

Technical Drainage Study
for
Mabel Hoggard Elementary School
950 North Tonopah Drive
Las Vegas, Nevada

APN: 139-28-210-007

Prepared by:
Atkins

2270 Corporate Circle, #200
Henderson, NV 89074
(702) 551-0365

Prepared for:
Clark County School District

Real Property Mgt.
1180 Military Tribute Pl.
Henderson, NV 89074
(702) 799-5214

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Mabel Hoggard School Replacement Date: February 11, 2020

Location of Development: a) Descriptive (Cross Streets) North/South: Tonopah
East/West: Washington

b) Section: 28 Township: 20 South Range: 61 East

c) APN : 139-28-210-007

Name of Owner: School Board of Trustees c/o Clark County School District real Property Management

Telephone No.: (702) 799-5214 Fax No.: _____ E-Mail Address: _____

Address: 1180 Miliatry Tribute Pl., Henderson, NV 89074

Contact Person-Name: Janelle Klein, PE Telephone No.: (702) 551-0365

* E-Mail Address: Janelle.Klein@atkinsglobal.com Fax No.: (702) 263-7200

Firm: Atkins

Address: 2270 Corporate Circle, Ste. 200, Henderson, NV 89074

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: 7.03 Acres Being Developed/Disturbed: 7.03 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

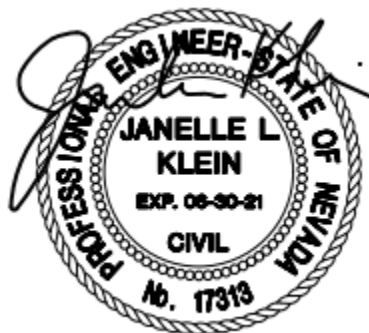
4. Proposed type of development (Residential, Commercial, Etc.): Civic District - School

5. Approximate upstream land area which drains to the subject site: +/- 199 Acres

6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Technical Drainage Study for Mabel Hoggard, by Martin & Martin, February 2001 (CLV DS #925)

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Existing Washington Avenue storm drain at Tonopah Drive and Comstock Drive (via Virginia City Ave and Ophir Drive)

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



2/11/2020

Engineer's Seal

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

***New Required Field**

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

Project Name: Mabel Hoggard School Replacement

Map ID: 139-28-210-007

Firm Name: **Atkins**

Engineer: JANELLE KLEIN PE

Address: 2270 Corporate Circle, Ste 200

City: Henderson

State:

NV

Zip: 89074

Phone Number: (702) 551-0330

Fax Number: (702) 263-7200

Property Owner: School Board of Trustees c/o Clark County School District real Property Management

Address: **1180 Miliatry Tribute Pl**

City: HENDERSON

State: NV

Zip: 89074

Reviewed By:

Date Received:

Date Accepted for Review:

The following checklist is intended as a guide for the engineer preparing a Technical Drainage Study to submit to the local entity and Clark County Regional Flood Control District (if necessary). The listed items are the minimum information required prior to the entity performing a review. The engineer will remain responsible to ensure the Technical Drainage Study is prepared within the guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (MANUAL).

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

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

I. GENERAL REQUIREMENT

Yes

No

X

Design Manual **Standard Form 1** with the engineer's seal and signature.

X

Design Manual **Standard Form 4**.

X

2 copies of the 24" x 36" Drainage Plan.

N/A

A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge.

II. MAPS AND EXHIBITS

Yes

No

X

A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.

X

A copy of the current CCRFCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

II. MAPS AND EXHIBITS (Continued)

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

III. DRAINAGE PLAN

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

III. DRAINAGE PLAN (Continued)

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

IV. HYDROLOGIC ANALYSIS

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

REFERENCE:

STANDARD FORM 2

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE SUBMITTAL CHECKLIST

V. HYDRAULIC ANALYSIS

Yes	No	
☐	☒ N/A	Flow split calculations and supporting documentation or reference for the method of flow split calculations used.
☒ X	☐	Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the Q_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan.
☒ X	☐	A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
☐	☒ 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.)
☐	☒ N/A	Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
☒ X	☐	Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q_{100} weir height or flow depth, whichever is greater.
☐	☒ N/A	A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. • Field survey data. • Input and output information. • Plotted cross-sections based on survey with proper encroachments. • A map showing the location of the cross-sections. • Analysis of both sub and super-critical flow segments. • A summary table and a discussion of the results in the text of the report.
☒ X	☐	Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
☒ X	☐	Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.
☒ X	☐	The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.
☐	☒ N/A	Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).

REFERENCE:

STANDARD FORM 2



CITY OF LAS VEGAS

MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

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

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

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



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February 10, 2020

Mr. Yuk (Albert) Sung, P.E., CFM
City of Las Vegas Public Works Department
333 N. Rancho Dr., 7th floor
Las Vegas, NV 89106

RE: TECHNICAL DRAINAGE STUDY FOR MABEL HOGGARD ELEMENTARY SCHOOL
ATKINS PROJECT NO: 100067217

Dear Mr. Sung:

Transmitted herewith is the Technical Drainage Study for Mabel Hoggard Elementary School. This letter certifies that that all items in the Technical Drainage Study for Mabel Hoggard Elementary School electronic submittal matches the paper version bound into the study.

Please contact Atkins at 702-551-0365 if you have any question regarding this submittal.

Sincerely,

Atkins,

Janelle Klein, P.E.
Senior Engineer
Land Development

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Figure 7A: 2005 CLV Central Neighborhood Flood Control Master Plan Map Existing Condition
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Figure 8: Existing Condition Subbasin Map
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- Appendix A-1: Existing Condition Hydrologic Parameters
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Appendix B. Reference Material

- Appendix B-1: CCSD – Mabel Hoggard Elementary School 2001
- Appendix B-2: Mabel Hoggard Sixth Grade Center 1992
- Appendix B-3: Freeway Channel – Washington, MLK to Rancho Drive
- Appendix B-4: Freeway Channel – Washington, MLK to Rancho Drive Update #1

Appendix C. Civil Improvement Plans

Appendix D. Electronic CD

1. Introduction

The Clark County School District is proposing to replace portions of the existing Mabel Hoggard Elementary School buildings and site equipment with new buildings and equipment. This report has been prepared as a Technical Drainage Study to present a detailed hydrologic and hydraulic analysis for the existing, interim, and ultimate onsite and offsite conditions, and determine adequate protection for the project from offsite and onsite flows. The following tasks were performed in the preparation of this report:

- Identify previous drainage studies for the project site and surrounding areas.
- Identify the FEMA floodplain designation for the site.
- Identify existing and proposed regional and city drainage facilities adjacent to the site.
- Estimate runoff generated for the peak 10-year and 100-year return period storm events.
- Recommend drainage facilities to protect the site from storm runoff.

2. Site Description and Location

The project site is located at 950 North Tonopah Drive, Las Vegas, Nevada. The parcel is within Section 28, Township 20 South, Range 61 East. The Assessor's Parcel Number is 139-28-210-007. The site is bordered on the west Tonopah Drive, on the east by existing Residence Estates District (R-E) lots and Virginia City Avenue, on the south by existing Residence Estates District (R-E) lots, on the north by existing Residence Estates District (R-E) lots. Refer to **Figure 1: Vicinity Map** and **Figure 2: Assessor's Parcel Map** for the project's location. The existing site is a 7.03-acre Civic District (C-V) lot with an elementary school that was originally constructed in 1960 with storm drain and site improvements in 1992 and 2001. The project site generally drains southeast. The Clark County School District is proposing to proceed with school replacement to open in the fall of 2021. School replacement consists of demolition of existing buildings, parking and onsite improvements; re-grading the site and constructing new buildings, parking, drive aisles, and site improvements. The administration building and adjacent classroom building, constructed in 2001 are to remain, protected in place. Refer to **Figure 3: Proposed Site Plan** for the layout of the new site improvements.

Figure 1. Vicinity Map

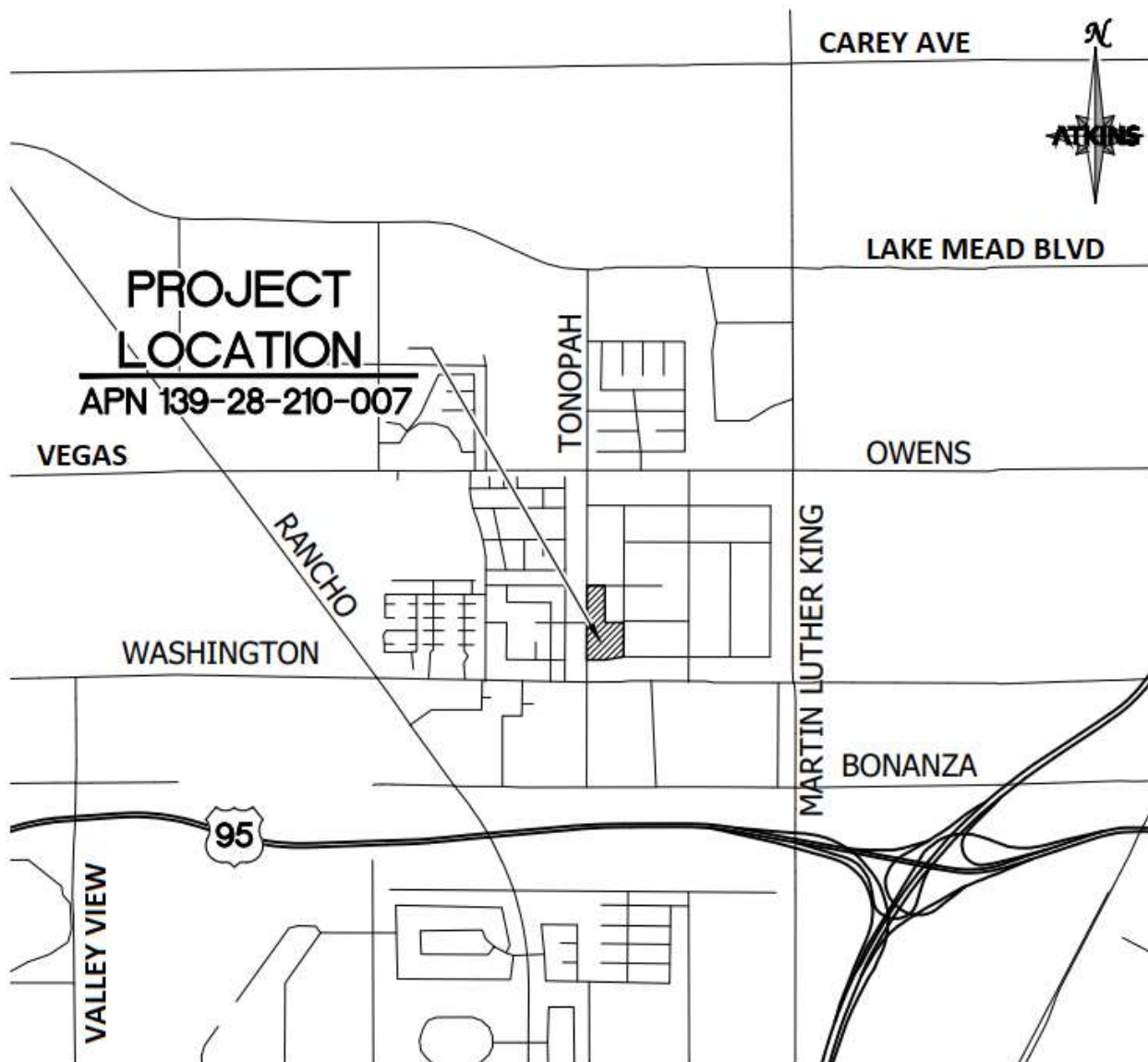
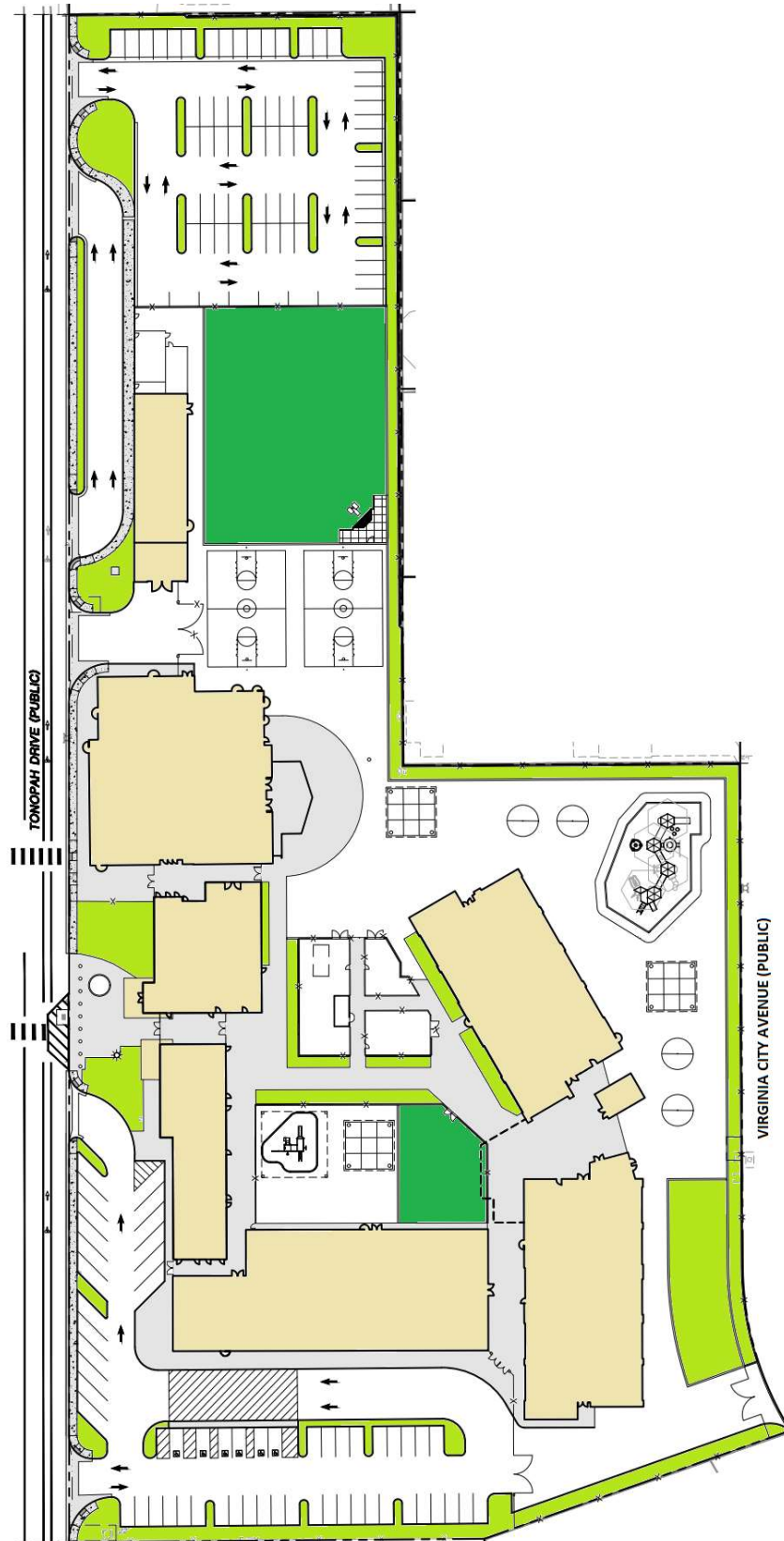


Figure 3. Proposed Site Plan



3. FEMA Floodplain Status

Figure 4: Effective FEMA Map is a reproduction of the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) for Clark County (Community Number 32003C), panel 2170F, dated November 16, 2011. As shown on **Figure 4**, the project site lies within a FEMA designated Shaded Zone X. Areas in a Shaded Zone X are defined as being areas of 0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile.

4. Clark County Regional Flood Control Facilities and Map

Figures 5A and **5B** are a reproduction of Figure F-24 and associated facilities summary table from the 2018 Las Vegas Valley Flood Control Master Plan Update (MPU). As shown on **Figure 5A**, there are no existing or proposed CCRFCD Facilities through or in the immediate vicinity of the project site, however there are existing local facilities that flow down Ophir Drive to regional facility LV15 0427 an existing 8' x 6' RCB in Washington Avenue at Comstock Drive. In addition, **Figure 6** is a reproduction of Figure W-5 Central Watershed from the 2018 MPU. The site is within subbasin VG07, with a soil designation of 1300 and land use of Schools.

5. City of Las Vegas Flood Control Master Plan

Figure 7A is a reproduction of Figure E-3 Existing Drainage Conditions, **Figure 7B** is a reproduction of Figure F-3 Future Drainage Conditions from the 2005 City of Las Vegas Central Neighborhood Flood Control Master Plan. As shown on **Figures 7A** and **7B**, there are no existing or proposed City Facilities shown in or adjacent to the project site, however the onsite storm drain connects to an 18" storm drain in Virginia City Avenue which connects via Ophir Drive and Comstock Drive to Washington Avenue was constructed in 2001. Based on Figure E-9 the project site is within sub-basin VG07. The existing flows within the adjacent Tonopah Drive are shown to be routed to facilities in the proposed condition.

6. Previous and/or Related Drainage Studies

Based on the City of Las Vegas Central Neighborhood Master Plan, the existing upstream tributary watershed is mostly developed residential with scattered vacant lots.

The referenced Drainage Plans and maps are provided in **Appendix C**.

- **Early Childhood Development Center**, Baughman & Turner, March 1995. CLV #1551
- **Mabel Hoggard Elementary School**, Martin & Martin, February 2001. CLV #925
- **Freeway Channel – Washington, MLK to Rancho Drive** and Update #1. Atkins, CLV#731-90

National Flood Hazard Layer FIRMette



Legend

SEE FIS REPORT FOR DETAILED LEGEND AND INDEX MAP FOR FIRM PANEL LAYOUT

SPECIAL FLOOD HAZARD AREAS		Without Base Flood Elevation (BFE) Zone A, V, A99
		With BFE or Depth Zone AE, AO, AH, VE, AR
		Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD		0.2% Annual Chance Flood Hazard, Areas of 1% annual chance flood with average depth less than one foot or with drainage areas of less than one square mile Zone X
		Future Conditions 1% Annual Chance Flood Hazard Zone X
		Area with Reduced Flood Risk due to Levee. See Notes. Zone X
		Area with Flood Risk due to Levee Zone D
OTHER AREAS		NO SCREEN Area of Minimal Flood Hazard Zone X
		Effective LOMRs
		Area of Undetermined Flood Hazard Zone D
GENERAL STRUCTURES		Channel, Culvert, or Storm Sewer
		Levee, Dike, or Floodwall
OTHER FEATURES		20.2 Cross Sections with 1% Annual Chance Water Surface Elevation
		17.5
		Coastal Transect
		Base Flood Elevation Line (BFE)
		Limit of Study
		Jurisdiction Boundary
MAP PANELS		Coastal Transect Baseline
		Profile Baseline
		Hydrographic Feature
MAP PANELS		Digital Data Available
		No Digital Data Available
		Unmapped



The pin displayed on the map is an approximate point selected by the user and does not represent an authoritative property location.

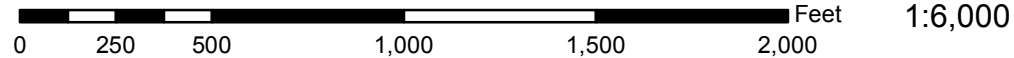
This map complies with FEMA's standards for the use of digital flood maps if it is not void as described below. The basemap shown complies with FEMA's basemap accuracy standards

The flood hazard information is derived directly from the authoritative NFHL web services provided by FEMA. This map was exported on 7/11/2019 at 4:29:43 PM and does not reflect changes or amendments subsequent to this date and time. The NFHL and effective information may change or become superseded by new data over time.

This map image is void if the one or more of the following map elements do not appear: basemap imagery, flood zone labels, legend, scale bar, map creation date, community identifiers, FIRM panel number, and FIRM effective date. Map images for unmapped and unmodernized areas cannot be used for regulatory purposes.



115°10'28.06"W



115°9'50.60"W

FIGURE 4



2018
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FIGURE F-24
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 |



Scale: 1 inch = 2,000 feet
AerialSource: Esri World Imagery 2017

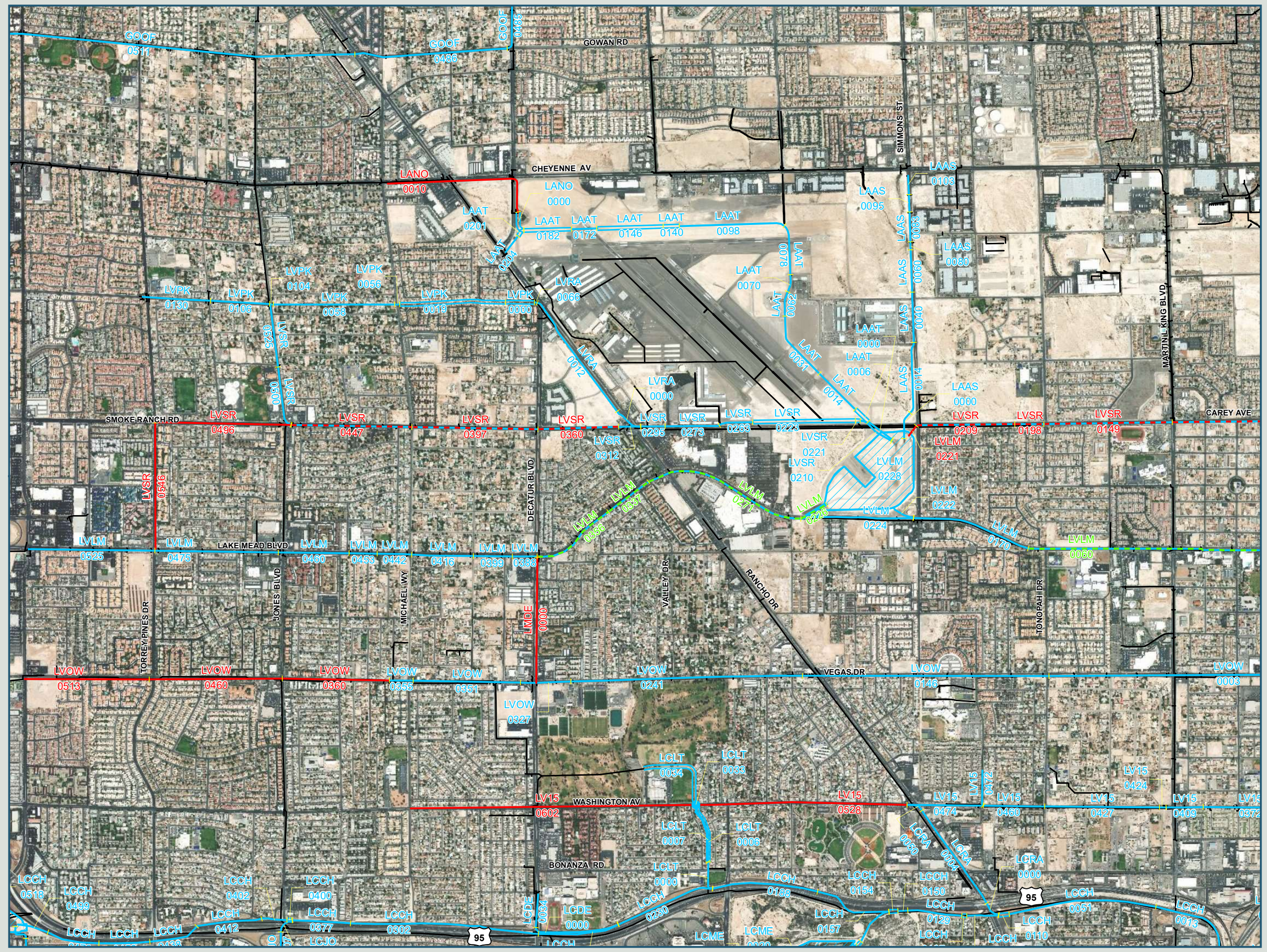
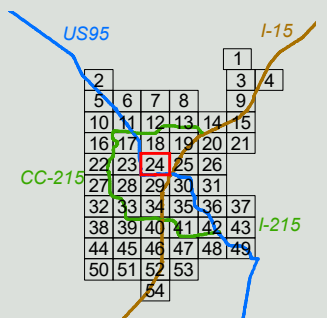


