



**Technical Drainage Study**  
**for**

***3<sup>RD</sup> STREET ASSEMBLAGE***

**Date Prepared:**  
May 2022

**Prepared for:**  
Southern Land Company  
1225 17<sup>th</sup> Street, Suite 2420  
Denver, CO 80202

**Prepared by:**  
Kimley-Horn and Associates, Inc.  
6671 Las Vegas Boulevard South, Suite 320  
Las Vegas, NV 89119  
702.862.3600

**Kimley»»Horn**

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL  
**DRAINAGE STUDY INFORMATION FORM**

Name of Development: 3rd Street Assemblage Date: May 2022

Location of Development: a) Descriptive (Cross Streets) North/South: 3rd Street  
 East/West: California Avenue

b) Section: 3 Township: 21S Range: 61E

c) APN : 162-03-110-005 thru -010 and -029 thru -033

Name of Owner: Vegas Arts Owner

Telephone No.: N/A Fax No.: N/A E-Mail Address: \_\_\_\_\_

Address: 3990 Hillsboro Pike, Suite 400 Nashville, TN 37215

Contact Person-Name: Michael Schwab, P.E. Telephone No.: 702.790.0206

\* E-Mail Address: michael.schwab@kimley-horn.com Fax No.: N/A

Firm: KIMLEY-HORN

Address: 6671 Las Vegas Boulevard South, Suite 320 Las Vegas, NV 89119

Type of Land Development/Land Disturbance Process:

<input type="checkbox"/>	Rezoning	<input type="checkbox"/>	Subdivision Map	<input type="checkbox"/>	Clearing and Grading Only
<input type="checkbox"/>	Parcel Map	<input checked="" type="checkbox"/>	Planned Unit Development	<input checked="" type="checkbox"/>	Other (Please specify below)
<input type="checkbox"/>	Large Parcel Map	<input type="checkbox"/>	Building Permit	GRADING PERMIT	

1. Total Owned Land Area: At Site: +/- 1.3 acres Being Developed/Disturbed: +/- 1.3 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.): Commercial

5. Approximate upstream land area which drains to the subject site: +/- 32 acres

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

1. Drainage Design Report for Phase 2 Main Street Improvements and 2. TDS for 4th Street Mini Storage Facility

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: 1. Surface street flow via 3rd Street and California Avenue

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

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

Engineer's Seal

Local Entity File No. \_\_\_\_\_

REFERENCE:

STANDARD FORM 1

<b>HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL</b>			
<b>DRAINAGE SUBMITTAL CHECKLIST</b>			
Project Name:	<b>3<sup>rd</sup> Street Assemblage</b>	Map ID:	
Firm Name:	<b>Kimley-Horn</b>	Engineer:	<b>Michael Schwab, P.E.</b>
Address:	<b>6671 Las Vegas Boulevard South, Suite 320</b>		
City:	<b>Las Vegas</b>	State:	<b>Nevada</b>
		Zip:	<b>89119</b>
Phone No.:	<b>(702) 790-0206</b>	Fax No.:	
Property Owner:	<b>Vegas Arts Owner, LLC</b>		
Address:	<b>3990 Hillsboro Pike, Suite 400</b>		
City:	<b>Nashville</b>	State:	<b>TN</b>
		Zip:	<b>37215</b>
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 (CCRCD) 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                       | N/A                                 |  |
|-------------------------------------|--------------------------|-------------------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Design Manual <b>Standard Form 1</b> with the Engineer's seal and signature.                   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | Design Manual <b>Standard Form 4</b> .   |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/>            | 2 copies of the 24" x 36" <b>Drainage Plan</b> .   |
| <input type="checkbox"/>            | <input type="checkbox"/> | <input checked="" type="checkbox"/> | A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge. |

### II. MAPS AND EXHIBITS

- | YES                                 | NO                       | N/A                      |  |
|-------------------------------------|--------------------------|--------------------------|--|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated.  |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | A copy of the current CCRCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated.                         |
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Off-site drainage basin maps for existing, interim, and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs. |

### II. MAPS AND EXHIBITS (CONTINUED)

- |                                     |                          |                          |   |
|-------------------------------------|--------------------------|--------------------------|---|
| <input checked="" type="checkbox"/> | <input type="checkbox"/> | <input type="checkbox"/> | Vicinity Map with local and major cross streets identified and a north arrow. |
|-------------------------------------|--------------------------|--------------------------|---|

