LOTS	RESIDENTIAL CONDOMINIUMS
D	95	88	85	93

Subbasin	AREA	LANDUSE	Cn
EON1	0.94	COM.	88.0
EON2	1.28	COM.	88.0
DON1	0.30	ROW	95.0
DON2	1.92	COM.	95.0

EOFF1	51.59	MIXED	88.8
-------	-------	-------	------

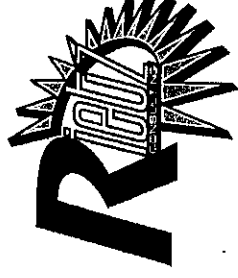
4.66 COM
28.12 RES
18.8 CONDO

TIME OF CONCENTRATION AND HEC-1 INPUT

Project Name: CHARLESTON & TENAYA MINI STORAGE

Date: Nov-17

By: JG



3060 E. Post Rd. Suite 110
Las Vegas NV 89120 Ph. 702-521-3355

SUB-BASIN DATA				INITIAL/OVERLAND TIME (T _i)			TRAVEL TIME (T _t)					T _c	T _c CHECK (URBANIZED BASINS)				
KK				BA										UD		LS	
Desig.	DEV./EX. (D or E)	K	AREA ac	AREA MI ²	INITIAL LENGTH FT	SLOPE %	T _i MIN.	TRAVEL LENGTH FT	SLOPE %	V ₁ VEL. FT/S	V ₂ VEL. FT/S	T _t MIN.	T _c Calc.	TOTAL LENGTH FT	T _c Check	TLAG3	CN
		[1]*		[2]*			[3]*			[4]*	[5]*	[6]*		[8]*	[13]*	[15]*	[16]*
EON1	E	0.772	0.94	0.00147	125	2.5	4.87	250	0.5	1.43	2.16	2.92	7.79	375	N/A	0.078	88.0
EON2	E	0.772	1.28	0.00200	125	2.5	4.87	350	0.5	1.05	2.08	5.57	10.44	475	N/A	0.104	88.0
DON1	D	0.864	0.30	0.00047	30	2.0	1.85	50	1.0	2.02	3.06	0.41	2.26	80	10.44	0.050	95.0
DON2	D	0.864	1.92	0.00300	30	2.0	1.85	500	0.40	1.28	1.94	6.52	8.37	530	12.94	0.084	95.0
EOFF1	D	0.782	51.59	0.08061	100	2.0	4.54	2400	2.37	3.11	4.71	9.40	13.94	2500	23.89	0.139	88.8

* Clark County Regional Flood Control District - Hydrologic Criteria and Drainage Design Manual

EXISTING HEC1 ANALYSIS

CTM-E.txt

ID
ID TECHNICAL DRAINAGE STUDY FOR CHARLESTON & TENAYA MINI STORAGE
ID LAS VEGAS, NEVADA
ID
ID PREPARED BY:
ID Rietz Consulting, Inc.
ID 3060 East Post Road, Suite 110
ID LAS VEGAS, NV 89120
ID
ID FILENAME:CTM-E.TXT
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IT 5 0 0 300
IO 5
IN 5
JR PREC 0.57 1.00
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KM ONSITE BASIN EON1
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PB 2.77
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.409
PC .499 .590 .710 .744 .781 .812 .819 .835 .851
.856
PC .860 .868 .876 .888 .910 .926 .937 .950 .970
.976
PC .982 .985 .987 .989 .990 .993 .993 .994 .995
.998
PC .998 .999 1.00
LS 0 88
UD 0.078
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KK EOFF1
KM OFFSITE BASIN CONTRIBUTING FLOW TO HOLMBY CHANNEL ON SOUTH SIDE OF SITE
BA.08061
LS 0 88.8
UD 0.144
*
KK EON2
KM ONSITE BASIN EON2
BA.00200
LS 0 88
UD 0.104
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KK CP1
KM COMBINE EOFF1 AND EON2
HC 2
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1*****
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* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 26DEC17 TIME 15:05:50 *
* *****

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

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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

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1 ID
2 ID
3 ID
4 ID
5 ID
6 ID
7 ID
8 ID
9 ID
10 ID
11 ID
12 ID
TECHNICAL DRAINAGE STUDY FOR CHARLESTON & TENAYA MINI STORAGE
LAS VEGAS, NEVADA
PREPARED BY:
Rietz Consulting, Inc.
3060 East Post Road, Suite 110
LAS VEGAS, NV 89120
FILENAME:CTM-E.TXT

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 1.00

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	RATIO 2
HYDROGRAPH AT +	EON1	.00	1	.57	1.00
			FLOW TIME	1.	2.
				3.50	3.50
HYDROGRAPH AT +	EOFF1	.08	1	.57	1.00
			FLOW TIME	48.	114.
				3.58	3.58
HYDROGRAPH AT +	EON2	.00	1	.57	1.00
			FLOW TIME	1.	3.
				3.58	3.50
2 COMBINED AT +	CP1	.08	1	.57	1.00
			FLOW TIME	49.	117.
				3.58	3.58

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

DEVELOPED HEC1 ANALYSIS

CTM-D.txt

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ID TECHNICAL DRAINAGE STUDY FOR CHARLESTON & TENAYA MINI STORAGE
ID LAS VEGAS, NEVADA
ID
ID PREPARED BY:
ID Rietz Consulting, Inc.
ID 3060 East Post Road, Suite 110
ID LAS VEGAS, NV 89120
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ID FILENAME:CTM-D.TXT
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IT 5 0 0 300
IO 5
IN 5
JR PREC 0.57 1.00
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KK DON1
KM ONSITE BASIN EON1
BA.00047
PB 2.77
PC .000 .020 .057 .070 .087 .108 .124 .130 .130
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PC .130 .130 .130 .133 .140 .142 .148 .158 .172
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PC .190 .197 .199 .200 .201 .204 .214 .229 .241
.249
PC .251 .256 .270 .278 .281 .283 .295 .322 .352
.409
PC .499 .590 .710 .744 .781 .812 .819 .835 .851
.856
PC .860 .868 .876 .888 .910 .926 .937 .950 .970
.976
PC .982 .985 .987 .989 .990 .993 .993 .994 .995
.998
PC .998 .999 1.00
LS 0 95
UD 0.050
*
KK EOFF1
KM OFFSITE BASIN CONTRIBUTING FLOW TO HOLMBY CHANNEL ON SOUTH SIDE OF SITE
BA.08061
LS 0 88.8
UD 0.144
*
KK DON2
KM ONSITE BASIN EON2
BA.00300
LS 0 95
UD 0.084
*
KK CP1
KM COMBINE EOFF1 AND DON2
HC 2
*
ZZ

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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 26DEC17 TIME 15:06:04
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*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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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

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

TECHNICAL DRAINAGE STUDY FOR CHARLESTON & TENAYA MINI STORAGE
LAS VEGAS, NEVADA

PREPARED BY:
Rietz Consulting, Inc.
3060 East Post Road, Suite 110
LAS VEGAS, NV 89120

