DS #: 5127

APN: 125-10-402-001 & 125-10-402-005

PROJECT: Rael & Tioga Residential Development

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:

CITY OF LAS VEGAS NEVADA

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: May 15, 2019
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Racel & Tioga Residential Development**			**COPIES TO:** Taney Engineering
Cross Streets:	SEC of Racel Street & Tioga Way			Adaven Homes
File Number:	F:\Depot\DSMemos\DS5127A.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-10-402-001 & 125-10-402-005			CCPW
Zoning Action:	TMP-?????			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	4/22/2019	5/14/2019	See Comments Below	$400.00	3099486: $400
			TOTAL FEES (LDDRS):	**$400.00**	**----**

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**TMP-?????**) 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.

   The civil plans do not propose any street improvements such as sidewalk and curb & gutter in the perimeter streets. Provide zoning/planning approval letter to verify waiver of street improvements in the next submittal.

2. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department.* The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.

3. The site is adjacent to the jurisdiction of Clark County. The engineer must coordinate with *Clark County Public Works Department* (CCPW) and incorporate any concerns for boundary conditions along the east and west borders. CCPW concurrence is required prior to final approval of the drainage study.

4. The subject study provides many drainage conditions maps from *Figure 8* to *Figure 14.* Some maps are actually overlapping but inconsistent, for example, *Figure 8 (Existing Condition)* and *Figure 12 (Existing Condition Offsite).*

   - Overlapping: Both Figures cover the same offsite and onsite areas. Why can't the two maps consolidate into one? Same for *Figure 10 / Figure 13* and *Figure 11 / Figure 14.*

   - Inconsistent: Some of the parameters at the same concentration point shows different values. For example, at CP1, the flow split shows FS1-E for 175/526 and FS1-S for 104/438 in *Figure 8*, but it shows FS1-E for 181/619 and FS1-S for 98/345 in *Figure 12.* There may be other inconsistency in the two maps. Review and explain the inconsistency in the next submittal.

   - Inconsistent: In the *Developed Condition Table*: For example, "CS A Racel 60' RW DEV 10YR / 100YR" shows 1.13'/2.00' in Figure 10, but 0.53'/0.76' in Figure 13 or 6.05ft/s/9.82ft/s in Figure 10, but 25.57ft/s/39.78ft/s in Figure 13 etc. This is disturbing for the reviewer. Provide an overall and better quality control in all the drainage conditions maps in the next submittal.

   - Simplify the presentation of drainage maps as possible.

5. The subject study states that the 10-Yr/100-Yr flows at the intersection of *Buffalo Drive* and *Racel Street* during the existing and developed conditions are 279cfs/964cfs. However, with the construction of the *Floyd Lamb Park Detention Basin* upstream of *Racel* and the *Buffalo* channel south of *Racel,* the 100-year flow in *Racel* has been greatly reduced in the vicinity of the subject development. The City, however, takes no exception if the engineer uses a higher flow rate to design the interior roadways and set the finished floor elevations accordingly.

6. In all drainage conditions except the ultimate condition, it is not likely that *Ackerman Avenue* adjacent to the south subdivision gets only 2cfs during a 100-year storm event. According to the Developed Condition, there are 215cfs in *Ackerman* west of the *Tioga* alignment and 218cfs in *Tioga* north of *Ackerman.* These two flow combine at the intersection of the two streets, a flow split occur and it is likely that Ackerman get more than 2cfs. Provide a flow split calculation at the intersection and revise all the hydraulic parameters in *Ackerman* and set the finished floor of houses along *Ackerman* accordingly.

7. **Sheet G1**: Per previous comments, the flow volume, flow depths and flow velocities are confusing as presented in the drainage conditions maps. The reviewer, however, estimate that the 100-year flow depth in Tioga Way should be about 1' and the velocity will be erosive. In this case, the interior *Private Street* must provide a hump with a minimum of 6" of freeboard.

   The proposed high point in *Private Street* does not meet the criteria. Review and revise the grading plan and the plan & profile sheet PP1 accordingly.

   Re-establish the proposed finished floor elevations accordingly.

   The perimeter walls shall be solid grouted at least 3-course to the bottom with 8"-CMU or equivalent.

   The proposed drainage easement must be "Public" drainage easement and COMMOM LOT to be privately maintained by the HOA.

   Clearly identify the existing drainage easement in the adjacent subdivision to the south and label with recorded document or final map number on the grading plan.

8. **Sheet G2**: Per previous comments, the flow volume, flow depths and flow velocities are confusing as presented in the drainage conditions maps. The reviewer, however, estimate that the 100-year flow depth in *Racel Street* should be at least 1' and the velocity will be erosive. In this case, the whole interior *Private Street* will be inundated up to the cul-de-sac end!

   Revise the *Private Street* so that the inundation shall not exceed fifty feet into the subdivision. Revise the plan & profile sheet PP3 accordingly.

   Re-establish the proposed finished floor elevations accordingly.

   The perimeter walls shall be solid grouted at least 3-course to the bottom with 8"-CMU or equivalent.

   The drainage easement in Lot 2 must be "Public" drainage easement to be privately maintained by the property owner.

9. **Sheet GD1**: Sections B, C and E: Revise the label Private to "PUBLIC" drainage easement to be privately maintained. Clearly call out the surface material in the drainage easements to be "CONCRETE".

In an effort to increase administrative efficiency, for all original and re-submittal packages including updates and the addenda, the City of Las Vegas Public Works Department requires both a hardcopy and a digital copy (PDF) on CD for the drainage study.

A letter sealed and signed by a Nevada registered civil engineer must be included in every submittal certifying documents on the electronic CD matches 100% of the hardcopy submittal. The new submittal requirement is effective on May 1, 2019. If there are any questions regarding these new requirements, please contact Albert Sung in the City Flood Control Section at (702) 229-6541.



Sample Letter to certify CD.pdf

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

END OF REMARKS
ays

T/R/S: T19S/R60E/10
AREA G-10

TECHNICAL DRAINAGE STUDY

FOR

Racel & Tioga

Residential Development

ADV-18-101

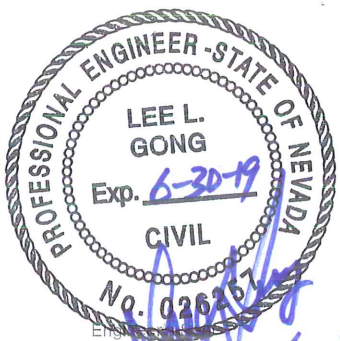
RACEL & TIOGA

City of Las Vegas

17 APRIL 2019

Prepared for:

Andrew Acuna
Adaven Homes
10091 Park Run Drive, #110
Las Vegas, NV 89145
(702) 365-8588



4-17-19

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: Racel & Tioga Development Date: Apr 17, 2019

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

East/West: Tioga

b) Section: 10 Township: 19S Range: 60E

c) APN : 125-10-402-001 & 005

Name of Owner: Adaven Homes

Telephone No.: (702) 365-8588 Fax No.: E-Mail Address:

Address: 10091 Park Run Drive, #110 Las Vegas, NV 89145

Contact Person-Name: Lee Gong, P.E. **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: 4.56+/- acres Being Developed/Disturbed: 5.34 +/- acres
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ **Yes**** ☒ **No**
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☐ **Yes**** ☒ **No**
4. Proposed type of development (Residential, Commercial, Etc.): Residential
5. Approximate upstream land area which drains to the subject site: 750+/- acres
6. Has the site drainage been evaluated in the past? ☒ **YES** ☐ **NO** If yes, please identify documentation: HTE: 13-46531
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: The site has two discharge points, the first discharge point will be to Racel St. and the second discharge point will be to an existing drainage easement in Verona Estates.
8. Briefly describe your proposed schedule for the subject project: A.S.A.P

PROFESSIONAL ENGINEER - STATE OF NEVADA
LEE L. GONG
Exp. 6-30-19
CIVIL
No. 026257

Engineer's Seal 4-17-19

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/01/2008

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name:	RACEL & TIOGA	Map ID:			
Firm Name:	TANEY ENGINEERING	Engineers:	Lee Gong, P.E.		
Address:	6030 S. JONES BLVD				
City:	LAS VEGAS	State:	NV	Zip:	89118
Phone Number:	(702)-362-8844	Fax Number:	(702)-362-5233		
Property Owner:	Adaven Homes				
Address:	10091 Park Run Drive, #110				
City:	LAS VEGAS	State:	NV	Zip:	89145

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	
X		Design Manual **Standard Form 1** with the engineer's seal and signature.
X		Design Manual **Standard Form 4**
X		2 Copies of the 24"x36" Drainage Plan
	X	A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

II. MAPS AND EXHIBITS

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

II. DRAINAGE PLAN

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE:	**STANDARD FORM 2**

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE:	STANDARD FORM 2

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
X		Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
X		Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. Q_{100} d x v ≤ 8. Q_{10} d x v ≤ 6 and 12 foot dry lane rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the grading plan.
	N/A	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
	N/A	Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
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.
X		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**

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1 INTRODUCTION AND GENERAL INFORMATION

1.1 Introduction

Adaven Homes is proposing to develop a new residential community on the east side of North Tioga Way and south of Racel Street. This residential development covers approximately 4.56 acres and will include 8 residential homes. This technical drainage study presents detailed hydrologic and hydraulic analyses for the existing and proposed onsite and offsite development, as required in the *Clark County Regional Flood Control District Hydrologic Criteria and Design Manual* (*HC&DDM*).

1.2 Location of Property

In general, the subject site is located east of North Tioga Way and south of Racel Street in Clark County, Nevada. The site is located within a portion of the Southwest Quarter (SW ¼) of the Southwest Quarter (SW ¼) of Section 10, Township 19 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 4.56 acres. Specifically the site includes APN 125-10-402-001 and 125-10-402-005. APN 125-10-402-001 site is bounded on the west by Tioga Way and to the north by Racel Street. To the east there is the existing developed residential lot. To the south the site is bordered by undeveloped land. APN 125-10-402-005 site is bounded on the west by Tioga Way and to the north by undeveloped land. To the east there are existing developed residential lots. To the south the site is bordered by the developed Verona Estates subdivision. The site exists in a natural desert condition, having shallow alluvial streams, sloping from northwest to southeast at a slope of approximately zero to four percent.

1.4 Floodplain Information

The Federal Emergency Management Agency (FEMA), Flood Insurance Rate Map (FIRM), Community Panel Numbers 32003C1745E, effective September 27, 2002, designates the project site as Zone 'X'. Zone 'X' is described as an area determined to be outside the 0.2% annual chance floodplain. See Figure 3 in Appendix A for the most current panel being used in this study.

1.5 Master Planning Information

1.5.1 CCRFCD 2018 Master Plan Update

As shown on *Figure F-11* of the *Las Vegas Valley Flood Control Master Plan Update of the Clark County Regional Flood Control District (MPU)*, the site is not bordered or crossed by any planned or existing regional flood control facilities. See Figures 6 and 6A for reproductions of the MPU figures for the project site.

The *MPU* does show an existing facility approximately 0.07 miles to the south of the project site. There is also a proposed local facility located along the Racel Street located directly north of APN 125-10-402-001.

1.5.2 Northwest Neighborhood Study by City of Las Vegas, revised Sept. 1999

The project site is located on Figures *E-8, E-9* and *F-8, F-9* of the *City of Las Vegas Northwest Neighborhood Study.* Refer to Figures 4, 4A, 5, and 5A of this study for reproductions of these figures, respectively.

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 Sections 500 and 600 of the HCDDM. 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 impacted by offsite runoff from the north and west portions of the project site. This flow will stay as offsite flow and the project site will be protected with retention walls along Racel and Tioga for parcel 125-10-402-001. Parcel 125-10-402-005 will be protected from offsite runoff from the north and west portions of the site with retention walls. The site itself will be developed as residential homes with a minimum lot size of 20,000sf. There is one street for each parcel, Lecar Street and Agoit Street, with a proposed high point approximately at each entrance of the site. One onsite basins will discharge to Racel (125-10-402-001) through a street flow and the other basin (125-10-402-005) will discharge to an existing drainage easement in Verona Estates.

3.2 Previous Drainage Studies

There were numerous Technical Drainage Studies that have been previously approved in the vicinity of the subject site. Although several studies were reviewed for general information, only the studies of which specific information was referenced are listed below. All reference material can be found in Appendix D.

Final Design Report Floyd Lamb Park North and South Environmental Enhancement Areas, LAS22O09

The Floyd Lamb Park Final Design report is located north of Racel St. and west of Coke St. This existing regional flood control basin and existing local park. The site conveys offsite flow through the park in multiple underground storm drain systems. Outlet flows from the Floyd Lamb Park have been referenced for use in all condition analysis of this study.

A review of this drainage study revealed the basins upstream of the Floyd Lamb Park convey most of the storm flow in the existing, interim and developed conditions. However, in the ultimate condition the flows are reduced dramatically with the proposed future storm drains west of I-95. The previously mentioned flows have been accepted and referenced for use in this study.

Technical Drainage Study for Verona Estates, HTE:13-46531

The Verona Estates Residential Development is a subdivision north of Grand Teton and east of Tioga Way. This single-family residential development conveys some offsite flow through multiple drainage easements. The drainage easement and the flows that were designed for have only been referenced for this study. The previously mentioned flows that drainage easement can handle have been accepted for use in this study.

Technical Drainage Study for Horse and Coke, DS4636

The Horse and Coke residential development is located west of Coke St and north of Racel St. This single-family residential development conveys onsite flow via surface flow to Coke St. Outlet flows from the subdivision have been referenced for use in all condition analysis of this study.

For all condition analysis of Horse and Coke, only the onsite flows from the subdivision have been referenced in this study. The previously mentioned flows have been accepted and referenced for use in this study.

4 HYDROLOGIC ANALYSIS

4.1 Existing Condition

In the existing condition offsite flow impacts the site from the existing surface flow from the northwest. Refer to Figure 8, *Existing Basin Map*, for basin boundaries and flow paths.

In the existing condition the project site is affected by offsite flow. This offsite flow comes from the west of I-95 highway. Flow is conveyed east through 3 underground drainage easements that takes the flow to Floyd Lamb Park. The flow is either conveyed north or south of the Floyd Lamb Park. The north portion of the flow is conveyed directly to Floyd Lamb Park where all the flow is retrieved.

The southern portion of the flow is conveyed through Racel as surface flow. There are numerous drain inlets to collect the flow to convey it to Floyd Lamb Park. The remaining amount that is not retrieved stays as surface flow. When the flow reaches the southwest corner of Floyd Lamb Park in Racel, the flow is 263/927 cfs. This flow will continue to travel east in Racel as it was designed. To remain conservative with this study, it was assumed the Stone Mountain Common area will collect none of the flow in Racel and the flow will continue east.

The REF1 flow of 263/927 cfs will combine with basins ST17, DST18, REF2, ST16, and DST15 at concentration point CP1. Once the flow reaches the intersection of Racel and Buffalo, a flow split occurs. A total of 98/345 cfs will be diverted and travel south on Buffalo Drive. The remaining amount of 181/619 cfs will continue east on Racel. From here the flow that continues in Racel will combine with DST14, ST13 and DOF5 at concentration point CP2. On CP2 another flow split occurs at Racel and Tioga, where 66/215 cfs heads south on Tioga and the remaining amount travels east on Racel. The remaining amount of 116/408 cfs combines with DST1 and ST2 at concentration point CP3. From here the flow continues to travel east away from the site matching existing drainage patterns.

The diverted flow from CP1 travels south on Buffalo and combines with DST12 and DOF3 at concentration point CP4. At CP4 there is another flow split, where the majority of the flow continues to travel south on Buffalo. However, a small amount of flow <1/20 travels east on Ackerman Ave. To remain conservative it was assumed the flow continues on Ackerman Ave instead of traveling southeast as the contours indicate. The flow from CP4 that continues east on Ackerman combines with ST10 and ST11 at concentration point CP5.

The diverted flow from CP2 that continues south on Tioga combines with DOF6, ST3 and ST4 at concentration point CP6. Note: a portion of DOF6 travels northeast and southeast, to remain conservative it was assumed DOF6 in its entirety will travel down Tioga to CP6. The flow continues to head south on Tioga where it combines with ST5, DOF4, and ST6 at concentration point CP7. Once the flow reaches CP7 it will combine with CP5 and continue to travel south on Tioga where it also combines with ST8, ST9 and DOF2 at concentration point CP8. From here the flow travels away from the site matching existing drainage patterns.

The onsite basin XON1 flows southeast where it combines with XOF1 and ST7 at concentration point 9. From here the flow travels east on Ackerman away from the site matching existing drainage patterns. Onsite flow from basin XON2 travels towards the southeast corner of the site where it is conveyed through an existing drainage easement in Verona Estates.

4.2 Interim Condition

In the interim condition, the subject site becomes developed, and the offsite basins remain in the existing condition. Refer to Figure 9, *Interim Basin Map*, for basin boundaries and flow paths. The proposed onsite development includes residential homes with a minimum lot size of 20,000sf. There is one street for each parcel, Lecar Street and Agoit Street, with a proposed high point approximately at each entrance of the site

There is an existing 10' public drainage easement with a concrete valley gutter along the southeast corner of the project site to convey runoff from DON2. The REF1 flow of 263/927 cfs will combine with basins IST17, DST18, REF2, IST16, and DST15 at concentration point ICP1. Once the flow reaches the intersection of Racel and Buffalo, a flow split occurs. A total of 98/345 cfs will be diverted and travel south on Buffalo Drive. The remaining amount of 181/619 cfs will continue east on Racel. From here the flow that continues on Racel will combine with DST12, IST11 and DOF5 at concentration point CP2. At ICP2 another flow split occurs at Racel and Tioga, where 66/215 cfs heads south on Tioga and the remaining amount travels east on Racel. The remaining amount of 116/408 cfs combines with DST1, IST2, and DON1 at concentration point ICP3. From here the flow continues to travel east away from the site matching existing drainage patterns.

The diverted flow from ICP1 travels south on Buffalo and combines with DST10 and DOF3 at concentration point ICP4. At ICP4 there is another flow split, where the majority of the flow continues to travel south on Buffalo. However, a small amount of flow (<1/20) travels east on Ackerman Ave. To remain conservative it was assumed the flow continues on Ackerman Ave instead of traveling southeast as the contours indicate. The flow from ICP4 that continues east on Ackerman combines with ST8 and ST9 at concentration point ICP5.

The diverted flow from ICP2 that continues south on Tioga combines with DOF6 and IST3 at concentration point CP6. Note: a portion of DOF6 travels northeast and southeast, to remain conservative it was assumed DOF6 in its entirety will travel down Tioga to ICP6. The flow continues to head south on Tioga where it combines with IST4 and DOF4 at concentration point ICP7. Once the flow reaches ICP7 it will combine with ICP5 and continue to travel south on Tioga where it also combines with ST7 and DOF2 at concentration point ICP8. From here the flow travels away from the site matching existing drainage patterns.

Offsite basin XOF1 follows the same path as in the existing condition and will combine with IST5 and IST6 and concentration ICP9. From here the flow will continue east on Ackerman matching existing drainage patterns.

4.3 Developed Condition

In the Developed condition it is assumed the subject site and all the offsite basins are fully developed. Refer to Figure 9, *Developed Basin Map* for basin boundaries and flow paths.

There is an existing 10' public drainage easement with a concrete valley gutter along the southeast corner of the project site to convey runoff from DON2. The REF1 flow of 263/927 cfs will combine with basins DST17, DST18, REF2, DST16, and DST15 at concentration point DCP1. Once the flow reaches the intersection of Racel and Buffalo, a flow split occurs. A total of 98/345 cfs will be diverted and travel south on Buffalo Drive. The remaining amount of 181/619 cfs will continue east on Racel. From here the flow that continues on Racel will combine with DST12, DST11 and DOF5 at concentration point DCP2. At of DCP2 another flow split occurs at Racel and Tioga, where 66/215 cfs heads south on Tioga and the remaining amount travels east on Racel. The remaining

amount of 117/409 cfs combines with DST1, DST2, and DON1 at concentration point DCP3. From here the flow continues to travel east away from the site matching existing drainage patterns.

The diverted flow from DCP1 travels south on Buffalo and combines with DST9 and DOF3 at concentration point DCP4. At DCP4 there is another flow split, where the majority of the flow travels east on Buffalo. In the developed condition Ackerman is considered to be developed in the rural condition. To remain conservative it is assumed the flow continues on Ackerman Ave instead of traveling southeast as the contours indicate. The flow from DCP4 that continues east on Ackerman combines with DST7 and DST8 at concentration point DCP5.

The diverted flow from DCP2 that continues south on Tioga combines with DOF6 and DST3 at concentration point DCP6. Note: a portion of DOF6 travels northeast and southeast; to remain conservative it is assumed DOF6 in its entirety will travel down Tioga to DCP6. The flow continues to head south on Tioga where it combines with DST4 and DOF4 at concentration point DCP7. Once the flow reaches DCP7 it will combine with DCP5 and continue to travel south on Tioga where it also combines with DST5 and DOF2 at concentration point DCP8. From here the flow travels away from the site matching existing drainage patterns.

It is assumed offsite basin DOF1 follows the same path as in the existing condition and will combine with DST6 at concentration ICP9. From here the flow will continue east on Ackerman matching existing drainage patterns.

4.4 Ultimate Condition

In the ultimate condition it is assumed the subject site and all the offsite basins are fully developed. Refer to Figure 11, *Ultimate Basin Map*, for basin boundaries and flow paths.

There is an existing 10’ public drainage easement with a concrete valley gutter along the southeast corner of the project site to convey runoff from DON2. The REF1 flow of 6/24 cfs will combine with basins UST17, UST18, REF2, UST16, and UST15 at concentration point UCP1. Once the flow reaches the intersection of Racel and Buffalo, a flow split occurs. A total of 7/21 cfs will be diverted and travel south on Buffalo Drive. The remaining amount of 15/40 cfs will continue east on Racel. From here the flow that continues on Racel will combine with UST10, UST11 and DOF5 at concentration point UCP2. At of UCP2 another flow split occurs at Racel and Tioga, where 6/17 cfs heads south on Tioga and the remaining amount travels east on Racel. The remaining amount of 11/28 cfs combines with UST1, UST2, and DON1 at concentration point UCP3. From here the flow continues to travel east away from the site matching existing drainage patterns.

The diverted flow from UCP1 travels south on Buffalo and combines with UST9 and DOF3 at concentration point UCP4. At UCP4 there is another flow split, where the majority of the flow continues to travel east on Buffalo. In the developed condition Ackerman is considered to be developed in the rural condition. To remain conservative it is assumed the flow continues on Ackerman Ave instead of traveling southeast as the contours indicate. The flow from UCP4 that continues east in Ackerman combines with UST7 and UST8 at concentration point UCP5.

The diverted flow from UCP2 continues south on Tioga combines with DOF6 and UST3 at concentration point UCP6. Note: a portion of DOF6 travels northeast and southeast; to remain conservative it is assumed DOF6 in its entirety will travel down Tioga to DCP6. The flow continues to head south on Tioga where it combines with UST4 and DOF4 at concentration point UCP7. Once the flow reaches UCP7 it will combine with UCP5 and continue to travel south on Tioga where it also combines with UST5 and DOF2 at concentration point UCP8. From here the flow travels away from the site matching existing drainage patterns.

It is assumed offsite basin DOF1 follows the same path as it did in the existing condition and will combine with UST6 at concentration UCP9. From here the flow will continue east on Ackerman matching existing drainage patterns.

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 7, 8 and 9. All street sections do not meet VxD and depth requirements for the 10-year and 100-year storm events in the existing condition and will not be made worse in the interim or developed condition.

Lecar Street and Agoit Street is being designed as a 48’ public street without a crown; the street cross sections slopes from west to east at 2%. Tioga Way is a typical 60’ rural public street matching the downstream street section. Racel Street is a 60’ public street with the north portion being fully developed and the southern portion in rural standards.

5.2 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.

The proposed finished floor elevations have also been protected to a minimum of twice the depth of flow along the northern wall fronting Racel Street and the western wall fronting Tioga Way. Cross sections D and H provides worst case hydraulic calculations for flow along the western wall and cross section C along the northern wall fronting Racel Street.

The proposed finished floor elevations have also been protected to a minimum of 18” above the water surface elevation and weir elevation where adjacent to drainage easements.

6 SUMMARY TABLES

Table 1: Basin Summary

Existing Condition			
Basin	**Area (acres)**	**Q_{10} (cfs)**	**Q_{100} (cfs)**
XON1	2.06	<1	1
XON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
ST2	0.23	<1	1
ST3	0.24	<1	1
ST4	0.24	<1	<1
ST5	0.26	<1	1
ST6	0.26	<1	<1
ST7	0.22	<1	<1
ST8	0.26	<1	1
ST9	0.26	<1	<1
ST10	0.45	<1	<1
ST11	0.41	<1	1
DST12	0.78	1	3
ST13	0.42	<1	1
DST14	0.42	1	2
DST15	0.51	1	2
ST16	0.50	1	1
ST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
CP1	-	279	964
CP2	-	182	623
CP3	-	117	410
CP4	-	99	348
CP5	-	<1	21

Interim Condition			
Basin	**Area (acres)**	**Q_{10} (cfs)**	**Q_{100} (cfs)**
DON1	2.06	<1	1
DON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
IST2	0.23	<1	1
IST3	0.24	<1	1
IST4	0.24	<1	1
IST5	0.26	<1	<1
IST6	0.26	<1	<1
IST7	0.22	<1	1
IST8	0.26	<1	<1
IST9	0.26	<1	1
IST10	0.45	1	3
IST11	0.41	<1	1
DST12	0.78	1	2
DST15	0.51	1	2
IST16	0.50	1	1
IST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
ICP1	-	279	964
ICP2	-	182	623
ICP3	-	117	411
ICP4	-	99	348
ICP5	-	<1	21
ICP6	-	67	216
ICP7	-	67	218

Developed Condition			
Basin	**Area (acres)**	**Q_{10} (cfs)**	**Q_{100} (cfs)**
DON1	2.06	<1	1
DON2	2.46	<1	1
DOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
DST2	0.23	<1	1
DST3	0.24	<1	1
DST4	0.24	<1	1
DST5	0.26	<1	1
DST6	0.26	<1	1
DST7	0.22	<1	1
DST8	0.26	<1	1
DST9	0.26	1	3
DST10	0.45	1	1
DST11	0.41	1	2
DST15	0.51	1	2
DST16	0.50	1	2
DST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
DCP1	-	279	964
DCP2	-	183	624
DCP3	-	117	411
DCP4	-	99	348
DCP5	-	51	215
DCP6	-	67	216
DCP7	-	67	218
DCP8	-	119	434

CP6	-	66	216
CP7	-	67	218
CP8	-	67	239
CP9	-	<1	2
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	<1	20
FS2-S	-	99	328
FS3-E	-	116	408
FS3-S	-	66	215

ICP8	-	67	240
ICP9	-	<1	1
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	<1	20
FS2-S	-	99	328
FS3-E	-	116	408
FS3-S	-	66	215

DCP9	-	<1	2
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	50	213
FS2-S	-	49	135
FS3-E	-	117	409
FS3-S	-	66	215

Ultimate Condition			
Basin	**Area (acres)**	**Q_{10} (cfs)**	**Q_{100} (cfs)**
XON1	2.06	<1	1
XON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
DST2	0.23	<1	1
DST3	0.24	<1	1
DST4	0.24	<1	1
DST5	0.26	<1	1
DST6	0.26	<1	1
DST7	0.22	<1	1
DST8	0.26	<1	1
DST9	0.26	1	3
DST10	0.45	1	1
DST11	0.41	1	2
DST15	0.51	1	2
DST16	0.50	1	2
DST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	6	24
REF2**	-	13	31
UCP1	-	22	61
UCP2	-	17	45

UCP3	-	12	31
UCP4	-	8	24
UCP5	-	3	16
UCP6	-	6	19
UCP7	-	7	20
UCP8	-	10	37
UCP9	-	1	2
FS1-E	-	15	40
FS1-S	-	7	21
FS2-E	-	2	14
FS2-S	-	6	10
FS3-E	-	11	28
FS3-S	-	6	17

Table 2: Cross Section Summary

Existing Condition						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
CS A RACEL 60' RW EX. 10 YR	CP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW EX. 100 YR	CP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW EX 10 YR	CP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW EX 100 YR	CP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW EX 10 YR	CP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW EX 100 YR	CP3	410	1.49	0.58	32.73	18.98
CS D TIOGA 60' RW EX 10 YR	CP6	66	0.27	0.37	9.39	3.47
CS D TIOGA 60' RW EX 100 YR	CP6	216	0.27	0.53	13.59	7.20
CS E TIOGA 60' RW EX 10 YR	CP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW EX 100 YR	CP6	218	0.61	0.46	17.97	8.27
CS F ACKERMAN 60' RW EX 10 YR	CP5	1	0.61	0.06	3.92	0.24
CS F ACKERMAN 60' RW EX 100 YR	CP5	21	0.61	0.20	8.41	1.68
CS G ACKERMAN 60' RW EX 10 YR	CP9	1	0.61	0.09	4.85	0.44
CS G ACKERMAN 60' RW EX 100 YR	CP9	2	0.61	0.12	5.77	0.69
CS H TIOGA 60' RW EX 10 YR	CP8	67	1.61	0.27	17.40	4.70
CS H TIOGA 60' RW EX 100 YR	CP8	240	1.61	0.40	25.68	10.27
CS I 3' VALLEY GUTTER EX 100 YR	XON2	1	0.01	0.16	2.03	0.32

Interim Condition						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
CS A RACEL 60' RW INT 10 YR	ICP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW INT 100 YR	ICP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW INT 10 YR	ICP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW INT 100 YR	ICP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW INT 10 YR	ICP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW INT 100 YR	ICP3	411	1.49	0.58	32.75	19.00
CS D TIOGA 60' RW INT 10 YR	ICP6	67	0.27	0.35	9.26	3.24
CS D TIOGA 60' RW INT 100 YR	ICP6	212	0.27	0.52	13.51	7.03
CS E TIOGA 60' RW INT 10 YR	ICP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW INT 100 YR	ICP6	214	0.61	0.45	17.86	8.04
CS F ACKERMAN 60' RW INT 10 YR	ICP5	0.1	0.61	0.03	2.23	0.07
CS F ACKERMAN 60' RW INT 100 YR	ICP5	21	0.61	0.20	8.41	1.68
CS G ACKERMAN 60' RW INT 10 YR	ICP9	0.1	0.01	0.09	0.63	0.06
CS G ACKERMAN 60' RW INT 100 YR	ICP9	2	0.01	0.28	1.32	0.37
CS H TIOGA 60' RW INT 10 YR	ICP8	67	1.61	0.26	16.71	4.34
CS H TIOGA 60' RW INT 100 YR	ICP8	240	1.61	0.40	25.68	10.27
CS I 3' VALLEY GUTTER INT 100 YR	DON2	1	0.01	0.16	2.03	0.32

Developed Condition						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
CS A RACEL 60' RW DEV 10 YR	DCP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW DEV 100 YR	DCP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW DEV 10 YR	DCP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW DEV 100 YR	DCP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW DEV 10 YR	DCP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW DEV 100 YR	DCP3	411	1.49	0.58	32.75	19.00
CS D TIOGA 60' RW DEV 10 YR	DCP6	67	0.27	0.35	9.26	3.24
CS D TIOGA 60' RW DEV 100 YR	DCP6	212	0.27	0.52	13.51	7.03
CS E TIOGA 60' RW DEV 10 YR	DCP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW DEV 100 YR	DCP6	218	0.61	0.48	18.02	8.65
CS F ACKERMAN 60' RW DEV 10 YR	DCP5	50	0.61	0.27	10.98	2.96
CS F ACKERMAN 60' RW DEV 100 YR	DCP5	215	0.61	0.45	17.89	8.05
CS G ACKERMAN 60' RW DEV 10 YR	DCP9	1	0.01	0.21	1.11	0.23
CS G ACKERMAN 60' RW DEV 100 YR	DCP9	2	0.01	0.28	1.32	0.37
CS H TIOGA 60' RW DEV 10 YR	DCP8	119	1.61	0.31	20.32	6.30
CS H TIOGA 60' RW DEV 100 YR	DCP8	435	1.61	0.49	31.19	15.28
CS I 3' VALLEY GUTTER DEV 100 YR	DON2	2	0.01	0.23	2.50	0.58

Ultimate Condition						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
CS A RACEL 60' RW ULT 10 YR	UCP1	22	1.21	0.27	12.33	3.33
CS A RACEL 60' RW ULT 100 YR	UCP1	21	1.21	0.26	12.14	3.16
CS B RACEL 60' RW ULT 10 YR	UCP2	17	1.14	0.26	11.87	3.09
CS B RACEL 60' RW ULT 100 YR	UCP2	45	1.14	0.33	15.16	5.00
CS C RACEL 60' RW ULT 10 YR	UCP3	12	1.49	0.23	12.10	2.78
CS C RACEL 60' RW ULT 100 YR	UCP3	31	1.49	0.29	15.19	4.41
CS D TIOGA 60' RW ULT 10 YR	UCP6	6	0.27	0.15	4.53	0.68
CS D TIOGA 60' RW ULT 100 YR	UCP6	19	0.27	0.23	6.03	1.39
CS E TIOGA 60' RW ULT 10 YR	UCP6	7	0.61	0.13	6.39	0.83
CS E TIOGA 60' RW ULT 100 YR	UCP6	20	0.61	0.20	8.32	1.66
CS F ACKERMAN 60' RW ULT 10 YR	UCP5	3	0.61	0.13	8.87	1.15
CS F ACKERMAN 60' RW ULT 100 YR	UCP5	16	0.61	0.25	13.47	3.37
CS G ACKERMAN 60' RW ULT 10 YR	UCP9	1	0.01	0.21	1.11	0.23
CS G ACKERMAN 60' RW ULT 100 YR	UCP9	1	0.01	0.21	1.11	0.23
CS H TIOGA 60' RW ULT 10 YR	UCP8	10	1.61	0.13	10.02	1.30
CS H TIOGA 60' RW ULT 100 YR	UCP8	37	1.61	0.21	13.96	2.93
CS I 3' VALLEY GUTTER ULT 100 YR	DON2	2	0.01	0.23	2.50	0.58

Table 3: Flow Split Summary

Flow Split Calculations						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
FS1-S BUFFALO & RACEL EX 10 YR	CP1	98	0.54	0.48	13.95	6.70
FS1-S BUFFALO & RACEL EX 100 YR	CP1	345	0.54	0.67	20.31	13.61
FS1-E BUFFALO & RACEL EX 10 YR	CP1	181	1.21	0.48	24.11	11.57
FS1-E BUFFALO & RACEL EX 100 YR	CP1	619	1.21	0.67	35.30	23.65
FS2-S BUFFALO & ACKERMAN EX 10 YR	CP2	99	0.32	0.36	8.48	3.05
FS2-S BUFFALO & ACKERMAN EX 100 YR	CP2	328	0.32	0.55	12.58	6.92
FS2-E BUFFALO & ACKERMAN EX 10 YR	CP2	0.1	0.63	0.03	2.72	0.08
FS2-E BUFFALO & ACKERMAN EX 100 YR	CP2	20	0.63	0.20	9.50	1.90
FS3-E RACEL & TIOGA EX 10 YR	CP4	116	1.14	0.42	20.54	8.63
FS3-E RACEL & TIOGA EX 100 YR	CP4	408	1.14	0.60	29.74	17.84
FS3-S RACEL & TIOGA EX 10 YR	CP4	66	0.27	0.35	9.22	3.23
FS3-S RACEL & TIOGA EX 100 YR	CP4	215	0.27	0.53	13.57	7.19

Flow Split Calculations						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
FS1-S BUFFALO & RACEL DEV 10 YR	DCP1	98	0.54	0.48	13.95	6.70
FS1-S BUFFALO & RACEL DEV 100 YR	DCP1	345	0.54	0.67	20.31	13.61
FS1-E BUFFALO & RACEL DEV 10 YR	DCP1	181	1.21	0.48	24.11	11.57
FS1-E BUFFALO & RACEL DEV 100 YR	DCP1	619	1.21	0.67	35.30	23.65
FS2-S BUFFALO & ACKERMAN DEV 10 YR	DCP2	117	1.14	0.43	20.60	8.86
FS2-S BUFFALO & ACKERMAN DEV 100 YR	DCP2	409	1.14	0.61	29.76	18.15
FS2-E BUFFALO & ACKERMAN DEV10 YR	DCP2	66	0.27	0.35	9.22	3.23
FS2-E BUFFALO & ACKERMAN DEV100 YR	DCP2	215	0.27	0.53	13.57	7.19
FS3-E RACEL & TIOGA DEV 10 YR	DCP4	49	2	0.34	21.37	7.27
FS3-E RACEL & TIOGA DEV 100 YR	DCP4	135	2	0.50	27.55	13.78
FS3-S RACEL & TIOGA DEV 10 YR	DCP4	50	2	0.34	19.34	6.58
FS3-S RACEL & TIOGA DEV 100 YR	DCP4	213	2	0.49	27.72	13.58

Flow Split Calculations						
Cross Section	**Description**	**Q (cfs)**	**Slope (%)**	**Depth (ft)**	**Velocity (ft/s)**	**DxV**
FS1-S BUFFALO & RACEL ULT 10 YR	UCP1	7	0.54	0.25	7.34	1.84
FS1-S BUFFALO & RACEL ULT 100 YR	UCP1	21	0.54	0.32	9.53	3.05
FS1-E BUFFALO & RACEL ULT 10 YR	UCP1	15	1.21	0.25	11.83	2.96
FS1-E BUFFALO & RACEL ULT 100 YR	UCP1	40	1.21	0.32	15.00	4.80
FS2-S BUFFALO & ACKERMAN ULT 10 YR	UCP2	6	0.32	0.16	5.21	0.83
FS2-S BUFFALO & ACKERMAN ULT 100 YR	UCP2	10	0.32	0.17	5.49	0.93
FS2-E BUFFALO & ACKERMAN ULT 10 YR	UCP2	2	0.63	0.08	4.71	0.38
FS2-E BUFFALO & ACKERMAN ULT 100 YR	UCP2	14	0.63	0.17	7.70	1.31
FS3-E RACEL & TIOGA ULT 10 YR	UCP4	11	1.14	0.23	10.69	2.46
FS3-E RACEL & TIOGA ULT 100 YR	UCP4	28	1.14	0.29	13.46	3.90
FS3-S RACEL & TIOGA ULT 10 YR	UCP4	6	0.27	0.15	4.53	0.68
FS3-S RACEL & TIOGA ULT 100 YR	UCP4	17	0.27	0.22	5.87	1.29

7 CONCLUSIONS AND RECOMMENDATIONS

As detailed in this study, the Racel and Tioga 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 will be met. Proposed finished floor elevations are adequately protected and are set a minimum of 18" above the adjacent top of curb elevation.

8 REFERENCES

2008 & 2013 Clark County Regional Flood Control District Flood Control Master Plan Update, PBS&J, G. C. Wallace, and Louis Berger Group.

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

FlowMaster Version V8i, Haestad Methods, Inc.

Flood Insurance Rate Map Number 32003C1745E, dated September 27, 2002, Federal Emergency Management Agency.

HEC-1 Flood Hydrograph Package Version 4.1, June 1998, U.S. Army Corps of Engineers.

Final Design Report Floyd Lamb Park, Louis Berger Group, LAS 22O09, 2009

Technical Drainage Study for Horse and Coke, Taney Engineering, DS4636, 2015

Technical Drainage Study for Verona Estates, Advantage Civil Design , HTE 13-46531, 2013

APPENDIX

APPENDIX A

Figures

APPENDIX B

Hydrologic Calculations

APPENDIX C

Hydraulic Calculations

APPENDIX D

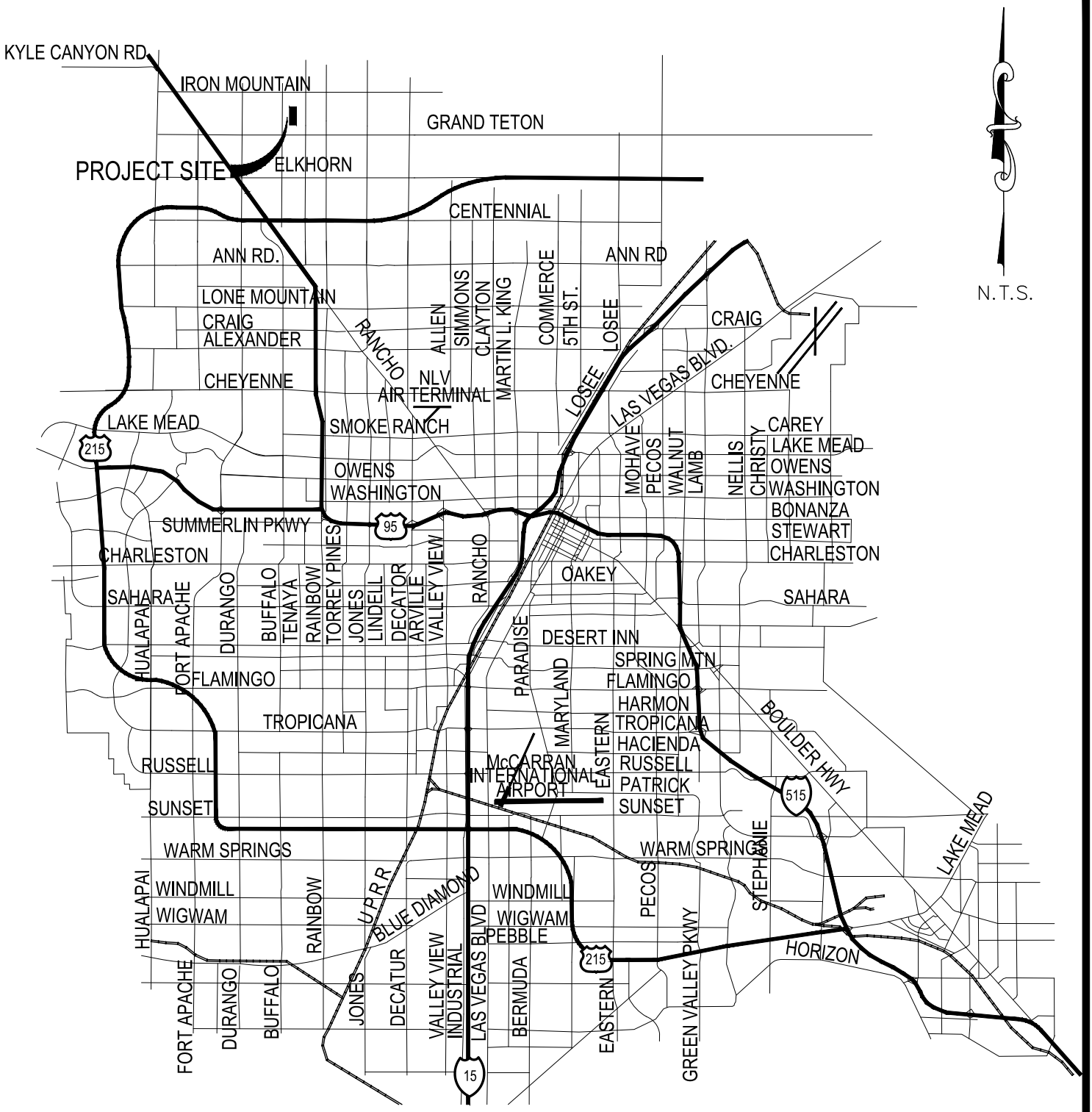
Reference Material

APPENDIX E

Improvement Plans

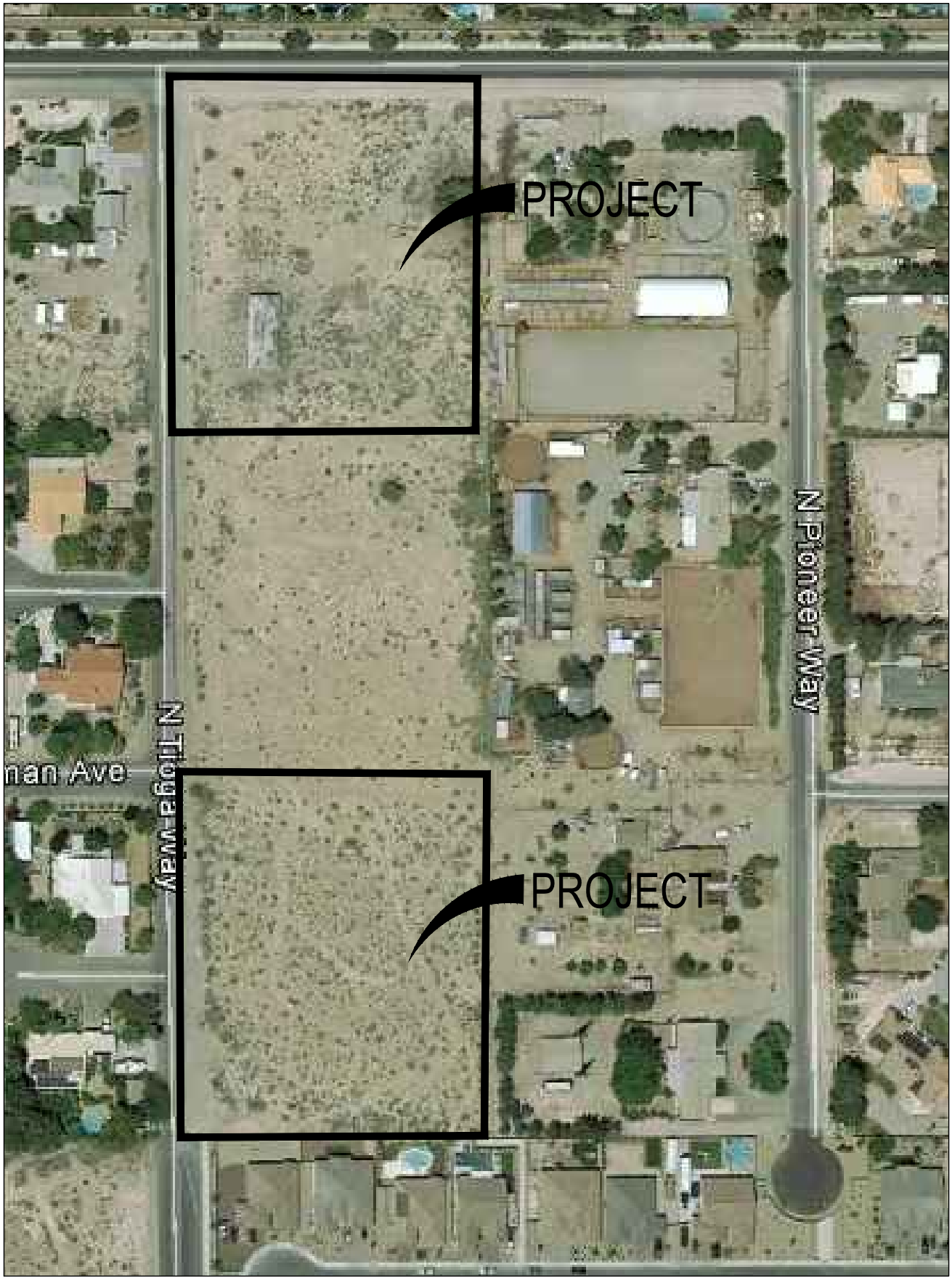
APPENDIX A

Figures



TANEY ENGINEERING
6030 S. JONES BLVD STE#100
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233

FIGURE 1
VICINITY MAP
RACEL & TIOGA



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LAS VEGAS, NV 89118
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FIGURE 2
LOCATION MAP
RACEL AND TIOGA

NOTES TO USERS

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

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

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

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

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

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

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

Vertical Network Branch, N/CG13
National Geodetic Survey, NOAA
Silver Spring Metro Center 3
1315 East-West Highway
Silver Spring, Maryland 20910
(301) 713-3191

To obtain current elevation, description, and/or location information for **bench marks** shown on this map, please contact the Information Services Branch of the National Geodetic Survey at **(301) 713-3242,** or visit their website at www.ngs.noaa.gov.

Base map information shown on this FIRM was provided in digital format by Clark County Regional Flood Control District. This information was converted using Orthophotography, dated 1999 or newer, and GBF/DIME data. Segments were digitized off of the orthophotography based on center of pavement.

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

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

An accompanying Flood Insurance Study report, Letters of Map Revision or Letters of Map Amendment revising portions of this panel, and digital versions of this PANEL may be available. Contact the **FEMA Map Service Center** at the following phone numbers and Internet address for information on all related products available from FEMA:

Phone: 800-358-9616
FAX: 800-358-9620
www.fema.gov/msc

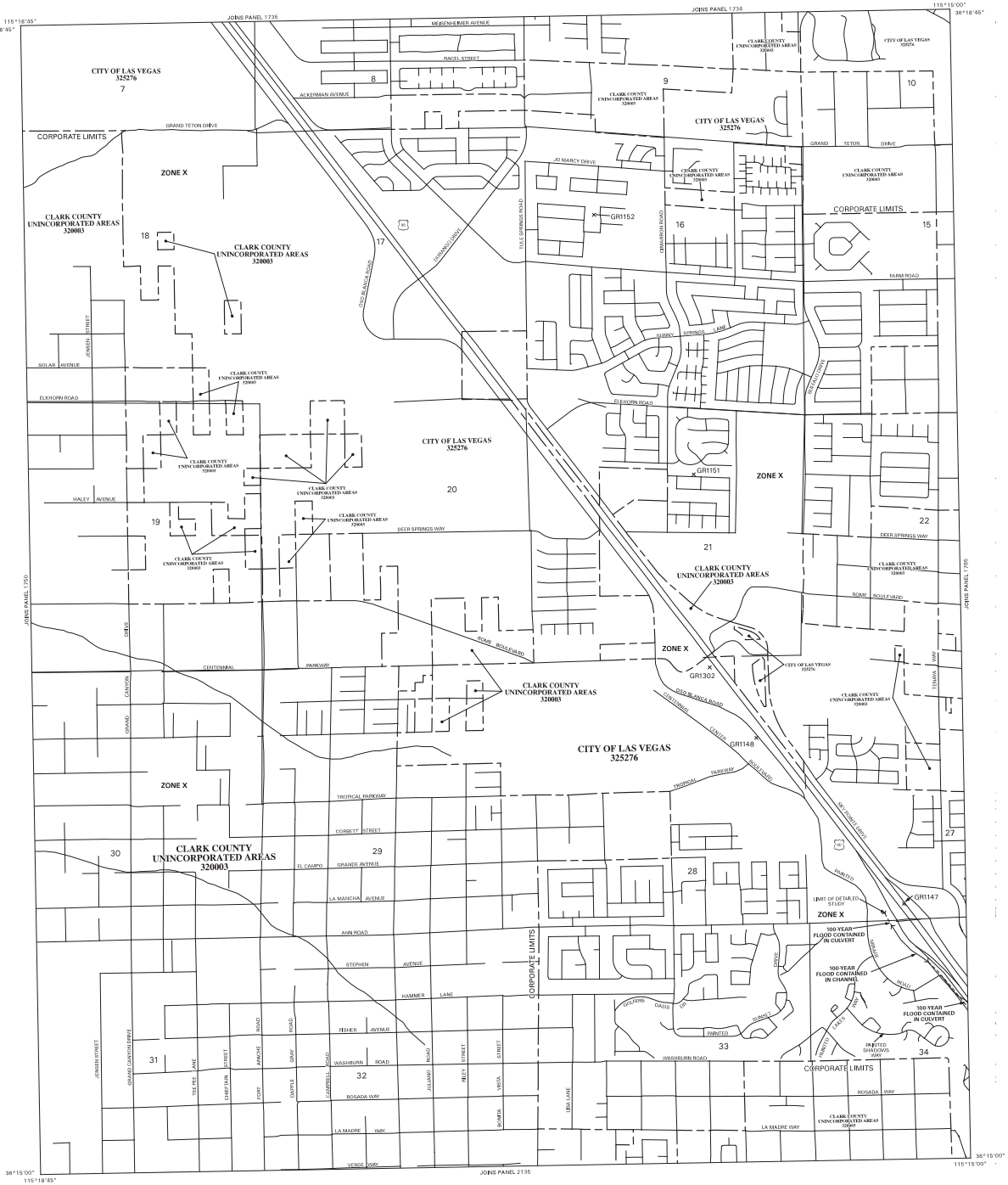
If you have **questions about this map** or questions concerning the National Flood Insurance Program in general, please call **1-877-FEMA-MAP** (1-877-336-2627) or visit the FEMA website at www.fema.gov.

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

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

This DFIRM reflects several innovative features. These include:
- Southern Nevada GIS--Cooperation among local governmental agencies throughout Clark County. The foundation of cooperation is the GIS Interlocal Agreements formed between fourteen regional participants. In part, the agreements specify that the Clark County GIS Management Office (GISMO) will be responsible for maintaining a GIS data warehouse and associated Southern Nevada GIS Metadata.
- The GISMO's responsibilities go beyond maintaining the GIS data warehouse. GISMO also maintains the Street Centerline Database used by 911 dispatch services. This centerline database serves as the base map for this DFIRM.

DIGITAL DATA AVAILABILITY: http://www.co.clark.nv.us/cell/gismo/gismo.htm


115°18'45"
36°18'45"
115°15'00"
36°15'00"
JOINS PANEL 1735
JOINS PANEL 1734
JOINS PANEL 1750
JOINS PANEL 1750
JOINS PANEL 2135
MEISENHEIMER AVENUE
RACHEL STREET
ACKERMAN AVENUE
GRAND TETON DRIVE
CORPORATE LIMITS
ZONE X
CLARK COUNTY UNINCORPORATED AREAS 320003
CITY OF LAS VEGAS 325276
JO MARCY DRIVE
GRAND TETON DRIVE
FARM ROAD
SUNNY SPRINGS LANE
ELKHORN ROAD
DEER SPRINGS WAY
ROME BOULEVARD
CENTENNIAL PARKWAY
TROPICAL PARKWAY
CORSETT STREET
EL CAMPO GRANDE AVENUE
LA MANCHA AVENUE
ANN ROAD
STEPHEN AVENUE
HAMMER LANE
FISHER AVENUE
WASHBURN ROAD
ROSADA WAY
LA MADRE WAY
VERDE WAY
HALEY AVENUE
SOLAR AVENUE
JENSEN STREET
GRAND CANYON DRIVE
TEE PEE LANE
CHEYENNE STREET
KANOSHE ROAD
FORT ROAD
CRATER ROAD
LAMBRETH ROAD
JULIARD ROAD
RILEY STREET
VISTA STREET
ROMA STREET
LISA LANE
TORREY PINES DRIVE
TENAYA WAY
DURANGO DRIVE
DECATUR BOULEVARD
SOUTH VALLEY VIEW BOULEVARD
OSO BLANCA ROAD
LAS VEGAS BOULEVARD
GR1148
GR1147
GR1151
GR1152
GR1302
100-YEAR FLOOD CONTAINED IN CULVERT
100-YEAR FLOOD CONTAINED IN CHANNEL
LIMIT OF DETAILED STUDY
PAINTED SHADOWS WAY
PAINTED DESERT DRIVE
PAINTED HILLS DRIVE
PAINTED CANYON DRIVE
GOLDEN OASIS DRIVE
SUNSET ROAD
SKY VIEW DRIVE
SKY VIEW LANE
SKY VIEW COURT
SKY VIEW DRIVE
SKY VIEW ROAD
SKY VIEW PARKWAY
SKY VIEW BOULEVARD
SKY VIEW STREET
SKY VIEW AVENUE
SKY VIEW WAY

CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY PHASE 2

LEGEND

SUB-BASIN BOUNDARY

FLOW ARROW

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

(FLOWS IN CFS)

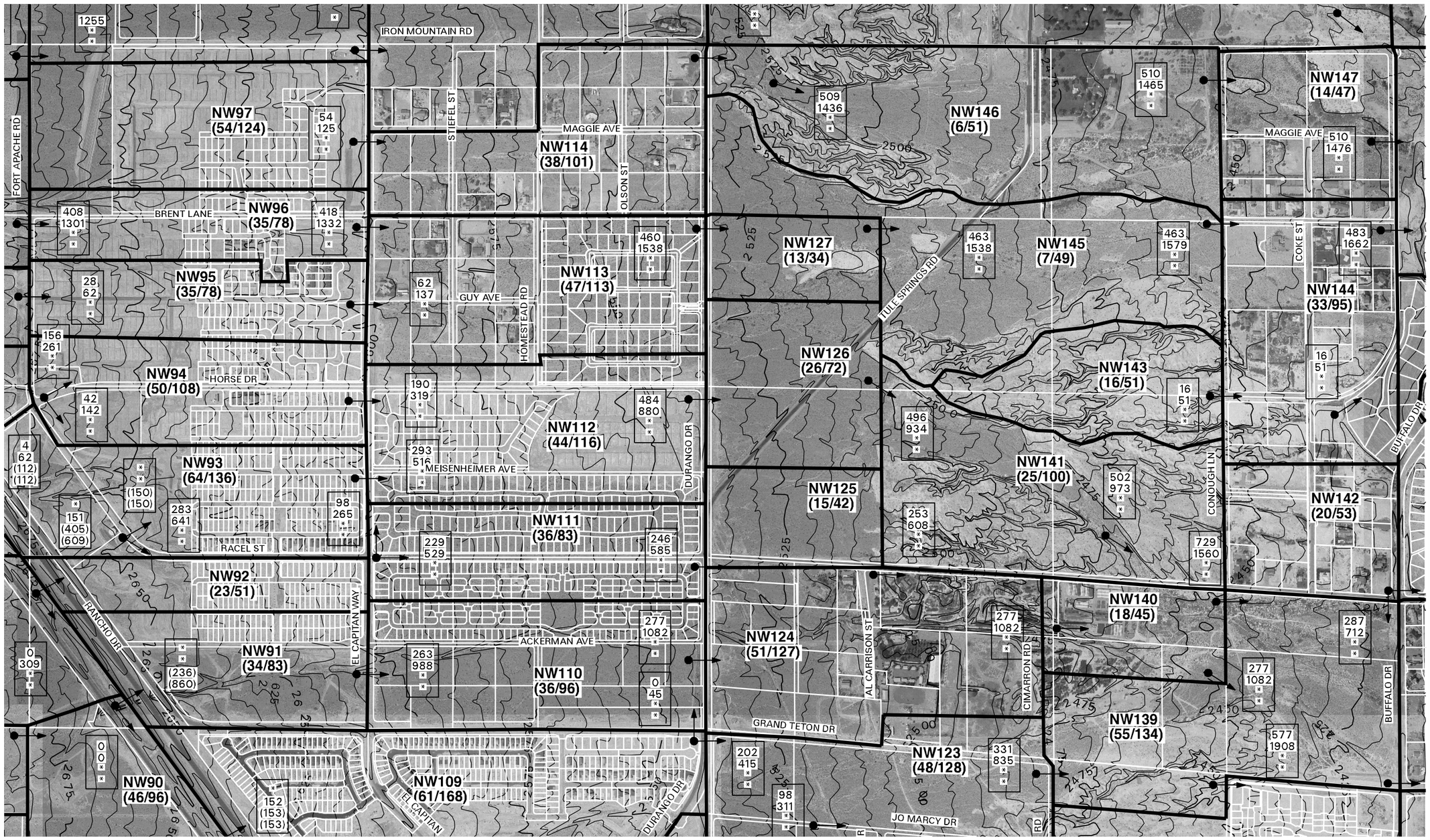
BWJS Basin-ID

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

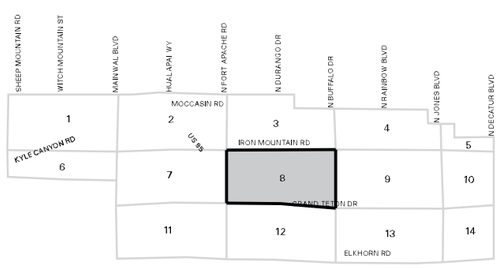
FIGURE 4

PHOTO DATE: SEPTEMBER 1998

FIGURE E-8



EXISTING DRAINAGE CONDITIONS



PBSJ
ENGINEERING PLANNING GIS SURVEYING CONSTRUCTION SERVICES
901 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014-6139
Phone: 702/263-7275
Fax: 702/263-7200

NOTE:

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

N W E S

800 600 400 200 0 400 800

(IN FEET)
SCALE: 1 INCH = 800 FEET

/FILES8/NWTEMP/E8.MAP

CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY PHASE 2

LEGEND

SUB-BASIN BOUNDARY

FLOW ARROW

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

(FLOWS IN CFS)

BWJS Basin-ID

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

FIGURE 4A

PHOTO DATE: SEPTEMBER 1998

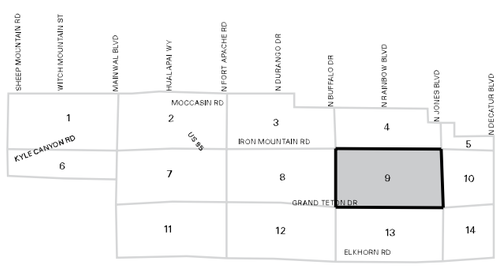
FIGURE E-9



EXISTING DRAINAGE CONDITIONS

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ENGINEERING PLANNING GIS SURVEYING CONSTRUCTION SERVICES

901 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014-6139
Phone: 702/263-7275
Fax: 702/263-7200



NOTE:

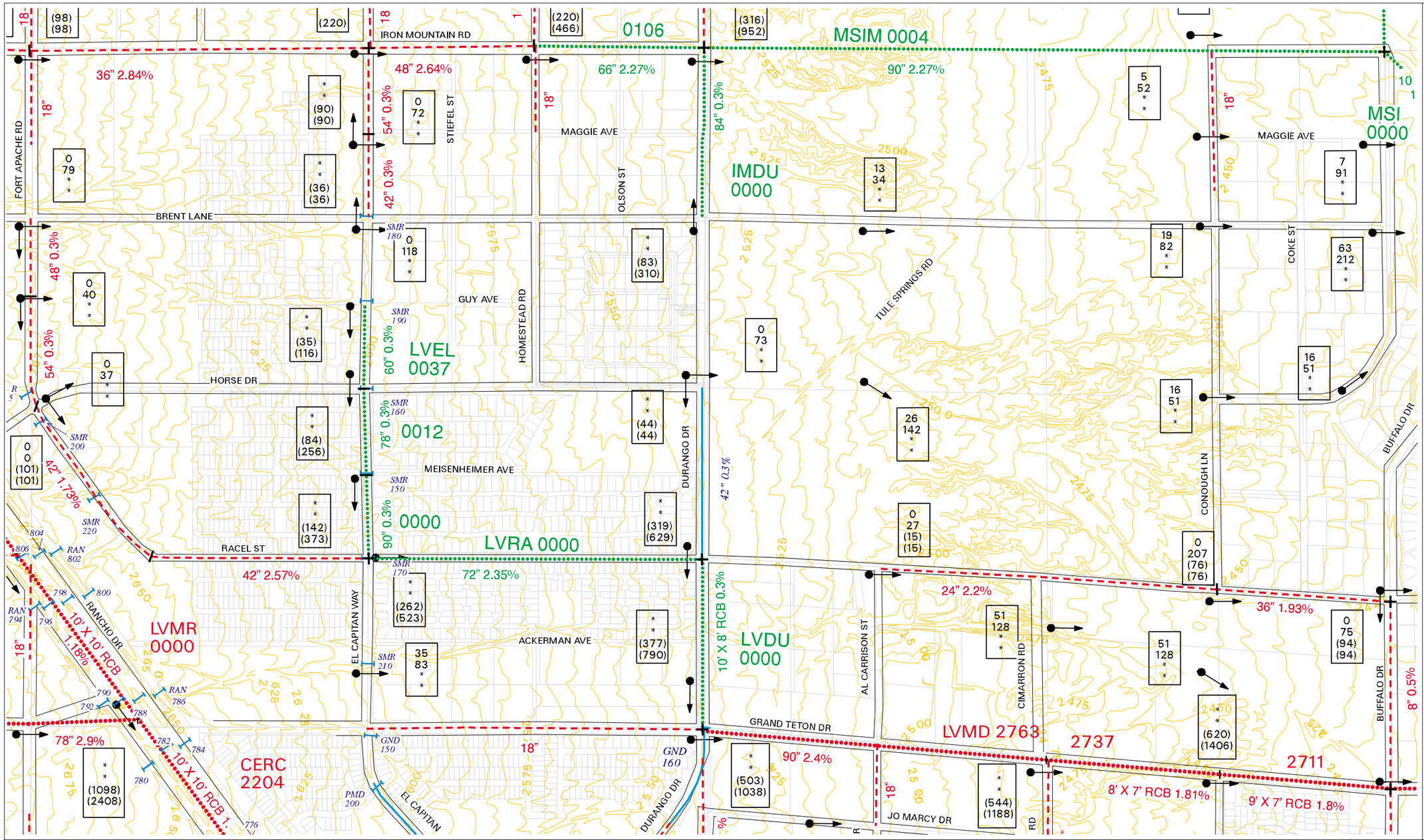
Existing conditions are based on future CN values with only existing local and CCRFCD facilities in place

N
W E
S

800 600 400 200 0 400 800

(IN FEET)
SCALE: 1 INCH = 800 FEET

/FILES8/NWTEMP/E9.MAP



CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY PHASE 2

LEGEND

- EXISTING REGIONAL DETENTION BASINS
- PROPOSED REGIONAL DETENTION BASINS (Not Included in 1996 MPU)
- EXISTING REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES (Not Included In 1996 MPU)
- EXISTING LOCAL BRIDGES
- PROPOSED REGIONAL CULVERT
- EXISTING REGIONAL CULVERT
- EXISTING LOCAL CULVERT
- EXISTING REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE (Not Included in 1996 MPU)
- EXISTING LOCAL PIPELINE
- PROPOSED LOCAL PIPELINE
- EXISTING REGIONAL CHANNEL
- PROPOSED REGIONAL CHANNEL
- EXISTING LOCAL CHANNEL
- PROPOSED LOCAL CHANNEL
- PROPOSED REGIONAL CHANNEL (Not Included In 1996 MPU)
- EXISTING REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE (Not Included In 1996 MPU)
- PROPOSED LOCAL DIKE/LEVEE

FIGURE F-8

FUTURE DRAINAGE CONDITIONS

FIGURE 5

N W E S

800 600 400 200 0 400 800

(IN FEET)
SCALE: 1 INCH = 800 FEET

FLOW ARROW

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

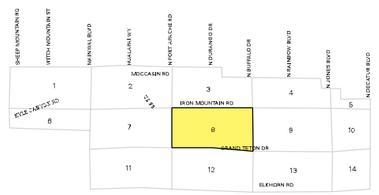
(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place.
Regional facility identifiers were established based on the methodology used in the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley."

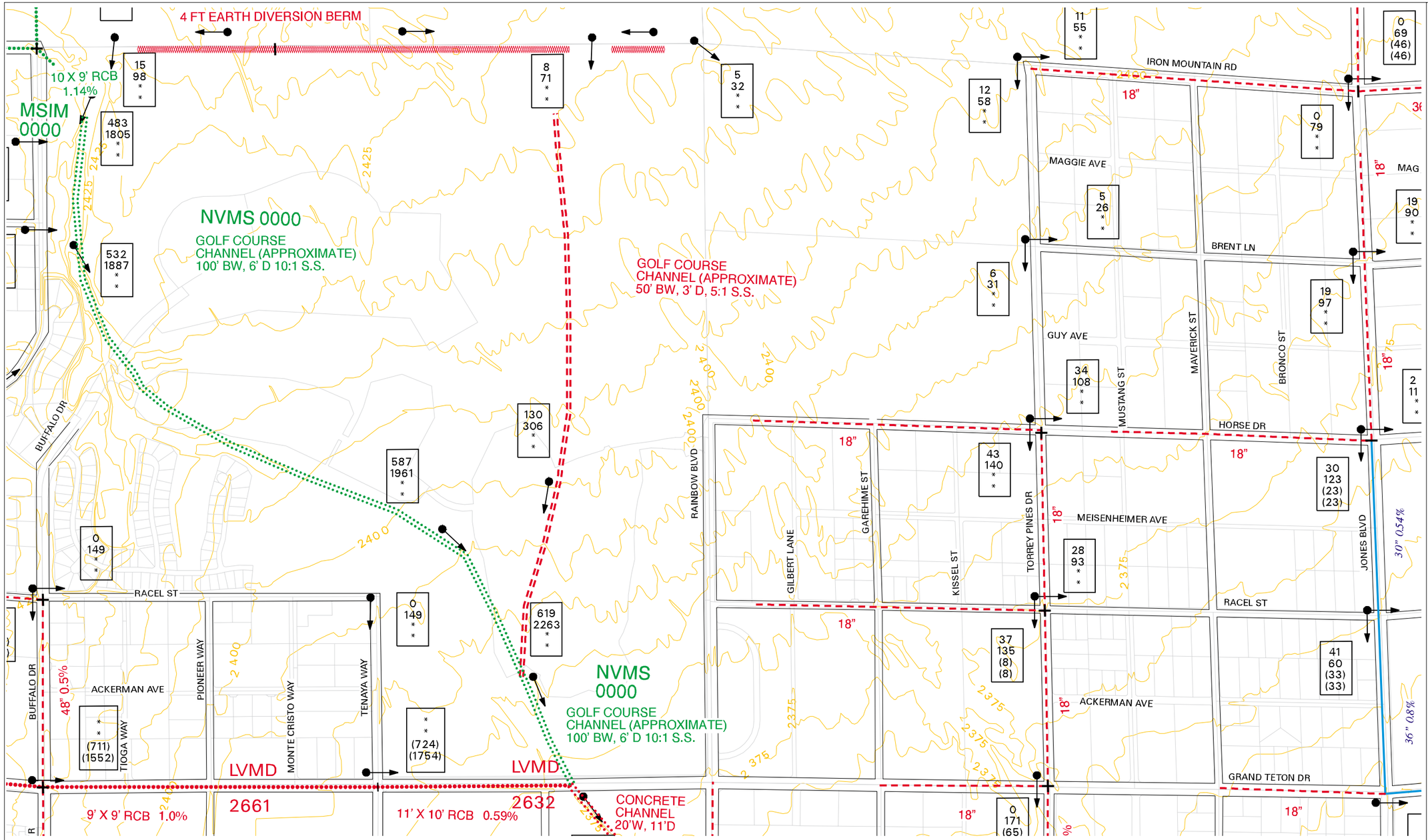
NOTE:

All regional facilities proposed in the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley" have been resized based on the flows developed in this study. In addition, many of these facilities have been changed from channels to reinforced concrete box culverts.



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/F7/NW/F8.MAP



NORTHWEST NEIGHBORHOOD STUDY PHASE 2

LEGEND

- EXISTING REGIONAL DETENTION BASINS
- PROPOSED REGIONAL DETENTION BASINS (Not Included in 1996 MPU)
- EXISTING REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES (Not Included In 1996 MPU)
- EXISTING LOCAL BRIDGES
- PROPOSED REGIONAL CULVERT
- EXISTING REGIONAL CULVERT
- EXISTING LOCAL CULVERT
- EXISTING REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE (Not Included in 1996 MPU)
- EXISTING LOCAL PIPELINE
- PROPOSED LOCAL PIPELINE
- EXISTING REGIONAL CHANNEL
- PROPOSED REGIONAL CHANNEL
- EXISTING LOCAL CHANNEL
- PROPOSED LOCAL CHANNEL
- PROPOSED REGIONAL CHANNEL (Not Included In 1996 MPU)
- EXISTING REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE (Not Included In 1996 MPU)
- PROPOSED LOCAL DIKE/LEVEE

FIGURE F-9

FUTURE DRAINAGE CONDITIONS

FIGURE 5A

N W E S

800 600 400 200 0 400 800

(IN FEET)
SCALE: 1 INCH = 800 FEET

FLOW ARROW

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

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place.
Regional facility identifiers were established based on the methodology used in the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley."

NOTE:

All regional facilities proposed in the "1996 Clark County Regional Flood Control Master Plan Update for the Las Vegas Valley" have been resized based on the flows developed in this study. In addition, many of these facilities have been changed from channels to reinforced concrete box culverts.



