DS #: 4922

APN: 138.13.512.001

PROJECT: Crystal Park Apartments

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS NEVADA

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: October 28, 2017
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: **Crystal Park Apartments**			**COPIES TO:** VTN, Nevada
Cross Streets:	SEQ of Cheyenne Boulevard & Michael Way			EAB Investment Company
File Number:	F:\Depot\DSMemos\DS4922A.ZNAE.doc			Bart Anderson, P.E., DevCo
Parcel Number:	138-13-512-001			CCRFCD
Zoning Action:	SDR-?????			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/2/2017 & 10/11/2017	10/25/2017	See Comments Below	$400.00	490395: $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 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. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.

3. A portion of the site is within a FEMA Special Flood Hazard Area (SFHA), Zone AE. Development within the SFHA requires that changes to the adopted water surface elevation and/or the Flood Zone Boundary mandate submittal and approval by FEMA. Provide a detail analysis of the Flood Zone impact from this development.

4. Since the project is within a FEMA Flood Zone AE, *Clark County Regional Flood Control District* (CCRFCD) concurrence is required prior to the final approval of the drainage study by the *City of Las Vegas*.

5. In a meeting attended by the developer, engineer and the *City of Las Vegas* flood control staff held on October 11, 2017, it was agreed that the developer contribute funding for the future installation of a 48"-RCP storm drain in *Michael Way* identified in the *City of Las Vegas Northwest Neighborhood Master Plan*. The engineer will submit a cost estimate for the construction of the required storm drain in the frontage of the subject site in *Michael Way* to *City Flood Control Section* for approval. The contribution money will be collected prior to the final approval of the improvement plans.

6. ***Figure 6: Existing Condition Drainage Map*** shows the Q_{10}/Q_{100} for "CPE4" as 21cfs/81cfs while Page 4 of the Study (Subchapter "Onsite Drainage Basin Description) shows 11cfs/24cfs. Clarify in the next submittal.

   Note: It is however, the opinion of the reviewer that Q_{10}/Q_{100}=11cfs/24cfs is more reasonable because in the existing condition the flow at the northeast corner of the site ("CPA") do sheet flow into the adjacent commercial lot. There is no berm or channel to direct the flow at the northeast corner to go south.

7. Per ***Figure 7: Developed Condition Drainage Map***, the proposed runoff at the southeast corner of the site Q_{10}/Q_{100}=24cfs/84cfs will be substantially higher and negatively impacting the adjacent commercial property. Either maintain the existing flow pattern or obtain a notarized letter of acknowledgment and acceptance of the proposed drainage from the owner of the commercial property prior to the final approval of the subject drainage study.

8. The proposed drainage of the subject site is to drain along the east boundary and go south. However, it is noticed that parking stalls are lined up adjacent to the east property line, ie, the parking stalls are used as a drainage corridor. This is not acceptable because it is likely that the parking stalls can be parked full of vehicles during a major storm event. The tires of the vehicles will reduce the effective conveyance area. The engineer must use only the drive aisle, not the parking stalls as flow corridor. Revise the pertinent hydraulic calculations and address whether the proposed finish floor elevations of the adjacent apartment buildings are still meeting criteria.

9. ***Figure 7: Developed Condition Drainage Map***: Four hydraulic sections in *Michael Way* do not have any nomenclature such as A-A, B-B etc. Review and revise accordingly.

10. **Sheet GR6**: It appears that a 2'-wide opening is proposed at the southeast corner of the site for the onsite discharge. However, for a 100-year flow of 84cfs, a 2'-opening is seemingly not adequate. Address and revise in the next submittal.

11. If wrought iron gate is proposed at the southeast corner for better discharge, please consider that the bottom of the wrought iron gate may be blocked by debris which will elevate the tailwater elevation at the discharge point and thus impact the nearest adjacent apartment building. Provide a weir calculation assuming a minimum of 6"-high of debris at the gate and verify whether the nearest buildings are still adequately flood protected.

12. **Sheet GR1**: A proposed top of curb (39.80TC) elevation in Michael Way at the entrance driveway appears to be a typo. Review and revise accordingly.

13. This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

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

END OF REMARKS
ays

T/R/S: T20S/R60E/13
AREA L-13

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

TRANSMISSION OK

JOB NO.	0698
DESTINATION ADDRESS	7023622597
PSWD/SUBADDRESS	
DESTINATION ID	
ST. TIME	10/28 11:44
USAGE T	01'48
PGS.	3
RESULT	OK

CITY OF LAS VEGAS
INTER-OFFICE MEMORANDUM

DATE: October 28, 2017

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:
Crystal Park Apartments

Cross Streets:	SEQ of Cheyenne Boulevard & Michael Way
File Number:	F:\Depot\DSMemos\DS4922A.ZNAE.doc
Parcel Number:	138-13-512-001
Zoning Action:	SDR-?????

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

COPIES TO:
VTN, Nevada
EAB Investment Company
Bart Anderson, P.E., DevCo
CCRFCD

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	10/2/2017 & 10/11/2017	10/25/2017	See Comments Below	$400.00	490395: $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 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. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-

Technical Drainage Study for

Crystal Park Apartments

Las Vegas, Nevada

W.O. # 7844

Prepared for:

EAB Investment Company

3065 N Rancho #130

Las Vegas, NV 89113

Submitted to:

City of Las Vegas

Department of Public Works

731 South Fourth Street

Las Vegas, NV 89101

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Crystal Park Apartments Date: September 27, 2017

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

East/West: Cheyenne Avenue

b) Section: 13 Township: 20S Range: 60E

c) APN : 138-13-512-001

Name of Owner: EAB Investment Company

Telephone No.: Fax No.: E-Mail Address:

Address: 3065 N Rancho #130, Las Vegas, NV 89113

Contact Person-Name: William Meyer **Telephone No.:** (702)-873-7550

* **E-Mail Address:** bmeyer@vtnnv.com **Fax No.:** (702)-362-2597

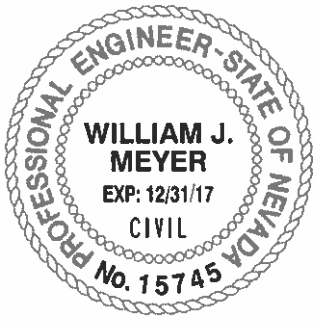
Firm: VTN Nevada

Address: 2727 S. Rainbow Blvd, LV, NV, 89146

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: +/- 10 Acres Being Developed/Disturbed: +/-10 Acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☒ **Yes**** ☐ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ **Yes**** ☒ **No**
4. Proposed type of development (Residential, Commercial, Etc.): Residential (Apartments)
5. Approximate upstream land area which drains to the subject site: +/- 0.34 sq.mi
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: Update to the TDS for Rancho Industrial Park (CLV DS# 2298); TDS for Crystal Park Apartments (CLV DS# 4734)
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Runoff will discharge east as surface flow to the existing Rancho Industrial Park site.
8. Briefly describe your proposed schedule for the subject project: As soon as possible



Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Crystal Park Apartments	Map ID:
Firm Name: VTN Nevada	Engineer: William Meyer
Address:	
City: Las Vegas	State: NV Zip: 89146-5148
Phone Number: (702) 873-7550	Fax Number: (702) 362-2597
Property Owner: EAB Investment Company	
Address: 3065 N. Rancho #130	
City: Las Vegas	State: NV Zip: 89113

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

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

II. MAPS AND EXHIBITS

Yes	No	
X		A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.
X		A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		Streets with off-set crowns.
X		Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
X		Property lines.
X		Right-of-way lines and widths, existing and proposed.
X		Existing improvements and their elevations.
X		Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year storm peak flows at basin concentration points.
X		Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
X		Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
X		Location and cross-section of street capacity calculations.
X		Cross-sectional detail for channels, including cutoff wall locations.
X		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.
X		Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
X		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.
X		Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
X		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.
X		Building and/or lot numbers.
NA		Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
X		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**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
X		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.
X		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.
X		Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
X		Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).

IV. HYDROLOGIC ANALYSIS

Yes	No	
X		Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.
X		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.
X		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.
X		Use of correct precipitation values in and around the McCarran Airport rainfall area.
X		A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.
X		A summary table of stormwater flows showing basin area, Q_{10} and Q_{100} for both individual basins and combined basin flows, where applicable.
X		Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
X		Calculation for impervious area for parking lots and LIDs (if required).

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
X		Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
X		Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v $\leq$ 8. Q_{10} d x v $\leq$ 6 and 12 foot dry lane for rights-of-way $\geq$ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
X		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.
X		Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
X		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.
X		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.
N/A		A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
N/A		Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
N/A		Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
X		The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
X		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 (CCRFCD) Manual Standard Form 2. The listed items are the minimum information required prior to the City performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the CCRFCD Hydrologic Criteria and Drainage Design Manual (Design Manual).

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

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

I. GENERAL REQUIREMENT		
Yes	No	
NA		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.)

II. GRADING PLAN INFORMATION		
Yes	No	
N/A		Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
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.
N/A		Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
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.
N/A		Commercial and Common Lot Landscape areas are not allowed to drain over the sidewalk. The grading plans show flow lines with grades and sidewalk under drains for all landscape areas draining to the public ROW.

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
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.
N/A		Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
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.

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

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

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

TECHNICAL DRAINAGE STUDY

FOR

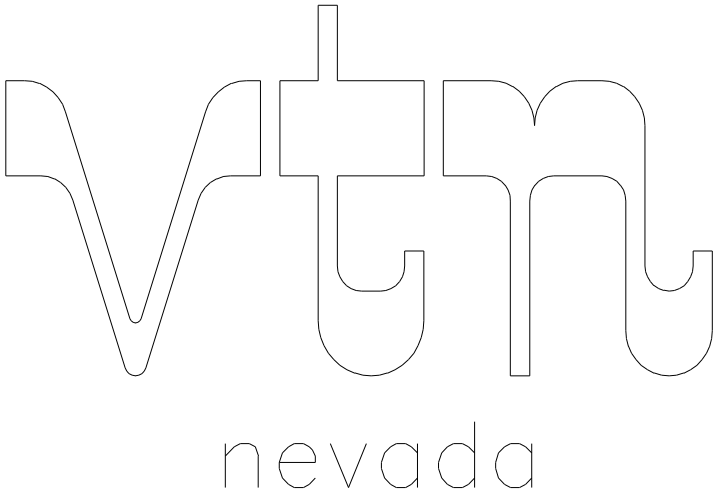
CRYSTAL PARK APARTMENTS

CITY OF LAS VEGAS, NEVADA

W.O. # 7844

Prepared for:
EARNEST A. BECKER
INVESTMENT COMPANY

Submitted to:
CITY OF LAS VEGAS
FLOOD CONTROL



September 27, 2014
W.O. #7844

City of Las Vegas
333 North Rancho – 7th Floor
Las Vegas, NV 89106

Attention: Albert Sung, P.E.

SUBJECT: TECHNICAL DRAINAGE STUDY FOR CRYSTAL PARK APARTMENTS

Mr. Albert Sung,

Transmitted herewith for your review are two (2) copies of the *Technical Drainage Study for Crystal Park Apartments*. The site is a ± 10 acre apartment development located within a portion of Section 13, Township 20 South, Range 60 East, M.D.M, Clark County, Nevada. If there are any questions concerning this study or if additional information is needed, please do not hesitate to contact this office.

Respectfully Submitted,

VTN Nevada

William J. Meyer, P.E.
Senior Engineer

TABLE OF CONTENTS

Page

I. INTRODUCTION 1
A. STUDY OVERVIEW AND PURPOSE 1
B. LOCATION 1
C. DESCRIPTION 1
D. FLOODPLAIN INFORMATION 1
E. MASTER PLANNING INFORMATION 1
F. REFERENCED HYDROLOGY STUDIES 2
II. HYDROLOGIC ANALYSIS 2
A. METHOD OF ANALYSIS 2
B. RAINFALL CRITERIA 2
C. RUNOFF COMPUTATION 2
D. PEAK FLOWS 3
III. ONSITE & OFFSITE BASIN ANALYSIS 3
A. EXISTING CONDITION ANALYSIS 3
1. OFFSITE DRAINAGE BASIN DESCRIPTION 4
2. ONSITE DRAINAGE BASIN DESCRIPTION 4
B. DEVELOPED CONDITION ANALYSIS 4
1. OFFSITE BASIN DESCRIPTION 5
2. ONSITE BASIN DESCRIPTION 5
IV. FACILITY DESIGN CALCULATIONS 5
A. ONSITE DRIVE AISLE FLOW 5
V. CONCLUSIONS 7

I. INTRODUCTION

A. STUDY OVERVIEW AND PURPOSE

This Technical Drainage Study serves to analyze the existing and developed drainage conditions for the proposed Crystal Park Apartments development, and to provide adequate flood protection. The methodology presented in this study in accordance with the criteria set forth in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual* (HCDDM) (Reference 1, hereinafter referred to as the Manual).

The proposed site consists of multi-family residential units, situated on ±10-acres. Approval of this study will allow construction of this project. Previously, the *Technical Drainage Study for Crystal Park Apartments*, by Lochsa Engineering (CLV DS# 4734, hereinafter referred to as the previously submitted study) was submitted to the City of Las Vegas (CLV). The previously submitted study provided a hydrologic analysis for the site and received review comments from the CLV dated June 8, 2015. This study proposes a new site plan and supersedes the information presented in the previously submitted study.

B. LOCATION

Crystal Park is located within a portion of Section 13, Township 20 South, Range 60 East, M.D.M, Clark County, Nevada. Specifically the site is located southeast of the intersection of Cheyenne Avenue and Michael Way (Refer to *Figure 1: Vicinity Map* included in *Appendix A*).

C. DESCRIPTION

The site slopes to the east at approximately 1.6% and is bounded by Michael Way to the west, residential developments to the north and south, and the Cheyenne Ranch Professional Plaza to the east. (Refer to *Figure 2, Site Description Map*)

D. FLOODPLAIN INFORMATION

According to the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) Community Panel Numbers 32003C2535F, Clark County, Nevada, and Incorporated Areas, dated November 16, 2011, (Reference 2) most of the site is located within a Zone "X" and a small portion of the site is within Zone "AE". A Zone "X" is described as an area determined to be outside the 0.2% annual chance floodplain. A Zone "AE" is described as a special flood hazard area subject to inundation by the 1% annual chance flood event where base flood elevations have been determined. (Refer to *Figure 3: Flood Insurance Rate Map*)

E. MASTER PLANNING INFORMATION

The proposed site is delineated on Figures F-26 and H-26, which were referenced from the 2013 CCRFCD Las Vegas Valley Flood Control Master Plan Update (Reference 3, hereinafter referred to as the MPU). The site lies within MPU sub-basin PD05A-C and is not adjacent to any existing or proposed CCRFCD facilities. (Refer to *Figure 4B: MPU Facilities Map and Figure 4C: MPU Hydrologic Map*)

F. REFERENCED HYDROLOGY STUDIES

The following drainage studies have been reviewed and referenced for the purposes of this report:

- *City of Las Vegas Northwest Neighborhood Master Study Phase 1*, by PBS&J. (Reference 4, hereinafter referred to as the Neighborhood Study)

  The Neighborhood Study quantified the flow rate conveyed within Michael Way adjacent to the west boundary of the proposed project.

II. HYDROLOGIC ANALYSIS

A. METHOD OF ANALYSIS

The hydrologic modeling for this study was prepared using the SCS Unit Hydrograph Methodology in conjunction with the HEC-1 computer program from the U.S. Army Corps of Engineers (USACOE) as outlined in the Clark County Regional Flood Control District *Hydrologic Criteria and Drainage Design Manual* (hereinafter referred to as the *Manual*). The computation and analyses have been included in the Appendix of this study.

B. RAINFALL CRITERIA

The project site is included in the McCarran Airport Rainfall Area as shown by Figure 513 in the Hydrologic Criteria and Drainage Design Manual. Rainfall depths were taken from Table 505 for the 6-hour 10-year and 100-year Recurrence Interval in the Hydrologic Criteria and Drainage Design Manual The design precipitation depth for the 10-year and 100-year storm events are 1.58 inches and 2.77 inches, respectively. Rainfall calculations are included in Appendix B.

C. RUNOFF COMPUTATION

According to the Natural Resources Conservation Service Web Soil Survey (Reference 7), the site consists of Soil Type 300 and Soil Type 380. The site and soil boundaries are depicted on *Figure 5: Soils Map.* Soil Type 300 is characterized as Las Vegas gravelly fine sandy loam with 0 to 2 percent slopes. Soil Type 380 is characterized as Skyhaven very find sandy loam with 0 to 4 percent slopes. Curve Numbers (CNs) were taken from Table 602 from the Manual assuming a land cover of desert shrub in poor condition for existing conditions, and commercial for developed conditions. The soil report and curve number calculations have been included in Appendix B.

The lag times quantify how long before basins are contributing to flow at the outlet and is a representative scale of an individual basin that were determined using Standard Form 4. Velocities used in Standard Form 4 have been calculated using the equation $V = CS^{1/2}$ from the *Manual*. The coefficient C = 14.8 represents wide channel flow with D = 0.25 and n = 0.04 for undeveloped conditions. The coefficient C = 29.4 represents wide channel flow with D = 0.7 and n = 0.04 for undeveloped conditions. The coefficient C = 20.2 represents street flow with n = 0.016 and a depth in the gutter of 0.3 feet for developed conditions. The coefficient C = 30.6 represents curb height street flow for developed conditions.

Travel Time velocities have been calculated based on the equation $V = CS^{1/2}$ from section 602.1 of the *Manual*. For basins analyzed in this study, the first 500 feet of the Travel Time Length uses the V_1 set of C coefficients from the *Manual* and the remaining Travel Time Length uses the larger V_2 set of coefficients. The Standard Form 4 computes the Travel Time separately for the V_1 and V_2 portions of the basin and adds them together to give the total Travel Time for the basin. Based on the hydrologic properties and land usages of the basins within this study, we feel that the 500-foot break point provides a conservative but representative assumption to where enough flow can be generated within the basin to warrant the use of the higher velocity coefficients. In summary,

Existing Conditions	Developed Conditions
$V_1 = 14.8*(S/100)^{1/2}$	$V_1 = 20.2*(S/100)^{1/2}$
$V_2 = 29.4*(S/100)^{1/2}$	$V_2 = 30.6*(S/100)^{1/2}$

D. PEAK FLOWS

The following table summarizes the peak flow generated by each offsite and onsite basin for the listed conditions. A discussion of each drainage condition may be found in the following section of this report.

TABLE 1:
EXISTING CONDITION HEC-1 SUMMARY

Basin	Area (ac)	Q100	Q10
OFFE1	1.31	4	2
CPA	-	57	10
ONE1	3.02	8	4
ONE2	6.46	17	7
CPE4	-	24	11
ONE3	0.48	1	1

TABLE 2:
DEVELOPED CONDITION HEC-1 SUMMARY

Basin	Area	Q100 (CFS)	Q10 (CFS)
OFFE1	1.31	4	2
CPA	-	57	10
ON1D	9.96	27	14

III. ONSITE & OFFSITE BASIN ANALYSIS

A. EXISTING CONDITION ANALYSIS

Existing condition for the proposed site is depicted on *Figure 6: Existing Condition Drainage Map.* In existing condition, the adjacent roadways and parcels are developed,

and the proposed site is assumed to be undeveloped. No offsite flows enter the site in existing condition.

1. OFFSITE DRAINAGE BASIN DESCRIPTION

The flow conveyed within Michael Way adjacent to the site has been referenced from the Neighborhood Study. The Neighborhood Study indicates that the 10-year and 100-year flows conveyed in Michael Way at the intersection of Cheyenne Avenue, are 36 cfs and 247 cfs, respectively. The flow in Michael Way continues south to combine with additional offsite flows generated by Basin PD04B (36/88cfs), located west of the proposed project, to produce a 10-year and 100-year flow rate of 73 cfs and 338 cfs, respectively. Refer to *Figure 9: Reference Basin PD04B from Northwest Neighborhood Master Study* included in Appendix A for a depiction of the offsite basin PD04B. The existing and ultimate condition drainage maps from the referenced Neighborhood Study have been included in Appendix D.

According to the Country Lane study, runoff generated by the development north of the proposed project is drains to a 20-foot wide alley along the northern boundary of the proposed site. The area tributary to the 20-foot wide valley has been analyzed as Basin OFF1E. Additional flows from Michael Way enter the alley and combine with Basin OFFE1 to give CPA. Flows within the alley (CPA) are then conveyed east towards the existing Rancho Industrial Park.

2. ONSITE DRAINAGE BASIN DESCRIPTION

Existing condition for the site was previously analyzed in the Rancho Industrial Park study. The Rancho Industrial Park study provided a swale along the eastern boundary of the proposed project that directed flows generated by site to the southeast corner of the site.

Three onsite basins have been used for the existing condition analysis (ONE1, ONE2, and ONE3). The flow generated by the onsite Basin ONE3 (1 cfs) drains west into Michael Way. The flow generated by onsite Basins ONE1 and ONE2 drain east into the existing Rancho Industrial Park. The total that discharges into the Rancho Industrial Park site during the 10-year and 100-year storm event is 11 cfs and 24 cfs, respectively (CPE4).

B. DEVELOPED CONDITION ANALYSIS

Developed condition for the proposed site is depicted on *Figure 7: Developed Condition Drainage Map.* Developed condition assumes that Crystal Park Apartments and the adjacent roadways and parcels are fully developed. No offsite flows enter the site in developed condition. Flows generated onsite are discharged southeast of the site to the Rancho Industrial Park, which is consistent with existing condition.

1. OFFSITE BASIN DESCRIPTION

The adjacent offsite areas are fully developed in both existing and developed condition. Therefore the offsite hydrology does not change between existing and developed condition.

2. ONSITE BASIN DESCRIPTION

The proposed site is modeled as one hydrologic basin (ON1D). Flows generated by the project are directed southeast of the project to match existing condition drainage patterns. In developed condition, a total of 27 cfs and 14 cfs are discharged towards the Rancho Industrial Site during the 100-year and 10-year storm events, respectively. Flows discharging from the project have been increased by 3 cfs from existing condition.

Prorated subbasins were used to determine flowrates at key locations onsite used for the normal depth street calculations. A copy of the Prorated Flowrate Calculations is included in Appendix B. Prorated Subbasins are depicted on Figure 7.

IV. FACILITY DESIGN CALCULATIONS

A. ONSITE DRIVE AISLE FLOW

The program FlowMaster, by Haestad Methods, has been utilized to determine the normal depth and velocity of the anticipated storm flows within the onsite drive aisles and the adjacent Michael Way. The results of the street flow analysis are summarized in Tables 3 and 4. Refer to Figure 7: Developed Condition Drainage Map for the location of the cross sections used in the analysis. Hydraulic calculations are included in Appendix C.

TABLE 3: NORMAL DEPTH STREET FLOW ANALYSIS SUMMARY TABLE (100-YEAR)						
Section	**Q (cfs)**	**Slope (%)**	**Velocity (fps)**	**Depth (ft)**	**V x D**	**Tributary Basins**
1	5	0.5%	2.60	0.54	1.40	OND1-A
2	2	0.5%	1.71	0.31	0.53	OND1-B
2B	1	1.2%	1.08	0.13	0.14	OND1-C
3	3	1.1%	2.05	0.29	0.59	OND1-D
4	8	1.5%	3.12	0.38	1.19	OND1-E, OND1-H
5	2	0.5%	2.24	0.34	0.76	OND1-F
6	2	1.5%	2.24	0.36	0.81	OND1-G
7	58	0.5%	4.00	0.98	3.92	CPA, 1/4OND1-I,
8	63	0.6%	4.84	1.23	5.95	CPA, 1/4OND1-I, -A
9	66	0.6%	5.31	1.35	7.17	CPA, 1/2OND1-I, -A, -B
10	67	0.6%	4.72	0.76	3.59	CPA, 1/2OND1-I, -A, -B, -C
11	71	0.6%	5.36	1.38	7.40	CPA, 3/4OND1-I, -A, -B, -C, -D
12	71	0.6%	4.96	1.22	6.05	CPA, 3/4OND1-I, -A, -B, -C, -D
13	80	0.6%	1.81	1.70	3.08	CPA, OND1-I, -A, -B, -C, -D -E, -H
14	82	0.6%	5.24	1.00	5.24	CPA, OND1-I, -A, -B, -C, -D -E ,-H, -F

The product V x D shown in Table 3 has been calculated to show that the flow within the drive aisles meets the Manual requirement to be less than 6 in the 10-year storm event and less than 8 in the 100-year storm event.

FINISHED FLOOR PROTECTION

Finished floors have been set at or above twice the depth of flow in the adjacent streets. Finished floor verification calculations are included in Appendix C. Solid grouted flood walls have been provided to protect the lots whose finished floor elevations are not at or above twice the depth of flow in the Michael Way and at the alley located at the north side of the proposed site. In addition, flood walls with 3 courses of solid grout have been provided to protect the lots adjacent to the drainage easements.

A driveway high point at the north site exit has been provided to protect the site from flows in Michael Way. The water surface elevation in Michael Way at the site exit is 37.96 feet. The driveway high point elevation (40.1 feet) is at least 0.50-foot above the water surface elevation in Michael Way.

A driveway high point at the south site entrance has been provided to protect the site from flows in Michael Way. The water surface elevation in Michael Way at the site is 36.28 feet. The driveway high point elevation (38.24 feet) is at least 0.50-foot above the water surface elevation in Michael Way.

Currently, Michael Way does not meet the 10-year dry lane criteria as presented in the CCRFCD HCCDM. The Northwest Neighborhood Study proposes a 48-inch RCP at this location. Discussion with the City of Las Vegas concerning the 48-inch RCP pipe located in Michael Way is pending, and no facility design is included with this submittal.

Located at the northeast corner, a small portion of the site falls within a FEMA Zone AE. No buildings are in this Zone AE; however, some site grading is required. Per a meeting with Albert Sung P.E. of the City of Las Vegas, a 24.67 feet opening in the wall has been provided. For security reasons, a wrought iron fence at this location will be provided. The intent of the fence is to allow runoff to flow freely, and not raise the water surface elevation at this location.

Flows within Michael Way have the potential to split at the existing alley adjacent to the north side of the proposed site. A Pima County Flow Split calculation included in Appendix C shows that a total of 51 cfs splits and travels east in the alley. Due to the wrought iron fence previously discussed, this flow will enter the site. A wall opening/weir calculation is also included in Appendix C. The flow will continue south through the site along the eastern most drive isle where it will then exit the site at the southeast corner. Finish floor elevations are protected along this isle form the offsite flows by both elevation and by flood walls that provide the required freeboard of twice the depth of flow.

Shown on the Existing Condition Drainage Map, the site drains from the northwest to the southeast of the proposed site. Development does increase the flows entering the adjacent site by 3 cfs. The existing condition flowrate at the southeast corner of the site is 81 cfs and the proposed condition flowrate is 84 cfs. However, this does not significantly increase the flows at this location. Note that the adjacent property to the proposed site, where the site drains, is also owned by Ernest A. Becker Investment Company. Copies of the county assessor information are included in Appendix D. The increase of flow does not represent an increase to the flowrate.

LOW IMPACT DEVELOPMENT (LID) MEASURES

According to the Manual, LID measures must be applied to parking lots for all new non-residential sites of 1-acre and larger in the Las Vegas Valley. The proposed 10-acre development falls within the large parking lot category, and treatment BMPs are required to treat storm water runoff from at least 75 percent of the parking lot.

A landscape swale is proposed to treat storm water runoff. The provided swale is intended to treat runoff from the 85th percentile storm. It was determined that approximately 78% of the site is considered impervious area. Calculations pertaining to LID measures have been included in Appendix C.

Due to site constraints, the LID swale is limited to a length of approximately 85 feet. This is less than the required length for the 10 acres of impervious area that is required by the HCCDM. The calculated velocity of 1.5 fps is sufficient to allow sediment to fall out of the flow. Review of the site has indicated that there are no other areas to capture this flow or to provide the required length of swale.

V. CONCLUSIONS

The proposed Crystal Park Apartments site has been designed to control storm water runoff for the 6-hour, 10-year, and 100-year floods as calculated in this study. This methodology used in this study is compliant with the Criteria established in the Manual.

The proposed development does not adversely impact any proposed or existing CCRFCD MPU facilities. The proposed development does not increase flow rates upstream or downstream of the project, therefore there are no adverse effects on upstream or downstream properties due to the proposed improvements.

REFERENCES

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

2. *Flood Insurance Rate Map*, Community Panel Number 32003C2535F, Clark County, Nevada and Incorporated Areas, effective date November 16, 2011, and is a digital duplication of the FIRM Map derived from the Clark County GIS database.

3. *CCRFCD Las Vegas Valley Flood Control Master Plan Update*, 2008 and 2013.

4. *City of Las Vegas Northwest Neighborhood Study Phase 1*, by PBS&J, dated April 1996.

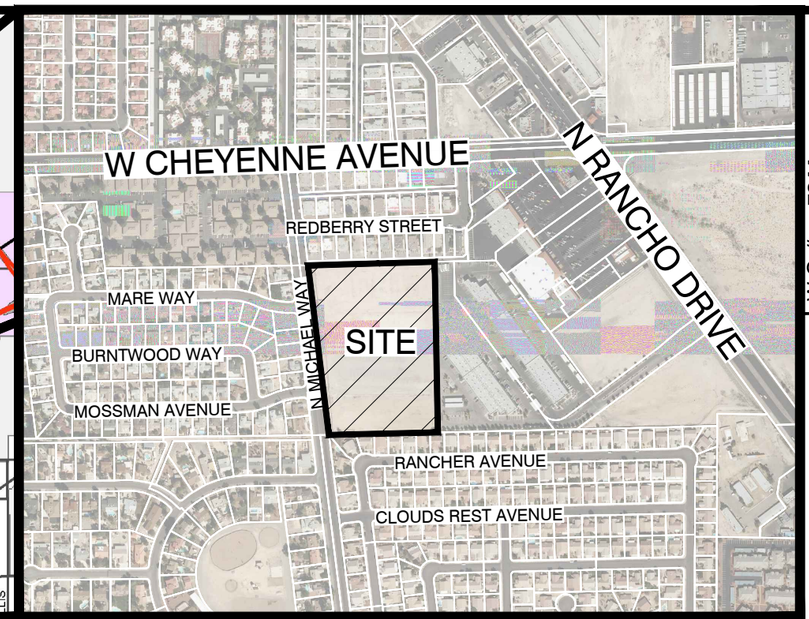
5. *Soil Survey of Las Vegas, Nevada, Part of Clark County*, by the United States Department of Agriculture, Soil Conservation Service.

APPENDIX

APPENDIX A
FIGURES AND EXHIBITS

FIGURE 1
VICINITY MAP
CRYSTAL PARK APARTMENTS

W.O.#:	7844
DATE:	MAY 2017
BY:	ACY
SCALE:	N.T.S
SHEET	1 OF 1



Lone Mountain

North Las Vegas

LAS VEGAS

Winchester

Spring Valley

Paradise Valley

Red Rock Canyon National Recreational Lands

McCARRAN INTERNATIONAL AIRPORT

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

H:\7844\Drainage\A Figures\7844 - Figures 1 and 2.dwg,ayup; May 02, 2017 - 1:40pm



GRAPHIC SCALE

500 0 250 500 1000

1" = 500'

NORTH

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

CRYSTAL PARK APARTMENTS

SITE DESCRIPTION MAP
FIGURE 2

SCALE	HORZ.	1"=500'
	VERT.	N/A
W.O. NO.		7844
DRAWN BY:		ACY
DATE:		MAY 2017
SHEET 1 OF 1		

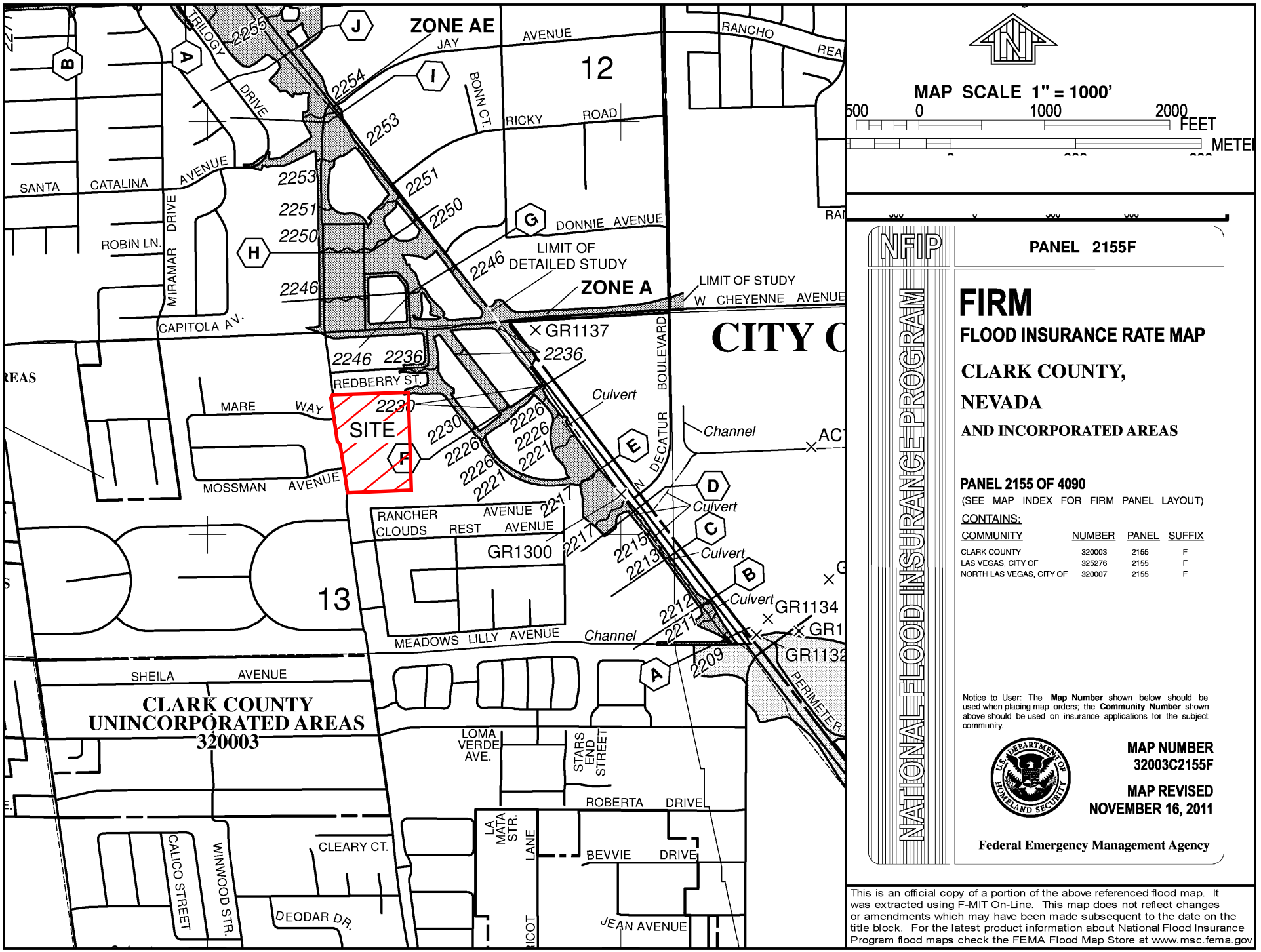

ZONE AE
ZONE A
LIMIT OF DETAILED STUDY
LIMIT OF STUDY
SITE
CITY C
CLARK COUNTY
UNINCORPORATED AREAS
320003
MAP SCALE 1" = 1000'
500 0 1000 2000 FEET
METE
NFIP
NATIONAL FLOOD INSURANCE PROGRAM
PANEL 2155F
FIRM
FLOOD INSURANCE RATE MAP
CLARK COUNTY,
NEVADA
AND INCORPORATED AREAS
PANEL 2155 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)
CONTAINS:
COMMUNITY NUMBER PANEL SUFFIX
CLARK COUNTY 320003 2155 F
LAS VEGAS, CITY OF 325276 2155 F
NORTH LAS VEGAS, CITY OF 320007 2155 F
Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.
MAP NUMBER
32003C2155F
MAP REVISED
NOVEMBER 16, 2011
Federal Emergency Management Agency
This is an official copy of a portion of the above referenced flood map. It was extracted using F-MIT On-Line. This map does not reflect changes or amendments which may have been made subsequent to the date on the title block. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov

FIGURE 3

NOTES

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

No liability is assumed for the accuracy of the data deliniated herein. Information on roads and other non-assessed parcels may be obtained from the Road Document Listing in the Assessor's Office.