FILENAME:CTM-D.TXT

```


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 1.00

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	RATIO 2
HYDROGRAPH AT	DON1	.00	1	1.	1.
				3.50	3.50
HYDROGRAPH AT	EOFF1	.08	1	48.	114.
				3.58	3.58
HYDROGRAPH AT	DON2	.00	1	3.	6.
				3.50	3.50
2 COMBINED AT	CP1	.08	1	51.	119.
				3.58	3.58

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

APPENDIX B: HYDRAULICS

FLOWMASTER SECTIONS

Worksheet for A CHARLESTON 10-YEAR

Results

Flow Area	13.70	ft ²
Wetted Perimeter	60.11	ft
Hydraulic Radius	0.23	ft
Top Width	59.05	ft
Normal Depth	0.67	ft
Critical Depth	0.81	ft
Critical Slope	0.00567	ft/ft
Velocity	5.40	ft/s
Velocity Head	0.45	ft
Specific Energy	1.12	ft
Froude Number	1.98	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.67	ft
Critical Depth	0.81	ft
Channel Slope	0.02430	ft/ft
Critical Slope	0.00567	ft/ft

Cross Section for A CHARLESTON 10-YEAR

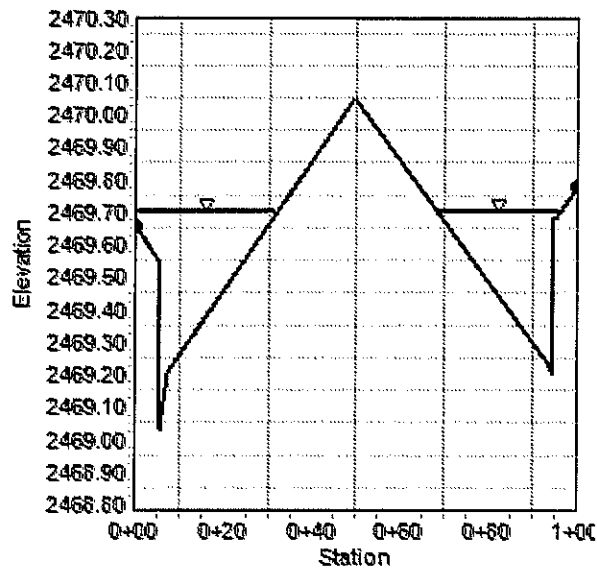
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope	0.02430	ft/ft
Normal Depth	0.67	ft
Discharge	74.00	ft ³ /s

Cross Section Image



Worksheet for A CHARLESTON 100-YEAR

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02430 ft/ft
Discharge 147.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2469.66
0+04.99	2469.55
0+05.58	2469.55
0+05.58	2469.03
0+07.12	2469.21
0+49.48	2470.05
0+93.08	2469.24
0+94.40	2469.20
0+94.40	2469.68
0+94.95	2469.68
1+00.00	2469.78

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2469.66)	(1+00.00, 2469.78)	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 0.80 ft
Elevation Range 2469.03 to 2470.05 ft

Worksheet for A CHARLESTON 100-YEAR

Results

Flow Area	23.02	ft ²
Wetted Perimeter	78.56	ft
Hydraulic Radius	0.29	ft
Top Width	77.31	ft
Normal Depth	0.80	ft
Critical Depth	1.00	ft
Critical Slope	0.00513	ft/ft
Velocity	6.39	ft/s
Velocity Head	0.63	ft
Specific Energy	1.44	ft
Froude Number	2.06	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.80	ft
Critical Depth	1.00	ft
Channel Slope	0.02430	ft/ft
Critical Slope	0.00513	ft/ft

Cross Section for A CHARLESTON 100-YEAR

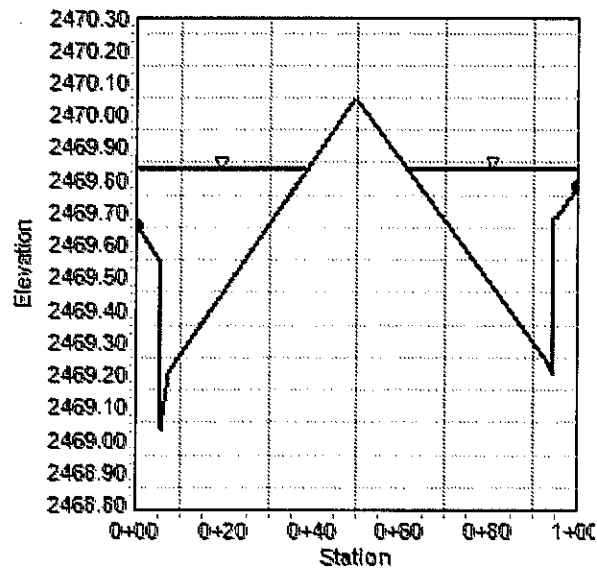
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02430	ft/ft
Normal Depth	0.80	ft
Discharge	147.00	ft ³ /s

Cross Section Image



Worksheet for B ONSITE SECTION

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00400 ft/ft
Discharge 1.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2472.50
0+05.00	2472.40
0+11.00	2472.06
0+12.00	2471.96
0+13.00	2472.06
0+19.00	2472.40
0+24.00	2472.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2472.50)	(0+24.00, 2472.50)	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	0.24 ft
Elevation Range	2471.96 to 2472.50 ft
Flow Area	0.76 ft ²
Wetted Perimeter	7.12 ft
Hydraulic Radius	0.11 ft
Top Width	7.10 ft

Worksheet for B ONSITE SECTION

Results

Normal Depth	0.24	ft
Critical Depth	0.22	ft
Critical Slope	0.00824	ft/ft
Velocity	1.32	ft/s
Velocity Head	0.03	ft
Specific Energy	0.27	ft
Froude Number	0.71	
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	0.24	ft
Critical Depth	0.22	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00824	ft/ft

Cross Section for B ONSITE SECTION

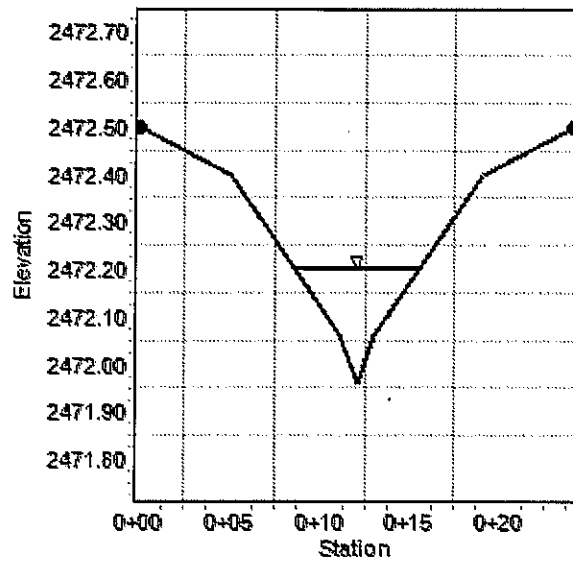
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	.000400	ft/ft
