

DS #:

4940

APN:

138-22.713.002

PROJECT:

Chik-fil-A Hwy 95 at Lake Mead

SUBMITTAL:

1st

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		January 2, 2018
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	
	Chik-fil-A Hwy 95 at Lake Mead	
Cross Streets:	SWC of Lake Mead Blvd & Rainbow Blvd	Chik-fil-A, Inc.
File Number:	F:\Depot\DSMemos\DS4940A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	138-22-713-002	
Zoning Action:	SDR-71994	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	12/14/2017	1/2/2018	See Comments Below	\$400.00	492213: \$400
			TOTAL FEES (LDDRS):	\$400.00	----

REMARKS:

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

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

1. The Q100 flow value of 96 cfs indicated on Figure PR-1 Proposed Condition Basin Map does not match the hydrologic results and summary tables.
2. Revise Construction Note 6 to reference sheet C4.3.
3. Label the APN of the subject site on the Grading Plans.
4. Identify and label the existing storm drain facilities within Rainbow Boulevard (CLV #107-V3519) as well as within the common lot between the subject site and Lake Mead Boulevard.

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

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

END OF REMARKS

jks

T/R/S: T20S/R60E/22
AREA L-22



TECHNICAL DRAINAGE STUDY for
Chik-fil-A HWY 95 at Lake Mead

APN: 138-22-713-002

**SWC OF Rainbow Boulevard & Lake Mead
Boulevard**

City of Las Vegas, Nevada

Prepared for:

Chik-fil-A, Inc.
1535 Alston Parkway, Suite 350
Irvine, California 92618
404.305.4834

Date Prepared:

December 12, 2017



December 12, 2017

Mr. Albert Sung, P.E.
City of Las Vegas Flood Control
333 Rancho Drive
Las Vegas, NV 89106

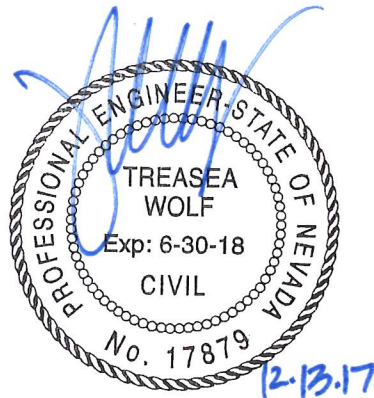
RE: *Technical Drainage Study for Chik-fil-A HWY 95 at Lake Mead (APN:138-22-713-002)*

Dear Mr. Sung,

Attached is one (1) copy of the Technical Drainage Study for "Chik-fil-A Highway 95 at Lake Mead" for your review. The project site encompasses approximately 0.91 acres on which a fast food restaurant with drive thru is proposed at the southwest corner (SWC) of Rainbow Boulevard and Lake Mead Boulevard located in the City of Las Vegas, Nevada

Please contact me at (702) 786.1830 or treasea.wolf@kimley-horn.com should you have any questions or concerns.

Sincerely,



Treasea Wolf, P.E., LEED AP

Cody Beck, E.I.
Civil Analyst

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Chik-Fil-A HWY 95 at Lake Mead Date: Dec 12, 2017
Location of Development: a) Descriptive (Cross Streets) North/South: Rainbow Boulevard
East/West: Lake Mead Boulevard
b) Section: 22 Township: 20S Range: 60E
c) APN : 138-22-713-002

Name of Owner: Restaurant Row LLC
Telephone No.: _____ Fax No.: _____ E-Mail Address: _____
Address: 10555 Richmond Ave. Houston, TX 77042

Contact Person-Name: Treasea Wolf, P.E., LEED AP Telephone No.: 702.786.1830
* E-Mail Address: treasea.wolf@kimley-horn.com Fax No.: _____
Firm: Kimley-Horn
Address: 6671 Las Vegas Boulevard South, Suite 320 Las Vegas, NV 89119

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	GRADING PERMIT

1. Total Owned Land Area: At Site: +/- 1.81 acres Being Developed/Disturbed: +/- 0.91 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: +/- 22 Acres
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: DS-1979
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: Rainbow Boulevard
8. Briefly describe your proposed schedule for the subject project: The Client intends to start construction as soon as practicable.
Any expediting of this permit would be appreciated.



Engineer's Seal

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

***New Required Field**

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

Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1



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	
	X	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>(Signature)</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.
	X	Sites with a grade difference two feet above or below existing ground are required to have approval from City of Las Vegas Current Planning. Current Planning approval is required prior to final approval of the drainage study.
X		On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners. (The project must pass flows through the site every 600 feet where the project is blocking flow paths.)
	X	This project uses a solid grouted stem wall (or approved alternate) at the back of sidewalk to provide erosion protection for landscaped areas where the depth of flow in the roadway exceeds the back of walk elevation. A corresponding cross-section detail is included.
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.
	X	Ten-foot wide public drainage easements to be privately maintained are allowed for flow less than 20 cfs. The depth of flow entering the easement must be checked using the submerged weir calculation.
	X	The limits of the flood zones and the base flood elevations (BFE) must be shown on all grading plans for all developments within a Special Flood Hazard Zone A, AO, AE, etc.
X		Minimum finish floor elevation is 6 inches above highest adjacent top of curb. Finish floor calculations must include allowances for super elevations on curves and velocity head for tee intersections.
	X	Finished floor elevations for buildings adjacent to public drainage easements must be a minimum of 18 inches above the Q100 weir of submerged weir elevation, whichever is greater.

CITY OF LAS VEGAS MINIMUM DRAINAGE STUDY CRITERIA CHECKLIST

III. Local Entity Criteria - City of Las Vegas – Manual Section 1600		
Yes	No	
		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.
		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.

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL			
DRAINAGE SUBMITTAL CHECKLIST			
Project Name:	Chik-fil-A HWY 95 at Lake Mead	Map ID:	138-22-713-002
Firm Name:	Kimley-Horn	Engineer:	Treasea Wolf, P.E., LEED AP
Address:	6671 Las Vegas Boulevard South, Suite 320		
City:	Las Vegas	State:	Nevada
Phone No.:	(702) 862-3600	Zip:	89119
		Fax No.	
Property Owner:	Restaurant Row LLC		
Address:	10555 Richmond Ave		
City:	Houston	State:	TX
		Zip:	77042
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

- | | | | |
|-------------------------------------|--------------------------|-------------------------------------|--|
| ☒ | ☐ | ☐ | Design Manual Standard Form 1 with the Engineer's seal and signature. |
| ☒ | ☐ | ☐ | Design Manual Standard Form 4 . |
| ☒ | ☐ | ☐ | 2 copies of the 24" x 36" Drainage Plan . |
| ☐ | ☐ | ☒ | A notarized letter from the adjacent property owner(s) allowing off-site grading or discharge. |

II. MAPS AND EXHIBITS

YES NO N/A

- | | | | |
|-------------------------------------|--------------------------|--------------------------|--|
| ☒ | ☐ | ☐ | A copy of a current Flood Insurance Rate Map (FIRM) with the site delineated. |
| ☒ | ☐ | ☐ | A copy of the current CCRCD Master Plan Update Figure, (F-x), for Flood Control Facilities and Environmental areas with the site delineated. |
| ☒ | ☐ | ☐ | Off-site drainage basin maps for existing, interim, and future conditions showing the existing topography, basin boundaries, concentration points, and flows in cfs. |

II. MAPS AND EXHIBITS (CONTINUED)

☒ ☐ ☐ Vicinity Map with local and major cross streets identified and a north arrow.

III. DRAINAGE PLAN

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

III. DRAINAGE PLAN (CONTINUED)

YES	NO	N/A	
☒	☐	☐	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.
☒	☐	☐	Existing and proposed drainage easements and widths shown with sufficient detail. A cross-sectional detail must be provided that shows appropriate lining and reinforcement.
☐	☐	☒	Location and detail of existing, proposed, and future block wall openings. Minimum size is 16"x48". Wrought iron gate is required for flows > 10 cfs.
☐	☐	☒	Location and detail of flood-wall(s) illustrating depth of flow, proposed grouting height, etc.
☒	☐	☐	Perimeter retaining wall locations. All existing and proposed walls (retaining screen and flood) must be shown with adjacent ground elevations. Flood walls with 8-inch concrete masonry unit.
☒	☐	☐	Building and/or lot numbers.
☒	☐	☐	Alignment of all existing, proposed, or future Regional Facilities adjacent to the site.
☐	☐	☒	Limits of existing floodplain based on current FIRM or best available information; limits of proposed floodplains based on best available information.
☐	☐	☒	For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE.
☒	☐	☐	Appropriately elevated "humps" 6 inches above the 100-year water surface elevation at the accesses where the intent is to protect the site from the Q ₁₀₀ flows.
☒	☐	☐	Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.
☐	☐	☒	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	
☒	☐	☐	Appropriate soil information and Soils Map for existing and future conditions with sub-basins and property delineated.
☒	☐	☐	Input and Output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	☐	Input and Output information for proposed conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.
☒	☐	☐	Use of correct precipitation values in and around the McCarran Airport rainfall area.
☒	☐	☐	A discussion in the text of the hydrologic analysis justifying sub-basin boundaries and cutoffs, supporting assumptions, and calculations.
☒	☐	☐	A summary table of stormwater flows showing basin area Q ₁₀ and Q ₁₀₀ for both individual basins and combined basin flows, where applicable.

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_{100} and Q_{10} flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$. $Q_{10} d \times v \leq 6$ and 12-foot dry lane for rights-of-way ≥ 80 feet. Calculations must be labeled by street name as indicated on the Grading Plan . |
| ☒ | ☐ | ☐ | A summary table of interior and exterior street capacity calculations showing the street name, Q_{100} flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12-foot dry lane criteria. |
| ☐ | ☐ | ☒ | Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.) |
| ☐ | ☐ | ☒ | Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate. |
| ☒ | ☐ | ☐ | Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Building 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. |
| ☐ | ☐ | ☒ | A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. <ul style="list-style-type: none">• 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) |

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INTRODUCTION

This report is a Technical Drainage Study for **Chik-fil-A HWY 95 at Lake Mead** which is a fast food restaurant with drive thru at the southwest corner (SWC) of Rainbow Boulevard and Lake Mead Boulevard in the City of Las Vegas, Nevada. Site improvements will include a 4,975 S.F. fast food restaurant with drive-thru, parking areas, landscaping, and drive aisles. The purpose of this study is as follows:

1. Determine the 10-year and 100-year onsite and offsite peak runoff for existing and fully developed conditions.
2. Determine the Finish Floor Elevation for the proposed buildings.

LOCATION AND DEVELOPMENT DESCRIPTION

The site is located in the North Half (N ½) of the Southeast Quarter (SE ¼) of Section 22, Township 20 South, Range 60 East, and M.D.M. Clark County, Nevada. The project site is composed of Assessor's Parcel Number 138-22-713-002. A copy of the *Assessor's Parcel Map* is included in **Appendix A**.

The project site is located within an existing commercial development and encompasses approximately 0.91 acres. The project site is bound by an existing screen wall to the north, Rainbow Boulevard to the east (80-foot public right-of-way), an existing parking lot to the south and an existing screen wall to the west. Rainbow Boulevard is a fully developed 80-foot public right-of-way which drains north to Lake Mead Boulevard.