FIGURE 5A

ID / Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOOF		GOWAN OUTFALL FACILITIES						
0485	E	90" RCP	1080	630	DGOW2A	GOW3B	1.37	0.47
0486	E	8" X 5' RCB	3200	630	DGOW2A	GOW3B	1.37	0.60
0511	E	8" X 5' RCB	8390	740	CPT6B-C	GOW3B	1.08	0.50
LAAS		NORTH LAS VEGAS AIR TERMINAL - SIMMONS						
0000	E	14" X 6' RCB	580	728	CR2-CA	NW3	2.57	0.50
0014	E	9" X 6' RCB	1489	728	CR2-CA	NW3	2.57	1.44
0040	E	8" X 6' RCB	1111	728	CR2-CA	NW3	2.57	1.74
0060	E	10" X 6' RCB	864	728	CR2-CA	NW3	2.57	0.60
0080	E	66" RCP	157	294	R-C	NW3	0.27	0.50
0083	E	60" RCP	627	294	R-C	NW3	0.27	1.42
0095	E	54" RCP	373	294	R-C	NW3	0.27	1.44
0103	E	48" RCP	400	294	R-C	NW3	0.27	1.75
LAAT		NORTH LAS VEGAS AIR TERMINAL						
0000	E	3: 8" X 5' RCB	650	1364	CB3-1	NW3	4.17	0.50
0006	E	CONC CHNL 20"W 8"D 1.5:1 SS	380	1364	CB3-1	NW3	4.17	0.50
0014	E	10" X 6' RCB	934	1364	CB3-1	NW3	4.17	1.84
0031	E	10" X 6' RCB	1618	1105	CB3-2	NW3	3.87	1.05
0062	E	12" X 8' RCB	511	1105	CB3-2	NW3	3.87	0.50
0070	E	12" X 6' RCB	376	1105	CB3-2	NW3	3.87	0.56
0078	E	10" X 6' RCB	1055	1105	CB3-2	NW3	3.87	0.58
0098	E	10" X 4' RCB	2207	696	CCA1-C	NW3	2.98	0.60
0140	E	CONC CHNL 6"W 4"D 1.5:1 SS	338	696	CCA1-C	NW3	2.98	0.64
0146	E	CONC CHNL 6"W 3"D 1.5:1 SS	1388	696	CCA1-C	NW3	2.98	0.68
0172	E	76" X 48" HERCP	536	494	CA1-C	NW3	2.77	0.75
0182	E	CONC CHNL 6"W 3"D 1.5:1 SS	997	494	CA1-C	NW3	2.77	0.83
0201	E	CONC CHNL 6"W 3"D 1.5:1 SS	184	494	CA1-C	NW3	2.77	0.37
0204	E	48" RCP	425	494	CA1-C	NW3	2.77	0.37
LANO		NORTH LAS VEGAS AIR TERMINAL NORTH						
0000	E	CONC CHNL 0"W 3"D 1.5:1 SS	470	494	CA1-C	NW3	2.77	0.30
0010	P	6" X 4' RCB	3375	211	DA1-C	NW3	2.46	1.13
LCCH		LAS VEGAS CREEK CHANNEL						
0013	E	2: 12" X 6' RCB	2035	3050	CLC20-C	MEADOWS4	9.60	0.82
0051	E	2: 14" X 7' RCB	3113	3050	CLC20-C	MEADOWS4	9.60	0.60
0110	E	TRANSITION STRUCTURE	220	3001	COLC16-C	MEADOWS4	9.50	
0114	E	2: 14" X 7' RCB	670	2386	CRMEDET	MEADOWS4	8.19	0.80
0127	E	TRANSITION STRUCTURE	110	2386	CRMEDET	MEADOWS4	8.19	
0129	E	2: 14" X 7' RCB	1130	2386	CRMEDET	MEADOWS4	8.19	0.50
0150	E	2: 13" X 7' RCB	200	2386	CRMEDET	MEADOWS4	8.19	0.95
0154	E	TRANSITION STRUCTURE	190	2386	CRMEDET	MEADOWS4	8.19	
0157	E	2: 12" X 6' RCB	1650	1700	COLC14-C	SW3	2.93	1.06
0188	E	2: 12" X 6' RCB	2225	1700	COLC14-C	SW3	2.93	1.36
0230	E	12" X 6' RCB	2140	1450	CLC14-C	SW3	2.53	1.74
0270	E	12" X 6' RCB	1705	814	CCWA02-C	SW3	1.84	0.54
0302	E	8" X 6' RCB	3940	814	CCWA02-C	SW3	1.84	2.49
0377	E	10" X 7' RCB	1226	814	CCWA02-C	SW3	1.84	0.74
0400	E	TRANSITION STRUCTURE	110	458	CWA02-C	SW3	1.47	0.49
0402	E	8" X 6' RCB @ JONES	535	458	CWA02-C	SW3	1.47	0.49
0412	E	60" RCP	1370	458	CWA02-C	SW3	1.47	1.08
0438	E	60" RCP	1090	171	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1060	171	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	171	CLC01-C	SW3	1.20	0.55
0499	E	42" RCP OUTLET	660	87	RAINBOWDB	SW3	1.11	1.88
0513	E	102 AC-FT RAINBOW DETENTION BASIN		1027	RAINBWIN	SW3	1.11	
LCDE		LAS VEGAS CREEK - DECATUR						
0000	E	6" X 5' RCB	1800	430	LC11-C	SW3	0.38	1.26
0034	E	72" RCP	700	430	LC11-C	SW3	0.38	0.50
LCJO		LAS VEGAS CREEK - JONES						
0000	E	6" X 6' RCB	380	381	AL01B-C	SW3	0.37	0.50
0007	E	6" X 5' RCB	675	381	AL01B-C	SW3	0.37	0.62
LCLO		LAS VEGAS CREEK - LORENZI						
0000	E	7" X 6' RCB	445	285	DAL00A	SW3	0.41	3.37
LCLO		LAS VEGAS CREEK - LORENZI						
0008	E	7" X 6' RCB	2983	285	DAL00A	SW3	0.41	0.40
LCLT		LAS VEGAS CREEK - LATERAL						
0000	E	6" X 6' RCB	620	250	WA10D	SW3	0.40	0.50
0006	E	CONC CHNL 10"W 4"D 0:1 SS	1230	125^	WA10D^	SW3	0.40	0.62
0007	E	23" x 14" HERCP	1230	125^	WA10D^	SW3	0.40	0.62
0033	E	10" X 4' RCBC @ WASHINGTON	96	372	WA10-C	SW3	0.40	0.50
0034	E	GRASS CHNL 12"W 5"D 1:1 SS	1750	372	WA10-C	SW3	0.40	0.20
LCME		LAS VEGAS CREEK - MEADOWS						
0000	E	14" X 8' RCB	895	1484	MEADOWDB	SW3SC	5.67	0.72
0016	E	STILLING BASIN	140	1484	MEADOWDB	SW3SC	5.67	0.21
0017	E	3,300 CFS SPILLWAY (REPLACE W/ LCME0018)		3300	MEADOWDB	SW3SC	5.67	
0018	P	MODIFY SPILLWAY, RAISE HEIGHT BY 1' (REPLACES LCME0017)		3300	MEADOWDB	SW3SC	5.67	
0019	E	1: 11" X 5' RCB AND 1: 11.5' X 5' RCB	110	1484	MEADOWDB	SW3SC	5.67	0.81
0020	E	213 AC-FT MEADOWS DETENTION BASIN		4909	MEADOWIN	SW3SC	7.55	
LCRA		LAS VEGAS CREEK - RANCHO						
0000	E	12" X 8' RCB	380	931	CLC16-C	SW3	1.71	0.60
0004	E	12" X 6' RCB	2367	931	CLC16-C	SW3	1.71	0.77
0050	E	8" X 6' RCB	355	694	WA13D	SW3	1.39	0.50
LMDE		LAKE MEAD BOULEVARD - DECATUR BRANCH						
0000	P	10" X 5' RCB	2640	673	DCVG04-C	NW3	1.25	0.90
LV15		FREEWAY CHANNEL						
0372	E	9" X 6' RCB	1970	1152	CWA20-C	NW3	4.52	0.66
0409	E	7" X 6' RCB	815	841	CVG07	NW3	4.09	0.91
0424	E	10" X 5' RCB	130	841	CVG07	NW3	4.09	0.40
0427	E	8" X 6' RCB	2411	841	CVG07	NW3	4.09	0.60
0460	E	6" X 5' RCB	1242	253	CCWA13-C	NW3	3.31	1.50
0472	E	60" RCP	713	410	WA15A-C	NW3	0.43	0.30
0474	E	5" X 5' RCB	1625	253	CCWA13-C	NW3	3.31	1.00
0528	P	8" X 8' RCB	4420	959	CWA13-C	SW3	1.39	1.19
0602	P	2: 66" RCP	5980	551	CWA09-C	SW3	0.63	1.59
LVLN		LAS VEGAS WASH - LAKE MEAD						
0059	E	72" RCP (REPLACE W/ LVLN0060)	5952	1159	CLM20-C	NW3SC	1.36	0.66
0060	P0	12" X 7' RCB (REPLACES LVLN0059)	5952	1159	CLM20-C	NW3SC	1.36	0.66
0170	E	78" RCP	2421	454	CLM16A-C	NW5	12.15	1.17
0221	P	48" RCP OUTLET	270	195	DR2	NW4	11.77	
0222	E	48" RCP OUTLET	500	368	DCAREY	NW4	11.77	
0224	E	36" RCP	2429					0.53
0225	E	90" RCP (REPLACE W/ LVLN0226)	641	2077	CLM10-C	NW3	3.01	1.35
0226	P0	2: 10" X 9' RCB (REPLACES LVLN0225)	641	2077	CLM10-C	NW3	3.01	0.50
0227	E	10,000 CFS PMF SPILLWAY		10000	CARYLMD8	NW4	11.77	
0228	E	607 AC-FT CAREY-LAKE MEAD DETENTION BASIN		5499	CARYLMIN	NW4	11.78	
0270	E	90" RCP (REPLACE W/ LVLN0271)	3473	2077	CLM10-C	NW3	3.01	1.35
0271	P0	12" X 8' RCB (REPLACES LVLN0270)	3473	2077	CLM10-C	NW3	3.01	1.35
0336	E	84" RCP (REPLACE W/ LVLN0337)	1050	1769	CLM06-C	NW3	2.60	1.16
0337	P0	12" X 8' RCB (REPLACES LVLN0336)	1050	1769	CLM06-C	NW3	2.60	1.16
0355	E	90" RCP (REPLACE W/ LVLN0356)	1840	1769	CLM06-C	NW3	2.60	0.40
0356	P0	12" X 11" RCB (REPLACES LVLN0355)	1840	1769	CLM06-C	NW3	2.60	0.40
0388	E	84" RCP	520	913	CLM05-C	NW3	1.00	1.40
0399	E	78" RCP	803	913	CLM05-C	NW3	1.00	1.07
0416	E	72" RCP	1320	913	CLM05-C	NW3	1.00	1.00
0442	E	60" RCP	725	591	CLM03-C	NW3	0.63	1.28
0453	E	54" RCP	589	591	CLM03-C	NW3	0.63	2.37
0460	E	54" RCP	1464	591	CLM03-C	NW3	0.63	2.05
0475	E	48" RCP	2632	242	LM02-C	NW3	0.29	1.24
0525	E	48" RCP	2600	565	CLM01-C	NW3	0.64	1.24
LVOW		OWENS AVENUE SYSTEM						
0003	E	96" RCP	7500	1219	CLM16B-C	NW3	2.43	0.70
0146	E	84" RCP	4800	570	DCVG20-C	NW3	2.04	0.90
0241	E	72" RCP	4832	416	CVG20-C	NW3	1.56	1.65
0327	E	7" X 5' RCB	360	416	CVG20-C	NW3	1.56	1.26
0351	E	72" RCP	2250	837	CVG04-C	NW3	1.25	1.44
LVOW		OWENS AVENUE SYSTEM						
0355	E	8" X 5' RCB	491	837	CVG04-C	NW3	1.25	0.40
0360	P	8" X 6' RCB	2300	837	CVG04-C	NW3	1.25	1.48
0460	P	7" X 6' RCB	2700	615	CVG03-C	NW3	0.95	1.48
0513	P	6" X 5' RCB	2615	463	CVG02-C	NW3	0.68	1.68
LVPK		PEAK DRIVE SYSTEM						
0000	E	CONC CHNL 15"W 6"D 0:1 SS	606	1081	CPD04B-C	NW3	1.59	1.22
0019	E	CONC CHNL 20"W 5.5"D 0:1 SS	2190	1081	CPD04B-C	NW3	1.59	0.57
0056	E	10" X 5' RCB	103	723	CCY04A-C	NW3	1.12	0.40
0058	E	9" X 6' RCB	2542	723	CCY04A-C	NW3	1.12	0.95
0104	E	10" X 6' RCB	76	723	CCY04A-C	NW3	1.12	1.26
0106	E	7" X 5' RCB	1235	723	CCY04A-C	NW3	1.12	0.61
0130	E	7" X 5' RCB	1435	383	CPD01-C	NW3	0.67	0.61
LVRA		LAS VEGAS WASH - RANCHO						
0000	E	12" X 8' RCB	612	1438	CCPD04BC	NW3	3.77	1.56
0012	E	12" X 8' RCB	2838	1438	CCPD04BC	NW3	3.77	0.78
0066	E	14" X 5' RCB	65	1438	CCPD04BC	NW3	3.77	1.22
LVSR		LAS VEGAS WASH - SMOKE RANCH						
0070	E	66" RCP (REPLACE W/ LVSR0071)	4118	1086	CS1-C	NW3SC	1.42	0.73
0071	P	10" X 8' RCB (REPLACES LVSR0070)	4118	1086	CS1-C	NW3SC	1.42	0.73
0148	E	54" RCP (REPLACE W/ LVSR0149)	2587	823	CS	NW3SC	0.95	0.58
0149	P	11" X 6' RCB (REPLACES LVSR0148)	2587	823	CS	NW3SC	0.95	0.58
0197	E	30" RCP (REPLACE W/ LVSR0198)	581	368	CR2-C	NW3SC	0.38	0.86
0198	P	8" X 4' RCB (REPLACES LVSR0197)	581	368	CR2-C	NW3SC	0.38	0.86
0208	E	54" RCP (REPLACE W/ LVSR0209)	2060	368	CR2-C	NW3SC	0.38	1.41
0209	P	7" X 4' RCB (REPLACES LVSR0208)	2060	368	CR2-C	NW3SC	0.38	1.41
0210	E	14" X 8' RCB	800	3092	CB1-C	NW3	6.34	1.73
0221	E	TRANSITION STRUCTURE	100	3092	CB1-C	NW3	6.34	7.08
0223	E	CONC CHNL 14"W 8"D 1.5:1 SS	2150	3092	CB1-C	NW3	6.34	0.96
0263	E	14" X 8' RCB	707					

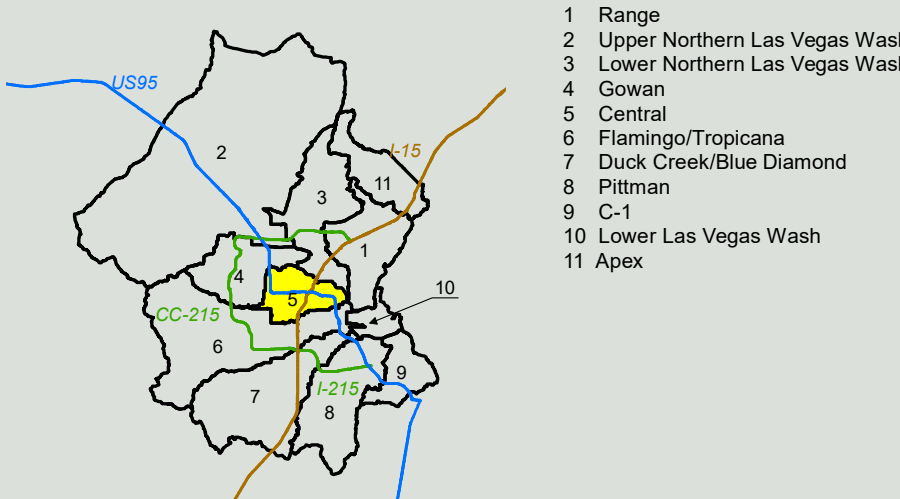


2018 Las Vegas Valley Master Plan Update

Figure W-5
Central Watershed

Legend

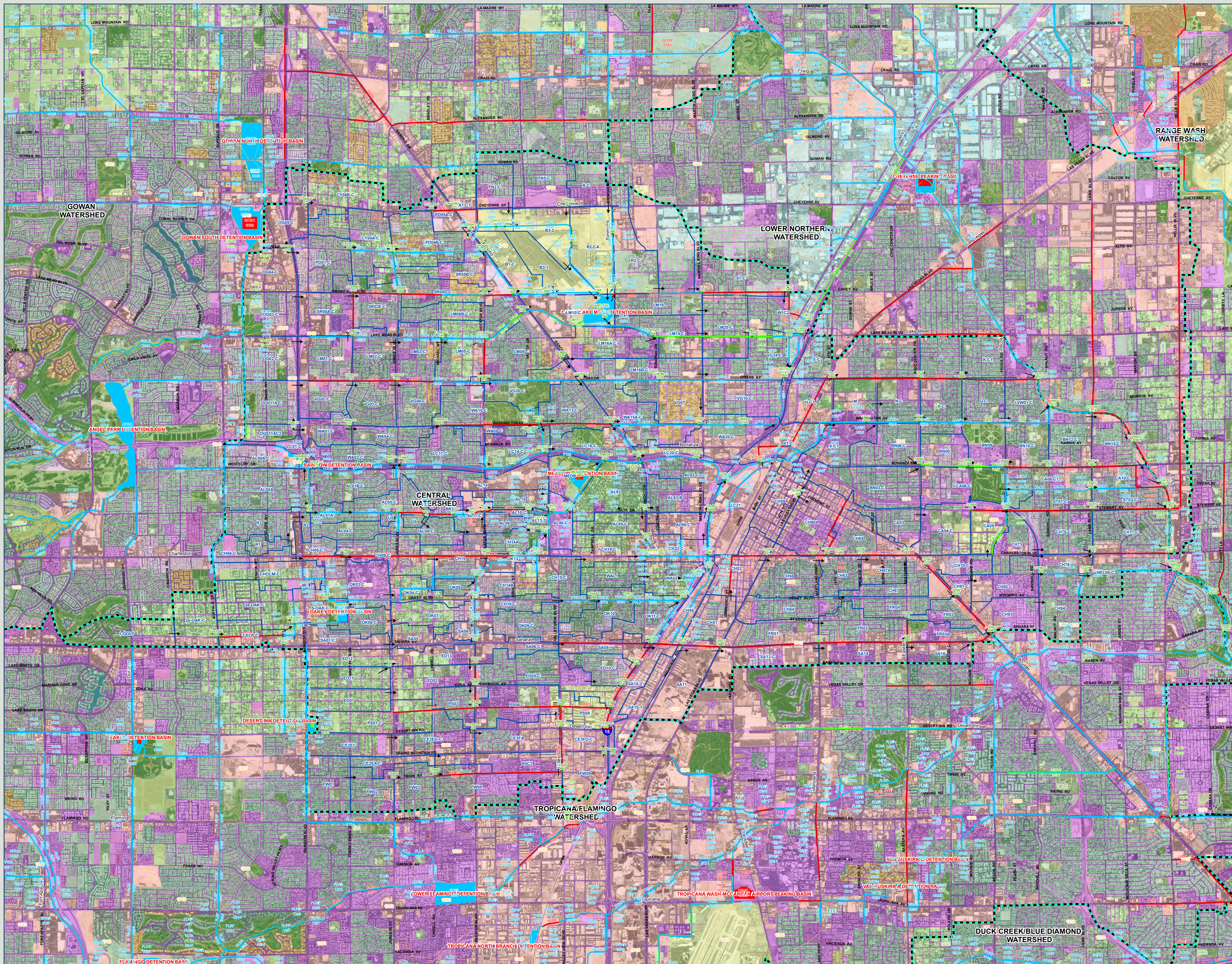
- Flow Arrows
- Concentration Points
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Ultimate Development Boundary
- Watershed
- Subbasins
- Soils
- 1: Undeveloped Land, Open desert
- 2: Parks, Golf Courses
- 3: Rural, 0.5-1 units per acre (uses 1 unit/acre)
- 4: Low-Density Residential, 1-2 units per acre (uses 2 units/acre)
- 5: Medium-Density Residential, 2-4 units per acre (uses 3 units/acre)
- 6: High-Density Residential, 4-8 units per acre (uses 6 units/acre)
- 7: Public Facility and Residential, 8-12 units/acre
- 8: Very High-Density Residential, 12 units/acre or more
- 9: Commercial, Retail, Casino, High Rise Condominiums
- 10: Light Industrial
- 11: Heavy Industrial
- 12: Schools
- 13: Lakes



Scale: 1 inch = 0.5 mile
0 0.25 0.5 1
Miles

ATKINS
Member of the SNC-Lavalin Group

Louis Berger



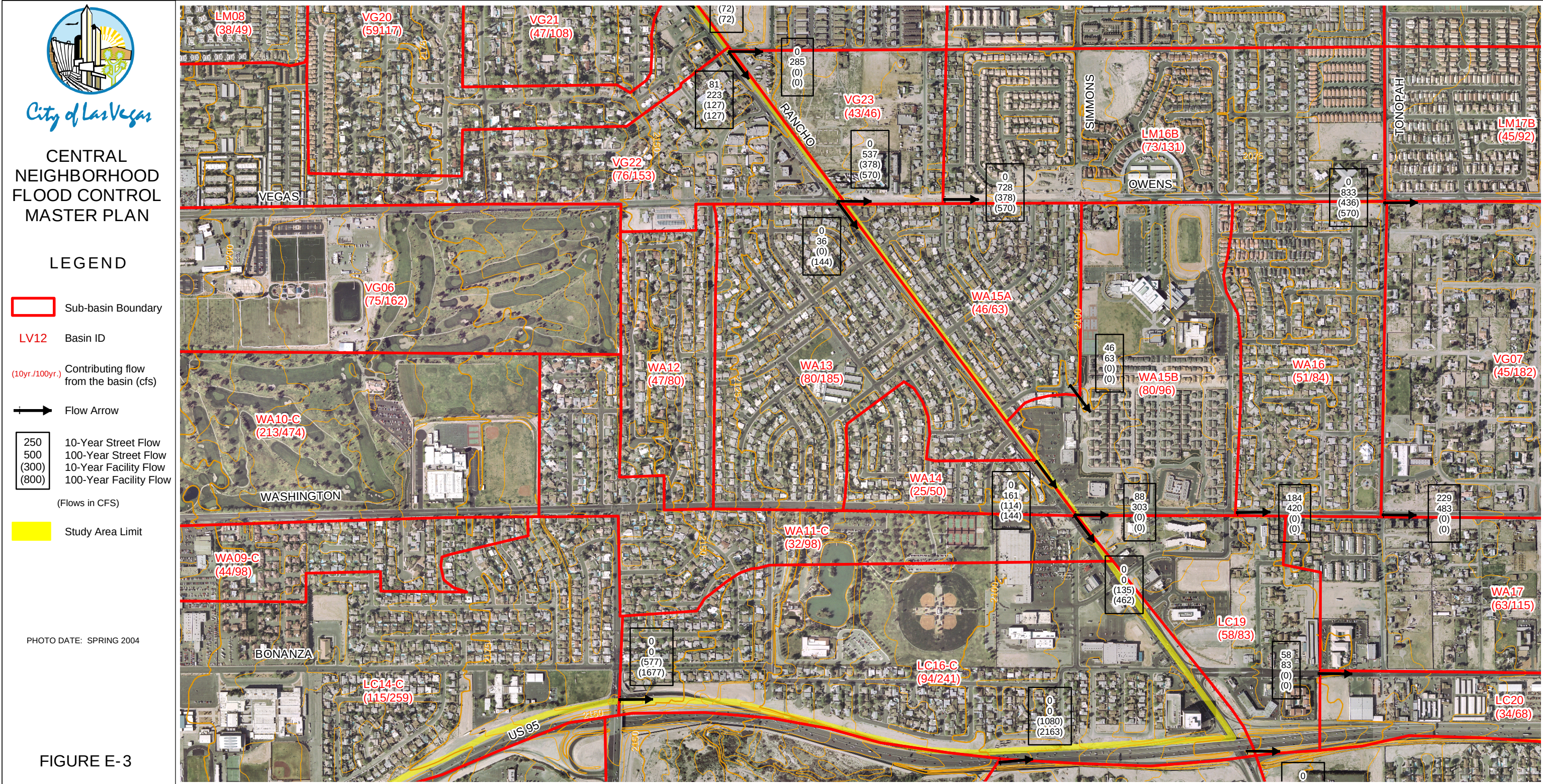


FIGURE E-3

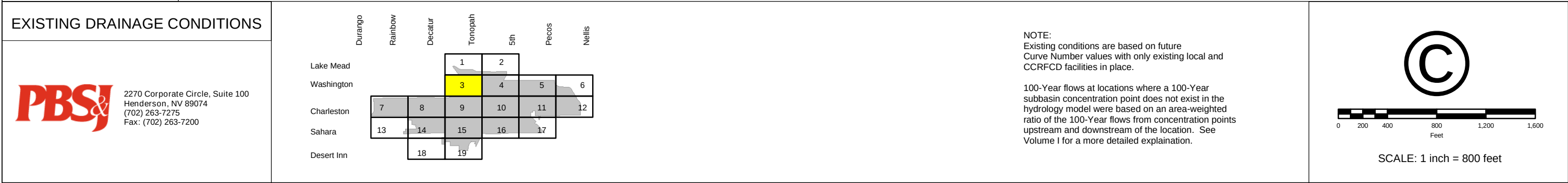


FIGURE 7A



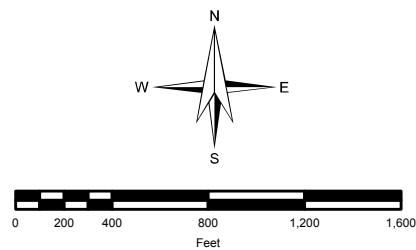
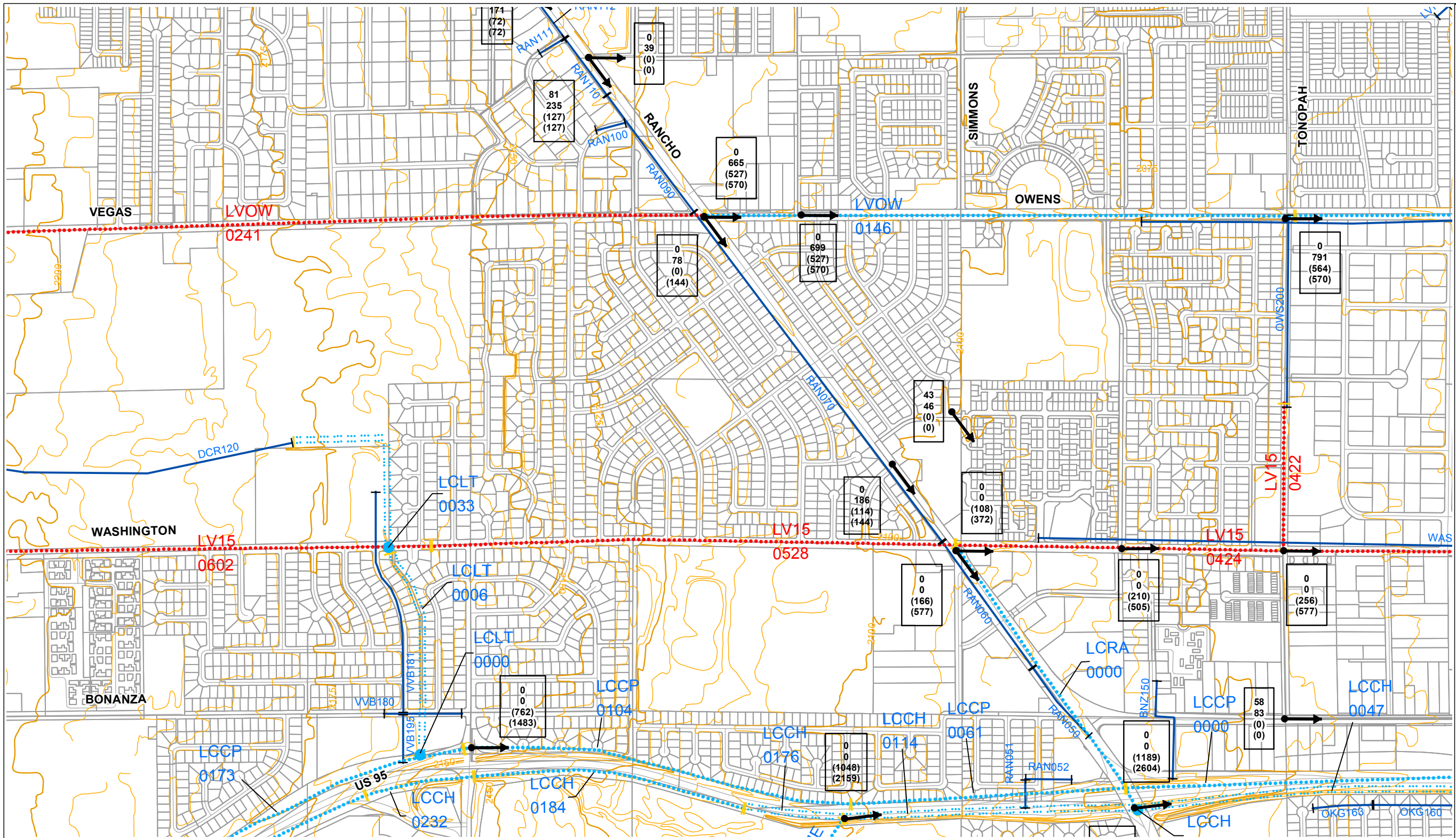
City of Las Vegas

CENTRAL NEIGHBORHOOD FLOOD CONTROL MASTER PLAN

LEGEND

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

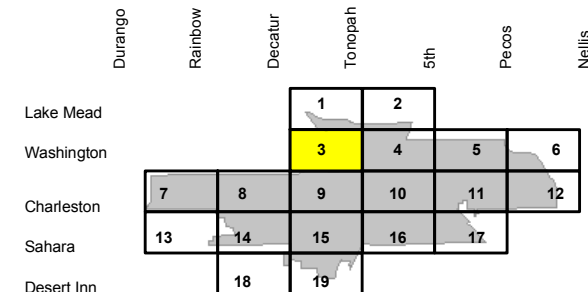
FIGURE F-3



- Flow Arrow
- 250
 - 500
 - (300)
 - (800)
- 10-Year Street Flow
100-Year Street Flow
10-Year Facility Flow
100-Year Facility Flow
- (Flows in CFS)

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

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



FUTURE DRAINAGE CONDITIONS

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

7. Topography Data and Survey

The existing topographic information for the project site is based on the following source:

Aerial photography completed by Aerotech Mapping, Inc.; Flight Date: November 21, 2018

The above source utilizes the vertical datum of North American Vertical Datum (NAVD) 88, and English Units.

