

DS #:

5290

APN:

138-09-201-020; 138-09-301-001

PROJECT:

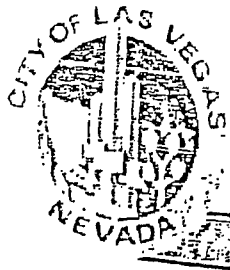
Durango and Gorman

SUBMITTAL:

1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		June 25, 2020
TO: Land Development Services Department of Building & Safety		FROM: Jennifer Shinn, P.E. Flood Control, Engr. Associate Department of Public Works
SUBJECT:	Drainage Study for:	COPIES TO:
	Durango and Gowan	Taney Engineering
Cross Streets:	NEC and SEC of Gowan Rd and Durango Dr	Emma Burns
File Number:	F:\Depot\DSMemos\DS5290A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	138-09-201-020; 138-09-301-001	CCRFCD
Zoning Action:		
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	6/4/2020	6/24/2020	See Comments Below	\$400.00	3874144: \$400
			TOTAL FEES (LDDRS):	\$400.00	----

REMARKS:

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

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

1. The site is adjacent to or crosses an existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the drainage study.

Please note that effective March 15, 2019, the CCRFCD adopted new requirements for drainage study concurrence submittal. Follow the link below for specific guidance.

<http://gustfront.ccrfcd.org/LandDev/LandDev.aspx>

Please note that effective April 6, 2020, only electronic submittals to the CCRFCD will be accepted for regional concurrence. Contact cwang@regionalflood.org for direction.

When it's applicable, structural calculations of facilities must be approved by the City prior to submittal to the Clark County Regional Flood Control District for their review and concurrence.

2. 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.

3. Private streets must be public drainage easements. Provide a note on the grading plans "Note: All private streets are P.U.E., Public Sewer Easements, and Public Drainage Easements to be privately maintained by HOA."
4. The engineer must provide a table on the grading plans that shows a quantity estimate of all drainage improvements within Public Drainage Easements. All drainage improvements within Public Drainage Easements must be bonded and inspected.
5. All drainage easements must be public drainage easements to be privately maintained and common lots to be labeled on the grading plans and to be dedicated as such in the final map.
6. Label Document Number or Book and Page Number for all existing easements on the Grading Plan.
7. Show the existing storm drain facilities in Durango Drive and label with CLV Drawing Number.
8. Complete the construction notes on the grading plan to include references to standard plans or details.
9. Show the high point and flow line elevations at the entries to demonstrate the driveways are adequately humped 6" above the depth of flow in Gowan Road during the 100-year event.
10. Provide flow line elevations along the northern swale of the northern portion of the project to demonstrate the drainage pattern in this area. Is is unclear if the intent is to drain this area towards the east, north of the proposed retaining wall. Provide discussion with the next submittal.
11. Provide the D_{100} for Durango Drive to verify the finish floor elevations meet CCRFCD criteria.
12. Locations where storm water will surface flow between private lots and across common elements must be designated a Public Drainage Easement. For example, the onsite swales collecting flows from private residential lots via 4" drains will require a Public Drainage Easement to be privately maintained by the HOA.
13. Provide an overall plan that delineates all the required public drainage easements (privately maintained) across the site in the next submittal.
14. Landscape areas (e.g. Common Elements) are not allowed to drain over the sidewalk. Provide flow lines with grades and sidewalk under drains for all landscape areas draining to the street. Revise all pertinent details accordingly.
15. Provide a note on the Grading Plans that all onsite storm drain facilities are privately owned and privately maintained by the HOA.
16. Revise Section Detail A on Sheet GD1 to match the Grading Plan.
17. Flip the directional arrow for callout R/GD1 on Sheet G1 to match the Section Detail.
18. Revise Section Detail AA on Sheet GD2 to reflect "Public" Drainage Easement. Delineate and call out the easement on the Grading Plan.
19. Review and revise all Section Details so that the finish floor elevations shown on the details match the Grading Plans.
20. 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

jks

T/R/S: T20S/R60E/09
AREA L-09

TECHNICAL DRAINAGE STUDY

FOR

DURANGO & GOWAN RESIDENTIAL DEVELOPMENT

BRN-19-002

CITY OF LAS VEGAS

MAY 2020

Prepared for:

Emma Burns
The EAB and ELB Family, LLC
(702) 688-9588
Email: emmaburns135@gmail.com



Engineer's Seal

TANEY ENGINEERING

6030 S. Jones Blvd.
Las Vegas, NV 89118
Phone (702) 362-8844
Fax (702) 362-5233

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Durango and Gowan Date: May 26, 2020

Location of Development: a) Descriptive (Cross Streets) North/South: Durango
East/West: Gowan Rd.

b) Section: 9 Township: 20 Range: 60

c) APN : 138-09-201-020; 138-09-301-001;

Name of Owner: Emma Burns

Telephone No.: (702) 688-9588 Fax No.: _____ E-Mail Address: emmaburns135@gmail.com

Address: 18

Contact Person-Name: Lee Gong, Ph.D, P.E., CFM Telephone No.: (702) 362-8844

* E-Mail Address: LeeG@taneycorp.com Fax No.: (702) 362-5233

Firm: Taney Engineering

Address: 6030 S. Jones, Suite 100, Las Vegas NV. 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 3.68+/- acres Being Developed/Disturbed: 3.68+/- 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

5. Approximate upstream land area which drains to the subject site: 0 +/- acres

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

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: The site will discharge to the east adjacent sites through two block wall opening and then will drain to the Gowan Rd.

8. Briefly describe your proposed schedule for the subject project: A.S.A.P



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.**

Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Durango and Gowan	Map ID:	
Firm Name: TANEY ENGINEERING	Engineers: LEE GONG	
Address: 6030 S. JONES BLVD		
City: LAS VEGAS	State: NV	Zip: 89118
Phone Number: (702)-362-8844	Fax Number: (702)-362-5233	
Property Owner: Emma Burns		
Address: The EAB and ELB Family, LLC		
City: LAS VEGAS	State: NV	Zip:
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 the items are not applicable for the subject site, provide N/A.

I. GENERAL REQUIREMENT

Yes	No	
☒	☐	Design Manual Standard Form 1 with the engineer's seal and signature.
☒	☐	Design Manual Standard Form 4
☒	☐	2 Copies of the 24"x36" Drainage Plan
☐	☐	N/A A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

II. MAPS AND EXHIBITS

☒	☐	A copy of a current Flood Insurance Map (FIRM) with the site delineated.
☒	☐	A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental area with the site delineated.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

II. DRAINAGE PLAN

Yes	No	
<u> X </u>	<u> </u>	Sheet size: 24"x36" sealed by a registered engineer in the State of Nevada
<u> X </u>	<u> </u>	Minimum scale: 1" = 60'
<u> X </u>	<u> </u>	Project Name.
<u> X </u>	<u> </u>	Vicinity Map with local and major cross streets.
<u> X </u>	<u> </u>	Revision box.
<u> X </u>	<u> </u>	North arrow and bar scale.
<u> X </u>	<u> </u>	Engineer's/consultants's address and phone number
<u> X </u>	<u> </u>	Elevation datum and benchmark
<u> X </u>	<u> </u>	Legend for symbols and abbreviations
<u> </u>	<u> X </u>	Cut/fill scarps, where applicable
<u> X </u>	<u> </u>	Street names, grades, widths.
<u> X </u>	<u> </u>	Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street.
<u> X </u>	<u> </u>	Existing contours encompassing the site and 100 feet beyond with spot elevations for important locations, where applicable.
<u> X </u>	<u> </u>	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
<u> X </u>	<u> </u>	Proposed typical street sections

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
<u> N/A </u>	<u> </u>	Streets with off-set crowns.
<u> X </u>	<u> </u>	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes
<u> X </u>	<u> </u>	Property Lines
<u> X </u>	<u> </u>	Right-of-way lines and widths, existing and proposed.
<u> X </u>	<u> </u>	Existing improvements and their elevations.
<u> X </u>	<u> </u>	Delineation of proposed on-site drainage basin(s) indicating area and 10-year and 100-year storm peak flows at basin concentration points.
<u> X </u>	<u> </u>	Concentration points and drainage flow direction with Q_{100} and V_{100} and D_{100} in streets.
<u> X </u>	<u> </u>	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<u> X </u>	<u> </u>	Location and cross-section of street capacity calculations.
<u> </u>	<u> N/A </u>	Cross-sectional detail for channels. Including cutoff wall locations.
<u> X </u>	<u> </u>	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk, ditches, swales, storm drain systems, unimproved and improved channels, and culverts, etc.) starting size, material, shape, and slope with plan and profile and HGL calculations.
<u> X </u>	<u> </u>	Existing and proposed drainage easements and widths shown with sufficient detail. A cross sectional detail must be provided that shows appropriate lining and reinforcement.
<u> X </u>	<u> </u>	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16" x 48". Wrought iron gate is required for flows > 10 cfs.
<u> </u>	<u> N/A </u>	Location and detail of flood walls illustrating depth of flow, proposed grouting height, etc.
<u> X </u>	<u> </u>	Perimeter retaining wall locations. All existing and proposed walls (retaining, screen & flood) must be shown with adjacent elevations. Flood wall with 8-inch concrete masonry unit.
<u> X </u>	<u> </u>	Building and/or lot numbers
<u> </u>	<u> N/A </u>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
<u> </u>	<u> N/A </u>	Limits of existing floodplain based on current FIRM or best available information, limits of proposed floodplains based on best available information

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☐	N/A	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish flood elevations must be a minimum of 18 inches above BFE.
☒	☐	Appropriately elevated "humps" 6 inches above the 100 year water surface elevations at site accesses where the intent is to protect the site from the Q_{100} flows.
☒	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
☐	N/A	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required)

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
_____	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. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane rights-of-way ≥ 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 fee 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 be provided with 18 inches of freeboard above Q_{100} weir height or flow depth, which ever is greater.
_____	N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross sections based on survey with proper encroachments. • A map showing the location of 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 calculations for drop inlets.
_____	N/A	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
_____	N/A	The mitigation of nuisance water, both during construction and in fully developed condition, must be addressed.
_____	N/A	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2



Table of Contents

1	Introduction and General Information	2
1.1	Introduction	2
1.2	Location of Property	2
1.3	Description of Property	2
1.4	Floodplain Information	2
1.5	Master Planning Information	2
1.6	Topographic Information	3
2	Methodology and Criteria	3
2.1	Compliance with Regulations and Adopted Plans	3
2.2	Hydrologic Methodology and Criteria	3
2.3	Hydraulic Methodology and Criteria	3
3	Drainage Summary.....	3
3.1	General Description	3
3.2	Previous Drainage Studies	3
4	Hydrologic Analysis	4
4.1	Existing Condition.....	4
4.2	Developed Condition.....	4
5	Hydraulic Analysis	4
5.1	Street Hydraulics	4
5.2	Onsite Grading.....	5
5.3	Finished Floor Elevations	5
6	Summary Tables.....	5
7	Conclusions and Recommendations	6
8	References.....	6

Appendices

- Appendix A – Figures
- Appendix B – Hydrologic Analysis
- Appendix C – Hydraulic Analysis
- Appendix D – Reference Material
- Appendix E – Improvement Plans



1 INTRODUCTION AND GENERAL INFORMATION

1.1 Introduction

EAB and ELB Family is proposing to develop new residential developments on the east of Durango and south and north of Gowan Rd. These residential developments cover approximately 4 acres and will include residential homes. This technical drainage study presents detailed hydrologic and hydraulic analyses for the existing, and developed onsite and offsite improvements required in the *Clark County Regional Flood Control District Hydrologic Criteria and Design Manual (HC&DDM)*.

1.2 Location of Property

There are two parcels for this study. The first parcel is located at the north of Gowan Rd. and east of Durango in Clark County, Nevada. The second parcel is located at the south of Gowan Rd. and east of Durango in Clark County, Nevada. The site is located within a portion of the Northeast Quarter (NE ¼) of the Northeast Quarter (NE ¼) of Section 9, Township 20 South, Range 60 East M.D.M., Clark County, Nevada. See Figure 1, *Vicinity Map*, and Figure 2, *Location Map*.

1.3 Description of Property

The project site consists of two parcels, totaling approximately 3.68 acres. Specifically, the site includes APN 138-09-201-020 and APN 138-09-301-001. The first parcel (APN 138-09-201-020) is bordered to the west by Durango and to the south by Gowan Rd. The second parcel (APN 138-09-301-001) is bordered to the west by Durango and to the north by Gowan Rd. The perimeter streets are not in an improved condition with asphalt pavement and graded roadside ditches. The site exists in a natural desert condition, sloping from west to east at a slope of approximately 1.5 percent.

1.4 Floodplain Information

The Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), Community Panel Numbers 32003C2135F, designates the project site as Zone 'X'. Zone 'X' is described as an area determined to be outside the 0.2% annual chance floodplain. The panel 2135F is not printed, per index sheet 32003CINDOC, dated November 16, 2011. Figure 3 shows that subject project site is in Zone X.

1.5 Master Planning Information

1.5.1 CCRFCD 2018 Master Plan Update

As shown on Figure F-39 of the *Las Vegas Valley Flood Control Master Plan Update of the Clark County Regional Flood Control District (MPU)*, the site is bordered along its northwestern boundary by an existing regional flood control facility. See Figures 4 and 4A for the reproductions of the MPU figures for the project site. Figure 5 represents the watershed area that impacts the project site. The soil and CN values were determined from figure from the 2018 Master Plan Update.



1.6 Topographic Information

Topographic information for this project was gathered from a number of sources including:

1. Aerial and field topographic survey completed by Taney Engineering and consultants at a 1-foot contour interval.
2. Two (2) foot LIDAR contour data provided by Clark County around 2016.

2 METHODOLOGY AND CRITERIA

2.1 Compliance with Regulations and Adopted Plans

The methodologies utilized in the preparation of this study are in compliance with the Clark County Regional Flood Control District's Hydrologic and Drainage Design Manual, local entity requirements and the approved zoning/planning conditions associated with this site.

2.2 Hydrologic Methodology and Criteria

Hydrologic methodologies used in this study are in accordance with the HCDDM and 2018 MPU. Discussion of specific parameters, methodologies and calculations can be found in Appendix B, Hydrologic Calculations.

2.3 Hydraulic Methodology and Criteria

Hydraulic methodologies used in this study in accordance with the HCDDM. FlowMaster has been used to assist in hydraulic calculations. Excel spreadsheets have also been used for any other necessary calculations. Hydraulic calculations can be found in Appendix C.

3 DRAINAGE SUMMARY

3.1 General Description

The project site is not impacted by any offsite surface flow which is conveyed in the adjacent perimeter streets. In the existing condition onsite flows are conveyed to Porch Swings Way and Cavaricci Ave, and then conveyed to Gowan Rd. In the developed condition, the flow pattern will be maintained as in the existing condition.

3.2 Previous Drainage Studies

There are numerous Technical Drainage Studies that have been previously approved in the vicinity of the subject site. Although several studies including two recent studies (2019) were reviewed for general information, only the studies of which specific information was referenced are listed below. The approved Drainage studies for Pine Cove III & IV and Pine Cove II Residential Subdivisions were referenced to determine the offsite drainage pattern. All reference material can be found in Appendix D.

Technical Drainage Study for Pine Cove II Residential Subdivisions

As shown in the Developed Drainage Basin Map attached in Appendix D, Offsite basin DEV1 doesn't impact the subject site and drains to the concentration point CP4. Their



drainage analyses have been reviewed and have been accepted and referenced for use in this study.

Technical Drainage Study for Pine Cove III & IV Residential Subdivisions

As shown in the Developed Drainage Basin Map attached in Appendix D, Offsite basin DEV2 doesn't impact the subject site and drains to the concentration point CPT4. Their drainage analyses have been reviewed and have been accepted and referenced for use in this study.

4 HYDROLOGIC ANALYSIS

4.1 Existing Condition

In the existing conditions, offsite flows do not impact our project site. Refer to Figures 6, *Existing Basin Map*, for basin boundaries and flow paths.

The onsite basin XON1 drains to Swings Way through a block wall opening and combines with the offsite basin of XOF1 at the concentration point of CP4. Onsite basin XON2 drains to the Cavaricci Ave. through a block wall opening and combines with the offsite basin of XOF2 at the same concentration point (CP4). Offsite basin ST1 also drains to the same concentration point of CP4. In the existing condition, the 100-year discharge at CP4 is 93 cfs.

4.2 Developed Condition

Since the offsite basins are all developed, the interim conditions are the same as the developed conditions. Refer to Figure 7, *developed Basin Map*, for basin boundaries and flow paths.

In the developed condition, the flow patterns remain the same as the existing condition.

The onsite basin DON1 drains to Swings Way through a block wall opening and combines with the offsite basin of XOF1 at the concentration point of CP4. Onsite basin DON2 drains to the Cavaricci Ave. through a block wall opening and combines with the offsite basin of XOF2 at the same concentration point (CP4). Offsite basin ST1 drains to the same concentration point of CP4. In the developed condition, the 100-year discharge at CP4 will be 98 cfs.

5 HYDRAULIC ANALYSIS

5.1 Street Hydraulics

Hydraulic calculations have been provided for all streets in the developed conditions. See Table 2 for a summary of results; calculations can be found in Appendix C. The location of the hydraulic cross sections can be found on Figures 6 and 7. All street sections meet VxD and depth requirements for the 100-year storm events.

There is a CCRFCD facility (12'x6' RCB) in N Durango Dr.



The facility collects the 100-year flood on N Durango Dr. meets the dry lane and VxD requirements.

As a result, the portion of N Durango Dr. adjacent to the project site meets the dry lane and VxD requirements. No hydraulic cross sections were provided for N. Durango Dr.

The Gowan Rd. is a 80' public streets. The dry lane and VxD have been analyzed.

5.2 Onsite Grading

The project sites have been designed to drain to Porch Swings Way and Cavaricci Ave. Because the flow is less than 10 cfs, a standard block wall opening size 48" wide and 16" tall is proposed. The finish Floor elevations have been elevated to flood protect the project site.

Hydraulic calculations have been completed for Gowan Rd. The calculations can be found in Appendix C.

5.3 Finished Floor Elevations

The proposed finished floor elevations have been set at a minimum vertical distance above the gutter flowline of at least twice the depth of flow in the gutter flowline up to a maximum of 18 inches above the water surface elevation in the street. The finished floor elevations are also a minimum of 18" above the top of curb elevation meeting Clark County requirements. Finished floor waivers will not be required. Street flow depth calculations for the perimeter streets have been provided in the Appendix C.

6 SUMMARY TABLES

Table 1: Basin Summary

Existing Condition			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
XON1	1.94	<1	2
XON2	1.94	<1	2
XOF1	2.39	<1	3
XOF2	0.96	<1	1
ST1	1	2	3
RF1	-	33	82
CP1	-	33	82
CP2	-	<1	2
CP3	-	<1	2
CP4	-	36	93

Developed Condition			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
DON1	1.94	1	4
DON2	1.94	1	3
XOF1	2.39	1	4
XOF2	0.96	1	2
ST1	1	2	3
RF1	-	33	82
CP1	-	33	82
CP2	-	<1	4
CP3	-	1	3
CP4	-	38	98



Table 2: Cross Section Summary- Existing Condition

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
A - Gowan Rd. 10YR	Section A	36	1.0	0.60	3.30	1.98
A - Gowan Rd. 100YR	Section A	93	1.0	0.80	4.34	3.47

Table 3: Cross Section Summary- Developed Condition

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
A - Gowan Rd. 10YR	A	38	1.0	0.60	3.36	2.02
A - Gowan Rd. 100YR	A	93	1.0	0.80	4.40	3.52
B (100YR)	Section B	1.2	0.7	0.13	1.20	0.16
C (100YR)	Section C	2	2.0	0.13	2.22	0.29
D (100YR)	Section B	2.2	0.5	0.18	1.35	0.24
E (100YR)	Section B	0.8	0.5	0.12	1.06	0.13
F (100YR)	Section B	1.2	0.5	0.14	1.16	0.16
G (100YR)	Section A	0.6	0.5	0.26	1.26	0.33
H (100YR)	Section A	0.45	2.3	0.16	3.26	0.52
I (100YR)	Section B	0.6	0.7	0.10	1.12	0.11
J (100YR)	Section B	0.9	0.7	0.12	1.23	0.15
K (100YR)	Section B	0.9	0.5	0.13	1.09	0.14
L (100YR)	Section C	1.5	1.8	0.12	1.99	0.24
M (100YR)	Section B	1.65	0.6	0.16	1.35	0.22

7 CONCLUSIONS AND RECOMMENDATIONS

As detailed in this study, the Durango and Gowan Rd. Residential Development is in compliance with the *HC&DDM*. No adverse effects are expected either upstream or downstream of the subject site. Street and drainage easement criteria have been met. Proposed finished floor elevations are adequately protected and are set a minimum of 18" above the adjacent top of curb elevation.

8 REFERENCES

Clark County Regional Flood Control District Flood Control Master Plan Update, PBS&J, G. C. Wallace, and Louis Berger Group, 2018.

Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, August 1999, WRC Engineering (updated by Montgomery Watson).

FlowMaster Version V8i, Bentley.



Flood Insurance Rate Map Number 2165E, 2002, Federal Emergency Management Agency.

USACE, Hydrologic Engineering Center, Hydrologic Modeling System HEC-HMS, Technical Reference Manual, Version. 4.0 march 2020. www.usace.army.mil

CCRFCD (Clark County Regional Flood Control District) (2018), Las Vegas Valley Flood Control Master Plan Update; CCRFCD: Las Vegas, NV, USA, 2018.

Update to the technical drainage study for Paradise Hills No.14 and 15, 2000.

Technical Drainage Study for Pine Cove II Residential Subdivisions

Technical Drainage Study for Pine Cove III & IV Residential Subdivisions



TANEY ENGINEERING

6030 S. JONES BOULEVARD, SUITE #100

LAS VEGAS, NV 89118

TELEPHONE: 702-362-8844

FAX: 702-362-5233

Proj. No: BRN-19-002

Date: 6/3/2020

Project Name: Durango and Gowan

Designed By: HZS

DEVELOPED CONDITION

FF Criteria Check				
Bldg #	FF Elev.	Depth	TC Elev.	Criteria Met
1	22.6	0.13	21.85	YES
2	22.6	0.13	21.69	YES
3	22.6	0.13	21.49	YES
4	22.6	0.13	21.28	YES
5	22.6	0.13	21.08	YES
6	22.5	0.12	21.39	YES
7	22.5	0.12	21.53	YES
8	22.5	0.12	21.67	YES
9	22.6	0.12	21.8	YES
10	22.6	0.12	21.67	YES
11	22.6	0.13	21.52	YES
12	22.6	0.13	21.12	YES
13	22.6	0.13	21.24	YES
14	22.6	0.13	21.45	YES
15	22.6	0.13	21.65	YES
16	22.6	0.13	21.85	YES
17	21	0.14	20.19	YES
18	21	0.14	20.08	YES
19	21	0.14	19.93	YES
20	21	0.14	19.79	YES
21	21	0.18	19.64	YES
22	20.5	0.18	19.73	YES
23	20.5	0.18	19.57	YES
24	20.5	0.35	19.42	YES
25	21.1	0.35	19.62	YES
26	21.1	0.14	19.76	YES
27	21.1	0.14	19.91	YES
28	21.1	0.14	20.05	YES
29	21.1	0.14	20.19	YES

Bldg #	FF Elev.	Depth	TC Elev.	Criteria Met
30	24.2	0.1	23.48	YES
31	24.2	0.1	23.28	YES
32	24.2	0.1	23.09	YES
33	24.7	0.12	23.14	YES
34	24.7	0.12	23.35	YES
35	24.7	0.12	23.55	YES
36	24.7	0.12	23.75	YES
37	24.7	0.12	23.92	YES
38	24.7	0.12	23.95	YES
39	24.7	0.12	23.77	YES
40	24.7	0.12	23.57	YES
41	24.7	0.12	23.37	YES
42	24.7	0.12	23.18	YES
43	24.4	0.12	23.25	YES
44	24.4	0.1	23.45	YES
45	24.4	0.1	23.65	YES
46	22.9	0.16	21.54	YES
47	22.4	0.18	21.38	YES
48	22.4	0.18	21.22	YES
49	22.8	0.18	21.4	YES
50	22.8	0.13	21.54	YES
51	22.8	0.13	21.69	YES
52	22.8	0.13	21.83	YES
53	22.8	0.13	21.97	YES
54	22.8	0.16	21.42	YES
55	22.8	0.13	21.56	YES
56	22.8	0.13	21.7	YES
57	22.8	0.13	21.85	YES
58	22.8	0.13	21.97	YES



APPENDIX

APPENDIX A

Figures

APPENDIX B

Hydrologic Calculations

APPENDIX C

Hydraulic Calculations

APPENDIX D

Reference Material

APPENDIX E

Improvement Plans

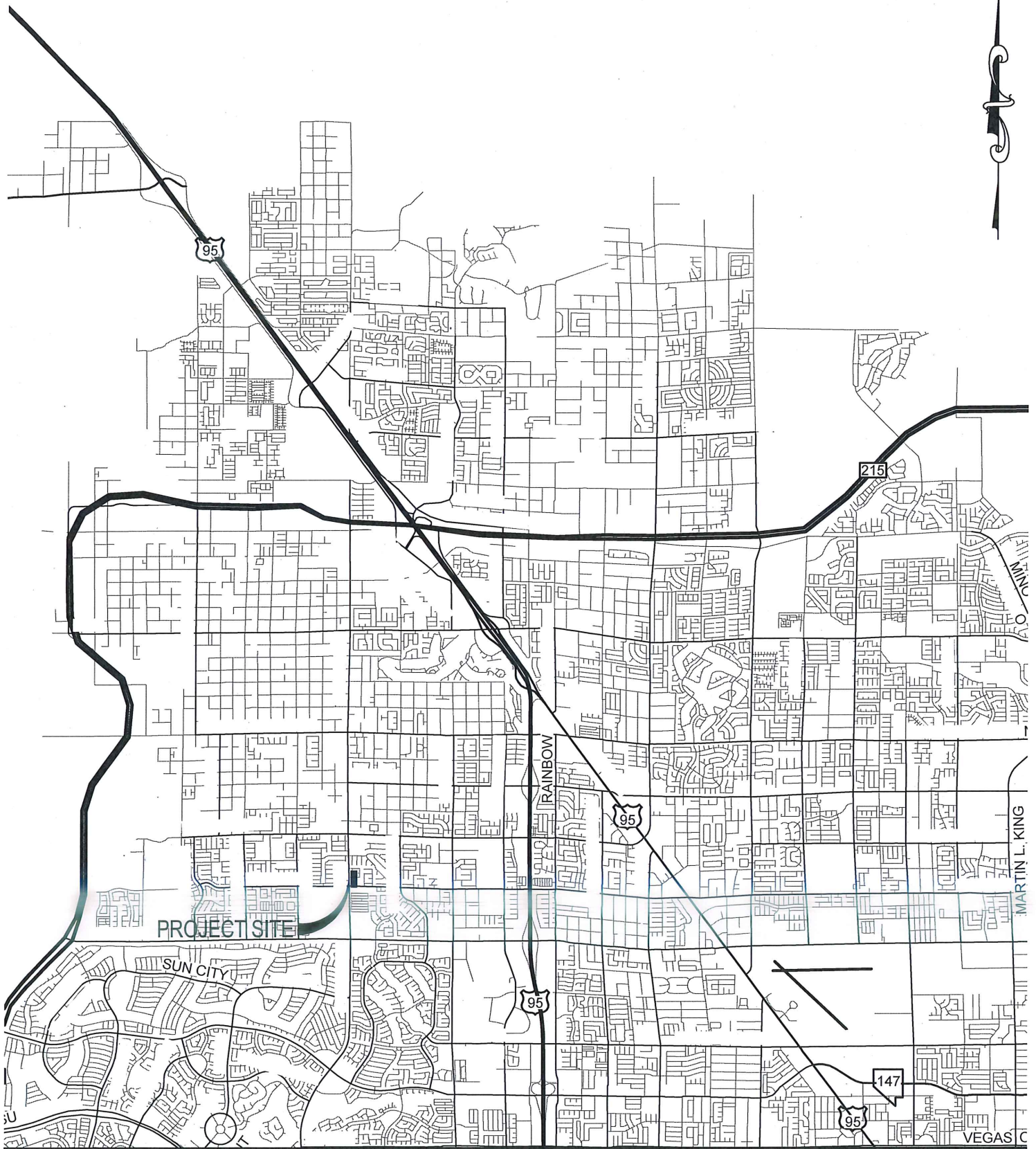


APPENDIX A

Figures

DURANGO & GOWAN

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LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233



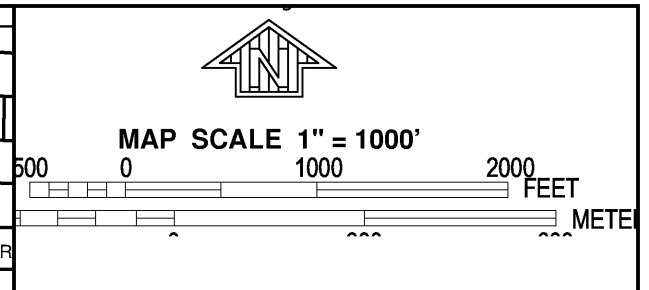
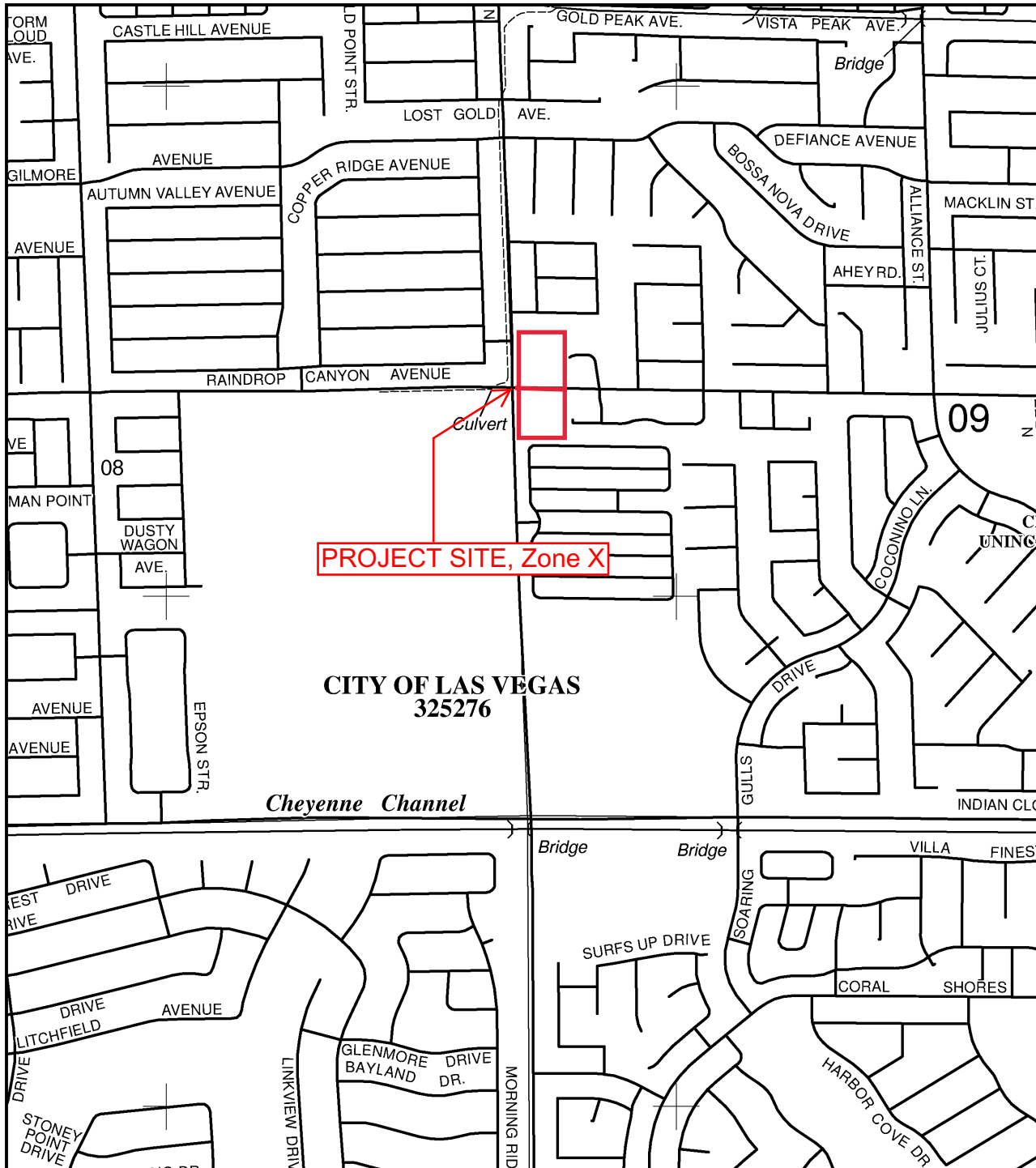
DATE: 4.28.2020
JOBNO:BRN-19-002

VICINITY MAP - FIGURE 1

DURANGO & GOWAN

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PANEL 2135F

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

PANEL 2135 OF 4090
 (SEE MAP INDEX FOR FIRM PANEL LAYOUT)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
CLARK COUNTY	320003	2135	F
LAS VEGAS, CITY OF	325276	2135	F

Figure 3.