### III. DRAINAGE PLAN

YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Sheet size: 24"x36" sealed by a registered engineer in the State of Nevada.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum scale: 1"=60'
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Project name.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Vicinity Map with local and major cross streets.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Revision box.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	North arrow and bar scale.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Engineer's/consultant's address and phone number.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Elevation datum and benchmark.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Legend for symbols and abbreviations.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cut/Fill scarps, where applicable.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Street names, grades, widths.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	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.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Existing contours encompassing the site and 100-feet beyond with spot elevations for important locations, where appropriate.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Minimum finish floor elevations with top-of-curb elevations at upstream end of lot.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Proposed typical street sections.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Streets with offset crowns.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Proposed contours or spot elevations in sufficient detail to exhibit intended drainage patterns and slopes.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Property lines.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Right-of-way lines and widths, existing and proposed.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Existing improvements and their elevations.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Delineation of proposed on-site drainage basins indicating area and 10-year and 100-year peak flows at basin concentration points.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Concentration points and drainage flow directions with $Q_{100}$ and $V_{100}$ and $D_{100}$ in streets.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cumulative flows, velocity, and direction of flow at upstream and downstream ends of site for the 10-year and 100-year flows.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Location and cross-section of street capacity calculations.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Cross-sectional detail for channels, including cutoff wall locations.

### III. DRAINAGE PLAN (CONTINUED)

YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Existing and proposed drainage facilities, appurtenances, and connections (i.e., sidewalk ditches, swales, storm drain systems, unimproved channels, and culverts, etc.) stating size, material shape, and slope with plan and profile and HGL calculations.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Existing and proposed drainage easements and widths shown with sufficient detail. A cross-sectional detail must be provided that shows appropriate lining and reinforcement.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16"x48". Wrought iron gate is required for flows > 10 cfs.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Location and detail of flood-wall(s) illustrating depth of flow, proposed grouting height, etc.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	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.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Building and/or lot numbers.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	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.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Appropriately elevated "humps" 6 inches above the 100-year water surface elevation at the accesses where the intent is to protect the site from the Q <sub>100</sub> flows.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
<input type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required)

### IV. HYDROLOGIC ANALYSIS

YES	NO	N/A	
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Appropriate soil information and Soils Map for existing and future conditions with sub-basins and property delineated.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Input and Output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Input and Output information for proposed conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	Use of correct precipitation values in and around the McCarran Airport rainfall area.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	A discussion in the text of the hydrologic analysis justifying sub-basin boundaries and cutoffs, supporting assumptions, and calculations.
<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	A summary table of stormwater flows showing basin area Q <sub>10</sub> and Q <sub>100</sub> for both individual basins and combined basin flows, where applicable.

**IV. HYDROLOGIC ANALYSIS (CONTINUED)**

- Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.
- On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law.
- Calculation for impervious area for parking lots and LIDs (if required)

**V. HYDRAULIC ANALYSIS**

**YES NO N/A**

- Flow split calculations and supporting documentation or reference for the method of flow calculation used.
- Normal depth street flow calculations and cross-section diagrams for all interior and perimeter streets. Provide “d x v” products for the Q<sub>100</sub> and Q<sub>10</sub> flows representing the worst case for interior and all perimeter streets. Q<sub>100</sub> d x v ≤ 8. Q<sub>10</sub> d x v ≤ 6 and 12 foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the **Grading Plan**.
- A summary table of interior and exterior street capacity calculations showing the street name, Q<sub>100</sub> flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.
- Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)
- Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.
- Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Building adjacent to drainage easements must always be provided with 18 inches of freeboard above the Q<sub>100</sub> weir height or flow depth, whichever is greater.
- A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones.
  - Field survey data.
  - Input and output information.
  - Plotted cross-sections based on survey with proper encroachments.
  - A map showing the location of the cross-sections.
  - Analysis of both sub and super-critical flow segments.
  - A summary table and a discussion of the results in the text of the report.
- Provide a 50 percent clogging factor in the capacity calculation for drop inlets.
- Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drainpipes in public rights-of-way, including headwater pool inundation.
- The mitigation of nuisance water, both during construction and in the fully developed condition must be addressed.
- Provide BMP type, size and supporting calculations for parking lots and LIDs (if required)