8. Hydrologic Analysis and Parameterization

The methodology used to develop the existing and ultimate condition hydrologic models, and associated input parameters for the Drainage Study is discussed in detail in the following paragraphs. Supporting documentation for the hydrologic analysis is included in **Appendix A**.

a. Computer Modeling

HEC-1 Version 4.1 (dated June 1998) was used for the hydrologic modeling in order to be consistent with the methodology used for the approved offsite tributary properties. As mentioned previously, all offsite subbasins were directly referenced from their respective approved technical drainage study. The limits of each reference study and print outs of the approved HEC-1 models/subbasin maps are provided in **Appendix C**.

b. Subbasin Delineation

The area that contributes to Virginia City Avenue and flows past the east side of the site is comprised of Residence Estates District (R-E) residential lots. There are high points in the adjacent streets near the southern boundary of the project site which limit offsite impact. For the onsite subbasins, the basin delineation is based on the grading plan for the project site. The existing 1-ft topography and existing conditions were reviewed to ensure that the overall onsite flow patterns are maintained and do not adversely increase the discharge leaving the project site at any of the existing downstream discharge points.

c. Design Storm

The hydrologic analysis was performed for both the 10 and 100-year storm events.

d. Precipitation Depths

All subbasins contributing runoff to the project site are within the McCarran Airport rainfall area as defined in the Design Manual. Therefore, the 10-year and 100-year, 6-hour rainfall depths are 1.58 and 2.77 inches, respectively for all subbasins. The 10-year rainfall depth was input into the HEC-1 model by applying a ratio of 0.57 to the 100-year rainfall depth.

e. Storm Distribution

The rainfall depths discussed in the previous section were distributed over the 6-hour design storm period using the SDN 3 storm distribution. According to established CCRFCD methodology, SDN 3 is used for drainage areas less than eight square miles. All combination points and subbasins have tributary areas less than eight square miles.

f. Depth-Area Reduction Factors

The precipitation depths obtained for the McCarran Airport Rainfall Area from the Design Manual represent rainfall frequency at isolated points. Storms, however, cause rainfall to occur over widespread areas simultaneously, with the most intense rainfall typically occurring near the center of the storm. To account for the rainfall variation, standard precipitation analysis methods require adjusting point precipitation depths downward in order to better represent the average depth of rainfall over the entire storm area. This is done using depth-area reduction curves that relate point precipitation reduction factors to storm area and duration. The reduction factors cause the rainfall depth to decrease as the tributary area increases.

The six-hour depth-area reduction factors (DARFs) from Table 502 in the Design Manual were applied to the rainfall depths in the HEC-1 models at each subbasin and concentration point based on upstream tributary area. Rather than interpolating precise reduction factors at every concentration point, an average DARF value was used for a range of tributary areas. The DARF values applied to the model are shown in **Table 1**:

Table 1. Depth-Area Reduction Factors

Tributary Area (sq mi)	100-year DARF	10-year DARF*
$0 \leq \text{Area} < 0.13$	1.00	0.57
$0.13 \leq \text{Area} < 0.5$	0.98	0.56

*10-year DARF is calculated by multiplying the 100-year DARF by the 10-year precipitation depth ratio of 0.57.

g. Soils

Soils data used for the onsite and adjacent offsite subbasins comes from the Soil Survey of the Las Vegas Valley Area by the National Resource Conservation Service (NRCS), dated July 1985. These soils data were used to be consistent with the 2018 Las Vegas Valley MPU. NRCS methodology divides soils into four hydrological groups, as defined below:

- A. High infiltration rate, low runoff potential
- B. Moderate infiltration rate, moderately low runoff potential
- C. Slow infiltration rate, moderately high runoff potential
- D. Very slow infiltration rate, high runoff potential

Each soil map unit number is made up of a certain percentage of hydrologic soil group A, B, C, and D. Curve number calculations for each of the subbasins were based on the individual breakdown of each soil type into the percentages of the minor hydrologic soil group components (A, B, C, or D). For the project site, onsite basins are comprised of Soil Type 300 (100% Type D). The west upstream subbasins are primarily Soil Type 236 and 300 (56.8% Type C, 43.2% Type D). The east upstream subbasins are primarily Soil Type 236 and 300 (61.4% Type C, 38.6% Type D).

h. Land Use

The existing condition land use for the entire project site is Civic District (C-V) school. The west upstream subbasins are Single Family Residence District (R-1) residential with 0.15 acre lots and east upstream subbasins are Ranch Acres District (R-A) residential with 0.65 acre lots. The land use data utilized for the Drainage Study hydrologic analysis is shown on Figures A-1, A-3 and A-5 included in Appendix A. The existing land use is based on the Clark County OpenWeb InfoMapper. The interim condition offsite land uses will remain the same and the onsite will be newly graded, the ultimate condition assumes that all onsite subbasins are fully developed.

i. Curve Numbers

Rainfall losses due to soil infiltration, depression storage, and other factors are computed using the NRCS curve number (CN) method described in the Design Manual. The curve number method is a function of soil type, land cover, and antecedent moisture condition. Based on the Design Manual, the average antecedent moisture condition (AMC II) is used for computing losses. Curve number information was compiled using GIS polygon processing of subbasin delineations, soil map unit delineations, and land use layers. To calculate a curve number for a given subbasin, the following procedure was used:

1. Base curve numbers are taken from the CCRFCD Design Manual for applicable land cover conditions shown for the applicable Hydrologic Soil Groups.
2. A curve number matrix is compiled to calculate a base curve number for a given combination of soil map unit and land use type.
3. The land use, soils, and subbasin polygons were overlaid in GIS to subdivide each subbasin into polygons (subareas) of unique land use and soil type combinations.
4. The curve number matrix is then used to assign a curve number for each subarea, and an area-weighted composite curve number is calculated for the whole subbasin based on the areas of the subdivided polygons and their associated curve numbers. The curve number and total area of each subbasin are then used in the hydrologic model input files.

The curve number calculations utilized for the Master Drainage Study hydrologic analysis are included in **Appendix A. Table 2** summaries the land use categories and associated curve numbers utilized for the hydrologic analysis.

Table 2. Land Use Categories and Associated Curve Numbers

Land Use Category	Soil Map Unit #	Hydrologic Soil Group	CN
Residential, 7,000 sq. ft. lots	300	D	91
Residential, 20,000 sq. ft. lots	300	D	85
Open space (good condition)	300	D	80
Newly Graded Areas	300	D	94
Streets and Roads (no curbs)	300	D	93
Commercial and Business	300	D	95

j. Lag Time

All subbasins are less than 0.5 square miles. As a result, the time of concentration equation (velocity method) from the Design Manual was utilized to calculate time of concentrations for each onsite subbasins, as well as the contributing offsite subbasin. This method is explained below.

The lag time is related to the time of concentration by the following empirical relationship:

$$T_{lag} = 0.6T_c$$

Where:

$$\begin{aligned} T_{lag} &= \text{Lag Time} \\ T_c &= \text{Time of concentration} \end{aligned}$$

The time of concentration is calculated as follows:

$$T_c = T_i + T_t$$

Where:

$$\begin{aligned} T_c &= \text{Time of concentration} \\ T_i &= \text{Initial, inlet, or overland flow time} \\ T_t &= \text{Travel time in the ditch, gutter, etc.} \end{aligned}$$

Initial flow time is calculated as follows:

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

Where:

$$\begin{aligned} T_i &= \text{Initial overland flow time (minutes)} \\ K &= 0.0132 * CN - 0.39 \\ CN &= \text{Curve number} \\ L_o &= \text{Length of overland flow (ft, maximum 500 feet)} \\ S &= \text{Average basin slope (percent)} \end{aligned}$$

Travel time is calculated as follows:

$$T_t = 500/(60 V_1) + (L_t - 500)/(60 V_2)$$

Where:

T_t = Travel time in the ditch, gutter, etc. (minutes)

L_t = Travel length (feet)

V_1 = Average velocity of flow for the first 500 feet of travel distance (feet/second)

V_2 = Average velocity of flow for the remaining travel distance (feet/second)

V_1 and V_2 are calculated as follows:

$$V_1 = C_1 * (S/100)^{1/2}$$

$$V_2 = C_2 * (S/100)^{1/2}$$

Where:

C_1 = 20.2 for developed areas

C_2 = 30.6 for developed areas

S = Average slope for the flow path (percent)

In urbanized areas, the time of concentration calculated above should not exceed the time of concentration calculated by the following equation:

$$T_c = (L / 180) + 10$$

Where:

T_c = Time of concentration

L = Watershed length (feet)

Minimum T_c for any watershed and should not be less than 5 minutes for developed basins or 10 minutes for undeveloped basins. Standard Form 4 from the Design Manual was used to compute lag times for the Drainage Study and is included in **Appendix A**. Note that all T_c values for the offsite subbasins are referenced from the applicable approved drainage study.

k. Routing

No routing was utilized for the onsite subbasins. No revisions were made to the approved offsite routes.

l. Concentration Points

Subbasins were combined using concentration points. These concentration points were inserted into the HEC-1 model to obtain peak flow rates. Several concentration points were located at the intersections of the proposed storm drain alignment and at the outlet to the street in order obtain peak flows.

9. Existing Condition Drainage Patterns and Hydrologic Analysis

In the existing condition, the hydraulic analysis includes offsite subbasins TLV and VCA, which contribute flow to the streets adjacent to the site (Refer to **Figure 8: Existing Condition Subbasin Map**).

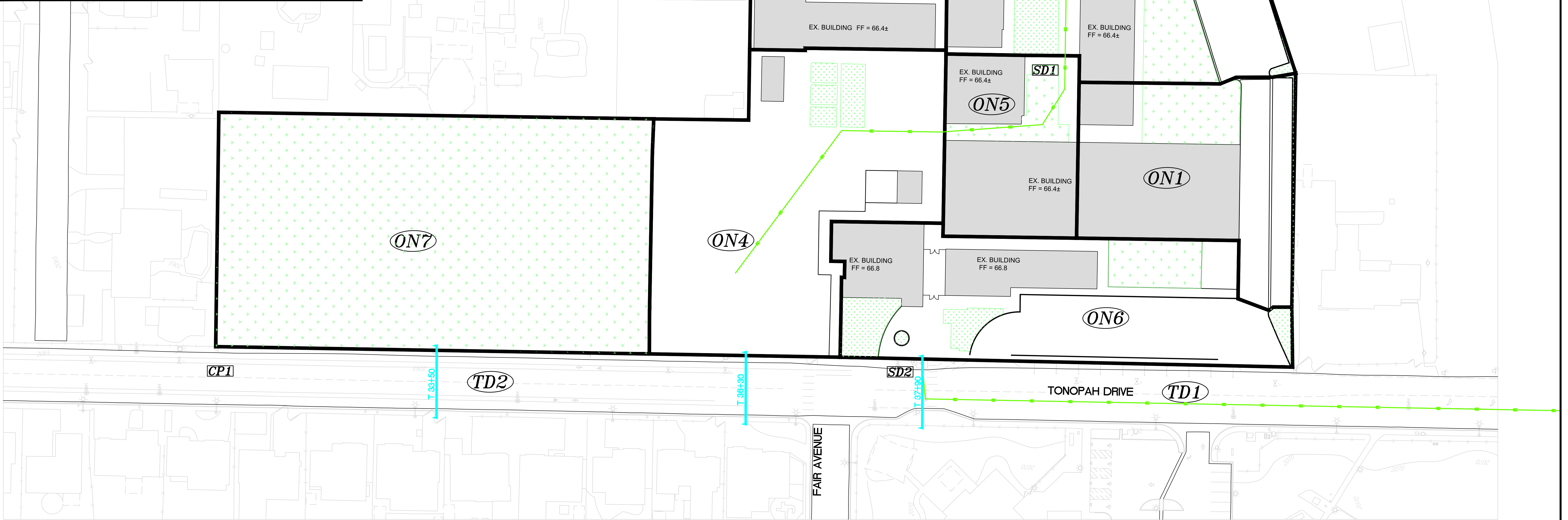
In the existing condition, the offsite tributary watersheds are an Early Childhood Education Center to the west and developed residential lots to the east. The project site is flanked by existing street improvements and existing development with CMU walls along the boundary. The downstream limit of the proposed project is the existing Tonopah Drive to the northwest and Virginia City Avenue to the east. Onsite basins ON2, ON3, ON4, ON5, and ON6 are collected in the existing onsite storm drain that flows to the 18" storm drain in Virginia City Avenue.

The CN and time of concentration calculations for all onsite subbasins are provided in **Appendix A**. Print-outs from the applicable referenced plans are provided in **Appendix C**. The existing condition HEC-1 model covers the project site and subbasins immediately upstream. The results of the existing condition HEC-1 model is provided in **Appendix A. Table 3** summarizes the results of the HEC-1 model for all subbasins and combination points.

Table 3. Existing Condition Flow Summary

HEC-1 Node	Tributary Area (acres)	Tributary Area (mi ²)	10-year Discharge (cfs)	100-year Discharge (cfs)
EX-ON7	1.92	0.0030	1	3
TD-2	0.39	0.0006	1	1
CP1	-	-	2	4
EX-ON6	1.02	0.0016	1	3
TD-1	0.28	0.0004	0	1
SD2	-	-	2	4
EX-ON5	0.46	0.0007	1	1
EX-ON4	1.30	0.0002	3	5
SD1	-	-	3	6
EX-ON3	0.61	0.0009	1	2
EX-ON1	0.71	0.0011	1	2
EX-ON2	1.13	0.0018	1	3
BVT	1.67	0.0026	1	3
VCA	0.22	0.0003	0	0
CP3	-	-	5	10

EXISTING CONDITION HYDROLOGY SUMMARY				
HEC-1 NODE	AREA (ACRES)	AREA (MI ²)	10-YEAR DISCHARGE (CFS)	100-YEAR DISCHARGE (CFS)
EX-ON7	1.92	0.0030	1	3
TD-2	0.39	0.0006	1	1
CP1	COMBINE EX-ON7 & TD2		2	4
EX-ON6	1.02	0.0016	1	3
TD-1	0.28	0.0004	0	1
SD2	COMBINE EX-ON6 & TD1		2	4
EX-ON5	0.46	0.0007	1	1
EX-ON4	1.30	0.0002	3	5
SD1	COMBINE EX-ON5 & ON4		3	6
EX-ON3	0.61	0.0009	1	2
EX-ON1	0.71	0.0011	1	2
EX-ON2	1.13	0.0018	1	3
BVT	1.67	0.0026	1	3
VCA	0.22	0.0003	0	0
CP3	COMBINE EX-ON3, ON1, ON2, BVT, & VCA		5	10



EXISTING CONDITION HYDRAULIC SUMMARY					
SECTION	SLOPE	FLOW (FT ³ /SEC)	VELOCITY (FT/SEC)	DEPTH (FT)	DxV
T 33+50	0.13%	2	0.83	0.32	0.27
T 36+30	0.31%	3	1.28	0.25	0.32
T 37+90	0.18%	2	1.19	0.20	0.24
V 18+50	0.40%	3	0.94	0.16	0.15

LEGEND:

ON4

DRAINAGE SUB-BASIN

CP2

CONCENTRATION POINT

T 33+50

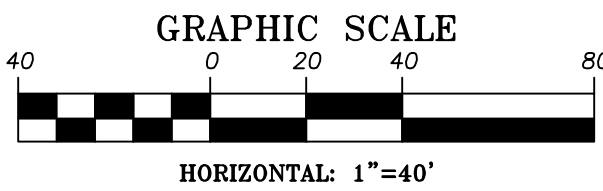
STREET SECTION

EXISTING STORM DRAIN

CENTERLINE

ROW

EDGE OF PAVEMENT



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FIGURE 8
EXISTING DRAINAGE
MABEL HOGGARD
ES REPLACEMENT

10. Ultimate Condition Drainage Patterns and Hydrologic Analysis

The ultimate condition HEC-1 model and associated hydrologic parameters are provided in **Appendix A. Table 5** below summarizes the hydrologic results of the ultimate condition HEC-1 model.

The difference between the existing and ultimate condition is the re-development of the onsite subbasins (ultimate condition) and the construction of a new onsite storm drain collection system. The overall existing drainage patterns and downstream discharge points were maintained in the ultimate condition for the Drainage Study. The onsite subbasins and associated peak discharges for the ultimate condition are shown on **Figure 10: Ultimate Condition Subbasin and Map**.

a. Virginia City Avenue

The offsite subbasin along Virginia City Avenue is same as in the existing condition; the properties drain to the existing Virginia City Avenue without curb or gutter. The overall existing drainage patterns are maintained in the ultimate condition throughout this area.

b. Tonopah Drive

Tonopah Drive has been revised with a driveway to the new parking lot at the north end of the site, the relocation of the bus pull-out area and addition of sidewalk, curb and gutter along the west boundary of the site. The overall existing drainage patterns are maintained in the ultimate condition through this area. Additional drop inlets to collect nuisance flows have been designed north of the existing drop inlet on the south side of the intersection with Fair Avenue.

c. Onsite Subbasins

The onsite basins have been delineated based on the proposed grading plan, with drainage to Tonopah Drive and Virginia City Avenue via the proposed drainage swales and storm drain. The onsite storm drain system will collect roof drain flows and courtyard drop inlet flows and drain east to the existing public storm drain system in Virginia City Avenue, the system has been designed to match the existing system approved design flows. Additional flows from the new north parking lot will be routed to a swale and collected in a drop inlet to flow west and south in an extension of the storm drain system in Tonopah Drive

d. Low Impact Development BMP

The site is larger than 1 acre, with more than 1 acre of proposed paved parking lots, resulting in a site categorization as large. The new proposed parking lot at the north end of the site, and the redeveloped parking lot at the south end of the site, will be designed with swales in the landscape buffers to treat storm drain runoff. Each parking lot is less than 1 acre, and the swales are designed with slopes less than 1%, 4:1 side slopes, and flow lengths greater than 40 feet.

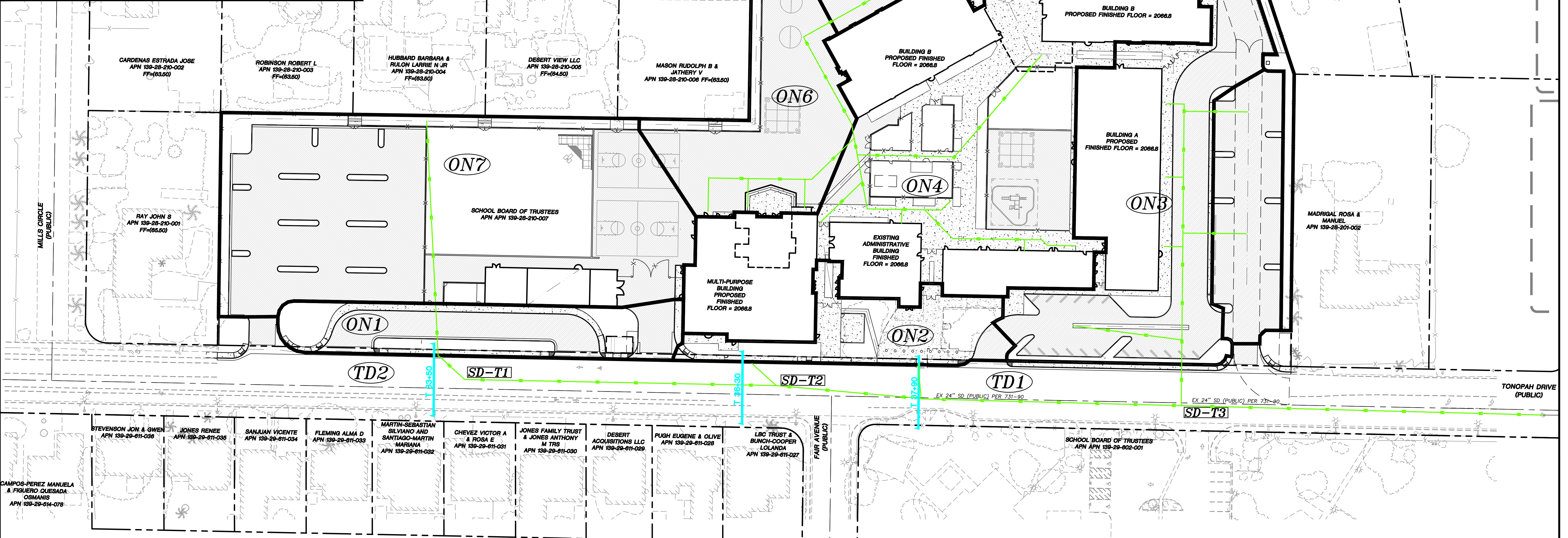
e. Ultimate Condition Hydrologic Results Summary

The HEC-1 results from the Drainage Study ultimate condition model are summarized in **Table 5** below and provided in **Appendix A**.

Table 4. Ultimate Condition Flow Summary

HEC-1 Node	Tributary Area (acres)	Tributary Area (mi²)	10-year Discharge (cfs)	100-year Discharge (cfs)
U-ON7	1.64	0.0026	2	4
TD-2	0.39	0.0006	1	1
U-ON1	0.39	0.0006	1	1
SD-TD1	-	-	4	7
U-ON2	0.32	0.0014	1	2
TD-1	0.28	0.0004	0	1
SD-TD2	-	-	2	3
U-ON3	1.35	0.0021	3	5
SD-T3	-	-	8	15
U-ON6	0.59	0.0009	1	2
U-ON5	0.92	0.0014	1	2
CP1	-	-	2	4
BVT	1.67	0.0026	1	3
VCA	0.22	0.0003	0	0
CP2	-	-	4	8
U-ON4	1.92	0.0030	4	6

ULTIMATE CONDITION HYDROLOGY SUMMARY				
HEC-1 NODE	AREA (ACRES)	AREA (MI ²)	10-YEAR DISCHARGE (CFS)	100-YEAR DISCHARGE (CFS)
U-ON7	1.64	0.0026	2	4
TD-2	0.39	0.0006	1	1
U-ON1	0.39	0.0006	1	1
SD-TD1	COMBINE ON7,ON1,&TD2		4	7
U-ON2	0.32	0.0014	1	2
TD-1	0.28	0.0004	0	1
SD-TD2	COMBINE U-ON2 & TD1		2	3
U-ON3	1.35	0.0021	3	5
SD-T3	COMBINE SDT2 & U-ON3		8	15
U-ON6	0.59	0.0009	1	2
U-ON5	0.92	0.0014	1	2
CP1	COMBINE U-ON5 & ON6		2	4
BVT	1.67	0.0026	1	3
VCA	0.22	0.0003	0	0
CP2	COMBINE BVT & VCA		4	8
U-ON4	1.92	0.0030	4	6



ULTIMATE CONDITION HYDRAULIC SUMMARY					
SECTION	SLOPE	FLOW (FT ³ /SEC)	VELOCITY (FT/SEC)	DEPTH (FT)	DxV
T 33+50	0.13%	2	1.00	0.40	0.40
T 36+30	0.31%	3	1.65	0.42	0.69
T 37+90	0.18%	2	1.10	0.19	0.21
V 18+50	0.40%	3	0.94	0.16	0.15

LEGEND:

ON4

DRAINAGE SUB-BASIN

CP2

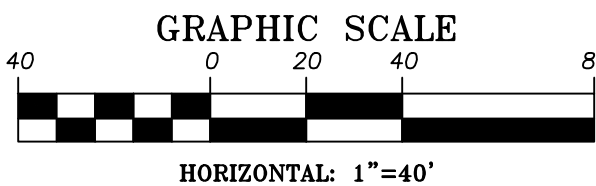
CONCENTRATION POINT

EXISTING STORM DRAIN

CENTERLINE

ROW

EDGE OF PAVEMENT



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FIGURE 9
ULTIMATE DRAINAGE
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ES REPLACEMENT

11. Ultimate Condition Storm Water Facility Plan

The following subsection includes information about the hydraulic analysis performed as part of the Drainage Study to establish an overall storm water facility plan for the anticipated ultimate condition for the project site (Refer to **Figure 10: Proposed Onsite Storm Water Facility Plan**). Note that the facilities sizes and layout shown on Figure 10 are for planning purposes and may be adjusted in the final construction plans.

a. Design Considerations

The following are the design considerations that were utilized to develop a storm water facility master plan for the proposed project site.