The project site is currently developed with a restaurant and parking lot which drains easterly to Rainbow Boulevard. Improvements to the project site will include a fast food restaurant with a drive thru, new parking areas and desert landscaping.

LAND USE CONDITIONS

The parcels on which the project site is located has a zoning classification of Limited Commercial District (C-1) and a master planned land use of Service Commercial. The preliminary conditions and staff report are included in **Appendix A**.

PREVIOUS DRAINAGE STUDIES

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

1. *Technical Drainage Study for Las Vegas Athletic Club Parking Lot Extension including Addenda; Prepared by Red-Rock Engineering & Surveying, Inc. Approved December 19, 2006. DS-4015 "LVAC Study"*

This study, hereafter referred to as the *LVAC Study*, provided a hydrologic analysis of APN: 138-22-812-001 at the northwest corner of Rainbow Boulevard and Vegas Drive. This project site is located downstream of the LVAC development and the concentration points indicated on reference **Figure 6** have been utilized for this study.

2. *Technical Hydrology Update for Marriott Courtyard West including Addenda; Prepared by Hunsaker & Associates Nevada, Inc. Approved November 5, 1997. DS-2156 "Marriott Study"*

This study, hereafter referred to as the *Marriott Study*, provided a hydrologic analysis of APN: 138-22-713-006, which is downstream of the LVAC development. This project site is located downstream of this development and the concentration points indicated on reference figure **G1** have been utilized for this study.

3. *Technical Hydrology Study Restaurant Row (Formerly Rainbow/Lake Mead) including Addenda; Prepared by Hunsaker & Associates Nevada, Inc. Approved January 29, 1997. DS-1979 "Restaurant Study"*

This study, hereafter referred to as the *Restaurant Row Study*, provided a hydrologic analysis of the Restaurant Row development located at the southwest corner of Rainbow Boulevard and Lake Mead Boulevard. The project site is located within this existing development and drainage patterns will not be altered from this study.

Kimley-Horn has reviewed the reference studies listed above and is in agreement with the information included therein except for where noted otherwise. The information referenced is for the purpose of determining the existing and proposed development drainage patterns and flow rates adjacent to the proposed project site. Runoff flow rates that are referenced are indicated throughout this report and are accepted by Kimley-Horn for the purpose of this study. Referenced portions of these particular Technical Drainage Studies are 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-25**, dated September 2013, as prepared by the Clark County Regional Flood Control District (CCRFCD) illustrates the existing and proposed master planned facilities in the area. A copy of Figure **F-25** has been included in **Appendix A**. As shown on **F-25**, the project site is not located adjacent to any existing CCRFCD Facilities. However, a local storm drain facility is also located along Lake Mead Boulevard.

FLOOD HAZARD DESIGNATION

The Special Flood Hazard Areas 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 Community Panel No. **32003C2155F** map revised November 16, 2011. As shown on our *FEMA FIRM* located in **Appendix A**, the subject site is located within a **Zone X** area, which is not a FEMA designated SFHA. **Zone X** are areas determined to be outside the 0.2% annual chance floodplain.

HYDROLOGIC METHODOLOGY

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

HYDROLOGIC MODEL

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.

PRECIPITATION

According to Figure 513 of the CCRFCD Manual, the project **does** lie within the McCarran Airport Rainfall Area. Therefore, point rainfall values for the 10-year and 100-year, six-hour storm duration are **1.58** inches and **2.77** inches, respectively. Refer to **Figure 513** included in **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 mostly of pits, gravel which does not have a classified hydrologic soil group.

A copy of "The Las Vegas Valley Flood Control Master Plan Update", Figure **H-25**, dated September 2008, prepared by Post, Buckley, Schuh & Jernigan, Inc. (PBS&J), Parsons Brinckerhoff and Louis Berger Group for the CCRFCD is included in **Appendix A** for the purpose of illustrating the Regional's hydrologic subareas, land use and soils in the area. According to Figure **H-25** the project area is classified as hydrologic soil group "**C**". Group "**C**" is characterized as having **moderately high** runoff potential.

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 on Standard Form 4 included in **Appendix B**.

EXISTING HYDROLOGIC CONDITION

OFFSITE DRAINAGE

The offsite drainage area has been delineated on the *Existing Condition Basin Map* included in **Appendix E**. Four offsite basins contribute surface runoff to the west half of Rainbow Boulevard. Rainbow Boulevard will convey all the offsite runoff north to the intersection at Lake Mead Boulevard.

Offsite basin ***LVAC** has been referenced from the *LVAC Study* and contributes ***33/65 cfs** to the west half of Rainbow Boulevard. Offsite basin **^MAR** has been referenced from the *Marriott Study* and contributes **^5/10 cfs** to the west half of Rainbow Boulevard. **OFF1** encompasses approximately 4.95 acres and generates **7/14 cfs**. Runoff generated by **OFF1** drains to the west half of Rainbow Boulevard. **RNB1** encompasses approximately 0.94 acres of the west half of Rainbow Boulevard. **RNB1** generates **2/3 cfs** that drains north to **CP1**. The offsite basins combine at **CP1** for a resulting flow rate of **47/92 cfs**.

ONSITE DRAINAGE

The project site encompasses approximately 0.91 acres and is located in basin **EX1**. **EX1** encompasses approximately 0.91 acres and generates **2/3 cfs** which drains to **CP2**. The offsite basins and **EX1** combine at **CP2** for a resulting flow rate of **49/95 cfs**.

Table 1 located below summarizes the results of the reference Existing Condition HEC-1 model that is located in **Appendix B**.

Table 1: Existing Condition HEC-1 Summary.

BASIN	BASIN AREA (ACRES)	10-YEAR FLOW (CFS)	100-YEAR FLOW (CFS)
*LVAC	-	33	65
^MAR	-	5	10
RNB1	0.94	2	3
OFF1	4.95	7	14
CP1	-	47	92
EX1	0.91	2	3
CP2	-	49	95

Note: "*" Indicates referenced flow rates from the *LVAC Study* and "^" indicates referenced flow rates from the *Marriot Study*. Refer to **Figure EX-1**, *Existing Condition Basin Map* in **Appendix D**.

PROPOSED HYDROLOGIC CONDITION

OFFSITE DRAINAGE

Generally, the offsite drainage patterns discussed previously remain valid during the proposed condition. The offsite area is developed and will not change based on development of the site.

ONSITE DRAINAGE

The onsite area from the existing condition has been delineated by basin **PR1**. **PR1** encompasses approximately 0.91 acres and generates **2/3 cfs** which drains to **CP2**. The offsite basins and **PR1** combine at **CP2** for a resulting flow rate of **49/95 cfs**.

Table 2 located below summarizes the results of the reference Proposed Condition HEC-1 model that is located in **Appendix B**.

Table 2: Proposed Condition HEC-1 Summary.

BASIN	BASIN AREA (ACRES)	10-YEAR FLOW (CFS)	100-YEAR FLOW (CFS)
*LVAC	-	33	65
^MAR	-	5	10
RNB1	0.94	2	3
OFF1	4.95	7	14
CP1	-	47	92
PR1	0.91	2	3
CP2	-	49	95

Note: "*" Indicates referenced flow rates from the LVAC Study and "^" indicates referenced flow rates from the Marriot Study. Refer to **Figure PR-1**, *Proposed Condition Basin Map* in **Appendix E**.

HYDRAULIC CALCULATIONS

HYDRAULIC SECTIONS - STREETS

Table 3 below contains a summary of the hydraulic sections taken along Rainbow Boulevard. All street and cross section analyses are included in **Appendix C**; please refer to **Figure PR-1** included in **Appendix E** for the location of each section. The results of the street analyses indicate that the product of depth and velocity are less than 6 for the 10-year storm and less than 8 for the 100-year storm. Furthermore, the depth within the streets are less than 1-foot during a 10-year storm and 2-feet during a 100-year storm.

Table 3: Offsite Hydraulic Cross Sections.

SECTION NAME	SLOPE	Q10 (CFS)	FLOW DEPTH (FT)	V10 (FPS)	DV	Q100 (CFS)	FLOW DEPTH (FT)	V100 (FPS)	DV	DRY LANE
RNB-1	1.57	47	0.71	5.23	3.71	92	0.87	6.82	5.93	NO
RNB-2	1.57	49	0.72	5.31	3.82	95	0.88	6.90	6.07	NO

HYDRAULIC SECTIONS - ONSITE

Appendix C includes four (4) hydraulic sections prepared in FlowMaster that represent locations throughout the project site. The physical characteristics of each cross section were taken from the Grading Plan located in **Appendix E**. Runoff flow rates were obtained from the HEC-1 model located in **Appendix B**. The resulting water surface elevation for each cross section was checked to confirm that the finished floor elevations of the proposed buildings are raised such that the building will be protected from onsite runoff. The finished floor check calculations for each onsite hydraulic section can be found in **Appendix C**. The results indicate that the finished floor elevation of the proposed building is adequately raised more than twice the depth of flow to protect it from the onsite runoff generated by the 100-year storm event. **Table 4** below is a summary of onsite hydraulic sections.

Table 4: Onsite Hydraulic Section Summary.

SECTION NAME	SLOPE	Q100 (CFS)	FLOW DEPTH (FT)	V100 (FPS)	2*D (ft)	FLOW LINE (ft)	FLOW LINE + 2D	FFE BLDG (ft)	FFE CHECK
HS-1	0.43	1	0.31	1.51	0.62	42.34	42.96	43.00	OK
HS-2	0.50	1	0.22	1.31	0.44	41.76	42.20	43.00	OK
HS-3	2.38	1	0.25	3.14	0.50	41.05	41.55	43.00	OK
HS-4	0.40	2	0.20	1.10	0.40	41.30	41.70	43.00	OK

PARKING LOT LOW IMPACT DEVELOPMENT (LID)

Per Section 1502.2 of the CCRFCD "Hydrologic Criteria and Drainage Design Manual", this project is considered a small parking lot category. Therefore, the site **does not** require Parking Lot Low Impact Development improvements since the area being developed is approximately **0.91 acres**.

FINISHED FLOOR ELEVATION

The Clark County Regional Flood Control District's requirement for finish floor elevation (FF) of proposed buildings is that each building 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. Additional finished floor elevation criteria require the building to be 6 inches above adjacent onsite flowline high point.

The finished floor elevation of the proposed building vary is **2343.00 feet**. The finished floor elevations of each building **will meet** CCRFCD's requirement of twice the depth of flow within Rainbow Boulevard. The proposed driveway along Rainbow Boulevard is elevated 6-inches above the water surface elevation in the

streets and will protect the development from offsite runoff. Finally, the proposed building is set more than 6 inches above the adjacent onsite flowline high point. Please refer to the grading plan included in **Appendix E**.

CONCLUSIONS AND RECOMMENDATIONS

The proposed commercial development will not adversely impact the surrounding areas in both the 10-year and 100-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*".
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 Flood Zone "**Zone X**".
5. The drainage facilities for this project have been designed to control and convey the onsite runoff from the 100-year storm safely around the site. In addition, they have been designed based upon generally accepted engineering practices and in accordance with local requirements.
6. The finished floor elevations of the proposed buildings meet the minimum requirements for the adjacent streets. Furthermore, the buildings will be raised or adequately protected from onsite runoff.