Normal Depth	0.24	ft
Discharge	1.00	ft ³ /s

Cross Section Image



Worksheet for C ONSITE SECTION

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00400 ft/ft
Discharge 3.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2470.03
0+00.50	2470.03
0+00.50	2469.53
0+02.00	2469.69
0+29.33	2470.40
0+34.33	2470.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2470.03)	(0+34.33, 2470.50)	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	0.42 ft
Elevation Range	2469.53 to 2470.50 ft
Flow Area	1.80 ft ²
Wetted Perimeter	11.90 ft
Hydraulic Radius	0.15 ft
Top Width	11.47 ft
Normal Depth	0.42 ft

Worksheet for C ONSITE SECTION

Results

Critical Depth	0.38	ft
Critical Slope	0.00756	ft/ft
Velocity	1.67	ft/s
Velocity Head	0.04	ft
Specific Energy	0.46	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	0.42	ft
Critical Depth	0.38	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00756	ft/ft

Cross Section for C ONSITE SECTION

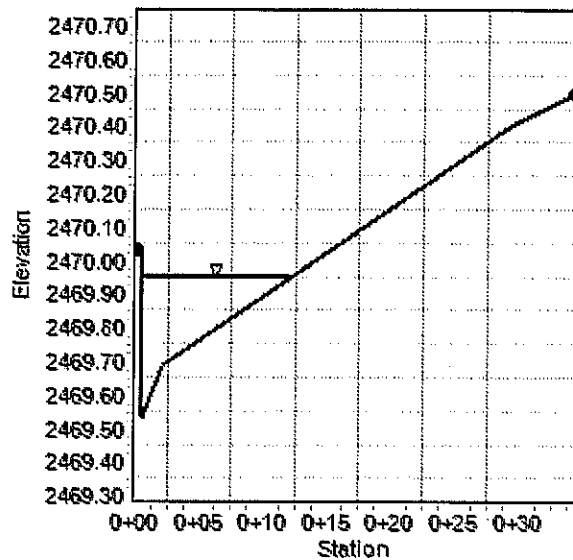
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.42	ft
Discharge	3.00	ft ³ /s

Cross Section Image



Worksheet for D HOLMBY CHANNEL EX

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03650 ft/ft
Discharge 117.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2472.00
0+38.92	2468.26
0+39.63	2468.26
0+39.63	2465.97
0+49.13	2465.97
0+49.13	2468.26

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2472.00)	(0+39.63, 2468.26)	0.030
(0+39.63, 2468.26)	(0+49.13, 2468.26)	0.013

Options

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

Results

Normal Depth	0.75 ft
Elevation Range	2465.97 to 2472.00 ft
Flow Area	7.15 ft ²
Wetted Perimeter	11.00 ft
Hydraulic Radius	0.65 ft
Top Width	9.50 ft

Worksheet for D HOLMBY CHANNEL EX

Results

Normal Depth	0.75	ft
Critical Depth	1.68	ft
Critical Slope	0.00310	ft/ft
Velocity	16.37	ft/s
Velocity Head	4.17	ft
Specific Energy	4.92	ft
Froude Number	3.33	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.75	ft
Critical Depth	1.68	ft
Channel Slope	0.03650	ft/ft
Critical Slope	0.00310	ft/ft

Cross Section for D HOLMBY CHANNEL EX

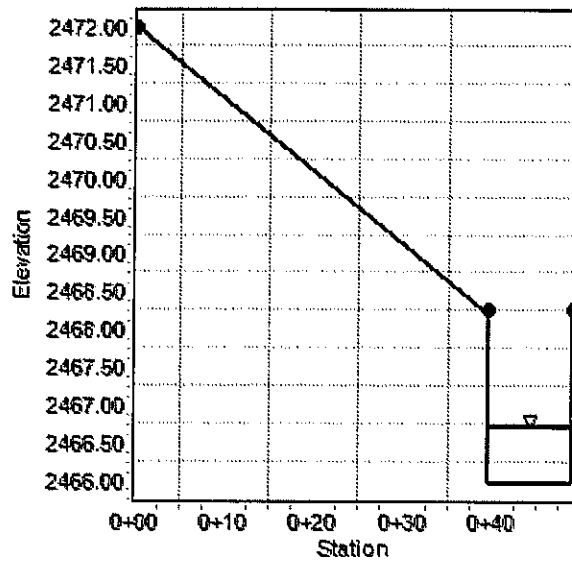
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03650	ft/ft
Normal Depth	0.75	ft
Discharge	117.00	ft ³ /s

Cross Section Image



Worksheet for D HOLMBY CHANNEL DEV

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.03650 ft/ft
Discharge 119.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2472.00
0+38.92	2468.26
0+39.63	2468.26
0+39.63	2465.97
0+49.13	2465.97
0+49.13	2468.26

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2472.00)	(0+39.63, 2468.26)	0.030
(0+39.63, 2468.26)	(0+49.13, 2468.26)	0.013

Options

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

Results

Normal Depth	0.76 ft
Elevation Range	2465.97 to 2472.00 ft
Flow Area	7.22 ft ²
Wetted Perimeter	11.02 ft
Hydraulic Radius	0.66 ft
Top Width	9.50 ft

Worksheet for D HOLMBY CHANNEL DEV

Results

Normal Depth	0.76	ft
Critical Depth	1.70	ft
Critical Slope	0.00310	ft/ft
Velocity	16.48	ft/s
Velocity Head	4.22	ft
Specific Energy	4.98	ft
Froude Number	3.33	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.76	ft
Critical Depth	1.70	ft
Channel Slope	0.03650	ft/ft
Critical Slope	0.00310	ft/ft

Cross Section for D HOLMBY CHANNEL DEV