Roof-drain locations and sizes were provided by the Architect. FlowMaster V8i was used to size the onsite storm drain inlets for the calculated ultimate condition 100-year discharge. Print-outs of the calculations are provided in **Appendix A**. WSPGW was used to calculate hydraulic grades within the storm drain systems.

b. Courtyard to Virginia City Avenue

The proposed drainage facility in the central courtyard of the school incorporates several laterals for the existing and proposed roof-drains as well as the area drains before draining into the existing storm drain system in Virginia City Avenue. The downstream HGL was obtained from the Storm Drain Plan and Profile Comstock Drive, page SD12 of the Freeway Channel – Washington, MLK to Rancho Update#1 (CNLV #731-90).

c. North Parking lot to Tonopah Drive

The proposed extension of the Tonopah Drive storm drain collects flow from the Tonopah Drive improvements and the new parking lot at the north end of the site. The pipe sizes were obtained from the Storm Drain Plan and Profile Tonopah Drive North, however the slopes were adjusted to match the survey verified manhole dips. The downstream HGL was obtained from the Storm Drain Plan and Profile Washington Avenue, page SD5 of the Freeway Channel – Washington, MLK to Rancho (CNLV #731-90).

12. Hydraulic Analysis

a. Street Flow Calculations

The computer program Bentley FlowMaster V8i was utilized to perform normal depth calculations for the adjacent street, proposed onsite drive aisles, drop inlets, and swales. These normal depth calculations were utilized to ensure that the proposed storm drain facilities are adequately designed and that flow depth and velocity in the street are not increased.

i. Existing Condition

For the existing condition, a total of four cross-sections were analyzed. **Figure 8: Existing Condition Subbasin Map** shows the location of each of the normal depth cross-sections. The cross-section locations were utilized to ensure that flow depth and velocity in the street are not increased.

ii. Ultimate Condition

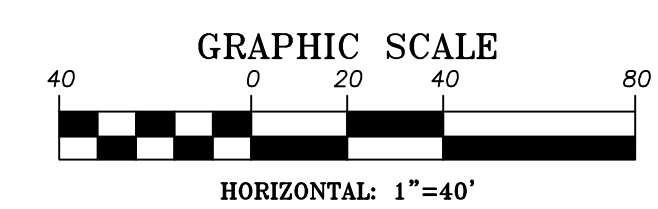
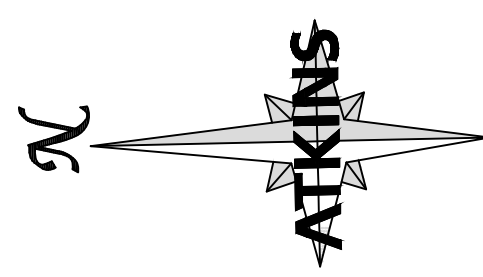
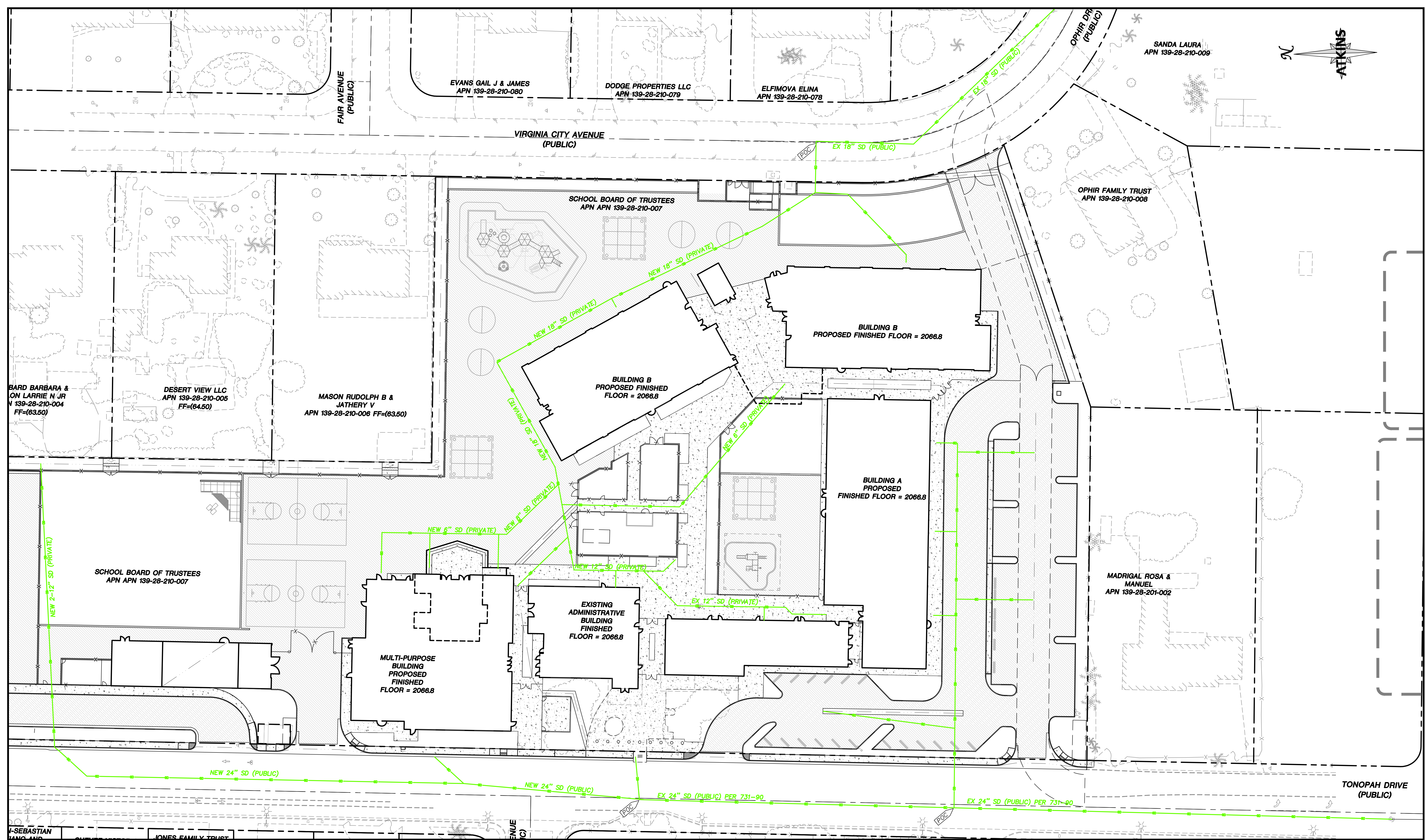
For the ultimate condition, a total of four cross-sections and three drop inlets were analyzed. The street cross-section locations are identical to those utilized for the existing condition analysis. **Figure 9: Ultimate Condition Subbasin Map** shows the location of each of the normal depth cross-sections, as well as the proposed drop inlet and roof drain locations for the storm drain analysis. There is a landscaped swale along the north and south sides of the site that accept a portion of the flow from the parking lots and drive aisles. Based on the HCDDM, the site is classified as a Large development with more than 1 acre of parking lot. More than 75% of the total parking lot area will drain to the adjacent landscaped swale. The landscaped swale acts as a BMP to treat the runoff before it is discharged offsite. The slope of the swale is less than 0.5% to maximize settlement of sediment. The length of the swales after the curb openings to accept the parking lot run off is more than 40-feet.

All normal depth calculations are provided in **Appendix A-7**.

b. Storm Drain System Modeling

The proposed storm drain system was modeled using Water Surface Pressure Gradient (WSPGW) Version 14.08. Flow from roof drains and on-grade drop inlets is collected at depicted locations within the courtyard and parking lots and routed out to the existing storm drain in Virginia City Avenue to the southeast and the extension of the Tonopah Drive storm drain to the west.

All storm drain hydraulic calculations are provided in **Appendix A-8**.



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FIGURE 10
ONSITE STORM DRAIN
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Appendix A

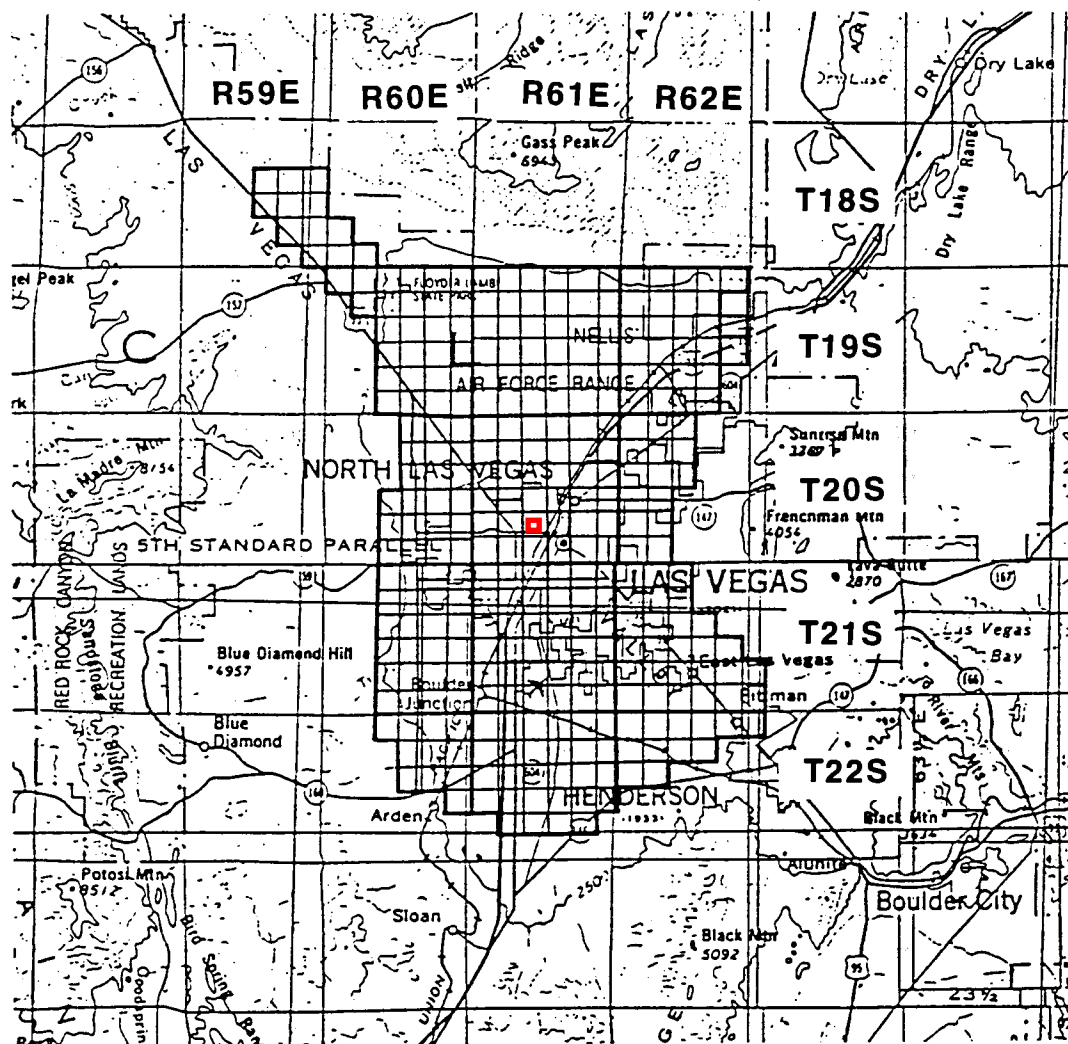
Drainage Study Appendix

- Appendix A-1: Existing Condition Hydrologic Parameters
- Appendix A-2: Existing Condition Hydrologic Model
- Appendix A-3: Ultimate Condition Hydrologic Parameters
- Appendix A-4: Ultimate Condition Hydrologic Model
- Appendix A-5: Normal Depth Calculations
- Appendix A-6: Ultimate Condition Hydraulic Model

Existing Condition Hydrologic Parameters

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

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

TOWNSHIP RANGE SECTIONS

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

Notes:

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

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

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

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

Revision	Date

RUNOFF CURVE NUMBERS (URBAN AREAS¹)

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

See Table 602A

Developing urban areas

Newly graded areas (pervious areas only, no vegetation) ⁵	77	86	91	94
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1 Average runoff condition, and $I_p = 0.2S$.

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

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

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

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

Revision	Date

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RUNOFF CURVE NUMBERS - RESIDENTIAL DISTRICTS

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

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

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

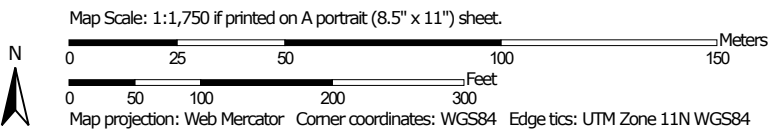
3 In cases where average residential lots are smaller than 6,000 sq ft, commercial/business/industrial land use should be used.

Revision	Date

REFERENCE:

TABLE 602A

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



Natural Resources
Conservation Service

Web Soil Survey
National Cooperative Soil Survey

7/11/2019
Page 1 of 3

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

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

 Soil Map Unit Polygons

 Soil Map Unit Lines

 Soil Map Unit Points

Special Point Features



Blowout



Borrow Pit



Clay Spot



Closed Depression



Gravel Pit



Gravelly Spot



Landfill



Lava Flow



Marsh or swamp



Mine or Quarry



Miscellaneous Water



Perennial Water



Rock Outcrop



Saline Spot



Sandy Spot



Severely Eroded Spot



Sinkhole



Slide or Slip



Sodic Spot



Spoil Area



Stony Spot



Very Stony Spot



Wet Spot



Other



Special Line Features

Water Features



Streams and Canals

Transportation



Rails



Interstate Highways



US Routes



Major Roads



Local Roads

Background



Aerial Photography

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service

Web Soil Survey URL:

Coordinate System: Web Mercator (EPSG:3857)

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

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

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

Survey Area Data: Version 13, Sep 14, 2018

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

Date(s) aerial images were photographed: Sep 26, 2013—Feb 25, 2014

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

Map Unit Legend

Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
300	Las Vegas gravelly fine sandy loam, 0 to 2 percent slopes	7.2	100.0%
Totals for Area of Interest		7.2	100.0%

Las Vegas Valley Area, Nevada, Part of Clark County

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

Map Unit Setting

National map unit symbol: hrbp

Elevation: 1,800 to 2,600 feet

Mean annual precipitation: 4 to 6 inches

Mean annual air temperature: 63 to 68 degrees F

Frost-free period: 220 to 260 days

Farmland classification: Not prime farmland

Map Unit Composition

Las Vegas and similar soils: 100 percent

Estimates are based on observations, descriptions, and transects of the mapunit.

Description of Las Vegas

Setting

Landform: Basin-floor remnants

Down-slope shape: Linear

Across-slope shape: Linear

Parent material: Alluvium derived from limestone

Typical profile

H1 - 0 to 1 inches: gravelly fine sandy loam

H2 - 1 to 7 inches: fine sandy loam

H3 - 7 to 11 inches: gravelly sandy clay loam

H4 - 11 to 15 inches: indurated

Properties and qualities

Slope: 0 to 2 percent

Depth to restrictive feature: 3 to 14 inches to petrocalcic

Natural drainage class: Well drained

Runoff class: Very high

Capacity of the most limiting layer to transmit water (Ksat): Very low (0.00 in/hr)

Depth to water table: More than 80 inches

Frequency of flooding: None

Frequency of ponding: None

Calcium carbonate, maximum in profile: 85 percent

Gypsum, maximum in profile: 5 percent

Salinity, maximum in profile: Nonsaline to slightly saline (0.0 to 4.0 mmhos/cm)

Sodium adsorption ratio, maximum in profile: 12.0

Available water storage in profile: Very low (about 1.5 inches)

Interpretive groups

Land capability classification (irrigated): None specified

Land capability classification (nonirrigated): 7s

Hydrologic Soil Group: D

Other vegetative classification: LIMY 3-5" P.Z. (030XB019NV_3)

Hydric soil rating: No

Data Source Information

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

Survey Area Data: Version 13, Sep 14, 2018

Hoggard Elementary School Existing Condition

Atkins Job # 100067217

Calculated by: JLK

Checked by: MMA

Subbasin Data						Initial Overland Time (t _i)			Travel Time (t _t)					t _c check (Urbanized basins)				Remarks
Subbasin	Dev. or Ex.	CN	K	Area (Acres)	Area (mi ²)	Length (ft)	Slope (%)	time (min)	Length (ft)	Slope (%)	V ₁ (fps)	V ₂ (fps)	Travel Time	t _c (calc)	Max t _c	Min t _c	Lag Time (hr)	
EX-ON1	D	95.81	0.875	0.71	0.0011	120	1.00	4.44	301	1.00	2.02	3.06	5.02	9.46	13.90	5.00	0.095	
EX-ON2	D	94.44	0.857	1.13	0.0018	455	1.00	9.35	425	1.00	2.02	3.06	7.08	16.43	18.15	5.00	0.164	
EX-ON3	D	95.97	0.877	0.61	0.0009	195	1.00	5.61	230	0.50	1.43	2.16	7.67	13.28	13.94	5.00	0.133	
EX-ON4	D	97.55	0.898	1.30	0.0020	30	2.00	1.58	630	1.00	2.02	3.06	4.10	5.68	16.11	5.00	0.057	
EX-ON5	D	95.70	0.873	0.46	0.0007	140	0.50	6.08	350	0.50	1.43	2.16	11.67	17.75	14.54	5.00	0.145	
EX-ON6	D	96.05	0.878	1.02	0.0016	275	0.55	8.09	660	0.80	1.81	2.74	4.57	12.66	18.66	5.00	0.127	
EX-ON7	D	84.0	0.719	1.92	0.0030	195	0.50	12.07	390	0.50	1.43	2.16	13.00	25.07	15.42	5.00	0.154	
TD-1	D	98	0.904	0.28	0.0004	30	2.00	1.54	400	0.50	1.43	2.16	13.33	14.87	13.98	5.00	0.140	
TD-2	D	98	0.904	0.39	0.0006	30	2.00	1.54	565	0.50	1.43	2.16	5.80	7.34	15.51	5.00	0.073	
BVT	D	85	0.732	1.67	0.0026	100	0.50	8.35	200	0.50	1.43	2.16	6.67	15.01	12.78	5.00	0.128	
VCA	D	93	0.838	0.22	0.0003	30	2.00	2.05	325	0.50	1.43	2.16	10.83	12.89	13.29	5.00	0.129	
Tc = Ti + Tt Tlag = 0.6 Tc Ti = 1.8 (1.1 - K) L^{1/2} / S^{1/3} K = 0.0132 (CN) - 0.39 Tc Check = L/180+10 For the travel time (Tt) calculations, V1 applies to the first 500 feet of travel distance; V2 applies to the remaining travel distance. Existing V1 = 14.8*(S/100)^{1/2} Existing V2 = 29.4*(S/100)^{1/2} Developed V1 = 20.2*(S/100)^{1/2} Developed V2 = 30.6*(S/100)^{1/2}																		
															STANDARD FORM 4			

Existing Condition Hydrologic Model

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 21JAN20 TIME 16:05:57
*
*****

```

Existing.OUT

```

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

```

```

X X XXXXXX XXXX X
X X X X XX
X X X X X
XXXXXX XXXX X XXXXX
X X X X X
X X X X X
X X XXXXXX XXXX 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 -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1 HEC-1 INPUT PAGE 1

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

```

*DIAGRAM
1 ID *****
2 ID *
3 ID *
4 ID * HOGGARD ELEMENTARY SCHOOL
5 ID * DRAINAGE STUDY
6 ID * EXISTING CONDITIONS
7 ID *
8 ID * RETURN PERIOD_ _ _ 100-YEAR & 10-YEAR
9 ID * DISTRIBUTION_ _ _ 6-HOUR SDN3
10 ID * PROJECT NO_ _ _ 100067217
11 ID * FILENAME_ _ _ EXISTING.H1
12 ID * DATE MODELED_ _ _ 01/21/20
13 ID * MODELED BY_ _ _ JLK
14 ID *
15 ID *****
16 ID
17 IT 5 0 0 300
18 IO 5
19 IN 5 0 0
20 JR PREC .57 1
*

21 KK EX-ON7
22 KM EXISTING ONSITE PLAYGROUND SUBBASIN ON7
23 KM AREA 1.92 AC
24 PB 2.77
25 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
26 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
27 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
28 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
29 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
30 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
31 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
32 PC .998 .999 1.00
33 BA .0030
34 LS 0 84.0
35 UD .154
*

36 KK TD-2
37 KM EXISTING TONOPAH DRIVE ADJACENT TO NORTH PORTION OF SITE
38 KM AREA 0.39 AC
39 BA .0006
40 LS 0 98.0
41 UD .073
*

42 KK CP1
43 KM COMBINES FLOWS FROM EX-ON7 AND TD-2
44 HC 2
*

```

1 HEC-1 INPUT PAGE 2

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

```

45 KK EX-ON6
46 KM EXISTING ONSITE PAVED PARKING, BUILDINGS, AND LANDSCAPING
47 KM AREA 1.02 AC
48 BA .0016
49 LS 0 96.0
50 UD .145

```


Existing.OUT

```

*
51      KK  TD-1
52      KM  EXISTING TONOPAH DRIVE ADJACENT TO SOUTH PORTION OF SITE
53      KM  AREA 0.28 AC
54      BA  .0004
55      LS  0 98.0
56      UD  .140
      *

57      KK  SD2
58      KM  COMBINES FLOWS FROM EX-ON6 AND TD-1
59      HC  2
      *

60      KK  EX-ON5
61      KM  EXISTING ONSITE BUILDING, AND LANDSCAPE AREA
62      KM  AREA 0.46 AC
63      BA  .0007
64      LS  0 95.7
65      UD  .145
      *

66      KK  EX-ON4
67      KM  EXISTING ONSITE PAVED PLAY AREA, GREENHOUSE AND GARDEN
68      KM  AREA 1.30 AC
69      BA  .0020
70      LS  0 97.6
71      UD  .057
      *

72      KK  SD1
73      KM  COMBINES FLOWS FROM EX-ON5 AND EX-ON4
74      HC  2
      *

75      KK  EX-ON3
76      KM  EXISTING ONSITE PLAYGOURND, BUILDING, AND PAVED AREA
77      KM  AREA 0.61 AC
78      BA  .0009
79      LS  0 96.0
80      UD  .133
      *

```

1

HEC-1 INPUT

PAGE 3

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

```

81      KK  EX-ON1
82      KM  EXISTING ONSITE BUILDING, PARKING AND LANDSCAPE AREA
83      KM  AREA 0.71 AC
84      BA  .0011
85      LS  0 95.8
86      UD  .095
      *

87      KK  EX-ON2
88      KM  EXISTING ONSITE BUILDING, LANDSCAPING, AND PARKING AREA
89      KM  AREA 1.13 AC
90      BA  .0018
91      LS  0 94.4
92      UD  .164
      *

93      KK  BVT
94      KM  EXISTING ADJACENT BONAZA VILLAGE TRACT 1/2 ACRE RESIDENTIAL LOTS
95      KM  AREA 1.67 AC
96      BA  .0026
97      LS  0 85.0
98      UD  .128
      *

99      KK  VCA
100     KM  EXISTING ADJACENT VIRGINIA CITY LANE SUBBASIN
101     KM  AREA 0.22 AC
102     BA  .0003
103     LS  0 93.0
104     UD  .129
      *

105     KK  CP3
106     KM  COMBINES FLOWS FROM EX-ON1, EX-ON2, EX-ON3, VCA, AND BVT
107     HC  5
      *

108     ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT LINE (V) ROUTING (--->) DIVERSION OR PUMP FLOW
NO. (.) CONNECTOR (<---) RETURN OF DIVERTED OR PUMPED FLOW

21  EX-ON7
    .
36  . TD-2
    .
42  CP1 .....
    .