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, "2008/2013 Las Vegas Valley Flood Control Master Plan Update," September 2008, 2013.
3. *Technical Drainage Study for Las Vegas Athletic Club Parking Lot Extension including Addenda; Prepared by Red-Rock Engineering & Surveying, Inc. Approved December 19, 2006. DS-4015 ("LVAC Study")*
4. *Technical Hydrology Update for Marriott Courtyard West including Addenda; Prepared by Hunsaker & Associates Nevada, Inc. Approved November 5, 1997. DS-2156 "Marriott Study"*
5. *Technical Hydrology Study Restaurant Row (Formerly Rainbow/Lake Mead) including Addenda; Prepared by Hunsaker & Associates Nevada, Inc. Approved January 29, 1997. DS-1979 "Restaurant Study"*

Appendix A – Documents & Figures

- Assessor's Parcel Map
- Vicinity Map
- Aerial Photograph
- FIRM Exhibit
- Figure F-25 - Flood Control Facilities
- Figure H-25 - Hydrologic Subareas, Land Use & Soils

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

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

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

USE THIS SCALE WHEN MAP REDUCED FROM 1:12,500 ORIGINAL

MAP LEGEND

- PARCEL BOUNDARY
 - SUB BOUNDARY
 - PAID BOUNDARY
 - MATCH / LEADER LINE
 - HISTORIC LOT LINE
 - HISTORIC SUB BOUNDARY
 - SECTION LINE
- CONDOMINIUM UNIT
 - AIR SPACE PCL
 - RIGHT OF WAY PCL
 - SUB-SURFACE PCL
 - 5 BLOCK NUMBER
 - 6.5 GOV LOT NUMBER

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

BOOK T20S R60E

SEC. 22

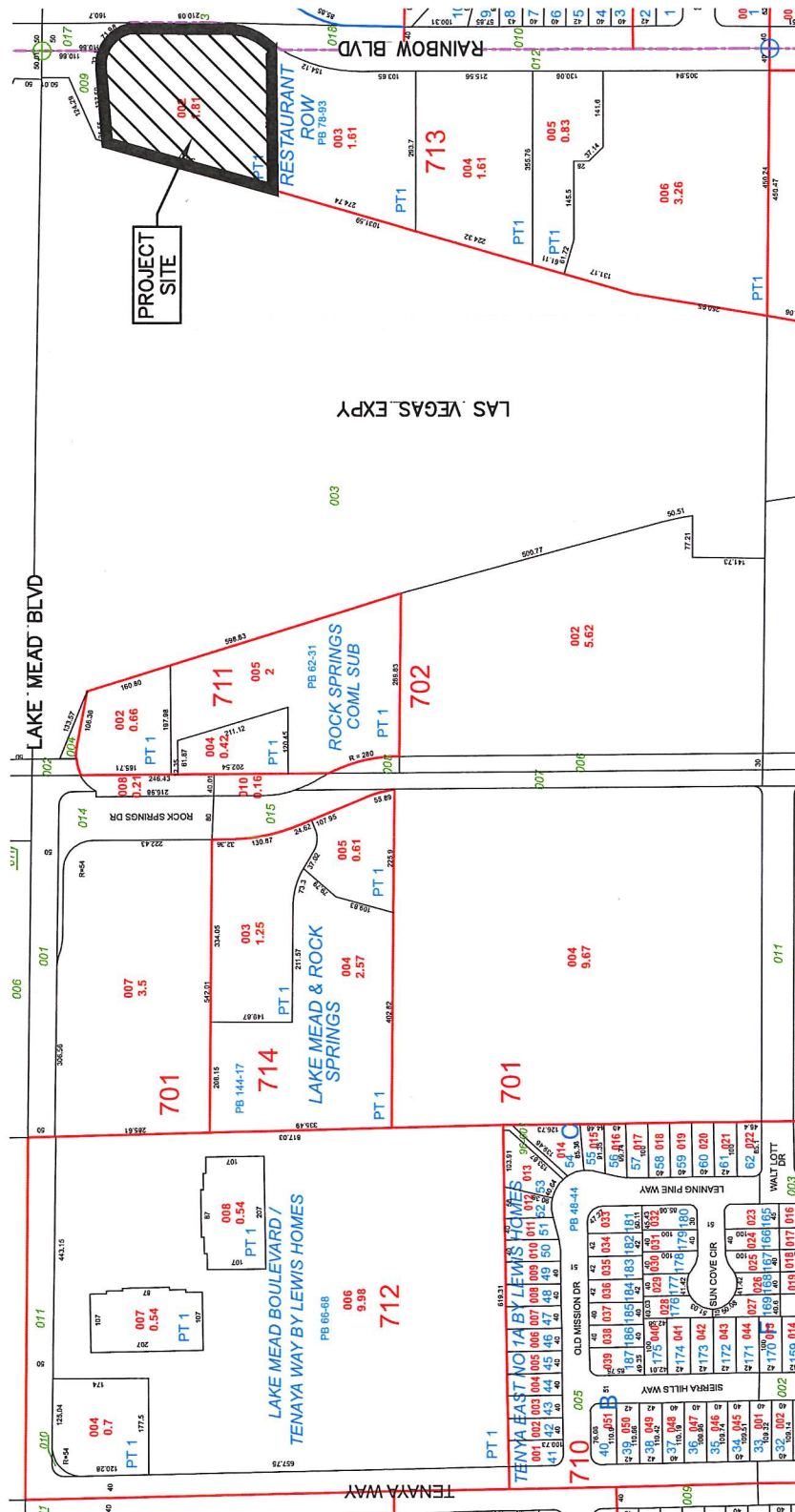
MAP N 2 SE 4

138-22-7



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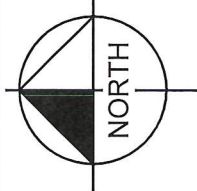
Rev: 8/19/2015



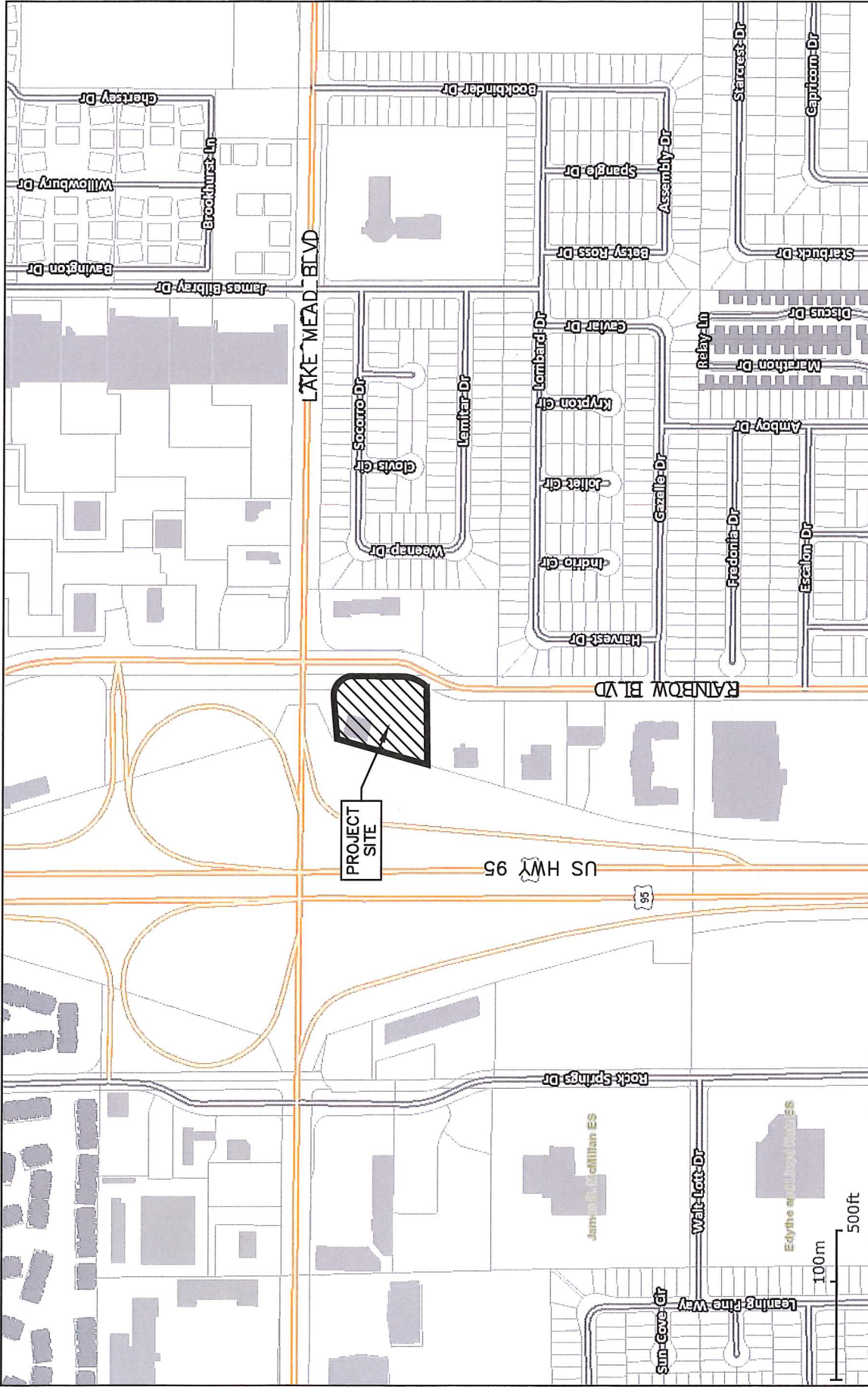
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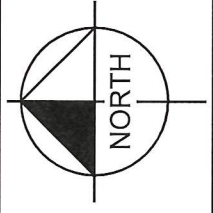
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ASSESSOR'S PARCEL MAP
NTS