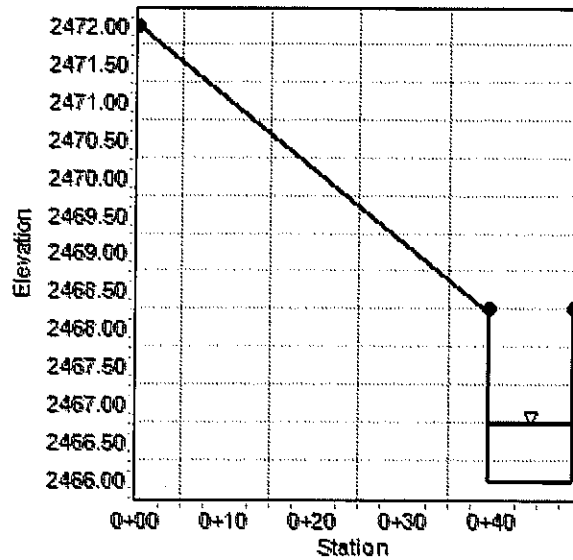
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.03650	ft/ft
Normal Depth	0.76	ft
Discharge	119.00	ft ³ /s

Cross Section Image



Worksheet for Rectangular Weir - 1

Project Description

Solve For Headwater Elevation

Input Data

Discharge	6.00	ft ³ /s
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Weir Coefficient	3.33	US
Crest Length	4.00	ft
Number Of Contractions	2	

Results

Headwater Elevation	0.60	ft
Headwater Height Above Crest	0.60	ft
Tailwater Height Above Crest	0.00	ft
Flow Area	2.40	ft ²
Velocity	2.50	ft/s
Wetted Perimeter	5.20	ft
Top Width	4.00	ft

Cross Section for Rectangular Weir - 1

Project Description

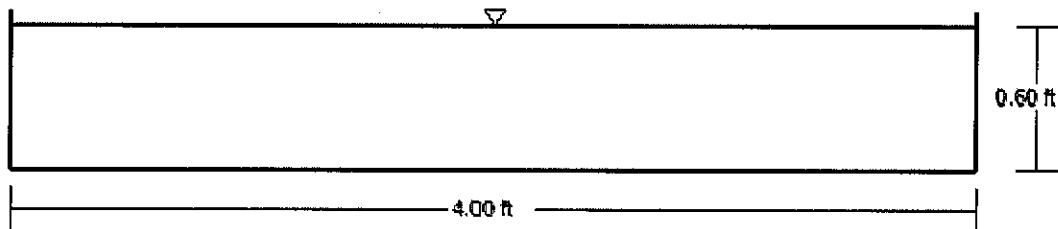
Solve For

Headwater Elevation

Input Data

Discharge	6.00	ft ³ /s
Headwater Elevation	0.60	ft
Crest Elevation	0.00	ft
Tailwater Elevation	0.00	ft
Weir Coefficient	3.33	US
Crest Length	4.00	ft
Number Of Contractions	2	

Cross Section Image



V: 1
H: 1

ONSITE STORM DRAIN DESIGN

Hydraulic Analysis Report

Project Data

Project Title:

Designer:

Project Date: Tuesday, December 26, 2017

Project Units: U.S. Customary Units

Notes:

Curb and Gutter Analysis: Curb and Gutter Analysis

Notes:

Gutter Input Parameters

Longitudinal Slope of Road: 0.0040 ft/ft

Cross-Slope of Pavement: 0.0500 ft/ft

Uniform Gutter Geometry

Manning's n: 0.0160

Gutter Width: 2.0000 ft

Design Flow: 2.0000 cfs

Gutter Result Parameters

Width of Spread: 6.2606 ft

Gutter Depression: 0.0000 in

Area of Flow: 0.9799 ft²

E_o (Gutter Flow to Total Flow): 0.6421

Gutter Depth at Curb: 3.7564 in

Inlet Input Parameters

Inlet Location: Inlet on Grade

Inlet Type: Grate

Grate Type: P - 1-7/8

Grate Width: 2.0000 ft

Grate Length: 1.0000 ft

Local Depression: 0.0000 in

Inlet Result Parameters

Intercepted Flow: 1.3447 cfs

Bypass Flow: 0.6553 cfs

Approach Velocity: 2.0410 ft/s

Splash-over Velocity: 5.6563 ft/s

Efficiency: 0.6724

Worksheet for 12" PIPE

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00540	ft/ft
Diameter	1.00	ft
Discharge	2.00	ft ³ /s

Results

Normal Depth	0.65	ft
Flow Area	0.54	ft ²
Wetted Perimeter	1.89	ft
Hydraulic Radius	0.29	ft
Top Width	0.95	ft
Critical Depth	0.60	ft
Percent Full	65.5	%
Critical Slope	0.00686	ft/ft
Velocity	3.67	ft/s
Velocity Head	0.21	ft
Specific Energy	0.86	ft
Froude Number	0.86	
Maximum Discharge	2.82	ft ³ /s
Discharge Full	2.62	ft ³ /s
Slope Full	0.00315	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	65.46	%
Downstream Velocity	Infinity	ft/s

Worksheet for 12" PIPE

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.65	ft
Critical Depth	0.60	ft
Channel Slope	0.00540	ft/ft
Critical Slope	0.00686	ft/ft

Cross Section for 12" PIPE

Project Description

Friction Method

Manning Formula

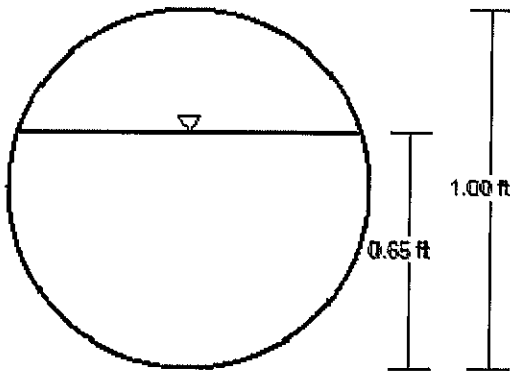
Solve For

Normal Depth

Input Data

Roughness Coefficient	0.013
Channel Slope	0.00540 ft/ft
Normal Depth	0.65 ft
Diameter	1.00 ft
Discharge	2.00 ft ³ /s

Cross Section Image



V: 1
H: 1



Worksheet for 15" pipe

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Roughness Coefficient	0.013	
Channel Slope	0.00410	ft/ft
Diameter	1.25	ft
Discharge	3.00	ft ³ /s

Results

Normal Depth	0.79	ft
Flow Area	0.82	ft ²
Wetted Perimeter	2.30	ft