```

```

45      .      EX-ON6
51      .      .      TD-1
57      .      SD2 .....
60      .      .      EX-ON5
66      .      .      .      EX-ON4
72      .      .      SD1 .....
75      .      .      .      EX-ON3
81      .      .      .      .      EX-ON1
87      .      .      .      .      .      EX-ON2
93      .      .      .      .      .      .      BVT
99      .      .      .      .      .      .      .      VCA
105     .      .      .      .      .      .      .      .      CP3 .....

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1 *****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
* RUN DATE 21JAN20 TIME 16:05:57
* *****

```

```

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

```

```

*****
* HOGGARD ELEMENTARY SCHOOL
* DRAINAGE STUDY
* EXISTING CONDITIONS
* RETURN PERIOD_ _ _ 100-YEAR & 10-YEAR
* DISTRIBUTION_ _ _ 6-HOUR SDN3
* PROJECT NO_ _ _ 100067217
* FILENAME_ _ _ EXISTING.H1
* DATE MODELED_ _ _ 01/21/20
* MODELED BY_ _ _ JLK
* *****

```

```

18 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

```


Existing.OUT
 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 +	EX-ON7	.00	1	FLOW TIME	1. 3.58	3. 3.58
HYDROGRAPH AT +	TD-2	.00	1	FLOW TIME	1. 3.50	1. 3.50
2 COMBINED AT +	CP1	.00	1	FLOW TIME	2. 3.58	4. 3.58
HYDROGRAPH AT +	EX-ON6	.00	1	FLOW TIME	1. 3.58	3. 3.58
HYDROGRAPH AT +	TD-1	.00	1	FLOW TIME	0. 3.58	1. 3.58
2 COMBINED AT +	SD2	.00	1	FLOW TIME	2. 3.58	4. 3.58
HYDROGRAPH AT +	EX-ON5	.00	1	FLOW TIME	1. 3.58	1. 3.58
HYDROGRAPH AT +	EX-ON4	.00	1	FLOW TIME	3. 3.50	5. 3.50
2 COMBINED AT +	SD1	.00	1	FLOW TIME	3. 3.50	6. 3.50
HYDROGRAPH AT +	EX-ON3	.00	1	FLOW TIME	1. 3.58	2. 3.58
HYDROGRAPH AT +	EX-ON1	.00	1	FLOW TIME	1. 3.50	2. 3.50
HYDROGRAPH AT +	EX-ON2	.00	1	FLOW TIME	1. 3.58	3. 3.58
HYDROGRAPH AT +	BVT	.00	1	FLOW TIME	1. 3.58	3. 3.58
HYDROGRAPH AT +	VCA	.00	1	FLOW TIME	0. 3.58	0. 3.58
5 COMBINED AT +	CP3	.01	1	FLOW TIME	5. 3.58	10. 3.58

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

Ultimate Condition Hydrologic Parameters

Wasden Elementary School Ultimate Condition

Atkins Job # 100062041

Calculated by: JLK
Checked by: MMA

Subbasin Data						Initial Overland Time (t _i)			Travel Time (t _t)					t _c check (Urbanized basins)				Remarks
Subbasin	Dev. or Ex.	CN	K	Area (Acres)	Area (mi ²)	Length (ft)	Slope (%)	time (min)	Length (ft)	Slope (%)	V ₁ (fps)	V ₂ (fps)	Travel Time	t _c (calc)	Max t _c	Min t _c	Lag Time (hr)	
U-ON1	D	95.9	0.876	0.39	0.0006	23	2.00	1.52	100	0.70	1.69	2.56	2.33	3.84	11.13	5.00	0.038	
U-ON2	D	94.6	0.859	0.32	0.0005	52	0.79	3.38	82	0.40	1.28	1.94	2.92	6.31	11.24	5.00	0.063	
U-ON3	D	97.3	0.895	1.35	0.0021	32	1.00	2.09	176	1.00	2.02	3.06	2.36	4.45	11.93	5.00	0.044	
U-ON4	D	97.0	0.890	1.92	0.0030	70	0.40	4.29	85	0.50	1.43	2.16	2.64	6.93	11.44	5.00	0.069	
U-ON5	D	95.0	0.863	0.92	0.0014	85	1.00	3.93	370	0.45	1.35	2.04	13.83	17.76	14.21	5.00	0.142	
U-ON6	D	96.8	0.888	0.59	0.0009	85	1.00	3.52	219	0.42	1.32	1.99	8.60	12.11	12.81	5.00	0.121	
U-ON7	D	93.6	0.846	1.64	0.0026	146	1.70	4.63	170	0.40	1.28	1.94	7.08	11.71	12.93	5.00	0.117	
TD-1	D	98	0.904	0.28	0.0004	30	2.00	1.54	400	0.50	1.43	2.16	13.33	14.87	13.98	5.00	0.140	
TD-2	D	98	0.904	0.39	0.0006	30	2.00	1.54	565	0.50	1.43	2.16	5.80	7.34	15.51	5.00	0.073	
BVT	D	85	0.732	1.67	0.0026	100	0.50	8.35	200	0.50	1.43	2.16	6.67	15.01	12.78	5.00	0.128	
VCA	D	93	0.838	0.22	0.0003	30	2.00	2.05	325	0.50	1.43	2.16	10.83	12.89	13.29	5.00	0.129	
Tc = Ti + Tt Tlag = 0.6 Tc Ti = 1.8 (1.1 - K) L ^{1/2} / S ^{1/3} K = 0.0132 (CN) - 0.39 Tc Check = L/180+10						For the travel time (Tt) calculations, V1 applies to the first 500 feet of travel distance; V2 applies to the remaining travel distance.						Existing V1 = 14.8*(S/100) ^{1/2} Developed V1 = 20.2*(S/100) ^{1/2} Existing V2 = 29.4*(S/100) ^{1/2} Developed V2 = 30.6*(S/100) ^{1/2}						
															STANDARD FORM 4			

Ultimate Condition Hydrologic Model


```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 23JAN20 TIME 07:54:13
*
*****

```

```

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

```

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

```

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 -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY, DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

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

*DIAGRAM

```

1 ID *****
2 ID *
3 ID * :
4 ID * : WASDEN ELEMENTARY SCHOOL :
5 ID * : DRAINAGE STUDY :
6 ID * : ULTIMATE CONDITIONS :
7 ID * :
8 ID * : RETURN PERIOD_ _ _ 100-YEAR & 10-YEAR :
9 ID * : DISTRIBUTION_ _ _ 6-HOUR SDN3 :
10 ID * : PROJECT NO_ _ _ 100067217 :
11 ID * : FILENAME_ _ _ ULTIMATE.H1 :
12 ID * : DATE MODELED_ _ _ 01/23/20 :
13 ID * : MODELED BY_ _ _ JLK :
14 ID * :
15 ID *****
16 ID
17 IT 5 0 0 300
18 IO 5
19 IN 5 0 0
20 JR PREC .57 1
*

```

```

21 KK U-ON7
22 KM PROPOSED ONSITE NORTH PARKING LOT AND PLAYGROUND
23 KM AREA 1.64 AC
24 PB 2.77
25 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
26 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
27 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
28 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
29 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
30 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
31 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
32 PC .998 .999 1.00
33 BA .0026
34 LS 0 93.6
35 UD .117
*

```

```

36 KK TD-2
37 KM TONOPAH DRIVE ADJACENT TO NORTH PORTION OF SITE
38 KM AREA 0.39 AC
39 BA .0006
40 LS 0 98.0
41 UD .073
*

```

```

42 KK U-ON1
43 KM PROPOSED BUS PULL OUT AREA
44 KM AREA 0.39 AC
45 BA .0006
46 LS 0 95.9
47 UD .050
*

```

1

HEC-1 INPUT

PAGE 2

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

```

48 KK SD-T1
49 KM COMBINES FLOWS FROM U-ON7, TD-2 AND U-ON1 - COLLECTED IN STORM DRAIN
50 HC 3

```

```

*
51      KK  U-ON2
52      KM  PROPOSED  ONSITE  PARKING AND LANDSCAPE
53      KM  AREA      0.92 AC
54      BA  .0014
55      LS  0         95.0
56      UD  .142
      *

57      KK  TD-1
58      KM  TONOPAH DRIVE ADJACENT TO SOUTH PORTION OF SITE
59      KM  AREA      0.28 AC
60      BA  .0004
61      LS  0         98.0
62      UD  .140
      *

63      KK  SD-T2
64      KM  COMBINES  FLOWS FROM U-ON3, AND U-ON4 - COLLECTED IN STORM DRAIN
65      HC  2
      *

66      KK  U-ON3
67      KM  PROPOSED  ONSITE  SOUTH PARKING AND BUILDINGS
68      KM  AREA      1.35 AC
69      BA  .0021
70      LS  0         97.3
71      UD  .050
      *

72      KK  SD-T3
73      KM  COMBINES  FLOWS FROM U-ON3, AND U-ON4 - COLLECTED IN STORM DRAIN
74      HC  3
      *

75      KK  U-ON6
76      KM  PROPOSED  ONSITE  PAVED PLAY AREA
77      KM  AREA      0.59 AC
78      BA  .0009
79      LS  0         96.8
80      UD  .121
      *

81      KK  U-ON5
82      KM  PROPOSED  ONSITE  PAVED PLAY AREA AND GARDEN
83      KM  AREA      0.92 AC
84      BA  .0014
85      LS  0         95.0
86      UD  .142
      *

```

1

HEC-1 INPUT

PAGE 3

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

```

87      KK  CP1
88      KM  COMBINES  FLOWS FROM U-ON6 AND U-ON5
89      HC  2
      *

90      KK  BVT
91      KM  EXISTING  ADJACENT BONAZA VILLAGE TRACT 1/2 ACRE RESIDENTIAL LOTS
92      KM  AREA      1.67 AC
93      BA  .0026
94      LS  0         85.0
95      UD  .128
      *

96      KK  VCA
97      KM  EXISTING  ADJACENT VIRGINIA CITY LANE SUBBASIN
98      KM  AREA      0.22 AC
99      BA  .0003
100     LS  0         93.0
101     UD  .129
      *

102     KK  CP2
103     KM  COMBINES  FLOWS FROM CP1, VCA, AND BVT
104     HC  3
      *

105     KK  U-ON4
106     KM  PROPOSED  ONSITE  BUILDINGS, COURTYARD AND ZOO
107     KM  AREA      1.92 AC
108     BA  .0030
109     LS  0         97.0
110     UD  .069
      *

111     ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

INPUT LINE (V) ROUTING      (--->) DIVERSION OR PUMP FLOW
NO.        (.) CONNECTOR   (<---) RETURN OF DIVERTED OR PUMPED FLOW

21         U-ON7
           .
           .
36         .         TD-2

```



```

*****
1 *****
*
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)
*   JUN      1998
*   VERSION  4.1
*
*   RUN DATE   23JAN20   TIME   07:54:13
*
*****

```

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