This map is compiled from official records, including surveys and deeds, but only contains the information required for assessment. See the recorded documents for more detailed legal information.

USE THIS SCALE(FEET) WHEN MAP REDUCED FROM 11X17 ORIGINAL

0 100 200 400 600 800

MAP LEGEND

ASSESSOR'S PARCELS - CLARK CO., NV.
Michele W. Shafe - Assessor

- PARCEL BOUNDARY
- SUB BOUNDARY
- PM/LD BOUNDARY
- ROAD EASEMENT
- MATCH / LEADER LINE
- HISTORIC LOT LINE
- HISTORIC SUB BOUNDARY
- HISTORIC PM/LD BOUNDARY
- SECTION LINE
- CONDOMINIUM UNIT
- AIR SPACE PCL
- RIGHT OF WAY PCL
- SUB-SURFACE PCL
- 001 ROAD PARCEL NUMBER
- 001 PARCEL NUMER
- 1.00 ACREAGE
- 202 PARCEL SUB/SEQ NUMBER
- PB 24-45 PLAT RECORDING NUMBER
- 5 BLOCK NUMBER
- 5 LOT NUMBER
- GL5 GOV. LOT NUMBER

126	125	124	123
137	138	139	140
164	163	162	161

6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

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

BOOK T20S R60E | SEC. 13 | MAP N 2 NE 4 | 138-13-5

CLARK COUNTY ASSESSOR MAPPING DIVISION NEVADA

Scale: 1" = 200 ' | Rev: 02/09/2011

CHEYENNE AVE
CHARLESTON HEIGHTS
TRACT NO 54-C
PB 10-10
PB 10-11
PB 22-21
REDBERRY ST
HAZELNUT LN
LEASE
TONOPAH PLAZA
PB 28-7
PB 95-52
MICHAEL WAY
US HIGHWAY NO 95
RANCHO DR
DECATUR BLVD
CHEYENNE RANCHO PROFESSIONAL PLAZA
SITE
001 9.97
505
001 21.35
511
512
502
503
510
811
501 PM 128-82
LD 2-83
LD 3-83
002 0.36
002 0.16
001 0.18
001 0.15
002 0.15
003 0.15
004 0.15
006 4.78
008 4.8
007 4.86
005 1.48
004 4.3
002 0.2
PT 1

FIGURE 4a

TAX DIST 250,200

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
FW15		**FREEWAY CHANNEL FROM DESERT INN TO EXPRESSWAY**						
0000	E	3: 12' X 10' RCB	2170	3728	CAL93	SW4	10.63	0.17
GOOF		**GOWAN OUTFALL FACILITIES**						
0485	E	90" RCP	1160	630	DGOW2A	GW3SC	1.38	0.47
0486	E	8' X 5' RCB	3300	630	DGOW2A	GW3SC	1.38	0.60
0511	E	8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50
LAAS		**NORTH LAS VEGAS AIR TERMINAL - SIMMONS**						
0000	E	14' X 6' RCB	760	698	CR2-CA	NW3	2.57	0.80
0014	E	12' X 6' RCB	1350	698	CR2-CA	NW3	2.57	1.12
0040	E	10' X 6' RCB	2105	698	CR2-CA	NW3	2.57	1.50
0080	E	66" RCP	157	285	R-C	NW3	0.27	1.10
0083	E	60" RCP	620	285	R-C	NW3	0.27	1.40
0095	E	54" RCP	400	285	R-C	NW3	0.27	1.44
0103	E	48" RCP	405	285	R-C	NW3	0.27	1.75
LAAT		**NORTH LAS VEGAS AIR TERMINAL**						
0000	E	3: 8' X 5' RCBC	650	1331	CB3-1	NW3	4.17	0.50
0006	E	Conc Chnl 20'W 8'D 1.5:1 SS	380	1331	CB3-1	NW3	4.17	0.50
0014	E	10' X 6' RCB	934	1331	CB3-1	NW3	4.17	1.84
0031	E	10' X 6' RCB	1618	1079	CB3-2	NW3	3.87	1.05
0062	E	12' X 8' RCB	511	1079	CB3-2	NW3	3.87	0.50
0070	E	12' X 6' RCB	376	1079	CB3-2	NW3	3.87	0.56
0078	E	10' X 6' RCB	1055	1079	CB3-2	NW3	3.87	0.58
0098	E	10' X 4' RCB	2207	677	CCA1-C	NW3	3.08	0.60
0140	E	Conc Chnl 6'W 4'D 1.5:1 SS	338	677	CCA1-C	NW3	3.08	0.64
0146	E	Conc Chnl 6'W 3'D 1.5:1 SS	1388	677	CCA1-C	NW3	3.08	0.68
0172	E	76" X 48" HERCP	536	480	CA1-C	NW3	2.87	0.75
0182	E	Conc Chnl 6'W 3'D 1.5:1 SS	997	480	CA1-C	NW3	2.87	0.83
0201	E	Conc Chnl 6'W 3'D 1.5:1 SS	184	294	A1-C1	NW3	0.31	0.37
0204	E	76" X 48" RCP	425	294	A1-C1	NW3	0.31	0.37
LANO		**NORTH LAS VEGAS AIR TERMINAL NORTH**						
0000	E	Conc Chnl 0'W 3'D 1.5:1 SS	470	294	A1-C1	NW3	0.31	0.30
LCCH		**LAS VEGAS CREEK CHANNEL**						
0000	E	2: 12' X 7' RCB	730	2894	CLC20-C	MEADOWS4	9.68	1.28
0013	E	2: 12' X 6' RCB	2035	2894	CLC20-C	MEADOWS4	9.68	0.82
0051	E	2:14' X 7' RCB	3113	2894	CLC20-C	MEADOWS4	9.68	0.60
0110	E	Transition Structure	220	2798	CCLC16-C	MEADOWS4	9.51	
0114	E	2: 14' X 7' RCB	670	2329	CRMEDET	MEADOWS4	8.25	0.80
0127	E	Transition Structure	110	2329	CRMEDET	MEADOWS4	8.25	
0129	E	2: 14' X 7' RCB	1130	2329	CRMEDET	MEADOWS4	8.25	0.50
0150	E	2: 13' X 7' RCB	200	2329	CRMEDET	MEADOWS4	8.25	0.95
0154	E	Transition Structure	190	2329	CRMEDET	MEADOWS4	8.25	
0157	E	2: 12' X 6' RCB	1650	1631	CCLC14-C	SW3	2.99	1.06
0188	E	2: 12' X 6' RCB	2225	1631	CCLC14-C	SW3	2.99	1.36
0230	E	12' X 6' RCB	2140	1381	CLC14-C	SW3	2.54	1.74
0270	E	12' X 6' RCB	1705	774	CCWA02-C	SW3	1.84	0.54
0302	E	8' X 6' RCB	3940	774	CCWA02-C	SW3	1.84	2.49
0377	E	10' X 7' RCB	1226	774	CCWA02-C	SW3	1.84	0.74
0400	E	Transition Structure	110	437	CWA02-C	SW3	1.47	0.49
0402	E	8' X 6' RCB @ Jones	535	437	CWA02-C	SW3	1.47	0.49
0412	E	60" RCP	1370	437	CWA02-C	SW3	1.47	1.08
0438	E	60" RCP	1090	162	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1060	162	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
LCDE		**LAS VEGAS CREEK - DECATUR**						
0000	E	6' X 5' RCB	1800	404	LC11-C	SW3	0.38	1.26
0034	E	72" RCP	700	404	LC11-C	SW3	0.38	0.50

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LCJO		**LAS VEGAS CREEK - JONES**						
0000	E	6' X 6' RCB	380	358	AL01B-C	SW3	0.37	0.50
0007	E	6' X 5' RCB	675	358	AL01B-C	SW3	0.37	0.62
LCLT		**LAS VEGAS CREEK - LATERAL**						
0000	E	6' X 6' RCB	490	250	WA10D	SW3	0.45	0.50
0006	E	Conc Chnl 10'W 4'D 0:1 SS	1364	250	WA10D	SW3	0.45	0.50
0033	E	10' X 4' RCBC @ Washington	96	405	WA10-C	NW3	0.45	0.50
0034	E	Grass Chnl 12'W 5'D 1:1 SS	1750	405	WA10-C	SW3	0.45	0.20
LCME		**LAS VEGAS CREEK - MEADOWS**						
0000	E	14' X 8' RCB	895	1423	MEADOWDB	SW3SC	5.67	0.72
0016	E	Stilling Basin	140	1423	MEADOWDB	SW3SC	5.67	0.21
0017	E	3,300 cfs Spillway (Replace w/ LCME0018)		3300	MEADOWIN	SW3SC	5.67	
0018	P1	Modify Spillway, raise height by 1' (Replaces LCME0017)		3300	MEADOWIN	SW3SC	5.67	
0019	E	1: 11' X 5' RCB and 1: 11.5' X 5' RCB	110	1423	MEADOWDB	SW3SC	5.67	0.81
0020	E	213 ac-ft Meadows Detention Basin		4713	MEADOWIN	SW3SC	5.67	
0021	P1	Upgrade to 235 ac-ft Meadows Detention Basin		4713	MEADOWIN	SW3SC	5.67	
LCRA		**LAS VEGAS CREEK - RANCHO**						
0000	E	12' X 8' RCB	380	783	CLC16-C	SW3	1.71	0.60
0004	E	12' X 6' RCB	2367	783	CLC16-C	SW3	1.71	0.77
0050	E	8' X 6' RCB	355	526	WA13D	SW3	1.40	0.50
LMDE		**LAKE MEAD BOULEVARD - DECATUR BRANCH**						
0000	P1	10' X 5' RCB	2640	665	DCVG04-C	NW3	1.26	0.90
LV15		**FREEWAY CHANNEL**						
0316	E	11' X 6' RCB	3010	985	CWA20-C	NW3	4.46	0.59
0372	E	9' X 6' RCB	1970	985	CWA20-C	NW3	4.46	0.66
0409	E	7' X 6' RCB	815	542	CWA15A-C	NW3	3.67	0.91
0424	P1	8' X 6' RCB	2500	542	CWA15A-C	NW3	3.67	0.73
0472	P1	2: 66" RCP	1200	265	WA15A-C	NW3	0.37	0.42
0474	P1	8' X 6' RCB	2880	322	CCWA13-C	NW3	3.29	0.73
0528	P1	8' X 7' RCB	4420	869	CWA13-C	NW3	1.39	1.19
0602	P1	2: 66" RCP	5980	504	CWA09-C	NW3	0.61	1.59
LVLM		**LAS VEGAS WASH - LAKE MEAD**						
0033	E	60" RCP (Replace w/ LVLM0034)	1186	994	CLM20-C	NW3SC	1.36	1.62
0034	P0	12' X 5' RCB (Replaces LVLM0033)	1186	994	CLM20-C	NW3SC	1.36	1.62
0059	E	72" RCP (Replace w/ LVLM0060)	5952	994	CLM20-C	NW3SC	1.36	0.66
0060	P0	12' X 6' RCB (Replaces LVLM0059)	5952	994	CLM20-C	NW3SC	1.36	0.66
0170	E	78" RCP	2421	378	CLM16A-C	NW3SC	0.38	1.17
0221	E	48" RCP Outlet	270	168	DR2	NW4	11.78	
0222	E	48" RCP Outlet	500	208	DCAREY	NW4	11.78	
0224	E	36" RCP	2429					0.53
0225	E	90" RCP (Replace w/ LVLM0226)	641	1933	CLM10-C	NW3	3.02	1.35
0226	P0	2: 10' X 8' RCB (Replaces LVLM0225)	641	1933	CLM10-C	NW3	3.02	0.50
0227	E	10,000 cfs PMF Spillway		10000	CARYLMIN	NW4	11.78	
0228	E	607 ac-ft Carey-Lake Mead Detention Basin		5184	CARYLMIN	NW4	11.78	
0270	E	90" RCP (Replace w/ LVLM0271)	3473	1933	CLM10-C	NW3	3.02	1.35
0271	P0	12' X 8' RCB (Replaces LVLM0270)	3473	1933	CLM10-C	NW3	3.02	1.35
0336	E	84" RCP (Replace w/ LVLM0337)	1050	1652	CLM06-C	NW3	2.61	1.16
0337	P0	12' X 8' RCB (Replaces LVLM0336)	1050	1652	CLM06-C	NW3	2.61	1.16
0355	E	90" RCP (Replace w/ LVLM0356)	1840	1652	CLM06-C	NW3	2.61	0.40
0356	P0	12' X 11' RCB (Replaces LVLM0355)	1840	1652	CLM06-C	NW3	2.61	0.40
0388	E	84" RCP	520	852	CLM05-C	NW3	1.00	1.40
0399	E	78" RCP	803	852	CLM05-C	NW3	1.00	1.07
0416	E	72" RCP	1320	852	CLM05-C	NW3	1.00	1.00
0442	E	60" RCP	725	565	CLM03-C	NW3	0.63	1.28
0453	E	54" RCP	589	565	CLM03-C	NW3	0.63	2.37
0460	E	54" RCP	1464	235	LM02-C	NW3	0.29	2.05
0475	E	48" RCP	2632	235	LM02-C	NW3	0.29	1.24
0525	E	48" RCP	2600	542	CLM01-C	NW3	0.64	1.24
LVOE		**OWENS AVENUE - EAST**						
0345	P1	13' X 11' RCB	1685	2369	DLVOE	SW5	22.79	0.60

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
LVOW		**OWENS AVENUE SYSTEM**						
0003	E	96" RCP	7500	1089	CLM16B-C	NW3	2.40	0.70
0146	E	84" RCP	4800	570	DCVG20-C	NW3	2.02	0.90
0241	E	66" RCP	5800	381	CVG20-C	NW3	1.57	1.40
0351	E	8' X 6' RCB	3000	829	CVG04-C	NW3	1.26	1.44
0360	P1	8' X 6' RCB	2300	829	CVG04-C	NW3	1.26	1.48
0460	P1	7' X 6' RCB	2700	616	CVG03-C	NW3	0.95	1.48
LVPK		**PEAK DRIVE SYSTEM**						
0000	E	Conc Chnl 15'W 6'D 0:1 SS	606	1024	CPD04B-C	NW3	1.59	1.22
0019	E	Conc Chnl 20'W 5.5'D 0:1 SS	2190	1024	CPD04B-C	NW3	1.59	0.57
0056	E	10' X 5' RCB	103	703	CCY04A-C	NW3	1.12	0.40
0058	E	9' X 6' RCB	2542	703	CCY04A-C	NW3	1.12	0.95
0104	E	10' X 6' RCB	76	703	CCY04A-C	NW3	1.12	1.26
0106	E	8' X 6' RCB	1235	703	CCY04A-C	NW3	1.12	0.54
0130	E	7' X 5' RCB	1435	400	CPD01-C	NW3	0.67	0.61
LVRA		**LAS VEGAS WASH - RANCHO**						
0000	E	12' X 8' RCB	612	1317	CCPD04BC	NW3	3.87	1.56
0012	E	12' X 8' RCB	2838	1317	CCPD04BC	NW3	3.87	0.78
0066	E	14' X 5' RCB	65	1317	CCPD04BC	NW3	3.87	1.22
LVSR		**LAS VEGAS WASH - SMOKE RANCH**						
0045	E	54" RCP (Replace w/ LVSR0046)	1180	1244	CS1-C	NW3SC	1.42	3.41
0046	P1	10' X 5' RCB (Replaces LVSR0045)	1180	1244	CS1-C	NW3SC	1.42	3.41
0070	E	66" RCP (Replace w/ LVSR0071)	4118	1244	CS1-C	NW3SC	1.42	0.73
0071	P1	10' X 9' RCB (Replaces LVSR0070)	4118	1244	CS1-C	NW3SC	1.42	0.73
0148	E	54" RCP (Replace w/ LVSR0149)	2587	951	CS	NW3SC	0.95	0.58
0149	P1	11' X 7' RCB (Replaces LVSR0148)	2587	951	CS	NW3SC	0.95	0.58
0197	E	30" RCP (Replace w/ LVSR0198)	581	445	CR2-C	NW3SC	0.38	0.86
0198	P1	8' x 5' RCB (Replaces LVSR0197)	581	445	CR2-C	NW3SC	0.38	0.86
0208	E	54" RCP (Replace w/ LVSR0209)	2060	445	CR2-C	NW3SC	0.38	1.41
0209	P1	7' X 5' RCB (Replaces LVSR0208)	2060	445	CR2-C	NW3SC	0.38	1.41
0210	E	14' X 8' RCB	800	2889	CB1-C	NW3	6.44	1.73
0221	E	Transition Structure	100	2889	CB1-C	NW3	6.44	7.08
0223	E	Conc Chnl 14'W 8'D 1.5:1 SS	2150	2889	CB1-C	NW3	6.44	0.96
0263	E	14' X 8' RCB	707	2889	CB1-C	NW3	6.44	0.63
0273	E	11' X 11' RCB	1140	2889	CB1-C	NW3	6.44	0.92
0295	E	11' X 11' RCB	510	2683	CCSR05B	NW3	6.16	2.85
0312	E	8' X 8' RCB	460	1607	CSR05B	NW3	2.30	1.63
0359	E	66" RCP (Replace w/ LVSR0360)	1690	1607	CSR05B	NW3	2.30	0.67
0360	P1	10' X 10' RCB (Replaces LVSR0359)	1690	1607	CSR05B	NW3	2.30	0.75
0396	E	60" RCP (Replace w/ LVSR0397)	2640	1461	CSR05D	NW3	1.94	1.14
0397	P1	10' X 9' RCB (Replaces LVSR0396)	2640	1461	CSR05D	NW3	1.94	0.87
0446	E	54" RCP (Replace w/ LVSR0447)	2530	1461	CSR05D	NW3	1.94	1.14
0447	P1	10' X 8' RCB (Replaces LVSR0446)	2530	1461	CSR05D	NW3	1.94	1.25
0496	P1	10' X 7' RCB	2855	1245	CSR02E	NW3	1.64	1.27
0500	E	60" RCP	1290					1.97
0525	E	54" RCP	1340					0.30
0546	P1	8' X 8' RCB	2640	758	CSR00A	NW3	1.01	0.57
LVWH		**WASHINGTON AVENUE CHANNEL**						
0431	E	3: 14.33' X 10' RCB	665	2870	DCLC21	SW5	22.79	0.15
0446	E	Junction Structure	69	2870	DCLC21	SW5	22.79	0.15
0447	E	3: 14.33' X 10' RCB	1955	4978	CCAL93	SW5	22.19	0.15
0484	E	Confluence Structure	455	4978	CCAL93	SW5	22.19	0.15
WAGC		**WASHINGTON AVENUE CHANNEL - GRAND CENTRAL**						
0000	E	2: 12' X 4' RCB	700	557	LC21	SW3	0.60	0.20
0014	E	1: 12' X 4' RCB and 1: 11' X 4' RCB	2440	557	LC21	SW3	0.60	0.20

** 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).

REGIONAL FLOOD CONTROL DISTRICT

2013 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY
FIGURE F - 26

LEGEND

ID (Facility Identifier) AABB
- Parent Stream Name
- Stream Name

River Mile 0000
- Distance Above Confluence with Parent Stream (Miles)
- Miles in Hundredths

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

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

Construction Features

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

FIGURE 4b

REGIONAL FLOOD CONTROL DISTRICT

2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F- 26

FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain

N

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

Scale: 1 inch = 2,000 feet

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

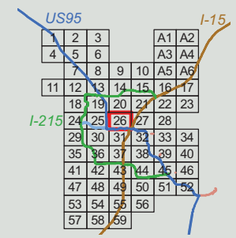
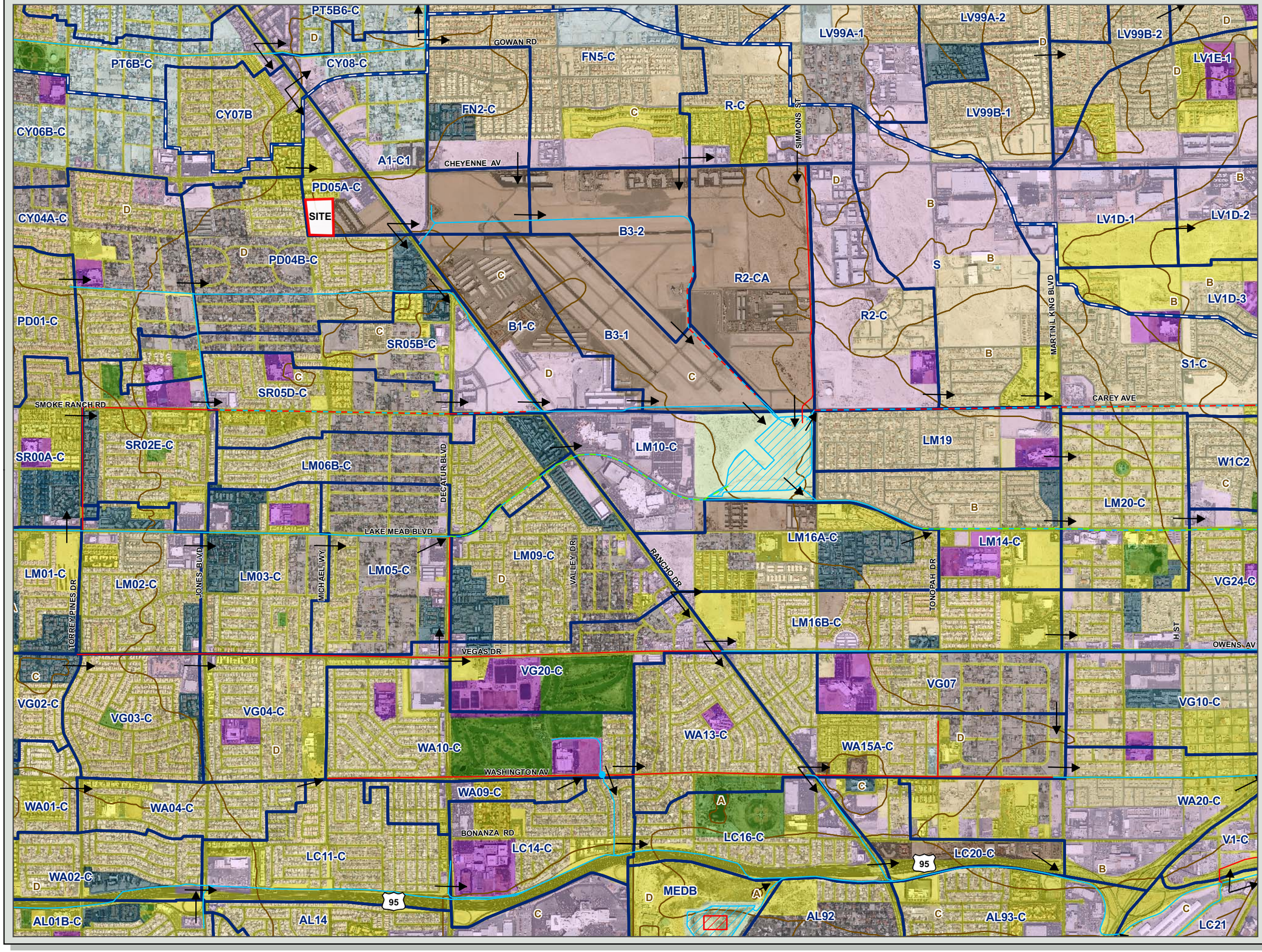


FIGURE 4b



REGIONAL FLOOD CONTROL DISTRICT

2008
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE H- 26
HYDROLOGIC SUMMARY

LEGEND

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

Flood Control Facilities

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

Type Hydrologic Soil Groups

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

Typical Land Use

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

* Drought Ordinance Applied

N

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

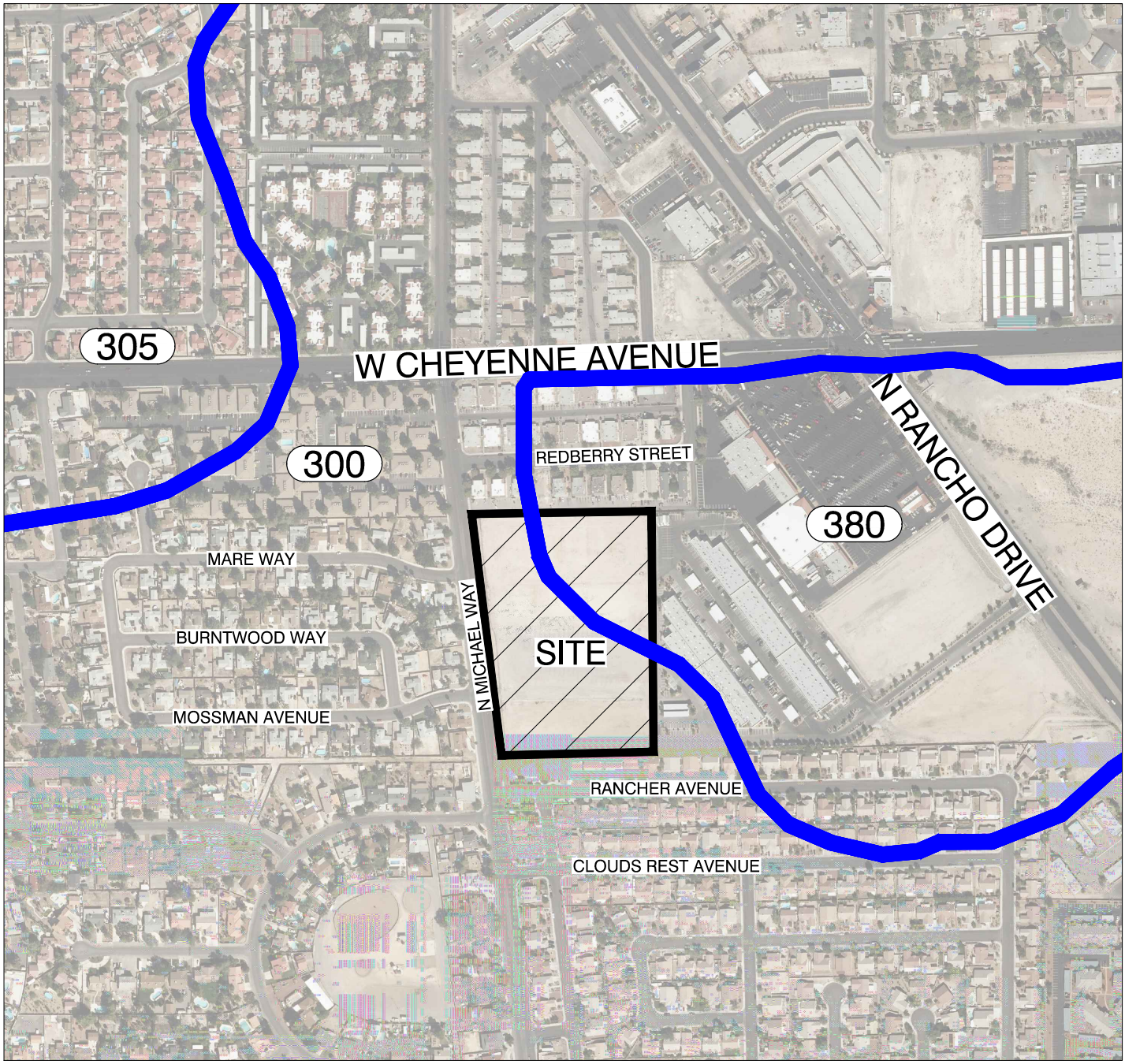
Scale: 1 inch = 2,000 feet

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

		1	2	3								
		4	5	6								
			7	8	9	10						
	11	12	13	14	15	16	17					
		18	19	20	21	22	23					
		24	25	26	27	28						
		29	30	31	32	33	34					
		35	36	37	38	39	40					
		41	42	43	44	45	46					
		47	48	49	50	51	52					
		53	54	55	56							
		57	58	59								

PBS&J PB

FIGURE 4c



LEGEND

SITE BOUNDARY

300 SOIL NUMBER

SOIL BOUNDARY

NOTE:
1. This data was taken from the following website: http://soildatamart.nrcs.usda.gov
2. This data is in state plane coordinates

NORTH

GRAPHIC SCALE

500 0 250 500 1000

1" = 500'

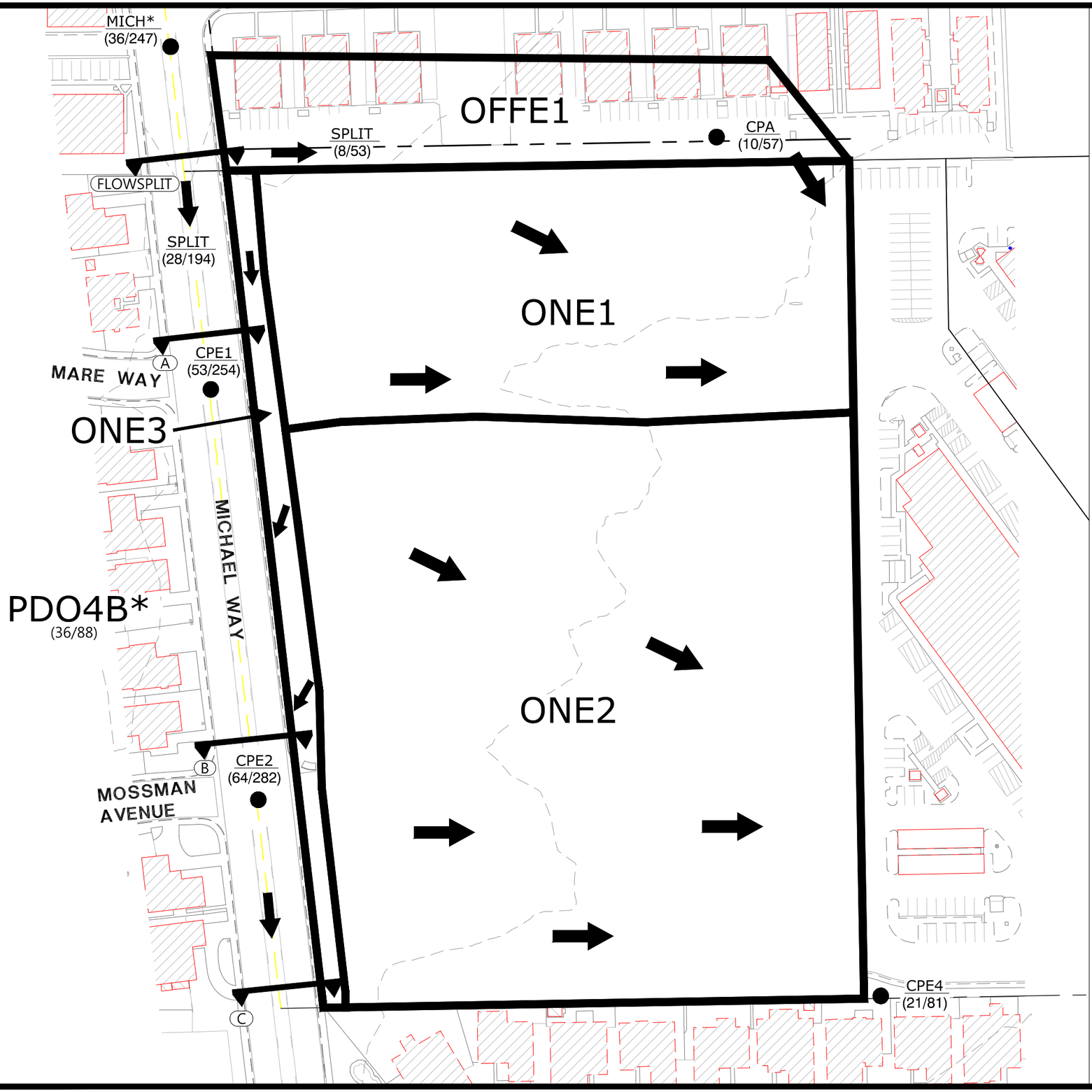
H:\7844\Drainage\A Figures\Figure 5 - Soils Map.dwg

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

FIGURE 5
SOILS MAP

CRYSTAL PARK APARTMENTS

SCALE	HORZ.	1"=500'
	VERT.	n/a
W.O. NO.		7844
DRAWN BY:		SPT
DATE:		JULY 2017
SHEET		OF



LEGEND

CP-1	CONCENTRATION POINT
ON1-D	DRAINAGE BASIN
	FLOW ARROW
FM1 FM1	NORMAL DEPTH SECTION

EXISTING CONDITION HEC-1 SUMMARY

Basin	Area (ac)	Q100	Q10
OFFE1	1.31	4	2
CPA	-	57	10
ONE1	3.02	8	4
ONE2	6.46	17	7
CPE4	-	81	21
ONE3	0.48	1	1

STREET FLOW ANALYSIS SUMMARY TABLE (10-YEAR)

Section	Q (cfs)	Slope (%)	Velocity (fps)	Depth (ft)	V x D
A	28	1.2%	3.38	0.54	1.83
B	53	0.4%	2.66	0.73	1.94
C	64	0.5%	3.07	0.75	2.30

STREET FLOW ANALYSIS SUMMARY TABLE (100-YEAR)

Section	Q (cfs)	Slope (%)	Velocity (fps)	Depth (ft)	V x D
A	194	1.2%	5.80	0.91	5.28
B	254	0.4%	4.71	1.16	5.46
C	282	0.5%	5.29	1.16	6.14

NORTH

GRAPHIC SCALE

100 0 50 100 200

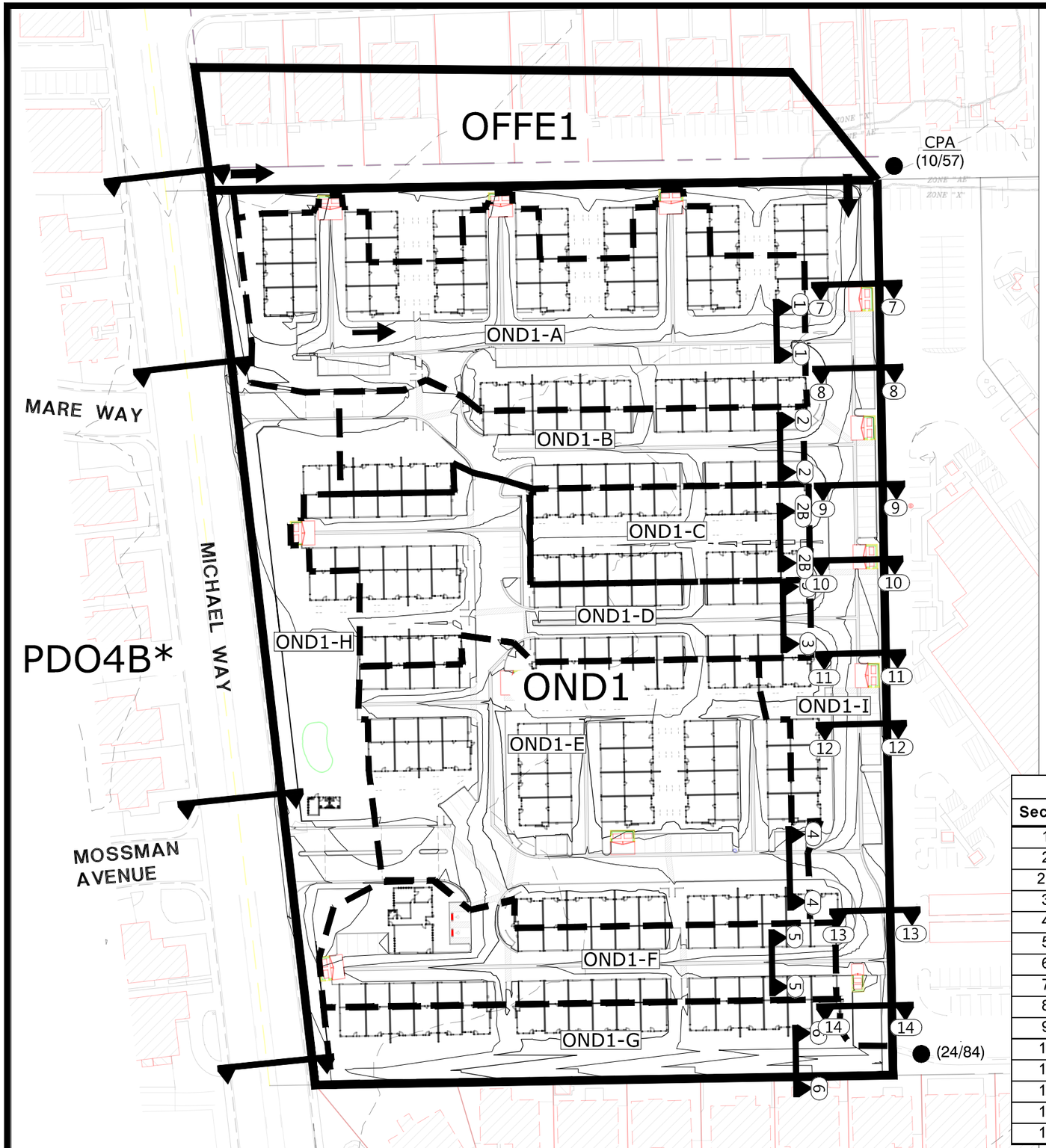
1" = 100'