# CITY OF LAS VEGAS

## MINIMUM DRAINAGE STUDY CRITERIA STANDARD FORM 2 CHECKLIST SUPPLEMENT

(Revised 5/18/11)

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

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

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

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

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

**CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST**

II. GRADING PLAN INFORMATION		
Yes	No	
	N/A	Proposed on-site and off-site storm drains and other flood control facilities with plan and profile sheets for public storm drains showing the class of pipe, (Class III, IV, V, etc.), design hydraulic grade line, (HGL) and 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying off-site flows. An overflow path must be provided over all storm drains.
X		All existing and "to be constructed" walls with cross-sections showing wall type, (e.g. block wall, retaining wall, flood wall, etc.), with limits clearly defined, adjacent ground elevations. Wall heights must meet current ordinances and in no case exceed 14 feet above the adjacent property.
X		Street slopes for both interior and perimeter streets. Note: The minimum slope for a roadway is 0.4 percent, a minimum 18-inch storm drain must be provided where minimum slopes cannot be met. <span style="color: red;">Existing roadway slopes are flatter</span>
	N/A	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	
	N/A	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.

## Technical Drainage Study

for

# *3<sup>RD</sup> STREET ASSEMBLAGE*

**Date Prepared:**

May 2022

**Prepared for:**

Southern Land Company

1225 17<sup>th</sup> Street, Suite 2420

Denver, CO 80202

**Prepared by:**

Kimley-Horn and Associates, Inc.

6671 Las Vegas Boulevard South, Suite 320

Las Vegas, NV 89119

702.862.3600



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## INTRODUCTION

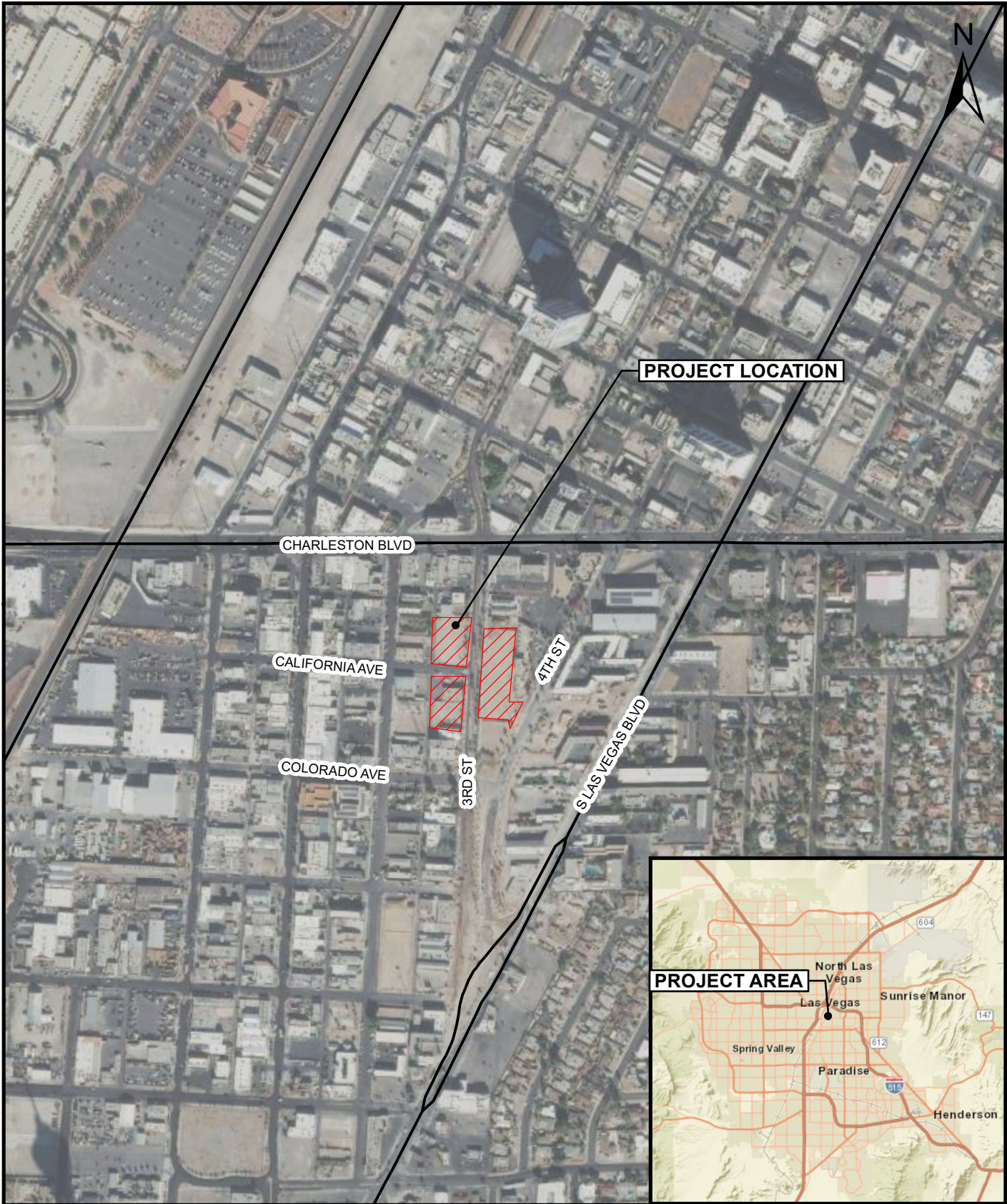
The **Southern Land Company, LLC** (herein referred to as “**SLC**”) is proposing to develop **3<sup>rd</sup> Street Assemblage** as a ±1.3-acre commercial site on several parcels located at the intersection of 3<sup>rd</sup> Street and California Avenue. The site consist of three (3) proposed buildings; one building is located at the northwest corner of 3<sup>rd</sup> Street and California Avenue, one building is located at the southwest corner of 3<sup>rd</sup> Street and California Avenue; and one building is located east of 3<sup>rd</sup> Street with the intersection of California Avenue. The purpose of this report is to accompany the grading plans and to provide detailed hydrologic and hydraulic analyses for the proposed commercial site. The following tasks were performed in the preparation of this report:

1. Identify previous drainage studies for the project site and surrounding areas.
2. Identify the FEMA floodplain designation for the project site.
3. Identify existing and proposed regional drainage facilities adjacent to the site.
4. Estimate runoff generated for the peak 100-year and 10-year return period storms for existing and proposed conditions.
5. Verify proposed finished floor elevations meet CLV Criteria.
6. Recommend drainage features to protect the project from storm runoff.

## LOCATION AND DEVELOPMENT DESCRIPTION

**3<sup>rd</sup> Street Assemblage** is located within Section 3, Township 21 South, Range 61 East, in Clark County, Nevada. The proposed project will consist of **commercial entertainment venue** within **±2.5 acres** of **APN 162-03-110-005 through -010 and -029 through -033**. A copy of the *Assessor's Parcel Map* is included in **Appendix A**. Please refer to **Figure 1 – Vicinity Map** following this page for the location of the project.

Currently, the site is developed and zoned under apartment residential and limited commercial. **3<sup>rd</sup> Street Assemblage** is surrounded by developed land with mixed commercial use, 3<sup>rd</sup> Street to the east of Buildings 2 and 3 and west of Building 1, and California Avenue to the north of Building 3, south of Building 2, and west of Building 1. The existing site west of 3<sup>rd</sup> Street generally slopes from west to the east with flow being conveyed via sheet flow to 3<sup>rd</sup> Street. The existing site east of 3<sup>rd</sup> Street generally slopes from west to east with flow being conveyed via sheet flow to 3<sup>rd</sup> Street. Drainage improvements will include swales, concrete channels, and roof drains to convey onsite storm runoff to 3<sup>rd</sup> Street. Offsite and onsite flow will follow existing drainage patterns.



**FIGURE 1: VICINITY MAP  
3RD STREET ASSEMBLAGE**

## PREVIOUS DRAINAGE STUDIES

Previous hydrology studies that was utilized in the preparation of this report:

1. *Final Drainage Design Report for the Phase 2 Main Street Improvements – Las Vegas Boulevard to Bonneville Avenue (Main Street Study, February 2016)*
  - a. The Main Street Study establishes drainage patterns for the watershed area west of Main Street. The flows from the *Main Street Study* do not impact the proposed site.
  
2. *Technical Drainage Study for Fourth Street Mini Storage Facility (Mini Study, February 1995)*
  - b. The Mini Study shows the historic drainage patterns at the time of the study which are still relevant today. Due to alterations to certain roadway alignments and storm drain infrastructure that has since been built, the hydrologic analysis is included but is not referenced with this report.