```
*****  
*                                     *  
*                                     *  
* WADSEN ELEMENTARY SCHOOL          *  
* DRAINAGE STUDY                    *  
* ULTIMATE CONDITIONS                *  
*                                     *  
* RETURN PERIOD_ _ _ _ 100-YEAR & 10-YEAR  
* DISTRIBUTION_ _ _ _ 6-HOUR SDN3  
* PROJECT NO_ _ _ _ 100067217  
* FILENAME_ _ _ _ _ ULTIMATE.H1  
* DATE MODELED_ _ _ _ 01/23/20  
* MODELED BY_ _ _ _ JLK  
*                                     *  
*****
```

Page 3

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 +	U-ON7	.00	1	FLOW TIME	2. 3.58	4. 3.58
HYDROGRAPH AT +	TD-2	.00	1	FLOW TIME	1. 3.50	1. 3.50
HYDROGRAPH AT +	U-ON1	.00	1	FLOW TIME	1. 3.50	1. 3.50
3 COMBINED AT +	SD-T1	.00	1	FLOW TIME	4. 3.50	7. 3.50
HYDROGRAPH AT +	U-ON2	.00	1	FLOW TIME	1. 3.58	2. 3.58
HYDROGRAPH AT +	TD-1	.00	1	FLOW TIME	0. 3.58	1. 3.58
2 COMBINED AT +	SD-T2	.00	1	FLOW TIME	2. 3.58	3. 3.58
HYDROGRAPH AT +	U-ON3	.00	1	FLOW TIME	3. 3.50	5. 3.50
3 COMBINED AT +	SD-T3	.01	1	FLOW TIME	8. 3.50	15. 3.50
HYDROGRAPH AT +	U-ON6	.00	1	FLOW TIME	1. 3.58	2. 3.58
HYDROGRAPH AT +	U-ON5	.00	1	FLOW TIME	1. 3.58	2. 3.58
2 COMBINED AT +	CP1	.00	1	FLOW TIME	2. 3.58	4. 3.58
HYDROGRAPH AT +	BVT	.00	1	FLOW TIME	1. 3.58	3. 3.58
HYDROGRAPH AT +	VCA	.00	1	FLOW TIME	0. 3.58	0. 3.58
3 COMBINED AT +	CP2	.01	1	FLOW TIME	4. 3.58	8. 3.58
HYDROGRAPH AT +	U-ON4	.00	1	FLOW TIME	4. 3.50	6. 3.50

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

Normal Depth Calculations

Cross Section for Ex Tonopah 33+50

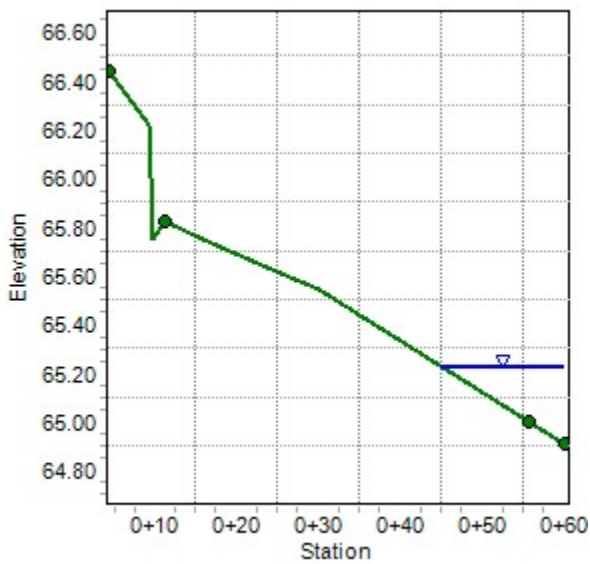
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00130	ft/ft
Normal Depth	0.32	ft
Discharge	2.00	ft ³ /s

Cross Section Image



Project Description

Input Data

Station (ft)	Elevation (ft)
--------------	----------------

Roughness Segment Definitions

Options

Bentley Systems, Inc. Haestad Methods Software
27 Siemons Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666
Page 1 of 2

Worksheet for Ex Tonopah 33+50

Results

Normal Depth		0.32	ft
Elevation Range	64.907 to 66.440 ft		
Flow Area		2.41	ft ²
Wetted Perimeter		15.404	ft
Hydraulic Radius		0.16	ft
Top Width		15.084	ft
Normal Depth		0.32	ft
Critical Depth		0.21	ft
Critical Slope		0.01105	ft/ft
Velocity		0.83	ft/s
Velocity Head		0.01	ft
Specific Energy		0.33	ft
Froude Number		0.37	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	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	0.32	ft
Critical Depth	0.21	ft
Channel Slope	0.00130	ft/ft
Critical Slope	0.01105	ft/ft

Cross Section for U Tonopah 33+50

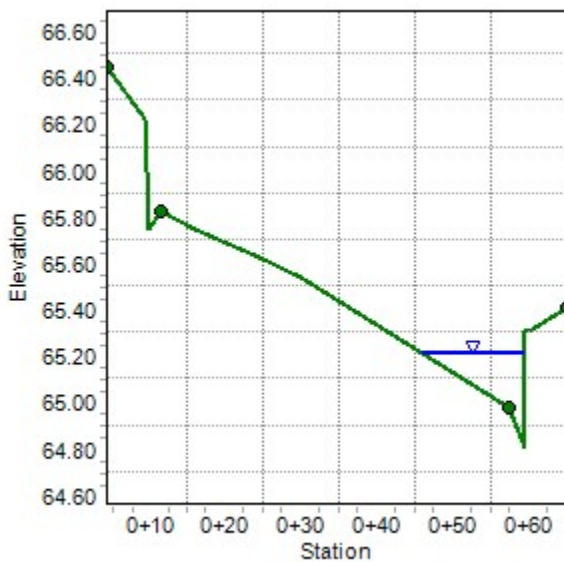
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00130	ft/ft
Normal Depth	0.40	ft
Discharge	2.00	ft ³ /s

Cross Section Image



Worksheet for U Tonopah 33+50

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00130	ft/ft
Discharge	2.00	ft ³ /s
Section Definitions		

Station (ft)	Elevation (ft)
0+04.39	66.44
0+09.39	66.22
0+09.67	66.00
0+09.91	65.75
0+11.39	65.82
0+15.92	65.75
0+23.76	65.63
0+30.00	65.54
0+57.33	64.98
0+59.50	64.81
0+59.50	65.31
0+60.00	65.31
0+65.00	65.41

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+04.39, 66.44)	(0+11.39, 65.82)	0.013
(0+11.39, 65.82)	(0+57.33, 64.98)	0.015
(0+57.33, 64.98)	(0+65.00, 65.41)	0.013

Options

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

Worksheet for U Tonopah 33+50

Results

Normal Depth		0.40	ft
Elevation Range	64.810 to 66.440 ft		
Flow Area		1.99	ft ²
Wetted Perimeter		13.838	ft
Hydraulic Radius		0.14	ft
Top Width		13.430	ft
Normal Depth		0.40	ft
Critical Depth		0.32	ft
Critical Slope		0.00679	ft/ft
Velocity		1.00	ft/s
Velocity Head		0.02	ft
Specific Energy		0.41	ft
Froude Number		0.46	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	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	0.40	ft
Critical Depth	0.32	ft
Channel Slope	0.00130	ft/ft
Critical Slope	0.00679	ft/ft

Cross Section for Ex Tonopah 36+30

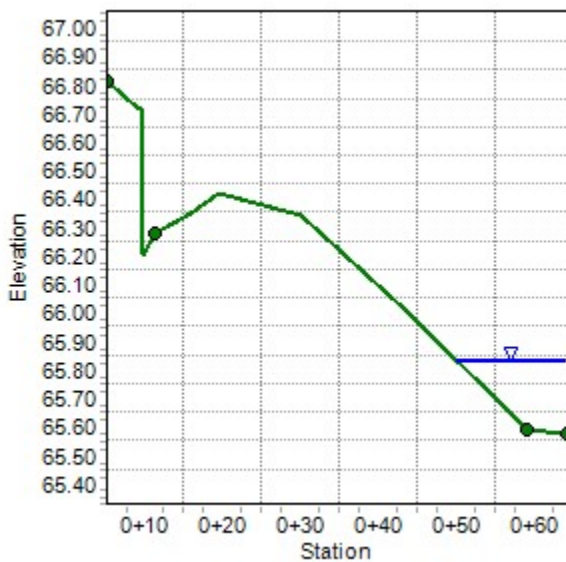
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00310	ft/ft
Normal Depth	0.25	ft
Discharge	3.00	ft ³ /s

Cross Section Image



Worksheet for Ex Tonopah 36+30

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00310 ft/ft
Discharge 3.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+05.36	66.81
0+09.36	66.71
0+09.86	66.71
0+09.94	66.20
0+11.31	66.28
0+15.92	66.35
0+19.54	66.42
0+30.00	66.34
0+43.66	66.00
0+59.00	65.59
0+64.00	65.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+05.36, 66.81)	(0+11.31, 66.28)	0.013
(0+11.31, 66.28)	(0+59.00, 65.59)	0.015
(0+59.00, 65.59)	(0+64.00, 65.57)	0.025

Options

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

Worksheet for Ex Tonopah 36+30

Results

Normal Depth		0.25	ft
Elevation Range	65.575 to 66.810 ft		
Flow Area		2.34	ft ²
Wetted Perimeter		14.251	ft
Hydraulic Radius		0.16	ft
Top Width		13.994	ft
Normal Depth		0.25	ft
Critical Depth		0.19	ft
Critical Slope		0.01100	ft/ft
Velocity		1.28	ft/s
Velocity Head		0.03	ft
Specific Energy		0.28	ft
Froude Number		0.55	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	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	0.25	ft
Critical Depth	0.19	ft
Channel Slope	0.00310	ft/ft
Critical Slope	0.01100	ft/ft

Cross Section for U Tonopah 36+30

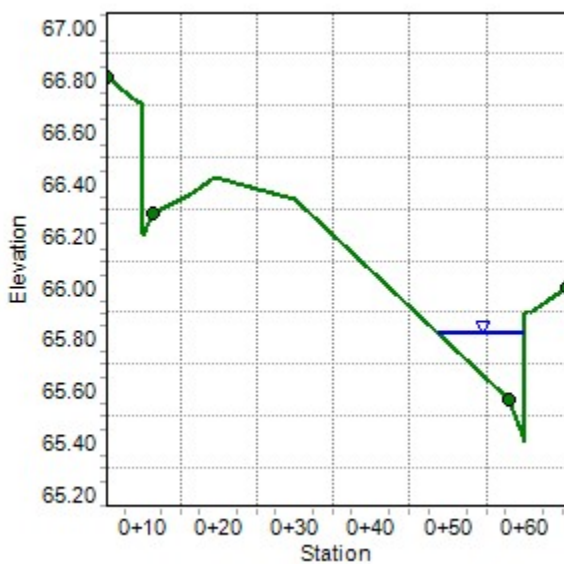
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00310	ft/ft
Normal Depth	0.42	ft
Discharge	3.00	ft ³ /s

Cross Section Image



Worksheet for U Tonopah 36+30

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00310	ft/ft
Discharge	3.00	ft ³ /s
Section Definitions		

Station (ft)	Elevation (ft)
0+05.36	66.81
0+09.36	66.71
0+09.86	66.71
0+09.94	66.20
0+11.31	66.28
0+15.92	66.35
0+19.54	66.42
0+30.00	66.34
0+58.00	65.57
0+60.00	65.40
0+60.08	65.90
0+60.50	65.90
0+65.50	66.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+05.36, 66.81)	(0+11.31, 66.28)	0.013
(0+11.31, 66.28)	(0+58.00, 65.57)	0.015
(0+58.00, 65.57)	(0+65.50, 66.00)	0.013

Options

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

Worksheet for U Tonopah 36+30

Results

Normal Depth		0.42	ft
Elevation Range	65.400 to 66.810 ft		
Flow Area		1.81	ft ²
Wetted Perimeter		11.492	ft
Hydraulic Radius		0.16	ft
Top Width		11.129	ft
Normal Depth		0.42	ft
Critical Depth		0.38	ft
Critical Slope		0.00619	ft/ft
Velocity		1.65	ft/s
Velocity Head		0.04	ft
Specific Energy		0.46	ft
Froude Number		0.72	
Flow Type	Subcritical		

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.42	ft
Critical Depth	0.38	ft
Channel Slope	0.00310	ft/ft
Critical Slope	0.00619	ft/ft

Cross Section for Ex Tonopah 37+90

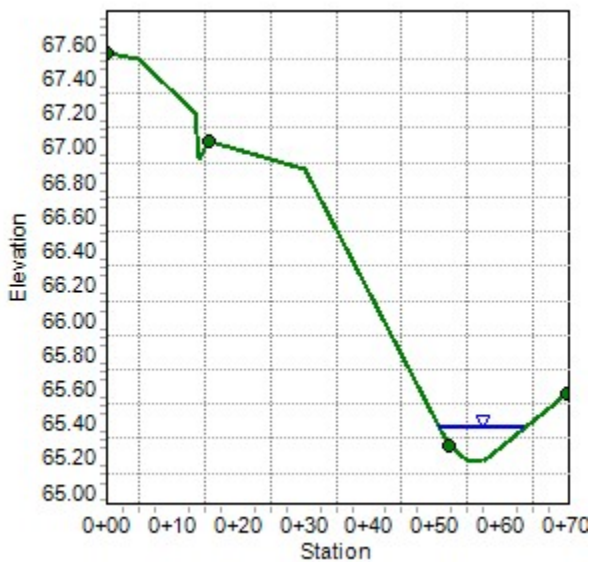
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00180	ft/ft
Normal Depth	0.20	ft
Discharge	2.00	ft ³ /s

Cross Section Image



Worksheet for Ex Tonopah 37+90

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00180 ft/ft
Discharge 2.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	67.54
0+04.77	67.51
0+13.38	67.19
0+13.95	66.92
0+15.47	67.03
0+30.00	66.87
0+52.10	65.26
0+55.29	65.17
0+57.29	65.17
0+70.00	65.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 67.54)	(0+15.47, 67.03)	0.013
(0+15.47, 67.03)	(0+52.10, 65.26)	0.015
(0+52.10, 65.26)	(0+70.00, 65.57)	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 0.20 ft

Worksheet for Ex Tonopah 37+90

Results

Elevation Range	65.170 to 67.540 ft	
Flow Area	1.67	ft ²
Wetted Perimeter	13.278	ft
Hydraulic Radius	0.13	ft
Top Width	13.269	ft
Normal Depth	0.20	ft
Critical Depth	0.16	ft
Critical Slope	0.00552	ft/ft
Velocity	1.19	ft/s
Velocity Head	0.02	ft
Specific Energy	0.23	ft
Froude Number	0.59	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	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	0.20	ft
Critical Depth	0.16	ft
Channel Slope	0.00180	ft/ft
Critical Slope	0.00552	ft/ft

Cross Section for U Tonopah 37+90

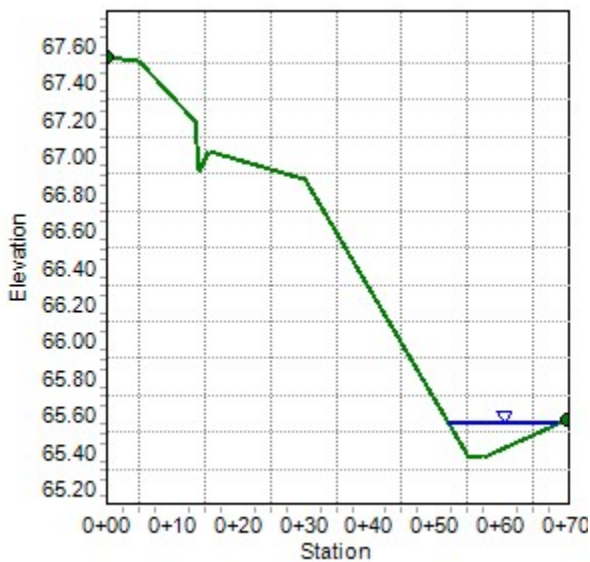
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00180	ft/ft
Normal Depth	0.19	ft
Discharge	2.00	ft ³ /s

Cross Section Image



Worksheet for U Tonopah 37+90

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00180 ft/ft
Discharge 2.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	67.54
0+04.77	67.51
0+13.38	67.19
0+13.95	66.92
0+15.47	67.03
0+30.00	66.87
0+55.29	65.36
0+57.29	65.36
0+70.00	65.57

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 67.54)	(0+70.00, 65.57)	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 0.19 ft
Elevation Range 65.360 to 67.540 ft
Flow Area 1.82 ft²
Wetted Perimeter 16.905 ft

Worksheet for U Tonopah 37+90

Results

Hydraulic Radius	0.11	ft
Top Width	16.898	ft
Normal Depth	0.19	ft
Critical Depth	0.15	ft
Critical Slope	0.00556	ft/ft
Velocity	1.10	ft/s
Velocity Head	0.02	ft
Specific Energy	0.21	ft
Froude Number	0.59	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	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	0.19	ft
Critical Depth	0.15	ft
Channel Slope	0.00180	ft/ft
Critical Slope	0.00556	ft/ft

Cross Section for Ex Virginia City 18+50

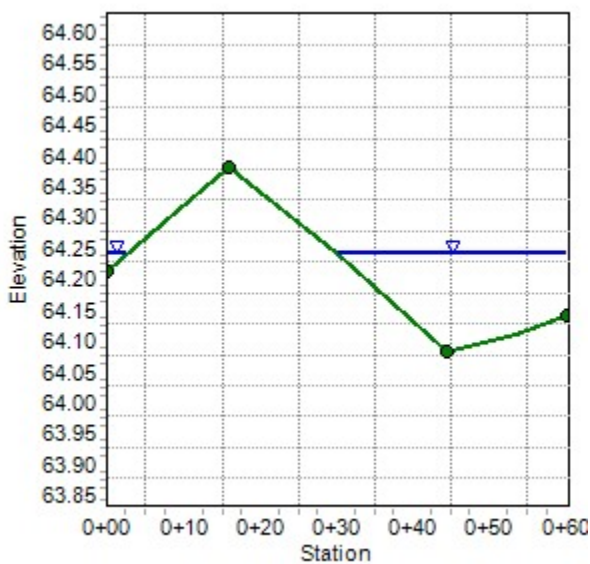
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.16	ft
Discharge	3.00	ft ³ /s

Cross Section Image



Worksheet for Ex Virginia City 18+50

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

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

Station (ft)	Elevation (ft)
0+00.00	64.21
0+09.20	64.31
0+15.95	64.38
0+30.00	64.24
0+44.46	64.08
0+53.80	64.11
0+60.00	64.14

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 64.21)	(0+15.95, 64.38)	0.025
(0+15.95, 64.38)	(0+44.46, 64.08)	0.015
(0+44.46, 64.08)	(0+60.00, 64.14)	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 0.16 ft
Elevation Range 64.080 to 64.380 ft
Flow Area 3.19 ft²
Wetted Perimeter 32.443 ft

Worksheet for Ex Virginia City 18+50

Results

Hydraulic Radius	0.10	ft
Top Width	32.317	ft
Normal Depth	0.16	ft
Critical Depth	0.11	ft
Critical Slope	0.01557	ft/ft
Velocity	0.94	ft/s
Velocity Head	0.01	ft
Specific Energy	0.17	ft
Froude Number	0.53	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.16	ft
Critical Depth	0.11	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.01557	ft/ft

Cross Section for U Virginia City 18+50

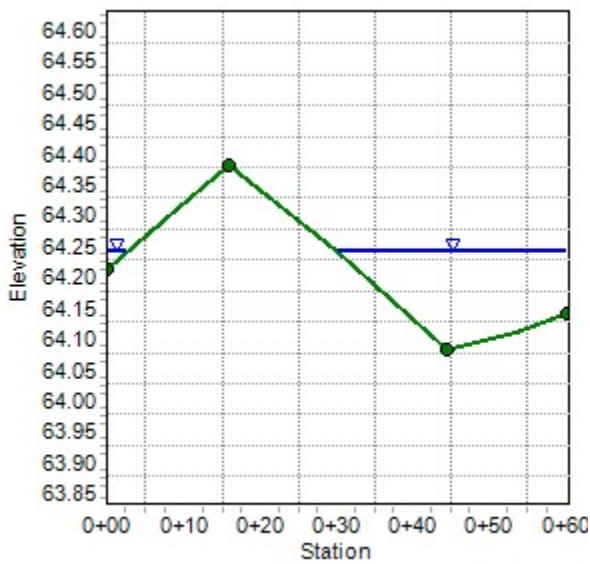
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.16	ft
Discharge	3.00	ft ³ /s

Cross Section Image



Worksheet for U Virginia City 18+50

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

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

Station (ft)	Elevation (ft)
0+00.00	64.21
0+09.20	64.31
0+15.95	64.38
0+30.00	64.24
0+44.46	64.08
0+53.80	64.11
0+60.00	64.14

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 64.21)	(0+15.95, 64.38)	0.025
(0+15.95, 64.38)	(0+44.46, 64.08)	0.015
(0+44.46, 64.08)	(0+60.00, 64.14)	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 0.16 ft
Elevation Range 64.080 to 64.380 ft
Flow Area 3.19 ft²
Wetted Perimeter 32.443 ft

Worksheet for U Virginia City 18+50

Results

Hydraulic Radius	0.10	ft
Top Width	32.317	ft
Normal Depth	0.16	ft
Critical Depth	0.11	ft
Critical Slope	0.01557	ft/ft
Velocity	0.94	ft/s
Velocity Head	0.01	ft
Specific Energy	0.17	ft
Froude Number	0.53	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.000	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.16	ft
Critical Depth	0.11	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.01557	ft/ft

Storm Drain System Hydraulic Model

Hoggard.WSW

0

T1 MABEL HOGGARD ES REBUILD									
T2 100-YEAR ULTIMATE CONDITION									
T3 ATKINS PROJECT 100067217 - JLK									
SO		.0002052.370	1			2053.880			
R		19.9902055.800	1		.013		.000	.000	0
R		55.5602056.630	1		.013		.000	-90.000	1
R		399.5602057.700	1		.013		.000	.000	1
R		749.0202058.800	1		.013		.000	.000	1
R		754.0202058.930	1		.013		.000	.000	0
R		927.9702059.490	1		.013		.000	45.000	1
R		932.9702059.610	1		.013		.000	.000	0
R		1001.5102059.840	1		.013		.000	45.000	1
R		1006.5102060.040	1		.013		.000	.000	0
R		1041.0102060.237	1		.013		.000	-90.000	1
JX		1043.0102060.337	1	4	.013	.800	2060.437	-86.9	.000
R		1046.0102060.437	1		.013			.000	63.760 1
R		1106.5302060.741	1		.013			.000	-4.330 0
R		1217.3102061.299	1		.013			.000	.000 0
JX		1217.8102061.302	1	2	.013	.800	2062.000	-90.0	.000
R		1218.3102061.791	1		.013			.000	.000 0
R		1316.6502062.232	1		.013			.000	-90.000 0
R		1406.7502062.384	1		.013			.000	18.610 0
R		1419.4902062.450	1		.013			.000	.000 0
JX		1419.9902062.460	3	4	.013	.900	2062.660	56.4	.000
R		1434.7902062.537	3		.013			.000	.000 1
JX		1435.2902062.547	3	4	.013	1.200	2062.660	-78.5	.000
R		1459.5602062.671	3		.013			.000	.000 0
JX		1460.0602062.681	3	2	.013	.010	2062.660	56.4	.000
R		1485.1402062.806	3		.013			.000	-78.500 0
R		1516.0302062.963	3		.013			.000	.000 0
JX		1516.5302062.973	3	2	.013	.400	2062.983	90.0	.000
R		1536.7302063.076	3		.013			.000	.000 0
JX		1537.2302063.086	3	4	.013	.800	2063.096	-22.5	.000
R		1537.7302063.096	3		.013			.000	45.000 0
R		1573.5202063.268	3		.013			.000	-45.000 0
R		1582.6902063.314	3		.013			.000	.000 0
JX		1583.1902063.324	3	4	.013	.700	2063.424	90.0	.000
R		1638.8602063.595	3		.013			.000	.000 0
JX		1639.3602063.605	2	2	.013	.200	2063.615	90.0	.000
R		1645.6902063.629	2		.013			.000	.000 0
R		1652.7302063.664	2		.013			.000	.000 0
R		1687.4202063.837	2		.013			.000	90.000 0
R		1692.4202063.937	2		.013			.000	.000 0
SH		1692.4202063.937	2				2063.937		
CD	1	4	1		.000	1.500	.000	.000	.000 .00
CD	2	4	1		.000	.500	.000	.000	.000 .00
CD	3	4	1		.000	1.000	.000	.000	.000 .00
CD	4	4	1		.000	0.667	.000	.000	.000 .00
Q					.200	.0			

HOGGARD.OUT

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WATER SURFACE PROFILE LISTING

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MABEL HOGGARD ES REBUILD
100-YEAR ULTIMATE CONDITION
ATKINS PROJECT 100067217 - JLK

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
.000	2052.370	.425	2052.796	6.01	14.57	3.30	2056.09	.00	.95	1.35	1.500	.000	.00	1 .0
3.448	.1716					.1006	.35	.43	4.65	.38	.013	.00	.00	PIPE
3.448	2052.962	.438	2053.400	6.01	14.01	3.05	2056.45	.00	.95	1.36	1.500	.000	.00	1 .0
3.171	.1716					.0891	.28	.44	4.40	.38	.013	.00	.00	PIPE
6.620	2053.506	.453	2053.959	6.01	13.35	2.77	2056.73	.00	.95	1.38	1.500	.000	.00	1 .0
2.521	.1716					.0780	.20	.45	4.12	.38	.013	.00	.00	PIPE
9.141	2053.939	.469	2054.407	6.01	12.73	2.52	2056.93	.00	.95	1.39	1.500	.000	.00	1 .0
2.056	.1716					.0683	.14	.47	3.85	.38	.013	.00	.00	PIPE
11.197	2054.292	.485	2054.777	6.01	12.14	2.29	2057.07	.00	.95	1.40	1.500	.000	.00	1 .0
1.708	.1716					.0598	.10	.49	3.60	.38	.013	.00	.00	PIPE
12.905	2054.584	.503	2055.087	6.01	11.58	2.08	2057.17	.00	.95	1.42	1.500	.000	.00	1 .0
1.438	.1716					.0524	.08	.50	3.37	.38	.013	.00	.00	PIPE
14.343	2054.831	.520	2055.352	6.01	11.04	1.89	2057.24	.00	.95	1.43	1.500	.000	.00	1 .0
1.221	.1716					.0459	.06	.52	3.15	.38	.013	.00	.00	PIPE
15.564	2055.041	.539	2055.580	6.01	10.52	1.72	2057.30	.00	.95	1.44	1.500	.000	.00	1 .0
1.043	.1716					.0403	.04	.54	2.94	.38	.013	.00	.00	PIPE
16.607	2055.220	.558	2055.778	6.01	10.03	1.56	2057.34	.00	.95	1.45	1.500	.000	.00	1 .0
.895	.1716					.0353	.03	.56	2.75	.38	.013	.00	.00	PIPE

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MABEL HOGGARD ES REBUILD
100-YEAR ULTIMATE CONDITION
ATKINS PROJECT 100067217 - JLK

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
17.503	2055.373	.578	2055.951	6.01	9.57	1.42	2057.37	.00	.95	1.46	1.500	.000	.00	1 .0
	.770	.1716				.0310	.02	.58	2.57	.38	.013	.00	.00	PIPE
18.273	2055.505	.599	2056.104	6.01	9.12	1.29	2057.40	.00	.95	1.47	1.500	.000	.00	1 .0
	.662	.1716				.0272	.02	.60	2.40	.38	.013	.00	.00	PIPE
18.935	2055.619	.621	2056.240	6.01	8.70	1.17	2057.41	.00	.95	1.48	1.500	.000	.00	1 .0
	.569	.1716				.0239	.01	.62	2.24	.38	.013	.00	.00	PIPE
19.504	2055.717	.644	2056.360	6.01	8.29	1.07	2057.43	.00	.95	1.48	1.500	.000	.00	1 .0
	.486	.1716				.0210	.01	.64	2.09	.38	.013	.00	.00	PIPE
19.990	2055.800	.668	2056.468	6.01	7.91	.97	2057.44	.00	.95	1.49	1.500	.000	.00	1 .0
	2.239	.0233				.0195	.04	.67	1.95	.64	.013	.00	.00	PIPE
22.229	2055.852	.670	2056.523	6.01	7.86	.96	2057.48	.00	.95	1.49	1.500	.000	.00	1 .0
	12.046	.0233				.0182	.22	.67	1.94	.64	.013	.00	.00	PIPE
34.276	2056.133	.695	2056.829	6.01	7.50	.87	2057.70	.00	.95	1.50	1.500	.000	.00	1 .0
	7.234	.0233				.0160	.12	.70	1.80	.64	.013	.00	.00	PIPE
41.510	2056.302	.721	2057.023	6.01	7.15	.79	2057.82	.00	.95	1.50	1.500	.000	.00	1 .0
	4.822	.0233				.0141	.07	.72	1.68	.64	.013	.00	.00	PIPE
46.332	2056.415	.749	2057.163	6.01	6.82	.72	2057.88	.00	.95	1.50	1.500	.000	.00	1 .0
	3.366	.0233				.0124	.04	.75	1.57	.64	.013	.00	.00	PIPE

HOGGARD.OUT

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WATER SURFACE PROFILE LISTING

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MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
         | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
49.698 | 2056.493 | .778 | 2057.271 | 6.01 | 6.50 | .66 | 2057.93 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
2.367 | .0233 |         |         |         |         | .0109 | .03 | .78 | 1.46 | .64 | .013 | .00 | .00 | PIPE
52.065 | 2056.548 | .808 | 2057.356 | 6.01 | 6.20 | .60 | 2057.95 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
1.640 | .0233 |         |         |         |         | .0096 | .02 | .81 | 1.36 | .64 | .013 | .00 | .00 | PIPE
53.705 | 2056.587 | .839 | 2057.426 | 6.01 | 5.91 | .54 | 2057.97 | .00 | .95 | 1.49 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
1.069 | .0233 |         |         |         |         | .0085 | .01 | .84 | 1.26 | .64 | .013 | .00 | .00 | PIPE
54.774 | 2056.612 | .873 | 2057.484 | 6.01 | 5.63 | .49 | 2057.98 | .00 | .95 | 1.48 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
.593 | .0233 |         |         |         |         | .0075 | .00 | .87 | 1.17 | .64 | .013 | .00 | .00 | PIPE
55.368 | 2056.625 | .908 | 2057.534 | 6.01 | 5.37 | .45 | 2057.98 | .00 | .95 | 1.47 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
.192 | .0233 |         |         |         |         | .0066 | .00 | .91 | 1.08 | .64 | .013 | .00 | .00 | PIPE
55.560 | 2056.630 | .947 | 2057.577 | 6.01 | 5.11 | .41 | 2057.98 | .00 | .95 | 1.45 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
1.077 | .0031 |         |         |         |         | .0059 | .01 | .95 | 1.00 | 1.27 | .013 | .00 | .00 | PIPE
56.637 | 2056.633 | .987 | 2057.620 | 6.01 | 4.88 | .37 | 2057.99 | .00 | .95 | 1.42 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
4.319 | .0031 |         |         |         |         | .0052 | .02 | .99 | .92 | 1.27 | .013 | .00 | .00 | PIPE
60.956 | 2056.647 | 1.029 | 2057.676 | 6.01 | 4.65 | .34 | 2058.01 | .00 | .95 | 1.39 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
10.018 | .0031 |         |         |         |         | .0047 | .05 | 1.03 | .85 | 1.27 | .013 | .00 | .00 | PIPE
70.974 | 2056.678 | 1.075 | 2057.753 | 6.01 | 4.43 | .31 | 2058.06 | .00 | .95 | 1.35 | 1.500 | .000 | .00 | 1 | .0
         |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
21.057 | .0031 |         |         |         |         | .0042 | .09 | 1.08 | .78 | 1.27 | .013 | .00 | .00 | PIPE

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WATER SURFACE PROFILE LISTING

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MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
92.031 | 2056.743 | 1.125 | 2057.869 | 6.01 | 4.23 | .28 | 2058.15 | .00 | .95 | 1.30 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
47.258 | .0031 |         |         |         |         | .0037 | .18 | 1.13 | .71 | 1.27 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
139.289 | 2056.890 | 1.180 | 2058.071 | 6.01 | 4.03 | .25 | 2058.32 | .00 | .95 | 1.23 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
143.545 | .0031 |         |         |         |         | .0034 | .49 | 1.18 | .64 | 1.27 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
282.834 | 2057.337 | 1.242 | 2058.579 | 6.01 | 3.84 | .23 | 2058.81 | .00 | .95 | 1.13 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
116.726 | .0031 |         |         |         |         | .0032 | .37 | 1.24 | .58 | 1.27 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
399.560 | 2057.700 | 1.255 | 2058.955 | 6.01 | 3.81 | .22 | 2059.18 | .00 | .95 | 1.11 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
185.513 | .0031 |         |         |         |         | .0031 | .58 | 1.26 | .56 | 1.26 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
585.073 | 2058.284 | 1.258 | 2059.542 | 6.01 | 3.80 | .22 | 2059.77 | .00 | .95 | 1.10 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
163.947 | .0031 |         |         |         |         | .0031 | .51 | 1.26 | .56 | 1.26 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
749.020 | 2058.800 | 1.258 | 2060.058 | 6.01 | 3.80 | .22 | 2060.28 | .00 | .95 | 1.10 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
1.819 | .0260 |         |         |         |         | .0033 | .01 | 1.26 | .56 | .62 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
750.839 | 2058.847 | 1.194 | 2060.042 | 6.01 | 3.98 | .25 | 2060.29 | .00 | .95 | 1.21 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
1.418 | .0260 |         |         |         |         | .0036 | .01 | 1.19 | .63 | .62 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
752.257 | 2058.884 | 1.138 | 2060.022 | 6.01 | 4.18 | .27 | 2060.29 | .00 | .95 | 1.28 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
1.090 | .0260 |         |         |         |         | .0041 | .00 | 1.14 | .70 | .62 | .013 | .00 | .00 | PIPE
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
753.347 | 2058.913 | 1.087 | 2060.000 | 6.01 | 4.38 | .30 | 2060.30 | .00 | .95 | 1.34 | 1.500 | .000 | .00 | 1 | .0
        |         |         |         |         |         |         |         |         |         |         |         |         |         |         |
.673 | .0260 |         |         |         |         | .0045 | .00 | 1.09 | .76 | .62 | .013 | .00 | .00 | PIPE

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HOGGARD.OUT

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Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
754.020 | 2058.930 | 1.048 | 2059.978 | 6.01 | 4.56 | .32 | 2060.30 | .00 | .95 | 1.38 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
14.909 | .0032 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
768.929 | 2058.978 | 1.096 | 2060.074 | 6.01 | 4.34 | .29 | 2060.37 | .00 | .95 | 1.33 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
33.430 | .0032 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
802.359 | 2059.086 | 1.148 | 2060.233 | 6.01 | 4.14 | .27 | 2060.50 | .00 | .95 | 1.27 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
92.372 | .0032 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
894.731 | 2059.383 | 1.205 | 2060.588 | 6.01 | 3.95 | .24 | 2060.83 | .00 | .95 | 1.19 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
33.239 | .0032 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
927.970 | 2059.490 | 1.214 | 2060.704 | 6.01 | 3.92 | .24 | 2060.94 | .00 | .95 | 1.18 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.684 | .0240 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
929.654 | 2059.531 | 1.155 | 2060.686 | 6.01 | 4.11 | .26 | 2060.95 | .00 | .95 | 1.26 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1.304 | .0240 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
930.958 | 2059.562 | 1.103 | 2060.665 | 6.01 | 4.32 | .29 | 2060.95 | .00 | .95 | 1.32 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.976 | .0240 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
931.934 | 2059.585 | 1.055 | 2060.640 | 6.01 | 4.53 | .32 | 2060.96 | .00 | .95 | 1.37 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.664 | .0240 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
932.597 | 2059.601 | 1.010 | 2060.611 | 6.01 | 4.75 | .35 | 2060.96 | .00 | .95 | 1.41 | 1.500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.352 | .0240 |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
        .0055 | .00 | 1.01 | .88 | .63 | .013 | .00 | .00 | PIPE

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

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Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
         | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem  | Ch Slope |          |          |          |          | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | *****
932.949 | 2059.610 | .969 | 2060.578 | 6.01 | 4.98 | .38 | 2060.96 | .00 | .95 | 1.43 | 1.500 | .000 | .00 | 1 | .0
         | .021 | .0240 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
932.970 | 2059.610 | .964 | 2060.574 | 6.01 | 5.01 | .39 | 2060.96 | .00 | .95 | 1.44 | 1.500 | .000 | .00 | 1 | .0
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
         | 2.541 | .0034 |          |          |          |          |          |          |          |          |          |          |          |          |          |
935.511 | 2059.619 | 1.005 | 2060.624 | 6.01 | 4.77 | .35 | 2060.98 | .00 | .95 | 1.41 | 1.500 | .000 | .00 | 1 | .0
         | 7.397 | .0034 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
942.907 | 2059.644 | 1.049 | 2060.693 | 6.01 | 4.55 | .32 | 2061.01 | .00 | .95 | 1.38 | 1.500 | .000 | .00 | 1 | .0
         | 17.051 | .0034 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
959.958 | 2059.701 | 1.097 | 2060.797 | 6.01 | 4.34 | .29 | 2061.09 | .00 | .95 | 1.33 | 1.500 | .000 | .00 | 1 | .0
         | 34.454 | .0034 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
994.412 | 2059.816 | 1.097 | 2060.913 | 6.01 | 4.34 | .29 | 2061.21 | .00 | .95 | 1.33 | 1.500 | .000 | .00 | 1 | .0
HYDRAULIC JUMP
994.412 | 2059.816 | .759 | 2060.576 | 6.01 | 6.69 | .70 | 2061.27 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         | 2.935 | .0034 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
997.347 | 2059.826 | .759 | 2060.586 | 6.01 | 6.69 | .70 | 2061.28 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         | 4.163 | .0034 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |
1001.510 | 2059.840 | .732 | 2060.572 | 6.01 | 7.02 | .77 | 2061.34 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         | 1.025 | .0400 |          |          |          |          |          |          |          |          |          |          |          |          |          |
         |          |          |          |          |          |          |          |          |          |          |          |          |          |          |          |

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

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Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
         | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope |
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
1002.535 | 2059.881 | .749 | 2060.630 | 6.01 | 6.82 | .72 | 2061.35 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | 1.335 | .0400 | | | | | .0124 | .02 | .75 | 1.57 | .55 | .013 | .00 | .00 | PIPE
1003.870 | 2059.935 | .778 | 2060.712 | 6.01 | 6.50 | .66 | 2061.37 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | 1.011 | .0400 | | | | | .0109 | .01 | .78 | 1.46 | .55 | .013 | .00 | .00 | PIPE
1004.881 | 2059.975 | .808 | 2060.783 | 6.01 | 6.20 | .60 | 2061.38 | .00 | .95 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | .740 | .0400 | | | | | .0096 | .01 | .81 | 1.36 | .55 | .013 | .00 | .00 | PIPE
1005.621 | 2060.005 | .839 | 2060.844 | 6.01 | 5.91 | .54 | 2061.39 | .00 | .95 | 1.49 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | .504 | .0400 | | | | | .0085 | .00 | .84 | 1.26 | .55 | .013 | .00 | .00 | PIPE
1006.125 | 2060.025 | .873 | 2060.897 | 6.01 | 5.63 | .49 | 2061.39 | .00 | .95 | 1.48 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | .289 | .0400 | | | | | .0075 | .00 | .87 | 1.17 | .55 | .013 | .00 | .00 | PIPE
1006.414 | 2060.036 | .908 | 2060.944 | 6.01 | 5.37 | .45 | 2061.39 | .00 | .95 | 1.47 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | .096 | .0400 | | | | | .0066 | .00 | .91 | 1.08 | .55 | .013 | .00 | .00 | PIPE
1006.510 | 2060.040 | .947 | 2060.987 | 6.01 | 5.11 | .41 | 2061.39 | .00 | .95 | 1.45 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | 6.967 | .0057 | | | | | .0059 | .04 | .95 | 1.00 | .98 | .013 | .00 | .00 | PIPE
1013.477 | 2060.080 | .976 | 2061.055 | 6.01 | 4.94 | .38 | 2061.43 | .00 | .95 | 1.43 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
         | 27.533 | .0057 | | | | | .0057 | .16 | .98 | .94 | .98 | .013 | .00 | .00 | PIPE
1041.010 | 2060.237 | .976 | 2061.213 | 6.01 | 4.94 | .38 | 2061.59 | .00 | .95 | 1.43 | 1.500 | .000 | .00 | 1 | .0
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR | .0499 | | | | | .0043 | .01 | .98 | .94 | .013 | .00 | .00 | PIPE

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

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Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
| Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
1043.010 | 2060.337 | 1.133 | 2061.470 | 5.21 | 3.64 | .21 | 2061.68 | .00 | .88 | 1.29 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
.995 | .0334 | | | | | .0031 | .00 | 1.13 | .61 | .53 | .013 | .00 | .00 | PIPE
1044.005 | 2060.370 | 1.083 | 2061.453 | 5.21 | 3.81 | .23 | 2061.68 | .00 | .88 | 1.34 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
.799 | .0334 | | | | | .0034 | .00 | 1.08 | .67 | .53 | .013 | .00 | .00 | PIPE
1044.804 | 2060.397 | 1.036 | 2061.433 | 5.21 | 4.00 | .25 | 2061.68 | .00 | .88 | 1.39 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
.622 | .0334 | | | | | .0039 | .00 | 1.04 | .73 | .53 | .013 | .00 | .00 | PIPE
1045.426 | 2060.417 | .993 | 2061.411 | 5.21 | 4.20 | .27 | 2061.68 | .00 | .88 | 1.42 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
.450 | .0334 | | | | | .0043 | .00 | .99 | .79 | .53 | .013 | .00 | .00 | PIPE
1045.877 | 2060.433 | .953 | 2061.385 | 5.21 | 4.40 | .30 | 2061.69 | .00 | .88 | 1.44 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
.134 | .0334 | | | | | .0047 | .00 | .95 | .86 | .53 | .013 | .00 | .00 | PIPE
1046.010 | 2060.437 | .937 | 2061.374 | 5.21 | 4.49 | .31 | 2061.69 | .00 | .88 | 1.45 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
19.987 | .0050 | | | | | .0049 | .10 | .94 | .88 | .92 | .013 | .00 | .00 | PIPE
1065.997 | 2060.537 | .925 | 2061.462 | 5.21 | 4.56 | .32 | 2061.78 | .00 | .88 | 1.46 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
40.533 | .0050 | | | | | .0050 | .20 | .92 | .91 | .92 | .013 | .00 | .00 | PIPE
1106.530 | 2060.741 | .925 | 2061.666 | 5.21 | 4.56 | .32 | 2061.99 | .00 | .88 | 1.46 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
5.057 | .0050 | | | | | .0050 | .03 | .92 | .91 | .92 | .013 | .00 | .00 | PIPE
1111.587 | 2060.766 | .924 | 2061.690 | 5.21 | 4.56 | .32 | 2062.01 | .00 | .88 | 1.46 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
87.616 | .0050 | | | | | .0050 | .44 | .92 | .91 | .92 | .013 | .00 | .00 | PIPE

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

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Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
      | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | | | | | | | | | | |
***** |*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
1199.203 | 2061.208 | .924 | 2062.131 | 5.21 | 4.56 | .32 | 2062.45 | .00 | .88 | 1.46 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
HYDRAULIC JUMP
1199.203 | 2061.208 | .808 | 2062.015 | 5.21 | 5.37 | .45 | 2062.46 | .00 | .88 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
3.778 | .0050 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1202.980 | 2061.227 | .808 | 2062.034 | 5.21 | 5.37 | .45 | 2062.48 | .00 | .88 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
4.649 | .0050 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1207.630 | 2061.250 | .778 | 2062.028 | 5.21 | 5.63 | .49 | 2062.52 | .00 | .88 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
4.824 | .0050 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1212.454 | 2061.275 | .749 | 2062.024 | 5.21 | 5.91 | .54 | 2062.57 | .00 | .88 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
4.856 | .0050 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1217.310 | 2061.299 | .722 | 2062.021 | 5.21 | 6.20 | .60 | 2062.62 | .00 | .88 | 1.50 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR | .0059 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1217.810 | 2061.302 | .505 | 2061.807 | 4.41 | 8.43 | 1.10 | 2062.91 | .00 | .81 | 1.42 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.074 | .9780 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1217.884 | 2061.375 | .521 | 2061.895 | 4.41 | 8.09 | 1.02 | 2062.91 | .00 | .81 | 1.43 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.078 | .9780 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1217.962 | 2061.450 | .539 | 2061.990 | 4.41 | 7.72 | .92 | 2062.91 | .00 | .81 | 1.44 | 1.500 | .000 | .00 | 1 | .0
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
.068 | .9780 | | | | | | | | | | | | | | |
      |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

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Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
         | Elev   | (FT)  | Elev   | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
         |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem  | Ch Slope |          |          |          |          | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | ***** | *****
1218.030 | 2061.517 | .558 | 2062.075 | 4.41 | 7.36 | .84 | 2062.92 | .00 | .81 | 1.45 | 1.500 | .000 | .00 | 1 | .0
         | .059 | .9780 |          |          |          | .0190 | .00 | .56 | 2.02 | .21 | .013 | .00 | .00 | PIPE
1218.088 | 2061.574 | .579 | 2062.153 | 4.41 | 7.02 | .76 | 2062.92 | .00 | .81 | 1.46 | 1.500 | .000 | .00 | 1 | .0
         | .051 | .9780 |          |          |          | .0167 | .00 | .58 | 1.88 | .21 | .013 | .00 | .00 | PIPE
1218.139 | 2061.623 | .599 | 2062.223 | 4.41 | 6.69 | .69 | 2062.92 | .00 | .81 | 1.47 | 1.500 | .000 | .00 | 1 | .0
         | .043 | .9780 |          |          |          | .0146 | .00 | .60 | 1.76 | .21 | .013 | .00 | .00 | PIPE
1218.182 | 2061.665 | .621 | 2062.287 | 4.41 | 6.38 | .63 | 2062.92 | .00 | .81 | 1.48 | 1.500 | .000 | .00 | 1 | .0
         | .036 | .9780 |          |          |          | .0128 | .00 | .62 | 1.64 | .21 | .013 | .00 | .00 | PIPE
1218.218 | 2061.700 | .644 | 2062.344 | 4.41 | 6.08 | .57 | 2062.92 | .00 | .81 | 1.48 | 1.500 | .000 | .00 | 1 | .0
         | .029 | .9780 |          |          |          | .0113 | .00 | .64 | 1.53 | .21 | .013 | .00 | .00 | PIPE
1218.247 | 2061.729 | .668 | 2062.397 | 4.41 | 5.80 | .52 | 2062.92 | .00 | .81 | 1.49 | 1.500 | .000 | .00 | 1 | .0
         | .023 | .9780 |          |          |          | .0099 | .00 | .67 | 1.43 | .21 | .013 | .00 | .00 | PIPE
1218.270 | 2061.752 | .693 | 2062.445 | 4.41 | 5.53 | .47 | 2062.92 | .00 | .81 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         | .018 | .9780 |          |          |          | .0087 | .00 | .69 | 1.33 | .21 | .013 | .00 | .00 | PIPE
1218.288 | 2061.769 | .719 | 2062.488 | 4.41 | 5.27 | .43 | 2062.92 | .00 | .81 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         | .012 | .9780 |          |          |          | .0077 | .00 | .72 | 1.24 | .21 | .013 | .00 | .00 | PIPE
1218.300 | 2061.781 | .746 | 2062.527 | 4.41 | 5.03 | .39 | 2062.92 | .00 | .81 | 1.50 | 1.500 | .000 | .00 | 1 | .0
         | .007 | .9780 |          |          |          | .0068 | .00 | .75 | 1.16 | .21 | .013 | .00 | .00 | PIPE

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Date: 1-28-2020 Time: 3: 2:25

ATKINS PROJECT 100067217 - JLK

12

HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

PAGE 12

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
| Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
1386.619 | 2062.350 | 1.058 | 2063.407 | 4.41 | 3.31 | .17 | 2063.58 | .00 | .81 | 1.37 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
20.131 | .0017 | | | | | .0024 | .05 | 1.06 | .59 | 1.26 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1406.750 | 2062.384 | 1.079 | 2063.463 | 4.41 | 3.24 | .16 | 2063.63 | .00 | .81 | 1.35 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
11.149 | .0052 | | | | | .0025 | .03 | 1.08 | .57 | .82 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1417.899 | 2062.442 | 1.033 | 2063.475 | 4.41 | 3.40 | .18 | 2063.65 | .00 | .81 | 1.39 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
1.591 | .0052 | | | | | .0026 | .00 | 1.03 | .62 | .82 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1419.490 | 2062.450 | 1.027 | 2063.477 | 4.41 | 3.42 | .18 | 2063.66 | .00 | .81 | 1.39 | 1.500 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0200 | | | | | .0055 | .00 | 1.03 | .63 | | | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1419.990 | 2062.460 | .954 | 2063.414 | 3.51 | 4.54 | .32 | 2063.73 | .00 | .80 | .42 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
10.375 | .0052 | | | | | .0087 | .09 | .95 | .59 | 1.00 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1430.365 | 2062.514 | 1.000 | 2063.514 | 3.51 | 4.47 | .31 | 2063.82 | .00 | .80 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
4.425 | .0052 | | | | | .0093 | .04 | 1.00 | .00 | 1.00 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1434.790 | 2062.537 | 1.025 | 2063.562 | 3.51 | 4.47 | .31 | 2063.87 | .00 | .80 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0200 | | | | | .0070 | .00 | 1.02 | .00 | | | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1435.290 | 2062.547 | 1.337 | 2063.884 | 2.31 | 2.94 | .13 | 2064.02 | .00 | .65 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
24.270 | .0051 | | | | | .0042 | .10 | 1.34 | .00 | .75 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1459.560 | 2062.671 | 1.315 | 2063.986 | 2.31 | 2.94 | .13 | 2064.12 | .00 | .65 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0200 | | | | | .0042 | .00 | 1.31 | .00 | | | .013 | .00 | .00 | PIPE

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

PAGE 13

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