W.O.#: 7844
DATE: SEPT 2017
BY: JYA
SCALE: 1" = 100'
SHEET OF

CRYSTAL PARK APARTMENTS
FIGURE 6: EXISTING CONDITION DRAINAGE MAP

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

H:\7844\Drainage\A Figures\7844 - Drainage Basin Maps.dwg;jayson; Sep 26, 2017 - 3:58pm



LEGEND

CP-1	CONCENTRATION POINT
OND-1	DRAINAGE BASIN
FM1 — FM1	FLOW ARROW
	NORMAL DEPTH SECTION
OND1-A	DRAINAGE SUB-BASIN

GRAPHIC SCALE

100 0 50 100 200

1" = 100'

DEVELOPED CONDITION HEC-1 SUMMARY

Basin	Area	Q100 (CFS)	Q10 (CFS)
OFFE1	1.31	4	2
CPA	-	57	10
ON1D	9.96	27	14

PRORATED SUBBASIN SUMMARY

BASIN	AREA		Q100	Q10
OND1	10.0		27	14
SUB BASIN	SUB AREA	SUB AREA	SUB Q100	SUB Q10
OND1-A	1.7	17%	5	2
OND1-B	0.7	7%	2	1
OND1-C	0.5	5%	1	1
OND1-D	1.0	10%	3	1
OND1-E	1.9	19%	5	3
OND1-F	0.8	8%	2	1
OND1-G	0.7	7%	2	1
ON1-H	0.9	9%	3	1
ON1-I	1.7	17%	5	2
TOTAL	10.0	100%	27	14

STREET FLOW ANALYSIS SUMMARY TABLE (100-YEAR)

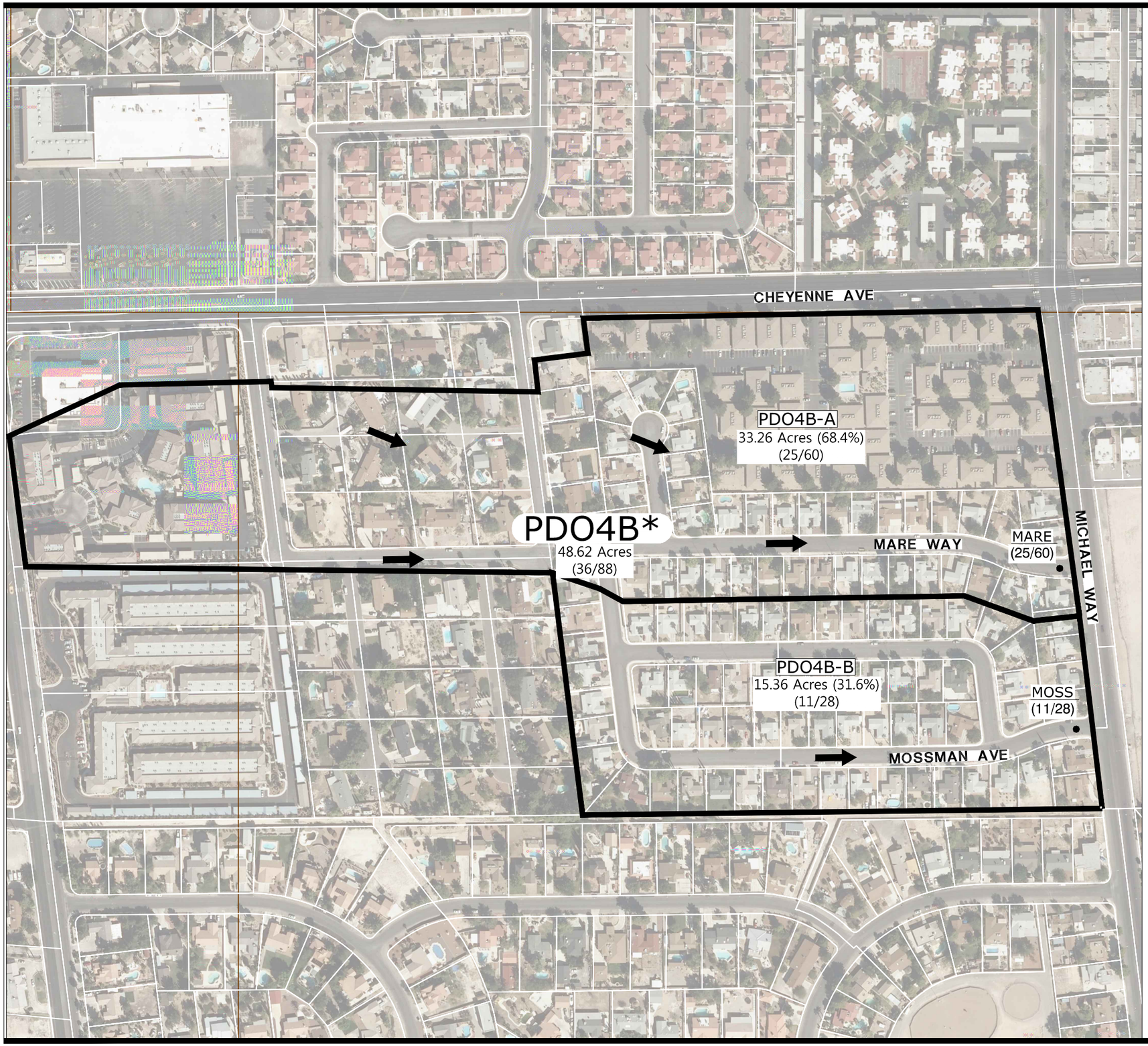
Section	Q (cfs)	Slope (%)	Velocity (fps)	Depth (ft)	V x D	Tributary Basins
1	5	0.5%	2.60	0.54	1.40	OND1-A
2	2	0.5%	1.71	0.31	0.53	OND1-B
2B	1	1.2%	1.08	0.13	0.14	OND1-C
3	3	1.1%	2.05	0.29	0.59	OND1-D
4	8	1.5%	3.12	0.38	1.19	OND1-E, OND1-H
5	2	0.5%	2.24	0.34	0.76	OND1-F
6	2	1.5%	2.24	0.36	0.81	OND1-G
7	58	0.5%	4.00	0.98	3.92	CPA, 1/4OND1-I,
8	63	0.6%	4.84	1.23	5.95	CPA, 1/4OND1-I, -A
9	66	0.6%	5.31	1.35	7.17	CPA, 1/2OND1-I, -A, -B
10	67	0.6%	4.72	0.76	3.59	CPA, 1/2OND1-I, -A, -B, -C
11	71	0.6%	5.36	1.38	7.40	CPA, 3/4OND1-I, -A, -B, -C, -D
12	71	0.6%	4.96	1.22	6.05	CPA, 3/4OND1-I, -A, -B, -C, -D
13	80	0.6%	1.81	1.70	3.08	CPA, OND1-I, -A, -B, -C, -D -E, -H
14	82	0.6%	5.24	1.00	5.24	CPA, OND1-I, -A, -B, -C, -D -E ,-H, -F

W.O.#: 7844
DATE: SEPT 2017
BY: JYA
SCALE: 1" = 100'
SHEET OF

CRYSTAL PARK APARTMENTS
FIGURE 7: DEVELOPED CONDITION DRAINAGE MAP

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

H:\7844\Drainage\A Figures\7844 - Drainage Basin Maps.dwg;jayson; Sep 26, 2017 - 5:23pm



LEGEND

- CP-1 — CONCENTRATION POINT
- ON1-D — DRAINAGE BASIN
- FLOW ARROW
- ON1-D — DRAINAGE SUB-BASIN

GRAPHIC SCALE

250 0 125 250 500

1" = 250'

W.O.#:	7844
DATE:	AUGUST 2017
BY:	ACY
SCALE:	1" = 250'
SHEET	OF

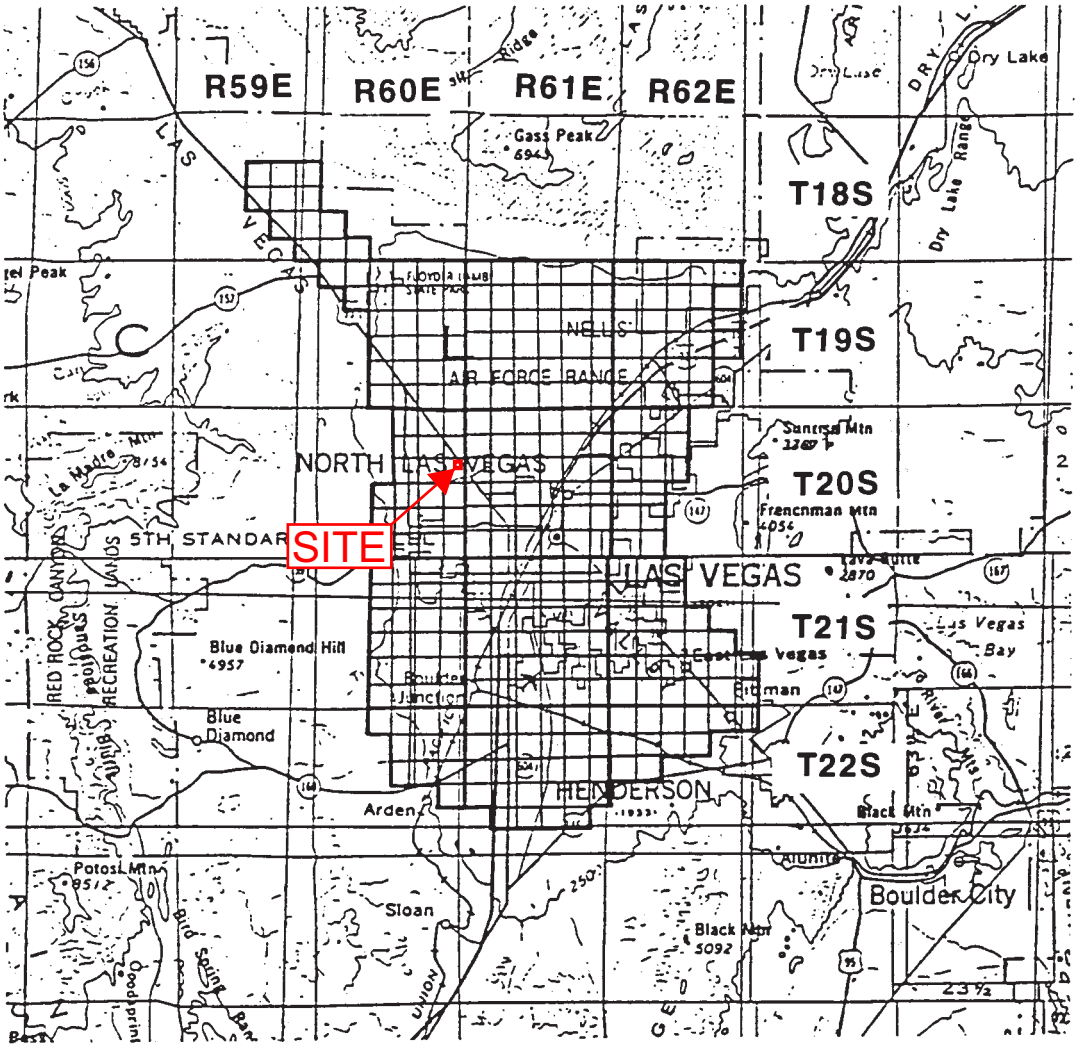
CRYSTAL PARK APARTMENTS
FIGURE 8: REFERENCE BASIN PDO4B FROM NORTHWEST NEIGHBORHOOD MASTER STUDY

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NV 89146-5148

APPENDIX B
HYDROLOGIC CALCULATIONS

RAINFALL INFORMATION

McCARRAN AIRPORT RAINFALL AREA



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

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

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

RAINFALL CALCULATIONS

CONDITION: Crystal Park
WO#: 7844

The project site is included in the McCarran Airport Rainfall Area as shown by Figure 513 in the Hydrologic Criteria and Drainage Design Manual. Rainfall depths were taken from Table 505 for the 6-hour 10-year and 100-year Recurrence Interval in the Hydrologic Criteria and Drainage Design Manual.

STREET INTERSECTION	TOWNSHIP	RANGE	SECTION
Cheyenne Avenue Michael Drive	*T20 South*	*R60 East*	*13*

STORM EVENT	RAINFALL DEPTH (IN)	RATIO TO NOAA ATLAS 2 ADJUSTMENT RATIO	DESIGN DEPTH (IN)
10-YEAR	1.58	1	1.58
100-YEAR	2.77	1	2.77

10-YEAR/100-YEAR DESIGN RAINFALL DEPTH RATIO: 0.57

CURVE NUMBER INFORMATION



Map Scale: 1:8,930 if printed on A landscape (11" x 8.5") sheet.

N

Meters: 0 100 200 400 600

Feet: 0 400 800 1600 2400

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

MAP LEGEND

Area of Interest (AOI)

- Area of Interest (AOI)

Soils

- Soil Map Unit Polygons
- Soil Map Unit Lines
- Soil Map Unit Points

Special Point Features

- Blowout
- Borrow Pit
- Clay Spot
- Closed Depression
- Gravel Pit
- Gravelly Spot
- Landfill
- Lava Flow
- Marsh or swamp
- Mine or Quarry
- Miscellaneous Water
- Perennial Water
- Rock Outcrop
- Saline Spot
- Sandy Spot
- Severely Eroded Spot
- Sinkhole
- Slide or Slip
- Sodic Spot
- Spoil Area
- Stony Spot
- Very Stony Spot
- Wet Spot
- Other
- Special Line Features

Water Features

- Streams and Canals

Transportation

- Rails
- Interstate Highways
- US Routes
- Major Roads
- Local Roads

Background

- Aerial Photography

MAP INFORMATION

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

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 11, Sep 16, 2016

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

Date(s) aerial images were photographed: May 7, 2011—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.

Map Unit Legend

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	**Map Unit Name**	**Acres in AOI**	**Percent of AOI**
300	Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes	278.5	67.0%
305	Las Vegas-DeStazo complex, 0 to 2 percent slopes	51.9	12.5%
380	Skyhaven very fine sandy loam, 0 to 4 percent slopes	85.5	20.6%
Totals for Area of Interest		**415.9**	**100.0%**

Las Vegas Valley Area, Nevada, Part of Clark County

300—Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes

Map Unit Setting

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

Map Unit Composition

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

Description of Las Vegas

Setting

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

Typical profile

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

Properties and qualities

Slope: 0 to 2 percent
Depth to restrictive feature: 3 to 14 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 85 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 12.0
Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified
Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 11, Sep 16, 2016

Las Vegas Valley Area, Nevada, Part of Clark County

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

Map Unit Setting

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

Map Unit Composition

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

Description of Las Vegas

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: D
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

Description of Destazo

Setting

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

Typical profile

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

Properties and qualities

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

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7e
Hydrologic Soil Group: C
Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)
Hydric soil rating: No

Minor Components

Glencarb

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: LOAMY BOTTOM (030XB020NV)
Hydric soil rating: No

Bluepoint

Percent of map unit: 5 percent
Landform: Fan piedmonts, sand sheets

Down-slope shape: Convex, linear
Across-slope shape: Convex, linear
Other vegetative classification: LIMY SAND 5-7" P.Z. (030XB037NV_2)
Hydric soil rating: No

Skyhaven

Percent of map unit: 5 percent
Landform: Alluvial flats
Down-slope shape: Linear
Across-slope shape: Linear
Other vegetative classification: SHALLOW LIMESTONE SLOPE 5-8 P.Z. (030XB030NV_2)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 11, Sep 16, 2016

Las Vegas Valley Area, Nevada, Part of Clark County

380—Skyhaven very fine sandy loam, 0 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrbz
Elevation: 1,800 to 2,300 feet
Mean annual precipitation: 4 to 6 inches
Mean annual air temperature: 63 to 68 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Skyhaven

Setting

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

Typical profile

H1 - 0 to 1 inches: very fine sandy loam
H2 - 1 to 8 inches: clay loam
H3 - 8 to 37 inches: gravelly silty clay loam
H4 - 37 to 41 inches: indurated

Properties and qualities

Slope: 0 to 4 percent
Depth to restrictive feature: 24 to 39 inches to petrocalcic
Natural drainage class: Well drained
Runoff class: Very high
Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 90 percent
Gypsum, maximum in profile: 5 percent
Salinity, maximum in profile: Moderately saline to strongly saline (8.0 to 16.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 13.0
Available water storage in profile: Low (about 5.5 inches)

Interpretive groups

Land capability classification (irrigated): 3e
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: C

Other vegetative classification: SHALLOW LIMESTONE SLOPE 5-8 P.Z. (030XB030NV_2)
Hydric soil rating: No

Data Source Information

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County
Survey Area Data: Version 11, Sep 16, 2016

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

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

See Table 602A

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

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

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS - 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

CURVE NUMBERS FOR SOILS

Soil #300 Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes					
Soil	Percent	Group	Commercial$_1$	Impervious$_2$	Newly Graded Area$_3$
Las Vegas	100%	D	95	98	94
Total	**100%**		**95**	**98**	**94**

Soil #380 Skyhaven very fine sandly loam, 0 to 4 percent slopes					
Soil	Percent	Group	Commercial$_1$	Impervious$_2$	Newly Graded Area$_3$
Skyhaven	100%	C	94	98	91
Total	**100%**		**94**	**98**	**91**

Notes:
1-Referenced Clark County's HCDDM Table 602 (1 of 4) Commercial and Business, and Table 602A
2-Referenced Clark County's HCDDM Table 602 (1 of 4) Impervious areas
3-Referenced Clark County's HCDDM Table 602 (1 of 4) Newly graded areas

Curve Number calculations for basins

Basin	Type	Soil #300	Soil #380	CN Value
EXISTING CONDITION				
ONE1	Newly Graded Area	33%	67%	**92**
ONE2	Newly Graded Area	14%	86%	**91**
ONE3	Newly Graded Area	100%		**94**
OFFE1	Res. < 6,000 sq ft lot	36%	64%	**94**
DEVELOPED CONDITION				
OND1	Res. < 6,000 sq ft lot	70%	30%	**95**
OFFE1	Res. < 6,000 sq ft lot	36%	64%	**94**

NOTE: Single Family Residential with less than 6,000 square feet average lot size - use Commercial CN

TRAVEL TIME CALCULATIONS

TRAVEL TIME CALCULATIONS

DEVELOPMENT: Crystal Park Apartments
W.O. # 7844 **CALCULATED BY:** ACY

$$Velocity = CS^{1/2}$$

C1 applies to the first 500 feet of travel distance
C2 applies to the remaining travel distance

Existing:		Developed	
C1=14.8	C2=29.4	C1=20.2	C2=30.6

					First 500 feet		Remaining Travel Distance	
Basin	**Length** (ft)	**High Elev** (ft)	**Low Elev** (ft)	**Slope** (ft/ft)	**C1**	**V1** (fps)	**C2**	**V2** (fps)
EXISTING CONDITION								
ONE1	630	2239	2234	0.008	14.8	1.3	29.4	2.7
ONE2	740	2240	2231	0.012	14.8	1.6	29.4	3.2
ONE3	462	2240	2237	0.007	14.8	1.2	29.4	2.4
OFFE1	579	2243	2234	0.015	20.2	2.5	30.6	3.8
DEVELOPED CONDITION								
OND1	1243	2240	2231	0.007	20.2	1.7	30.6	2.5
OFFE1	579	2243	2234	0.015	20.2	2.5	30.6	3.8

STANDARD FORM 4 ANALYSIS

STANDARD FORM 4

DEVELOPMENT: Crystal Park Apartments

W.O. # 7844 **CALCULATED BY:** ACY

V1 applies to the first 500 feet of travel distance
V2 applies to the remaining travel distance

Existing:		Developed	
$V1 = 148 * S^{1/2}$	$V2 = 294 * S^{1/2}$	$V1 = 202 * S^{1/2}$	$V2 = 306 * S^{1/2}$

$$T_i = \frac{1.8(1.1 - k)L^{1/2}}{S^{1/3}} \qquad T_t = \frac{L}{60V}$$

$$k = 0.0132 C_n - 0.39 \qquad T_c = T_i + T_t$$

SUB-BASIN DATA					INITIAL/OVERLAND TIME (Ti)			TRAVEL TIME (Tt)					Tc CHECK (URBANIZED BASINS)		FINAL Tc	LAG TIME	REMARKS
DESIG. (1)	Cn	K (2)	AREA Ac. (3)	AREA Mi^2	LENGTH Ft (4)	SLOPE % (5)	Ti Min. (6)	LENGTH Ft. (7)	SLOPE % (8)	V1 fps (9a)	V2 fps (9b)	Tt Min. (10)	TOTAL LENGTH (11)	Tc Min. (12)	Min.	TLAG Hr.	
EXISTING CONDITION																	
ONE1	92	0.824	3.02	0.0047	50	0.8	3.78	630	0.8	1.3	2.7	7.02	680	13.78	10.80	0.108	
ONE2	91	0.817	6.46	0.0101	50	1.2	3.39	740	1.2	1.6	3.2	6.52	790	14.39	9.91	0.099	
ONE3	94	0.851	0.48	0.0008	50	0.7	3.57	462	0.7	1.2	2.4	6.42	512	12.84	10.00	0.100	
OFFE1	94	0.856	1.31	0.0020	50	1.5	2.72	579	1.5	2.5	3.8	3.71	629	13.49	6.43	0.064	
DEVELOPED CONDITION																	
OND1	95	0.860	9.96	0.0156	100	1.6	3.69	1243	0.7	1.7	2.5	9.89	1343	17.46	13.59	0.136	
OFFE1	94	0.856	1.3	0.0020	50	1.6	2.66	579	1.5	2.5	3.8	3.71	629	13.49	6.37	0.064	

EXISTING CONDITION
HEC-1 ANALYSIS

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *             JUN   1998               *
 *          VERSION 4.1                 *
 *                                      *
 *  RUN DATE   25SEP17  TIME  13:34:02  *
 *                                      *
 ****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

                         *DIAGRAM
             1           ID   CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
             2           ID   EXISTING CONDITION
             3           ID   FILE: 7844-EXI10.DAT
             4           ID   09/05/17
             5           ID   10YR STORM EVENT
             6           IT       5     0     300
             7           IN       5     0
             8           IO       5     0
             9           JR    PREC     .57
                         *

            10           KK   OFFE1
            11           KM   BASEFLOW IS FLOW SPLITTING INTO 20' ALLEY FROM MICHAEL
            12           BA   0.002
            13           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
            14           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
            15           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
            16           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
            17           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
            18           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
            19           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
            20           PC    .998    .999   1.00
            21           PB   2.77
            22           LS           94.0
            23           UD   .064
                         *

            24           KK   CPA
            25           KM   COMBINES FLOW SPLIT AND OFFE1
            26           BF       8
                         *

            27           KK   ONE1
            28           BF       0
            29           BA   .0047
            30           LS           92.0
            31           UD   .108
                         *

            32           KK   ONE2
            33           BA   .0101
            34           LS           91.0
            35           UD   .100
                         *

            36           KK   CPE4
            37           KM   COMBINE BASINS CPA, ONE1 AND ONE2
            38           HC       3
                         *
```

1 HEC-1 INPUT PAGE 2

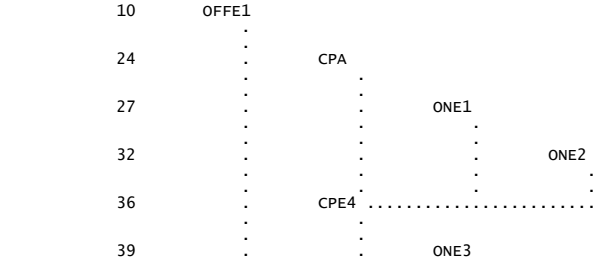
```
          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            39           KK   ONE3
            40           KM   WEST PORTION OF SITE DISCHARGING WESTERLY ONTO MICHAEL WAY
            41           BA   .0008
            42           LS           94.0
            43           UD   .100
                         *
            44           ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1**************************************
 *                                    *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
 *              JUN   1998            *
 *            VERSION 4.1             *
 *                                    *
 *  RUN DATE   25SEP17  TIME  13:34:02   *
 *                                    *
 **************************************
```

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

CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
EXISTING CONDITION
FILE: 7844-EXI10.DAT
09/05/17
10YR STORM EVENT

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

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1  0 0  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         101  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     13    0  ENDING DATE
                       NDTIME       2020  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE    8.33 HOURS

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

     JP         MULTI-PLAN OPTION
                      NPLAN           1  NUMBER OF PLANS

     JR         MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                    .57
1
```

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1
					.57
HYDROGRAPH AT					
+	OFFE1	.00	1	FLOW	2.
				TIME	3.50
HYDROGRAPH AT					
+	CPA	.00	1	FLOW	10.
				TIME	3.50
HYDROGRAPH AT					
+	ONE1	.00	1	FLOW	4.
				TIME	3.50
HYDROGRAPH AT					
+	ONE2	.01	1	FLOW	7.
				TIME	3.50
3 COMBINED AT					
+	CPE4	.02	1	FLOW	21.
				TIME	3.50
HYDROGRAPH AT					
+	ONE3	.00	1	FLOW	1.
				TIME	3.50

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

```
1****************************************
 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *
 *             JUN   1998               *
 *          VERSION 4.1                 *
 *                                      *
 *  RUN DATE   25SEP17  TIME  13:32:57  *
 *                                      *
 ****************************************
```

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

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

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

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

1 HEC-1 INPUT PAGE 1

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

                         *DIAGRAM
             1           ID   CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
             2           ID   EXISTING CONDITION
             3           ID   FILE: 7844-EXI100.DAT
             4           ID   09/05/17
             5           ID   100YR STORM EVENT
             6           IT       5     0     300
             7           IN       5     0
             8           IO       5     0
             9           JR    PREC  1.00
                         *

            10           KK   OFFE1
            11           KM   BASEFLOW IS FLOW SPLITTING INTO 20' ALLEY FROM MICHAEL
            12           BA   0.002
            13           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
            14           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
            15           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
            16           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
            17           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
            18           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
            19           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
            20           PC    .998    .999   1.00
            21           PB   2.77
            22           LS            94.0
            23           UD   .064
                         *

            24           KK   CPA
            25           KM   COMBINES FLOW SPLIT AND OFFE1
            26           BF      53
                         *

            27           KK   ONE1
            28           BF       0
            29           BA   .0047
            30           LS            92.0
            31           UD   .108
                         *

            32           KK   ONE2
            33           BA   .0101
            34           LS            91.0
            35           UD   .100
                         *

            36           KK   CPE4
            37           KM   COMBINE BASINS CPA, ONE1 AND ONE2
            38           HC       3
                         *
```

1 HEC-1 INPUT PAGE 2

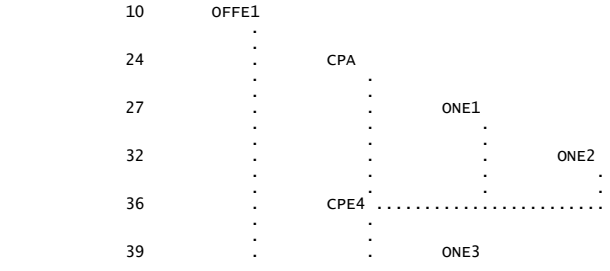
```
          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

            39           KK   ONE3
            40           KM   WEST PORTION OF SITE DISCHARGING WESTERLY ONTO MICHAEL WAY
            41           BA   .0008
            42           LS            94.0
            43           UD   .100
                         *
            44           ZZ
```

1 SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************                    *************************************
 *                                       *                    *                                   *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS   *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER  *
 *            VERSION 4.1                *                    *         609 SECOND STREET         *
 *                                       *                    *      DAVIS, CALIFORNIA 95616      *
 *  RUN DATE   25SEP17  TIME  13:32:57   *                    *          (916) 756-1104           *
 *                                       *                    *                                   *
 *****************************************                    *************************************
```

CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
EXISTING CONDITION
FILE: 7844-EXI100.DAT
09/05/17
100YR STORM EVENT

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

     IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1  0 0  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         101  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     13    0  ENDING DATE
                       NDTIME       2020  ENDING TIME
                       ICENT          19  CENTURY MARK

                  COMPUTATION INTERVAL     .08 HOURS
                      TOTAL TIME BASE    8.33 HOURS

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

     JP         MULTI-PLAN OPTION
                      NPLAN           1  NUMBER OF PLANS

     JR         MULTI-RATIO OPTION
                    RATIOS OF PRECIPITATION
                   1.00
1
```

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1
					1.00
HYDROGRAPH AT					
+	OFFE1	.00	1	FLOW	4.
				TIME	3.50
HYDROGRAPH AT					
+	CPA	.00	1	FLOW	57.
				TIME	3.50
HYDROGRAPH AT					
+	ONE1	.00	1	FLOW	8.
				TIME	3.50
HYDROGRAPH AT					
+	ONE2	.01	1	FLOW	17.
				TIME	3.50
3 COMBINED AT					
+	CPE4	.02	1	FLOW	81.
				TIME	3.50
HYDROGRAPH AT					
+	ONE3	.00	1	FLOW	1.
				TIME	3.50

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

DEVELOPED CONDITION
HEC-1 ANALYSIS

```
1****************************************
****************************************
 *                                      *                                                *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                                *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                                *          609 SECOND STREET
*
 *                                      *                                                *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   21SEP17  TIME  13:14:06  *                                                *           (916) 756-1104
*
 *                                      *                                                *
*
 ****************************************
****************************************
```

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

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

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


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

                        *DIAGRAM
            1           ID   CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
            2           ID   DEVELOPED CONDITION
            3           ID   FILE: 7844-DEV10.DAT
            4           ID   09/07/17
            5           ID   10YR STORM EVENT
            6           IT       5     0     300
            7           IN       5     0
            8           IO       5     0
            9           JR    PREC     .57
                        *

           10           KK   OFFE1
           11           KM   BASEFLOW IS FLOW SPLITTING INTO 20' ALLEY FROM MICHAEL
           12           BA   0.002
           13           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           14           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           15           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           16           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           17           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           18           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           19           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           20           PC    .998    .999    1.00
           21           PB   2.77
           22           LS            94.0
           23           UD   .064
                        *

           24           KK   CPA
           25           KM   COMBINES OFFE1 AND FLOW SPLITTING INTO 20' ALLEY FROM MICHAEL
           26           BF       8
                        *

           27           KK   OND1
           28           BF       0
           29           BA   .0156
           30           LS            95.0
           31           UD   .136
                        *
           32           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

    10       OFFE1
```

```
                .
                .
    24          .       CPA
                .           .
                .           .
    27          .           .       OND1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                                    *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                    *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                                    *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                                    *          609 SECOND STREET
*
 *                                      *                                                    *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   21SEP17  TIME  13:14:06  *                                                    *           (916) 756-1104
*
 *                                      *                                                    *
*
 ****************************************
****************************************
```

CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
DEVELOPED CONDITION
FILE: 7844-DEV10.DAT
09/07/17
10YR STORM EVENT

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

      IT          HYDROGRAPH TIME DATA
                        NMIN           5  MINUTES IN COMPUTATION INTERVAL
                       IDATE      1  0 0  STARTING DATE
                       ITIME        1200  STARTING TIME
                          NQ         101  NUMBER OF HYDROGRAPH ORDINATES
                      NDDATE     13    0  ENDING DATE
                      NDTIME        2020  ENDING TIME
                      ICENT           19  CENTURY MARK

                   COMPUTATION INTERVAL     .08 HOURS
                        TOTAL TIME BASE    8.33 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .57
1
```

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1
					.57
HYDROGRAPH AT					
+	OFFE1	.00	1	FLOW	2.
				TIME	3.50
HYDROGRAPH AT					
+	CPA	.00	1	FLOW	10.
				TIME	3.50
HYDROGRAPH AT					
+	OND1	.02	1	FLOW	14.
				TIME	3.58

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

```
1****************************************
****************************************
 *                                      *                                                *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                                *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                                *          609 SECOND STREET
*
 *                                      *                                                *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   21SEP17  TIME  13:15:30  *                                                *           (916) 756-1104
*
 *                                      *                                                *
*
 ****************************************
****************************************
```

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

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

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


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

                        *DIAGRAM
            1           ID   CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
            2           ID   DEVELOPED CONDITION
            3           ID   FILE: 7844-DEV100.DAT
            4           ID   09/05/17
            5           ID   100YR STORM EVENT
            6           IT       5     0     300
            7           IN       5     0
            8           IO       5     0
            9           JR    PREC  1.00
                        *

           10           KK   OFFE1
           11           KM   OFFSITE SUBBASIN
           12           BA   0.002
           13           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           14           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           15           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           16           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           17           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           18           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           19           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           20           PC    .998    .999    1.00
           21           PB   2.77
           22           LS            94.0
           23           UD   .064
                        *

           24           KK   CPA
           25           KM   COMBINES OFFE1 AND FLOWSPLIT AT MICHAEL WAY
           26           KM   BASEFLOW IS FLOW SPLITTING INTO 20' ALLEY FROM MICHAEL
           27           BF      53
                        *

           28           KK   OND1
           29           BF       0
           30           BA   .0156
           31           LS            95.0
           32           UD   .136
                        *
           33           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

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

```
    10       OFFE1
                 .
                 .
    24           .       CPA
                 .          .
                 .          .
    28           .          .       OND1

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *                                                *
*
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                                *    U.S. ARMY CORPS OF ENGINEERS
*
 *               JUN   1998             *                                                *    HYDROLOGIC ENGINEERING CENTER
*
 *            VERSION 4.1               *                                                *          609 SECOND STREET
*
 *                                      *                                                *       DAVIS, CALIFORNIA 95616
*
 *  RUN DATE   21SEP17  TIME  13:15:30  *                                                *           (916) 756-1104
*
 *                                      *                                                *
*
 ****************************************
****************************************



                          CRYSTAL PARK APARTMENTS - TECHNICAL DRAINAGE STUDY
                          DEVELOPED CONDITION
                          FILE: 7844-DEV100.DAT
                          09/05/17
                          100YR STORM EVENT

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

      IT          HYDROGRAPH TIME DATA
                         NMIN           5  MINUTES IN COMPUTATION INTERVAL
                        IDATE      1  0 0  STARTING DATE
                        ITIME        1200  STARTING TIME
                           NQ         101  NUMBER OF HYDROGRAPH ORDINATES
                       NDDATE     13    0  ENDING DATE
                       NDTIME        2020  ENDING TIME
                       ICENT           19  CENTURY MARK

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE    8.33 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                     1.00
1

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


                                                                      RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1
                                                        1.00

 HYDROGRAPH AT
+                 OFFE1       .00     1   FLOW           4.
                                           TIME         3.50

 HYDROGRAPH AT
+                 CPA         .00     1   FLOW          57.
                                           TIME         3.50