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
32003C2135F

MAP REVISED
NOVEMBER 16, 2011

Federal Emergency Management Agency

NATIONAL FLOOD INSURANCE PROGRAM

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



Legend:

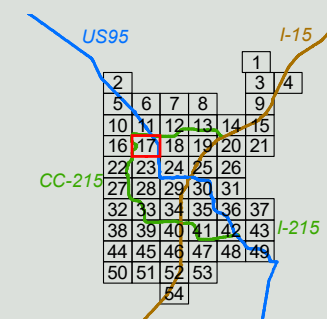
- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Detention Basin
- Culvert or Bridge Crossing
- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

Remove & Replace/Parallel Facilities

Category A	Category B
Channel	Channel
Stormdrain	Stormdrain
Crossing	Crossing

Scale: 1 inch = 2,000 feet

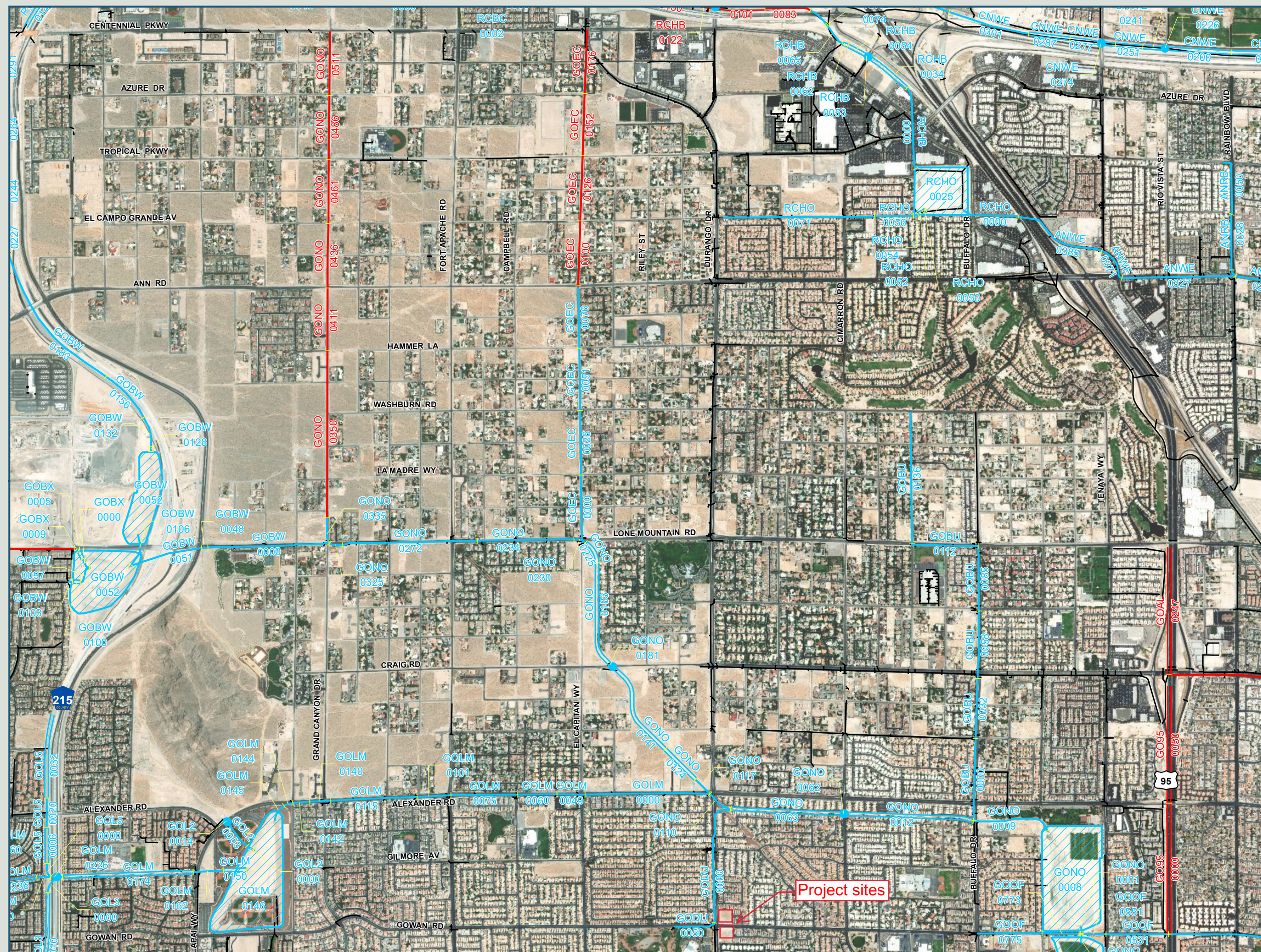
AerialSource:Esri World Imagery 2017



ATKINS
Member of the SNC-Lavalin Group



Louis Berger



ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
ANRB		ANN ROAD CHANNEL WEST - RAINBOW						
0000	E	9' X 6' RCB	167	817	CNW2B5-C	WEST3	0.99	0.30
0028	E	11' X 5' RCB	1140	817	CNW2B5-C	WEST3	0.99	0.23
0050	E	10' X 3' RCB	1240	517	CNW2A3-C	WEST3	0.63	0.35
ANWE		ANN ROAD CHANNEL WEST						
0290	E	8' X 8' RCB	2050	817	2CNW2B5C	CWEST3	0.99	0.70
0327	E	6' X 6' RCB	2360	135	RCHODB	WEST3	4.61	0.87
0371	E	6' X 6' RCB	760	135	RCHODB	WEST3	4.61	0.34
0385	E	54" RCP	1950	135	RCHODB	WEST3	4.61	1.17
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0195	E	CONC CHNL 36"W 9'D 0:1 SS	1130	3771	CNW3B3-C	WEST3	5.64	0.60
0200	E	CONC CHNL 36"W 9'D 0:1 SS	1340	3523	CNW2D4-C	WEST3	5.14	1.00
0226	E	2: 18' X 8.5' RCBC @ RIO VISTA	100	3523	CNW2D4-C	WEST3	5.14	0.51
0241	E	CONC CHNL 36"W 9.5'D 0:1 SS	405	3523	CNW2D4-C	WEST3	5.14	0.51
0251	E	CONC CHNL 36"W 9'D 0:1 SS	575	3234	CNW2D3-C	WEST3	4.64	0.51
0271	E	CONC CHNL 32"W 10'D 0:1 SS	229	3234	CNW2D3-C	WEST3	4.64	0.51
0274	E	32' X 10' RCBC @ TENAYA	142	3234	CNW2D3-C	WEST3	4.64	0.51
0277	E	CONC CHNL 32"W 9'D 0:1 SS	579	3234	CNW2D3-C	WEST3	4.64	0.64
0287	E	CONC CHNL 32"W 8'D 0:1 SS	865	2992	CNW2B2-C	WEST3	3.83	1.59
0301	E	2: 15' X 7' RCB	1738	2992	CNW2B2-C	WEST3	3.83	1.30
0304	E	22' X 7' RCB	3410	2992	CNW2B2-C	WEST3	3.83	1.85
GO95		GOWAN OUTFALL - U.S. 95 CHANNEL						
0000	P	CONC CHNL 12"W 4'D 2:1 SS	2640	318	GD17BG-C	GOW3A	0.36	0.30
0050	P	CONC CHNL 12"W 4'D 2:1 SS	2450	318	GD17BG-C	GOW3A	0.36	0.30
GOAL		GOWAN OUTFALL - ALEXANDER ROAD FACILITIES						
0168	P	10' X 7' RCB	4200	829	CPT2B2	GOW3A	2.32	0.50
0247	P	CONC CHNL 12"W 5.5'D 2:1 SS	2640	574	CGD20BMC	GOW3A	2.02	0.30
GOBU		GOWAN NORTH - BUFFALO BRANCH						
0000	E	2: 12' X 6' RCB	1705	421	CGD14CBC	GOW3A	2.52	0.20
0032	E	2: 12' X 5' RCB	1248	343	CGD14AAC	GOW3A	2.29	0.25
0058	E	2: 11' X 4' RCB	1398	301	CGD17AAC	GOW3A	1.87	0.25
0085	E	11' X 5' RCB	1356	241	CGD17ABC	GOW3A	1.49	0.25
0112	E	8' X 5' RCB	1380	180	CGD20ACC	GOW3A	1.12	0.65
0136	E	5' X 5' RCB	2740	72	GD20AA-C	GOW3A	0.44	0.50
GOBW		GOWAN BELTWAY WEST						
0000	E	48" RCP	2527	115	LMBWDB	GOW4A	10.81	4.37
0048	E	72" RCP	131	115	LMBWDB	GOW4A	10.81	2.21
0051	E	72" RCP OUTLET	1522	115	LMBWDB	GOW4A	10.81	0.30
0052	E	588 AC-FT LONE MOUNTAIN-BELTWAY DETENTION BASIN		5316	CLMBW1	GOW3B	3.64	
0082	E	17,100 CFS PMF SPILLWAY		17100	CLMBW1	GOW3B	3.64	
0097	E	60" RCP	375	660	UVB1-1	GOW3A	0.37	8.06
0100	E	ENERGY DISSIPATOR	162	660	UVB1-1	GOW3A	0.37	50.00
0103	E	42" RCP	92	660	UVB1-1	GOW3A	0.37	7.00
0106	E	8' X 8' RCB CONNECTOR PIPE UNDER LONE MOUNTAIN	699				0.25	
0128	E	20' X 10' RCB	100	3589	CWRBW1	GOW3B	2.41	25.00
0132	E	14' X 9' RCB	648	3156	CHLBW1-C	GOW3A	5.83	1.27
0156	E	14' X 9' RCB	1182	3156	CHLBW1-C	GOW3A	5.83	2.89
0183	E	14' X 9' RCB	3414	3156	CHLBW1-C	GOW3A	5.83	1.77
0227	E	10' X 8' RCB	739	1823	CEFPOA2	GOW3A	4.94	2.78
GOBX		GOWAN BOX CANYON						
0000	E	66" RCP	258	696	LWBW1	GOW3A	0.47	10.00
0005	E	ENERGY DISSIPATOR	206	696	LWBW1	GOW3A	0.47	39.00
0009	E	6' X 4' RCB	95	696	LWBW1	GOW3A	0.47	4.72
0015	P	66" RCP	6783	39	BOXDET	GOW3A	3.41	6.55
GODU		GOWAN NORTH - DURANGO BRANCH						
0000	E	12' X 6' RCB	2629	905	CLV14-C	GOW3A	1.40	0.91
0050	E	9' X 6' RCB	865	681	CLV20-C	GOW3A	0.98	1.50
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0000	E	10' X 8' RCB	1436	474	CWRJS-C*	GOW3A	1.95	1.07
0026	E	10' X 7' RCB	1330	474	CWRJS-C	GOW3A	1.95	0.82
0051	E	10' X 7' RCB	1290	439	CHLFR-C	GOW3A	1.69	1.06
0076	E	10' X 7' RCB	1335	392	CARFR-C	GOW3A	1.45	0.54
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0100	P	10' X 6' RCB	1320	321	CEAFR-C	GOW3A	1.21	0.76
0126	P	10' X 7' RCB	1320	290	CTRFR-C	GOW3A	0.96	0.38
0152	P	7' X 6' RCB	1320	238	CARFP-C	GOW3A	0.70	0.77
0176	P	78" RCP	1320	190	CCPFR-C	GOW3A	0.46	1.15
GOL2		GOWAN LONE MOUNTAIN SYSTEM-BRANCH 2						
0000	E	5' X 4' RCB	150	359	CRBW	GOW3A	0.36	14.60
0003	E	66" RCP	607	359	CRBW	GOW3A	0.36	1.97
0014	E	84" RCP @ ALEXANDER	125	359	CRBW	GOW3A	0.36	4.00
GOL3		GOWAN LONE MOUNTAIN SYSTEM-BRANCH 3						
0000	E	2: 10' X 10' RCBC @ BELTWAY	500	3713	CLMT5	GOW3A	7.83	3.39
0010	E	CONC CHNL 20"W 10'D 0:1 SS	3037	3277	CRCLMT1R	GOW3A	7.31	2.78
GOL5		GOWAN LONE MOUNTAIN SYSTEM-BRANCH 5						
0000	E	6' X 5' RCB	309	421	UVB2	GOW3A	0.33	7.69
0006	E	CONC CHNL 6"W 5'D 0:1 SS	740	421	UVB2	GOW3A	0.33	3.85
0020	E	6' X 5' RCBC @ ALEXANDER RD	615	421	UVB2	GOW3A	0.33	2.08
0032	E	CONC CHNL 6"W 5'D 0:1 SS	1756	421	UVB2	GOW3A	0.33	1.67
GOLM		GOWAN LONE MOUNTAIN SYSTEM						
0000	E	78" RCP	2590	278	CLV15-C	GOW4A	11.09	1.80
0049	E	6' X 5' RCB	585	278	CLV15-C	GOW4A	11.09	1.87
0060	E	66" RCP	817	278	CLV15-C	GOW4A	11.09	2.40
0075	E	60" RCP	1385	278	CLV15-C	GOW4A	11.09	2.55
0101	E	54" RCP	700	184	LMTNDB	GOW4A	10.74	1.74
0115	E	48" RCP	1799	184	LMTNDB	GOW4A	10.74	3.08
0140	E	42" RCP	438	184	LMTNDB	GOW4A	10.74	1.60
0142	E	48" RCP	348	184	LMTNDB	GOW4A	10.74	2.14
0144	E	66" RCP	196	184	LMTNDB	GOW4A	10.74	5.44
0145	E	66" RCP OUTLET	378	184	LMTNDB	GOW4A	10.74	0.90
0146	E	888 AC-FT LONE MOUNTAIN DETENTION BASIN		6518	LMTNIN	GOW3B	6.43	
0147	E	36,000 CFS PMF SPILLWAY		36000	LMTNIN	GOW3B	6.43	
0150	E	DROP STRUCTURE	481	5731	CGABW	GOW3B	5.49	
0162	E	28' X 8' RCBC @ HUALAPAI	625	5731	CGABW	GOW3B	5.49	1.86
0174	E	CONC CHNL 28"W 8'D 0:1 SS	2715	5532	COLMT5	GOW3B	5.19	3.20
0226	E	10' X 10' RCBC @ BELTWAY	246	2246	CUVB2	GOW3A	1.67	2.50
0230	E	10' X 10' RCB	290	1931	CLMT3	GOW3A	1.34	2.50
0236	E	CONC CHNL 15"W 8'D 0:1 SS	869	1931	CLMT3	GOW3A	1.34	3.69
GOLO		GOWAN OUTFALL - LONE MTN. ROAD BRANCH						
0275	E	8' X 6' RCB	3000	580	CPT3AA2	GOW3A	1.17	1.04
0332	E	8' X 6' RCB	150	492	C33AA1	GOW3A	1.02	1.90
GONO		GOWAN NORTH SYSTEM						
0000	E	8' X 8' RCB OUTLET	184	523	GWNNDB	GOW5A	68.55	0.51
0001	E	8' X 8' RCB OUTLET	156	523	GWNNDB	GOW5A	68.55	0.63
0006	E	30,780 CFS PMF SPILLWAY		30780	CCLV43-C*	GOW4B	11.91	
0008	E	921 AC-FT GOWAN NORTH DETENTION BASIN		2599	CCLV43-C*	GOW4B	11.91	
0009	E	3: 13' X 8' RCB	1662	2281	CLV43-C	GOW4B	11.22	0.62
0012	E	CONC CHNL 30"W 8'9.5'D 0:1 SS	2665	2131	CCLV36-C	GOW4B	8.53	1.18
0062	E	BRIDGE 30'W 8.5'D @ CIMARRON	80	1912	CCLV15-C	GOW4B	8.02	0.30
0063	E	CONC CHNL 30"W 8.5'-10'D 0:1 SS	2302	1912	CCLV15-C	GOW4B	8.02	1.00
0110	E	2: 12' X 8' RCAC @ ALEXANDER	547	1392	CHAFR2-C	GOW3B	6.26	1.00
0117	E	2: 12' X 8' RCAP	424	1392	CHAFR2-C	GOW3B	6.26	1.10
0124	E	CONC CHNL 24"W 9'D 0:1 SS	887	1392	CHAFR2-C	GOW3B	6.26	1.36
0141	E	CONC CHNL 24"W 9'-10.5'D 0:1 SS	2064	1367	CCRSFR-C	GOW3B	6.12	0.59
0181	E	BRIDGE 30'W 7'D @ CRAIG	142	1367	CCRSFR-C	GOW3B	6.12	0.65
0183	E	CONC CHNL 22"W 8'-10.6'D 0:1 SS	2193	1185	CCRSFR-C	GOW3B	5.19	0.72
0225	E	CONC CHNL WIDTH VARIES DEPTH VARIES 0:1 SS	508	1144	CCLWFR-E	GOW3B	4.54	1.05
0230	E	13' X 5' RCB	256	766	CLWFR-W	GOW3B	2.46	2.78
0234	E	12' X 6' RCB	2010	766	CLWFR-W	GOW3B	2.46	1.67
0272	E	10' X 6' RCB	2797	766	CLWFR-W	GOW3B	2.46	3.15
0325	E	15' X 7' RCB	291	749	CWWRHW-C	GOW3B	2.34	4.20
0335	E	15' X 7' RCB	529	749	CWWRHW-C	GOW3A	2.34	0.40
0350	P	10' X 6' RCB	3473	749	CWRRHW-C	GOW3A	2.34	0.88
0411	P	10' X 6' RCB	1320	679	CARHW-C	GOW3A	1.84	0.76
ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GONO		GOWAN NORTH SYSTEM						
0436	P	8' X 6' RCB	1320	607	CEAHW-C	GOW3A	1.50	1.14
0461	P	8' X 7' RCB	1320	508	CTRHW-C	GOW3A	1.21	0.38
0486	P	7' X 5' RCB	1320	400	CADHW-C	GOW3A	0.90	0.76
0511	P	6' X 5' RCB	1320	326	CCPHW-C	GOW3A	0.60	1.14
GOOF		GOWAN OUTFALL FACILITIES						
0511	E	8' X 5' RCB	8390	740	CPT6B-C	GOW3B	1.08	0.50
0531	E	8' X 5' RCB	1300	523	GWNNDB	GOW5A	68.55	0.50
0551	E	72" RCP	524	523	GWNNDB	GOW5A	68.55	0.62
0773	E	60" RCP	803	255	LV30-C	GOW3A	0.42	1.40
0775	E	60" RCP	1300	255	LV30-C	GOW3A	0.42	1.00
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0140	E	CONC CHNL 10"W 5'D 0:1 SS	2155	475	CDMNA1	WEST3	0.43	1.65
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0000	E	2: 12' X 8.5' RCAP	1700	1766	CNW1C-W*	WEST3	3.91	0.63
0034	E	CONC CHNL 21"W 8'D 0:1 SS	1000	1766	CNW1C-W	WEST3	3.91	1.19
0053	E	2: 12' X 8' RCBC @ SOUTH RAMP CONNECTOR	85	1465	CDW1C1-C	WEST3	3.55	1.40
0054	E	CONC CHNL 21"W 8'D 0:1 SS	432	1465	CDW1C1-C	WEST3	3.55	1.51
0062	E	TRANSITION STRUCTURE	130	1465	CDW1C1-C	WEST3	3.55	1.51
0065	E	24' X 7' RCB	480	1465	CDW1C1-C	WEST3	3.55	0.30
0074	E	24' X 6' RCB	50	1414	CNWB6C-C	WEST3	3.41	0.30
0075	E	20' X 6' RCBC @ BELTWAY	428	1414	CNWB6C-C	WEST3	3.41	2.81
0083	P	20' X 4' RCB	950	1414	CNWB6C-C	WEST3	3.41	2.49
0101	P	CONC CHNL 20"W 5'D 0:1 SS	980	1414	CNWB6C-C	WEST3	3.41	2.38
0120	E	20' X 6' RCBC @ GRAND MONTECITO	120	1414	CNWB6C-C	WEST3	3.41	1.00
0122	P	CONC CHNL 16'-20'W 6'D 0:1 SS	350	1414	CNWB6C-C	WEST3	3.41	1.84
RCHO		RANCHO ROAD SYSTEM						
0000	E	60" RCP W/ 36" ORIFICE PLATE	1183	135	RCHODB</			

Figure 5- Watershed MAp



Existing Condition			
Basin	Area (acres)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
XON1	1.94	<1	2
XON2	1.94	<1	2
XOF1	2.39	<1	3
XOF2	0.96	<1	1
ST1	1	2	3
RF1	-	33	82
CP1	-	33	82
CP2	-	<1	2
CP3	-	<1	2
CP4	-	36	93

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
A - Gowan Rd. 10YR	Section A	36	1.0	0.60	3.30	1.98
A - Gowan Rd. 100YR	Section A	93	1.0	0.80	4.34	3.47

SCALE: 1" = 100'

100' 50' 0' 100'

DRAINAGE LEGEND

XX/XXX
(XX/XXX)

BASIN IDENTIFICATION

BASIN AREA (ACRES)

BASIN BOUNDARY

CONCENTRATION POINT

FLOW PATH

PROJECT SITE

CROSS SECTION

10-YR/100-YR FLOW (CFS)

REFERENCE FLOW (CFS)

EXISTING CONDITION

FIGURE 6



DEVELOPED CONDITION

FIGURE 7



DURANGO & GOWAN
BRN-19-002

Hydrologic Calculations



HYDROLOGIC METHODOLOGY AND CRITERIA

The *HEC-HMS* from U.S. Army Corps of Engineers was used to determine the peak runoff values generated by the 10-year and 100-year, 6-hour storm events. The *HEC-HMS* computer model has the ability to simulate the surface runoff response of a drainage basin to precipitation. Both programs represent the basin as an interconnected system of hydraulic components. Each component models an aspect of the rainfall runoff process within a portion of the entire basin. This basin portion is referred to as a sub-basin. The computed hydrographs of each sub-basin are then combined at the appropriate locations and a final discharge hydrograph is obtained.

Hydrologic Parameters

Basin Area

The offsite drainage basins were determined from available topographic maps, aerial photographs, field investigation, and reference studies. The proposed onsite areas were determined from the onsite improvement plans in AutoCAD format. The drainage basins are shown on Figures 4, 4-A, and 5.

Precipitation

The project site is located outside of the limits for McCarran Airport Rainfall. Precipitation values have been referenced from Figures 503 and 506 of the HCDDM. The rainfall depths of 1.61 inches and 2.86 inches were selected for 10- and 100-year storm events. The site encompasses less than 8 square miles, therefore the Storm Distribution Number Three (SDN No. 3) was used for the *HEC-HMS* Model.

Table 1
6-Hour Rainfall Depths

Year	Rainfall Depth	Adjustment Ratio	Adjusted Rainfall Depth	Percentage of 100 Year
10	1.30	1.24	1.61	0.55
100	2.00	1.43	2.86	1.00

Depth-Area Reduction Factor

A Depth-Area Reduction Factor or DARF is used to reduce the rainfall depth for a specified area to account for typical storm intensity distribution. DARFs were not used in this analysis as the drainage basins were too small and based on the Table 502, the DARF is about 1.



Hydrologic Abstractions

Interception, infiltration, surface storage, evaporation, and evapotranspiration are regarded as hydrologic abstractions. The primary rainfall loss component in hydrologic models is infiltration.

The SCS curve number method was used to approximate the infiltration rates for the onsite watershed. Curve numbers are a function of the hydrologic soil group, vegetative cover and its hydrologic condition, land use, and the soil's antecedent soil moisture condition. Curve numbers are referenced from the Las Vegas Valley Flood Control Master Plan Update (2018 MPU).

The project site and offsite basins are located in the area with Soil Map Unit of 1502 and Land Use Category Index Number of 6. Therefore, the curve number was calculated using a spreadsheet for Curve Number matrix as 73 and 80 for the undeveloped and developed conditions.

Lag Time

Lag time (TLAG) is described as the time measured between the centroid of rainfall to the peak of the outflow hydrograph. It is a measure of the watershed's response time and is associated to basin length, slope, roughness characteristics, and land use.

Lag-times have been estimated by calculating the drainage basins' time of concentration, T_c . The time of concentration consists of two component times; the initial overland flow time, t_i , and the travel time for the flow within the gutter, swale, or channel, t_t . The equation for the time of concentration is as follows:

$$T_c = t_i + t_t$$

$$\text{where } t_i = 1.8 * (1.1 - K) * L_0^{1/2} / S^{1/3}$$

$$t_i = 1.8 * (1.1 - K) * L_0^{1/2} / S^{1/3}$$

$$K = \text{Flow Resistance Coefficient } (K = 0.0132 * CN - 0.30)$$

CN = Curve Number

L_0 = Length of Overland Flow

S = Average Basin Slope

$$\text{And, } t_t = L / (60 * V)$$

L = Length of Gutter/Channel (ft)

V = Flow Velocity (ft/s)

Velocity is calculated from the Manning's Equation with

$$Q = 0.6 * Q_T \quad Q_T = \text{Total Discharge}$$

Lag-times are estimated with the following equation: $TLAG = 0.6 * T_c$.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

PRECIPITATION ADJUSTMENT RATIOS

<u>Recurrence Interval</u>	<u>Ratio to NOAA Atlas 2</u>
2-year	1.00
5-year	1.16
10-year	1.24
25-year	1.33
50-year	1.39
100-year	1.43

- NOTE: 1. Multiply the values obtained from the NOAA Atlas 2 by the above ratios to obtain the adjusted precipitation values.
2. NOAA Atlas 2 values for use with TR-55 shall not be adjusted by the above ratios.
3. Tables 505 and 506 require no adjustments.

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

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

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

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

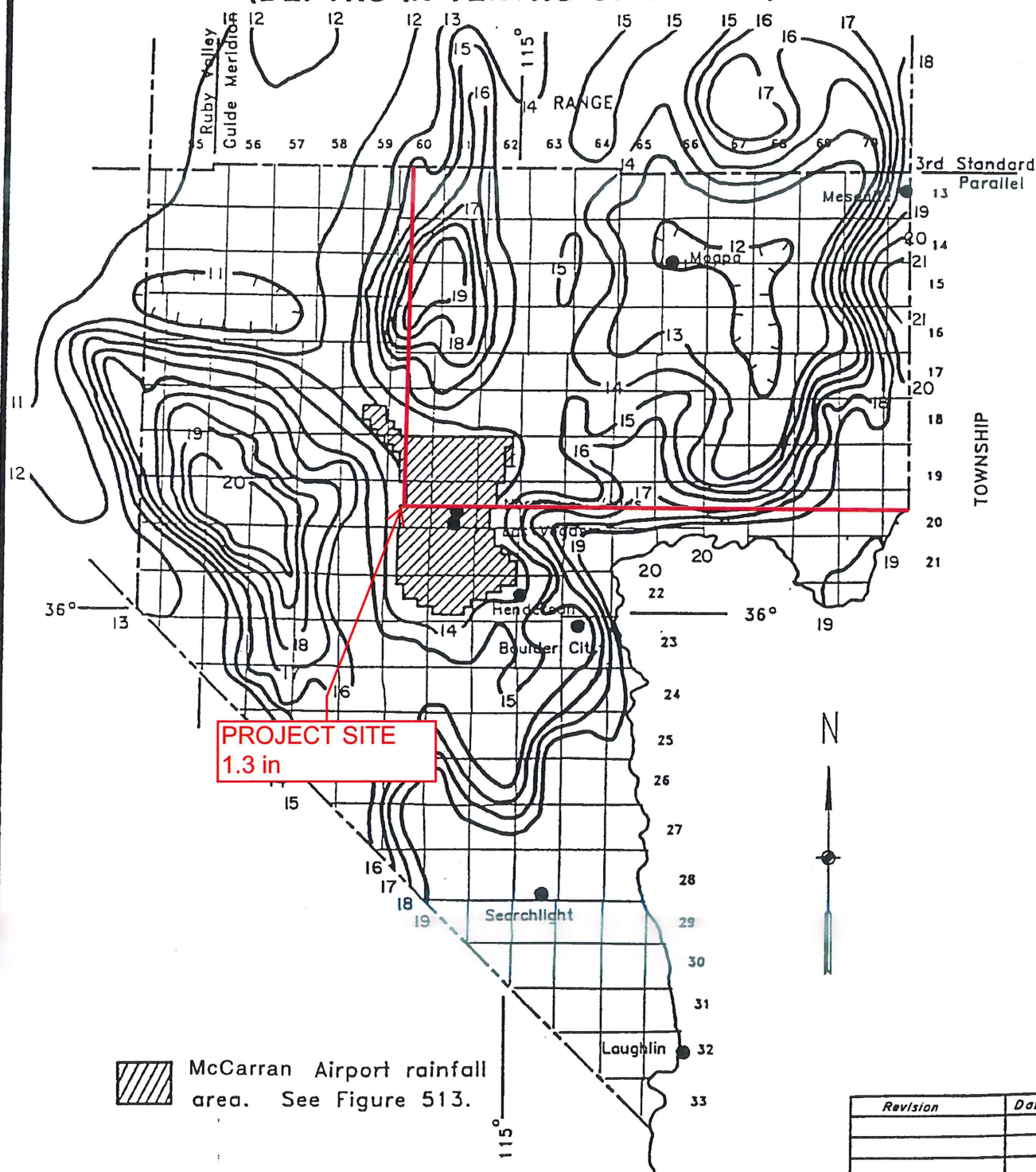
Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 10-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)

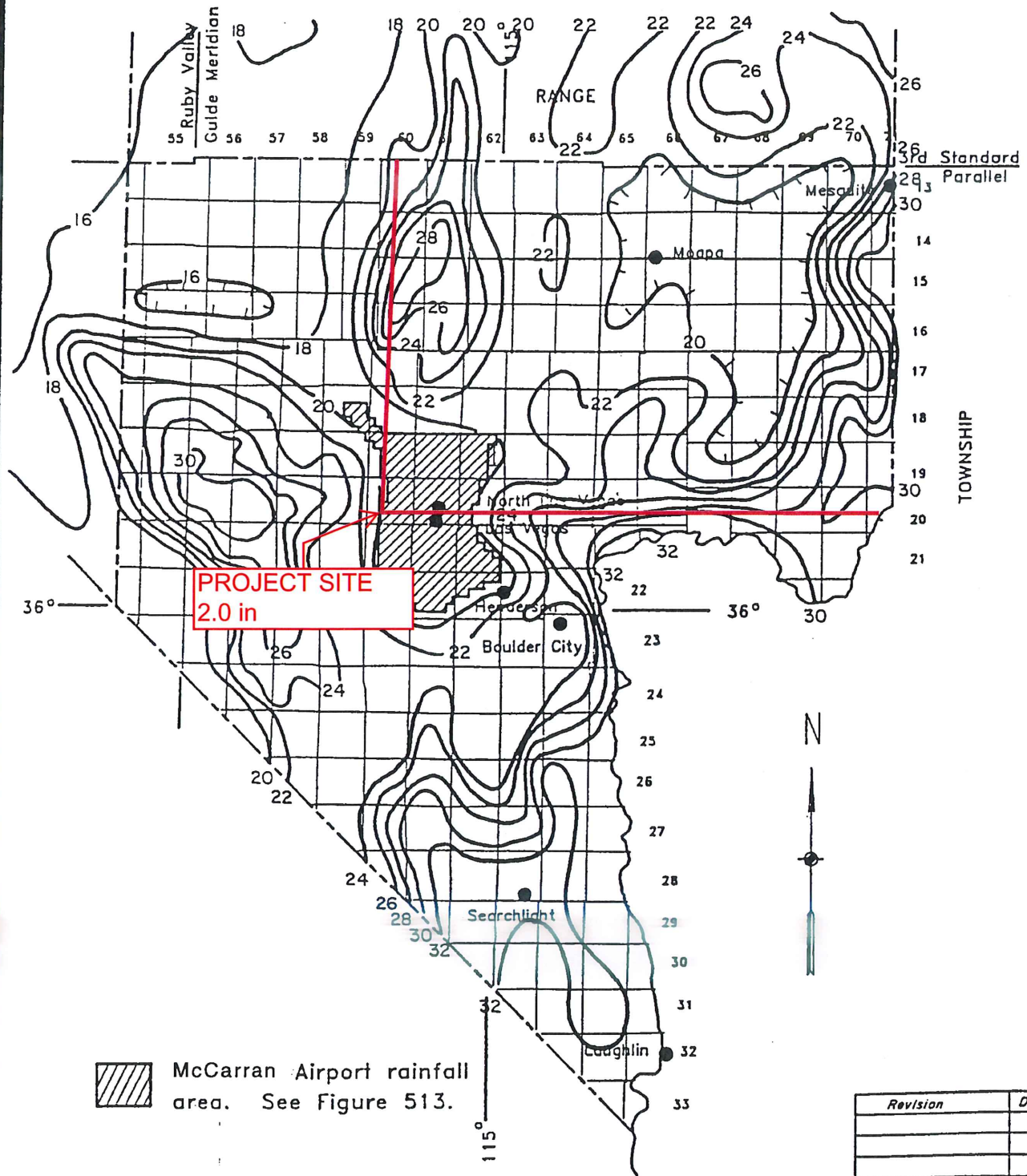


McCarran Airport rainfall area. See Figure 513.

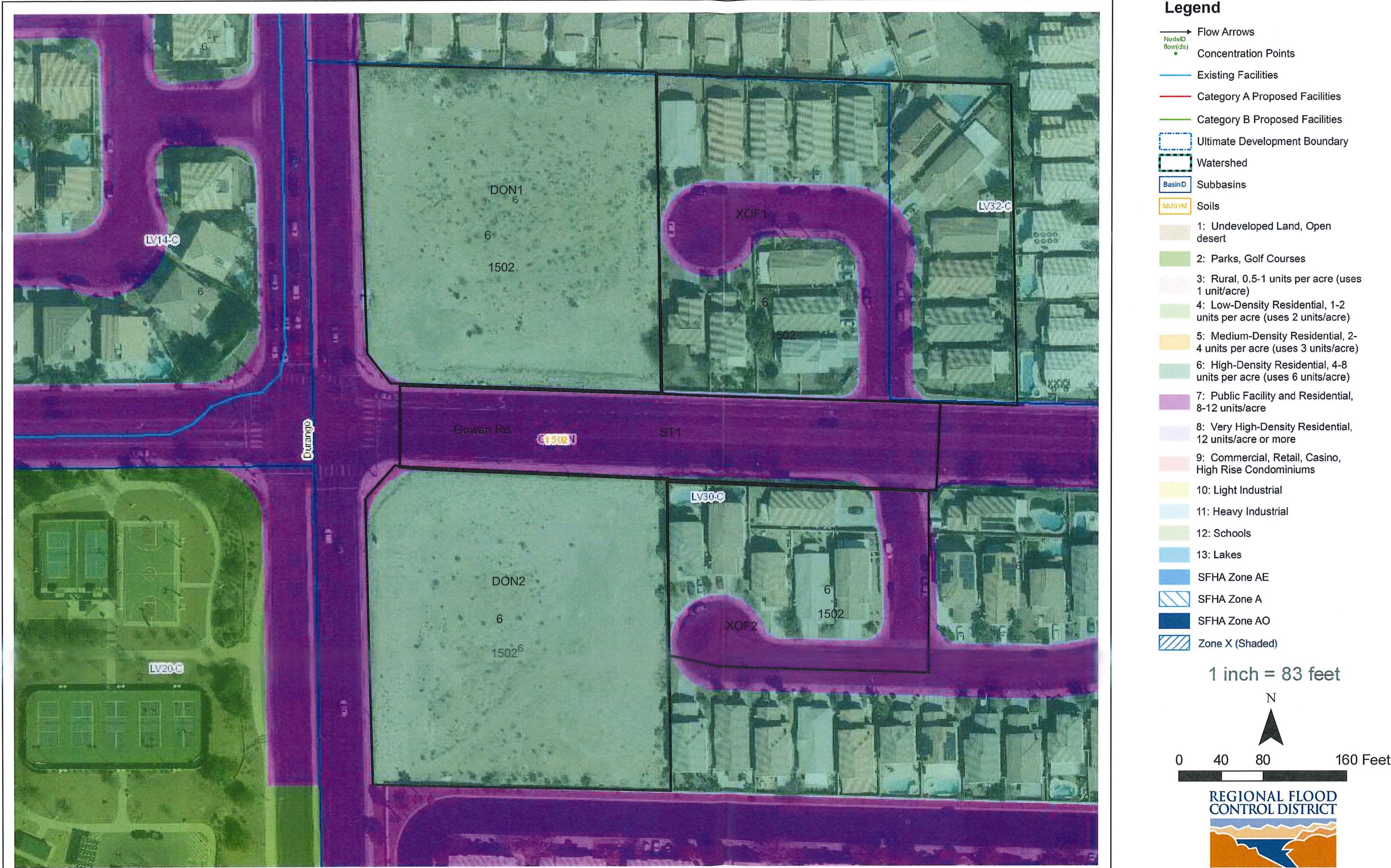
Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RAINFALL DEPTH-DURATION-FREQUENCY 100-YEAR, 6-HOUR (DEPTHS IN TENTHS OF INCHES)



Soil Map Developed



Curve Number Matrix

SOIL MAP UNIT	HYDROLOGIC SOIL GROUP					LAND USE CATEGORY INDEX NUMBER												
	A	B	C	D	ROCK OUTCROP	1	2	3	4	5	6	7	8	9	10	11	12	13
	CN ---->					63	47	57	60	62	74	84	89	92	86	92	71	30
		CN ---->				77	66	73	74	76	83	89	93	94	91	94	81	30
			CN ---->			85	77	82	83	84	88	92	95	95	93	95	87	30
				CN ---->		88	83	86	87	88	91	94	96	96	95	96	90	30
					CN ---->	90	90	92	92	92	94	96	96	97	96	97	94	30
	%	%	%	%	%	SOIL TYPE COMPOSITE CN FOR LAND USE CATEGORY												
1301	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1302	35	20	0	45	0	77.0	67.0	73.0	75.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1305	5	0	35	60	0	86.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1307	10	0	30	60	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	96.0	93.0	96.0	87.0	30.0
1313	8	68	0	24	0	79.0	68.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	82.0	30.0
1314	80	5	0	15	0	67.0	53.0	62.0	65.0	67.0	77.0	86.0	91.0	92.0	88.0	92.0	74.0	30.0
1320	0	2	0	83	15	88.0	83.0	87.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1323	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1325	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1326	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1340	9	0	0	71	20	86.0	81.0	85.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1341	0	100	0	0	0	77.0	66.0	73.0	74.0	76.0	83.0	89.0	93.0	94.0	91.0	94.0	81.0	30.0
1342	0	7	0	78	15	88.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1360	15	0	0	35	50	85.0	81.0	84.0	85.0	86.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1380	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1390	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1400	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1415	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1417	5	0	55	10	30	86.0	80.0	84.0	85.0	86.0	89.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1419	35	0	55	10	0	78.0	67.0	74.0	75.0	77.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1440	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1450	1	0	0	89	10	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1484	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1500	60	0	0	35	5	73.0	61.0	69.0	71.0	73.0	81.0	88.0	92.0	93.0	89.0	93.0	79.0	30.0
1501	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1502	60	0	0	40	0	73.0	61.0	69.0	71.0	72.0	80.0	88.0	92.0	93.0	89.0	93.0	79.0	30.0
1505	55	0	0	40	5	74.0	63.0	70.0	72.0	74.0	81.0	88.0	92.0	94.0	90.0	94.0	80.0	30.0
1506	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1508	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1510	10	0	0	55	35	86.0	82.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1540	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0
1541	4	0	0	76	20	87.0	83.0	86.0	87.0	87.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1542	60	0	30	10	0	72.0	59.0	67.0	69.0	71.0	80.0	87.0	92.0	93.0	89.0	93.0	78.0	30.0
1545	60	0	10	30	0	73.0	60.0	68.0	70.0	72.0	80.0	88.0	92.0	93.0	89.0	93.0	78.0	30.0
1600	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1605	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1610	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1615	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1630	0	0	0	100	0	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1635	7	0	5	63	25	87.0	82.0	85.0	86.0	87.0	90.0	94.0	95.0	96.0	94.0	96.0	89.0	30.0
1640	0	0	0	10	90	90.0	90.0	91.0	91.0	92.0	94.0	96.0	96.0	97.0	96.0	97.0	94.0	30.0
1645	0	0	100	0	0	85.0	77.0	82.0	83.0	84.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1674	27	26	0	45	2	78.0	69.0	75.0	76.0	78.0	84.0	90.0	93.0	94.0	91.0	94.0	83.0	30.0
1700	0	0	3	93	4	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1710	2	89	0	9	0	78.0	67.0	74.0	75.0	77.0	83.0	89.0	93.0	94.0	91.0	94.0	82.0	30.0
1731	10	2	0	88	0	85.0	79.0	83.0	84.0	85.0	89.0	93.0	95.0	96.0	94.0	96.0	88.0	30.0
1732	3	0	0	96	1	87.0	82.0	85.0	86.0	87.0	90.0	94.0	95.0	96.0	94.0	96.0	89.0	30.0
1753	0	8	0	90	2	87.0	81.0	85.0	86.0	87.0	90.0	93.0	95.0	96.0	94.0	96.0	89.0	30.0
1850	0	0	0	94	6	88.0	83.0	86.0	87.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	90.0	30.0
1853	0	0	0	85	15	88.0	84.0	87.0	88.0	88.0	91.0	94.0	96.0	96.0	95.0	96.0	91.0	30.0
1871	17	0	0	83	0	84.0	76.0	81.0	82.0	83.0	88.0	92.0	95.0	95.0	93.0	95.0	87.0	30.0
1999	100	0	0	0	0	63.0	47.0	57.0	60.0	62.0	74.0	84.0	89.0	92.0	86.0	92.0	71.0	30.0