```

*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
| Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
1460.060 | 2062.681 | 1.309 | 2063.990 | 2.30 | 2.93 | .13 | 2064.12 | .00 | .65 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
25.080 | .0050 | | | | | .0042 | .10 | 1.31 | .00 | .75 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1485.140 | 2062.806 | 1.323 | 2064.129 | 2.30 | 2.93 | .13 | 2064.26 | .00 | .65 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
30.890 | .0051 | | | | | .0042 | .13 | 1.32 | .00 | .75 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1516.030 | 2062.963 | 1.295 | 2064.258 | 2.30 | 2.93 | .13 | 2064.39 | .00 | .65 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0200 | | | | | .0035 | .00 | 1.29 | .00 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1516.530 | 2062.973 | 1.371 | 2064.344 | 1.90 | 2.42 | .09 | 2064.43 | .00 | .59 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
20.200 | .0051 | | | | | .0028 | .06 | 1.37 | .00 | .64 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1536.730 | 2063.076 | 1.326 | 2064.401 | 1.90 | 2.42 | .09 | 2064.49 | .00 | .59 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0200 | | | | | .0019 | .00 | 1.33 | .00 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1537.230 | 2063.086 | 1.369 | 2064.455 | 1.10 | 1.40 | .03 | 2064.49 | .00 | .44 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
.500 | .0200 | | | | | .0010 | .00 | 1.37 | .00 | .32 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1537.730 | 2063.096 | 1.364 | 2064.460 | 1.10 | 1.40 | .03 | 2064.49 | .00 | .44 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
35.790 | .0048 | | | | | .0010 | .03 | 1.36 | .00 | .47 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1573.520 | 2063.268 | 1.230 | 2064.498 | 1.10 | 1.40 | .03 | 2064.53 | .00 | .44 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
9.170 | .0050 | | | | | .0010 | .01 | 1.23 | .00 | .46 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1582.690 | 2063.314 | 1.193 | 2064.507 | 1.10 | 1.40 | .03 | 2064.54 | .00 | .44 | .00 | 1.000 | .000 | .00 | 1 | .0
| | | | | | | | | | | | | | | |
JUNCT STR | .0200 | | | | | .0005 | .00 | 1.19 | .00 | .013 | .00 | .00 | PIPE

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HOGGARD.OUT

FILE: HOGGARD.WSW

W S P G W - CIVILDESIGN Version 14.08

PAGE 14

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 3: 2:25

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
Station | Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
        | Elev  | (FT)  | Elev  | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
L/Elem | Ch Slope | | | | | | | | | | | | | | |
***** |*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|
1583.190 | 2063.324 | 1.236 | 2064.560 | .40 | .51 | .00 | 2064.56 | .00 | .26 | .00 | 1.000 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
49.810 | .0049 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1633.000 | 2063.566 | 1.000 | 2064.566 | .40 | .51 | .00 | 2064.57 | .00 | .26 | .00 | 1.000 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
5.860 | .0049 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1638.860 | 2063.595 | .971 | 2064.566 | .40 | .51 | .00 | 2064.57 | .00 | .26 | .33 | 1.000 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
JUNCT STR | .0200 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1639.360 | 2063.605 | .962 | 2064.567 | .20 | 1.02 | .02 | 2064.58 | .00 | .22 | .00 | .500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
6.330 | .0038 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1645.690 | 2063.629 | .946 | 2064.575 | .20 | 1.02 | .02 | 2064.59 | .00 | .22 | .00 | .500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
7.040 | .0050 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1652.730 | 2063.664 | .920 | 2064.584 | .20 | 1.02 | .02 | 2064.60 | .00 | .22 | .00 | .500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
34.690 | .0050 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1687.420 | 2063.837 | .796 | 2064.633 | .20 | 1.02 | .02 | 2064.65 | .00 | .22 | .00 | .500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
5.000 | .0200 | | | | | | | | | | | | | | |
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
1692.420 | 2063.937 | .702 | 2064.639 | .20 | 1.02 | .02 | 2064.66 | .00 | .22 | .00 | .500 | .000 | .00 | 1 | .0
        |-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|

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HOGGARD-RD6-LATERAL.WSW

0

T1	MABEL HOGGARD ES REBUILD								
T2	100-YEAR ULTIMATE CONDITION								
T3	ATKINS PROJECT 100067217 - JLK								
SO	1043.0102060.337	1						2061.470	
R	1066.5902060.555	1		.013					.000 45.000 0
R	1130.8502060.789	1		.013					.000 45.000 0
R	1136.4802060.902	1		.013					.000 .000 0
SH	1136.4802060.902	1						2060.902	
CD	1 4 1		.000	.500	.000	.000	.000	.00	
Q			.800	.0					

HOGGARD-RD6-LATERAL.OUT

FILE: HOGGARD-RD6-LATERAL.WSW

W S P G W - CIVILDESIGN Version 14.08

PAGE 1

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-29-2020 Time: 9:36:18

MABEL HOGGARD ES REBUILD

`100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ I.D.	ZL	No Wth	Prs/Pip		
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch			

1043.010	2060.337	1.133	2061.470	.80	4.07	.26	2061.73	.00	.44	.00	.500	.000	.00	1	.0		
	23.580	.0092				.0203	.48	1.13	.00	.50	.013	.00	.00	PIPE			
1066.590	2060.555	1.433	2061.988	.80	4.07	.26	2062.25	.00	.44	.00	.500	.000	.00	1	.0		
	64.260	.0036				.0203	1.31	1.43	.00	.50	.013	.00	.00	PIPE			
1130.850	2060.789	2.543	2063.332	.80	4.07	.26	2063.59	.00	.44	.00	.500	.000	.00	1	.0		
	5.630	.0201				.0203	.11	2.54	.00	.41	.013	.00	.00	PIPE			
1136.480	2060.902	2.544	2063.447	.80	4.07	.26	2063.70	.00	.44	.00	.500	.000	.00	1	.0		

HOGGARD-MP-LATERAL.WSW

0

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T1 MABEL HOGGARD ES REBUILD
T2 100-YEAR ULTIMATE CONDITION
T3 ATKINS PROJECT 100067217 - JLK
SO 1419.9902062.460 1 2063.414
R 1473.7732062.729 1 .013 .000 45.000 0
R 1479.7702062.759 1 .013 .000 .000 0
JX 1480.2702062.769 2 3 .013 .300 2062.869 -90.0 .000
R 1531.2902063.017 2 .013 .000 .000 0
JX 1531.7902063.027 2 3 .013 .400 2063.127 -90.0 .000
R 1567.2802063.197 2 .013 .000 -90.000 0
R 1597.5402063.499 2 .013 .000 .000 0
SH 1597.5402063.499 2 2063.499
CD 1 4 1 .000 .667 .000 .000 .000 .00
CD 2 4 1 .000 .500 .000 .000 .000 .00
CD 3 4 1 .000 .333 .000 .000 .000 .00
Q .300 .0

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HOGGARD-MP-LATERAL.OUT

FILE: HOGGARD-MP-LATERAL.WSW

W S P G W - CIVILDESIGN Version 14.08

PAGE 1

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 5: 2:32

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
1419.990	2062.460	.954	2063.414	1.00	2.92	.13	2063.55	.00	.48	.00	.660	.000	.00	1 .0
53.783	.0050					.0072	.39	.95	.00	.66	.013	.00	.00	PIPE
1473.773	2062.729	1.093	2063.822	1.00	2.92	.13	2063.96	.00	.48	.00	.660	.000	.00	1 .0
5.997	.0050					.0072	.04	1.09	.00	.66	.013	.00	.00	PIPE
1479.770	2062.759	1.107	2063.865	1.00	2.92	.13	2064.00	.00	.48	.00	.660	.000	.00	1 .0
JUNCT STR	.0200					.0114	.01	1.11	.00		.013	.00	.00	PIPE
1480.270	2062.769	1.152	2063.921	.70	3.57	.20	2064.12	.00	.42	.00	.500	.000	.00	1 .0
51.020	.0049					.0156	.79	1.15	.00	.50	.013	.00	.00	PIPE
1531.290	2063.017	1.698	2064.715	.70	3.57	.20	2064.91	.00	.42	.00	.500	.000	.00	1 .0
JUNCT STR	.0200					.0092	.00	1.70	.00		.013	.00	.00	PIPE
1531.790	2063.027	2.014	2065.042	.30	1.53	.04	2065.08	.00	.28	.00	.500	.000	.00	1 .0
35.490	.0048					.0029	.10	2.01	.00	.33	.013	.00	.00	PIPE
1567.280	2063.197	1.957	2065.154	.30	1.53	.04	2065.19	.00	.28	.00	.500	.000	.00	1 .0
30.260	.0100					.0029	.09	1.96	.00	.26	.013	.00	.00	PIPE
1597.540	2063.499	1.741	2065.240	.30	1.53	.04	2065.28	.00	.28	.00	.500	.000	.00	1 .0

HOGGARD-ZOO-LATERAL.WSW

0

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T1 MABEL HOGGARD ES REBUILD
T2 100-YEAR ULTIMATE CONDITION
T3 ATKINS PROJECT 100067217 - JLK
SO 1435.2902062.547 1 2063.884
R 1457.4902062.658 1 .013
JX 1457.9902062.758 2 2 .013 .400 2062.858
R 1522.8302062.984 2 .013
R 1639.7202063.569 2 .013
SH 1639.7202063.569 2 2063.569
CD 1 4 1 .000 .667 .000 .000 .000 .00
CD 2 4 1 .000 .500 .000 .000 .000 .00
Q .800 .0

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hoggard-zoo-lateral.OUT

FILE: hoggard-zoo-lateral.WSW

W S P G W - CIVILDESIGN Version 14.08

PAGE 1

Program Package Serial Number: 7271

WATER SURFACE PROFILE LISTING

Date: 1-28-2020 Time: 5:20:52

MABEL HOGGARD ES REBUILD

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

*****																	*****	
Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ I.D.	ZL	No Wth Prs/Pip				
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch				
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****				
1435.290	2062.547	1.337	2063.884	1.20	3.51	.19	2064.07	.00	.52	.00	.660	.000	.00	1	.0			
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
22.200	.0050					.0104	.23	1.34	.00	.66	.013	.00	.00	PIPE				
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
1457.490	2062.658	1.457	2064.115	1.20	3.51	.19	2064.31	.00	.52	.00	.660	.000	.00	1	.0			
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
JUNCT STR	.2002					.0154	.01	1.46	.00	.013	.00	.00	.00	PIPE				
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
1457.990	2062.758	1.474	2064.232	.80	4.07	.26	2064.49	.00	.44	.00	.500	.000	.00	1	.0			
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
64.840	.0035					.0203	1.32	1.47	.00	.50	.013	.00	.00	PIPE				
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
1522.830	2062.984	2.612	2065.596	.80	4.07	.26	2065.85	.00	.44	.00	.500	.000	.00	1	.0			
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
116.890	.0050					.0203	2.38	2.61	.00	.50	.013	.00	.00	PIPE				
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				
1639.720	2063.569	4.403	2067.972	.80	4.07	.26	2068.23	.00	.44	.00	.500	.000	.00	1	.0			
	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -	- -				

Hoggard-Tonopah.WSW

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T1 Mabel Hoggard ES Rebuild
T2 100-YEAR ULTIMATE CONDITION
T3 ATKINS PROJECT 100067217 - JLK
SO .0002053.810 1 2061.000
R 57.5102054.010 1 .013 .000 2.470 1
R 62.5102054.210 1 .013 .000 .000 0
R 180.4002054.640 1 .013 .000 -2.040 1
R 185.4002054.840 1 .013 .000 .000 0
R 385.7102055.560 1 .013 .000 .000 0
JX 387.7102055.660 1 2 .013 5.000 2055.967 89.5 .000
R 390.7102055.760 1 .013 .000 .000 0
R 618.4302056.580 1 .013 .000 .000 1
JX 620.4302056.730 1 1 .013 1.000 2057.310 84.4 .000
R 623.4302056.740 1 .013 .000 4.060 0
R 753.8502057.616 1 .013 .000 .000 0
JX 755.8502057.716 1 2 .013 2.000 2058.087 39.9 .000
R 758.8502057.816 1 .013 .000 -3.890 1
R 1036.5102058.664 1 .013 .000 .000 0
R 1041.5102058.764 1 .013 .000 .000 1
R 1069.4202058.863 1 .013 .000 43.870 1
JX 1071.4202058.963 4 3 .013 2.000 2059.965 90.0 .000
R 1074.4202059.063 4 .013 .000 41.950 0
R 1285.1102059.906 4 .013 .000 .000 0
SH 1285.1102059.906 4 2060.906
CD 1 4 1 .000 2.000 .000 .000 .000 .00
CD 2 4 1 .000 1.500 .000 .000 .000 .00
CD 3 2 0 .000 3.000 2.000 .000 .000 -.10
CD 4 4 2 .000 1.000 .000 .000 .000 .00
Q 4.000 .0

HOGGARD-TONOPAH.OUT

FILE: HOGGARD-TONOPAH.WSW

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PAGE 1

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WATER SURFACE PROFILE LISTING

Date: 1-29-2020 Time: 5:33: 8

Mabel Hoggard ES Rebuild

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****
	.000	2053.810	7.190	2061.000	14.00	4.46	.31	2061.31	.00	1.35	.00	2.000	.000	.00 1 .0
57.510	.0035					.0038	.22	7.19	.00	1.75	.013	.00	.00	PIPE
57.510	2054.010	7.228	2061.238	14.00	4.46	.31	2061.55	.00	1.35	.00	2.000	.000	.00	1 .0
5.000	.0400					.0038	.02	7.23	.00	.76	.013	.00	.00	PIPE
62.510	2054.210	7.047	2061.257	14.00	4.46	.31	2061.57	.00	1.35	.00	2.000	.000	.00	1 .0
117.890	.0036					.0038	.45	7.05	.00	1.69	.013	.00	.00	PIPE
180.400	2054.640	7.086	2061.726	14.00	4.46	.31	2062.03	.00	1.35	.00	2.000	.000	.00	1 .0
5.000	.0400					.0038	.02	7.09	.00	.76	.013	.00	.00	PIPE
185.400	2054.840	6.905	2061.745	14.00	4.46	.31	2062.05	.00	1.35	.00	2.000	.000	.00	1 .0
200.310	.0036					.0038	.77	6.91	.00	1.70	.013	.00	.00	PIPE
385.710	2055.560	6.952	2062.512	14.00	4.46	.31	2062.82	.00	1.35	.00	2.000	.000	.00	1 .0
JUNCT STR	.0499					.0027	.01	6.95	.00		.013	.00	.00	PIPE
387.710	2055.660	7.219	2062.879	9.00	2.86	.13	2063.01	.00	1.07	.00	2.000	.000	.00	1 .0
3.000	.0334					.0016	.00	7.22	.00	.63	.013	.00	.00	PIPE
390.710	2055.760	7.123	2062.883	9.00	2.86	.13	2063.01	.00	1.07	.00	2.000	.000	.00	1 .0
227.720	.0036					.0016	.36	7.12	.00	1.19	.013	.00	.00	PIPE
618.430	2056.580	6.670	2063.250	9.00	2.86	.13	2063.38	.00	1.07	.00	2.000	.000	.00	1 .0
JUNCT STR	.0750					.0014	.00	6.67	.00		.013	.00	.00	PIPE

HOGGARD-TONOPAH.OUT

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WATER SURFACE PROFILE LISTING

Date: 1-29-2020 Time: 5:33: 8

Mabel Hoggard ES Rebuild

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/I.D.	ZL	No Wth Prs/Pip
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch
620.430	2056.730	6.576	2063.306	8.00	2.55	.10	2063.41	.00	1.01	.00	2.000	.000	.00	1 .0
3.000	.0033					.0013	.00	6.58	.00	1.13	.013	.00	.00	PIPE
623.430	2056.740	6.571	2063.311	8.00	2.55	.10	2063.41	.00	1.01	.00	2.000	.000	.00	1 .0
130.420	.0067					.0013	.16	6.57	.00	.92	.013	.00	.00	PIPE
753.850	2057.616	5.858	2063.474	8.00	2.55	.10	2063.57	.00	1.01	.00	2.000	.000	.00	1 .0
JUNCT STR	.0500					.0010	.00	5.86	.00		.013	.00	.00	PIPE
755.850	2057.716	5.831	2063.547	6.00	1.91	.06	2063.60	.00	.87	.00	2.000	.000	.00	1 .0
3.000	.0333					.0007	.00	5.83	.00	.52	.013	.00	.00	PIPE
758.850	2057.816	5.737	2063.553	6.00	1.91	.06	2063.61	.00	.87	.00	2.000	.000	.00	1 .0
277.660	.0031					.0007	.20	5.74	.00	.98	.013	.00	.00	PIPE
1036.510	2058.664	5.084	2063.748	6.00	1.91	.06	2063.80	.00	.87	.00	2.000	.000	.00	1 .0
5.000	.0200					.0007	.00	5.08	.00	.59	.013	.00	.00	PIPE
1041.510	2058.764	4.991	2063.755	6.00	1.91	.06	2063.81	.00	.87	.00	2.000	.000	.00	1 .0
27.910	.0036					.0007	.02	4.99	.00	.93	.013	.00	.00	PIPE
1069.420	2058.863	4.922	2063.785	6.00	1.91	.06	2063.84	.00	.87	.00	2.000	.000	.00	1 .0
JUNCT STR	.0499					.0019	.00	4.92	.00		.013	.00	.00	PIPE
1071.420	2058.963	4.843	2063.806	4.00	2.55	.10	2063.91	.00	.60	.00	1.000	.000	.00	2 .0
3.000	.0334					.0032	.01	4.84	.00	.38	.013	.00	.00	PIPE

HOGGARD-TONOPAH.OUT

FILE: HOGGARD-TONOPAH.WSW

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WATER SURFACE PROFILE LISTING

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Mabel Hoggard ES Rebuild

100-YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

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*****
| Invert | Depth | Water | Q | Vel | Vel | Energy | Super | Critical | Flow Top | Height/ | Base Wt | | No Wth
Station | Elev | (FT) | Elev | (CFS) | (FPS) | Head | Grd.El. | Elev | Depth | Width | Dia.-FT | or I.D. | ZL | Prs/Pip
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
L/Elem | Ch Slope | | | | | SF Ave | HF | SE Dpth | Froude N | Norm Dp | "N" | X-Fall | ZR | Type Ch
*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****|*****
| | | | | | | | | | | | | | | |
1074.420 | 2059.063 | 4.766 | 2063.829 | 4.00 | 2.55 | .10 | 2063.93 | .00 | .60 | .00 | 1.000 | .000 | .00 | 2 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-
210.690 | .0040 | | | | | .0032 | .66 | 4.77 | .00 | .73 | .013 | .00 | .00 | PIPE
| | | | | | | | | | | | | | | |
1285.110 | 2059.906 | 4.587 | 2064.493 | 4.00 | 2.55 | .10 | 2064.59 | .00 | .60 | .00 | 1.000 | .000 | .00 | 2 | .0
-|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|- -|-

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HOGGARD-SOUTHWEST.WSW

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T1 MABEL HOGGARD ES REBUILD
T2 100 YEAR ULTIMATE CONDITION
T3 ATKINS PROJECT 100067217 - JLK
SO 390.7102055.760 1 2062.883
R 448.7102059.379 1 .013
JX 449.2102059.579 3 2 .013 1.100 2059.579
R 532.9802060.001 3 .013
JX 533.4802060.011 3 2 .013 .300 2060.011
R 545.3002060.062 3 .013
JX 545.8002060.072 3 2 .013 1.000 2060.072
R 595.9202060.315 3 .013
JX 596.4202060.325 3 2 .013 .400 2060.325
R 655.6802060.614 3 .013
JX 656.1802060.624 2 2 .013 1.700 2060.624
R 662.3102060.647 2 .013
R 677.9902060.804 2 .013
SH 677.9902060.804 2 2061.114
CD 1 4 1 .000 1.500 .000 .000 .000 .00
CD 2 4 1 .000 .500 .000 .000 .000 .00
CD 3 4 1 .000 1.000 .000 .000 .000 .00
CD 4 4 1 .000 .667 .000 .000 .000 .00
Q .400 .0

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hoggard-southwest.OUT

FILE: hoggard-southwest.WSW

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WATER SURFACE PROFILE LISTING

Date: 1-30-2020 Time: 4:27:30

MABEL HOGGARD ES REBUILD

100 YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

*****															*****	
Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/ Dia.-FT	Base Wt/ I.D.	ZL	No Wth Prs/Pip		
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch		
*****															*****	
390.710	2055.760	7.123	2062.883	4.90	2.77	.12	2063.00	.00	.85	.00	1.500	.000	.00	1 .0		
58.000	.0624					.0022	.13	7.12	.00	.44	.013	.00	.00	PIPE		
448.710	2059.379	3.636	2063.015	4.90	2.77	.12	2063.13	.00	.85	.00	1.500	.000	.00	1 .0		
JUNCT STR	.4004					.0068	.00	3.64	.00		.013	.00	.00	PIPE		
449.210	2059.579	3.305	2062.884	3.80	4.84	.36	2063.25	.00	.83	.00	1.000	.000	.00	1 .0		
83.770	.0050					.0114	.95	3.31	.00	1.00	.013	.00	.00	PIPE		
532.980	2060.001	3.836	2063.837	3.80	4.84	.36	2064.20	.00	.83	.00	1.000	.000	.00	1 .0		
JUNCT STR	.0200					.0105	.01	3.84	.00		.013	.00	.00	PIPE		
533.480	2060.011	3.942	2063.953	3.50	4.46	.31	2064.26	.00	.80	.00	1.000	.000	.00	1 .0		
11.820	.0043					.0097	.11	3.94	.00	1.00	.013	.00	.00	PIPE		
545.300	2060.062	4.005	2064.067	3.50	4.46	.31	2064.38	.00	.80	.00	1.000	.000	.00	1 .0		
JUNCT STR	.0200					.0073	.00	4.00	.00		.013	.00	.00	PIPE		
545.800	2060.072	4.300	2064.372	2.50	3.18	.16	2064.53	.00	.68	.00	1.000	.000	.00	1 .0		
50.120	.0048					.0049	.25	4.30	.00	.83	.013	.00	.00	PIPE		
595.920	2060.315	4.304	2064.619	2.50	3.18	.16	2064.78	.00	.68	.00	1.000	.000	.00	1 .0		
JUNCT STR	.0200					.0042	.00	4.30	.00		.013	.00	.00	PIPE		
596.420	2060.325	4.389	2064.714	2.10	2.67	.11	2064.82	.00	.62	.00	1.000	.000	.00	1 .0		
59.260	.0049					.0035	.21	4.39	.00	.70	.013	.00	.00	PIPE		

hoggard-southwest.OUT

FILE: hoggard-southwest.WSW

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WATER SURFACE PROFILE LISTING

Date: 1-30-2020 Time: 4:27:30

MABEL HOGGARD ES REBUILD

100 YEAR ULTIMATE CONDITION

ATKINS PROJECT 100067217 - JLK

*****																	*****	
Station	Invert Elev	Depth (FT)	Water Elev	Q (CFS)	Vel (FPS)	Vel Head	Energy Grd.El.	Super Elev	Critical Depth	Flow Top Width	Height/Dia.-FT	Base Wt/I.D.	ZL	No Wth	Prs/Pip			
L/Elem	Ch Slope					SF Ave	HF	SE Dpth	Froude N	Norm Dp	"N"	X-Fall	ZR	Type Ch				
*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****	*****		
655.680	2060.614	4.306	2064.920	2.10	2.67	.11	2065.03	.00	.62	.00	1.000	.000	.00	1	.0			
JUNCT STR	.0200					.0043	.00	4.31	.00		.013	.00	.00	PIPE				
656.180	2060.624	4.602	2065.226	.40	2.04	.06	2065.29	.00	.32	.00	.500	.000	.00	1	.0			
6.130	.0037					.0051	.03	4.60	.00	.50	.013	.00	.00	PIPE				
662.310	2060.647	4.632	2065.279	.40	2.04	.06	2065.34	.00	.32	.00	.500	.000	.00	1	.0			
15.680	.0100					.0051	.08	4.63	.00	.31	.013	.00	.00	PIPE				
677.990	2060.804	4.555	2065.358	.40	2.04	.06	2065.42	.00	.32	.00	.500	.000	.00	1	.0			

Appendix B

Reference Material

- Appendix B-1: Early Childhood Development Center, 1995
- Appendix B-2: Mabel Hoggard Elementary School, 2001
- Freeway Channel – Washington, MLK to Rancho Drive, 2015
- Freeway Channel – Washington, MLK to Rancho Drive Update #1

Hydrology Study

Early Childhood Development Center, 1995

File

CITY OF LAS VEGAS

DATE:

INTER-OFFICE MEMORANDUM

August 4, 1995

TO:

Nenad Mirkovic, P.E.
Land Development Services
Department of Public Works

FROM:

Dennis W. Stransky, P.E.
Flood Control
Dept. of Public Works

SUBJECT:

Early Childhood Development Center

File No. DS1551B
Date of Engineer's Stamp: 07/03/95
Date Received by City: 07/20/95

COPIES TO:

School Board of Trustees (Owner)
Baughman & Turner
John McNellis, P.E.