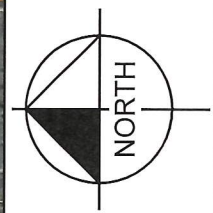


VICINITY MAP NTS

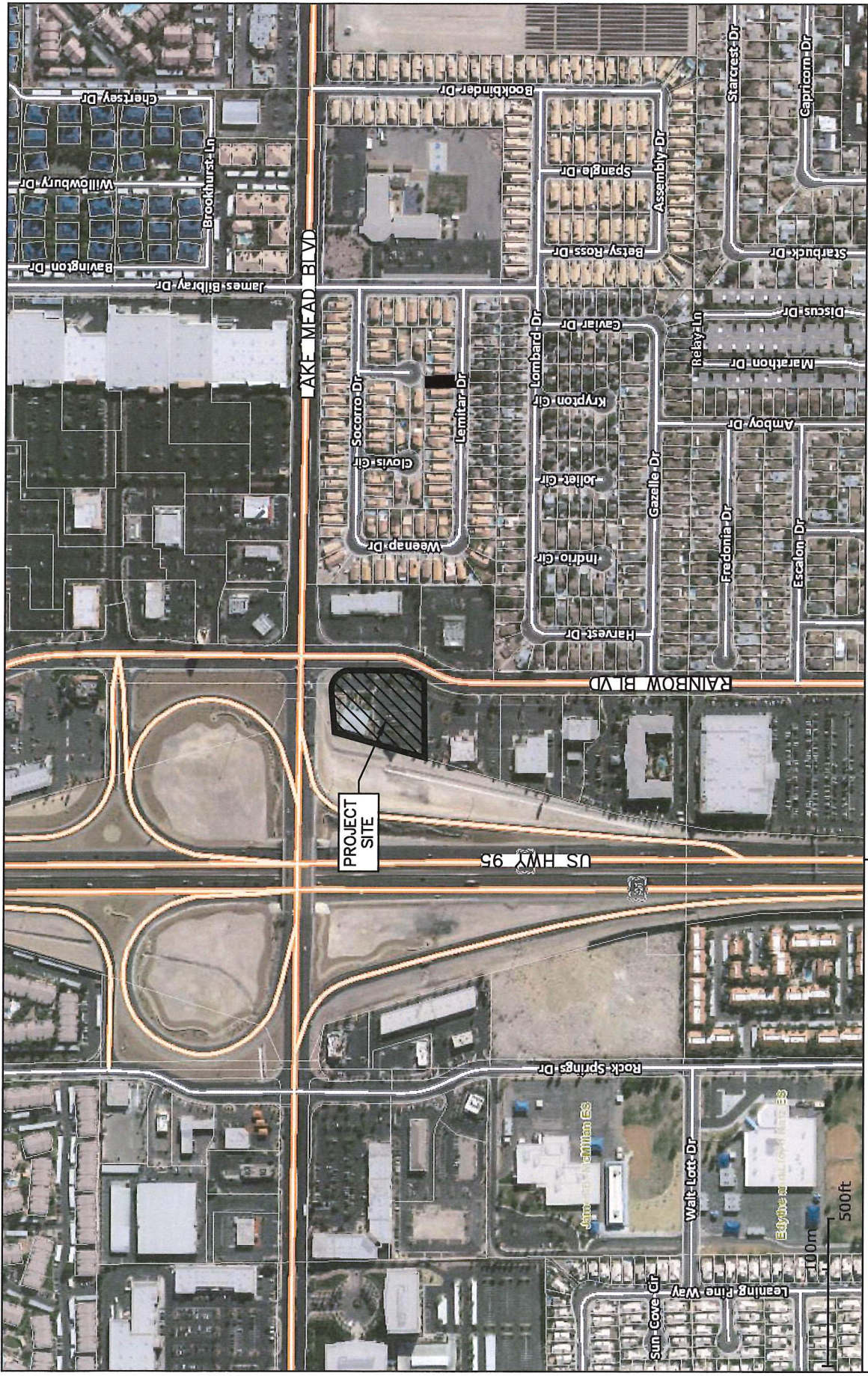


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AERIAL PHOTOGRAPH NTS



FACILITY INVENTORY									FACILITY INVENTORY								
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **	ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
APMD		ANGEL PARK - MIDDLE BRANCH							GOSO		GOWAN SOUTH FACILITIES						
0000	E	Natural Wash	940	6048	C11A-3*	ALLGOW4	11.31	2.90	0000	E	72" RCP Outlet	2303	454	GWNSDB	GW5SC	12.13	0.53
0027	E	1: 12" X 10" and 2: 12" X 2" RCBC @ Canyon Run	170	6048	C11A-3*	ALLGOW4	11.31	3.00	0050	E	39,030 cfs PMF Spillway		39030	GWNSIN	GW5SC	12.13	
0030	E	Natural Wash	7000	6048	C11A-3*	ALLGOW4	11.31	3.00	0051	E	624 ac-ft Gowan South Detention Basin		5625	GWNSIN	GW5SC	12.13	
0132	E	2: 12"x10" RCBC @ Hualapai	120	6048	C11A-3*	ALLGOW4	11.31	1.00	0052	P1	Upgrade to 686 ac-ft Gowan South Detention Basin		5625	GWNSIN	GW5SC	12.13	
APNO		ANGEL PARK NORTH							0068	E	Conc Chnl 15'W 7'D 2:1 SS	380	3796	CBUF01-C	GW3SC	4.88	0.40
0001	E	1,512 ac-ft Angel Park Detention Basin		9199	ANGLPKIN	ALLGOW5	21.99		0076	E	2: 10' X 7' RCBC @ Peak Dr	80	2119 ^Δ	CBUF01-C ^Δ	GW3SC	4.88	0.56
0002	E	2: 33" & 1: 42" RCP Emergency Outlet	190	406	ANGLPKDB	ALLGOW5	21.99		0077	P0	Add 2: 14' X 7' RCBC @ Peak Dr	80	1677 ^Δ	CBUF01-C ^Δ	GW3SC	4.88	0.56
0004	E	14' X 12' RCB Connector Pipe under Summerlin Pkwy	380	9199	ANGLPKIN	ALLGOW5	21.99	1.00	0078	E	Conc Chnl 22'W 10'D 0:1 SS	60	3796	CBUF01-C	GW3SC	4.88	0.56
0005	E	Natural Wash	1559	7988	CC3B-2B*	GW3SC	7.68	2.00	0080	E	Conc Chnl 12'W 7'D 2:1 SS	2078	3796	CBUF01-C	GW3SC	4.88	0.56
0012	E	3: 12' X 10' RCBC @ Rampart	232	7988	CC3B-2B*	GW3SC	7.68	1.00	0119	E	Conc Chnl 22'W 10'D 0:1 SS	180	3587	CCCVIL23	GW3SC	4.52	0.95
0013	E	Natural Wash	1283	7988	CC3B-2B	GW3SC	7.68	1.40	0123	E	2: 10' X 7' RCBC @ Smoke Ranch	100	2229 ^Δ	CCCVIL23 ^Δ	GW3SC	4.52	0.62
0015	E	Two Span Bridge 28' W 14'D @ Summerlin Pkwy	236	7988	CC3B-2B	GW3SC	7.68	1.00	0124	P0	Add 2: 10' X 7' RCBC @ Smoke Ranch	100	1358 ^Δ	CCCVIL23 ^Δ	GW3SC	4.52	0.62
APOF		ANGEL PARK OUTFALL							0125	E	Conc Chnl 22'W 9'D 0:1 SS	50	3587	CCCVIL23	GW3SC	4.52	0.62
0000	E	66" RCP	1297	728	CGD34AC	GW3SC	0.65	1.90	0126	E	Conc Chnl 12'W 7'D 2:1 SS	2155	3587	CCCVIL23	GW3SC	4.52	0.62
0015	E	60" RCP	5472	454	CGD34AB	ALLGOW5	22.25	2.20	0170	E	Conc Chnl 12'W 7'D 2:1 SS	220	2657	CCGD34AC	GW3SC	3.06	0.62
0124	E	54" RCP Outlet	810	406	ANGLPKDB	ALLGOW5	21.99	2.50	0173	E	Conc Chnl 22'W 7'D 0:1 SS	158	2657	CCGD34AC	GW3SC	3.06	0.62
APSP		ANGEL PARK - SUMMERLIN PARKWAY							0176	E	2: 10' X 7' RCBC @ Lake Mead	100	2657	CCGD34AC	GW3SC	3.06	0.62
0000	E	Concrete Chute Drop	103	7988	CC3B-2B	GW3SC	7.68	3.00	0178	E	Conc Chnl 22'W 7'D 0:1 SS	150	2657	CCGD34AC	GW3SC	3.06	1.00
0001	E	Unlined Chnl with Gabion Drops 20'W Depth Varies 2:1 SS	3924	2746	C3B-2B	ALLGOW3	2.67	3.00	0181	E	Conc Chnl 12'W 7'D 2:1 SS	2429	2657	CCGD34AC	GW3SC	3.06	0.58
0002	E	Unlined Chnl with Gabion Drops 50'W 3:1 SS	1424	2746	C3B-2B	ALLGOW3	2.67	3.50	0227	E	2: 10' X 7' RCBC @ Vegas Drive	100	2065	CGD34AA	ALLGOW3	2.41	1.36
0066	E	5: 8' X 4' RCBC @ Town Center Dr.	200	1697	C8B-2	ALLGOW3	1.56	2.40	0229	E	Conc Chnl 12'W 7'D 1:1 SS	2649	2065	CGD34AA	ALLGOW3	2.41	1.36
0069	E	Conc Chnl 10'W 6'D 2:1 SS	3195	1697	C8B-2	ALLGOW3	1.56	2.40	0279	E	12' X 7' RCB	80	2065	CGD34AA	ALLGOW3	2.41	1.36
0133	E	3: 9'X4' RCBC @ Crestdale	180	1173	C8B-1	ALLGOW3	1.14	2.33	0280	E	12' X 8' RCB	875	2065	CGD34AA	ALLGOW3	2.41	0.34
0135	E	Conc Chnl 10'W 6'D 2:1 SS	2030	1173	C8B-1	ALLGOW3	1.14	2.40	0297	E	12' X 7' RCB	2124	1825	CW1BB-C	ALLGOW3	2.14	1.60
GO02		GOWAN SOUTH FACILITIES (CHEYENNE CHANNEL)							0336	E	12' X 7' RCB	602	1593	C1-WESTC	ALLGOW3	1.84	3.40
0000	E	Free Span Bridge 34'W 9.25'D @ Ronemus	100	4978	C16-C	ALLGOW3	7.09	0.50	0352	E	2: 8' X 5' RCB	2740	1374	C1-DUCHC	ALLGOW3	1.60	0.73
0010	E	Conc Chnl 30'W 9'D 0:1 SS	600	4978	C16-C	ALLGOW3	7.09	0.50	GOTE		GOWAN -TENAYA BRANCH						
0015	E	Free Span Bridge 31'W 7.25'D @ Buffalo	102	4978	C16-C	ALLGOW3	7.09	1.40	0000	E	60" RCP	1954	272	LV29-C	ALLGOW3	0.28	1.30
0018	E	Conc Chnl 30'W 9'D 0:1 SS	250	4978	C16-C	ALLGOW3	7.09	1.50	GOWC		GOWAN SOUTH FACILITIES - WEST CLIFF						
0020	E	Conc Chnl 10'W 7.25'D 1.5:1 SS	1000	4978	C16-C	ALLGOW3	7.09	1.50	0000	E	24" RCP	5400	257	1-WEST-C	ALLGOW3	0.24	1.67
0028	E	Free Span Bridge 35'W 7'D @ Soft Breezes	72	4800	CC7-C	ALLGOW3	6.78	2.20	LCCH		LAS VEGAS CREEK CHANNEL						
0029	E	Conc Chnl 10'W 7.25'D 1.5:1 SS	2700	4800	CC7-C	ALLGOW3	6.78	1.50	0438	E	60" RCP	1090	162	CLC01-C	SW3	1.20	1.60
0084	E	Free Span Bridge 35'W 7'D @ Soaring Gulls	95	4657	CCB-C	ALLGOW3	6.07	1.30	0458	E	60" RCP	1060	162	CLC01-C	SW3	1.20	1.60
0085	E	Conc Chnl 10'W 7.25'D 1.5:1 SS	1240	4657	CCB-C	ALLGOW3	6.07	1.50	0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
0111	E	Free Span Bridge 35'W 7'D @ Rampart	127	4657	CCB-C	ALLGOW3	6.07	2.90	0499	E	42" RCP Outlet	660	85	RAINBWDB	SW3	1.11	1.88
0112	E	Conc Chnl 10'W 7'D 1.5:1 SS	7640	4225	CC-C	ALLGOW3	5.42	2.30	0513	E	102 ac-ft Rainbow Detention Basin	970	970	RAINBWIN	SW3	1.11	
0257	E	Conc Chnl 10'W 6.75'D 1.5:1 SS	4293	2577	CCJ-C	ALLGOW3	2.97	4.10	0518	E	60" RCP Connector Pipe Under Rainbow Blvd	670	970	RAINBWIN	SW3	1.11	1.85
GO95		GOWAN OUTFALL - U.S. 95 CHANNEL							0534	E	60" RCP	460	279	AL00A-C	SW3	0.23	5.38
0000	P1	Conc Chnl 12'W 4'D 2:1 SS	2640	299	GD17BG-C	ALLGOW3	0.36	0.30	0543	E	Conc Chnl 10'W 4'D 0:1 SS	700	279	AL00A-C	SW3	0.23	1.88
GODU		GOWAN NORTH - DURANGO BRANCH							LALO		LAS VEGAS CREEK - LORENZI						
0000	E	12' X 6' RCB	2629	1150	CLV14-C	ALLGOW3	1.40	0.91	0000	P3	7' X 6' RCB	445	265	DAL00A	SW3	0.41	3.37
0050	E	9' X 6' RCB	865	835	CLV20-C	ALLGOW3	0.97	1.50	0008	P3	7' X 6' RCB	2415	265	DAL00A	SW3	0.41	0.40
GOLB		GOWAN LAKE MEAD-BUFFALO							LVLN		LAS VEGAS WASH - LAKE MEAD						
0000	E	12' X 6' RCB	1294	1071	CCVILL23	ALLGOW3	1.46	1.50	0475	E	48" RCP	2632	235	LM02-C	NW3	0.29	1.24
0025	E	10' X 7' RCB	145	1071	CCVILL23	ALLGOW3	1.46	0.50	0525	E	48" RCP	2600	542	CLM01-C	NW3	0.64	1.24
0030	E	2: 8' X 4' RCB	408	1071	CCVILL23	ALLGOW3	1.46	0.85	LVOW		OWENS AVENUE SYSTEM						
GOLM		GOWAN LONE MOUNTAIN SYSTEM							0460	P1	7' X 6' RCB	2700	616	CVG03-C	NW3	0.95	1.48
0146	E	888 ac-ft Lone Mountain Detention Basin		7252	LMTNIN	GW3SC	6.13		LVPK		PEAK DRIVE SYSTEM						
GONO		GOWAN NORTH SYSTEM							0130	E	7' X 5' RCB	1435	400	CPD01-C	NW3	0.67	0.61
0000	E	8' X 8' RCB Outlet	184	558	GWNNDB	ALLGOW5	68.49	0.51	LVSF		LAS VEGAS WASH - SMOKE RANCH						
0001	E	8' X 8' RCB Outlet	156	558	GWNNDB	ALLGOW5	68.49	0.63	0496	P1	10' X 7' RCB	2855	1245	CSR02E	NW3	1.84	1.27
0006	E	30,780 cfs PMF Spillway		30780	GWNNDB	ALLGOW5	68.49		0546	P1	8' X 8' RCB	2640	758	CSR00A	NW3	1.01	0.57
0008	E	921 ac-ft Gowan North Detention Basin		4937	CCLV43-C*	GW4SC	11.93										
GOOF		GOWAN OUTFALL FACILITIES															
0511	E	8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50									
0531	E	8' X 5' RCB	1300	558	GWNNDB	ALLGOW5	68.49	0.50									
0551	E	72" RCP	524	558	GWNNDB	ALLGOW5	68.49	0.62									
0773	E	60" RCP	803	286	LV30-C	ALLGOW3	0.42	1.40									
0775	E	60" RCP	1300	286	LV30-C	ALLGOW3	0.42	1.00									