Hydraulic Radius	0.36	ft
Top Width	1.21	ft
Critical Depth	0.70	ft
Percent Full	63.2	%
Critical Slope	0.00602	ft/ft
Velocity	3.67	ft/s
Velocity Head	0.21	ft
Specific Energy	1.00	ft
Froude Number	0.79	
Maximum Discharge	4.45	ft ³ /s
Discharge Full	4.14	ft ³ /s
Slope Full	0.00216	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	63.16	%
Downstream Velocity	Infinity	ft/s

Worksheet for 15" pipe

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	0.79	ft
Critical Depth	0.70	ft
Channel Slope	0.00410	ft/ft
Critical Slope	0.00602	ft/ft

Cross Section for 15" pipe

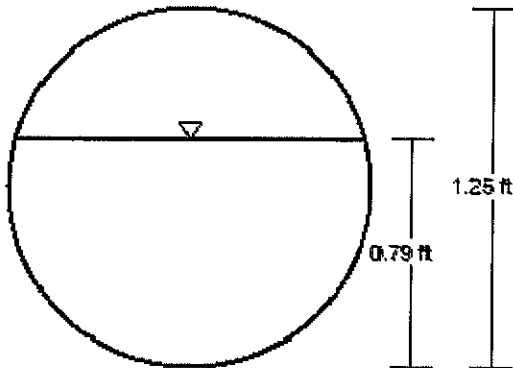
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.013
Channel Slope	0.00410 ft/ft
Normal Depth	0.79 ft
Diameter	1.25 ft
Discharge	3.00 ft ³ /s

Cross Section Image



V: 1 
H: 1

$$V = 3 * (d_{50})^{0.5} * (S_s - 1) / S^{0.17} \quad \text{HCDDM Eq. 743}$$

V =	5.75 fps	> 3.67 fps OK
d ₅₀	0.25	from 15" pipe velocity
S _s	2.5	
S	0.004 ft/ft	

3" D50 ROCK IS ACCEPTABLE

APPENDIX C: PLANS AND DETAILS

LEGEND

	PROPERTY BOUNDARY
	RIGHT-OF-WAY
	PROPERTY LINE
	CENTER LINE
	EASEMENT
	EXST 'L' TYPE CURB
	EXST 'A' TYPE CURB
	EXST MAJOR CONTOUR LINE
	EXST MINOR CONTOUR LINE
	EXST SCREEN WALL AS INDICATED
	EXST EDGE OF PAVEMENT
	EXST EDGE OF SIDEWALK
	EXST UNDERGROUND POWER
	EXST FIBER OPTICS
	EXST STORM DRAIN
	EXISTING
	PROPOSED

	FIRE HYDRANT
	STORM MANHOLE
	TELEPHONE BOX
	TELEPHONE MANHOLE
	FIBER BOX
	CABLE TV BOX
	ELECTRICAL MANHOLE
	STREET LIGHT BOX
	POWER POLE
	SERVICE POLE
	GUY WIRE
	TRANSFORMER
	STREET LIGHT CABINET
	STREET LIGHT
	TRAFFIC SIGNAL BOX
	AREA LIGHT
	'L' TYPE CURB
	'A' TYPE CURB
	EDGE OF SIDEWALK
	CHAIN LINK FENCE
	WROUGHT IRON FENCE
	SWALE FLOW LINE
	SAWCUT

NOTES

- CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING STRUCTURES AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATION AND ELEVATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.
- OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED OR OBSOURED DURING CONSTRUCTION.

FLOOD ZONE

THIS SITE IS LOCATED IN ZONE "X", AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C2145F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

BENCHMARK

CLARK COUNTY VERTICAL CONTROL
RIVET AND SQUARE ALUMINUM PLATE IN TOP OF CURB, NORTHEAST CORNER OF SAHARA AVENUE AND BUFFALO DRIVE NEAR THE PC OF SAHARA AVENUE
ELEVATION: 767.569 METERS = 2518.355 FEET
NAVD88

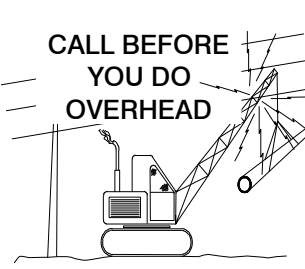
BASIS OF BEARING

S 89°20'31" W THE SOUTH LINE OF THE NORTH HALF (N 1/2) OF THE NORTHWEST QUARTER OF SECTION 9, TOWNSHIP 21 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SEEN IN FILE 86, PAGE 50 OF PARCEL MAPS RECORDED IN THE CLARK COUNTY NEVADA'S RECORDERS OFFICE.

DISCLAIMER NOTE:

EXISTING UTILITY LOCATIONS SHOWN HEREON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT LOCATION AND HORIZONTAL LOCATION OF ALL EXISTING UNDERGROUND UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.



1-702-227-2929

Call before you Dig

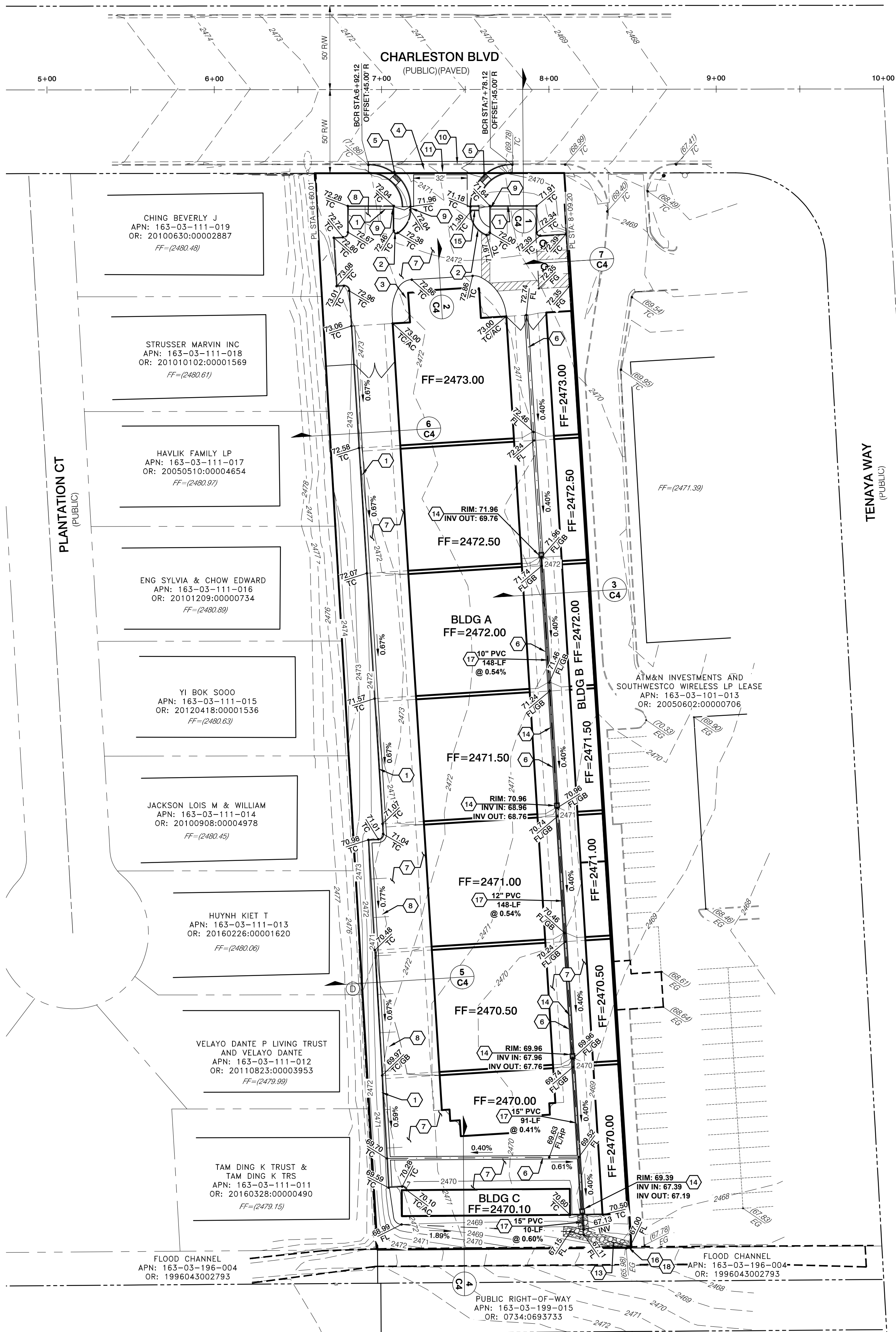
Avoid cutting underground utility lines. It's costly.



1-800-227-2600

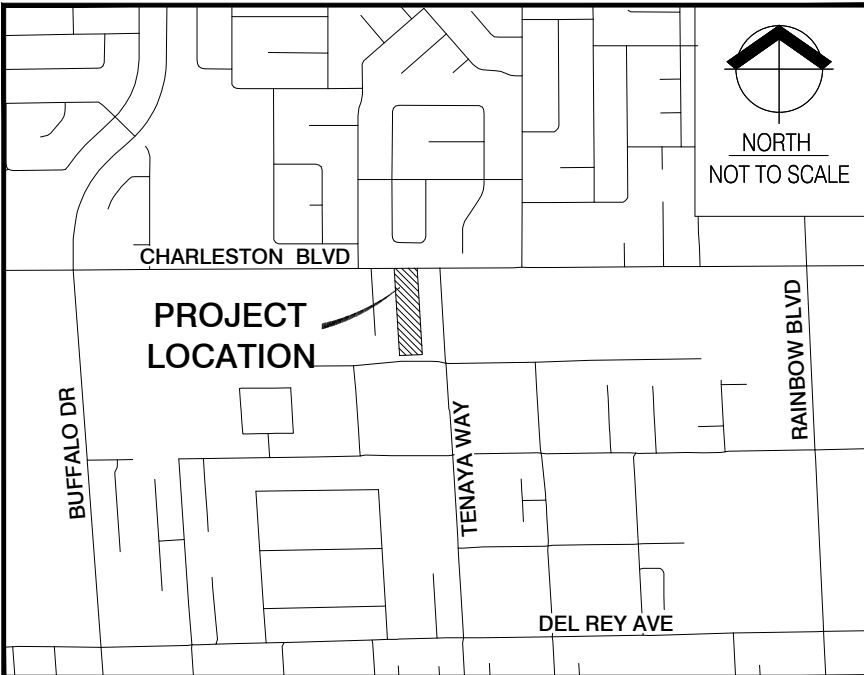


1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM
OF TRANSPORTATION



QUANTITIES

STORM SYSTEM	PRIVATE	PUBLIC
1. SIDEWALK UNDERDRAIN	EA 1	-