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ENGINEERING PLANNING GIS SURVEYING CONSTRUCTION SERVICES

/F7/NW/F9.MAP

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BCHU		**BELTWAY CHANNEL - HUALAPAI**						
0000	E	12' X 5' RCAP	853	206	DBA3-C	WEST3	0.84	1.11
0017	E	8' X 5' RCAP	1216	218	CBA3-C	WEST3	0.84	1.33
0040	E	66" RCP	60	57	DNW26-C	WEST3	0.51	1.04
0042	E	60" RCP	615	57	DNW26-C	WEST3	0.51	1.42
0054	E	54" RCP	615	57	DNW26-C	WEST3	0.51	1.23
BRDB		**BRENT DRAINAGE SYSTEM**						
0000	E	36" RCP WITH 18" ORIFICE PLATE	2170	36	BRDB	WEST3	2.37	0.40
0031	E	45,080 CFS PMF SPILLWAY		45080	CBRDB	WEST3	2.37	
0032	E	450 AC-FT SOUTH ENVIRONMENTAL ENHANCEMENT AREA		1685	CBRDB	WEST3	2.37	
0033	E	ENERGY DISSIPATOR	100	1052	CNW147W	WEST3	1.75	
0043	E	20' X 7' RCBC	135	1052	CNW147W	WEST3	1.75	0.50
0045	E	CONC CHNL 12'W 7'D 2:1 SS	983	1052	CNW147W	WEST3	1.75	2.00
0058	E	12' X 6' RCB	1688	951	CNW113-C	WEST3	1.47	1.81
0107	P	8' X 6' RCB	2560	951	CNW113-C	WEST3	1.47	2.40
0157	P	12' X 7' RCB	2580	621	CNW96-C	WEST3	0.84	0.25
CN95		**CENTENNIAL PKWY CHANNEL WEST / U.S 95 BRANCH**						
0000	E	20' X 7' RCB	3335	2778	CNWBB3-C	WEST3	3.35	2.00
0068	E	20' X 7' RCB	2300	2725	CNW103-C	WEST3	3.04	2.10
0102	E	CONC CHNL 20'W 9'D 0:1 SS	375	2548	2CNW89-C	WEST3	2.65	1.77
0104	E	2: 12' X 10' RCB	300	2548	2CNW89-C	WEST3	2.65	1.10
0167	E	16' X 8' RCB	3521	2548	2CNW89-C	WEST3	2.65	1.58
0199	E	15' X 9' RCB	407	1467	2CNW72-C	WEST3	1.13	0.41
0218	E	15' X 9' RCB	1227	1467	2CNW72-C	WEST3	1.13	0.82
0257	E	TRANSITION STRUCTURE	59	1467	2CNW72-C	WEST3	1.13	0.77
0259	E	15' X 9' RCB	284	599	CNW74-C	WEST3	0.40	0.77
0313	E	10' X 6' RCB	2680	599	CNW74-C	WEST3	0.40	2.50
0318	E	TRANSITION STRUCTURE	60	599	CNW74-C	WEST3	0.40	1.50
0333	E	5' X 5' RCB	670	259	NW62-S	WEST3	0.16	1.50
CNFR		**CENTENNIAL PKWY CHANNEL WEST / FARM ROAD**						
0000	P	8' X 6' RCB	8350	776	CNW89-C	WEST3	1.05	2.00
CNGT		**CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH**						
0000	E	10' X 5' RCB	2376	543	CNW71-E	WEST3	0.47	2.58
0020	E	10' X 5' RCB	1570	543	CNW71-E	WEST3	0.47	3.50
0043	E	8' X 6' RCB	2470	543	CNW71-E	WEST3	0.47	3.60
0118	E	6' X 5' RCAP	5472	349	KYLEDET	KYLEDB	58.61	3.72
CNKC		**CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH**						
0000	E	12' X 4' RCB	377	954	CNW72-C	WEST3	0.74	4.58
0007	E	10' X 5' RCB	874	954	CNW72-C	WEST3	0.74	3.28
0024	E	8' X 5' RCB	1385	954	CNW72-C	WEST3	0.74	2.40
0050	E	72" RCP	2757	437	NW45-S	WEST3	0.31	3.60
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
0314	E	22' X 7' RCB	703	2822	CNWBD2-N	WEST3	3.45	1.94
EKBU		**ELKHORN SPRINGS AND BUFFALO**						
0000	E	60" RCP	1046	255	NW134-C	WEST3	0.46	0.89
EKDB		**ELKHORN SPRINGS DETENTION BASIN**						
0000	E	GRASS CHNL 15'W 5.8'D 3.5:1 SS	2575	221	CNW150-C	WEST3	1.41	0.39
0025	E	4' X 3' RCB	160	106	ELKBASIN	WEST3	0.84	0.50
0026	E	48" RCP	1270	106	ELKBASIN	WEST3	0.84	1.23
0049	E	60" RCP	1095	106	ELKBASIN	WEST3	0.84	0.13
0070	E	48 AC-FT ELKHORN SPRINGS DETENTION BASIN		456	CNW133-C	WEST3	0.84	

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
EKHU		**ELKHORN AND HUALAPAI**						
0003	E	6' X 4' RCAP	980	393	CNW26-C	WEST3	0.51	3.61
0020	E	6' X 5' RCAP	150	393	CNW26-C	WEST3	0.51	3.61
0023	E	8' X 5' RCAP	1200	393	CNW26-C	WEST3	0.51	0.90
GOEC		**GOWAN NORTH - EL CAPITAN BRANCH**						
0176	P	78" RCP	1320	190	CCPFR-C	GOW3A	0.46	1.15
GONO		**GOWAN NORTH SYSTEM**						
0511	P	6' X 5' RCB	1320	326	CCPHW-C	GOW3A	0.60	1.14
LVMD		**LAS VEGAS WASH - MIDDLE**						
2507	E	2: 13' X 9' RCB	2831	1808	CNW168-C	CWEST3	4.43	0.36
2525	E	24' X 8' RCB	1140	1598	CNW159-C	CWEST3	3.92	0.40
2550	E	24' X 8' RCB	1445	1312	CD161-C	CWEST3	3.42	0.40
2574	E	24' X 8' RCB	1430	1312	CD161-C	CWEST3	3.42	0.41
2599	E	CONC CHNL 24'W 7'D 2:1 SS	1577	1268	CNW162-C	CWEST3	3.10	0.51
2632	E	18' X 5' RCB	1443	695	CNW138-C	WEST3	1.16	0.47
2661	E	18' X 5' RCB	3003	695	CNW138-C	WEST3	1.16	0.78
2711	E	10' X 5' RCB	2440	560	CNW139-C	WEST3	0.93	2.00
2737	E	8' X 5' RCB	265	560	CNW139-C	WEST3	0.93	2.25
2763	E	6' X 5' RCB	1565	560	CNW139-C	WEST3	0.93	2.41
2789	E	6' X 5' RCB	910	560	CNW139-C	WEST3	0.93	2.00
MOHU		**MOCCASIN-HUALAPAI BRANCH**						
0000	P0	13' X 6' RCB	1476	924	2CNW33-C	LOWER3	2.08	1.80
0026	P0	11' X 6' RCB	1654	560	CNW45-N	LOWER3	1.25	0.50
0061	P0	9' X 6' RCB	779	560	CNW45-N	LOWER3	1.25	0.50
0076	P0	60" RCP	1000	263	CNW45-C	LOWER3	1.03	3.00
0095	P0	NATURAL WASH	865	263	CNW45-C	LOWER3	1.03	3.00
0111	P0	6' X 5' RCBC @ EGAN CREB DR	164	263	CNW45-C	LOWER3	1.03	6.10
0116	P0	NATURAL WASH	1900	263	CNW45-C	LOWER3	1.03	3.00
0151	P0	54" RCPC @ SHAUMBER	438	72	MODB1	LOWER3	0.86	2.00
MOIR		**MOCCASIN - IRON MOUNTAIN BRANCH**						
0000	P0	60" RCP	1060	410	CNW33-C	LOWER3	0.83	4.50
0020	P0	54" RCP	1161	71	MODB2	LOWER3	0.56	3.20
0041	P0	42" RCP	1236	71	MODB2	LOWER3	0.56	5.00
0065	P0	60" RCP	1099	71	MODB2	LOWER3	0.56	0.40
MOKC		**MOCCASIN AND KYLE CANYON**						
0000	P0	9' X 6' RCB	6140	1072	CNW35-C	LOWER3	2.69	3.40
MOLC		**MOCCASIN - LOG CABIN BRANCH**						
0000	P0	20' X 10' RCB	2206	2265	2CNW64	LOWER3	6.06	0.65
0072	P0	12' X 8' RCB	4493	2265	2CNW64	LOWER3	6.06	2.66
0149	E	13' X 8' RCB	520	1817	CNW62-N	LOWER3	4.88	2.00
0157	P	13' X 8' RCB	288	1817	CNW62-N	LOWER3	4.88	1.40
0162	P0	13' X 6' RCB	435	1817	CNW62-N	LOWER3	4.88	1.80
MSNV		**MOUNTAIN SPA/VISTA RANCH**						
0000	E	6: 12' X 5' RCBC @ GRAND TETON	273	639	CNW163-C	CWEST3	1.69	0.40
0005	E	GRASS CHNL 100'W 4.5'D 10:1 SS	6325	259	CNW155-C	WEST3	4.46	0.40
0125	E	GRASS CHNL 100'W 4.5'D 10:1 SS	1300	66	CNW147E	WEST3	1.55	0.40
RACO		**RACEL STREET COLLECTOR**						
0000	E	14' X 7' RCB BAFFLED ENERGY DISSIPATOR	87	424	CNW111S	WEST3	0.55	0.29
0001	E	78" RCP	3245	424	CNW111S	WEST3	0.55	2.46
0064	E	78" RCP	2650	347	DNW111S	WEST3	0.44	2.09
RCBC		**RANCHO ROAD SYSTEM - BELTWAY CHANNEL**						
0000	E	6' X 5' RCB	1062	173	FADB	WEST3	1.54	1.04
0002	E	54" RCP OUTLET WITH 41" ORIFICE	503	173	FADB	WEST3	1.54	2.38
0003	E	2,341 CFS PMF SPILLWAY		2341	FADBIN	WEST3	1.54	
0004	E	76 AC-FT FORT APACHE DETENTION BASIN		658	FADBIN	WEST3	1.54	
0007	E	ENERGY DISSIPATOR	100	658	FADBIN	WEST3	1.54	
0009	E	12' X 6' RCBC @ FORT APACHE DETENTION BASIN	133	658	FADBIN	WEST3	1.54	1.79
0012	E	CONC CHNL 12'W 6'-7'D 0:1 SS	1937	658	FADBIN	WEST3	1.54	3.15
0048	E	12' X 6' RCBC @ GRAND CANYON	140	559	CMNA1	WEST3	1.27	3.15
0051	E	CONC CHNL 12'W 6'-8'D 0:1 SS	2660	559	CMNA1	WEST3	1.27	3.44
0096	E	1: 10' X 6' AND 1: 6' X 6' RCBC @ HUALAPAI WAY	190	559	CMNA1	WEST3	1.27	1.93
0100	E	CONC CHNL 12'W 5.5'D 0:1 SS	2085	475	CDMNA1	WEST3	0.43	2.88

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
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**						
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	CNWBC6-C	WEST3	3.41	0.30
0075	E	20' X 6' RCBC @ BELTWAY	428	1414	CNWBC6-C	WEST3	3.41	2.81
0083	P	20' X 4' RCB	950	1414	CNWBC6-C	WEST3	3.41	2.49
0101	P	CONC CHNL 20'W 5'D 0:1 SS	980	1414	CNWBC6-C	WEST3	3.41	2.38
0120	E	20' X 6' RCBC @ GRAND MONTECITO	120	1414	CNWBC6-C	WEST3	3.41	1.00
0122	P	CONC CHNL 16'-20'W 6'D 0:1 SS	350	1414	CNWBC6-C	WEST3	3.41	1.84
0130	P	CONC CHNL 16'W 5.5'D 0:1 SS	1012	1414	CNWBC6-C	WEST3	3.41	2.67
0149	P	CONC CHNL 16'W 5-5.5'D 0:1 SS	87	1115	CNWBC3	WEST3	2.99	2.27
0151	P	CONC CHNL 16'W 5'D 0:1 SS	1255	1115	CNWBC3	WEST3	2.99	2.65
0171	E	16' X 6' RCBC @ EL CAPITAN WAY	234	1115	CNWBC3	WEST3	2.99	1.75
0175	E	CONC CHNL 14'W 7'D 0:1 SS	1220	1115	CNWBC3	WEST3	2.99	2.93
0198	E	CONC CHNL 14'W 7'D 0:1 SS	225	788	CNWBA6-C	WEST3	1.88	2.93
0227	E	12' X 6' RCB	995	788	CNWBA6-C	WEST3	1.88	1.73
0250	E	12' X 6' RCB	4020	788	CNWBA6-C	WEST3	1.88	1.12
0275	E	7' X 6' RCB	2650	535	CNW66-C	WEST3	1.04	3.30
0295	P	7' X 6' RCB	2980	431	CNW53-C	WEST3	0.80	3.60
TSDB		**TULE SPRINGS DRAINAGE SYSTEM**						
0000	E	2: 10' X 4' RCBC @ ECHO GRANDE	100	25	TULEDB	WEST3	1.37	1.04
0002	E	36" RCP WITH 22" ORIFICE PLATE	320	25	TULEDB	WEST3	1.37	0.33
0010	E	14,013 CFS PMF SPILLWAY		14013	CTULEDB	WEST3	1.37	
0011	E	117 AC-FT NORTH ENVIRONMENTAL ENHANCEMENT AREA		551	CTULEDB	WEST3	1.37	
0012	E	ENERGY DISSIPATOR	260	333	CNW148-C	WEST3	0.59	
0023	P	78" RCP	1320	333	CNW148-C	WEST3	0.59	0.80
0059	P	72" RCP	2640	333	CNW148-C	WEST3	0.59	1.03

FIGURE 6

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

REGIONAL FLOOD CONTROL DISTRICT

2018 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY FIGURE F-11

LEGEND

ID (Facility Identifier) AABB
Parent Stream Name
Stream Name
Mile 0000
Distance Above Confluence with Parent Stream (Miles)
Miles in Hundredths

Existing Facility.....E
Proposed or Modified Facility.....P
Contingency Level
Category A.....P
Category B.....P0

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

Construction Features

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

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REGIONAL FLOOD CONTROL DISTRICT

2018
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-11
FLOOD CONTROL FACILITIES

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

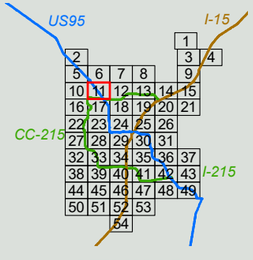
FIGURE 6A

N

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

Scale: 1 inch = 2,000 feet

AAerialSource:Esri World Imagery 2017



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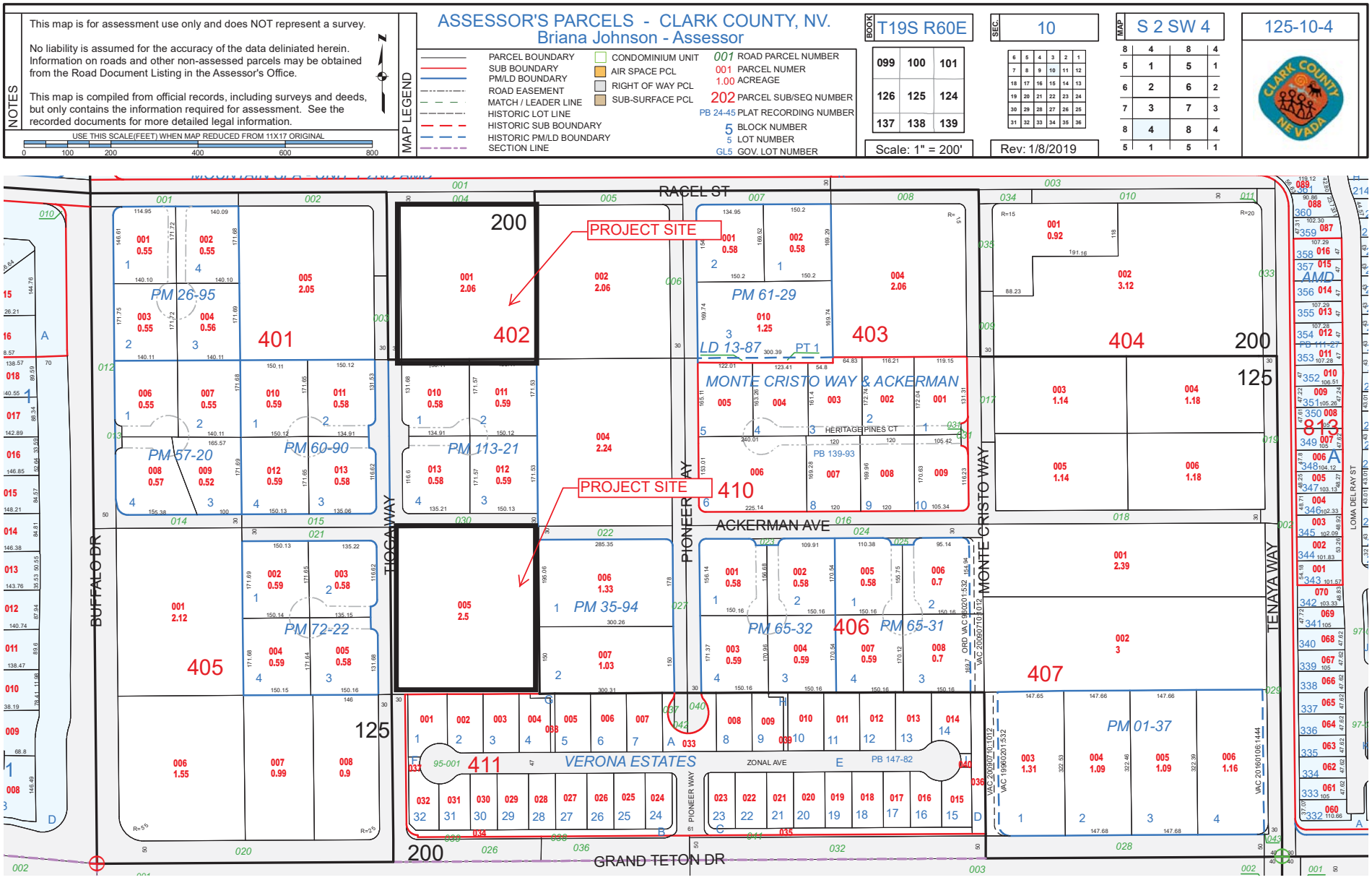
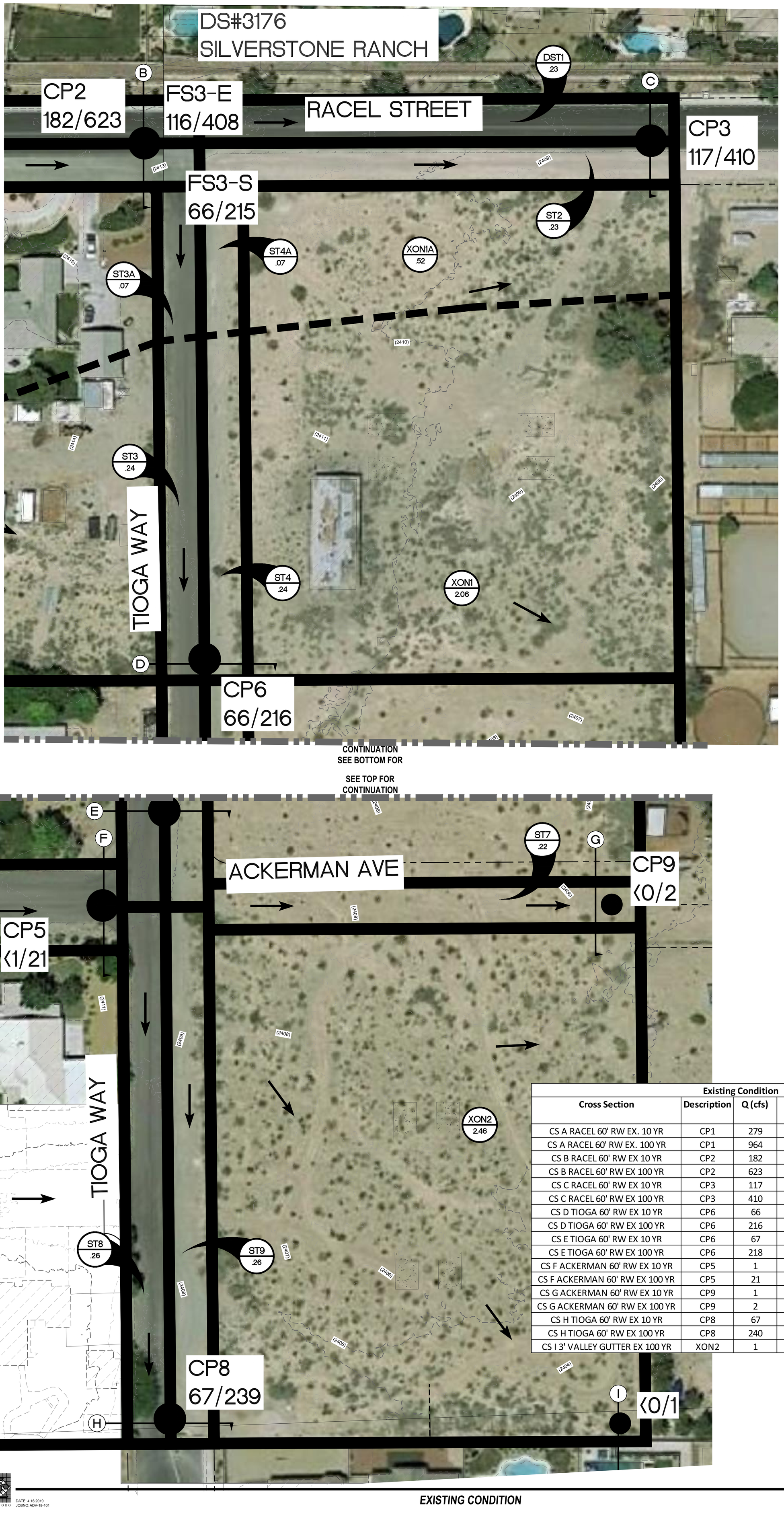


FIGURE 7

TAX DIST 125



Existing Condition			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
XON1	2.06	<1	1
XON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
ST2	0.23	<1	1
ST3	0.24	<1	1
ST4	0.24	<1	<1
ST5	0.26	<1	1
ST6	0.26	<1	<1
ST7	0.22	<1	<1
ST8	0.26	<1	1
ST9	0.26	<1	<1
ST10	0.45	<1	<1
ST11	0.41	<1	1
DST12	0.78	1	3
ST13	0.42	<1	1
DST14	0.42	1	2
DST15	0.51	1	2
ST16	0.50	1	1
ST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
CP1	-	279	964
CP2	-	182	623
CP3	-	117	410
CP4	-	99	348
CP5	-	<1	21
CP6	-	66	216
CP7	-	67	218
CP8	-	67	239
CP9	-	<1	2
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	<1	20
FS2-S	-	99	328
FS3-E	-	116	408
FS3-S	-	66	215

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Existing Condition						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW EX. 10 YR	CP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW EX. 100 YR	CP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW EX 10 YR	CP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW EX 100 YR	CP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW EX 10 YR	CP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW EX 100 YR	CP3	410	1.49	0.58	32.73	18.98
CS D TIOGA 60' RW EX 10 YR	CP6	66	0.27	0.37	9.39	3.47
CS D TIOGA 60' RW EX 100 YR	CP6	216	0.27	0.53	13.59	7.20
CS E TIOGA 60' RW EX 10 YR	CP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW EX 100 YR	CP6	218	0.61	0.46	17.97	8.27
CS F ACKERMAN 60' RW EX 10 YR	CP5	1	0.61	0.06	3.92	0.24
CS F ACKERMAN 60' RW EX 100 YR	CP5	21	0.61	0.20	8.41	1.68
CS G ACKERMAN 60' RW EX 10 YR	CP9	1	0.61	0.09	4.85	0.44
CS G ACKERMAN 60' RW EX 100 YR	CP9	2	0.61	0.12	5.77	0.69
CS H TIOGA 60' RW EX 10 YR	CP8	67	1.61	0.27	17.40	4.70
CS H TIOGA 60' RW EX 100 YR	CP8	240	1.61	0.40	25.68	10.27
CS I 3' VALLEY GUTTER EX 100 YR	XON2	1	0.01	0.16	2.03	0.32

SCALE: 1" = 30'
30' 15' 0' 30'

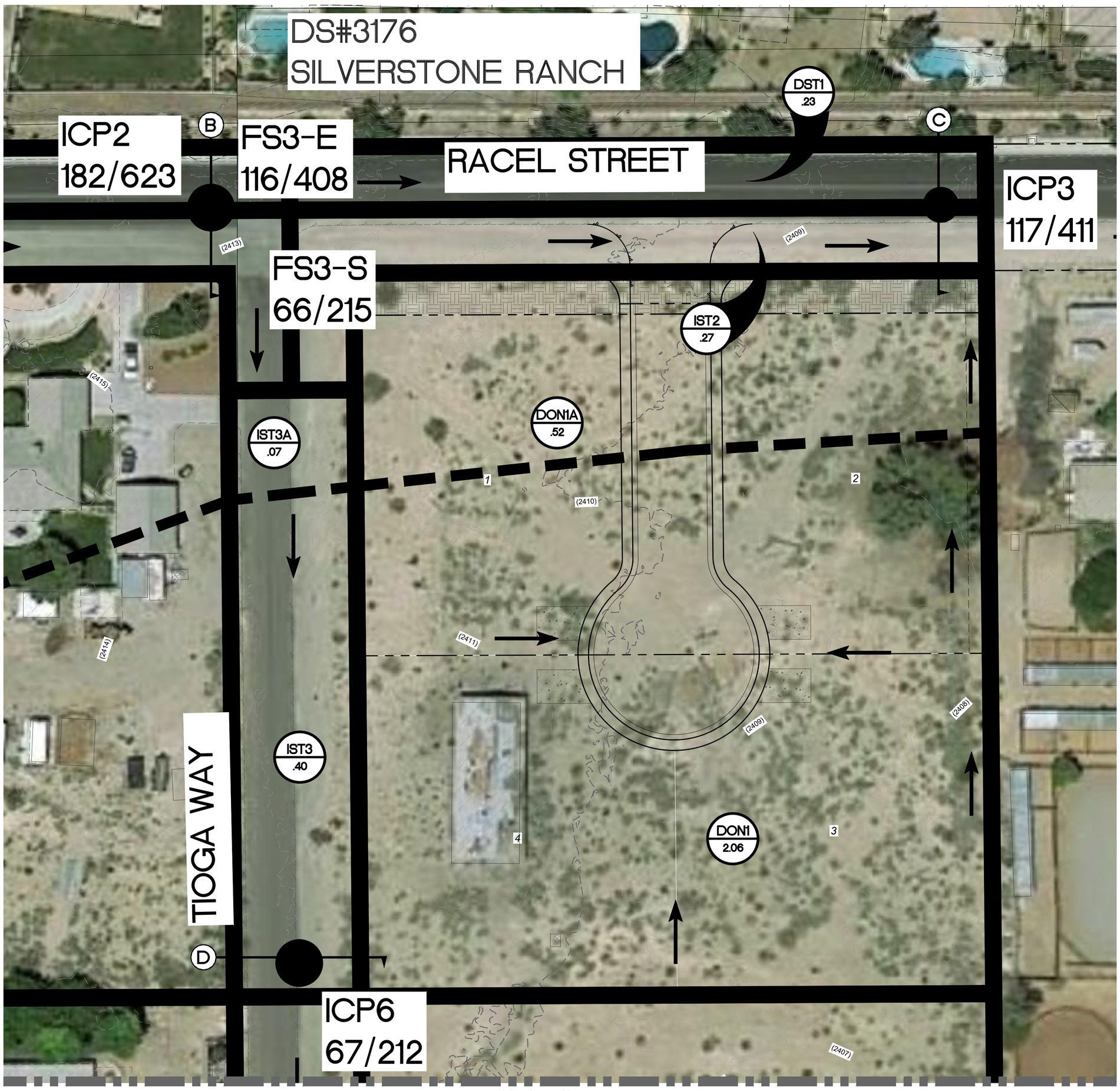
DRAINAGE LEGEND

XOF1 / xxx	BASIN IDENTIFICATION / BASIN AREA (ACRES)
C1	BASIN BOUNDARY / CONCENTRATION POINT
	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

EST. 2000
DATE: 4.16.2019
JOBNO: ADV-18-101

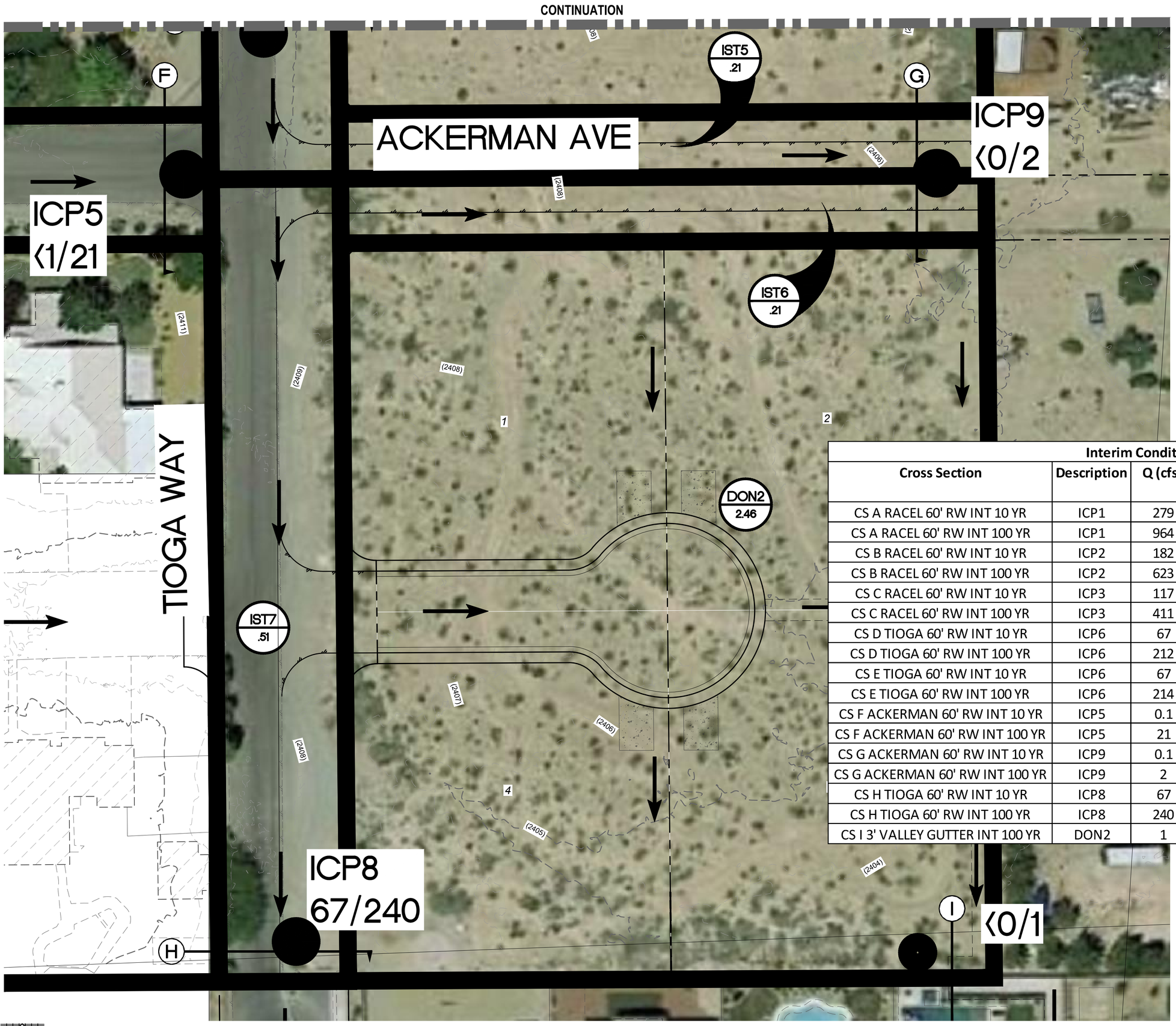
EXISTING CONDITION

FIGURE 8



CONTINUATION
SEE BOTTOM FOR

SEE TOP FOR
CONTINUATION



Interim Condition			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
DON1	2.06	<1	1
DON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
IST2	0.23	<1	1
IST3	0.24	<1	1
IST4	0.24	<1	1
IST5	0.26	<1	<1
IST6	0.26	<1	<1
IST7	0.22	<1	1
IST8	0.26	<1	<1
IST9	0.26	<1	1
IST10	0.45	1	3
IST11	0.41	<1	1
DST12	0.78	1	2
DST15	0.51	1	2
IST16	0.50	1	1
IST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
ICP1	-	279	964
ICP2	-	182	623
ICP3	-	117	411
ICP4	-	99	348
ICP5	-	<1	21
ICP6	-	67	216
ICP7	-	67	218
ICP8	-	67	240
ICP9	-	<1	1
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	<1	20
FS2-S	-	99	328
FS3-E	-	116	408
FS3-S	-	66	215

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Interim Condition						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW INT 10 YR	ICP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW INT 100 YR	ICP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW INT 10 YR	ICP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW INT 100 YR	ICP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW INT 10 YR	ICP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW INT 100 YR	ICP3	411	1.49	0.58	32.75	19.00
CS D TIOGA 60' RW INT 10 YR	ICP6	67	0.27	0.35	9.26	3.24
CS D TIOGA 60' RW INT 100 YR	ICP6	212	0.27	0.52	13.51	7.03
CS E TIOGA 60' RW INT 10 YR	ICP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW INT 100 YR	ICP6	214	0.61	0.45	17.86	8.04
CS F ACKERMAN 60' RW INT 10 YR	ICP5	0.1	0.61	0.03	2.23	0.07
CS F ACKERMAN 60' RW INT 100 YR	ICP5	21	0.61	0.20	8.41	1.68
CS G ACKERMAN 60' RW INT 10 YR	ICP9	0.1	0.01	0.09	0.63	0.06
CS G ACKERMAN 60' RW INT 100 YR	ICP9	2	0.01	0.28	1.32	0.37
CS H TIOGA 60' RW INT 10 YR	ICP8	67	1.61	0.26	16.71	4.34
CS H TIOGA 60' RW INT 100 YR	ICP8	240	1.61	0.40	25.68	10.27
CS I 3' VALLEY GUTTER INT 100 YR	DON2	1	0.01	0.16	2.03	0.32

SCALE: 1" = 30'
30' 15' 0' 30'

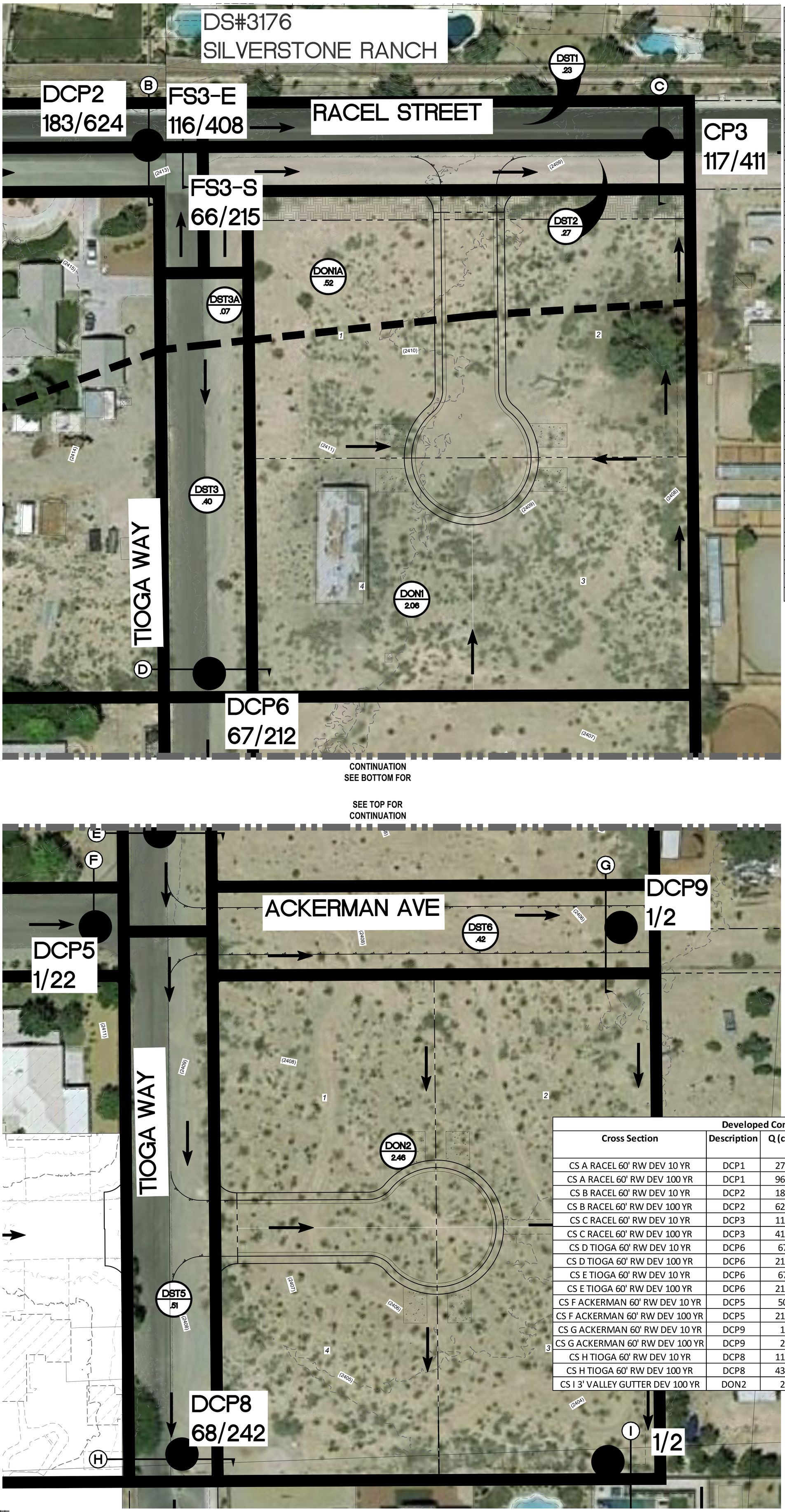
DRAINAGE LEGEND

XOF1 / xxx	BASIN IDENTIFICATION / BASIN AREA (ACRES)
	BASIN BOUNDARY
● C1	CONCENTRATION POINT
→	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

EST. 2000
DATE: 4.16.2019
JOBNO: ADV-18-101

INTERIM CONDITION

FIGURE 9



Developed Condition			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
DON1	2.06	<1	1
DON2	2.46	<1	1
DOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
DST2	0.23	<1	1
DST3	0.24	<1	1
DST4	0.24	<1	1
DST5	0.26	<1	1
DST6	0.26	<1	1
DST7	0.22	<1	1
DST8	0.26	<1	1
DST9	0.26	1	3
DST10	0.45	1	1
DST11	0.41	1	2
DST15	0.51	1	2
DST16	0.50	1	2
DST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
DCP1	-	279	964
DCP2	-	183	624
DCP3	-	117	411
DCP4	-	99	348
DCP5	-	51	215
DCP6	-	67	216
DCP7	-	67	218
DCP8	-	119	434
DCP9	-	<1	2
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	50	213
FS2-S	-	49	135
FS3-E	-	117	409
FS3-S	-	66	215

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Developed Condition						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW DEV 10 YR	DCP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW DEV 100 YR	DCP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW DEV 10 YR	DCP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW DEV 100 YR	DCP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW DEV 10 YR	DCP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW DEV 100 YR	DCP3	411	1.49	0.58	32.75	19.00
CS D TIOGA 60' RW DEV 10 YR	DCP6	67	0.27	0.35	9.26	3.24
CS D TIOGA 60' RW DEV 100 YR	DCP6	212	0.27	0.52	13.51	7.03
CS E TIOGA 60' RW DEV 10 YR	DCP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW DEV 100 YR	DCP6	218	0.61	0.48	18.02	8.65
CS F ACKERMAN 60' RW DEV 10 YR	DCP5	50	0.61	0.27	10.98	2.96
CS F ACKERMAN 60' RW DEV 100 YR	DCP5	215	0.61	0.45	17.89	8.05
CS G ACKERMAN 60' RW DEV 10 YR	DCP9	1	0.01	0.21	1.11	0.23
CS G ACKERMAN 60' RW DEV 100 YR	DCP9	2	0.01	0.28	1.32	0.37
CS H TIOGA 60' RW DEV 10 YR	DCP8	119	1.61	0.31	20.32	6.30
CS H TIOGA 60' RW DEV 100 YR	DCP8	435	1.61	0.49	31.19	15.28
CS I 3' VALLEY GUTTER DEV 100 YR	DON2	2	0.01	0.23	2.50	0.58

SCALE: 1" = 30'
30' 15' 0' 30'

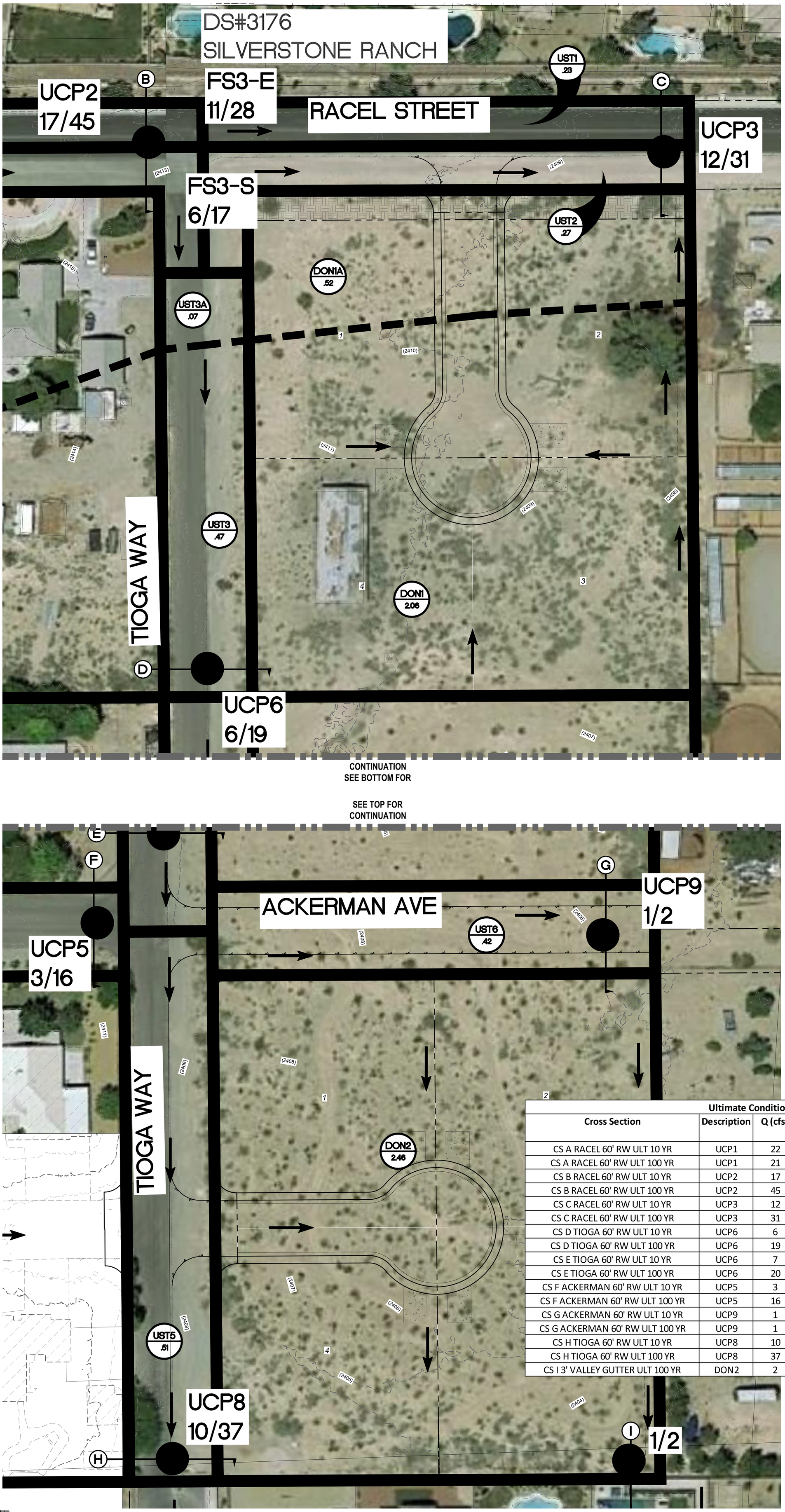
DRAINAGE LEGEND

XOF1 / XXX	BASIN IDENTIFICATION / BASIN AREA (ACRES)
C1	BASIN BOUNDARY / CONCENTRATION POINT
	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

EST. 2000
DATE: 4.16.2019
JOBNO: ADV-18-101

DEVELOPED CONDITION

FIGURE 10



Ultimate Condition			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
XON1	2.06	<1	1
XON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
DST2	0.23	<1	1
DST3	0.24	<1	1
DST4	0.24	<1	1
DST5	0.26	<1	1
DST6	0.26	<1	1
DST7	0.22	<1	1
DST8	0.26	<1	1
DST9	0.26	1	3
DST10	0.45	1	1
DST11	0.41	1	2
DST15	0.51	1	2
DST16	0.50	1	2
DST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	6	24
REF2**	-	13	31
UCP1	-	22	61
UCP2	-	17	45
UCP3	-	12	31
UCP4	-	8	24
UCP5	-	3	16
UCP6	-	6	19
UCP7	-	7	20
UCP8	-	10	37
UCP9	-	1	2
FS1-E	-	15	40
FS1-S	-	7	21
FS2-E	-	2	14
FS2-S	-	6	10
FS3-E	-	11	28
FS3-S	-	6	17

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Ultimate Condition						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW ULT 10 YR	UCP1	22	1.21	0.27	12.33	3.33
CS A RACEL 60' RW ULT 100 YR	UCP1	21	1.21	0.26	12.14	3.16
CS B RACEL 60' RW ULT 10 YR	UCP2	17	1.14	0.26	11.87	3.09
CS B RACEL 60' RW ULT 100 YR	UCP2	45	1.14	0.33	15.16	5.00
CS C RACEL 60' RW ULT 10 YR	UCP3	12	1.49	0.23	12.10	2.78
CS C RACEL 60' RW ULT 100 YR	UCP3	31	1.49	0.29	15.19	4.41
CS D TIOGA 60' RW ULT 10 YR	UCP6	6	0.27	0.15	4.53	0.68
CS D TIOGA 60' RW ULT 100 YR	UCP6	19	0.27	0.23	6.03	1.39
CS E TIOGA 60' RW ULT 10 YR	UCP6	7	0.61	0.13	6.39	0.83
CS E TIOGA 60' RW ULT 100 YR	UCP6	20	0.61	0.20	8.32	1.66
CS F ACKERMAN 60' RW ULT 10 YR	UCP5	3	0.61	0.13	8.87	1.15
CS F ACKERMAN 60' RW ULT 100 YR	UCP5	16	0.61	0.25	13.47	3.37
CS G ACKERMAN 60' RW ULT 10 YR	UCP9	1	0.01	0.21	1.11	0.23
CS G ACKERMAN 60' RW ULT 100 YR	UCP9	1	0.01	0.21	1.11	0.23
CS H TIOGA 60' RW ULT 10 YR	UCP8	10	1.61	0.13	10.02	1.30
CS H TIOGA 60' RW ULT 100 YR	UCP8	37	1.61	0.21	13.96	2.93
CS I 3' VALLEY GUTTER ULT 100 YR	DON2	2	0.01	0.23	2.50	0.58

SCALE: 1" = 30'
30' 15' 0' 30'

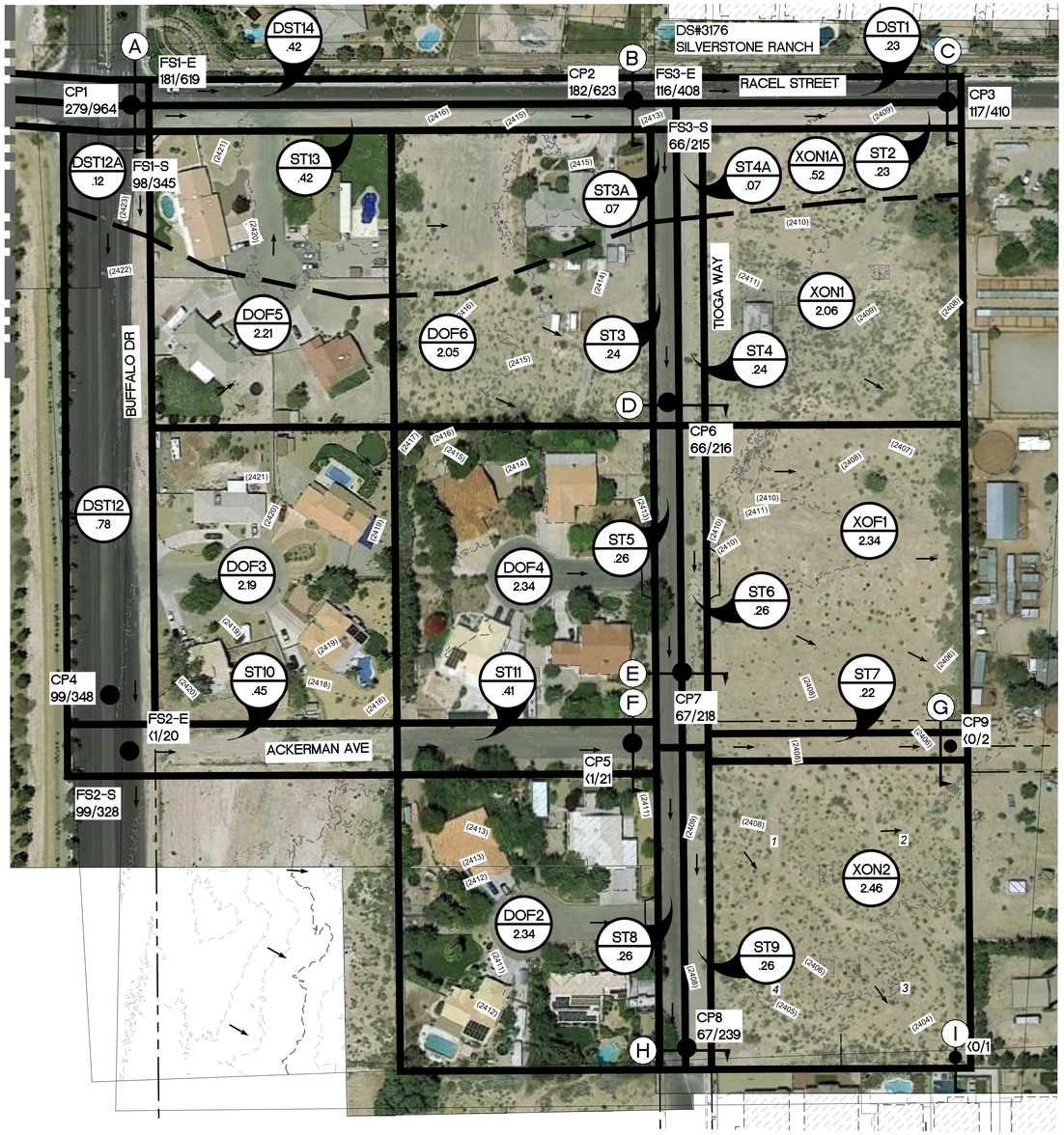
DRAINAGE LEGEND

XOF1 / xxx	BASIN IDENTIFICATION / BASIN AREA (ACRES)
C1	BASIN BOUNDARY / CONCENTRATION POINT
	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

EST. 2000
DATE: 4.16.2019
JOBNO: ADV-18-101

ULTIMATE CONDITION

FIGURE 11


SEE BOTTOM FOR CONTINUATION
DS#3176 SILVERSTONE RANCH
RACEL STREET
TIOGA WAY
BUFFALO DR
ACKERMAN AVE
CP1 279/964
CP2 182/623
CP3 117/410
CP4 99/348
CP5 (1/21
CP6 66/216
CP7 67/218
CP8 67/239
CP9 (0/2
FS1-E 181/619
FS1-S 98/345
FS2-E (1/20
FS2-S 99/328
FS3-E 116/408
FS3-S 66/215
DST14 .42
DST1 .23
DST12A .12
ST13 .42
ST3A .07
ST4A .07
XON1A .52
ST2 .23
DOF5 2.21
DOF6 2.05
ST3 .24
ST4 .24
XON1 2.06
DST12 .78
DOF3 2.19
DOF4 2.34
ST5 .26
ST6 .26
XOF1 2.34
ST10 .45
ST11 .41
ST7 .22
DOF2 2.34
ST8 .26
ST9 .26
XON2 2.46
1
2
3
4
A
B
C
D
E
F
G
H
I


REF1* 263/927
REF2** 13/31
ST17 .47
DST18 .47
ST16 .50
DST15 .51
CP1 279/964
FS1-E 181/619
DST12A .12
FS1-S 98/345
A
CONTINUATION SEE TOP FOR

Flow Split Calculations

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
FS1-S BUFFALO & RACEL EX 10 YR	CP1	98	0.54	0.48	13.95	6.70
FS1-S BUFFALO & RACEL EX 100 YR	CP1	345	0.54	0.67	20.31	13.61
FS1-E BUFFALO & RACEL EX 10 YR	CP1	181	1.21	0.48	24.11	11.57
FS1-E BUFFALO & RACEL EX 100 YR	CP1	619	1.21	0.67	35.30	23.65
FS2-S BUFFALO & ACKERMAN EX 10 YR	CP2	99	0.32	0.36	8.48	3.05
FS2-S BUFFALO & ACKERMAN EX 100 YR	CP2	328	0.32	0.55	12.58	6.92
FS2-E BUFFALO & ACKERMAN EX 10 YR	CP2	0.1	0.63	0.03	2.72	0.08
FS2-E BUFFALO & ACKERMAN EX 100 YR	CP2	20	0.63	0.20	9.50	1.90
FS3-E RACEL & TIOGA EX 10 YR	CP4	116	1.14	0.42	20.54	8.63
FS3-E RACEL & TIOGA EX 100 YR	CP4	408	1.14	0.60	29.74	17.84
FS3-S RACEL & TIOGA EX 10 YR	CP4	66	0.27	0.35	9.22	3.23
FS3-S RACEL & TIOGA EX 100 YR	CP4	215	0.27	0.53	13.57	7.19

Existing Condition

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW EX. 10 YR	CP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW EX. 100 YR	CP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW EX 10 YR	CP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW EX 100 YR	CP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW EX 10 YR	CP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW EX 100 YR	CP3	410	1.49	0.58	32.73	18.98
CS D TIOGA 60' RW EX 10 YR	CP6	66	0.27	0.37	9.39	3.47
CS D TIOGA 60' RW EX 100 YR	CP6	216	0.27	0.53	13.59	7.20
CS E TIOGA 60' RW EX 10 YR	CP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW EX 100 YR	CP6	218	0.61	0.46	17.97	8.27
CS F ACKERMAN 60' RW EX 10 YR	CP5	1	0.61	0.06	3.92	0.24
CS F ACKERMAN 60' RW EX 100 YR	CP5	21	0.61	0.20	8.41	1.68
CS G ACKERMAN 60' RW EX 10 YR	CP9	1	0.61	0.09	4.85	0.44
CS G ACKERMAN 60' RW EX 100 YR	CP9	2	0.61	0.12	5.77	0.69
CS H TIOGA 60' RW EX 10 YR	CP8	67	1.61	0.27	17.40	4.70
CS H TIOGA 60' RW EX 100 YR	CP8	240	1.61	0.40	25.68	10.27
CS I 3' VALLEY GUTTER EX 100 YR	XON2	1	0.01	0.16	2.03	0.32

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Existing Condition

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
XON1	2.06	<1	1
XON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
ST2	0.23	<1	1
ST3	0.24	<1	1
ST4	0.24	<1	<1
ST5	0.26	<1	1
ST6	0.26	<1	<1
ST7	0.22	<1	<1
ST8	0.26	<1	1
ST9	0.26	<1	<1
ST10	0.45	<1	<1
ST11	0.41	<1	1
DST12	0.78	1	3
ST13	0.42	<1	1
DST14	0.42	1	2
DST15	0.51	1	2
ST16	0.50	1	1
ST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
CP1	-	279	964
CP2	-	182	623
CP3	-	117	410
CP4	-	99	348
CP5	-	<1	21
CP6	-	66	216
CP7	-	67	218
CP8	-	67	239
CP9	-	<1	2
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	<1	20
FS2-S	-	99	328
FS3-E	-	116	408
FS3-S	-	66	215

80' 40' 0 80'

DRAINAGE LEGEND

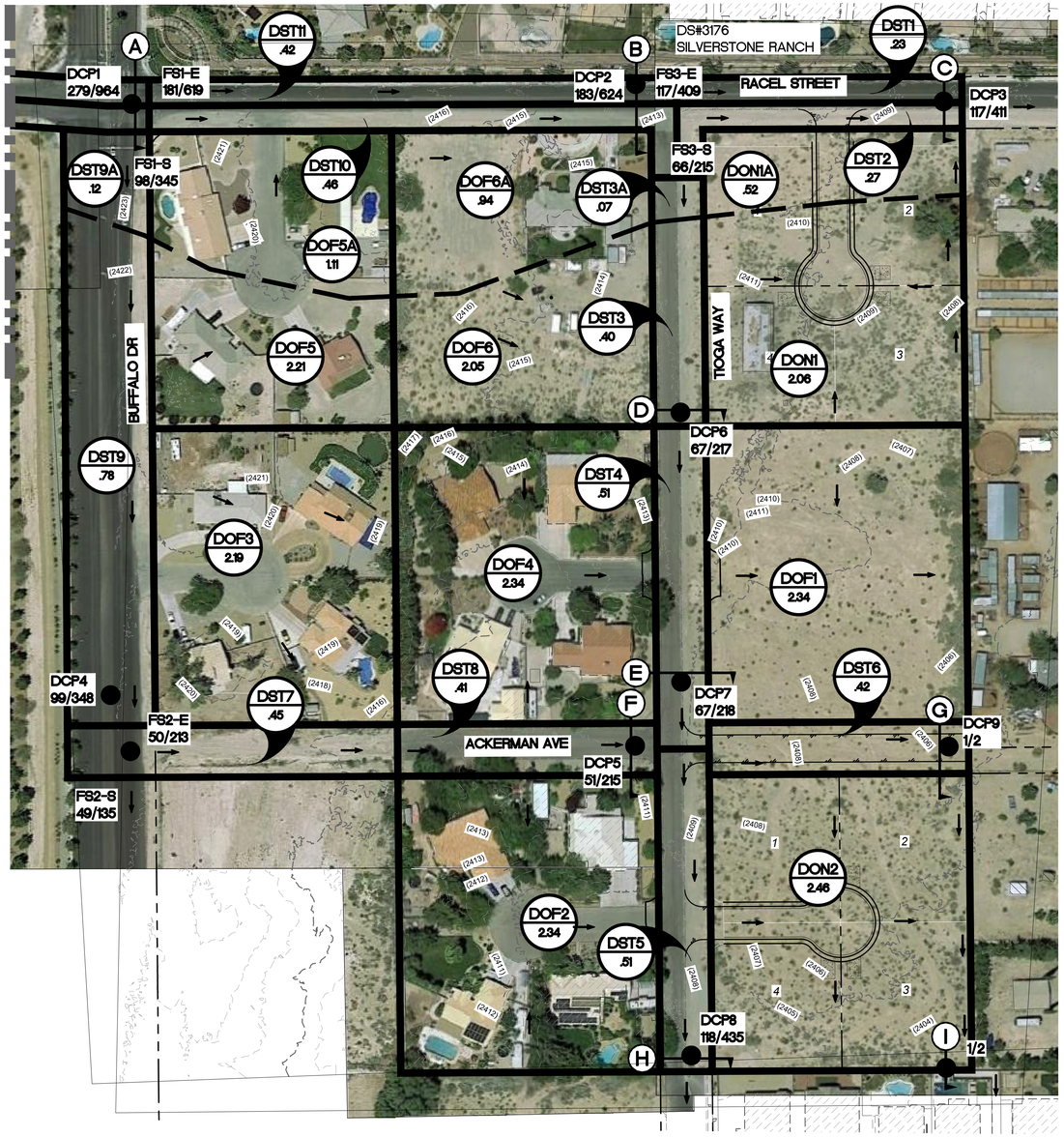
XOF1 / XXX	BASIN IDENTIFICATION / BASIN AREA (ACRES)
C1	BASIN BOUNDARY / CONCENTRATION POINT
	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

DATE: 4.16.2019
JOBNO: ADV-18-101

EST. 2000

EXISTING CONDITION OFFSITE

FIGURE 12





Developed Condition

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW DEV 10 YR	DCP1	279	1.21	0.53	25.57	13.55
CS A RACEL 60' RW DEV 100 YR	DCP1	964	1.21	0.76	39.78	30.23
CS B RACEL 60' RW DEV 10 YR	DCP2	182	1.14	0.48	23.67	11.36
CS B RACEL 60' RW DEV 100 YR	DCP2	623	1.14	0.68	34.78	23.65
CS C RACEL 60' RW DEV 10 YR	DCP3	117	1.49	0.41	22.56	9.25
CS C RACEL 60' RW DEV 100 YR	DCP3	411	1.49	0.58	32.75	19.00
CS D TIOGA 60' RW DEV 10 YR	DCP6	67	0.27	0.35	9.26	3.24
CS D TIOGA 60' RW DEV 100 YR	DCP6	212	0.27	0.52	13.51	7.03
CS E TIOGA 60' RW DEV 10 YR	DCP6	67	0.61	0.30	12.14	3.64
CS E TIOGA 60' RW DEV 100 YR	DCP6	218	0.61	0.48	18.02	8.65
CS F ACKERMAN 60' RW DEV 10 YR	DCP5	50	0.61	0.27	10.98	2.96
CS F ACKERMAN 60' RW DEV 100 YR	DCP5	215	0.61	0.45	17.89	8.05
CS G ACKERMAN 60' RW DEV 10 YR	DCP9	1	0.01	0.21	1.11	0.23
CS G ACKERMAN 60' RW DEV 100 YR	DCP9	2	0.01	0.28	1.32	0.37
CS H TIOGA 60' RW DEV 10 YR	DCP8	119	1.61	0.31	20.32	6.30
CS H TIOGA 60' RW DEV 100 YR	DCP8	435	1.61	0.49	31.19	15.28
CS I 3' VALLEY GUTTER DEV 100 YR	DON2	2	0.01	0.23	2.50	0.58

Flow Split Calculations

Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
FS1-S BUFFALO & RACEL DEV 10 YR	DCP1	98	0.54	0.48	13.95	6.70
FS1-S BUFFALO & RACEL DEV 100 YR	DCP1	345	0.54	0.67	20.31	13.61
FS1-E BUFFALO & RACEL DEV 10 YR	DCP1	181	1.21	0.48	24.11	11.57
FS1-E BUFFALO & RACEL DEV 100 YR	DCP1	619	1.21	0.67	35.30	23.65
FS2-S BUFFALO & ACKERMAN DEV 10 YR	DCP2	117	1.14	0.43	20.60	8.86
FS2-S BUFFALO & ACKERMAN DEV 100 YR	DCP2	409	1.14	0.61	29.76	18.15
FS2-E BUFFALO & ACKERMAN DEV10 YR	DCP2	66	0.27	0.35	9.22	3.23
FS2-E BUFFALO & ACKERMAN DEV100 YR	DCP2	215	0.27	0.53	13.57	7.19
FS3-E RACEL & TIOGA DEV 10 YR	DCP4	49	2	0.34	21.37	7.27
FS3-E RACEL & TIOGA DEV 100 YR	DCP4	135	2	0.50	27.55	13.78
FS3-S RACEL & TIOGA DEV 10 YR	DCP4	50	2	0.34	19.34	6.58
FS3-S RACEL & TIOGA DEV 100 YR	DCP4	213	2	0.49	27.72	13.58

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Developed Condition

Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
DON1	2.06	<1	1
DON2	2.46	<1	1
DOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
DST2	0.23	<1	1
DST3	0.24	<1	1
DST4	0.24	<1	1
DST5	0.26	<1	1
DST6	0.26	<1	1
DST7	0.22	<1	1
DST8	0.26	<1	1
DST9	0.26	1	3
DST10	0.45	1	1
DST11	0.41	1	2
DST15	0.51	1	2
DST16	0.50	1	2
DST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	263	927
REF2**	-	13	31
DCP1	-	279	964
DCP2	-	183	624
DCP3	-	117	411
DCP4	-	99	348
DCP5	-	51	215
DCP6	-	67	216
DCP7	-	67	218
DCP8	-	119	434
DCP9	-	<1	2
FS1-E	-	181	619
FS1-S	-	98	345
FS2-E	-	50	213
FS2-S	-	49	135
FS3-E	-	117	409
FS3-S	-	66	215

80' 40' 0 80'

DRAINAGE LEGEND

XOF1 xxx	BASIN IDENTIFICATION BASIN AREA (ACRES)
	BASIN BOUNDARY
● C1	CONCENTRATION POINT
	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) REFERENCE FLOW (CFS)

DATE: 4.16.2019
JOBNO: ADV-18-101

EST. 2000

DEVELOPED CONDITION OFFSITE

FIGURE 13

Ultimate Condition						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
CS A RACEL 60' RW ULT 10 YR	UCP1	22	1.21	0.27	12.33	3.33
CS A RACEL 60' RW ULT 100 YR	UCP1	21	1.21	0.26	12.14	3.16
CS B RACEL 60' RW ULT 10 YR	UCP2	17	1.14	0.26	11.87	3.09
CS B RACEL 60' RW ULT 100 YR	UCP2	45	1.14	0.33	15.16	5.00
CS C RACEL 60' RW ULT 10 YR	UCP3	12	1.49	0.23	12.10	2.78
CS C RACEL 60' RW ULT 100 YR	UCP3	31	1.49	0.29	15.19	4.41
CS D TIOGA 60' RW ULT 10 YR	UCP6	6	0.27	0.15	4.53	0.68
CS D TIOGA 60' RW ULT 100 YR	UCP6	19	0.27	0.23	6.03	1.39
CS E TIOGA 60' RW ULT 10 YR	UCP6	7	0.61	0.13	6.39	0.83
CS E TIOGA 60' RW ULT 100 YR	UCP6	20	0.61	0.20	8.32	1.66
CS F ACKERMAN 60' RW ULT 10 YR	UCP5	3	0.61	0.13	8.87	1.15
CS F ACKERMAN 60' RW ULT 100 YR	UCP5	16	0.61	0.25	13.47	3.37
CS G ACKERMAN 60' RW ULT 10 YR	UCP9	1	0.01	0.21	1.11	0.23
CS G ACKERMAN 60' RW ULT 100 YR	UCP9	1	0.01	0.21	1.11	0.23
CS H TIOGA 60' RW ULT 10 YR	UCP8	10	1.61	0.13	10.02	1.30
CS H TIOGA 60' RW ULT 100 YR	UCP8	37	1.61	0.21	13.96	2.93
CS I 3' VALLEY GUTTER ULT 100 YR	DON2	2	0.01	0.23	2.50	0.58

Flow Split Calculations						
Cross Section	Description	Q (cfs)	Slope (%)	Depth (ft)	Velocity (ft/s)	DxV
FS1-S BUFFALO & RACEL ULT 10 YR	UCP1	7	0.54	0.25	7.34	1.84
FS1-S BUFFALO & RACEL ULT 100 YR	UCP1	21	0.54	0.32	9.53	3.05
FS1-E BUFFALO & RACEL ULT 10 YR	UCP1	15	1.21	0.25	11.83	2.96
FS1-E BUFFALO & RACEL ULT 100 YR	UCP1	40	1.21	0.32	15.00	4.80
FS2-S BUFFALO & ACKERMAN ULT 10 YR	UCP2	6	0.32	0.16	5.21	0.83
FS2-S BUFFALO & ACKERMAN ULT 100 YR	UCP2	10	0.32	0.17	5.49	0.93
FS2-E BUFFALO & ACKERMAN ULT 10 YR	UCP2	2	0.63	0.08	4.71	0.38
FS2-E BUFFALO & ACKERMAN ULT 100 YR	UCP2	14	0.63	0.17	7.70	1.31
FS3-E RACEL & TIOGA ULT 10 YR	UPC4	11	1.14	0.23	10.69	2.46
FS3-E RACEL & TIOGA ULT 100 YR	UPC4	28	1.14	0.29	13.46	3.90
FS3-S RACEL & TIOGA ULT 10 YR	UPC4	6	0.27	0.15	4.53	0.68
FS3-S RACEL & TIOGA ULT 100 YR	UPC4	17	0.27	0.22	5.87	1.29

NOTES:
*REFERENCED FROM THE LAS 22O09 FINAL DESIGN REPORT FLOYD LAMB PARK
**INCLUDES REFERENCED FLOWS FROM DS #4636 HORSE AND COKE

Ultimate Condition			
Basin	Area (acres)	Q_{10} (cfs)	Q_{100} (cfs)
XON1	2.06	<1	1
XON2	2.46	<1	1
XOF1	2.34	<1	1
DOF2	2.34	<1	<1
DOF3	2.19	<1	<1
DOF4	2.34	<1	<1
DOF5	2.21	<1	2
DOF6	2.05	<1	1
DST1	0.23	1	1
DST2	0.23	<1	1
DST3	0.24	<1	1
DST4	0.24	<1	1
DST5	0.26	<1	1
DST6	0.26	<1	1
DST7	0.22	<1	1
DST8	0.26	<1	1
DST9	0.26	1	3
DST10	0.45	1	1
DST11	0.41	1	2
DST15	0.51	1	2
DST16	0.50	1	2
DST17	0.47	1	1
DST18	0.47	1	2
REF1*	-	6	24
REF2**	-	13	31
UCP1	-	22	61
UCP2	-	17	45
UCP3	-	12	31
UCP4	-	8	24
UCP5	-	3	16
UCP6	-	6	19
UCP7	-	7	20
UCP8	-	10	37
UCP9	-	1	2
FS1-E	-	15	40
FS1-S	-	7	21
FS2-E	-	2	14
FS2-S	-	6	10
FS3-E	-	11	28
FS3-S	-	6	17

80' 40' 0 80'

DRAINAGE LEGEND

XOF1 / XX	BASIN IDENTIFICATION / BASIN AREA (ACRES)
	BASIN BOUNDARY
● C1	CONCENTRATION POINT
	FLOW PATH
	PROJECT SITE
A	CROSS SECTION
XX/XXX (XX/XXX)	10-YR/100-YR FLOW (CFS) / REFERENCE FLOW (CFS)

DATE: 4.16.2019
JOBNO: ADV-18-101

EST. 2000

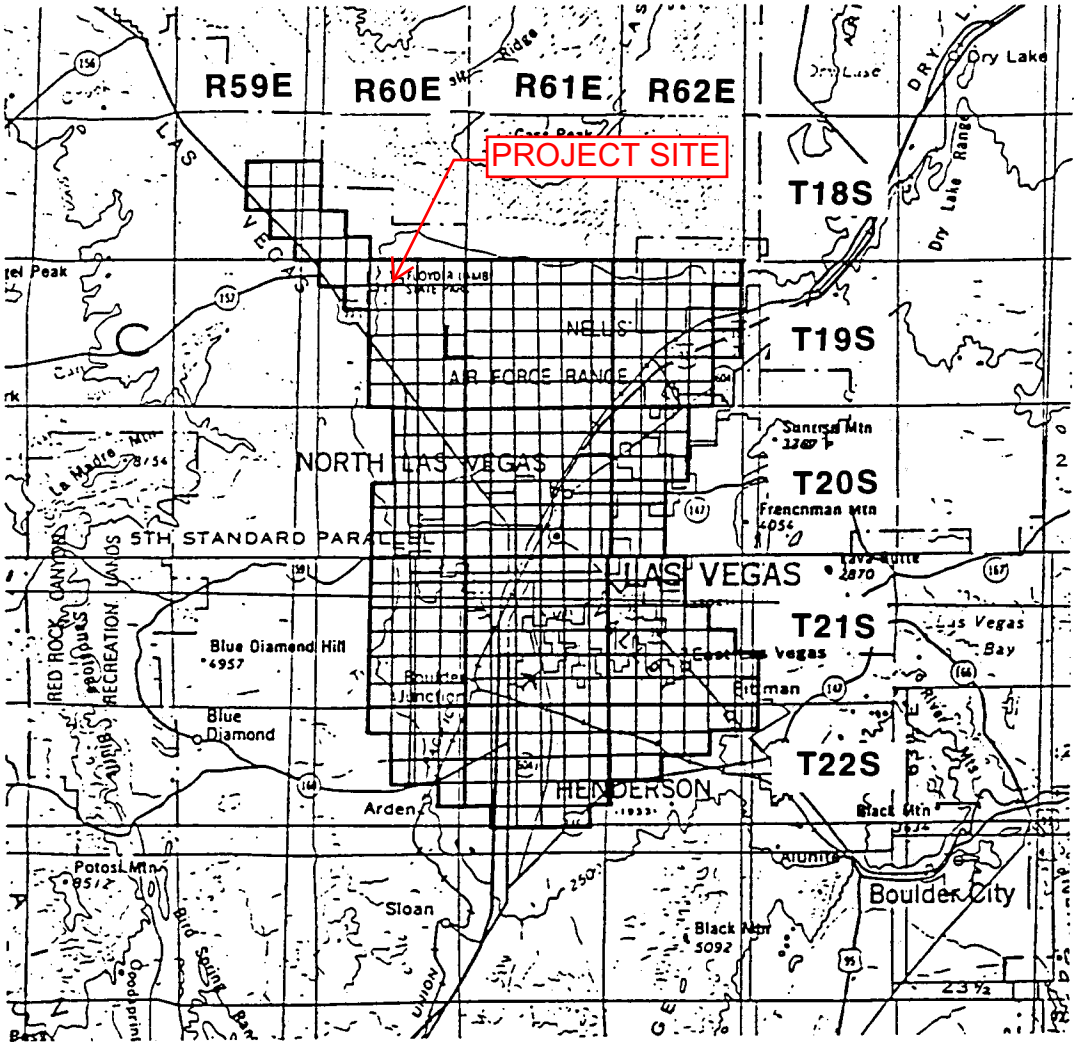
ULTIMATE CONDITION OFFSITE

FIGURE 14

APPENDIX B

Hydrologic Calculations

McCARRAN AIRPORT RAINFALL AREA



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

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

Revision	Date

WRC ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

FIGURE 513

DEPTH-DURATION-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA

(IN INCHES)

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

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

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

3. Table 501 adjustments not required.

Revision	Date

SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

NOTES: 1. A graphical representation of these factors is presented in Figure 514.

2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

Revision	Date

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

RUNOFF CURVE NUMBERS
(URBAN AREAS[1])

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved: curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved: open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
See Table 602A					
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94

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

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

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

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

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

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

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

Revision	Date

REFERENCE:

TABLE 602A

HYDROLOGIC METHODOLOGY AND CRITERIA

The U.S. Army Corps of Engineers *HEC-1 Flood Hydrograph Package* was used to determine the peak runoff values generated by the 100-year, 6-hour storm event. The HEC-1 computer model has the ability to simulate the surface runoff response of a drainage basin to precipitation. The HEC-1 Program represents 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 and field investigation. The proposed onsite areas were determined from the onsite improvement plans in AutoCAD format. The drainage basins are shown on Figures 8 through 15.

Precipitation

The project site is located inside of the limits for McCarran Airport Rainfall. Precipitation values have been referenced from Table 505 of the HCDDM.

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 CCRFCD's Hydrologic Criteria and Drainage Design Manual, Tables 602 and 602A.

Hydrologic soil group information was determined from the Web Soil Survey website (http://websoilsurvey.nrcs.usda.gov). The project site and offsite basins are located within a Hydrologic Soil Group A which has a low runoff potential and a Hydrologic Soil Group D which has a high runoff potential. Composite SCS curve number calculations were calculated using a spreadsheet.

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:

$$T_c = t_i + t_t$$

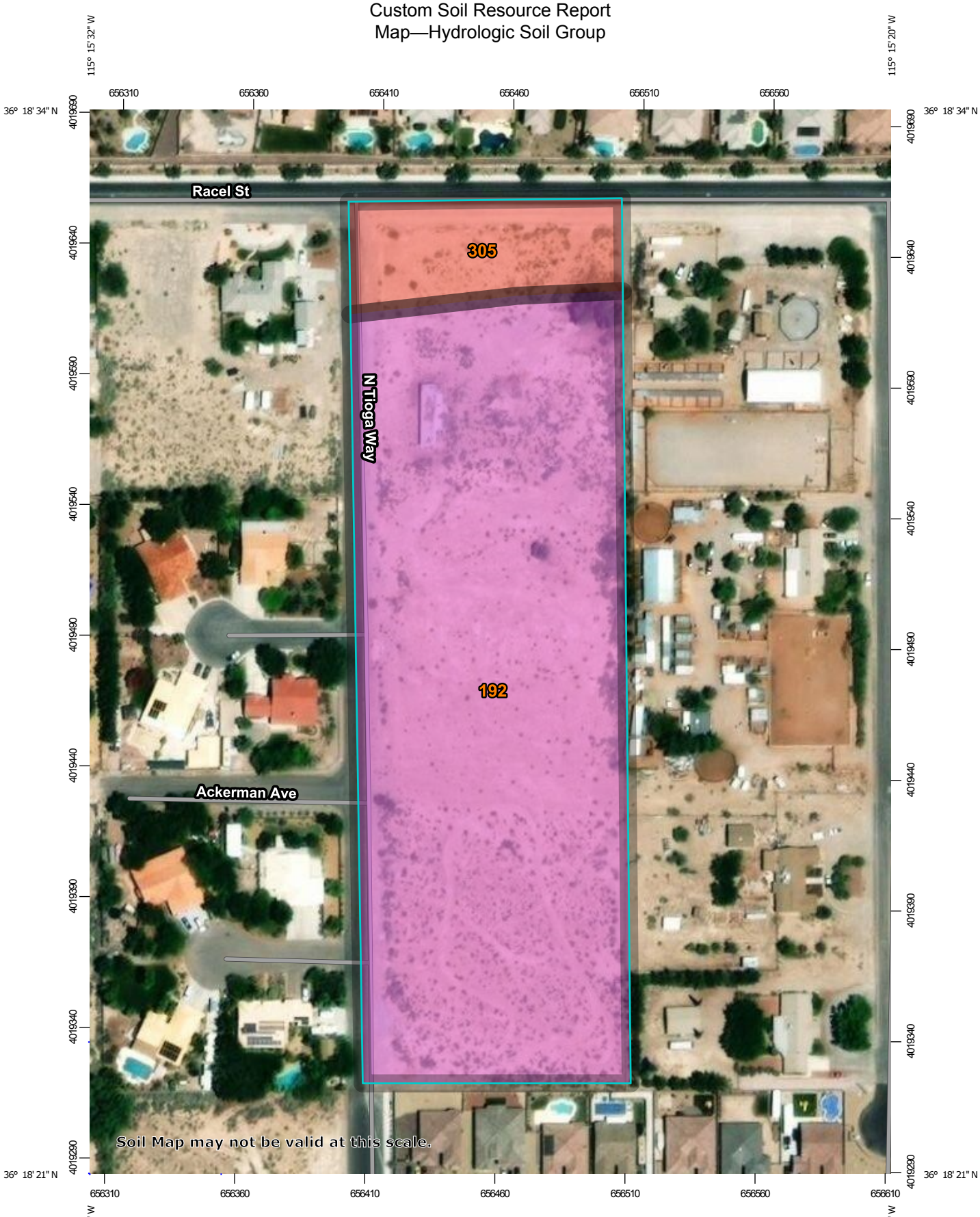
Where, $t_i = 1.8(1.1-K)L_O^{1/2}/S^{1/3}$

K = Flow Resistance Coefficient (K = 0.0132CN-0.39)
CN = Curve Number
L_O = Length of the Overland Flow
S = Average Basin Slope

And, $t_t = L/(60V)$

L = Length of Gutter/Channel (ft)
V = Flow Velocity (ft/s) – Velocity is calculated from the Manning's Equation with $Q = 0.6Q_T$, where Q_T = Total Discharge

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



Map Scale: 1:1,980 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 25 50 100 150

Feet
0 50 100 200 300

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

Table—Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
192	Dalian-McCullough complex, 0 to 4 percent slopes	A	7.7	88.5%
305	Las Vegas-DeStazo complex, 0 to 2 percent slopes	D	1.0	11.5%
Totals for Area of Interest			**8.7**	**100.0%**

Rating Options—Hydrologic Soil Group

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TANEY ENGINEERING
6030 S. JONES BOULEVARD, SUITE #100
LAS VEGAS, NV 89118
TELEPHONE: 702-362-8844
FAX: 702-362-5233

Composite Curve Number Calculations

Proj. No: ADV-18-101 **Project Name:** RACEL & TIOGA
Date: 4/15/2019 **Designed By:** DMW

Basin	Basin Area (ac)	Sub-region Cover Type	Sub-region Soil Type	Sub-region CN	Sub-region Area (ac)	Percent of Basin	Cumulative Percent	Areal Weighted CN	Cumulative CN	Composite CN
XON1	2.06	Desert Shrub, Poor	A	63	1.55	75.0%	75.0%	47.3	47.3	
XON1	2.06	Desert Shrub, Poor	D	88	0.52	25.0%	100.0%	22.0	69.3	**69**
XON2	2.46	Desert Shrub, Poor	A	63	2.46	100.0%	100.0%	63.0	63.0	**63**
XOF1	2.34	Desert Shrub, Poor	A	63	2.34	100.0%	100.0%	63.0	63.0	**63**
DOF2	2.34	Residential, 14000sf, 30% Imp	A	57	2.34	100.0%	100.0%	57.0	57.0	**57**
DOF3	2.19	Residential, 14000sf, 30% Imp	A	57	2.19	100.0%	100.0%	57.0	57.0	**57**
DOF4	2.34	Residential, 14000sf, 30% Imp	A	57	2.34	100.0%	100.0%	57.0	57.0	**57**
DOF5	2.21	Residential, 14000sf, 30% Imp	A	57	1.11	50.2%	50.2%	28.6	28.6	
DOF5	2.21	Residential, 14000sf, 30% Imp	D	86	1.10	49.8%	100.0%	42.8	71.4	**71**
DOF6	2.05	Residential, 20000sf, 25% Imp	A	54	1.11	54.1%	54.1%	29.2	29.2	
DOF6	2.05	Residential, 20000sf, 25% Imp	D	85	0.94	45.9%	100.0%	39.0	68.2	**68**
DST1	0.23	Impervious	D	98	0.23	100.0%	100.0%	98.0	98.0	**98**
ST2	0.23	Desert Shrub, Poor	D	88	0.23	100.0%	100.0%	88.0	88.0	**88**
ST3	0.24	Streets, Paved w/ditches	A	83	0.17	70.8%	70.8%	58.8	58.8	
ST3	0.24	Streets, Paved w/ditches	D	93	0.07	29.2%	100.0%	27.1	85.9	**86**
ST4	0.24	Desert Shrub, Poor	A	63	0.17	70.8%	70.8%	44.6	44.6	
ST4	0.24	Desert Shrub, Poor	D	88	0.07	29.2%	100.0%	25.7	70.3	**70**
ST5	0.26	Streets, Paved w/ditches	A	83	0.26	100.0%	100.0%	83.0	83.0	**83**
ST6	0.26	Desert Shrub, Poor	A	63	0.26	100.0%	100.0%	63.0	63.0	**63**
ST7	0.22	Desert Shrub, Poor	A	63	0.22	100.0%	100.0%	63.0	63.0	**63**
ST8	0.26	Streets, Paved w/ditches	A	83	0.26	100.0%	100.0%	83.0	83.0	**83**
ST9	0.26	Desert Shrub, Poor	A	63	0.26	100.0%	100.0%	63.0	63.0	**63**
ST10	0.45	Desert Shrub, Poor	A	63	0.45	100.0%	100.0%	63.0	63.0	**63**
ST11	0.41	Streets, Paved w/ditches	A	83	0.41	100.0%	100.0%	83.0	83.0	**83**
ST12	0.78	Impervious	A	98	0.66	84.6%	84.6%	82.9	82.9	

ST12	0.78	Impervious	D	98	0.12	15.4%	100.0%	15.1	98.0	**98**
ST13	0.42	Desert Shrub, Poor	D	88	0.42	100.0%	100.0%	88.0	88.0	**88**
DST14	0.42	Impervious	D	98	0.42	100.0%	100.0%	98.0	98.0	**98**
DST1	0.23	Impervious	D	98	0.23	100.0%	100.0%	98.0	98.0	**98**
IST2	0.27	Streets, Paved w/ditches	D	93	0.27	100.0%	100.0%	93.0	93.0	**93**
IST3	0.47	Streets, Paved w/ditches	A	83	0.40	85.1%	85.1%	70.6	70.6	
IST3	0.47	Streets, Paved w/ditches	D	93	0.07	14.9%	100.0%	13.9	84.5	**84**
IST4	0.51	Streets, Paved w/ditches	A	83	0.51	100.0%	100.0%	83.0	83.0	**83**
IST5	0.21	Desert Shrub, Poor	A	63	0.21	100.0%	100.0%	63.0	63.0	**63**
IST6	0.21	Streets, Paved w/ditches	A	83	0.21	100.0%	100.0%	83.0	83.0	**83**
IST7	0.51	Streets, Paved w/ditches	A	83	0.51	100.0%	100.0%	83.0	83.0	**83**
IST8	0.45	Desert Shrub, Poor	A	63	0.45	100.0%	100.0%	63.0	63.0	**63**
IST9	0.41	Streets, Paved w/ditches	A	83	0.41	100.0%	100.0%	83.0	83.0	**83**
DST10	0.78	Impervious	A	98	0.66	84.6%	84.6%	82.9	82.9	
DST10	0.78	Impervious	D	98	0.12	15.4%	100.0%	15.1	98.0	**98**
IST11	0.46	Desert Shrub, Poor	D	88	0.46	100.0%	100.0%	88.0	88.0	**88**
DST12	0.42	Impervious	D	98	0.42	100.0%	100.0%	98.0	98.0	**98**
DST1	0.23	Impervious	D	98	0.23	100.0%	100.0%	98.0	98.0	**98**
DST2	0.27	Streets, Paved w/ditches	D	93	0.27	100.0%	100.0%	93.0	93.0	**93**
DST3	0.47	Streets, Paved w/ditches	A	83	0.33	70.2%	70.2%	58.3	58.3	
DST3	0.47	Streets, Paved w/ditches	D	93	0.14	29.8%	100.0%	27.7	86.0	**86**
DST4	0.51	Streets, Paved w/ditches	A	83	0.51	100.0%	100.0%	83.0	83.0	**83**
DST5	0.51	Streets, Paved w/ditches	A	83	0.51	100.0%	100.0%	83.0	83.0	**83**
DST6	0.42	Streets, Paved w/ditches	A	83	0.42	100.0%	100.0%	83.0	83.0	**83**
DST7	0.45	Streets, Paved w/ditches	A	83	0.45	100.0%	100.0%	83.0	83.0	**83**
DST8	0.41	Streets, Paved w/ditches	A	83	0.41	100.0%	100.0%	83.0	83.0	**83**
DST9	0.78	Impervious	A	98	0.66	84.6%	84.6%	82.9	82.9	
DST9	0.78	Impervious	D	98	0.12	15.4%	100.0%	15.1	98.0	**98**
DST10	0.42	Streets, Paved w/ditches	D	93	0.42	100.0%	100.0%	93.0	93.0	**93**
DST11	0.42	Impervious	D	98	0.42	100.0%	100.0%	98.0	98.0	**98**
DON1	2.06	Residential, 10000sf, 38% Imp	A	61	1.55	75.2%	75.2%	45.9	45.9	
DON1	2.06	Residential, 10000sf, 38% Imp	D	87	0.52	25.2%	100.5%	22.0	67.9	**68**
DON2	2.46	Residential, 10000sf, 38% Imp	A	61	2.46	100.0%	100.0%	61.0	61.0	**61**
DOF1	2.34	Residential, 10000sf, 38% Imp	A	61	2.34	100.0%	100.0%	61.0	61.0	**61**
DST15	0.51	Impervious	D	98	0.51	100.0%	100.0%	98.0	98.0	**98**
ST16	0.50	Streets, Paved w/ditches	D	93	0.50	100.0%	100.0%	93.0	93.0	**93**
ST17	0.47	Streets, Paved w/ditches	D	93	0.47	100.0%	100.0%	93.0	93.0	**93**

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

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

PROJECT NO. : ADV-18-101 **PROJECT: RACEL AND TIOGA**

FILE : STD_FRM4 **CALCULATED BY: DMW** **DATE : 04/15/19**

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	CN	K	AREA (acres)	AREA (mi^2)	LENGTH (ft)	SLOPE (%)	T_i (min)	LENGTH (ft)	SLOPE (%)	V_1 (fps)	V_2 (fps)	T_t (min)	$T_c=T_i+T_t$ (min)	TOTAL (ft)	T_c (min)	T_c (min)	T_{lag} (hrs)	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)	(18)	(19)
EXISTING CONDITION																		
XON1	69	0.521	2.06	0.0032	92	0.97	10.1	450	1.18	1.61	N/A	4.7	14.8	N/A	N/A	14.77	0.148	
XON2	63	0.442	2.46	0.0038	84	1.31	9.9	470	1.40	1.75	N/A	4.5	14.4	N/A	N/A	14.40	0.144	
XOF1	63	0.442	2.34	0.0037	86	0.27	17.0	469	0.97	1.46	N/A	5.4	22.4	N/A	N/A	22.37	0.224	
DOF2	57	0.362	2.34	0.0037	76	1.34	10.5	387	1.89	2.78	N/A	2.3	12.8	463	12.6	12.57	0.126	
DOF3	57	0.362	2.19	0.0034	153	0.15	30.9	451	1.61	2.56	N/A	2.9	33.8	604	13.4	13.36	0.134	
DOF4	57	0.362	2.34	0.0037	79	3.89	7.5	382	2.13	2.95	N/A	2.2	9.7	461	12.6	9.66	0.097	
DOF5	71	0.547	2.21	0.0035	129	1.54	9.8	448	1.08	2.10	N/A	3.6	13.3	577	13.2	13.21	0.132	
DOF6	68	0.51	2.05	0.0032	91	1.13	9.8	461	0.96	1.98	N/A	3.9	13.6	552	13.1	13.07	0.131	
DST1	98	0.904	0.23	0.0004	15	1.07	1.3	330	1.47	2.45	N/A	2.2	3.6	345	11.9	3.58	0.050	
ST2	88	0.772	0.23	0.0004	15	1.60	2.0	330	1.42	1.76	N/A	3.1	5.1	N/A	N/A	5.08	0.100	
ST3	86	0.745	0.24	0.0004	15	1.71	2.1	343	0.22	0.95	N/A	6.0	8.1	358	12.0	8.10	0.081	
ST4	70	0.534	0.24	0.0004	15	3.22	2.7	343	0.21	0.68	N/A	8.4	11.1	N/A	N/A	11.10	0.111	
ST5	83	0.706	0.26	0.0004	15	0.55	3.4	376	0.44	1.34	N/A	4.7	8.0	391	12.2	8.03	0.080	
ST6	63	0.442	0.26	0.0004	15	2.42	3.4	376	0.44	0.98	N/A	6.4	9.8	N/A	N/A	9.80	0.100	
ST7	63	0.442	0.22	0.0003	15	0.73	5.1	300	1.06	1.52	N/A	3.3	8.4	N/A	N/A	8.38	0.100	
ST8	83	0.71	0.26	0.0004	15	0.56	3.3	374	0.52	1.46	N/A	4.3	7.6	389	12.2	7.61	0.076	
ST9	63	0.44	0.26	0.0004	15	2.43	3.4	374	0.52	1.07	N/A	5.8	9.3	N/A	N/A	9.25	0.100	
ST10	63	0.44	0.45	0.0007	30	0.04	19.0	330	1.61	2.56	N/A	2.1	21.1	360	12.0	12.00	0.120	
ST11	83	0.71	0.41	0.0006	30	0.70	4.4	300	1.26	1.66	N/A	3.0	7.4	N/A	N/A	7.39	0.100	
DST12	98	0.90	0.78	0.0012	15	0.43	1.8	686	0.71	1.70	2.58	6.1	7.9	701	13.9	7.91	0.079	
ST13	88	0.77	0.42	0.0007	15	0.82	2.4	610	1.68	1.92	3.81	4.8	7.3	N/A	N/A	7.27	0.100	
DST14	98	0.90	0.42	0.0007	15	0.83	1.5	610	1.68	2.62	3.97	3.6	5.1	625	13.5	5.10	0.051	
DST15	98	0.90	0.51	0.0008	15	1.00	1.4	678	1.00	2.02	3.06	5.1	6.5	693	13.9	6.46	0.065	
ST16	93	0.84	0.50	0.0008	15	1.00	1.8	678	1.00	1.48	2.94	6.6	8.5	N/A	N/A	8.47	0.100	
ST17	93	0.84	0.47	0.0007	15	1.00	1.8	678	1.00	1.48	2.94	6.6	8.5	N/A	N/A	8.47	0.100	
DST18	98	0.90	0.47	0.0007	15	1.00	1.4	678	1.00	2.02	3.06	5.1	6.5	693	13.9	6.46	0.065	
INTERIM CONDITION																		
DON1	68	0.508	2.06	0.0032	191	2.98	10.2	441	1.02	2.04	N/A	3.6	13.8	632.0	13.5	13.5	0.135	
DON2	61	0.415	2.46	0.0038	173	2.72	11.6	457	1.17	2.18	N/A	3.5	15.1	630.0	13.5	13.5	0.135	
IST2	93	0.838	0.27	0.0004	15	1.44	1.6	330	2.00	2.86	N/A	1.9	3.5	345.0	11.9	3.5	0.050	
IST3	84	0.719	0.47	0.0007	30	2.00	3.0	343	0.31	1.12	N/A	5.1	8.1	373.0	12.1	8.1	0.081	
IST4	83	0.706	0.51	0.0008	30	2.46	2.9	373	0.56	1.51	N/A	4.1	7.0	403.0	12.2	7.0	0.070	
IST5	63	0.442	0.21	0.0003	15	2.24	3.5	300	0.98	1.47	N/A	3.4	6.9	N/A	N/A	6.9	0.100	
IST6	83	0.706	0.21	0.0003	15	2.00	2.2	300	1.14	2.16	N/A	2.3	4.5	315.0	11.8	4.5	0.050	
IST7	83	0.706	0.51	0.0008	30	2.00	3.1	373	0.53	1.47	N/A	4.2	7.3	403.0	12.2	7.3	0.073	
IST8	63	0.442	0.45	0.0007	30	0.04	19.0	330	1.61	2.56	N/A	2.1	21.1	360.0	12.0	12.0	0.120	
IST9	83	0.706	0.41	0.0006	30	0.70	4.4	300	1.26	1.66	N/A	3.0	7.4	N/A	N/A	7.4	0.100	
IST10	98	0.904	0.78	0.0012	15	0.43	1.8	686	0.71	1.70	2.58	6.1	7.9	701.0	13.9	7.9	0.079	
IST11	88	0.772	0.46	0.0007	15	0.82	2.4	610	1.68	1.92	3.81	4.8	7.3	N/A	N/A	7.3	0.100	
DST12	98	0.904	0.42	0.0007	15	0.83	1.5	610	1.68	2.62	3.97	3.6	5.1	625.0	13.5	5.1	0.051	
DEVELOPED CONDITION																		
DOF1	61	0.415	2.34	0.0037	176	0.75	18.0	455	1.46	2.44	N/A	3.1	21.1	631.0	13.5	13.5	0.135	
DST1	98	0.904	0.23	0.0004	15	1.07	1.3	330	1.47	2.45	N/A	2.2	3.6	345.0	11.9	3.6	0.050	
DST2	93	0.838	0.27	0.0004	15	1.44	1.6	330	2.00	2.86	N/A	1.9	3.5	345.0	11.9	3.5	0.050	
DST3	86	0.745	0.47	0.0007	30	2.00	2.8	343	0.31	1.12	N/A	5.1	7.9	373.0	12.1	7.9	0.079	
DST4	83	0.706	0.51	0.0008	30	2.46	2.9	373	0.56	1.51	N/A	4.1	7.0	403.0	12.2	7.0	0.070	
DST5	83	0.706	0.51	0.0008	30	2.00	3.1	373	0.53	1.47	N/A	4.2	7.3	403.0	12.2	7.3	0.073	
DST6	83	0.706	0.42	0.0007	30	2.00	3.1	300	1.26	2.27	N/A	2.2	5.3	330.0	11.8	5.3	0.053	
DST7	83	0.706	0.45	0.0007	30	0.04	11.4	330	1.61	2.56	N/A	2.1	13.5	360.0	12.0	12.0	0.120	
DST8	83	0.706	0.41	0.0006	30	2.00	3.1	300	1.26	2.27	N/A	2.2	5.3	330.0	11.8	5.3	0.053	
DST9	98	0.904	0.78	0.0012	15	0.43	1.8	686	0.71	1.70	2.58	6.1	7.9	701.0	13.9	7.9	0.079	
DST10	93	0.838	0.42	0.0007	15	0.82	2.0	610	1.68	2.62	3.97	3.6	5.6	625.0	13.5	5.6	0.056	
DST11	98	0.904	0.42	0.0007	15	2.00	1.1	610	1.68	2.62	3.97	3.6	4.7	625.0	13.5	4.7	0.050	
DST16	93	0.84	0.50	0.0008	15	1.00	1.8	678	1.00	2.02	3.06	5.1	6.9	693	13.9	6.92	0.069	
DST17	93	0.84	0.47	0.0007	15	1.00	1.8	678	1.00	2.02	3.06	5.1	6.9	693	13.9	6.92	0.069	

$T_c=T_i+T_t$

K=0.0132(CN)-.39

T_{lag} = 0.6T_c

V_1 applies to the first 500 feet of travel distance;
V_2 applies to the remaining travel distance.