 HYDROGRAPH AT
+                 OND1        .02     1   FLOW          27.
                                           TIME         3.58
```

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

DEVELOPED CONDITION
100-YEAR
PROROATED FLOWRATE CALCULATIONS

PRORATED SUBBASIN SUMMARY				
BASIN	**AREA**		**Q100**	**Q10**
OND1	10.0		27	14
SUB BASIN	**SUB AREA**	**SUB AREA**	**SUB Q100**	**SUB Q10**
OND1-A	1.7	17%	5	2
OND1-B	0.7	7%	2	1
OND1-C	0.5	5%	1	1
OND1-D	1.0	10%	3	1
OND1-E	1.9	19%	5	3
OND1-F	0.8	8%	2	1
OND1-G	0.7	7%	2	1
ON1-H	0.9	9%	3	1
ON1-I	1.7	17%	5	2
TOTAL	10.0	100%	27	14

APPENDIX C
HYDRAULIC CALCULATIONS

OFFSITE NORMAL DEPTH CALCULATIONS

Worksheet for A-A Michael Way 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.2	%
Discharge	28	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.00	0.50
0+06.00	0.50
0+06.00	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+75.00	0.00
0+75.00	0.50
0+75.00	0.50
0+80.00	0.60
0+80.00	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.00)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+73.00, 0.13)	0.016
(0+73.00, 0.13)	(0+80.00, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for A-A Michael Way 10

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.54	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		8.29	ft²
Wetted Perimeter		45.67	ft
Hydraulic Radius		0.18	ft
Top Width		44.56	ft
Normal Depth		0.54	ft
Critical Depth		0.59	ft
Critical Slope		0.00613	ft/ft
Velocity		3.38	ft/s
Velocity Head		0.18	ft
Specific Energy		0.71	ft
Froude Number		1.38	
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	0.54	ft
Critical Depth	0.59	ft
Channel Slope	1.2	%
Critical Slope	0.00613	ft/ft

Cross Section for A-A Michael Way 10

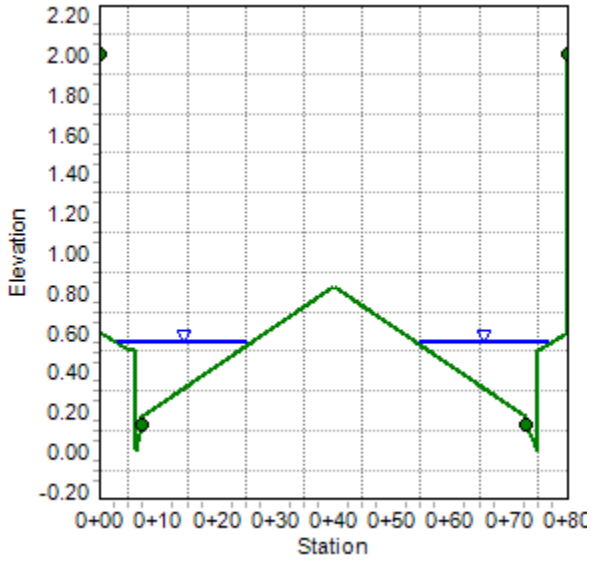
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.2	%
Normal Depth	0.54	ft
Discharge	28	ft³/s

Cross Section Image



Worksheet for A-A Michael Way 100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.2	%
Discharge	194	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.00	0.50
0+06.00	0.50
0+06.00	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+75.00	0.00
0+75.00	0.50
0+75.00	0.50
0+80.00	0.60
0+80.00	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.00)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+73.00, 0.13)	0.016
(0+73.00, 0.13)	(0+80.00, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for A-A Michael Way 100

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.91	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		33.47	ft²
Wetted Perimeter		81.72	ft
Hydraulic Radius		0.41	ft
Top Width		80.00	ft
Normal Depth		0.91	ft
Critical Depth		1.06	ft
Critical Slope		0.00436	ft/ft
Velocity		5.80	ft/s
Velocity Head		0.52	ft
Specific Energy		1.43	ft
Froude Number		1.58	
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	0.91	ft
Critical Depth	1.06	ft
Channel Slope	1.2	%
Critical Slope	0.00436	ft/ft

Cross Section for A-A Michael Way 100

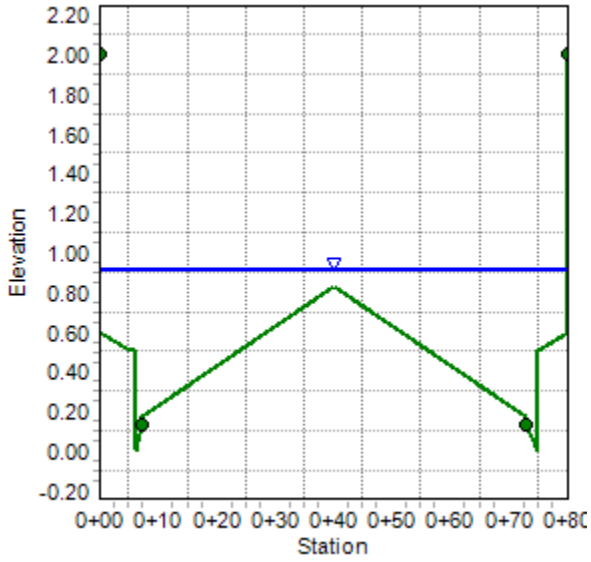
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.2	%
Normal Depth	0.91	ft
Discharge	194	ft³/s

Cross Section Image



Worksheet for B-B Michael Way 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.4	%
Discharge	53	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.00	0.50
0+06.00	0.50
0+06.00	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+75.00	0.00
0+75.00	0.50
0+75.00	0.50
0+80.00	0.60
0+80.00	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.00)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+73.00, 0.13)	0.016
(0+73.00, 0.13)	(0+80.00, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for B-B Michael Way 10

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.73	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		19.92	ft²
Wetted Perimeter		71.67	ft
Hydraulic Radius		0.28	ft
Top Width		70.30	ft
Normal Depth		0.73	ft
Critical Depth		0.71	ft
Critical Slope		0.00551	ft/ft
Velocity		2.66	ft/s
Velocity Head		0.11	ft
Specific Energy		0.84	ft
Froude Number		0.88	
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	0.73	ft
Critical Depth	0.71	ft
Channel Slope	0.4	%
Critical Slope	0.00551	ft/ft

Cross Section for B-B Michael Way 10

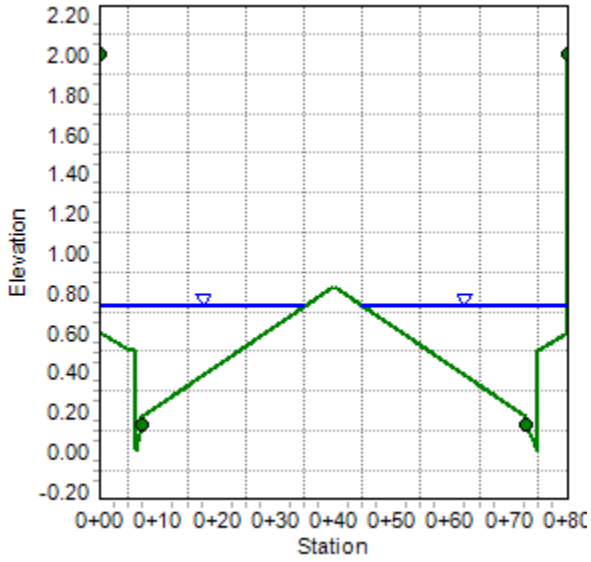
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.4	%
Normal Depth	0.73	ft
Discharge	53	ft³/s

Cross Section Image



Worksheet for B-B Michael Way 100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.4	%
Discharge	254	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.00	0.50
0+06.00	0.50
0+06.00	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+75.00	0.00
0+75.00	0.50
0+75.00	0.50
0+80.00	0.60
0+80.00	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.00)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+73.00, 0.13)	0.016
(0+73.00, 0.13)	(0+80.00, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for B-B Michael Way 100

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		1.16	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		53.97	ft²
Wetted Perimeter		82.24	ft
Hydraulic Radius		0.66	ft
Top Width		80.00	ft
Normal Depth		1.16	ft
Critical Depth		1.17	ft
Critical Slope		0.00411	ft/ft
Velocity		4.71	ft/s
Velocity Head		0.34	ft
Specific Energy		1.51	ft
Froude Number		1.01	
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	1.16	ft
Critical Depth	1.17	ft
Channel Slope	0.4	%
Critical Slope	0.00411	ft/ft

Cross Section for B-B Michael Way 100

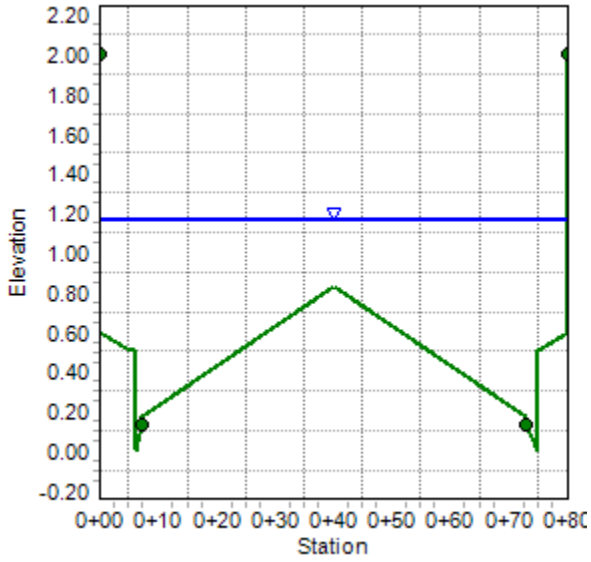
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.4	%
Normal Depth	1.16	ft
Discharge	254	ft³/s

Cross Section Image



Worksheet for C-C Michael Way 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Discharge	64	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.00	0.50
0+06.00	0.50
0+06.00	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+75.00	0.00
0+75.00	0.50
0+75.00	0.50
0+80.00	0.60
0+80.00	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.00)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+73.00, 0.13)	0.016
(0+73.00, 0.13)	(0+80.00, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for C-C Michael Way 10

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.75	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		20.83	ft²
Wetted Perimeter		72.98	ft
Hydraulic Radius		0.29	ft
Top Width		71.58	ft
Normal Depth		0.75	ft
Critical Depth		0.75	ft
Critical Slope		0.00536	ft/ft
Velocity		3.07	ft/s
Velocity Head		0.15	ft
Specific Energy		0.89	ft
Froude Number		1.00	
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	0.75	ft
Channel Slope	0.5	%
Critical Slope	0.00536	ft/ft

Cross Section for C-C Michael Way 10

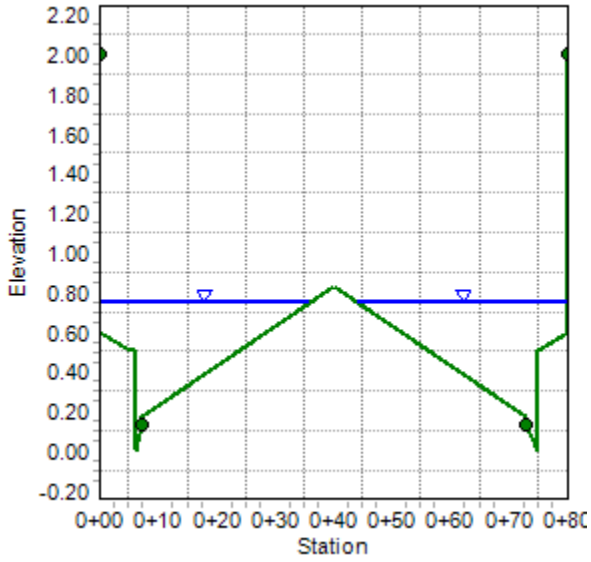
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Normal Depth	0.75	ft
Discharge	64	ft³/s

Cross Section Image



Worksheet for C-C Michael Way 100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Discharge	282	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.00
0+00.00	0.60
0+05.00	0.50
0+06.00	0.50
0+06.00	0.00
0+07.00	0.13
0+07.00	0.17
0+40.00	0.83
0+73.00	0.17
0+73.00	0.13
0+75.00	0.00
0+75.00	0.50
0+75.00	0.50
0+80.00	0.60
0+80.00	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.00)	(0+07.00, 0.13)	0.013
(0+07.00, 0.13)	(0+73.00, 0.13)	0.016
(0+73.00, 0.13)	(0+80.00, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for C-C Michael Way 100

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		1.16	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		53.29	ft²
Wetted Perimeter		82.22	ft
Hydraulic Radius		0.65	ft
Top Width		80.00	ft
Normal Depth		1.16	ft
Critical Depth		1.22	ft
Critical Slope		0.00402	ft/ft
Velocity		5.29	ft/s
Velocity Head		0.44	ft
Specific Energy		1.59	ft
Froude Number		1.14	
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	1.16	ft
Critical Depth	1.22	ft
Channel Slope	0.5	%
Critical Slope	0.00402	ft/ft

Cross Section for C-C Michael Way 100

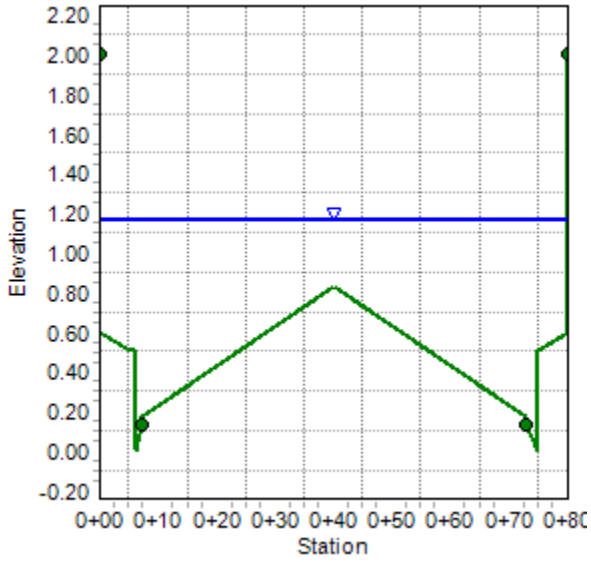
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Normal Depth	1.16	ft
Discharge	282	ft³/s

Cross Section Image



ONSITE NORMAL DEPTH CALCULATIONS

Worksheet for Section 1

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Discharge	5	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.00	0.00
0+01.00	0.13
0+01.00	0.17
0+02.50	0.20
0+24.50	1.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+02.50, 0.20)	0.013
(0+02.50, 0.20)	(0+24.50, 1.57)	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		0.54	ft
Elevation Range	0.00 to 1.57 ft		
Flow Area		1.92	ft²
Wetted Perimeter		8.54	ft
Hydraulic Radius		0.23	ft
Top Width		7.94	ft

Worksheet for Section 1

Results

Normal Depth		0.54	ft
Critical Depth		0.53	ft
Critical Slope		0.00584	ft/ft
Velocity		2.60	ft/s
Velocity Head		0.10	ft
Specific Energy		0.64	ft
Froude Number		0.93	
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	0.54	ft
Critical Depth	0.53	ft
Channel Slope	0.5	%
Critical Slope	0.00584	ft/ft

Cross Section for Section 1

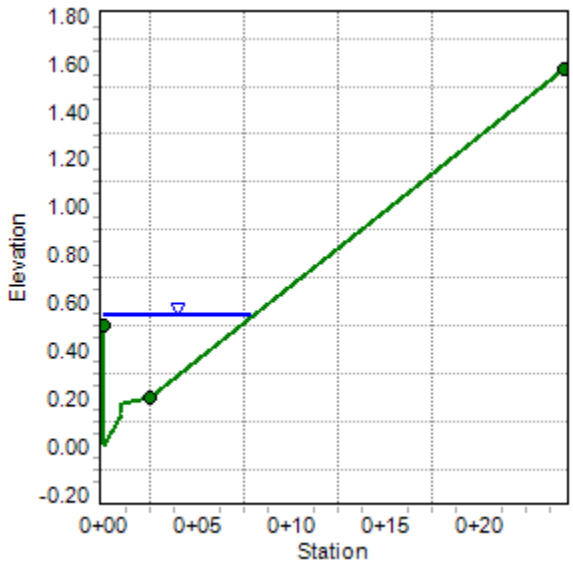
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Normal Depth	0.54	ft
Discharge	5	ft³/s

Cross Section Image



Worksheet for Section 2

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Discharge	2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.70
0+12.00	0.17
0+13.50	0.00
0+15.00	0.17
0+27.00	0.70

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.70)	(0+12.00, 0.17)	0.016
(0+12.00, 0.17)	(0+15.00, 0.17)	0.013
(0+15.00, 0.17)	(0+27.00, 0.70)	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	0.31	ft
Elevation Range	0.00 to 0.70 ft	
Flow Area	1.17	ft²
Wetted Perimeter	9.60	ft
Hydraulic Radius	0.12	ft
Top Width	9.58	ft

Worksheet for Section 2

Results

Normal Depth		0.31	ft
Critical Depth		0.30	ft
Critical Slope		0.00686	ft/ft
Velocity		1.71	ft/s
Velocity Head		0.05	ft
Specific Energy		0.36	ft
Froude Number		0.86	
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	0.31	ft
Critical Depth	0.30	ft
Channel Slope	0.5	%
Critical Slope	0.00686	ft/ft

Cross Section for Section 2

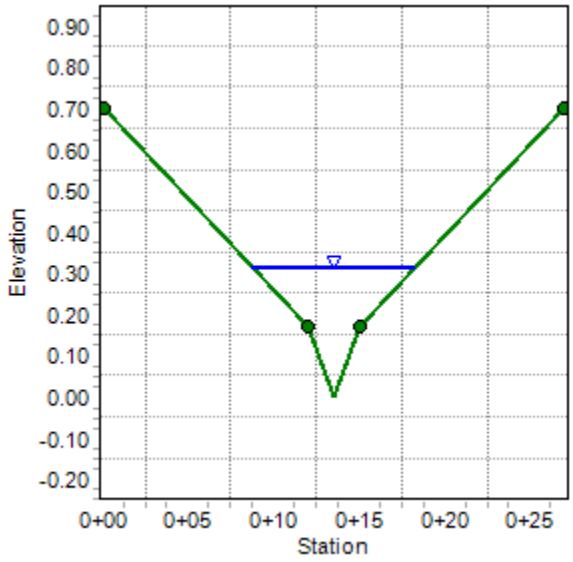
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Normal Depth	0.31	ft
Discharge	2	ft³/s

Cross Section Image



Worksheet for Section 2B

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.2	%
Discharge	1	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+12.85	0.64
0+25.52	0.14
0+32.85	0.00
0+40.52	0.15

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+12.85, 0.64)	(0+25.52, 0.14)	0.013
(0+25.52, 0.14)	(0+40.52, 0.15)	0.025

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	0.13	ft
Elevation Range	0.00 to 0.64 ft	
Flow Area	0.92	ft²
Wetted Perimeter	13.84	ft
Hydraulic Radius	0.07	ft
Top Width	13.84	ft
Normal Depth	0.13	ft
Critical Depth	0.12	ft

Worksheet for Section 2B

Results

Critical Slope		0.02336	ft/ft
Velocity		1.08	ft/s
Velocity Head		0.02	ft
Specific Energy		0.15	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	0.13	ft
Critical Depth	0.12	ft
Channel Slope	1.2	%
Critical Slope	0.02336	ft/ft

Cross Section for Section 2B

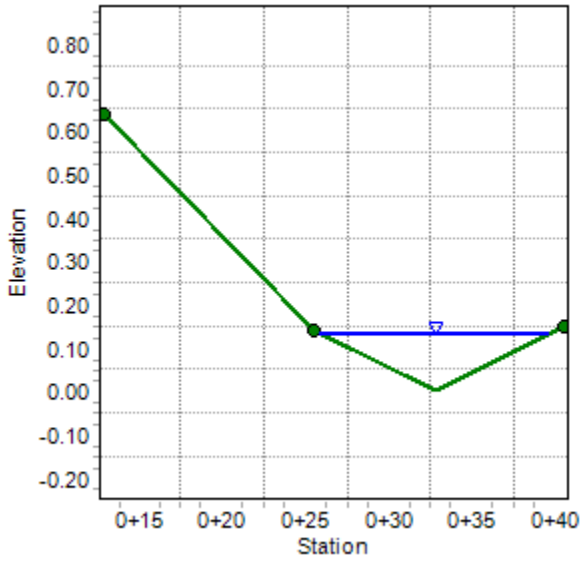
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.2	%
Normal Depth	0.13	ft
Discharge	1	ft³/s

Cross Section Image



Worksheet for Section 3

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.1	%
Discharge	3	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.40
0+12.00	0.17
0+13.50	0.00
0+15.00	0.17
0+27.00	0.40

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.40)	(0+12.00, 0.17)	0.016
(0+12.00, 0.17)	(0+15.00, 0.17)	0.013
(0+15.00, 0.17)	(0+27.00, 0.40)	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		0.29	ft
Elevation Range	0.00 to 0.40 ft		
Flow Area		1.47	ft²
Wetted Perimeter		16.09	ft
Hydraulic Radius		0.09	ft
Top Width		16.07	ft

Worksheet for Section 3

Results

Normal Depth		0.29	ft
Critical Depth		0.31	ft
Critical Slope		0.00761	ft/ft
Velocity		2.05	ft/s
Velocity Head		0.06	ft
Specific Energy		0.36	ft
Froude Number		1.19	
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	0.29	ft
Critical Depth	0.31	ft
Channel Slope	1.1	%
Critical Slope	0.00761	ft/ft

Cross Section for Section 3

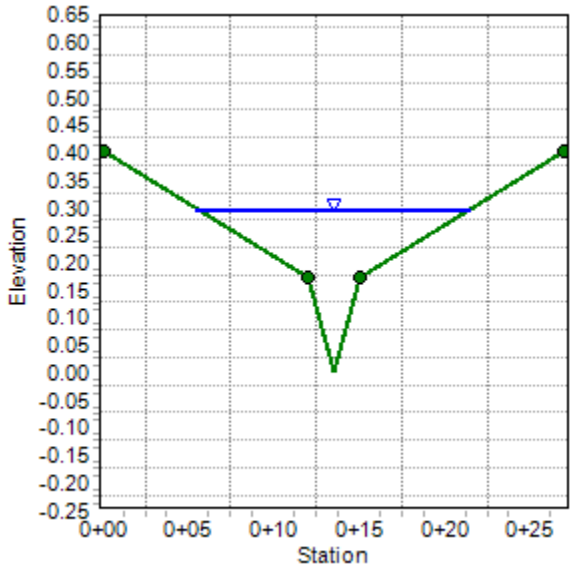
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.1	%
Normal Depth	0.29	ft
Discharge	3	ft³/s

Cross Section Image



Worksheet for Section 4

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.5	%
Discharge	8	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1.42
0+02.14	0.57
0+02.56	0.55
0+19.14	0.17
0+20.64	0.00
0+22.14	0.17
0+44.64	0.94
0+44.73	1.42
0+77.06	1.72

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.42)	(0+02.14, 0.57)	0.013
(0+02.14, 0.57)	(0+19.14, 0.17)	0.016
(0+19.14, 0.17)	(0+22.14, 0.17)	0.013
(0+22.14, 0.17)	(0+44.64, 0.94)	0.016
(0+44.64, 0.94)	(0+77.06, 1.72)	0.013

Options

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

Worksheet for Section 4

Results

Normal Depth		0.38	ft
Elevation Range	0.00 to 1.72 ft		
Flow Area		2.56	ft²
Wetted Perimeter		18.61	ft
Hydraulic Radius		0.14	ft
Top Width		18.59	ft
Normal Depth		0.38	ft
Critical Depth		0.43	ft
Critical Slope		0.00650	ft/ft
Velocity		3.12	ft/s
Velocity Head		0.15	ft
Specific Energy		0.54	ft
Froude Number		1.48	
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	0.38	ft
Critical Depth	0.43	ft
Channel Slope	1.5	%
Critical Slope	0.00650	ft/ft

Cross Section for Section 4

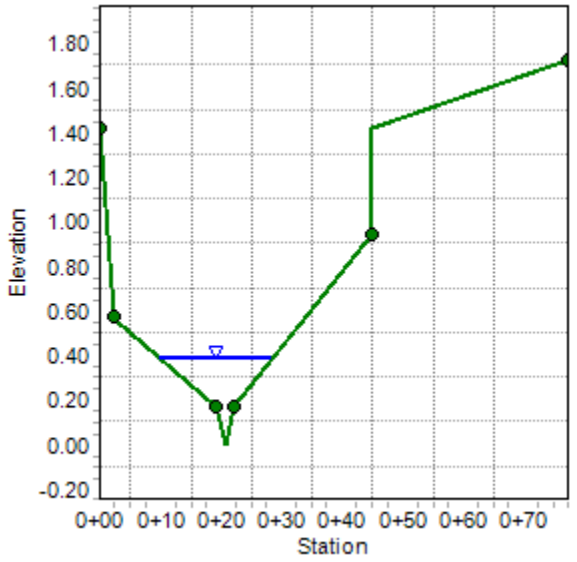
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.5	%
Normal Depth	0.38	ft
Discharge	8	ft³/s

Cross Section Image



Worksheet for Section 5

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Discharge	2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2.13
0+11.00	0.26
0+12.50	0.00
0+14.00	0.16
0+26.00	1.43

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2.13)	(0+11.00, 0.26)	0.016
(0+11.00, 0.26)	(0+14.00, 0.16)	0.013
(0+14.00, 0.16)	(0+26.00, 1.43)	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		0.34	ft
Elevation Range	0.00 to 2.13 ft		
Flow Area		0.89	ft²
Wetted Perimeter		5.27	ft
Hydraulic Radius		0.17	ft
Top Width		5.22	ft

Worksheet for Section 5

Results

Normal Depth		0.34	ft
Critical Depth		0.34	ft
Critical Slope		0.00550	ft/ft
Velocity		2.24	ft/s
Velocity Head		0.08	ft
Specific Energy		0.42	ft
Froude Number		0.96	
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	0.34	ft
Critical Depth	0.34	ft
Channel Slope	0.5	%
Critical Slope	0.00550	ft/ft

Cross Section for Section 5

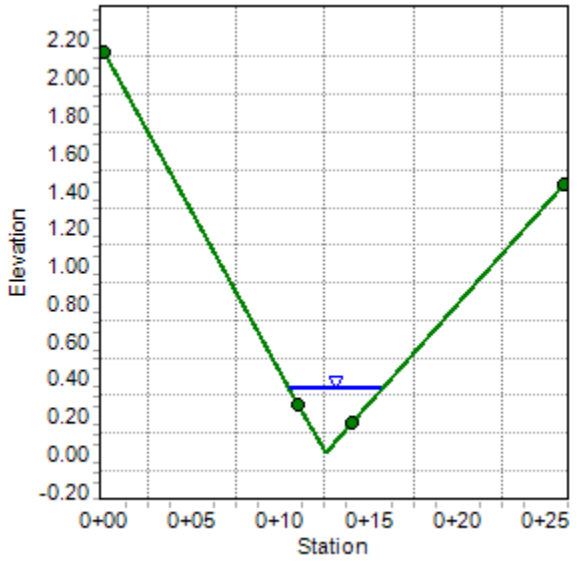
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Normal Depth	0.34	ft
Discharge	2	ft³/s

Cross Section Image



Worksheet for Section 6

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.5	%
Discharge	2	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1.87
0+17.13	1.56
0+26.88	0.65
0+33.20	0.00
0+35.01	0.41
0+43.73	0.67

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.87)	(0+43.73, 0.67)	0.025

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	0.36	ft
Elevation Range	0.00 to 1.87 ft	
Flow Area	0.89	ft²
Wetted Perimeter	5.08	ft
Hydraulic Radius	0.18	ft
Top Width	5.02	ft
Normal Depth	0.36	ft

Worksheet for Section 6

Results

Critical Depth		0.35	ft
Critical Slope		0.01659	ft/ft
Velocity		2.24	ft/s
Velocity Head		0.08	ft
Specific Energy		0.43	ft
Froude Number		0.94	
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	0.36	ft
Critical Depth	0.35	ft
Channel Slope	1.5	%
Critical Slope	0.01659	ft/ft

Cross Section for Section 6

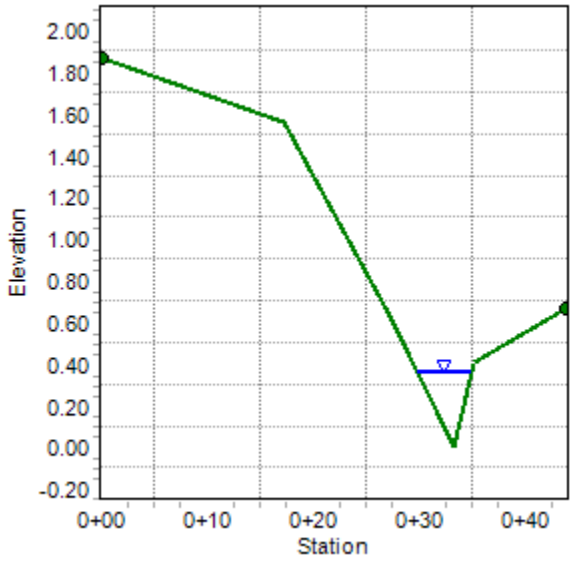
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	1.5	%
Normal Depth	0.36	ft
Discharge	2	ft³/s

Cross Section Image



Worksheet for Section 7

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Discharge	58.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	1.00
1+30.00	0.00
1+30.00	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+30.00, 3.00)	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	0.98	ft
Elevation Range	0.00 to 3.00 ft	
Flow Area	14.50	ft²
Wetted Perimeter	30.49	ft
Hydraulic Radius	0.48	ft
Top Width	29.49	ft
Normal Depth	0.98	ft
Critical Depth	0.99	ft
Critical Slope	0.00494	ft/ft

Worksheet for Section 7

Results

Velocity		4.00	ft/s
Velocity Head		0.25	ft
Specific Energy		1.23	ft
Froude Number		1.01	
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	0.98	ft
Critical Depth	0.99	ft
Channel Slope	0.5	%
Critical Slope	0.00494	ft/ft

Cross Section for Section 7

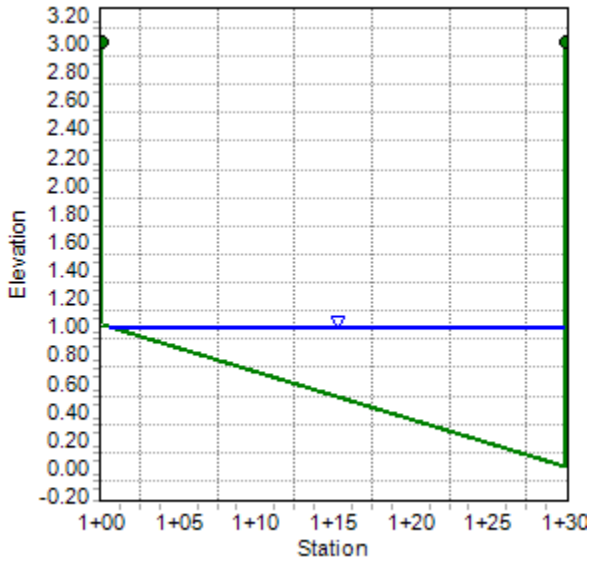
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.5	%
Normal Depth	0.98	ft
Discharge	58.00	ft³/s

Cross Section Image



Worksheet for Section 8

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	63.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	2.12
1+05.50	2.01
1+05.50	1.51
1+31.50	0.00
1+31.50	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+31.50, 3.00)	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	1.23	ft
Elevation Range	0.00 to 3.00 ft	
Flow Area	13.03	ft²
Wetted Perimeter	22.45	ft
Hydraulic Radius	0.58	ft
Top Width	21.18	ft
Normal Depth	1.23	ft

Worksheet for Section 8

Results

Critical Depth		1.27	ft
Critical Slope		0.00469	ft/ft
Velocity		4.84	ft/s
Velocity Head		0.36	ft
Specific Energy		1.59	ft
Froude Number		1.09	
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		1.23	ft
Critical Depth		1.27	ft
Channel Slope		0.6	%
Critical Slope		0.00469	ft/ft

Cross Section for Section 8

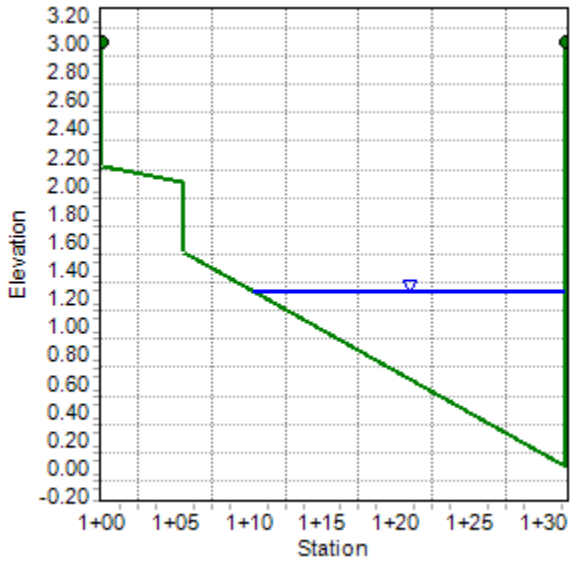
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	1.23	ft
Discharge	63.00	ft³/s

Cross Section Image



Worksheet for Section 9

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	66.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	2.51
1+05.50	2.40
1+05.50	1.90
1+31.50	0.00
1+31.50	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+31.50, 3.00)	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	1.35	ft
Elevation Range	0.00 to 3.00 ft	
Flow Area	12.43	ft²
Wetted Perimeter	19.84	ft
Hydraulic Radius	0.63	ft
Top Width	18.44	ft
Normal Depth	1.35	ft

Worksheet for Section 9

Results

Critical Depth		1.42	ft
Critical Slope		0.00461	ft/ft
Velocity		5.31	ft/s
Velocity Head		0.44	ft
Specific Energy		1.79	ft
Froude Number		1.14	
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		1.35	ft
Critical Depth		1.42	ft
Channel Slope		0.6	%
Critical Slope		0.00461	ft/ft

Cross Section for Section 9

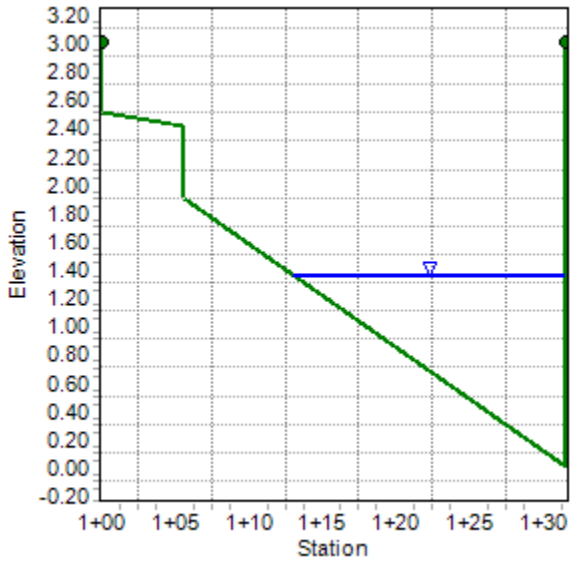
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	1.35	ft
Discharge	66.00	ft³/s

Cross Section Image



Worksheet for Section 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	67.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	1.03
1+05.50	0.92
1+05.50	0.42
1+31.50	0.00
1+31.50	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+31.50, 3.00)	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	0.76	ft
Elevation Range	0.00 to 3.00 ft	
Flow Area	14.20	ft²
Wetted Perimeter	27.10	ft
Hydraulic Radius	0.52	ft
Top Width	26.00	ft
Normal Depth	0.76	ft

Worksheet for Section 10

Results

Critical Depth		0.80	ft
Critical Slope		0.00472	ft/ft
Velocity		4.72	ft/s
Velocity Head		0.35	ft
Specific Energy		1.10	ft
Froude Number		1.13	
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	0.80	ft
Channel Slope	0.6	%
Critical Slope	0.00472	ft/ft

Cross Section for Section 10

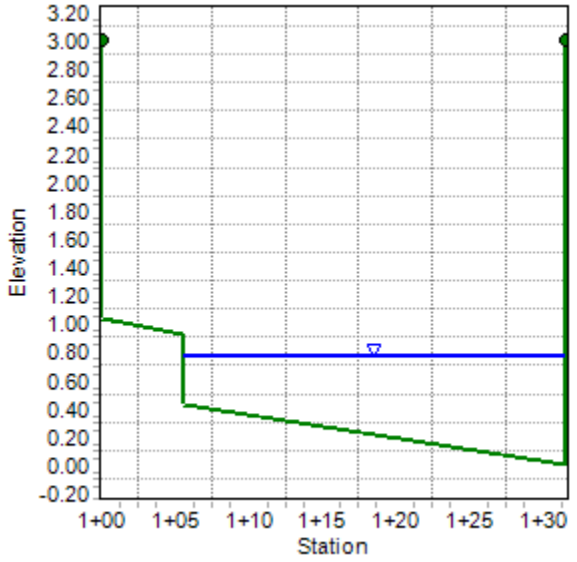
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	0.76	ft
Discharge	67.00	ft³/s

Cross Section Image



Worksheet for Section 11

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	71.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	2.48
1+05.50	2.37
1+05.50	1.87
1+31.50	0.00
1+31.50	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+31.50, 3.00)	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	1.38	ft
Elevation Range	0.00 to 3.00 ft	
Flow Area	13.25	ft²