2. 2' VALLEY GUTTER	LF -	-
3. 2'X2' DROP INLET	EA 4	-
4. 10" PVC STORM DRAIN	LF 148	-
5. 12" PVC STORM DRAIN	LF 148	-
6. 15" PVC STORM DRAIN	LF 101	-
7. BLOCK WALL OPENING	EA 1	-
8. BMP SWALE	LF 50	-
STREET IMPROVEMENTS	PRIVATE	PUBLIC
1. COMMERCIAL DRIVEWAY	SF -	693
2. ACCESSIBLE RAMPS	EA 2	2
3. 'L' CURB AND GUTTER	LF 574	-
4. 'A' CURB	LF 213	-
5. 2" AC PAVEMENT	SY 189	-
6. 3" AC PAVEMENT	SY 3,717	-
7. SIDEWALK	SF 652	-
8. TYPE II AGGREGATE	CY 490	13



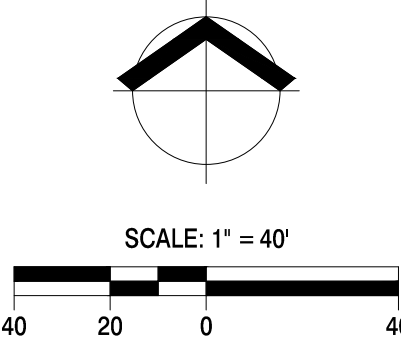
VICINITY MAP

LEGEND

EXISTING	PROPOSED
TOP BACK CURB	TOP BACK CURB
EXISTING GROUND	FINISH GRADE
EDGE OF PAVEMENT	EDGE OF PAVEMENT
FLOW LINE	FLOW LINE
ASPHALT CONCRETE	ASPHALT CONCRETE
TOP OF RET. WALL	TOP OF RET. WALL
TOP OF FOOTER	TOP OF FOOTER
	HIGH POINT
	GRADE BREAK

GRADING

- CONSTRUCT 'L' CURB AND GUTTER PER CCAUSD #216
- CONSTRUCT 'A' CURB AND GUTTER PER CCAUSD #219
- CONSTRUCT SIDEWALK PER CCAUSD #234
- CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225 & #228
- CONSTRUCT CASE I SIDEWALK RAMPS USING ARMOR TILE TRUNCATED DOMES OR EQUIV. TRUNCATED DOMES SHALL BE SOURCED FROM NDOT QUALIFIED PRODUCT LIST 'A' & 'B' = 8', UNLESS OTHERWISE NOTED
- 2' VALLEY GUTTER SEE DETAIL 'A' SHEET C4
- MAIN CORRIDOR (TRUCK ACCESS) INSTALL 3' AC OVER 4' TYPE II AGGREGATE BASE
- AUTOMOBILE ROUTE / PARKING. INSTALL 2' AC OVER 4' TYPE II AGGREGATE BASE
- 2' CURB OPENING, SEE DETAIL 'B' SHEET C4
- REMOVE EXISTING CURB AND GUTTER
- REMOVE EXISTING SIDEWALK
- 2' SIDEWALK UNDER DRAIN PER CCAUSD #236
- CONSTRUCT BMP SWALE W/ 6" THICK 3' D50 LANDSCAPE ROCK PER DETAIL C, SHEET C4
- 2'X2' DROP INLET PER DETAIL 'F', SHEET C4
- SIDEWALK UNDER DRAIN PER CCAUSD #236
- BLOCK WALL OPENING PER DETAIL 'D', SHEET C4
- PVC STORM DRAIN, SIZE PER PLAN, TRENCH PER DETAIL 'E', SHEET C4
- REMOVE EXISTING BLOCK WALL/RETAINING WALL NECESSARY TO CONSTRUCT BLOCK WALL OPENING



SITE DATA

APN No. 163-03-101-014 ACREAGE: 2.22 ZONING: P-R

DATUM

THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS OTHERWISE NOTED.

DRAINAGE CERTIFICATION

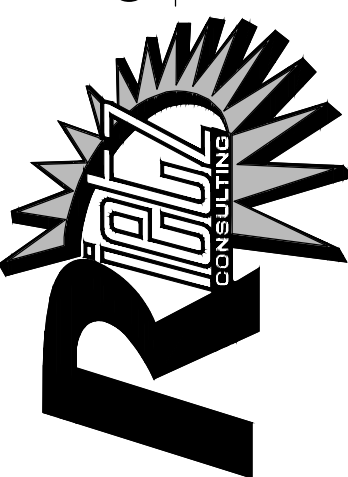
I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY CLV # XXXXXX FOR THIS SITE ON FILE AT CITY OF LAS VEGAS FOR THIS PROJECT.

ERIC J. RIETZ, P.E. No. 16350

DATE

RIETZ
CONSULTING INC.

3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397



GRADING PLAN

TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

1/2/2018

JG

EJR

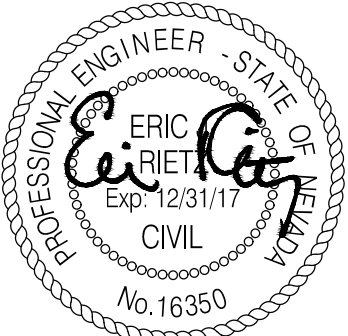
1"=40'

DATE:

DRAFTER:

CHECKED:

SCALE:



1/2/2018

SHEET

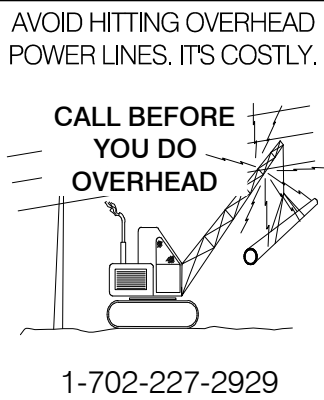
C3

SHEET 3 OF 6 SHEETS

###

P:\Charleston and Tanaya Mini Storage\CD\DWG\DETAILS.dwg - 1/2/2018 7:59 AM

DISCLAIMER NOTE:
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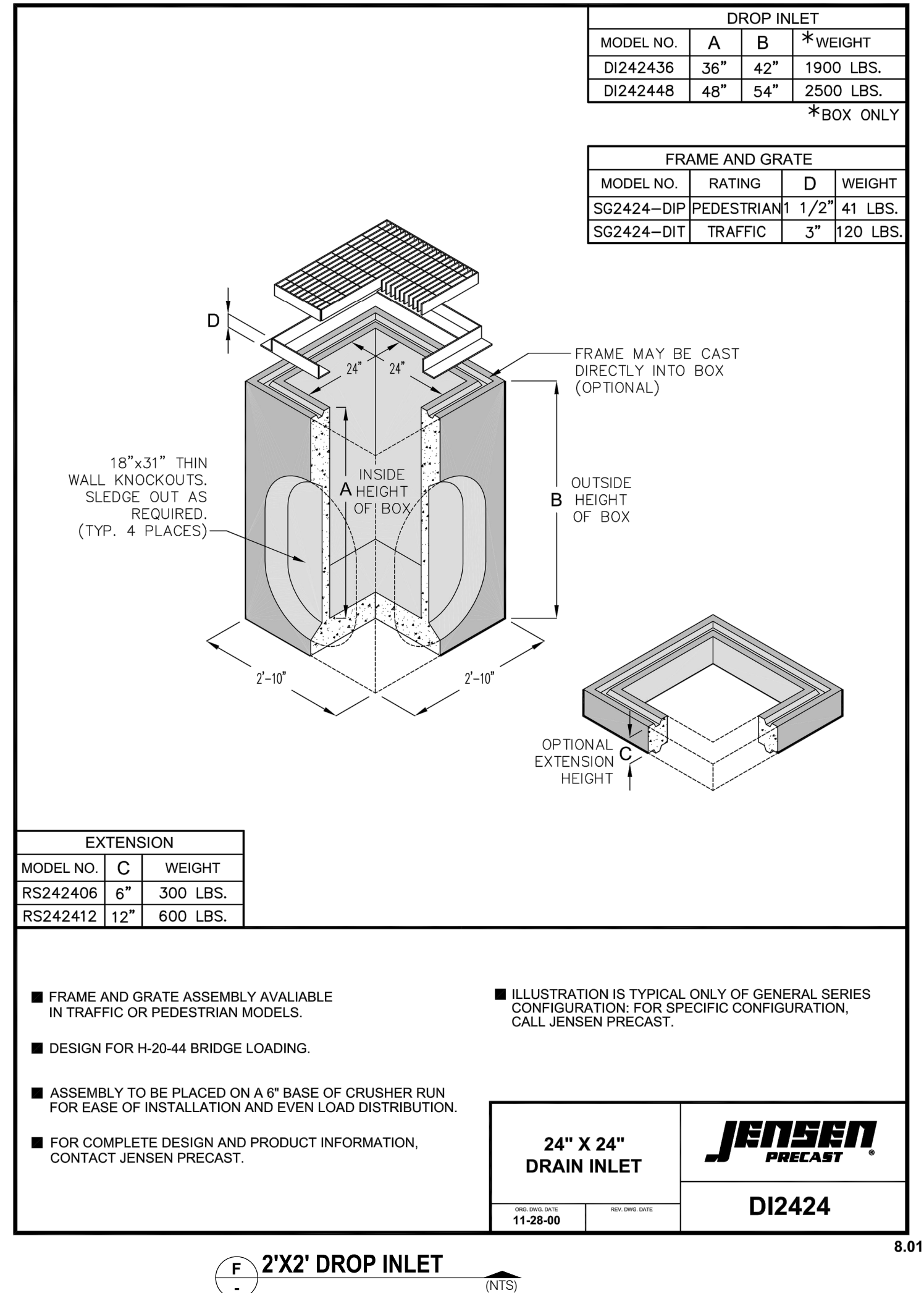
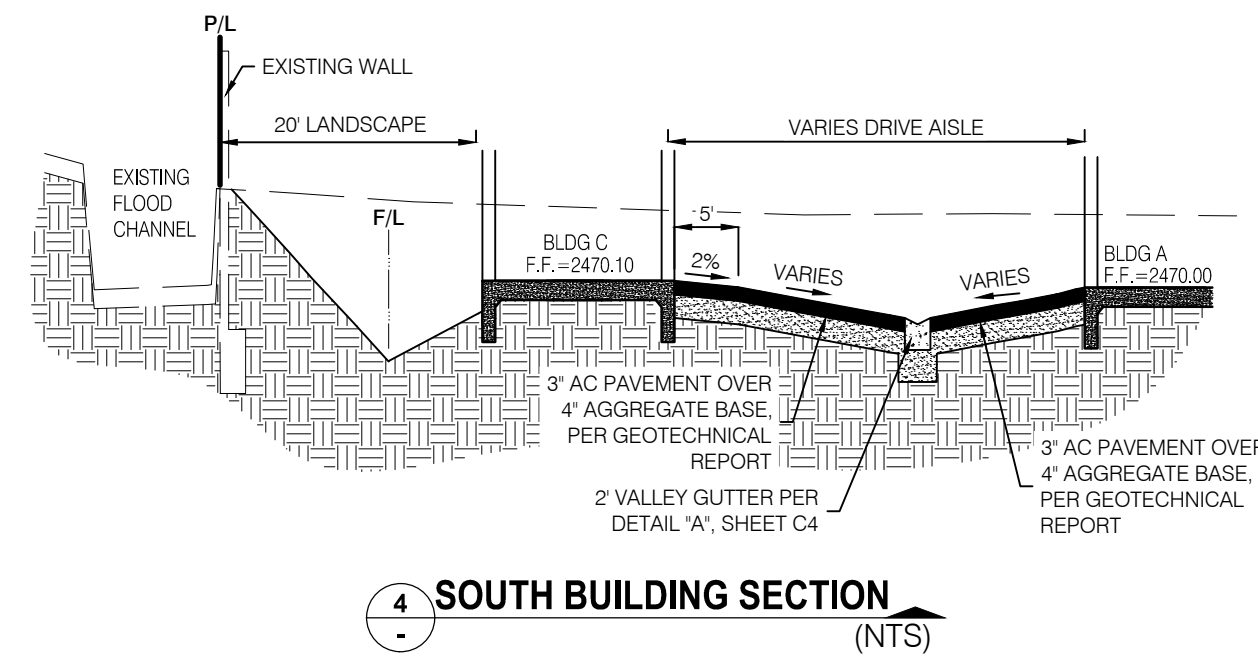
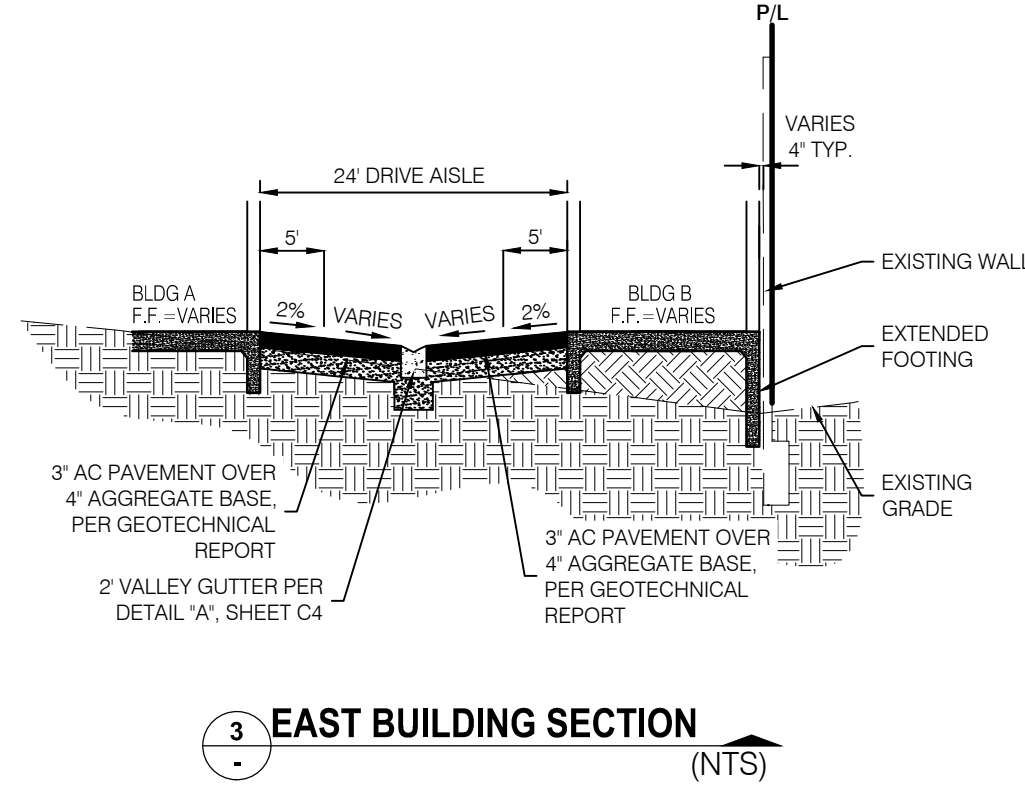
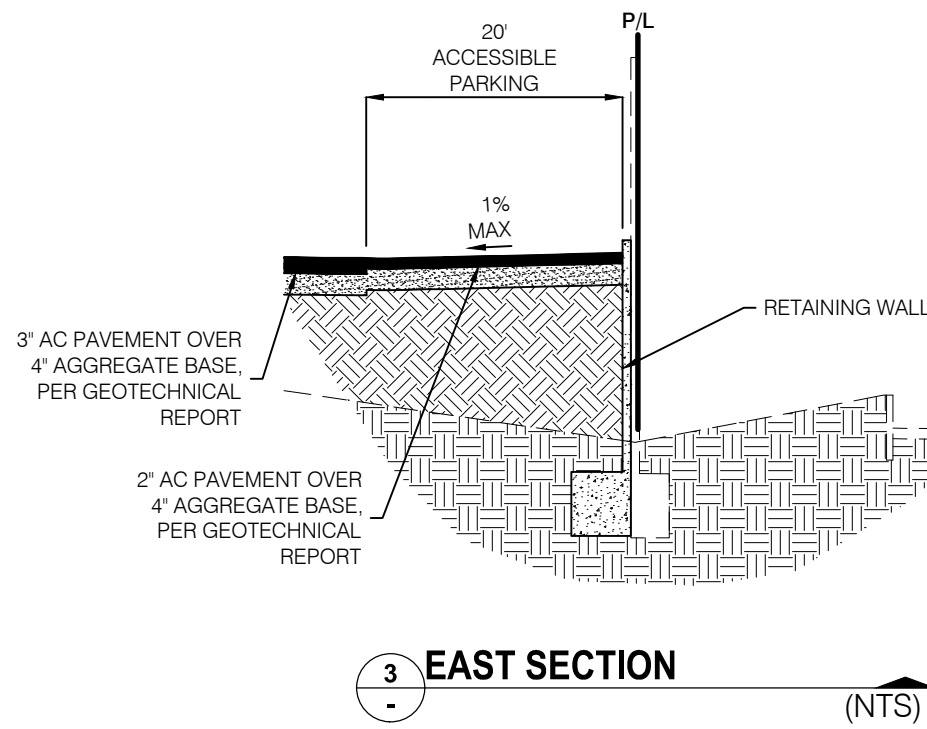
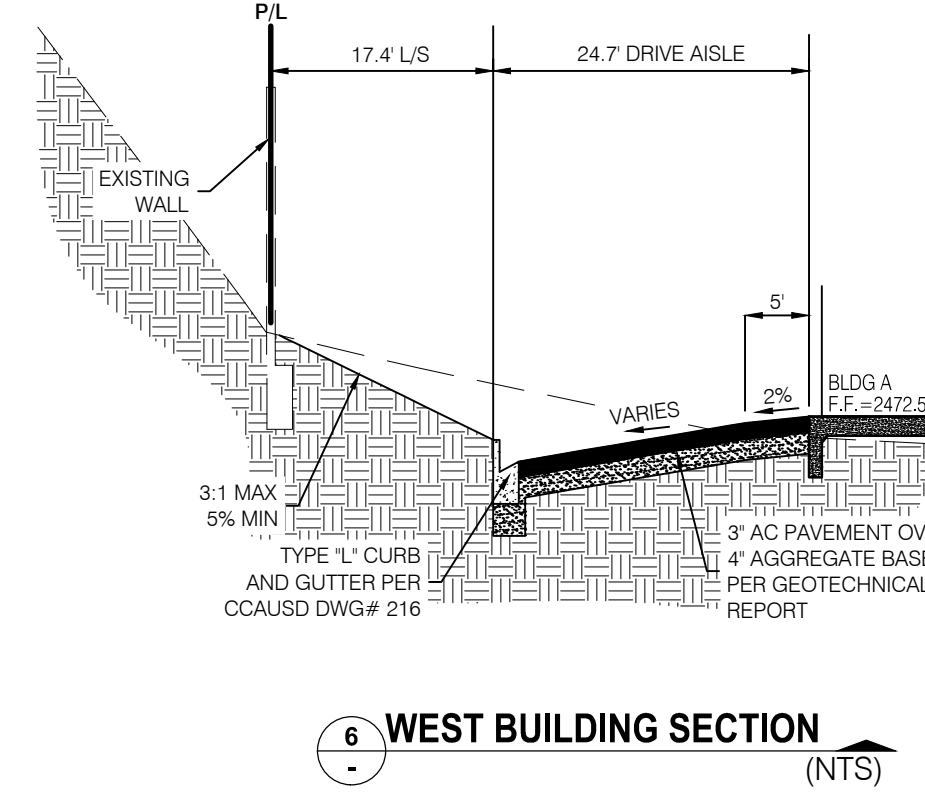
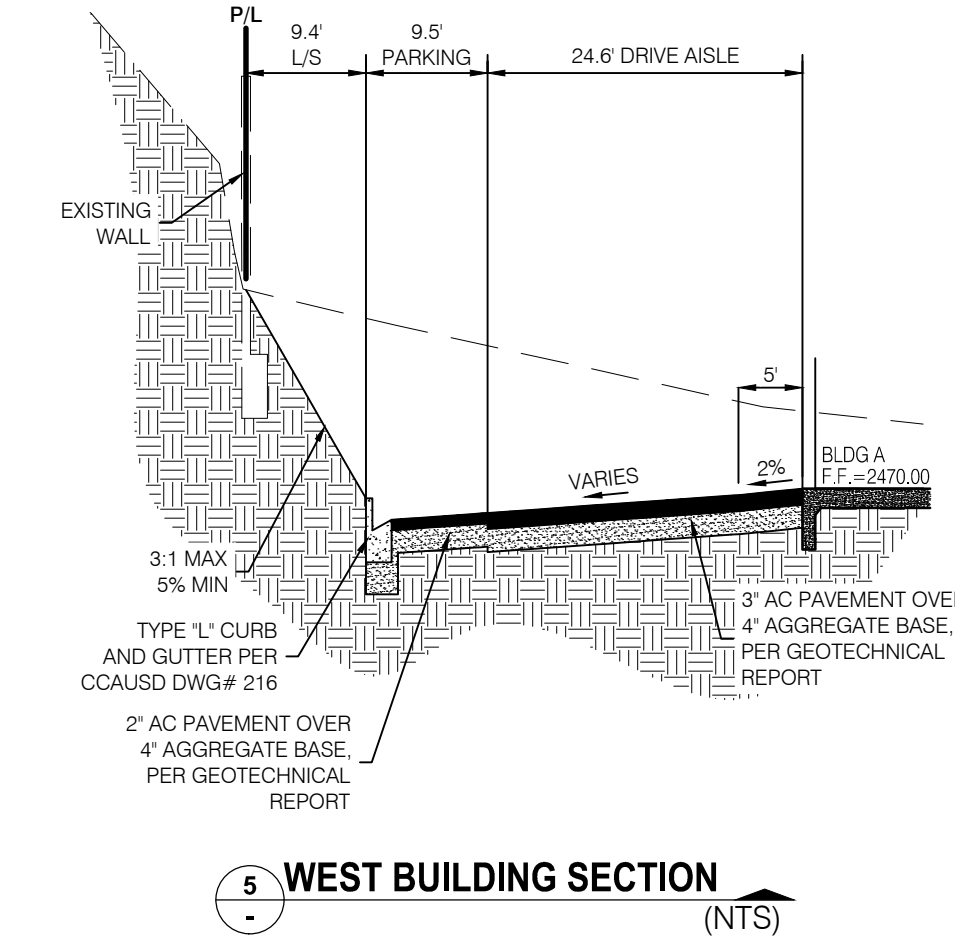
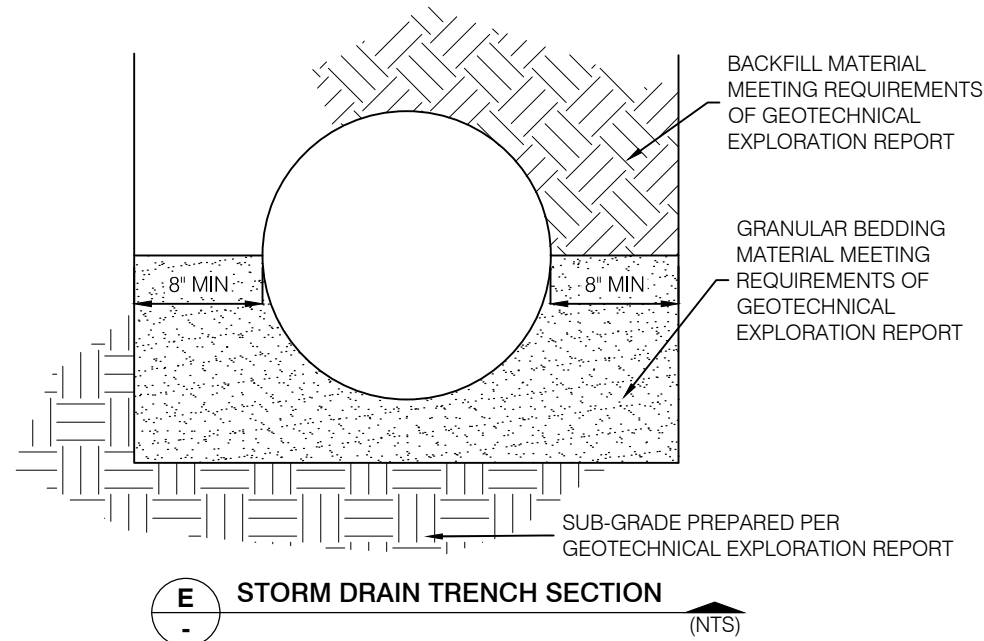
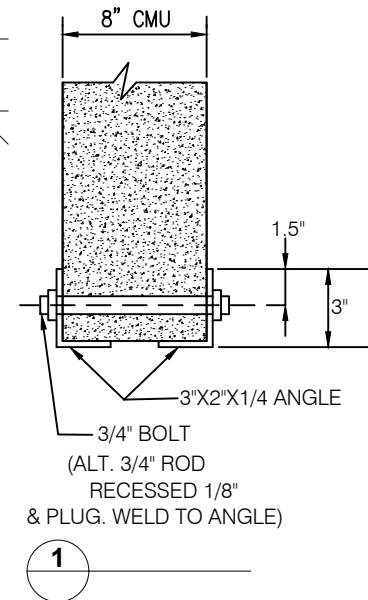
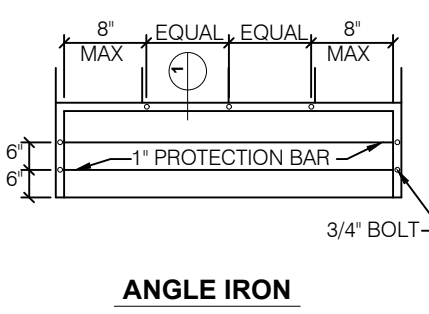
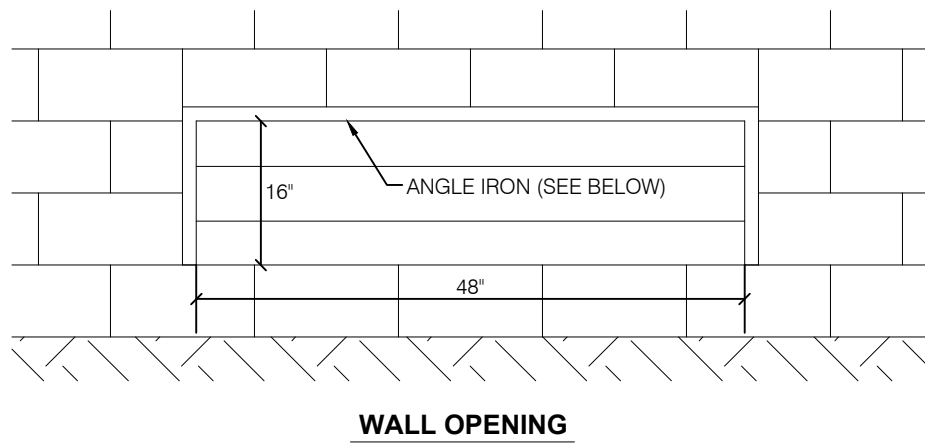
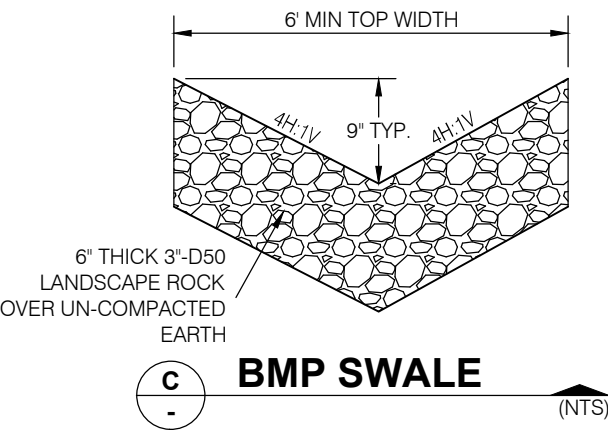
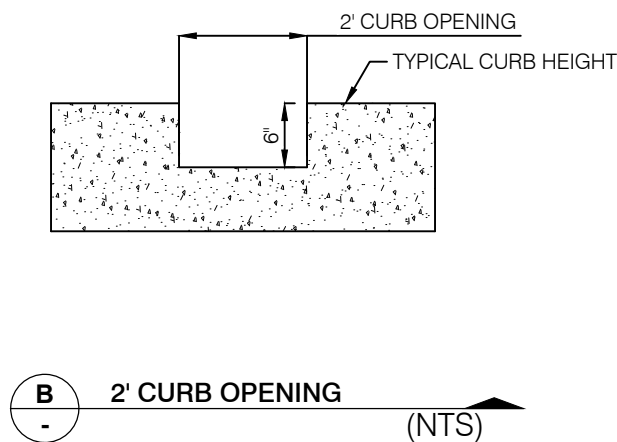
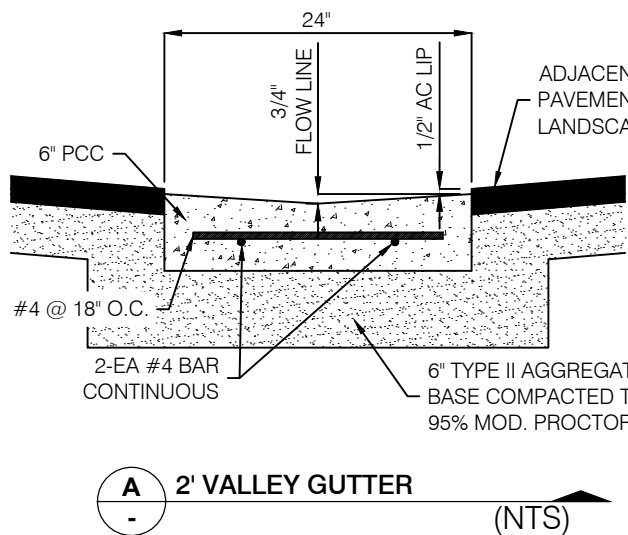
Call before you Dig