Kimley-Horn has reviewed the reference studies listed and agrees with the information included therein unless otherwise noted. The information referenced is for determining the existing and proposed flow patterns of the proposed project site. Pertinent reference material is included in **Appendix D**.

## CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT (CCRFCD) MASTER PLAN FACILITIES

“*The Las Vegas Valley Flood Control Master Plan Update*”, **Figure F-30**, dated December 2018, as prepared by the Clark County Regional Flood Control District (CCRFCD) illustrates the existing and proposed master planned facilities in the area (**See Appendix A**). As shown on the exhibit, the project site **is not** located adjacent to any existing or proposed Regional facilities.

## FEMA FLOOD HAZARD DESIGNATION

The Special Flood Hazard Areas (SFHA) for both the unincorporated and the incorporated portions of Clark County, Nevada, are outlined in the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Maps. This subject site is located on FEMA Flood Insurance Rate Map (FIRM) Community Panel No. **32003C 2170F**, revised November 2011. As shown on the FEMA FIRM Exhibit (see **Appendix A**), the subject site is located within a FEMA-designated **Zone X**. Therefore, this project is not currently located in a FEMA-designated SFHA. Areas described as Zone X are areas determined to be outside the 0.2% annual chance (500-year) floodplain.

## HYDROLOGIC METHODOLOGY

The hydrologic model and design of this site development are in compliance with local requirements, including Clark County (CC), the CCRFCD's "Hydrologic Criteria and Drainage Design Manual", and the CCRFCD's "Flood Control Master Plan Update".

### MODEL DESCRIPTION

The hydrologic model utilized in this study is the **HEC-1** Flood Hydrograph Package developed by the U.S. Army Corps of Engineers Hydrologic Engineering Center. **HEC-1** is a rainfall runoff event simulation model utilizing an interconnected system of hydrologic and hydraulic components to simulate the surface runoff response of a drainage area to precipitation. The calculations of this study were performed using the SCS Unit Hydrograph of the **HEC-1** Flood Hydrograph Model. The detailed explanation of the theory and background is presented in Section 4 of the SCS National Engineering Handbook and the **HEC-1** User Manual. Since the drainage area for the overall watershed is less than 8 square miles, and **SDN3** design storm was selected for the use in the HEC-1 computer model.

### PRECIPITATION

According to Figure 513 of the Manual, the project is located within the **McCarran Airport Rainfall Area**; therefore, point rainfall values for the 10-year and 100-year, six-hour storm duration are **1.58** and **2.77** inches, respectively (see **Appendix B**).

### CURVE NUMBER

The soils information for the project watershed was referenced from the Soil Survey of Las Vegas Area, Nevada, Part of Clark County" prepared by the United States Department of Agriculture Natural Resources Conservation Services (USDA NRCS). A *Custom Soil Resource Report* for the project site is included in **Appendix B**. The report indicates that the project area consists of Soil Types 615 (Urban Land) which is classified as Hydrologic Soil Group "**C**". HSG "**C**" is characterized as having a moderately high runoff rate.

The land use within the tributary watershed is consistent with the 2018 MPU assumptions about future growth and development. The majority of the offsite tributary area is fully developed. The land uses/land covers for the project site consist of: "**High-Density Residential, 4-8 units per acre**", "**Public Facility and Residential, 8-12 units per acre**", and "**Commercial, Retail, Casino, High Rise Condominiums**" for developed areas.

Due to the presence of mixed land uses, a weighted average curve number computation was prepared. These calculations are included in **Appendix B**.

For the given soil, CN values were determined from the MPU. Curve numbers ranging from **89.2** to **94.2** were determined for the existing and proposed conditions subbasins.

A copy of "*The Las Vegas Valley Flood Control Master Plan Update*", Figure **W-5**, dated December 2018, as prepared by CCRFCD is included in **Appendix A** to illustrate Regional's hydrologic subareas, land use and soils in the area.

## DRAINAGE AREAS AND FLOW PATTERNS

The subbasins and flow patterns used for the hydrologic modeling were determined from elevations established for the project site in a master grading digital file. Aerial topography with 2-foot contour intervals and survey data has been used for subbasin delineations.