Wetted Perimeter	20.63	ft
Hydraulic Radius	0.64	ft
Top Width	19.20	ft
Normal Depth	1.38	ft

Worksheet for Section 11

Results

Critical Depth		1.45	ft
Critical Slope		0.00457	ft/ft
Velocity		5.36	ft/s
Velocity Head		0.45	ft
Specific Energy		1.83	ft
Froude Number		1.14	
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	1.38	ft
Critical Depth	1.45	ft
Channel Slope	0.6	%
Critical Slope	0.00457	ft/ft

Cross Section for Section 11

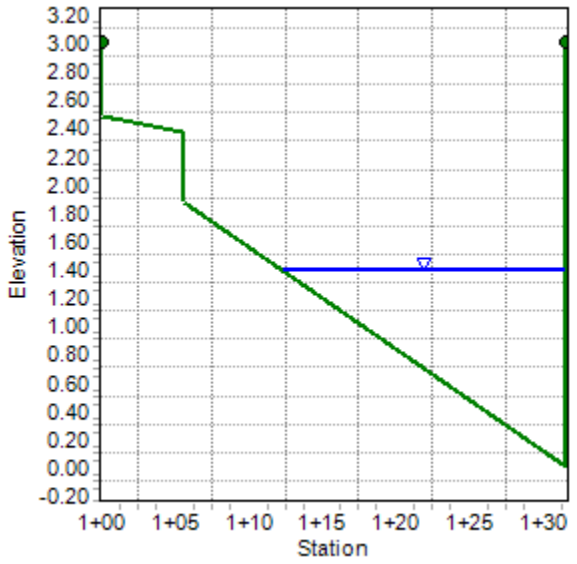
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	1.38	ft
Discharge	71.00	ft³/s

Cross Section Image



Worksheet for Section 12

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	68.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	2.03
1+05.50	1.92
1+05.50	1.42
1+31.50	0.00
1+31.50	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+31.50, 3.00)	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	1.22	ft
Elevation Range	0.00 to 3.00 ft	
Flow Area	13.71	ft²
Wetted Perimeter	23.67	ft
Hydraulic Radius	0.58	ft
Top Width	22.41	ft
Normal Depth	1.22	ft

Worksheet for Section 12

Results

Critical Depth		1.28	ft
Critical Slope		0.00466	ft/ft
Velocity		4.96	ft/s
Velocity Head		0.38	ft
Specific Energy		1.61	ft
Froude Number		1.12	
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		1.22	ft
Critical Depth		1.28	ft
Channel Slope		0.6	%
Critical Slope		0.00466	ft/ft

Cross Section for Section 12

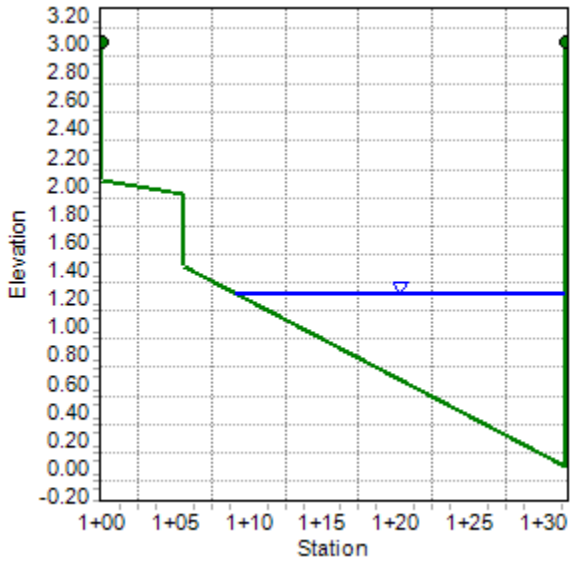
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	1.22	ft
Discharge	68.00	ft³/s

Cross Section Image



Worksheet for Section 13

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	80.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	3.00
0+00.00	3.00
0+00.00	1.90
1+25.36	1.04
1+25.36	0.54
1+34.36	0.00
1+34.36	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 3.00)	(1+34.36, 3.00)	0.035

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		1.70	ft
Elevation Range	0.00 to 3.00 ft		
Flow Area		44.17	ft²
Wetted Perimeter		106.80	ft
Hydraulic Radius		0.41	ft
Top Width		104.58	ft

Worksheet for Section 13

Results

Normal Depth		1.70	ft
Critical Depth		1.47	ft
Critical Slope		0.02657	ft/ft
Velocity		1.81	ft/s
Velocity Head		0.05	ft
Specific Energy		1.75	ft
Froude Number		0.49	
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		1.70	ft
Critical Depth		1.47	ft
Channel Slope		0.6	%
Critical Slope		0.02657	ft/ft

Cross Section for Section 13

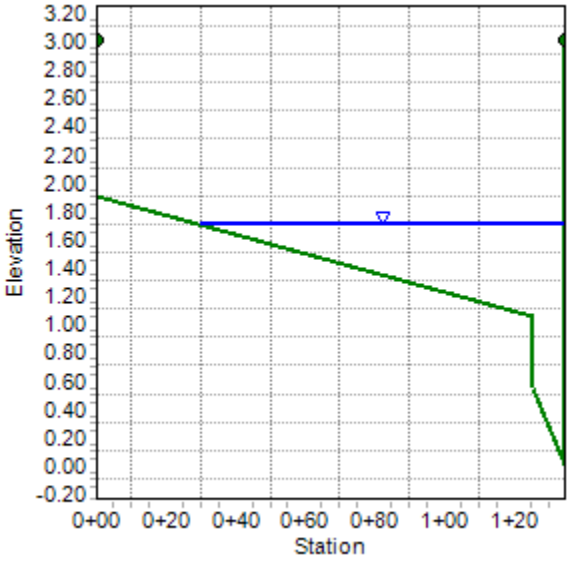
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	1.70	ft
Discharge	80.00	ft³/s

Cross Section Image



Worksheet for Section 14

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	82.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	0.66
1+23.50	0.00
1+23.50	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+23.50, 3.00)	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		1.00	ft
Elevation Range	0.00 to 3.00 ft		
Flow Area		15.64	ft²
Wetted Perimeter		24.84	ft
Hydraulic Radius		0.63	ft
Top Width		23.50	ft
Normal Depth		1.00	ft
Critical Depth		1.05	ft
Critical Slope		0.00450	ft/ft

Worksheet for Section 14

Results

Velocity		5.24	ft/s
Velocity Head		0.43	ft
Specific Energy		1.42	ft
Froude Number		1.13	
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	1.00	ft
Critical Depth	1.05	ft
Channel Slope	0.6	%
Critical Slope	0.00450	ft/ft

Cross Section for Section 14

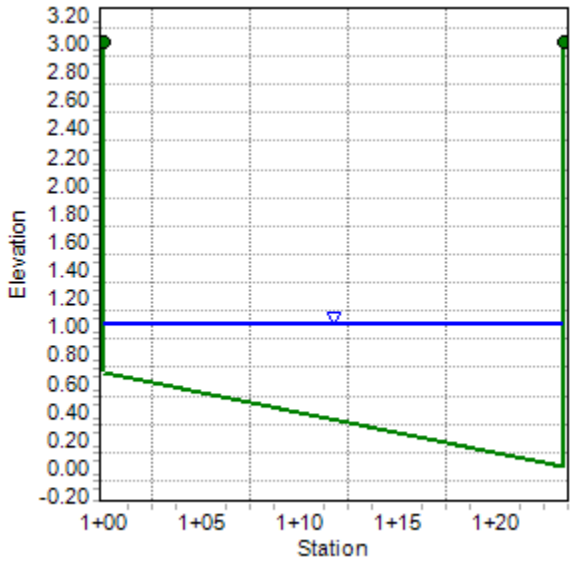
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Normal Depth	1.00	ft
Discharge	82.00	ft³/s

Cross Section Image



FLOWSPLIT CALCULATIONS

PIMA COUNTY FLOW SPLIT CALCULATIONS - EXISTING CONDITION 10-YEAR

$$Q_L = 0.042\left[\frac{\left(Q_m^{0.93}\right)\left(W_{ss}^{0.85}\right)}{\left(S_m^{0.41}\right)\left(W_m^{0.79}\right)}\right]$$

$$Q_o = 46.8 \times W_{ss} \times Y_o \times S_{ss}^{0.5} - Q_L$$

$$Q_T = Q_L + Q_o$$

Where: Q_m = Main street flow measured between the curbs (cfs)
S_m = Longitudinal slope of the main street (ft / ft)
W_m = Width of the main street (ft)
W_{ss} = Width of side street (ft)
S_{ss} = Longitudinal slope of the side street (feet/foot)
Y_o= Average depth of overbank flow intercepted by the side street (ft)
Q_{OB} = Overbank flow on downstream side of Main Street (cfs)
Q_L = Lateral flow into the side street (cfs)
Q_O = Overbank flow intercepted by the side street (cfs)
Q_T = Total flow intercepted by the side street (cfs)
Q_R = Flow remaining in Main Street after split (cfs)

DESCRIPTIONS			INPUT							OUTPUT		RESULTS	
Flow Split Identifier	Main Street	Side Street	Q_m (cfs)	S_m (ft/ft)	W_m (ft)	W_{ss} (ft)	S_{ss} (ft/ft)	Y_o (ft)	Q_{OB} (cfs)	Q_L (cfs)	Q_O (cfs)	**Q_T (cfs)**	**Q_R (cfs)**
Michael Way and 20' Wide Alley	Michael	Alley	33	0.012	34.5	20	0.008	0.69	3	5	3	**8**	**28**

Worksheet for Michael Way and 20' Alley Main 10

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	36.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2.00
0+00	0.60
0+05	0.50
0+06	0.50
0+06	0.00
0+07	0.13
0+07	0.17
0+40	0.83

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2.00)	(0+07, 0.13)	0.013
(0+07, 0.13)	(0+40, 0.83)	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	0.69	ft
Elevation Range	0.00 to 2.00 ft	
Flow Area	8.51	ft²
Wetted Perimeter	33.66	ft

Worksheet for Michael Way and 20' Alley Main 10

Results

Hydraulic Radius		0.25	ft
Top Width		33.02	ft
Normal Depth		0.69	ft
Critical Depth		0.77	ft
Critical Slope		0.00524	ft/ft
Velocity		4.23	ft/s
Velocity Head		0.28	ft
Specific Energy		0.97	ft
Froude Number		1.47	
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	0.69	ft
Critical Depth	0.77	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00524	ft/ft

Cross Section for Michael Way and 20' Alley Main 10

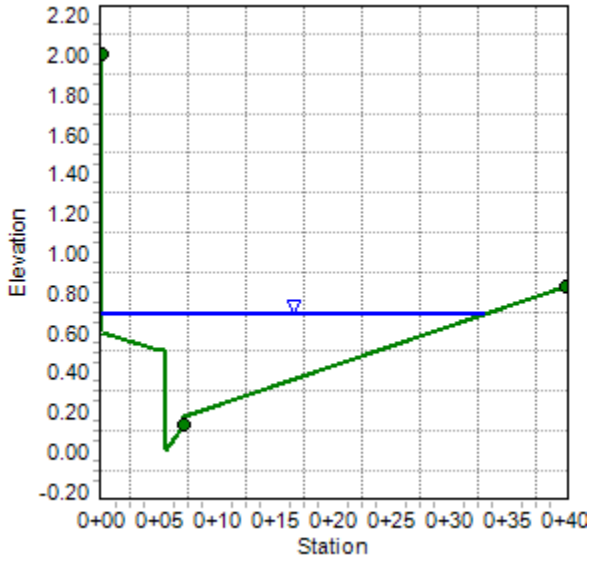
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.69	ft
Discharge	36.00	ft³/s

Cross Section Image



Worksheet for Michael Way and 20' Alley Curb 10

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.69	ft

Section Definitions

Station (ft)	Elevation (ft)
0+06	3.00
0+06	0.00
0+07	0.13
0+07	0.17
0+40	0.83
0+40	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+06, 3.00)	(0+07, 0.13)	0.013
(0+07, 0.13)	(0+40, 3.00)	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

Discharge	33.36	ft³/s
Elevation Range	0.00 to 3.00 ft	
Flow Area	7.70	ft²
Wetted Perimeter	28.24	ft
Hydraulic Radius	0.27	ft
Top Width	27.50	ft

Worksheet for Michael Way and 20' Alley Curb 10

Results

Normal Depth		0.69	ft
Critical Depth		0.78	ft
Critical Slope		0.00547	ft/ft
Velocity		4.33	ft/s
Velocity Head		0.29	ft
Specific Energy		0.98	ft
Froude Number		1.44	
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	0.69	ft
Critical Depth	0.78	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00547	ft/ft

Cross Section for Michael Way and 20' Alley Curb 10

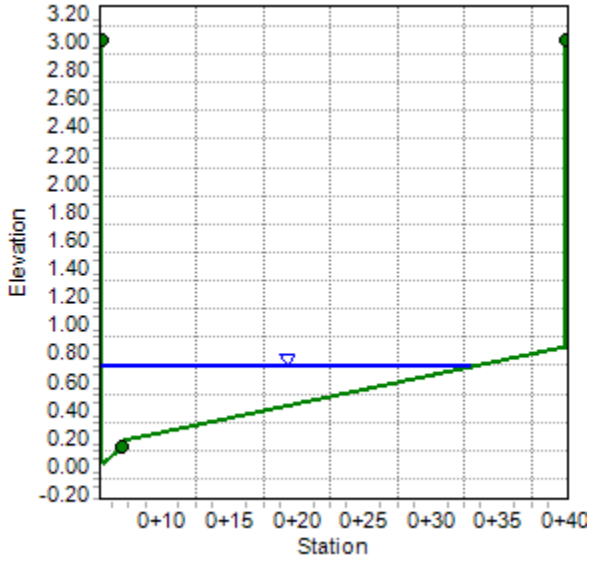
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.69	ft
Discharge	33.36	ft³/s

Cross Section Image



PIMA COUNTY FLOW SPLIT CALCULATIONS - EXISTING CONDITION 10-YEAR

$$Q_L = 0.042\left[\frac{\left(Q_m^{0.93}\right)\left(W_{ss}^{0.85}\right)}{\left(S_m^{0.41}\right)\left(W_m^{0.79}\right)}\right]$$

$$Q_o = 46.8 \times W_{ss} \times Y_o \times S_{ss}^{0.5} - Q_L$$

$$Q_T = Q_L + Q_o$$

Where: Q_m = Main street flow measured between the curbs (cfs)
S_m = Longitudinal slope of the main street (ft / ft)
W_m = Width of the main street (ft)
W_{ss} = Width of side street (ft)
S_{ss} = Longitudinal slope of the side street (feet/foot)
Y_o= Average depth of overbank flow intercepted by the side street (ft)
Q_{OB} = Overbank flow on downstream side of Main Street (cfs)
Q_L = Lateral flow into the side street (cfs)
Q_O = Overbank flow intercepted by the side street (cfs)
Q_T = Total flow intercepted by the side street (cfs)
Q_R = Flow remaining in Main Street after split (cfs)

DESCRIPTIONS			INPUT							OUTPUT		RESULTS	
Flow Split Identifier	Main Street	Side Street	Q_m (cfs)	S_m (ft/ft)	W_m (ft)	W_{ss} (ft)	S_{ss} (ft/ft)	Y_o (ft)	Q_{OB} (cfs)	Q_L (cfs)	Q_O (cfs)	**Q_T (cfs)**	**Q_R (cfs)**
Michael Way and 20' Wide Alley	Michael	Alley	211	0.012	69	20	0.008	0.97	36	17	36	**53**	**194**

Worksheet for Michael Way and 20' Alley Main 100

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Discharge	247.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
0+00	2.00
0+00	0.60
0+05	0.50
0+06	0.50
0+06	0.00
0+07	0.13
0+07	0.17
0+40	0.83
0+73	0.17
0+73	0.13
0+75	0.00
0+75	0.50
0+75	0.50
0+80	0.60
0+80	2.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 2.00)	(0+07, 0.13)	0.013
(0+07, 0.13)	(0+73, 0.13)	0.016
(0+73, 0.13)	(0+80, 2.00)	0.013

Options

Current Roughness Weighted Method	Pavlovskii's Method

Worksheet for Michael Way and 20' Alley Main 100

Options

Open Channel Weighting Method	Pavlovskii's Method
Closed Channel Weighting Method	Pavlovskii's Method

Results

Normal Depth		0.97	ft
Elevation Range	0.00 to 2.00 ft		
Flow Area		38.69	ft²
Wetted Perimeter		81.85	ft
Hydraulic Radius		0.47	ft
Top Width		80.00	ft
Normal Depth		0.97	ft
Critical Depth		1.16	ft
Critical Slope		0.00414	ft/ft
Velocity		6.38	ft/s
Velocity Head		0.63	ft
Specific Energy		1.61	ft
Froude Number		1.62	
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	0.97	ft
Critical Depth	1.16	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00414	ft/ft

Cross Section for Michael Way and 20' Alley Main 100

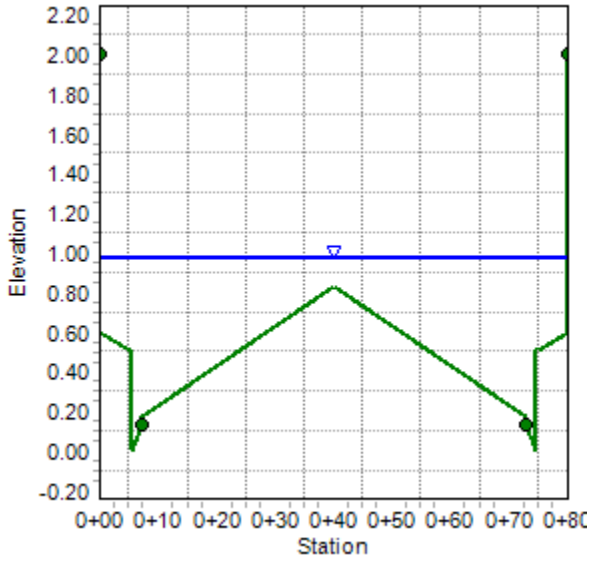
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.97	ft
Discharge	247.00	ft³/s

Cross Section Image



Worksheet for Michael Way and 20' Alley Curb 100

Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.97	ft

Section Definitions

Station (ft)	Elevation (ft)
0+06	3.00
0+06	0.00
0+07	0.13
0+07	0.17
0+40	0.83
0+73	0.17
0+73	0.13
0+75	0.00
0+75	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+06, 3.00)	(0+07, 0.13)	0.013
(0+07, 0.13)	(0+73, 0.13)	0.016
(0+73, 0.13)	(0+75, 3.00)	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

Discharge	211.41	ft³/s
Elevation Range	0.00 to 3.00 ft	

Worksheet for Michael Way and 20' Alley Curb 100

Results

Flow Area		33.74	ft²
Wetted Perimeter		71.04	ft
Hydraulic Radius		0.47	ft
Top Width		69.00	ft
Normal Depth		0.97	ft
Critical Depth		1.14	ft
Critical Slope		0.00437	ft/ft
Velocity		6.27	ft/s
Velocity Head		0.61	ft
Specific Energy		1.58	ft
Froude Number		1.58	
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	0.97	ft
Critical Depth	1.14	ft
Channel Slope	0.01200	ft/ft
Critical Slope	0.00437	ft/ft

Cross Section for Michael Way and 20' Alley Curb 100

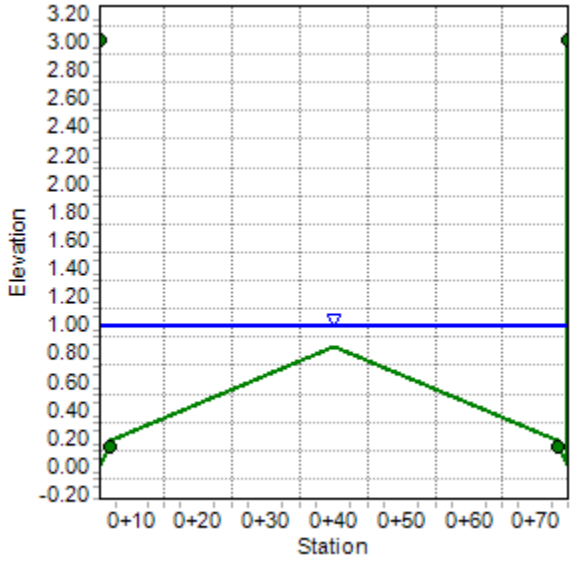
Project Description

Friction Method	Manning Formula
Solve For	Discharge

Input Data

Channel Slope	0.01200	ft/ft
Normal Depth	0.97	ft
Discharge	211.41	ft³/s

Cross Section Image



BLOCK WALL OPENING/WEIR CALCULATION

BLOCK WALL OPENING CALCULATIONS

DEVELOPMENT CRYSTAL PARK

W.O. # 7519 **CALCULATED BY** WJM

Description		Orifice Calculation			Weir Calculation			Opening Size	
Location	Q (cfs)	C_d	h (ft)	L (ft)	C_d	h (ft)	L (ft)	H (ft)	L (ft)
Northeast Site Corner	114	0.65	0.66667	**20.1**	3	1.33333	**24.7**	**1.3**	**24.7**

Notes: Minimum Block wall opening is 16" x 48"

Opening size is calculated with both Orifice and Weir, using the larger of the two

Use double the Q value to account for 50% clogging factor

ORIFICE EQUATION

$$Q = A * C_d * (2gh)^{1/2}$$

Q= Flow value (cfs) g= Gravity (32.2)

A= Area (sf)= L * 2h h= Orifice Height (ft)

C= Constant (0.65)

WEIR EQUATION

$$Q = C_d \times L \times h^{3/2}$$

Q= Flow value (cfs) h= Flow Depth (ft)

L= Length of weir (ft)

C= Constant (3.0)

LID CALCULATIONS

STORM WATER QUALITY CALCULATIONS

PROJECT: Crystal Park Apartments
W.O.# : 7844
INTERSECTION: Michael Way
CALCULATED BY: JYA

STORM WATER QUALITY CALCULATIONS
Section 1502.3 of the 2013 CCRFCD Manual

1.) Determine BMP Design Precipitation - 85th Percentile Rainfall Depth

D_2(site)= 0.72 in.

D_2(McCarran)= 0.72 in.

$$D_{85} = 0.32 \frac{D_{2(site)}}{D_{2(McCarran)}}$$

D_{85}= 0.320 in.

2.) Calculate BMP Design Peak Discharge

Calculate unit discharge for the 90 percent average percent impervious area condition based on the D_{85} value.

$$Q_P / A = 1.5042 D_{85} - 0.0066$$

Q_p/A= 0.475

Calculate the unit discharge for the site based on the actual percent impervious area of the parking lot and associated landscaped areas.

% Impervious= 78 %

$Ratio\ {}^{Q_P}/_{A}$=0.0059(% Impervious)+0.4688

Ratio Q_p/A= 0.9290

$Q_p/A_{(site)}$= 0.4410

Calculate the peak design discharge in cfs .

Site Area= 10 acres

$$Q_P = {}^{Q_P}/_{A} \times A$$

Q_p= 4.4104 cfs

3.) Calculate BMP Design Peak Runoff Volume

Calculate unit runoff volume (Vol/A) for the 90 percent average percent impervious area condition based on the D_{85} value.

$$Vol/_A = 0.0887 D_{85} + 0.0057$$

Vol/A= 0.0341

Calculate the unit runoff volume for the site based on the actual percent impervious area of the parking lot and associated landscaped areas.

$Vol/A_{(site)}$= 0.0317

Calculate the peak design runoff volume in acre-feet.

$$Vol = Vol/_A * A$$

Q_P= 0.3166 acre-feet

NOTES:
Minimum swale length = 40-feet
Maximum swale depth = 0.75-feet
75% of site area must flow to swale

Worksheet for LID Ditch

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.6	%
Discharge	4.00	ft³/s

Section Definitions

Station (ft)	Elevation (ft)
1+00.00	3.00
1+00.00	1.90
1+25.36	1.04
1+25.36	0.45
1+34.36	0.00
1+34.36	3.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(1+00.00, 3.00)	(1+25.36, 0.45)	0.016
(1+25.36, 0.45)	(1+34.36, 3.00)	0.035

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		0.54	ft
Elevation Range	0.00 to 3.00 ft		
Flow Area		2.79	ft²
Wetted Perimeter		9.63	ft
Hydraulic Radius		0.29	ft
Top Width		9.00	ft

Worksheet for LID Ditch

Results

Normal Depth		0.54	ft
Critical Depth		0.40	ft
Critical Slope		0.03246	ft/ft
Velocity		1.43	ft/s
Velocity Head		0.03	ft
Specific Energy		0.57	ft
Froude Number		0.45	
Flow Type	Subcritical		

GVF Input Data

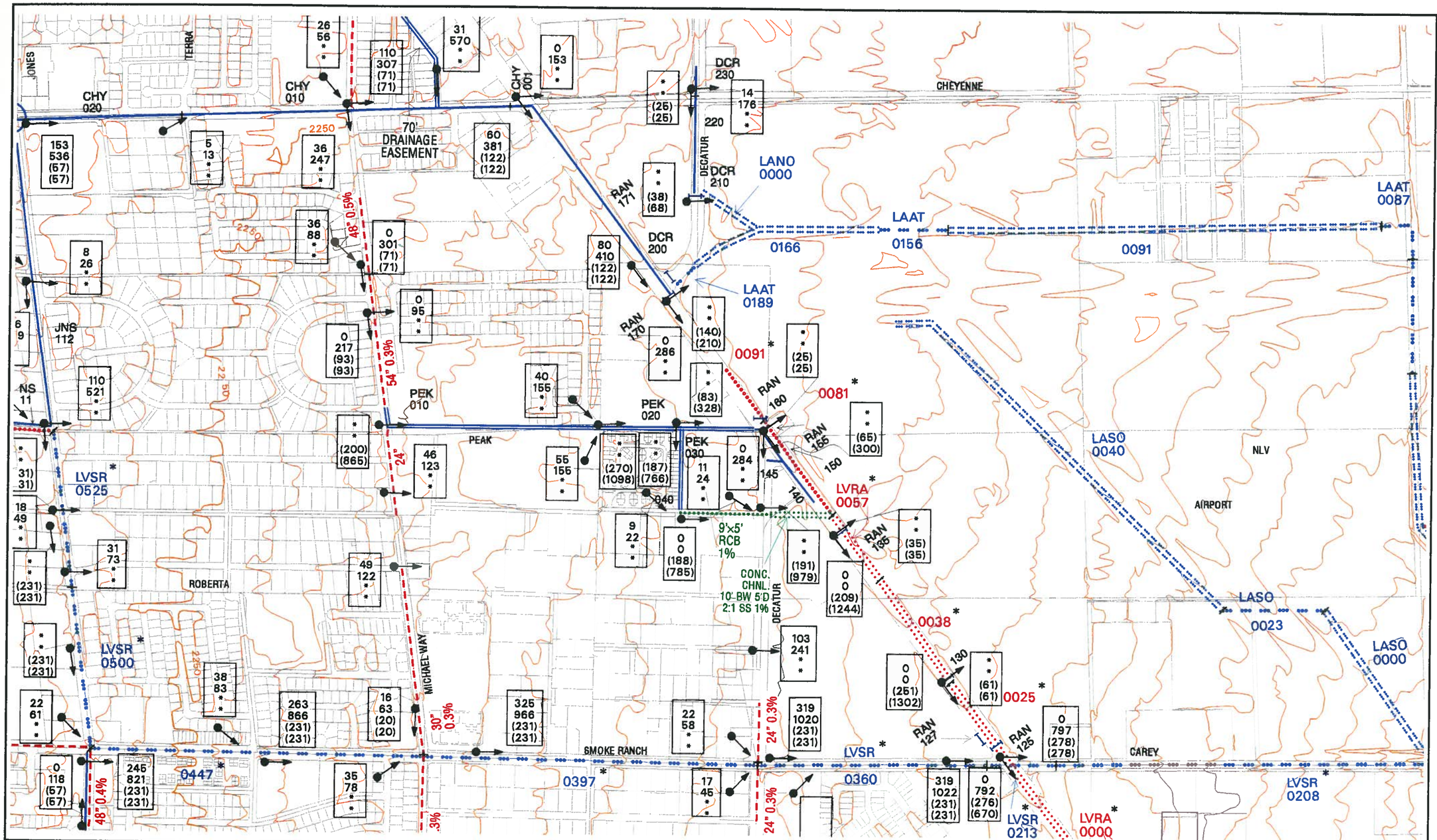
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

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	0.54	ft
Critical Depth	0.40	ft
Channel Slope	0.6	%
Critical Slope	0.03246	ft/ft

APPENDIX D
REFERENCE MATERIAL

NORTHWEST NIEGHBORHOOD STUDY



NORTHWEST NEIGHBORHOOD STUDY

LEGEND

- EXISTING REGIONAL DETENTION BASINS
- PROPOSED REGIONAL DETENTION BASINS
- EXISTING LOCAL DETENTION BASINS
- EXISTING REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES
- EXISTING LOCAL BRIDGES
- EXISTING REGIONAL CULVERT
- PROPOSED REGIONAL CULVERT
- EXISTING LOCAL CULVERT
- EXISTING REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE
- EXISTING LOCAL PIPELINE
- PROPOSED LOCAL PIPLINE
- EXISTING REGIONAL CHANNEL
- PROPOSED REGIONAL CHANNEL
- EXISTING LOCAL CHANNEL
- PROPOSED REGIONAL PIPELINE (Not Included in 1996 MPU)
- PROPOSED REGIONAL CHANNEL (Not Included in 1996 MPU)
- EXISTING REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE
- EXISTING LOCAL DIKE/LEVEE
- EXISTING STORM WATER PUMPING STATION
- PROPOSED BELTWAY ALIGNMENT

FIGURE F-16

N W E S

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

→ FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
(300)	10-YEAR FACILITY FLOW
(800)	100-YEAR FACILITY FLOW

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place

* See Chapter 7 of Volume I for additional proposed facilities in this area.

HUALPAI	FT. APACHE	DURANGO	BUFFALO	RAINBOW	JONES	DECATUR	
1		2		3			ELKHORN
4		5		6			CENTENNIAL
7		8		9			ANN
10		11		12			LONE MOUNTAIN
				13		14	ALEXANDER
				15		16	CHEYENNE
				17		18	SMOKE RANCH

FUTURE DRAINAGE CONDITIONS

PBS

POST, BUCKLEY, SCHUH & JERNIGAN, INC.

ENGINEERING PLANNING SURVEYING GIS

901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014

Phone: (702) 263-7275 Fax: (702) 263-7300

CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

SUB-BASIN BOUNDARY

FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
300	10-YEAR FACILITY FLOW
800	100-YEAR FACILITY FLOW

(FLOWS IN CFS)

BWJS ←→ Basin-ID

(13 / 59) ←→ Contributing flow (10-Year / 100-Year) from the basin (cfs)

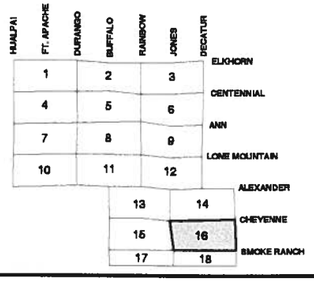
PHOTO DATE: APRIL 1996

FIGURE E-16



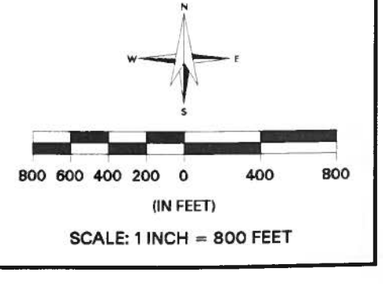
EXISTING DRAINAGE CONDITIONS

PBS&J
POST, BUCKLEY, SCHUH & JERNIGAN, INC.
ENGINEERING PLANNING SURVEYING GIS
901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200



NOTE:

Existing conditions are based on future CN values with only existinig local and CCRFCD facilities in place



SCALE: 1 INCH = 800 FEET

COMMENT LETTER FOR PRVIOUS LOCHSA STUDY

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM			DATE: June 8, 2015
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: Crystal Park Apartments		COPIES TO: Lochsa Engineering
Cross Streets:	SEQ of Cheyenne Ave. & Michael Way		3000M W LLC
File Number:	F:\Depot\DSMemos\DS4734A.ZNAE.doc		Bart Anderson, P.E., DevCo
Parcel Number:	138-13-512-001		CCRFCD
Zoning Action:	SDR-57685		
FEMA Flood Zone:	YES X	NO	
Proposed Storm Drain:	YES	NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	5/19/2015	6/4/2015	See Comments Below	$400.00	398185: $400
			TOTAL FEES (LDDRS):	$400.00	----

REMARKS:

A portion of the site is located within a FEMA Special Flood Hazard Area, Zone AE.

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. A portion of the site is within a FEMA Special Flood Hazard Area (SFHA), Zone AE. Development within the SFHA requires that changes to the adopted water surface elevation and/or the Flood Zone Boundary mandate submittal and approval by FEMA. Provide a detailed analysis of the Flood Zone impacts from this development. Flood Control recommends a meeting to discuss the detailed analysis prior to resubmittal of the drainage study.

2. Since the project is within a FEMA Flood Zone AE, *Clark County Regional Flood Control District* (CCRFCD) concurrence is required prior to the final approval of the drainage study by the *City of Las Vegas.*

3. A review of the grading plan shows an elevation difference of approximately XX-feet of cut/fill adjacent to developed properties. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.

4. On the ***Developed Condition Onsite Drainage Map***, it appears that the summary information for ***Hydraulic Cross Sections DD*** and from ***1 to 12*** are missing. Provide as such on the drainage map in the next submittal.

5. It appears that there could be a flow split at the intersection of Michael Way and the alley to the north. The subject project proposes to construct a retaining wall/north property wall. This will narrow down the flow corridor in the alley and will negatively impact the residences along the north side of the alley. Address the flow split and the wall impact to the adjacent houses in the existing versus proposed conditions in the next submittal.

6. Per *Figure F-16* of the *City of Las Vegas Northwest Neighborhood Master Plan*, a 48" storm drain main line is planned in *Michael Way* along the frontage of the subject development to mitigate the anticipated non-compliance of the 10-year "dry-lane" and the 100-year "DV-value" exceeding 8.0. The subject drainage study did confirm the non-compliance without the 48"-storm drain in ***Section 2.2***. The developer or owner of the project must therefore construct such storm drain and the associated facilities such as drop inlets, laterals and manholes concurrently with the onsite improvements. Show the design of this system in the next submittal.

7. In the next submittal, provide a copy of a parcel map that shall verify that the subject development has the right to perpetuate the runoff to the adjacent lot to the east. Drainage Easement?