Avoid cutting underground utility lines. It's costly.

Call
811

OR
1-800-227-2600

FAST
Call before you UnderGround

1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



RIETZ CONSULTING INC.
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

DATE: 1/2/2018
DRAFTER: JG
CHECKED: EJR
SCALE: NTS

PROFESSIONAL ENGINEER - STATE OF NEVADA
ERIC RIETZ
Exp. 12/31/17
No. 16350
CIVIL

SHEET
C4
4 OF 6 SHEETS
###

LEGEND

	PROPERTY BOUNDARY
	RIGHT-OF-WAY
	PROPERTY LINE
	CENTER LINE
	EASEMENT
	EXST 'L' TYPE CURB
	EXST 'A' TYPE CURB
	EXST MAJOR CONTOUR LINE
	EXST MINOR CONTOUR LINE
	EXST SCREEN WALL AS INDICATED
	EXST EDGE OF PAVEMENT
	EXST EDGE OF SIDEWALK
	EXST UNDERGROUND POWER
	EXST FIBER OPTICS
	EXST STORM DRAIN
	EXISTING
	PROPOSED

	FIRE HYDRANT
	STORM MANHOLE
	TELEPHONE BOX
	TELEPHONE MANHOLE
	FIBER BOX
	CABLE TV BOX
	ELECTRICAL MANHOLE
	STREET LIGHT BOX
	POWER POLE
	SERVICE POLE
	GUY WIRE
	TRANSFORMER
	STREET LIGHT CABINET
	STREET LIGHT
	TRAFFIC SIGNAL BOX
	AREA LIGHT
	'L' TYPE CURB
	'A' TYPE CURB
	EDGE OF SIDEWALK
	CHAIN LINK FENCE
	WROUGHT IRON FENCE
	SWALE FLOW LINE
	SAWCUT

NOTES

- CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING STRUCTURES AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATION AND ELEVATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.
- OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED OR OBSOURED DURING CONSTRUCTION.

FLOOD ZONE

THIS SITE IS LOCATED IN ZONE "X", AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C2145F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

BENCHMARK

CLARK COUNTY VERTICAL CONTROL
RIVET AND SQUARE ALUMINUM PLATE IN TOP OF CURB, NORTHEAST CORNER OF SAHARA AVENUE AND BUFFALO DRIVE NEAR THE PC OF SAHARA AVENUE
ELEVATION: 767.569 METERS = 2518.355 FEET
NAVD88

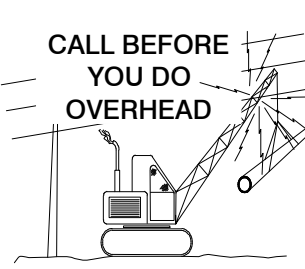
BASIS OF BEARING

S 89°20'31" W THE SOUTH LINE OF THE NORTH HALF (N 1/2) OF THE NORTHWEST QUARTER OF SECTION 9, TOWNSHIP 21 SOUTH, RANGE 60 EAST, M.D.M., CLARK COUNTY, NEVADA, AS SEEN IN FILE 86, PAGE 50 OF PARCEL MAPS RECORDED IN THE CLARK COUNTY NEVADA'S RECORDERS OFFICE.

DISCLAIMER NOTE:

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AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.



1-702-227-2929

Call before you Dig

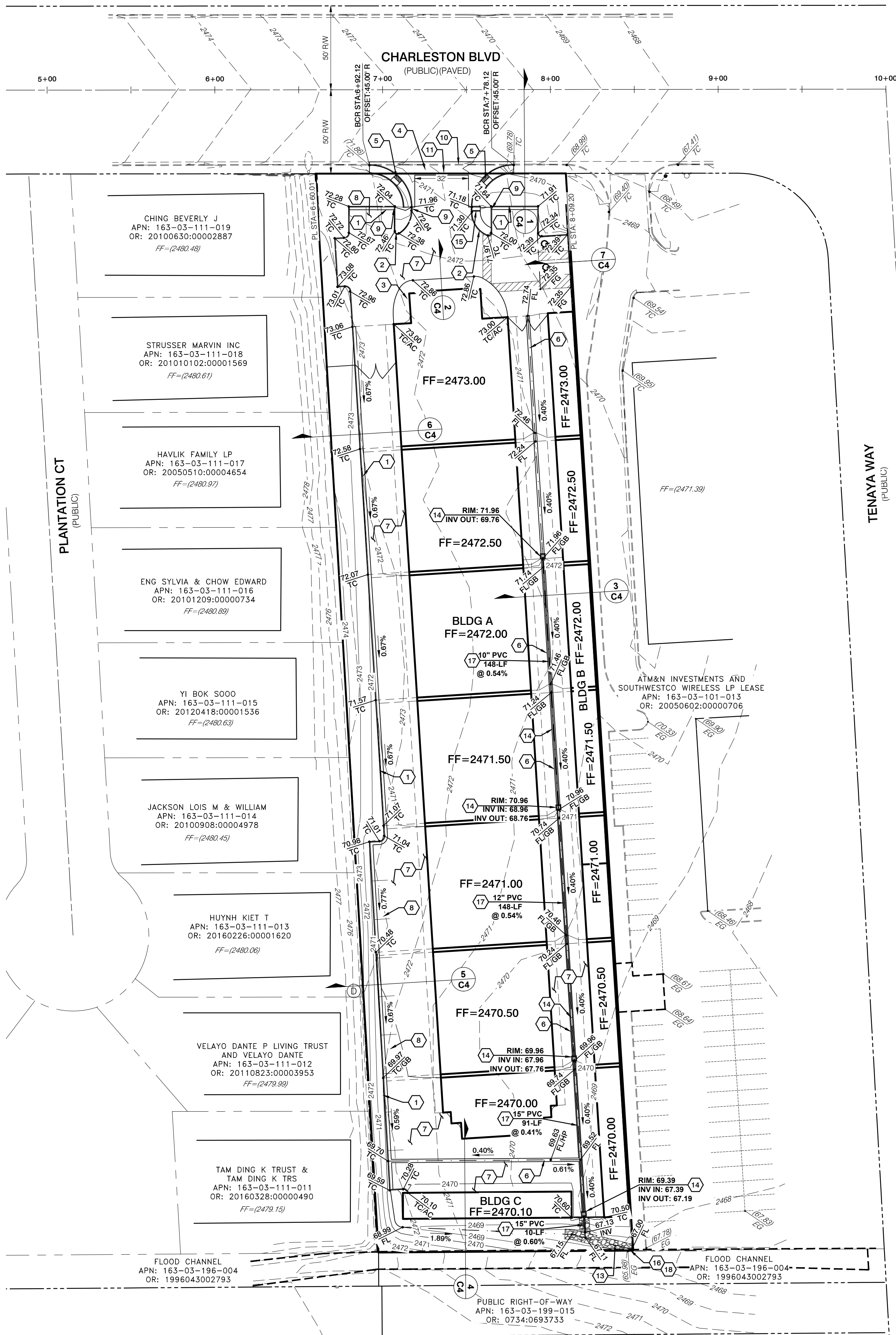
Avoid cutting underground utility lines. It's costly.



1-800-227-2600

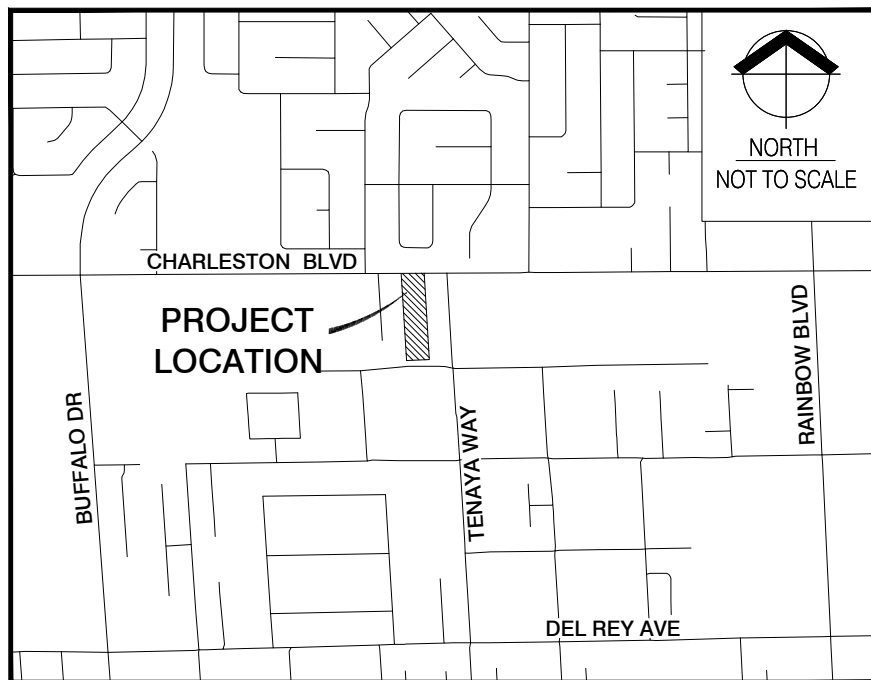


1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM
OF TRANSPORTATION



QUANTITIES

STORM SYSTEM	PRIVATE	PUBLIC
1. SIDEWALK UNDERDRAIN	EA 1	-
2. 2' VALLEY GUTTER	LF -	-
3. 2'X2' DROP INLET	EA 4	-
4. 10" PVC STORM DRAIN	LF 148	-
5. 12" PVC STORM DRAIN	LF 148	-
6. 15" PVC STORM DRAIN	LF 101	-
7. BLOCK WALL OPENING	EA 1	-
8. BMP SWALE	LF 50	-
STREET IMPROVEMENTS	PRIVATE	PUBLIC
1. COMMERCIAL DRIVEWAY	SF -	693
2. ACCESSIBLE RAMPS	EA 2	2
3. 'L' CURB AND GUTTER	LF 574	-
4. 'A' CURB	LF 213	-
5. 2" AC PAVEMENT	SY 189	-
6. 3" AC PAVEMENT	SY 3,717	-
7. SIDEWALK	SF 652	-
8. TYPE II AGGREGATE	CY 490	13



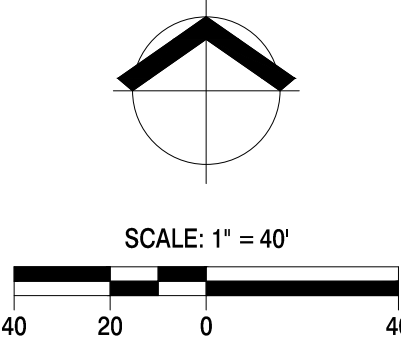
VICINITY MAP

LEGEND

EXISTING	PROPOSED
TOP BACK CURB	TOP BACK CURB
EXISTING GROUND	FINISH GRADE
EDGE OF PAVEMENT	EDGE OF PAVEMENT
FLOW LINE	FLOW LINE
ASPHALT CONCRETE	ASPHALT CONCRETE