## LAG TIME

The time between a brief, heavy rain and maximum runoff rate is called Lag Time. Lag Time can be estimated from historical hydrographs or it can be estimated from specific watershed characteristics such as watershed length, slope, and flow impedance. Based on studies of many storm events for a range of watershed conditions, the following empirical relationship between Lag Time (T) and Time of Concentration ( $T_c$ ) was derived:

$$T = 0.6T_c$$

The Time of Concentration ( $T_c$ ) is defined as the time required for runoff to the flow from the most remote part of the drainage basin to the outlet or to a combination point. The procedure for calculating the  $T_c$  is outlined in **Section 602** of CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*". Lag time calculations for this site are included in **Appendix B** as shown on **Standard Form 4**.

## HYDROLOGY

Existing and Proposed Conditions hydrology have been analyzed for the impacts to the project site. Proposed Conditions hydrology has been prepared to address the proposed improvements. Existing condition subbasins have been included on **Figure EX** and depict the drainage patterns used in the hydrologic analysis for the project. Proposed condition hydrology has been prepared to analyze the offsite flow impacting the site. Proposed condition subbasins have been included on **Figure PRO** and depict the drainage patterns used in the proposed condition for the project. Copies of the figures are included in **Appendix A**. HEC-1 Models for Existing and Proposed Conditions subbasins have been included in **Appendix B**. Tables summarizing the results of the HEC-1 models have been included on the figures in **Appendix A**.

## EXISTING CONDITIONS

Existing conditions assume the project site and the offsite tributary area as developed. Historic land use of the project site is residential. The adjacent streets, 3<sup>rd</sup> Street and California Avenue, are assumed developed per the MPU. The majority of the project site drains toward 3<sup>rd</sup> Street as surface flow.

The project-specific existing conditions hydrology consists of three (3) offsite subbasins (**OF1, OF2, & OF3**) and three (3) onsite subbasins (**EON1, EON2, & EON3**). **Figure EX-1 – Existing Conditions Drainage Map** depicts the subbasins and drainage patterns in the existing conditions analysis. **Table 1** summarizes the HEC-1 flows for existing conditions. Hydrologic calculations have been included in **Appendix B**.

**Table 1: Existing Condition Flow Summary**

BASIN ID/ COMB. PT.	BASIN AREA	100-YR FLOW	10-YR FLOW
	(ac)	(cfs)	(cfs)
OF1	4.16	11	5
OF2	5.29	14	7
CP1	-	25	12
OF3	17.99	42	20
EON1	1.40	3	2
EON2	1.20	3	2
EON3	1.97	4	2
CP2	-	77	38

## PROPOSED CONDITIONS

The proposed conditions drainage patterns assume the project site as fully developed, and the offsite basins as developed as in existing conditions. The proposed onsite flow patterns are similar to existing conditions. See **Figure PRO** in **Appendix A**.

The project-specific ultimate conditions hydrology consists of three (3) onsite subbasin (**DON1, DON2, & DON3**). **Figure PRO - Proposed Condition Drainage Map** depicts the subbasins and is located in **Appendix A**. **Table 2** summarizes the HEC-1 results for proposed conditions. Hydrologic calculations have been included in **Appendix B**.

**Table 2: Proposed Condition Flow Summary**

BASIN ID/ COMB. PT.	BASIN AREA	100-YR FLOW	10-YR FLOW
	(ac)	(cfs)	(cfs)
OF1	4.16	11	5
OF2	5.29	14	7
CP1	-	25	12
OF3	17.99	42	20
DON1	1.40	4	2
DON2	1.20	3	2
DON3	1.97	5	3
CP2	-	78	39

## HYDRAULIC CALCULATIONS

### STREETS

The resulting street flow data based on the flows generated during existing and proposed conditions has been presented in **Table 3** and **Table 4**, respectively. **Figure PRO** in **Appendix A** shows the locations of the cross sections corresponding to the calculations included in **Table 3** and **Table 4**. Hydraulic calculations have been included in **Appendix C**. 3<sup>rd</sup> Street and California Avenue consist of an 80-foot wide right of way measured from back-of-sidewalk to back-of-sidewalk with L-type curb and gutter on both sides.