8. The proposed drainage pattern of the subject site is to drain along the east boundary and go south. However, it is noticed that majority of the parking stalls are lined up right adjacent to the east property line, ie, the parking stalls are used as a drainage corridor. This is not acceptable because it is highly likely that the parking stalls can be parked full of vehicles during a major storm event. The tires of the vehicles will reduce the effective conveyance area seriously. The engineer/developer must use the drive isles instead of the parking stalls as flow corridor. Revise the grading design and pertinent cross sections such as ***D/C5.02***, ***E/C5.02*** and ***F/C5.02*** accordingly.

9. At the southeast corner of the site, the engineer must consider that the bottom of the wrought iron gate will be blocked by debris which will elevate the tailwater elevation at the discharge point and thus impact the nearest adjacent apartment building in a negative way. Provide a weir calculation assuming a minimum of 6"-high of debris at the gate and verify whether the nearest building are still adequately flood protected.

10. The aggregate areas of the parking lots are over one acre. Per ***Section 1502*** of the *Clark County Regional Flood Control District's Hydrologic Criteria and Drainage Design Manual*, the subject improvements must provide for Low Impact Development (LID) measures. Please review and address the issue in the next submittal.

11. This drainage study assumes that the project will be constructed in one phase. If improvement plans are submitted to break the project into separate phases, a drainage study update will be required for each phase addressing the interim condition.

12. The proposed wrought iron fence must utilize *City of Las Vegas* Standard Drawing 421B. Contact Raul Cruz at 229-3224 for the AutoCAD details (421 series) to be included with the improvement plans.

13. Revise Section C/5.02 along the north boundary to include the existing alley section adjacent to the site.

14. Explain why ***Detail Section L*** does not have an A-curb behind the sidewalk. Provide a swale in the landscape area.

15. **Sheet C3.02**: Label the finish floor elevations of the existing houses adjacent to the south on the grading plan.

16. ***Detail Sections A*** and ***B*** in ***Sheet C5.02*** show a 1'-high A-curb flatly sitting adjacent to a sidewalk without any key. This appears that the lateral soil pressure from the landscape behind will overturn or move the A-curb in no time. Provide a foundation or key at the bottom as an integral structure in the next submittal. Review and revise accordingly.

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

END OF REMARKS
ays

T/R/S: T20S/R60E/13
AREA L-13

CLARK COUNTY ASSESOR INFORMATION

GENERAL INFORMATION	
PARCEL NO.	138-13-512-001
OWNER AND MAILING ADDRESS	3000M W L L C %E A BECKER INVEST CO 3065 N RANCHO RD #130 LAS VEGAS NV 89130
LOCATION ADDRESS **CITY/UNINCORPORATED TOWN**	3000 N MICHAEL WAY LAS VEGAS
ASSESSOR DESCRIPTION	CHEYENNE RANCHO PROFESSIONAL PLAZA PLAT BOOK 95 PAGE 52 LOT 2
RECORDED DOCUMENT NO.	* 20120531:04657
RECORDED DATE	May 31 2012
VESTING	NS

*Note: Only documents from September 15, 1999 through present are available for viewing.

ASSESSMENT INFORMATION AND VALUE EXCLUDED FROM PARTIAL ABATEMENT	
TAX DISTRICT	200
APPRAISAL YEAR	2016
FISCAL YEAR	2017-18
SUPPLEMENTAL IMPROVEMENT VALUE	0
INCREMENTAL LAND	0
INCREMENTAL IMPROVEMENTS	0

REAL PROPERTY ASSESSED VALUE		
FISCAL YEAR	2016-17	2017-18
LAND	348950	610663
IMPROVEMENTS	0	0
PERSONAL PROPERTY	0	0
EXEMPT	0	0
GROSS ASSESSED (SUBTOTAL)	348950	610663
TAXABLE LAND+IMP (SUBTOTAL)	997000	1744751
COMMON ELEMENT ALLOCATION ASSD	0	0
TOTAL ASSESSED VALUE	348950	610663
TOTAL TAXABLE VALUE	997000	1744751

ESTIMATED LOT SIZE AND APPRAISAL INFORMATION	
ESTIMATED SIZE	9.97 Acres
ORIGINAL CONST. YEAR	0
LAST SALE PRICE **MONTH/YEAR** **SALE TYPE**	0
LAND USE	12.000 - Vacant - Single Family Residential
DWELLING UNITS	0

PRIMARY RESIDENTIAL STRUCTURE

1ST FLOOR SQ. FT.	0	**CASITA SQ. FT.**	0	**ADDN/CONV**	
2ND FLOOR SQ. FT.	0	**CARPORT SQ. FT.**	0	**POOL**	NO
3RD FLOOR SQ. FT.	0	**STYLE**		**SPA**	NO
UNFINISHED BASEMENT SQ. FT.	0	**BEDROOMS**	0	**TYPE OF CONSTRUCTION**	
FINISHED BASEMENT SQ. FT.	0	**BATHROOMS**	0	**ROOF TYPE**	
BASEMENT GARAGE SQ. FT.	0	**FIREPLACE**	0		
TOTAL GARAGE SQ. FT.	0				

GENERAL INFORMATION	
PARCEL NO.	138-13-512-007
OWNER AND MAILING ADDRESS	RANCHO PROPERTIES L L C %E A BECKER INVEST CO 3065 N RANCHO RD #130 LAS VEGAS NV 89130
LOCATION ADDRESS **CITY/UNINCORPORATED TOWN**	3013 N RANCHO DR LAS VEGAS
ASSESSOR DESCRIPTION	CHEYENNE RANCHO PROFESSIONAL PLAZA PLAT BOOK 95 PAGE 52 PT LOT 1
RECORDED DOCUMENT NO.	* 20101118:04456
RECORDED DATE	Nov 18 2010
VESTING	NS
COMMENTS	SF 110-10;A-20100316:3985

*Note: Only documents from September 15, 1999 through present are available for viewing.

ASSESSMENT INFORMATION AND VALUE EXCLUDED FROM PARTIAL ABATEMENT	
TAX DISTRICT	200
APPRAISAL YEAR	2016
FISCAL YEAR	2017-18
SUPPLEMENTAL IMPROVEMENT VALUE	0
INCREMENTAL LAND	0
INCREMENTAL IMPROVEMENTS	0

REAL PROPERTY ASSESSED VALUE		
FISCAL YEAR	2016-17	2017-18
LAND	346768	377888
IMPROVEMENTS	845710	853850
PERSONAL PROPERTY	0	0
EXEMPT	0	0
GROSS ASSESSED (SUBTOTAL)	1192478	1231738
TAXABLE LAND+IMP (SUBTOTAL)	3407080	3519251
COMMON ELEMENT ALLOCATION ASSD	0	0
TOTAL ASSESSED VALUE	1192478	1231738
TOTAL TAXABLE VALUE	3407080	3519251

ESTIMATED LOT SIZE AND APPRAISAL INFORMATION	
ESTIMATED SIZE	4.86 Acres
ORIGINAL CONST. YEAR	2002
LAST SALE PRICE **MONTH/YEAR** **SALE TYPE**	0
LAND USE	50.240 - Light Manufacturing. Storage Facilities
DWELLING UNITS	1

PRIMARY RESIDENTIAL STRUCTURE					
1ST FLOOR SQ. FT.	0	CASITA SQ. FT.	0	ADDN/CONV	
2ND FLOOR SQ. FT.	0	CARPORT SQ. FT.	0	POOL	NO
3RD FLOOR SQ. FT.	0	STYLE	Industrial Flex Building	SPA	NO
UNFINISHED BASEMENT SQ. FT.	0	BEDROOMS	0	TYPE OF CONSTRUCTION	
FINISHED BASEMENT SQ. FT.	0	BATHROOMS	0	ROOF TYPE	
BASEMENT GARAGE SQ. FT.	0	FIREPLACE	0		
TOTAL GARAGE SQ. FT.	0				

GENERAL INFORMATION	
PARCEL NO.	138-13-512-001
OWNER AND MAILING ADDRESS	3000M W L L C %E A BECKER INVEST CO 3065 N RANCHO RD #130 LAS VEGAS NV 89130
LOCATION ADDRESS **CITY/UNINCORPORATED TOWN**	3000 N MICHAEL WAY LAS VEGAS
ASSESSOR DESCRIPTION	CHEYENNE RANCHO PROFESSIONAL PLAZA PLAT BOOK 95 PAGE 52 LOT 2
RECORDED DOCUMENT NO.	* 20120531:04657
RECORDED DATE	May 31 2012
VESTING	NS

*Note: Only documents from September 15, 1999 through present are available for viewing.

ASSESSMENT INFORMATION AND VALUE EXCLUDED FROM PARTIAL ABATEMENT	
TAX DISTRICT	200
APPRAISAL YEAR	2016
FISCAL YEAR	2017-18
SUPPLEMENTAL IMPROVEMENT VALUE	0
INCREMENTAL LAND	0
INCREMENTAL IMPROVEMENTS	0

REAL PROPERTY ASSESSED VALUE		
FISCAL YEAR	2016-17	2017-18
LAND	348950	610663
IMPROVEMENTS	0	0
PERSONAL PROPERTY	0	0
EXEMPT	0	0
GROSS ASSESSED (SUBTOTAL)	348950	610663
TAXABLE LAND+IMP (SUBTOTAL)	997000	1744751
COMMON ELEMENT ALLOCATION ASSD	0	0
TOTAL ASSESSED VALUE	348950	610663
TOTAL TAXABLE VALUE	997000	1744751

ESTIMATED LOT SIZE AND APPRAISAL INFORMATION	
ESTIMATED SIZE	9.97 Acres
ORIGINAL CONST. YEAR	0
LAST SALE PRICE **MONTH/YEAR** **SALE TYPE**	0
LAND USE	12.000 - Vacant - Single Family Residential
DWELLING UNITS	0

PRIMARY RESIDENTIAL STRUCTURE

1ST FLOOR SQ. FT.	0	**CASITA SQ. FT.**	0	**ADDN/CONV**	
2ND FLOOR SQ. FT.	0	**CARPORT SQ. FT.**	0	**POOL**	NO
3RD FLOOR SQ. FT.	0	**STYLE**		**SPA**	NO
UNFINISHED BASEMENT SQ. FT.	0	**BEDROOMS**	0	**TYPE OF CONSTRUCTION**	
FINISHED BASEMENT SQ. FT.	0	**BATHROOMS**	0	**ROOF TYPE**	
BASEMENT GARAGE SQ. FT.	0	**FIREPLACE**	0		
TOTAL GARAGE SQ. FT.	0				

GENERAL INFORMATION	
PARCEL NO.	138-13-512-007
OWNER AND MAILING ADDRESS	RANCHO PROPERTIES L L C %E A BECKER INVEST CO 3065 N RANCHO RD #130 LAS VEGAS NV 89130
LOCATION ADDRESS **CITY/UNINCORPORATED TOWN**	3013 N RANCHO DR LAS VEGAS
ASSESSOR DESCRIPTION	CHEYENNE RANCHO PROFESSIONAL PLAZA PLAT BOOK 95 PAGE 52 PT LOT 1
RECORDED DOCUMENT NO.	* 20101118:04456
RECORDED DATE	Nov 18 2010
VESTING	NS
COMMENTS	SF 110-10;A-20100316:3985

*Note: Only documents from September 15, 1999 through present are available for viewing.

ASSESSMENT INFORMATION AND VALUE EXCLUDED FROM PARTIAL ABATEMENT	
TAX DISTRICT	200
APPRAISAL YEAR	2016
FISCAL YEAR	2017-18
SUPPLEMENTAL IMPROVEMENT VALUE	0
INCREMENTAL LAND	0
INCREMENTAL IMPROVEMENTS	0

REAL PROPERTY ASSESSED VALUE		
FISCAL YEAR	2016-17	2017-18
LAND	346768	377888
IMPROVEMENTS	845710	853850
PERSONAL PROPERTY	0	0
EXEMPT	0	0
GROSS ASSESSED (SUBTOTAL)	1192478	1231738
TAXABLE LAND+IMP (SUBTOTAL)	3407080	3519251
COMMON ELEMENT ALLOCATION ASSD	0	0
TOTAL ASSESSED VALUE	1192478	1231738
TOTAL TAXABLE VALUE	3407080	3519251

ESTIMATED LOT SIZE AND APPRAISAL INFORMATION	
ESTIMATED SIZE	4.86 Acres
ORIGINAL CONST. YEAR	2002
LAST SALE PRICE **MONTH/YEAR** **SALE TYPE**	0
LAND USE	50.240 - Light Manufacturing. Storage Facilities
DWELLING UNITS	1

PRIMARY RESIDENTIAL STRUCTURE					
1ST FLOOR SQ. FT.	0	CASITA SQ. FT.	0	ADDN/CONV	
2ND FLOOR SQ. FT.	0	CARPORT SQ. FT.	0	POOL	NO
3RD FLOOR SQ. FT.	0	STYLE	Industrial Flex Building	SPA	NO
UNFINISHED BASEMENT SQ. FT.	0	BEDROOMS	0	TYPE OF CONSTRUCTION	
FINISHED BASEMENT SQ. FT.	0	BATHROOMS	0	ROOF TYPE	
BASEMENT GARAGE SQ. FT.	0	FIREPLACE	0		
TOTAL GARAGE SQ. FT.	0				

CRYSTAL PARK APARTMENTS

APN: 138-13-512-001

CITY OF LAS VEGAS

STATE OF NEVADA

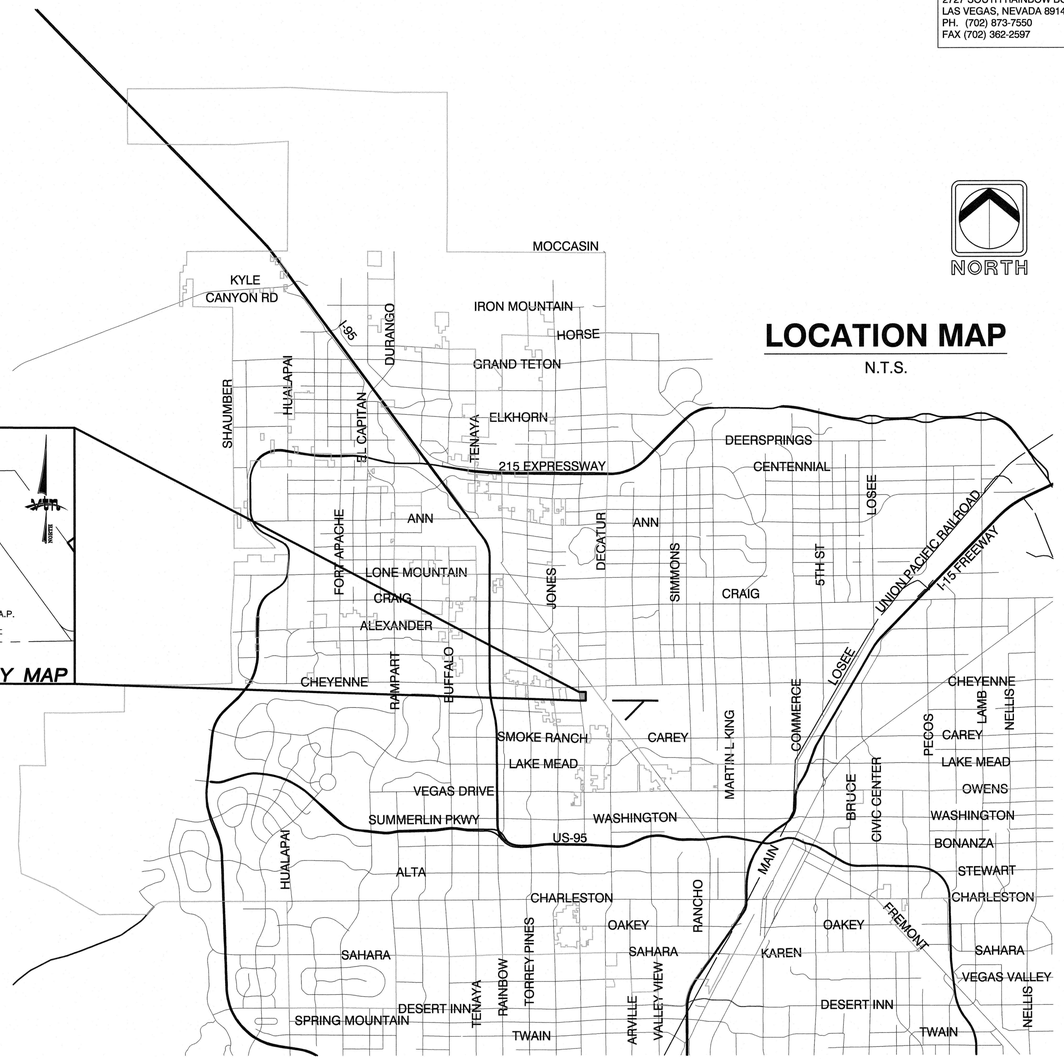
DEVELOPED BY:

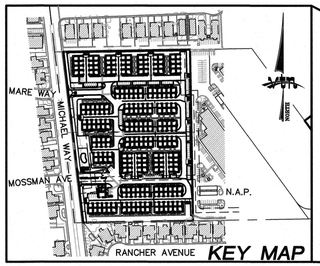
EAB INVESTMENT COMPANY

3065 N. RANCHO #130
LAS VEGAS, NV 89113

SHEET INDEX

SHEET #	SHEET	DESCRIPTION	
1	CV	COVER SHEET	
2	NT	NOTE SHEET	--
3	GR1	GRADING PLAN 1	
4	GR2	GRADING PLAN 2	
5	GR3	GRADING PLAN 3	
6	GR4	GRADING PLAN 4	
7	GR5	GRADING PLAN 5	
8	GR6	GRADING PLAN 6	
9	DT1	DETAIL SHEET 1	
10	DT2	DETAIL SHEET 2	
11	DT3	DETAIL SHEET 3	





LOCATION MAP

N.T.S.

NORTH

OWNER
EAB INVESTMENT COMPANY
3065 N. RANCHO #130
LAS VEGAS, NV 89113

DEVELOPER
EAB INVESTMENT COMPANY
3065 N. RANCHO #130
LAS VEGAS, NV 89113

ENGINEERING FIRM
VTN
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7550
FAX (702) 362-2597

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013N6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,186.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)

THESE PLANS AND THE DESIGN CRITERIA CONTAINED WITHIN THESE PLANS ARE BASED UPON THE INFORMATION PRESENTLY KNOWN BY THE ENGINEER AND INTENDED SOLELY AS A GENERAL GUIDELINE FOR CONSTRUCTION. ALL CONSTRUCTION SHALL BE IN CONFORMANCE WITH ALL APPLICABLE LOCAL, STATE AND FEDERAL STATUTES, LAWS, CODES, REGULATIONS AND ORDINANCES, INCLUDING BUT NOT LIMITED TO THE FEDERAL FAIR HOUSING AMENDMENTS ACT, AMERICANS WITH DISABILITIES ACT, THE ARCHITECTURAL BARRIERS ACT AND ANY APPLICABLE UNIFORM STANDARDS, SPECIFICATIONS OR DRAWINGS. THE PERSON OR ENTITY PERFORMING THE CONSTRUCTION SHALL BE SOLELY RESPONSIBLE TO MAKE SURE CONSTRUCTION IS IN CONFORMANCE WITH ALL LOCAL, STATE AND FEDERAL STATUES, LAWS, CODES, REGULATIONS, STANDARDS, GUIDELINES AND ORDINANCES AND FURTHER, IS IN CONFORMANCE WITH ANY APPLICABLE DESIGN CRITERIA, INCLUDING BUT NOT LIMITED TO SOILS REPORTS, TRAFFIC STUDIES, GEOTECHNICAL REPORTS, ARCHITECTURAL PLANS AND SPECIFICATIONS, DRAINAGE PLANS OR STUDIES AND ANY OTHER CRITERIA, STANDARDS OR REQUIREMENTS LISTED IN THE PLANS OR THE GENERAL NOTES RELATED TO THESE PLANS OR PROVIDED BY ANYONE IN REFERENCE TO THIS PROJECT.

APPROVALS

CITY ENGINEER ALLEN PAVELKA, P.E. # 9029

APPROVAL OF THESE PLANS BY THE CITY ENGINEER IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARD THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARDS IN FAVOR OF THE UNIFORM STANDARD DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA NEVADA.

CHRIS KNIGHT, DIRECTOR OF BUILDING & SAFETY DATE

THIS PLAN MEETS THE APPLICABLE STANDARDS OF THE PLANNING AND DEVELOPMENT DEPARTMENT

CENTRAL TELEPHONE COMPANY d/b/a CENTURYLINK DATE

"THE AFFIXED CENTURY LINK NEVADA APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS."

NV ENERGY DATE

NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NVENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.

COX COMMUNICATIONS LAS VEGAS, INC. DATE

SOUTHWEST GAS CORPORATION DATE

LAS VEGAS FIRE & RESCUE DATE

LAS VEGAS VALLEY WATER DISTRICT

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER

PROJECT:---- DATE:_____;

SHEETS:

FIRE DEPARTMENT APPROVAL

APPROVAL BY THE FIRE DEPARTMENT HAVING JURISDICTION IS REQUIRED PRIOR TO OBTAINING FINAL APPROVAL FROM THE LVVWD.

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.
CALL 811 OR
1-800-227-2600 AND
1-702-455-6000
CLARK COUNTY TRAFFIC OPERATIONS

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL AND STREET LIGHT SYSTEM CONDUITS IT'S COSTLY.
Call before you Underground
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-229-6611
LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3065 N. RANCHO #130
LAS VEGAS, NV 89113

LAS VEGAS, NV

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7550 FAX (702) 362-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

COVER SHEET

CRYSTAL PARK APARTMENTS

DRAWN BY: KDH	04/25/2017	SCALE:	HORIZ. N/A
DESIGNED BY: DEH	04/25/2017		VERT: N/A
CHECKED BY: WJM	08/14/2017		
PROJECT NO: 7844			

PROFESSIONAL ENGINEER STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745
9/28/17

SHEET
CV
1 OF **11** SHEETS

DRAWING NO.

H:\7844\Sheet Set\7844-CV.dwg

CITY OF LAS VEGAS GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA NEVADA", LATEST ISSUE; THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA NEVADA", LATEST REVISED EDITION; THE "SUMMERLIN IMPROVEMENT STANDARDS" FOR WORK IN SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON THIS SHEET AS "DEVIATIONS FROM STANDARDS".
2. THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE, LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCE'S WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUTIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.
3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER AND OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.
4. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS, ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.
5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE CONCRETE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGN TO BE APPROVED BY THE CITY PRIOR TO THE USE ON THE PROJECT.
6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.
7. EXPANSION JOINTS REQUIRED, MAXIMUM EVERY 300' IN EXTRUDED-TYPE CURB.
8. AC PAVEMENT TO BE ONE-HALF INCH (1/2") ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS AND CROSS GUTTERS.
9. CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY OF LAS VEGAS SHALL BE REMOVED AND REPLACED PER STANDARD DRAWING 216.
10. SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD DRAWING 235. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.
11. CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE SHOWN ON PLANS.
12. ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY : ----, PROJECT NO. ----, DATED ----.
13. EXACT LOCATION OF ALL SAWCUT LINES MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS ENGINEER IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES REALLOCATIONS.
14. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. STATUTE NO. 625.380 AND CITY OF LAS VEGAS TITLE 18, APPENDIX D.
15. UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC., SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY AND THE CITY ENGINEER.

WALL NOTES:

16. ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS; FLOOD CONTROL AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPARATE PERMIT AND INSPECTION BY THE BUILDING DEPARTMENT.
17. ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHT OF WAY.
18. CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, AND SEWER CLEAN OUTS, ETC. TO FINISH GRADE AS APPLICABLE WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.
19. MATERIALS, HANDLING AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF "NDOT" OR THE CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND DETAILS SHOWN HEREON.
20. WHEN INSTALLING UNDERGROUND FACILITIES THAT REQUIRE UNDERGROUND LOCATING DEVICES SUCH AS MARKER BALLS, LOCATING RIBBON, ETC., THE CONTRACTOR SHALL PROVIDE WRITTEN DOCUMENTATION TO OFFSITE INSPECTION AND TESTING CERTIFYING THAT ALL DEVICES HAVE BEEN PLACED AND VERIFIED TO BE IN GOOD WORKING CONDITION PRIOR TO THE CONSTRUCTION OF ANY ROAD BASE.
21. SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S) SHALL BE PROVIDED TO THE CITY AND APPROVED PRIOR TO ACCEPTANCE OF FACILITY VIDEO INSPECTION. PROJECT ACCEPTANCE. THE MAP(S) SHALL INCLUDE THE HORIZONTAL AND VERTICAL (INVERT) LOCATION OF PUBLIC SEWER MANHOLES, STORM DRAIN MANHOLES TRANSITION STRUCTURES, STORM DRAIN LATERALS AT THE CONNECTION TO THE STORM DRAIN MAIN AND AT THE CONNECTION TO A DROP INLET, THE CONNECTION OF SEWER SERVICE LATERALS TO THE SEWER MAIN AND WHERE THE SEWER SERVICE LATERALS EXIT THE PUBLIC RIGHT-OF-WAY. AND STORM DRAIN MAIN ALIGNMENT, INCLUDING DEFLECTION POINTS. THE LOCATION SHALL BE DESCRIBED BY COORDINATES WHICH SHALL BE BASED ON THE OFFICIAL HORIZONTAL AND VERTICLE AND CERTIFIED BY A NEVADA PROFESSIONAL LAND SURVEYOR TO HAVE POSITIONAL CERTAINTIES OF +/- 0.09 METER (+/- 0.3 FEET) HORIZONTALLY AND VERTICALLY. A SEPARATE ELECTRONIC COMMA DELIMITED FILE FOR THE SANITARY SEWER AND STORM DRAIN COORDINATES SHALL ALSO ACCOMPANY THE SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S).
22. CCTV VIDEO INSPECTION IS REQUIRED FOR ALL SEWER AND STORM DRAINS. THE CCTV VIDEO INSPECTIONS NEED TO BE PERFORMED PER THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS LATEST EDITION.
23. A SEPARATE BORING PERMIT IS REQUIRED FOR BORING ACTIVITIES.

REVISED 04/05/10

CITY OF LAS VEGAS STREETLIGHT NOTES:

1. ALL STREET LIGHTING INSTALLATIONS SHALL BE IN ACCORDANCE WITH THE STREET LIGHTING PLANS, THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION, AND THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST REVISION.
2. NO DEVIATION OF STREET LIGHT, PULL BOX, CONDUITS (ETC.) LOCATIONS SHALL BE PERMITTED WITH OUT WRITTEN APPROVAL OF THE TRAFFIC/ELECTRICAL FIELD OPERATIONS DIVISION AND THE CITY ENGINEER. ANY DEVIATION FROM THE PLAN LOCATION WILL REQUIRE COMPLIANCE WITH SECTION 623.LO.03 (E) OF THE SPECIFICATIONS.
3. ALL EXISTING STREET LIGHTING SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.
4. ALL EMPTY CONDUIT SHALL HAVE PULL STRINGS INSTALLED PRIOR TO FINAL INSPECTION.
5. ANY STRUCTURE SUCH AS BLOCK WALLS, CHAIN LINK FENCES, RETAINING WALLS, ETC. SHALL LEAVE A MINIMUM CLEARANCE OF EIGHTEEN INCHES (18") TO THE FACE OF STREET LIGHTING POLE ON ALL SIDES WHEN STREETLIGHT IS INSTALLED BEHIND SIDEWALK, AND SHALL AT NO TIME COMPLETELY ENCLOSE THE STREET LIGHTING POLE.
6. AS-BUILT DRAWINGS SHALL BE SUPPLIED TO THE ELECTRICAL SERVICES SECTION PRIOR TO ANY PRE-FINAL INSPECTION. THE AS-BUILT DRAWING NEEDS TO BE STAMPED AS-BUILT AND SIGNED BY THE PREPARER.
7. SERVICE POINT SHALL BE COORDINATED WITH NEVADA POWER COMPANY, AND WHEREVER POSSIBLE, BE LOCATED NEAR THE CENTER OF THE CIRCUIT. SERVICE POINTS SHALL BE SHOWN ON THE PLANS.
8. IT SHALL BE ASSUMED THAT IN THE ABSENCE OF AN EXISTING, WORKABLE CIRCUIT TO ATTACH TO ALL INSTALLATIONS SHALL REQUIRE A NEW SERVICE FOR OPERATION OF THE CIRCUIT.
9. WHEREVER THERE IS AN OVERHEAD UTILITY THAT MAY CONFLICT WITH THE INSTALLATION OF STREET LIGHTING CIRCUITS AND/OR POLES, THESE CONFLICTS MUST BE RESOLVED BETWEEN THE DEVELOPER AND THE UTILITIES INVOLVED BEFORE STREETLIGHT BASES ARE INSTALLED AT NO EXPENSE TO THE CITY OF LAS VEGAS.
10. THE CONTRACTOR SHALL FURNISH COMPLETE SERVICE TO TRANSFORMERS AND CONTROL SYSTEMS IF REQUIRED ON PLANS.