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4



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Las Vegas, NV 89118

PROJECT NO. : BRN-19-002

PROJECT: PLANNING AREA 8

FILE : STD_FRM4

CALCULATED BY: TN

DATE : 06/01/20

Sub-Basin Data					Initial/Overland Time (T _i)			Travel Time (T _t)					T _c	T _c Check (Urbanized Basins)		Final T _c	T _{lag}	Remarks
DESIG (1)	CN (2)	K (3)	AREA (acres) (4)	AREA (mi ²) (5)	LENGTH (ft) (6)	SLOPE (%) (7)	T _i (min) (8)	LENGTH (ft) (9)	SLOPE (%) (10)	V ₁ (fps) (11)	V ₂ (fps) (12)	T _t (min) (13)	T _c =T _i +T _t (min) (14)	TOTAL (ft) (15)	T _c (min) (16)	T _c (min) (17)	T _{lag} (min) (18)	Remarks (19)

EXISTING CONDITION

XON1	73	0.574	1.94	0.0030	20	0.6	5.0	260	0.6	1.15	N/A	3.8	8.8	N/A	N/A	8.80	6.0	
XON2	73	0.574	1.94	0.0030	20	0.3	6.3	260	0.5	1.05	N/A	4.1	10.5	N/A	N/A	10.47	6.3	
XOF1	73	0.574	2.39	0.0037	30	0.3	7.8	330	0.3	1.11	N/A	5.0	12.7	360	12.0	12.00	7.2	
XOF2	73	0.574	0.96	0.0015	30	1.3	4.8	330	1.3	2.30	N/A	2.4	7.1	360	12.0	7.14	4.3	
ST1	98	0.904	1.00	0.0016	60	1.0	2.7	560	0.1	0.64	0.97	14.1	16.8	620	13.4	13.44	8.1	

$T_i=(1.8(1.1-K)L^{1/2})/(S^{1/3})$ For the travel time (T_i) calculations, $T_c=T_i+T_t$ V_1 applies to the first 500 feet of travel distance; $K=0.0132(CN)-.39$ V_2 applies to the remaining travel distance. $T_{lag} = 0.6T_c$		Travel Time Velocity Formulas		All basins over one square mile are calculated by the equation $T_{lag}=20Kn(L*L_c/S^{0.5})^{0.33}$ and denoted by shaded gray (See Worksheet).
		Existing	Developed	
		$V_1 = 14.8*(S/100)^{1/2}$	$V_1 = 20.2*(S/100)^{1/2}$	
		$V_2 = 29.4*(S/100)^{1/2}$	$V_2 = 30.6*(S/100)^{1/2}$	

REFERENCE:

CCRCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

STANDARD FORM 4

Taney Engineering
6030 S. Jones, Suite #100
Las Vegas, NV 89118

PROJECT NO. : BRN-19-002

PROJ PLANNING AREA 8

FILE : STD_FRM4

C/TN

DATE 06/01/20

[illegible][illegible]

DON1	80	0.666	1.94	0.0030	20	0.6	4.1	260	0.6	1.56	N/A	2.8	6.9	280	11.6	6.91	4.1
DON2	80	0.666	1.94	0.0030	20	0.3	5.2	260	0.5	1.43	N/A	3.0	8.3	280	11.6	8.25	5.0
XOF1	80	0.666	2.39	0.0037	30	0.3	6.4	330	0.3	1.11	N/A	5.0	11.4	360	12.0	11.36	6.8
XOF2	80	0.666	0.96	0.0015	30	1.3	3.9	330	1.3	2.30	N/A	2.4	6.3	360	12.0	6.31	3.8
ST1	98	0.904	1.00	0.0016	60	1.0	2.7	560	0.1	0.64	0.97	14.1	16.8	620	13.4	13.44	8.1

$T_i = (1.8(1.1-K)L^{(1/2)}) / (S^{1/3})$	For the travel time (T_i) calculations,	Travel Time Velocity Formulas		All basins over one square mile are calculated by the equation $T_{lag} = 20Kn(L \cdot L_c / S^{0.5})^{0.33}$ and denoted by shaded gray (See Worksheet).
$T_c = T_i + T_1$	V_1 applies to the first 500 feet of travel distance;	Existing	Developed	
$K = 0.0132(CN) - .39$	V_2 applies to the remaining travel distance.	$V_1 = 14.8 \cdot (S/100)^{1/2}$ $V_2 = 29.4 \cdot (S/100)^{1/2}$	$V_1 = 20.2 \cdot (S/100)^{1/2}$ $V_2 = 30.6 \cdot (S/100)^{1/2}$	
$T_{lag} = 0.6T_c$				

REFERENCE:

CCRFCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

STANDARD FORM 4



DURANGO & GOWAN
BRN-19-002

EXISTING CONDITION 10 YEAR

Precipitation Gages

6HR Dist-SDN3

01Jan2018, 00:00 - 01Jan2018, 06:00

Components Compute Results

Time (ddMMYYYY, HH:mm)	Precipitation (IN)
01Jan2018, 00:00	0.000
01Jan2018, 00:05	0.020
01Jan2018, 00:10	0.057
01Jan2018, 00:15	0.070
01Jan2018, 00:20	0.087
01Jan2018, 00:25	0.108
01Jan2018, 00:30	0.124
01Jan2018, 00:35	0.130
01Jan2018, 00:40	0.130
01Jan2018, 00:45	0.130
01Jan2018, 00:50	0.130
01Jan2018, 00:55	0.130
01Jan2018, 01:00	0.130
01Jan2018, 01:05	0.133
01Jan2018, 01:10	0.140
01Jan2018, 01:15	0.142
01Jan2018, 01:20	0.148
01Jan2018, 01:25	0.158
01Jan2018, 01:30	0.172
01Jan2018, 01:35	0.181
01Jan2018, 01:40	0.190
01Jan2018, 01:45	0.197
01Jan2018, 01:50	0.199
01Jan2018, 01:55	0.200
01Jan2018, 02:00	0.201
01Jan2018, 02:05	0.204
01Jan2018, 02:10	0.214
01Jan2018, 02:15	0.229
01Jan2018, 02:20	0.241
01Jan2018, 02:25	0.249
01Jan2018, 02:30	0.251
01Jan2018, 02:35	0.256
01Jan2018, 02:40	0.270

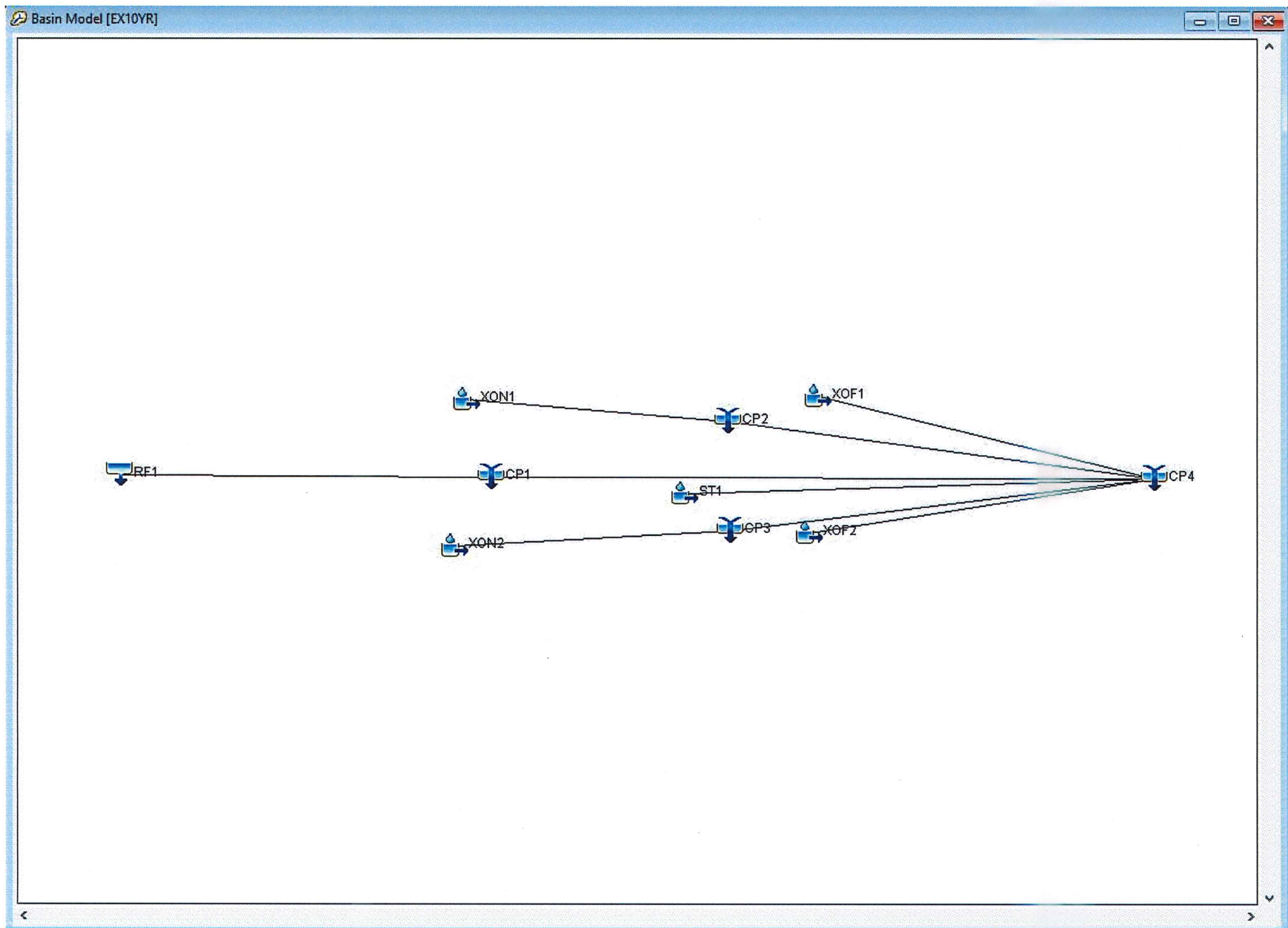
Precipitation Gages

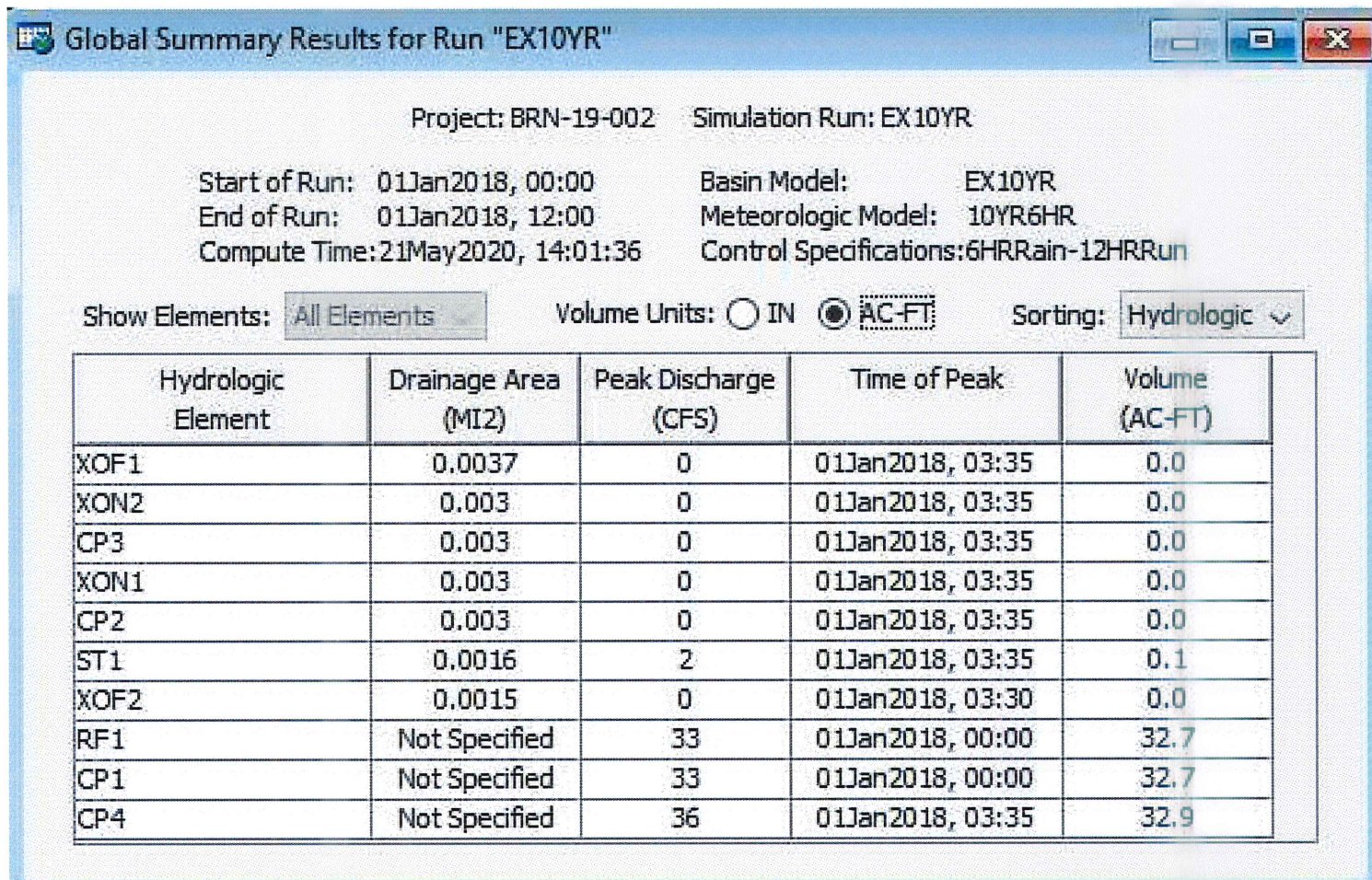
6HR Dist-SDN3

01Jan2018, 00:00 - 01Jan2018, 06:00

Components Compute Results

Time (ddMMYYYY, HH:mm)	Precipitation (IN)
01Jan2018, 02:40	0.270
01Jan2018, 02:45	0.278
01Jan2018, 02:50	0.281
01Jan2018, 02:55	0.283
01Jan2018, 03:00	0.295
01Jan2018, 03:05	0.322
01Jan2018, 03:10	0.352
01Jan2018, 03:15	0.409
01Jan2018, 03:20	0.499
01Jan2018, 03:25	0.590
01Jan2018, 03:30	0.710
01Jan2018, 03:35	0.744
01Jan2018, 03:40	0.781
01Jan2018, 03:45	0.812
01Jan2018, 03:50	0.819
01Jan2018, 03:55	0.835
01Jan2018, 04:00	0.851
01Jan2018, 04:05	0.856
01Jan2018, 04:10	0.860
01Jan2018, 04:15	0.868
01Jan2018, 04:20	0.876
01Jan2018, 04:25	0.888
01Jan2018, 04:30	0.910
01Jan2018, 04:35	0.926
01Jan2018, 04:40	0.937
01Jan2018, 04:45	0.950
01Jan2018, 04:50	0.970
01Jan2018, 04:55	0.976
01Jan2018, 05:00	0.982
01Jan2018, 05:05	0.985
01Jan2018, 05:10	0.987
01Jan2018, 05:15	0.989
01Jan2018, 05:20	0.990
01Jan2018, 05:25	0.993
01Jan2018, 05:30	0.993
01Jan2018, 05:35	0.994
01Jan2018, 05:40	0.995
01Jan2018, 05:45	0.998
01Jan2018, 05:50	0.998
01Jan2018, 05:55	0.999
01Jan2018, 06:00	1.000





 Curve Number Loss [EX10YR]

Show Elements: All Elements ▾

Sorting: Hydrologic ▾

Subbasin	Initial Abstraction (IN)	Curve Number	Impervious (%)
XOF1		73	0.0
XON2		73	0.0
XON1		73	0.0
ST1		98	0.0
XOF2		73	0.0

Apply

Close

SCS Transform[EX10YR]

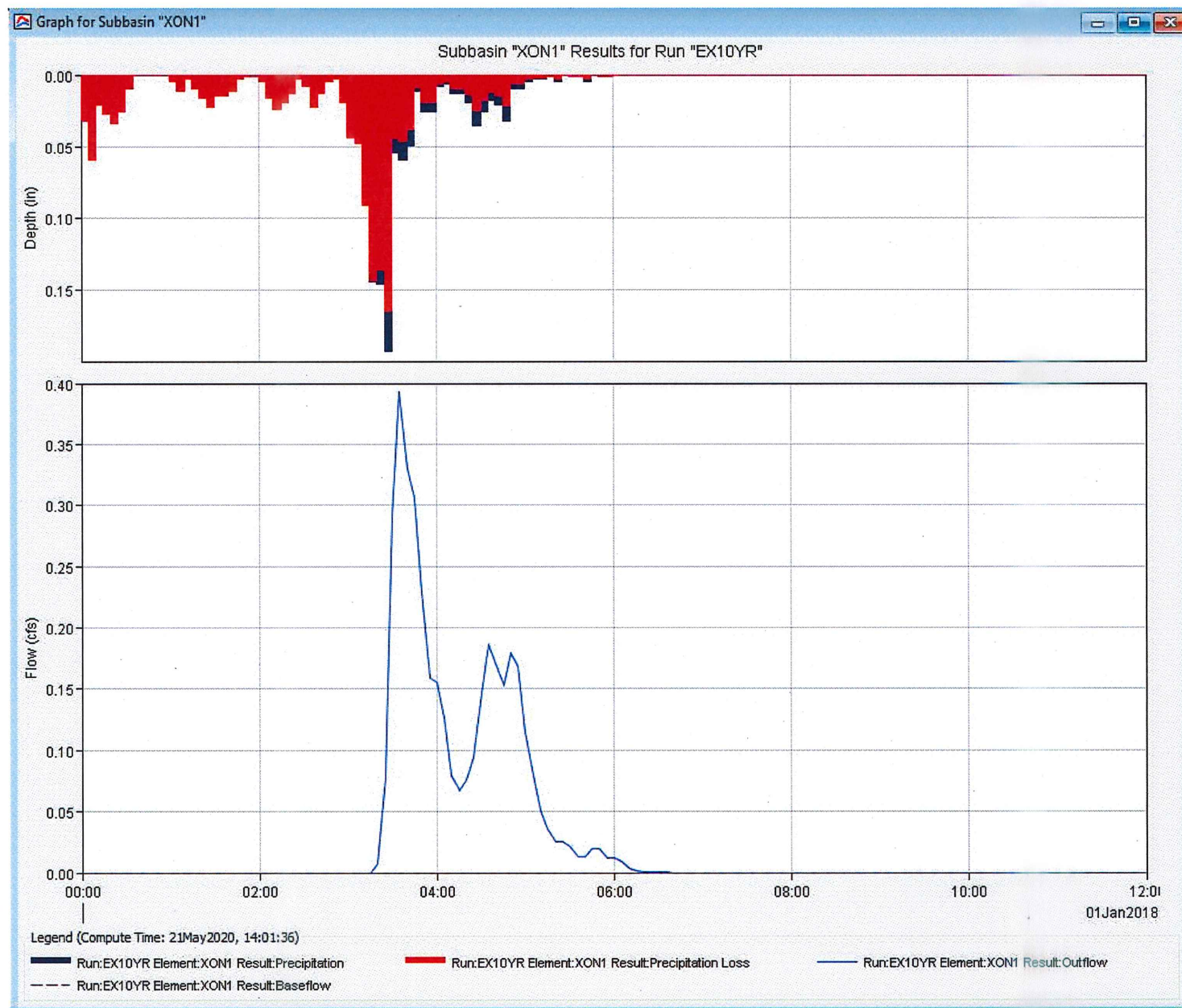
Show Elements: All Elements

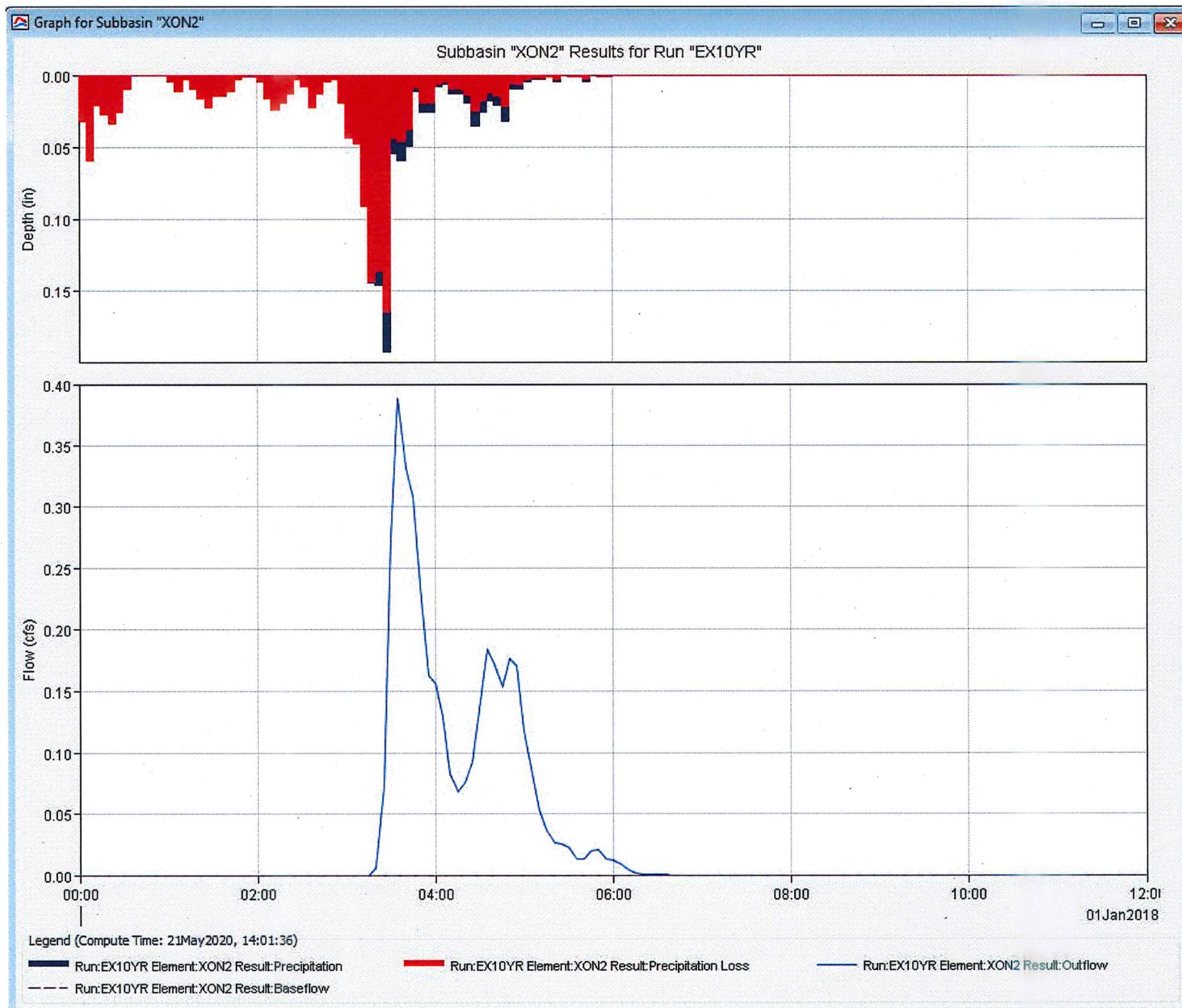
Sorting: Hydrologic

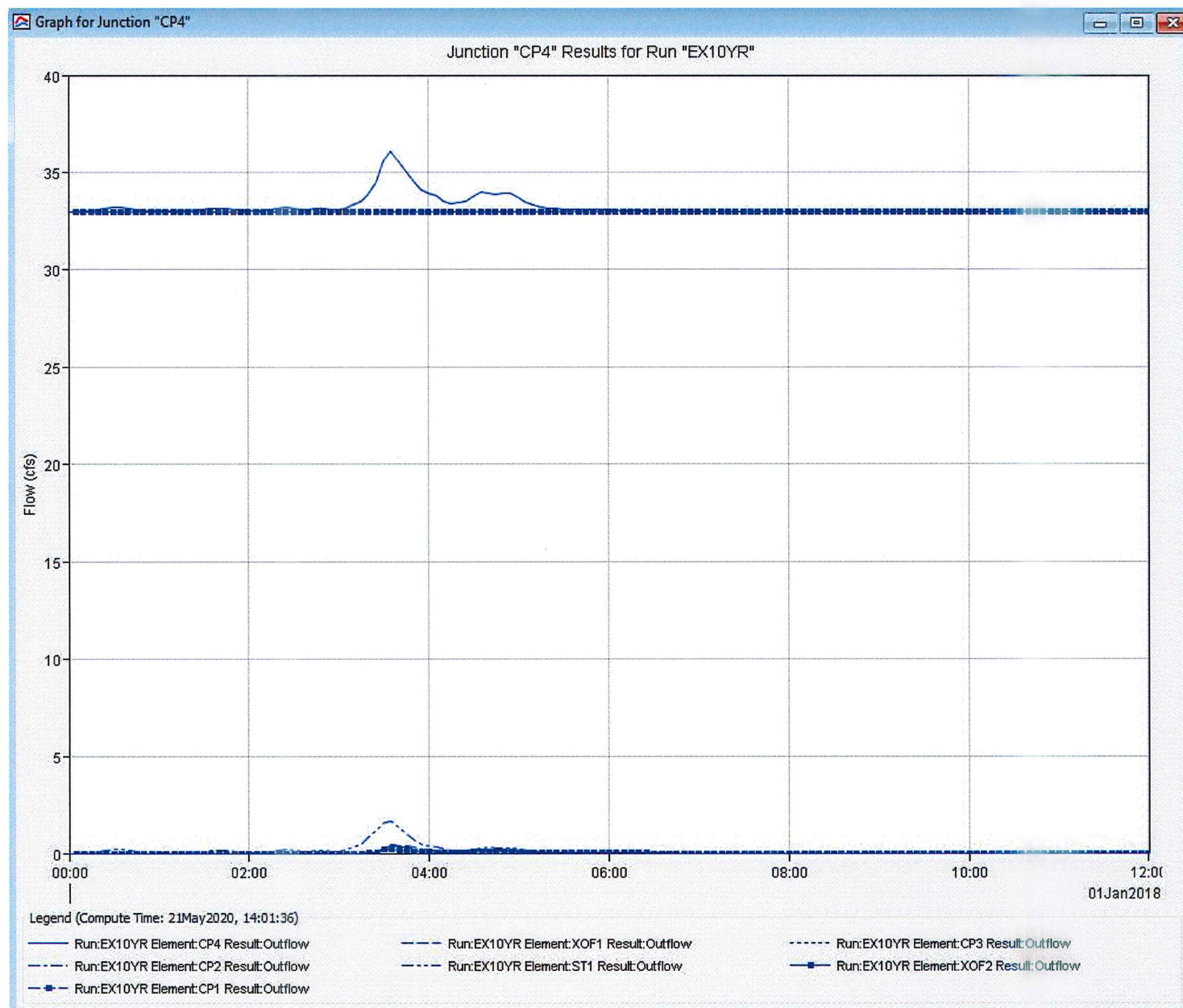
Subbasin	Graph Type	Lag Time (MIN)
XOF1	Standard	7.2
XON2	Standard	6.3
XON1	Standard	6
ST1	Standard	8.1
XOF2	Standard	4.3

Apply

Close









DURANGO & GOWAN
BRN-19-002

EXISTING CONDITION 100 YEAR

Global Summary Results for Run "EX100YR"

Project: BRN-19-002 Simulation Run: EX100YR

Start of Run: 01Jan2018, 00:00

Basin Model: EX100YR

End of Run: 01Jan2018, 12:00

Meteorologic Model: 100YR6HR

Compute Time: 21May2020, 14:22:04

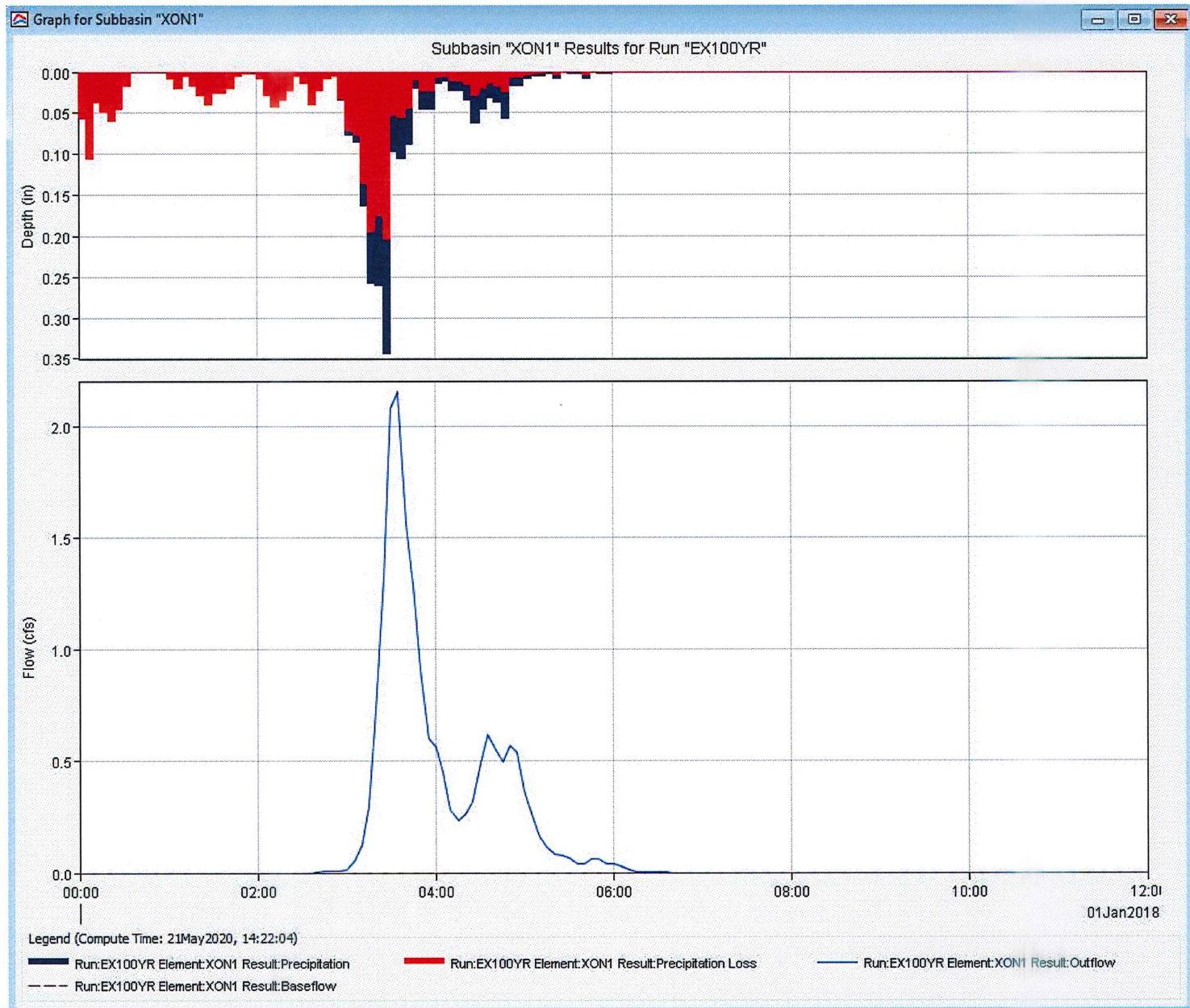
Control Specifications: 6HRRain-12HRRun

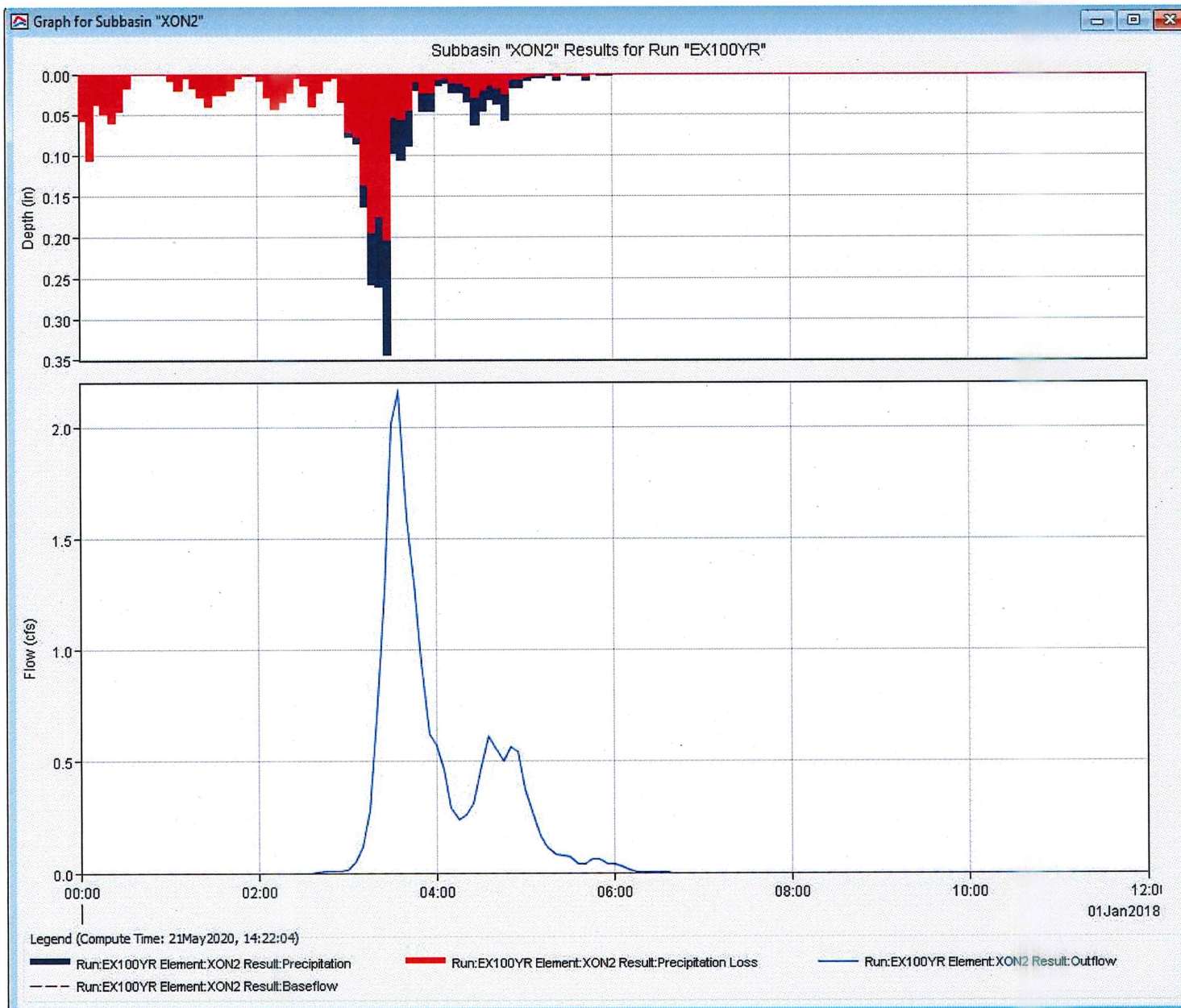
Show Elements: All Elements

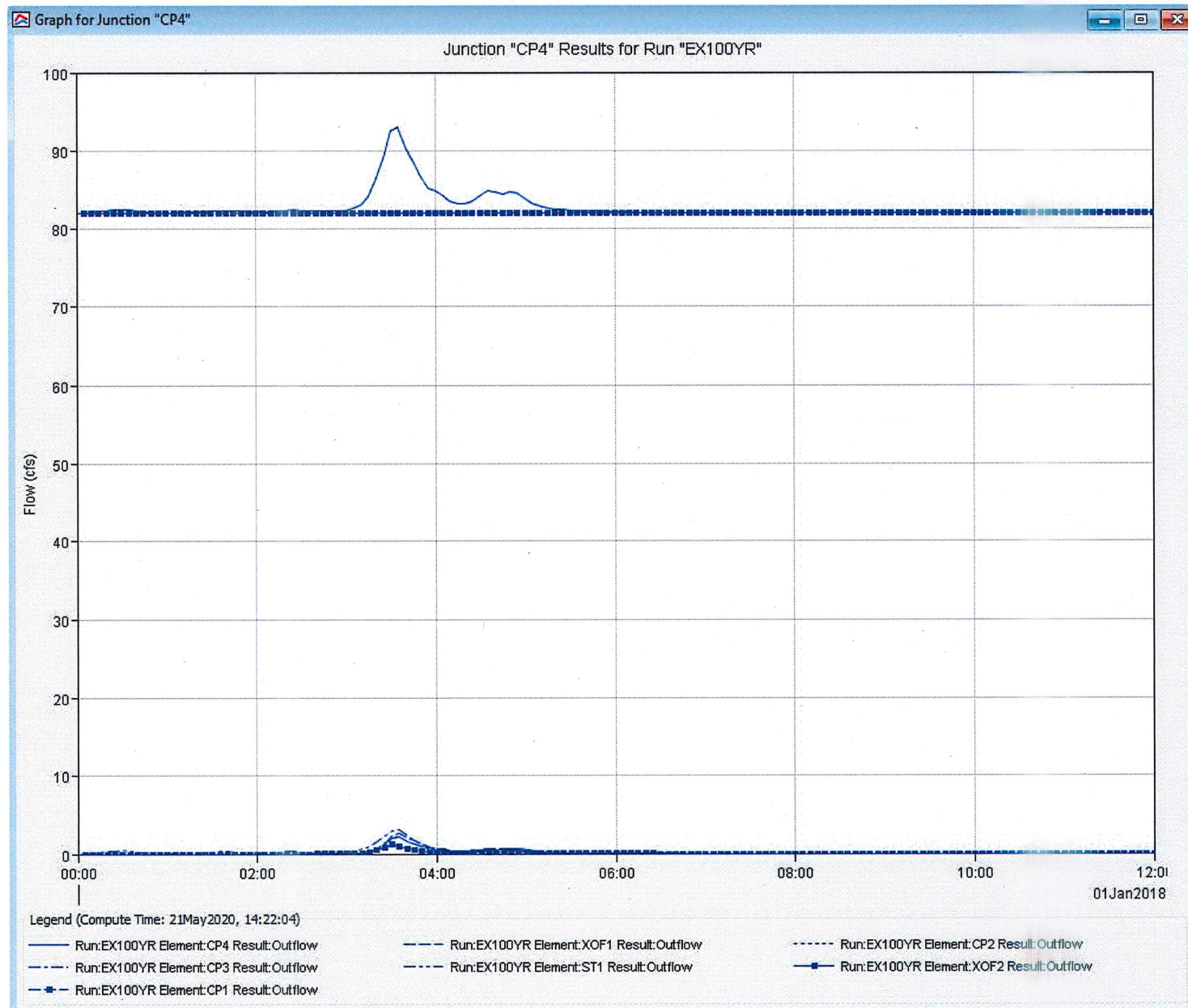
Volume Units: ☐ IN ☒ AC-FT

Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI2)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
XOF1	0.0037	3	01Jan2018, 03:35	0.2
XON1	0.003	2	01Jan2018, 03:35	0.1
CP2	0.003	2	01Jan2018, 03:35	0.1
XON2	0.003	2	01Jan2018, 03:35	0.1
CP3	0.003	2	01Jan2018, 03:35	0.1
ST1	0.0016	3	01Jan2018, 03:35	0.2
XOF2	0.0015	1	01Jan2018, 03:30	0.1
RF1	Not Specified	82	01Jan2018, 00:00	81.3
CP1	Not Specified	82	01Jan2018, 00:00	81.3
CP4	Not Specified	93	01Jan2018, 03:35	82.0