HISTORY:

1st Submittal: 03/31/95 - Not Acceptable
2nd Submittal: 08/04/95 - See Comments Below

REVIEW FEES:

\$250

N/C

REVIEW FEES SUBTOTAL:

\$250

REMARKS:

The drainage study for the subject project has been reviewed and

X

is acceptable in concept subject to conformance to all City standards and the following conditions.

 must be resubmitted or supplemented.

NOTE:

Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by CLV Flood Control. Additionally, conditional acceptance of a drainage study is valid for a period of one (1) year from date of issuance. 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.

END OF REMARKS

CRZ

T/R/S: 20/60/29

M-29

Storm Drainage Report for
Mabel Hoggard Elementary School, 2001

February 5, 2001

City of Las Vegas
731 So. 4th Street
Las Vegas, Nevada 89101

Attn: Mr. Greg McDermott, P.E.
Project Manager - Flood Control

Re: Mabel Hoggard Elementary School

Dear Mr. McDermott:

Martin & Martin have been retained to design storm drainage improvements for the Mabel Hoggard Elementary School located at 950 North Tonopah Drive. The drainage system is designed to discharge approximately 6 c.f.s. of storm water from the site. The purpose of the system is to reduce ponding from certain buildings and school yard areas.

The discharge of the proposed system would be into an existing 18" storm drain at Comstock Drive and Washington Avenue. Permission is therefore requested to connect to the existing city storm drain at this point. A set of construction documents are enclosed for your review. Please feel free to call me with any questions.

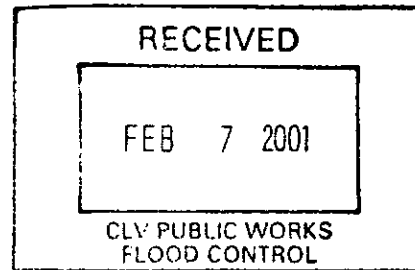
Sincerely,
MARTIN & MARTIN


Richard W. Cummock, P.E.
Project Engineer

Enclosed: (1) set blueines

cc: Clark County School District
c/o Mr. Dale Scheideman, Director

J:\ALL\1811.00\design\drainageimprovements.wpd



John A. Martin, S.E.
John A. Martin, Jr., S.E.
Roger M. Peltyn, P.E.

James R. Davis, P.E.

925
M28
\$250

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		February 21, 2001
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	COPIES TO:	
Drainage Study for:	Martin & Martin, Inc.	
CCSD – Mabel Hoggard Elementary School	CCSD	
Cross Streets:	Cheri Edelman, P.E., DEVCO	
NEC of Washington and Tonopah		
FILE NO.:		
F:\Depot\DSMEMOS\DS0925A.doc		
Parcel Number:		
139-28-210-007		
Zoning Action:		
FEMA Flood Zone	YES	No X
Proposed Storm Drain	YES X (onsite)	No

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1 st Submittal	2/7/2001	2/21/2001	See Comments Below	N/C
			TOTAL FEES (LDDRS):	N/C

REMARKS:

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

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

1. It must be noted that the proposed storm drain system is to reduce onsite ponding problem only. The existing pipe in Washington Avenue is not capable to mitigate any flooding from a major storm event.
2. A bubbler must be provided for the storm drain at Station 10+60± in Comstock Drive.
3. Label the size and slope of the existing storm drain in Washington Avenue.

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

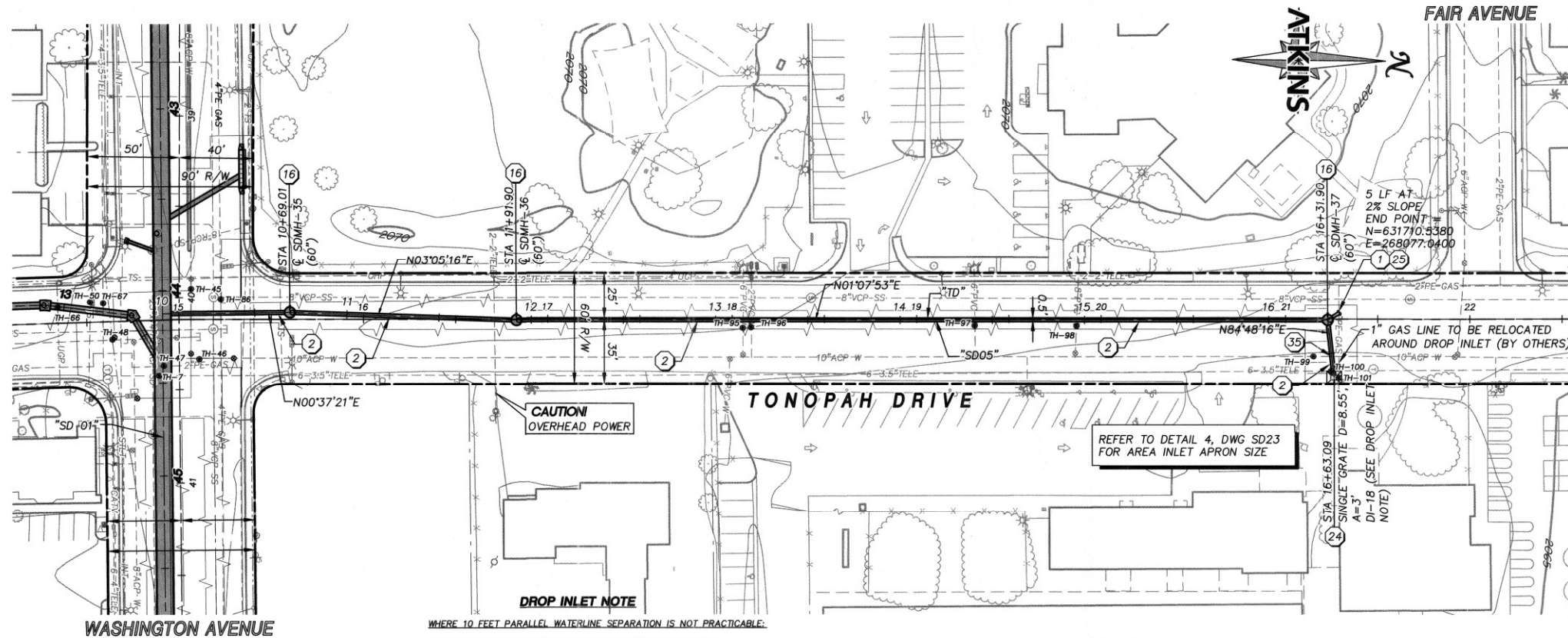
END OF REMARKS

ays

T/R/S: T20S/R61E/28

AREA M28

Freeway Channel – Washington, MLK to Rancho, 2015



STORM DRAIN CONSTRUCTION NOTES

- INSTALL 18" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 24" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 30" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 36" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 42" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 48" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 60" RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 45"x29" HE RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 53"x34" HE RCP SD PER TRENCH DETAIL 1 DRAWING SD21
- INSTALL 5'x5' PRECAST RCB SD PER TRENCH DETAIL 2 DRAWING SD21
- INSTALL 6'x5' PRECAST RCB SD PER TRENCH DETAIL 2 DRAWING SD21
- INSTALL 7'x5' PRECAST RCB SD PER TRENCH DETAIL 2 DRAWING SD21
- INSTALL 8'x5' PRECAST RCB SD PER TRENCH DETAIL 2 DRAWING SD21
- INSTALL 10'x5' PRECAST RCB SD PER TRENCH DETAIL 2 DRAWING SD21
- INSTALL PRECAST RCB TRANSITION
- CONSTRUCT TYPE I SDMH PER USD #403.1
- CONSTRUCT TYPE II SDMH PER USD #405.1
- CONSTRUCT TYPE III SDMH PER USD #406.1
- CONSTRUCT JUNCTION STRUCTURE PER DRAWING ST02
- CONSTRUCT 36" ACCESS MANHOLE PER DETAIL 3 DRAWING SD21
- CONSTRUCT 48" ACCESS MANHOLE PER DETAIL 4 DRAWING SD21
- CONSTRUCT TYPE "D" MODIFIED DROP INLET PER USD #412.1
- INSTALL PRECAST CURB INLET PER DETAIL 1 DRAWING SD22
- CONSTRUCT TYPE 2 INLET PER NDOT STD. DRAWING R-4.2.1 & R-4.2.7
- PLUG EXISTING/PROPOSED STORM DRAIN PER DETAIL 6 DRAWING SD21
- CONSTRUCT CONCRETE COLLAR PER DETAIL 5 DRAWING SD21
- CONNECT EXISTING 6"x3" RCB STORM DRAIN TO PROPOSED 5'x5' RCB PER DRAWING ST03
- CONSTRUCT RCB END CAP PER DETAIL A DRAWING ST01
- CONNECT EXISTING 7'x6" RCB TO PROPOSED 7'x6" RCB PER DETAIL D DRAWING ST01
- RELOCATE EXISTING UTILITY (BY OTHERS)
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Call before you Dig

811

1-800-227-2600

FAST

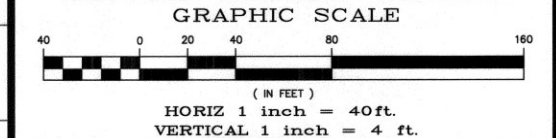
Underground

1-702-432-5300

Call before you Dig

FAST

1-702-227-2929

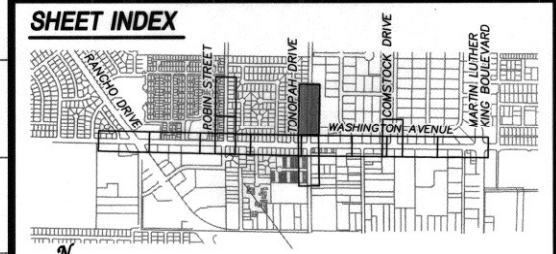


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ATKINS

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Henderson, Nevada 89074
Telephone: 702/263-7275
Fax: 702/263-7200

DEPARTMENT OF PUBLIC WORKS

CAPITAL PROJECT MANAGEMENT SECTION

CITY ENGINEER: ALLEN E. PAVELKA, P.E.
CITY PROGRAM MANAGER: MARK SORESEN, P.E.
PROJECT MANAGER: MATT BAIRD, P.E.
DESIGN BY: SMB
CHECK BY: SCR
DRAWN BY: TKS
DATE: AUGUST, 2016

CITY OF LAS VEGAS

FREEWAY CHANNEL - WASHINGTON

MLK BOULEVARD TO RANCHO DRIVE

(WASHINGTON AVE. STORM DRAIN)

STORM DRAIN PLAN AND PROFILE

TONOPAH DRIVE NORTH

STA 10+00.00 TO STA 17+00.00

PROFESSIONAL ENGINEER STATE OF NEVADA

MATTHEW S. BAIRD

EXP. 12-31-18

CIVIL

No. 13884

SHEET:

SD12

26 of 75

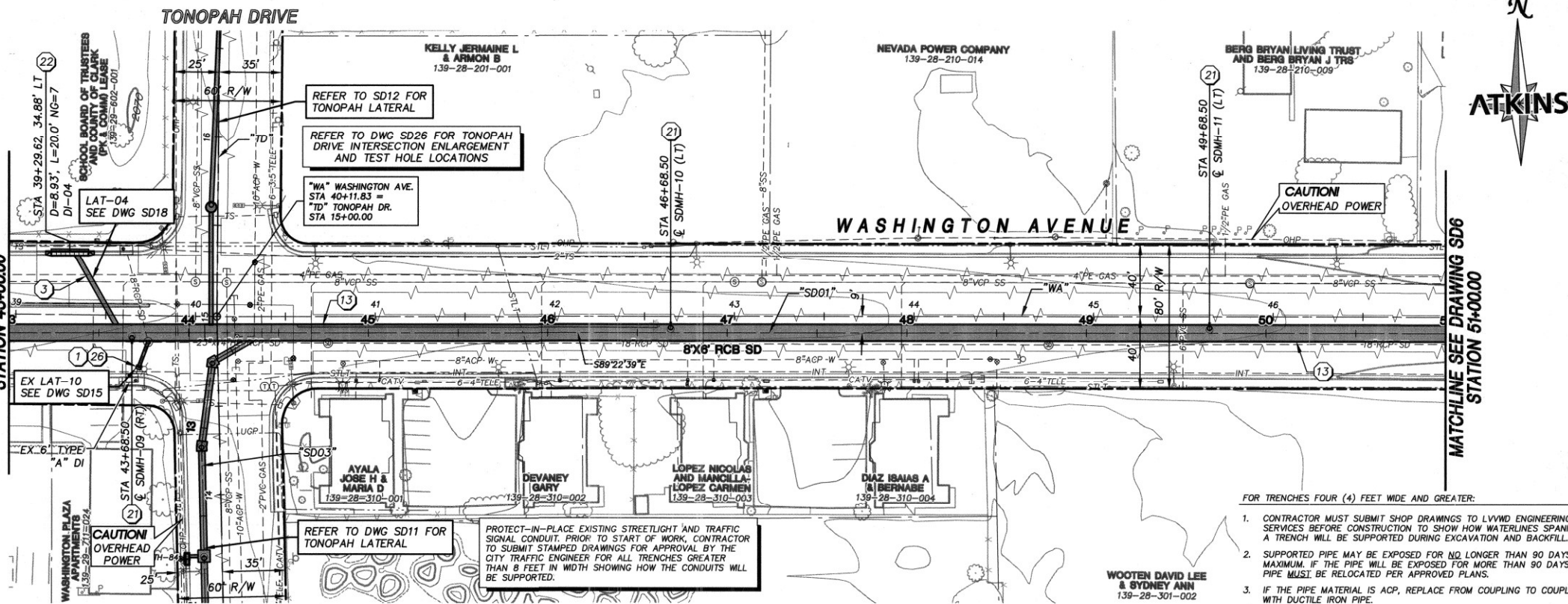
DRAWING#

731-90

MATCHLINE SEE DRAWING SD4
STATION 43+00.00

MATCHLINE SEE DRAWING SD4
STATION 43+00.00

MATCHLINE SEE DRAWING SD6
STATION 51+00.00



- FOR TRENCHES FOUR (4) FEET WIDE AND GREATER:
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 3. IF THE PIPE MATERIAL IS ACP, REPLACE FROM COUPLING TO COUPLING WITH DUCTILE IRON PIPE.

APPROVED FOR CONSTRUCTION
DISNEY BRIDGE
Las Vegas Valley Water District Engineering Services Manager
Date: 3/23/15 Project No. 12356 ESN 018

STORM DRAIN CONSTRUCTION NOTES

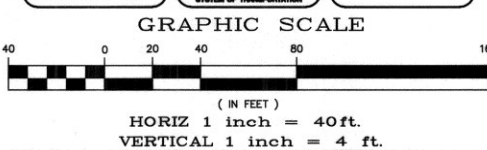
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17. CONSTRUCT TYPE II SDMH PER USD #405.1
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21. CONSTRUCT 48" ACCESS MANHOLE PER DETAIL 4 DRAWING SD21
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24. CONSTRUCT TYPE 2 INLET PER NDOT STD. DRAWING R-4.2.1 & R-4.2.7
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Call before you Dig
811
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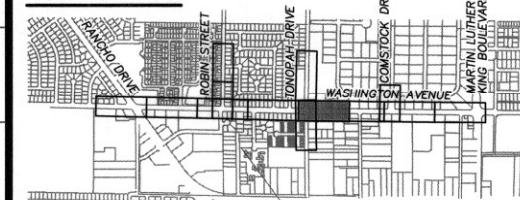
FAST
Call before you UnderGround
1-702-432-5300

CALL BEFORE YOU DIG OVERHEAD
1-702-227-2929



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SHEET INDEX



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89074 Telephone:
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Fax: 702/263-7200

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CITY ENGINEER: ALLEN E. PAVELKA, P.E.
CITY PROGRAM MANAGER: MARK SORSENSEN, P.E.
PROJECT MANAGER: MATT BAIRD, P.E.
DESIGN BY: SMB
CHECK BY: SCR
DRAWN BY: TKS
DATE: FEBRUARY, 2015

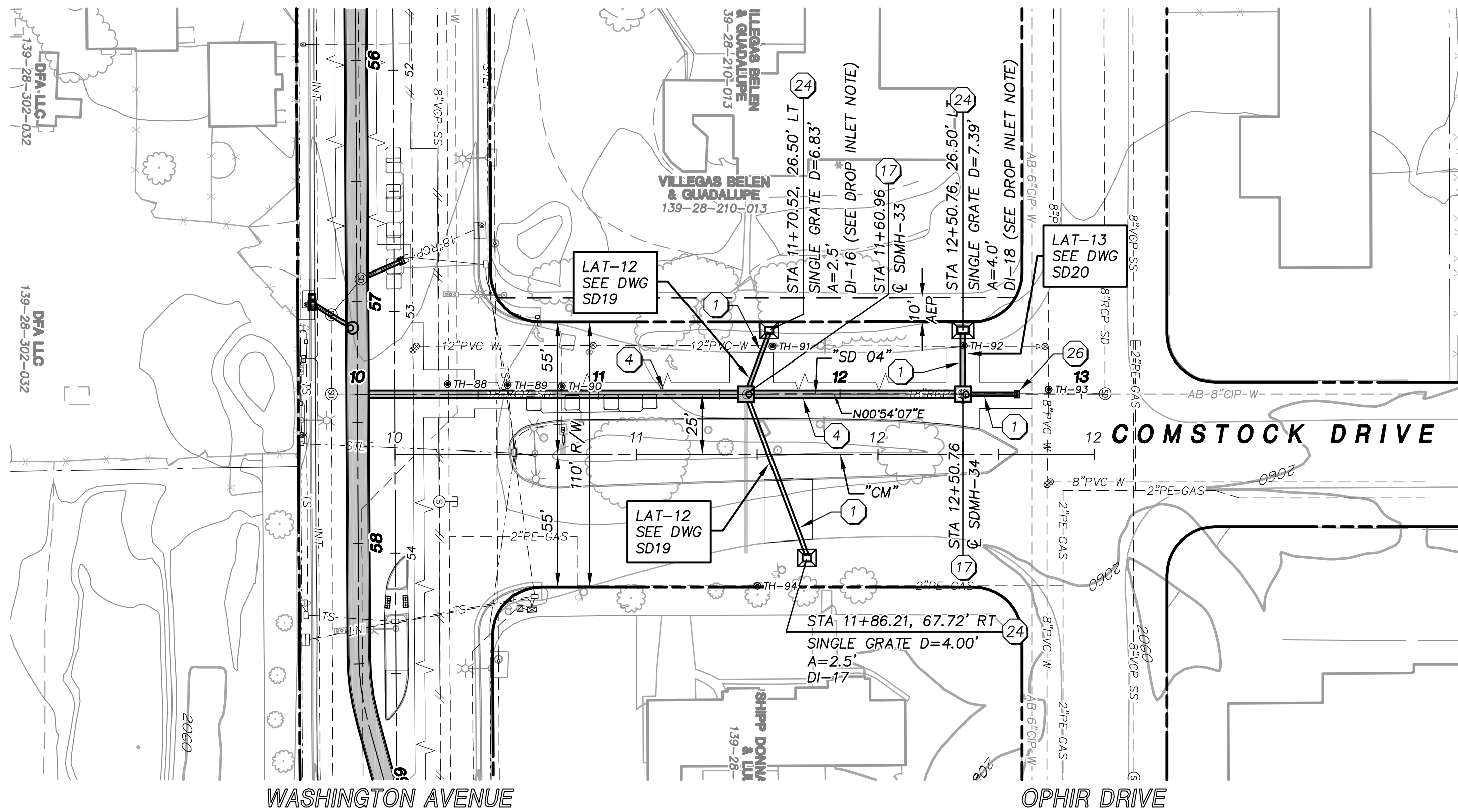
FREEWAY CHANNEL - WASHINGTON
MLK BOULEVARD TO RANCHO DRIVE
(WASHINGTON AVE. STORM DRAIN)
STORM DRAIN PLAN AND PROFILE
WASHINGTON AVENUE
STA 43+00.00 TO STA 51+00.00

PROFESSIONAL SEAL
MATTHEW S. BAIRD
EXP. 12-31-18
CIVIL
NO. 13684

SHEET:
SD5
19 of 75
DRAWING#
731-90

Update#1 Freeway Channel – Washington, MLK to
Rancho, 2015

C:\Temp\AcPublish_6472\22151-3-SD12 *7-17-14 02:06pm



- DROP INLET NOTE
- WHERE 10 FEET PARALLEL SEPARATION IS NOT PRACTICABLE, CAST-IN-PLACE MONOLITHIC POUR WITH WATERSTOP BETWEEN SLAB AND WALLS. BASE, WALLS AND TOP TO BE CONSTRUCTED WITH WATERSTOPS, CENTER BULB, OR FLAT STRIP (VINYLEX, GREENSTREAK, PLASTIC PRODUCTS OR APPROVED EQUAL)
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APPROVED FOR CONSTRUCTION

Las Vegas Valley Water District Engineering Services Manager
Date 12/25/13 Project No. 12352 ESN 078

STORM DRAIN CONSTRUCTION NOTES

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GRAPHIC SCALE



(IN FEET)

HORIZ 1 inch = 40ft.

VERTICAL 1 inch = 4 ft.

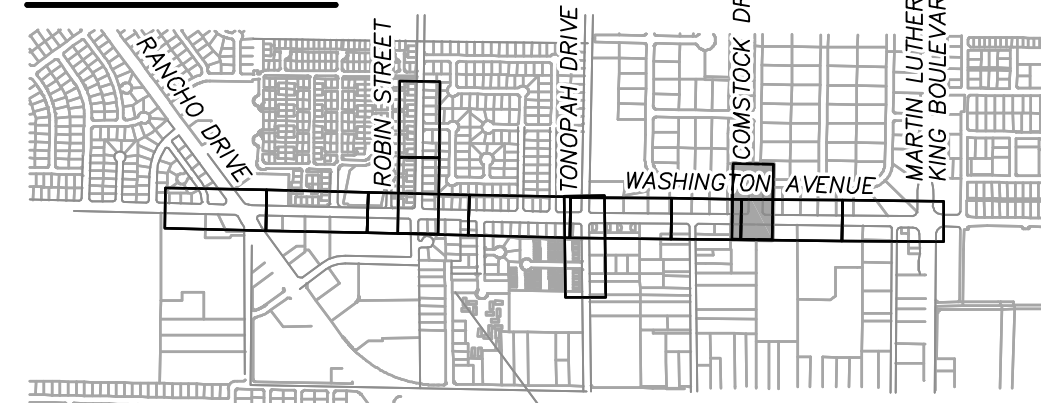
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CAPITAL PROJECT MANAGEMENT SECTION



FREWAY CHANNEL - WASHINGTON MLK BOULEVARD TO RANCHO DRIVE (WASHINGTON AVE. STORM DRAIN)

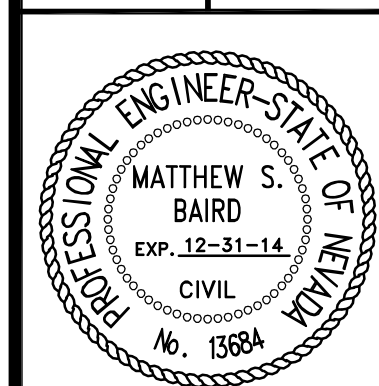
STORM DRAIN PLAN AND PROFILE

COMSTOCK DRIVE

STA 10+00.00 TO STA 15+00.00

TITLE:

SHEET:



SHEET:

SD12
25 of 73

DRAWING#
731-90

NOT FOR CONSTRUCTION — PRE-FINAL SUBMITTAL

Civil Improvement Plans