DEPARTMENT OF PUBLIC WORKS NOTES

1. NON-STANDARD KNUCKLES APPROVED PER TMP-50117

CITY OF LAS VEGAS FIRE DEPARTMENT NOTES

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LAS VEGAS FIRE AND RESCUE ADOPTED FIRE CODE ORDINANCE #6324 FOR HYDRANT SPECIFICATIONS AND HYDRANT INSTALLATION SPECIFICATIONS.
2. ONLY FIRE HYDRANTS THAT ARE ON THE LAS VEGAS VALEY WATER DISTRICTS - APPROVED PRODUCTS LIST ARE ALLOWED TO BE INSTALLED.
3. A PERMIT IS REQUIRED FROM LAS VEGAS FIRE AND RESCUE FOR THE INSTALLATION OF ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTORS MATERIAL TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER BEFORE COMMENCEMENT OF WORK.
4. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS, FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED BEFORE COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDER AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW. **SNFC #6124, SECTION 1412**
5. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, THE CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTERLINE OF THE STREET ADJACENT TO THE FIRE HYDRANTS. **SNFC #6124 SECTION 507.5.7.3**
6. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED BEFORE COVERING THE LINES. CENTER LOADING IS ACCEPTABLE FOR THE HYDRO TESTS WITH PRIOR FIRE PREVENTION APPROVAL.
7. ALL ON-SITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE U.L. LISTED, A.W.W.A APPROVED AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE. **SNFC 507.2.1, NFPA 24**
8. PAINTING OF CURBS, FIRE HYDRANTS, PADS, PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, AND ALL OTHER WORK NECESSARY PER PLANS SHALL BE COMPLETED BEFORE APPROVAL BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION. **IFC 507; SNFC 507.5.7**
9. PRIVATE HYDRANTS SHALL BE PAINTED RED. **SNFC 507.5.7.1**
10. PRIOR TO THE FINAL OCCUPANCY, A FIRE FLOW TEST SHALL BE WITNESSED BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW. **IFC 507; SNFC 507.1**
11. FIRE HYDRANT SPACING SHALL BE AS FOLLOWS: **SNFC C102**
    - RESIDENTIAL – 500 FT UNSPRINKLERED; 600 FT SPRINKLERED.
    - COMMERCIAL – 300 FT UNSPRINKLERED; 400 FT SPRINKLERED.
12. WHERE THE WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED WHERE FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF THE STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT A MAXIMUM OF 1000 FT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR (4) OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FT ON AN ALTERNATING BASIS. **SNFC C102.14**
13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE RADIUS OF A CUL-DE-SAC OR WITHIN 20 FT OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.
14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FT OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION. **SNFC C102.12**
15. A MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FT, AS MEASURED BY AN APPROVED ROUTE. **SNFC 102.4**
16. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FT, AS MEASURED BY AN APPROVED ROUTE. **SNFC C102.7**
17. THE MAXIMUM DISTANCE FROM A HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FT. **SNFC 102.6**
18. TWO (2) SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE IS 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-INS ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN.
19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS. **SNFC 503.2.3**
20. THE GRADIENT FOR THE FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 12%. ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FT PRIOR TO OR AFTER THE GRADE CHANGE. ADJACENT TO THE STRUCTURES GRADIENT SHALL NOT EXCEED 6%. **SNFC 503.2.7 / 503.2.8**
21. THE TURNING RADIUS OF THE FIRE APPARATUS ACCESS ROADS SHALL BE NO LESS THAN 52 FT OUTSIDE AND 28 FT INSIDE TURNING RADIUS. **IFC SNFC 503.2.4**
22. VERTICAL CLEARANCE OF ALL FIRE APPARATUS ACCESS ROADS SHALL NOT BE LESS THAN 13FT 6 INS. **SNFC 503.2.1.1 / IFC 503**
23. FIRE DEPARTMENT ACCESS ROADS IN ALL **RESIDENTIAL** DEVELOPMENTS (EXCEPT APARTMENT BUILDINGS) SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 36 FT FLOW LINE TO FLOW LINE (THIS WIDTH MAY BE REDUCED TO 24 FT IF ALL BUILDINGS FRONTING THE STREET ARE SPRINKLERED) FOR MAIN RESIDENTIAL STREETS, WITH PARKING PERMITTED ON BOTH SIDES OF THE STREET. PRIVATE DRIVE AISLES, DRIVEWAYS, ETC. SHALL BE ALLOWED TO BE REDUCED TO A MINIMUM WIDTH OF 24 FT FLOW LINE TO FLOW LINE WHEN SERVING NO MORE THE 6 RESIDENTS, AND WHEN ON STREET PARKING IS DISALLOWED. **SNFC 503.2.1 / 503.2.11**
24. ALL FIRE APPARATUS ACCESS ROADS IN **COMMERCIAL** DEVELOPMENTS AND **APARTMENT COMPLEXES** SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 24 FT (FLOW LINE TO FLOW LINE), PROVIDED NO PARKING IS ALLOWED ON EITHER SIDE; 32 FT (FLOW LINE TO FLOW LINE), WITH PARALLEL PARKING ON ONE SIDE. AND 36 FT (FLOW LINE TO FLOW LINE), IF PARALLEL PARKING IS ALLOWED ON BOTH SIDES. THESE WIDTHS MAY BE REDUCED TO 24 FT IF SPRINKLERED. SNFC 503.2.1.1
25. A FIRE APPARATUS ACCESS ROAD SHALL BE REQUIRED WHEN ANY PORTION OF AN EXTERIOR WALL OF THE FIRST STORY IS LOCATED MORE THAN 150 FT FROM A FIRE DEPARTMENT VEHICLE ACCESS. THIS DISTANCE COULD BE INCREASED TO 250 FT IF THE BUILDING IS SPRINKLERED. **IFC 503.1.1 / SNFC 503.11**
26. APPROVED SECONDARY FIRE APPARATUS ACCESS SHALL BE PROVIDED FOR 100 OR MORE DWELLING UNITS, ROAD(S) WITH DEAD-ENDS OR WITH A SINGLE POINT OF ACCESS IN EXCESS OF 600 FT, AND FOR ALL COMMERCIAL, INDUSTRIAL, AND MULTI-FAMILY RESIDENTIAL DEVELOPMENTS. **SNFC 503.1.2**
27. ALL DEAD-END FIRE APPARATUS ROADS AND/OR FIRE LANES, PUBLIC OR PRIVATE, IN EXCESS OF 150 FT IN LENGTH SHALL BE PROVIDED WITH AN APPROVED TURN AROUND HAVING A MINIMUM DIAMETER OF 81 FT. **SNFC 503.2.5**
28. ALL FIRE APPARATUS ACCESS ROADS SHALL BE MARKED BY PLACING APPROVED SIGNS AT THE START OF THE DESIGNATED FIRE LANE, ONE SIGN AT THE END OF THE FIRE LANE AND WITH SIGNS AT INTERVALS OF 100 FT ALONG THE DESIGNATED FIRE LANES. SIGNS TO BE PLACED ON BOTH SIDES OF AN ACCESS ROADWAY IF NEEDED TO PREVENT PARKING ON EITHER SIDE. SIGNS TO BE INSTALLED NO HIGHER THAN 10 FT OR LESS THAN 6 FT FROM THE ROADWAY LEVEL. THE CURB ALONG OR ON THE PAVEMENT OR CEMENT (IF NO CURB IS PROVIDED) SHALL BE PAINTED WITH A RED WEATHER RESISTANT PAINT IN ADDITION TO THE SIGNS. **SNFC 503.3**
29. ELECTRICALLY CONTROLLED ACCESS GATES SHALL BE PROVIDED WITH AN APPROVED EMERGENCY VEHICLE DETECTOR/RECEIVER SYSTEM. SAID SYSTEM SHALL BE INSTALLED IN ACCORDANCE WITH THE CITY OF LAS VEGAS GUIDELINES FOR AUTOMATIC EMERGENCY VEHICLE ACCESS GATES. **IFC / SNFC 503.6**

CITY OF LAS VEGAS TRAFFIC NOTES

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE THE "NEVADA WORK ZONE TRAFFIC CONTROL HANDBOOK", LATEST EDITION, AND TO THE "MANUAL ON UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.
2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.
3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONE. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENTS INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER FIRST GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.
4. WHEN A DESIGNATED "SAFE ROUTE TO SCHOOL" IS ENCROACHED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING THROUGH THAT WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.
5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTIONS, TEMPORARY REMOVAL OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.
7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE (5) FEET OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGNPOST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGNPOST SHALL BE ELIMINATED.
8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HEREUNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.
9. STREET SIGNS AND STOP SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.
10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO ENSURE THE SAFETY OF THE PUBLIC IN OR AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIALIST SETUP, MAINTAIN, AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHTS-OF-WAY.
11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO TRAVELING PUBLIC.
12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING CITIZENS AREA TRANSIT (C.A.T.) IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET TO ARRANGE FOR TEMPORARY RELOCATION OF STOP.
13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE No. IS 229.3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONTROL. FEES FOR THE USE OF THESE OFFICERS SHALL BE SET UP BY METRO AND WILL BE PAID BY CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL ARRANGEMENTS WITH METRO.
14. ANY WORK WITHIN 300' OF A SIGNALIZED INTERSECTION WILL BE NIGHT WORK, UNLESS DIRECTED BY THE CITY OF LAS VEGAS TRAFFIC ENGINEER.

LAS VEGAS VALLEY WATER DISTRICT STANDARD NOTES

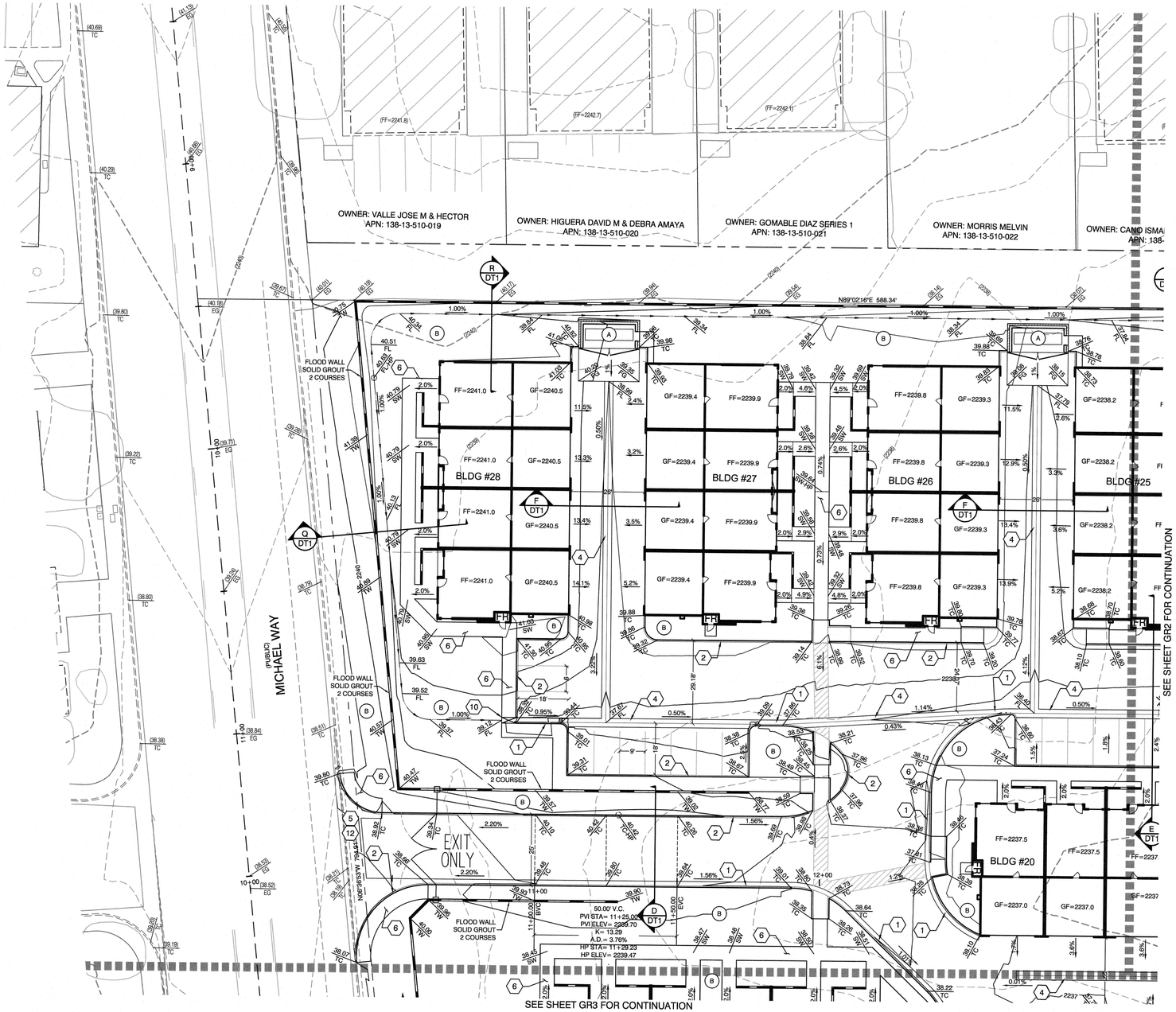
LVVWD PROJECT #----

1. NO WORK SHALL BEGIN UNTIL THE WATER PLANS HAVE BEEN APPROVED FOR CONSTRUCTION BY THE LVVWD. FOLLOWING WATER PLAN APPROVAL, NOTICE SHALL BE GIVEN TO THE LVVWD COMMUNICATION SUPPORT CENTER (258-7171) TWO (2) WORKING DAYS PRIOR TO THE START OF CONSTRUCTION. FOR FUTURE INSPECTIONS, NOTICE MUST BE GIVEN BY 2:00 P.M. THE BUSINESS DAY PRIOR TO THE REQUESTED LVVWD INSPECTION. WHEN REQUESTING INSPECTIONS, PLEASE REFER TO THE PROJECT # IDENTIFIED ABOVE.
2. ALL WORK SHALL CONFORM TO LVVWD STANDARD PLATES, DRAWINGS, AND SPECIFICATIONS AND TO THE 2010 EDITION OF THE UNIFORM DESIGN AND CONSTRUCTION STANDARDS FOR POTABLE WATER SYSTEMS (UDACS).
3. ALL WORK, EXCEPT AS MODIFIED BY THESE PLANS OR BY NOTE 2 ABOVE, SHALL BE DONE IN ACCORDANCE WITH THE MOST RECENT DRAFT OR EDITION OF THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFFSITE IMPROVEMENT, CLARK COUNTY AREA.
4. A SINGLE PIPE MATERIAL SHALL BE USED THROUGHOUT THE PROJECT UNLESS OTHERWISE APPROVED BY THE LVVWD.
5. ALL SERVICE LATERALS TWO (2) INCHES IN DIAMETER AND SMALLER SHALL BE TYPE K COPPER TUBING WITH LVVWD APPROVED SERVICE SADDLES.
6. ALL WATER METER BOXES SHALL BE LOCATED OUTSIDE OF DRIVEWAY AREAS.
7. ALL VALVES SHALL BE LOCATED OUTSIDE OF DRIVEWAYS, VALLEY AND CURB GUTTERS.
8. ALL WATER AND STORM DRAIN OR SANITARY SEWER CROSSINGS SHALL CONFORM TO SECTION 2.22 OF THE 2010 EDITION OF THE UDACS.
9. ALL WATER FACILITIES SHALL BE FILLED, DISINFECTED, PRESSURE TESTED, FLUSHED, FILLED AND AN ACCEPTABLE WATER SAMPLE OBTAINED, PRIOR TO CONNECTION TO THE LVVWD'S DISTRIBUTION SYSTEM
10. THE CONTRACTOR MUST OBTAIN ALL METERS TWO (2) INCHES AND SMALLER FROM LVVWD CENTRAL STORES. TELEPHONE 258-3152 OR 258-3802 TWO (2) WORKING DAYS PRIOR TO METER PICKUP.
11. ANY INTERUPTION OF SERVICE MUST BE PERFORMED IN ACCORDANCE WITH UDACS SECTION 3.14.01, AND APPROVED BY THE LVVWD INSPECTION DIVISION PRIOR TO SHUTDOWN. PROPER WRITTEN NOTIFICATION MUST BE GIVEN TO ALL AFFECTED CUSTOMERS.
12. ALL WATER FACILITY CONSTRUCTION MATERIALS USED MUST BE AS LISTED ON THE LVVWD PRE-APPROVED MATERIALS AND MANUFACTURERS LISTING FOR NEW FACILITIES, LATEST REVISION, OR SPECIFICALLY APPROVED ON THESE PLANS.
13. TELEPHONE "CALL BEFORE YOU DIG" AT "811" OR 1-800-227-2600.
14. THE INSTALLATION OF LAS VEGAS VALLEY WATER DISTRICT (LVVWD) MUNICIPAL WATER FACILITIES WITHIN ALL STREETS IS ASSUMED TO BE IN COMPLIANCE WITH THE UNIFORM STANDARDS, INCLUDING THE PLACEMENT OF ASPHALT PAVING STREET SURFACES. ANY REPAIR WORK DONE BY THE LVVWD TO THE MUNICIPAL WATER FACILITIES WILL INCLUDE THE PLACEMENT OF AN APPROPRIATELY SIZED ASPHALT REPAIR PATCH ON THE STREET SURFACE.

    ANY DECORATIVE PAVING SURFACE WITHIN THE STREET IS THE RESPONSIBILITY OF THE OWNERS ASSOCIATION, OR ANY INDIVIDUAL PROPERTY OWNERS IF NO OWNER'S ASSOCIATION IS IN EXISTENCE, OR THE AGENCY HAVING JURISDICTION. DECORATIVE SURFACE MATERIALS PLACED WITHIN THE TEN FOOT EASEMENT ABUTTING A PUBLIC OR PRIVATE STREET, IF DISTURBED BY THE LVVWD DURING THE REPAIR OPERATION OF ITS FACILITIES, WILL BE REPLACED BY THE LVVWD WITH AN APPROPRIATELY SIZED PLAIN FINISH CONCRETE PATCH, AND WILL NOT BE RESPONSIBLE FOR THE RESTORATION OF ANY DECORATIVE PAVING SURFACE WITHIN THE STREET. THE LVVWD WILL NOT ATTEMPT TO MATCH COLOR OR FINISH OF ANY ADJACENT MATERIALS.

CITY OF LAS VEGAS SEWER NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE LATEST EDITION OF THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS AND THE UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA, AS AMENDED. IT WILL BE THE RESPONSIBILITY OF THE CONTRACTOR TO BE AWARE OF THE CONTENTS OF THE ABOVE SPECIFICATIONS.
2. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO PERFORM CONSTRUCTION AS PER PLANS. ANY ADDITIONS, DELETIONS, OR CHANGES SHALL FIRST MEET WITH THE APPROVAL OF THE CITY ENGINEER.
3. CHISEL "S" OR "G" IN CURBS WHERE SEWER OR GAS LATERALS PASS UNDER THE CURB.
4. POLYVINYL (PVC) SEWER PIPE SHALL MEET ASTM D-3034 SDR 35 SPECIFICATIONS, INSTALLED WITH SAND BEDDING AND BACK FILL OF TYPE II AGGREGATE BASE.
5. ALL MANHOLES IN PAVED STREETS 80' R/W AND LARGER, SHALL HAVE CONCRETE COLLARS. STREETS LESS THAN EIGHTY (80') FOOT R/W WILL REQUIRE RETROFIT IF PAVING DOES NOT CONFORM TO CITY STANDARDS AT THE MANHOLE
6. TEE SADDLES SHALL BE USED TO CONNECT SEWER LATERALS TO EXISTING MAIN LINES UP TO TWELVE INCH (12") DIAMETER. CONNECTIONS TO FIFTEEN INCH (15") OR LARGER MAINS SHALL REQUIRE SPECIAL PROCEDURES. IN LINE

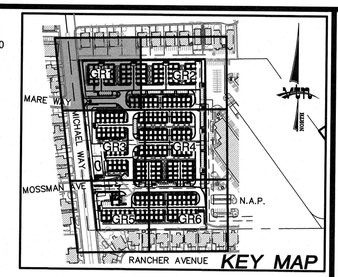


GRAPHIC SCALE

-20 0 10 20 40

1" = 20'

NORTH



LEGEND

DESCRIPTION	PROPOSED	EXISTING	FUTURE
CONTOUR (5' INTERVAL)	2450	(2450)	(2450)
CONTOUR (1' INTERVAL)			
EDGE OF PAVEMENT			
SAW CUT			
RETAINING WALL			
SCREEN WALL			
RIGHT OF WAY			
CENTER LINE			
BACK OF CURB			
LIP OF GUTTER			
FACE OF CURB			
SIDEWALK			
UNIT BOUNDARY LINE			
PROPERTY LINE			
SLOPE AND FLOW DIRECTION			
SCARP AREA			
MATCHLINE			
SIDEWALK RAMP			
SIGHT VISIBILITY ZONES			
PAVED ROAD			
PAVEMENT REMOVAL			
RIP RAP			
LANDSCAPE ROCK			

CONSTRUCTION NOTES

1. CONSTRUCT 24" TYPE "L" CURB & GUTTER PER CCAUSD #216.
2. CONSTRUCT TYPE "A" CURB PER CCAUSD #219.
3. 0" CURB FACE PER DETAIL ON SHEET DT3
4. CONSTRUCT 3' VALLEY GUTTER PER THE DETAIL ON SHEET DT3
5. CONSTRUCT 8' VALLEY GUTTER PER CCAUSD # 228
6. CONSTRUCT 5' SIDEWALK PER CCAUSD # 234
7. INSTALL PRECAST BUMPER BLOCK PER CCAUSD #238.
8. INSTALL LANDSCAPE ROCK D50=6" 12" THK
9. CONSTRUCT 2' CURB CUT PER DETAIL ON SHEET DT3
10. CONSTRUCT SIDE WALK UNDER DRAIN PER CCAUSD #236.
11. CONSTRUCT "U" CHANNEL PER DETAIL ON SHEET DT3
12. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225
13. CONSTRUCT 6" PVC STORM DRAIN

HANDICAP ACCESS TO THE RIGHT OF WAY

REMOVE EXISTING PAVEMENT

COORDINATION ITEMS

A. SEE ARCHITECTURAL DRAWINGS FOR TRASH ENCLOSURE PLAN AND DETAILS. MAXIMUM 1% SLOPE ON TRASH ENCLOSURE SLAB.

B. SEE ARCHITECTURAL AND LANDSCAPE PLANS FOR DETAILS OF OPEN SPACE AREAS.

ENGINEER DISCLAIMER NOTE:

UTILITY LOCATIONS SHOWN HERE ON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERE ON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH LAS VEGAS, NV, #----

15745 , P.E. No. WILLIAM J. MEYER DATE

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013NE6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)



Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL
811
OR
1-800-227-2600
AND
1-702-455-6000
CLARK COUNTY TRAFFIC OPERATIONS



SIGHT VISIBILITY ZONES:

NO STRUCTURE, WALLS, VEGETATION, OR OBJECT OF ANY KIND IS PERMITTED OVER TWENTY-FOUR (24) INCHES IN HEIGHT (MEASURED FROM THE TOP OF ADJACENT CURB IF CURB EXISTS) WITHIN THE SIGHT VISIBILITY ZONES.

EARTHWORK QUANTITIES

CUT	FILL	NET
8,336 CUBIC YARDS	19,754 CUBIC YARDS	11,418 CUBIC YARDS (FILL)

GRADING PERMIT NOTE

THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHERS STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE.

GEOTECHNICAL NOTE:

REFER TO SOILS REPORT: ----
PROJECT #----, DATED ----
HTE #----

SIDEWALK RAMPS TABLE

(PER CCAUSD No. 235, CASE I)

NO.	DIM "A"	DIM "B"	CASE
1	4.5'	12'	I
2	4.5'	9.5'	I
3	8'	8'	I
4	9.5'	4.5'	I
5	12'	4.5'	I

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3065 N. RANCHO #130
LAS VEGAS, NV 89113

LAS VEGAS, NV
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7500 FAX (702) 362-2697 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

GRADING PLAN 1

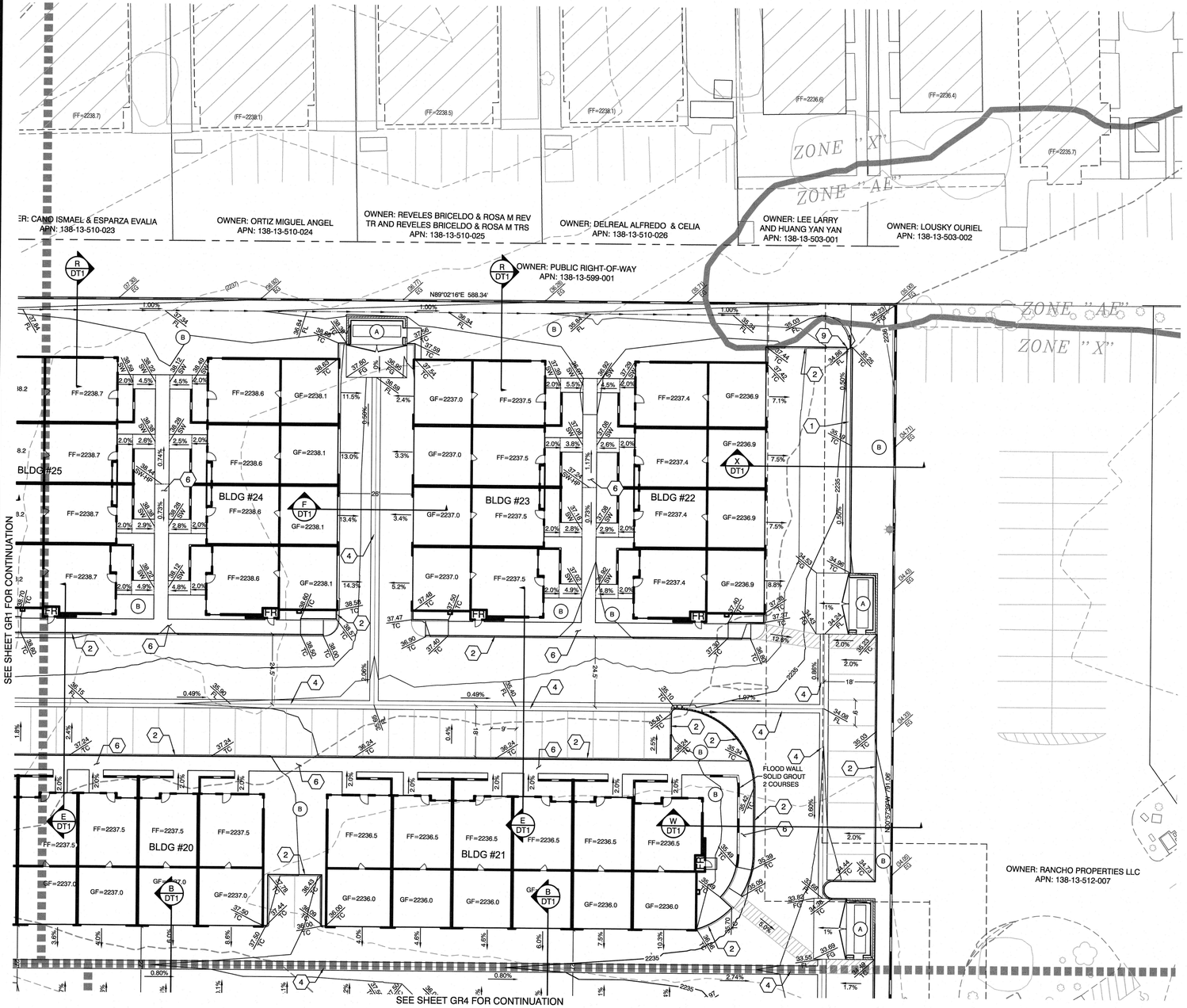
CRYSTAL PARK APARTMENTS

DRAWN BY: KDH	08/14/2017		SCALE: 1"=20'	HORIZ
DESIGNED BY: DSH	08/14/2017			VERT: N/A
CHECKED BY: WJM	08/14/2017		PROJECT NO: 7844	

PROFESSIONAL ENGINEER — STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745
9/28/17

SHEET
GR1
3 OF 11 SHEETS
DRAWING NO.

H:\7844\Sheet Set\7844-GR.dwg

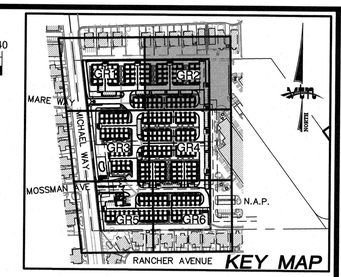


GRAPHIC SCALE

-20 0 10 20 40

1" = 20'

NORTH



LEGEND

DESCRIPTION	PROPOSED	EXISTING	FUTURE
CONTOUR (5' INTERVAL)	2450	(2450)	(2450)
CONTOUR (1' INTERVAL)			
EDGE OF PAVEMENT			
SAW CUT			
RETAINING WALL			
SCREEN WALL			
RIGHT OF WAY			
CENTER LINE			
BACK OF CURB			
LIP OF GUTTER			
FACE OF CURB			
SIDEWALK			
UNIT BOUNDARY LINE			
PROPERTY LINE			
SLOPE AND FLOW DIRECTION			
SCARP AREA			
MATCHLINE			
SIDEWALK RAMP			
SIGHT VISIBILITY ZONES			
PAVED ROAD			
PAVEMENT REMOVAL			
RIP RAP			
LANDSCAPE ROCK			

CONSTRUCTION NOTES

1. CONSTRUCT 24" TYPE "L" CURB & GUTTER PER CCAUSD #216.
2. CONSTRUCT TYPE "A" CURB PER CCAUSD #219.
3. 0" CURB FACE PER DETAIL ON SHEET DT3
4. CONSTRUCT 3' VALLEY GUTTER PER THE DETAIL ON SHEET DT3
5. CONSTRUCT 8' VALLEY GUTTER PER CCAUSD # 228
6. CONSTRUCT 5' SIDEWALK PER CCAUSD # 234
7. INSTALL PRECAST BUMPER BLOCK PER CCAUSD #238.
8. INSTALL LANDSCAPE ROCK D50=6" 12" THK
9. CONSTRUCT 2' CURB CUT PER DETAIL ON SHEET DT3
10. CONSTRUCT SIDE WALK UNDER DRAIN PER CCAUSD #236.
11. CONSTRUCT "U" CHANNEL PER DETAIL ON SHEET DT3
12. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225
13. CONSTRUCT 6" PVC STORM DRAIN

HANDICAP ACCESS TO THE RIGHT OF WAY

REMOVE EXISTING PAVEMENT

COORDINATION ITEMS

(A) SEE ARCHITECTURAL DRAWINGS FOR TRASH ENCLOSURE PLAN AND DETAILS. MAXIMUM 1% SLOPE ON TRASH ENCLOSURE SLAB.

(B) SEE ARCHITECTURAL AND LANDSCAPE PLANS FOR DETAILS OF OPEN SPACE AREAS.

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013NE6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL AND STREET LIGHT SYSTEM CONDUITS
IT'S COSTLY

Call before you Underground
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
1-702-229-6611
LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811
OR
1-800-227-2600
AND
1-702-455-6000
CLARK COUNTY TRAFFIC OPERATIONS

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DO OVERHEAD
1-702-227-2929

SIGHT VISIBILITY ZONES:

NO STRUCTURE, WALLS, VEGETATION, OR OBJECT OF ANY KIND IS PERMITTED OVER TWENTY-FOUR (24) INCHES IN HEIGHT (MEASURED FROM THE TOP OF ADJACENT CURB IF CURB EXISTS) WITHIN THE SIGHT VISIBILITY ZONES.

EARTHWORK QUANTITIES

CUT	FILL	NET
8,336 CUBIC YARDS	19,754 CUBIC YARDS	11,418 CUBIC YARDS (FILL)

GRADING PERMIT NOTE

THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHERS STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE.

GEOTECHNICAL NOTE:

REFER TO SOILS REPORT: ----
PROJECT #----, DATED ----
HTE #----

SIDEWALK RAMPS TABLE

(PER CCAUSD No. 235, CASE I)

NO.	DIM "A"	DIM "B"	CASE
1	4.5'	12'	I
2	4.5'	9.5'	I
3	8'	8'	I
4	9.5'	4.5'	I
5	12'	4.5'	I

ENGINEER DISCLAIMER NOTE:

UTILITY LOCATIONS SHOWN HERE ON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERE ON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH LAS VEGAS, NV, #----

15745 , P.E. No. WILLIAM J. MEYER DATE

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3061 N. RANCHO #130
LAS VEGAS, NV 89113

LAS VEGAS, NV

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH: (702) 873-7500 FAX: (702) 362-2997 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

GRADING PLAN 2