* The HEC-1 node shown identifies the controlling concentration point for the associated facility and is located upstream of this facility due to decreasing peak flow with increasing tributary area caused by storm distribution transitions, depth area reduction factors, or attenuation of flow from routing.

** As-built or design slopes were used when available. All other slopes are based on existing topography. The user should verify the facility slope listed prior to performing any facility specific analysis.

Δ For parallel facilities, the existing facility flow equals its normal depth capacity, and the proposed parallel facility flow equals the remaining flow (i.e., HEC-1 Node flow = existing facility normal depth capacity + proposed parallel facility flow).

REGIONAL FLOOD CONTROL DISTRICT

2013 LAS VEGAS VALLEY FLOOD CONTROL MASTER PLAN UPDATE

FACILITY INVENTORY

FIGURE F - 25

L
E
G
E
N
D

ID (Facility Identifier)

Parent Stream Name

Stream Name

River Mile

Distance Above Confluence with Parent Stream (Miles)

Miles in Hundredths

AABP

0000

Existing Facility.....E

Proposed or Modified Facility.....P

Contingency Level

Category B.....P0

Master Plan.....P1

Preliminary Design.....P2

Design.....P3

Bottom Width.....W

Depth.....D

Side Slope, H:V.....SS

Construction Features

Cast in Place Concrete Pipe.....CIPCP

Reinforced Concrete Arch Culvert.....RCAC

Corrugated Metal Arch Pipe Culvert.....CMAP

Reinforced Concrete Box.....RCB

Corrugated Metal Pipe Culvert.....CMPC

Reinforced Concrete Box Culvert.....RCBC

High Density Polyethylene.....HDPE

Reinforced Concrete Pipe.....RCP

Horizontal Elliptical Reinforced Concrete Pipe.....HERCP

Reinforced Concrete Pipe Culvert.....RCPC

Reinforced Concrete Arch Pipe.....RCAP

Storm Sewer Pipe.....SSP

City of Las Vegas

AGENDA MEMO - PLANNING

PLANNING COMMISSION MEETING DATE: DECEMBER 12, 2017

DEPARTMENT: PLANNING

ITEM DESCRIPTION: APPLICANT: CHICK-FIL-A, INC. - OWNER: RESTAURANT ROW, LLC

**** STAFF RECOMMENDATION(S) ****

CASE NUMBER	RECOMMENDATION	REQUIRED FOR APPROVAL
SDR-71994	Staff recommends APPROVAL, subject to conditions:	

**** NOTIFICATION ****

NEIGHBORHOOD ASSOCIATIONS NOTIFIED 18

NOTICES MAILED 199

PROTESTS 0

APPROVALS 2

**** CONDITIONS ****

SDR-71994 CONDITIONS

Planning

1. This approval shall be void two years from the date of final approval, unless exercised pursuant to the provisions of LVMC Title 19.16. An Extension of Time may be filed for consideration by the City of Las Vegas.
2. All development shall be in conformance with the site plan, landscape plan, and building elevations, date stamped 10/30/17, except as amended by conditions herein.
3. A Waiver from Title 19.08 is hereby approved, to allow a three-foot landscape buffer along the north property line where 15 feet is required.
4. A Waiver from Title 19.08 is hereby approved, to allow the building to not be oriented to the corner or street front where such is required.
5. An Exception from Title 19.08 is hereby approved, to allow nine parking lot trees where ten are required.
6. An Exception from Title 19.08 is hereby approved, to allow nine landscape buffer trees where 25 are required.
7. All necessary building permits shall be obtained and final inspections shall be completed in compliance with Title 19 and all codes as required by the Department of Building and Safety.
8. These Conditions of Approval shall be affixed to the cover sheet of any plan set submitted for building permit.
9. A technical landscape plan, signed and sealed by a Registered Architect, Landscape Architect, Residential Designer or Civil Engineer, must be submitted prior to or at the same time application is made for a building permit. A permanent underground sprinkler system is required, and shall be permanently maintained in a satisfactory manner; the landscape plan shall include irrigation specifications. Installed landscaping shall not impede visibility of any traffic control device.

Conditions Page Two**December 12, 2017 - Planning Commission Meeting**

10. A fully operational fire protection system, including fire apparatus roads, fire hydrants and water supply, shall be installed and shall be functioning prior to construction of any combustible structures.
11. All City Code requirements and design standards of all City Departments must be satisfied, except as modified herein.

Public Works

12. Correct all American's with Disabilities Act (ADA) deficiencies, if any, on the sidewalk along Rainbow Boulevard adjacent to this site in accordance with code requirements of Title 13.56.040 to the satisfaction of the City Engineer concurrent with development of this site. All existing paving damaged or removed by this development shall be restored at its original location and to its original width concurrent with development of this site.
13. All private improvements and landscaping installed with this project shall be situated and maintained so as to not create sight visibility obstructions for vehicular traffic at all development access drives and abutting street intersections.
14. The proposed driveway location and on-site circulation shall be revised to match the design and queuing analysis as approved in the required Traffic Impact Analysis.
15. A Traffic Impact Analysis must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits, submittal of any construction drawings for this site, or the recordation of a map, whichever may occur first. Comply with drive through queuing analysis recommendations and mitigations to avoid a negative impact onto the public right-of-way. The Traffic Impact Analysis shall also include a section addressing Standard Drawings #234.1 #234.2 and #234.3 to determine additional right-of-way requirements for bus turnouts adjacent to this site, if any; dedicate all areas recommended by the approved Traffic Impact Analysis.
16. A Drainage Plan and Technical Drainage Study must be submitted to and approved by the Department of Public Works prior to the issuance of any building or grading permits or submittal of any construction drawings, whichever may occur first. Provide and improve all drainage ways recommended in the approved drainage plan/study. The developer of this site shall be responsible to construct such neighborhood or local drainage facility improvements as are recommended by the City of Las Vegas Neighborhood Drainage Studies and approved Drainage Plan/Study concurrent with development of this site.

**Staff Report Page One
December 12, 2017 - Planning Commission Meeting**

**** STAFF REPORT ****

PROJECT DESCRIPTION

The applicant is proposing to demolish the existing Restaurant at 1991 North Rainbow Boulevard and replace it with a new 4,975 square-foot Restaurant with Drive Through.

ISSUES

- A Waiver is requested to allow a reduced buffer width along the northern property line. Staff supports this request.
- Title 19.08 requires buildings on corner lots to be oriented to the corner and street front. The applicant is requesting a Waiver to not orient the building to the corner or street front. Staff is supporting this request.
- As a consequence of the reduced landscape buffer width, an Exception for the amount of landscape materials required has been requested. Staff supports the request.

ANALYSIS

The applicant has proposed to demolish an existing restaurant (Joe's Crab Shack) and replace it with a 4,975 square-foot restaurant with drive through (Chick-fil-A).