TOP OF RET. WALL	TOP OF RET. WALL
TOP OF FOOTER	TOP OF FOOTER
	HIGH POINT
	GRADE BREAK

GRADING

- CONSTRUCT 'L' CURB AND GUTTER PER CCAUSD #216
- CONSTRUCT 'A' CURB AND GUTTER PER CCAUSD #219
- CONSTRUCT SIDEWALK PER CCAUSD #234
- CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225 & #228
- CONSTRUCT CASE I SIDEWALK RAMPS USING ARMOR TILE TRUNCATED DOMES OR EQUIV. TRUNCATED DOMES SHALL BE SOURCED FROM NDOT QUALIFIED PRODUCT LIST 'A' & 'B' = 8, UNLESS OTHERWISE NOTED
- 2' VALLEY GUTTER SEE DETAIL 'A' SHEET C4
- MAIN CORRIDOR (TRUCK ACCESS) INSTALL 3" AC OVER 4" TYPE II AGGREGATE BASE
- AUTOMOBILE ROUTE / PARKING. INSTALL 2" AC OVER 4" TYPE II AGGREGATE BASE
- 2' CURB OPENING, SEE DETAIL 'B' SHEET C4
- REMOVE EXISTING CURB AND GUTTER
- REMOVE EXISTING SIDEWALK
- 2' SIDEWALK UNDER DRAIN PER CCAUSD #236
- CONSTRUCT BMP SWALE W/ 6" THICK 3" D50 LANDSCAPE ROCK PER DETAIL C, SHEET C4
- 2'X2' DROP INLET PER DETAIL 'F', SHEET C4
- SIDEWALK UNDER DRAIN PER CCAUSD #236
- BLOCK WALL OPENING PER DETAIL 'D', SHEET C4
- PVC STORM DRAIN, SIZE PER PLAN, TRENCH PER DETAIL 'E', SHEET C4
- REMOVE EXISTING BLOCK WALL/RETAINING WALL NECESSARY TO CONSTRUCT BLOCK WALL OPENING



SITE DATA

APN No. 163-03-101-014 ACREAGE: 2.22 ZONING: P-R

DATUM

THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS OTHERWISE NOTED.

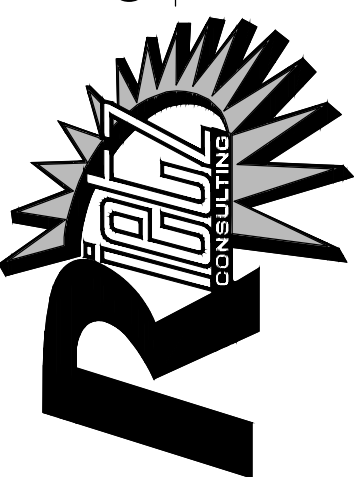
DRAINAGE CERTIFICATION

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY CLV # XXXXXX FOR THIS SITE ON FILE AT CITY OF LAS VEGAS FOR THIS PROJECT.

ERIC J. RIETZ, P.E. No. 16350

DATE

RIETZ
CONSULTING INC.



TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

GRADING PLAN

1/2/2018

JG

EJR

1"=40'

DATE:

DRAFTER:

CHECKED:

SCALE:

1/2/2018

SHEET

C3

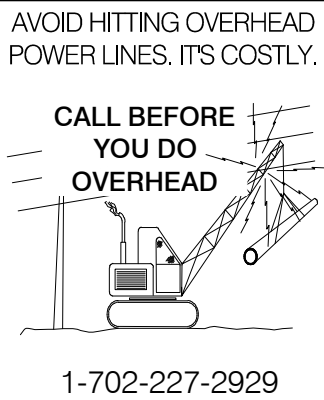
3 OF 6

SHEETS

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P:\Charleston and Tanaya Mini Storage\CD\DWG\DETAILS.dwg - 1/20/18 7:59 AM

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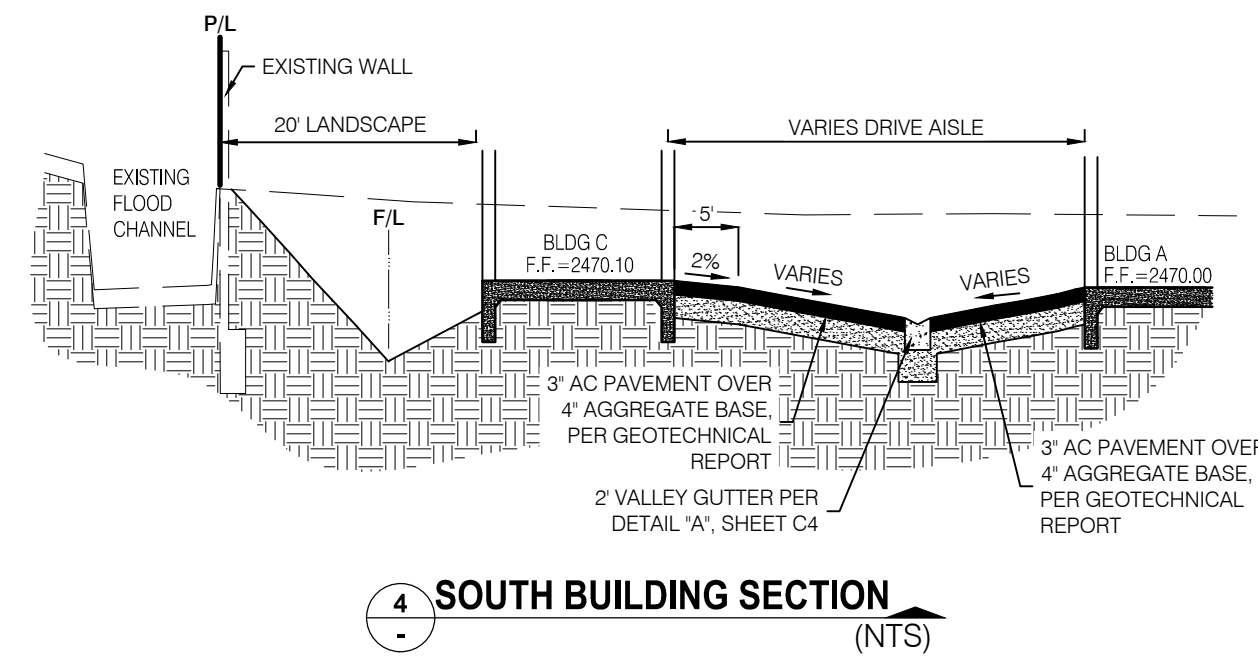
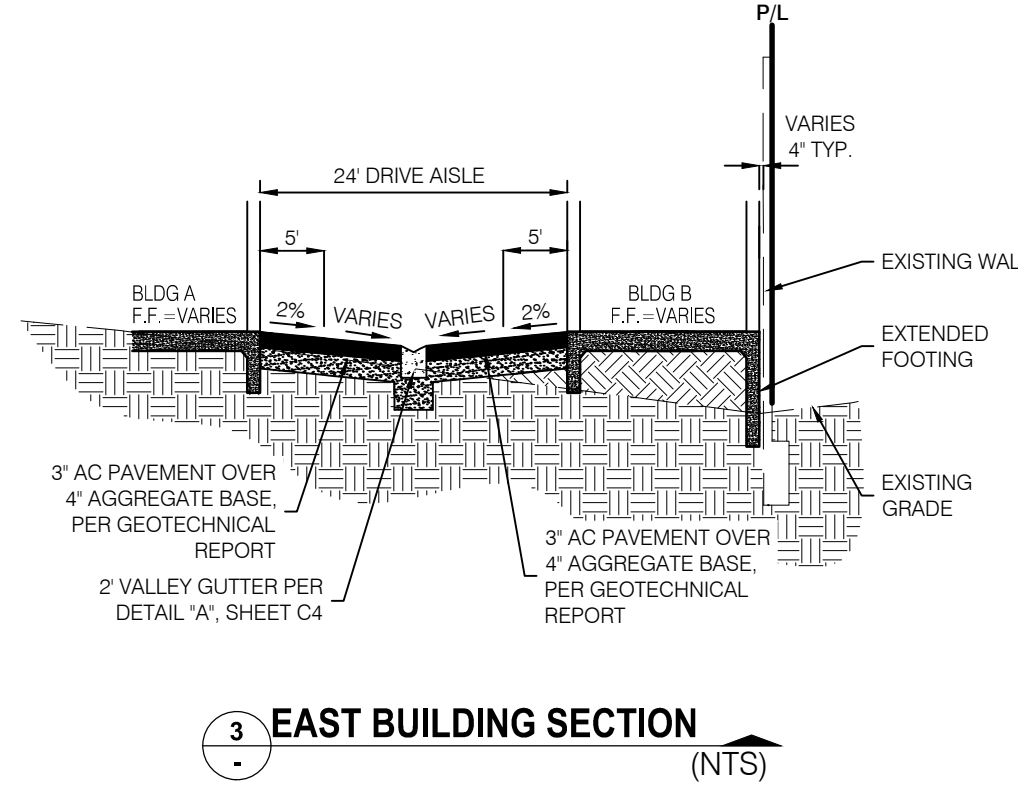
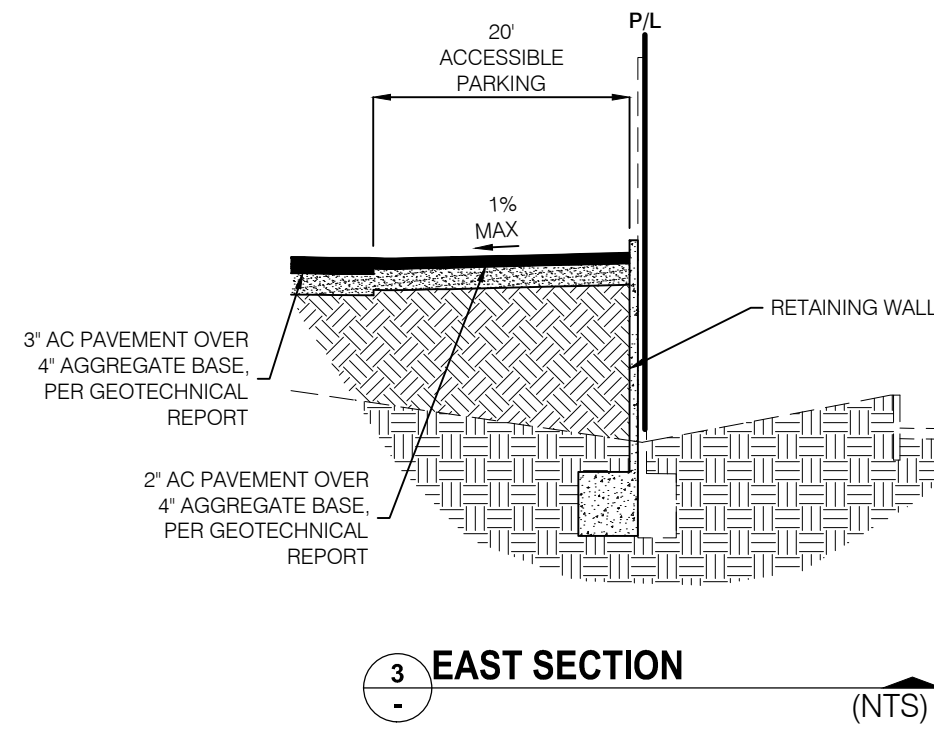
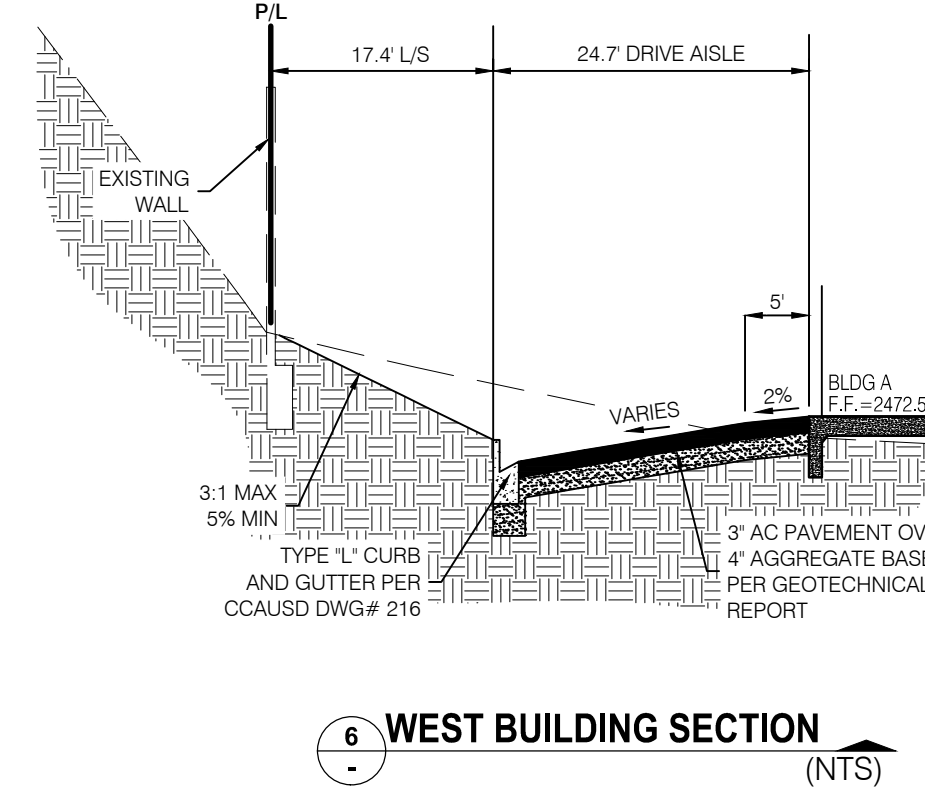
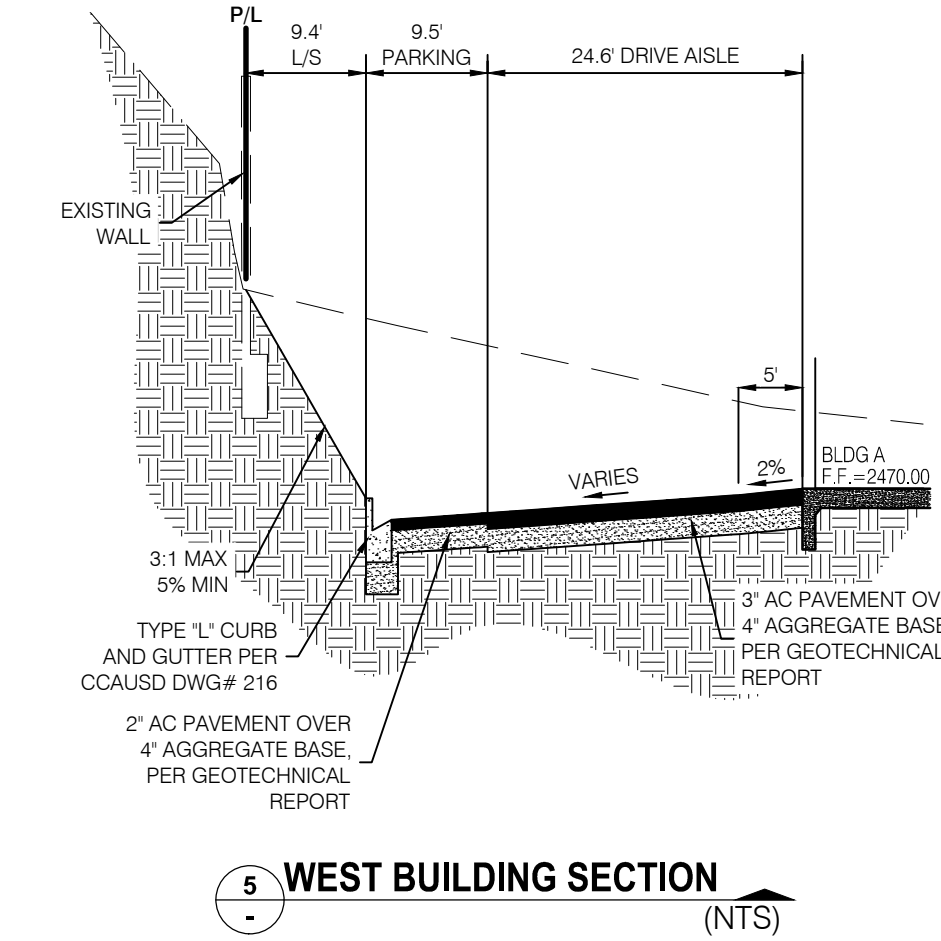
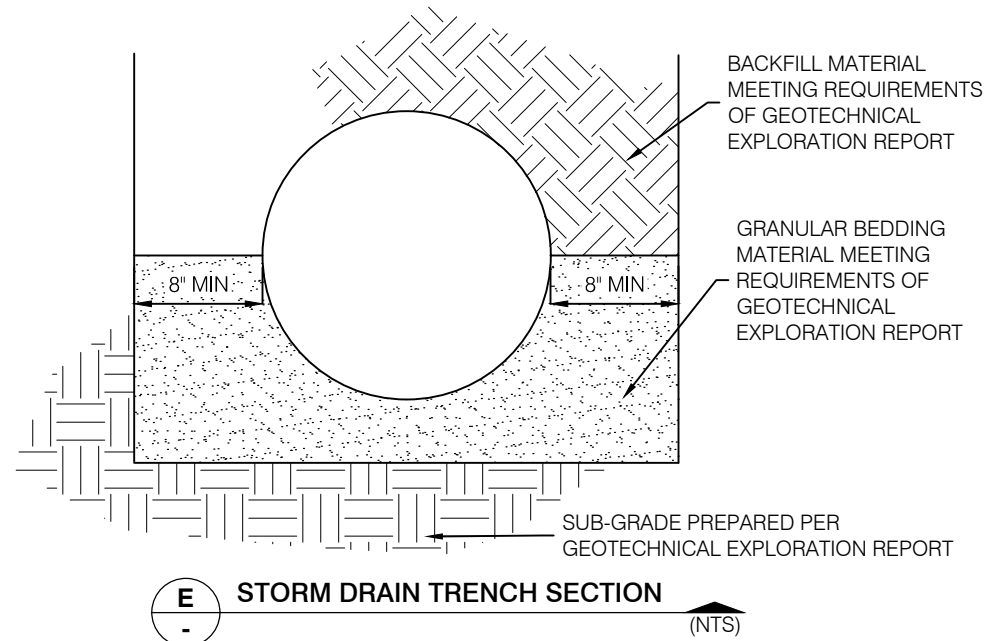
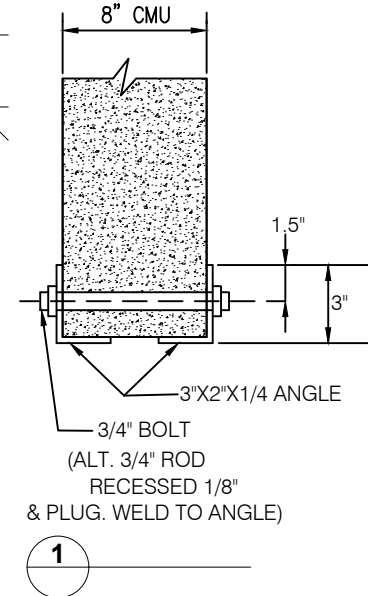
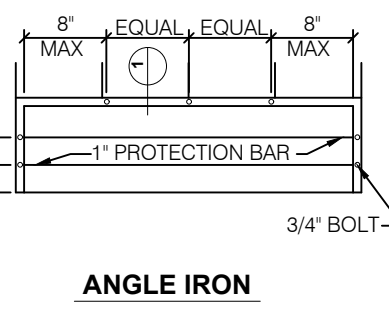
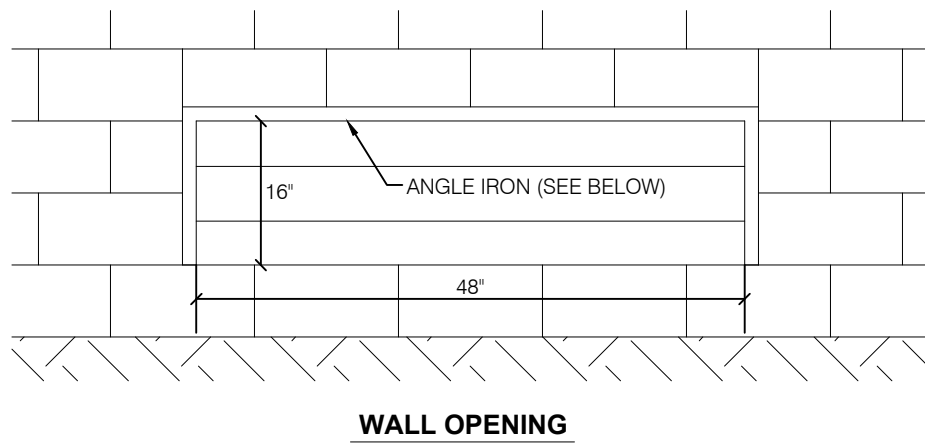
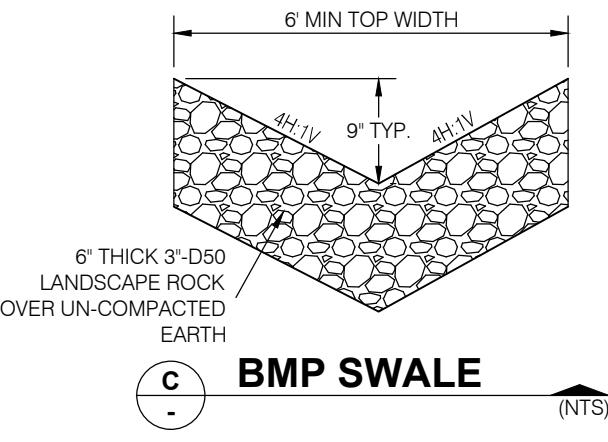
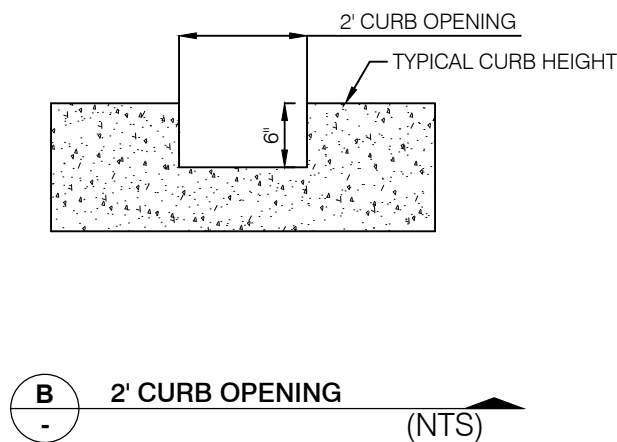
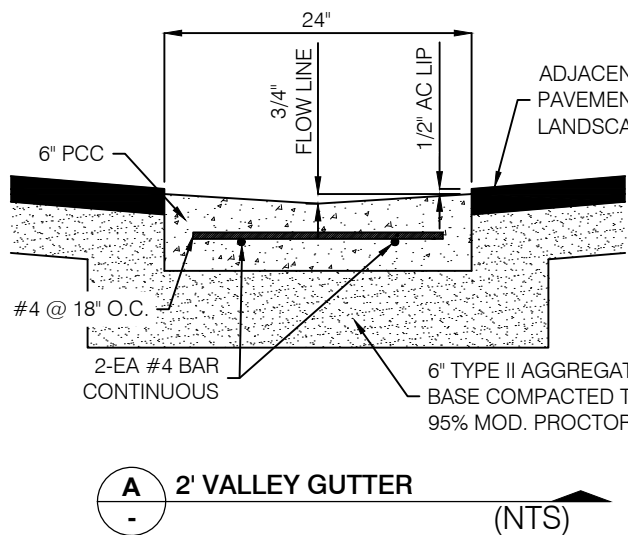
Call before you Dig
Avoid cutting underground utility lines. It's costly.

Call
811

OR
1-800-227-2600

FAST
Call before you UnderGround

1-702-432-5300
FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



DROP INLET			
MODEL NO.	A	B	*WEIGHT
DI242436	36"	42"	1900 LBS.
DI242448	48"	54"	2500 LBS.

*BOX ONLY

FRAME AND GRATE			
MODEL NO.	RATING	D	WEIGHT
SG2424-DIP	PEDESTRIAN	1 1/2"	41 LBS.
SG2424-DIT	TRAFFIC	3"	120 LBS.

RIETZ CONSULTING INC.
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

DETAILS

TOWNE STORAGE AT CHARLESTON
LAS VEGAS, NEVADA
APN # 163-03-101-014

DATE: 1/2/2018
DRAFTER: JG
CHECKED: EJR
SCALE: NTS

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ERIC RIETZ
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4 OF 6 SHEETS
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