V_1 = 14.8*(S/100)^1/2
V_2 = 29.4*(S/100)^1/2

V_1 = 20.2*(S/100)^1/2
V_2 = 30.6*(S/100)^1/2

T_{lag}=20Kn(L*L_c/S^0.5)^0.33
and denoted by shaded gray
(See Worksheet).

REFERENCE: **CCRFCD HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL**

STANDARD FORM 4

EXISTING CONDITION

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1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                 *         609 SECOND STREET            *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  10:50:51  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************

                                        X     X  XXXXXXX   XXXXX           X
                                        X     X  X        X     X         XX
                                        X     X  X        X               X
                                        XXXXXXX  XXXX     X        XXXXX  X
                                        X     X  X        X               X
                                        X     X  X        X     X         X
                                        X     X  XXXXXXX   XXXXX         XXX
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THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        10-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        EXISTING CONDITION
           11           ID        FILE: EX10.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF     263
           35           LS       0      63
           36           UD      .6
                        *
           37           KK    ST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.100
                        *
           42           KK   DST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
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                *
1                                       HEC-1 INPUT                                             PAGE  2

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

            46          KK    REF2
            47          KM   REFERENCED FROM DS4636 HORSE AND COKE
            48          BA   .0001
            49          BF      13
            50          LS       0      63
            51          UD      .6
                        *

            52          KK    ST16
            53          BA   .0008
            54          BF       0
            55          LS       0      93
            56          UD   0.100
                        *

            57          KK   DST15
            58          BA   .0008
            59          LS       0      98
            60          UD   0.065
                        *

            61          KK     CP1
            62          KM   COMBINE REF1, REF2, ST17, DST18, ST16, DST15
            63          HC       6
                        *

            64          KK      D1
            65          KM   FLOW SPLIT AT BUFFALO AND RACEL
            66          DT     CP1
            67          DI     279
            68          DQ      98
                        *

            69          KK    ST13
            70          BA   .0007
            71          LS       0      88
            72          UD   0.100
                        *

            73          KK   DST14
            74          BA   .0007
            75          LS       0      98
            76          UD   0.051
                        *

            77          KK    DOF5
            78          BA   .0035
            79          LS       0      71
            80          UD    .132
                        *
1                                       HEC-1 INPUT                                             PAGE  3

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

            81          KK     CP2
            82          KM   COMBINE CP1, ST13, DST14, DOF5
            83          HC       4
                        *

            84          KK     DI2
            85          KM   FLOW SPLIT AT TIOGA AND RACEL
            86          DT     CP2
            87          DI     182
            88          DQ      66
                        *

            89          KK    DST1
            90          BA   .0004
            91          LS       0      98
            92          UD   0.050
                        *

            93          KK     ST2
            94          BA   .0004
            95          LS       0      88
            96          UD   0.100
                        *

            97          KK     CP3
            98          KM   COMBINE CP2, DST1, ST2
            99          HC       3
                        *
```

```
 100          KK    DOF3
 101          BA   .0034
 102          LS      0      57
 103          UD    .134
              *

 104          KK   DST12
 105          BA   .0012
 106          LS      0      98
 107          UD   0.079
              *

 108          KK   RETD1
 109          KM   RETRIEVE D1
 110          DR     CP1
              *

 111          KK     CP4
 112          KM   COMBINE DST12, RETD1, DOF3
 113          HC       3
              *
```



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

 114          KK     DI3
 115          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 116          DT     CP4
 117          DI      99
 118          DQ      99
              *

 119          KK    ST10
 120          BA   .0007
 121          LS      0      63
 122          UD   0.120
              *

 123          KK    ST11
 124          BA   .0006
 125          LS      0      83
 126          UD   0.120
              *

 127          KK     CP5
 128          KM   COMBINE ST11, DST10
 129          HC       2
              *

 130          KK    DOF6
 131          BA   .0032
 132          LS      0      68
 133          UD    .131
              *

 134          KK     ST3
 135          BA   .0004
 136          BF       0
 137          LS      0      86
 138          UD   0.081
              *

 139          KK     ST4
 140          BA   .0004
 141          BF       0
 142          LS      0      70
 143          UD   0.111
              *

 144          KK   RETD2
 145          KM   RETRIEVE D2
 146          DR     CP2
              *
```



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

 147          KK     CP6
 148          KM   COMBINE DOF6, ST3, ST4, RETD2
 149          HC       3
              *

 150          KK     ST5
 151          BA   .0004
 152          BF       0
 153          LS      0      83
 154          UD   0.080
              *
```

```
            155           KK     ST6
            156           BA   .0004
            157           BF       0
            158           LS       0      63
            159           UD   0.100
                          *

            160           KK    DOF4
            161           BA   .0037
            162           LS       0      57
            163           UD    .097
                          *

            164           KK     CP7
            165           KM   COMBINE CP6, ST5, ST6, DOF4, CP5
            166           HC       5
                          *

            167           KK     ST8
            168           BA   .0004
            169           BF       0
            170           LS       0      83
            171           UD   0.076
                          *

            172           KK     ST9
            173           BA   .0004
            174           BF       0
            175           LS       0      63
            176           UD   0.100
                          *

            177           KK    DOF2
            178           BA   .0037
            179           LS       0      57
            180           UD    .126
                          *
1                                          HEC-1 INPUT                                          PAGE  6

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


            181           KK     CP8
            182           KM   COMBINE CP7, ST8, ST9, CP5, DOF2
            183           HC       5
                          *

            184           KK    XON1
            185           BA   .0032
            186           LS       0      69
            187           UD    .148
                          *

            188           KK    XOF1
            189           BA   .0037
            190           LS       0      63
            191           UD    .224
                          *

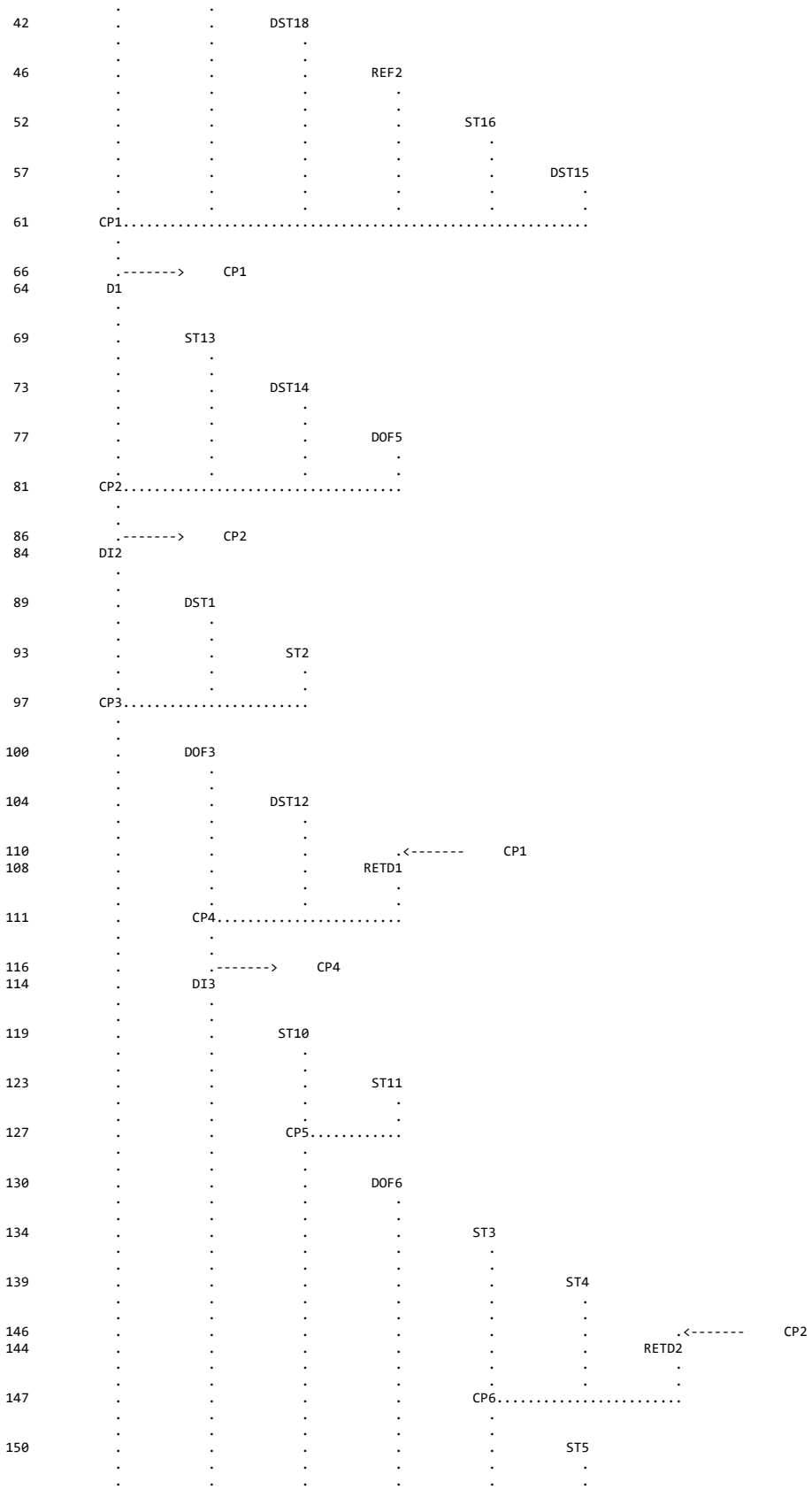
            192           KK     ST7
            193           BA   .0003
            194           BF       0
            195           LS       0      63
            196           UD   0.100
                          *

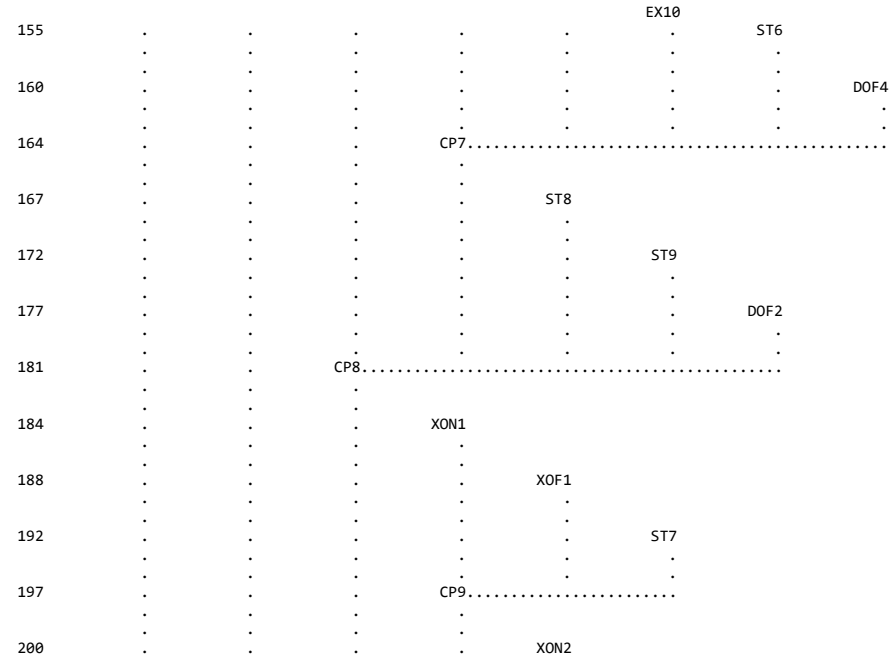
            197           KK     CP9
            198           KM   COMBINE XON1, XOF1, ST7
            199           HC       3
                          *

            200           KK    XON2
            201           BA   .0038
            202           LS       0      63
            203           UD    .144
                          *
            204           ZZ
1
                SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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

    22        REF1
                 .
                 .
    37           .        ST17
                 .          .
```


DST18
REF2
ST16
DST15
CP1
CP1
D1
ST13
DST14
DOF5
CP2
CP2
DI2
DST1
ST2
CP3
DOF3
DST12
CP1
RETD1
CP4
CP4
DI3
ST10
ST11
CP5
DOF6
ST3
ST4
CP2
RETD2
CP6
ST5



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *          609 SECOND STREET            *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   11APR19  TIME  10:50:51   *                    *           (916) 756-1104              *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
                          <><><><><><><><><><><><><><><><><><><><>
                            RACEL/TIOGA
                            HYDROLOGIC MODEL
                            ----------------------------

                            10-YR STORM EVENT
                            ----------------------------
                            TANEY ENGINEERING
                            EXISTING CONDITION
                            FILE: EX10.DAT
                            PROJECT No: ADV-18-101
                            DATE:  APR 2019
                          <><><><><><><><><><><><><><><><><><><><>

                           ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

           ENGLISH UNITS
                DRAINAGE AREA         SQUARE MILES
                PRECIPITATION DEPTH   INCHES
                LENGTH, ELEVATION     FEET
                FLOW                  CUBIC FEET PER SECOND
```

STORAGE VOLUME ACRE-FEET
SURFACE AREA ACRES
TEMPERATURE DEGREES FAHRENHEIT

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 1.00
1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT						
+	REF1	.00	1	FLOW	263.	263.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	ST17	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST18	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	REF2	.00	1	FLOW	13.	13.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	ST16	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST15	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
6 COMBINED AT						
+	CP1	.00	1	FLOW	279.	282.
				TIME	3.50	3.50
DIVERSION TO						
+	CP1	.00	1	FLOW	98.	99.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D1	.00	1	FLOW	181.	183.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ST13	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST14	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF5	.00	1	FLOW	0.	2.
				TIME	3.67	3.58
4 COMBINED AT						
+	CP2	.01	1	FLOW	182.	187.
				TIME	3.50	3.50
DIVERSION TO						
+	CP2	.01	1	FLOW	66.	68.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DI2	.01	1	FLOW	116.	119.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST1	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ST2	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
3 COMBINED AT						

```
+                    CP3       .01     1   FLOW         117.     121.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    DOF3      .00     1   FLOW           0.       0.
                                           TIME         5.00     3.75

 HYDROGRAPH AT
+                   DST12      .00     1   FLOW           1.       3.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   RETD1      .00     1   FLOW          98.      99.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                    CP4       .00     1   FLOW          99.     102.
                                           TIME         3.50     3.50

 DIVERSION TO
+                    CP4       .00     1   FLOW          99.     102.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    DI3       .00     1   FLOW           0.       0.
                                           TIME          .00      .00

 HYDROGRAPH AT
+                    ST10      .00     1   FLOW           0.       0.
                                           TIME         4.83     3.58

 HYDROGRAPH AT
+                    ST11      .00     1   FLOW           0.       1.
                                           TIME         3.58     3.58

  2 COMBINED AT
+                    CP5       .00     1   FLOW           0.       1.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                    DOF6      .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                    ST3       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST4       .00     1   FLOW           0.       0.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                   RETD2      .00     1   FLOW          66.      68.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                    CP6       .00     1   FLOW          66.      69.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST5       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST6       .00     1   FLOW           0.       0.
                                           TIME         4.58     3.58

 HYDROGRAPH AT
+                    DOF4      .00     1   FLOW           0.       0.
                                           TIME         4.92     3.58

  5 COMBINED AT
+                    CP7       .01     1   FLOW          67.      71.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST8       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST9       .00     1   FLOW           0.       0.
                                           TIME         4.58     3.58

 HYDROGRAPH AT
+                    DOF2      .00     1   FLOW           0.       0.
                                           TIME         4.92     3.75

  5 COMBINED AT
+                    CP8       .01     1   FLOW          67.      72.
                                           TIME         3.50     3.58
```

```
 HYDROGRAPH AT
+                   XON1       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                   XOF1       .00     1   FLOW           0.       1.
                                           TIME         4.92     3.75

 HYDROGRAPH AT
+                    ST7       .00     1   FLOW           0.       0.
                                           TIME         4.58     3.58

  3 COMBINED AT
+                    CP9       .01     1   FLOW           0.       2.
                                           TIME         4.92     3.67

 HYDROGRAPH AT
+                   XON2       .00     1   FLOW           0.       1.
                                           TIME         4.92     3.67


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

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                 *         609 SECOND STREET            *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  10:53:03  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        100-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        EXISTING CONDITION
           11           ID        FILE: EX100.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF     927
           35           LS       0      63
           36           UD      .6
                        *
           37           KK    ST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.100
                        *
           42           KK   DST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                *
1                                       HEC-1 INPUT                                             PAGE  2

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

            46      KK    REF2
            47      KM   REFERENCED FROM DS4636 HORSE AND COKE
            48      BA   .0001
            49      BF      31
            50      LS       0      63
            51      UD      .6
                    *

            52      KK    ST16
            53      BA   .0008
            54      BF       0
            55      LS       0      93
            56      UD   0.100
                    *

            57      KK   DST15
            58      BA   .0008
            59      LS       0      98
            60      UD   0.065
                    *

            61      KK     CP1
            62      KM   COMBINE REF1, REF2, ST17, DST18, ST16, DST15
            63      HC       6
                    *

            64      KK      D1
            65      KM   FLOW SPLIT AT BUFFALO AND RACEL
            66      DT     CP1
            67      DI     964
            68      DQ     345
                    *

            69      KK    ST13
            70      BA   .0007
            71      LS       0      88
            72      UD   0.100
                    *

            73      KK   DST14
            74      BA   .0007
            75      LS       0      98
            76      UD   0.051
                    *

            77      KK    DOF5
            78      BA   .0035
            79      LS       0      71
            80      UD    .132
                    *
1                                       HEC-1 INPUT                                             PAGE  3

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

            81      KK     CP2
            82      KM   COMBINE CP1, ST13, DST14, DOF5
            83      HC       4
                    *

            84      KK      D2
            85      KM   FLOW SPLIT AT TIOGA AND RACEL
            86      DT     CP2
            87      DI     623
            88      DQ     215
                    *

            89      KK    DST1
            90      BA   .0004
            91      LS       0      98
            92      UD   0.050
                    *

            93      KK     ST2
            94      BA   .0004
            95      LS       0      88
            96      UD   0.100
                    *

            97      KK     CP3
            98      KM   COMBINE CP2, DST1, ST2
            99      HC       3
                    *
```

```
 100          KK    DOF3
 101          BA   .0034
 102          LS      0      57
 103          UD    .134
              *

 104          KK   DST12
 105          BA   .0012
 106          LS      0      98
 107          UD   0.079
              *

 108          KK   RETD1
 109          KM   RETRIEVE D1
 110          DR     CP1
              *

 111          KK     CP4
 112          KM   COMBINE DST12, RETD1, DOF3
 113          HC       3
              *
```



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

 114          KK      D3
 115          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 116          DT     CP4
 117          DI     348
 118          DQ      20
              *

 119          KK    ST10
 120          BA   .0007
 121          LS      0      63
 122          UD   0.120
              *

 123          KK    ST11
 124          BA   .0006
 125          LS      0      83
 126          UD   0.120
              *

 127          KK   RETD3
 128          KM   RETRIEVE D3
 129          DR     CP4
              *

 130          KK     CP5
 131          KM   COMBINE ST11, DST10, RETD3
 132          HC       3
              *

 133          KK    DOF6
 134          BA   .0032
 135          LS      0      68
 136          UD    .131
              *

 137          KK     ST3
 138          BA   .0004
 139          BF      0
 140          LS      0      86
 141          UD   0.081
              *

 142          KK     ST4
 143          BA   .0004
 144          BF      0
 145          LS      0      70
 146          UD   0.111
              *
```



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

 147          KK   RETD2
 148          KM   RETRIEVE D2
 149          DR     CP2
              *

 150          KK     CP6
 151          KM   COMBINE DOF6, ST3, ST4, RETD2
 152          HC       3
              *

 153          KK     ST5
```

```
            154           BA   .0004
            155           BF       0
            156           LS       0      83
            157           UD   0.080
                          *

            158           KK     ST6
            159           BA   .0004
            160           BF       0
            161           LS       0      63
            162           UD   0.100
                          *

            163           KK    DOF4
            164           BA   .0037
            165           LS       0      57
            166           UD    .097
                          *

            167           KK     CP7
            168           KM   COMBINE CP6, ST5, ST6, DOF4, CP5
            169           HC       5
                          *

            170           KK     ST8
            171           BA   .0004
            172           BF       0
            173           LS       0      83
            174           UD   0.076
                          *

            175           KK     ST9
            176           BA   .0004
            177           BF       0
            178           LS       0      63
            179           UD   0.100
                          *
1                                                HEC-1 INPUT                                                PAGE  6

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


            180           KK    DOF2
            181           BA   .0037
            182           LS       0      57
            183           UD    .126
                          *

            184           KK     CP8
            185           KM   COMBINE CP7, ST8, ST9, CP5, DOF2
            186           HC       5
                          *

            187           KK    XON1
            188           BA   .0032
            189           LS       0      69
            190           UD    .148
                          *

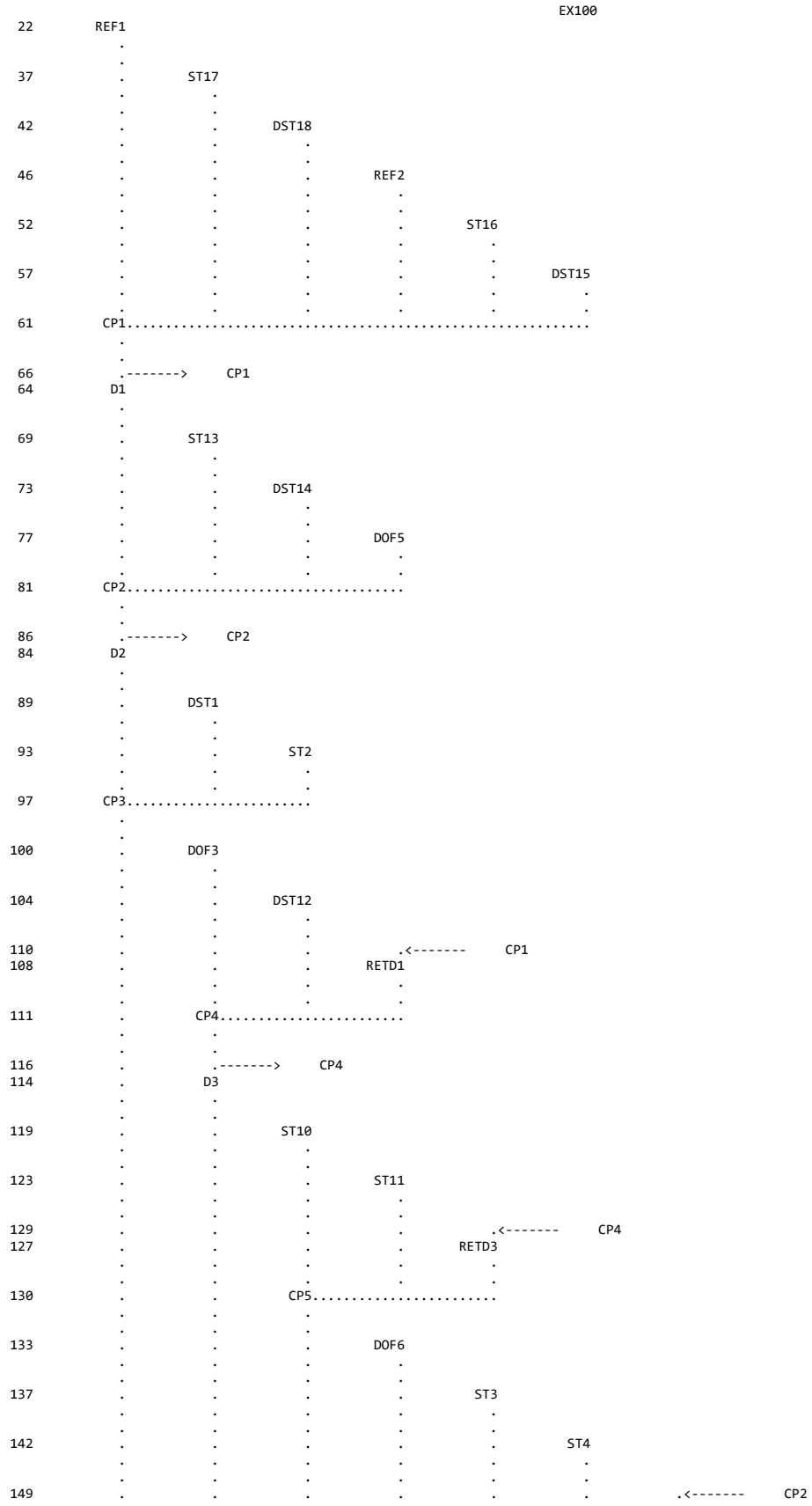
            191           KK    XOF1
            192           BA   .0037
            193           LS       0      63
            194           UD    .224
                          *

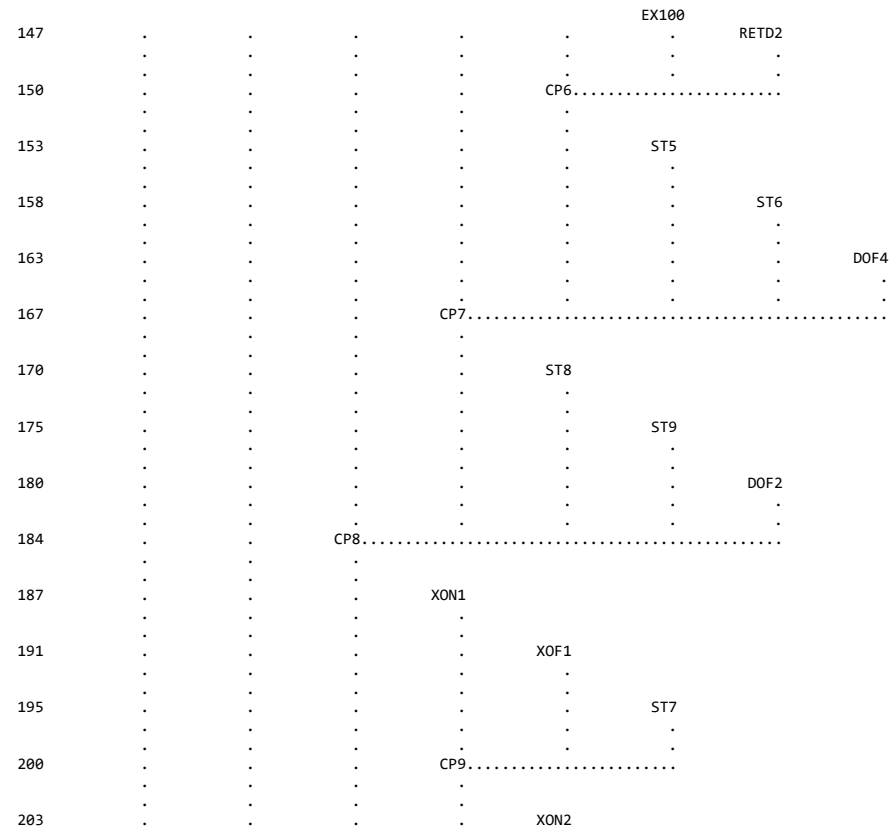
            195           KK     ST7
            196           BA   .0003
            197           BF       0
            198           LS       0      63
            199           UD   0.100
                          *

            200           KK     CP9
            201           KM   COMBINE XON1, XOF1, ST7
            202           HC       3
                          *

            203           KK    XON2
            204           BA   .0038
            205           LS       0      63
            206           UD    .144
                          *
            207           ZZ
1
                    SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW

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


REF1
ST17
DST18
REF2
ST16
DST15
CP1
CP1
D1
ST13
DST14
DOF5
CP2
CP2
D2
DST1
ST2
CP3
DOF3
DST12
CP1
RETD1
CP4
CP4
D3
ST10
ST11
CP4
RETD3
CP5
DOF6
ST3
ST4
CP2



(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```
1*****************************************                    *****************************************
 *                                       *                    *                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *                    *    U.S. ARMY CORPS OF ENGINEERS       *
 *              JUN   1998               *                    *    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *                    *         609 SECOND STREET             *
 *                                       *                    *       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   11APR19  TIME  10:53:03   *                    *          (916) 756-1104               *
 *                                       *                    *                                       *
 *****************************************                    *****************************************
```

```
                          <><><><><><><><><><><><><><><><><><><><><><><><>
                            RACEL/TIOGA
                            HYDROLOGIC MODEL
                            ---------------------------

                            100-YR STORM EVENT
                            ---------------------------
                            TANEY ENGINEERING
                            EXISTING CONDITION
                            FILE: EX100.DAT
                            PROJECT No: ADV-18-101
                            DATE:  APR 2019
                          <><><><><><><><><><><><><><><><><><><><><><><><>

                           ---> 6-HOUR / SDN 3 <---


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

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

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 1.00
1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.57	1.00
HYDROGRAPH AT						
+	REF1	.00	1	FLOW	927.	927.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	ST17	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST18	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	REF2	.00	1	FLOW	31.	31.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	ST16	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST15	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
6 COMBINED AT						
+	CP1	.00	1	FLOW	961.	964.
				TIME	3.50	3.50
DIVERSION TO						
+	CP1	.00	1	FLOW	344.	345.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D1	.00	1	FLOW	617.	619.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ST13	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST14	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF5	.00	1	FLOW	0.	2.
				TIME	3.67	3.58
4 COMBINED AT						
+	CP2	.01	1	FLOW	619.	623.
				TIME	3.50	3.50
DIVERSION TO						
+	CP2	.01	1	FLOW	213.	215.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D2	.01	1	FLOW	405.	408.
				TIME	3.50	3.50

```
 HYDROGRAPH AT
+                   DST1       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST2       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                    CP3       .01     1   FLOW         406.     410.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF3       .00     1   FLOW           0.       0.
                                           TIME         5.00     3.75

 HYDROGRAPH AT
+                  DST12       .00     1   FLOW           1.       3.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  RETD1       .00     1   FLOW         344.     345.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                    CP4       .00     1   FLOW         345.     348.
                                           TIME         3.50     3.50

 DIVERSION TO
+                    CP4       .00     1   FLOW          20.      20.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D3       .00     1   FLOW         326.     328.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   ST10       .00     1   FLOW           0.       0.
                                           TIME         4.83     3.58

 HYDROGRAPH AT
+                   ST11       .00     1   FLOW           0.       1.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                  RETD3       .00     1   FLOW          20.      20.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                    CP5       .00     1   FLOW          20.      21.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                   DOF6       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                    ST3       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST4       .00     1   FLOW           0.       0.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                  RETD2       .00     1   FLOW         213.     215.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                    CP6       .00     1   FLOW         214.     216.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST5       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST6       .00     1   FLOW           0.       0.
                                           TIME         4.58     3.58

 HYDROGRAPH AT
+                   DOF4       .00     1   FLOW           0.       0.
                                           TIME         4.92     3.58

  5 COMBINED AT
+                    CP7       .01     1   FLOW         214.     218.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST8       .00     1   FLOW           0.       1.
```

```
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                    ST9       .00     1   FLOW          0.       0.
                                           TIME         4.58     3.58

 HYDROGRAPH AT
+                   DOF2       .00     1   FLOW          0.       0.
                                           TIME         4.92     3.75

  5 COMBINED AT
+                    CP8       .01     1   FLOW        234.     239.
                                           TIME         3.50     3.58

 HYDROGRAPH AT
+                   XON1       .00     1   FLOW          0.       1.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                   XOF1       .00     1   FLOW          0.       1.
                                           TIME         4.92     3.75

 HYDROGRAPH AT
+                    ST7       .00     1   FLOW          0.       0.
                                           TIME         4.58     3.58

  3 COMBINED AT
+                    CP9       .01     1   FLOW          0.       2.
                                           TIME         4.92     3.67

 HYDROGRAPH AT
+                   XON2       .00     1   FLOW          0.       1.
                                           TIME         4.92     3.67


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

INTERIM CONDITION

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                 *         609 SECOND STREET            *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  13:28:39  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        10-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        INTERIM CONDITION
           11           ID        FILE: INT10.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF     263
           35           LS       0      63
           36           UD      .6
                        *
           37           KK   IST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.100
                        *
           42           KK   DST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                *
1                                       HEC-1 INPUT                                             PAGE  2

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


            46          KK    REF2
            47          KM   REFERENCED FROM DS4636 HORSE AND COKE
            48          BA   .0001
            49          BF      13
            50          LS       0      63
            51          UD      .6
                        *

            52          KK   IST16
            53          BA   .0008
            54          BF       0
            55          LS       0      93
            56          UD   0.100
                        *

            57          KK   DST15
            58          BA   .0008
            59          LS       0      98
            60          UD   0.065
                        *

            61          KK    ICP1
            62          KM   COMBINE REF1, REF2, IST17, DST18, IST16, DST15
            63          HC       6
                        *

            64          KK      D1
            65          KM   FLOW SPLIT AT BUFFALO AND RACEL
            66          DT    ICP1
            67          DI     279
            68          DQ      98
                        *

            69          KK   DST12
            70          BA   .0007
            71          LS       0      98
            72          UD   0.051
                        *

            73          KK   IST11
            74          BA   .0007
            75          LS       0      88
            76          UD   0.100
                        *

            77          KK    DOF5
            78          BA   .0035
            79          LS       0      71
            80          UD    .132
                        *
1                                       HEC-1 INPUT                                             PAGE  3

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


            81          KK    ICP2
            82          KM   COMBINE ICP1, IST11, DST12, DOF5
            83          HC       4
                        *

            84          KK      D2
            85          KM   FLOW SPLIT AT TIOGA AND RACEL
            86          DT    ICP2
            87          DI     182
            88          DQ      66
                        *

            89          KK    DST1
            90          BA   .0004
            91          LS       0      98
            92          UD   0.050
                        *

            93          KK    IST2
            94          BA   .0004
            95          LS       0      93
            96          UD   0.050
                        *

            97          KK    DON1
            98          BA   .0032
            99          LS       0      68
           100          UD    .135
                        *
```

```
 101          KK    ICP3
 102          KM   COMBINE ICP2, DST1, IST2, DON1
 103          HC       4
              *

 104          KK   DST10
 105          BA   .0012
 106          LS       0      98
 107          UD   0.079
              *

 108          KK    DOF3
 109          BA   .0034
 110          LS       0      57
 111          UD    .134
              *

 112          KK   RETD1
 113          KM   RETRIEVE D1
 114          DR    ICP1
              *
1                                      HEC-1 INPUT                                      PAGE  4

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

 115          KK    ICP4
 116          KM   COMBINE DST10, RETD1, DOF3
 117          HC       3
              *

 118          KK     DI3
 119          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 120          DT    ICP4
 121          DI      99
 122          DQ       0
              *

 123          KK    IST8
 124          BA   .0007
 125          LS       0      63
 126          UD   0.120
              *

 127          KK    IST9
 128          BA   .0006
 129          LS       0      83
 130          UD   0.100
              *

 131          KK    ICP5
 132          KM   COMBINE IST8, IST9
 133          HC       2
              *

 134          KK    DOF6
 135          BA   .0032
 136          LS       0      68
 137          UD    .131
              *

 138          KK    IST3
 139          BA   .0007
 140          LS       0      84
 141          UD   0.081
              *

 142          KK   RETD2
 143          KM   RETRIEVE D2
 144          DR    ICP2
              *

 145          KK    ICP6
 146          KM   COMBINE DOF6, IST3
 147          HC       2
              *
1                                      HEC-1 INPUT                                      PAGE  5

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

 148          KK    IST4
 149          BA   .0008
 150          LS       0      83
 151          UD   0.070
              *

 152          KK    DOF4
 153          BA   .0037
```

```
            154          LS       0      57
            155          UD    .097
                         *

            156          KK    ICP7
            157          KM   COMBINE ICP6, IST4, DOF4, ICP5
            158          HC       4
                         *

            159          KK    IST7
            160          BA   .0008
            161          LS       0      83
            162          UD   0.073
                         *

            163          KK    DOF2
            164          BA   .0037
            165          LS       0      57
            166          UD    .126
                         *

            167          KK    ICP8
            168          KM   COMBINE ICP7, IST7, ICP5, DOF2
            169          HC       4
                         *

            170          KK    XOF1
            171          BA   .0037
            172          LS       0      63
            173          UD    .224
                         *

            174          KK    IST5
            175          BA   .0003
            176          LS       0      63
            177          UD   0.100
                         *

            178          KK    IST6
            179          BA   .0003
            180          LS       0      83
            181          UD   0.050
                         *
```



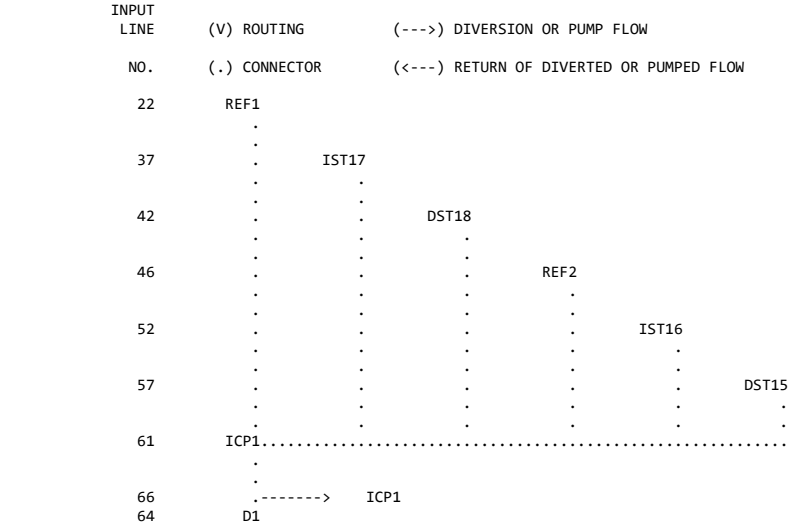
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          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

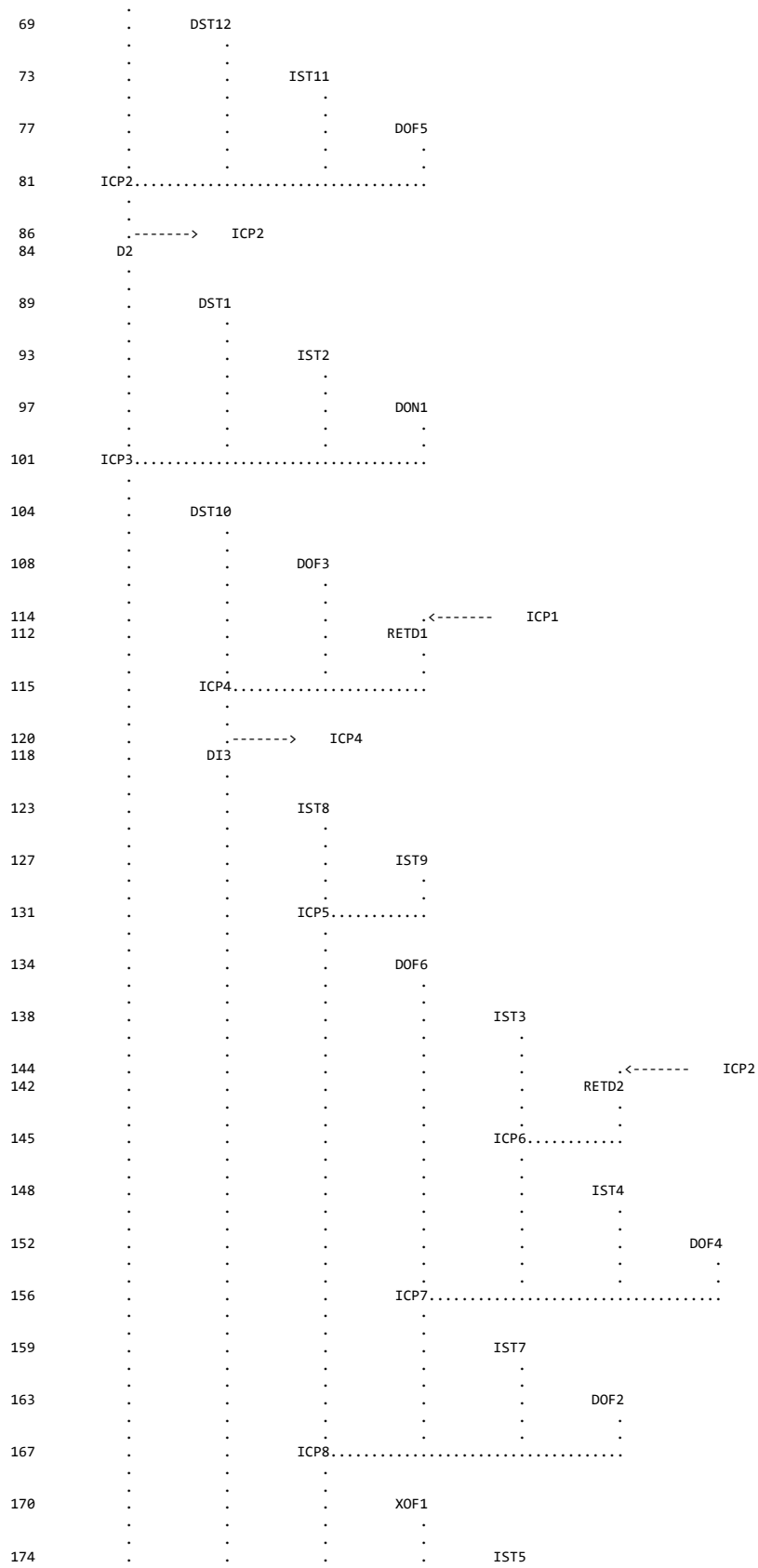

            182          KK    ICP9
            183          KM   COMBINE XOF1, IST5, IST6
            184          HC       3
                         *

            185          KK    DON2
            186          BA   .0038
            187          LS       0      61
            188          UD    .135
                         *
            189          ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK




69 DST12
73 IST11
77 DOF5
81 ICP2
86 ICP2
84 D2
89 DST1
93 IST2
97 DON1
101 ICP3
104 DST10
108 DOF3
114 ICP1
112 RETD1
115 ICP4
120 ICP4
118 DI3
123 IST8
127 IST9
131 ICP5
134 DOF6
138 IST3
144 ICP2
142 RETD2
145 ICP6
148 IST4
152 DOF4
156 ICP7
159 IST7
163 DOF2
167 ICP8
170 XOF1
174 IST5

```
                                                                    INT10
               .          .          .          .          .
               .          .          .          .          .
  178          .          .          .          .          .       IST6
               .          .          .          .          .         .
               .          .          .          .          .         .
  182          .          .          .       ICP9.....................
               .          .          .          .
               .          .          .          .
  185          .          .          .          .       DON2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  13:28:39  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************
```

```
                              <><><><><><><><><><><><><><><><><><><><>
                                RACEL/TIOGA
                                HYDROLOGIC MODEL
                                ---------------------------

                                10-YR STORM EVENT
                                ---------------------------
                                TANEY ENGINEERING
                                INTERIM CONDITION
                                FILE: INT10.DAT
                                PROJECT No: ADV-18-101
                                DATE:  APR 2019
                              <><><><><><><><><><><><><><><><><><><><>

                               ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                     .57      1.00
1

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


                                                                        RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                         .57     1.00

 HYDROGRAPH AT
+                  REF1       .00     1   FLOW         263.     263.
                                           TIME         5.08     4.08
```

```
 HYDROGRAPH AT
+                  IST17       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST18       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   REF2       .00     1   FLOW          13.      13.
                                           TIME         5.08     4.08

 HYDROGRAPH AT
+                  IST16       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST15       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

  6 COMBINED AT
+                   ICP1       .00     1   FLOW         279.     282.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   ICP1       .00     1   FLOW          98.      99.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D1       .00     1   FLOW         181.     183.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST12       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  IST11       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF5       .00     1   FLOW           0.       2.
                                           TIME         3.67     3.58

  4 COMBINED AT
+                   ICP2       .01     1   FLOW         182.     187.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   ICP2       .01     1   FLOW          66.      68.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D2       .01     1   FLOW         116.     119.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST1       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   IST2       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DON1       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

  4 COMBINED AT
+                   ICP3       .01     1   FLOW         117.     122.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST10       .00     1   FLOW           1.       3.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF3       .00     1   FLOW           0.       0.
                                           TIME         5.00     3.75

 HYDROGRAPH AT
+                  RETD1       .00     1   FLOW          98.      99.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   ICP4       .00     1   FLOW          99.     102.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   ICP4       .00     1   FLOW           0.       0.
```

				TIME	.00	.00
HYDROGRAPH AT						
+	DI3	.00	1	FLOW	99.	102.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	IST8	.00	1	FLOW	0.	0.
				TIME	4.83	3.58
HYDROGRAPH AT						
+	IST9	.00	1	FLOW	0.	1.
				TIME	3.58	3.50
2 COMBINED AT						
+	ICP5	.00	1	FLOW	0.	1.
				TIME	3.58	3.58
HYDROGRAPH AT						
+	DOF6	.00	1	FLOW	0.	1.
				TIME	3.75	3.58
HYDROGRAPH AT						
+	IST3	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	RETD2	.00	1	FLOW	66.	68.
				TIME	3.50	3.50
2 COMBINED AT						
+	ICP6	.00	1	FLOW	67.	69.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	IST4	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF4	.00	1	FLOW	0.	0.
				TIME	4.92	3.58
4 COMBINED AT						
+	ICP7	.01	1	FLOW	67.	71.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	IST7	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF2	.00	1	FLOW	0.	0.
				TIME	4.92	3.75
4 COMBINED AT						
+	ICP8	.01	1	FLOW	67.	73.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	XOF1	.00	1	FLOW	0.	1.
				TIME	4.92	3.75
HYDROGRAPH AT						
+	IST5	.00	1	FLOW	0.	0.
				TIME	4.58	3.58
HYDROGRAPH AT						
+	IST6	.00	1	FLOW	0.	0.
				TIME	3.50	3.50
3 COMBINED AT						
+	ICP9	.00	1	FLOW	0.	1.
				TIME	3.50	3.75
HYDROGRAPH AT						
+	DON2	.00	1	FLOW	0.	1.
				TIME	4.92	3.67

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

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                 *         609 SECOND STREET            *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  13:29:22  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ---------------------------
            6           ID
            7           ID        100-YR STORM EVENT
            8           ID        ---------------------------
            9           ID        TANEY ENGINEERING
           10           ID        INTERIM CONDITION
           11           ID        FILE: INT100.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF     927
           35           LS       0      63
           36           UD      .6
                        *
           37           KK   IST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.100
                        *
           42           KK   DST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                *
1                                       HEC-1 INPUT                                             PAGE  2

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

              46        KK    REF2
              47        KM   REFERENCED FROM DS4636 HORSE AND COKE
              48        BA   .0001
              49        BF      31
              50        LS       0      63
              51        UD      .6
                        *

              52        KK   IST16
              53        BA   .0008
              54        BF       0
              55        LS       0      93
              56        UD   0.100
                        *

              57        KK   DST15
              58        BA   .0008
              59        LS       0      98
              60        UD   0.065
                        *

              61        KK    ICP1
              62        KM   COMBINE REF1, REF2, IST17, DST18, IST16, DST15
              63        HC       6
                        *

              64        KK      D1
              65        KM   FLOW SPLIT AT BUFFALO AND RACEL
              66        DT    ICP1
              67        DI     964
              68        DQ     345
                        *

              69        KK   DST12
              70        BA   .0007
              71        LS       0      98
              72        UD   0.051
                        *

              73        KK   IST11
              74        BA   .0007
              75        LS       0      88
              76        UD   0.100
                        *

              77        KK    DOF5
              78        BA   .0035
              79        LS       0      71
              80        UD    .132
                        *
1                                       HEC-1 INPUT                                             PAGE  3

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

              81        KK    ICP2
              82        KM   COMBINE ICP1, IST11, DST12, DOF5
              83        HC       4
                        *

              84        KK      D2
              85        KM   FLOW SPLIT AT TIOGA AND RACEL
              86        DT    ICP2
              87        DI     623
              88        DQ     215
                        *

              89        KK    DST1
              90        BA   .0004
              91        LS       0      98
              92        UD   0.050
                        *

              93        KK    IST2
              94        BA   .0004
              95        LS       0      93
              96        UD   0.050
                        *

              97        KK    DON1
              98        BA   .0032
              99        LS       0      68
             100        UD    .135
                        *
```

```
 101          KK    ICP3
 102          KM   COMBINE ICP2, DST1, IST2, DON1
 103          HC       4
              *

 104          KK   DST10
 105          BA   .0012
 106          LS       0      98
 107          UD   0.079
              *

 108          KK    DOF3
 109          BA   .0034
 110          LS       0      57
 111          UD    .134
              *

 112          KK   RETD1
 113          KM   RETRIEVE D1
 114          DR    ICP1
              *
1                                        HEC-1 INPUT                                        PAGE  4

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

 115          KK    ICP4
 116          KM   COMBINE DST10, RETD1, DOF3
 117          HC       3
              *

 118          KK      D3
 119          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 120          DT    ICP4
 121          DI     348
 122          DQ      20
              *

 123          KK    IST8
 124          BA   .0007
 125          LS       0      63
 126          UD   0.120
              *

 127          KK    IST9
 128          BA   .0006
 129          LS       0      83
 130          UD   0.100
              *

 131          KK   RETD3
 132          KM   RETRIEVE D3
 133          DR    ICP4
              *

 134          KK    ICP5
 135          KM   COMBINE IST8, IST9, RETD3
 136          HC       3
              *

 137          KK    DOF6
 138          BA   .0032
 139          LS       0      68
 140          UD    .131
              *

 141          KK    IST3
 142          BA   .0007
 143          BF       0
 144          LS       0      84
 145          UD   0.081
              *

 146          KK   RETD2
 147          KM   RETRIEVE D2
 148          DR    ICP2
              *
1                                        HEC-1 INPUT                                        PAGE  5

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

 149          KK    ICP6
 150          KM   COMBINE DOF6, IST3
 151          HC       2
              *

 152          KK    IST4
 153          BA   .0008
```

```
            154          LS       0      83
            155          UD   0.070
                         *

            156          KK    DOF4
            157          BA   .0037
            158          LS       0      57
            159          UD    .097
                         *

            160          KK    ICP7
            161          KM   COMBINE ICP6, IST4, DOF4, ICP5
            162          HC       4
                         *

            163          KK    IST7
            164          BA   .0008
            165          LS       0      83
            166          UD   0.073
                         *

            167          KK    DOF2
            168          BA   .0037
            169          LS       0      57
            170          UD    .126
                         *

            171          KK    ICP8
            172          KM   COMBINE ICP7, IST7, ICP5, DOF2
            173          HC       4
                         *

            174          KK    XOF1
            175          BA   .0037
            176          LS       0      63
            177          UD    .224
                         *

            178          KK    IST5
            179          BA   .0003
            180          LS       0      63
            181          UD   0.100
                         *
```



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

            182          KK    IST6
            183          BA   .0003
            184          LS       0      83
            185          UD   0.050
                         *

            186          KK    ICP9
            187          KM   COMBINE XOF1, IST5, IST6
            188          HC       3
                         *

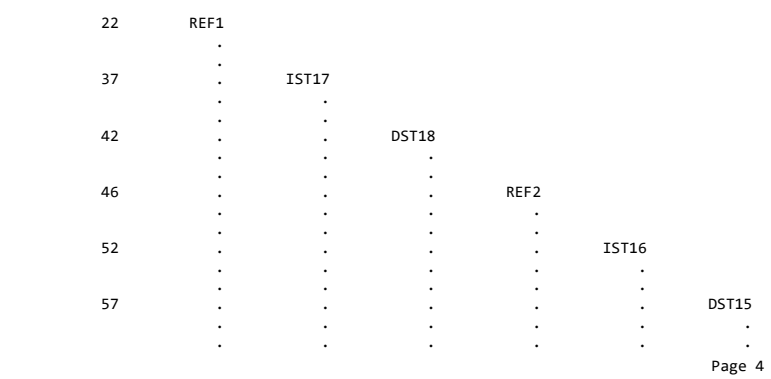
            189          KK    DON2
            190          BA   .0038
            191          LS       0      61
            192          UD    .135
                         *
            193          ZZ
```

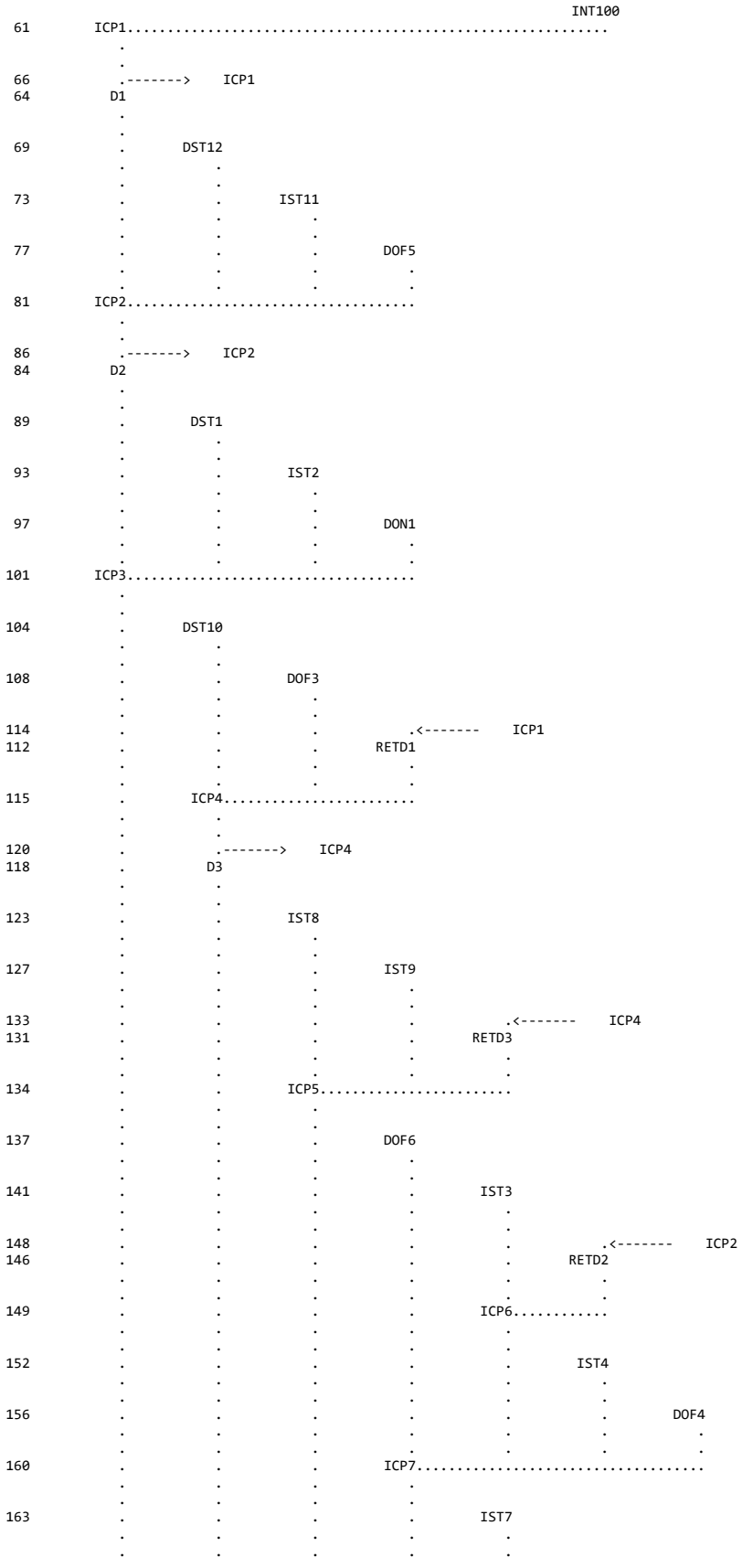

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE NO.

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

(.) CONNECTOR (<----) RETURN OF DIVERTED OR PUMPED FLOW




INT100
61 ICP1
66 ICP1
64 D1
69 DST12
73 IST11
77 DOF5
81 ICP2
86 ICP2
84 D2
89 DST1
93 IST2
97 DON1
101 ICP3
104 DST10
108 DOF3
114 ICP1
112 RETD1
115 ICP4
120 ICP4
118 D3
123 IST8
127 IST9
133 ICP4
131 RETD3
134 ICP5
137 DOF6
141 IST3
148 ICP2
146 RETD2
149 ICP6
152 IST4
156 DOF4
160 ICP7
163 IST7

```
                                                                    INT100
  167          .           .           .           .           .       DOF2
               .           .           .           .           .          .
               .           .           .           .           .          .
  171          .           .       ICP8.................................
               .           .           .
               .           .           .
  174          .           .           .       XOF1
               .           .           .           .
               .           .           .           .
  178          .           .           .           .       IST5
               .           .           .           .           .
               .           .           .           .           .
  182          .           .           .           .           .       IST6
               .           .           .           .           .          .
               .           .           .           .           .          .
  186          .           .           .       ICP9.....................
               .           .           .           .
               .           .           .           .
  189          .           .           .           .       DON2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *             JUN   1998               *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *           VERSION 4.1                *                                  *         609 SECOND STREET            *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  13:29:22  *                                  *          (916) 756-1104              *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************
```

```
                            <><><><><><><><><><><><><><><><><><><><>
                              RACEL/TIOGA
                              HYDROLOGIC MODEL
                              ----------------------------

                              100-YR STORM EVENT
                              ----------------------------
                              TANEY ENGINEERING
                              INTERIM CONDITION
                              FILE: INT100.DAT
                              PROJECT No: ADV-18-101
                              DATE:  APR 2019
                            <><><><><><><><><><><><><><><><><><><><>

                             ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .57      1.00
1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1	RATIO 2
					.57	1.00
HYDROGRAPH AT						
+	REF1	.00	1	FLOW	927.	927.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	IST17	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST18	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	REF2	.00	1	FLOW	31.	31.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	IST16	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST15	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
6 COMBINED AT						
+	ICP1	.00	1	FLOW	961.	964.
				TIME	3.50	3.50
DIVERSION TO						
+	ICP1	.00	1	FLOW	344.	345.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D1	.00	1	FLOW	617.	619.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST12	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	IST11	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF5	.00	1	FLOW	0.	2.
				TIME	3.67	3.58
4 COMBINED AT						
+	ICP2	.01	1	FLOW	619.	623.
				TIME	3.50	3.50
DIVERSION TO						
+	ICP2	.01	1	FLOW	213.	215.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D2	.01	1	FLOW	405.	408.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST1	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	IST2	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DON1	.00	1	FLOW	0.	1.
				TIME	3.75	3.58
4 COMBINED AT						
+	ICP3	.01	1	FLOW	406.	411.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DST10	.00	1	FLOW	1.	3.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF3	.00	1	FLOW	0.	0.
				TIME	5.00	3.75

```
 HYDROGRAPH AT
+                  RETD1       .00     1   FLOW         344.     345.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   ICP4       .00     1   FLOW         345.     348.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   ICP4       .00     1   FLOW          20.      20.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D3       .00     1   FLOW         326.     328.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   IST8       .00     1   FLOW           0.       0.
                                           TIME         4.83     3.58

 HYDROGRAPH AT
+                   IST9       .00     1   FLOW           0.       1.
                                           TIME         3.58     3.50

 HYDROGRAPH AT
+                  RETD3       .00     1   FLOW          20.      20.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   ICP5       .00     1   FLOW          20.      21.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF6       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                   IST3       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  RETD2       .00     1   FLOW         213.     215.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   ICP6       .00     1   FLOW         214.     216.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   IST4       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF4       .00     1   FLOW           0.       0.
                                           TIME         4.92     3.58

  4 COMBINED AT
+                   ICP7       .01     1   FLOW         214.     218.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   IST7       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF2       .00     1   FLOW           0.       0.
                                           TIME         4.92     3.75

  4 COMBINED AT
+                   ICP8       .01     1   FLOW         235.     240.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   XOF1       .00     1   FLOW           0.       1.
                                           TIME         4.92     3.75

 HYDROGRAPH AT
+                   IST5       .00     1   FLOW           0.       0.
                                           TIME         4.58     3.58

 HYDROGRAPH AT
+                   IST6       .00     1   FLOW           0.       0.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   ICP9       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.75

 HYDROGRAPH AT
+                   DON2       .00     1   FLOW           0.       1.
```

INT100

TIME 4.92 3.67

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

DEVELOPED CONDITION

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                 *         609 SECOND STREET            *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   15APR19  TIME  15:13:11  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        10-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        DEVELOPED CONDITION
           11           ID        FILE: DEV10.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF     263
           35           LS       0      63
           36           UD      .6
                        *
           37           KK   DST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.069
                        *
           42           KK   DST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                *
1                                       HEC-1 INPUT                                             PAGE  2

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

            46      KK    REF2
            47      KM   REFERENCED FROM DS4636 HORSE AND COKE
            48      BA   .0001
            49      BF      13
            50      LS       0      63
            51      UD      .6
                    *

            52      KK   DST16
            53      BA   .0008
            54      BF       0
            55      LS       0      93
            56      UD   0.069
                    *

            57      KK   DST15
            58      BA   .0008
            59      LS       0      98
            60      UD   0.065
                    *

            61      KK    DCP1
            62      KM   COMBINE REF1, REF2, DST17, DST18, DST16, DST15
            63      HC       6
                    *

            64      KK      D1
            65      KM   FLOW SPLIT AT BUFFALO AND RACEL
            66      DT    DCP1
            67      DI     279
            68      DQ      98
                    *

            69      KK   DST10
            70      BA   .0007
            71      LS       0      93
            72      UD   0.056
                    *

            73      KK   DST11
            74      BA   .0007
            75      LS       0      98
            76      UD   0.050
                    *

            77      KK    DOF5
            78      BA   .0035
            79      LS       0      71
            80      UD    .132
                    *
1                                       HEC-1 INPUT                                             PAGE  3

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

            81      KK    DCP2
            82      KM   COMBINE DCP1, DST11, DST10, DOF5
            83      HC       4
                    *

            84      KK     DI2
            85      KM   FLOW SPLIT AT TIOGA AND RACEL
            86      DT    DCP2
            87      DI     182
            88      DQ      66
                    *

            89      KK    DST1
            90      BA   .0004
            91      LS       0      98
            92      UD   0.050
                    *

            93      KK    DST2
            94      BA   .0004
            95      LS       0      93
            96      UD   0.050
                    *

            97      KK    DON1
            98      BA   .0032
            99      LS       0      68
           100      UD    .135
                    *
```

```
 101          KK    DCP3
 102          KM   COMBINE DCP2, DST1, DST2, DON1
 103          HC       4
              *

 104          KK    DST9
 105          BA   .0012
 106          LS       0      98
 107          UD   0.079
              *

 108          KK    DOF3
 109          BA   .0034
 110          LS       0      57
 111          UD    .134
              *

 112          KK   RETD1
 113          KM   RETRIEVE D1
 114          DR    DCP1
              *
1                                      HEC-1 INPUT                                      PAGE  4

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

 115          KK    DCP4
 116          KM   COMBINE DST10, RETD1, DOF3
 117          HC       3
              *

 118          KK     DI3
 119          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 120          DT    DCP4
 121          DI      99
 122          DQ      50
              *

 123          KK    DST7
 124          BA   .0007
 125          LS       0      83
 126          UD   0.120
              *

 127          KK    DST8
 128          BA   .0006
 129          LS       0      84
 130          UD   0.053
              *

 131          KK   RETD3
 132          KM   RETRIEVE D3
 133          DR    DCP4
              *

 134          KK    DCP5
 135          KM   COMBINE DST7, DST8, RETD3
 136          HC       3
              *

 137          KK    DOF6
 138          BA   .0032
 139          LS       0      68
 140          UD    .131
              *

 141          KK    DST3
 142          BA   .0007
 143          LS       0      86
 144          UD   0.079
              *

 145          KK   RETD2
 146          KM   RETRIEVE D2
 147          DR    DCP2
              *
1                                      HEC-1 INPUT                                      PAGE  5

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

 148          KK    DCP6
 149          KM   COMBINE DOF6, DST3
 150          HC       3
              *

 151          KK    DST4
 152          BA   .0008
 153          LS       0      83
```

```
            154           UD   0.070
                          *

            155           KK    DOF4
            156           BA   .0037
            157           LS       0      57
            158           UD    .097
                          *

            159           KK    DCP7
            160           KM   COMBINE DCP6, DST4, DOF4
            161           HC       3
                          *

            162           KK    DST5
            163           BA   .0008
            164           LS       0      83
            165           UD   0.073
                          *

            166           KK    DOF2
            167           BA   .0037
            168           LS       0      57
            169           UD    .126
                          *

            170           KK    DCP8
            171           KM   COMBINE DCP7, DCP5, DOF2, DST5
            172           HC       4
                          *

            173           KK    DOF1
            174           BA   .0037
            175           LS       0      61
            176           UD    .135
                          *

            177           KK    DST6
            178           BA   .0007
            179           LS       0      83
            180           UD   0.053
                          *
```



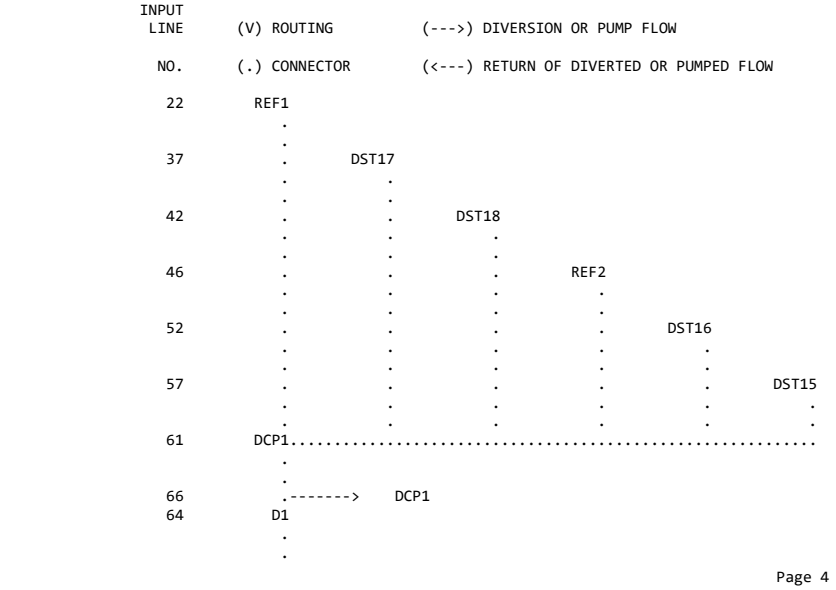
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           LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

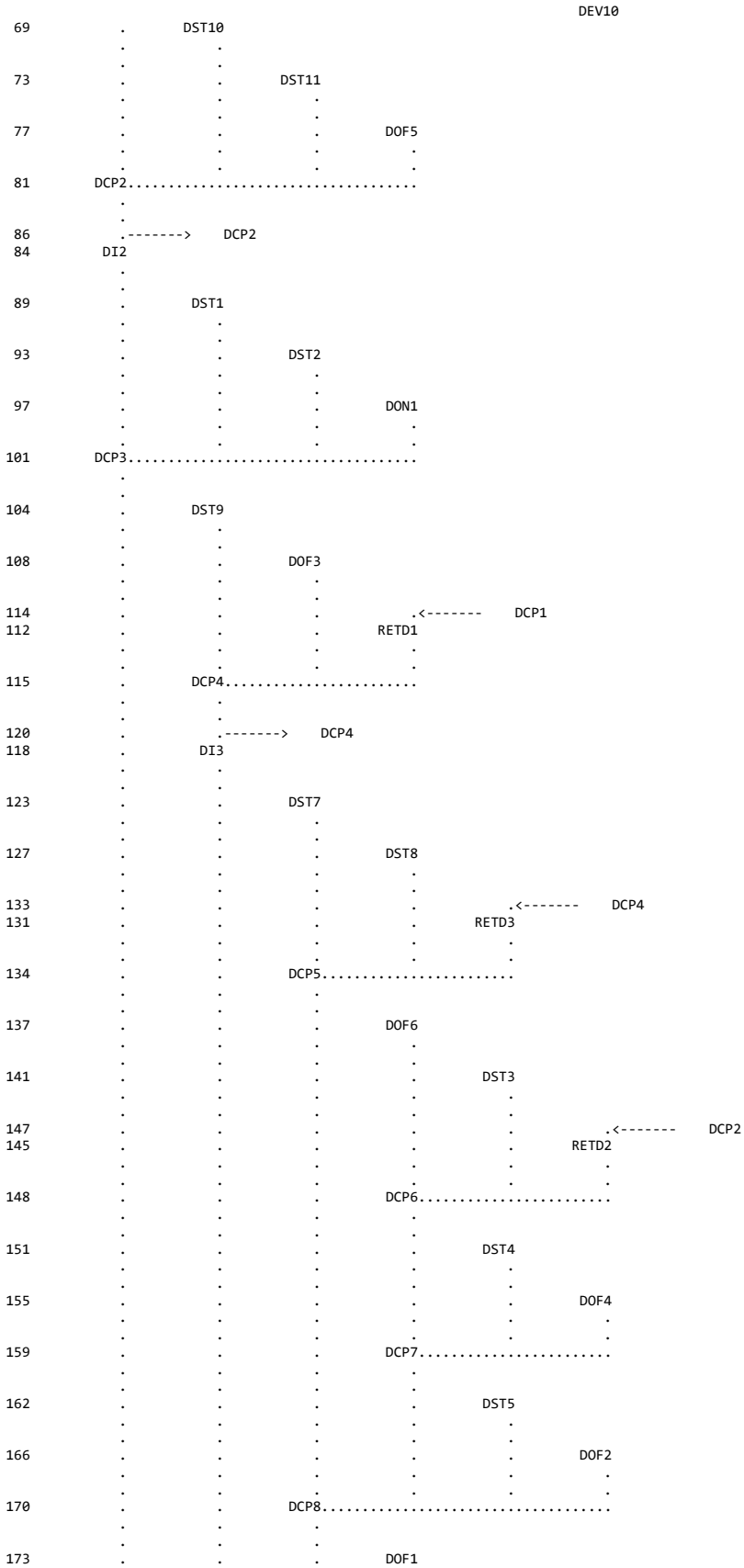
            181           KK    DCP9
            182           KM   COMBINE DOF1, DST6
            183           HC       2
                          *

            184           KK    DON2
            185           BA   .0038
            186           LS       0      61
            187           UD    .135
                          *
            188           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK




69 DST10
73 DST11
77 DOF5
81 DCP2
86 .-------> DCP2
84 DI2
89 DST1
93 DST2
97 DON1
101 DCP3
104 DST9
108 DOF3
114 .<------- DCP1
112 RETD1
115 DCP4
120 .-------> DCP4
118 DI3
123 DST7
127 DST8
133 .<------- DCP4
131 RETD3
134 DCP5
137 DOF6
141 DST3
147 .<------- DCP2
145 RETD2
148 DCP6
151 DST4
155 DOF4
159 DCP7
162 DST5
166 DOF2
170 DCP8
173 DOF1