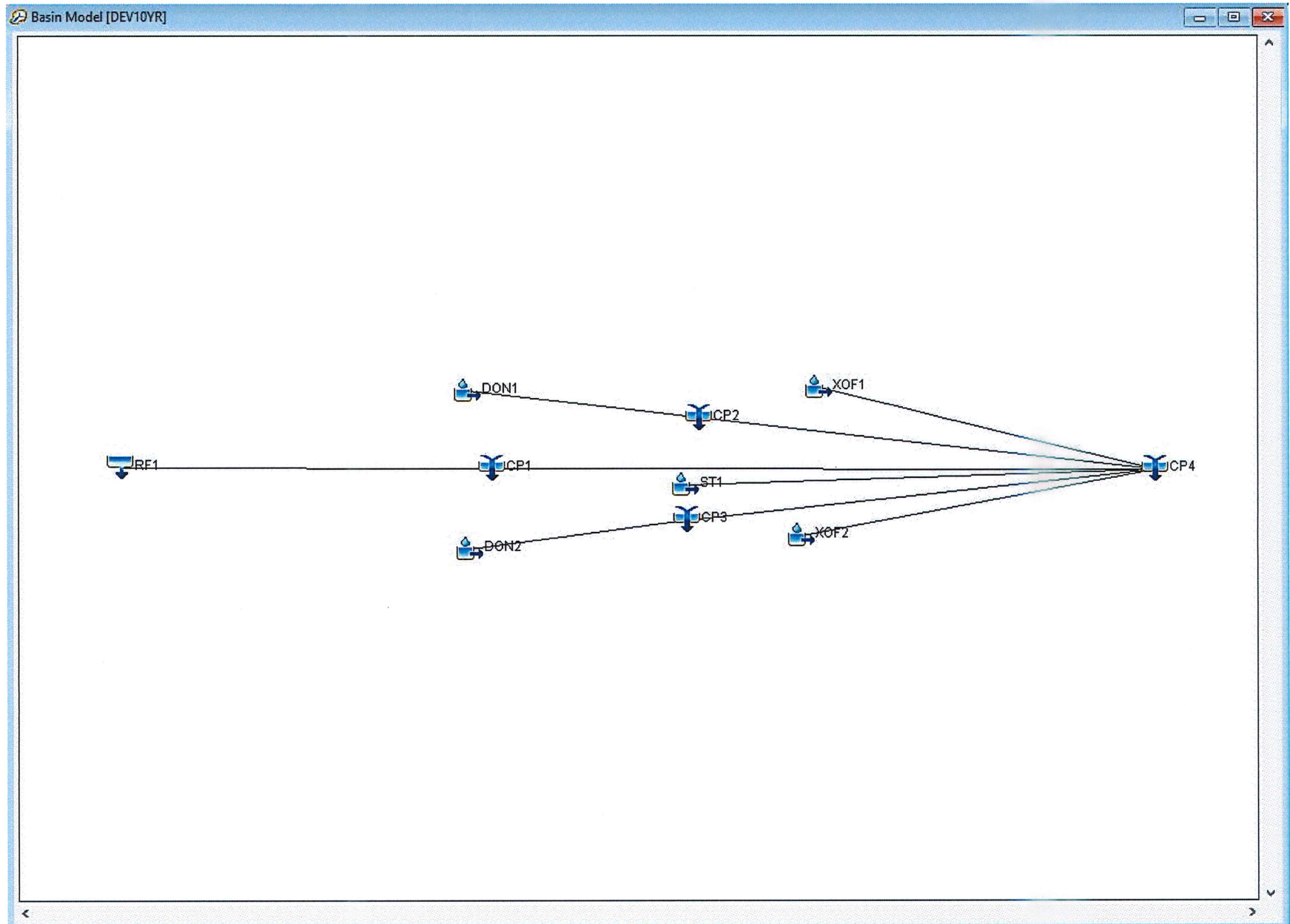


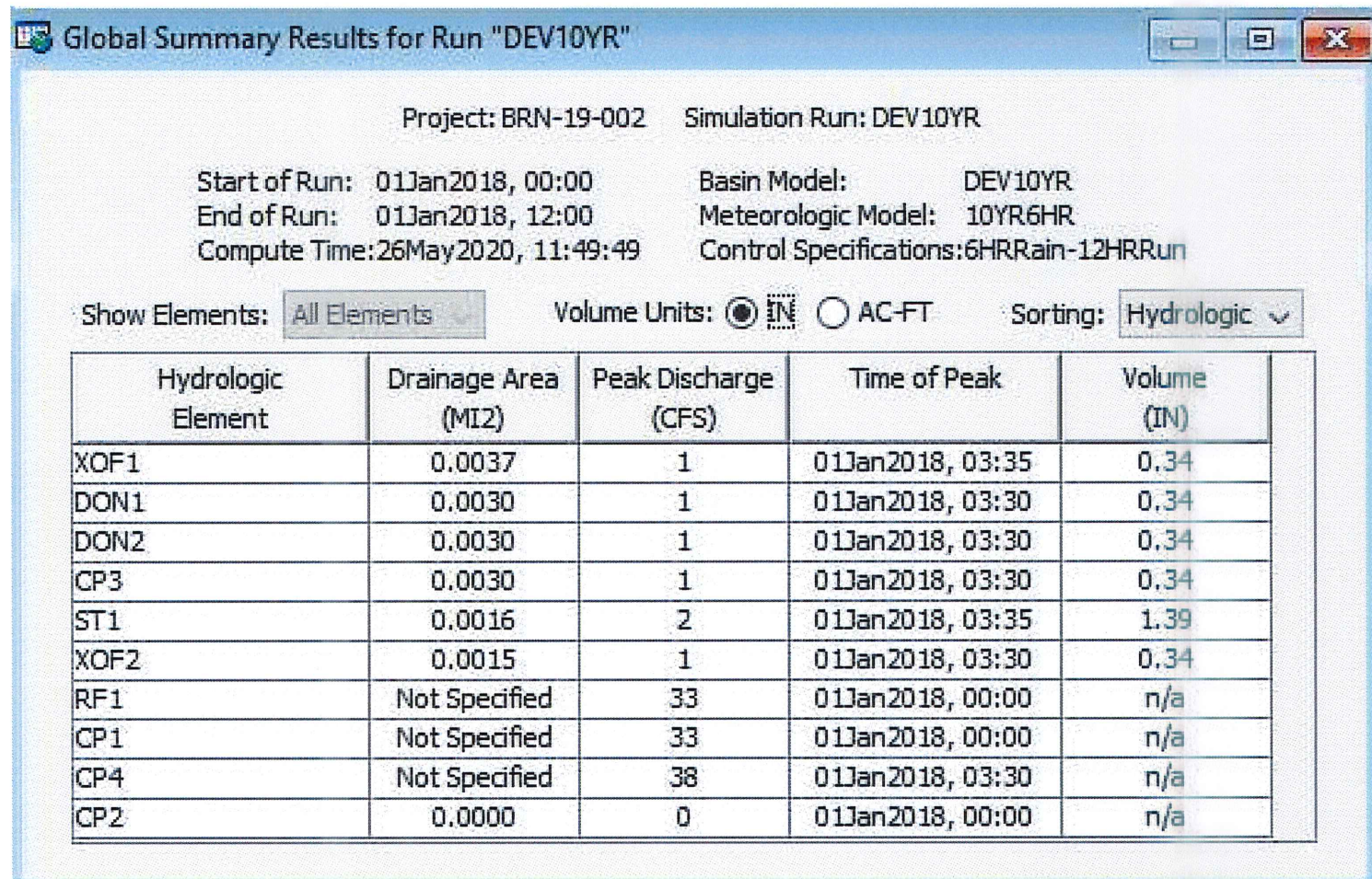




DURANGO & GOWAN
BRN-19-002

DEVELOPED CONDITION 10 YEAR





 Curve Number Loss [DEV10YR]

Show Elements: All Elements

Sorting: Hydrologic

Subbasin	Initial Abstraction (IN)	Curve Number	Impervious (%)
XOF1		80	0.0
DON1		80	0.0
DON2		80	0.0
ST1		98	0.0
XOF2		80	0.0

Apply

Close

SCS Transform[DEV10YR]

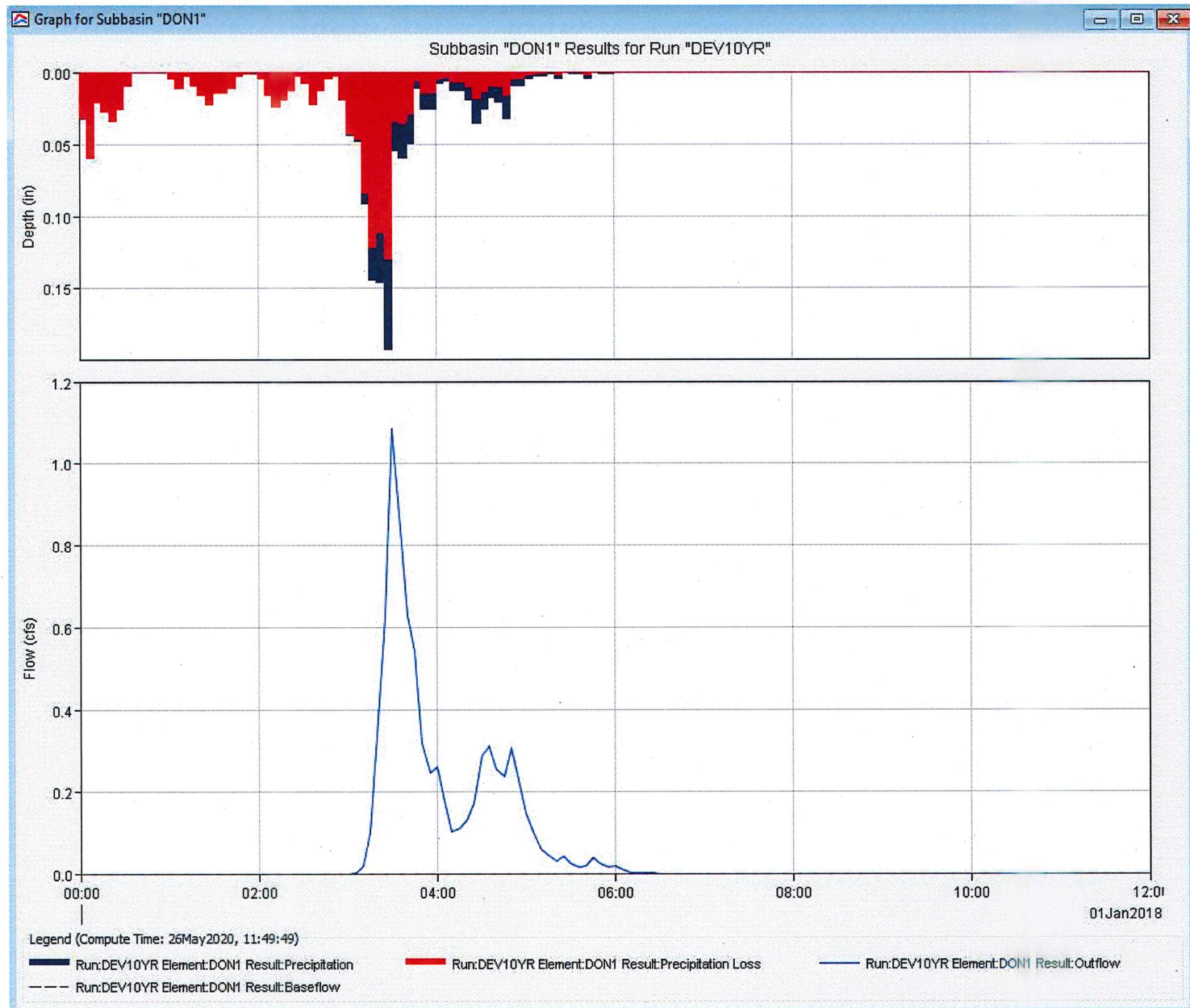
Show Elements: All Elements

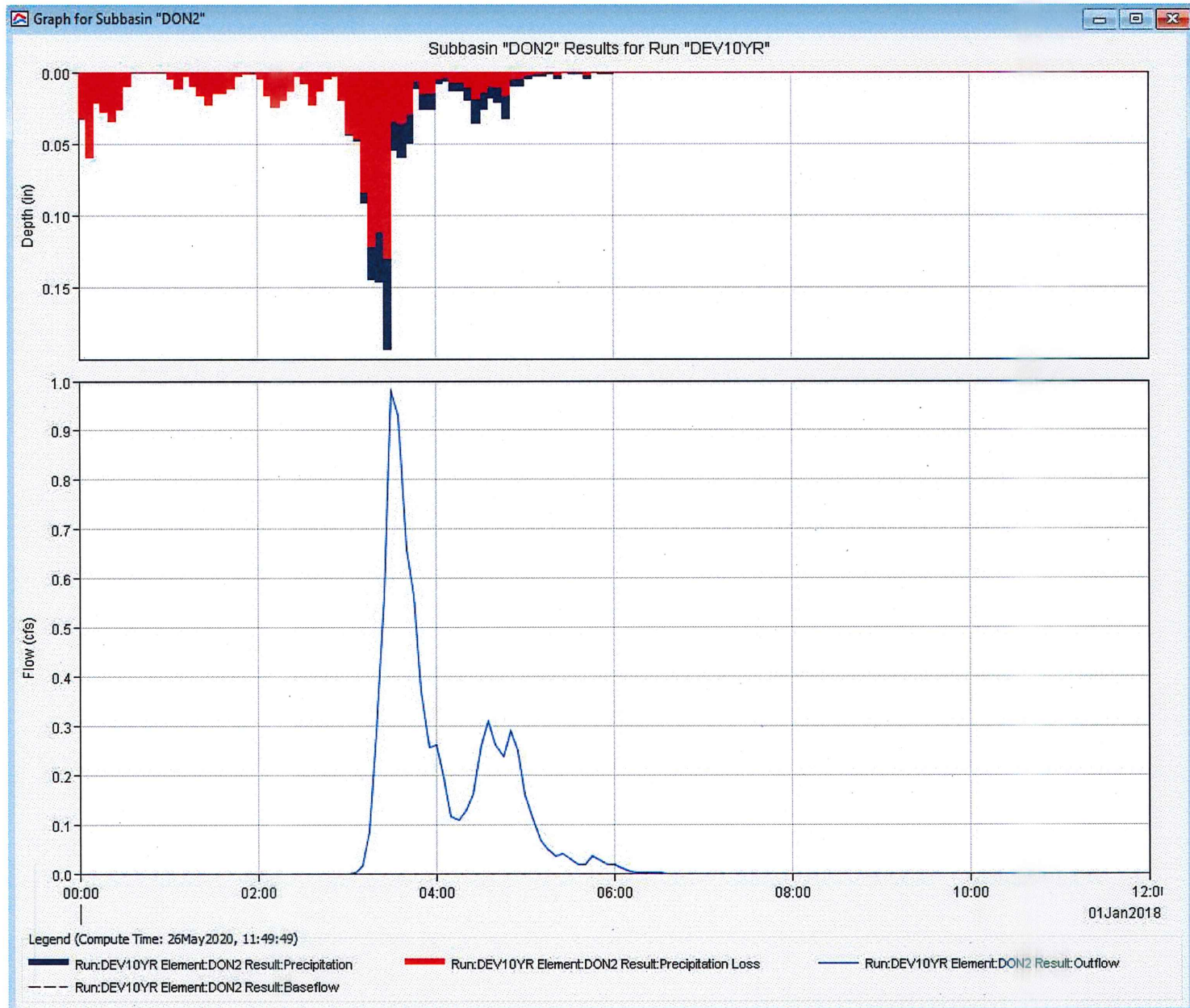
Sorting: Hydrologic

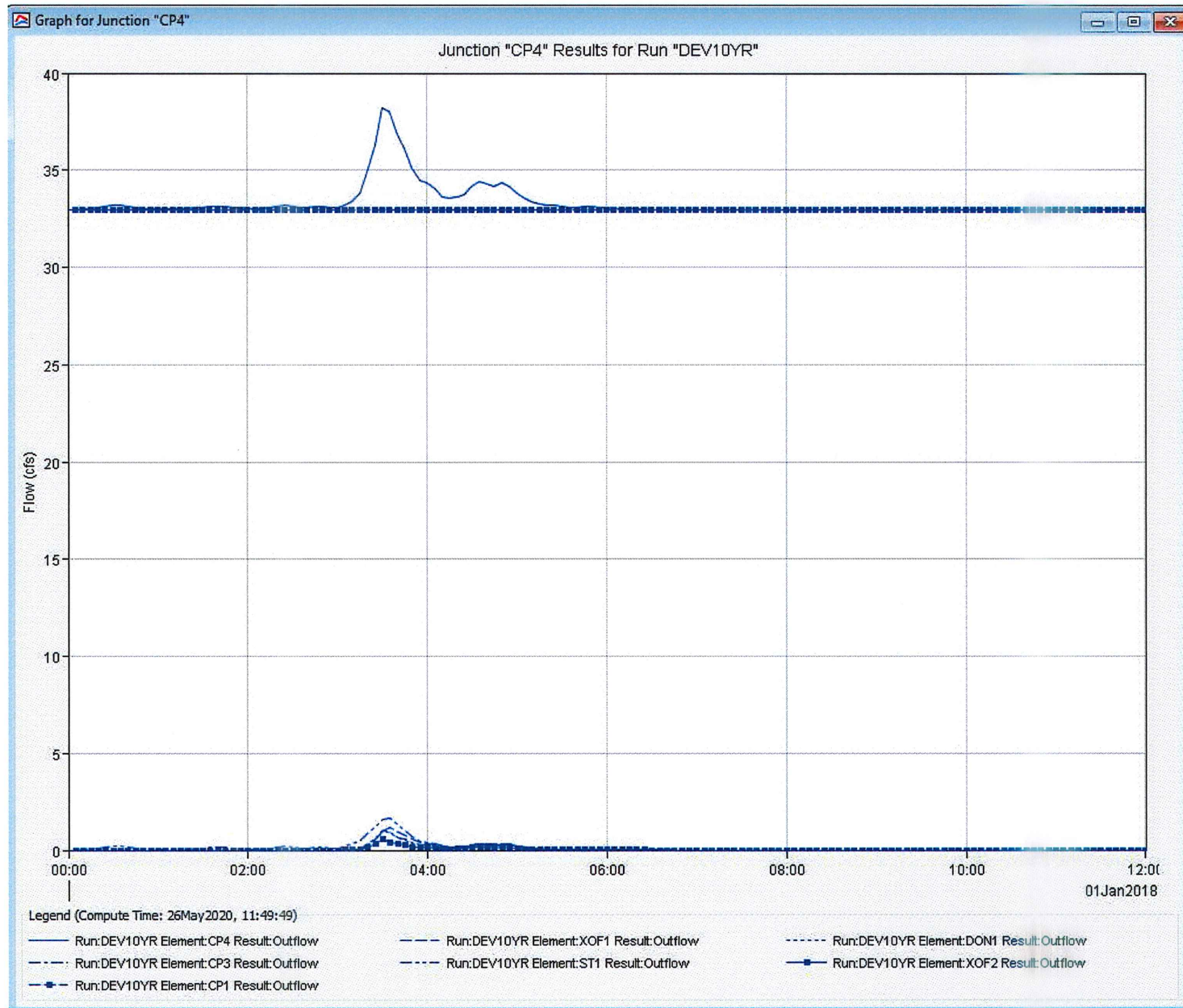
Subbasin	Graph Type	Lag Time (MIN)
XOF1	Standard	6.8
DON1	Standard	4.1
DON2	Standard	5
ST1	Standard	8.1
XOF2	Standard	3.8

Apply

Close









DURANGO & GOWAN
BRN-19-002

DEVELOPED CONDITION 100 YEAR

Global Summary Results for Run "DEV100YR"

Project: BRN-19-002 Simulation Run: DEV100YR

Start of Run: 01Jan2018, 00:00

Basin Model: DEV100YR

End of Run: 01Jan2018, 12:00

Meteorologic Model: 100YR6HR

Compute Time: 25May2020, 23:52:32

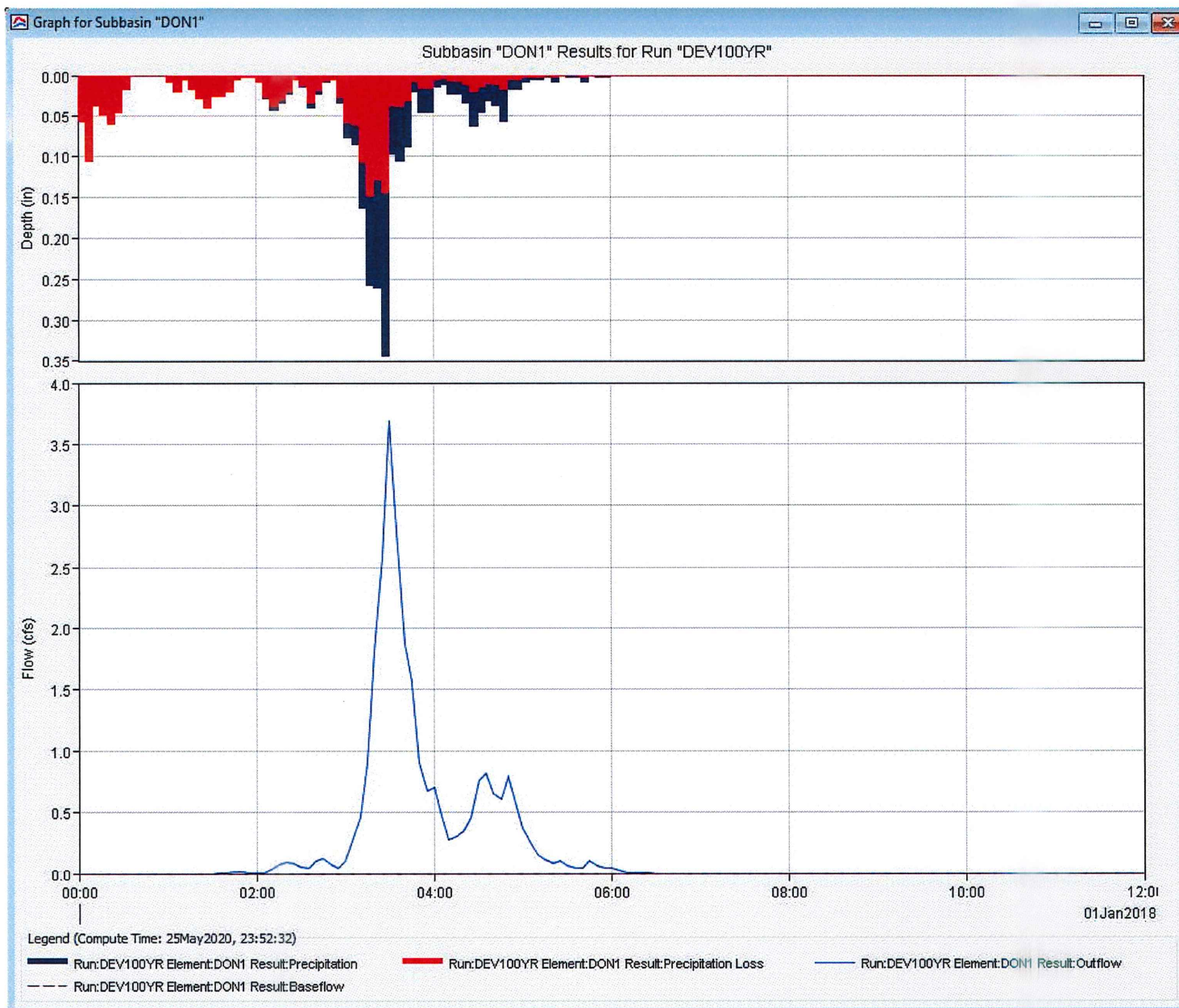
Control Specifications: 6HRRain-12HRRun

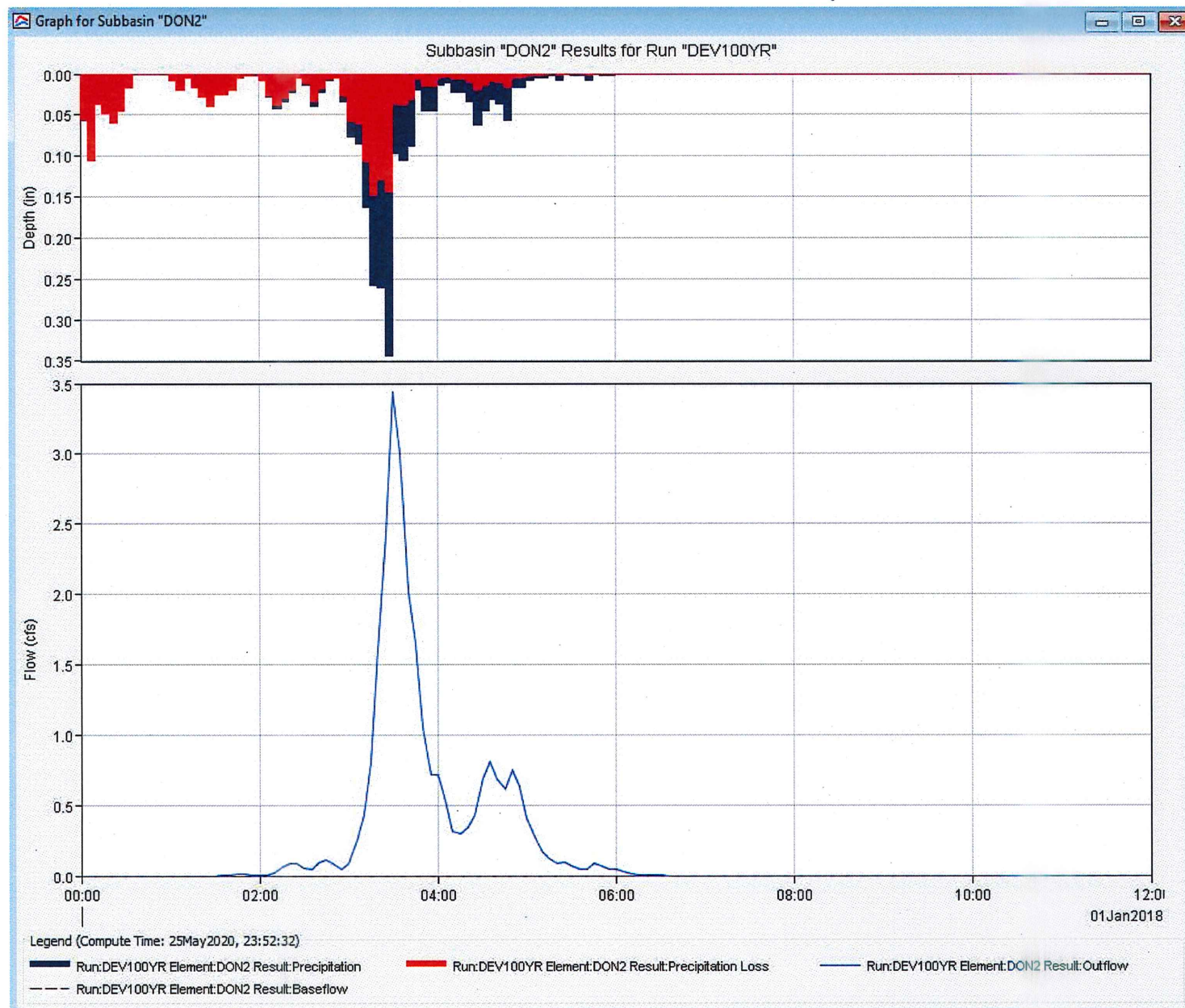
Show Elements: All Elements

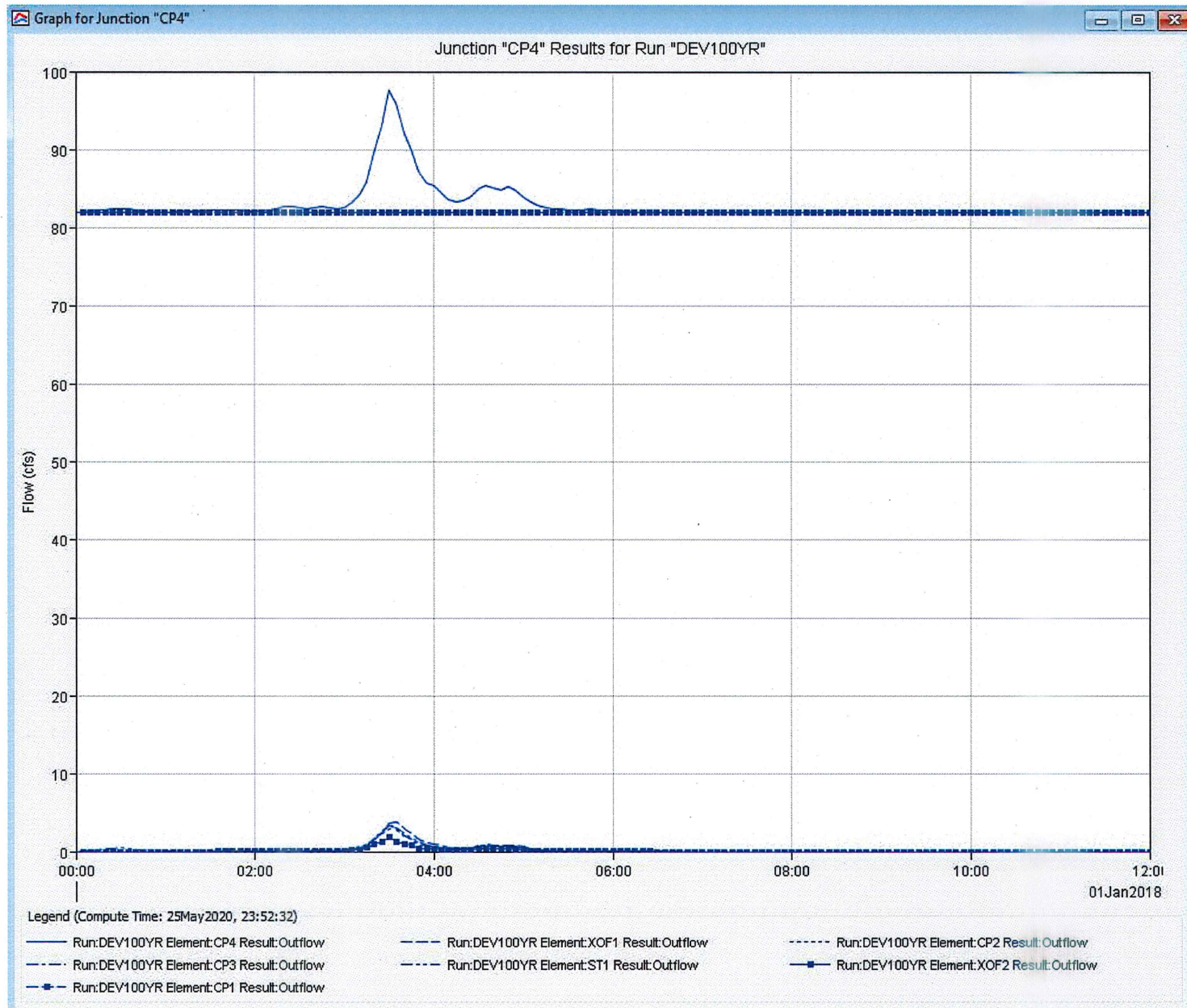
Volume Units: ☐ IN ☒ AC-FT

Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
XOF1	0.0037	4	01Jan2018, 03:35	0.2
DON1	0.003	4	01Jan2018, 03:30	0.2
CP2	0.003	4	01Jan2018, 03:30	0.2
DON2	0.003	3	01Jan2018, 03:30	0.2
CP3	0.003	3	01Jan2018, 03:30	0.2
ST1	0.0016	3	01Jan2018, 03:35	0.2
XOF2	0.0015	2	01Jan2018, 03:30	0.1
RF1	Not Specified	82	01Jan2018, 00:00	81.3
CP1	Not Specified	82	01Jan2018, 00:00	81.3
CP4	Not Specified	98	01Jan2018, 03:30	82.2