**Table 3:** Existing Condition Hydraulic Street Sections – 10 Year Flow

STREET SECTION	TRIBUTARY BASINS	SLOPE	Q <sub>10</sub>	FLOW DEPTH	VELOCITY	D*V	DRY LANE
		%	(cfs)	(ft)	(ft/s)	ft <sup>2</sup> /s	
ST1	CP1	0.50	12	0.52	2.08	1.08	19.2
ST2	OF3 + DON2	0.60	22	0.50	2.19	1.10	0
ST3	CP2	0.10	38	0.79	1.41	1.11	0

**Table 4:** Proposed Condition Hydraulic Street Sections – 10 Year Flow

STREET SECTION	TRIBUTARY BASINS	SLOPE	Q <sub>10</sub>	FLOW DEPTH	VELOCITY	D*V	DRY LANE
		%	(cfs)	(ft)	(ft/s)	ft <sup>2</sup> /s	
ST1	CP1	0.50	12	0.52	2.08	1.08	19.2
ST2	OF3 + DON2	0.60	22	0.50	2.19	1.10	0
ST3	CP2	0.10	39	0.80	1.42	1.14	0

Dry lane criteria is required for streets with Right-of-Way greater than 80 feet. However, due to the excess flow in California Avenue and 3<sup>rd</sup> Street (CP1 and CP2, respectively), dry lane criteria is not met in the existing conditions. With the project improvements, the ultimate condition flows for these streets is equal to the existing condition flow, except for section ST-3 which has increase of flow of 1 cfs. However, this slight increase in runoff does not increase the depth in the street demonstrating that the project development does not negatively impact these streets.

Based on the calculated flow characteristics, the Manual criteria for depth (D) and velocity times depth (V\*D) during the 10-year and 100-year storm event will be met. Refer to **Table 6** for the 100-year flow characteristics.

### FLOOD CONTROL FACILITIES AND PROTECTION

Proposed onsite swales have been provided to direct flows away from onsite structures and ultimately to 3<sup>rd</sup> Street. Information for the swales has been included on **Figures PRO** and summarized in **Table 5**. Normal depth calculations have been included in **Appendix B**.

**Table 5: Proposed Condition Hydraulic Swale Sections**

STREET SECTION	TRIBUTARY BASINS	CHANNEL SLOPE	Q <sub>100</sub>	FLOW DEPTH	VELOCITY	D*V	TYPE	SIDE SLOPES		Req'd d <sub>50</sub>
		%	(cfs)	(ft)	(ft/s)	ft <sup>2</sup> /s				
SW1	OF1-B	0.30	3	0.17	0.97	0.16	V	3.9%	0.5%	N/A
SW2	OF2-B	0.60	3	0.20	1.53	0.31	V	1.1%	10.0%	N/A
SW3	DON3-B	0.40	0.5	0.19	0.78	0.15	V	3.1%	33.3%	N/A

## FINISHED FLOOR ELEVATION

The Clark County Regional Flood Control District requirement for the finish floor elevation (FF) is that it must be 18 inches above the centerline grade of the adjacent street or be elevated to twice the depth of flow up to 18 inches above the water surface elevation (WSE). Additional criteria require the finished floor elevation to be a minimum 6 inches above adjacent upstream top of curb. The proposed finished floor elevation has been elevated at or above at least twice the depth of flow in the adjacent drive aisles. **Table 6** summarizes the proposed FFE for the proposed building and verifies that the minimum criteria is met. The onsite hydraulic summary table on **Figure PRO** in **Appendix A** shows the proposed finished floor elevation in relation to the proposed flow depths. Hydraulic calculations have been included in **Appendix C**.

**Table 6: Proposed Condition Hydraulic Street Sections - 100 Year Flow & Building FFE Check Summary**

STREET SECTION	TRIBUTARY BASINS	SLOPE	Q <sub>100</sub>	FLOW DEPTH	VELOCITY	D*V	*FLOW LINE	*FLOW LINE + 2D	*FFE BLDG 1	*FFE BLDG 2	*FFE BLDG 3	BLDG PROTECTED?
		%	(cfs)	(ft)	(ft/s)	ft <sup>2</sup> /s	(ft)	(ft)	(ft)	(ft)	(ft)	
ST1	CP1	0.50	25	0.64	2.31	1.48	28.22	29.50	-	29.80	-	YES
ST1	CP1	0.50	25	0.64	2.31	1.48	28.10	29.38	-	-	30.70	YES
ST2	OF3 + DON2	0.60	45	0.61	2.60	1.59	28.10	29.32	30.00	-	-	YES
ST2	OF3 + DON2	0.60	45	0.61	2.60	1.59	28.20	29.42	-	-	30.70	YES
ST3	CP2	0.10	78	0.98	1.87	1.83	28.00	29.96	30.00	-	-	YES
ST3	CP2	0.10	78	0.98	1.87	1.83	27.80	29.76	-	29.80	-	YES