```
               .          .          .          .
               .          .          .          .
   177         .          .          .          .       DST6
               .          .          .          .          .
               .          .          .          .          .
   181         .          .          .       DCP9...........
               .          .          .          .
               .          .          .          .
   184         .          .          .          .       DON2

  (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   15APR19  TIME  15:13:11  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************



                              <><><><><><><><><><><><><><><><><><><><><><><><>
                                RACEL/TIOGA
                                HYDROLOGIC MODEL
                                --------------------------

                                10-YR STORM EVENT
                                --------------------------
                                TANEY ENGINEERING
                                DEVELOPED CONDITION
                                FILE: DEV10.DAT
                                PROJECT No: ADV-18-101
                                DATE:  APR 2019
                              <><><><><><><><><><><><><><><><><><><><><><><><>

                               ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .57      1.00
1


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


                                                                        RATIOS APPLIED TO PRECIPITATION
  OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                          .57     1.00

  HYDROGRAPH AT
+                   REF1       .00     1   FLOW         263.     263.
                                           TIME         5.08     4.08
```

```
 HYDROGRAPH AT
+                  DST17       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST18       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   REF2       .00     1   FLOW          13.      13.
                                           TIME         5.08     4.08

 HYDROGRAPH AT
+                  DST16       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST15       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

  6 COMBINED AT
+                   DCP1       .00     1   FLOW         279.     282.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   DCP1       .00     1   FLOW          98.      99.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D1       .00     1   FLOW         181.     183.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST10       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST11       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF5       .00     1   FLOW           0.       2.
                                           TIME         3.67     3.58

  4 COMBINED AT
+                   DCP2       .01     1   FLOW         183.     188.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   DCP2       .01     1   FLOW          66.      68.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                    DI2       .01     1   FLOW         117.     120.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST1       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST2       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DON1       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

  4 COMBINED AT
+                   DCP3       .01     1   FLOW         118.     122.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST9       .00     1   FLOW           1.       3.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF3       .00     1   FLOW           0.       0.
                                           TIME         5.00     3.75

 HYDROGRAPH AT
+                  RETD1       .00     1   FLOW          98.      99.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   DCP4       .00     1   FLOW         100.     102.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   DCP4       .00     1   FLOW          50.      51.
```

```
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                    DI3       .00     1   FLOW          49.      50.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST7       .00     1   FLOW           0.       1.
                                           TIME         3.58     3.58

 HYDROGRAPH AT
+                   DST8       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  RETD3       .00     1   FLOW          50.      51.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   DCP5       .00     1   FLOW          51.      53.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF6       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

 HYDROGRAPH AT
+                   DST3       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  RETD2       .00     1   FLOW          66.      68.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   DCP6       .00     1   FLOW          67.      70.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST4       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF4       .00     1   FLOW           0.       0.
                                           TIME         4.92     3.58

  3 COMBINED AT
+                   DCP7       .01     1   FLOW          67.      71.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST5       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF2       .00     1   FLOW           0.       0.
                                           TIME         4.92     3.75

  4 COMBINED AT
+                   DCP8       .01     1   FLOW         118.     126.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF1       .00     1   FLOW           0.       1.
                                           TIME         4.92     3.67

 HYDROGRAPH AT
+                   DST6       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

  2 COMBINED AT
+                   DCP9       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DON2       .00     1   FLOW           0.       1.
                                           TIME         4.92     3.67


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

```
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *   U.S. ARMY CORPS OF ENGINEERS       *
 *             JUN   1998               *                                  *   HYDROLOGIC ENGINEERING CENTER      *
 *           VERSION 4.1                *                                  *        609 SECOND STREET             *
 *                                      *                                  *      DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   15APR19  TIME  15:54:34  *                                  *         (916) 756-1104               *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        100-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        DEVELOPED CONDITION
           11           ID        FILE: DEV100.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF     927
           35           LS       0      63
           36           UD      .6
                        *
           37           KK   DST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.069
                        *
           42           KK   DST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                *
1                                       HEC-1 INPUT                                             PAGE  2

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


            46          KK    REF2
            47          KM   REFERENCED FROM DS4636 HORSE AND COKE
            48          BA   .0001
            49          BF      31
            50          LS       0      63
            51          UD      .6
                        *

            52          KK   DST16
            53          BA   .0008
            54          BF       0
            55          LS       0      93
            56          UD   0.069
                        *

            57          KK   DST15
            58          BA   .0008
            59          LS       0      98
            60          UD   0.065
                        *

            61          KK    DCP1
            62          KM   COMBINE REF1, REF2, DST17, DST18, DST16, DST15
            63          HC       6
                        *

            64          KK      D1
            65          KM   FLOW SPLIT AT BUFFALO AND RACEL
            66          DT    DCP1
            67          DI     964
            68          DQ     345
                        *

            69          KK   DST11
            70          BA   .0007
            71          LS       0      98
            72          UD   0.050
                        *

            73          KK   DST10
            74          BA   .0007
            75          LS       0      93
            76          UD    .056
                        *

            77          KK    DOF5
            78          BA   .0035
            79          LS       0      71
            80          UD    .132
                        *
1                                       HEC-1 INPUT                                             PAGE  3

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


            81          KK    DCP2
            82          KM   COMBINE DCP1, DST11, DST10, DOF5
            83          HC       4
                        *

            84          KK      D2
            85          KM   FLOW SPLIT AT TIOGA AND RACEL
            86          DT    DCP2
            87          DI     623
            88          DQ     215
                        *

            89          KK    DST1
            90          BA   .0004
            91          LS       0      98
            92          UD   0.050
                        *

            93          KK    DST2
            94          BA   .0004
            95          LS       0      93
            96          UD   0.050
                        *

            97          KK    DON1
            98          BA   .0032
            99          LS       0      68
           100          UD    .135
                        *
```

```
 101          KK    DCP3
 102          KM   COMBINE DCP2, DST1, DST2, DON1
 103          HC       4
              *

 104          KK    DST9
 105          BA   .0012
 106          LS       0      98
 107          UD   0.079
              *

 108          KK    DOF3
 109          BA   .0034
 110          LS       0      57
 111          UD    .134
              *

 112          KK   RETD1
 113          KM   RETRIEVE D1
 114          DR    DCP1
              *
1                                      HEC-1 INPUT                                        PAGE  4

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

 115          KK    DCP4
 116          KM   COMBINE DST10, RETD1, DOF3
 117          HC       3
              *

 118          KK      D3
 119          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 120          DT    DCP4
 121          DI     348
 122          DQ     213
              *

 123          KK    DST7
 124          BA   .0007
 125          LS       0      83
 126          UD   0.120
              *

 127          KK    DST8
 128          BA   .0006
 129          LS       0      84
 130          UD   0.053
              *

 131          KK   RETD3
 132          KM   RETRIEVE D3
 133          DR    DCP4
              *

 134          KK    DCP5
 135          KM   COMBINE DST7, DST8, RETD3
 136          HC       3
              *

 137          KK    DOF6
 138          BA   .0032
 139          LS       0      68
 140          UD    .131
              *

 141          KK    DST3
 142          BA   .0007
 143          LS       0      86
 144          UD   0.079
              *

 145          KK   RETD2
 146          KM   RETRIEVE D2
 147          DR    DCP2
              *
1                                      HEC-1 INPUT                                        PAGE  5

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

 148          KK    DCP6
 149          KM   COMBINE DOF6, DST3, RETD2
 150          HC       3
              *

 151          KK    DST4
 152          BA   .0008
 153          LS       0      83
```

```
            154           UD   0.070
                          *

            155           KK    DOF4
            156           BA   .0037
            157           LS       0      57
            158           UD    .097
                          *

            159           KK    DCP7
            160           KM   COMBINE DCP6, DST4, DOF4
            161           HC       3
                          *

            162           KK    DST5
            163           BA   .0008
            164           LS       0      83
            165           UD   0.073
                          *

            166           KK    DOF2
            167           BA   .0037
            168           LS       0      57
            169           UD    .126
                          *

            170           KK    DCP8
            171           KM   COMBINE DCP7, DCP5, DOF2, DST5
            172           HC       4
                          *

            173           KK    DOF1
            174           BA   .0037
            175           LS       0      61
            176           UD    .135
                          *

            177           KK    DST6
            178           BA   .0007
            179           LS       0      83
            180           UD   0.053
                          *
```



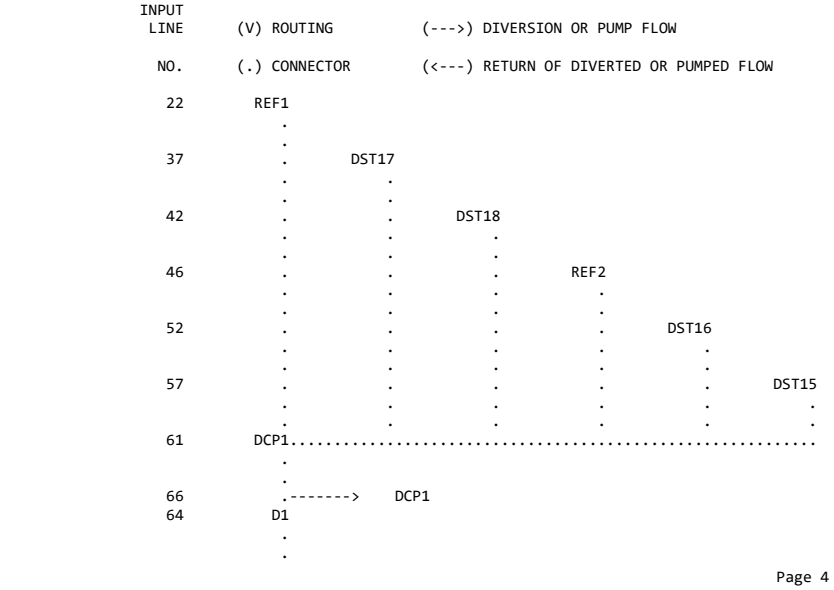
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          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

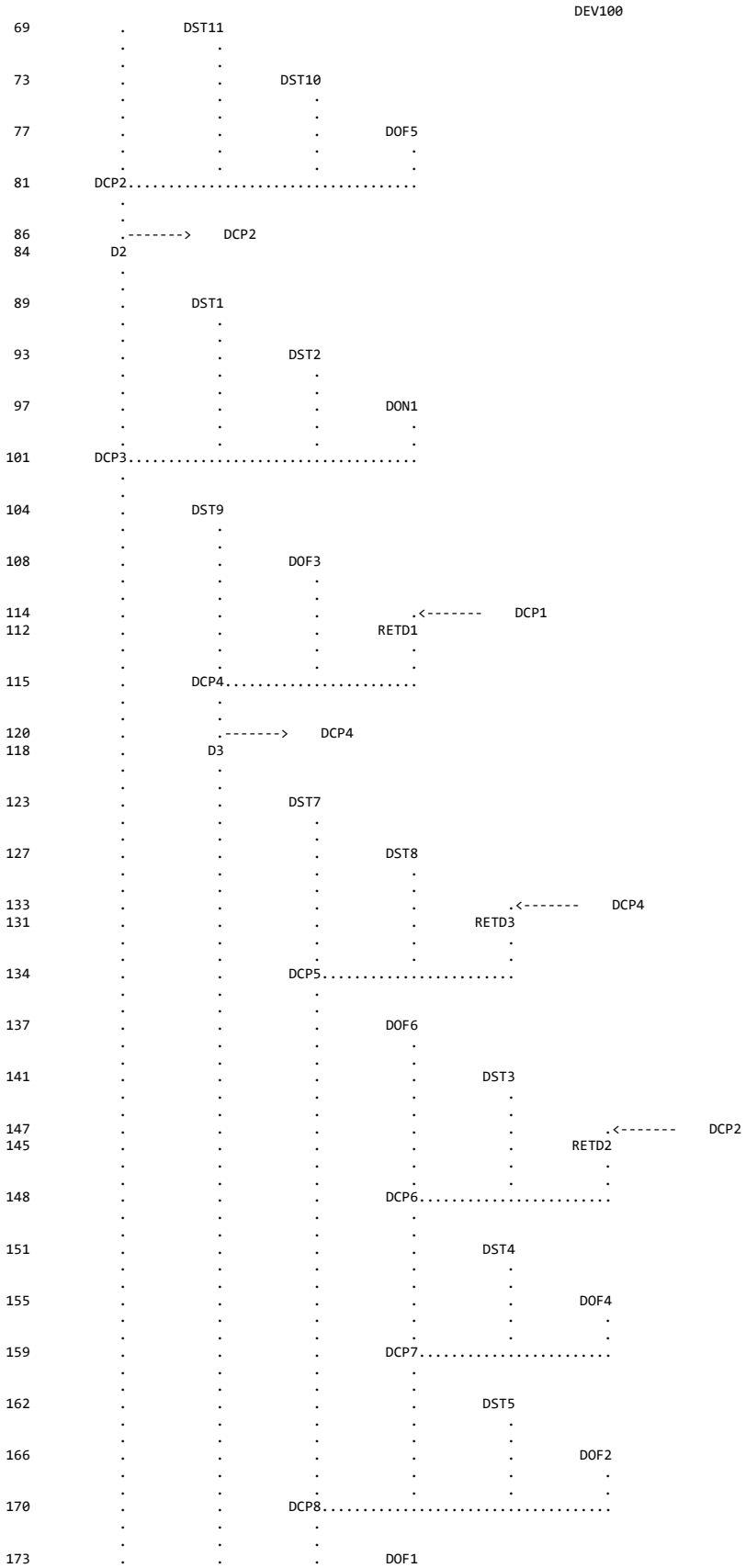
            181           KK    DCP9
            182           KM   COMBINE DOF1, DST5
            183           HC       2
                          *

            184           KK    DON2
            185           BA   .0038
            186           LS       0      61
            187           UD    .135
                          *
            188           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK




DST11
DST10
DOF5
DCP2
DCP2
D2
DST1
DST2
DON1
DCP3
DST9
DOF3
DCP1
RETD1
DCP4
DCP4
D3
DST7
DST8
DCP4
RETD3
DCP5
DOF6
DST3
DCP2
RETD2
DCP6
DST4
DOF4
DCP7
DST5
DOF2
DCP8
DOF1

```
                .          .          .          .
                .          .          .          .
   177          .          .          .          .       DST6
                .          .          .          .          .
                .          .          .          .          .
   181          .          .          .       DCP9...........
                .          .          .          .
                .          .          .          .
   184          .          .          .          .       DON2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   15APR19  TIME  15:54:34  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************
```

```
                              <><><><><><><><><><><><><><><><><><><><>
                                RACEL/TIOGA
                                HYDROLOGIC MODEL
                                ---------------------------

                                100-YR STORM EVENT
                                ---------------------------
                                TANEY ENGINEERING
                                DEVELOPED CONDITION
                                FILE: DEV100.DAT
                                PROJECT No: ADV-18-101
                                DATE:  APR 2019
                              <><><><><><><><><><><><><><><><><><><><>

                               ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .57      1.00
1

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


                                                                        RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                         .57     1.00

 HYDROGRAPH AT
+                  REF1       .00     1   FLOW         927.     927.
                                           TIME         5.08     4.08
```

```
 HYDROGRAPH AT
+                  DST17       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST18       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   REF2       .00     1   FLOW          31.      31.
                                           TIME         5.08     4.08

 HYDROGRAPH AT
+                  DST16       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST15       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

  6 COMBINED AT
+                   DCP1       .00     1   FLOW         961.     964.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   DCP1       .00     1   FLOW         344.     345.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D1       .00     1   FLOW         617.     619.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST11       .00     1   FLOW           1.       2.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                  DST10       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF5       .00     1   FLOW           0.       2.
                                           TIME         3.67     3.58

  4 COMBINED AT
+                   DCP2       .01     1   FLOW         619.     624.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   DCP2       .01     1   FLOW         214.     215.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                     D2       .01     1   FLOW         405.     409.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST1       .00     1   FLOW           1.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST2       .00     1   FLOW           0.       1.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DON1       .00     1   FLOW           0.       1.
                                           TIME         3.75     3.58

  4 COMBINED AT
+                   DCP3       .01     1   FLOW         406.     411.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST9       .00     1   FLOW           1.       3.
                                           TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF3       .00     1   FLOW           0.       0.
                                           TIME         5.00     3.75

 HYDROGRAPH AT
+                  RETD1       .00     1   FLOW         344.     345.
                                           TIME         3.50     3.50

  3 COMBINED AT
+                   DCP4       .00     1   FLOW         345.     348.
                                           TIME         3.50     3.50

 DIVERSION TO
+                   DCP4       .00     1   FLOW         211.     213.
```

```
                                        TIME         3.50     3.50

 HYDROGRAPH AT
+                    D3       .00     1   FLOW        134.     135.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST7      .00     1   FLOW          0.       1.
                                         TIME         3.58     3.58

 HYDROGRAPH AT
+                   DST8      .00     1   FLOW          0.       1.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                  RETD3      .00     1   FLOW        211.     213.
                                         TIME         3.50     3.50

  3 COMBINED AT
+                   DCP5      .00     1   FLOW        212.     214.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF6      .00     1   FLOW          0.       1.
                                         TIME         3.75     3.58

 HYDROGRAPH AT
+                   DST3      .00     1   FLOW          0.       1.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                  RETD2      .00     1   FLOW        214.     215.
                                         TIME         3.50     3.50

  3 COMBINED AT
+                   DCP6      .00     1   FLOW        214.     217.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST4      .00     1   FLOW          0.       1.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF4      .00     1   FLOW          0.       0.
                                         TIME         4.92     3.58

  3 COMBINED AT
+                   DCP7      .01     1   FLOW        214.     219.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DST5      .00     1   FLOW          0.       1.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF2      .00     1   FLOW          0.       0.
                                         TIME         4.92     3.75

  4 COMBINED AT
+                   DCP8      .01     1   FLOW        427.     434.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DOF1      .00     1   FLOW          0.       1.
                                         TIME         4.92     3.67

 HYDROGRAPH AT
+                   DST6      .00     1   FLOW          0.       1.
                                         TIME         3.50     3.50

  2 COMBINED AT
+                   DCP9      .00     1   FLOW          0.       1.
                                         TIME         3.50     3.50

 HYDROGRAPH AT
+                   DON2      .00     1   FLOW          0.       1.
                                         TIME         4.92     3.67


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

ULTIMATE CONDITION

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                 *         609 SECOND STREET            *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  14:01:51  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        10-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        ULTIMATE CONDITION
           11           ID        FILE: ULT10.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF       6
           35           LS       0      63
           36           UD      .6
                        *
           37           KK   UST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.100
                        *
           42           KK   UST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                *
1                                       HEC-1 INPUT                                             PAGE  2

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

              46        KK    REF2
              47        KM   REFERENCED FROM DS4636 HORSE AND COKE
              48        BA   .0001
              49        BF      13
              50        LS       0      63
              51        UD      .6
                        *

              52        KK   UST16
              53        BA   .0008
              54        BF       0
              55        LS       0      93
              56        UD   0.100
                        *

              57        KK   UST15
              58        BA   .0008
              59        LS       0      98
              60        UD   0.065
                        *

              61        KK    UCP1
              62        KM   COMBINE REF1, REF2, UST17, UST18, UST16, UST15
              63        HC       6
                        *

              64        KK      D1
              65        KM   FLOW SPLIT AT BUFFALO AND RACEL
              66        DT    UCP1
              67        DI      22
              68        DQ       7
                        *

              69        KK   UST11
              70        BA   .0007
              71        LS       0      98
              72        UD   0.050
                        *

              73        KK   UST10
              74        BA   .0007
              75        LS       0      93
              76        UD   0.056
                        *

              77        KK    DOF5
              78        BA   .0035
              79        LS       0      71
              80        UD    .132
                        *
1                                       HEC-1 INPUT                                             PAGE  3

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

              81        KK    UCP2
              82        KM   COMBINE UCP1, UST10, UST11, DOF5
              83        HC       4
                        *

              84        KK      D2
              85        KM   FLOW SPLIT AT TIOGA AND RACEL
              86        DT    UCP2
              87        DI      17
              88        DQ       6
                        *

              89        KK    UST1
              90        BA   .0004
              91        LS       0      98
              92        UD   0.050
                        *

              93        KK    UST2
              94        BA   .0004
              95        LS       0      93
              96        UD   0.050
                        *

              97        KK    DON1
              98        BA   .0032
              99        LS       0      68
             100        UD    .135
                        *
```

```
 101          KK    UCP3
 102          KM   COMBINE UCP2, UST1, UST2, DON1
 103          HC       4
              *

 104          KK    UST9
 105          BA   .0012
 106          LS       0      98
 107          UD   0.079
              *

 108          KK    DOF3
 109          BA   .0034
 110          LS       0      57
 111          UD    .134
              *

 112          KK   RETD1
 113          KM   RETRIEVE D1
 114          DR    UCP1
              *
1                                      HEC-1 INPUT                                        PAGE  4

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

 115          KK    UCP4
 116          KM   COMBINE UST9, RETD1, DOF3
 117          HC       3
              *

 118          KK      D3
 119          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 120          DT    UCP4
 121          DI       8
 122          DQ       2
              *

 123          KK    UST7
 124          BA   .0006
 125          LS       0      83
 126          UD   0.053
              *

 127          KK    UST8
 128          BA   .0012
 129          LS       0      83
 130          UD   0.096
              *

 131          KK   RETD3
 132          KM   RETRIEVE D3
 133          DR    UCP4
              *

 134          KK    UCP5
 135          KM   COMBINE UST8, UST9, RETD3
 136          HC       3
              *

 137          KK    DOF6
 138          BA   .0032
 139          LS       0      68
 140          UD    .131
              *

 141          KK    UST3
 142          BA   .0007
 143          LS       0      86
 144          UD   0.079
              *

 145          KK   RETD2
 146          KM   RETRIEVE D2
 147          DR    UCP2
              *
1                                      HEC-1 INPUT                                        PAGE  5

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

 148          KK    UCP6
 149          KM   COMBINE DOF6, UST3, RETD2
 150          HC       3
              *

 151          KK    UST4
 152          BA   .0008
 153          LS       0      83
```

```
            154           UD   0.070
                          *

            155           KK    DOF4
            156           BA   .0037
            157           LS       0      57
            158           UD    .097
                          *

            159           KK    UCP7
            160           KM   COMBINE UCP6, UST4, DOF4
            161           HC       3
                          *

            162           KK    UST5
            163           BA   .0008
            164           LS       0      83
            165           UD   0.073
                          *

            166           KK    DOF2
            167           BA   .0037
            168           LS       0      57
            169           UD    .126
                          *

            170           KK    UCP8
            171           KM   COMBINE UCP7, UST5, UCP5, DOF2
            172           HC       4
                          *

            173           KK    DOF1
            174           BA   .0037
            175           LS       0      61
            176           UD    .135
                          *

            177           KK    UST6
            178           BA   .0007
            179           LS       0      83
            180           UD   0.053
                          *
```



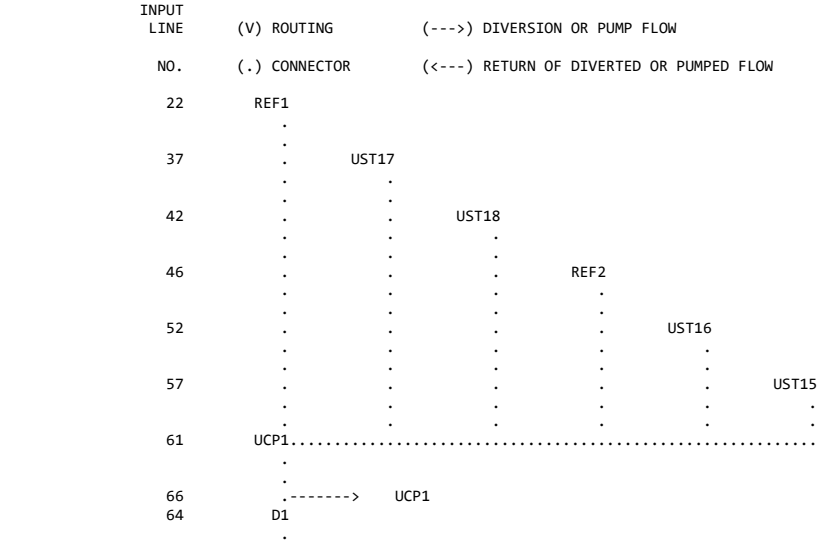
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          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

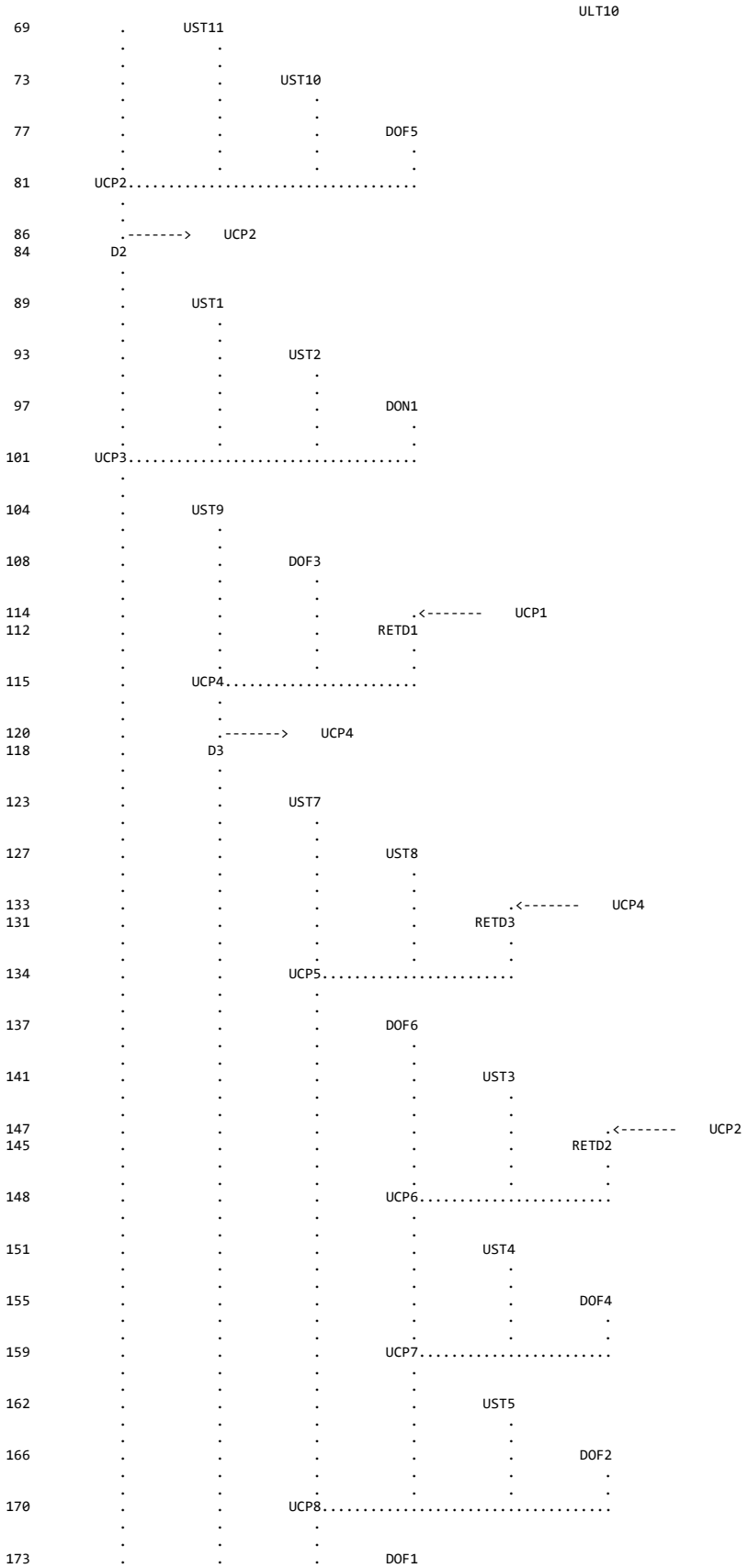
            181           KK    UCP9
            182           KM   COMBINE DOF1, UST6
            183           HC       2
                          *

            184           KK    DON2
            185           BA   .0038
            186           LS       0      61
            187           UD    .135
                          *
            188           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK




ULT10
UST11
UST10
DOF5
UCP2
UCP2
D2
UST1
UST2
DON1
UCP3
UST9
DOF3
UCP1
RETD1
UCP4
UCP4
D3
UST7
UST8
UCP4
RETD3
UCP5
DOF6
UST3
UCP2
RETD2
UCP6
UST4
DOF4
UCP7
UST5
DOF2
UCP8
DOF1

```
               .          .          .          .
               .          .          .          .
   177         .          .          .          .       UST6
               .          .          .          .          .
               .          .          .          .          .
   181         .          .          .       UCP9...........
               .          .          .          .
               .          .          .          .
   184         .          .          .          .       DON2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  14:01:51  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************
```

```
                              <><><><><><><><><><><><><><><><><><><><>
                                RACEL/TIOGA
                                HYDROLOGIC MODEL
                                ---------------------------

                                10-YR STORM EVENT
                                ---------------------------
                                TANEY ENGINEERING
                                ULTIMATE CONDITION
                                FILE: ULT10.DAT
                                PROJECT No: ADV-18-101
                                DATE:  APR 2019
                              <><><><><><><><><><><><><><><><><><><><>

                               ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .57      1.00
1

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


                                                                        RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                         .57     1.00

 HYDROGRAPH AT
+                  REF1       .00     1   FLOW           6.       6.
                                           TIME         5.08     4.08
```

HYDROGRAPH AT						
+	UST17	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST18	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	REF2	.00	1	FLOW	13.	13.
				TIME	5.08	4.08
HYDROGRAPH AT						
+	UST16	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST15	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
6 COMBINED AT						
+	UCP1	.00	1	FLOW	22.	25.
				TIME	3.50	3.50
DIVERSION TO						
+	UCP1	.00	1	FLOW	7.	8.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D1	.00	1	FLOW	15.	17.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST11	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST10	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF5	.00	1	FLOW	0.	2.
				TIME	3.67	3.58
4 COMBINED AT						
+	UCP2	.01	1	FLOW	17.	22.
				TIME	3.50	3.50
DIVERSION TO						
+	UCP2	.01	1	FLOW	6.	8.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	D2	.01	1	FLOW	11.	14.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST1	.00	1	FLOW	1.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST2	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DON1	.00	1	FLOW	0.	1.
				TIME	3.75	3.58
4 COMBINED AT						
+	UCP3	.01	1	FLOW	12.	17.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST9	.00	1	FLOW	1.	3.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF3	.00	1	FLOW	0.	0.
				TIME	5.00	3.75
HYDROGRAPH AT						
+	RETD1	.00	1	FLOW	7.	8.
				TIME	3.50	3.50
3 COMBINED AT						
+	UCP4	.00	1	FLOW	8.	11.
				TIME	3.50	3.50
DIVERSION TO						
+	UCP4	.00	1	FLOW	2.	3.

				TIME	3.50	3.50
HYDROGRAPH AT						
+	D3	.00	1	FLOW	6.	8.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST7	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST8	.00	1	FLOW	0.	1.
				TIME	3.58	3.50
HYDROGRAPH AT						
+	RETD3	.00	1	FLOW	2.	3.
				TIME	3.50	3.50
3 COMBINED AT						
+	UCP5	.00	1	FLOW	3.	5.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF6	.00	1	FLOW	0.	1.
				TIME	3.75	3.58
HYDROGRAPH AT						
+	UST3	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	RETD2	.00	1	FLOW	6.	8.
				TIME	3.50	3.50
3 COMBINED AT						
+	UCP6	.00	1	FLOW	6.	10.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST4	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF4	.00	1	FLOW	0.	0.
				TIME	4.92	3.58
3 COMBINED AT						
+	UCP7	.01	1	FLOW	7.	11.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST5	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF2	.00	1	FLOW	0.	0.
				TIME	4.92	3.75
4 COMBINED AT						
+	UCP8	.01	1	FLOW	10.	17.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF1	.00	1	FLOW	0.	1.
				TIME	4.92	3.67
HYDROGRAPH AT						
+	UST6	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
2 COMBINED AT						
+	UCP9	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DON2	.00	1	FLOW	0.	1.
				TIME	4.92	3.67

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

```
1****************************************                 ****************************************
 *                                      *                 *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                 *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                 *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                 *          609 SECOND STREET           *
 *                                      *                 *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  14:02:29  *                 *          (916) 756-1104              *
 *                                      *                 *                                      *
 ****************************************                 ****************************************
```

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

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

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


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

                        *DIAGRAM
            1           ID
            2           ID      <><><><><><><><><><><><><><><><><><><><>
            3           ID        RACEL/TIOGA
            4           ID        HYDROLOGIC MODEL
            5           ID        ----------------------------
            6           ID
            7           ID        100-YR STORM EVENT
            8           ID        ----------------------------
            9           ID        TANEY ENGINEERING
           10           ID        ULTIMATE CONDITION
           11           ID        FILE: ULT100.DAT
           12           ID        PROJECT No: ADV-18-101
           13           ID        DATE:  APR 2019
           14           ID      <><><><><><><><><><><><><><><><><><><><>
           15           ID
           16           ID       ---> 6-HOUR / SDN 3 <---
           17           ID
           18           IT       5       0       0     300
           19           IO       5
           20           IN       5
           21           JR    PREC    0.57    1.00
                        *
           22           KK    REF1
           23           KM   REFERENCED FROM LAS 22O09 FINAL DESIGN REPORT
           24           BA   .0001
           25           PB    2.77
           26           PC    .000    .020    .057    .070    .087    .108    .124    .130    .130    .130
           27           PC    .130    .130    .130    .133    .140    .142    .148    .158    .172    .181
           28           PC    .190    .197    .199    .200    .201    .204    .214    .229    .241    .249
           29           PC    .251    .256    .270    .278    .281    .283    .295    .322    .352    .409
           30           PC    .499    .590    .710    .744    .781    .812    .819    .835    .851    .856
           31           PC    .860    .868    .876    .888    .910    .926    .937    .950    .970    .976
           32           PC    .982    .985    .987    .989    .990    .993    .993    .994    .995    .998
           33           PC    .998    .999    1.00
           34           BF      24
           35           LS       0      63
           36           UD      .6
                        *
           37           KK   UST17
           38           BA   .0007
           39           BF       0
           40           LS       0      93
           41           UD   0.100
                        *
           42           KK   UST18
           43           BA   .0007
           44           LS       0      98
           45           UD   0.065
```

```
                  *
1                                        HEC-1 INPUT                                                PAGE  2

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


             46          KK    REF2
             47          KM   REFERENCED FROM DS4636 HORSE AND COKE
             48          BA   .0001
             49          BF      31
             50          LS       0      63
             51          UD      .6
                         *

             52          KK   UST16
             53          BA   .0008
             54          BF       0
             55          LS       0      93
             56          UD   0.100
                         *

             57          KK   UST15
             58          BA   .0008
             59          LS       0      98
             60          UD   0.065
                         *

             61          KK    UCP1
             62          KM   COMBINE REF1, REF2, UST17, UST18, UST16, UST15
             63          HC       6
                         *

             64          KK      D1
             65          KM   FLOW SPLIT AT BUFFALO AND RACEL
             66          DT    UCP1
             67          DI      61
             68          DQ      21
                         *

             69          KK   UST11
             70          BA   .0007
             71          LS       0      98
             72          UD   0.050
                         *

             73          KK   UST10
             74          BA   .0007
             75          LS       0      93
             76          UD   0.056
                         *

             77          KK    DOF5
             78          BA   .0035
             79          LS       0      71
             80          UD    .132
                         *
1                                        HEC-1 INPUT                                                PAGE  3

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


             81          KK    UCP2
             82          KM   COMBINE UCP1, UST10, UST11, DOF5
             83          HC       4
                         *

             84          KK      D2
             85          KM   FLOW SPLIT AT TIOGA AND RACEL
             86          DT    UCP2
             87          DI      45
             88          DQ      17
                         *

             89          KK    UST1
             90          BA   .0004
             91          LS       0      98
             92          UD   0.050
                         *

             93          KK    UST2
             94          BA   .0004
             95          LS       0      93
             96          UD   0.050
                         *

             97          KK    DON1
             98          BA   .0032
             99          LS       0      68
            100          UD    .135
                         *
```

```
 101          KK    UCP3
 102          KM   COMBINE UCP2, UST1, UST2, DON1
 103          HC       4
              *

 104          KK    UST9
 105          BA   .0012
 106          LS       0      98
 107          UD   0.079
              *

 108          KK    DOF3
 109          BA   .0034
 110          LS       0      57
 111          UD    .134
              *

 112          KK   RETD1
 113          KM   RETRIEVE D1
 114          DR    UCP1
              *
1                                      HEC-1 INPUT                                        PAGE  4

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

 115          KK    UCP4
 116          KM   COMBINE UST9, RETD1, DOF3
 117          HC       3
              *

 118          KK      D3
 119          KM   FLOW SPLIT AT TIOGA AND ACKERMAN
 120          DT    UCP4
 121          DI      24
 122          DQ      14
              *

 123          KK    UST7
 124          BA   .0006
 125          LS       0      83
 126          UD   0.053
              *

 127          KK    UST8
 128          BA   .0012
 129          LS       0      83
 130          UD   0.096
              *

 131          KK   RETD3
 132          KM   RETRIEVE D3
 133          DR    UCP4
              *

 134          KK    UCP5
 135          KM   COMBINE UST8, UST9, RETD3
 136          HC       3
              *

 137          KK    DOF6
 138          BA   .0032
 139          LS       0      68
 140          UD    .131
              *

 141          KK    UST3
 142          BA   .0007
 143          LS       0      86
 144          UD   0.079
              *

 145          KK   RETD2
 146          KM   RETRIEVE D2
 147          DR    UCP2
              *
1                                      HEC-1 INPUT                                        PAGE  5

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

 148          KK    UCP6
 149          KM   COMBINE DOF6, UST3, RETD2
 150          HC       3
              *

 151          KK    UST4
 152          BA   .0008
 153          LS       0      83
```

```
            154           UD   0.070
                          *

            155           KK    DOF4
            156           BA   .0037
            157           LS       0      57
            158           UD    .097
                          *

            159           KK    UCP7
            160           KM   COMBINE UCP6, UST4, DOF4
            161           HC       3
                          *

            162           KK    UST5
            163           BA   .0008
            164           LS       0      83
            165           UD   0.073
                          *

            166           KK    DOF2
            167           BA   .0037
            168           LS       0      57
            169           UD    .126
                          *

            170           KK    UCP8
            171           KM   COMBINE UCP7, UST5, UCP5, DOF2
            172           HC       4
                          *

            173           KK    DOF1
            174           BA   .0037
            175           LS       0      61
            176           UD    .135
                          *

            177           KK    UST6
            178           BA   .0007
            179           LS       0      83
            180           UD   0.053
                          *
```



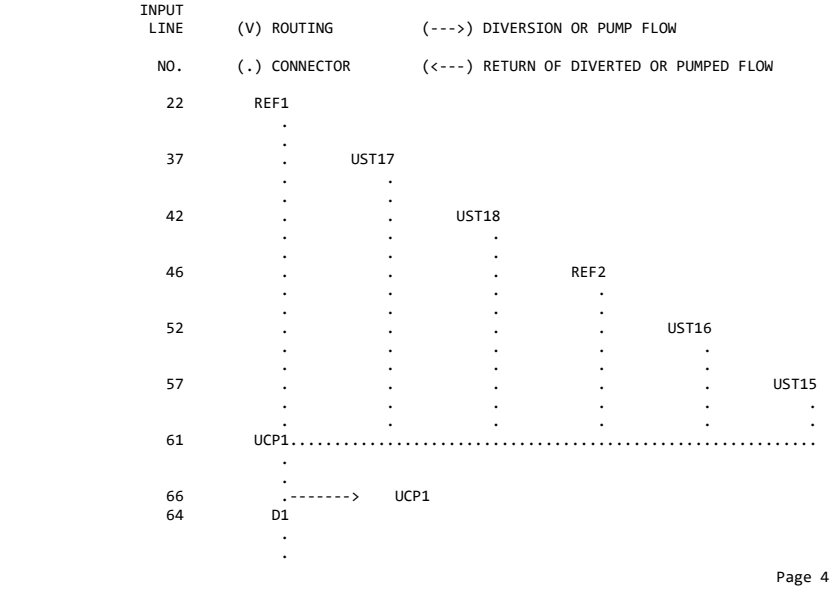
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          LINE           ID.......1.......2.......3.......4.......5.......6.......7.......8.......9......10

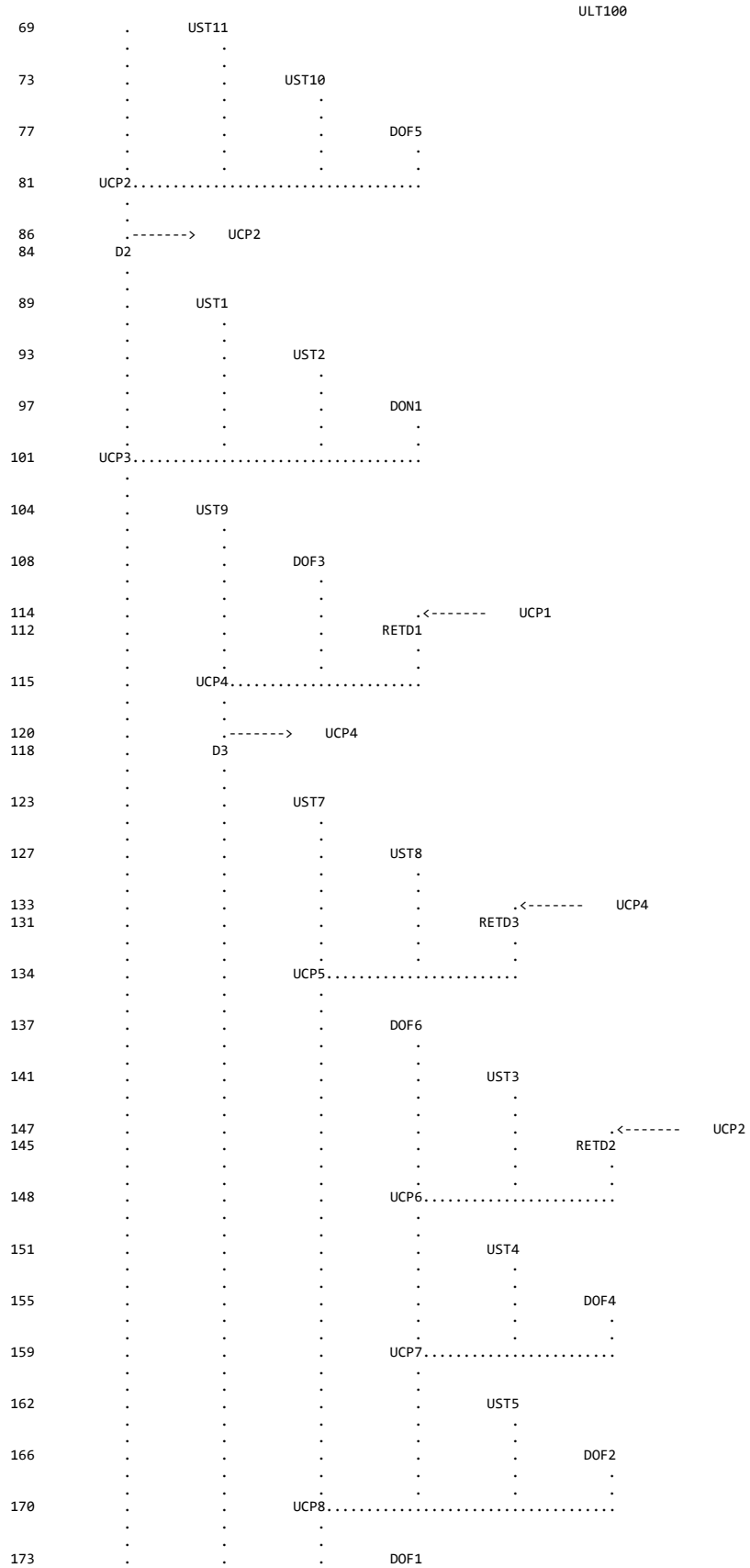
            181           KK    UCP9
            182           KM   COMBINE DOF1, UST6
            183           HC       2
                          *

            184           KK    DON2
            185           BA   .0038
            186           LS       0      61
            187           UD    .135
                          *
            188           ZZ
```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK




UST11
UST10
DOF5
UCP2
UCP2
D2
UST1
UST2
DON1
UCP3
UST9
DOF3
UCP1
RETD1
UCP4
UCP4
D3
UST7
UST8
UCP4
RETD3
UCP5
DOF6
UST3
UCP2
RETD2
UCP6
UST4
DOF4
UCP7
UST5
DOF2
UCP8
DOF1

```
               .          .          .          .
               .          .          .          .
   177         .          .          .          .       UST6
               .          .          .          .          .
               .          .          .          .          .
   181         .          .          .       UCP9...........
               .          .          .          .
               .          .          .          .
   184         .          .          .          .       DON2

 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************                                  ****************************************
 *                                      *                                  *                                      *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)  *                                  *    U.S. ARMY CORPS OF ENGINEERS      *
 *              JUN   1998              *                                  *    HYDROLOGIC ENGINEERING CENTER     *
 *            VERSION 4.1               *                                  *          609 SECOND STREET           *
 *                                      *                                  *       DAVIS, CALIFORNIA 95616        *
 *  RUN DATE   11APR19  TIME  14:02:29  *                                  *           (916) 756-1104             *
 *                                      *                                  *                                      *
 ****************************************                                  ****************************************
```

```
                              <><><><><><><><><><><><><><><><><><><><>
                                RACEL/TIOGA
                                HYDROLOGIC MODEL
                                ---------------------------

                                100-YR STORM EVENT
                                ---------------------------
                                TANEY ENGINEERING
                                ULTIMATE CONDITION
                                FILE: ULT100.DAT
                                PROJECT No: ADV-18-101
                                DATE:  APR 2019
                              <><><><><><><><><><><><><><><><><><><><>

                               ---> 6-HOUR / SDN 3 <---


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

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

                    COMPUTATION INTERVAL     .08 HOURS
                         TOTAL TIME BASE   24.92 HOURS

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

      JP          MULTI-PLAN OPTION
                        NPLAN           1  NUMBER OF PLANS

      JR          MULTI-RATIO OPTION
                      RATIOS OF PRECIPITATION
                      .57      1.00
1

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


                                                                        RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION     AREA    PLAN            RATIO 1  RATIO 2
                                                         .57     1.00

 HYDROGRAPH AT
+                  REF1       .00     1   FLOW          24.      24.
                                           TIME         5.08     4.08
```

```
 HYDROGRAPH AT
+                  UST17       .00     1   FLOW          1.       1.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                  UST18       .00     1   FLOW          1.       2.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   REF2       .00     1   FLOW         31.      31.
                                           TIME        5.08     4.08

 HYDROGRAPH AT
+                  UST16       .00     1   FLOW          1.       1.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                  UST15       .00     1   FLOW          1.       2.
                                           TIME        3.50     3.50

  6 COMBINED AT
+                   UCP1       .00     1   FLOW         58.      61.
                                           TIME        3.50     3.50

 DIVERSION TO
+                   UCP1       .00     1   FLOW         20.      21.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                     D1       .00     1   FLOW         38.      40.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                  UST11       .00     1   FLOW          1.       2.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                  UST10       .00     1   FLOW          1.       1.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   DOF5       .00     1   FLOW          0.       2.
                                           TIME        3.67     3.58

  4 COMBINED AT
+                   UCP2       .01     1   FLOW         40.      45.
                                           TIME        3.50     3.50

 DIVERSION TO
+                   UCP2       .01     1   FLOW         15.      17.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                     D2       .01     1   FLOW         25.      28.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   UST1       .00     1   FLOW          1.       1.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   UST2       .00     1   FLOW          0.       1.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   DON1       .00     1   FLOW          0.       1.
                                           TIME        3.75     3.58

  4 COMBINED AT
+                   UCP3       .01     1   FLOW         26.      31.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   UST9       .00     1   FLOW          1.       3.
                                           TIME        3.50     3.50

 HYDROGRAPH AT
+                   DOF3       .00     1   FLOW          0.       0.
                                           TIME        5.00     3.75

 HYDROGRAPH AT
+                  RETD1       .00     1   FLOW         20.      21.
                                           TIME        3.50     3.50

  3 COMBINED AT
+                   UCP4       .00     1   FLOW         21.      24.
                                           TIME        3.50     3.50

 DIVERSION TO
+                   UCP4       .00     1   FLOW         12.      14.
```

				TIME	3.50	3.50
HYDROGRAPH AT						
+	D3	.00	1	FLOW	9.	10.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST7	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST8	.00	1	FLOW	0.	1.
				TIME	3.58	3.50
HYDROGRAPH AT						
+	RETD3	.00	1	FLOW	12.	14.
				TIME	3.50	3.50
3 COMBINED AT						
+	UCP5	.00	1	FLOW	13.	16.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF6	.00	1	FLOW	0.	1.
				TIME	3.75	3.58
HYDROGRAPH AT						
+	UST3	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	RETD2	.00	1	FLOW	15.	17.
				TIME	3.50	3.50
3 COMBINED AT						
+	UCP6	.00	1	FLOW	15.	19.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST4	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF4	.00	1	FLOW	0.	0.
				TIME	4.92	3.58
3 COMBINED AT						
+	UCP7	.01	1	FLOW	16.	20.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	UST5	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF2	.00	1	FLOW	0.	0.
				TIME	4.92	3.75
4 COMBINED AT						
+	UCP8	.01	1	FLOW	29.	37.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DOF1	.00	1	FLOW	0.	1.
				TIME	4.92	3.67
HYDROGRAPH AT						
+	UST6	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
2 COMBINED AT						
+	UCP9	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	DON2	.00	1	FLOW	0.	1.
				TIME	4.92	3.67

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

APPENDIX C

Hydraulic Calculations

EXISTING CONDITION

Worksheet for CS A RACEL 60' RW EX. 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	279.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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	0.53	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	10.9	ft^2
Wetted Perimeter	48.68	ft
Hydraulic Radius	0.22	ft
Top Width	47.96	ft
Normal Depth	0.53	ft
Critical Depth	1.24	ft
Critical Slope	0.009	ft/ft
Velocity	25.57	ft/s
Velocity Head	10.16	ft
Specific Energy	10.69	ft
Froude Number	9.450	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

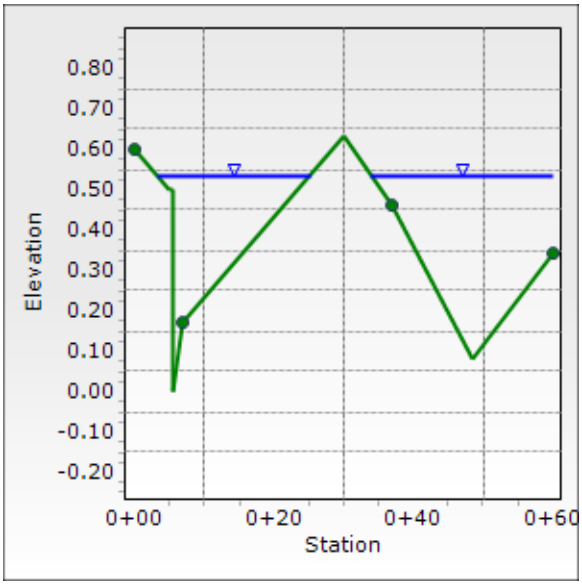
Worksheet for CS A RACEL 60' RW EX. 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	1.24 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS A RACEL 60' RW EX. 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.53 ft
Discharge	279.00 cfs



Worksheet for CS A RACEL 60' RW EX. 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	964.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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

Results		
Normal Depth	0.76	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	24.2	ft^2
Wetted Perimeter	61.12	ft
Hydraulic Radius	0.40	ft
Top Width	60.00	ft
Normal Depth	0.76	ft
Critical Depth	2.36	ft
Critical Slope	0.006	ft/ft
Velocity	39.78	ft/s
Velocity Head	24.59	ft
Specific Energy	25.36	ft
Froude Number	11.036	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

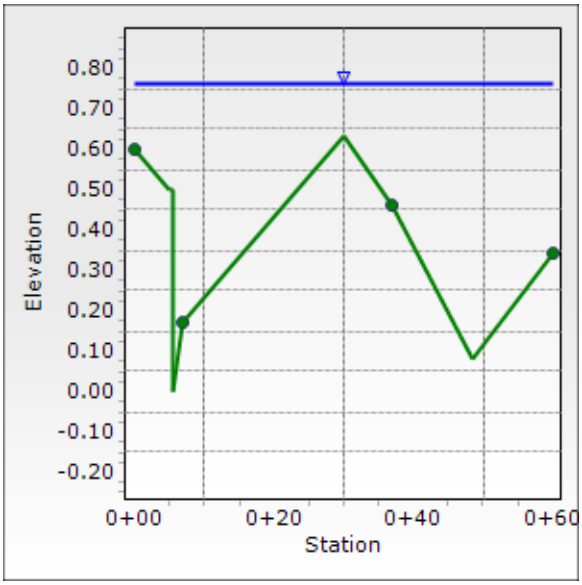
Worksheet for CS A RACEL 60' RW EX. 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.76 ft
Critical Depth	2.36 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS A RACEL 60' RW EX. 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.76 ft
Discharge	964.00 cfs



Worksheet for CS B RACEL 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	182.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	7.7	ft^2
Wetted Perimeter	40.17	ft
Hydraulic Radius	0.19	ft
Top Width	39.52	ft
Normal Depth	0.48	ft
Critical Depth	1.04	ft
Critical Slope	0.009	ft/ft
Velocity	23.67	ft/s
Velocity Head	8.71	ft
Specific Energy	9.19	ft
Froude Number	9.460	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

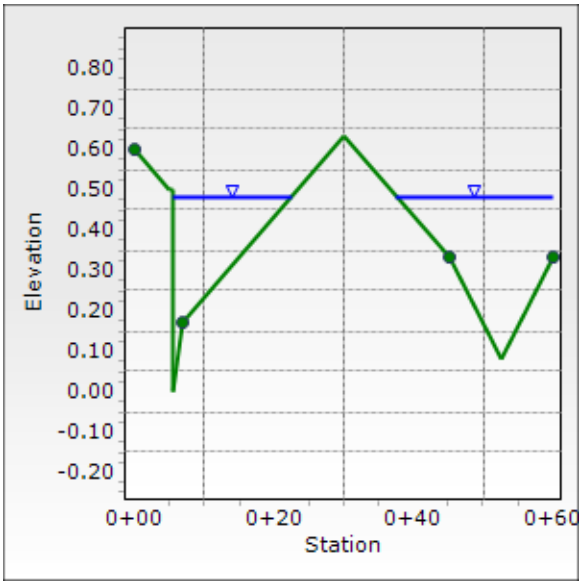
Worksheet for CS B RACEL 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.04 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS B RACEL 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.48 ft
Discharge	182.00 cfs



Worksheet for CS B RACEL 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	623.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.68	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	17.9	ft^2
Wetted Perimeter	60.95	ft
Hydraulic Radius	0.29	ft
Top Width	60.00	ft
Normal Depth	0.68	ft
Critical Depth	1.87	ft
Critical Slope	0.006	ft/ft
Velocity	34.78	ft/s
Velocity Head	18.79	ft
Specific Energy	19.47	ft
Froude Number	11.220	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

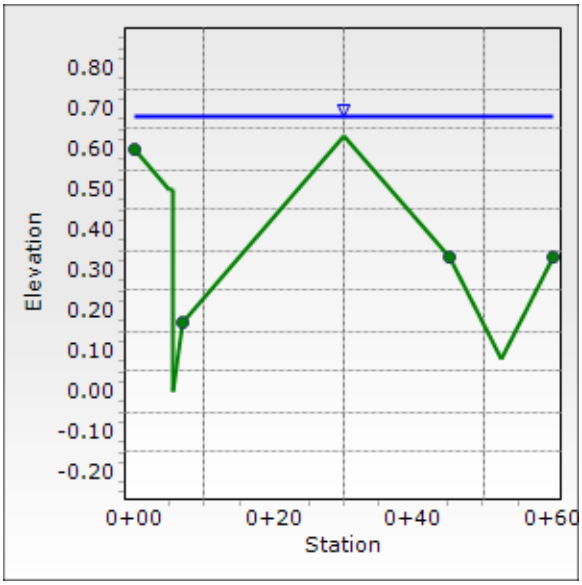
Worksheet for CS B RACEL 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.68 ft
Critical Depth	1.87 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS B RACEL 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.68 ft
Discharge	623.00 cfs



Worksheet for CS C RACEL 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	117.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.41	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	5.2	ft^2
Wetted Perimeter	33.09	ft
Hydraulic Radius	0.16	ft
Top Width	32.57	ft
Normal Depth	0.41	ft
Critical Depth	0.87	ft
Critical Slope	0.010	ft/ft
Velocity	22.56	ft/s
Velocity Head	7.91	ft
Specific Energy	8.32	ft
Froude Number	9.966	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

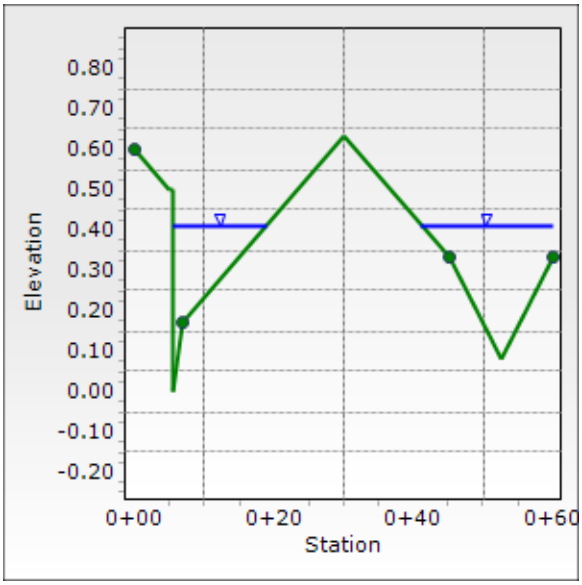
Worksheet for CS C RACEL 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.87 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS C RACEL 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.41 ft
Discharge	117.00 cfs



Worksheet for CS C RACEL 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	410.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.58	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	12.5	ft^2
Wetted Perimeter	55.32	ft
Hydraulic Radius	0.23	ft
Top Width	54.54	ft
Normal Depth	0.58	ft
Critical Depth	1.51	ft
Critical Slope	0.006	ft/ft
Velocity	32.73	ft/s
Velocity Head	16.64	ft
Specific Energy	17.23	ft
Froude Number	12.038	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

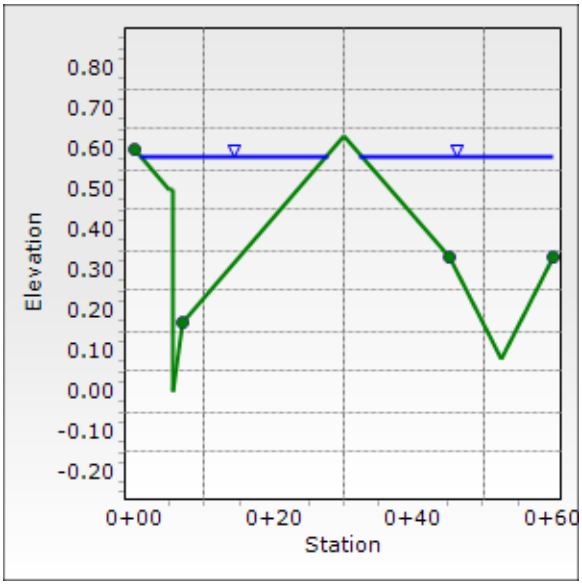
Worksheet for CS C RACEL 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.58 ft
Critical Depth	1.51 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS C RACEL 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.58 ft
Discharge	410.00 cfs



Worksheet for CS D TIOGA 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	66.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.63)	0.030

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

Results	
Normal Depth	0.37 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	7.0 ft²
Wetted Perimeter	39.37 ft
Hydraulic Radius	0.18 ft
Top Width	39.21 ft
Normal Depth	0.37 ft
Critical Depth	0.62 ft
Critical Slope	0.014 ft/ft
Velocity	9.39 ft/s
Velocity Head	1.37 ft
Specific Energy	1.74 ft
Froude Number	3.908
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

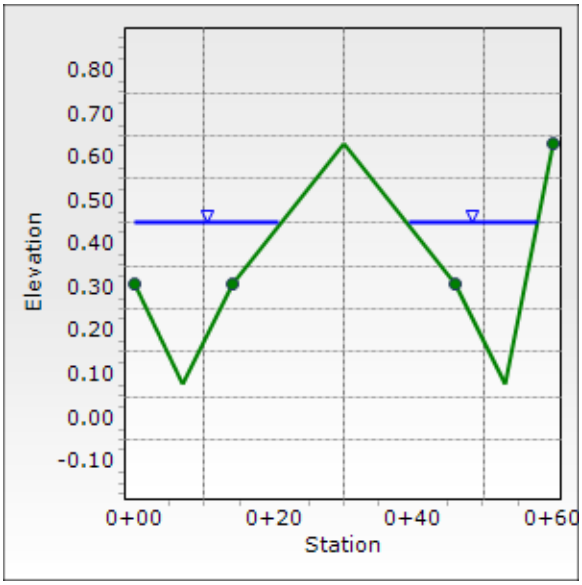
Worksheet for CS D TIOGA 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.37 ft
Critical Depth	0.62 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.014 ft/ft

Cross Section for CS D TIOGA 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.37 ft
Discharge	66.00 cfs



Worksheet for CS D TIOGA 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	216.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.53 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	15.9 ft²
Wetted Perimeter	58.22 ft
Hydraulic Radius	0.27 ft
Top Width	57.61 ft
Normal Depth	0.53 ft
Critical Depth	1.00 ft
Critical Slope	0.010 ft/ft
Velocity	13.59 ft/s
Velocity Head	2.87 ft
Specific Energy	3.40 ft
Froude Number	4.562
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

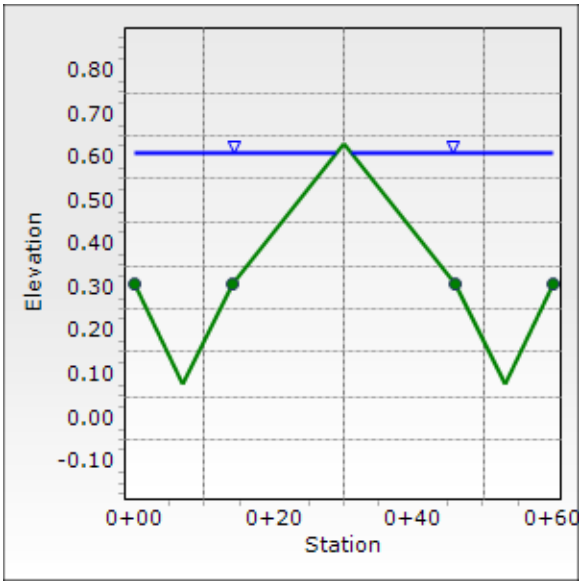
Worksheet for CS D TIOGA 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	1.00 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS D TIOGA 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.53 ft
Discharge	216.00 cfs



Worksheet for CS E TIOGA 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.30 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	5.5 ft²
Wetted Perimeter	35.43 ft
Hydraulic Radius	0.16 ft
Top Width	35.27 ft
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Critical Slope	0.016 ft/ft
Velocity	12.14 ft/s
Velocity Head	2.29 ft
Specific Energy	2.59 ft
Froude Number	5.409
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

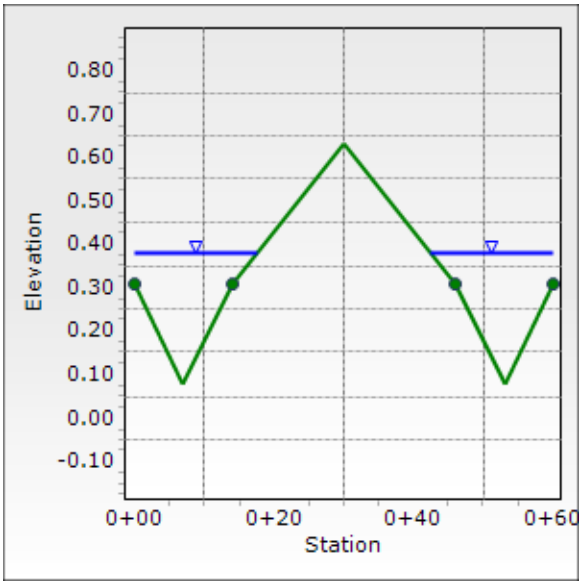
Worksheet for CS E TIOGA 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.016 ft/ft

Cross Section for CS E TIOGA 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.30 ft
Discharge	67.00 cfs



Worksheet for CS E TIOGA 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	218.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.46 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	12.1 ft²
Wetted Perimeter	51.13 ft
Hydraulic Radius	0.24 ft
Top Width	50.66 ft
Normal Depth	0.46 ft
Critical Depth	1.00 ft
Critical Slope	0.010 ft/ft
Velocity	17.97 ft/s
Velocity Head	5.02 ft
Specific Energy	5.47 ft
Froude Number	6.473
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

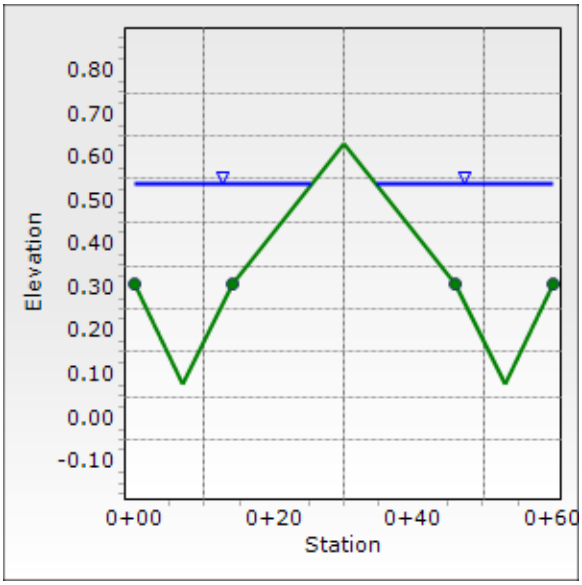
Worksheet for CS E TIOGA 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.46 ft
Critical Depth	1.00 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS E TIOGA 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.46 ft
Discharge	218.00 cfs



Worksheet for CS F ACKERMAN 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.06 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	0.3 ft²
Wetted Perimeter	7.88 ft
Hydraulic Radius	0.03 ft
Top Width	7.88 ft
Normal Depth	0.06 ft
Critical Depth	0.11 ft
Critical Slope	0.034 ft/ft
Velocity	3.92 ft/s
Velocity Head	0.24 ft
Specific Energy	0.30 ft
Froude Number	3.843
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

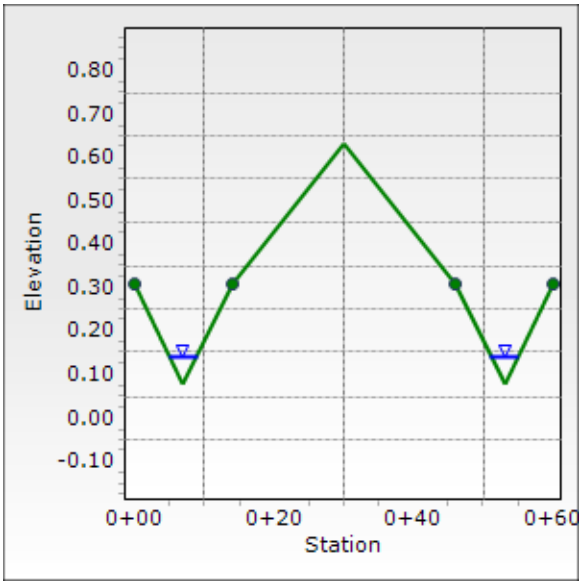
Worksheet for CS F ACKERMAN 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.06 ft
Critical Depth	0.11 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.034 ft/ft

Cross Section for CS F ACKERMAN 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.06 ft
Discharge	1.00 cfs



Worksheet for CS F ACKERMAN 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.610	ft/ft
Discharge	21.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.20	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	2.5	ft^2
Wetted Perimeter	24.67	ft
Hydraulic Radius	0.10	ft
Top Width	24.66	ft
Normal Depth	0.20	ft
Critical Depth	0.38	ft
Critical Slope	0.023	ft/ft
Velocity	8.41	ft/s
Velocity Head	1.10	ft
Specific Energy	1.30	ft
Froude Number	4.658	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

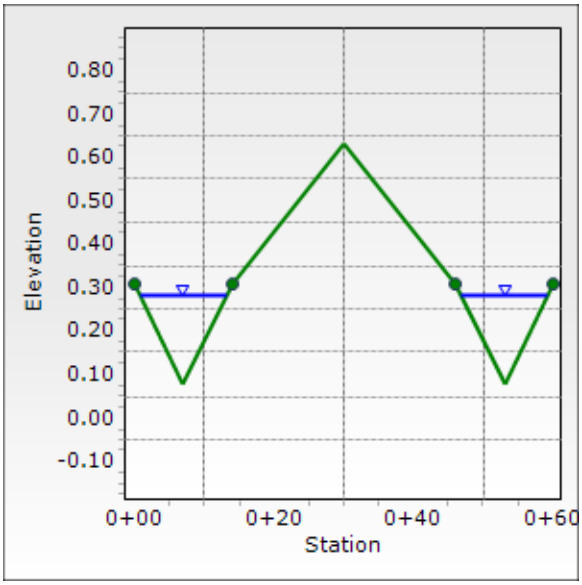
Worksheet for CS F ACKERMAN 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.20 ft
Critical Depth	0.38 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.023 ft/ft

Cross Section for CS F ACKERMAN 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.20 ft
Discharge	21.00 cfs



Worksheet for CS G ACKERMAN 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.610	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,406.03
0+04.30	2,406.06
0+16.24	2,406.26
0+22.21	2,406.17
0+29.90	2,406.16
0+34.98	2,406.07
0+44.99	2,405.70
0+51.31	2,405.21
0+60.00	2,405.43

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,406.03)	(0+60.00, 2,405.43)	0.030

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	0.09 ft
Elevation Range	2,405.21 to 2,406.26 ft
Flow Area	0.2 ft²
Wetted Perimeter	4.65 ft
Hydraulic Radius	0.04 ft
Top Width	4.65 ft
Normal Depth	0.09 ft
Critical Depth	0.16 ft
Critical Slope	0.031 ft/ft
Velocity	4.85 ft/s
Velocity Head	0.37 ft
Specific Energy	0.45 ft
Froude Number	4.059
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

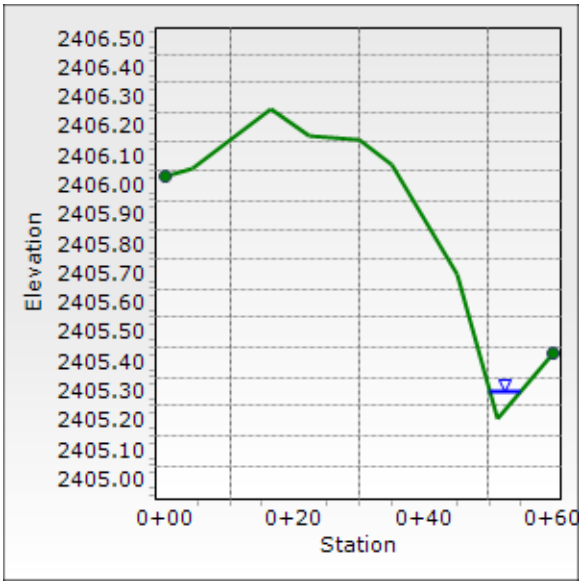
Worksheet for CS G ACKERMAN 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.09 ft
Critical Depth	0.16 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.031 ft/ft

Cross Section for CS G ACKERMAN 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.09 ft
Discharge	1.00 cfs



Worksheet for CS G ACKERMAN 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.610	ft/ft
Discharge	2.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,406.03
0+04.30	2,406.06
0+16.24	2,406.26
0+22.21	2,406.17
0+29.90	2,406.16
0+34.98	2,406.07
0+44.99	2,405.70
0+51.31	2,405.21
0+60.00	2,405.43

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,406.03)	(0+60.00, 2,405.43)	0.030

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	2,405.21 to 2,406.26	ft
Flow Area	0.3	ft^2
Wetted Perimeter	6.03	ft
Hydraulic Radius	0.06	ft
Top Width	6.03	ft
Normal Depth	0.12	ft
Critical Depth	0.21	ft
Critical Slope	0.028	ft/ft
Velocity	5.77	ft/s
Velocity Head	0.52	ft
Specific Energy	0.63	ft
Froude Number	4.241	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

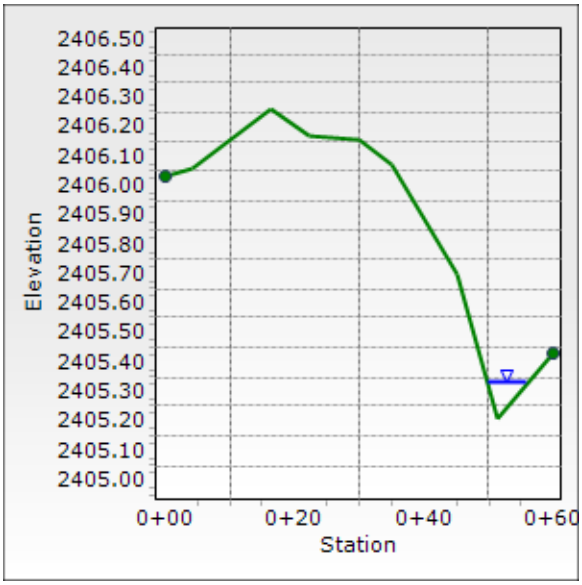
Worksheet for CS G ACKERMAN 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.12 ft
Critical Depth	0.21 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.028 ft/ft

Cross Section for CS G ACKERMAN 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.12 ft
Discharge	2.00 cfs



Worksheet for CS H TIOGA 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.63)	0.030

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	0.27 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	3.8 ft²
Wetted Perimeter	28.70 ft
Hydraulic Radius	0.13 ft
Top Width	28.64 ft
Normal Depth	0.27 ft
Critical Depth	0.62 ft
Critical Slope	0.017 ft/ft
Velocity	17.40 ft/s
Velocity Head	4.71 ft
Specific Energy	4.98 ft
Froude Number	8.369
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

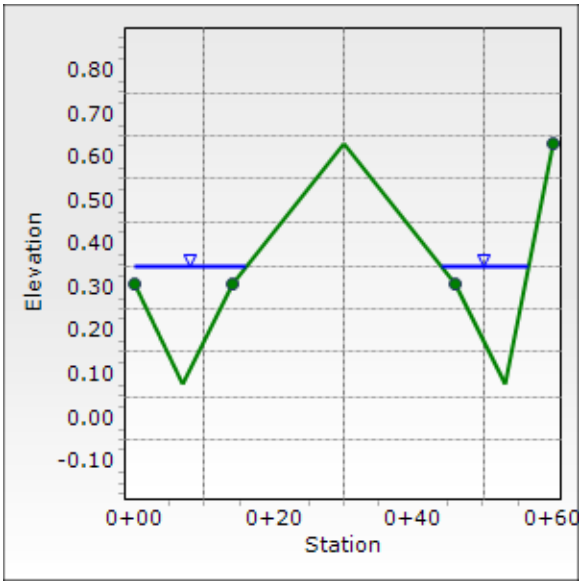
Worksheet for CS H TIOGA 60' RW EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.62 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.017 ft/ft

Cross Section for CS H TIOGA 60' RW EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.27 ft
Discharge	67.00 cfs



Worksheet for CS H TIOGA 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	240.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.40 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	9.3 ft²
Wetted Perimeter	45.18 ft
Hydraulic Radius	0.21 ft
Top Width	44.83 ft
Normal Depth	0.40 ft
Critical Depth	1.05 ft
Critical Slope	0.011 ft/ft
Velocity	25.68 ft/s
Velocity Head	10.24 ft
Specific Energy	10.64 ft
Froude Number	9.913
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

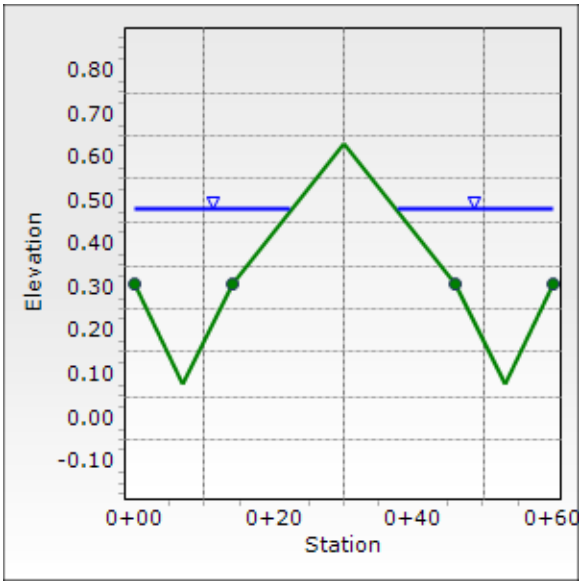
Worksheet for CS H TIOGA 60' RW EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.40 ft
Critical Depth	1.05 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.011 ft/ft

Cross Section for CS H TIOGA 60' RW EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.40 ft
Discharge	240.00 cfs



Worksheet for CS I 3' VALLEY GUTTER EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	102.72
0+06.50	101.65
0+08.00	101.61
0+09.50	101.65
0+10.00	101.72
0+10.00	105.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 102.72)	(0+06.50, 101.65)	0.025
(0+06.50, 101.65)	(0+09.50, 101.65)	0.013
(0+09.50, 101.65)	(0+10.00, 101.72)	0.025
(0+10.00, 101.72)	(0+10.00, 105.00)	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	101.61 to 105.00	ft
Flow Area	0.5	ft^2
Wetted Perimeter	4.27	ft
Hydraulic Radius	0.12	ft
Top Width	4.21	ft
Normal Depth	0.16	ft
Critical Depth	0.16	ft
Critical Slope	0.009	ft/ft
Velocity	2.03	ft/s
Velocity Head	0.06	ft
Specific Energy	0.22	ft
Froude Number	1.046	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