The subject site is the northern portion of an existing commercial subdivision zoned C-1 (Limited Commercial) on the southwest corner of Lake Mead Boulevard and Rainbow Boulevard. The proposed redevelopment includes a small portion of the parking lot in addition to the building site. Proposed is a rectangular building with a dual drive through lane that allows stacking for up to 21 vehicles. This drive through lane begins as two lanes on the east side of the proposed building, merges into a single lane along the northern edge of the building, with the pick-up window located on the western façade of the proposed building. This dual drive through lane also displaces parking spaces, which have been relocated to the south side of the proposed building. In order to accommodate the proposed dual drive through, the applicant has requested two Waivers.

The first Waiver requested is of Title 19.08, which requires buildings on corner lots to be oriented to the corner and street fronts. The applicant has proposed to construct the building setback approximately 76 feet from the front in order to accommodate the above mentioned dual drive through. To screen the proposed dual drive through lane, the applicant has proposed to increase the existing landscape buffer along Rainbow

Staff Report Page Two**December 12, 2017 - Planning Commission Meeting**

Boulevard from 10 feet to 15 feet. Staff finds the installation of a landscape buffer in accordance with current Title 19.08 requirements with landscape buffer width requirements will screen the dual drive through, and the dual drive through lane design will enhance site access and circulation; therefore, staff is supporting this Waiver request.

The second Waiver requested is also of Title 19.08, which requires a 15-foot landscape buffer adjacent to right-of-way. The applicant has proposed to reduce the north perimeter landscape buffer adjacent to Lake Mead Boulevard to three feet in order to accommodate the dual drive through lane and add additional parking to the south side of the proposed building. This particular portion of Lake Mead Boulevard is elevated making this portion of the subject site not visible to vehicular or pedestrian traffic. Due to the reduced visibility of this portion of the site, staff supports this Waiver request.

The western portion of the subject site will continue the existing landscape buffer that exists south of the site, widening in some portions to aide in the screening of the drive through lane and trash enclosure. As this portion of the subject site's landscape buffer is a continuation of existing condition within the shopping center, a Waiver is not required.

The requested Exceptions of the required landscape materials are a consequence of the reduced landscape buffer requested in the Waiver. Staff supports the Exception requests as the reduced landscape buffer, three feet, is not able to support healthy plant materials.

In a report prepared by the Traffic Division of Public Works, the proposed project would add approximately 1,539 trips per day on Rainbow Boulevard and Lake Mead Boulevard. Currently, Rainbow Boulevard is at approximately 65 percent of capacity and Lake Mead Boulevard is at approximately 69 percent of capacity. With the addition of this project to the area, Rainbow Boulevard is expected to be at approximately 72 percent of capacity and Lake Mead Boulevard to be approximately 73 percent of capacity. Based on Peak Hour use, the proposed development would add into the area approximately 147 additional vehicles or approximately five vehicles every two minutes.

Staff finds the proposed restaurant to be compatible with adjacent existing commercial development and is recommending approval of the application with Waivers. If denied, the applicant will not be able to redevelop the subject site and the existing building will remain vacant.

FINDINGS (SDR-71994)

In order to approve a Site Development Plan Review application, per Title 19.16.100(E) the Planning Commission and/or City Council must affirm the following:

Staff Report Page Three

December 12, 2017 - Planning Commission Meeting

1. **The proposed development is compatible with adjacent development and development in the area;**

The subject site is surrounded by existing commercial uses and is compatible with the development in the area.

2. **The proposed development is consistent with the General Plan, this Title, and other duly-adopted city plans, policies and standards;**

The proposed Restaurant with Drive Through has met the minimum development standards set forth by Title 19. 08 with the exception of the building orientation and a portion of the landscape buffer width. Due to the elevated roadway and the double stacking lanes provided for drive through traffic, staff is supporting the Waiver requests.

3. **Site access and circulation do not negatively impact adjacent roadways or neighborhood traffic;**

Existing site access is not altered, and the proposed drive through lane has been designed to stack vehicle traffic in an orderly fashion to not impact adjacent roadways or neighborhood traffic.

4. **Building and landscape materials are appropriate for the area and for the City;**

The building materials proposed consist of stucco with brick veneer and aluminum awnings for accent with desert friendly landscape materials. All materials proposed are appropriate for the area and the City.

5. **Building elevations, design characteristics and other architectural and aesthetic features are not unsightly, undesirable, or obnoxious in appearance; create an orderly and aesthetically pleasing environment; and are harmonious and compatible with development in the area;**

The proposed building elevations and design characteristics are not unsightly or undesirable and create an orderly and aesthetically pleasing environment. The proposed building and land use are harmonious and compatible with the existing commercial development in the area.

6. **Appropriate measures are taken to secure and protect the public health, safety and general welfare.**

Staff Report Page Four

December 12, 2017 - Planning Commission Meeting

The proposed building is subject to building permit review during the design phase and regular site inspections during the construction phase of the project. Once completed, the proposed restaurant will be subject to regular inspections by several governing agencies to ensure the public health, safety and general welfare is protected.

BACKGROUND INFORMATION

<i>Related Relevant City Actions by Planning, Fire, Bldg., etc.</i>	
02/24/97	The City Council approved a request for a Special Use Permit (U-0157-96) for a proposed Supperclub in conjunction with a proposed Restaurant on property located on the southwest corner of Lake Mead Boulevard and Rainbow Boulevard. The Board of Zoning adjustment recommended approval.
04/28/97	The City Council approved a request for a Special Use Permit (U-0018-97) for a proposed Supperclub on property located on the west side of Rainbow Boulevard, approximately 550 feet south of Lake Mead Boulevard. The Board of Zoning adjustment recommended approval.
09/06/06	The City Council approved a request for a Special Use Permit (SUP-14721) for a proposed General Business-Related Gaming Establishment in conjunction with an existing Supper Club at 1991 North Rainbow Boulevard. The Planning Commission and staff recommended approval.

<i>Most Recent Change of Ownership</i>	
07/17/97	A deed was recorded for a change in ownership.

<i>Related Building Permits/Business Licenses</i>	
08/19/97	A business license (R09-00809) was issued for a Restaurant at 1991 North Rainbow Boulevard (Joe's Crab Shack). The license was not renewed and is now in delinquent status.
	A business license (L21-00009) was issued for a Supper Club at 1991 North Rainbow Boulevard (Joe's Crab Shack). The license was not renewed and is now marked "out-of-business."
08/15/16	A business license (P64-00184) was issued for a Restaurant with Alcohol at 1991 North Rainbow Boulevard (Joe's Crab Shack). The license was due for renewal on 04/01/17.
	A business license (L64-00110) was issued for a Restaurant with Alcohol at 1991 North Rainbow Boulevard (Joe's Crab Shack). The license was renewed on 10/01/17 and is currently active.

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Pre-Application Meeting	
09/07/17	Staff conducted a pre-application meeting where the submittal requirements for a Site Development Plan Review were discussed.

Neighborhood Meeting
A Neighborhood meeting was not required, nor was one held.

Field Check	
11/02/17	Staff performed a routine field check and found the subject site to be well-maintained, free of graffiti and debris.

Details of Application Request	
Site Area	
Net Acres	1.81

Surrounding Property	Existing Land Use Per Title 19.12	Planned or Special Land Use Designation	Existing Zoning District
Subject Property	Vacant	SC (Service Commercial)	C-1 (Limited Commercial)
North	Right-of-Way	Right-of-Way	Right-of-Way
South	Restaurant	SC (Service Commercial)	C-1 (Limited Commercial)
East	Financial Institution, Specified	SC (Service Commercial)	C-1 (Limited Commercial)
	Liquor Establishment (Tavern)		
	Restaurant		
West	Right-of-Way	Right-of-Way	Right-of-Way

Master and Neighborhood Plan Areas	Compliance
No Applicable Master Plan Area	N/A
Special Area and Overlay Districts	Compliance
A-O (Airport Overlay) District – 140 Feet	Y

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<i>Other Plans or Special Requirements</i>	<i>Compliance</i>
Trails – Pedestrian Path	Y
Las Vegas Redevelopment Plan Area	N/A
Interlocal Agreement	N/A
Project of Significant Impact (Development Impact Notification Assessment)	N/A
Project of Regional Significance	N/A

DEVELOPMENT STANDARDS

Pursuant to Title 19.08, the following standards apply:

<i>Standard</i>	<i>Required/Allowed</i>	<i>Provided</i>	<i>Compliance</i>
Min. Setbacks			
• Front	10 Feet	76 Feet	Y*
• Corner	10 Feet	24 Feet	Y*
• Rear	20 Feet	28 Feet	Y
Max. Building Height	123 Feet	22 Feet	Y**
Trash Enclosure	Screened, Gated, w/ a Roof or Trellis	By Condition	By Condition
Mech. Equipment	Screened	By Condition	By Condition

**Although the proposed building footprint meets the setback requirements set forth by Title 19.08, Title 19.08 also requires buildings on corner lots to be oriented to the corner and street front. The applicant has requested a Waiver of this standard.*

***Building height in the C-1 (Limited Commercial) zoning district is determined by Residential Adjacency. In this instance, single family homes exist approximately 370 feet to the east, which would allow a building height of 123 feet.*

Pursuant to Title 19.08, the following standards apply:

<i>Landscaping and Open Space Standards</i>				
<i>Standards</i>	<i>Required</i>		<i>Provided</i>	<i>Compliance</i>
	<i>Ratio</i>	<i>Trees</i>		
Buffer Trees:				
• North	1 Tree / 20 Linear Feet	10 Trees	Zero Trees	N*
• East	1 Tree / 20 Linear Feet	7 Trees	7 Trees	Y
• West	1 Tree / 20 Linear Feet	8 Trees	2 Trees	N*

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Landscaping and Open Space Standards				
Standards	Required		Provided	Compliance
	Ratio	Trees		
TOTAL PERIMETER TREES		25 Trees	9 Trees	N*
Parking Area Trees	1 Tree / 6 Uncovered Spaces, plus 1 tree at the end of each row of spaces	10 Trees	9 Trees	N*
LANDSCAPE BUFFER WIDTHS				
Min. Zone Width				
• North	15 Feet		3 Feet	N*
• East	15 Feet		15 Feet	Y
• West	8 Feet		8 Feet	Y

*The applicant has requested a Waiver and an Exception of the Landscape Buffer widths and materials required.