\*Add 2000 ft

Additionally, a hump has been provided for driveways, or the driveways are slope to the street, to keep offsite flow from entering the site. The humps will provide a minimum of **0.5 feet of freeboard at the entries**. Please refer to the grading plans included in **Appendix E**.

**PARKING LOT LOW IMPACT DEVELOPMENT (LID)**

The proposed site includes an interior parking lot within the building that is not exposed to rainfall. Per Section 1502.2 of the CCRFCD “Hydrologic Criteria and Drainage Design Manual”, parking lots are defined as “impervious area outside the building footprint.” Therefore, this project is not required to treat storm water runoff from the site since only building rooftops are exposed to rainfall.

## CONCLUSIONS AND RECOMMENDATIONS

**The proposed 3<sup>rd</sup> Street Assemblage development will not adversely impact the surrounding areas in the 100-year and 10-year storm events.** The development of this project site is in compliance with the *CCRFCD Hydrologic Criteria and Design Manual* and Clark County criteria.

1. This project is in compliance with the applicable drainage laws recognized by the State of Nevada.
2. This project is in compliance with the CCRFCD's "*Master Plan Update*" and will **not** conflict with any Master Planned Facilities.
3. This project is in compliance with the CCRFCD's "*Hydrologic Criteria and Drainage Design Manual*", with the exceptions noted in the study.
4. This project lies within FEMA-designated **Flood Zone X**. Therefore, the project is not currently located in a FEMA-designated Special Flood Hazard Area.
5. Buildings to be constructed with this project will have adequate freeboard protection from flows conveyed in the adjacent streets.
6. Runoff generated from, or conveyed by, the project will not adversely impact any downstream properties or facilities.

**REFERENCES**

1. Clark County Regional Flood Control District, "*Hydrologic Criteria and Drainage Design Manual*," August 1999, Revise September 2013.
2. Clark County Regional Flood Control District, "*2018 Las Vegas Valley Flood Control Master Plan Update*," November 2018.
3. U. S. Department of Agriculture Soil Conservation Service, *Soil Survey of Las Vegas Valley Area, Nevada, Part of Clark County*, August 2020, Version 16.
4. U.S. Army Corps of Engineers. HEC-1 Flood Hydrograph Package. Revised June 1998.
5. Final Drainage Design Report for the Phase 2 Main Street Improvements – Las Vegas Boulevard to Bonneville Avenue (Main Street Study, February 2016)
6. Technical Drainage Study for Fourth Street Mini Storage Facility (Mini Study, February 1995)

## LIST OF APPENDICES

### Appendix A – Documents & Figures

- EX Existing Condition Basin Map
- PRO Proposed Condition Basin Map
- Assessor's Parcel Maps
- FIRM Exhibit
- Figure F-30 Flood Control Facilities
- Figure W5 Hydrologic Subareas, Land Use & Soils
- City of Las Vegas Central Neighborhood Flood Control Master Plan
- Architectural Drawings

### Appendix B – Hydrologic Parameters & HEC-1 Analyses

- Figure 513 McCarran Airport Rainfall Area
- Table 503 Six-hour Storm Distributions
- Table 505 Depth-Duration-Frequency Values
- USDA NRCS Custom Soils Resource Report for Las Vegas Valley
- Curve Number Calculations
- Existing Condition Standard Form 4
- Existing Condition HEC-1 Output
- Proposed Condition Standard Form 4
- Proposed Condition HEC-1 Output

### Appendix C – Hydraulic Calculations

- Normal Depth Calculations – Streets
- Normal Depth Calculations – Swales

### Appendix D – Reference Materials

- Final Drainage Design Report for the Phase 2 Main Street Improvements – Las Vegas Boulevard to Bonneville Avenue (Main Street Study, February 2016)
- Technical Drainage Study for Fourth Street Mini Storage Facility (Mini Study, February 1995)

### Appendix E – Improvement Plans

### Appendix F – Data CD