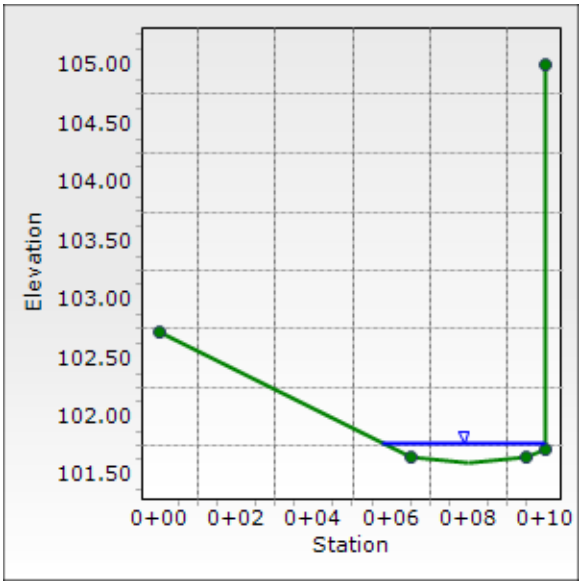
Worksheet for CS I 3' VALLEY GUTTER EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.16 ft
Critical Depth	0.16 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS I 3' VALLEY GUTTER EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.16 ft
Discharge	1.00 cfs



INTERIM CONDITION

Worksheet for CS A RACEL 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	279.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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	0.53	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	10.9	ft^2
Wetted Perimeter	48.68	ft
Hydraulic Radius	0.22	ft
Top Width	47.96	ft
Normal Depth	0.53	ft
Critical Depth	1.24	ft
Critical Slope	0.009	ft/ft
Velocity	25.57	ft/s
Velocity Head	10.16	ft
Specific Energy	10.69	ft
Froude Number	9.450	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

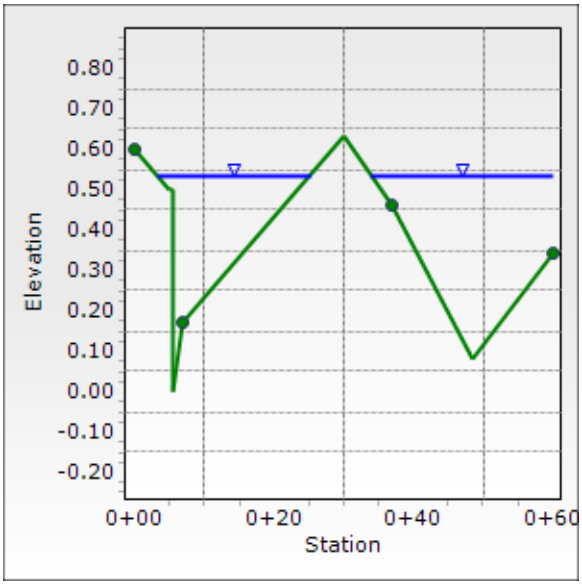
Worksheet for CS A RACEL 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	1.24 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS A RACEL 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.53 ft
Discharge	279.00 cfs



Worksheet for CS A RACEL 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Discharge	964.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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

Results	
Normal Depth	0.76 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	24.2 ft²
Wetted Perimeter	61.12 ft
Hydraulic Radius	0.40 ft
Top Width	60.00 ft
Normal Depth	0.76 ft
Critical Depth	2.36 ft
Critical Slope	0.006 ft/ft
Velocity	39.78 ft/s
Velocity Head	24.59 ft
Specific Energy	25.36 ft
Froude Number	11.036
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

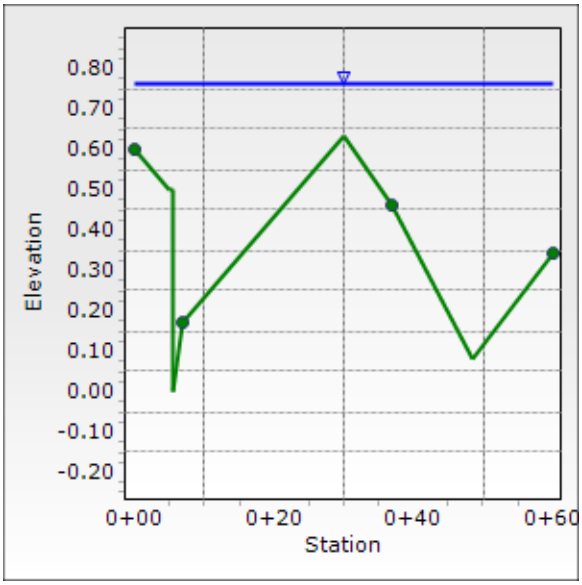
Worksheet for CS A RACEL 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.76 ft
Critical Depth	2.36 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS A RACEL 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.76 ft
Discharge	964.00 cfs



Worksheet for CS B RACEL 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	182.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	7.7	ft^2
Wetted Perimeter	40.17	ft
Hydraulic Radius	0.19	ft
Top Width	39.52	ft
Normal Depth	0.48	ft
Critical Depth	1.04	ft
Critical Slope	0.009	ft/ft
Velocity	23.67	ft/s
Velocity Head	8.71	ft
Specific Energy	9.19	ft
Froude Number	9.460	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

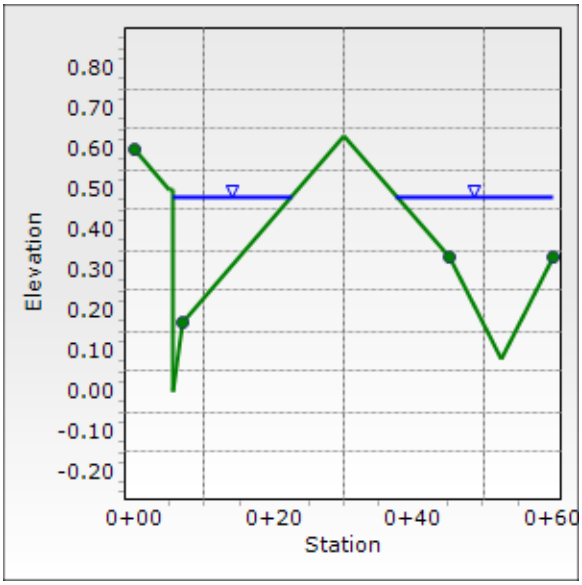
Worksheet for CS B RACEL 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.04 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS B RACEL 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.48 ft
Discharge	182.00 cfs



Worksheet for CS B RACEL 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Discharge	623.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.68 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	17.9 ft²
Wetted Perimeter	60.95 ft
Hydraulic Radius	0.29 ft
Top Width	60.00 ft
Normal Depth	0.68 ft
Critical Depth	1.87 ft
Critical Slope	0.006 ft/ft
Velocity	34.78 ft/s
Velocity Head	18.79 ft
Specific Energy	19.47 ft
Froude Number	11.220
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

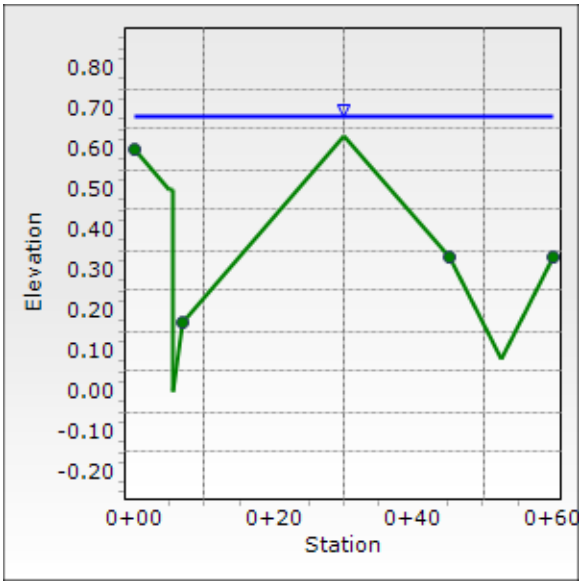
Worksheet for CS B RACEL 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.68 ft
Critical Depth	1.87 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS B RACEL 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.68 ft
Discharge	623.00 cfs



Worksheet for CS C RACEL 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	117.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.41	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	5.2	ft^2
Wetted Perimeter	33.09	ft
Hydraulic Radius	0.16	ft
Top Width	32.57	ft
Normal Depth	0.41	ft
Critical Depth	0.87	ft
Critical Slope	0.010	ft/ft
Velocity	22.56	ft/s
Velocity Head	7.91	ft
Specific Energy	8.32	ft
Froude Number	9.966	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

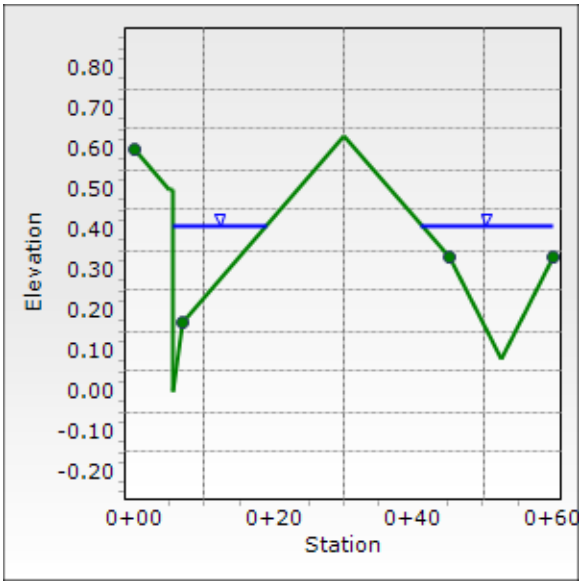
Worksheet for CS C RACEL 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.87 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS C RACEL 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.41 ft
Discharge	117.00 cfs



Worksheet for CS C RACEL 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	411.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.58	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	12.6	ft^2
Wetted Perimeter	55.38	ft
Hydraulic Radius	0.23	ft
Top Width	54.60	ft
Normal Depth	0.58	ft
Critical Depth	1.51	ft
Critical Slope	0.006	ft/ft
Velocity	32.75	ft/s
Velocity Head	16.67	ft
Specific Energy	17.25	ft
Froude Number	12.042	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

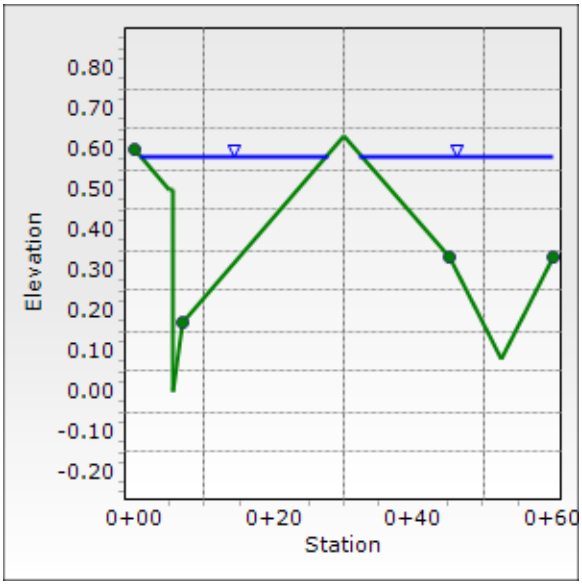
Worksheet for CS C RACEL 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.58 ft
Critical Depth	1.51 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS C RACEL 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.58 ft
Discharge	411.00 cfs



Worksheet for CS D TIOGA 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.35 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	7.2 ft²
Wetted Perimeter	40.09 ft
Hydraulic Radius	0.18 ft
Top Width	39.83 ft
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Critical Slope	0.015 ft/ft
Velocity	9.26 ft/s
Velocity Head	1.33 ft
Specific Energy	1.68 ft
Froude Number	3.832
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

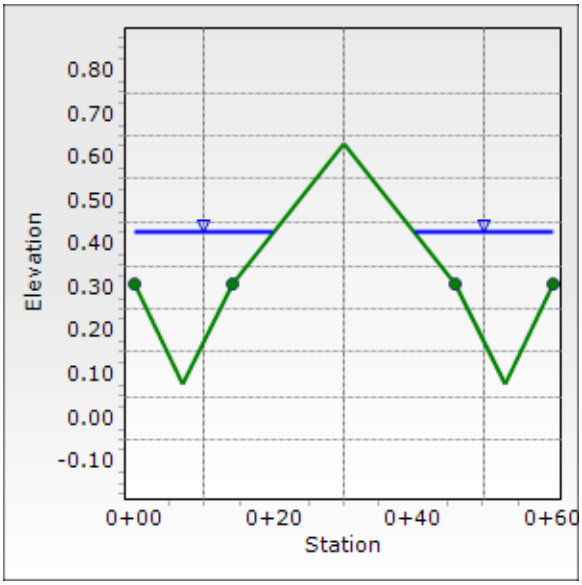
Worksheet for CS D TIOGA 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS D TIOGA 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.35 ft
Discharge	67.00 cfs



Worksheet for CS D TIOGA 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	212.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.52 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	15.7 ft²
Wetted Perimeter	57.86 ft
Hydraulic Radius	0.27 ft
Top Width	57.25 ft
Normal Depth	0.52 ft
Critical Depth	0.99 ft
Critical Slope	0.010 ft/ft
Velocity	13.51 ft/s
Velocity Head	2.84 ft
Specific Energy	3.36 ft
Froude Number	4.550
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

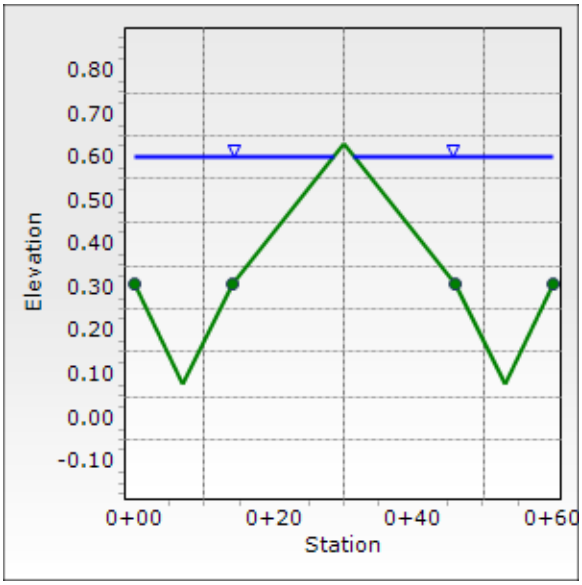
Worksheet for CS D TIOGA 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.52 ft
Critical Depth	0.99 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS D TIOGA 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.52 ft
Discharge	212.00 cfs



Worksheet for CS E TIOGA 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.30 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	5.5 ft²
Wetted Perimeter	35.43 ft
Hydraulic Radius	0.16 ft
Top Width	35.27 ft
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Critical Slope	0.016 ft/ft
Velocity	12.14 ft/s
Velocity Head	2.29 ft
Specific Energy	2.59 ft
Froude Number	5.409
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

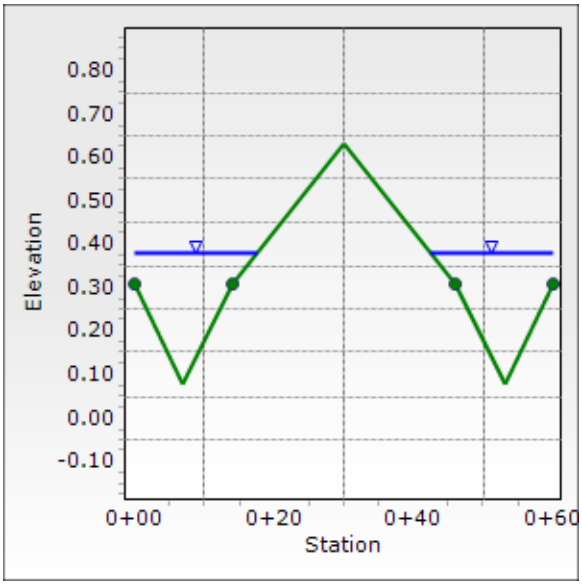
Worksheet for CS E TIOGA 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.016 ft/ft

Cross Section for CS E TIOGA 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.30 ft
Discharge	67.00 cfs



Worksheet for CS E TIOGA 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	214.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.45 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	12.0 ft²
Wetted Perimeter	50.83 ft
Hydraulic Radius	0.24 ft
Top Width	50.36 ft
Normal Depth	0.45 ft
Critical Depth	1.00 ft
Critical Slope	0.010 ft/ft
Velocity	17.86 ft/s
Velocity Head	4.96 ft
Specific Energy	5.41 ft
Froude Number	6.456
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

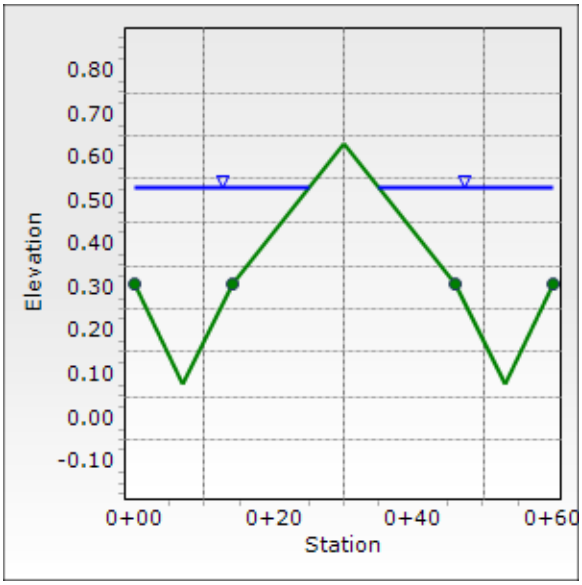
Worksheet for CS E TIOGA 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.45 ft
Critical Depth	1.00 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS E TIOGA 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.45 ft
Discharge	214.00 cfs



Worksheet for CS F ACKERMAN 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.06 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	0.3 ft²
Wetted Perimeter	7.88 ft
Hydraulic Radius	0.03 ft
Top Width	7.88 ft
Normal Depth	0.06 ft
Critical Depth	0.11 ft
Critical Slope	0.034 ft/ft
Velocity	3.92 ft/s
Velocity Head	0.24 ft
Specific Energy	0.30 ft
Froude Number	3.843
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

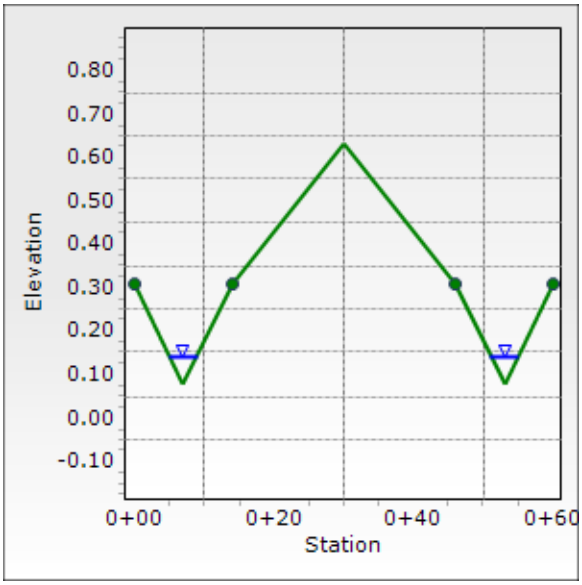
Worksheet for CS F ACKERMAN 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.06 ft
Critical Depth	0.11 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.034 ft/ft

Cross Section for CS F ACKERMAN 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.06 ft
Discharge	1.00 cfs



Worksheet for CS F ACKERMAN 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	21.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.20 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	2.5 ft²
Wetted Perimeter	24.67 ft
Hydraulic Radius	0.10 ft
Top Width	24.66 ft
Normal Depth	0.20 ft
Critical Depth	0.38 ft
Critical Slope	0.023 ft/ft
Velocity	8.41 ft/s
Velocity Head	1.10 ft
Specific Energy	1.30 ft
Froude Number	4.658
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

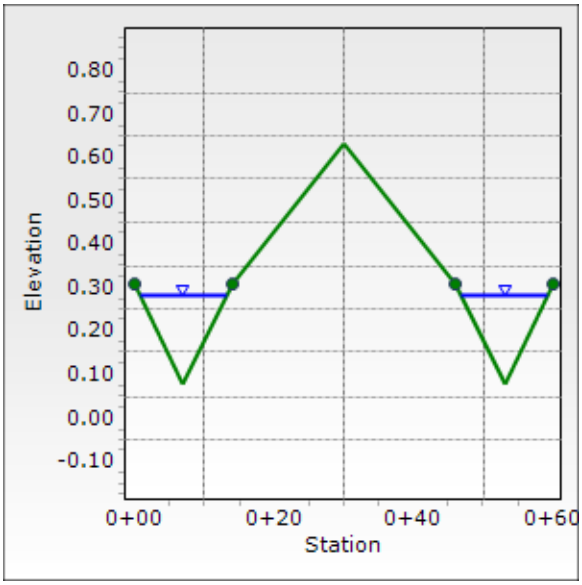
Worksheet for CS F ACKERMAN 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.20 ft
Critical Depth	0.38 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.023 ft/ft

Cross Section for CS F ACKERMAN 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.20 ft
Discharge	21.00 cfs



Worksheet for CS G ACKERMAN 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.21	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	0.9	ft^2
Wetted Perimeter	8.53	ft
Hydraulic Radius	0.11	ft
Top Width	8.48	ft
Normal Depth	0.21	ft
Critical Depth	0.17	ft
Critical Slope	0.030	ft/ft
Velocity	1.11	ft/s
Velocity Head	0.02	ft
Specific Energy	0.23	ft
Froude Number	0.598	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for CS G ACKERMAN 60' RW INT 10 YR

GVF Input Data	
Length	0.00 ft
Number Of Steps	0

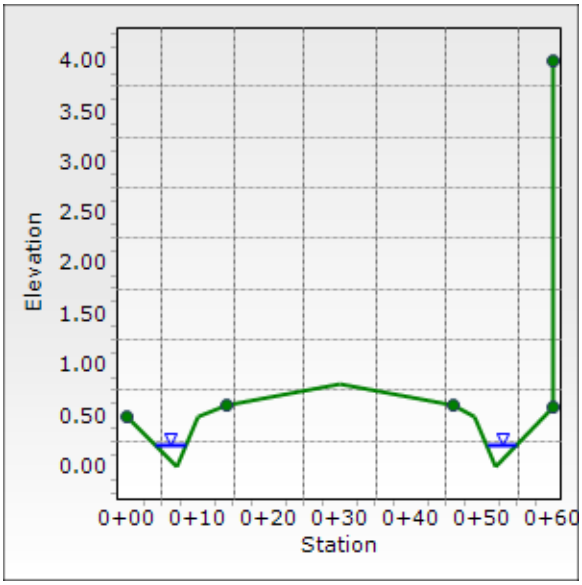
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.17 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.030 ft/ft

Messages	
Messages	Flow is divided.

Cross Section for CS G ACKERMAN 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.21 ft
Discharge	1.00 cfs



Worksheet for CS G ACKERMAN 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	2.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.28	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	1.5	ft^2
Wetted Perimeter	11.06	ft
Hydraulic Radius	0.14	ft
Top Width	10.99	ft
Normal Depth	0.28	ft
Critical Depth	0.23	ft
Critical Slope	0.027	ft/ft
Velocity	1.32	ft/s
Velocity Head	0.03	ft
Specific Energy	0.30	ft
Froude Number	0.625	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for CS G ACKERMAN 60' RW INT 100 YR

GVF Input Data	
Length	0.00 ft
Number Of Steps	0

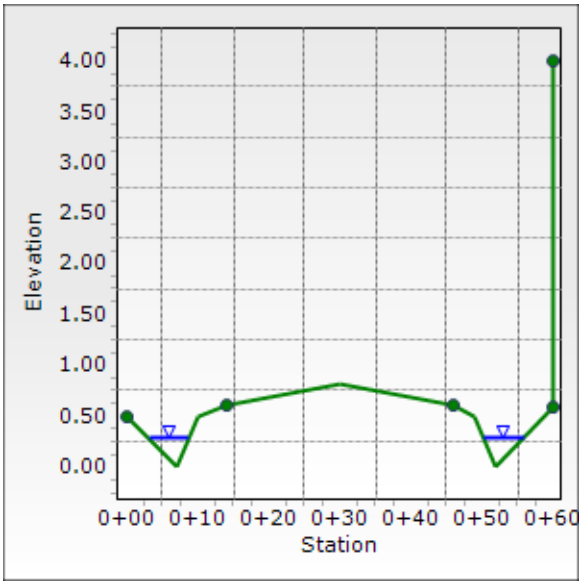
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.28 ft
Critical Depth	0.23 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.027 ft/ft

Messages	
Messages	Flow is divided.

Cross Section for CS G ACKERMAN 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.28 ft
Discharge	2.00 cfs



Worksheet for CS H TIOGA 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.08 to 0.63 ft
Flow Area	4.0 ft²
Wetted Perimeter	30.76 ft
Hydraulic Radius	0.13 ft
Top Width	30.69 ft
Normal Depth	0.26 ft
Critical Depth	0.60 ft
Critical Slope	0.018 ft/ft
Velocity	16.71 ft/s
Velocity Head	4.34 ft
Specific Energy	4.59 ft
Froude Number	8.147
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

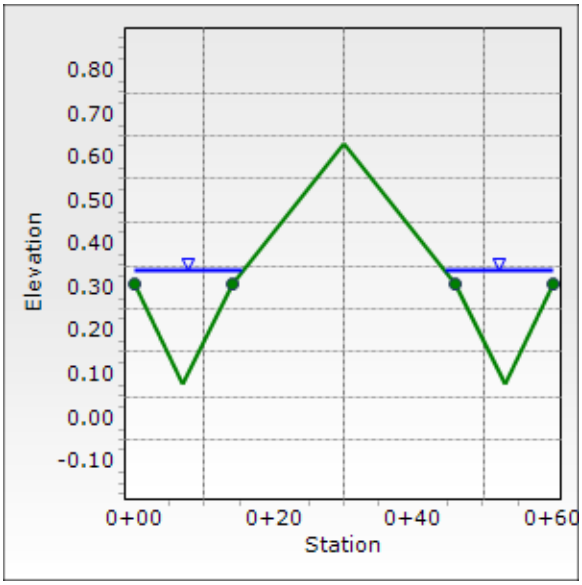
Worksheet for CS H TIOGA 60' RW INT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.26 ft
Critical Depth	0.60 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.018 ft/ft

Cross Section for CS H TIOGA 60' RW INT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.26 ft
Discharge	67.00 cfs



Worksheet for CS H TIOGA 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	240.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.40 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	9.3 ft²
Wetted Perimeter	45.18 ft
Hydraulic Radius	0.21 ft
Top Width	44.83 ft
Normal Depth	0.40 ft
Critical Depth	1.05 ft
Critical Slope	0.011 ft/ft
Velocity	25.68 ft/s
Velocity Head	10.24 ft
Specific Energy	10.64 ft
Froude Number	9.913
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

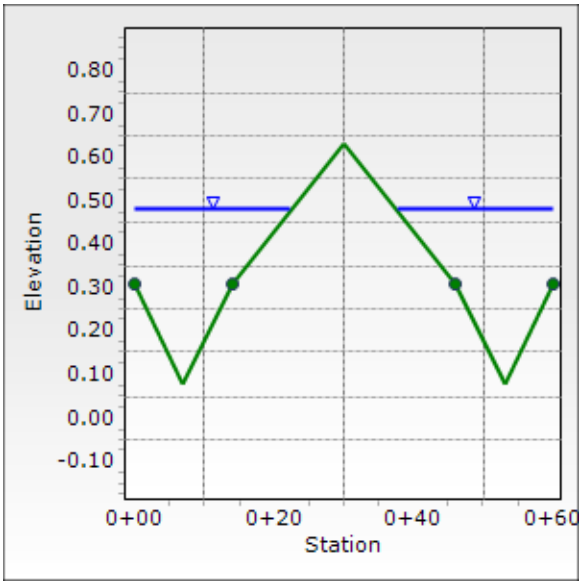
Worksheet for CS H TIOGA 60' RW INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.40 ft
Critical Depth	1.05 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.011 ft/ft

Cross Section for CS H TIOGA 60' RW INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.40 ft
Discharge	240.00 cfs



Worksheet for CS I 3' VALLEY GUTTER INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	102.72
0+06.50	101.65
0+08.00	101.61
0+09.50	101.65
0+10.00	101.72
0+10.00	105.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 102.72)	(0+06.50, 101.65)	0.025
(0+06.50, 101.65)	(0+09.50, 101.65)	0.013
(0+09.50, 101.65)	(0+10.00, 101.72)	0.025
(0+10.00, 101.72)	(0+10.00, 105.00)	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	101.61 to 105.00	ft
Flow Area	0.5	ft^2
Wetted Perimeter	4.27	ft
Hydraulic Radius	0.12	ft
Top Width	4.21	ft
Normal Depth	0.16	ft
Critical Depth	0.16	ft
Critical Slope	0.009	ft/ft
Velocity	2.03	ft/s
Velocity Head	0.06	ft
Specific Energy	0.22	ft
Froude Number	1.046	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

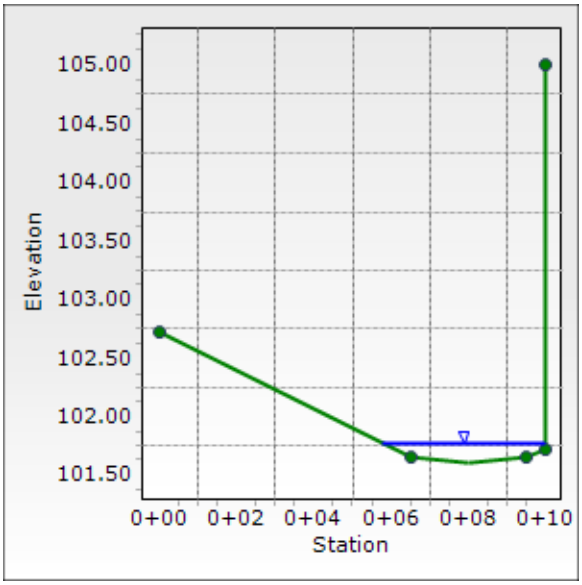
Worksheet for CS I 3' VALLEY GUTTER INT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.16 ft
Critical Depth	0.16 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS I 3' VALLEY GUTTER INT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.16 ft
Discharge	1.00 cfs



DEVELOPED CONDITION

Worksheet for CS A RACEL 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	964.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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

Results		
Normal Depth	0.76	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	24.2	ft^2
Wetted Perimeter	61.12	ft
Hydraulic Radius	0.40	ft
Top Width	60.00	ft
Normal Depth	0.76	ft
Critical Depth	2.36	ft
Critical Slope	0.006	ft/ft
Velocity	39.78	ft/s
Velocity Head	24.59	ft
Specific Energy	25.36	ft
Froude Number	11.036	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

Bentley Systems, Inc. Haestad Methods Solution Center
27 Siemon Company Drive Suite 200 W Watertown, CT
06795 USA +1-203-755-1666

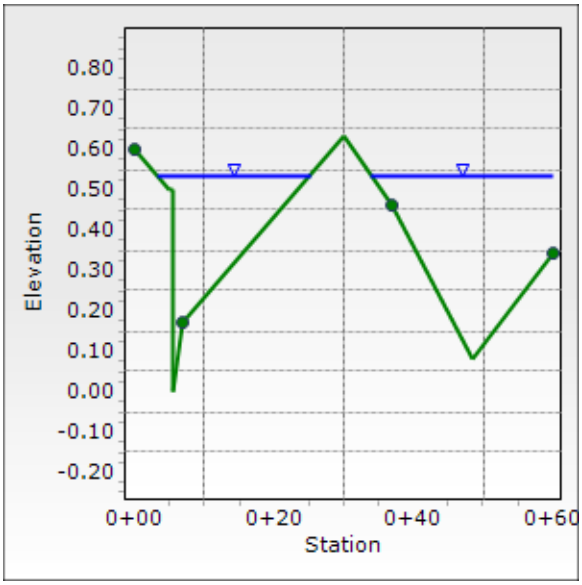
Worksheet for CS A RACEL 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.76 ft
Critical Depth	2.36 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS A RACEL 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.53 ft
Discharge	279.00 cfs



Worksheet for CS A RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Discharge	22.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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	0.27 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	1.8 ft²
Wetted Perimeter	20.40 ft
Hydraulic Radius	0.09 ft
Top Width	20.12 ft
Normal Depth	0.27 ft
Critical Depth	0.48 ft
Critical Slope	0.017 ft/ft
Velocity	12.33 ft/s
Velocity Head	2.36 ft
Specific Energy	2.63 ft
Froude Number	7.298
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

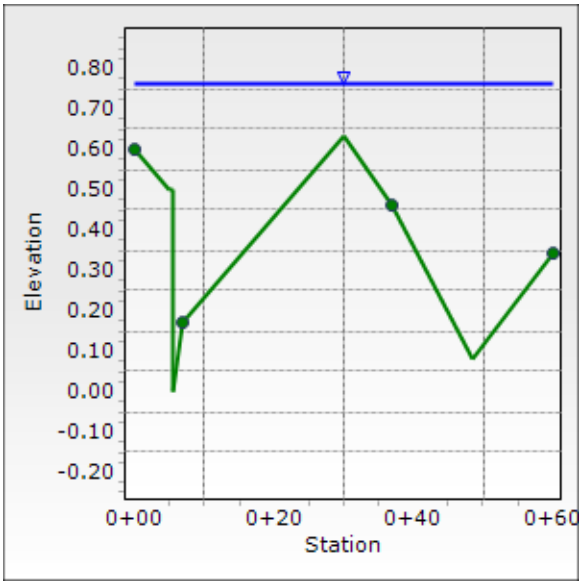
Worksheet for CS A RACEL 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.48 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.017 ft/ft

Cross Section for CS A RACEL 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.76 ft
Discharge	964.00 cfs



Worksheet for CS B RACEL 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	182.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	7.7	ft^2
Wetted Perimeter	40.17	ft
Hydraulic Radius	0.19	ft
Top Width	39.52	ft
Normal Depth	0.48	ft
Critical Depth	1.04	ft
Critical Slope	0.009	ft/ft
Velocity	23.67	ft/s
Velocity Head	8.71	ft
Specific Energy	9.19	ft
Froude Number	9.460	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

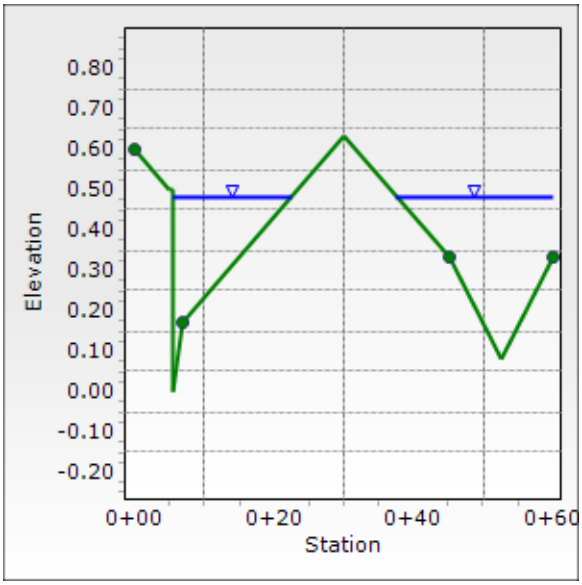
Worksheet for CS B RACEL 60' RW DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.04 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS B RACEL 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.48 ft
Discharge	182.00 cfs



Worksheet for CS B RACEL 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Discharge	623.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.68 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	17.9 ft²
Wetted Perimeter	60.95 ft
Hydraulic Radius	0.29 ft
Top Width	60.00 ft
Normal Depth	0.68 ft
Critical Depth	1.87 ft
Critical Slope	0.006 ft/ft
Velocity	34.78 ft/s
Velocity Head	18.79 ft
Specific Energy	19.47 ft
Froude Number	11.220
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

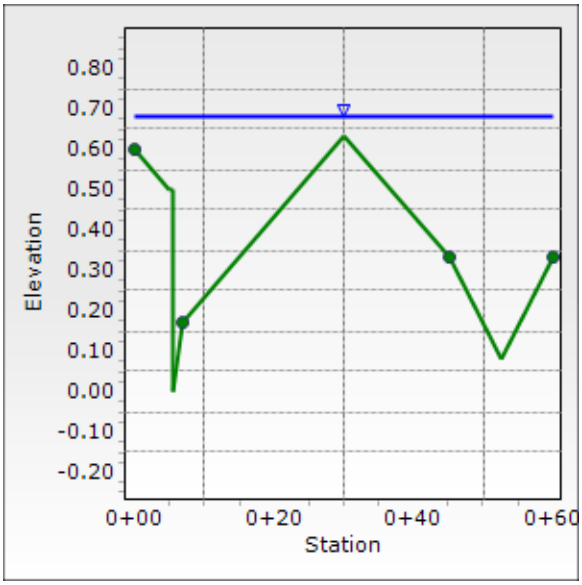
Worksheet for CS B RACEL 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.68 ft
Critical Depth	1.87 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS B RACEL 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.68 ft
Discharge	623.00 cfs



Worksheet for CS C RACEL 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	117.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.41	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	5.2	ft^2
Wetted Perimeter	33.09	ft
Hydraulic Radius	0.16	ft
Top Width	32.57	ft
Normal Depth	0.41	ft
Critical Depth	0.87	ft
Critical Slope	0.010	ft/ft
Velocity	22.56	ft/s
Velocity Head	7.91	ft
Specific Energy	8.32	ft
Froude Number	9.966	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

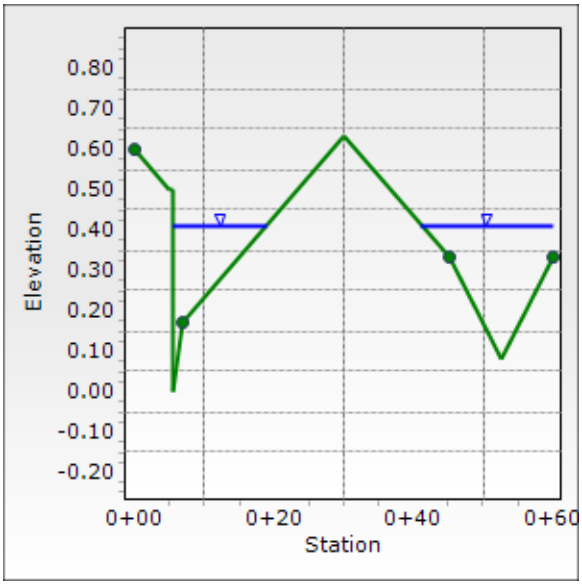
Worksheet for CS C RACEL 60' RW DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.87 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS C RACEL 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.41 ft
Discharge	117.00 cfs



Worksheet for CS C RACEL 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	411.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.58	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	12.6	ft^2
Wetted Perimeter	55.38	ft
Hydraulic Radius	0.23	ft
Top Width	54.60	ft
Normal Depth	0.58	ft
Critical Depth	1.51	ft
Critical Slope	0.006	ft/ft
Velocity	32.75	ft/s
Velocity Head	16.67	ft
Specific Energy	17.25	ft
Froude Number	12.042	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

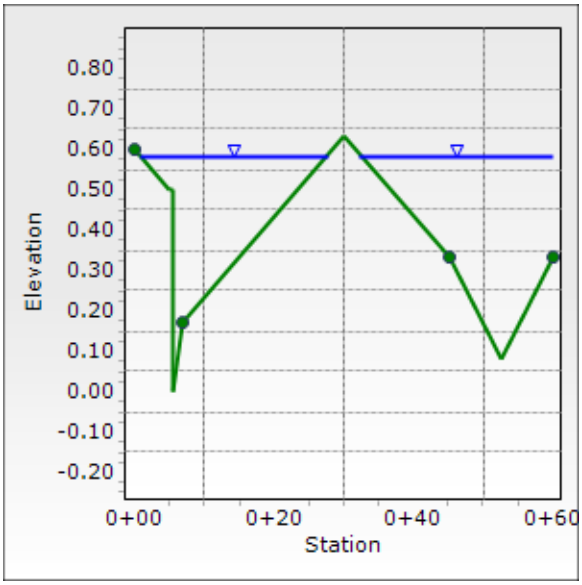
Worksheet for CS C RACEL 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.58 ft
Critical Depth	1.51 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for CS C RACEL 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.58 ft
Discharge	411.00 cfs



Worksheet for CS D TIOGA 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.270	ft/ft
Discharge	67.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.35	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	7.2	ft^2
Wetted Perimeter	40.09	ft
Hydraulic Radius	0.18	ft
Top Width	39.83	ft
Normal Depth	0.35	ft
Critical Depth	0.60	ft
Critical Slope	0.015	ft/ft
Velocity	9.26	ft/s
Velocity Head	1.33	ft
Specific Energy	1.68	ft
Froude Number	3.832	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

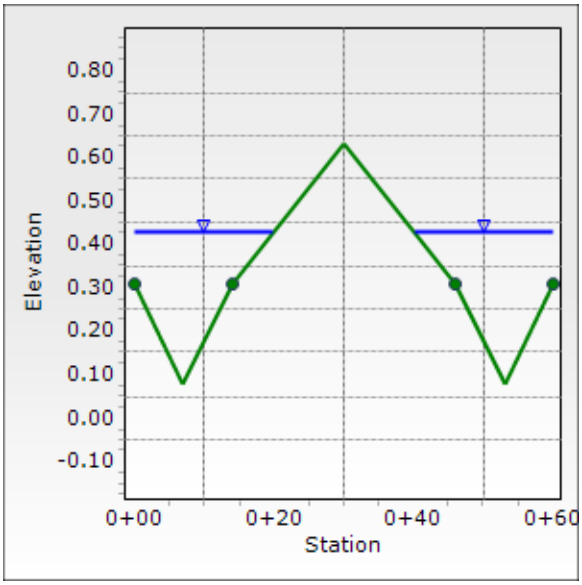
Worksheet for CS D TIOGA 60' RW DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS D TIOGA 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.35 ft
Discharge	67.00 cfs



Worksheet for CS D TIOGA 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.270	ft/ft
Discharge	212.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.52	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	15.7	ft^2
Wetted Perimeter	57.86	ft
Hydraulic Radius	0.27	ft
Top Width	57.25	ft
Normal Depth	0.52	ft
Critical Depth	0.99	ft
Critical Slope	0.010	ft/ft
Velocity	13.51	ft/s
Velocity Head	2.84	ft
Specific Energy	3.36	ft
Froude Number	4.550	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

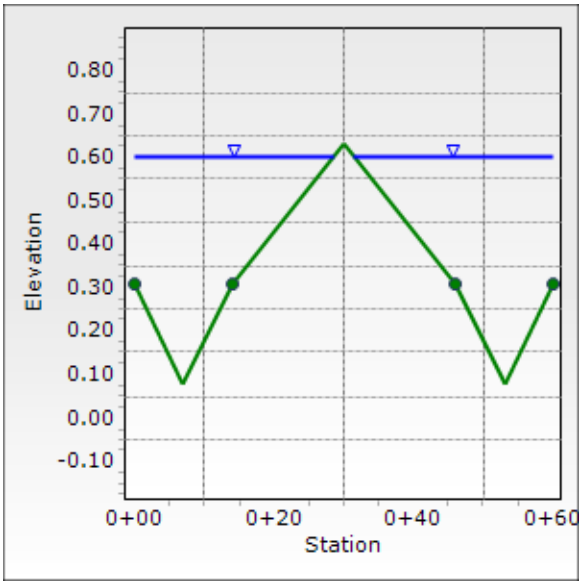
Worksheet for CS D TIOGA 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.52 ft
Critical Depth	0.99 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS D TIOGA 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.52 ft
Discharge	212.00 cfs



Worksheet for CS E TIOGA 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.30 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	5.5 ft²
Wetted Perimeter	35.43 ft
Hydraulic Radius	0.16 ft
Top Width	35.27 ft
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Critical Slope	0.016 ft/ft
Velocity	12.14 ft/s
Velocity Head	2.29 ft
Specific Energy	2.59 ft
Froude Number	5.409
Flow Type	Supercritical

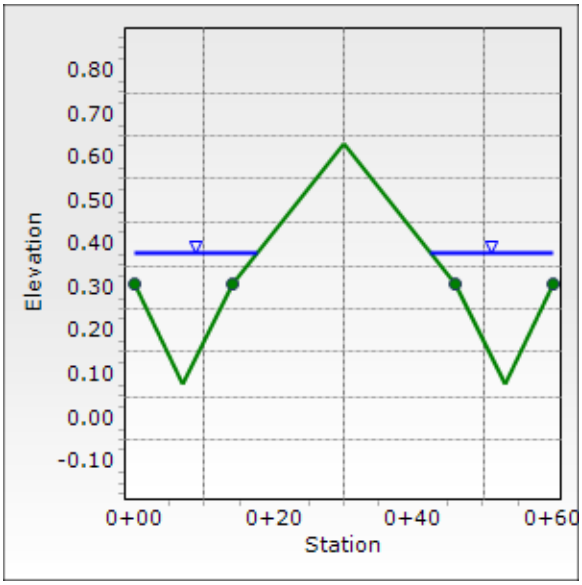
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Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

Cross Section for CS E TIOGA 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.30 ft
Discharge	67.00 cfs



Worksheet for CS E TIOGA 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	218.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.63)	0.030

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	0.48 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	12.1 ft²
Wetted Perimeter	52.04 ft
Hydraulic Radius	0.23 ft
Top Width	51.76 ft
Normal Depth	0.48 ft
Critical Depth	1.02 ft
Critical Slope	0.010 ft/ft
Velocity	18.02 ft/s
Velocity Head	5.05 ft
Specific Energy	5.52 ft
Froude Number	6.572
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

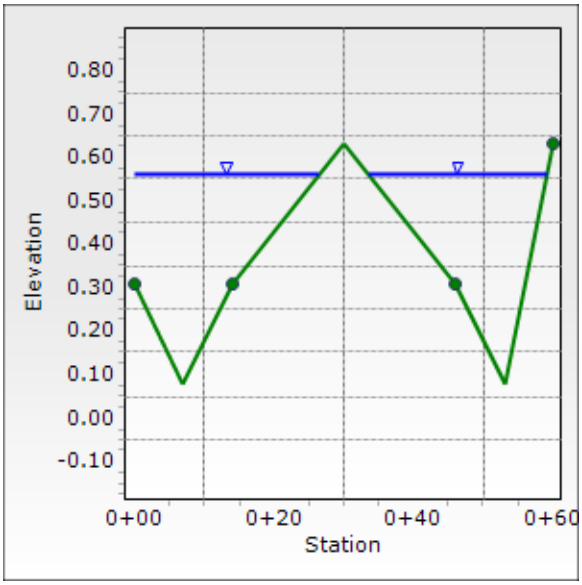
Worksheet for CS E TIOGA 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.02 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS E TIOGA 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.48 ft
Discharge	218.00 cfs



Worksheet for CS F ACKERMAN 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	50.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.27 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	4.6 ft²
Wetted Perimeter	32.51 ft
Hydraulic Radius	0.14 ft
Top Width	32.41 ft
Normal Depth	0.27 ft
Critical Depth	0.54 ft
Critical Slope	0.018 ft/ft
Velocity	10.98 ft/s
Velocity Head	1.88 ft
Specific Energy	2.15 ft
Froude Number	5.167
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

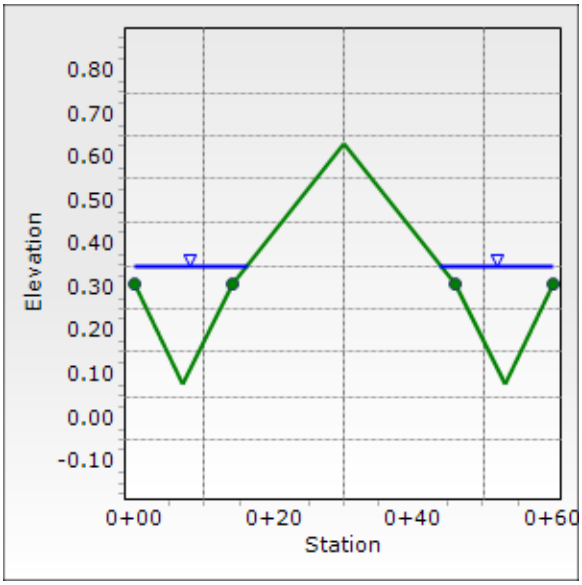
Worksheet for CS F ACKERMAN 60' RW DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.54 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.018 ft/ft

Cross Section for CS F ACKERMAN 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.27 ft
Discharge	50.00 cfs



Worksheet for CS F ACKERMAN 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	215.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.45 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	12.0 ft²
Wetted Perimeter	50.91 ft
Hydraulic Radius	0.24 ft
Top Width	50.44 ft
Normal Depth	0.45 ft
Critical Depth	1.00 ft
Critical Slope	0.010 ft/ft
Velocity	17.89 ft/s
Velocity Head	4.97 ft
Specific Energy	5.43 ft
Froude Number	6.460
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

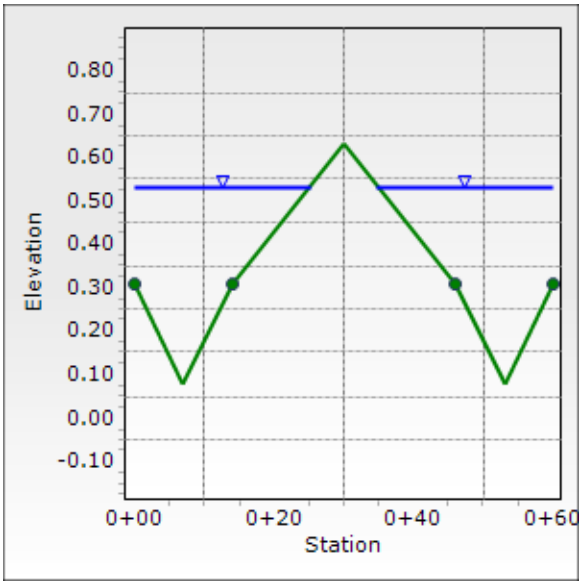
Worksheet for CS F ACKERMAN 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.45 ft
Critical Depth	1.00 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS F ACKERMAN 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.45 ft
Discharge	215.00 cfs



Worksheet for CS G ACKERMAN 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.21	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	0.9	ft^2
Wetted Perimeter	8.53	ft
Hydraulic Radius	0.11	ft
Top Width	8.48	ft
Normal Depth	0.21	ft
Critical Depth	0.17	ft
Critical Slope	0.030	ft/ft
Velocity	1.11	ft/s
Velocity Head	0.02	ft
Specific Energy	0.23	ft
Froude Number	0.598	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for CS G ACKERMAN 60' RW DEV 10 YR

GVF Input Data	
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.17 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.030 ft/ft

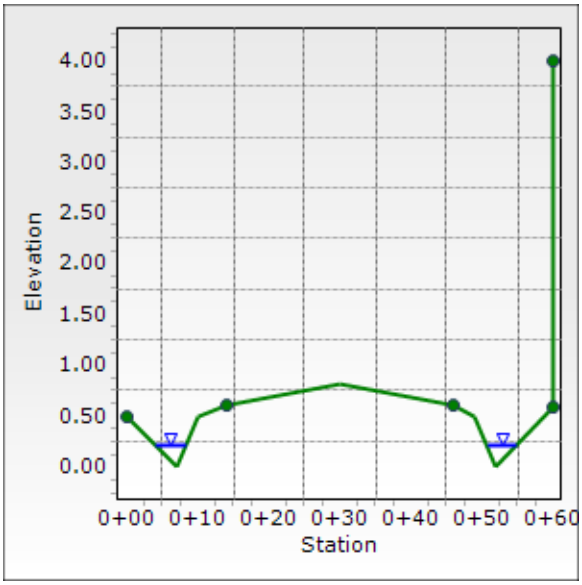
Messages	
Messages	Flow is divided.

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Cross Section for CS G ACKERMAN 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.21 ft
Discharge	1.00 cfs



Worksheet for CS G ACKERMAN 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	2.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.28	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	1.5	ft^2
Wetted Perimeter	11.06	ft
Hydraulic Radius	0.14	ft
Top Width	10.99	ft
Normal Depth	0.28	ft
Critical Depth	0.23	ft
Critical Slope	0.027	ft/ft
Velocity	1.32	ft/s
Velocity Head	0.03	ft
Specific Energy	0.30	ft
Froude Number	0.625	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for CS G ACKERMAN 60' RW DEV 100 YR

GVF Input Data	
Length	0.00 ft
Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.28 ft
Critical Depth	0.23 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.027 ft/ft

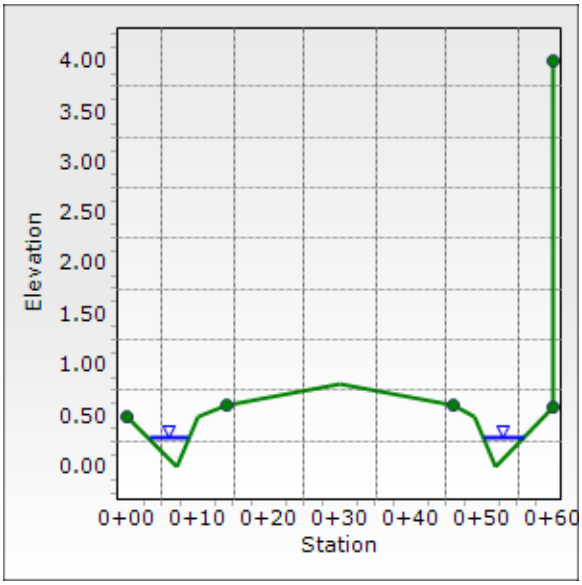
Messages	
Messages	Flow is divided.

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Cross Section for CS G ACKERMAN 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.28 ft
Discharge	2.00 cfs



Worksheet for CS H TIOGA 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.610	ft/ft
Discharge	119.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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

Results		
Normal Depth	0.31	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	5.9	ft^2
Wetted Perimeter	36.39	ft
Hydraulic Radius	0.16	ft
Top Width	36.21	ft
Normal Depth	0.31	ft
Critical Depth	0.76	ft
Critical Slope	0.014	ft/ft
Velocity	20.32	ft/s
Velocity Head	6.41	ft
Specific Energy	6.73	ft
Froude Number	8.906	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

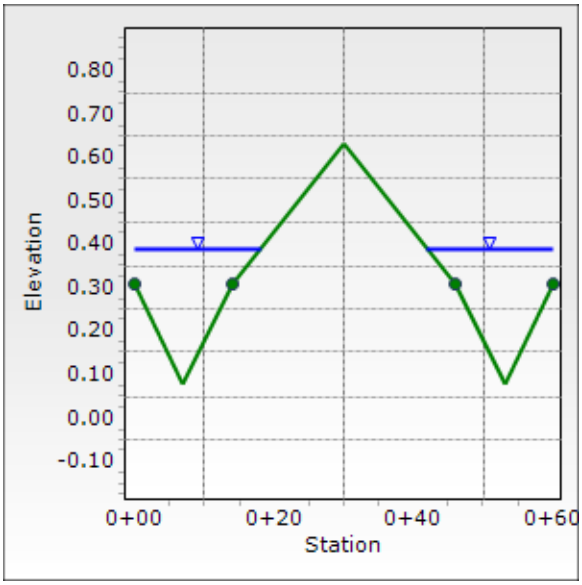
Worksheet for CS H TIOGA 60' RW DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.31 ft
Critical Depth	0.76 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.014 ft/ft

Cross Section for CS H TIOGA 60' RW DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.31 ft
Discharge	119.00 cfs



Worksheet for CS H TIOGA 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	435.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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

Results	
Normal Depth	0.49 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	13.9 ft²
Wetted Perimeter	54.67 ft
Hydraulic Radius	0.26 ft
Top Width	54.12 ft
Normal Depth	0.49 ft
Critical Depth	1.44 ft
Critical Slope	0.009 ft/ft
Velocity	31.19 ft/s
Velocity Head	15.12 ft
Specific Energy	15.61 ft
Froude Number	10.832
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

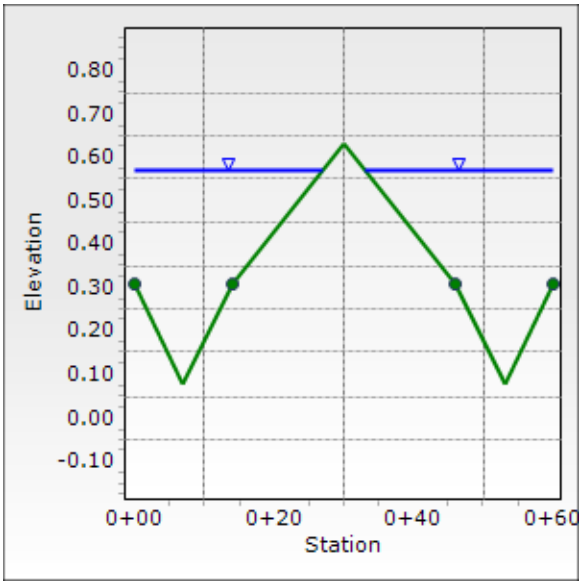
Worksheet for CS H TIOGA 60' RW DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.49 ft
Critical Depth	1.44 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS H TIOGA 60' RW DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.49 ft
Discharge	435.00 cfs



Worksheet for CS I 3' VALLEY GUTTER DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.010 ft/ft
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	102.72
0+06.50	101.65
0+08.00	101.61
0+09.50	101.65
0+10.00	101.72
0+10.00	105.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 102.72)	(0+06.50, 101.65)	0.025
(0+06.50, 101.65)	(0+09.50, 101.65)	0.013
(0+09.50, 101.65)	(0+10.00, 101.72)	0.025
(0+10.00, 101.72)	(0+10.00, 105.00)	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	0.23 ft
Elevation Range	101.61 to 105.00 ft
Flow Area	0.8 ft²
Wetted Perimeter	4.77 ft
Hydraulic Radius	0.17 ft
Top Width	4.63 ft
Normal Depth	0.23 ft
Critical Depth	0.23 ft
Critical Slope	0.009 ft/ft
Velocity	2.50 ft/s
Velocity Head	0.10 ft
Specific Energy	0.32 ft
Froude Number	1.060
Flow Type	Supercritical

GVF Input Data

Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

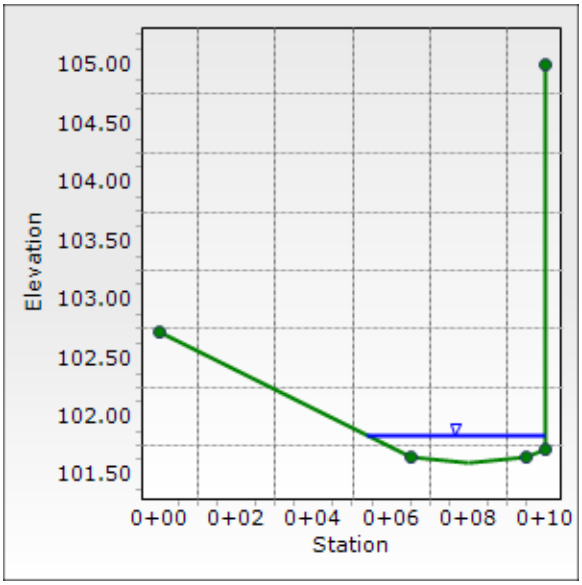
Worksheet for CS I 3' VALLEY GUTTER DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.23 ft
Critical Depth	0.23 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS I 3' VALLEY GUTTER DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.23 ft
Discharge	2.00 cfs



ULTIMATE CONDITION

Worksheet for CS A RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Discharge	22.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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	0.27 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	1.8 ft²
Wetted Perimeter	20.40 ft
Hydraulic Radius	0.09 ft
Top Width	20.12 ft
Normal Depth	0.27 ft
Critical Depth	0.48 ft
Critical Slope	0.017 ft/ft
Velocity	12.33 ft/s
Velocity Head	2.36 ft
Specific Energy	2.63 ft
Froude Number	7.298
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

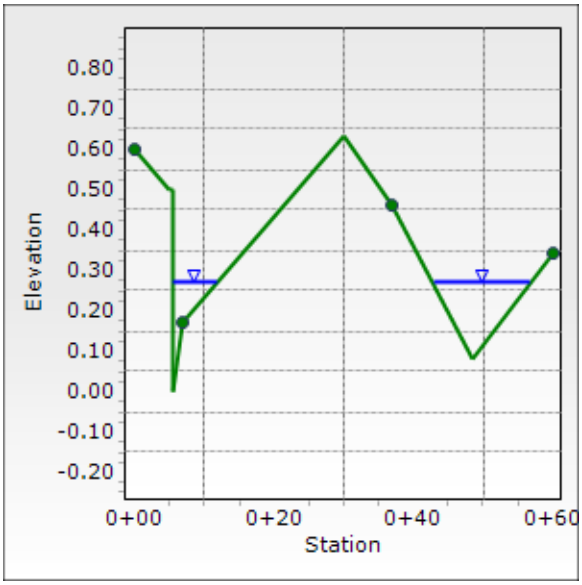
Worksheet for CS A RACEL 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.27 ft
Critical Depth	0.48 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.017 ft/ft

Cross Section for CS A RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.27 ft
Discharge	22.00 cfs



Worksheet for CS A RACEL 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	61.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+37.00	0.46
0+48.50	0.08
0+60.00	0.34

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+37.00, 0.46)	0.016
(0+37.00, 0.46)	(0+60.00, 0.34)	0.030

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	0.35	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	3.8	ft^2
Wetted Perimeter	30.31	ft
Hydraulic Radius	0.13	ft
Top Width	29.93	ft
Normal Depth	0.35	ft
Critical Depth	0.68	ft
Critical Slope	0.015	ft/ft
Velocity	15.92	ft/s
Velocity Head	3.94	ft
Specific Energy	4.28	ft
Froude Number	7.843	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

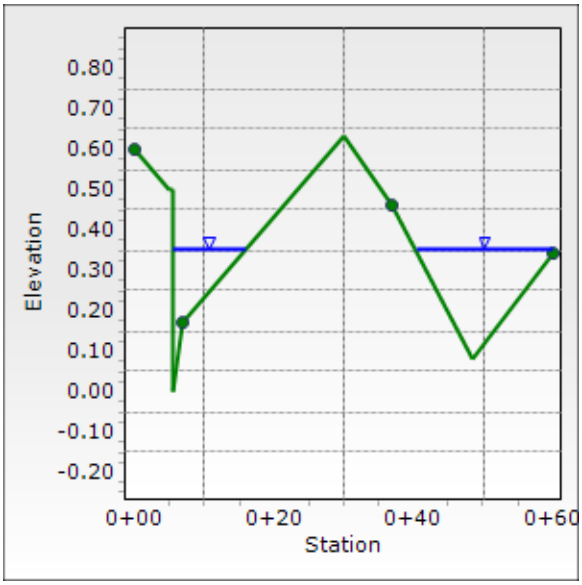
Worksheet for CS A RACEL 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.68 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS A RACEL 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.35 ft
Discharge	61.00 cfs



Worksheet for CS B RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	182.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	7.7	ft^2
Wetted Perimeter	40.17	ft
Hydraulic Radius	0.19	ft
Top Width	39.52	ft
Normal Depth	0.48	ft
Critical Depth	1.04	ft
Critical Slope	0.009	ft/ft
Velocity	23.67	ft/s
Velocity Head	8.71	ft
Specific Energy	9.19	ft
Froude Number	9.460	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

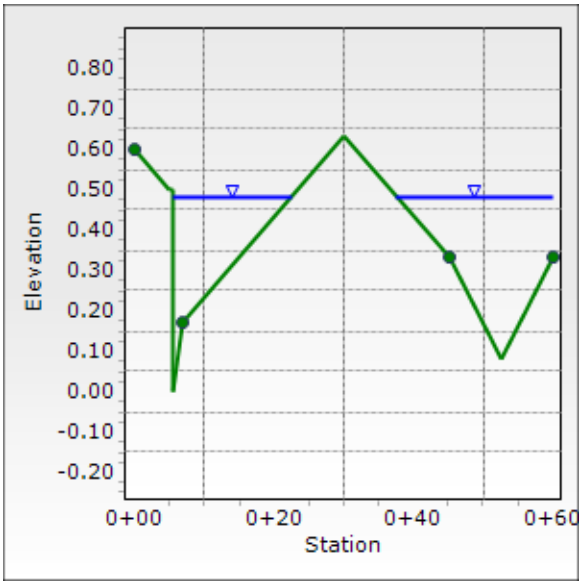
Worksheet for CS B RACEL 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.04 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS B RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.48 ft
Discharge	182.00 cfs



Worksheet for CS B RACEL 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	182.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	7.7	ft^2
Wetted Perimeter	40.17	ft
Hydraulic Radius	0.19	ft
Top Width	39.52	ft
Normal Depth	0.48	ft
Critical Depth	1.04	ft
Critical Slope	0.009	ft/ft
Velocity	23.67	ft/s
Velocity Head	8.71	ft
Specific Energy	9.19	ft
Froude Number	9.460	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

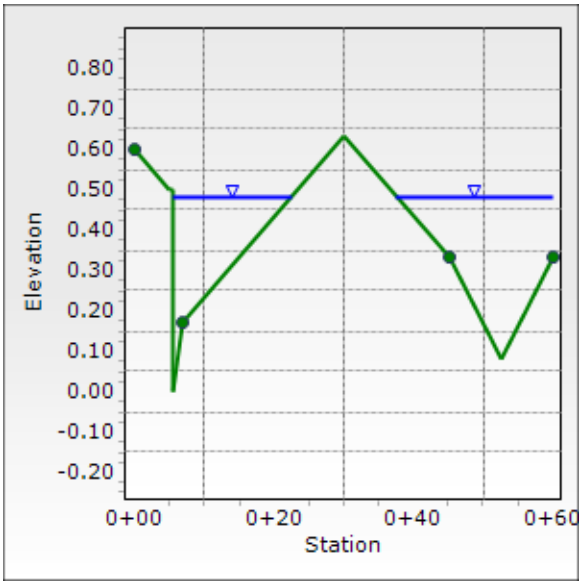
Worksheet for CS B RACEL 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.04 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS B RACEL 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.48 ft
Discharge	182.00 cfs



Worksheet for CS C RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Discharge	117.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.41 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	5.2 ft²
Wetted Perimeter	33.09 ft
Hydraulic Radius	0.16 ft
Top Width	32.57 ft
Normal Depth	0.41 ft
Critical Depth	0.87 ft
Critical Slope	0.010 ft/ft
Velocity	22.56 ft/s
Velocity Head	7.91 ft
Specific Energy	8.32 ft
Froude Number	9.966
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

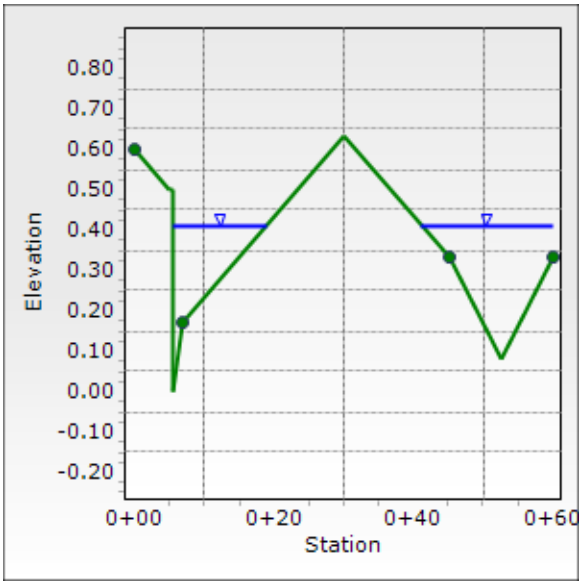
Worksheet for CS C RACEL 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.87 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS C RACEL 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.41 ft
Discharge	117.00 cfs



Worksheet for CS C RACEL 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.490	ft/ft
Discharge	117.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.41	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	5.2	ft^2
Wetted Perimeter	33.09	ft
Hydraulic Radius	0.16	ft
Top Width	32.57	ft
Normal Depth	0.41	ft
Critical Depth	0.87	ft
Critical Slope	0.010	ft/ft
Velocity	22.56	ft/s
Velocity Head	7.91	ft
Specific Energy	8.32	ft
Froude Number	9.966	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

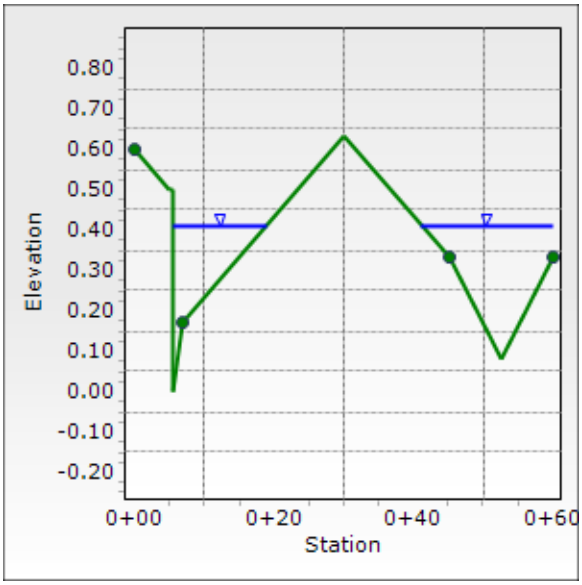
Worksheet for CS C RACEL 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.41 ft
Critical Depth	0.87 ft
Channel Slope	1.490 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for CS C RACEL 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.490 ft/ft
Normal Depth	0.41 ft
Discharge	117.00 cfs



Worksheet for CS D TIOGA 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.35 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	7.2 ft²
Wetted Perimeter	40.09 ft
Hydraulic Radius	0.18 ft
Top Width	39.83 ft
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Critical Slope	0.015 ft/ft
Velocity	9.26 ft/s
Velocity Head	1.33 ft
Specific Energy	1.68 ft
Froude Number	3.832
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

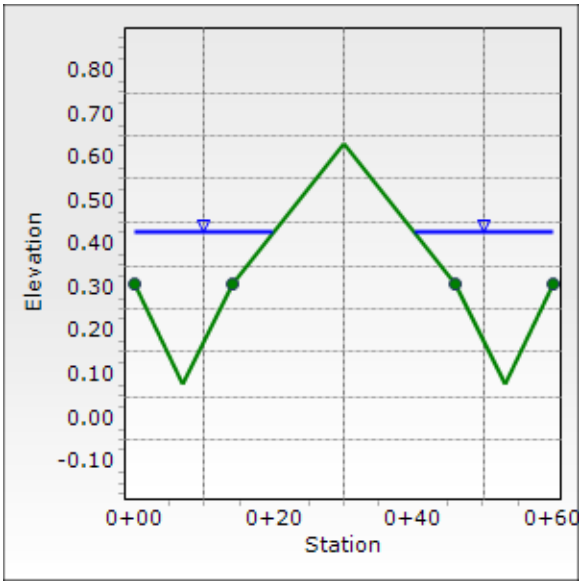
Worksheet for CS D TIOGA 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS D TIOGA 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.35 ft
Discharge	67.00 cfs



Worksheet for CS D TIOGA 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.35 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	7.2 ft²
Wetted Perimeter	40.09 ft
Hydraulic Radius	0.18 ft
Top Width	39.83 ft
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Critical Slope	0.015 ft/ft
Velocity	9.26 ft/s
Velocity Head	1.33 ft
Specific Energy	1.68 ft
Froude Number	3.832
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

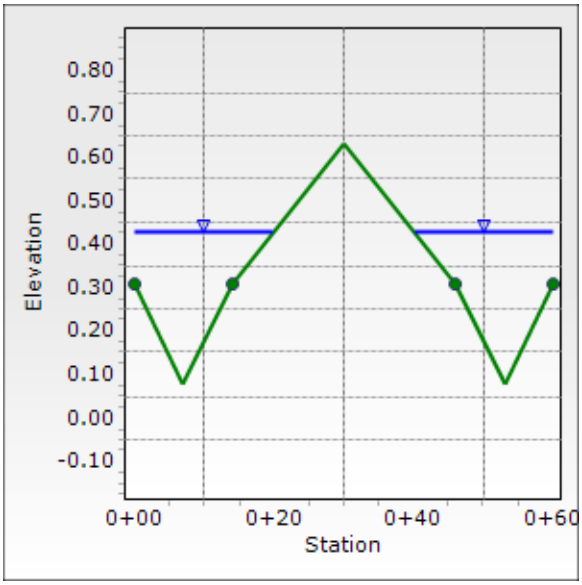
Worksheet for CS D TIOGA 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS D TIOGA 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.35 ft
Discharge	67.00 cfs



Worksheet for CS E TIOGA 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.30 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	5.5 ft²
Wetted Perimeter	35.43 ft
Hydraulic Radius	0.16 ft
Top Width	35.27 ft
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Critical Slope	0.016 ft/ft
Velocity	12.14 ft/s
Velocity Head	2.29 ft
Specific Energy	2.59 ft
Froude Number	5.409
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

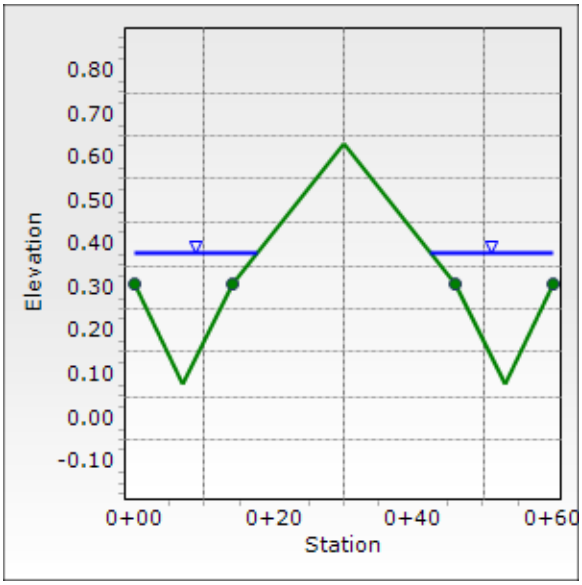
Worksheet for CS E TIOGA 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.016 ft/ft

Cross Section for CS E TIOGA 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.30 ft
Discharge	67.00 cfs



Worksheet for CS E TIOGA 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	67.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.30 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	5.5 ft²
Wetted Perimeter	35.43 ft
Hydraulic Radius	0.16 ft
Top Width	35.27 ft
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Critical Slope	0.016 ft/ft
Velocity	12.14 ft/s
Velocity Head	2.29 ft
Specific Energy	2.59 ft
Froude Number	5.409
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

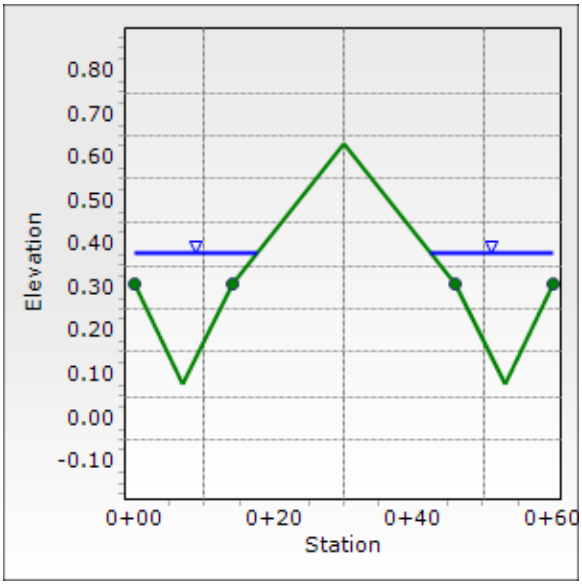
Worksheet for CS E TIOGA 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.30 ft
Critical Depth	0.60 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.016 ft/ft

Cross Section for CS E TIOGA 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.30 ft
Discharge	67.00 cfs



Worksheet for CS F ACKERMAN 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,410.87
0+16.05	2,410.35
0+18.90	2,410.29
0+35.84	2,410.33
0+37.83	2,410.52
0+55.05	2,409.88
0+60.00	2,410.29

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,410.87)	(0+35.84, 2,410.33)	0.030
(0+35.84, 2,410.33)	(0+55.05, 2,409.88)	0.016
(0+55.05, 2,409.88)	(0+60.00, 2,410.29)	0.030

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	0.09 ft
Elevation Range	2,409.88 to 2,410.87 ft
Flow Area	0.1 ft²
Wetted Perimeter	3.41 ft
Hydraulic Radius	0.04 ft
Top Width	3.40 ft
Normal Depth	0.09 ft
Critical Depth	0.18 ft
Critical Slope	0.015 ft/ft
Velocity	6.73 ft/s
Velocity Head	0.70 ft
Specific Energy	0.79 ft
Froude Number	5.677
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

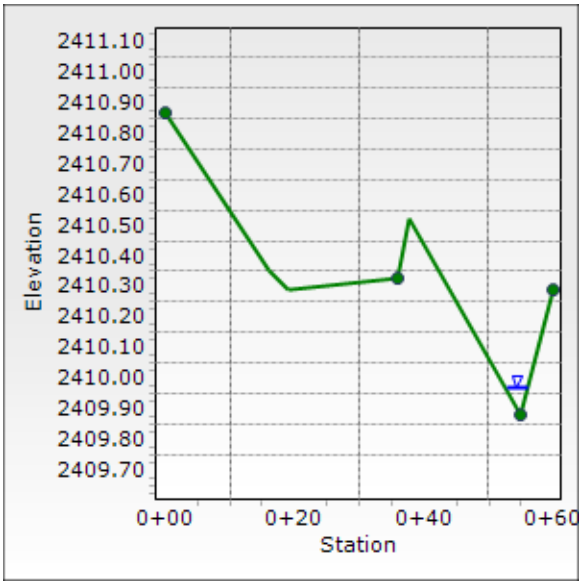
Worksheet for CS F ACKERMAN 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.09 ft
Critical Depth	0.18 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS F ACKERMAN 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.09 ft
Discharge	1.00 cfs



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Worksheet for CS F ACKERMAN 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Discharge	1.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,410.87
0+16.05	2,410.35
0+18.90	2,410.29
0+35.84	2,410.33
0+37.83	2,410.52
0+55.05	2,409.88
0+60.00	2,410.29

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,410.87)	(0+35.84, 2,410.33)	0.030
(0+35.84, 2,410.33)	(0+55.05, 2,409.88)	0.016
(0+55.05, 2,409.88)	(0+60.00, 2,410.29)	0.030

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	0.09 ft
Elevation Range	2,409.88 to 2,410.87 ft
Flow Area	0.1 ft²
Wetted Perimeter	3.41 ft
Hydraulic Radius	0.04 ft
Top Width	3.40 ft
Normal Depth	0.09 ft
Critical Depth	0.18 ft
Critical Slope	0.015 ft/ft
Velocity	6.73 ft/s
Velocity Head	0.70 ft
Specific Energy	0.79 ft
Froude Number	5.677
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

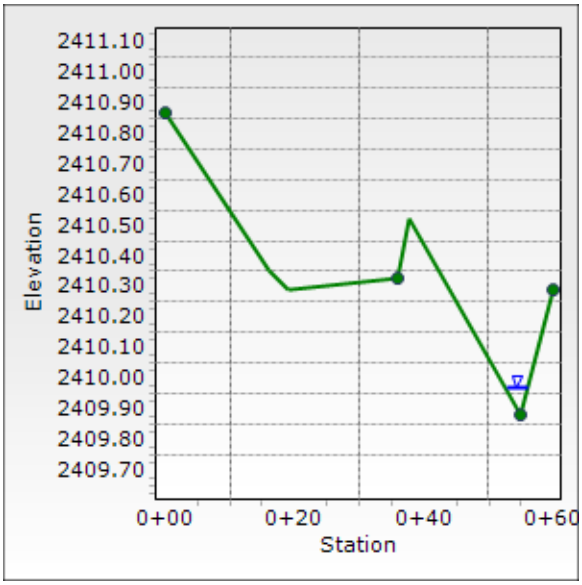
Worksheet for CS F ACKERMAN 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.09 ft
Critical Depth	0.18 ft
Channel Slope	0.610 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for CS F ACKERMAN 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.610 ft/ft
Normal Depth	0.09 ft
Discharge	1.00 cfs



Worksheet for CS G ACKERMAN 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.21	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	0.9	ft^2
Wetted Perimeter	8.53	ft
Hydraulic Radius	0.11	ft
Top Width	8.48	ft
Normal Depth	0.21	ft
Critical Depth	0.17	ft
Critical Slope	0.030	ft/ft
Velocity	1.11	ft/s
Velocity Head	0.02	ft
Specific Energy	0.23	ft
Froude Number	0.598	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for CS G ACKERMAN 60' RW ULT 10 YR

GVF Input Data	
Length	0.00 ft
Number Of Steps	0

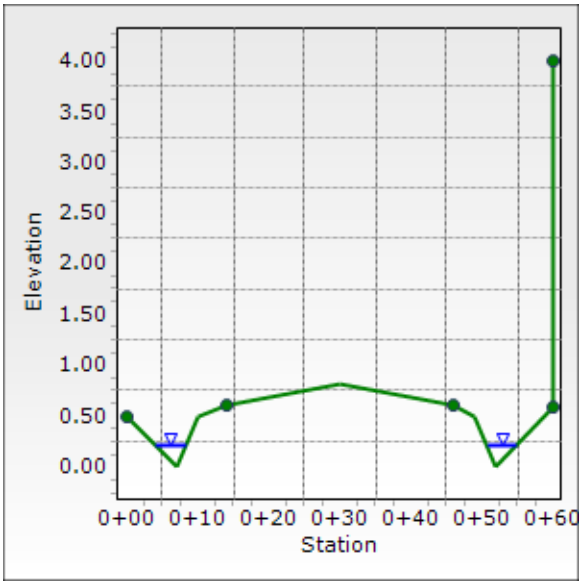
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.17 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.030 ft/ft

Messages	
Messages	Flow is divided.