Street Name	Functional Classification of Street(s)	Governing Document	Actual Street Width (Feet)	Compliance with Street Section
North Rainbow Boulevard	Collector	Master Plan of Streets and Highways	90	Y
Lake Mead Boulevard	Primary Arterial	Master Plan of Streets and Highways	120	Y

Pursuant to Title 19.08 and 19.12, the following parking standards apply:

Parking Requirement							
Use	Gross Floor Area or Number of Units	Required		Provided		Compliance	
		Parking Ratio	Parking		Parking		
			Regular	Handi-capped	Regular	Handi-capped	
Shopping Center	118,342 SF	1:250	476				
TOTAL SPACES REQUIRED			476		542		Y
Regular and Handicap Spaces Required			467	9	520	22	Y

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Waivers		
Requirement	Request	Staff Recommendation
15-foot wide landscape buffer adjacent to right-of-way.	A 3-foot wide landscape buffer adjacent to right-of-way.	Approval
Buildings on corner lots should be oriented to the corner and to the street fronts.	To not orient the building to the corner and street front.	Approval

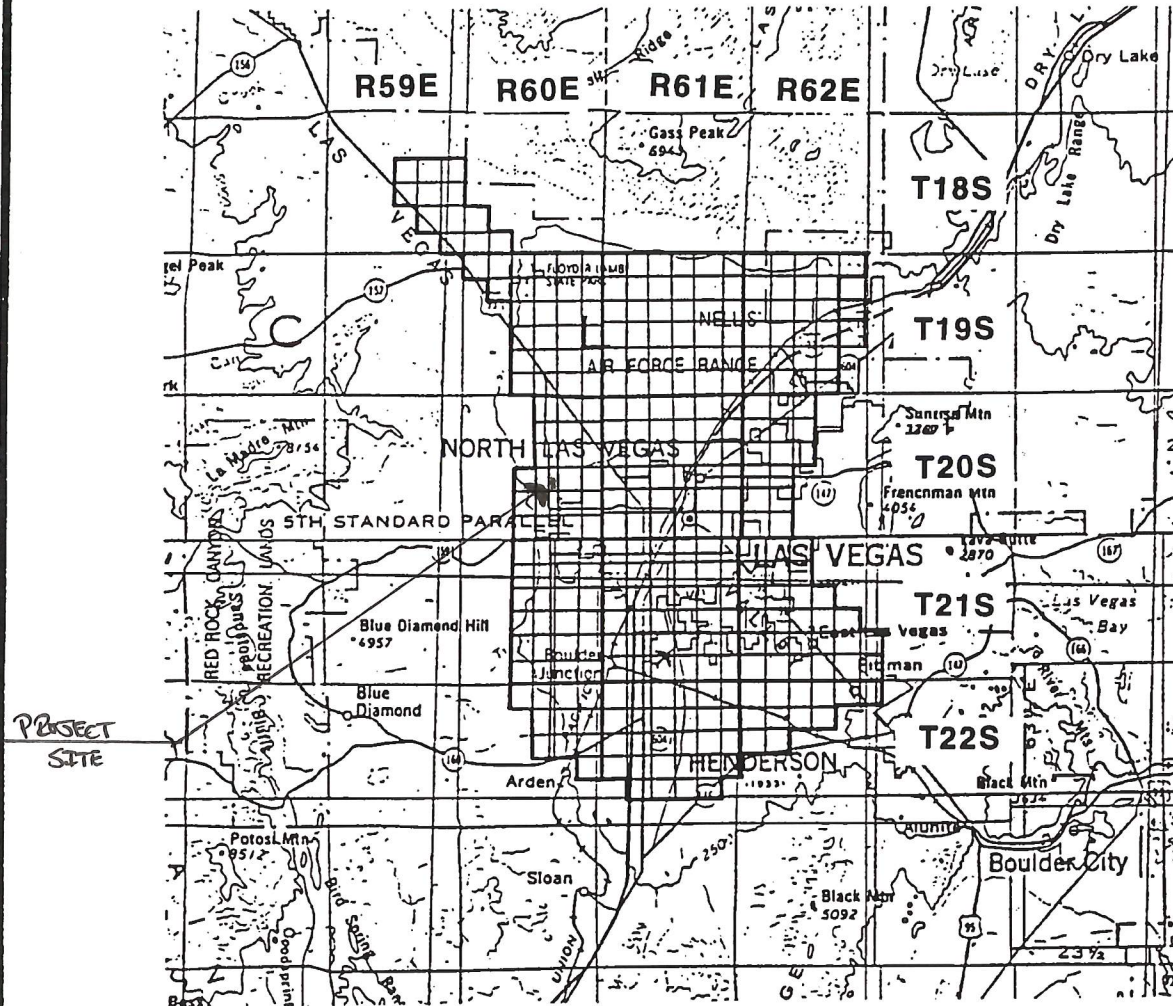
Exceptions		
Requirement	Request	Staff Recommendation
25 trees are required within the landscape buffer areas.	To provide nine trees in the landscape buffer areas.	Approval
Ten trees are requirement in the parking lot landscape islands.	To provide nine trees in the parking lot landscape islands.	Approval

Appendix B – Hydrologic Parameters

- Figure 513 – McCarran Airport Rainfall Area
- Table 503 - Six-Hour Storm Distributions
- Table 505 - Depth-Duration-Frequency Values
- Table 602 page 1 of 4 - Runoff Curve Numbers (Urban Areas)
- USDA NRCS Custom Soils Resource Report for Las Vegas Valley

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

McCARRAN AIRPORT RAINFALL AREA



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

Notes:

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

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

SIX-HOUR STORM DISTRIBUTIONS

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

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

Revision	Date

REFERENCE:

TABLE 503

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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	<u>1.58</u> ✓	2.05	2.41	<u>2.77</u> ✓
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

WRC
ENGINEERING

REFERENCE:
USACE, Los Angeles District, 1988

TABLE 505

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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
--	----	----	----	----

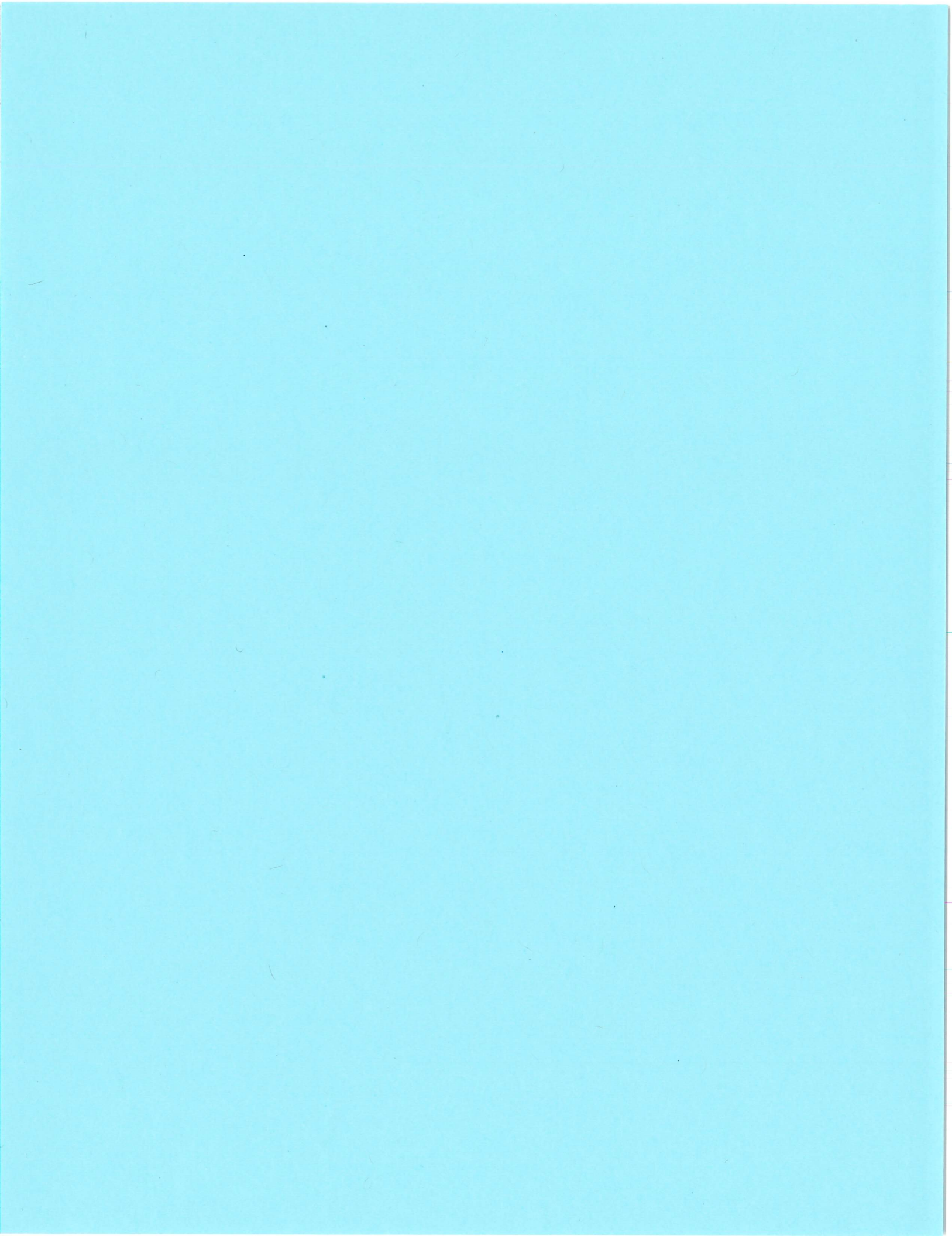
- 1 Average runoff condition, and $I_p = 0.25$.
- 2 The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system. Impervious areas have a CN of 98, and pervious areas are considered equivalent 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

**WRC
ENGINEERING**

REFERENCE:
SCS TR-55, USDA, June 1986.