DURANGO & GOWAN
BRN-19-002

Hydraulic Calculations



DURANGO & GOWAN
BRN-19-002

EXISTING CONDITION 10 YEAR

Worksheet for EX10YR-Gowan. 80' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.010 ft/ft
Discharge	36.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	17.87
0+05	17.77
0+06	17.77
0+06	17.27
0+07	17.40
0+07	17.44
0+40	18.17
0+73	17.44
0+73	17.40
0+74	17.27
0+74	17.77
0+75	17.77
0+80	17.87

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 17.87)	(0+07, 17.44)	0.013
(0+07, 17.44)	(0+73, 17.40)	0.016
(0+73, 17.40)	(0+80, 17.87)	0.013

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

Results	
Normal Depth	0.6 ft
Elevation Range	17.3 to 18.2 ft
Flow Area	10.9 ft ²
Wetted Perimeter	55.3 ft
Hydraulic Radius	0.2 ft
Top Width	54.18 ft

Worksheet for EX10YR-Gowan. 80' R/W

Results

Normal Depth	0.6 ft
Critical Depth	0.7 ft
Critical Slope	0.006 ft/ft
Velocity	3.30 ft/s
Velocity Head	0.17 ft
Specific Energy	0.78 ft
Froude Number	1.298
Flow Type	Supercritical

GVF Input Data

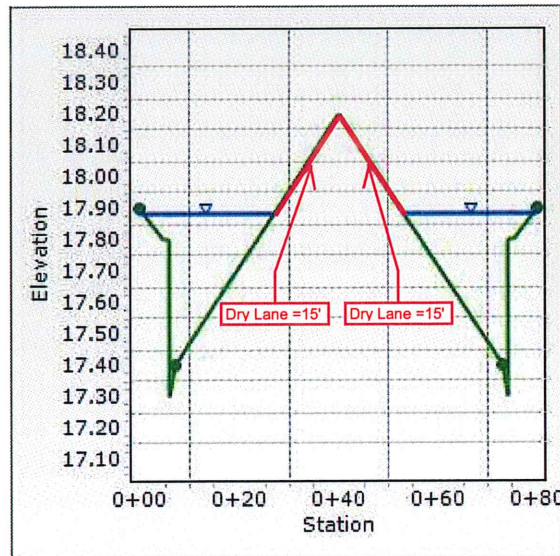
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.6 ft
Critical Depth	0.7 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for EX10YR-Gowan. 80' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.6 ft
Discharge	36.00 cfs



Dry Lane = $(18.17 - 17.87) / 0.02 = 15$ ft



DURANGO & GOWAN
BRN-19-002

EXISTING CONDITION 100 YEAR

Worksheet for EX100YR-Gowan. 80' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.010 ft/ft
Discharge	93.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	17.87
0+05	17.77
0+06	17.77
0+06	17.27
0+07	17.40
0+07	17.44
0+40	18.17
0+73	17.44
0+73	17.40
0+74	17.27
0+74	17.77
0+75	17.77
0+80	17.87

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 17.87)	(0+07, 17.44)	0.013
(0+07, 17.44)	(0+73, 17.40)	0.016
(0+73, 17.40)	(0+80, 17.87)	0.013

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

Results	
Normal Depth	0.8 ft
Elevation Range	17.3 to 18.2 ft
Flow Area	21.4 ft ²
Wetted Perimeter	71.0 ft
Hydraulic Radius	0.3 ft
Top Width	69.56 ft

Worksheet for EX100YR-Gowan. 80' R/W

Results

Normal Depth	0.8 ft
Critical Depth	0.9 ft
Critical Slope	0.005 ft/ft
Velocity	4.34 ft/s
Velocity Head	0.29 ft
Specific Energy	1.08 ft
Froude Number	1.379
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.8 ft
Critical Depth	0.9 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.005 ft/ft

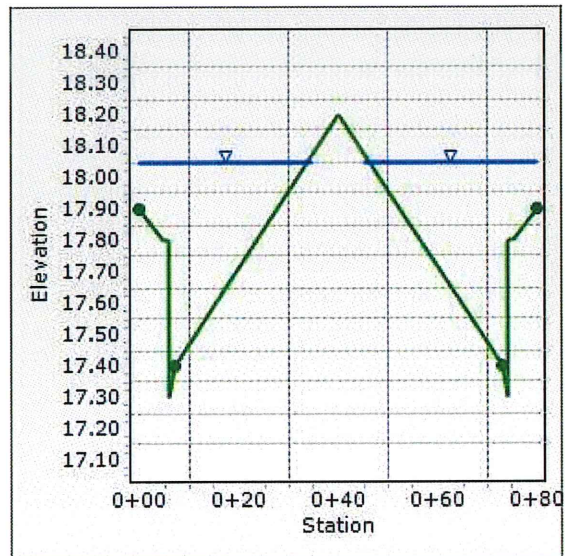
Cross Section for EX100YR-Gowan. 80' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.010 ft/ft
Normal Depth	0.8 ft
Discharge	93.00 cfs





DURANGO & GOWAN
BRN-19-002

DEVELOPED CONDITION10 YEAR

Worksheet for DEV10YR-Gowan. 80' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.010 ft/ft
Discharge	38.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	17.87
0+05	17.77
0+06	17.77
0+06	17.27
0+07	17.40
0+07	17.44
0+40	18.17
0+73	17.44
0+73	17.40
0+74	17.27
0+74	17.77
0+75	17.77
0+80	17.87

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 17.87)	(0+07, 17.44)	0.013
(0+07, 17.44)	(0+73, 17.40)	0.016
(0+73, 17.40)	(0+80, 17.87)	0.013

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

Results	
Normal Depth	0.6 ft
Elevation Range	17.3 to 18.2 ft
Flow Area	11.3 ft ²
Wetted Perimeter	56.0 ft
Hydraulic Radius	0.2 ft
Top Width	54.88 ft

Worksheet for DEV10YR-Gowan. 80' R/W

Results

Normal Depth	0.6 ft
Critical Depth	0.7 ft
Critical Slope	0.006 ft/ft
Velocity	3.36 ft/s
Velocity Head	0.17 ft
Specific Energy	0.80 ft
Froude Number	1.302
Flow Type	Supercritical

GVF Input Data

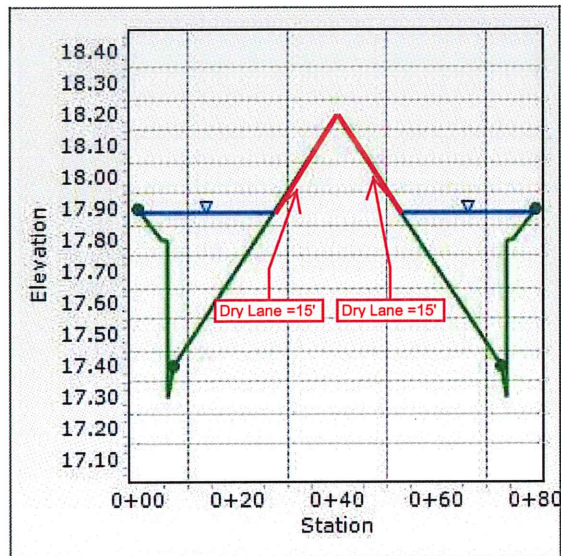
Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.6 ft
Critical Depth	0.7 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for DEV10YR-Gowan. 80' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.6 ft
Discharge	38.00 cfs



Dry Lane = $(18.17 - 17.87) / 0.02 = 15$ ft



DURANGO & GOWAN
BRN-19-002

DEVELOPED CONDITION100 YEAR

Worksheet for DEV100YR-Gowan. 80' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.010 ft/ft
Discharge	98.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	17.87
0+05	17.77
0+06	17.77
0+06	17.27
0+07	17.40
0+07	17.44
0+40	18.17
0+73	17.44
0+73	17.40
0+74	17.27
0+74	17.77
0+75	17.77
0+80	17.87

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 17.87)	(0+07, 17.44)	0.013
(0+07, 17.44)	(0+73, 17.40)	0.016
(0+73, 17.40)	(0+80, 17.87)	0.013

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

Results	
Normal Depth	0.8 ft
Elevation Range	17.3 to 18.2 ft
Flow Area	22.3 ft ²
Wetted Perimeter	72.1 ft
Hydraulic Radius	0.3 ft
Top Width	70.62 ft

Worksheet for DEV100YR-Gowan. 80' R/W

Results

Normal Depth	0.8 ft
Critical Depth	0.9 ft
Critical Slope	0.005 ft/ft
Velocity	4.40 ft/s
Velocity Head	0.30 ft
Specific Energy	1.10 ft
Froude Number	1.383
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.0 ft
Length	0.0 ft
Number Of Steps	0

GVF Output Data

Upstream Depth	0.0 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.8 ft
Critical Depth	0.9 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.005 ft/ft

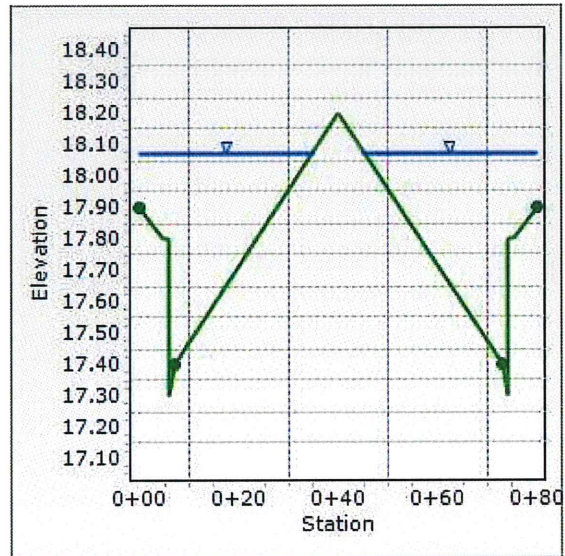
Cross Section for DEV100YR-Gowan. 80' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.010 ft/ft
Normal Depth	0.8 ft
Discharge	98.00 cfs



Worksheet for B-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.007 ft/ft
Discharge	1.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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	
Normal Depth	0.13 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.9 ft ²
Wetted Perimeter	13.5 ft
Hydraulic Radius	0.07 ft

Worksheet for B-Internal St. 30' R/W

Results	
Top Width	13.49 ft
Normal Depth	0.13 ft
Critical Depth	0.13 ft
Critical Slope	0.009 ft/ft
Velocity	1.32 ft/s
Velocity Head	0.03 ft
Specific Energy	0.16 ft
Froude Number	0.895
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 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	0.13 ft
Channel Slope	0.007 ft/ft
Critical Slope	0.009 ft/ft

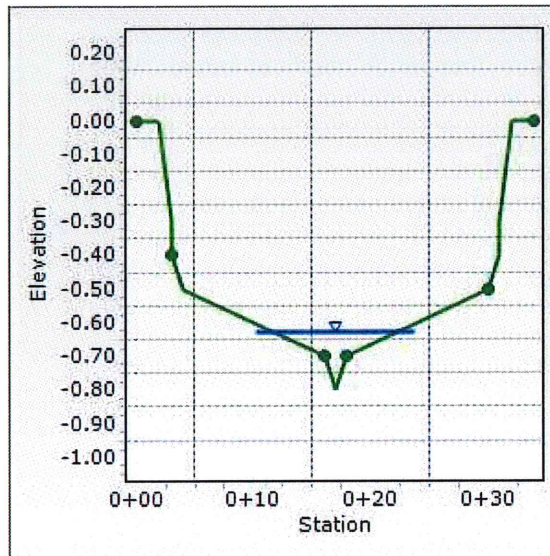
Cross Section for B-Internal St. 30' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.007 ft/ft
Normal Depth	0.13 ft
Discharge	1.20 cfs



Worksheet for C-Internal St.

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.020 ft/ft
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+33	-0.44
0+51	-0.27
0+52	-0.27

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+04, -0.50)	0.013
(0+04, -0.50)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+51, -0.27)	0.016
(0+51, -0.27)	(0+52, -0.27)	0.013

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

Normal Depth	0.13 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.9 ft ²
Wetted Perimeter	13.4 ft
Hydraulic Radius	0.07 ft
Top Width	13.41 ft
Normal Depth	0.13 ft

Worksheet for C-Internal St.

Results

Critical Depth	0.16 ft
Critical Slope	0.008 ft/ft
Velocity	2.22 ft/s
Velocity Head	0.08 ft
Specific Energy	0.21 ft
Froude Number	1.515
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

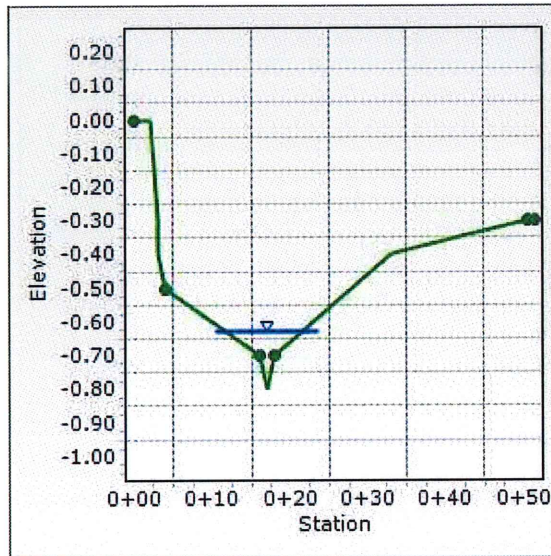
GVF Output Data

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	0.16 ft
Channel Slope	0.020 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for C-Internal St.

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.020 ft/ft
Normal Depth	0.13 ft
Discharge	2.00 cfs



Worksheet for D-Internal St. 30' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.005 ft/ft
Discharge	2.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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	
Normal Depth	0.18 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	1.6 ft ²
Wetted Perimeter	18.1 ft
Hydraulic Radius	0.09 ft

Worksheet for D-Internal St. 30' R/W

Results	
Top Width	18.07 ft
Normal Depth	0.18 ft
Critical Depth	0.16 ft
Critical Slope	0.008 ft/ft
Velocity	1.35 ft/s
Velocity Head	0.03 ft
Specific Energy	0.21 ft
Froude Number	0.790
Flow Type	Subcritical
GVF Input Data	
Downstream Depth	0.00 ft
Length	0.0 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	0.18 ft
Critical Depth	0.16 ft
Channel Slope	0.005 ft/ft
Critical Slope	0.008 ft/ft

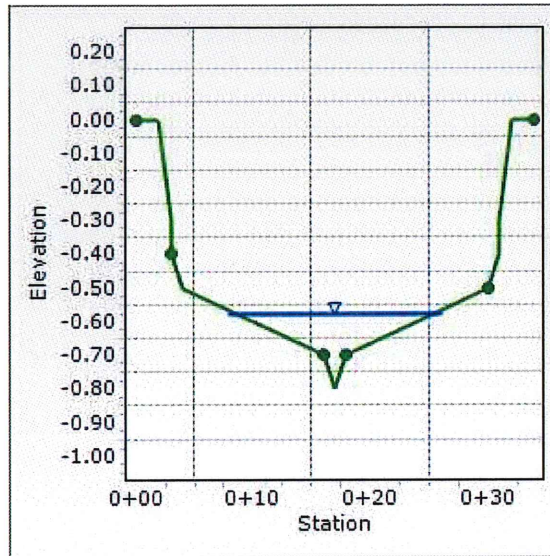
Cross Section for D-Internal St. 30' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.005 ft/ft
Normal Depth	0.18 ft
Discharge	2.20 cfs



Worksheet for E-Internal St. 30' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.005 ft/ft
Discharge	0.80 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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	
Normal Depth	0.12 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.8 ft ²
Wetted Perimeter	12.3 ft
Hydraulic Radius	0.06 ft

Worksheet for E-Internal St. 30' R/W

Results

Top Width	12.31 ft
Normal Depth	0.12 ft
Critical Depth	0.11 ft
Critical Slope	0.009 ft/ft
Velocity	1.06 ft/s
Velocity Head	0.02 ft
Specific Energy	0.14 ft
Froude Number	0.750
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

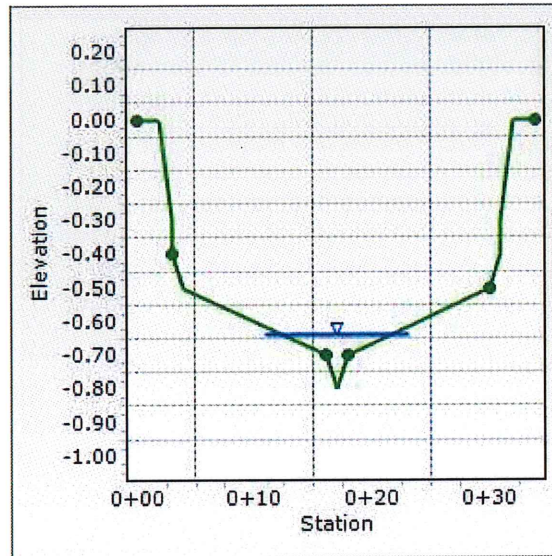
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.12 ft
Critical Depth	0.11 ft
Channel Slope	0.005 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for E-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.005 ft/ft
Normal Depth	0.12 ft
Discharge	0.80 cfs



Worksheet for F-Internal St. 30' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.005 ft/ft
Discharge	1.20 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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	
Normal Depth	0.14 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	1.0 ft ²
Wetted Perimeter	14.4 ft
Hydraulic Radius	0.07 ft

Worksheet for F-Internal St. 30' R/W

Results

Top Width	14.37 ft
Normal Depth	0.14 ft
Critical Depth	0.13 ft
Critical Slope	0.009 ft/ft
Velocity	1.16 ft/s
Velocity Head	0.02 ft
Specific Energy	0.16 ft
Froude Number	0.765
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 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	0.14 ft
Critical Depth	0.13 ft
Channel Slope	0.005 ft/ft
Critical Slope	0.009 ft/ft

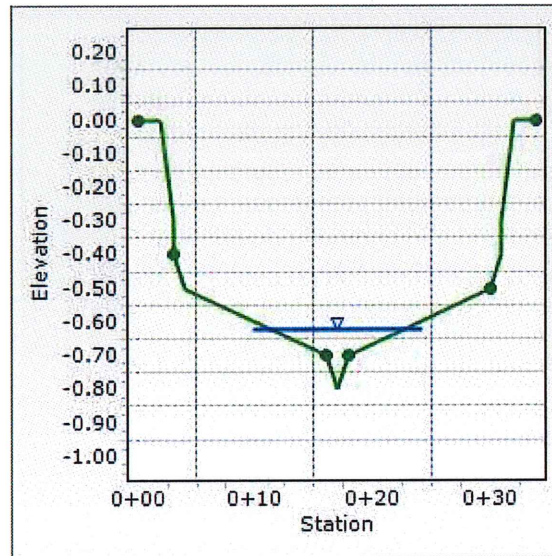
Cross Section for F-Internal St. 30' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.005 ft/ft
Normal Depth	0.14 ft
Discharge	1.20 cfs



Worksheet for G-Internal St. 35' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.005 ft/ft
Discharge	0.60 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.61
0+00	0.61
0+01	0.60
0+01	0.10
0+02	0.23
0+02	0.27
0+33	0.89
0+33	0.85
0+35	0.72
0+35	1.22
0+35	1.23
0+35	1.23

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.61)	(0+02, 0.27)	0.013
(0+02, 0.27)	(0+33, 0.85)	0.016
(0+33, 0.85)	(0+35, 1.23)	0.013

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

Results	
Normal Depth	0.26 ft
Elevation Range	0.1 to 1.2 ft
Flow Area	0.5 ft ²
Wetted Perimeter	6.1 ft
Hydraulic Radius	0.08 ft
Top Width	5.84 ft
Normal Depth	0.26 ft
Critical Depth	0.24 ft

Worksheet for G-Internal St. 35' R/W

Results

Critical Slope	0.009 ft/ft
Velocity	1.26 ft/s
Velocity Head	0.02 ft
Specific Energy	0.28 ft
Froude Number	0.778
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

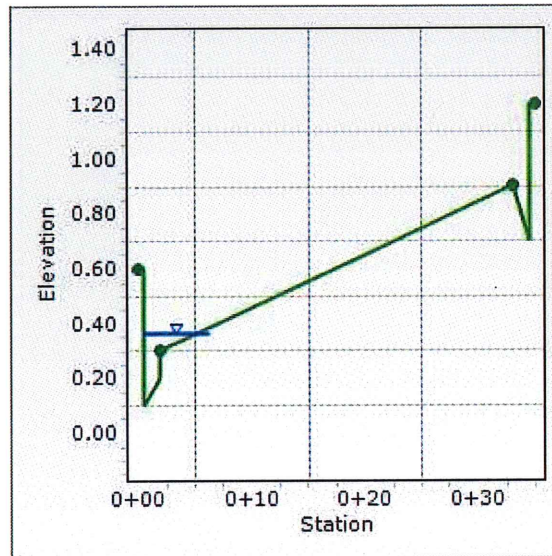
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Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.26 ft
Critical Depth	0.24 ft
Channel Slope	0.005 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for G-Internal St. 35' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.005 ft/ft
Normal Depth	0.26 ft
Discharge	0.60 cfs



Worksheet for H-Internal St. 35' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.023 ft/ft
Discharge	0.45 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.61
0+00	0.61
0+01	0.60
0+01	0.10
0+02	0.23
0+02	0.27
0+33	0.89
0+33	0.85
0+35	0.72
0+35	1.22
0+35	1.23
0+35	1.23

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.61)	(0+02, 0.27)	0.013
(0+02, 0.27)	(0+33, 0.85)	0.016
(0+33, 0.85)	(0+35, 1.23)	0.013

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

Results	
Normal Depth	0.16 ft
Elevation Range	0.1 to 1.2 ft
Flow Area	0.1 ft ²
Wetted Perimeter	1.7 ft
Hydraulic Radius	0.08 ft
Top Width	1.50 ft
Normal Depth	0.16 ft
Critical Depth	0.22 ft

Worksheet for H-Internal St. 35' R/W

Results

Critical Slope	0.006 ft/ft
Velocity	3.26 ft/s
Velocity Head	0.17 ft
Specific Energy	0.32 ft
Froude Number	1.895
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 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	0.16 ft
Critical Depth	0.22 ft
Channel Slope	0.023 ft/ft
Critical Slope	0.006 ft/ft

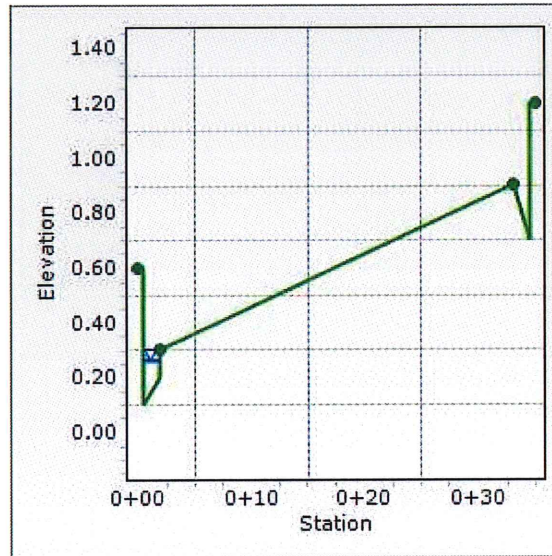
Cross Section for H-Internal St. 35' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.023 ft/ft
Normal Depth	0.16 ft
Discharge	0.45 cfs



Worksheet for I-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.007 ft/ft
Discharge	0.60 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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

Normal Depth	0.10 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.5 ft ²
Wetted Perimeter	10.4 ft
Hydraulic Radius	0.05 ft

Worksheet for I-Internal St. 30' R/W

Results

Top Width	10.36 ft
Normal Depth	0.10 ft
Critical Depth	0.10 ft
Critical Slope	0.010 ft/ft
Velocity	1.12 ft/s
Velocity Head	0.02 ft
Specific Energy	0.12 ft
Froude Number	0.865
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

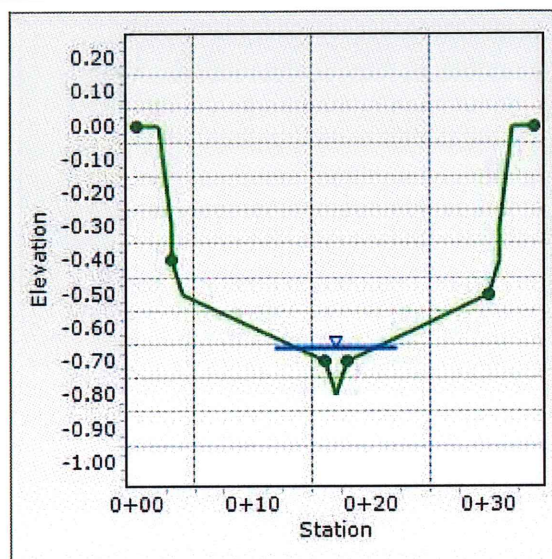
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.10 ft
Critical Depth	0.10 ft
Channel Slope	0.007 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for I-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.007 ft/ft
Normal Depth	0.10 ft
Discharge	0.60 cfs



Worksheet for J-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.007 ft/ft
Discharge	0.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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	
Normal Depth	0.12 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.7 ft ²
Wetted Perimeter	12.1 ft
Hydraulic Radius	0.06 ft

Worksheet for J-Internal St. 30' R/W

Results

Top Width	12.09 ft
Normal Depth	0.12 ft
Critical Depth	0.11 ft
Critical Slope	0.009 ft/ft
Velocity	1.23 ft/s
Velocity Head	0.02 ft
Specific Energy	0.14 ft
Froude Number	0.883
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

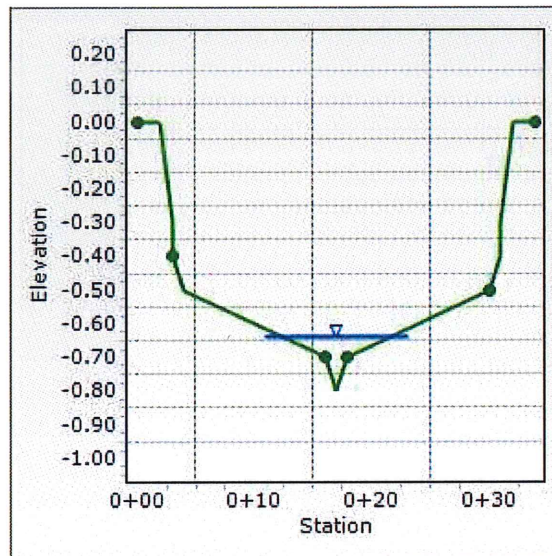
GVF Output Data

Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.12 ft
Critical Depth	0.11 ft
Channel Slope	0.007 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for J-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.007 ft/ft
Normal Depth	0.12 ft
Discharge	0.90 cfs



Worksheet for K-Internal St. 30' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.005 ft/ft
Discharge	0.90 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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

Normal Depth	0.13 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.8 ft ²
Wetted Perimeter	12.9 ft
Hydraulic Radius	0.06 ft

Worksheet for K-Internal St. 30' R/W

Results

Top Width	12.88 ft
Normal Depth	0.13 ft
Critical Depth	0.12 ft
Critical Slope	0.009 ft/ft
Velocity	1.09 ft/s
Velocity Head	0.02 ft
Specific Energy	0.15 ft
Froude Number	0.754
Flow Type	Subcritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.0 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	0.005 ft/ft
Critical Slope	0.009 ft/ft

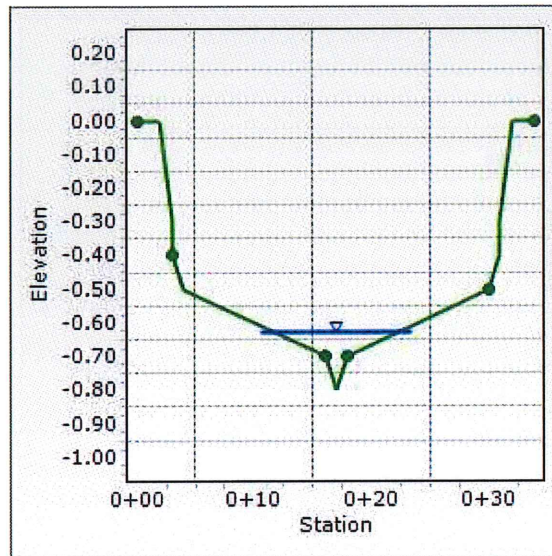
Cross Section for K-Internal St. 30' R/W

Project Description

Friction Method	Manning
	Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.005 ft/ft
Normal Depth	0.13 ft
Discharge	0.90 cfs



Worksheet for L-Internal St.

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.018 ft/ft
Discharge	1.50 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+33	-0.44
0+51	-0.27
0+52	-0.27

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+04, -0.50)	0.013
(0+04, -0.50)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+51, -0.27)	0.016
(0+51, -0.27)	(0+52, -0.27)	0.013

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

Results	
Normal Depth	0.12 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	0.8 ft ²
Wetted Perimeter	12.3 ft
Hydraulic Radius	0.06 ft
Top Width	12.27 ft
Normal Depth	0.12 ft

Worksheet for L-Internal St.

Results

Critical Depth	0.14 ft
Critical Slope	0.009 ft/ft
Velocity	1.99 ft/s
Velocity Head	0.06 ft
Specific Energy	0.18 ft
Froude Number	1.418
Flow Type	Supercritical

GVF Input Data

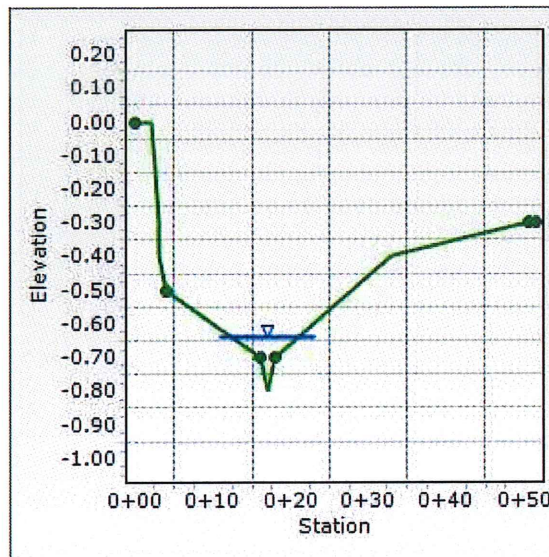
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.12 ft
Critical Depth	0.14 ft
Channel Slope	0.018 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for L-Internal St.

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.018 ft/ft
Normal Depth	0.12 ft
Discharge	1.50 cfs



Worksheet for M-Internal St. 30' R/W

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.006 ft/ft
Discharge	1.65 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00	0.00
0+02	0.00
0+03	-0.29
0+03	-0.38
0+04	-0.50
0+16	-0.74
0+17	-0.76
0+18	-0.74
0+30	-0.50
0+31	-0.38
0+31	-0.29
0+32	0.00
0+34	0.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00, 0.00)	(0+03, -0.38)	0.013
(0+03, -0.38)	(0+16, -0.74)	0.016
(0+16, -0.74)	(0+18, -0.74)	0.013
(0+18, -0.74)	(0+30, -0.50)	0.016
(0+30, -0.50)	(0+34, 0.00)	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

Normal Depth	0.16 ft
Elevation Range	-0.8 to 0.0 ft
Flow Area	1.2 ft ²
Wetted Perimeter	15.7 ft
Hydraulic Radius	0.08 ft

Worksheet for M-Internal St. 30' R/W

Results

Top Width	15.65 ft
Normal Depth	0.16 ft
Critical Depth	0.15 ft
Critical Slope	0.009 ft/ft
Velocity	1.35 ft/s
Velocity Head	0.03 ft
Specific Energy	0.18 ft
Froude Number	0.849
Flow Type	Subcritical

GVF Input Data

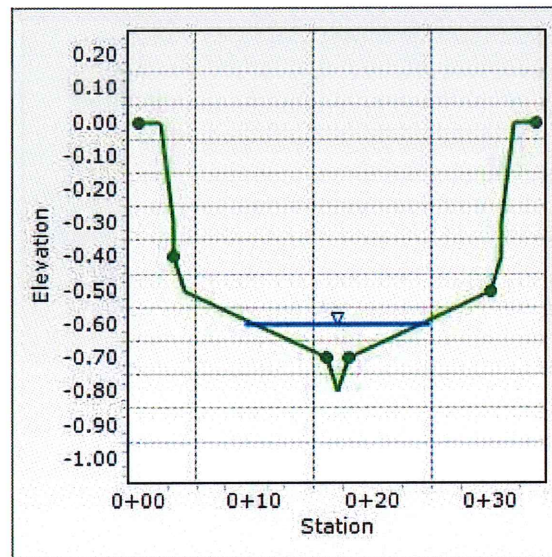
Downstream Depth	0.00 ft
Length	0.0 ft
Number Of Steps	0

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	0.16 ft
Critical Depth	0.15 ft
Channel Slope	0.006 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for M-Internal St. 30' R/W

Project Description	
Friction Method	Manning
	Formula
Solve For	Normal Depth
Input Data	
Channel Slope	0.006 ft/ft
Normal Depth	0.16 ft
Discharge	1.65 cfs





APPENDIX D

Reference Material



DS# 3142

DS INDEX

APN 138-09-301-002,-003

PROJECT Pine Cove III and IV

SUBMITTAL 2nd



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		July 19, 2002 <i>AS</i>
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: Pine Cove III & IV	COPIES TO: Hearthstone Homebuilders, Inc.
Cross Streets:	SEC Durango Drive & Gowan Road	Taney Engineering
File Number:	F:\Depot\DSMEMOS\DS3142B.doc	Cheri Edelman, P.E., DEVCO
Parcel Number:	138-09-301-002 & -003	
Zoning Action:	Z-0082-01	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	6/6/2002	6/20/2002	Not Accepted	\$250.00
2 nd Submittal	7/5/2002	7/19/2002	See Comments Below	\$250.00
TOTAL FEES (LDDRS):				\$500.00

REMARKS:

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

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

1. All drainage easements must be common lots and labeled as "Public Drainage Easement to be privately maintained by the Homeowners Association" in the grading plan and recorded as such on the final map.
2. *Coordinate the driveway layout with the City Traffic Engineering Division due to the proximity of the driveways to the return off Gowan Road.*

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the City of Las Vegas Flood Control Section. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the City of Las Vegas reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

END OF REMARKS
B&H/ssn

T/R/S: T20S/R60E/09
AREA L-09



TANEY ENGINEERING

4445 S. JONES #1

LAS VEGAS, NEVADA 89103

TELEPHONE: (702) 362-8844

FAX: (702) 362-5233

Transmittal

To:	Albert Sung	From:	Lawrence Phillips
Company:	City of Las Vegas Flood Control Department	Date:	July 3, 2002
Project:	Pine Cove III & IV	Job No.:	HRT-01-014
Re:	Addendum to TDS		

Items Attached:

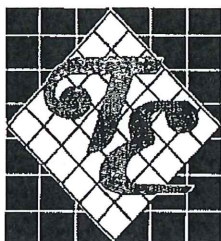
1. 1 Addendum to TDS for Pine Cove III & IV
- 2.
- 3.
- 4.
- 5.
- 6.

Comments:

--

Received By:

Date:



TANEY ENGINEERING

4445 S. JONES #1

LAS VEGAS, NEVADA 89103

TELEPHONE: (702) 362-8844

FAX: (702) 362-5233

Transmittal

3142
L9

To:	Matt Pinjuv	From:	Debi Guma
Company:	CLV - Planning	Date:	7/18/02
Project:	Pine Cove III & IV	Job No.:	HRT 01-014
Re:	Grading Plans		

Items Attached:

1. 1 set of grading plans
- 2.
- 3.
- 4.
- 5.
- 6.