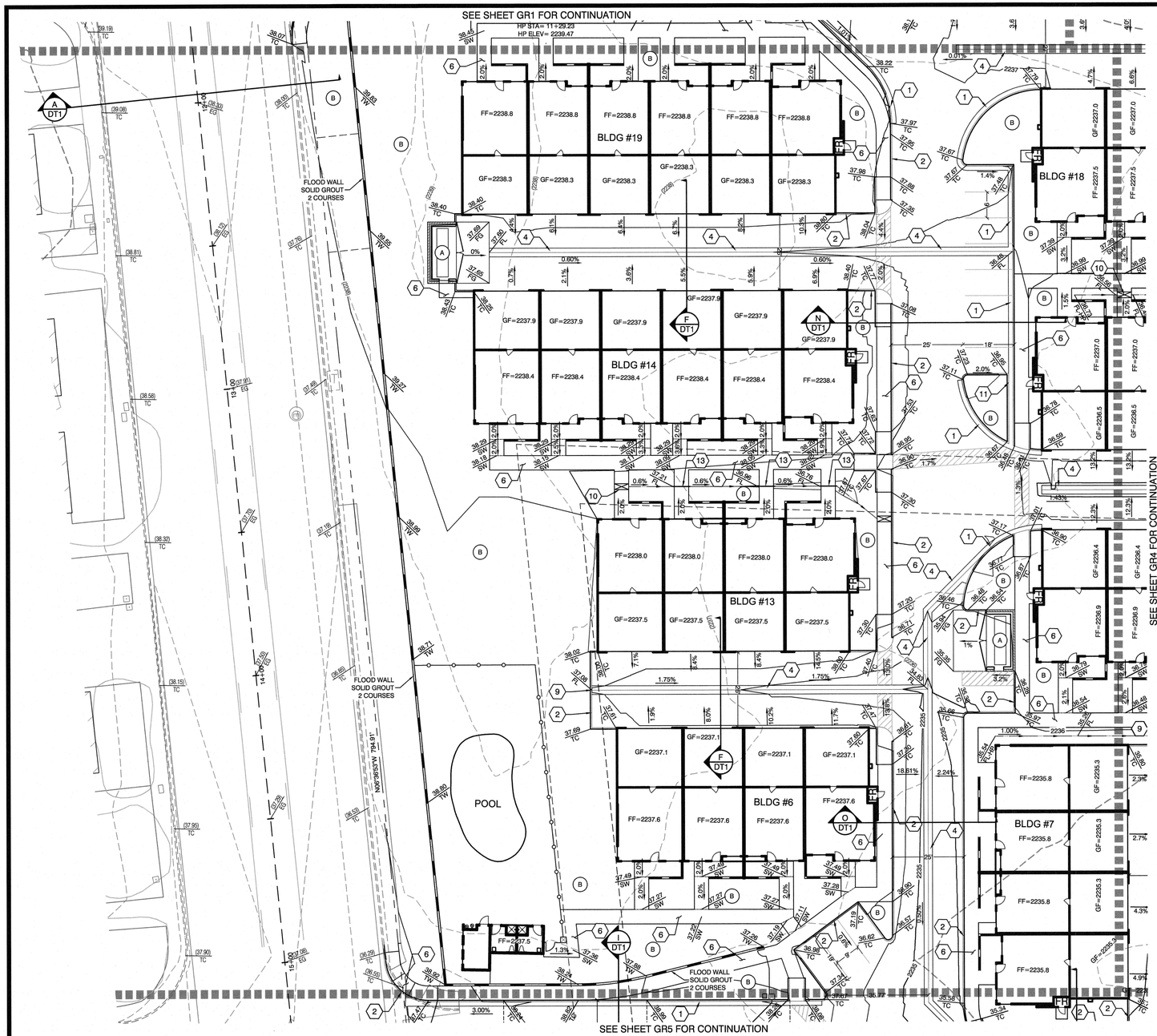
CRYSTAL PARK APARTMENTS

DRAWN BY:	DESIGNED BY:	CHECKED BY:	PROJECT NO:	SCALE:	HORIZ.
KDH	DEH	WJM	7844	1"=20'	N/A
08/14/2017	08/14/2017	08/14/2017			VERT:

PROFESSIONAL ENGINEER STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745

SHEET
GR2
4 OF 11 SHEETS
DRAWING NO.

H:\7844\Sheet Set\7844-GR.dwg

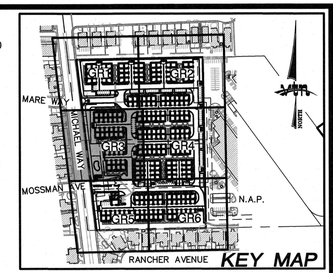


GRAPHIC SCALE

-20 0 10 20 40

1" = 20'

NORTH



LEGEND

DESCRIPTION	PROPOSED	EXISTING	FUTURE
CONTOUR (5' INTERVAL)	2450	(2450)	(2450)
CONTOUR (1' INTERVAL)			
EDGE OF PAVEMENT			
SAW CUT			
RETAINING WALL			
SCREEN WALL			
RIGHT OF WAY			
CENTER LINE			
BACK OF CURB			
LIP OF GUTTER			
FACE OF CURB			
SIDEWALK			
UNIT BOUNDARY LINE			
PROPERTY LINE			
SLOPE AND FLOW DIRECTION			
SCARP AREA			
MATCHLINE			
SIDEWALK RAMP			
SIGHT VISIBILITY ZONES			
PAVED ROAD			
PAVEMENT REMOVAL			
RIP RAP			
LANDSCAPE ROCK			

CONSTRUCTION NOTES

1. CONSTRUCT 24" TYPE "L" CURB & GUTTER PER CCAUSD #216.
2. CONSTRUCT TYPE "A" CURB PER CCAUSD #219.
3. 0" CURB FACE PER DETAIL ON SHEET DT3
4. CONSTRUCT 3' VALLEY GUTTER PER THE DETAIL ON SHEET DT3
5. CONSTRUCT 8' VALLEY GUTTER PER CCAUSD # 228
6. CONSTRUCT 5' SIDEWALK PER CCAUSD # 234
7. INSTALL PRECAST BUMPER BLOCK PER CCAUSD #238.
8. INSTALL LANDSCAPE ROCK D50=6" 12" THK
9. CONSTRUCT 2' CURB CUT PER DETAIL ON SHEET DT3
10. CONSTRUCT SIDE WALK UNDER DRAIN PER CCAUSD #236.
11. CONSTRUCT "U" CHANNEL PER DETAIL ON SHEET DT3
12. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225
13. CONSTRUCT 6" PVC STORM DRAIN

HANDICAP ACCESS TO THE RIGHT OF WAY

REMOVE EXISTING PAVEMENT

COORDINATION ITEMS

(A) SEE ARCHITECTURAL DRAWINGS FOR TRASH ENCLOSURE PLAN AND DETAILS. MAXIMUM 1% SLOPE ON TRASH ENCLOSURE SLAB.

(B) SEE ARCHITECTURAL AND LANDSCAPE PLANS FOR DETAILS OF OPEN SPACE AREAS.

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013NE6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE. NORTH AMERICAN DATUM OF 1983, SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL AND STREET LIGHT SYSTEM CONDUITS IT'S COSTLY

Call before you Underground

1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-256-5811
LAS VEGAS AREA COMMUNICATIONS TRAFFIC SYSTEM

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811
OR
1-800-227-2600
AND
1-702-455-6000
CLARK COUNTY TRAFFIC OPERATIONS

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.

CALL BEFORE YOU DO OVERHEAD

1-702-227-2929

SIGHT VISIBILITY ZONES:

NO STRUCTURE, WALLS, VEGETATION, OR OBJECT OF ANY KIND IS PERMITTED OVER TWENTY-FOUR (24) INCHES IN HEIGHT (MEASURED FROM THE TOP OF ADJACENT CURB IF CURB EXISTS) WITHIN THE SIGHT VISIBILITY ZONES.

EARTHWORK QUANTITIES

CUT	FILL	NET
8,336 CUBIC YARDS	19,754 CUBIC YARDS	11,418 CUBIC YARDS (FILL)

GRADING PERMIT NOTE

THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHERS STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE.

GEOTECHNICAL NOTE:

REFER TO SOILS REPORT: ----
PROJECT #----, DATED ----
HTE #----

SIDEWALK RAMPS TABLE

(PER CCAUSD No. 235, CASE I)

NO.	DIM "A"	DIM "B"	CASE
1	4.5'	12'	I
2	4.5'	9.5'	I
3	8'	8'	I
4	9.5'	4.5'	I
5	12'	4.5'	I

ENGINEER DISCLAIMER NOTE:

UTILITY LOCATIONS SHOWN HERE ON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERE ON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH LAS VEGAS, NV, #----

15745 , P.E. No. WILLIAM J. MEYER DATE

PROFESSIONAL ENGINEER STATE OF NEVADA WILLIAM J. MEYER EXP: 12/31/17 CIVIL No. 15745

6/26/17

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3085 E. FLAMINGO RD. #130
LAS VEGAS, NV 89113

LAS VEGAS, NV

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7500 FAX (702) 362-2697 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

GRADING PLAN 3

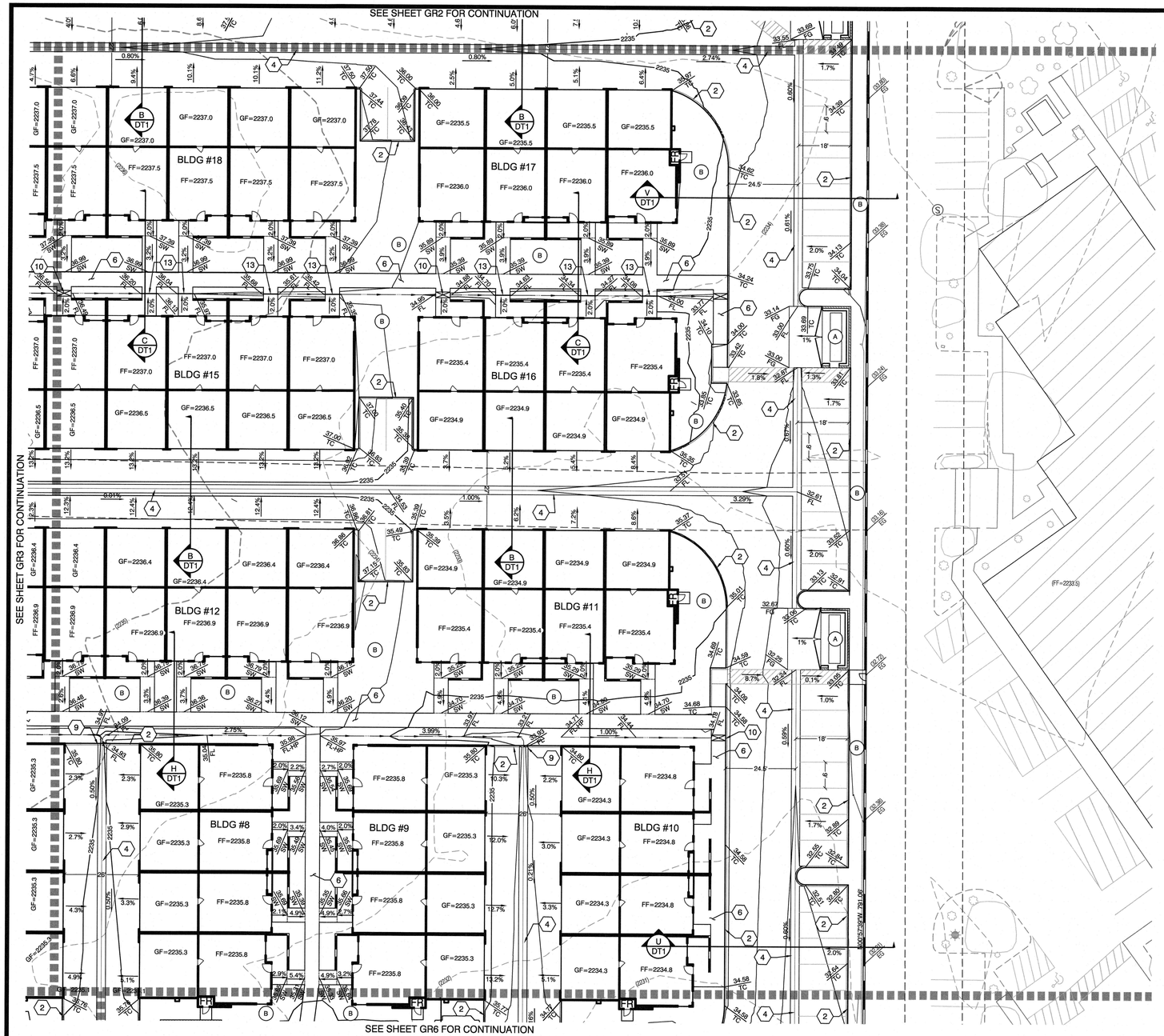
CRYSTAL PARK APARTMENTS

DRAWN BY: KDH — 08/14/2017
DESIGNED BY: DSH — 08/14/2017
CHECKED BY: WJM — 08/14/2017
PROJECT NO: 7944
SCALE: HORIZ. 1"=20' VERT. N/A

SHEET
GR3
5 OF 11 SHEETS

DRAWING NO.

H:\7944\Sheet Set\7944-GR.dwg

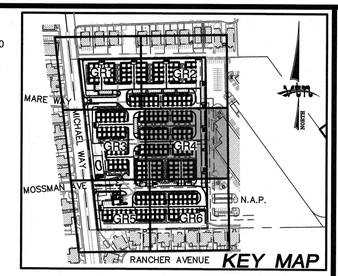


GRAPHIC SCALE

-20 0 10 20 40

1" = 20'

NORTH



LEGEND

DESCRIPTION	PROPOSED	EXISTING	FUTURE
CONTOUR (5' INTERVAL)	2450	(2450)	(2450)
CONTOUR (1' INTERVAL)			
EDGE OF PAVEMENT			
SAW CUT			
RETAINING WALL			
SCREEN WALL			
RIGHT OF WAY			
CENTER LINE			
BACK OF CURB			
LIP OF GUTTER			
FACE OF CURB			
SIDEWALK			
UNIT BOUNDARY LINE			
PROPERTY LINE			
SLOPE AND FLOW DIRECTION			
SCARP AREA			
MATCHLINE			
SIDEWALK RAMP			
SIGHT VISIBILITY ZONES			
PAVED ROAD			
PAVEMENT REMOVAL			
RIP RAP			
LANDSCAPE ROCK			

CONSTRUCTION NOTES

1. CONSTRUCT 24" TYPE "L" CURB & GUTTER PER CCAUSD #216.
2. CONSTRUCT TYPE "A" CURB PER CCAUSD #219.
3. 0" CURB FACE PER DETAIL ON SHEET DT3
4. CONSTRUCT 3' VALLEY GUTTER PER THE DETAIL ON SHEET DT3
5. CONSTRUCT 8' VALLEY GUTTER PER CCAUSD # 228
6. CONSTRUCT 5' SIDEWALK PER CCAUSD # 234
7. INSTALL PRECAST BUMPER BLOCK PER CCAUSD #238.
8. INSTALL LANDSCAPE ROCK D50=6" 12" THK
9. CONSTRUCT 2' CURB CUT PER DETAIL ON SHEET DT3
10. CONSTRUCT SIDE WALK UNDER DRAIN PER CCAUSD #236.
11. CONSTRUCT "U" CHANNEL PER DETAIL ON SHEET DT3
12. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225
13. CONSTRUCT 6" PVC STORM DRAIN

HANDICAP ACCESS TO THE RIGHT OF WAY

REMOVE EXISTING PAVEMENT

COORDINATION ITEMS

(A) SEE ARCHITECTURAL DRAWINGS FOR TRASH ENCLOSURE PLAN AND DETAILS. MAXIMUM 1% SLOPE ON TRASH ENCLOSURE SLAB.

(B) SEE ARCHITECTURAL AND LANDSCAPE PLANS FOR DETAILS OF OPEN SPACE AREAS.

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013NE6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN: 1.0001 (EXACT)

Call before you Underground
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-229-9511
LAS VEGAS AREA COMPUTERIZED TRAFFIC SYSTEM

AVOID HITTING UNDERGROUND TRAFFIC SIGNAL AND STREET LIGHT SYSTEM CONDUITS IT'S COSTLY

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811
OR
1-800-227-2600
AND
1-702-455-6000
CLARK COUNTY TRAFFIC OPERATIONS

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.

CALL BEFORE YOU DIG OVERHEAD

1-702-227-2929

SIGHT VISIBILITY ZONES:

NO STRUCTURE, WALLS, VEGETATION, OR OBJECT OF ANY KIND IS PERMITTED OVER TWENTY-FOUR (24) INCHES IN HEIGHT (MEASURED FROM THE TOP OF ADJACENT CURB IF CURB EXISTS) WITHIN THE SIGHT VISIBILITY ZONES.

EARTHWORK QUANTITIES

CUT	FILL	NET
8,336 CUBIC YARDS	19,754 CUBIC YARDS	11,418 CUBIC YARDS (FILL)

GRADING PERMIT NOTE

THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHERS STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE.

GEOTECHNICAL NOTE:

REFER TO SOILS REPORT: ----
PROJECT #----, DATED ----
HTE #----

SIDEWALK RAMPS TABLE

(PER CCAUSD No. 235, CASE I)

NO.	DIM "A"	DIM "B"	CASE
1	4.5'	12'	I
2	4.5'	9.5'	I
3	8'	8'	I
4	9.5'	4.5'	I
5	12'	4.5'	I

ENGINEER DISCLAIMER NOTE:

UTILITY LOCATIONS SHOWN HERE ON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERE ON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH LAS VEGAS, NV, #----

15745 , P.E. No. WILLIAM J. MEYER DATE

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3065 N. RANCHO #130
LAS VEGAS, NV 89115

LAS VEGAS, NV

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7500 FAX (702) 362-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

GRADING PLAN 4

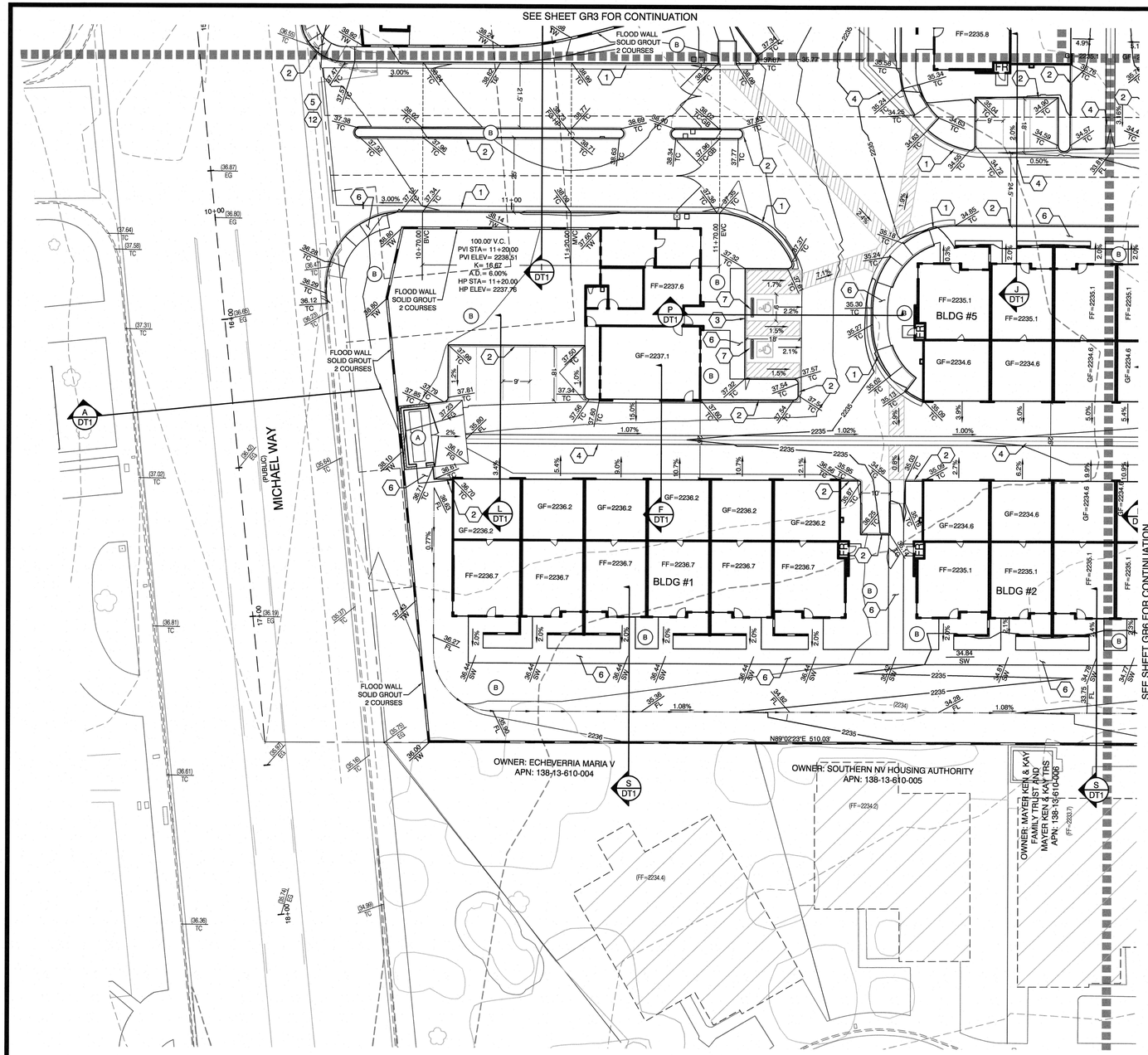
CRYSTAL PARK APARTMENTS

DRAWN BY: KDH
DESIGNED BY: DEH
CHECKED BY: WJM
PROJECT NO: 7844
SCALE: 1"=20'
HORIZ: N/A
VERT: N/A
08/14/2017

PROFESSIONAL ENGINEER, STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745
8/28/17

SHEET
GR4
6 OF 11 SHEETS
DRAWING NO.

H:\7844\Sheet Set\7844-GR.dwg

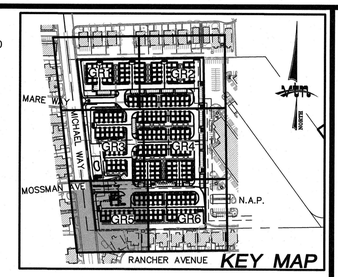


GRAPHIC SCALE

-20 0 10 20 40

1" = 20'

NORTH



LEGEND

DESCRIPTION	PROPOSED	EXISTING	FUTURE
CONTOUR (5' INTERVAL)	2450	(2450)	(2450)
CONTOUR (1' INTERVAL)			
EDGE OF PAVEMENT			
SAW CUT			
RETAINING WALL			
SCREEN WALL			
RIGHT OF WAY			
CENTER LINE			
BACK OF CURB			
LIP OF GUTTER			
FACE OF CURB			
SIDEWALK			
UNIT BOUNDARY LINE			
PROPERTY LINE			
SLOPE AND FLOW DIRECTION			
SCARP AREA			
MATCHLINE			
SIDEWALK RAMP			
SIGHT VISIBILITY ZONES			
PAVED ROAD			
PAVEMENT REMOVAL			
RIP RAP			
LANDSCAPE ROCK			

CONSTRUCTION NOTES

1. CONSTRUCT 24" TYPE "L" CURB & GUTTER PER CCAUSD #216.
2. CONSTRUCT TYPE "A" CURB PER CCAUSD #219.
3. 0" CURB FACE PER DETAIL ON SHEET DT3
4. CONSTRUCT 3' VALLEY GUTTER PER THE DETAIL ON SHEET DT3
5. CONSTRUCT 8' VALLEY GUTTER PER CCAUSD # 228
6. CONSTRUCT 5' SIDEWALK PER CCAUSD # 234
7. INSTALL PRECAST BUMPER BLOCK PER CCAUSD #238.
8. INSTALL LANDSCAPE ROCK D50=6" 12" THK
9. CONSTRUCT 2' CURB CUT PER DETAIL ON SHEET DT3
10. CONSTRUCT SIDE WALK UNDER DRAIN PER CCAUSD #236.
11. CONSTRUCT "U" CHANNEL PER DETAIL ON SHEET DT3
12. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225
13. CONSTRUCT 6" PVC STORM DRAIN

HANDICAP ACCESS TO THE RIGHT OF WAY

REMOVE EXISTING PAVEMENT

COORDINATION ITEMS

(A) SEE ARCHITECTURAL DRAWINGS FOR TRASH ENCLOSURE PLAN AND DETAILS. MAXIMUM 1% SLOPE ON TRASH ENCLOSURE SLAB.

(B) SEE ARCHITECTURAL AND LANDSCAPE PLANS FOR DETAILS OF OPEN SPACE AREAS.

ENGINEER DISCLAIMER NOTE:

UTILITY LOCATIONS SHOWN HERE ON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTORS RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERE ON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH LAS VEGAS, NV, #----

15745 , P.E. No. WILLIAM J. MEYER DATE

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013NE6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE, NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)

Call before you Dig
Underground
1-702-455-7511
CLARK COUNTY TRAFFIC OPERATIONS
AND
1-702-229-9811
LAS VEGAS AXIS COMPUTERIZED TRAFFIC SYSTEM

Call before you Dig
Avoid cutting underground utility lines. It's costly.
CALL 811
OR
1-800-227-2600
AND
1-702-455-6000
CLARK COUNTY TRAFFIC OPERATIONS

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.
CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929

SIGHT VISIBILITY ZONES:

NO STRUCTURE, WALLS, VEGETATION, OR OBJECT OF ANY KIND IS PERMITTED OVER TWENTY-FOUR (24) INCHES IN HEIGHT (MEASURED FROM THE TOP OF ADJACENT CURB IF CURB EXISTS) WITHIN THE SIGHT VISIBILITY ZONES.

EARTHWORK QUANTITIES

CUT	FILL	NET
8,336 CUBIC YARDS	19,754 CUBIC YARDS	11,418 CUBIC YARDS (FILL)

GRADING PERMIT NOTE

THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHERS STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE.

GEOTECHNICAL NOTE:

REFER TO SOILS REPORT: ----
PROJECT #----, DATED ----
HTE #----

SIDEWALK RAMPS TABLE

(PER CCAUSD No. 235, CASE I)

NO.	DIM "A"	DIM "B"	CASE
1	4.5'	12'	I
2	4.5'	9.5'	I
3	8'	8'	I
4	9.5'	4.5'	I
5	12'	4.5'	I

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3060 W. RANCHO DR #103
LAS VEGAS, NV 89118

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7500 FAX (702) 362-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

LAS VEGAS, NV

GRADING PLAN 5

CRYSTAL PARK APARTMENTS

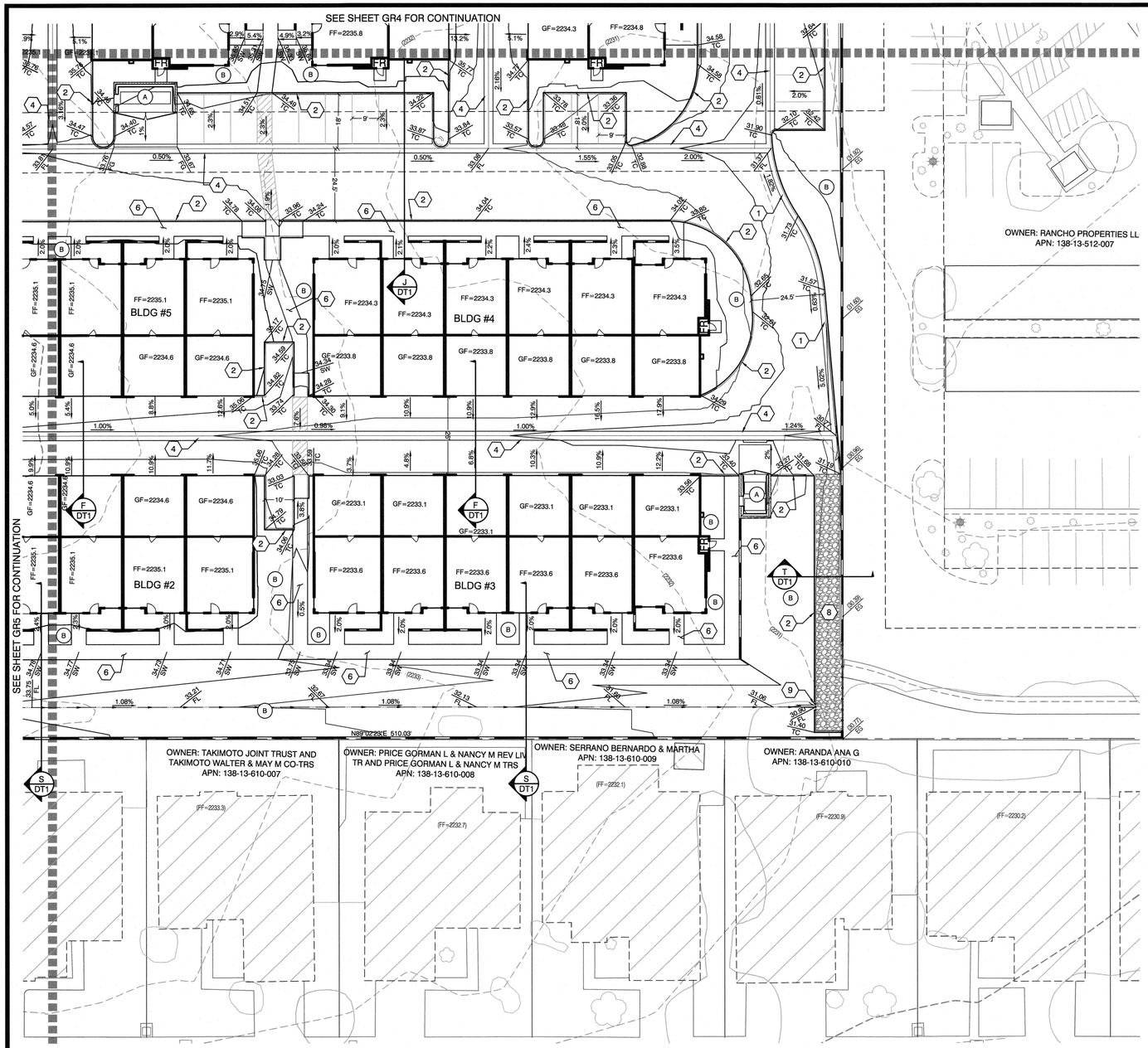
DRAWN BY:	DESIGNED BY:	CHECKED BY:	PROJECT NO:	SCALE:	HORIZ.
KDH 08/14/2017	DEH 08/14/2017	WJM 08/14/2017	7844	1"=20'	VERT. N/A

PROFESSIONAL ENGINEER STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745
12/20/17

SHEET
GR5
7 OF 11 SHEETS

DRAWING NO.

H:\7844\Sheet Set\7844-GR.dwg

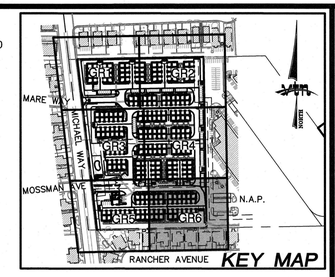


GRAPHIC SCALE

-20 0 10 20 40

1" = 20'

NORTH



LEGEND

DESCRIPTION	PROPOSED	EXISTING	FUTURE
CONTOUR (5' INTERVAL)	2450	(2450)	(2450)
CONTOUR (1' INTERVAL)			
EDGE OF PAVEMENT			
SAW CUT			
RETAINING WALL			
SCREEN WALL			
RIGHT OF WAY			
CENTER LINE			
BACK OF CURB			
LIP OF GUTTER			
FACE OF CURB			
SIDEWALK			
UNIT BOUNDARY LINE			
PROPERTY LINE			
SLOPE AND FLOW DIRECTION			
SCARP AREA			
MATCHLINE			
SIDEWALK RAMP			
SIGHT VISIBILITY ZONES			
PAVED ROAD			
PAVEMENT REMOVAL			
RIP RAP			
LANDSCAPE ROCK			

CONSTRUCTION NOTES

1. CONSTRUCT 24" TYPE "L" CURB & GUTTER PER CCAUSD #216.
2. CONSTRUCT TYPE "A" CURB PER CCAUSD #219.
3. 0" CURB FACE PER DETAIL ON SHEET DT3
4. CONSTRUCT 3' VALLEY GUTTER PER THE DETAIL ON SHEET DT3
5. CONSTRUCT 8' VALLEY GUTTER PER CCAUSD # 228
6. CONSTRUCT 5' SIDEWALK PER CCAUSD # 234
7. INSTALL PRECAST BUMPER BLOCK PER CCAUSD #238.
8. INSTALL LANDSCAPE ROCK D50=6" 12" THK
9. CONSTRUCT 2' CURB CUT PER DETAIL ON SHEET DT3
10. CONSTRUCT SIDE WALK UNDER DRAIN PER CCAUSD #236.
11. CONSTRUCT "U" CHANNEL PER DETAIL ON SHEET DT3
12. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #225
13. CONSTRUCT 6" PVC STORM DRAIN

HANDICAP ACCESS TO THE RIGHT OF WAY

REMOVE EXISTING PAVEMENT

COORDINATION ITEMS

A. SEE ARCHITECTURAL DRAWINGS FOR TRASH ENCLOSURE PLAN AND DETAILS. MAXIMUM 1% SLOPE ON TRASH ENCLOSURE SLAB.

B. SEE ARCHITECTURAL AND LANDSCAPE PLANS FOR DETAILS OF OPEN SPACE AREAS.

BENCHMARK

PROJECT DATUM: NORTH AMERICAN VERTICAL DATUM OF 1988 (NAVD88)

CITY OF LAS VEGAS BENCHMARK: 2LV0013NE6 (REVISED 2008)
NAVD88 ELEVATION: 679.739 METERS (2230.11 FEET)

FOUND RIVET AND PLATE IN THE TOP OF CURB ON THE WEST SIDE OF RANCHO AT 3101 RANCHO

BASIS OF BEARING

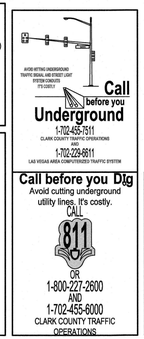
GRID NORTH AS DEFINED BY THE CENTRAL MERIDIAN OF THE NEVADA COORDINATE REFERENCE SYSTEM (NCRS), LAS VEGAS ZONE. NORTH AMERICAN DATUM OF 1983; SAID MERIDIAN BEING COINCIDENT WITH 114°58' WEST OF THE GREENWICH MERIDIAN.

LINEAR UNIT: US SURVEY FOOT (FTUS)

DATUM (REFERENCE FRAME): NAD 83 (2011) EPOCH 2010.00
SYSTEM: NEVADA COORDINATE REFERENCE SYSTEM (NCRS)

ZONE: LAS VEGAS

PROJECTION: TRANSVERSE MERCATOR
STANDARD PARALLEL (AND LATITUDE OF GRID ORGIN):36°15'00"N
LONGITUDE OF CENTRAL MERIDIAN:114°58'00"W
NORTHING AT GRID ORIGIN: 200,000.000 M (656,166.6667 FTUS)
EASTING AT CENTRAL MERIDIAN: 100,000.000 M (328,083.3333 FTUS)
SCALE FACTOR ON CENTRAL MERIDIAN; 1.0001 (EXACT)





SIGHT VISIBILITY ZONES:

NO STRUCTURE, WALLS, VEGETATION, OR OBJECT OF ANY KIND IS PERMITTED OVER TWENTY-FOUR (24) INCHES IN HEIGHT (MEASURED FROM THE TOP OF ADJACENT CURB IF CURB EXISTS) WITHIN THE SIGHT VISIBILITY ZONES.

EARTHWORK QUANTITIES

CUT	FILL	NET
8,336 CUBIC YARDS	19,754 CUBIC YARDS	11,418 CUBIC YARDS (FILL)

GRADING PERMIT NOTE

THIS GRADING PERMIT DOES NOT INCLUDE THE CONSTRUCTION OF RETAINING WALLS AND OTHERS STRUCTURES. SEPARATE PERMITS AND APPLICATIONS ARE REQUIRED FOR THESE.

GEOTECHNICAL NOTE:

REFER TO SOILS REPORT: ----
PROJECT #----, DATED ----
HTE #----

SIDEWALK RAMPS TABLE

(PER CCAUSD No. 235, CASE I)

NO.	DIM "A"	DIM "B"	CASE
1	4.5'	12'	I
2	4.5'	9.5'	I
3	8'	8'	I
4	9.5'	4.5'	I
5	12'	4.5'	I

ENGINEER DISCLAIMER NOTE:

UTILITY LOCATIONS SHOWN HERE ON ARE APPROXIMATE ONLY. IT SHALL BE THE CONTRACTOR'S RESPONSIBILITY TO DETERMINE THE EXACT HORIZONTAL AND VERTICAL LOCATION OF ALL EXISTING UNDERGROUND AND OVERHEAD UTILITIES AND NOTIFY THE DESIGN ENGINEER IMMEDIATELY OF ANY DISCREPANCIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HERE ON. THE ENGINEER ASSUMES NO RESPONSIBILITY FOR UTILITIES NOT SHOWN OR UTILITIES NOT SHOWN IN THEIR PROPER LOCATION.

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE WITH LAS VEGAS, NV, #----

15745 , P.E. No. WILLIAM J. MEYER DATE

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3900 E. RANCHO # 130
LAS VEGAS, NV 89113

LAS VEGAS, NV

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7550 FAX (702) 362-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

GRADING PLAN 6

CRYSTAL PARK APARTMENTS

DRAWN BY:	KDH 08/14/2017
DESIGNED BY:	DEH 08/14/2017
CHECKED BY:	WJM 08/14/2017
PROJECT NO:	7844
SCALE:	1"=20' HORIZ N/A VERT

PROFESSIONAL ENGINEER - STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745
08/28/17

SHEET
GR6
8 OF 11 SHEETS

DRAWING NO.

H:\7844\Sheet Set\7844-GR.dwg

A - TYPICAL SECTION NTS

B - TYPICAL SECTION NTS

C - TYPICAL SECTION NTS

D - TYPICAL SECTION NTS

E - TYPICAL SECTION NTS

F - TYPICAL SECTION NTS

H - TYPICAL SECTION NTS

I - TYPICAL SECTION NTS

J - TYPICAL SECTION NTS

L - TYPICAL SECTION NTS

N - TYPICAL SECTION NTS

O - TYPICAL SECTION NTS

REV	DATE	BY	REVISION

EAB INVESTMENT COMPANY
3065 N. RANCHO # 130
LAS VEGAS, NV 89113

LAS VEGAS, NV

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7500 FAX (702) 362-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS● PLANNERS● LAND SURVEYORS

DETAIL SHEET 1

CRYSTAL PARK APARTMENTS

DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:	
KDH	DEH	WJM		HORIZ.
08/14/2017	08/14/2017	08/14/2017	N/A	HORIZ.
			N/A	VERT.

PROJECT NO: 7844

PROFESSIONAL ENGINEER STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745

SHEET
DT1
9 OF **11** SHEETS

DRAWING NO.

H:\7844\Sheet Set\7844-DT.dwg

P - TYPICAL SECTION NTS

Q - TYPICAL SECTION NTS

R - TYPICAL SECTION NTS

S - TYPICAL SECTION NTS

T - TYPICAL SECTION NTS

U - TYPICAL SECTION NTS

V - TYPICAL SECTION NTS

W - TYPICAL SECTION NTS

X - TYPICAL SECTION NTS

REV	DATE	BY	REVISION

LAS VEGAS, NV

EAB INVESTMENT COMPANY
3065 N. RANCHO #130
LAS VEGAS, NV 89113

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH: (702) 873-7550 FAX (702) 382-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

DETAIL SHEET 2

CRYSTAL PARK APARTMENTS

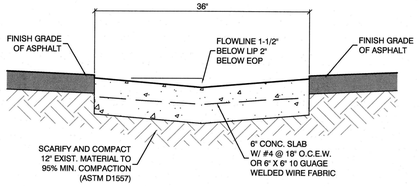
DRAWN BY:	DESIGNED BY:	CHECKED BY:	SCALE:
KDH	DEH	WJM	N/A HORIZ.
08/14/2017	08/14/2017	08/14/2017	N/A VERT.

PROJECT NO: 7844

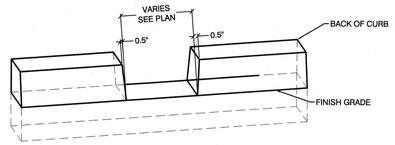
PROFESSIONAL ENGINEER - STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
NO. 15745

SHEET
DT2
10 OF **11** SHEETS
DRAWING NO.

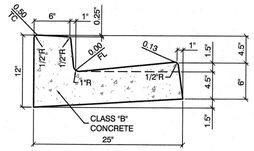
H:\7844\Sheet Set\7844-DT.dwg



36" WIDE VALLEY GUTTER
WITHIN PAVING AREAS
NTS

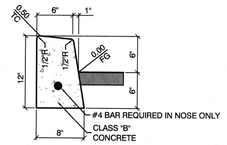


DEPRESSED "A" CURB
NTS

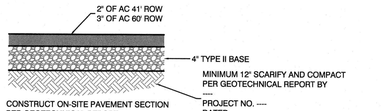


"L" TYPE CURB & GUTTER
NTS REFER TO USD 216

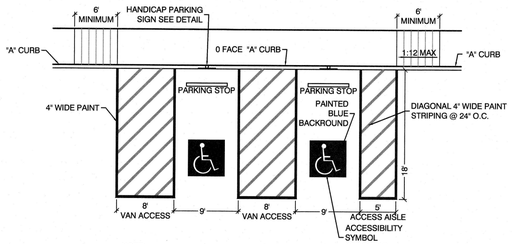
NOTES:
1. 1" BATTER ON GUTTER FACE OPTIONAL.



"A" CURB PRIVATE SECTION
NTS REFER TO USD 219

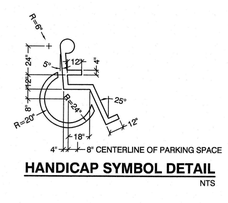


ON-SITE ASPHALT CONCRETE
PAVEMENT SECTION
NTS

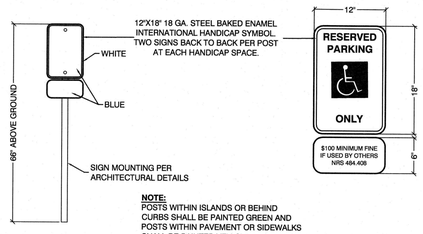


NOTE:
MAINTAIN A MAXIMUM OF 2% SLOPE IN ANY DIRECTION ON PAVING WITHIN HANDICAP PARKING SPACES AND PAINTED UNLOADING AREAS.

TYPICAL ACCESSIBLE PARKING DETAIL
NTS



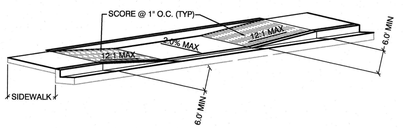
HANDICAP SYMBOL DETAIL
NTS



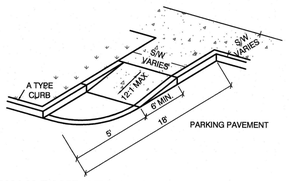
NOTE:
POSTS WITHIN ISLANDS OR BEHIND CURBS SHALL BE PAINTED GREEN AND POSTS WITHIN PAVEMENT OR SIDEWALKS SHALL BE PAINTED YELLOW.

HANDICAP SIGN DETAIL
NTS

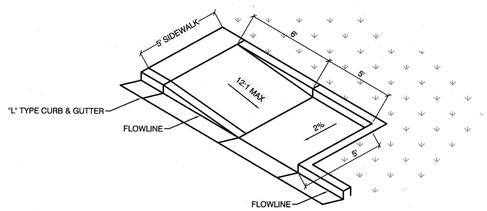
NOTE:
ALL AGGREGATE BASES SHALL BE COMPACTED PER GEOTECHNICAL REPORT HTE #17-25526 PRELIMINARY PAVEMENT SECTIONS SHALL BE VERIFIED WITH THE FINAL PAVEMENT SECTION RECOMMENDATION REPORT (MPSR) PRIOR TO CONSTRUCTION. IF FINAL PAVEMENT SECTIONS ARE DIFFERENT, A REVISION TO THE IMPROVEMENT PLANS WILL BE REQUIRED.



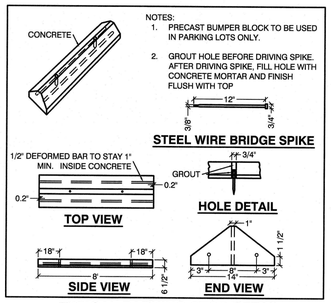
DUAL SIDEWALK RAMP
NTS



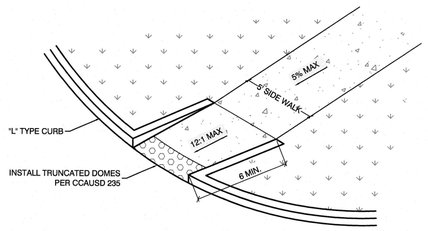
SIDEWALK RAMP AT PARKING ISLAND OR BAY (PRIVATE)
N.T.S.



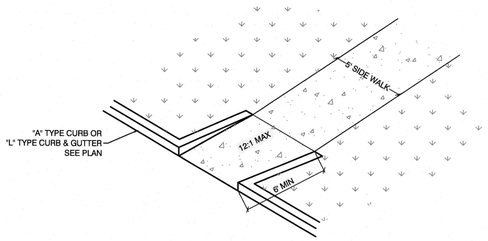
SIDE WALK RAMP (PRIVATE)
NTS



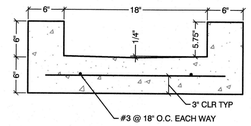
TYPICAL PARKING STOP DETAIL
NTS



SIDE WALK RAMP AT ENTRY DRIVEWAY
NTS



SIDE WALK RAMP (PRIVATE)
NTS



"U" CHANNEL
NTS

EAB INVESTMENT COMPANY
3066 N. RANCHO #130
LAS VEGAS, NV 89113

LAS VEGAS, NV
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH. (702) 873-7500 FAX (702) 362-2597 WEB WWW.VTNNV.COM
CONSULTING ENGINEERS ● PLANNERS ● LAND SURVEYORS

REV	DATE	BY	REVISION

DETAIL SHEET 3

CRYSTAL PARK APARTMENTS

DRAWN BY: KDH 08/14/2017
DESIGNED BY: DEH 08/14/2017
CHECKED BY: WJM 08/14/2017
PROJECT NO: 7844
SCALE: HORIZ. N/A VERT. N/A

PROFESSIONAL ENGINEER-STATE OF NEVADA
WILLIAM J. MEYER
EXP: 12/31/17
CIVIL
No. 15745
9/28/17

SHEET
DT3
11 OF 11 SHEETS
DRAWING NO.

H:\7844\Sheet Set\7844-DT.dwg