Cross Section for CS G ACKERMAN 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.21 ft
Discharge	1.00 cfs



Worksheet for CS G ACKERMAN 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	1.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.21	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	0.9	ft^2
Wetted Perimeter	8.53	ft
Hydraulic Radius	0.11	ft
Top Width	8.48	ft
Normal Depth	0.21	ft
Critical Depth	0.17	ft
Critical Slope	0.030	ft/ft
Velocity	1.11	ft/s
Velocity Head	0.02	ft
Specific Energy	0.23	ft
Froude Number	0.598	
Flow Type	Subcritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for CS G ACKERMAN 60' RW ULT 100 YR

GVF Input Data	
Length	0.00 ft
Number Of Steps	0

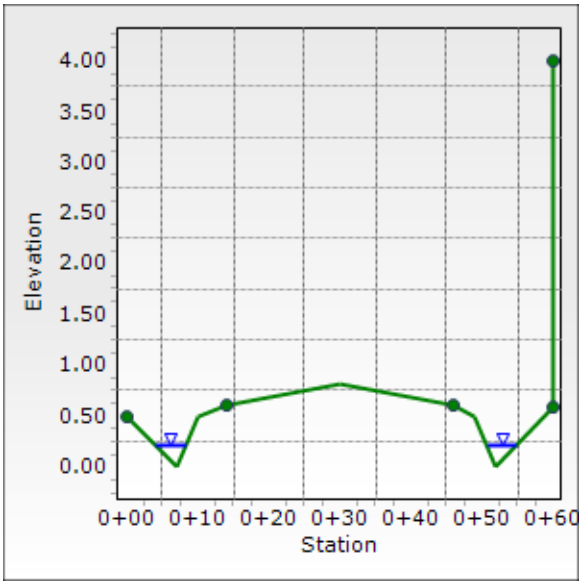
GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.21 ft
Critical Depth	0.17 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.030 ft/ft

Messages	
Messages	Flow is divided.

Cross Section for CS G ACKERMAN 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.21 ft
Discharge	1.00 cfs



Worksheet for CS H TIOGA 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	68.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.08 to 0.63 ft
Flow Area	4.1 ft²
Wetted Perimeter	30.90 ft
Hydraulic Radius	0.13 ft
Top Width	30.83 ft
Normal Depth	0.26 ft
Critical Depth	0.60 ft
Critical Slope	0.018 ft/ft
Velocity	16.79 ft/s
Velocity Head	4.38 ft
Specific Energy	4.64 ft
Froude Number	8.164
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

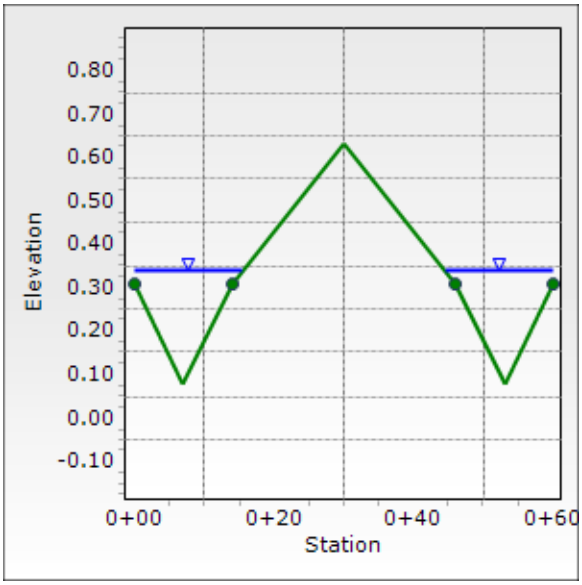
Worksheet for CS H TIOGA 60' RW ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.26 ft
Critical Depth	0.60 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.018 ft/ft

Cross Section for CS H TIOGA 60' RW ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.26 ft
Discharge	68.00 cfs



Worksheet for CS H TIOGA 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Discharge	68.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.08 to 0.63 ft
Flow Area	4.1 ft²
Wetted Perimeter	30.90 ft
Hydraulic Radius	0.13 ft
Top Width	30.83 ft
Normal Depth	0.26 ft
Critical Depth	0.60 ft
Critical Slope	0.018 ft/ft
Velocity	16.79 ft/s
Velocity Head	4.38 ft
Specific Energy	4.64 ft
Froude Number	8.164
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

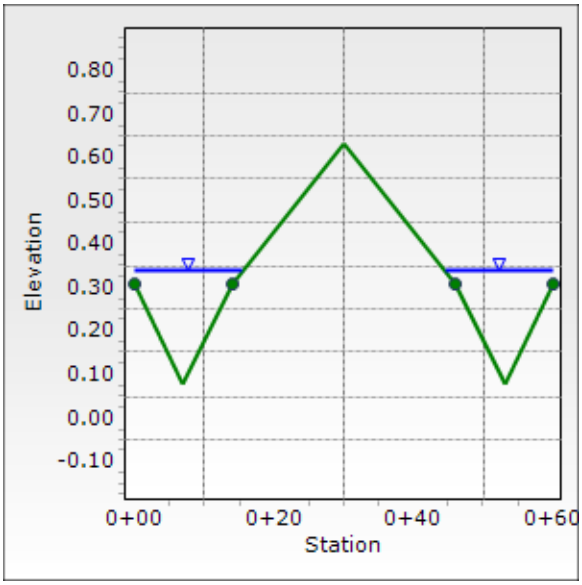
Worksheet for CS H TIOGA 60' RW ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.26 ft
Critical Depth	0.60 ft
Channel Slope	1.610 ft/ft
Critical Slope	0.018 ft/ft

Cross Section for CS H TIOGA 60' RW ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.610 ft/ft
Normal Depth	0.26 ft
Discharge	68.00 cfs



Worksheet for CS I 3' VALLEY GUTTER ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.010	ft/ft
Discharge	2.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	102.72
0+06.50	101.65
0+08.00	101.61
0+09.50	101.65
0+10.00	101.72
0+10.00	105.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 102.72)	(0+06.50, 101.65)	0.025
(0+06.50, 101.65)	(0+09.50, 101.65)	0.013
(0+09.50, 101.65)	(0+10.00, 101.72)	0.025
(0+10.00, 101.72)	(0+10.00, 105.00)	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	0.23	ft
Elevation Range	101.61 to 105.00	ft
Flow Area	0.8	ft^2
Wetted Perimeter	4.77	ft
Hydraulic Radius	0.17	ft
Top Width	4.63	ft
Normal Depth	0.23	ft
Critical Depth	0.23	ft
Critical Slope	0.009	ft/ft
Velocity	2.50	ft/s
Velocity Head	0.10	ft
Specific Energy	0.32	ft
Froude Number	1.060	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

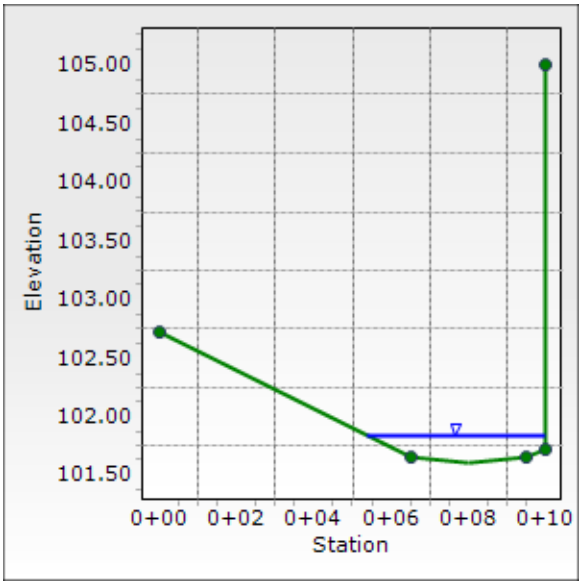
Worksheet for CS I 3' VALLEY GUTTER ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.23 ft
Critical Depth	0.23 ft
Channel Slope	0.010 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for CS I 3' VALLEY GUTTER ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.010 ft/ft
Normal Depth	0.23 ft
Discharge	2.00 cfs



FLOW SPLIT CALCULATIONS

EXISTING CONDITION

Worksheet for FS1-E BUFFALO & RACEL EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Discharge	181.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	7.5 ft²
Wetted Perimeter	39.69 ft
Hydraulic Radius	0.19 ft
Top Width	39.05 ft
Normal Depth	0.48 ft
Critical Depth	1.03 ft
Critical Slope	0.009 ft/ft
Velocity	24.11 ft/s
Velocity Head	9.04 ft
Specific Energy	9.51 ft
Froude Number	9.697
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

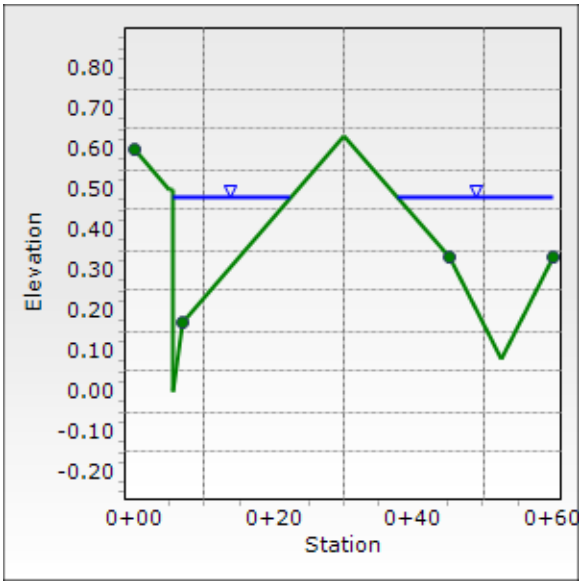
Worksheet for FS1-E BUFFALO & RACEL EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.03 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for FS1-E BUFFALO & RACEL EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.48 ft
Discharge	181.00 cfs



Worksheet for FS1-E BUFFALO & RACEL EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	619.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.67	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	17.5	ft^2
Wetted Perimeter	60.93	ft
Hydraulic Radius	0.29	ft
Top Width	60.00	ft
Normal Depth	0.67	ft
Critical Depth	1.87	ft
Critical Slope	0.006	ft/ft
Velocity	35.30	ft/s
Velocity Head	19.37	ft
Specific Energy	20.04	ft
Froude Number	11.513	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

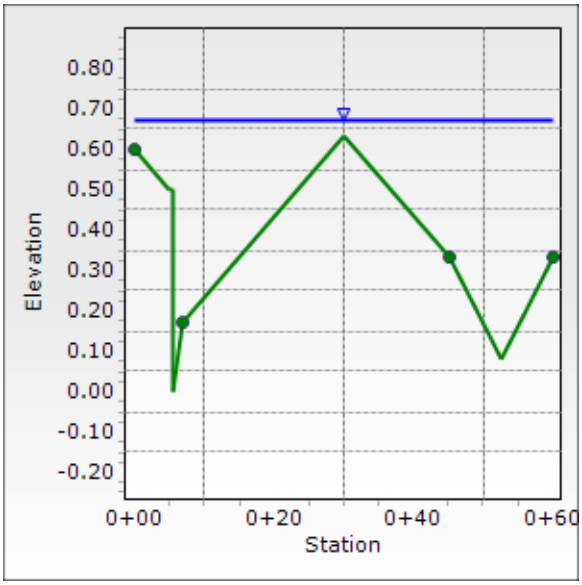
Worksheet for FS1-E BUFFALO & RACEL EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.67 ft
Critical Depth	1.87 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for FS1-E BUFFALO & RACEL EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.67 ft
Discharge	619.00 cfs



Worksheet for FS1-S BUFFALO & RACEL EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.540	ft/ft
Discharge	98.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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	0.48	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	7.0	ft^2
Wetted Perimeter	39.49	ft
Hydraulic Radius	0.18	ft
Top Width	38.98	ft
Normal Depth	0.48	ft
Critical Depth	0.83	ft
Critical Slope	0.013	ft/ft
Velocity	13.95	ft/s
Velocity Head	3.02	ft
Specific Energy	3.50	ft
Froude Number	5.794	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

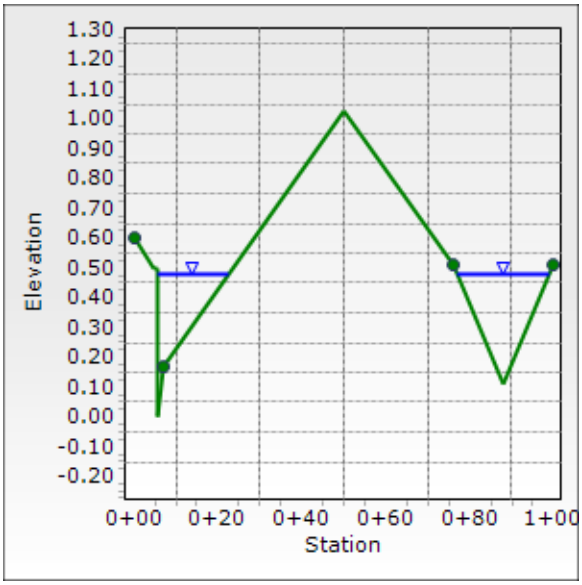
Worksheet for FS1-S BUFFALO & RACEL EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	0.83 ft
Channel Slope	0.540 ft/ft
Critical Slope	0.013 ft/ft

Cross Section for FS1-S BUFFALO & RACEL EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.540 ft/ft
Normal Depth	0.48 ft
Discharge	98.00 cfs



Worksheet for FS1-S BUFFALO & RACEL EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.540	ft/ft
Discharge	345.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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	0.67	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	17.0	ft^2
Wetted Perimeter	64.59	ft
Hydraulic Radius	0.26	ft
Top Width	63.83	ft
Normal Depth	0.67	ft
Critical Depth	1.28	ft
Critical Slope	0.008	ft/ft
Velocity	20.31	ft/s
Velocity Head	6.41	ft
Specific Energy	7.08	ft
Froude Number	6.943	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

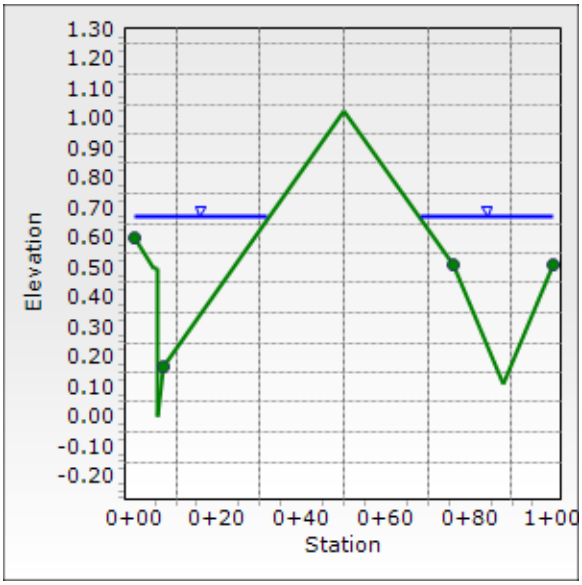
Worksheet for FS1-S BUFFALO & RACEL EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.67 ft
Critical Depth	1.28 ft
Channel Slope	0.540 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for FS1-S BUFFALO & RACEL EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.540 ft/ft
Normal Depth	0.67 ft
Discharge	345.00 cfs



Worksheet for FS2-E BUFFALO & ACKERMAN EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.630	ft/ft
Discharge	0.10	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,419.46
0+07.50	2,419.49
0+12.87	2,419.66
0+19.91	2,418.88
0+22.00	2,418.76
0+24.88	2,418.53
0+70.00	2,418.87
0+92.50	2,418.37
1+15.00	2,418.77

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,419.46)	(0+24.88, 2,418.53)	0.030
(0+24.88, 2,418.53)	(0+92.50, 2,418.37)	0.016
(0+92.50, 2,418.37)	(1+15.00, 2,418.77)	0.030

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	0.03	ft
Elevation Range	2,418.37 to 2,419.66	ft
Flow Area	0.0	ft²
Wetted Perimeter	2.73	ft
Hydraulic Radius	0.01	ft
Top Width	2.73	ft
Normal Depth	0.03	ft
Critical Depth	0.05	ft
Critical Slope	0.031	ft/ft
Velocity	2.72	ft/s
Velocity Head	0.11	ft
Specific Energy	0.14	ft
Froude Number	4.123	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

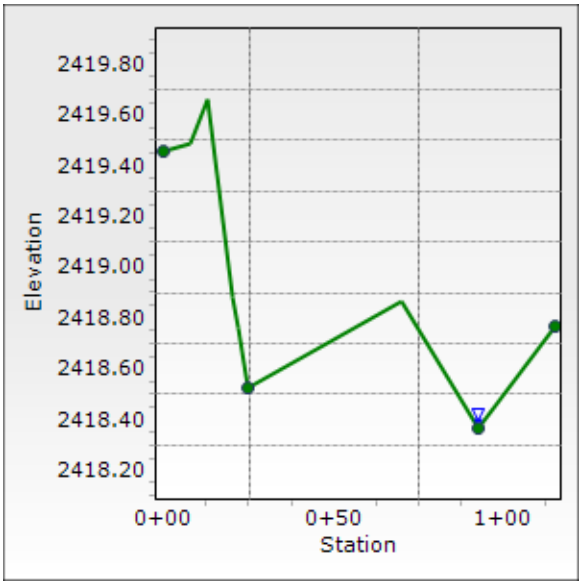
Worksheet for FS2-E BUFFALO & ACKERMAN EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.03 ft
Critical Depth	0.05 ft
Channel Slope	0.630 ft/ft
Critical Slope	0.031 ft/ft

Cross Section for FS2-E BUFFALO & ACKERMAN EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.630 ft/ft
Normal Depth	0.03 ft
Discharge	0.10 cfs



Worksheet for FS2-E BUFFALO & ACKERMAN EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.630	ft/ft
Discharge	20.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,419.46
0+12.87	2,419.66
0+19.91	2,418.88
0+24.88	2,418.53
0+70.00	2,418.87
0+92.50	2,418.37
1+15.00	2,418.77

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,419.46)	(0+24.88, 2,418.53)	0.030
(0+24.88, 2,418.53)	(0+92.50, 2,418.37)	0.016
(0+92.50, 2,418.37)	(1+15.00, 2,418.77)	0.030

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	0.20	ft
Elevation Range	2,418.37 to 2,419.66	ft
Flow Area	2.1	ft^2
Wetted Perimeter	25.77	ft
Hydraulic Radius	0.08	ft
Top Width	25.76	ft
Normal Depth	0.20	ft
Critical Depth	0.36	ft
Critical Slope	0.015	ft/ft
Velocity	9.50	ft/s
Velocity Head	1.40	ft
Specific Energy	1.60	ft
Froude Number	5.862	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

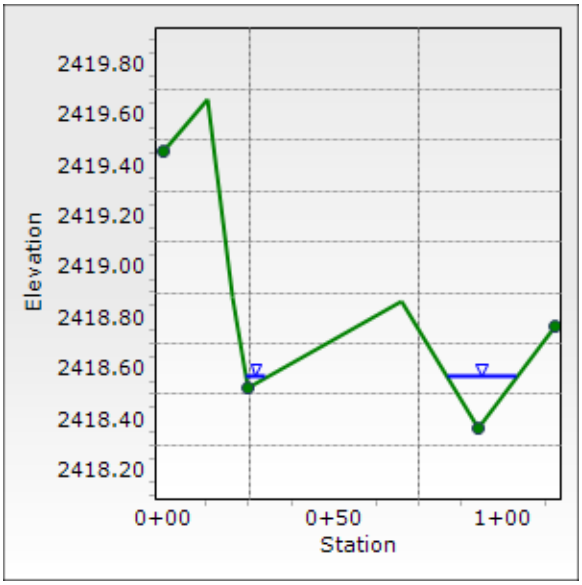
Worksheet for FS2-E BUFFALO & ACKERMAN EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.20 ft
Critical Depth	0.36 ft
Channel Slope	0.630 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for FS2-E BUFFALO & ACKERMAN EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.630 ft/ft
Normal Depth	0.20 ft
Discharge	20.00 cfs



Worksheet for FS2-S BUFFALO & ACKERMAN EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.320	ft/ft
Discharge	99.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,418.36
0+16.33	2,418.71
0+25.35	2,418.70
0+42.87	2,418.27
0+52.99	2,418.31
0+72.90	2,418.16
0+83.53	2,418.26
1+07.02	2,418.02

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,418.36)	(1+07.02, 2,418.02)	0.030

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

Results		
Normal Depth	0.36	ft
Elevation Range	2,418.02 to 2,418.71	ft
Flow Area	11.7	ft^2
Wetted Perimeter	70.18	ft
Hydraulic Radius	0.17	ft
Top Width	69.79	ft
Normal Depth	0.36	ft
Critical Depth	0.59	ft
Critical Slope	0.019	ft/ft
Velocity	8.48	ft/s
Velocity Head	1.12	ft
Specific Energy	1.48	ft
Froude Number	3.654	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.00	ft

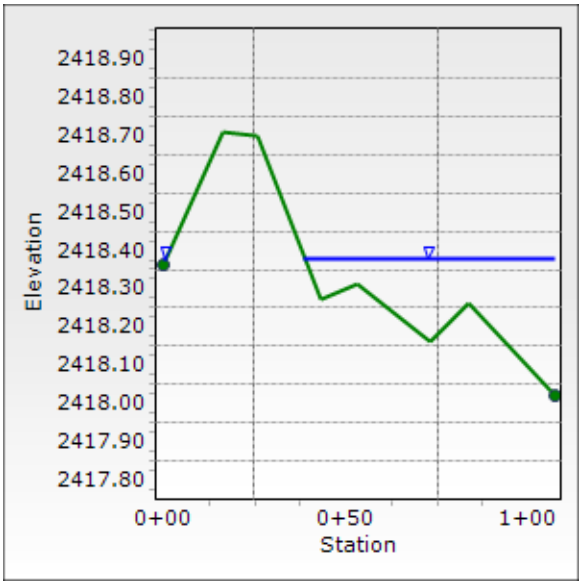
Worksheet for FS2-S BUFFALO & ACKERMAN EX 10 YR

GVF Output Data	
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.36 ft
Critical Depth	0.59 ft
Channel Slope	0.320 ft/ft
Critical Slope	0.019 ft/ft

Cross Section for FS2-S BUFFALO & ACKERMAN EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.320 ft/ft
Normal Depth	0.36 ft
Discharge	99.00 cfs



Worksheet for FS2-S BUFFALO & ACKERMAN EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.320	ft/ft
Discharge	328.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	2,418.36
0+16.33	2,418.71
0+25.35	2,418.70
0+42.87	2,418.27
0+52.99	2,418.31
0+72.90	2,418.16
0+83.53	2,418.26
1+07.02	2,418.02

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 2,418.36)	(1+07.02, 2,418.02)	0.030

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	0.55	ft
Elevation Range	2,418.02 to 2,418.71	ft
Flow Area	26.1	ft²
Wetted Perimeter	86.72	ft
Hydraulic Radius	0.30	ft
Top Width	85.96	ft
Normal Depth	0.55	ft
Critical Depth	0.99	ft
Critical Slope	0.015	ft/ft
Velocity	12.58	ft/s
Velocity Head	2.46	ft
Specific Energy	3.01	ft
Froude Number	4.025	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data		
Upstream Depth	0.00	ft

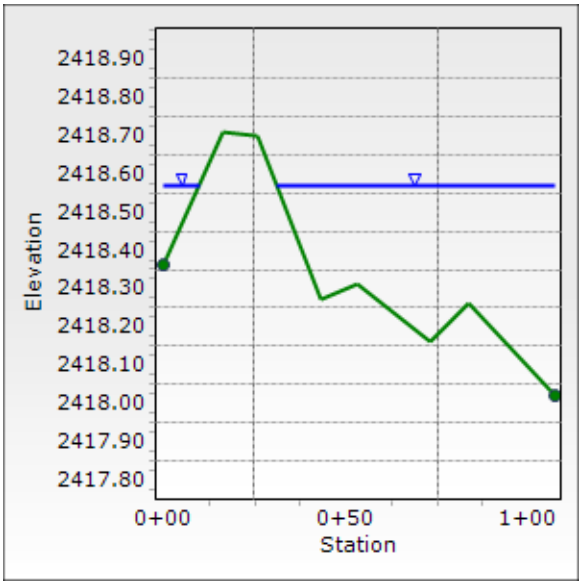
Worksheet for FS2-S BUFFALO & ACKERMAN EX 100 YR

GVF Output Data	
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.55 ft
Critical Depth	0.99 ft
Channel Slope	0.320 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for FS2-S BUFFALO & ACKERMAN EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.320 ft/ft
Normal Depth	0.55 ft
Discharge	328.00 cfs



Worksheet for FS3-E RACEL & TIOGA EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	116.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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

Results		
Normal Depth	0.42	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	5.6	ft^2
Wetted Perimeter	34.50	ft
Hydraulic Radius	0.16	ft
Top Width	33.96	ft
Normal Depth	0.42	ft
Critical Depth	0.86	ft
Critical Slope	0.010	ft/ft
Velocity	20.54	ft/s
Velocity Head	6.56	ft
Specific Energy	6.98	ft
Froude Number	8.881	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

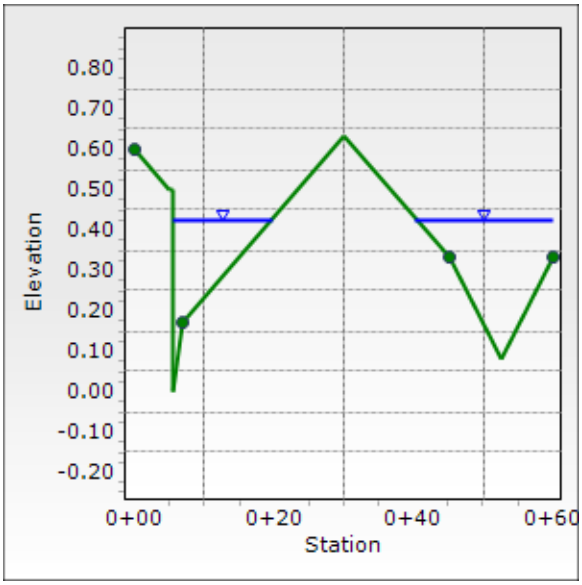
Worksheet for FS3-E RACEL & TIOGA EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.42 ft
Critical Depth	0.86 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for FS3-E RACEL & TIOGA EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.42 ft
Discharge	116.00 cfs



Worksheet for FS3-E RACEL & TIOGA EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	408.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.60	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	13.7	ft^2
Wetted Perimeter	58.29	ft
Hydraulic Radius	0.24	ft
Top Width	57.49	ft
Normal Depth	0.60	ft
Critical Depth	1.51	ft
Critical Slope	0.006	ft/ft
Velocity	29.74	ft/s
Velocity Head	13.74	ft
Specific Energy	14.35	ft
Froude Number	10.731	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

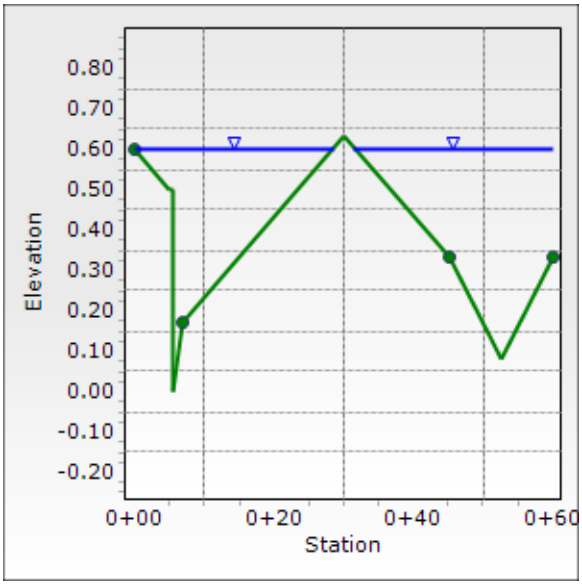
Worksheet for FS3-E RACEL & TIOGA EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.60 ft
Critical Depth	1.51 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for FS3-E RACEL & TIOGA EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.60 ft
Discharge	408.00 cfs



Worksheet for FS3-S RACEL & TIOGA EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	66.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.35 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	7.2 ft²
Wetted Perimeter	39.90 ft
Hydraulic Radius	0.18 ft
Top Width	39.65 ft
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Critical Slope	0.015 ft/ft
Velocity	9.22 ft/s
Velocity Head	1.32 ft
Specific Energy	1.67 ft
Froude Number	3.823
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

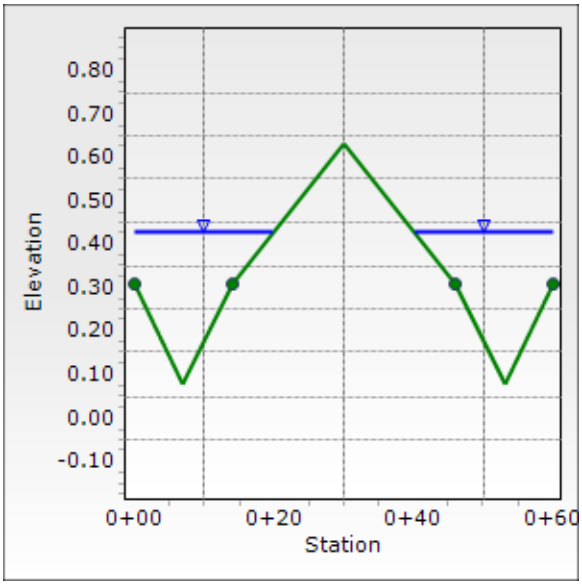
Worksheet for FS3-S RACEL & TIOGA EX 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for FS3-S RACEL & TIOGA EX 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.35 ft
Discharge	66.00 cfs



Worksheet for FS3-S RACEL & TIOGA EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.270	ft/ft
Discharge	215.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.53	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	15.8	ft^2
Wetted Perimeter	58.13	ft
Hydraulic Radius	0.27	ft
Top Width	57.52	ft
Normal Depth	0.53	ft
Critical Depth	1.00	ft
Critical Slope	0.010	ft/ft
Velocity	13.57	ft/s
Velocity Head	2.86	ft
Specific Energy	3.39	ft
Froude Number	4.559	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

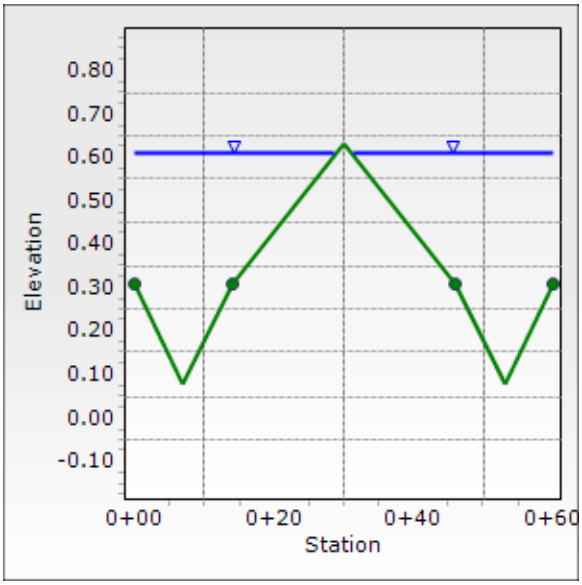
Worksheet for FS3-S RACEL & TIOGA EX 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	1.00 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for FS3-S RACEL & TIOGA EX 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.53 ft
Discharge	215.00 cfs



DEVELOPED CONDITION

Worksheet for FS1-E BUFFALO & RACEL DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	181.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.48	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	7.5	ft^2
Wetted Perimeter	39.69	ft
Hydraulic Radius	0.19	ft
Top Width	39.05	ft
Normal Depth	0.48	ft
Critical Depth	1.03	ft
Critical Slope	0.009	ft/ft
Velocity	24.11	ft/s
Velocity Head	9.04	ft
Specific Energy	9.51	ft
Froude Number	9.697	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

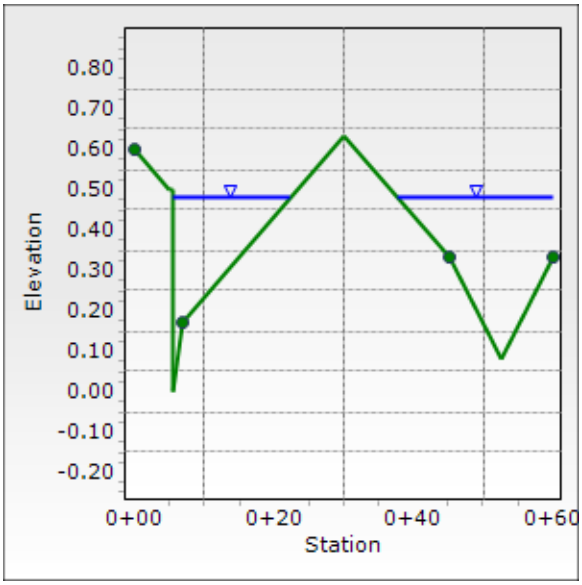
Worksheet for FS1-E BUFFALO & RACEL DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	1.03 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.009 ft/ft

Cross Section for FS1-E BUFFALO & RACEL DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.48 ft
Discharge	181.00 cfs



Worksheet for FS1-E BUFFALO & RACEL DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Discharge	619.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.67 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	17.5 ft²
Wetted Perimeter	60.93 ft
Hydraulic Radius	0.29 ft
Top Width	60.00 ft
Normal Depth	0.67 ft
Critical Depth	1.87 ft
Critical Slope	0.006 ft/ft
Velocity	35.30 ft/s
Velocity Head	19.37 ft
Specific Energy	20.04 ft
Froude Number	11.513
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

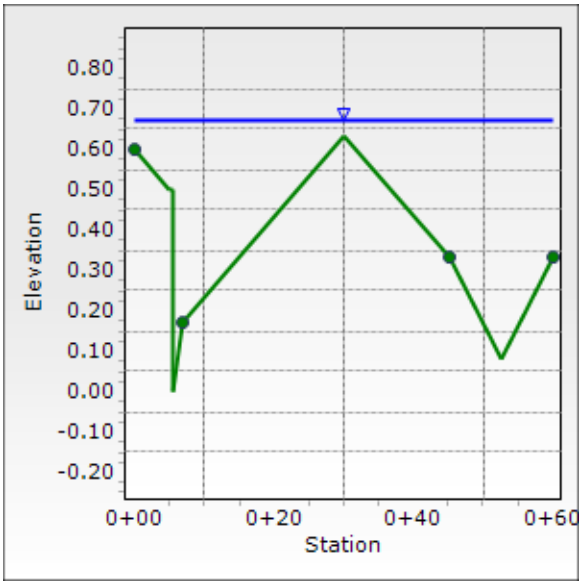
Worksheet for FS1-E BUFFALO & RACEL DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.67 ft
Critical Depth	1.87 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for FS1-E BUFFALO & RACEL DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.67 ft
Discharge	619.00 cfs



Worksheet for FS1-S BUFFALO & RACEL DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.540	ft/ft
Discharge	98.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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	0.48	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	7.0	ft^2
Wetted Perimeter	39.49	ft
Hydraulic Radius	0.18	ft
Top Width	38.98	ft
Normal Depth	0.48	ft
Critical Depth	0.83	ft
Critical Slope	0.013	ft/ft
Velocity	13.95	ft/s
Velocity Head	3.02	ft
Specific Energy	3.50	ft
Froude Number	5.794	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

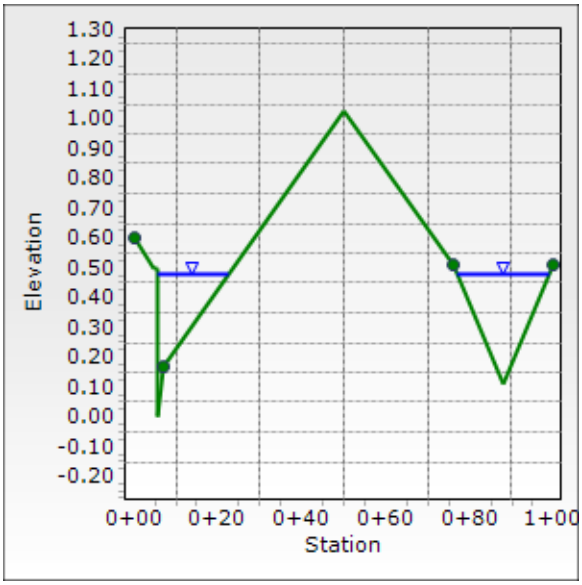
Worksheet for FS1-S BUFFALO & RACEL DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.48 ft
Critical Depth	0.83 ft
Channel Slope	0.540 ft/ft
Critical Slope	0.013 ft/ft

Cross Section for FS1-S BUFFALO & RACEL DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.540 ft/ft
Normal Depth	0.48 ft
Discharge	98.00 cfs



Worksheet for FS1-S BUFFALO & RACEL DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.540	ft/ft
Discharge	345.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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	0.67	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	17.0	ft^2
Wetted Perimeter	64.59	ft
Hydraulic Radius	0.26	ft
Top Width	63.83	ft
Normal Depth	0.67	ft
Critical Depth	1.28	ft
Critical Slope	0.008	ft/ft
Velocity	20.31	ft/s
Velocity Head	6.41	ft
Specific Energy	7.08	ft
Froude Number	6.943	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

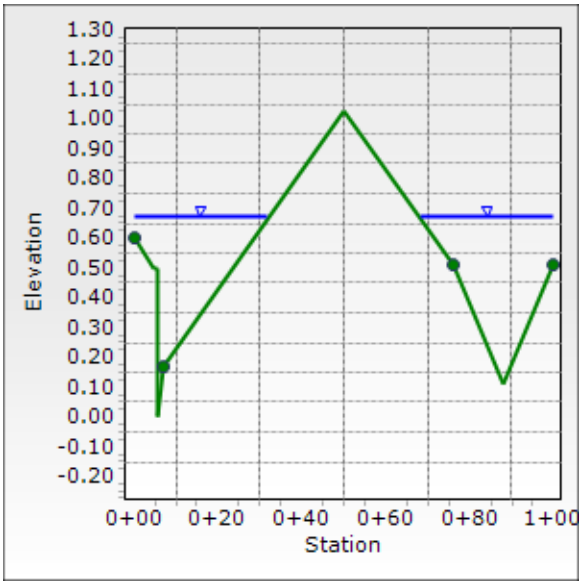
Worksheet for FS1-S BUFFALO & RACEL DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.67 ft
Critical Depth	1.28 ft
Channel Slope	0.540 ft/ft
Critical Slope	0.008 ft/ft

Cross Section for FS1-S BUFFALO & RACEL DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.540 ft/ft
Normal Depth	0.67 ft
Discharge	345.00 cfs



Worksheet for FS2-E BUFFALO & ACKERMAN DEV10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	2.000	ft/ft
Discharge	50.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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

Results		
Normal Depth	0.34	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	2.6	ft^2
Wetted Perimeter	23.65	ft
Hydraulic Radius	0.11	ft
Top Width	23.30	ft
Normal Depth	0.34	ft
Critical Depth	0.67	ft
Critical Slope	0.014	ft/ft
Velocity	19.34	ft/s
Velocity Head	5.81	ft
Specific Energy	6.15	ft
Froude Number	10.238	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

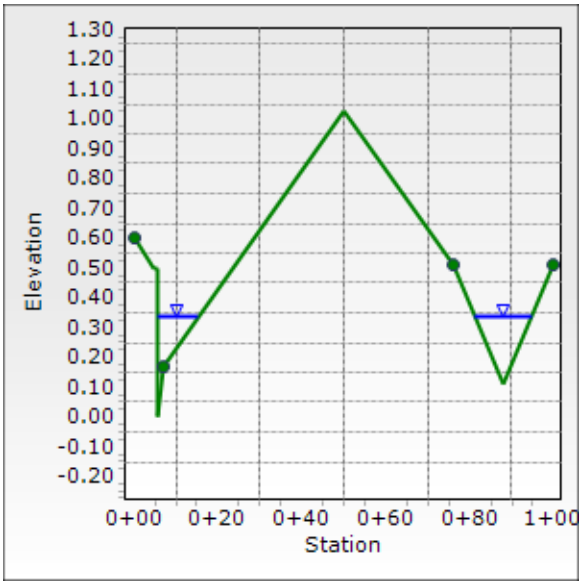
Worksheet for FS2-E BUFFALO & ACKERMAN DEV10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.34 ft
Critical Depth	0.67 ft
Channel Slope	2.000 ft/ft
Critical Slope	0.014 ft/ft

Cross Section for FS2-E BUFFALO & ACKERMAN DEV10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.000 ft/ft
Normal Depth	0.34 ft
Discharge	50.00 cfs



Worksheet for FS2-E BUFFALO & ACKERMAN DEV100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	2.000	ft/ft
Discharge	213.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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

Results		
Normal Depth	0.49	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	7.7	ft^2
Wetted Perimeter	41.32	ft
Hydraulic Radius	0.19	ft
Top Width	40.80	ft
Normal Depth	0.49	ft
Critical Depth	1.08	ft
Critical Slope	0.011	ft/ft
Velocity	27.72	ft/s
Velocity Head	11.94	ft
Specific Energy	12.43	ft
Froude Number	11.260	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

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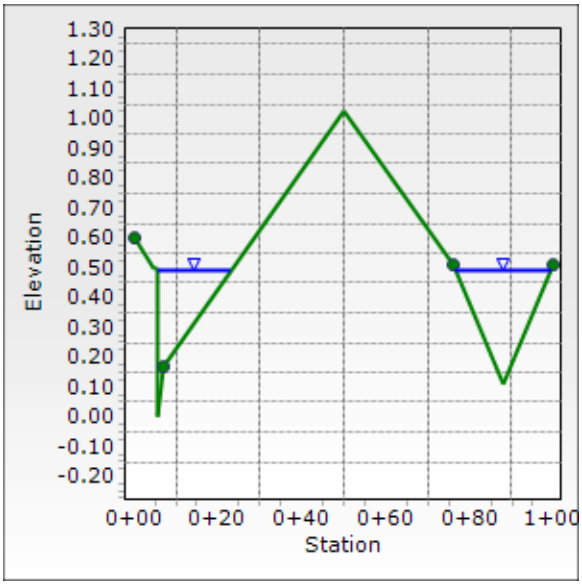
Worksheet for FS2-E BUFFALO & ACKERMAN DEV100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.49 ft
Critical Depth	1.08 ft
Channel Slope	2.000 ft/ft
Critical Slope	0.011 ft/ft

Cross Section for FS2-E BUFFALO & ACKERMAN DEV100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.000 ft/ft
Normal Depth	0.49 ft
Discharge	213.00 cfs



Worksheet for FS2-S BUFFALO & ACKERMAN DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.000 ft/ft
Discharge	49.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results	
Normal Depth	0.34 ft
Elevation Range	0.00 to 4.00 ft
Flow Area	2.3 ft²
Wetted Perimeter	13.59 ft
Hydraulic Radius	0.17 ft
Top Width	13.51 ft
Normal Depth	0.34 ft
Critical Depth	0.81 ft
Critical Slope	0.020 ft/ft
Velocity	21.37 ft/s
Velocity Head	7.10 ft
Specific Energy	7.43 ft
Froude Number	9.143
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft

Worksheet for FS2-S BUFFALO & ACKERMAN DEV 10 YR

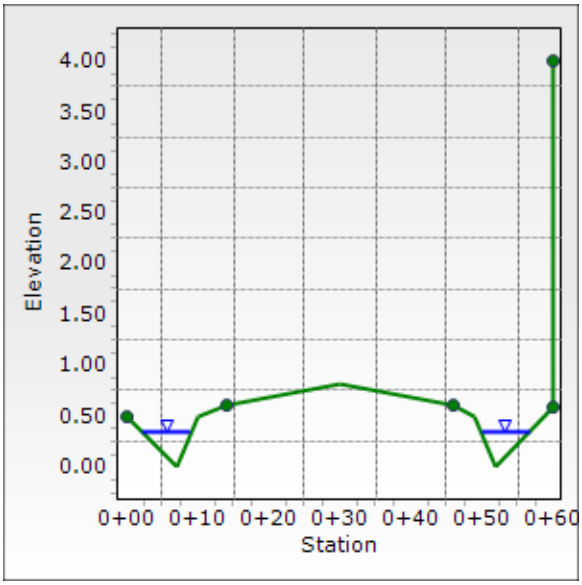
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Number Of Steps	0

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.34 ft
Critical Depth	0.81 ft
Channel Slope	2.000 ft/ft
Critical Slope	0.020 ft/ft

Cross Section for FS2-S BUFFALO & ACKERMAN DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.000 ft/ft
Normal Depth	0.34 ft
Discharge	49.00 cfs



Worksheet for FS2-S BUFFALO & ACKERMAN DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	2.000	ft/ft
Discharge	135.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+07.00	0.00
0+10.00	0.50
0+14.00	0.60
0+30.00	0.82
0+46.00	0.60
0+49.00	0.50
0+52.00	0.00
0+60.00	0.58
0+60.00	4.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+14.00, 0.60)	0.030
(0+14.00, 0.60)	(0+46.00, 0.60)	0.016
(0+46.00, 0.60)	(0+60.00, 0.58)	0.030
(0+60.00, 0.58)	(0+60.00, 4.00)	0.025

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

Results		
Normal Depth	0.50	ft
Elevation Range	0.00 to 4.00	ft
Flow Area	4.9	ft^2
Wetted Perimeter	19.87	ft
Hydraulic Radius	0.25	ft
Top Width	19.75	ft
Normal Depth	0.50	ft
Critical Depth	1.08	ft
Critical Slope	0.017	ft/ft
Velocity	27.55	ft/s
Velocity Head	11.80	ft
Specific Energy	12.29	ft
Froude Number	9.751	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft

Worksheet for FS2-S BUFFALO & ACKERMAN DEV 100 YR

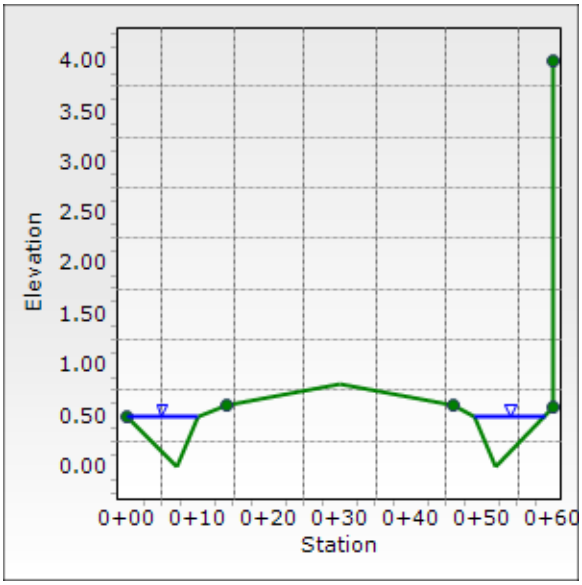
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Number Of Steps	0

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	0.50 ft
Critical Depth	1.08 ft
Channel Slope	2.000 ft/ft
Critical Slope	0.017 ft/ft

Cross Section for FS2-S BUFFALO & ACKERMAN DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	2.000 ft/ft
Normal Depth	0.50 ft
Discharge	135.00 cfs



Worksheet for FS3-E RACEL & TIOGA DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	117.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.43	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	5.7	ft^2
Wetted Perimeter	34.60	ft
Hydraulic Radius	0.16	ft
Top Width	34.05	ft
Normal Depth	0.43	ft
Critical Depth	0.87	ft
Critical Slope	0.010	ft/ft
Velocity	20.60	ft/s
Velocity Head	6.60	ft
Specific Energy	7.02	ft
Froude Number	8.893	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

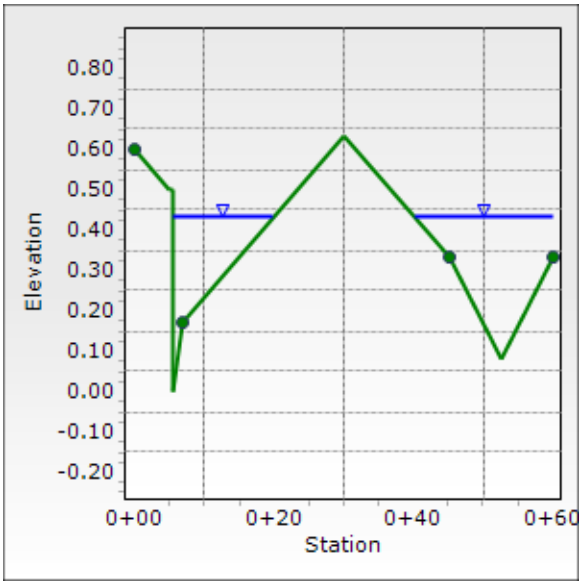
Worksheet for FS3-E RACEL & TIOGA DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.43 ft
Critical Depth	0.87 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for FS3-E RACEL & TIOGA DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.43 ft
Discharge	117.00 cfs



Worksheet for FS3-E RACEL & TIOGA DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	409.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.61	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	13.7	ft²
Wetted Perimeter	58.33	ft
Hydraulic Radius	0.24	ft
Top Width	57.53	ft
Normal Depth	0.61	ft
Critical Depth	1.51	ft
Critical Slope	0.006	ft/ft
Velocity	29.76	ft/s
Velocity Head	13.76	ft
Specific Energy	14.37	ft
Froude Number	10.734	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

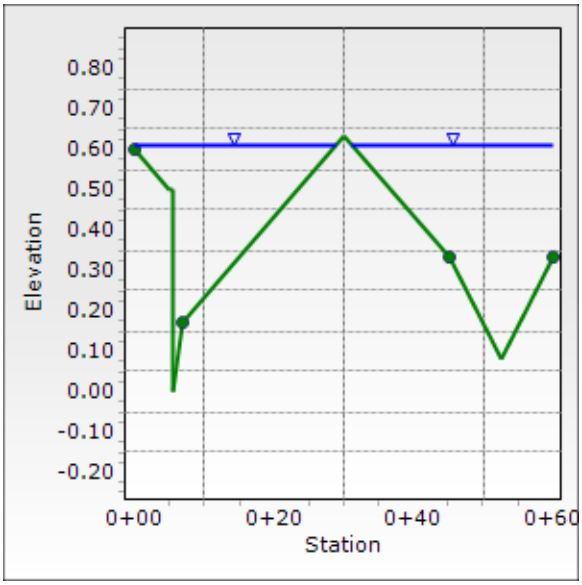
Worksheet for FS3-E RACEL & TIOGA DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.61 ft
Critical Depth	1.51 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.006 ft/ft

Cross Section for FS3-E RACEL & TIOGA DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.61 ft
Discharge	409.00 cfs



Worksheet for FS3-S RACEL & TIOGA DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.270	ft/ft
Discharge	66.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.35	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	7.2	ft^2
Wetted Perimeter	39.90	ft
Hydraulic Radius	0.18	ft
Top Width	39.65	ft
Normal Depth	0.35	ft
Critical Depth	0.60	ft
Critical Slope	0.015	ft/ft
Velocity	9.22	ft/s
Velocity Head	1.32	ft
Specific Energy	1.67	ft
Froude Number	3.823	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

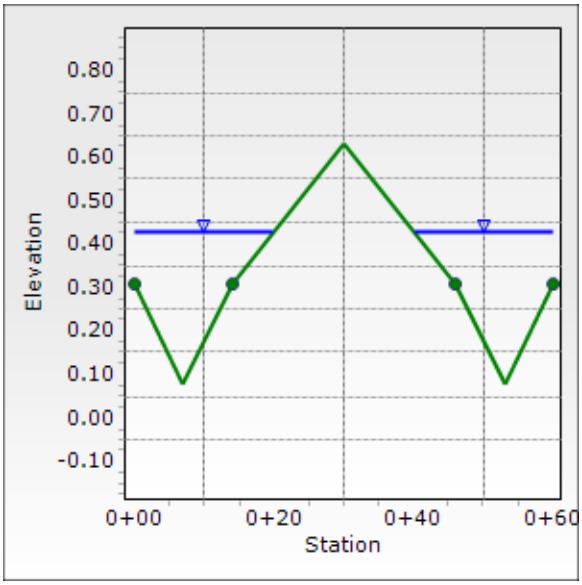
Worksheet for FS3-S RACEL & TIOGA DEV 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.35 ft
Critical Depth	0.60 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for FS3-S RACEL & TIOGA DEV 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.35 ft
Discharge	66.00 cfs



Worksheet for FS3-S RACEL & TIOGA DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.270	ft/ft
Discharge	215.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.53	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	15.8	ft^2
Wetted Perimeter	58.13	ft
Hydraulic Radius	0.27	ft
Top Width	57.52	ft
Normal Depth	0.53	ft
Critical Depth	1.00	ft
Critical Slope	0.010	ft/ft
Velocity	13.57	ft/s
Velocity Head	2.86	ft
Specific Energy	3.39	ft
Froude Number	4.559	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

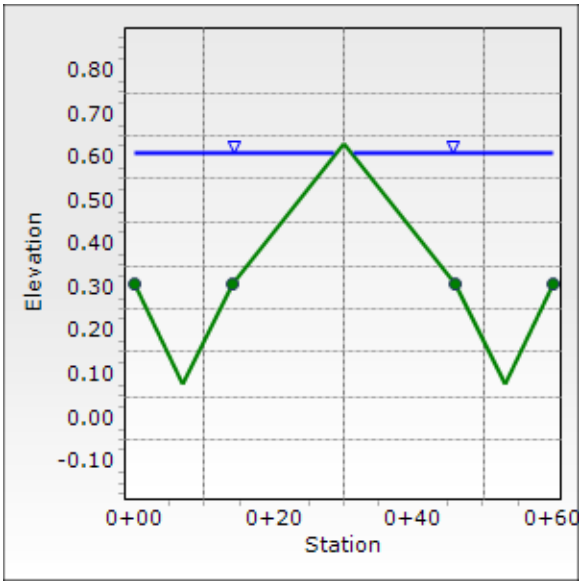
Worksheet for FS3-S RACEL & TIOGA DEV 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.53 ft
Critical Depth	1.00 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.010 ft/ft

Cross Section for FS3-S RACEL & TIOGA DEV 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.53 ft
Discharge	215.00 cfs



ULTIMATE CONDITION

Worksheet for FS1-E BUFFALO & RACEL ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Discharge	15.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.25 ft
Elevation Range	0.00 to 0.63 ft
Flow Area	1.3 ft²
Wetted Perimeter	15.92 ft
Hydraulic Radius	0.08 ft
Top Width	15.66 ft
Normal Depth	0.25 ft
Critical Depth	0.44 ft
Critical Slope	0.017 ft/ft
Velocity	11.83 ft/s
Velocity Head	2.17 ft
Specific Energy	2.42 ft
Froude Number	7.327
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

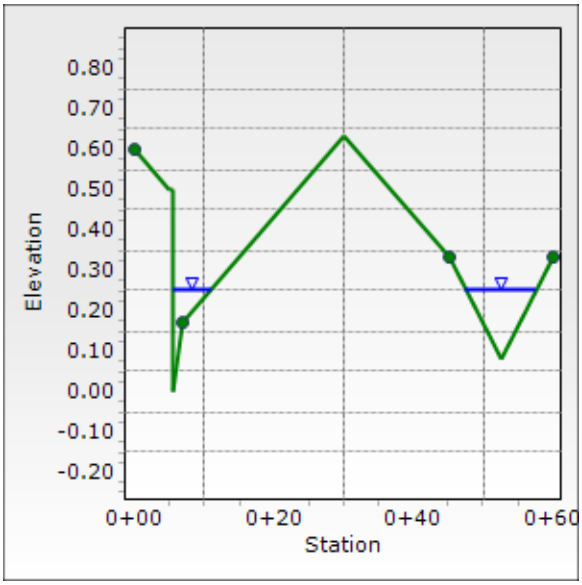
Worksheet for FS1-E BUFFALO & RACEL ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.25 ft
Critical Depth	0.44 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.017 ft/ft

Cross Section for FS1-E BUFFALO & RACEL ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.25 ft
Discharge	15.00 cfs



Worksheet for FS1-E BUFFALO & RACEL ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.210	ft/ft
Discharge	40.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.32	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	2.7	ft^2
Wetted Perimeter	23.85	ft
Hydraulic Radius	0.11	ft
Top Width	23.51	ft
Normal Depth	0.32	ft
Critical Depth	0.61	ft
Critical Slope	0.015	ft/ft
Velocity	15.00	ft/s
Velocity Head	3.50	ft
Specific Energy	3.82	ft
Froude Number	7.850	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

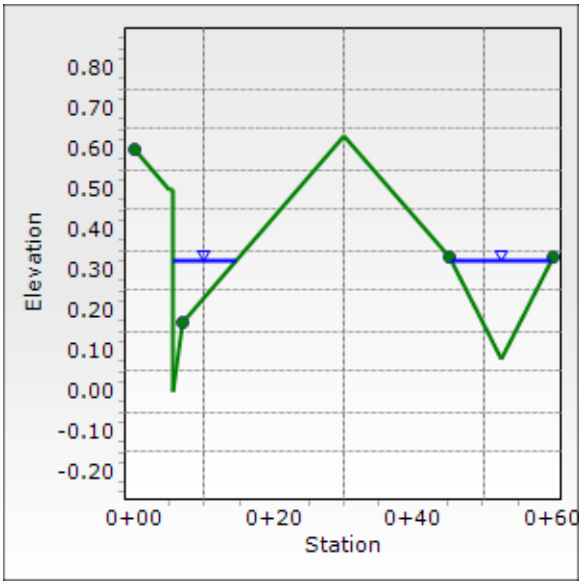
Worksheet for FS1-E BUFFALO & RACEL ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.32 ft
Critical Depth	0.61 ft
Channel Slope	1.210 ft/ft
Critical Slope	0.015 ft/ft

Cross Section for FS1-E BUFFALO & RACEL ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.210 ft/ft
Normal Depth	0.32 ft
Discharge	40.00 cfs



Worksheet for FS1-S BUFFALO & RACEL ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.540	ft/ft
Discharge	7.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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	0.25	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	1.0	ft^2
Wetted Perimeter	13.83	ft
Hydraulic Radius	0.07	ft
Top Width	13.57	ft
Normal Depth	0.25	ft
Critical Depth	0.37	ft
Critical Slope	0.019	ft/ft
Velocity	7.34	ft/s
Velocity Head	0.84	ft
Specific Energy	1.08	ft
Froude Number	4.879	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

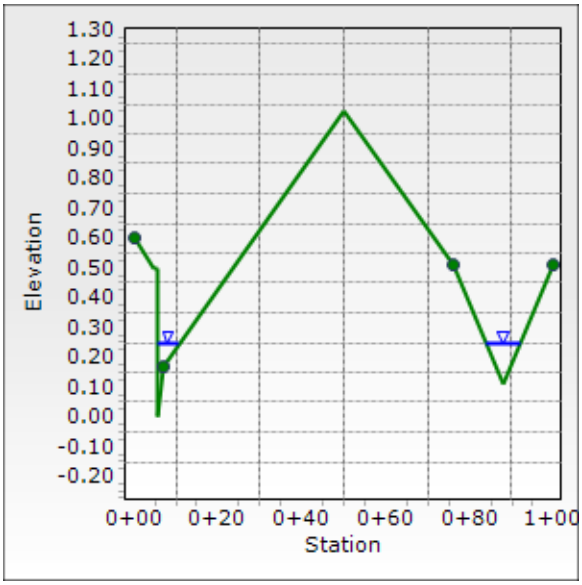
Worksheet for FS1-S BUFFALO & RACEL ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.25 ft
Critical Depth	0.37 ft
Channel Slope	0.540 ft/ft
Critical Slope	0.019 ft/ft

Cross Section for FS1-S BUFFALO & RACEL ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.540 ft/ft
Normal Depth	0.25 ft
Discharge	7.00 cfs



Worksheet for FS1-S BUFFALO & RACEL ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.540	ft/ft
Discharge	21.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+50.00	1.03
0+76.00	0.51
0+88.00	0.11
1+00.00	0.51

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+76.00, 0.51)	0.016
(0+76.00, 0.51)	(1+00.00, 0.51)	0.030

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	0.32	ft
Elevation Range	0.00 to 1.03	ft
Flow Area	2.2	ft²
Wetted Perimeter	21.76	ft
Hydraulic Radius	0.10	ft
Top Width	21.42	ft
Normal Depth	0.32	ft
Critical Depth	0.51	ft
Critical Slope	0.016	ft/ft
Velocity	9.53	ft/s
Velocity Head	1.41	ft
Specific Energy	1.73	ft
Froude Number	5.241	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

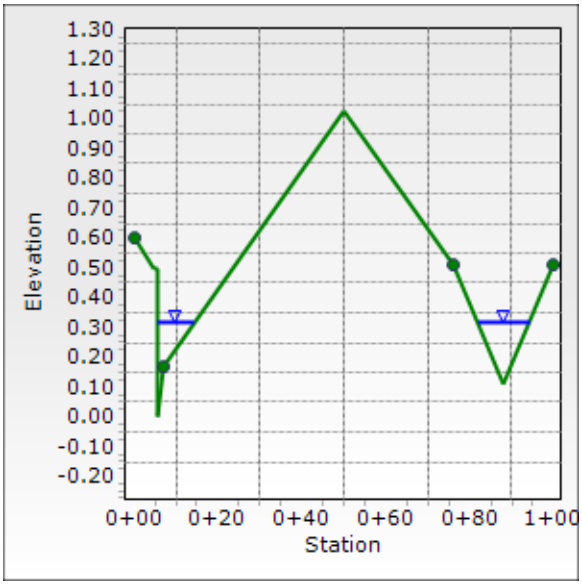
Worksheet for FS1-S BUFFALO & RACEL ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.32 ft
Critical Depth	0.51 ft
Channel Slope	0.540 ft/ft
Critical Slope	0.016 ft/ft

Cross Section for FS1-S BUFFALO & RACEL ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.540 ft/ft
Normal Depth	0.32 ft
Discharge	21.00 cfs



Worksheet for FS2-E BUFFALO & ACKERMAN ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.630 ft/ft
Discharge	2.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.08 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	0.4 ft²
Wetted Perimeter	10.18 ft
Hydraulic Radius	0.04 ft
Top Width	10.17 ft
Normal Depth	0.08 ft
Critical Depth	0.15 ft
Critical Slope	0.031 ft/ft
Velocity	4.71 ft/s
Velocity Head	0.34 ft
Specific Energy	0.43 ft
Froude Number	4.060
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

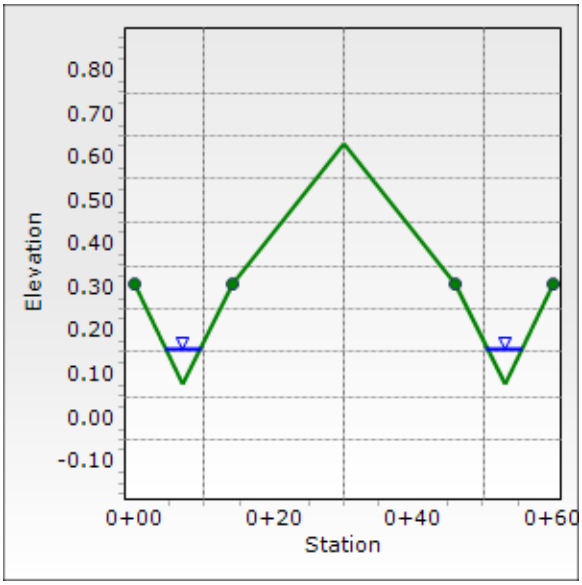
Worksheet for FS2-E BUFFALO & ACKERMAN ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.08 ft
Critical Depth	0.15 ft
Channel Slope	0.630 ft/ft
Critical Slope	0.031 ft/ft

Cross Section for FS2-E BUFFALO & ACKERMAN ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.630 ft/ft
Normal Depth	0.08 ft
Discharge	2.00 cfs



Worksheet for FS2-E BUFFALO & ACKERMAN ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.630	ft/ft
Discharge	14.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.17	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	1.8	ft^2
Wetted Perimeter	21.05	ft
Hydraulic Radius	0.09	ft
Top Width	21.04	ft
Normal Depth	0.17	ft
Critical Depth	0.32	ft
Critical Slope	0.024	ft/ft
Velocity	7.70	ft/s
Velocity Head	0.92	ft
Specific Energy	1.09	ft
Froude Number	4.619	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

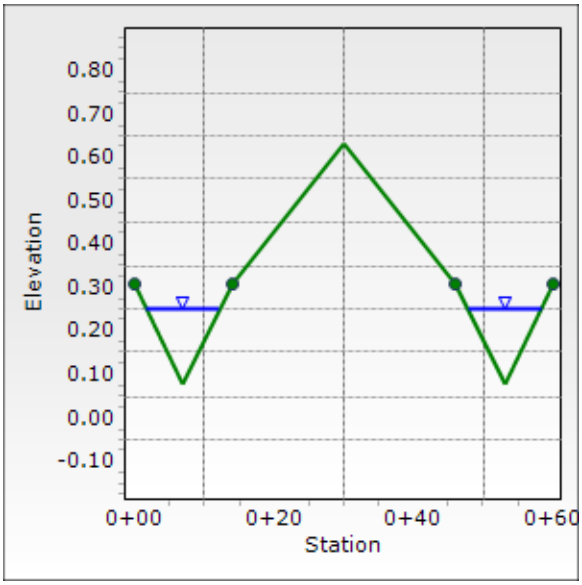
Worksheet for FS2-E BUFFALO & ACKERMAN ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.17 ft
Critical Depth	0.32 ft
Channel Slope	0.630 ft/ft
Critical Slope	0.024 ft/ft

Cross Section for FS2-E BUFFALO & ACKERMAN ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.630 ft/ft
Normal Depth	0.17 ft
Discharge	14.00 cfs



Worksheet for FS2-S BUFFALO & ACKERMAN ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.320	ft/ft
Discharge	6.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.00
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.00
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.00 to 0.63	ft
Flow Area	1.2	ft^2
Wetted Perimeter	14.44	ft
Hydraulic Radius	0.08	ft
Top Width	14.43	ft
Normal Depth	0.16	ft
Critical Depth	0.26	ft
Critical Slope	0.026	ft/ft
Velocity	5.21	ft/s
Velocity Head	0.42	ft
Specific Energy	0.58	ft
Froude Number	3.248	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

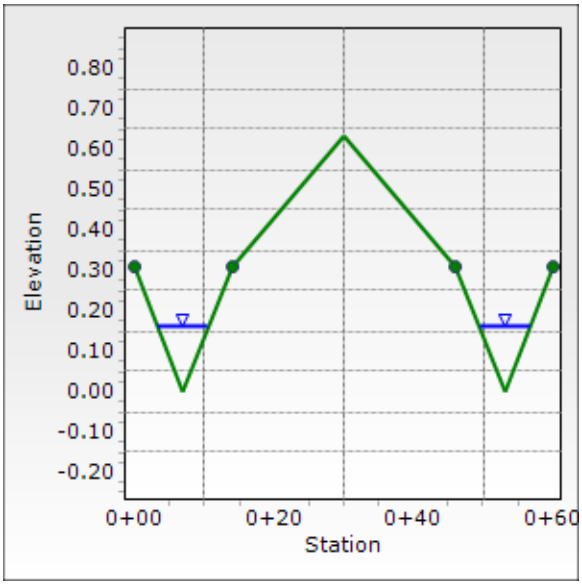
Worksheet for FS2-S BUFFALO & ACKERMAN ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.16 ft
Critical Depth	0.26 ft
Channel Slope	0.320 ft/ft
Critical Slope	0.026 ft/ft

Cross Section for FS2-S BUFFALO & ACKERMAN ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.320 ft/ft
Normal Depth	0.16 ft
Discharge	6.00 cfs



Worksheet for FS2-S BUFFALO & ACKERMAN ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.320	ft/ft
Discharge	10.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.17	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	1.8	ft^2
Wetted Perimeter	21.07	ft
Hydraulic Radius	0.09	ft
Top Width	21.06	ft
Normal Depth	0.17	ft
Critical Depth	0.28	ft
Critical Slope	0.025	ft/ft
Velocity	5.49	ft/s
Velocity Head	0.47	ft
Specific Energy	0.64	ft
Froude Number	3.292	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

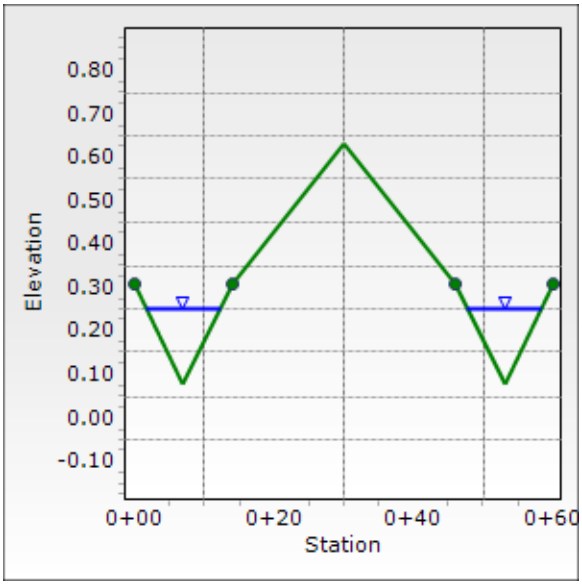
Worksheet for FS2-S BUFFALO & ACKERMAN ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.17 ft
Critical Depth	0.28 ft
Channel Slope	0.320 ft/ft
Critical Slope	0.025 ft/ft

Cross Section for FS2-S BUFFALO & ACKERMAN ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.320 ft/ft
Normal Depth	0.17 ft
Discharge	10.00 cfs



Worksheet for FS3-E RACEL & TIOGA ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	11.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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	0.23	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	1.0	ft^2
Wetted Perimeter	14.13	ft
Hydraulic Radius	0.07	ft
Top Width	13.88	ft
Normal Depth	0.23	ft
Critical Depth	0.40	ft
Critical Slope	0.018	ft/ft
Velocity	10.69	ft/s
Velocity Head	1.77	ft
Specific Energy	2.01	ft
Froude Number	6.917	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

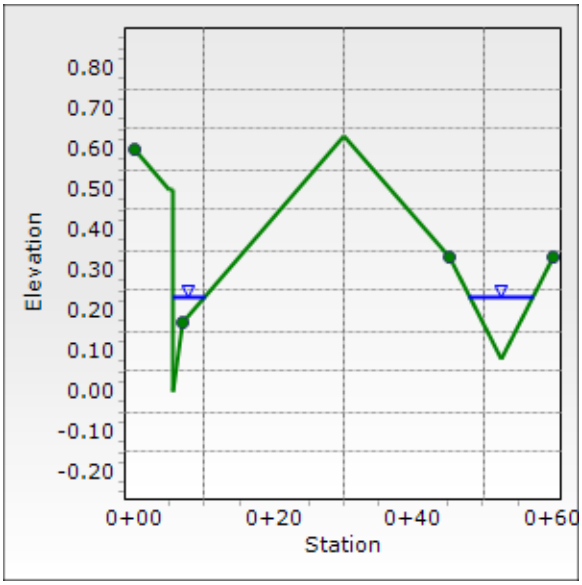
Worksheet for FS3-E RACEL & TIOGA ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.23 ft
Critical Depth	0.40 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.018 ft/ft

Cross Section for FS3-E RACEL & TIOGA ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.23 ft
Discharge	11.00 cfs



Worksheet for FS3-E RACEL & TIOGA ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	1.140	ft/ft
Discharge	28.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.17
0+30.00	0.63
0+45.00	0.33
0+52.50	0.08
0+60.00	0.33

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+07.00, 0.17)	0.013
(0+07.00, 0.17)	(0+45.00, 0.33)	0.016
(0+45.00, 0.33)	(0+60.00, 0.33)	0.030

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

Results		
Normal Depth	0.29	ft
Elevation Range	0.00 to 0.63	ft
Flow Area	2.1	ft^2
Wetted Perimeter	20.90	ft
Hydraulic Radius	0.10	ft
Top Width	20.59	ft
Normal Depth	0.29	ft
Critical Depth	0.55	ft
Critical Slope	0.016	ft/ft
Velocity	13.46	ft/s
Velocity Head	2.81	ft
Specific Energy	3.11	ft
Froude Number	7.463	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

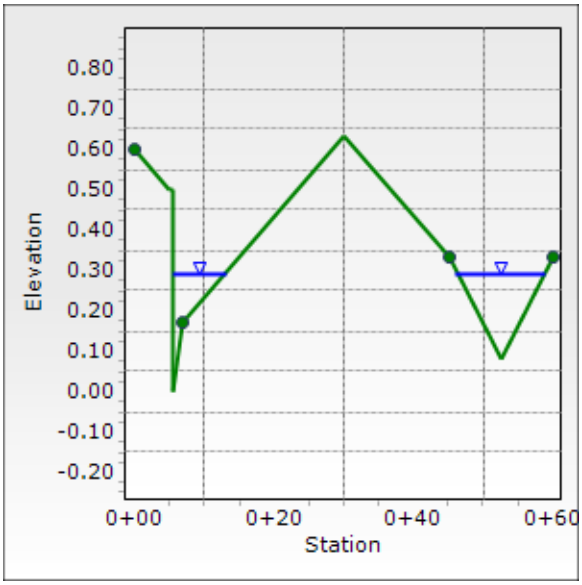
Worksheet for FS3-E RACEL & TIOGA ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.29 ft
Critical Depth	0.55 ft
Channel Slope	1.140 ft/ft
Critical Slope	0.016 ft/ft

Cross Section for FS3-E RACEL & TIOGA ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	1.140 ft/ft
Normal Depth	0.29 ft
Discharge	28.00 cfs



Worksheet for FS3-S RACEL & TIOGA ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Discharge	6.00 cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.15 ft
Elevation Range	0.08 to 0.63 ft
Flow Area	1.3 ft²
Wetted Perimeter	17.96 ft
Hydraulic Radius	0.07 ft
Top Width	17.96 ft
Normal Depth	0.15 ft
Critical Depth	0.23 ft
Critical Slope	0.027 ft/ft
Velocity	4.53 ft/s
Velocity Head	0.32 ft
Specific Energy	0.47 ft
Froude Number	2.942
Flow Type	Supercritical

GVF Input Data	
Downstream Depth	0.00 ft
Length	0.00 ft
Number Of Steps	0

GVF Output Data

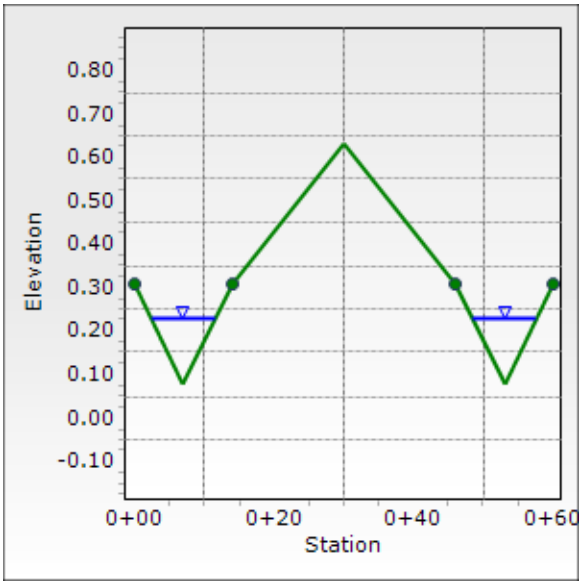
Worksheet for FS3-S RACEL & TIOGA ULT 10 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.15 ft
Critical Depth	0.23 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.027 ft/ft

Cross Section for FS3-S RACEL & TIOGA ULT 10 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.15 ft
Discharge	6.00 cfs



Worksheet for FS3-S RACEL & TIOGA ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data		
Channel Slope	0.270	ft/ft
Discharge	17.00	cfs

Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.31
0+07.00	0.08
0+14.00	0.31
0+30.00	0.63
0+46.00	0.31
0+53.00	0.08
0+60.00	0.31

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.31)	(0+14.00, 0.31)	0.030
(0+14.00, 0.31)	(0+46.00, 0.31)	0.016
(0+46.00, 0.31)	(0+60.00, 0.31)	0.030

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	0.22	ft
Elevation Range	0.08 to 0.63	ft
Flow Area	2.9	ft^2
Wetted Perimeter	26.56	ft
Hydraulic Radius	0.11	ft
Top Width	26.55	ft
Normal Depth	0.22	ft
Critical Depth	0.34	ft
Critical Slope	0.023	ft/ft
Velocity	5.87	ft/s
Velocity Head	0.54	ft
Specific Energy	0.75	ft
Froude Number	3.136	
Flow Type	Supercritical	

GVF Input Data		
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

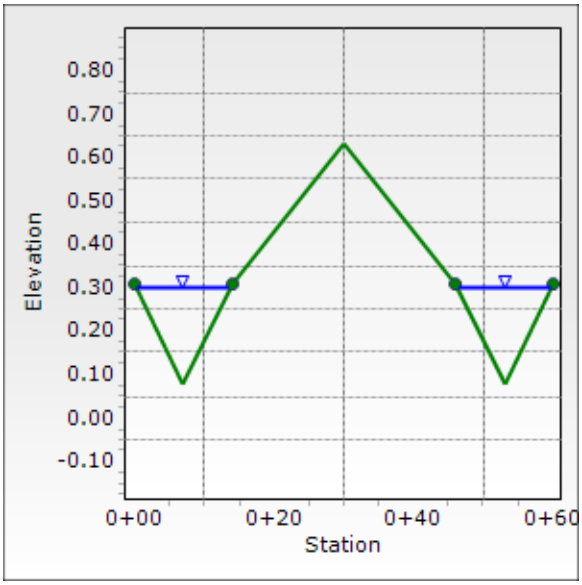
Worksheet for FS3-S RACEL & TIOGA ULT 100 YR

GVF Output Data	
Upstream Depth	0.00 ft
Profile Description	N/A
Profile Headloss	0.00 ft
Downstream Velocity	Infinity ft/s
Upstream Velocity	Infinity ft/s
Normal Depth	0.22 ft
Critical Depth	0.34 ft
Channel Slope	0.270 ft/ft
Critical Slope	0.023 ft/ft

Cross Section for FS3-S RACEL & TIOGA ULT 100 YR

Project Description	
Friction Method	Manning Formula
Solve For	Normal Depth

Input Data	
Channel Slope	0.270 ft/ft
Normal Depth	0.22 ft
Discharge	17.00 cfs



APPENDIX D

Reference Material

HTE: 13-46531

TECHNICAL DRAINAGE STUDY FOR VERONA ESTATES RESIDENTIAL DEVELOPMENT

ADVANTAGE CIVIL DESIGN GROUP
1170 Center Point Drive Henderson, Nevada 89074 mail@advantagecivil-nv.com

ADDENDUM #1 TO THE TECHNICAL HYDROLOGY STUDY FOR VERONA ESTATES
RESIDENTIAL DEVELOPMENT

CLARK COUNTY, NEVADA

HTE# 13-46531

PREPARED FOR:

Richmond American Homes of Nevada
7770 S. Dean Martin Drive, Suite 308
Las Vegas, NV 89139

PREPARED BY:

Advantage Civil Design Group, LLP
1170 Center Point Drive
Henderson, Nevada 89074

February 4, 2014

Department of Public Works

500 S Grand Central Pky • Box 554000 • Las Vegas NV 89155-4000
(702) 455-6000 • Fax (702) 455-6040

Denis Cederburg, P.E., Director • E-Mail: dlc@ClarkCountyNV.gov

Drainage Study Approval Letter

Date: May 6, 2014
Firm: Advantage Civil
Engineer: Brandon G. Doty, P.E.
Address: 1170 Center Point Drive, Henderson, NV 89074
Phone: (702) 432-2234
Fax: (702) 436-2234
E-mail: Brandon@advantagecivil-nv.com

Subject: Technical Drainage Study for Verona Estates
Location: NEC of Grand Teton Drive and Tioga Way
APN: 125-10-402-008, -009 & 125-10-406-009
Sec, Township, Range: S10, T19S, R60E
Flood Zone & Panel: Zone X, 1745E, Dated September 27, 2002
Application Tracking #: 13-46531

HTE13-46531

Submittals	Date Received	Date Returned	Reviewer	Miscellaneous
Technical	11/14/2013	01/20/2014	WG	
Addendum #1	02/05/2014	03/03/2014	WG	
Addendum #2	04/01/2014	05/06/2014	WG	

Concurrence Required: (Must be obtained prior to permit issuance)		Reason Concurrence is required
	City of Henderson	Adjacent to or Impacts Henderson
X	City of Las Vegas	Adjacent to or Impacts Las Vegas
	City of North Las Vegas	Adjacent to or Impacts North Las Vegas
	Nevada Department of Transportation	Adjacent to or Impacts NDOT Facility
	Union Pacific Rail Road	Adjacent to or Impacts a UPRR Facility
	US Army Corp of Engineers	Impacts a USACE Facility
X	Clark County Regional Flood Control District	Regional Significance, Adjacent to or Impacts CCRFCD MPU Facility or in a SFHA

BOARD OF COUNTY COMMISSIONERS
STEVE SISOLAK, Chairman • LARRY BROWN, Vice Chairman
SUSAN BRAGER • TOM COLLINS • CHRIS GIUNCHIGLIANI • MARY BETH SCOW • LAWRENCE WEEKLY
DONALD G. BURNETTE, County Manager

The referenced **Technical Drainage Study** has been reviewed and is accepted as complying with minimum improvement standards. As set forth in the subject drainage study, the following measures will be taken to mitigate flood hazards.