Comments:

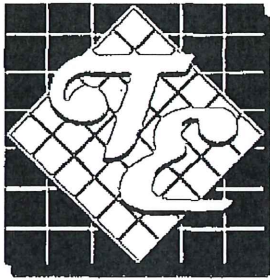
For your review and approval

Received By:	
Date:	

APPROVED

GRADE DIFFERENCE ONLY

BY Matt Pinjuv 7/18/02
CURRENT PLANNING DIVISION
CITY OF LAS VEGAS



TANEY ENGINEERING

JUL -5 2002

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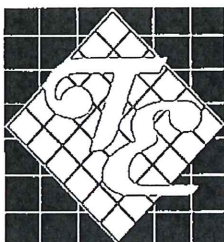
**ADDENDUM TO THE
TECHNICAL DRAINAGE STUDY
FOR
PINE COVE III & IV
RESIDENTIAL SUBDIVISION**

**City of Las Vegas
Nevada**

July 2, 2002

Prepared by:
Taney Engineering
4445 S. Jones Boulevard, Suite #1
Las Vegas Nevada 89103
Telephone: (702) 362-8844
Fax: (702) 362-5233

Prepared for:
Hearthstone Homebuilders, Inc.
6320 McLeod Drive, Suite #1
Las Vegas, Nevada 89120
Telephone: 632-8844
Fax: 651-6218



TANEY ENGINEERING

4445 S. JONES #1

LAS VEGAS, NEVADA 89103

TELEPHONE: (702) 362-8844

FAX: (702) 362-5233

July 2, 2002

Job No. HRT-01-014

Mr. Albert Sung, P.E.
City of Las Vegas
Department of Public Works
Engineering Planning
Flood Control Section
731 South Fourth Street
Las Vegas, NV 89101

**Subject: Addendum to the Technical Drainage Study for Pine Cove III & IV
Residential Subdivision**

Dear Mr. Sung:

Taney Engineering is pleased to provide one copy of the Addendum to the Technical Drainage Study and Grading and Detail Plans for the above-mentioned study. The Pine Cove III & IV Residential Subdivision development is located within a portion of the North half (N 1/2) of the Southwest Quarter (SW 1/4) of Section 09, Township 20 South, Range 60 East, in the City of Las Vegas, Nevada. The site is bordered by an undeveloped parcel to the west, Gowan Road to the north, proposed Pine Cove I residential subdivision to the east, and the existing Mira Vista residential subdivision to the south.

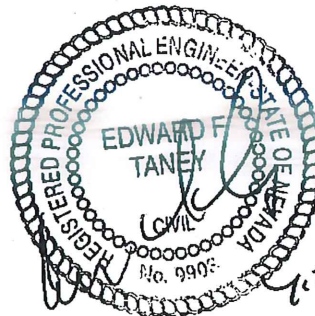
The proposed residential development is comprised of approximately 5.00 acres, consisting of 33 residential homes.

If you have any questions or comments, please do not hesitate to call this office.

Sincerely,

TANEY ENGINEERING

Lawrence Phillips
Hydrology/Hydraulics Manager



Edward F. Taney, P.E.
President

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Pine Cove III & IV Residential SubdivisionDate: July 2, 2002Location of Development: a) Descriptive (Cross Streets) North/South: Durango West: Gowan Road
b) Sect. 9 Town 20S Range 60EName of Owner Hearthstone Homebuilders, Inc Assessors Parcel No.: 138-09-301-002.003Telephone No.: (702) 632-3248Facsimile No.: (702) 651-6218Address: 6320 McLeod Drive, Suite #1Las Vegas, Nevada 89120Contact Person - Name: Lawrence PhillipsTelephone No.: (702) 362-8844Firm: Taney EngineeringAddress: 4445 S. Jones Boulevard, Suite #1, Las Vegas, Nevada 89103

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: 5.00+/- acres Being Developed/Disturbed: 5.00+/- 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

☒ NO4. Proposed type of development (Residential, Commercial, etc.)? Residential

5. Approximate upstream land area which drains to the subject site? _____

6. Has the site drainage been evaluated in the past?

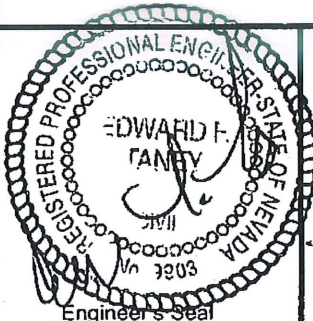
YES

☒ NO

If yes, please identify

documentation: _____

7. If known, please briefly identify the proposed discharge point (s) of runoff from the site:

The proposed discharge point is at the entrance of Gowan Road and easterly towards Pine Cove I8. Briefly describe your proposed schedule for the subject project: A.S.A.P.

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

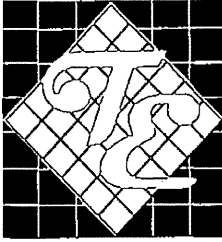
* Review and concurrence of the Clark County Regional Flood Control District is required.

Local Entity File No. _____

Revision	Date

REFERENCE:

STANDARD FORM 1



TANEY ENGINEERING

4445 S. JONES #1

LAS VEGAS, NEVADA 89103

TELEPHONE: (702) 362-8844

FAX: (702) 362-5233

July 2, 2002

Job No. HRT-01-014

Mr. Albert Sung, P.E.
City of Las Vegas
Department of Public Works
Engineering Planning
Flood Control Section
731 South Fourth Street
Las Vegas, NV 89101

**Subject: Addendum to the Technical Drainage Study for Pine Cove III & IV
Residential Subdivision**

Dear Mr. Sung:

Taney Engineering has received the City of Las Vegas Public Works review memorandum issued on June 20, 2002 for the above-referenced study. The comments have been addressed as follows:

Comment 1: Sites with a grade difference 2 feet above or below existing are required to have approval from City of Las Vegas Current Planning. The engineer must send one copy of the Grading plans and Detail sheet with a letter justifying the grade difference to Mr. Matt Pinjuv (Phone: 229-6793) at the City of Las Vegas Current Planning. A representative from Current Planning will fax back to the engineer Current Planning approval or comment. Provide Current Planning approval with the next submittal.

Response 1: Noted. A copy of the grading plans and Detail sheet have been submitted concurrently with this addendum to Mr. Matt Pinjuv, City of Las Vegas Current Planning. We request conditional approval at this time.

Comment 2: The engineer must provide a table on the grading plans that shows a quantity estimate of all private flood control improvement such as solid grouted stem wall, protection berm and/or riprap. The private flood control improvements must be bonded and inspected.

Response 2: Noted. Refer to revised Grading Plan in Appendix C.

Comment 3: On Sheet G1, provide a stem wall at the back of walk along Gowan road. Close off the stem wall at both ends of the development. Carry the stem wall into Porch Swings Court and connect to the walls for Lots 32 and 35. Provide a reference at Lot 28 for Detail H/GD1 between the wall opening and the sidewalk underdrain. Concrete the whole 10' wide drainage easement.

Response 3: Noted. Refer to revised Grading Plan in Appendix C.

Comment 4: On Sheet GD1 Section A, provide a stem wall solid grouted a minimum of five cells above the back of walk. On Section B, indicate the wall as a floodwall, solid grouted two cells above the adjacent high grade. On Section G change the title to "Public Drainage and Sewer Easement, Privately Maintained", replace the Concrete Flume with a concrete channel between both walls, properly detailed with aggregate base, expansion joints and steel reinforcement; indicate the new wall to be solid grouted 4 cells above the top of concrete pavement, and provide a solid grouted stem wall on the east side against the existing wall 4 cells above the top of the concrete pavement.

Response 4: Noted. Refer to revised Grading Plan in Appendix C. Per phone conversation with Albert Sung, City of Las Vegas Flood Control, on July 2, 2002, the 25' Drainage easement will transition from a concrete channel to a concrete flume bordered with rip-rap. Rip-rap calculations are located in Appendix B.

Comment 5: For Lots 33 and 34 the finished floors must either be raised from 2416.03 to 2419.5 and from 2416.43 to 2417.0 respectively; or a solid grouted stem wall must be installed along Gowan Road to a height 18" above the Q100 flow depth. The driveways of Lots 33 and 34 must also be raised to provide a hump; the proposed design appears to inundate both lots completely in a 100-year storm event.

Response 5: Noted. Refer to revised Grading Plan in Appendix C.

Comment 6: The 100-year flow depth in Gowan Road appears to weir over the high point in Porch Swings Court on the east curb return and inundates the interior street Cavaricci Court. (13.25FL in Gowan + 2.21' 100-yr flow depth = 15.46WS higher than 15.79TC/15.29FL at the curb return of Porch Swings) **Revise to show a hump of 6"- freeboard in Porch Swings Court.** ✓

Response 6: Noted. Refer to revised Grading Plan in Appendix C.

Comment 7: Provide calculations for the Q100 depth of flow in Blazing Sun Avenue. Calculate the weir depth in Blazing Sun Avenue at the drainage easement between Lots 11 and 12. Modify the walls along that street as necessary to provide solid grouted walls 6" above the Q100 flow depth

Pine Cove III & IV Residential Subdivision

including the weir depth above the flow depth. Indicate the easement to be a Public Drainage and Sewer Easement, Privately Maintained.

Response 7: Per phone conversation with Albert Sung, City of Las Vegas Flood Control, on July 2, 2002, comment 7 will be omitted, except for the indication of drainage easement maintenance. OK

Comment 8: The grading plan shows landscaping at the back of walk in Gowan Road and two privately maintained public drainage easements. Address whether a Homeowner Association will be formed to maintain the above mentioned facilities. The maintenance responsibility must be clearly conferred in the final map.

Response 8: Noted.

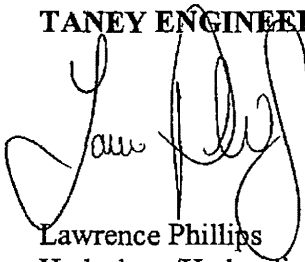
Comment 9: Coordinate the driveway layout with the City Traffic Department due to the proximity of the driveways to the return off Gowan Road.

Response 9: Noted.

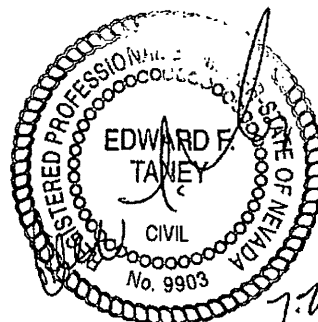
I hope this further completes your concerns in your review. If you need any additional information, please do not hesitate to call me at my office.

Sincerely,

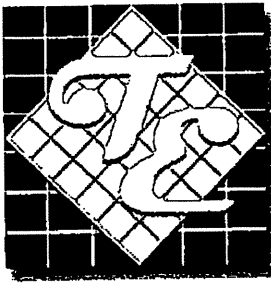
TANEY ENGINEERING



Lawrence Phillips
Hydrology/Hydraulics Manager



Edward F. Taney, P.E.
President



TANEY ENGINEERING

RECEIVED

JUN -6 2002

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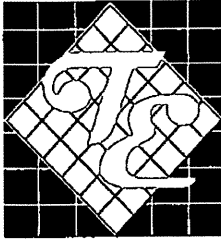
TECHNICAL DRAINAGE STUDY FOR PINE COVE III & IV RESIDENTIAL SUBDIVISION

City of Las Vegas
Nevada

June 3, 2002

Prepared by:
Taney Engineering
4445 S. Jones Boulevard, Suite #1
Las Vegas Nevada 89103
Telephone: (702) 362-8844
Fax: (702) 362-5233

Prepared for:
Hearthstone Homebuilders, Inc.
6320 McLeod Drive, Suite #1
Las Vegas, Nevada 89120
Telephone: 632-8844
Fax: 651-6218



TANEY ENGINEERING

4445 S. JONES #1

LAS VEGAS, NEVADA 89103

TELEPHONE: (702) 362-8844

FAX: (702) 362-5233

June 3, 2002

Job No. HRT-01-014

Mr. Albert Sung, P.E.
City of Las Vegas
Department of Public Works
Engineering Planning
Flood Control Section
731 South Fourth Street
Las Vegas, NV 89101

Subject: Technical Drainage Study for Pine Cove III & IV Residential Subdivision

Dear Mr. Sung:

Taney Engineering is pleased to provide one copy of the Technical Drainage Study and Grading and Detail Plans for the above-mentioned study. The Pine Cove III & IV Residential Subdivision development is located within a portion of the North half (N 1/2) of the Southwest Quarter (SW 1/4) of Section 09, Township 20 South, Range 60 East, in the City of Las Vegas, Nevada. The site is bordered by an undeveloped parcel to the west, Gowan Road to the north, proposed Pine Cove I residential subdivision to the east, and the existing Mira Vista residential subdivision to the south.

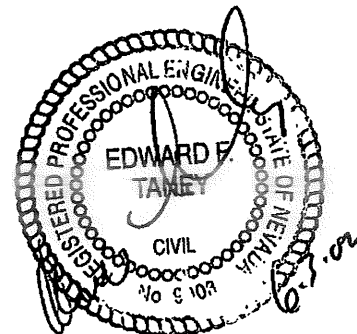
The proposed residential development is comprised of approximately 5.00 acres, consisting of 33 residential homes.

If you have any questions or comments, please do not hesitate to call our office.

Sincerely,

TANEY ENGINEERING

Lawrence Phillips
Hydrology/Hydraulics Manager



Edward F. Taney, P.E.
President

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Pine Cove III & IV Residential Subdivision Date: June 3, 2002

Location of Development: a) Descriptive (Cross Streets) North/South: Durango West: Gowan Road
b) Sect. 9 Town 20S Range 60E

Name of Owner Hearthstone Homebuilders, Inc. Assessors Parcel No.: 138-09-301-002,003

Telephone No.: (702) 632-3248 Facsimile No.: (702) 651-6218

Address: 6320 McLeod Drive, Suite #1
Las Vegas, Nevada 89120

Contact Person - Name: Lawrence Phillips Telephone No.: (702) 362-8844

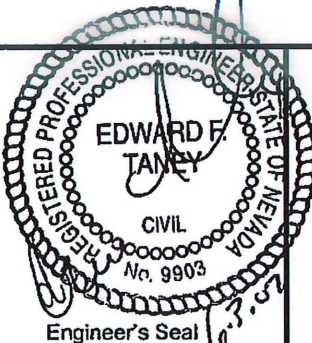
Firm: Taney Engineering

Address: 4445 S. Jones Boulevard, Suite #1, Las Vegas, Nevada 89103

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: 5.00+/- acres Being Developed/Disturbed: 5.00+/- 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
5. Approximate upstream land area which drains to the subject site? _____
6. Has the site drainage been evaluated in the past? YES ☐ NO ☒ If yes, please identify documentation: _____
7. If known, please briefly identify the proposed discharge point (s) of runoff from the site:
The proposed discharge point is at the entrance of Gowan Road and easterly towards Pine Cove I
8. Briefly describe your proposed schedule for the subject project: A.S.A.P.



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

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

Local Entity File No. _____

Revision	Date

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: PINE COVE III & IV RESIDENTIAL		Map ID:
Firm Name: Taney Engineering		Engineer: Edward F. Taney, P.E.
Address: 4445 S. Jones Boulevard, Suite #1		
City: Las Vegas	State: Nevada	Zip: 89103
Phone Number: (702) 362-8844	Fax Number: (702) 362-5233	
Property Owner: Hearthstone Homebuilders, Inc.		
Address: 6320 McLeod Drive, Suite #1		
City: Las Vegas	State: Nevada	Zip: 89120
Reviewed By: AYS	Date Received: 6/6/02	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	
☒	☐	Design Manual Standard Form 1 with the engineer's seal and signature.
☒	☐	Design Manual Standard Form 4.
☒	☐	2 copies of the 24" x 36" Drainage Plan.
☒	☒	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS

Yes No

- | | | |
|-------------------------------------|--------------------------|--|
| ☒ | ☐ | A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated. |
| ☒ | ☐ | A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated. |
| ☒ | ☐ | Off-site drainage basin maps for existing, interim and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs. |
| ☒ | ☐ | On-site drainage basin maps for existing and proposed conditions showing the existing topography, basin boundaries, concentration points, and on-site and off-site flows in cfs. |
| ☒ | ☐ | Vicinity Map with local and major cross streets identified and a north arrow. |

III. DRAINAGE PLAN

Yes No

- | | | |
|-------------------------------------|--------------------------|---|
| ☒ | ☐ | Sheet size: 24" x 36" sealed by a registered engineer in the State of Nevada. |
| ☒ | ☐ | Minimum scale: 1" = 60'. |
| ☒ | ☐ | Project Name. |
| ☒ | ☐ | Vicinity Map with local and major cross streets. |
| ☒ | ☐ | Revision box. |
| ☒ | ☐ | North arrow and bar scale. |
| ☒ | ☐ | Engineer's/consultant's address and phone number. |
| ☒ | ☐ | Elevation datum and benchmark. |
| ☒ | ☐ | Legend for symbols and abbreviations. |
| ☒ | ☐ | Cut/fill scarps, where applicable. |
| ☒ | ☐ | Street names, grades, widths. |
| ☒ | ☐ | Proposed future and existing spot grades for top of curbs and street crowns at lot lines, grade breaks, and along curb returns on both sides of the street. |

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

Yes	No	
☒	☐	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
☒	☐	Building and/or lot numbers.
☐	☒	Alignment of all existing, proposed, or future Regional facilities adjacent to the site.
☐	☒	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
☐	☒	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
☒	☒	Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q_{100} flows.
☒	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

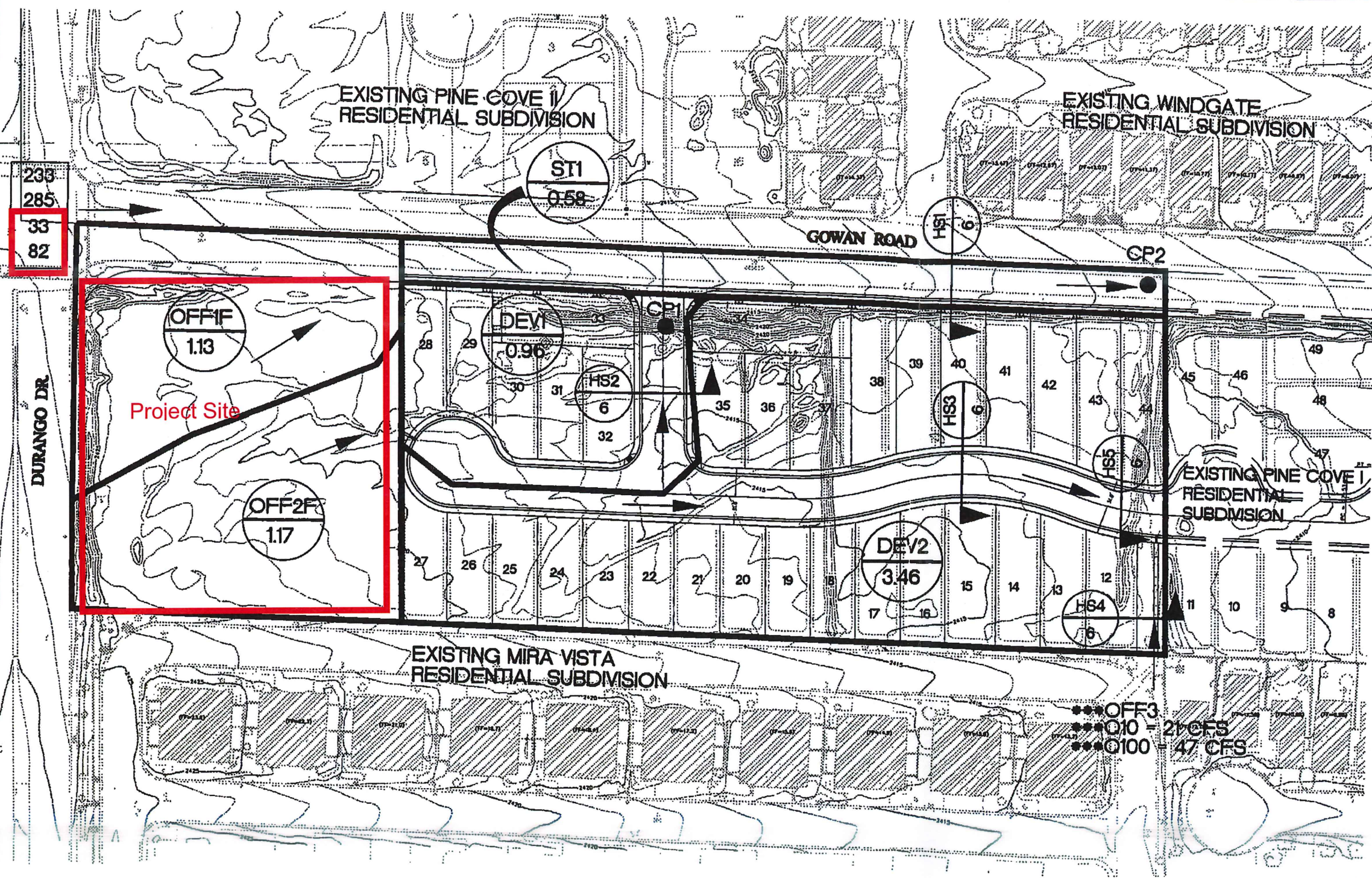
DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
☐	☒	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
☒	☐	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$, $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
☒	☐	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
☒	☐	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged).
☒	☐	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
☒	☐	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum 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, which ever is greater.
☐	☒	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.
☐	☒	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
☐	☒	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.
☒	☐	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.

REFERENCE:

STANDARD FORM 2



285	EXISTING 10-YR FLOW •
233	EXISTING 100-YR FLOW •
33	FUTURE 10-YR FLOW ••
82	FUTURE 10-YR FLOW ••

*NOTE: REFERENCED FROM THE DRAINAGE COMPLIANCE LETTER FOR ST. GEORGE EPISCOPAL CHURCH PREPARED BY ALPHA ENGINEERING CO.

**NOTE: REFERENCED FROM THE CITY OF LAS VEGAS NEIGHBORHOOD STUDY (FIGURE 7, SEE APPENDIX E, REFERENCED MATERIALS) PREPARED BY CITY OF LAS VEGAS.

***NOTE: REFERENCED FROM THE HYDROLOGY STUDY FOR PINE COVE I PREPARED BY JOHNNY VEGA, DATED 11/2001.

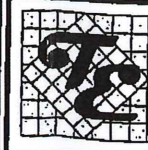
DRAINAGE LEGEND	
5/9	DETERMINED/ESTABLISHED 10-YR/100-YR FLOWS (CFS)
→	FLOW PATH
—	BASIN BOUNDARY
●	CP1 CONCENTRATION POINT #
OFF1	BASIN IDENTIFICATION
2.50	BASIN ACREAGE
HS1	HYDRAULIC SECTION (HS) ID#
6	HYDRAULIC X-SECTION
FIGURE #	

EXISTING STORM FLOW RATES			
BASIN	AREA (AC)	Q10 (CFS)	Q100 (CFS)
DEV1	0.96	1	3
DEV2	3.46	4	10
ST1	0.58	1	2
OFF1F	1.17	2	4
OFF2F	1.13	2	4
***OFF3	—	21	47
COMBINATION PT		Q10 (CFS)	Q100 (CFS)
CP1		3	7
CP2		6	12

GRAPHIC SCALE



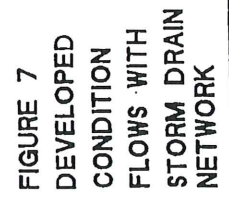
(IN FEET)
1 inch = 100 ft.



TANEY ENGINEERING
4445 S. JONES BLVD. SUITE #1
LAS VEGAS, NV 89103
(702) 362-8844 FAX: (702) 362-5233

FIGURE 6

DEVELOPED OFFSITE/ONSITE BASIN MAP





DS# 3055

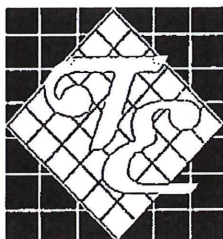
DS INDEX _____

APN 138-09-201-021,-022

PROJECT Pine Cove II Subdivision

SUBMITTAL 1st and Revision





TANEY ENGINEERING

4445 S. JONES #1

LAS VEGAS, NEVADA 89103

TELEPHONE: (702) 362-8844

FAX: (702) 362-5233

Transmittal

To:	Matt Pinjuv	From:	Debi Guma
Company:	CLV - Planning	Date:	2/4/02
Project:	Pine Cove II	Job No.:	HRT 01-016
Re:	Grading Plans		

Items Attached:

1. 1 blue line of grading and details

3055
L09

Comments:

For your review and approval

Received By:

Date:

APPROVED

GRADE DIFFERENCE ONLY

BY

[Signature]
CURRENT PLANNING DIVISION
CITY OF LAS VEGAS

2/5/02

RECEIVED
20. MAR 11 3 30 PM
PLANNING DIV.
CITY OF LAS VEGAS

CITY OF LAS VEGAS		DATE: Revised: January 9, 2002	
INTER-OFFICE MEMORANDUM		January 3, 2002 <i>MS</i>	
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works	
SUBJECT:	Drainage Study for:		
	Pine Cove II Subdivision		
Cross Streets:	NEC Gowan Road & Durango Drive		
FILE NO.	F:\Depot\DSMEMOS\DS3055A-Rev.doc		
Parcel Number:	138-09-201-021, 022		
Zoning Action:	TM - 0045 - 01		
FEMA Flood Zone	YES	No	X
Proposed Storm Drain	YES	No	X
COPIES TO:		Hearthstone Homebuilders, Inc.	
		Taney Engineering	
		Cheri Edelman, DEVCO	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	12/20/2001	1/3/2002	Not Acceptable	\$250.00
Revision	1/9/2002	1/9/2002	See Comments Below	N/C
			TOTAL FEES (LDDRS):	\$250.00

REMARKS:

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

	is acceptable in concept subject to conformance to all City standards and the following conditions.
X	must be resubmitted or supplemented including the following:
	Must have Clark County Regional Flood Control District concurrence

1. The contribution for the Lone Mountain Detention Basin and/or Outfall System is no longer needed since the City has fully reimbursed the original company that built the basin. The previous comment #1 requiring a contribution of \$11,500.00 is eliminated per this revision.

The following comments are repeated until they are complete:

2. Sites with a grade difference 2 feet above or below existing are required to have approval from City of Las Vegas Current Planning. Provide Current Planning approval with the next submittal. The engineer is directed to contact Mr. Matt Pinjuv of the City of Las Vegas at 229-6793.
3. A site visit reveals that there is a graded swale in the off site parcel west of the site. It is not clear if this swale is directing flows north toward the block wall or south toward Gowan Road. Provide topographic information for the swale in the next submittal. If the swale is directing flows south toward Gowan Road, there may not need to be an easement. It is also noted that the offsite flows could be directed to the cul-de-sac along lot 6 which would reduce the length of easement required. The engineer must revise the study and plans as necessary.
4. This site accepts offsite flows and conveys them through the site. Provide a 10'-wide "Public Drainage Easement to be Privately Maintained" if the 100-year flow conveyed is less than 20cfs. Show the easement on the grading plan. Public drainage easements must be recorded prior to the final approval of the improvement plans.
5. Page 14 of the study refers to reference material from the St. George Episcopal Church study in the appendix for flow rates in Gowan Road. Figure 8 of that study is titled Revised Interim Condition Flows With Durango Drive Improvements. The 10-year and 100-year flows shown are 233cfs and 285cfs respectively. The calculated depth of flow in Gowan Road with 285cfs is 2.00 feet. This depth of flow will back up into the cul-de-sac. The entrance of the cul-de-sac must be humped to an elevation of 13.58 +

2.00 + 0.5 = 16.18 to be 6 inches above the 100- year depth of flow in Gowan Road. This elevation may change with the street flow calculation revised to use a slope of 0.5% which occurs at the east property line. The plans must be revised accordingly.

6. The study must be revised to include a statement accepting the results of the referenced studies.
7. Show and label a 3'-valley gutter in the drainage easement in the grading plan for low flow conveyance. The remainder of the section must be riprap lined for erosion protection. Provide riprap sizing calculation and label geotextile filter fabric bedding material in detail 1/D1.
8. The street flow calculations for Gowan Road use a slope of 1.42%. Calculations utilizing a slope of 0.5%, which occurs at the east end of the site, must be submitted.
9. Figure 6, Developed Offsite and Onsite Basin Map, contains a table of storm flow rates. The title of the table must be revised to change "Existing" to "Developed" and the third basin listed must be revised from "DEV1" to "DEV2".
10. Page 10 of the study includes discussion regarding Precipitation. It is noted that the text incorrectly states that the site is within the McCarran Airport Rainfall Area. Therefore the precipitation values identified in the text are incorrect. The values utilized in the analyses however are correct.
11. Table 3 on page 14 of the study has the 10-year and 100-year information reversed on the first line. The table must be revised accordingly.
12. The street name for the onsite cul-de-sac is Pine Cove Street in the study and Porch Swings Court on the plan. The name must be clarified.
13. Recommendation number 6 on page 16 of the study states "Solid grouted floodwalls shall be constructed along Gowan Road as shown on the Grading Plan". A cross section of the walls must be provided. Also, the grading plan doesn't seem to show a flood wall all along the frontage in Gowan Road.
14. Recommendation number 7 of the study states that lots 6 through 16 shall be constructed with Type "B" drainage. The onsite developed analysis, Figure 6, also shows Type "B" drainage. The grading plan however shows all lots with Type "A" drainage. The grading plan or developed condition analysis must be revised accordingly.
15. The Regional Flood Control District Manual requires 1% minimum slope around the bulb of a cul-de-sac where storm water is drained through in section 1602. Provide the required slope in all cul-de-sacs.
16. Revise the title in the Grading Plan from "Gowan & Durango" to "Pine Cove II Subdivision".
17. The following comments must be addressed on the grading plans:
 - a. Include project name in the title block
 - b. Revise the drainage easement width to 10 feet
 - c. Provide an appropriate section for 2/D1 at the southwest corner of the site
 - d. Revise the line type along the west property line to show a block wall
 - e. Provide a wrought iron opening and detail at the outlet of the drainage easement
 - f. Include the text "Public" in the drainage easement details 1/D1 and 2/D1
 - g. Indicate where section 6/D1 applies on the plan

END OF REMARKS
Wld/cos/413a

T/R/S: T20S/R60E/09
AREA L-09



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 06/06/01)

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 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 Clark County Regional Flood Control District (CCRFC) Hydrologic Criteria and Drainage Design Manual (Design Manual).

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

I. GENERAL REQUIREMENT

Yes	No	
N/A		A notarized letter from the adjacent property owner(s) allowing off-site grading. (A copy of the letter must be received prior to final acceptance of the drainage study.)
To be faxed		Copies of all conditions of approval for development related to this property. (e.g. zoning, use permit, tentative map, etc.) Verify compliance with conditions.

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.)
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.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

II. GRADING PLAN INFORMATION		
Yes	No	
☒		Back of lot elevations and lot drainage pattern for all lots including common lots.
☒		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.
☒		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.)
☒		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.
☒		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	
☒		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.
☒		10-foot ^{NOT 6'} 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.
☒		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.
☒		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.
☒		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.
☒		Lots with "B and C Type Drainage" shall be required to install an underground nuisance drainage system or a 2-foot valley gutter through the lot. 16" x 24" minimum block wall openings are required for both options.
☒		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.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

- An appointment must be made to preview this checklist in conjunction with Clark County Regional Flood Control District Manual Standard Form 2 prior to the City accepting a new Drainage Study for review. The engineer may contact the Flood Control Section at 229-6541.
- Following the acceptance of the Drainage Study (meeting the minimum acceptable information above), there will be a charge of \$250 for each Drainage Study review submittal. These fees are payable at the time the Grading Permit is obtained.
- The Drainage Study must be accepted prior to submitting grading plans to the Land Development Section 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.

F:\Depot\DOCS\Memos\jbCHKLIST7.doc
6-Jun-01

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		March 7, 2002
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	COPIES TO:	
	Hearthstone Homebuilders, Inc.	
Cross Streets:	Taney Engineering	
FILE NO.:	Cheri Edelman, DEVCO	
Parcel Number:	138-09-201-021, 022	
Zoning Action:	TM - 0045 - 01	
FEMA Flood Zone	YES	No X
Proposed Storm Drain	YES	No X

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	12/20/2001	1/3/2002	Not Acceptable	\$250.00
Revision	1/9/2002	1/9/2002	Not Acceptable	N/C
2 nd Submittal	2/5/2002	2/19/2002	Not Acceptable	\$250.00
3 rd Submittal	2/25/2002	3/7/2002	See Comments Below	\$250.00
			TOTAL FEES (LDDRS):	\$750.00

REMARKS:

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

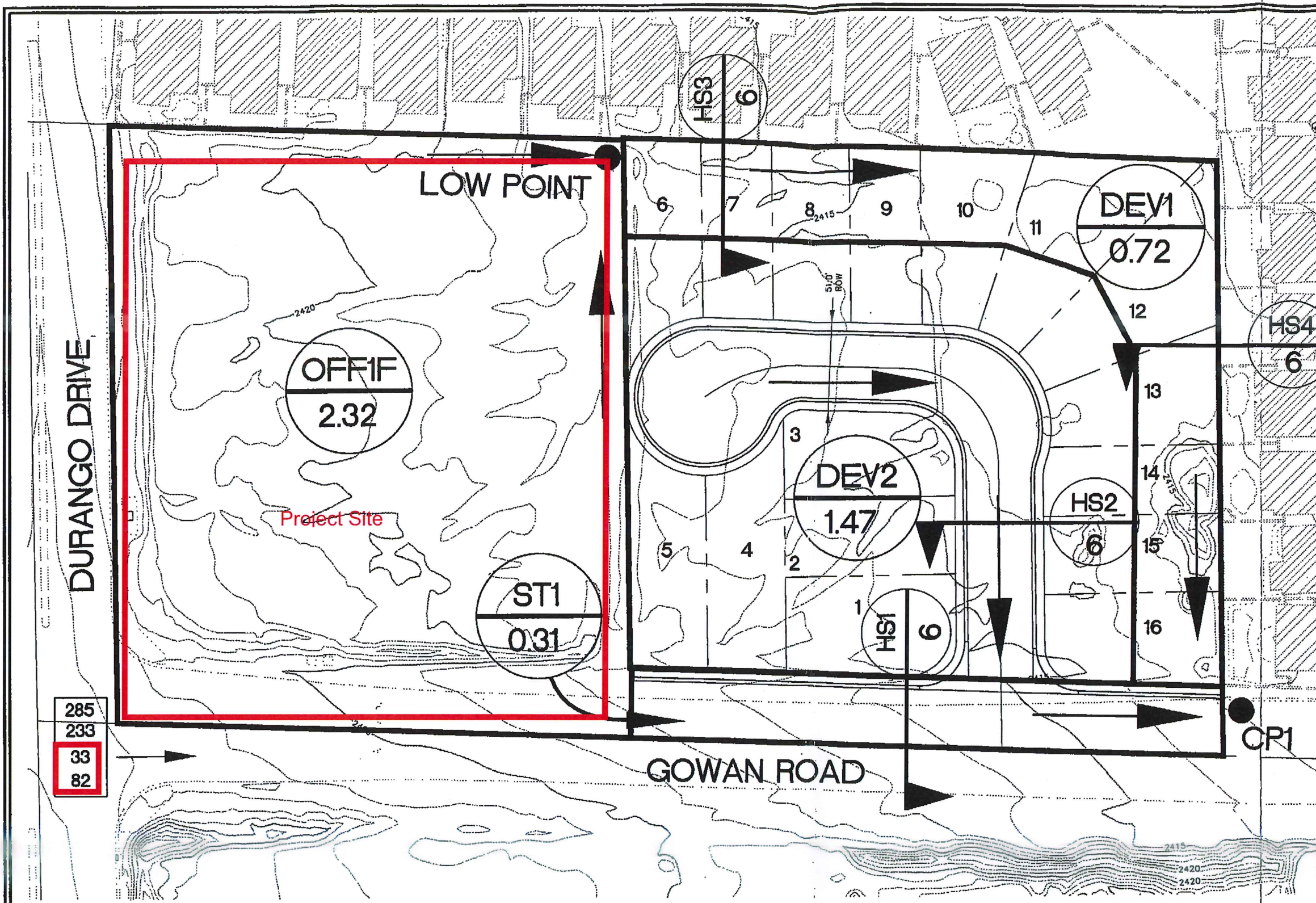
X	is acceptable in concept subject to conformance to all City standards and the following conditions.
	must be resubmitted or supplemented including the following:
	Must have Clark County Regional Flood Control District concurrence

- Per previous comment #2, the shaded area in the grading plan must be labeled as "100-year storm event inundation area".

NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the City of Las Vegas Flood Control Section. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year. If the proposed construction has not been completed in that time period, the City of Las Vegas reserves the right to require additional conditions and/or submission and acceptance of a complete drainage study update prior to further construction of a project.

END OF REMARKS
Wld/ays

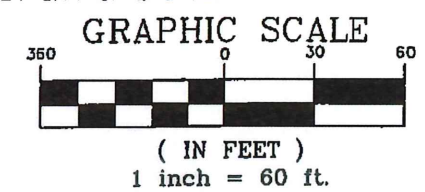
Post-it [®] Fax Note	7671	Date	3/7/02	# of Pages	1
To	James Aquino	From	Albert Sung	Co.	City of Las Vegas
Cd/Dept.	Taney Engineering	Phone #	725-2000	Fax #	725-8551
Phone #	725-5233				



- 285 EXISTING 10-YR FLOW *
- 233 EXISTING 100-YR FLOW *
- 33 FUTURE 10-YR FLOW **
- 82 FUTURE 10-YR FLOW **

*NOTE: REFERENCED FROM THE DRAINAGE COMPLIANCE LETTER FOR ST. GEORGE EPISCOPAL CHURCH PREPARED BY ALPHA ENGINEERING CO.

**NOTE: REFERENCED FROM THE CITY OF LAS VEGAS NEIGHBORHOOD STUDY (FIGURE 7, SEE APPENDIX E, REFERENCED MATERIALS) PREPARED BY CITY OF LAS VEGAS.



DRAINAGE LEGEND	
5/9	DETERMINED/ESTABLISHED 10-YR/100-YR FLOWS (CFS)
→	FLOW PATH
—	BASIN BOUNDARY
● CP1	CONCENTRATION POINT *
OFFIF	BASIN IDENTIFICATION
2.50	BASIN ACREAGE
HS1	HYDRAULIC SECTION (HS) ID#
6	HYDRAULIC X-SECTION
FIGURE #	

Developed

EXISTING STORM FLOW RATES			
BASIN	AREA (AC)	Q10 (CFS)	Q100 (CFS)
OFFIF	2.32	5	9 ✓
DEV1	0.72	1	2 ✓
DEV2	1.47	2	5 ✓
ST1	0.31	1	1 ✓
COMBINATION PT		Q10 (CFS)	Q100 (CFS)
CP1		7	17 ✓

NOTE: REFER TO APPENDIX E, REFERENCED MATERIAL, FOR OFFSITE FLOWS IMPACTING GOWAN ROAD.

ANEY ENGINEERING
 4445 S. JONES BLVD. SUITE #1
 LAS VEGAS, NV 89103
 (702) 362-8844 FAX: (702) 362-5233

FIGURE 6
DEVELOPED OFFSITE AND ONSITE BASIN MAP



DURANGO & GOWAN
BRN-19-002

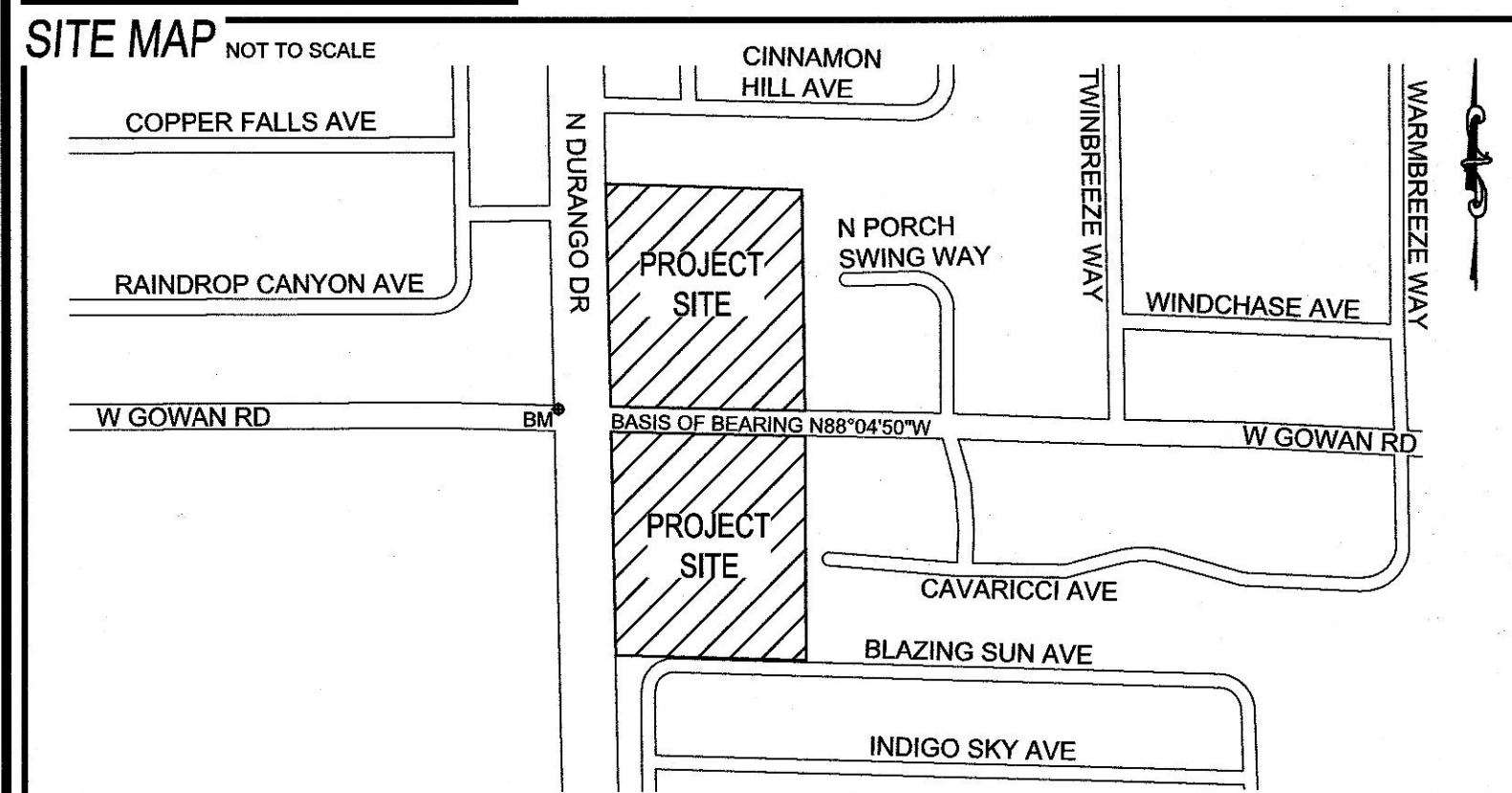
APPENDIX E

Improvement Plans

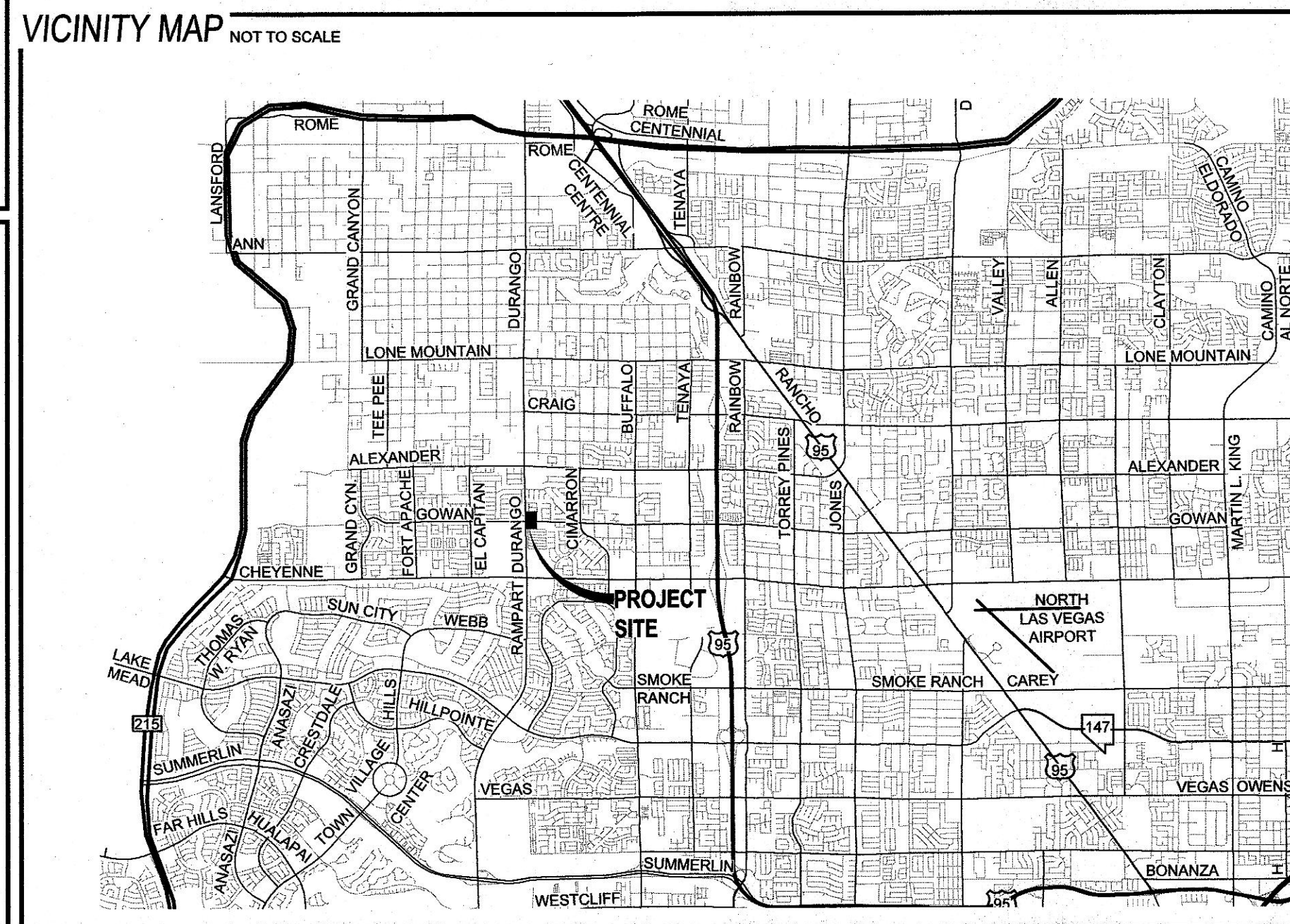
IMPROVEMENT PLANS FOR DURANGO & GOWAN RESIDENTIAL SUBDIVISION (TOWNHOMES) CITY OF LAS VEGAS, NEVADA APN: 138-09-201-020 & -301-001 5.34 AC (GROSS) / 3.66 (NET)

ENGINEER
TANEY ENGINEERING
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LAS VEGAS, NV 89118
(702) 362-8844 PHONE (702) 362-5233 FAX
INFO@TANEYCORP.COM

DEVELOPER
THE EAB & ELB FAMILY, LLC
9875 W LA MANCHA AVE
LAS VEGAS, NV 89149
(702) 688-3888
EMAIL: EMMABURNS135@GMAIL.COM



ABBREVIATIONS			
AC	ASPHALTIC CONCRETE	EX	EXISTING
ACP	ASBESTOS CEMENT PIPE	FF	FINISH FLOOR ELEVATION
AVE	AVENUE	FG	FINISH GRADE
BC	BACK OF CURB	FB	FIRE HYDRANT
BCR	BACK OF CURB RADIUS	FL	FLOW LINE
BFE	BASE FLOOD ELEVATION	FT	FEET
BFP	BACK FLOW PREVENTOR	G	GRADING
BLM	BUREAU OF LAND MANAGEMENT	GB	GRADE BREAK
BM	BENCH MARK	GBF	GARAGE FINISH FLOOR
BO	BOUNDARY	HP	HIGH POINT
BRPM	BLUE RAISED PAVEMENT MARKER	HPG	HIGH PRESSURE GAS
BVC	BEGIN VERTICAL CURVE	INV	INVERT
BW	BOTTOM OF WALL	LF	LINEAR FEET
CATV	CABLE TELEVISION	LN	LANE
CC	CLARK COUNTY	LS	LANDSCAPE
CCFD	CLARK COUNTY FIRE DEPARTMENT	LT	LEFT
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT	LWVD	LAS VEGAS VALLEY WATER DISTRICT
CL	CENTERLINE	MAX	MAXIMUM
CLSM	CONTROLLED LOW STRENGTH MATERIAL	MN	MANHOLE
CLV	CITY OF LAS VEGAS	MIN	MINIMUM
CMP	CORRUGATED METAL PIPE	NO	NUMBER
CNVL	CITY OF NORTH LAS VEGAS	NTS	NOT TO SCALE
CO	CLEAN OUT, SEWER	OC	ON CENTER
COH	CITY OF HENDERSON	PB	PULL BOX
CY	CUBIC YARD	PC	POINT OF CURVE
DCSWS	DESIGN AND CONSTRUCTION STANDARDS FOR WASTE WATER COLLECTION SYSTEMS	PCC	POINT OF COMPOUND CURVE
DG	DECOMPOSED GRANITE	PI	POINT OF INTERSECTION
DI	DROP INLET	PL	PROPERTY LINE
DIP	DUCTILE IRON PIPE	PLT	PLATE
DR	DRIVE	PP	POINT OF CONNECTION
EC	END OF CURVE	PPF	POWER POLE
ELEG	EXISTING GRADE	P&P	PLAN AND PROFILE
ELEC	ELECTRICAL	PRC	POINT OF REVERSE CURVE
EP	EDGE OF PAVEMENT	PROJ	PROJECT
EVC	END VERTICAL CURVE	PRV	PRESSURE REDUCING VALVE
PT	POINT OF TANGENCY	PT	POINT OF TANGENCY
PVC	POLYVINYL CHLORIDE	R	RADIUS
RCB	REINFORCED CONCRETE BOX	RCB	REINFORCED CONCRETE BOX
RCP	REINFORCED CONCRETE PIPE	RCP	REINFORCED CONCRETE PIPE
RT	RIGHT-OF-WAY	RT	RIGHT-OF-WAY
RT	RIGHT	SD	STORM DRAIN
SD	STORM DRAIN	SHT	SHEET
STLT	STREETLIGHT	STLT	STREETLIGHT
SNWA	SOUTHERN NEVADA WATER AUTHORITY	SS	SANITARY SEWER
SS	SANITARY SEWER	ST	STREET
ST	STREET	STA	STATION
STD	STANDARD	STD	STANDARD
SVZ	SIGHT VISIBILITY ZONE	SVZ	SIGHT VISIBILITY ZONE
SW	SIDEWALK	SW	SIDEWALK
SY	SQUARE YARD	SY	SQUARE YARD
TC	TOP OF CURB	TC	TOP OF CURB
TELE	TELEPHONE	TELE	TELEPHONE
TF	TOP OF FOOTING	TF	TOP OF FOOTING
T.O.P.	TOP OF PIPE	T.O.P.	TOP OF PIPE
TR	TOP OF RETAINING	TR	TOP OF RETAINING
TW	TOP OF WALL	TW	TOP OF WALL
TYP	TYPICAL	TYP	TYPICAL
UDACS	UNIFORM DESIGN AND CONSTRUCTION STANDARDS	UDACS	UNIFORM DESIGN AND CONSTRUCTION STANDARDS
UT	UTILITY	UT	UTILITY
USD	UNIFORM STANDARD DRAWING	USD	UNIFORM STANDARD DRAWING
VC	VERTICAL CURVE	VC	VERTICAL CURVE
VCP	VITRIFIED CLAY PIPE	VCP	VITRIFIED CLAY PIPE
VG	VALLEY GUTTER	VG	VALLEY GUTTER
W	WATER	W	WATER
ZC	ZERO LIP CURB	ZC	ZERO LIP CURB



SHEET TABLE LIST

SHEET #	SHEET NAME	SHEET TITLE
01	C1	COVER SHEET
02	C2	NOTES SHEET
03	G1	GRADING PLAN 1
04	G2	GRADING PLAN 2
05	GD1	GRADING DETAILS 1
06	GD2	GRADING DETAIL 2

SUBDIVISION INFORMATION

ACRES: 5.34 AC (GROSS)
AREA DISTURBED: 3.66 AC (NET)
LOTS: 58
LOT SIZE: 1,600 SF (MIN)
ZONING: R-TH
FMP: XX
TMP: 77559
SETBACKS:
FRONT: 10 FT
REAR: 05 FT
SIDE: 00 FT
CORNER: 10 FT

UTILITY DISCLAIMER

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

BASIS OF BEARING

NORTH 88°04'50" WEST BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 9, TOWNSHIP 20 SOUTH, RANGE 80 EAST, M.D.M., CLARK COUNTY, NEVADA AS SHOWN IN BOOK 106 PAGE 15 OF PLATS, CLARK COUNTY OFFICIAL RECORDS.

BENCHMARK

MONUMENT ID: 8LV008E4
T205 R00E S08
RIVET & PLATE IN TOP OF CURB AT NW CORNER OF GOWAN & DURANGO
ELEVATION: 739.09 (METERS) / 2424.84 (FEET)

LEGAL DESCRIPTION

138-09-201-020
THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 9, TOWNSHIP 20 SOUTH, RANGE 80 EAST, M.D.M.
138-09-301-001
THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF THE NORTHWEST QUARTER (NW 1/4) OF SECTION 9, TOWNSHIP 20 SOUTH, RANGE 80 EAST, M.D.M.

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1-702-227-2929

Call before you Dig
Avoid cutting underground utility lines, it's costly.
CALL 811
OR
1-800-227-2600

LEGEND	EXISTING	PROPOSED
PROJECT BOUNDARY		
RIGHT-OF-WAY		
CENTERLINE		
PROPERTY LINE		
EDGE OF PAVEMENT		
SIDEWALK		
CURB AND GUTTER		
FENCE		
CONTOUR (1' INTERVAL)		
CONTOUR (5' INTERVAL)		
DIRECTION OF FLOW		
CUT LINE-ASPHALT		
SCARP (SLOPE VARIES)		
DESIGN ELEVATION	(10.00)	(10.00)
FUTURE ELEVATION		(10.00)
STEP RETAINING COURSES		
RETAINING WALL		
CMU WALL		
SOLID GROUTED WALL - NO RETAINING		
CUT-OFF WALL		
POWER POLE		
SIDEWALK RAMP		
CURB DROP INLET		
STORM DRAIN W/MANHOLE		
CUT-FILL LINE		
SIGHT VISIBILITY ZONE		
CAP & 2" BLOW OFF VALVE		
WATERLINE FITTINGS		
GATE VALVE		
FIRE HYDRANT		
SEWER LINE W/MANHOLE		
SEWER LATERAL		
WATER LINE		
WATER LATERAL W/METER		
PRESSURE REDUCING VALVE		
BACKWATER VALVE		
200A SERVICE PEDESTAL		
STREET LIGHT CONDUIT		
F.A.S.T. CONDUIT		
TRAFFIC SIGN		
STOP SIGN W/STREET NAME SIGN		
100W HPS LUMINAIRE W/11 GA. POLE		
250W HPS LUMINAIRE W/11 GA. POLE		
400W HPS LUMINAIRE W/11 GA. POLE		

APPROVAL SIGNATURES

APPROVED FOR CONSTRUCTION	
COX COMMUNICATIONS LAS VEGAS, INC.	DATE
SOUTHWEST GAS CORPORATION	DATE
CENTRAL TELEPHONE COMPANY dba CENTURYLINK	DATE
"THE AFFIXED CENTURYLINK APPROVAL DOES NOT ASSUME OR GUARANTEE LIABILITY FOR KNOWN OR UNKNOWN CONFLICTS WITH EXISTING OR PROPOSED IMPROVEMENTS. RESOLUTION OF ANY CONFLICT WILL BE ACCOMPLISHED PURSUANT TO LOCAL ORDINANCES, NEVADA REVISED STATUTES AND/OR PUBLIC UTILITY COMMISSION RULES AND REGULATIONS"	
NV ENERGY	DATE
NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.	
LAS VEGAS FIRE AND RESCUE	DATE
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES PROJECT# 122XXX, FIRST APPROVED DATE LWVWD APPROVED FIRE FLOW: XXXX GPM AT 20 PSI RESIDUAL MAXIMUM AVAILABLE FIRE SPRINKLER FLOW XXXX GPM SHEETS: XXXXXX	

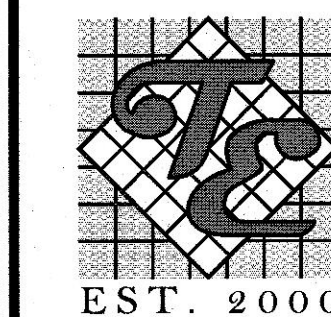
CLV CIVIL ENGINEERING APPROVAL

CLV CIVIL ENGINEERING APPROVAL

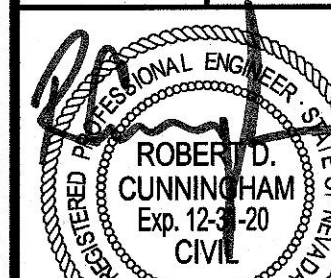
CLV PLANNING APPROVAL

CLV PLANNING APPROVAL

THE EAB & ELB FAMILY, LLC
9875 W LA MANCHA AVE
LAS VEGAS, NV 89149
(702) 688-3888
EMAIL: EMMABURNS135@GMAIL.COM



**DURANGO & GOWAN
TOWNHOMES**



DATE: 6/4/2020

SCALE:

JOB NO: BRN-19-002

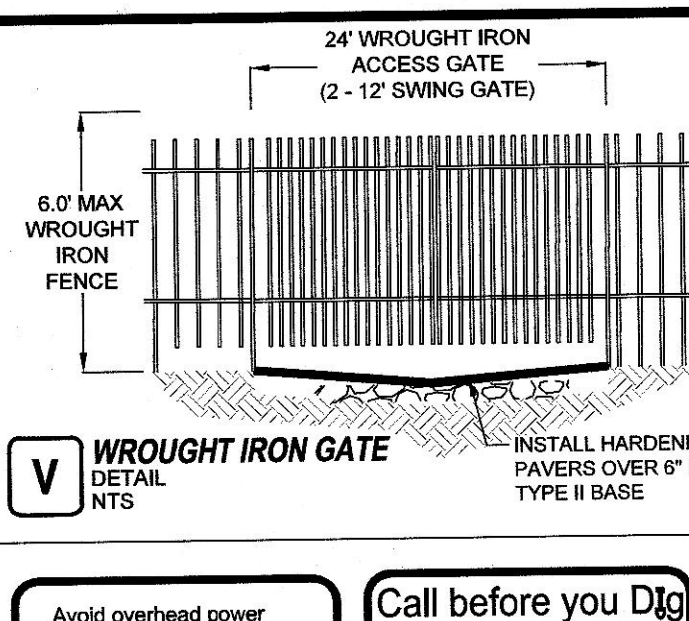
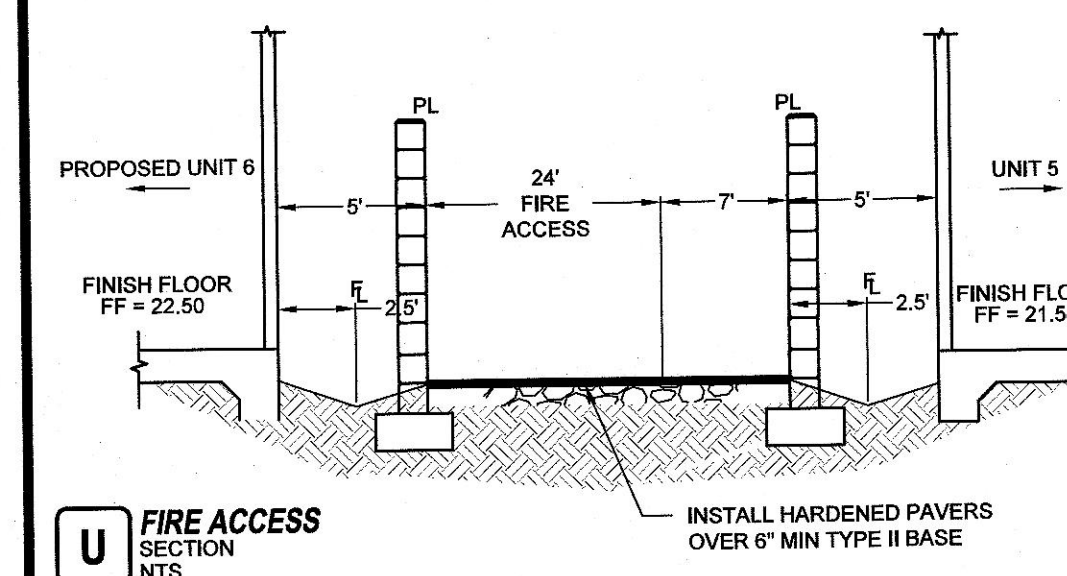
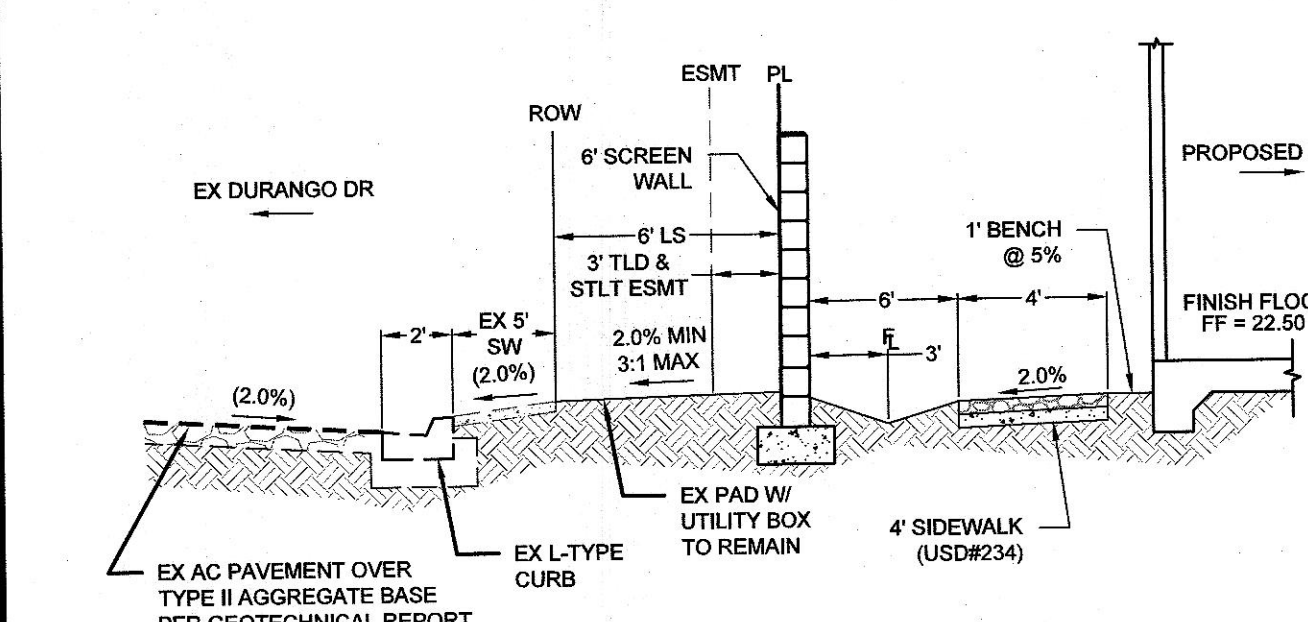
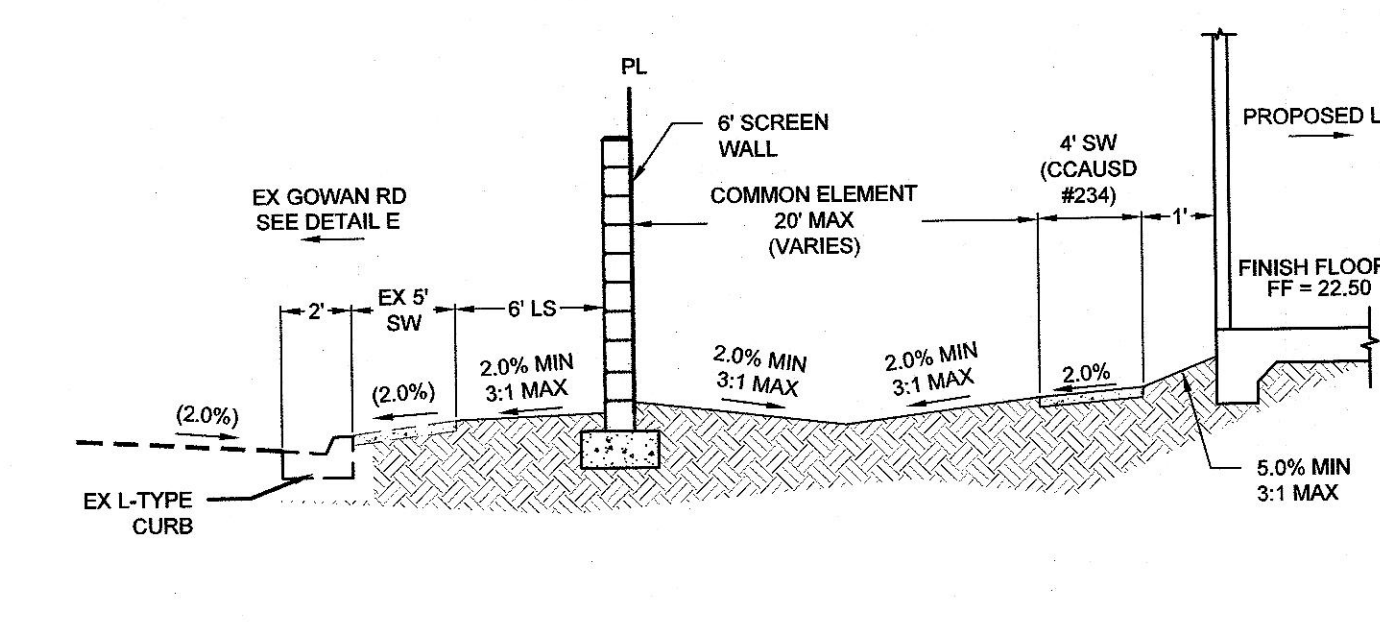
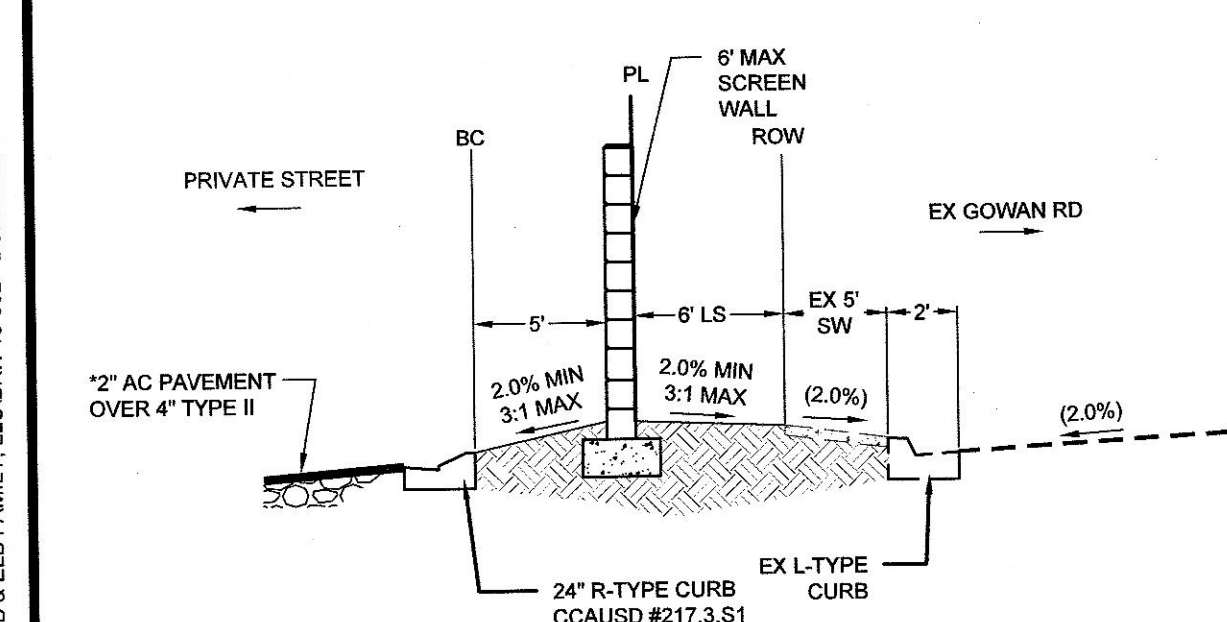
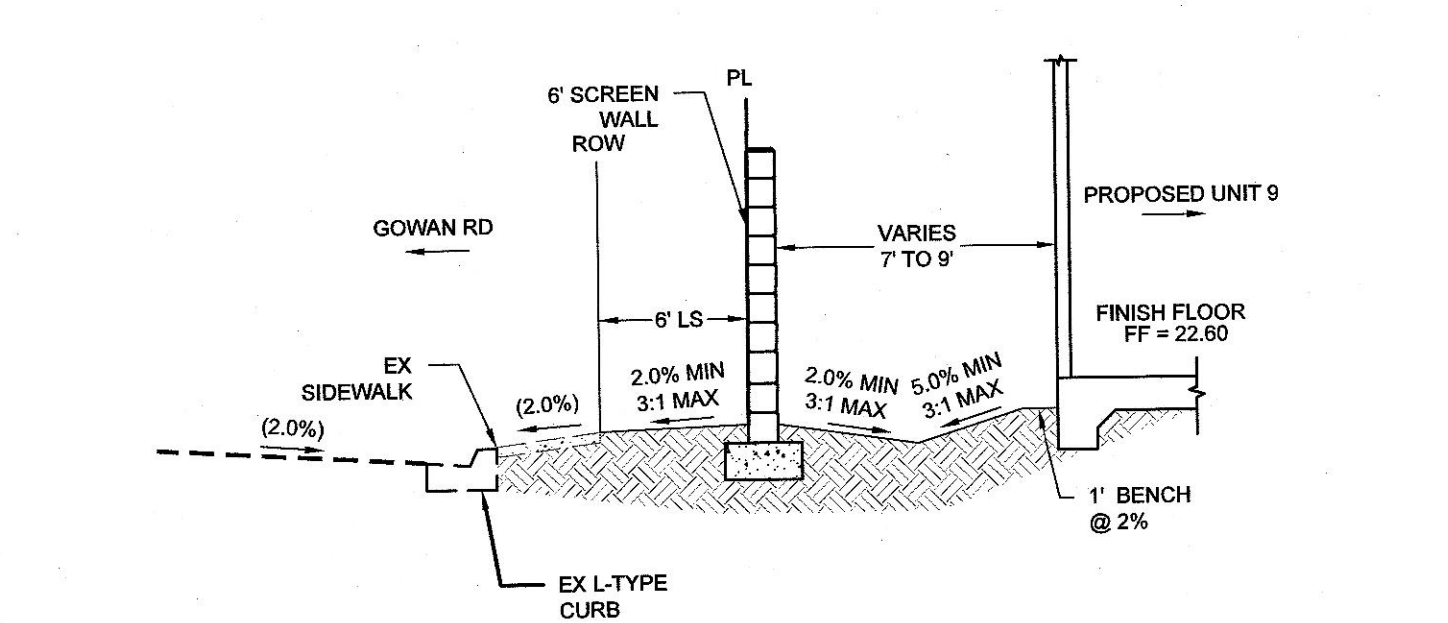
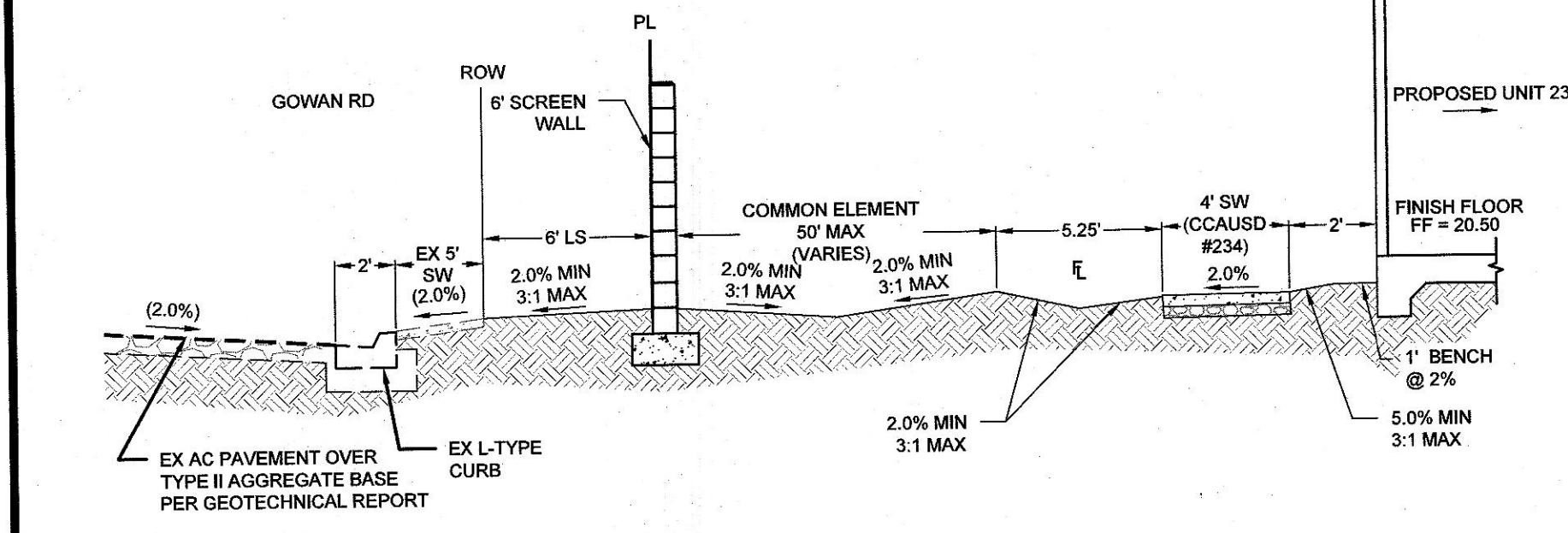
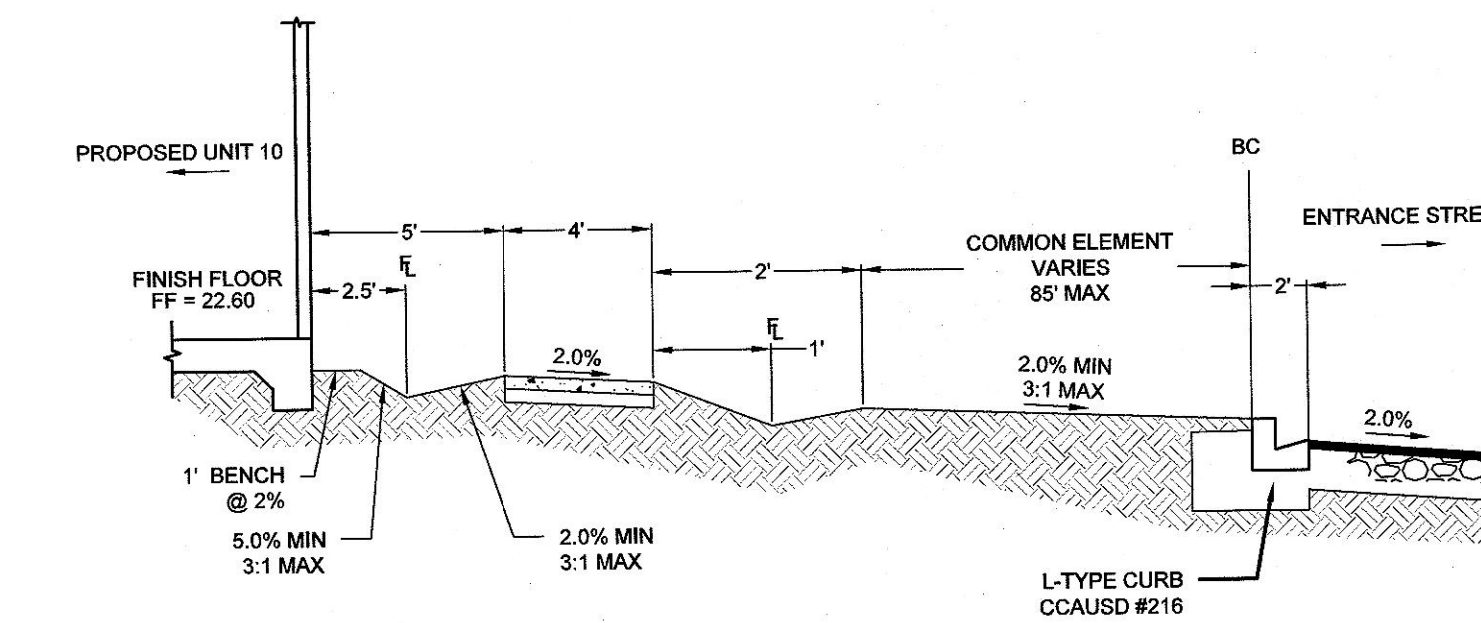
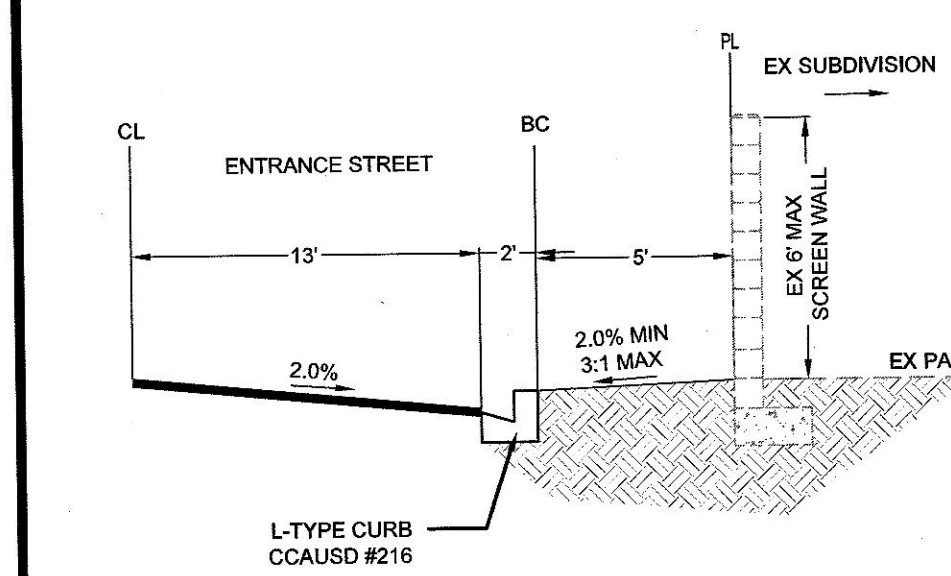
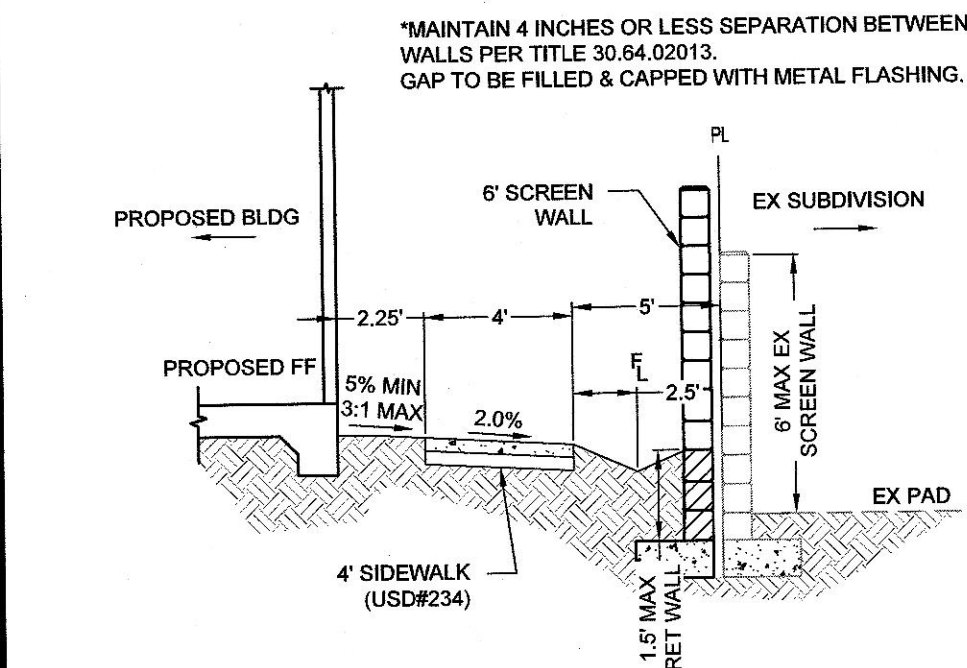
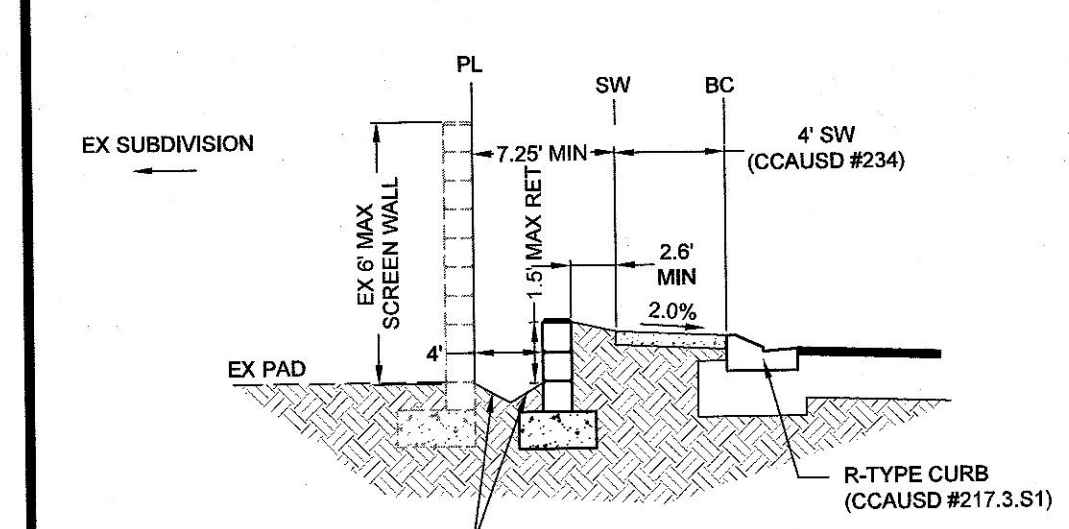
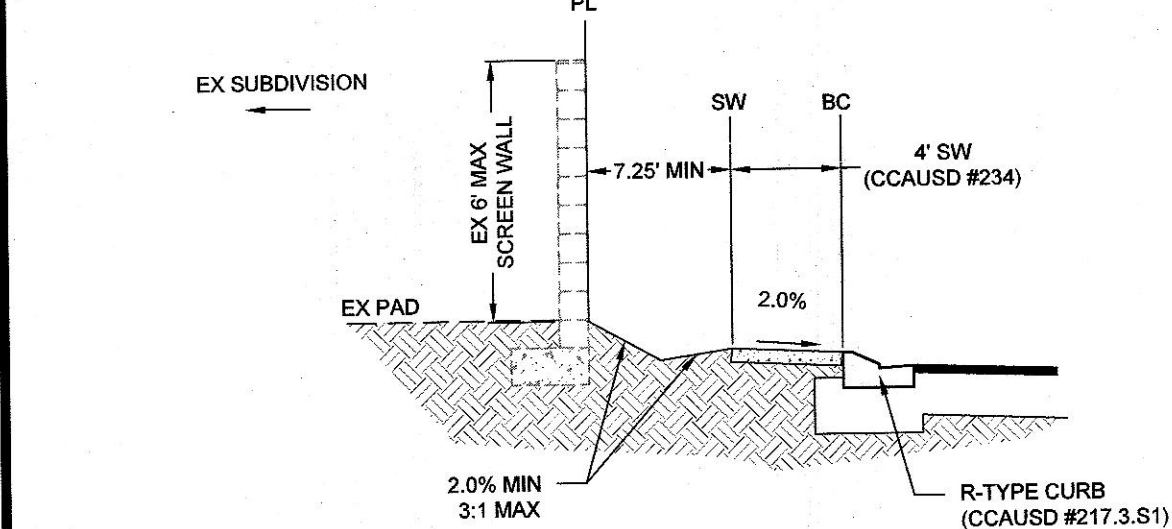
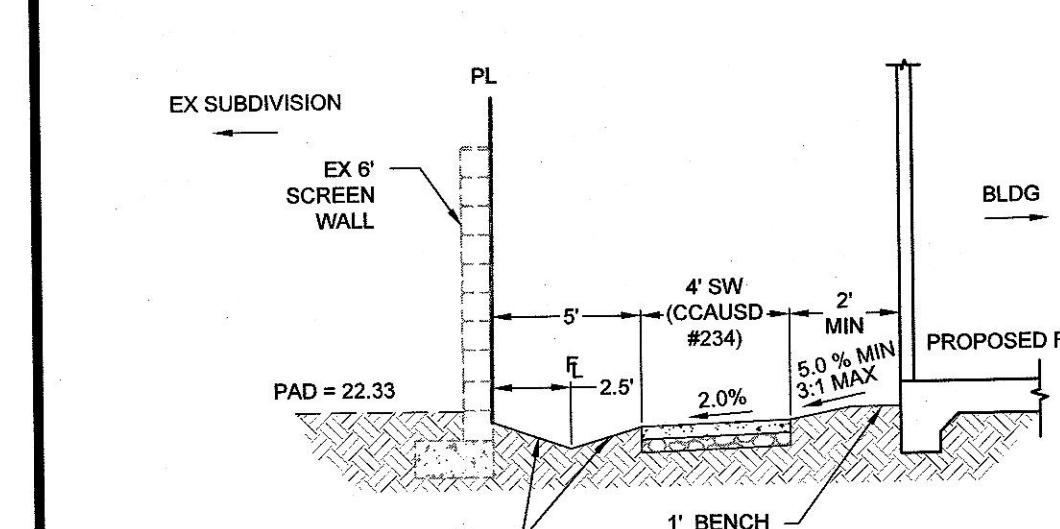
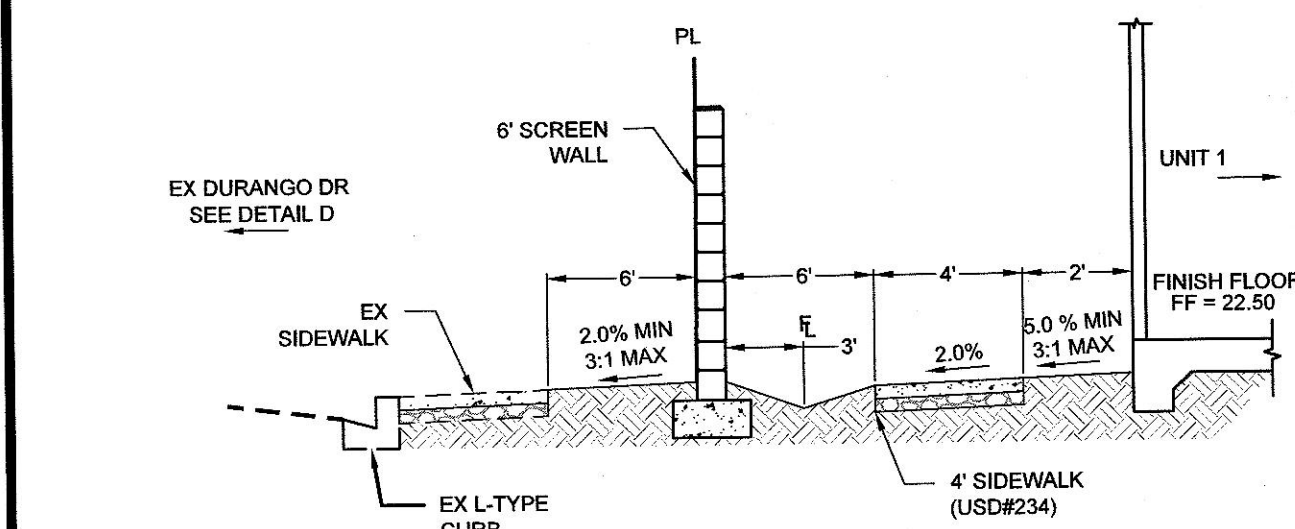
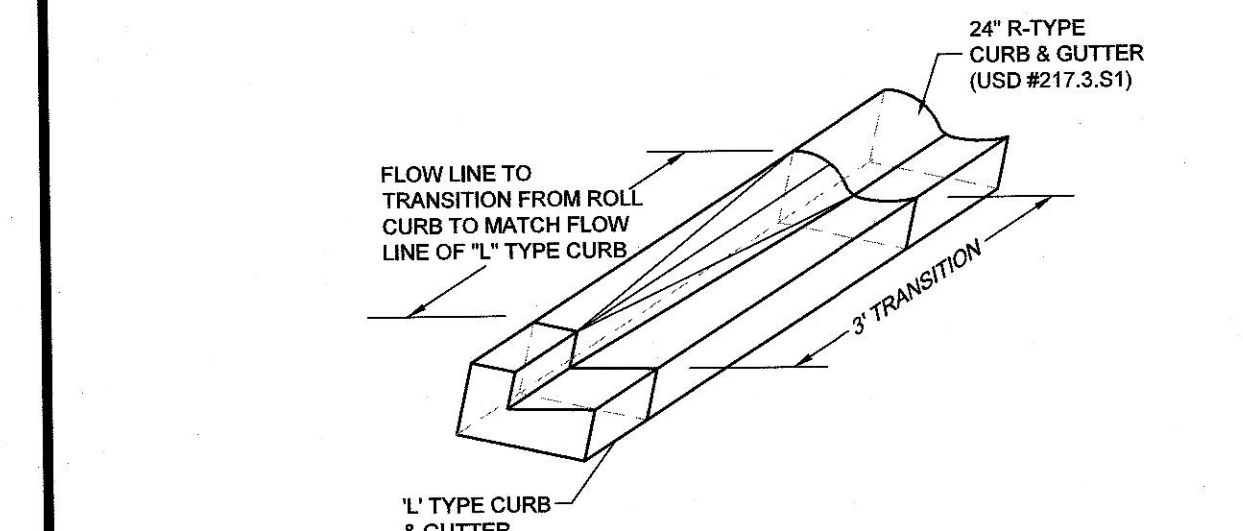
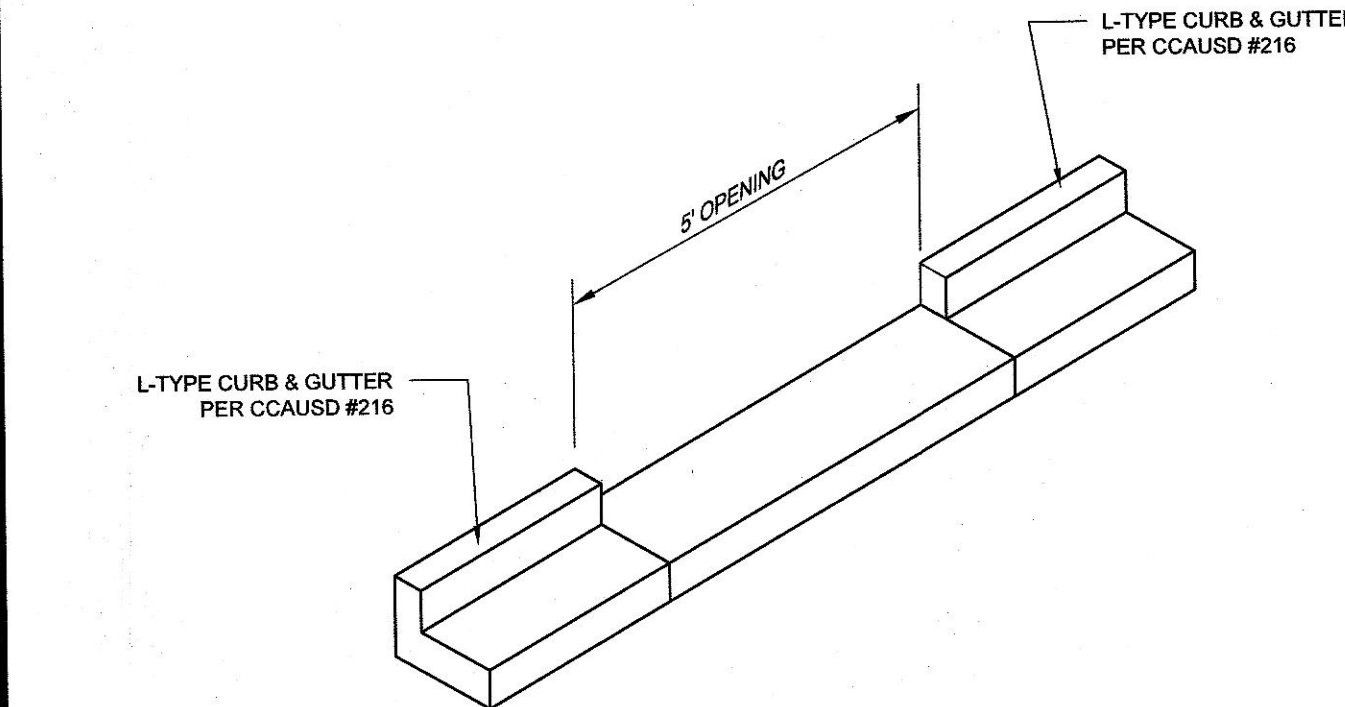
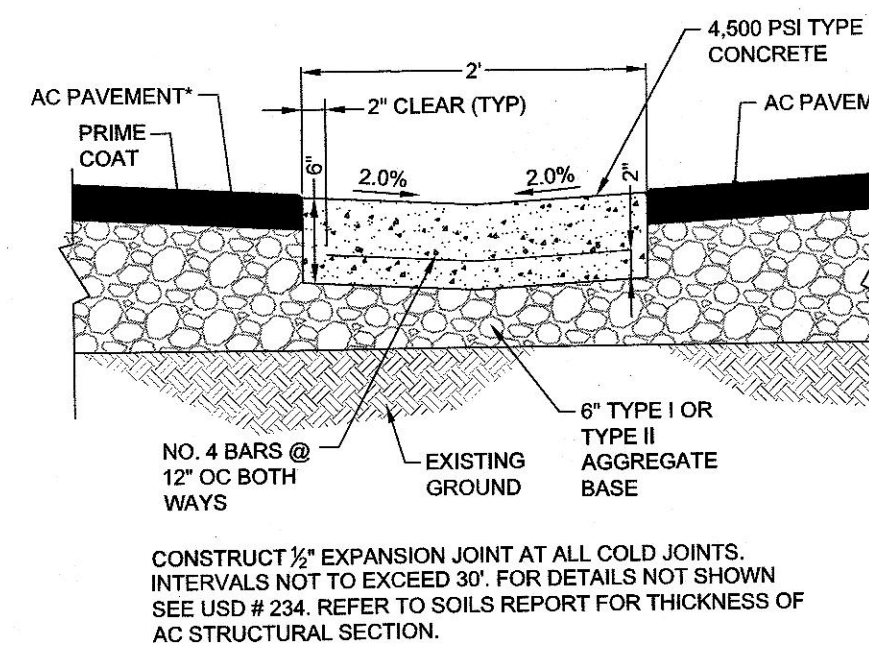
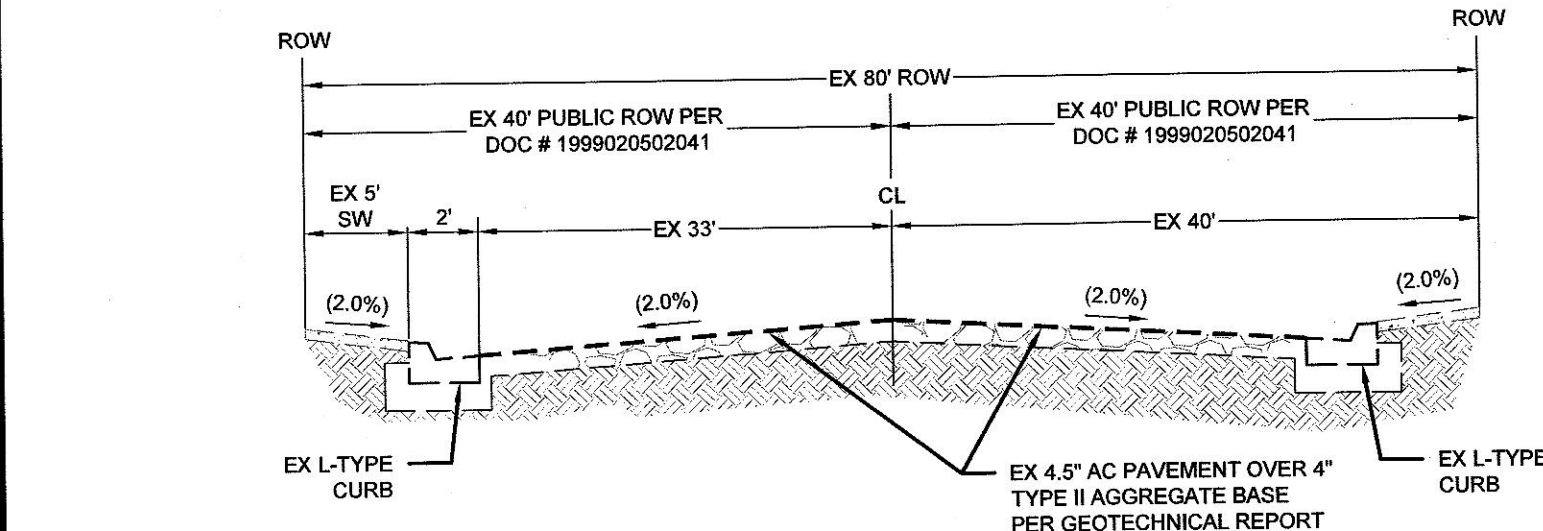
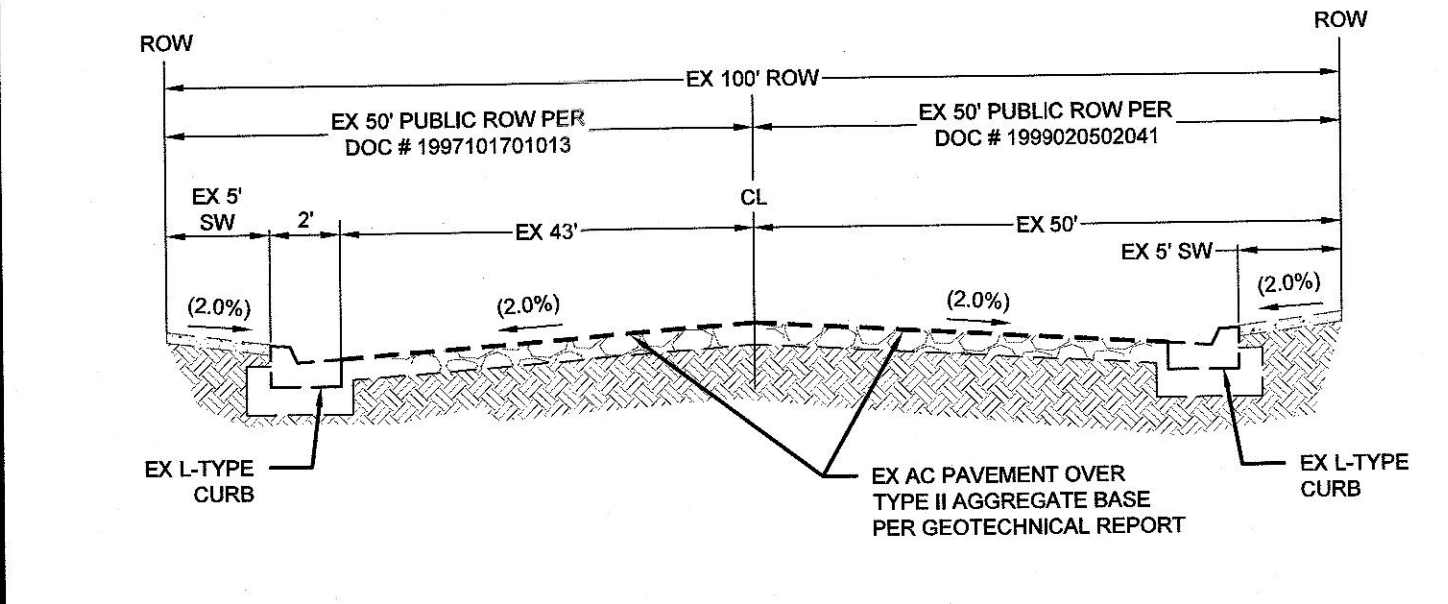
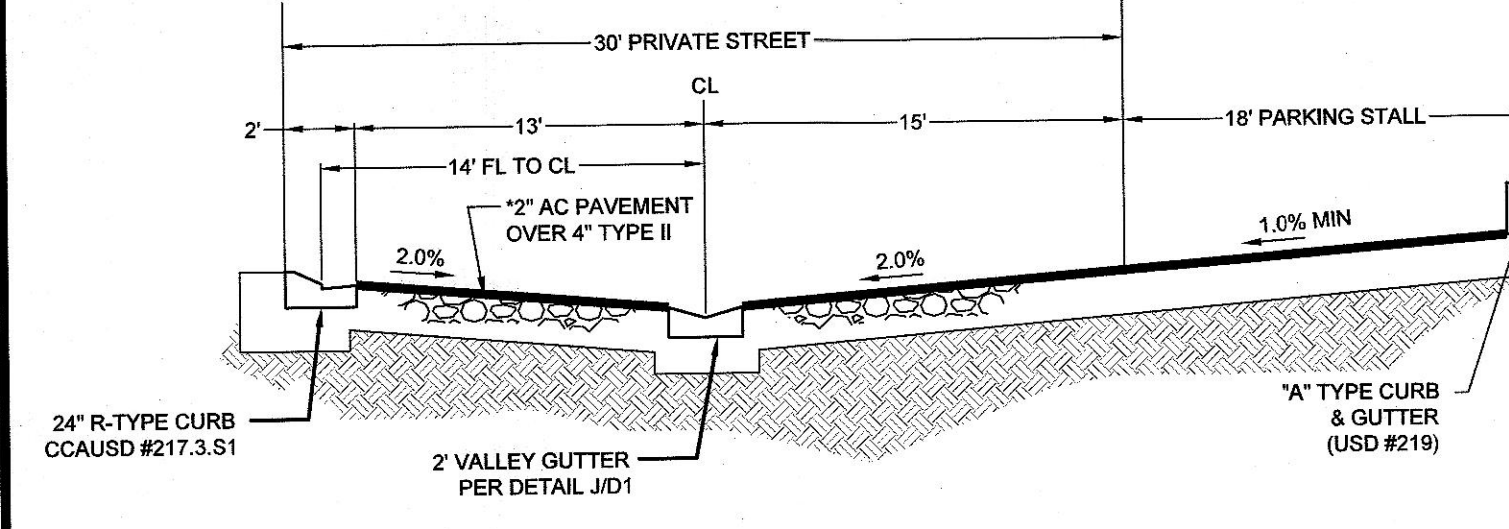
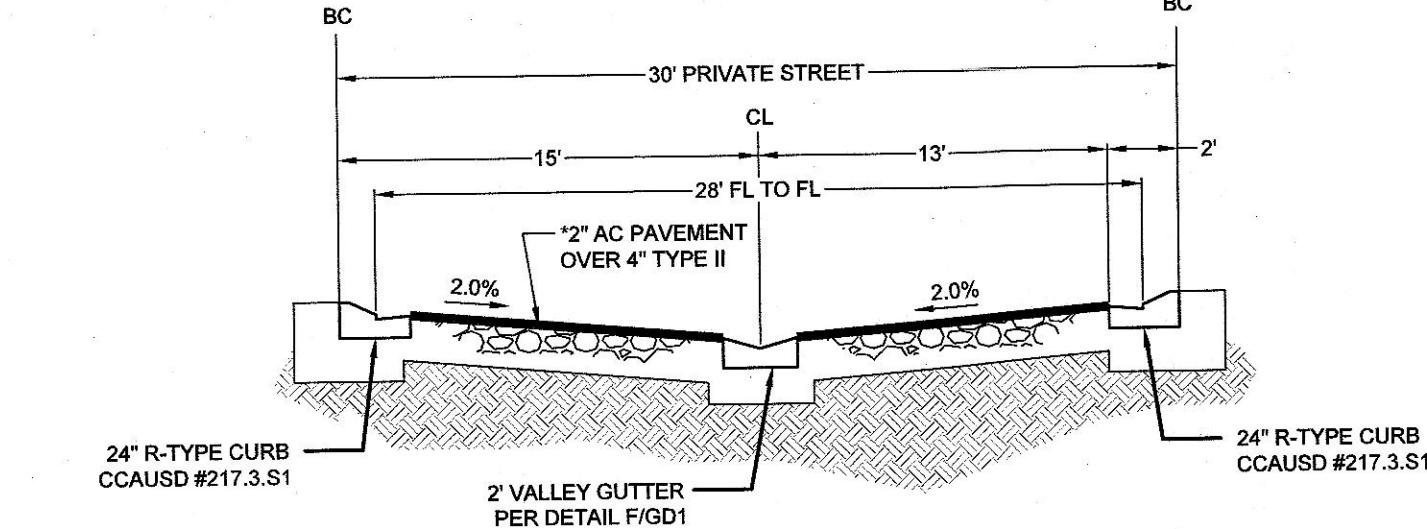
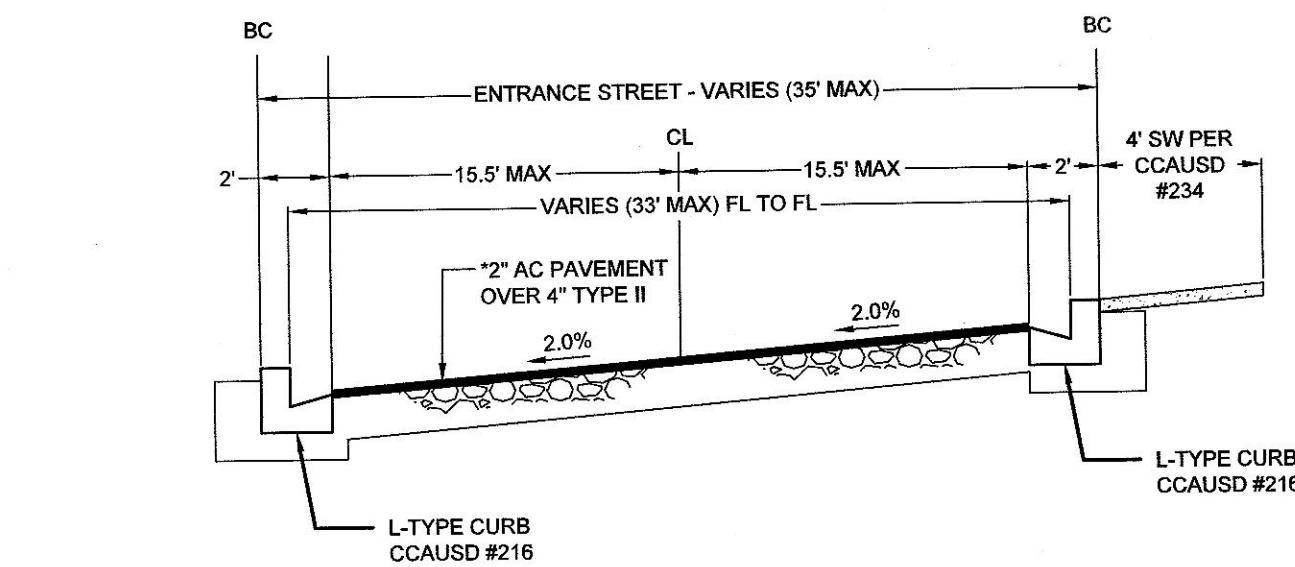
DESIGNED BY: JD CHECKED BY: RC

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SHEET NUMBER: C1

01 OF 07

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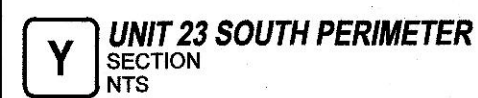


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OR
1-800-227-2600

 EST. 2000		TANEY & ENGINEERING 8030 S. JONES BOULEVARD LAS VEGAS, NV 89118 (702) 332-5844 EMAIL: INFO@TANEECORP.COM		NO.		DESCRIPTION		BY		SHTS.		APPR.		DATE	
DURANGO & GOWAN		TOWNHOMES		GRADING DETAIL 2		REVISIONS									
DATE: 6/3/2020		SCALE: 1"=30'		BRN-19-002		DESIGNED BY: JD		CHECKED BY: RC		HEET NAME: GD2		HEET NUMBER: 06 OF 07		LV 00000000	