The site shall be graded with respect to drainage as shown on "Verona Estates", grading plan sheets GP1, GP2, DE1, DE2, PP1, PP2, PP3, PP5, PP6, PP7, PP9, signed and sealed by Brandon G. Doty, P.E., on April 1, 2014.

Check appropriate conditions

	Retaining/screen wall combination may be in excess of current **Clark County Unified Development Code, Chapter 30.64.050.**
	A FEMA Elevation Certificate, completed by a licensed surveyor, must be submitted to and approved by CCPW Development Review Plan Check prior to the issuance of Certificates of Occupancy for those structures.
X	Mylars of the grading plan must be submitted to the CCPW Development Review Plan Check for approval signatures prior to map recordation (residential) or permit issuance (commercial).
	An administrative variance to allow the finished floor elevation(s) to be set below the current Clark County criteria must be approved. The finished floor variance must be submitted to CCPW Development Review front counter after drainage study approval and prior to offsite final review.
	The grading plan will be reviewed by the Building Office Operations Division to ensure compliance with the ADA access requirements. Revisions to the grading plan may be required if the site accessibility design does not comply with the requirements set forth in the Accessibility Chapter of the Clark County Building Code.
	The plans show work is proposed on another property. Notarized written permission must be obtained **prior to** plan approval. A grading permit must be obtained from Building Dept prior to grading.
X	Right-of-way dedication must be verified.
	Any previously approved drainage easements that are not being used must be vacated.
X	Per *Regional Flood Control District policies and Procedures manual, Section VIII. D. 13. Uniform Regulations for the Control of Drainage*, the Engineer of Record shall provide As-Built plans or record drawings to the District after completion and final inspection of such privately installed flood control facilities that have regional flood control significance.
	Structural calculations are required. The structural calculations, plans, and details must be approved prior to "Offsite" submittal and prior to CCRFCD submittal, if applicable.
X	Plan revisions can be found on the red-lined plans and must be addressed.
X	Prepare drainage easement documents as shown on the grading plans.

The County's review is solely based on the information submitted by the Engineer of Record. The County's review is strictly limited to compliance with minimum County Codes and Standards. The Engineer of Record is responsible for researching and addressing situations that may require designs above and beyond the minimum codes for issues of public safety and impacts to upstream, downstream and adjacent properties. The County assumes no liability for information data, designs or conclusions of the Engineer of Record.

By _____

W. Layne Weber, P.E., CFM
Principal Engineer
Clark County Public Works
Development Review

VERONA ESTATES
8-3FT GUTTER INTERIM 100-YR

Input Parameters- English Units

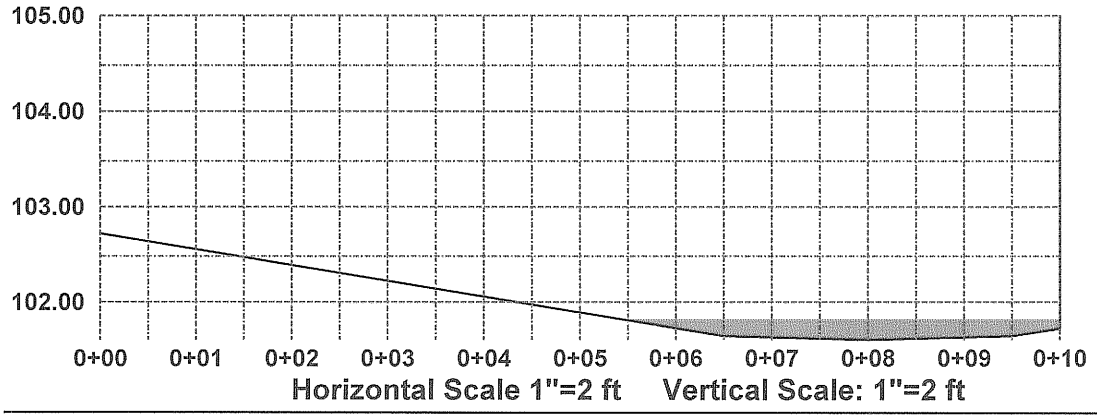
Manning's N Value	0.01759	
Manning Method	Horton	
Channel Slope	0.01000	ft/ft
Normal Depth	0.22	ft
Channel Discharge	2.00	cfs
Solve For	Normal Depth	

Channel Section- English Units

Station (ft)	Elevation (ft)	Start N-Value
0+00.00	102.72	0.02500
0+06.50	101.65	0.01300
0+08.00	101.61	0.01300
0+09.50	101.65	0.02500
0+10.00	101.72	0.01300
0+10.00	105.00	0.01300

Output Parameters- English Units

Water Surface Elevation	101.83	ft
Flow Area	0.79	sq.ft.
Wetted Perimeter	4.75	ft
Top Width	4.61	ft
Hydraulic Depth	0.170	ft
Hydraulic Radius	0.165	ft
Critical Depth	0.23	ft
Critical Slope	0.00843	ft/ft
Velocity	2.55	ft/s
Velocity Head	0.10	ft
Specific Energy	0.32	ft
Froude Number	1.088	
Velocity x Depth Product	0.57	sq.ft./s
Flow Type	Super-Critical	
Turbulent Flow	Yes	



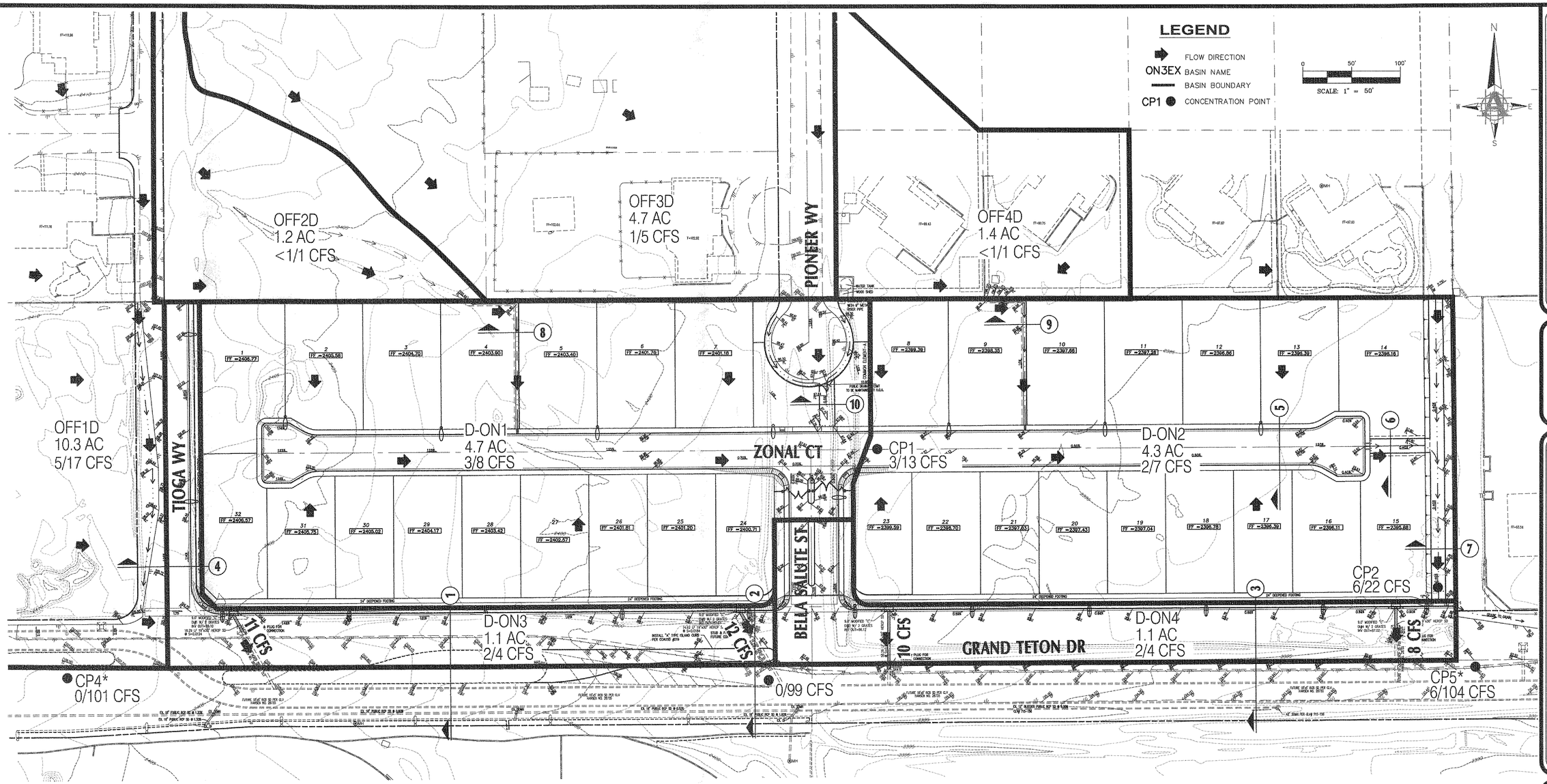


TABLE 3
BASIN RUNOFF AMOUNTS
FUTURE CONDITION

BASIN NAME	AREA (acres)	Q10 (cfs)	Q100 (cfs)
D-ON1	4.7	3	8
OFF2D	1.2	<1	1
OFF3D	4.7	1	5
CP1	--	3	13
OFF4D	1.4	<1	1
D-ON2	4.3	2	7
CP2	--	6	22
OFF1D	10.3	5	17
D-ON3	1.1	2	4
D-ON4	1.1	2	4
CP 4* Grand Teton Drive Total Flow	--	661**	1181
CP4 Flow in Storm Drain	--	661	1080
CP4 Flow in Street	--	--	101
CP5 (CP3+CP4)	--	6	104

*Per *Grand Teton Storm Drain* analysis
** Calculated based on rainfall ratio of 1.61/2.86 = 0.56

TABLE 6
FUTURE CONDITION
HYDRAULIC CAPACITY CALCULATION SUMMARY
6-HOUR, 10-YEAR STORM

SECTION	Q10 (CFS)	V10 (FT/SEC)	D10 (FT)	D10 X V10	DRY LANE (FT)
1--Grand Teton	<1	2.29	0.15	0.34	35.5
2—Grand Teton	<1	1.41	0.14	0.20	36.0
3—Grand Teton	6	1.98	0.38	0.75	42.5
4--Tioga Way	5	1.86	0.36	0.7	n/a

TABLE 7
FUTURE CONDITION
HYDRAULIC CAPACITY CALCULATION SUMMARY
6-HOUR, 100-YEAR STORM

SECTION	Q100 (CFS)	V100 (FT/SEC)	D100 (FT)	D100 X V100
1--Grand Teton	111	4.51	0.89	4.01
2—Grand Teton	99	3.30	0.84	2.77
3—Grand Teton	104	3.53	0.83	2.93
4--Tioga Way	17	2.43	0.51	1.2

ADVANTAGE CIVIL DESIGN GROUP, LLP
1170 CENTER POINT DRIVE
HENDERSON, NEVADA
89074
Office: 702.492.2294
Fax: 702.896.2294
Email: WK@ADVANTAGECIVIL-NV.COM
CIVIL ENGINEERING PLANNING CONSULTING

FUTURE CONDITION
DRAINAGE BASIN MAP

VERONA ESTATES
Richmond American Homes of Nevada

REVISIONS
NO. | DATE | DESCRIPTION | BY

JOB NUMBER: 63-001
DRAWN BY: BGD
DESIGNED BY: BGD
CHECKED BY: JRM
DATE:

FIG 6 1/1

PLOT DATE: 02-04-14 PLOT TIME: 15:55:24 DWG PATH: K:\Richmond\Borrough Heights\Dwg\Hydro\Addendum #1\63-001 Developed Drainage.dwg
bddy

LAS 22O09

FINAL DESIGN REPORT FLOYD LAMB PARK NORTH AND SOUTH ENVIRONMENTAL ENHANCEMENT AREAS

FINAL DESIGN REPORT

FLOYD LAMB PARK
NORTH AND SOUTH
ENVIRONMENTAL ENHANCEMENT AREAS
CLV PROJECT: 06-12828

PREPARED FOR:

CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS
400 STEWART AVENUE
LAS VEGAS, NV 89101

PREPARED BY:

THE LOUIS BERGER GROUP, INC.
500 E. AMIGO COURT, SUITE 100
LAS VEGAS, NV 89119

May 2009

4.0 HYDROLOGIC ANALYSIS

Three hydrologic conditions were evaluated for the purposes of this study: 1) existing; 2) interim; and, 3) future. Under existing and interim conditions, storm water crosses under US 95 and into the project watershed through culverts. In the future, a channel will be constructed along US 95 to divert the flow into the CC 215 (Las Vegas Beltway) channel. The US 95 and beltway channels are identified in the MPU (2007), Figure 2.1, as CN95 and CNWE, respectively. There will be a period of time (approximately 10-years or more) in which the NEEA and SEEA will be operational and the upstream diversion channel will not be in place. In the interim, without the US 95 diversion channel, flow will continue to cross under US 95 and into the detention basins. Under interim conditions, the 100-year flow entering the SEEA and NEEA basins will be approximately 45% and 55% higher than future conditions, respectively. The basins were designed to contain the interim conditions 100-year, 6-hour storm flow volume.

This section presents the steps taken to develop the 2-year, 10-year, and 100-year, and PMF HEC-1 hydrologic models for existing, interim, and future conditions. Figures 4.1a and 4.1b show the watershed limits, basin boundaries, and 2-year, 10-year, and 100-year peak flow rates for interim conditions. Figure 4.2 shows future conditions and Figure 4.3 existing conditions. This section concentrates on the assumptions and data used for preparing the hydrologic model. Discussion of the model results as they relate to the design is reserved until Sections 5, 6, and 7.

4.1 Existing and Interim Conditions Models

The existing conditions model was prepared as a baseline from which to compare the benefits and effects of the project on the regional flow patterns and flow rates. The interim conditions watershed model is based on existing conditions but incorporates the NEEA and SEEA, the Racel Street and El Capitan Way lateral storm drains.

Runoff in the project area watershed generally follows the terrain, flowing from west to east. A major feature that traverses the watershed is the US 95 Freeway, which runs southeast to northwest, situated about 1.5 miles to the west of the project site (See Figures 4.1a and 4.1b). The freeway consists of three roads running in parallel - southbound and northbound lanes, and a frontage road east of the northbound lanes. Under existing and interim conditions, ditches on the upstream side capture and convey runoff parallel to the three roads. Runoff is passed underneath the three roads through a series of culverts and drop inlets. The culverts are generally in series under each of the three roads. The culverts were analyzed exhaustively by VTN (2004) as part of the Conceptual Offsite Hydrology Report for US-95 Environmental Document, Rainbow Boulevard to Kyle Canyon Road (see Volume II of Berger 2007 Preliminary Design Report for excerpts of the study). The analysis prepared by VTN (2004) was incorporated into the existing and interim condition HEC-1 models. Diversions for the

US 95 culverts in the HEC-1 model generally have the designation “DCHDxxA”, “DCHDxxB”, and “DCHDxxC", where “A” represents the culvert under the southbound lanes, “B” the northbound lanes, and “C” the frontage road. Similarly, diversions representing flows overtopping the roadside ditches have the designations “DSHDxxA”, “DSHDxxB”, and “DSHDxxC". As flow is diverted out of the “A” series culverts and ditches it is then retrieved in the “B” series and finally the “C” series. There is a small roadside ditch just east of the frontage road, but the capacity of this is assumed to be negligible.

Between the US 95 freeway and the SEEA, runoff generally flows easterly along major streets - Racel Street, Horse Drive, Meisenheimer Avenue, Brent Lane, and Iron Mountain Road. These streets serve as collectors for runoff from adjacent subdivisions. Runoff along Iron Mountain Road runs through Floyd Lamb Park, before discharging into the SEEA. Ultimately, the runoff is collected by facilities along the west and north of the SEEA where it is discharged into the detention basin. Similarly, runoff between the US 95 freeway and the NEEA is conveyed eastward along collector streets from adjacent subdivisions into the detention basin. Runoff from the Log Cabin Ranch subdivisions is discharged to the east along Log Cabin Way and then southward into the project area.

4.2 Future Conditions Model

The future conditions HEC-1 model is the same as the interim conditions model except that three additional Master Plan facilities have been incorporated (see Figure 2.1):

1. Centennial Parkway Channel/US 95 Branch MPU ID miles CN95 0000 through CN95 0295
2. Brent Lane Detention Basin Collector facility ID miles BRDB 0032 through BRDB 0207
3. Tule Springs Detention Basin Collector facility ID mile TSDB 0059

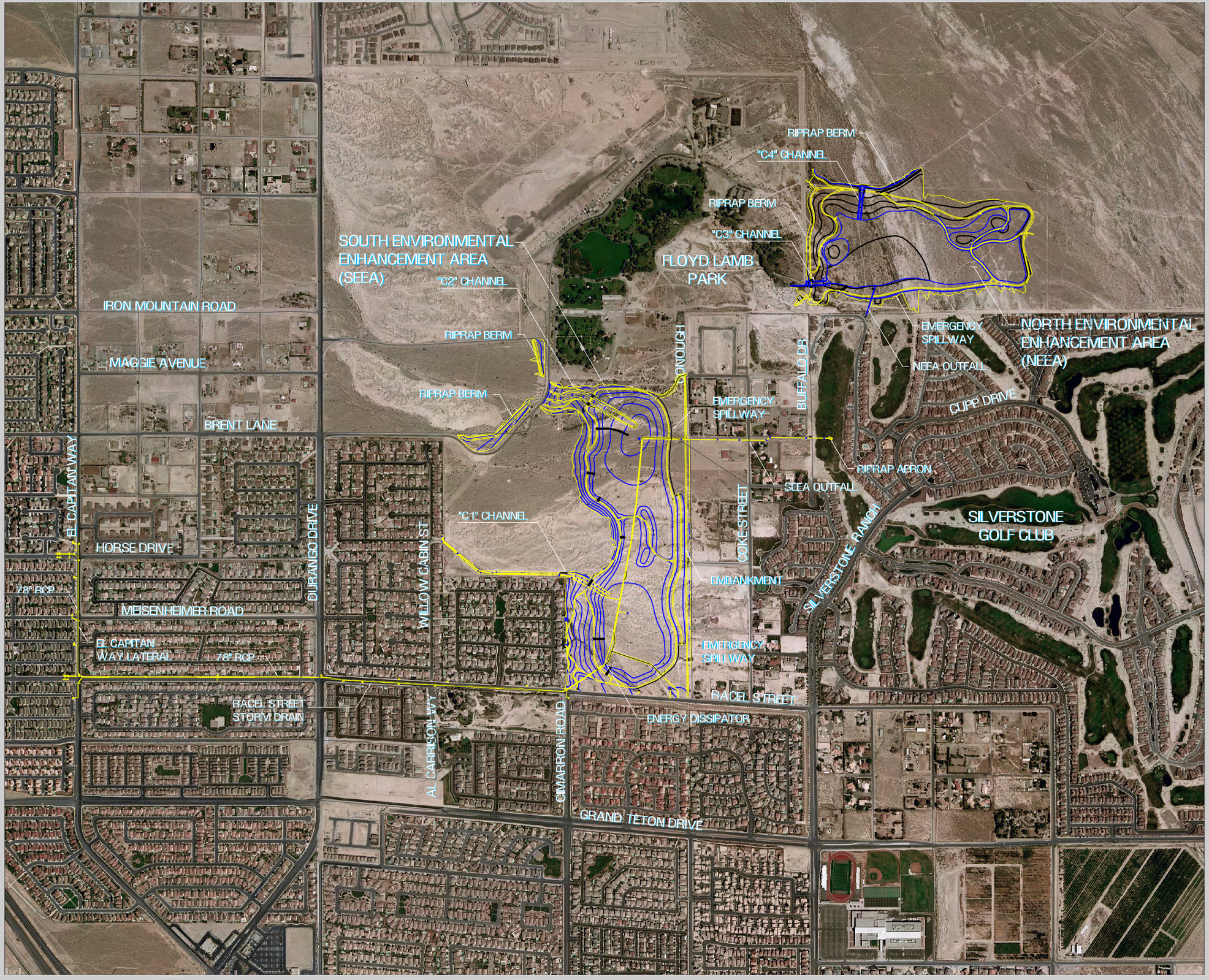
The facility along the Buffalo Drive Alignment (ID mile TSDB 0023) is assumed to not be constructed since there are few downstream improvements to that would benefit from additional flood protection.

A deviation from the hydrologic models for the 2002 Master Plan Update and Master Plan Amendment is that basin NW128S is assumed to be captured by the NEEA, instead of bypassing it. Since the NEEA can contain this runoff in the interim, there is little likelihood it would be diverted away from the detention basin in the near future.

For reference, an additional future condition model was developed based on the 2007 Amendment to the 2002 MPU. This model reflects changes to the rating curves for the NEEA and SEEA and is presented in Appendix A. The basis for hydrology for the 2007 Amendment was the 2002 MPU. Since this model represents the ultimate build-out of flood control facilities and property development, it serves as a basis for evaluating ultimate design volumes and freeboard.

FLOYD LAMB PARK ENVIRONMENTAL ENHANCEMENT AREAS

PROJECT OVERVIEW



Prepared for:
Department of Public Works
City of Las Vegas

Prepared by:
The Louis Berger Group
Las Vegas, Nevada

FIGURE 1.2

Basin ID	Q100 (cfs)	Q10 (cfs)	Area (acre)
EL1	66	29	30
EL2	36	18	14
EL3	94	44	41
EL4	45	20	20
EL5	47	21	21
EL6	37	17	16
EL7	38	17	16
EL8	38	17	19
EL9	42	18	21
EL10	13	3	14
EL11	12	6	5
EL12	4	1	2
EL13	2	1	1
EL14	3	1	1
EL15	56	25	25
EL16	131	51	76
EL17	4	2	1
EL18	14	6	1

CON. Points	Q100 (cfs)	Q10 (cfs)	Area (acre)
CPT1	56	28	45
CEL2	98	59	13
CEL3	170	88	147
CEL4	66	32	64
CEL6	3	0	13
CEL7	7	2	160
CEL8	39	16	179
CEL9	81	35	205
CEL10	44	16	218
CEL11	40	15	224
CEL12	36	15	218
CEL13	82	35	179
CEL14	28	10	224
CEL15	209	55	64
CEL16	192	77	180
CEL17	30	11	224
CNW75B	143	100	16
CNW76B	101	87	22
CNW77B	87	66	66

LEGEND

CEL 10
XXX cfs / XX cfs
100-YR FLOW
10-YR FLOW

- SURFACE FLOW DIRECTION
- STORM DRAIN FLOW DIRECTION
- 20 FT CONTOURS
- RACEL ST STORM DRAIN
- RACEL STREET EXTENSION
- BASIN BOUNDARY
- SOUTH ENVIRONMENTAL ENHANCEMENT AREA
- FLOYD LAMB PARK BOUNDARY
- EL1 BASIN NAME
- CONCENTRATION POINT

N

0 400 800 1,600 Feet

EL CAPITAN MODEL
10 Year & 100 Year Flow Hydrology Map
Figure 4.4

Conc. Points	Q100 (cfs)	Q10 (cfs)	Area (acre)	Conc. Points	Q100 (cfs)	Q10 (cfs)	Area (acre)
C04C	308	211	2042	CNW126	554	466	3923
C05C	343	181	1997	CNW128N	493	162	493
C06C	974	553	2650	CNW128S	841	262	793
C07C	183	24	2694	CNW143	595	56	4038
CNW94	289	137	2906	CNW157	380	136	333
CNW93	507	175	3872	CNW163*	776	271	7455
CCNW115	692	347	2432	CRASD2	504	455	3859
CD92C2	973	246	3872	CSDB*	2755	1292	5312
CD93C5	358	156	3872	CTULEDB	1135	357	1184
CNW114S	1357	705	3733	BRENTDB	43	37	1254
CNW125	927	263	4083	TULEDB	30	21	1146

* Indicates SDN4 Storm. All others are SDN3

SEE FIGURE 4.1b

N

800 400 0 800 1,600 2,400 3,200 Feet

DURANGO

CIMARRON

BUFFALO

MOCCASIN

LOG CABIN

IRON MOUNTAIN

HORSE

GRAND TETON

FARM

FLOYD LAMB STATE PARK

SILVERSTONE GOLF COURSE

SEEA

NEEA

NDB

SDB

ONCP

RAGEL

US 95

EL CAPITAN

HUALAPAI

GRAND CANYON

FT APACHE

TENAYA

RAINBOW

*Note: SDN4 Flow

Basin ID	Q100 (cfs)	Q10 (cfs)	Area (acre)	Basin ID	Q100 (cfs)	Q10 (cfs)	Area (acre)	Basin ID	Q100 (cfs)	Q10 (cfs)	Area (acre)
OFF14A	87	33	45	NW82	56	27	22	NW127	40	9	41
OFF17	272	109	135	NW83	60	30	28	NW128N	124	27	182
OFF20A	172	61	122	NW92	102	45	46	NW128S	76	17	107
OFF20B	130	49	67	NW93	99	44	43	NW129	88	38	53
OFF21A	28	12	13	NW94	105	49	50	NW130	98	41	52
OFF21B	48	20	17	NW95	78	35	38	NW131	171	71	105
OFF23	35	13	16	NW96	71	32	35	NW141	27	10	15
OFF24A	40	16	20	NW97	120	52	61	NW143	9	2	8
OFF24B	87	36	34	NW98	99	36	72	NW144	95	33	64
OFF25	15	2	19	NW99	71	26	46	NW145	12	2	15
OFF26	20	3	32	NW100N	53	19	75	NW146E	38	14	36
OFF27A	14	2	18	NW100S	86	31	75	NW146W	80	24	53
OFF27B	9	1	11	NW111	83	36	45	NW147	67	12	93
OFF28	732	275	528	NW112	116	44	70	NW148	73	19	85
NDB	45	5	75	NW113	112	46	69	NW155	173	67	102
NW75	43	21	16	NW114N	50	18	31	NW156	248	93	179
NW76	54	25	22	NW114S	82	30	31	NW157	49	9	88
NW77	148	67	66	NW115	79	19	81	NW163	243	95	141
NW78	104	42	57	NW116	83	22	80	NW164	307	126	192
NW79	70	28	38	NW117	44	11	39	NW165	147	37	218
NW80	69	25	48	NW125	24	6	22	SDB	116	22	136
NW81	132	47	95	NW126	44	10	49				

LB

CITY OF LAS VEGAS NEVADA

LEGEND

100-YR SURFACE FLOW (cfs)

100-YR FACILITY FLOW (cfs)

SOUTH ENVIRONMENTAL ENHANCEMENT AREA

UNCOLLECTED DRAINAGE AREA

NORTH ENVIRONMENTAL ENHANCEMENT AREA

WEST AREA OF U-95

DETENTION BASIN

OFF1A BASIN NAME

STORM DRAIN

CONCENTRATION POINT

Floyd Lamb Park North and South Environmental Enhancement Areas Interim Conditions Hydrology Figure 4.1a

Conc. Points	Q100 (cfs)	Q10 (cfs)	Q2 (cfs)	Area (acre)
CNW114S	1097	369	40	2733
CNW114N	129	36	2	109
CNW128S	151	33	1	326
CNW128N	273	57	1	493
CNW143	160	51	5	211
CNW146WB	1237	403	39	928
CNW157	480	170	24	422
CNW163	1002	352	50	3430
CRASD2	541	257	47	320
CSDB	1978	679	75	1580
CTULEDB	700	197	22	1184
BRENTDB	36	32	26	1254
TULEDB	26	18	2	1146

Basin ID	Q100 (cfs)	Q10 (cfs)	Q2 (cfs)	Area (acre)	Basin ID	Q100 (cfs)	Q10 (cfs)	Q2 (cfs)	Area (acre)
NDB	45	5	0	75	NW116	83	22	1	80
NW75	43	21	6	16	NW117	44	11	0	39
NW76	54	25	6	22	NW125	24	6	0	22
NW77	148	67	15	66	NW126	44	10	0	49
NW78	103	41	6	57	NW127	40	9	0	41
NW79	69	28	4	38	NW128N	124	27	0	182
NW80	69	25	2	48	NW128S	76	17	0	107
NW81	132	47	5	95	NW129	88	38	7	53
NW82	56	27	7	22	NW130	98	41	7	52
NW83	60	30	9	28	NW131	171	71	12	105
NW92	102	45	10	46	NW141	27	10	1	15
NW93	99	44	9	43	NW143	9	2	0	8
NW94	105	49	12	50	NW144	95	33	3	64
NW95	78	35	8	38	NW145	12	2	0	15
NW96	71	32	7	35	NW146E	38	14	1	36
NW97	120	52	10	61	NW146W	80	24	1	53
NW98	99	36	4	72	NW147	67	12	0	93
NW99	71	26	3	46	NW148	73	19	1	85
NW100N	53	19	2	75	NW155	173	67	9	102
NW100S	86	31	3	75	NW156	240	93	12	179
NW111	83	36	7	45	NW157	49	9	0	88
NW112	116	44	5	70	NW163	243	95	13	141
NW113	112	46	8	69	NW164	307	126	20	192
NW114N	50	18	2	31	NW165	147	37	1	218
NW114S	82	30	3	31	SDB	116	22	0	136
NW115	79	19	0	81					

LEGEND

100-YR FACILITY FLOW (cfs) (1234)

100-YR SURFACE FLOW (cfs) 456

SOUTH ENVIRONMENTAL ENHANCEMENT AREA

UNCOLLECTED DRAINAGE AREA

NORTH ENVIRONMENTAL ENHANCEMENT AREA

DETENTION BASIN

OFF1A BASIN NAME

STORM DRAIN

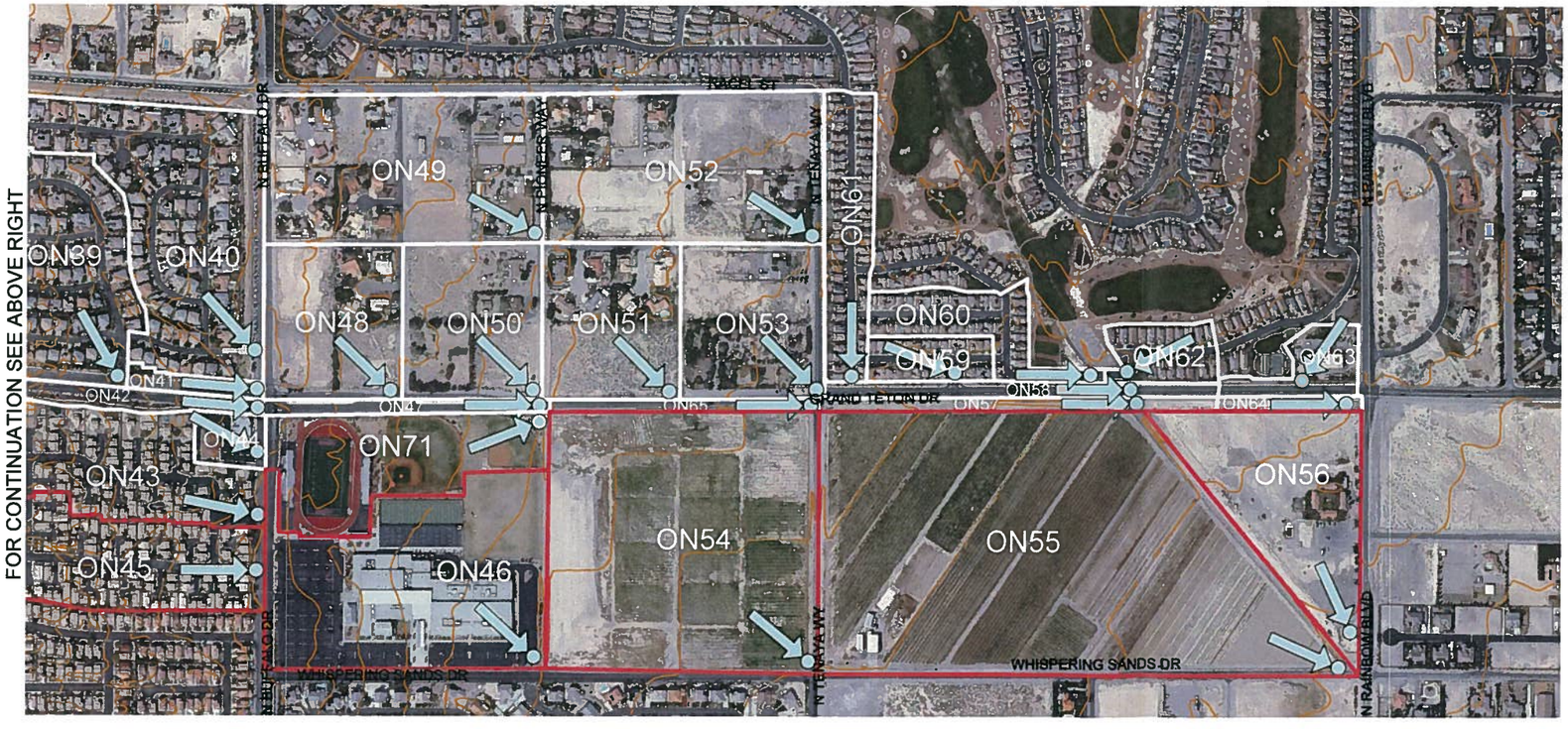
CONCENTRATION POINT

Floyd Lamb Park North and South Environmental Enhancement Areas Future Conditions Hydrology Figure 4.2

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FOR CONTINUATION SEE BELOW LEFT



FOR CONTINUATION SEE ABOVE RIGHT

ONXX ~ SUBBASIN NAME

FLOW DIRECTION ⇨ DISCHARGE POINT

Note: White basin boundaries represent tributary onsite flow basins while red boarders represent basins that flow offsite

GRAPHIC SCALE

350 0 175 350 700 1400

(IN FEET)
1 inch = 350 ft.
(VERIFY SCALE - PLANS MAY HAVE BEEN REDUCED)

NORTH

PUBLIC WORKS DEPARTMENT
333 N. RANCHO DRIVE
LAS VEGAS, NV 89106
702-229-6272

2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148
PH (702) 362-7900
FAX (702) 362-2997
WEB SITE WWW.VTNNV.COM

REV	DATE	BY	REVISION

ONSITE SUBBASIN MAP

LAS VEGAS WASH MIDDLE BRANCH
GRAND TETON STORM DRAIN
DURANGO DR TO RAINBOW BLVD.

DRAWN BY: DAB 1/2012
DESIGNED BY: VTN 1/2012
CHECKED BY:
PROJECT NO: 7381
SCALE HORZ. .350 VERT. NA

PRELIMINARY NOT FOR CONSTRUCTION

SHEET
FIG. D.1.1
1 OF 1 SHEETS
DRAWING NO.

EXISTING CONDITIONS
ONSITE FLOW CALCULATIONS

Basin ID	Basin Area			Runoff Coeficient			Time of Conc.	Rainfall Intensity (In/hr)		Adj. Factor	Runoff CFS	
	FT^2	MI^2	Acres	C_{10}	C_{100}	ADJ CN	tc (min)	I_{10}	I_{100}	k	Q_{10}	Q_{100}
ON1	249366	0.0089	5.725	0.25	0.50	77	16	2.81	5.03	0.5	2.01	7.20
ON2	651630	0.0234	14.959	0.73	0.80	88	11	3.28	5.87	0.5	17.89	35.12
ON3	1556745	0.0558	35.738	0.73	0.80	87	12	3.17	5.67	0.5	41.33	81.12
ON4	688462	0.0247	15.805	0.73	0.80	87	12	3.17	5.67	0.5	18.28	35.88
ON5	1414298	0.0507	32.468	0.73	0.80	87	15	2.96	5.28	0.5	35.08	68.57
ON6	656460	0.0235	15.070	0.73	0.80	87	12	3.17	5.67	0.5	17.43	34.21
ON7	293886	0.0105	6.747	0.88	0.89	87	10	3.42	6.12	0.5	10.15	18.37
ON8	290627	0.0104	6.672	0.73	0.80	87	10	3.42	6.12	0.5	8.33	16.33
ON9	272186	0.0098	6.249	0.73	0.80	87	11	3.28	5.87	0.5	7.47	14.67
ON10	289398	0.0104	6.644	0.73	0.80	87	11	3.28	5.87	0.5	7.94	15.60
ON11	134034	0.0048	3.077	0.73	0.80	87	8	3.67	6.58	0.5	4.12	8.10
ON12	167847	0.0060	3.853	0.90	0.93	87	15	2.96	5.28	0.5	5.13	9.46
ON13	292044	0.0105	6.704	0.73	0.80	87	10	3.42	6.12	0.5	8.37	16.41
ON14	95722	0.0034	2.197	0.75	0.83	96	7	3.84	6.88	0.5	3.16	6.27
ON15	123727	0.0044	2.840	0.75	0.83	96	6	4.03	7.22	0.5	4.29	8.51
ON16	344535	0.0124	7.909	0.73	0.80	87	10	3.42	6.12	0.5	9.87	19.36
ON17	161432	0.0058	3.706	0.75	0.83	88	10	3.42	6.12	0.5	4.75	9.41
ON18	123921	0.0044	2.845	0.90	0.93	98	8	3.67	6.58	0.5	4.70	8.71
ON19	127044	0.0046	2.917	0.73	0.80	87	9	3.52	6.32	0.5	3.75	7.37
ON20	177967	0.0064	4.086	0.73	0.80	87	10	3.42	6.12	0.5	5.10	10.00
ON21	196290	0.0070	4.506	0.73	0.80	87	14	2.98	5.33	0.5	4.90	9.61
ON22	1442441	0.0517	33.114	0.73	0.80	87	16	2.81	5.03	0.5	33.99	66.65
ON23	120159	0.0043	2.758	0.73	0.80	87	10	3.42	6.12	0.5	3.44	6.75
ON24	172234	0.0062	3.954	0.73	0.80	87	9	3.52	6.32	0.5	5.09	9.99
ON25	232736	0.0083	5.343	0.73	0.80	87	9	3.52	6.32	0.5	6.87	13.50
ON26	301936	0.0108	6.931	0.73	0.80	87	9	3.52	6.32	0.5	8.92	17.52
ON27	261017	0.0094	5.992	0.49	0.64	81	14	2.98	5.33	0.5	4.37	10.22
ON28	426702	0.0153	9.796	0.73	0.80	93	12	3.17	5.67	0.5	11.33	22.24
ON29	729070	0.0262	16.737	0.73	0.80	93	9	3.52	6.32	0.5	21.53	42.29
ON30	240265	0.0086	5.516	0.73	0.80	90	9	3.52	6.32	0.5	7.10	13.94
ON31	359895	0.0129	8.262	0.73	0.80	88	10	3.42	6.12	0.5	10.31	20.23
ON32	188664	0.0068	4.331	0.73	0.80	89	14	2.98	5.33	0.5	4.71	9.23
ON33	150665	0.0054	3.459	0.73	0.80	90	10	3.42	6.12	0.5	4.32	8.47
ON34	313051	0.0112	7.187	0.73	0.80	87	10	3.42	6.12	0.5	8.97	17.59
ON35	562236	0.0202	12.907	0.73	0.80	89	11	3.28	5.87	0.5	15.43	30.30
ON36	351814	0.0126	8.077	0.73	0.80	89	10	3.42	6.12	0.5	10.08	19.77
ON37	422106	0.0151	9.690	0.73	0.80	90	10	3.42	6.12	0.5	12.10	23.72
ON38	1328555	0.0477	30.499	0.73	0.80	90	14	2.98	5.33	0.5	33.14	65.03
ON39	774738	0.0278	17.786	0.73	0.80	89	13	3.07	5.50	0.5	19.92	39.10
ON40	1018245	0.0365	23.376	0.73	0.80	88	15	2.96	5.28	0.5	25.26	49.37
ON41	58019	0.0021	1.332	0.90	0.93	98	7	3.84	6.88	0.5	2.30	4.26
ON42	165923	0.0060	3.809	0.90	0.93	98	9	3.52	6.32	0.5	6.04	11.19
ON43	906926	0.0325	20.820	0.73	0.80	90	12	3.17	5.67	0.5	24.08	47.26
ON44	86915	0.0031	1.995	0.75	0.83	97	6	4.03	7.22	0.5	3.01	5.98
ON45	596217	0.0214	13.687	0.73	0.80	90	11	3.28	5.87	0.5	16.37	32.13
ON46	1088643	0.0390	24.992	0.62	0.71	86	14	2.98	5.33	0.5	23.07	47.29
ON47	93275	0.0033	2.141	0.90	0.93	98	11	3.28	5.87	0.5	3.16	5.84
ON48	495875	0.0178	11.384	0.53	0.67	81	13	3.07	5.50	0.5	9.26	20.96
ON49	958532	0.0344	22.005	0.53	0.67	81	15	2.96	5.28	0.5	17.26	38.92
ON50	500221	0.0179	11.483	0.53	0.67	81	13	3.07	5.50	0.5	9.34	21.14
ON51	496603	0.0178	11.400	0.53	0.67	80	15	2.96	5.28	0.5	8.94	20.17
ON52	978166	0.0351	22.456	0.53	0.67	80	17	2.74	4.90	0.5	16.29	36.84
ON53	517958	0.0186	11.891	0.53	0.67	80	15	2.96	5.28	0.5	9.33	21.03

EXISTING CONDITIONS
ONSITE FLOW CALCULATIONS

Basin ID	Basin Area			Runoff Coeficient			Time of Conc.	Rainfall Intensity (In/hr)		Adj. Factor	Runoff CFS	
	FT^2	MI^2	Acres	C_{10}	C_{100}	ADJ CN	tc (min)	I_{10}	I_{100}	k	Q_{10}	Q_{100}
ON54	1612121	0.0578	37.009	0.25	0.50	80	22	2.42	4.32	0.5	11.18	39.98
ON55	2616168	0.0938	60.059	0.25	0.50	80	32	1.95	3.48	0.5	14.67	52.30
ON56	661729	0.0237	15.191	0.25	0.50	80	19	2.60	4.65	0.5	4.94	17.65
ON57	125370	0.0045	2.878	0.40	0.50	85	26	2.21	3.95	0.5	1.27	2.84
ON58	141078	0.0051	3.239	0.90	0.93	85	26	2.21	3.95	0.5	3.22	5.94
ON59	128695	0.0046	2.954	0.73	0.80	87	12	3.17	5.67	0.5	3.42	6.71
ON60	232141	0.0083	5.329	0.73	0.80	87	15	2.96	5.28	0.5	5.76	11.26
ON61	314448	0.0113	7.219	0.73	0.80	87	17	2.74	4.90	0.5	7.21	14.14
ON62	147074	0.0053	3.376	0.73	0.80	87	13	3.07	5.50	0.5	3.78	7.42
ON63	136650	0.0049	3.137	0.75	0.83	97	11	3.28	5.87	0.5	3.85	7.64
ON64	48748	0.0017	1.119	0.40	0.50	85	14	2.98	5.33	0.5	0.67	1.49
ON65	75784	0.0027	1.740	0.90	0.93	98	14	2.98	5.33	0.5	2.33	4.31
ON66	315370	0.0113	7.240	0.73	0.80	87	10	3.42	6.12	0.5	9.04	17.72
ON67	90233	0.0032	2.071	0.73	0.80	87	8	3.67	6.58	0.5	2.77	5.45
ON68	343125	0.0123	7.877	0.73	0.80	89	12	3.17	5.67	0.5	9.11	17.88
ON69	1836214	0.06587	42.1537	0.73	0.80	90	15	2.96	5.28	0.5	45.54	89.03
ON70	698144	0.02504	16.0272	0.73	0.80	92	17	2.74	4.90	0.5	16.01	31.39
ON71	561195	0.02013	12.8833	0.62	0.71	86	21	2.48	4.42	0.5	9.89	20.24
ON72	698144	0.02504	16.0272	0.73	0.80	92	12	3.17	5.67	0.5	18.53	36.38
ON73	762346	0.02735	17.5011	0.73	0.80	87	12	3.17	5.67	0.5	20.24	39.73

4.4 Drainage Basin Delineation and Flow Patterns

Baseline studies for drainage basin boundaries and flow patterns developed for the interim conditions hydrologic models were referenced from the City of Las Vegas Northwest Neighborhood Flood Control Master Plan Phase 2 (CLV, 1999) and the Las Vegas Wash Middle Branch Preliminary Design Report (LBG, 2006) for basins east of US 95, and the Conceptual Offsite Hydrology Report for the US 95 Environmental Document, Rainbow Boulevard to Kyle Canyon Road (VTN, 2004) for basins west of US 95. Figure A-2A and A-2B in Appendix A provide a graphic representation of the source for each basin in the model (see volume II of 30% Preliminary Design Report for excerpts of these three studies).

The Northwest Neighborhood Flood Control Master Plan hydrologic basin boundaries and parameters were used for basins east of US 95. Some of the Northwest Neighborhood basin boundaries and flow patterns east of US 95 were modified slightly in the Las Vegas Wash Middle Branch Preliminary Design Report based on field observations and recent land development.

The Conceptual Offsite Hydrology Report for the US 95 Environmental Document was used for basins west of US 95 and flow diversions through culverts at US 95. While the Northwest Neighborhood study also included the area west of US 95 and flow diversions, the VTN report is more current and detailed than the Northwest Neighborhood study.

Basin boundaries in the area of developments for Log Cabin Ranch, Tule Springs Ranch South, Spring Mountain Twilight, and Paiute Crossing at Tule Springs (NW92, NW93, NW125, NW126, NW127, NW141, NW129, NW130, and NW131) were redrawn to more accurately reflect the flow patterns. The remaining modified basin boundaries (See Figure A-2A) were redrawn to reflect current topography or to more accurately quantify inflow into the detention basins.

The direction of flow for runoff is mostly from west to east as it works its way through the developed area between US 95 and the NEEA and SEEA. The south boundary of the SEEA watershed (See Figures 4.1 through 4.3) generally follows Racel Street. Under Interim conditions, the dividing line between the SEEA and NEEA watersheds largely follows O'Hare Avenue between US 95 and Durango Drive. Under future conditions, it is assumed that runoff west of El Capitan Way is cut off by that storm drain system and directed into the SEEA. The northern boundary of the watersheds is irregular and is based on the Las Vegas Wash Middle Branch – Alternatives Summary Memorandum. Flow summary tables showing basin name, acreage, and flow are provided on Figures 4.1 through 4.4.

Table 5.9 - Interim Condition 100-yr Storm

Basin	Volume (ac-ft)	Q_p (cfs)	Y_s (tons)	Wash Load (ac-ft)	BML (ac-ft)	Total Sediment (ac-ft)	Total Sediment (ac-ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CCNW115	117	745	86	0.027	1.217	1.244	South Enhancement Area 2.617
CNW114S	186	1351	156	0.049	1.215	1.265	
NW146W	6	80	5	0.002	0.107	0.108	
CNW128N	50	493	250	0.079	0.000	0.079	North Enhancement Area 0.172
CNW128S	25	302	127	0.040	0.000	0.040	
CNW157	33	380	169	0.053	0.000	0.053	

Table 5.10 - Future Condition of 100-yr Storm

Basin	Volume (ac-ft)	Q_p (cfs)	Y_s (tons)	Wash Load (ac-ft)	BML (ac-ft)	Total Sediment (ac-ft)	Total Sediment (ac-ft)
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
CNW114N	10	129	10	0.003	0.051	0.054	South Enhancement Area 0.717
CNW114S	90	1058	107	0.034	0.521	0.555	
NW146W	6	83	6	0.002	0.107	0.109	
CNW128N	26	273	175	0.055	0.000	0.055	North Enhancement Area 0.184
CNW128S	14	158	91	0.029	0.000	0.029	
CNW157	43	480	318	0.100	0.000	0.100	

The design sediment loads for the two Environmental Enhancement Areas under interim and future conditions for 2-yr storm were shown in Table 5.11. and Table 5.12, respectively.

6.0 CONVEYANCE FACILITY DESIGN

Methods applied for the sizing of conveyance facilities and appurtenances including energy dissipaters, channels, storm drains, are drop inlets are discussed briefly in this section. Table 6.1 shows the design summary for freeboard, design velocity, and riprap sizes for various locations throughout the project. The channels were sized for the greater of one foot of freeboard under future conditions or no freeboard under interim conditions. The hydraulic characteristics (Y_{max} and S_e) utilized in determining the minimum rock size was based on the 100-year water flow depth and channel slope.

For the "C1", "C2", "C3", and "C4" channels the riprap was sized using the methods outlined in Chapter 6 of Hydrologic Engineering Circular No. 15 (HEC-15). Riprap in remaining locations was sized using Equation 736 (Tractive Stress equation) documented in the Manual. The Tractive Stress method typically results in a more conservative, larger size than HEC-15; however the quantities involved are smaller than the channels and it gives an increased factor of safety where embankments are involved.

The maximum riprap D50 size for the project is 24 inches. The steepest design slope for riprap is 2.5 horizontal to 1 vertical. The maximum design velocity exceeds the recommended value of 10 feet/sec for loose riprap in some cases. Although the Manual calls for grouted riprap, the loose riprap has advantages, such as remaining flexible over time and being more visually appealing in the park environment. Using future flows for riprap design results in slightly more maintenance expense under interim conditions. The thickness of the riprap along the berms was designed to be two times D_{50}, and the top of the riprap will be set at the 100-year water surface calculated using Manning's equation and freeboard requirements. The toe protection for the berm side slope revetment will be based on the Method shown in Figure 705D the Manual. A riprap apron was designed for the downstream side of the sloping rock drop structures to protect against local scour downstream of the structure. The size of riprap for the apron would be the same size calculated for the drop structure.

Table 6.1 – Channel/Berm Design Summary

Location	Minimum Freeboard	Maximum Velocity	Riprap D_{50}	Design Flow	Design Condition
SEEA North Berm	1 ft	3.96 ft/sec	6 inches	692 cfs	Interim
SEEA South Berm	4.04 ft	8.64 ft/sec	24 inches	1357 cfs	Interim
"C1" Channel	-	9.07 ft/sec	18 inches	441 cfs	Interim
"C2" Channel	1.14 ft	5.82 ft/sec	18 inches	1237 cfs	Future
"C2" Drop Structure	1.29 ft	8.49 ft/sec	24 inches	1237 cfs	Future

"C3" Channel	1.08 ft	3.94 ft/sec	12 inches	273 cfs	Future
"C3" Channel Drop Structure	1.12 ft	7.47 ft/sec	12 inches	273 cfs	Future
"C4" Channel	1.16 ft	8.23 ft/sec	18 inches	480 cfs	Future
"C4" Channel Transition	1.14 ft	4.23 ft/sec	24 inches	480 cfs	Future
NEEA South Berm	1 ft	4.06 ft/sec	6 inches	273 cfs	Future
NEEA North Berm	1 ft	3.96 ft/sec	6 inches	480 cfs	Future
NEEA West Berm	1 ft	2.84 ft/sec	6 inches	273 cfs	Future

6.1 SEEA Conveyance Facilities

There are four main collection facilities for the SEEA: 1) the Racel Street and El Capitan Way storm drains; 2) the drainage easement storm drains to the west of the SEEA; 3) the "C1" channel and the "C2" channel (see Figure 6.1). The Racel Street and El Capitan Way storm drain facility extends from the intersection of El Capitan Way and Horse Drive to the southwest corner of the SEEA. This facility consists of storm drain pipe ranging in size from 60-inch RCP to 96-inch (baffled) RCP at the discharge point into the SEEA. See the design plans for a layout of the above mentioned facilities.

6.1.1 Racel Street Storm Drain

The majority of the Racel Street storm drain is 78-inch RCP and conveys a 100-year flow of approximately 657 cfs (see Figure 6.1 and the design plans).

This storm drain system was designed to capture convey the 100-year, 6-hour storm flow entering El Capitan Way between Horse Drive and Racel Street and entering Racel Street between El Capitan Way and Cimarron Road. The storm drain also intercepts runoff conveyed in the existing 48-inch storm drain at Racel Street and Durango Drive.

Topographic Constraints

Along El Capitan Way, the slope of the pipe is opposite the street surface; therefore, the design slope of the pipe was set as flat as possible to minimize excessive excavation and trench depth. A minimum of 1 foot of cover above the hydraulic grade line was maintained in the design (See design plans for RCP profile). The pipe invert at the upstream end is controlled by the existing storm drain north of Horse Drive. As the storm drain turns down Racel Street to the east, the grade was held to a minimum until the pipe depth was level. From there it will follow the street slope. The storm drain will not be downsized on Racel Street in order to minimize potential clogging at the choke

DS#4636

TECHNICAL DRAINAGE STUDY FOR HORSE AND COKE RESIDENTIAL DEVELOPMENT

DS #: 4636.1

APN: 125.09.702.001 & More

PROJECT: Horse and Colce Residential Development Update #1

SUBMITTAL: 4th

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: September 29, 2015
TO: **Land Development Services** Department of Building & Safety				FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for: **Horse and Coke Residential Development – Update #1**			**COPIES TO:** Taney Engineering
Cross Streets:	West of Horse Drive & Coke Avenue			William Lyon Homes
File Number:	F:\Depot\DSMemos\DS4636E.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-09-702-001 & More			CLV Operations & Maintenance Attn: Daphnee Legarza, P.E.
Zoning Action:	TMP-41623; EOT-50733			CCRFCD
FEMA Flood Zone	YES	NO	X	CCPW
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1st Submittal	11/4/2013	11/19/2013	Not Approved	$400.00	338365: $400
2nd Submittal	1/21/2014	2/4/2014	Not Approved	$400.00	345547: $400
3rd Submittal	7/7/2014	7/21/2014	Conditional Approval	$400.00	362663: $400
CCRFCD	8/26/2014	8/26/2014	Concurrence Recv'd	N/C	N/C
CCPW	8/29/2014	9/29/2015	Concurrence Recv'd	N/C	N/C
4th Submittal	9/15/2015	9/29/2015	See Comments Below	$100.00	414623: $100
			TOTAL FEES (LDDRS):	**$1,300.00**	----

REMARKS:

4th Submittal: Update #1 to add Optional Accessory Structures in backyard

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

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

The following comments are repeated until they are complete:

1. The *City Council* of the *City of Las Vegas* recently adopted an amendment to Title 20 of the Municipal Code in which Section 20.10.030 requires all public drainage easements to be concrete lined.

   Revise the grading plan, *Detail Sections M/GD2, N/GD2, O/GD2* and all pertinent plans and construction notes to provide all concrete in the 10'-wide drainage channel portion. Also clearly distinguish the width of the drainage easement as 10'-wide only. Do not mingle the drainage with other purposes (such as pedestrian access) in one easement.

2. 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.

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 the 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.

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

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

END OF REMARKS

ays

T/R/S: T19S/R60E/09
AREA G-09

```
                    IDATE      1    0  STARTING DATE
                    ITIME           0000  STARTING TIME
                       NQ            300  NUMBER OF HYDROGRAPH ORDINATES
                    NDDATE     2    0  ENDING DATE
                    NDTIME          0055  ENDING TIME
                    ICENT             19  CENTURY MARK

                  COMPUTATION INTERVAL      .08 HOURS
                      TOTAL TIME BASE    24.92 HOURS

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

     JP          MULTI-PLAN OPTION
                      NPLAN              1  NUMBER OF PLANS

     JR          MULTI-RATIO OPTION
                     RATIOS OF PRECIPITATION
                     .57      1.00
1

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


                                                                    RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN                  RATIO 1  RATIO 2
                                                                 .57     1.00

 HYDROGRAPH AT
+                   DON1        .02      1   FLOW              11.      26.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                   DOF2        .00      1   FLOW               3.       6.
                                             TIME            3.50     3.50

 HYDROGRAPH AT
+                   XOF1        .03      1   FLOW               0.       6.
                                             TIME            4.83     3.58

 HYDROGRAPH AT
+                   XOF2        .00      1   FLOW               4.       7.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                   XOF3        .00      1   FLOW               3.       5.
                                             TIME            3.50     3.50

  5 COMBINED AT
+                    CP1        .05      1   FLOW              20.      49.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                   DON2        .02      1   FLOW               9.      23.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                   DOF3        .00      1   FLOW               3.       6.
                                             TIME            3.50     3.50

 HYDROGRAPH AT
+                   XOF4        .00      1   FLOW               2.       4.
                                             TIME            3.50     3.50

  3 COMBINED AT
+                    CP2        .02      1   FLOW              13.      31.
                                             TIME            3.58     3.58


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

```
                IDATE      1    0  STARTING DATE
                ITIME           0000  STARTING TIME
                   NQ            300  NUMBER OF HYDROGRAPH ORDINATES
               NDDATE      2    0  ENDING DATE
               NDTIME           0055  ENDING TIME
               ICENT             19  CENTURY MARK

            COMPUTATION INTERVAL     .08 HOURS
                TOTAL TIME BASE   24.92 HOURS

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

JP          MULTI-PLAN OPTION
               NPLAN             1  NUMBER OF PLANS

JR          MULTI-RATIO OPTION
              RATIOS OF PRECIPITATION
              .57      1.00
1

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

                                                                  RATIOS APPLIED TO PRECIPITATION
 OPERATION       STATION      AREA     PLAN                 RATIO 1  RATIO 2
                                                               .57     1.00

 HYDROGRAPH AT
+                  DON1        .02      1    FLOW             11.      26.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                  DOF2        .00      1    FLOW              3.       6.
                                             TIME            3.50     3.50

 HYDROGRAPH AT
+                  DOF1        .03      1    FLOW              6.      24.
                                             TIME            3.50     3.50

 HYDROGRAPH AT
+                  XOF2        .00      1    FLOW              4.       7.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                  XOF3        .00      1    FLOW              3.       5.
                                             TIME            3.50     3.50

  5 COMBINED AT
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                                             TIME            3.58     3.50

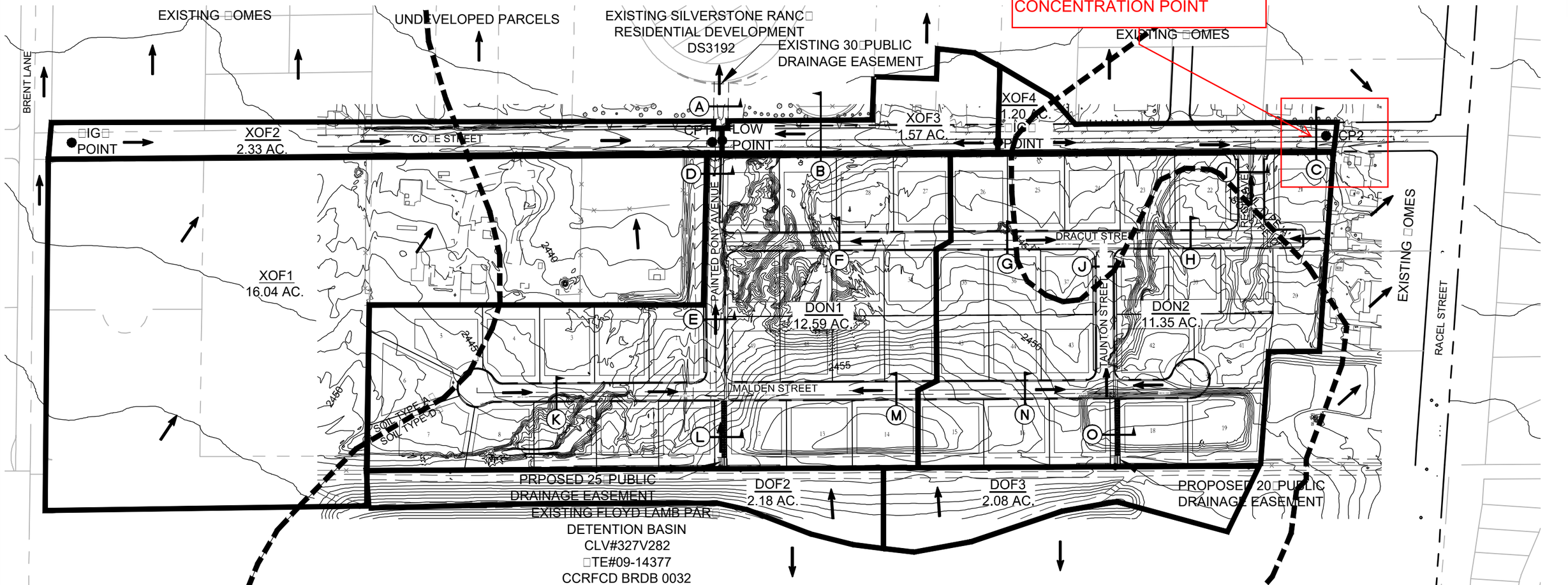
 HYDROGRAPH AT
+                  DON2        .02      1    FLOW              9.      23.
                                             TIME            3.58     3.58

 HYDROGRAPH AT
+                  DOF3        .00      1    FLOW              3.       6.
                                             TIME            3.50     3.50

 HYDROGRAPH AT
+                  XOF4        .00      1    FLOW              2.       4.
                                             TIME            3.50     3.50

  3 COMBINED AT
+                   CP2        .02      1    FLOW             13.      31.
                                             TIME            3.58     3.58

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



Cross Section	Description	Q (cfs)	Depth (ft)	Velocity (ft/s)	DxV	Cross Section	Description	Q (cfs)	Depth (ft)	Velocity (ft/s)	DxV
A	CP1	64	0.60	4.70	2.82	H - 10yr	DON2+DOF3	12	0.55	3.82	2.10
B - 100yr	XOF3	5	0.36	2.00	0.72	I - 10 yr	DON2+DOF3	12	0.43	2.10	0.90
B - 10yr	XOF3	3	0.32	1.78	0.57	I - 100 yr	DON2+DOF3	29	0.54	2.74	1.48
C - 100yr	CP2	31	0.48	3.03	1.45	J - 100yr	DON2+DOF3	29	0.49	2.78	1.36
C - 10yr	CP2	13	0.36	2.55	0.92	J - 10yr	DON2+DOF3	12	0.38	1.95	0.74
D - 100yr	DON1+DOF2	32	0.43	4.81	2.07	K - 100yr	1/2(DON1)	13	0.64	2.93	1.88
D - 10yr	DON1+DOF2	14	0.32	3.52	1.13	K - 10yr	1/2(DON1)	5.5	0.48	2.36	1.13
E - 100yr	DON1+DOF2	32	0.43	3.96	1.70	L	DOF2	6	0.57	1.78	1.01
E - 10yr	DON1+DOF2	14	0.35	2.87	1.00	M - 100yr	1/2(DON1)	13	0.49	5.36*	2.63
F - 100yr	1/2(DON1)	13	0.51	4.93	2.51	M - 10yr	1/2(DON1)	5.5	0.37	4.38	1.62
F - 10yr	1/2(DON1)	5.5	0.39	3.96	1.54	N - 100yr	1/2(DON2)	11.5	0.50	4.61	2.31
G - 100yr	1/2(DON2)	11.5	0.54	3.78	2.04	N - 10yr	1/2(DON2)	4.5	0.37	3.69	1.37
G - 10yr	1/2(DON2)	4.5	0.40	2.98	1.19	O	DOF3	6	0.57	1.78	1.01
H - 100yr	DON2+DOF3	29	0.74	4.76	3.52						

*True flow is only 1/4 of DON1; therefore velocity is acceptable

Interim Condition			
Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
CP1	34.71	20	49
CP2	14.63	13	31
DOF2	2.183	3	6
DOF3	2.084	3	6
DON1	12.59	11	26
DON2	11.35	9	23
XOF1	16.04	0	6
XOF2	2.33	4	7
XOF3	1.57	3	5
XOF4	1.2	2	4

DRAINAGE LEGEND

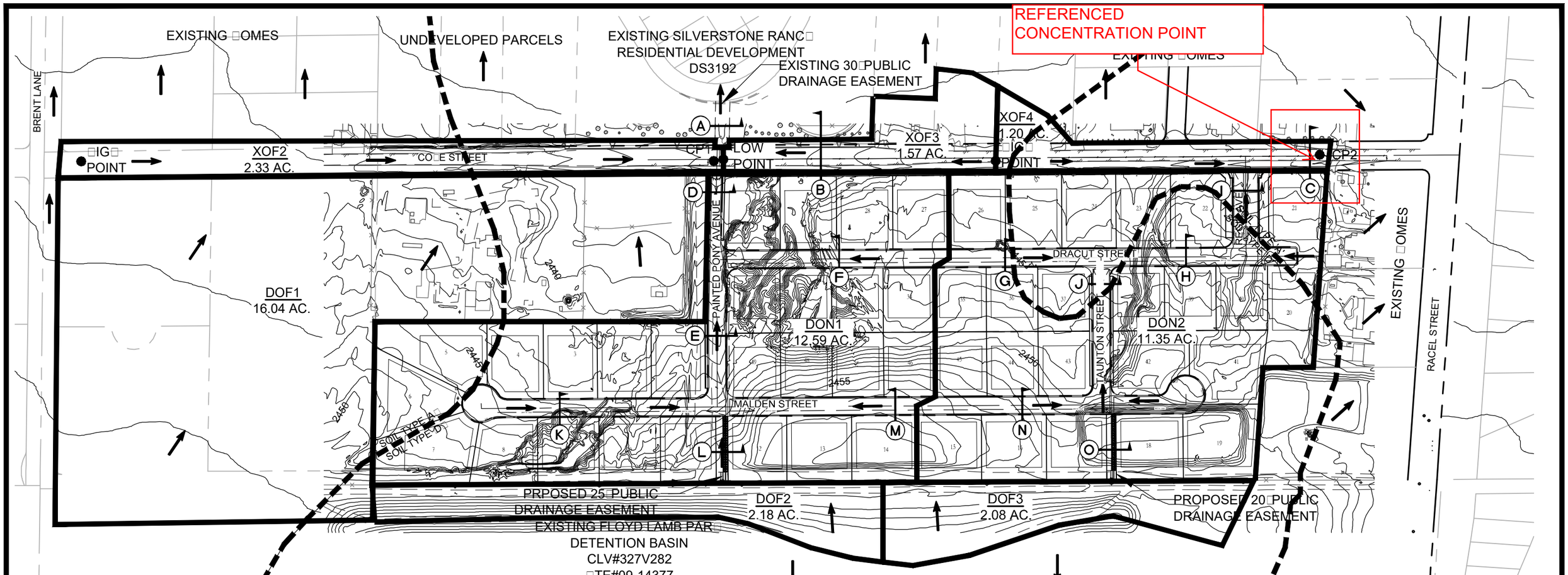
XOF1	BASIN IDENTIFICATION
	BASIN BOUNDARY
C1	CONCENTRATION POINT
	FLOW PATH
A	CROSS SECTION
XX/XXX	10-YR/100-YR FLOW (CFS)
(XX/XXX)	REFERENCE FLOW (CFS)

200 0 100 200 400

(IN FEET)
1 inch = 200ft.

TANEY ENGINEERING
6030 S. JONES BLVD STE#100
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233

FIGURE 9
INTERIM BASIN MAP
HORSE & COKE



Cross Section	Description	Q (cfs)	Depth (ft)	Velocity (ft/s)	DxV
A	CP1	64	0.60	4.70	2.82
B - 100yr	XOF3	5	0.36	2.00	0.72
B - 10yr	XOF3	3	0.32	1.78	0.57
C - 100yr	CP2	31	0.48	3.03	1.45
C - 10yr	CP2	13	0.36	2.55	0.92
D - 100yr	DON1+DOF2	32	0.43	4.81	2.07
D - 10yr	DON1+DOF2	14	0.32	3.52	1.13
E - 100yr	DON1+DOF2	32	0.43	3.96	1.70
E - 10yr	DON1+DOF2	14	0.35	2.87	1.00
F - 100yr	1/2(DON1)	13	0.51	4.93	2.51
F - 10yr	1/2(DON1)	5.5	0.39	3.96	1.54
G - 100yr	1/2(DON2)	11.5	0.54	3.78	2.04
G - 10yr	1/2(DON2)	4.5	0.40	2.98	1.19
H - 100yr	DON2+DOF3	29	0.74	4.76	3.52

Cross Section	Description	Q (cfs)	Depth (ft)	Velocity (ft/s)	DxV
H - 10yr	DON2+DOF3	12	0.55	3.82	2.10
I - 10 yr	DON2+DOF3	12	0.43	2.10	0.90
I - 100 yr	DON2+DOF3	29	0.54	2.74	1.48
J - 100yr	DON2+DOF3	29	0.49	2.78	1.36
J - 10yr	DON2+DOF3	12	0.38	1.95	0.74
K - 100yr	1/2(DON1)	13	0.64	2.93	1.88
K - 10yr	1/2(DON1)	5.5	0.48	2.36	1.13
L	DOF2	6	0.57	1.78	1.01
M - 100yr	1/2(DON1)	13	0.49	5.36*	2.63
M - 10yr	1/2(DON1)	5.5	0.37	4.38	1.62
N - 100yr	1/2(DON2)	11.5	0.50	4.61	2.31
N - 10yr	1/2(DON2)	4.5	0.37	3.69	1.37
O	DOF3	6	0.57	1.78	1.01

*True flow is only 1/4 of DON1; therefore velocity is acceptable

Ultimate Condition			
Basin	Area (ac)	Q_{10} (cfs)	Q_{100} (cfs)
CP1	34.71	25	64
CP2	14.63	13	31
DOF1	2.183	6	24
DOF2	2.084	3	6
DON1	12.59	3	6
DON2	11.35	11	26
XOF1	16.04	9	23
XOF2	2.33	4	7
XOF3	1.57	3	5
XOF4	1.2	2	4

DRAINAGE LEGEND	
XOF1	BASIN IDENTIFICATION
	BASIN BOUNDARY
C1	CONCENTRATION POINT
	FLOW PATH
A	CROSS SECTION
XX/XXX	10-YR/100-YR FLOW (CFS)
(XX/XXX)	REFERENCE FLOW (CFS)

200 0 100 200 400

(IN FEET)
1 inch = 200ft.

TANEY ENGINEERING
6030 S. JONES BLVD STE#100
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233

FIGURE 10
ULTIMATE BASIN MAP
HORSE & COKE

APPENDIX E

Improvement Plans

IMPROVEMENT PLANS
FOR
RACEL & TIOGA
RESIDENTIAL SUBDIVISION
CITY OF LAS VEGAS, NEVADA
APN: 125-10-402-001

FAST Call before you Underground 1-702-432-5300 FREEWAY & ARTERIAL SYSTEM OF TRANSPORTATION

Avoid overhead power line contact. it's costly. Call before you Overhead 1-702-227-2929

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

SHEET INDEX		
Sheet Number	Sheet Title	Sheet Description
01	C1	COVER SHEET
02	C2	NOTES AND QUANTITIES
03	G1	GRADING PLAN - SOUTH
04	G2	GRADING PLAN - NORTH
05	GD1	GRADING DETAILS
06	PP1	PLAN AND PROFILE - PRIVATE ST - SOUTH
07	PP2	PLAN AND PROFILE - ACKERMAN AVE
08	PP3	PLAN AND PROFILE - PRIVATE ST - NORTH

LEGEND

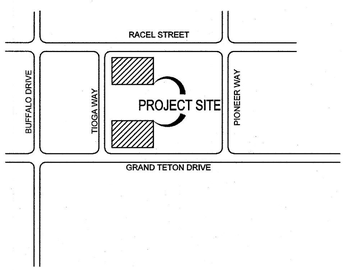
	EXISTING	PROPOSED
PROJECT BOUNDARY		
RIGHT-OF-WAY		
CENTERLINE		
PROPERTY LINE		
EDGE OF PAVEMENT		
SIDEWALK		
CURB AND GUTTER		
FENCE		
CONTOUR (1' INTERVAL)		
CONTOUR (5' INTERVAL)		
DIRECTION OF FLOW		
CUT LINE-ASPHALT		
SCARP (SLOPE VARIES)		
DESIGN ELEVATION	(10.00)	10.00
FUTURE ELEVATION		[10.00]
NUMBER OF RETAINING COURSES		10
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		PRV
BACKWATER VALVE		BWV
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		

OWNER
INVESTOR EQUITY HOMES LLC
3960 HOWARD HUGHES PKWY, SUITE 150
LAS VEGAS, NV 89169

ENGINEER
TANEY ENGINEERING
6030 SOUTH JONES BLVD
LAS VEGAS, NV 89118
(702) 362-5844 PHONE (702) 362-5233 FAX
EMAIL: INFO@TANEYCORP.COM

DEVELOPER
AMH DEVELOPMENT, LLC
280 PILOT RD., SUITE 100
LAS VEGAS, NV 89119
(702) 703-3542

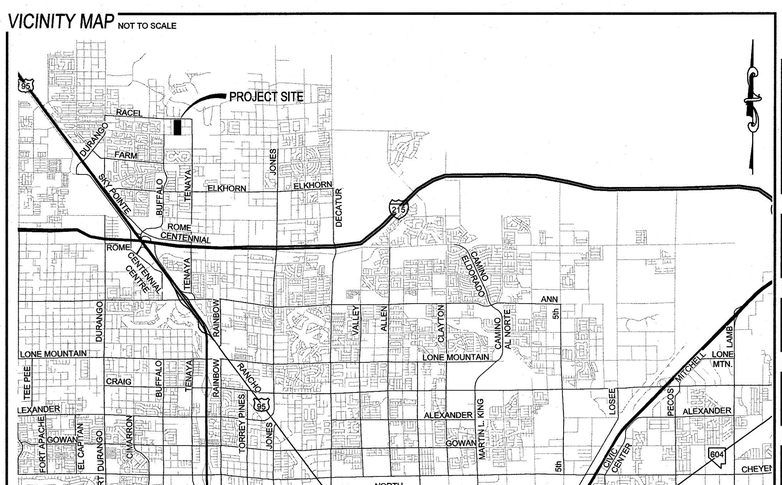
SITE MAP
NOT TO SCALE



ABBREVIATIONS

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

VICINITY MAP
NOT TO SCALE



SUBDIVISION INFORMATION

ACRES:	4.5 AC
AREA DISTURBED:	4.5 AC
LOTS:	8
LOT SIZE:	24243 SF
ZONING:	RESIDENCE ESTATES DISTRICT (R-E)
FMP:	N/A
TMP:	N/A
SETBACKS:	
FRONT:	30 FT
REAR:	35 FT
SIDE:	10 FT
CORNER:	15 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 89°40'02" EAST,
BEING THE BEARING OF THE SOUTH LINE OF THE SOUTHWEST QUARTER (SW1/4)OF THE SOUTHWEST QUARTER (SW1/4)OF SECTION 10, T. 19 S., R. 60 E., M.D.M., CLARK COUNTY, NEVADA, AS SHOWN BY THE FINAL MAP RECORDED OCTOBER 7, 2014IN BOOK 147 OF PLATS, PAGE 82, OFFICIAL RECORDS OF CLARK, COUNTY NEVADA

BENCHMARK
CITY OF LAS VEGAS BENCHMARK MONUMENT ID NUMBER 6LV9010SW6 RIVET & PLATE TOP CURB N. SIDE RACEL ST. @ PIONEER WAY.
ELEVATION: 732.93709 METERS (NAVD88)
2,404.64 FEET

LEGAL DESCRIPTION
THE SOUTH HALF (S 1/2) OF THE SOUTHEAST QUARTER (SE 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) SECTION 27, TOWNSHIP 22 SOUTH, RANGE 61 EAST, M.D.B. & M. EXCEPTING THEREFROM THE SOUTH 45 FEET OF SAID SOUTH 1/2.

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# I22XXX FIRST APPROVED DATE
LVWD APPROVED FIRE FLOW: XXXX GPM AT 20 PSI RESIDUAL
MAXIMUM AVAILABLE FIRE SPRINKLER FLOW XXXX GPM
SHEETS: XXXXXX

CITY ENGINEER – ALLEN PAVELKA, PE #9029 DATE
APPROVAL OF THESE PLANS BY THE CITY ENGINEER IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY, AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARDS. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARD IN FAVOR OF THE UNIFORM STANDARD DRAWINGS AND SPECIFICATIONS, CLARK COUNTY AREA, NEVADA.

CITY OF LAS VEGAS, PLANNING DEPARTMENT DATE
THIS PLAN MEETS THE APPLICABLE STANDARDS OF THE PLANNING DEPARTMENT.

NO.	DESCRIPTION	BY	APPR.	DATE
REVISIONS				

ADAVEN HOMES
3425 CLIFF SHADOWS PKWY
LAS VEGAS, NV 89129
(702) 395-8588 FAX: —

TANEY ENGINEERING
6030 S. JONES BLVD
LAS VEGAS, NV 89118
(702) 362-5844 FAX: (702) 362-5233

EST. 2000

RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
COVER SHEET

PROFESSIONAL ENGINEER STATE OF NEVADA
S. JUSTIN THORNE
Exp. 06-30-20
CIVIL
No. 22841
4/17/19

DATE:	4/17/2019
SCALE:	1"=30'
JOB NO:	ADV-18-101
DESIGNED BY:	JT
CHECKED BY:	BEM
SHEET NAME:	C1
SHEET NUMBER:	01 OF 8
—	—
CITY	0000000

LAST PLOT: Matt Khalfa
FILE NAME: S:\ACTIVE\ADAVEN HOMES\ADV-18-101 - RACEL & TIOGA\ENG\PS\DWGS\DWGS\SHEET DWGS\ADV18101_SHT_C.DWG

CLV GENERAL NOTES

1. ALL CONSTRUCTION AND MATERIALS SHALL BE IN ACCORDANCE WITH THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY, NEVADA AREA". LATEST ISSUE. THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION, CLARK COUNTY AREA, NEVADA" LATEST REVISED EDITION; THE "SUMMERLIN IMPROVEMENT STANDARDS" FOR WORK IN THE SUMMERLIN AREA; AND OTHER APPLICABLE APPROVED STANDARDS ISSUED BY THE CONTROLLING AGENCY; THE UNIFORM BUILDING CODE; AND ALL LOCAL CITY CODES AND ORDINANCES APPLICABLE, EXCEPT AS NOTED ON THIS SHEET AS "DEVIATIONS FROM STANDARDS".

2. THE EXISTENCE AND LOCATION OF ANY OVERHEAD OR UNDERGROUND UTILITY LINES, PIPES, OR STRUCTURES SHOWN ON THESE PLANS ARE OBTAINED BY A RESEARCH OF THE AVAILABLE RECORDS. EXISTING UTILITIES AS SHOWN FROM CLV PLANS LIBRARY ARE APPROXIMATE AND FOR RECORD PURPOSES. EXISTING UTILITIES ARE LOCATED ON PLANS ONLY FOR THE CONVENIENCE OF THE CONTRACTOR. EXISTING UTILITY SERVICE LATERALS MAY NOT BE SHOWN ON THE PLANS. THE CONTRACTOR SHALL, AT HIS OWN EXPENSE. LOCATE ALL UNDERGROUND AND OVERHEAD INTERFERENCES WHICH MAY AFFECT HIS OPERATION DURING CONSTRUCTION AND SHALL TAKE ALL NECESSARY PRECAUITIONS TO AVOID DAMAGE TO SAME. THE CONTRACTOR SHALL USE EXTREME CAUTION WHEN WORKING NEAR OVERHEAD UTILITIES SO AS TO SAFELY PROTECT ALL PERSONNEL AND EQUIPMENT, AND SHALL BE RESPONSIBLE FOR ALL COST AND LIABILITY IN CONNECTION THEREWITH.

3. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONARY MEASURES NECESSARY TO PROTECT EXISTING UTILITY LINES, STRUCTURES, AND STREET IMPROVEMENTS WHICH ARE TO REMAIN IN PLACE, FROM DAMAGE, AND ALL SUCH IMPROVEMENTS OR STRUCTURES DAMAGED BY THE CONTRACTOR'S OPERATIONS SHALL BE REPAIRED OR REPLACED SATISFACTORY TO THE CITY ENGINEER AND OWNING UTILITY COMPANY AT THE EXPENSE OF THE CONTRACTOR.

4. ALL CONSTRUCTION SHALL BE AS SHOWN ON THESE PLANS. ANY REVISIONS SHALL HAVE THE PRIOR WRITTEN APPROVAL OF THE CITY ENGINEER.

5. TYPE V CEMENT SHALL BE USED IN ALL OFF-SITE WORK. CONCRETE TO BE 3000 P.S.I. MINIMUM @ 28 DAYS. MIX DESIGN TO BE APPROVED BY THE CITY, PRIOR TO USE ON THE PROJECT.

6. PERMITS ARE REQUIRED FOR ANY WORK IN THE PUBLIC RIGHT-OF-WAY. THE CONTRACTOR SHALL SECURE ALL PERMITS AND INSPECTIONS REQUIRED FOR THIS CONSTRUCTION.

7. EXPANSION JOINTS REQUIRED, MAXIMUM OF EVERY 300' IN EXTRUDED-TYPE CURB.

8. AC PAVEMENT TO BE ONE-HALF INCH (1/2") ABOVE LIP OF ALL GUTTERS AFTER COMPACTION, EXCEPT AT SIDEWALK RAMPS AND CROSS GUTTERS.

9. CURB AND GUTTER FOUND TO BE UNACCEPTABLE TO THE CITY OF LAS VEGAS SHALL BE REMOVED AND REPLACED PER STANDARD DRAWING 216.

10.SIDEWALK RAMPS SHALL BE CONSTRUCTED IN EACH QUADRANT OF AN INTERSECTION PER STANDARD DRAWING 235. EXACT LOCATION OF RAMPS MAY BE ADJUSTED IN THE FIELD BY A CITY INSPECTOR.

11.CONTRACTOR SHALL PROVIDE ALL NECESSARY HORIZONTAL AND VERTICAL TRANSITIONS BETWEEN NEW CONSTRUCTION AND EXISTING SURFACES TO PROVIDE FOR PROPER DRAINAGE AND FOR INGRESS AND EGRESS TO NEW CONSTRUCTION. THE EXTENT OF TRANSITIONS TO BE AS SHOWN ON PLANS.

12.ALL GRADING WORK SHALL CONFORM TO THE SOILS REPORT AS PREPARED BY THE (COMPANY_REPORT#, DATE) APPROVED BY THE CITY ENGINEER, AND AS SHOWN ON THESE PLANS.

13.EXACT LOCATION OF ALL SAWCUT LINES MAY BE ADJUSTED OR DETERMINED IN THE FIELD BY A CITY OF LAS VEGAS ENGINEER IF LOCATION ON PLANS IS NOT CLEARLY SHOWN, OR EXISTING PAVEMENT CONDITION REQUIRES RELOCATIONS.

14. THE CONTRACTOR SHALL TAKE ALL PRECAUTIONS NECESSARY TO PROTECT EXISTING PERMANENT SURVEY MONUMENTS. ANY MONUMENTS DISTURBED SHALL BE REPLACED AND ADJUSTED PER AVAILABLE RECORDS IN ACCORDANCE WITH N.R.S. STATUTE No. 625.380 & CITY OF LAS VEGAS TITLE 18, APPENDIX D.

15.UTILITY COMPANY METER BOXES, MANHOLE LIDS, VALVE COVERS, ETC. SHALL BE LOCATED OUT OF DRIVEWAYS, DRIVEWAY APRONS, FLOWLINES, AND CROSS GUTTERS UNLESS WRITTEN APPROVAL IS GRANTED BY THE UTILITY COMPANY AND THE CITY ENGINEER.

WALL NOTES:

16.ALL WALLS, NEW OR EXISTING, ARE ONLY SHOWN ON CIVIL PLANS FOR THE PURPOSE OF REVIEWING GRADING RELATIONSHIPS, FLOOD CONTROL, AND SIGHT DISTANCE AT INTERSECTIONS. NEW WALLS REQUIRE A SEPARATE PERMIT AND INSPECTION BY THE BUILDING DEPARTMENT.

17.ASPHALT MIX DESIGN MUST BE SUBMITTED AND APPROVED BY THE CITY ENGINEER PRIOR TO THE PLACEMENT OF ASPHALT WITHIN CITY RIGHT OF WAY.

18.CONTRACTOR SHALL ADJUST ALL NEW AND EXISTING INLETS, VALVE BOXES, MANHOLE RIMS, AND SEWER CLEANOUTS, ETC. TO FINISH GRADE AS APPLICABLE, WHETHER OR NOT THEY ARE SHOWN ON THE PLANS.

19.MATERIALS, HANDLING, AND PLACEMENT OF PORTLAND CEMENT CONCRETE SHALL BE IN ACCORDANCE WITH APPLICABLE SECTIONS OF NDOT OR THE CLARK COUNTY AREA SPECIFICATIONS (AS APPLICABLE) AND THE PLANS AND DETAILS SHOWN HEREON.

20.WHEN INSTALLING UNDERGROUND FACILITIES THAT REQUIRE UNDERGROUND LOCATING DEVICES SUCH AS MARKER BALLS, LOCATING RIBBON, ETC. THE CONTRACTOR SHALL PROVIDE WRITTEN DOCUMENTATION TO OFFSITE INSPECTION AND TESTING CERTIFYING THAT ALL DEVICES HAVE BEEN PLACED AND VERIFIED TO BE IN GOOD WORKING CONDITION PRIOR TO THE CONSTRUCTION OF ANY ROAD BASE.

21.SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S) SHALL BE PROVIDED TO THE CITY AND APPROVED PRIOR TO ACCEPTANCE OF FACILITY VIDEO INSPECTION. THE MAP(S) SHALL INCLUDE THE HORIZONTAL AND VERTICAL (INVERT) LOCATION OF PUBLIC SEWER MANHOLES, STORM DRAIN MANHOLES AND TRANSITION STRUCTURES, STORM DRAIN LATERALS AT THE CONNECTION TO THE STORM DRAIN MAIN AND AT THE CONNECTION TO A DROP INLET, THE CONNECTION OF SEWER SERVICE LATERALS TO THE SEWER MAIN AND WHERE THE SEWER SERVICE LATERALS EXIT THE PUBLIC RIGHT-OF-WAY, AND STORM DRAIN MAIN ALIGNMENT, INCLUDING DEFLECTION POINTS. THE LOCATION SHALL BE DESCRIBED BY COORDINATES WHICH SHALL BE BASED ON THE OFFICIAL HORIZONTAL AND VERTICAL CONTROL NETWORKS OF THE CITY OF LAS VEGAS. FINAL LOCATION MAPS MUST BE SEALED AND CERTIFIED BY A NEVADA PROFESSIONAL LAND SURVEYOR TO HAVE POSITIONAL CERTAINTIES OF ± 0.09 METERS (± 0.3 FEET) HORIZONTALLY AND VERTICALLY. A SEPARATE ELECTRONIC COMMA DELIMITED FILE FOR THE SANITARY SEWER AND STORM DRAIN COORDINATES SHALL ALSO ACCOMPANY THE SANITARY SEWER AND STORM DRAIN FINAL LOCATION MAP(S).

22.CCTV VIDEO INSPECTION IS REQUIRED FOR ALL SEWER AND STORM DRAINS. THE CCTV VIDEO INSPECTIONS NEED TO BE PERFORMED PER THE DESIGN AND CONSTRUCTION STANDARDS FOR WASTEWATER COLLECTION SYSTEMS LATEST EDITION.

23. A SEPARATE BORING PERMIT IS REQUIRED FOR ALL BORING ACTIVITIES.

CLV STREETLIGHT NOTES

1. ALL STREET LIGHTING INSTALLATION SHALL BE IN ACCORDANCE WITH THE STREET LIGHTING PLANS, THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY, NEVADA AREA", LATEST REVISION, AND THE "UNIFORM STANDARD DRAWINGS FOR PUBLIC WORKS CONSTRUCTION OFF-SITE IMPROVEMENTS, CLARK COUNTY, NEVADA AREA", LATEST REVISION.

2. NO DEVIATION OF STREET LIGHT, PULL BOX, CONDUITS, ETC., LOCATIONS SHALL BE PERMITTED WITHOUT WRITTEN APPROVAL OF THE TRAFFIC/ELECTRICAL FIELD OPERATIONS DIVISION AND THE CONSTRUCTION PROJECT REPRESENTATIVE. ANY DEVIATION FROM THE PLAN LOCATION WILL REQUIRE COMPLIANCE WITH SECTION 623.10.03 (E) OF THE SPECIFICATIONS.

3. ALL EXISTING STREET LIGHTING SHALL REMAIN OPERATIONAL DURING CONSTRUCTION.

4. ALL EMPTY CONDUIT SHALL HAVE PULL STRINGS INSTALLED PRIOR TO FINAL INSPECTION.

5. ANY STRUCTURE, SUCH AS BLOCK WALLS, CHAIN LINK FENCES, RETAINING WALLS, ETC., SHALL LEAVE A MINIMUM OF EIGHTEEN INCHES (18") TO THE FACE OF STREET LIGHTING POLE ON ALL SIDES WHEN STREET LIGHT IS INSTALLED BEHIND SIDEWALK, AND SHALL AT NO TIME COMPLETELY ENCLOSE THE STREET LIGHTING POLE.

6. AS-BUILT DRAWINGS SHALL BE SUPPLIED TO THE ELECTRICAL SERVICES SECTION PRIOR TO ANY PRE-FINAL INSPECTION. THE AS-BUILT DRAWINGS SHALL BE STAMPED AS-BUILT AND SIGNED BY THE PREPARER.

7. SERVICE POINTS SHALL BE COORDINATED WITH NEVADA POWER COMPANY, AND WHEREVER POSSIBLE, SHALL BE LOCATED NEAR THE CENTER OF THE CIRCUIT. SERVICE POINTS SHALL BE SHOWN ON THE PLANS.

8. IT SHALL BE ASSUMED THAT IN THE ABSENCE OF AN EXISTING, WORKABLE CIRCUIT TO ATTACH TO, ALL INSTALLATIONS SHALL REQUIRE A NEW SERVICE FOR OPERATION OF THE CIRUCIT.

9. WHEREVER THERE IS AN OVERHEAD UTILITY THAT MAY CONFLICT WITH THE INSTALLATION OF STREET LIGHTING CIRCUITS AND/OR POLES, THESE CONFLICTS MUST BE RESOLVED BETWEEN THE DEVELOPER AND THE UTILITIES INVOLVED BEFORE STREET LIGHT BASES ARE INSTALLED AT NO EXPENSE TO THE CITY OF LAS VEGAS.

10. THE CONTRACTOR SHALL FURNISH COMPLETE SERVICE TO TRANSFORMERS AND CONTROL SYSTEMS IF REQUIRED ON THE PLANS.

LEGAL DESCRIPTION

THE SOUTH HALF (S 1/2) OF THE SOUTHEAST QUARTER (SE 1/4) OF THE SOUTHWEST QUARTER (SW 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) SECTION 27, TOWNSHIP 22 SOUTH, RANGE 61 EAST, M.D.B. & M. EXCEPTING THEREFROM THE SOUTH 45 FEET OF SAID SOUTH 1/2.

EARTHWORK

TOTAL FOR OVERALL DEVELOPMENT: 819.38 CY CUT / 12,586 CY FILL / 11,766.62 CY NET FILL

NOTE: THIS OPINION OF THE CUT AND FILL QUANTITIES IS PROVIDED AS REQUIRED BY THE GOVERNING ENTITY. THIS INFORMATION SHOULD NOT BE USED FOR BIDDING PURPOSES. ALL CONTRACTORS ARE RESPONSIBLE FOR THEIR OWN QUANTITIES. THESE TOTALS ARE RAW AND DO NOT ACCOUNT FOR SHRINKAGE AND SUBSIDENCE.

CLV TRAFFIC NOTES

1. ALL CONSTRUCTION SIGNING, BARRICADING, AND TRAFFIC DELINEATION SHALL CONFORM TO THE "MANUAL OF UNIFORM TRAFFIC CONTROL DEVICES", LATEST EDITION.

2. THE STREET SIGN CONTRACTOR SHALL OBTAIN STREET NAMES AND BLOCK NUMBERING FROM THE PLANNING DEPARTMENT PRIOR TO CONSTRUCTION.

3. BEFORE ANY WORK IS STARTED IN THE RIGHT-OF-WAY, THE CONTRACTOR SHALL INSTALL ALL ADVANCE WARNING SIGNS FOR THE CONSTRUCTION ZONES. THE CONTRACTOR SHALL INSTALL TEMPORARY STOP SIGNS AT ALL NEW STREET ENCROACHMENT INTO EXISTING CITY STREETS WHERE WARRANTED IMMEDIATELY AFTER GRADING WORK IS ACCOMPLISHED, AND SHALL MAINTAIN SAID SIGNS UNTIL PERMANENT SIGNS ARE INSTALLED.

4. WHEN A DESIGNATED "SAFE ROUTE TO SCHOOL" IS ENCROACHED UPON BY A CONSTRUCTION WORK ZONE AND PUBLIC WORKS STAFF IDENTIFIES A NEED FOR STUDENTS TO BE ASSISTED IN THE SAFE CROSSING THROUGH THAT WORK ZONE, THE CONTRACTOR SHALL BE REQUIRED TO PROVIDE A QUALIFIED "CROSSING GUARD". THE GUARD SHALL BE PRESENT FOR THE FULL DURATION OF TIME THAT CHILDREN ARE LIKELY TO BE PRESENT.

5. IF THE IMPROVEMENTS NECESSITATE THE OBLITERATION, TEMPORARY OBSTRUCTION, TEMPORARY REMOVAL, OR RELOCATION OF ANY EXISTING TRAFFIC PAVEMENT MARKING, SUCH PAVEMENT MARKING SHALL BE RESTORED OR REPLACED WITH LIKE MATERIALS TO THE SATISFACTION OF THE CITY TRAFFIC ENGINEER.

6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR PROVIDING AND INSTALLING ALL PERMANENT SIGNS SHOWN ON THE PLANS. STREET NAME SIGNS SHALL CONFORM IN THEIR ENTIRETY TO CURRENT CITY STANDARDS. ALL OTHER SIGNS SHALL BE STANDARD SIZE UNLESS OTHERWISE SPECIFIED ON THE PLANS. ALL SIGN POSTS SHALL BE INSTALLED IN ACCORDANCE WITH THE CURRENT CITY STANDARDS.

7. WHEN A PROPOSED STREET LIGHT STANDARD IS LOCATED WITHIN FIVE FEET (5') OF ANY PROPOSED SIGN SHOWN ON THE PLANS TO BE MOUNTED ON A SIGN POST, THE SIGN SHALL BE MOUNTED ON THE STREET LIGHT STANDARD AND THE SIGN POST SHALL BE ELIMINATED.

8. ALL PERMANENT TRAFFIC CONTROL DEVICES CALLED FOR HEREON SHALL BE IN PLACE AND IN FINAL POSITION PRIOR TO ALLOWING ANY PUBLIC TRAFFIC ONTO THE PORTIONS OF THE ROAD(S) BEING IMPROVED HEREUNDER, REGARDLESS OF THE STATUS OF COMPLETION OF PAVING OR OTHER OFF-SITE IMPROVEMENTS CALLED FOR BY THESE PLANS.

9. STREET SIGNS AND STOP SIGNS SHALL BE INSTALLED PER CITY STANDARD SPECIFICATIONS FOR PLACEMENT OF STREET NAME SIGNS.

10. THE CONTRACTOR SHALL PROVIDE ALL NECESSARY TRAFFIC CONTROL DEVICES AND FLAGGERS TO EQUIPMENT AND FLAG PERSONS NECESSARY TO ENSURE THE SAFETY OF THE PUBLIC IN AND AROUND THE WORK AREA. THE CONTRACTOR SHALL HAVE A CERTIFIED ATSSA TRAFFIC CONTROL TECHNICIAN OR IMSA WORK ZONE SAFETY SPECIALIST SET UP, MAINTAIN AND/OR REMOVE ALL TRAFFIC CONTROL DEVICES IN THE CITY OF LAS VEGAS RIGHTS-OF-WAY.

11. WORK IN PUBLIC STREETS, ONCE BEGUN, SHALL BE EXPEDITED TO COMPLETION SO AS TO PROVIDE MINIMUM INCONVENIENCE TO ADJACENT PROPERTY OWNERS AND TO THE TRAVELING PUBLIC.

12. THE CONTRACTOR SHALL BE RESPONSIBLE FOR NOTIFYING CITIZEN AREA TRANSIT (C.A.T.) IF THE CONSTRUCTION INTERRUPTS OR RELOCATES A BUS STOP OR HAS AN ADVERSE EFFECT ON BUS SERVICE ON THAT STREET AND SHALL ARRANGE FOR TEMPORARY RELOCATION OF THE STOP.

13. GUARDS SHALL BE OBTAINED BY CONTACTING THE METROPOLITAN POLICE DEPARTMENT SPECIAL EVENTS UNIT (PHONE NO. 229-3442) WHO WILL PROVIDE OFFICERS PROPERLY TRAINED IN TRAFFIC CONTROL. FEES FOR THE USE OF THESE OFFICERS SHALL BE SET BY METRO AND WILL BE PAID BY THE CONTRACTOR. THE CONTRACTOR IS RESPONSIBLE FOR ALL ARRANGEMENTS WITH METRO.

14. ALL WORK WITHIN 300' OF A SIGNALIZED INTERSECTION WILL BE NIGHT WORK, UNLESS DIRECTED BY THE CITY OF LAS VEGAS TRAFFIC ENGINEER.

15. CONTRACTOR SHALL CONTACT THE TRAFFIC ENGINEERING DIVISION (TRANSPORTATION SECTION) THROUGH THE PROJECT'S OFFSITE INSPECTOR PRIOR TO INITIATING PAVING TO RECEIVE DIRECTION FOR ANY PERMANENT OR TEMPORARY MODIFICATIONS TO THE APPROVED DRAWINGS REGARDING FINAL PAVEMENT TRANSITIONS, MARKINGS AND SIGNING THAT ARE REQUIRED TO MATCH ADJACENT ROADWAY SEGMENTS. THE CONTRACTOR SHALL PROVIDE A DRAWING FOR APPROVAL BY THE TRAFFIC ENGINEERING DIVISION DEPICTING ANY ADJUSTMENTS TO THE FINAL PAVEMENT MARKINGS AND SIGNAGE, WHICH MAY INCLUDE OMITTING, ADDING OR MODIFYING PAVEMENT MARKINGS AND TRAFFIC CONTROL SIGNS SUCH THAT ADEQUATE TRANSITIONS AND LANE TERMINATIONS BETWEEN ADJACENT ROADWAY SEGMENTS ARE CONSTRUCTED.

CLV GRADING NOTES

1. IN THE EVENT THAT ANY UNFORESEEN CONDITIONS NOT COVERED BY THESE NOTES ARE ENCOUNTERED DURING GRADING OPERATIONS, THE OWNER/ENGINEER SHALL BE IMMEDIATELY NOTIFIED FOR DIRECTION.

2. IT SHALL BE THE RESPONSIBILITY OF THE CONTRACTOR TO PERFORM ALL NECESSARY CUTS AND FILLS WITHIN THE LIMITS OF THIS PROJECT AND THE RELATED OFF-SITE WORK, SO AS TO GENERATE THE DESIRED SUBGRADE, FINISH GRADES AND SLOPES SHOWN.

3. CONTRACTOR SHALL TAKE FULL RESPONSIBILITY FOR ALL EXCAVATION. ADEQUATE SHORING SHALL BE DESIGNED AND PROVIDED BY THE CONTRACTOR TO PREVENT UNDERMINING OF ANY ADJACENT FEATURES OR FACILITIES AND/OR CAVING OF EXCAVATION.

4. THE CONTRACTOR IS WARNED THAT AN EARTHWORK BALANCE WAS NOT NECESSARILY THE INTENT OF THIS PROJECT. ANY ADDITIONAL MATERIAL REQUIRED OR LEFTOVER MATERIAL FOLLOWING EARTHWORK OPERATIONS BECOMES THE RESPONSIBILITY OF THE CONTRACTOR.

5. THE GRADING CONTRACTOR IS RESPONSIBLE TO COORDINATE WITH THE OWNER TO PROVIDE FOR THE REQUIREMENTS OF THE PROJECT STORM WATER POLLUTION PREVENTION PLAN (SWPPP) AND ASSOCIATED PERMIT.

6. THE CONTRACTOR SHALL GRADE TO THE LINES AND ELEVATIONS SHOWN ON THE PLANS WITHIN THE FOLLOWING HORIZONTAL AND VERTICAL TOLERANCES AND DEGREES OF COMPACTION IN THE AREAS INDICATED:

	HORIZONTAL	VERTICAL	COMPACTION	
A.	PAVEMENT AREA SUBGRADE	0.1'	+0.0' TO -0.1'	SEE SOILS REPORT
B.	ENGINEERED FILL	0.5'	+0.1' TO -0.1'	SEE SOILS REPORT

COMPACTION TESTING WILL BE PERFORMED BY THE OWNER OR HIS REPRESENTATIVE.

7. ALL CUT AND FILL SLOPES SHALL BE PROTECTED UNTIL EFFECTIVE EROSION CONTROL HAS BEEN ESTABLISHED.

8. THE USE OF POTABLE WATER WITHOUT A SPECIAL PERMIT FOR BUILDING OR CONSTRUCTION PURPOSES INCLUDING CONSOLIDATION OF BACKFILL OR DUST CONTROL IS PROHIBITED. THE CONTRACTOR SHALL OBTAIN ALL NECESSARY PERMITS FOR CONSTRUCTION WATER.

9. THE CONTRACTOR SHALL MAINTAIN THE STREETS, SIDEWALKS, AND ALL OTHER PUBLIC RIGHT-OF-WAY IN A CLEAN, SAFE, AND USABLE CONDITION. ALL SPILLS OF SOIL, ROCK, OR CONSTRUCTION DEBRIS SHALL BE PROMPTLY REMOVED FROM THE PUBLICLY OWNED PROPERTY DURING CONSTRUCTION AND UPON COMPLETION OF THE PROJECT. ALL ADJACENT PROPERTY, PRIVATE OR PUBLIC SHALL BE MAINTAINED IN A CLEAN, SAFE, AND USABLE CONDITION.

10.IN THE EVENT THAT ANY TEMPORARY CONSTRUCTION ITEM IS REQUIRED THAT IS NOT SHOWN ON THESE DRAWINGS, THE OWNER AGREES TO PROVIDE AND INSTALL SUCH ITEM AT HIS OWN EXPENSE AND AT THE DIRECTION OF THE CITY ENGINEER. TEMPORARY CONSTRUCTION INCLUDES DITCHES, BERMS, ROAD SIGNS, BARRICADES, ETC.

STORMWATER RUNOFF MANAGEMENT NOTES

1. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATE IN, THE PUBLIC RIGHTS OF WAY OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.

2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN CLARK COUNTY TITLE 24.40 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES MANUAL.

3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION IIIA.5.

4. AT A MINIMUM, THE CONTRACTOR R HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS AND ALL BMPS WEEKLY, AND WITHIN 24 HOURS AFTER AND ACTUAL RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECCESSARY. SOME EXCEPTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION IIIA.12.

5. ACCUMULATED SEDIMENT IN BMPS SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

SOUTHERN NEVADA SOUTHWEST GAS CORP. GENERAL NOTES

1. IN THE EVENT OF NATURAL GAS EMERGENCIES CALL 911 AND 1-877-860-6020.
2. MINIMUM HORIZONTAL AND VERTICAL CLEARANCES BETWEEN NATURAL GAS FACILITIES AND ANY UNDERGROUND UTILITIES AND/OR STRUCTURES, INCLUDING BUT NOT LIMITED TO WATER, SEWER, STORM DRAIN, COMMUNICATIONS, AND ELECTRIC SHALL BE AT LEAST 12-INCHES OR GREATER AS DICTATED BY LOCAL CODES AND STANDARDS.
   A) ANY DEVIATION FROM SPECIFIED MINIMUM CLEARANCES MUST BE APPROVED BY ALL AFFECTED UTILITIES AND/OR MUNICIPALITIES.
3. FOR VALVE ADJUSTMENT CONTACT 702-668-6107 48 HOURS PRIOR TO CONSTRUCTION.
4. IN THE EVENT OF A NATURAL GAS CONFLICT WITH PROPOSED UTILITIES AND/OR STRUCTURES CONTACT 702-365-2099.
5. SWG STANDBY CONTACT NUMBER: (702-400-1789)

SOUTHWEST GAS CORPORATION _____ DATE

CLV FIRE DEPARTMENT NOTES

1. ALL WORK SHALL BE DONE IN STRICT ACCORDANCE WITH THE LAS VEGAS FIRE AND RESCUE ADOPTED FIRE CODE ORDINANCE # 6325 FOR HYDRANT SPECIFICATIONS AND HYDRANT INSTALLATION SPECIFICATIONS.

2. ONLY FIRE HYDRANTS THAT ARE ON THE LAS VEGAS VALLEY WATER DISTRICT'S APPROVED PRODUCTS LIST ARE ALLOWED TO BE INSTALLED.

3. A PERMIT IS REQUIRED FROM LAS VEGAS FIRE AND RESCUE FOR THE INSTALLATION OF ON-SITE WATER LINES AND FIRE HYDRANTS. THE PERMIT AND CONTRACTORS MATERIAL TEST CERTIFICATE FOR UNDERGROUND PIPING FORM SHALL BE OBTAINED FROM THE FIRE PROTECTION ENGINEER BEFORE COMMENCEMENT OF WORK. [IFC § 105.7.12]

4. ON ANY RESIDENTIAL OR COMMERCIAL INSTALLATIONS, FIRE HYDRANTS SHALL BE INSTALLED AND FIRE APPARATUS ACCESS ROADS SHALL BE MAINTAINED BEFORE COMMENCEMENT OF ANY COMBUSTIBLE CONSTRUCTION. ALL FIRE HYDRANTS SHALL BE IN GOOD WORKING ORDER AND SHALL BE CAPABLE OF DELIVERING THE REQUIRED FIRE FLOW. [IFC § 3310, § 3312]

5. TO IDENTIFY THE FIRE HYDRANT LOCATIONS, THE CONTRACTOR SHALL PLACE A BLUE REFLECTIVE MARKER AT THE CENTER LINE OF THE STREET ADJACENT TO THE FIRE HYDRANTS. [IFC § 507.5.7.3]

6. ALL UNDERGROUND INSPECTIONS, PRESSURE AND FLUSH VERIFICATIONS OF ALL FIRE HYDRANTS AND FIRE LINES, SHALL BE CONDUCTED BEFORE COVERING THE LINES. CENTER LOADING IS ACCEPTABLE FOR THE HYDRO TESTS WITH PRIOR FIRE PREVENTION APPROVAL. [IFC § 106.3]

7. ALL ON-SITE UNDERGROUND WATER MAINS AND MATERIALS SHALL BE U.L. LISTED, A.W.W.A APPROVED AND SHALL BE RATED FOR THE APPROPRIATE WORKING PRESSURE. [IFC § 507.2.1, NFPA 24]

8. PAINTING OF CURBS, FIRE HYDRANTS, PADS, PROTECTION OF FIRE HYDRANTS FROM PHYSICAL DAMAGE, AND ALL OTHER WORK NECESSARY PER PLANS SHALL BE COMPLETED BEFORE APPROVAL BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION. [IFC § 507]

9. PRIVATE HYDRANTS SHALL BE PAINTED RED. [IFC § 507.5.7.1]

10. PRIOR TO THE FINAL OCCUPANCY, A FIRE FLOW TEST SHALL BE WITNESSED BY LAS VEGAS FIRE AND RESCUE, FIRE PREVENTION DIVISION TO VERIFY AVAILABILITY OF THE REQUIRED FIRE FLOW. [IFC § 507]

11. FIRE HYDRANT SPACING SHALL BE AS FOLLOWS: [IFC § C102]
- RESIDENTIAL – 500 FT UNSPRINKLERED; 600 FT SPRINKLERED.
- COMMERCIAL – 300 FT UNSPRINKLERED; 400 FT SPRINKLERED.

12. WHERE THE WATER MAINS ARE EXTENDED ALONG STREETS OR NEW STREETS ARE INSTALLED WHERE FIRE HYDRANTS ARE NOT NEEDED FOR PROTECTION OF THE STRUCTURES, FIRE HYDRANTS SHALL BE INSTALLED AT A MAXIMUM OF 1000 FT SPACING, TO PROVIDE FOR TRANSPORTATION HAZARDS. WHERE STREETS ARE PROVIDED WITH MEDIAN DIVIDERS OR HAVE FOUR (4) OR MORE TRAFFIC LANES AND HAVE A TRAFFIC COUNT OF MORE THAN 30,000 PER DAY, HYDRANTS ARE REQUIRED ON EACH SIDE OF THE STREET SPACED AT 500 FT ON AN ALTERNATING BASIS. [IFC § C102.8]

13. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN THE RADIUS OF A CUL-DE-SAC OR WITHIN 20 FT OF THE PERIMETER OF THE RADIUS OF THE CUL-DE-SAC.

14. NO FIRE HYDRANTS SHALL BE LOCATED WITHIN 6 FT OF ANY CURB RETURN, DRIVEWAY, POWER POLE, STREETLIGHT OR ANY OTHER OBSTRUCTION. [IFC § C102.12]

15. A MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A ONE-TWO FAMILY DWELLING SHALL NOT EXCEED 300 FT, AS MEASURED BY ANAPPROVED ROUTE. [IFC § C102.4]

16. THE MAXIMUM DISTANCE FROM A FIRE HYDRANT TO A FIRE DEPARTMENT CONNECTION (FDC) SHALL NOT EXCEED 100 FT, AS MEASURED BY AN APPROVED ROUTE. [IFC § C102.7]

17. THE MAXIMUM DISTANCE FROM A HYDRANT TO THE END OF A DEAD-END STREET SHALL NOT EXCEED 200 FT. [IFC § C102.6]

18, TWO (2) SOURCES OF SUPPLY ARE REQUIRED WHENEVER THERE IS 4 OR MORE FIRE HYDRANTS/SPRINKLER LEAD-INS ARE INSTALLED ON A SINGLE SYSTEM. SECTIONAL CONTROL VALVES SHALL BE INSTALLED SO THAT NO MORE THAN 2 FIRE HYDRANTS CAN BE OUT OF SERVICE DUE TO A BREAK IN A WATER MAIN. [IFC § C104]

19. ALL FIRE APPARATUS ACCESS ROADS SHALL BE PAVED TO PROVIDE ALL-WEATHER DRIVING CAPABILITIES, AND SHALL BE DESIGNED AND MAINTAINED TO SUPPORT THE IMPOSED LOADS OF THE FIRE APPARATUS. [IFC § 503.2.3]

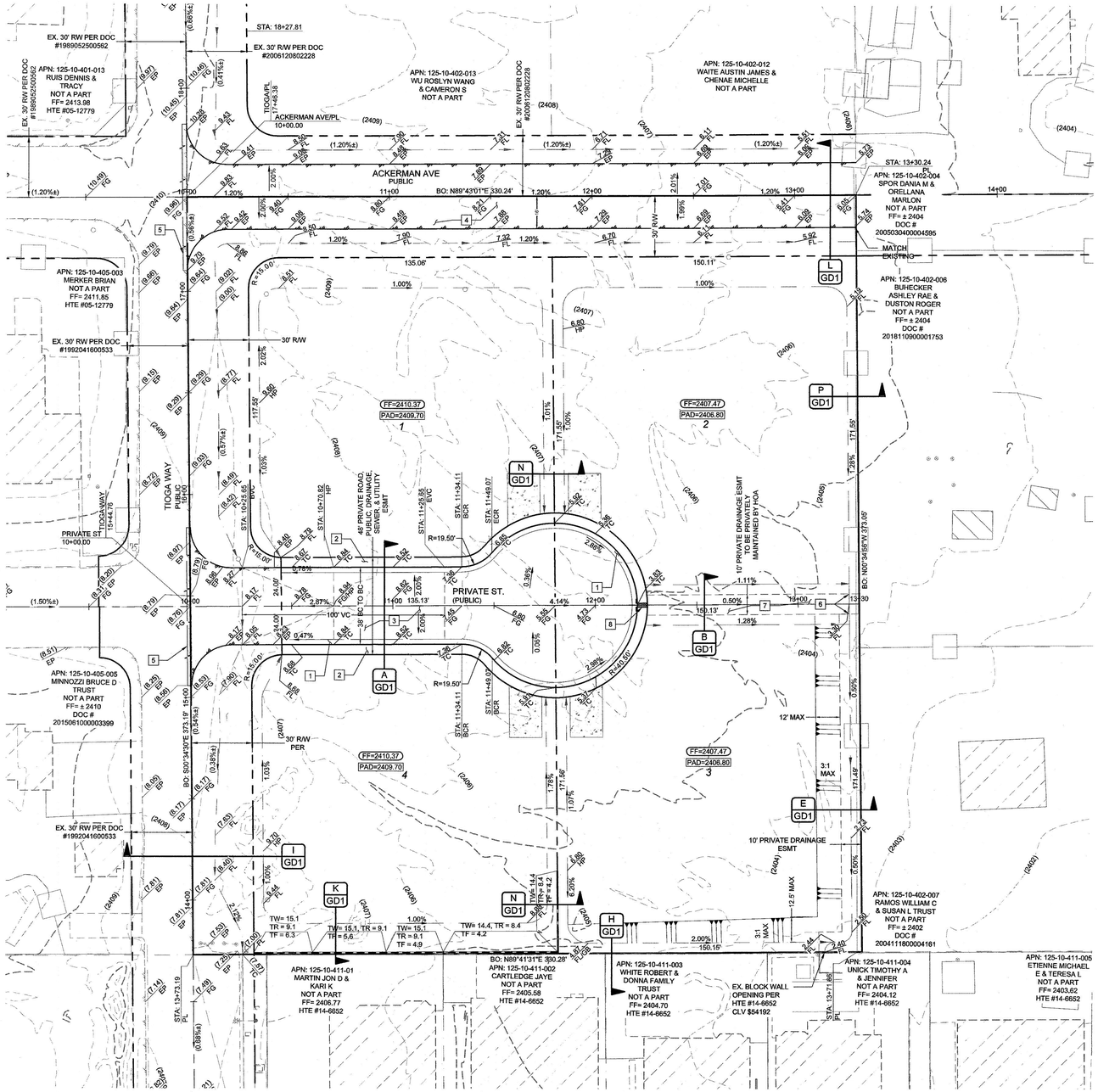
20. THE GRADIENT FOR THE FIRE APPARATUS ACCESS ROADS SHALL NOT EXCEED 12%. ANGLES OF APPROACH AND ANGLES OF DEPARTURE SHALL NOT EXCEED 6% FOR 25 FT PRIOR TO OR AFTER THE GRADE CHANGE. ADJACENT TO THE STRUCTURES GRADIENT SHALL NOT EXCEED 6%. [IFC § 503.2.7, § 503.2.8]

21. THE TURNING RADIUS OF THE FIRE APPARATUS ACCESS ROADS SHALL BE NO LESS THAN 52 FT OUTSIDE AND 28 FT INSIDE TURNING RADIUS. [IFC § 503.2.4]

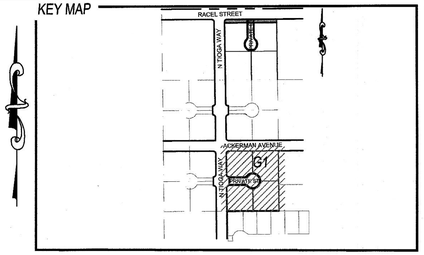
22. VERTICAL CLEARANCE OF ALL FIRE APPARATUS ACCESS ROADS SHALL NOT BE LESS THAN 13FT 6 INS. [IFC § 503.2.1]

23. FIRE DEPARTMENT ACCESS ROADS SHALL HAVE A MINIMUM UNOBSTRUCTED WIDTH OF NOT LESS THAN 40 FT FLOW LINE TO FLOW LINE WITH PARALLEL PARKING PERMITTED ON BOTH SIDES. NOT LESS THAN 32 FT WIDE, FLOW-LINE TO FLOW-LINE, WHERE PARKING IS PERMITTED ONLY ON ONE SIDE OF THE FIRE APPARATUS ACCESS ROAD. NOT LESS THAN 24 FT WIDE, FLOW-LINE TO FLOW-LINE, WHERE NO PARKING IS PERMITTED ON EITHER SIDE. FIRE LANES THROUGH PARKING LOTS SHALL BE NOT LESS THAN 24 FT. [IFC § 503.2.1.1]

24. A FIRE APPARATUS ACCESS ROAD SHALL BE REQUIRED WHEN ANY



KEY MAP



SCALE: 1" = 30'

30' 15' 30' 60' 90'

GRADING CONSTRUCTION NOTES

1. 24" R-TYPE CURB (USD #217.3.S1)
2. 5.0' SIDEWALK (CCAUSD #234)
3. 2" AC PAVEMENT OVER 4" TYPE II PER SOILS REPORT
4. 3.0" AC PAVEMENT OVER 4" TYPE II PER SOILS REPORT
5. SAWCUT & MATCH EXISTING AC PAVEMENT (PER CCAUSD #500.3, 500.4, 503)
6. INSTALL 48" X 16" BLOCK WALL OPENING (SEE DETAIL D/GD1)
7. INSTALL CONCRETE VALLEY GUTTER (SEE F/GD1)
8. INSTALL SIDEWALK UNDERDRAIN (CCAUSD #236)

GEOTECHNICAL

GEOTEK RESIDENTIAL, LLC
SOUTH ESCONDIDO STREET, SUITE B
LAS VEGAS, NV 89119
(702) 897-1424
REPORT NO: 12861-LVR
DATE: 03/15/2016

Avoid overhead power line contact. it's costly.
Call before you Overhead
1-702-227-2929

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

EARTHWORK

TOTAL FOR OVERALL DEVELOPMENT: 819.38 CY CUT / 12,586 CY FILL / 11,766.62 CY NET FILL

NOTE: THIS OPINION OF THE CUT AND FILL QUANTITIES IS PROVIDED AS REQUIRED BY THE GOVERNING ENTITY. THIS INFORMATION SHOULD NOT BE USED FOR BIDDING PURPOSES. ALL CONTRACTORS ARE RESPONSIBLE FOR THEIR OWN QUANTITIES. THESE TOTALS ARE RAW AND DO NOT ACCOUNT FOR SHRINKAGE AND SUBSIDENCE.

FLOOD ZONE

THIS PROJECT IS LOCATED IN FLOOD ZONE "X", AN AREA DETERMINED TO BE OUTSIDE OF THE 0.2% ANNUAL CHANCE FLOOD PLAIN PER FIRM PANEL 32003C2150E, REVISED DATE.

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ADD XX00 FEET TO ALL GRADE TAGS TO GET ACTUAL ELEVATION.

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BENCHMARK

CITY OF LAS VEGAS BENCHMARK MONUMENT ID NUMBER 6LV9010SW6 RIVET & PLATE TOP CURB N. SIDE RACEL ST. @ PIONEER WAY.
ELEVATION: 732.93709 METERS (NAVD88)
2,404.64 FEET

GRADING CERTIFICATION

I CERTIFY THIS GRADING PLAN COMPLIES WITH THE APPROVED DRAINAGE STUDY, HTE# XX-XXXXX, ON FILE WITH CITY OF LAS VEGAS FOR THIS PROJECT.

JUSTIN THORNE, PE — DATE

ACCEPTANCE OF PLANS FOR FILING

BY: DEVELOPMENT AND FLOOD CONTROL — DATE

NO.	DESCRIPTION	BY	SHTS.	APPR.	DATE
	REVISIONS				

ADAVEN HOMES
3425 CLIFF SHADOWS PKWY
LAS VEGAS, NV 89129
(702) 365-8588 FAX: —

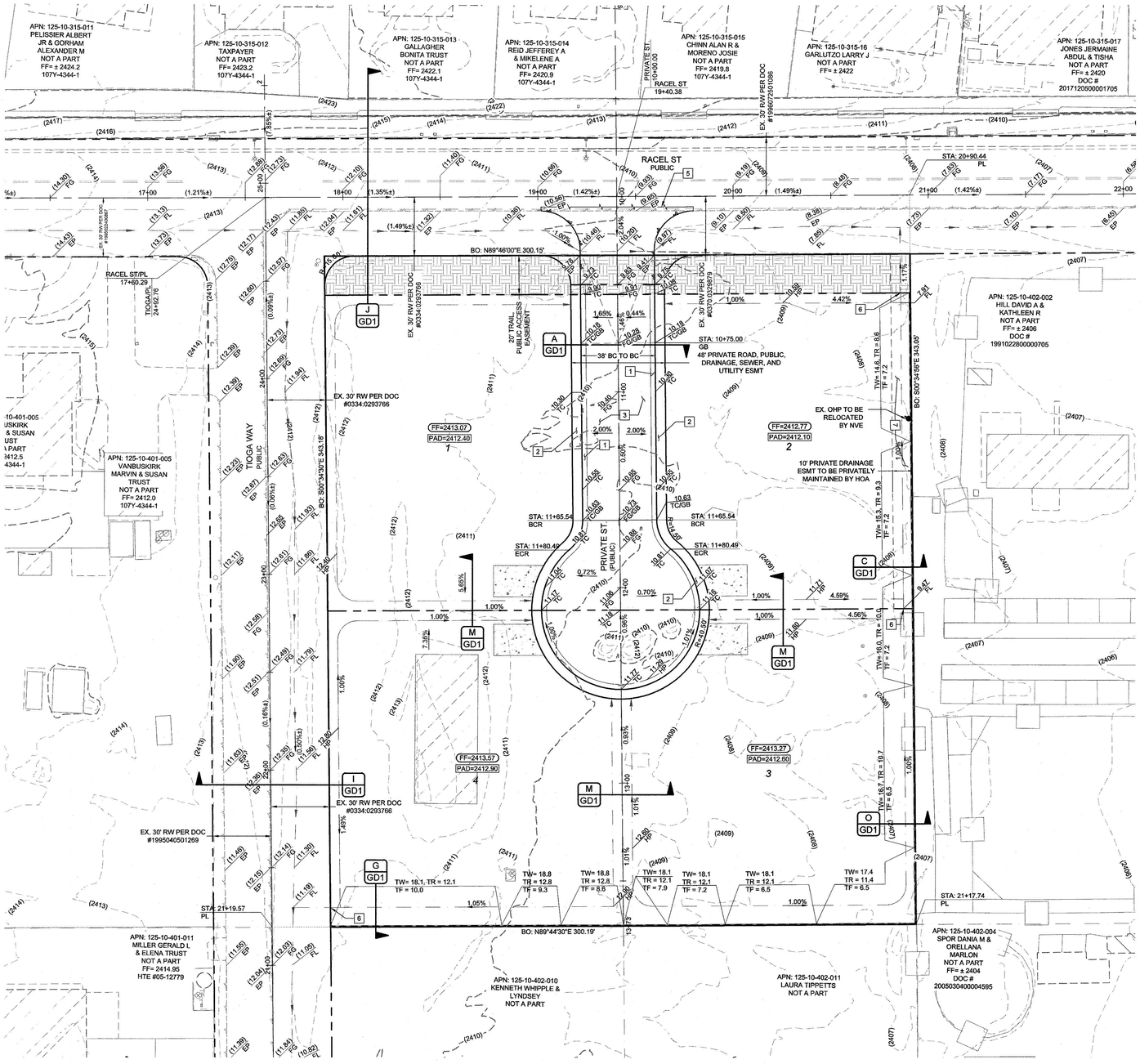
TANEY ENGINEERING
6030 S. JONES BOULEVARD
LAS VEGAS, NEVADA 89118
(702) 362-8844 FAX: (702) 362-5233
EST. 2000

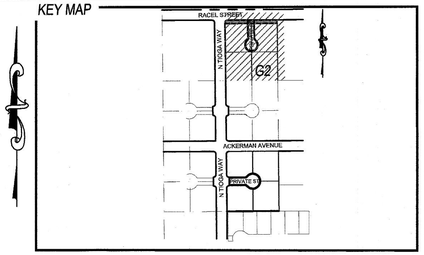
RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
GRADING PLAN - SOUTH

REGISTERED PROFESSIONAL ENGINEER — STATE OF NEVADA
S. JUSTIN THORNE Exp. 06-30-20 CIVIL No. 22841

DATE:	4/17/2019
SCALE:	1"=30'
JOB NO:	ADV-18-101
DESIGNED BY: JT	CHECKED BY: BEM
SHEET NAME:	G1
SHEET NUMBER:	03 OF 8
—	—
CITY	0000000

LAST PLOT: Mohit Khadka
FILE NAME: S:\ACTIVE\ADAVEN HOMES\ADV-18-101 - RACEL & TIOGA\ENGINP\SDWGS\SHEET DWGS\ADV18101_SHT_G.DWG





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CITY OF LAS VEGAS BENCHMARK MONUMENT ID NUMBER 8LV9010SW6 RIVET & PLATE TOP CURB N. SIDE RACEL ST. @ PIONEER WAY.
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ACCEPTANCE OF PLANS FOR FILING

BY: DEVELOPMENT AND FLOOD CONTROL DATE

NO.	DESCRIPTION	BY	SH'TS.	APPR.	DATE
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ADAVEN HOMES
3425 CLIFF SHADOWS PKWY
LAS VEGAS, NV 89129
(702) 385-8388 FAX: —

TANEY ENGINEERING
6030 S. JONES BOULEVARD
LAS VEGAS, NEVADA 89118
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EST. 2000

RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
GRADING PLAN - NORTH

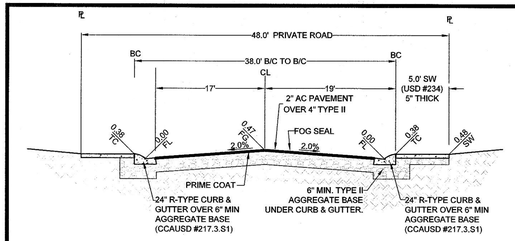
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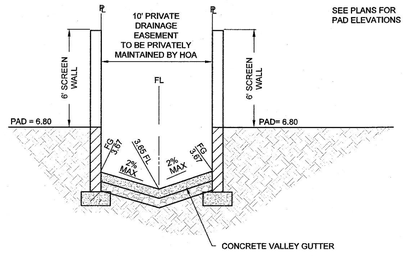
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LAST PLOT: Mohit Khatka
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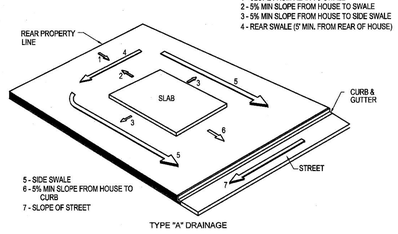


SECTION A
PRIVATE STREET
NTS

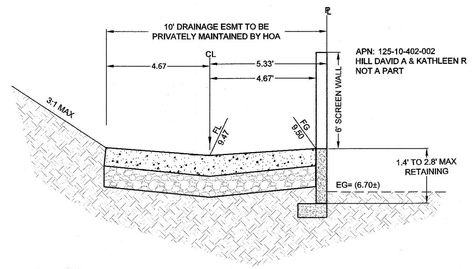
NOTE:
ALL AGGREGATE BASES SHALL BE COMPACTED PER GEOTECHNICAL REPORT XXXXXXX. PRELIMINARY PAVEMENT SECTIONS SHALL BE VERIFIED WITH THE FINAL PAVEMENT SECTION RECOMMENDATION REPORT PRIOR TO CONSTRUCTION. IF FINAL PAVEMENT SECTIONS ARE DIFFERENT, A REVISION TO THE IMPROVEMENT PLANS WILL BE REQUIRED.



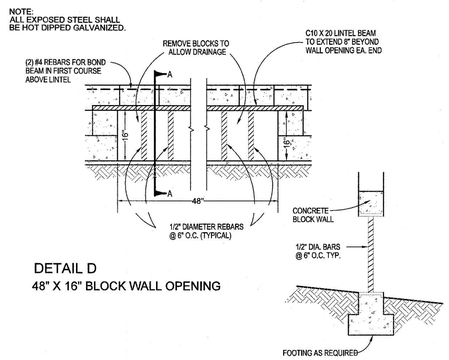
SECTION B
PRIVATE DRAINAGE ESMT
NTS



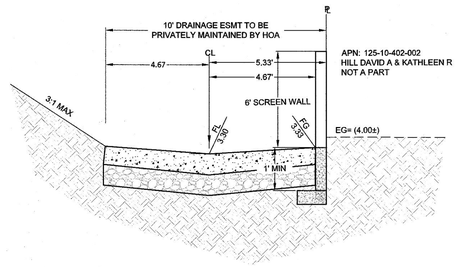
TYPICAL GRADING DETAIL TYPE A



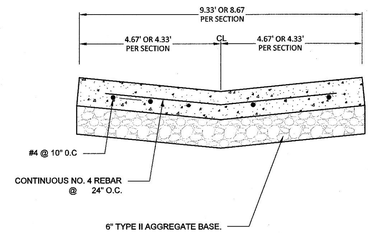
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PRIVATE DRAINAGE ESMT
NTS



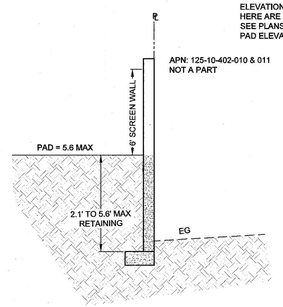
DETAIL D
48" X 16" BLOCK WALL OPENING



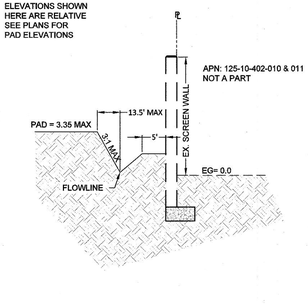
SECTION E
PRIVATE DRAINAGE ESMT
NTS



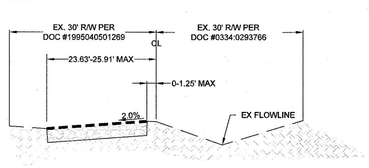
SECTION F
10' CONCRETE VALLEY GUTTER
NTS



SECTION G
SOUTH PROPERTY LINE
NTS

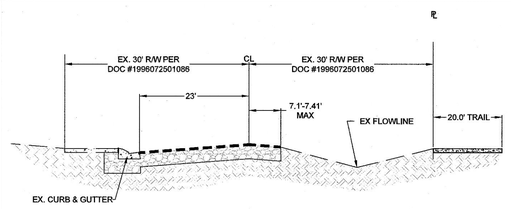


SECTION H
SOUTH PROPERTY LINE
NTS



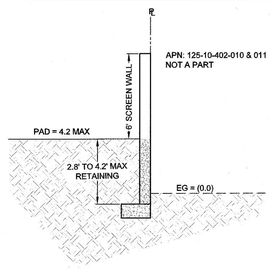
NOTE:
ALL AGGREGATE BASES SHALL BE COMPACTED PER GEOTECHNICAL REPORT XXXXXXX. PRELIMINARY PAVEMENT SECTIONS SHALL BE VERIFIED WITH THE FINAL PAVEMENT SECTION RECOMMENDATION REPORT PRIOR TO CONSTRUCTION. IF FINAL PAVEMENT SECTIONS ARE DIFFERENT, A REVISION TO THE IMPROVEMENT PLANS WILL BE REQUIRED.

SECTION I
TIOGA WAY
NTS

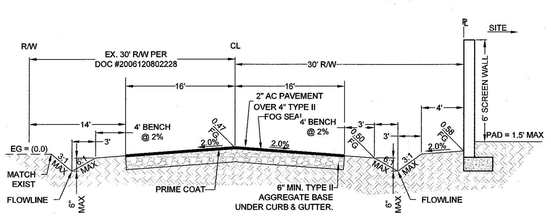


NOTE:
ALL AGGREGATE BASES SHALL BE COMPACTED PER GEOTECHNICAL REPORT 1286I-LVR. PRELIMINARY PAVEMENT SECTIONS SHALL BE VERIFIED WITH THE FINAL PAVEMENT SECTION RECOMMENDATION REPORT PRIOR TO CONSTRUCTION. IF FINAL PAVEMENT SECTIONS ARE DIFFERENT, A REVISION TO THE IMPROVEMENT PLANS WILL BE REQUIRED.

SECTION J
RACEL STREET
NTS

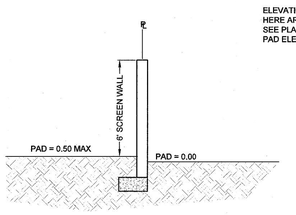


SECTION K
SOUTH PROPERTY LINE
NTS

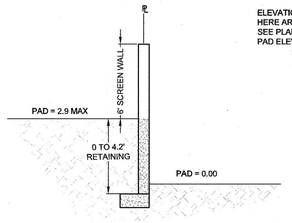


NOTE:
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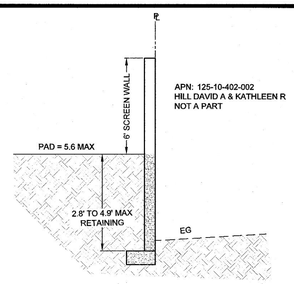
SECTION L
ACKERMAN AVE
NTS



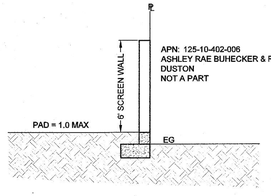
SECTION M
SIDE TO BACK/SIDE
NTS



SECTION N
SIDE TO SIDE
NTS



SECTION O
SOUTH PROPERTY LINE
NTS



SECTION P
EAST PROPERTY LINE
NTS

NO.	DESCRIPTION	BY	SHTS.	APPR.	DATE
	REVISIONS				

ADAVEN HOMES
3425 CLIFF SHADOWS PKWY
LAS VEGAS, NV 89129
(702) 365-5588 FAX: —

TANEY ENGINEERING
6030 S. JONES BOULEVARD
LAS VEGAS, NEVADA 89118
(702) 362-8844 FAX: (702) 362-9233

EST. 2000

RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
GRADING DETAILS

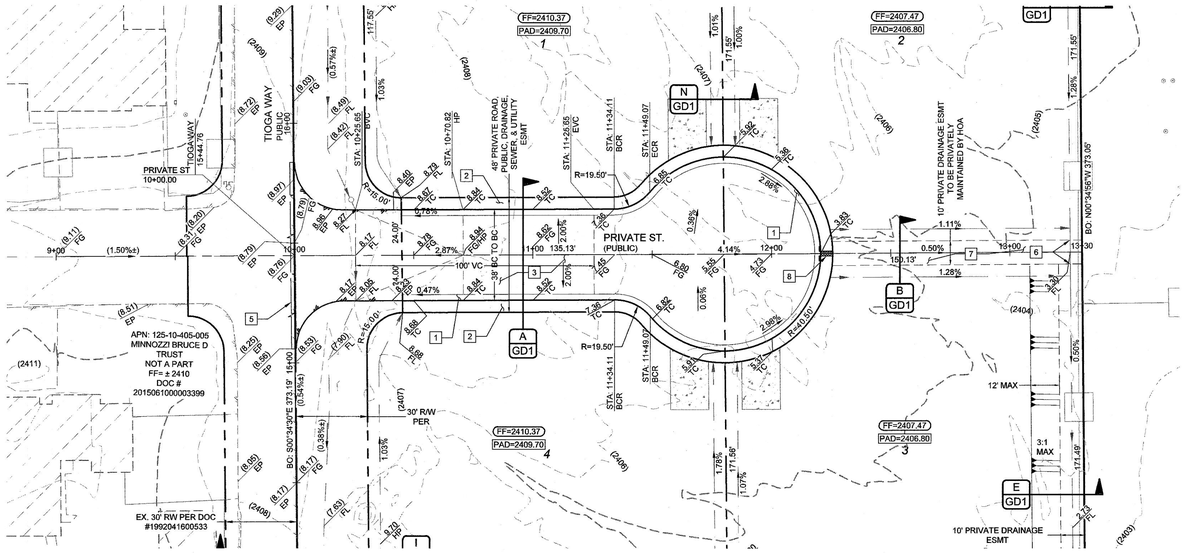


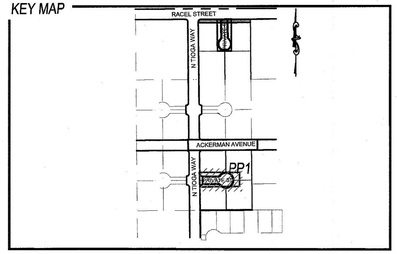
DATE:	4/17/2019
SCALE:	NTS
JOB NO:	ADV-18-101
DESIGNED BY:	JT
CHECKED BY:	BEM
SHEET NAME:	GD1
SHEET NUMBER:	05 OF 8
—	—
CITY	0000000

Avoid overhead power line contact. It's costly.
Call before you Overhead
1-702-227-2929

Call before you Dig
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CALL 811
OR
1-800-227-2600

LAST PLOT: Mohit Khatka
FILE NAME: S:\ACTIVE\ADAVEN HOMES\ADV-18-101 - RACEL & TIOGA\ENG\PSD\DWGS\SHEET DWGS\ADV18101_SHT_GD.DWG

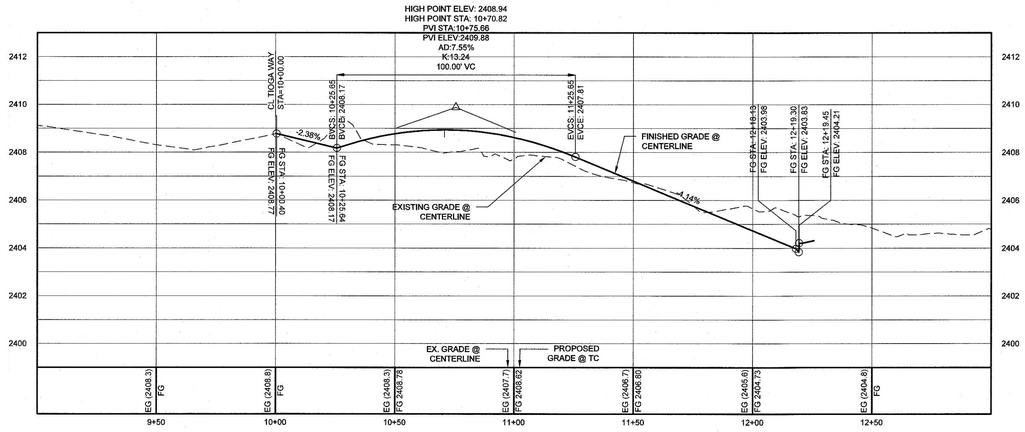




GRADING CONSTRUCTION NOTES

1. 24" R-TYPE CURB (USD #217.3,S1)
2. 5.0' SIDEWALK (CCAUSD #234)
3. 2" AC PAVEMENT OVER 4" TYPE II PER SOILS REPORT
4. 3.0" AC PAVEMENT OVER 4" TYPE II PER SOILS REPORT
5. SAWCUT & MATCH EXISTING AC PAVEMENT (PER CCAUSD #500.3, 500.4, 503)
6. INSTALL 48" X 16" BLOCK WALL OPENING (SEE DETAIL D/GD1)
7. INSTALL CONCRETE VALLEY GUTTER (SEE F/GD1)
8. INSTALL SIDEWALK UNDERDRAIN (CCAUSD #236)

PRIVATE ST - PLAN
STA: 9+00.00 TO 13+00.00



PRIVATE ST - PROFILE
STA: 9+00.00 TO 13+00.00
SCALE: 1"=30' HORIZONTAL; 1"=3' VERTICAL

DEPTH OF COVER DURING CONSTRUCTION
MAINTAIN MINIMUM TWENTY-FOUR (24) INCH COVER PER UDACS SECTION 2.08.04. GRADING MUST BE COMPLETED PRIOR TO WATERLINE INSTALLATION.

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

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1-702-227-2929

GEOTECHNICAL
GEOTEK RESIDENTIAL, LLC
SOUTH ESCONDIDO STREET, SUITE B
LAS VEGAS, NV 89119
(702) 897-1424
REPORT NO: 12861-LVR
DATE: 03/15/2016

UTILITY DISCLAIMER
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LINE AND CURVE DATA
FOR LINE AND CURVE DATA TABLES, SEE THE GRADING PLAN SHEETS FOR THIS PROJECT.

PROFILE NOTES
ADD XX00 FEET TO ALL GRADE TAGS TO GET ACTUAL ELEVATION.

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ALL WORK TO BE PERFORMED OUTSIDE OF THE PROJECT BOUNDARY AND ON PRIVATE PROPERTY SHALL NOT BE PERFORMED UNTIL WRITTEN PERMISSION AND EASEMENTS HAVE BEEN OBTAINED FROM THE OFFSITE OWNER AND GIVEN TO GOVERNING ENTITY.

BENCHMARK
CITY OF LAS VEGAS BENCHMARK MONUMENT ID NUMBER 6LV9010SW6 RIVET & PLATE TOP CURB N. SIDE RACEL ST. @ PIONEER WAY.
ELEVATION: 732.93709 METERS (NAVD88)
2,404.64 FEET

ACCEPTANCE OF PLANS

SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES
PROJECT# 122XXX FIRST APPROVED DATE
LVVWD APPROVED FIRE FLOW: XXXX GPM AT 20 PSI RESIDUAL
MAXIMUM AVAILABLE FIRE SPRINKLER FLOW XXXX GPM

ACCEPTANCE OF PLANS FOR FILING

BY:
DEVELOPMENT AND FLOOD CONTROL DATE

NO.	DESCRIPTION	BY	SHTS.	APPR.	DATE
	REVISIONS				

ADAVEN HOMES
3425 CLIFF SHADOWS PKWY
LAS VEGAS, NV 89129
(702) 365-8888 FAX: —

TANEY ENGINEERING
6030 S. JONES BOULEVARD
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5233

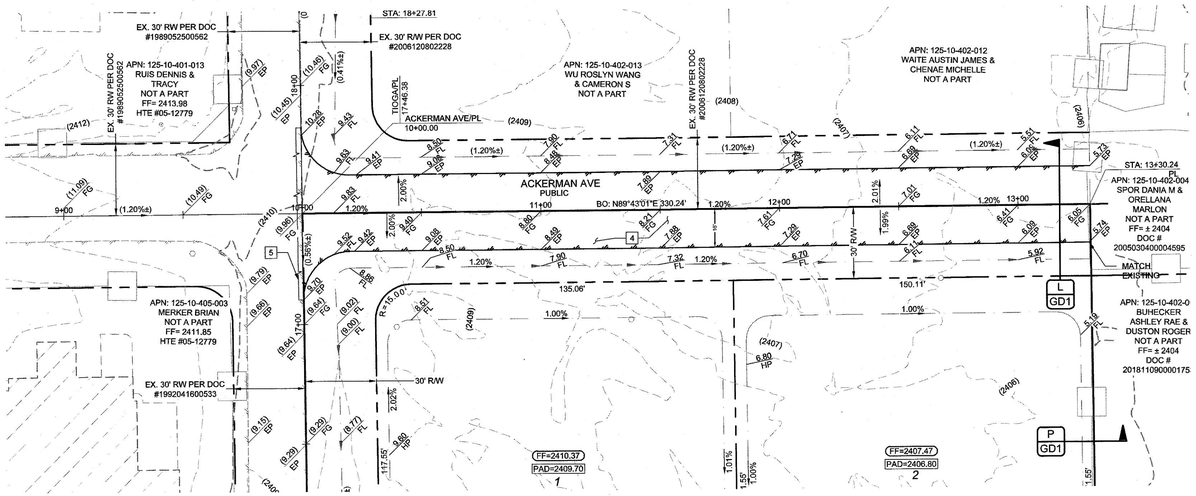
EST. 2000

RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
PLAN AND PROFILE
PRIVATE ST - SOUTH

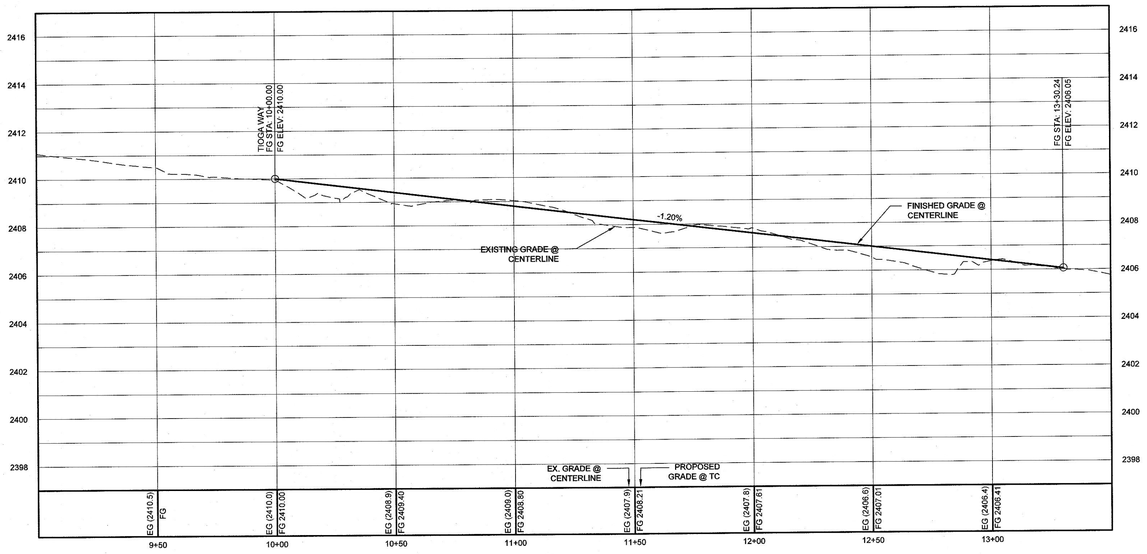
PROFESSIONAL ENGINEER STATE OF NEVADA
S. JUSTIN THORNE
Exp. 06-30-20
CIVIL
No. 22841
4/17/19

DATE:	4/17/2019
SCALE:	1"=30'
JOB NO:	ADV-18-101
DESIGNED BY: JT	CHECKED BY: BEM
SHEET NAME:	PP1
SHEET NUMBER:	06 OF 8
—	—
CITY	0000000

LAST PLOT: Mohit Khadka
FILE NAME: S:\ACTIVE\ADAVEN HOMES\ADV-18-101 - RACEL & TIOGA\ENG\PS\DWGS\SHEET DWGS\ADV18101_SHT_PP.DWG



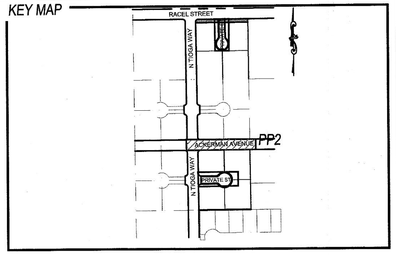
ACKERMAN AVE (PUBLIC) - PLAN
STA: 9+00.00 TO 13+50.00



ACKERMAN AVE - PROFILE
STA: 9+00.00 TO 13+50.00

SCALE: 1"=30' HORIZONTAL; 1"=3' VERTICAL

KEY MAP



SCALE: 1" = 30'
30' 15' 30' 60' 90'

GRADING CONSTRUCTION NOTES

1. 24" R-TYPE CURB (USD #217.3.S1)
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GEOTECHNICAL

GEOTEK RESIDENTIAL, LLC
SOUTH ESCONDIDO STREET, SUITE B
LAS VEGAS, NV 89119
(702) 897-1424
REPORT NO: 12861-LVR
DATE: 03/15/2016

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BENCHMARK

CITY OF LAS VEGAS BENCHMARK MONUMENT ID NUMBER 6LV9010SW6 RIVET & PLATE TOP CURB N. SIDE RACEL ST. @ PIONEER WAY.
ELEVATION: 732.93709 METERS (NAVD88)
2,404.64 FEET

ACCEPTANCE OF PLANS
SOUTHWEST GAS CORPORATION DATE

APPROVED FOR CONSTRUCTION
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES
PROJECT# 122XXX, FIRST APPROVED DATE: _____
LVVWD APPROVED FIRE FLOW: XXXX GPM AT 20 PSI RESIDUAL
MAXIMUM AVAILABLE FIRE SPRINKLER FLOW XXXX GPM

ACCEPTANCE OF PLANS FOR FILING
BY:_____
DEVELOPMENT AND FLOOD CONTROL DATE

NO.	DESCRIPTION	BY	SHTS.	APPR.	DATE
	REVISIONS				

ADAVEN HOMES
3425 LAS VEGAS BLVD SOUTH
LAS VEGAS, NV 89129
(702) 365-5588 FAX: ---

TANEY ENGINEERING
8030 S. JONES BOULEVARD
LAS VEGAS, NV 89118
(702) 362-8844 FAX: (702) 362-5223

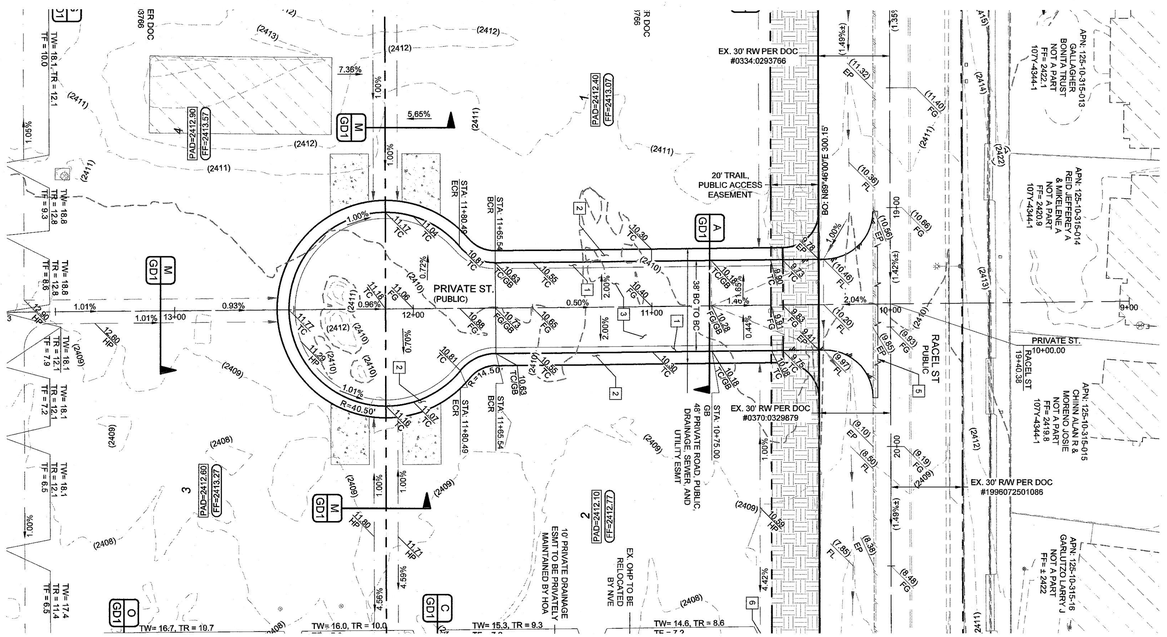
EST. 2000

RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
PLAN AND PROFILE - ACKERMAN AVE

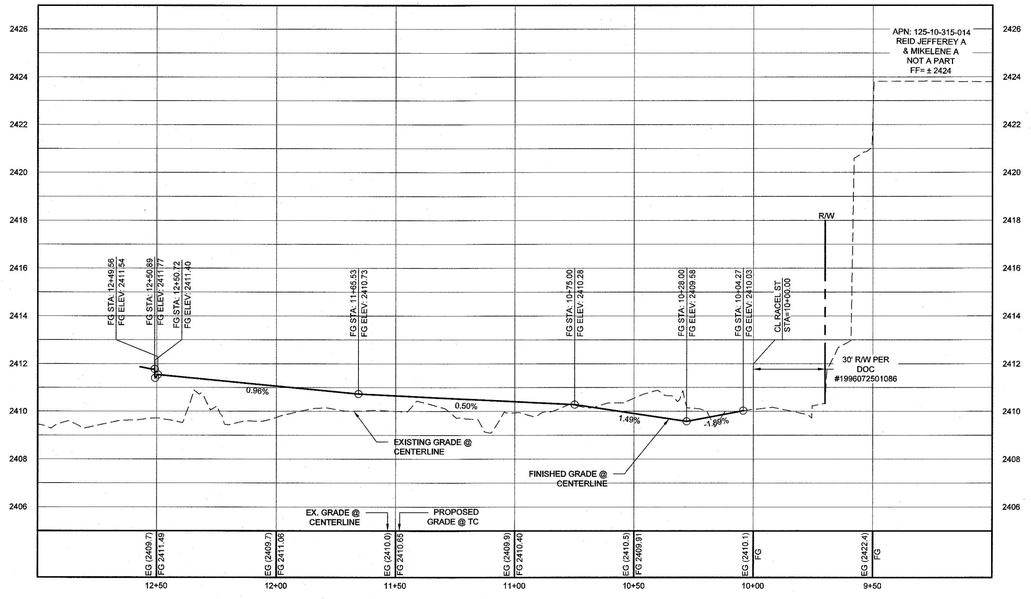
PROFESSIONAL ENGINEER STATE OF NEVADA
S. JUSTIN THORNE
Exp. 06-30-20
CIVIL
No. 22841

DATE:	4/17/2019
SCALE:	1"=30'
JOB NO:	ADV-18-101
DESIGNED BY: JT	CHECKED BY: BEM
SHEET NAME:	PP2
SHEET NUMBER:	07 OF 8
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CITY	0000000

LAST PLOT: Mohit Khadka
FILE NAME: S:\ACTIVE\ADAVEN HOMES\ADV-18-101 - RACEL & TIOGA\ENGR\PS\DWGS\SHEET DWGS\ADV18101_SHT_PP.DWG

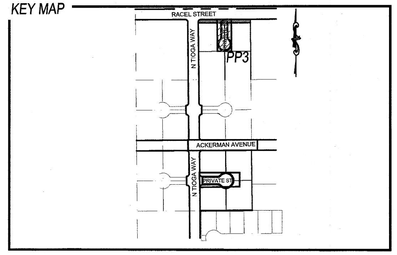


PRIVATE ST. - PLAN
STA: 9+00.00 TO 13+00.00



PRIVATE ST. - PROFILE
STA: 9+00.00 TO 13+00.00
SCALE: 1"=30' HORIZONTAL; 1"=3' VERTICAL

KEY MAP



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GEOTECHNICAL

GEOTEK RESIDENTIAL, LLC
SOUTH ESCONDIDO STREET, SUITE B
LAS VEGAS, NV 89119
(702) 897-1424
REPORT NO: 12861-LVR
DATE: 03/15/2016

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CITY OF LAS VEGAS BENCHMARK MONUMENT ID NUMBER 6LV9010SW6 RIVET & PLATE TOP CURB N. SIDE RACEL ST. @ PIONEER WAY.
ELEVATION 732.93709 METERS (NAVD88)
2,404.64 FEET

ACCEPTANCE OF PLANS

SOUTHWEST GAS CORPORATION — DATE

APPROVED FOR CONSTRUCTION

LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES
PROJECT# 122XXX FIRST APPROVED DATE _____
LVVWD APPROVED FIRE FLOW: XXXX GPM AT 20 PSI RESIDUAL
MAXIMUM AVAILABLE FIRE SPRINKLER FLOW XXXX GPM

ACCEPTANCE OF PLANS FOR FILING

BY: _____
DEVELOPMENT AND FLOOD CONTROL — DATE

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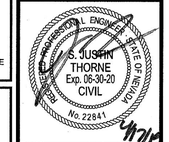
NO.	DESCRIPTION	BY	SHTS.	APPR.	DATE
	REVISIONS				

ADAVEN HOMES
3425 CLIFF SHADOWS PKWY
LAS VEGAS, NV 89129
(702) 365-8588 FAX: —

TANEY ENGINEERING
8030 S. JONES BOULEVARD
LAS VEGAS, NEVADA 89139
(702) 362-8844 FAX: (702) 362-5233

EST. 2000

RACEL & TIOGA
A RESIDENTIAL SUBDIVISION
PLAN AND PROFILE - PRIVATE ST - NORTH



DATE:	4/17/2019
SCALE:	1"=30'
JOB NO:	ADV-18-101
DESIGNED BY: JT	CHECKED BY: BEM
SHEET NAME:	PP3
SHEET NUMBER:	08 OF 8
CITY	0000000

LAST PLOT: Mehdi Khalka
FILE NAME: S:\ACTIVE\ADAVEN HOMES\ADV-18-101 - RACEL & TIOGA\ENG\PS\DWGS\SHEET DWGS\ADV18101_SHT_PP.DWG