**TABLE 602
1 of 4**





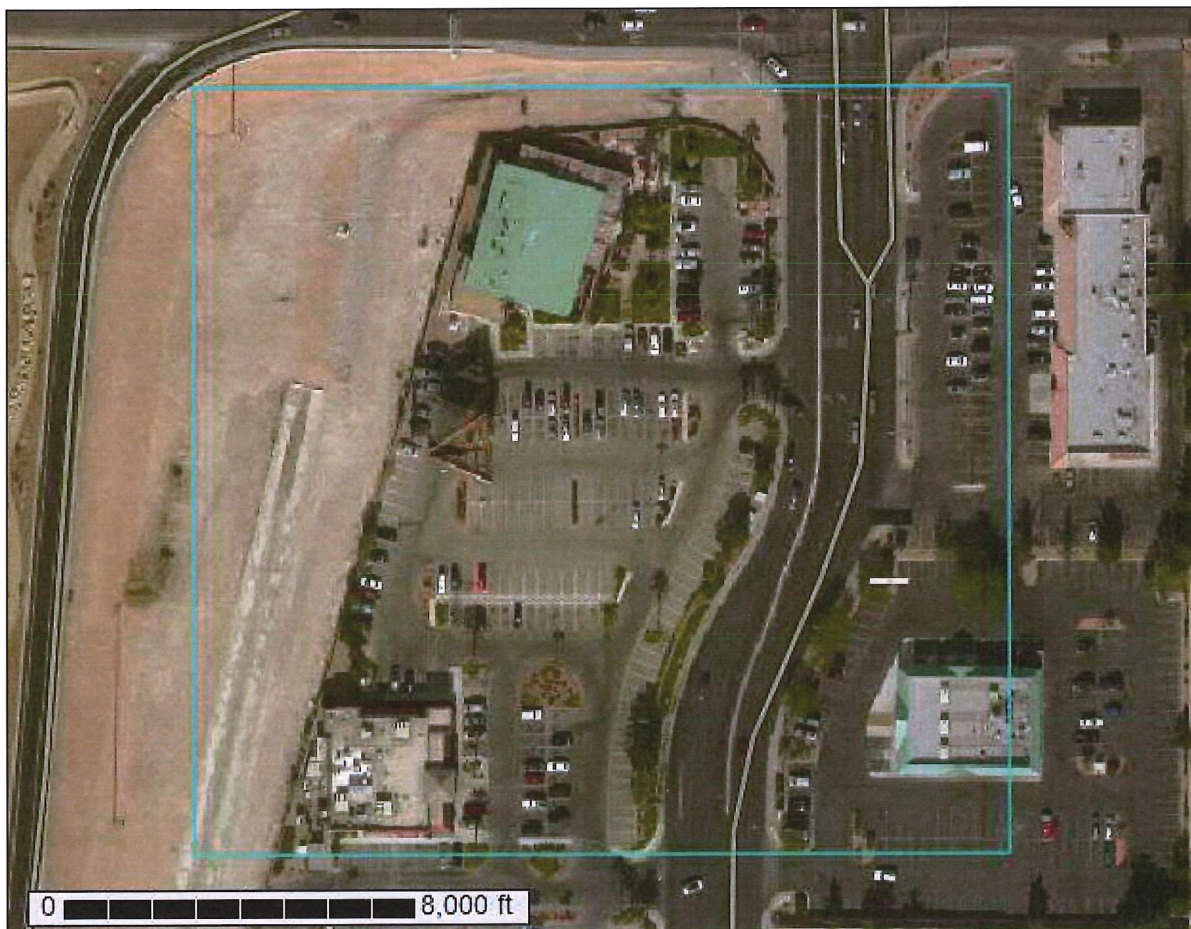
United States
Department of
Agriculture

NRCS

Natural
Resources
Conservation
Service

A product of the National
Cooperative Soil Survey,
a joint effort of the United
States Department of
Agriculture and other
Federal agencies, State
agencies including the
Agricultural Experiment
Stations, and local
participants

Custom Soil Resource Report for Las Vegas Valley Area, Nevada, Part of Clark County



September 6, 2017

Preface

Soil surveys contain information that affects land use planning in survey areas. They highlight soil limitations that affect various land uses and provide information about the properties of the soils in the survey areas. Soil surveys are designed for many different users, including farmers, ranchers, foresters, agronomists, urban planners, community officials, engineers, developers, builders, and home buyers. Also, conservationists, teachers, students, and specialists in recreation, waste disposal, and pollution control can use the surveys to help them understand, protect, or enhance the environment.

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. Soil surveys identify soil properties that are used in making various land use or land treatment decisions. The information is intended to help the land users identify and reduce the effects of soil limitations on various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

Although soil survey information can be used for general farm, local, and wider area planning, onsite investigation is needed to supplement this information in some cases. Examples include soil quality assessments (<http://www.nrcs.usda.gov/wps/portal/nrcs/main/soils/health/>) and certain conservation and engineering applications. For more detailed information, contact your local USDA Service Center (<https://offices.sc.egov.usda.gov/locator/app?agency=nrcs>) or your NRCS State Soil Scientist (http://www.nrcs.usda.gov/wps/portal/nrcs/detail/soils/contactus/?cid=nrcs142p2_053951).

Great differences in soil properties can occur within short distances. Some soils are seasonally wet or subject to flooding. Some are too unstable to be used as a foundation for buildings or roads. Clayey or wet soils are poorly suited to use as septic tank absorption fields. A high water table makes a soil poorly suited to basements or underground installations.

The National Cooperative Soil Survey is a joint effort of the United States Department of Agriculture and other Federal agencies, State agencies including the Agricultural Experiment Stations, and local agencies. The Natural Resources Conservation Service (NRCS) has leadership for the Federal part of the National Cooperative Soil Survey.

Information about soils is updated periodically. Updated information is available through the NRCS Web Soil Survey, the site for official soil survey information.

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How Soil Surveys Are Made

Soil surveys are made to provide information about the soils and miscellaneous areas in a specific area. They include a description of the soils and miscellaneous areas and their location on the landscape and tables that show soil properties and limitations affecting various uses. Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of crops and native plants; and the kinds of bedrock. They observed and described many soil profiles. A soil profile is the sequence of natural layers, or horizons, in a soil. The profile extends from the surface down into the unconsolidated material in which the soil formed or from the surface down to bedrock. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity.

Currently, soils are mapped according to the boundaries of major land resource areas (MLRAs). MLRAs are geographically associated land resource units that share common characteristics related to physiography, geology, climate, water resources, soils, biological resources, and land uses (USDA, 2006). Soil survey areas typically consist of parts of one or more MLRA.

The soils and miscellaneous areas in a survey area occur in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation of the area. Each kind of soil and miscellaneous area is associated with a particular kind of landform or with a segment of the landform. By observing the soils and miscellaneous areas in the survey area and relating their position to specific segments of the landform, a soil scientist develops a concept, or model, of how they were formed. Thus, during mapping, this model enables the soil scientist to predict with a considerable degree of accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Commonly, individual soils on the landscape merge into one another as their characteristics gradually change. To construct an accurate soil map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationship, are sufficient to verify predictions of the kinds of soil in an area and to determine the boundaries.

Soil scientists recorded the characteristics of the soil profiles that they studied. They noted soil color, texture, size and shape of soil aggregates, kind and amount of rock fragments, distribution of plant roots, reaction, and other features that enable them to identify soils. After describing the soils in the survey area and determining their properties, the soil scientists assigned the soils to taxonomic classes (units).

Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systematically. Soil taxonomy, the system of taxonomic classification used in the United States, is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After the soil

Custom Soil Resource Report

scientists classified and named the soils in the survey area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

The objective of soil mapping is not to delineate pure map unit components; the objective is to separate the landscape into landforms or landform segments that have similar use and management requirements. Each map unit is defined by a unique combination of soil components and/or miscellaneous areas in predictable proportions. Some components may be highly contrasting to the other components of the map unit. The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The delineation of such landforms and landform segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, onsite investigation is needed to define and locate the soils and miscellaneous areas.

Soil scientists make many field observations in the process of producing a soil map. The frequency of observation is dependent upon several factors, including scale of mapping, intensity of mapping, design of map units, complexity of the landscape, and experience of the soil scientist. Observations are made to test and refine the soil-landscape model and predictions and to verify the classification of the soils at specific locations. Once the soil-landscape model is refined, a significantly smaller number of measurements of individual soil properties are made and recorded. These measurements may include field measurements, such as those for color, depth to bedrock, and texture, and laboratory measurements, such as those for content of sand, silt, clay, salt, and other components. Properties of each soil typically vary from one point to another across the landscape.

Observations for map unit components are aggregated to develop ranges of characteristics for the components. The aggregated values are presented. Direct measurements do not exist for every property presented for every map unit component. Values for some properties are estimated from combinations of other properties.

While a soil survey is in progress, samples of some of the soils in the area generally are collected for laboratory analyses and for engineering tests. Soil scientists interpret the data from these analyses and tests as well as the field-observed characteristics and the soil properties to determine the expected behavior of the soils under different uses. Interpretations for all of the soils are field tested through observation of the soils in different uses and under different levels of management. Some interpretations are modified to fit local conditions, and some new interpretations are developed to meet local needs. Data are assembled from other sources, such as research information, production records, and field experience of specialists. For example, data on crop yields under defined levels of management are assembled from farm records and from field or plot experiments on the same kinds of soil.

Predictions about soil behavior are based not only on soil properties but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the survey area, they drew the boundaries of these bodies on aerial photographs and

Custom Soil Resource Report

identified each as a specific map unit. Aerial photographs show trees, buildings, fields, roads, and rivers, all of which help in locating boundaries accurately.

Soil Map

The soil map section includes the soil map for the defined area of interest, a list of soil map units on the map and extent of each map unit, and cartographic symbols displayed on the map. Also presented are various metadata about data used to produce the map, and a description of each soil map unit.

Custom Soil Resource Report Soil Map



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)			Spoil Area
	Area of Interest (AOI)		Stony Spot
Soils			Very Stony Spot
	Soil Map Unit Polygons		Wet Spot
	Soil Map Unit Lines		Other
	Soil Map Unit Points		Special Line Features
Special Point Features		Water Features	
	Blowout		Streams and Canals
	Borrow Pit	Transportation	
	Clay Spot		Rails
	Closed Depression		Interstate Highways
	Gravel Pit		US Routes
	Gravelly Spot		Major Roads
	Landfill		Local Roads
	Lava Flow	Background	
	Marsh or swamp		Aerial Photography
	Mine or Quarry		
	Miscellaneous Water		
	Perennial Water		
	Rock Outcrop		
	Saline Spot		
	Sandy Spot		
	Severely Eroded Spot		
	Sinkhole		
	Slide or Slip		
	Sodic Spot		

MAP INFORMATION

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

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

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

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

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

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

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

Date(s) aerial images were photographed: 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

Custom Soil Resource Report

MAP LEGEND

MAP INFORMATION

imagery displayed on these maps. As a result, some minor
shifting of map unit boundaries may be evident.

Map Unit Legend

Las Vegas Valley Area, Nevada, Part of Clark County (NV788)			
Map Unit Symbol	Map Unit Name	Acres in AOI	Percent of AOI
264	Jean very gravelly loamy fine sand, 2 to 4 percent slopes	2.8	39.5%
610	Pits, gravel	4.3	60.5%
Totals for Area of Interest		7.1	100.0%

Map Unit Descriptions

The map units delineated on the detailed soil maps in a soil survey represent the soils or miscellaneous areas in the survey area. The map unit descriptions, along with the maps, can be used to determine the composition and properties of a unit.

A map unit delineation on a soil map represents an area dominated by one or more major kinds of soil or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some minor components that belong to taxonomic classes other than those of the major soils.

Most minor soils have properties similar to those of the dominant soil or soils in the map unit, and thus they do not affect use and management. These are called noncontrasting, or similar, components. They may or may not be mentioned in a particular map unit description. Other minor components, however, have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting, or dissimilar, components. They generally are in small areas and could not be mapped separately because of the scale used. Some small areas of strongly contrasting soils or miscellaneous areas are identified by a special symbol on the maps. If included in the database for a given area, the contrasting minor components are identified in the map unit descriptions along with some characteristics of each. A few areas of minor components may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of minor components in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into landforms or landform segments that have similar use and management requirements. The delineation of such segments on the map provides sufficient information for the development of resource plans. If intensive use of small areas is planned, however,

Custom Soil Resource Report

onsite investigation is needed to define and locate the soils and miscellaneous areas.

An identifying symbol precedes the map unit name in the map unit descriptions. Each description includes general facts about the unit and gives important soil properties and qualities.

Soils that have profiles that are almost alike make up a *soil series*. Except for differences in texture of the surface layer, all the soils of a series have major horizons that are similar in composition, thickness, and arrangement.

Soils of one series can differ in texture of the surface layer, slope, stoniness, salinity, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*. Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, Alpha silt loam, 0 to 2 percent slopes, is a phase of the Alpha series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. Alpha-Beta complex, 0 to 6 percent slopes, is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the survey area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. Alpha-Beta association, 0 to 2 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. Alpha and Beta soils, 0 to 2 percent slopes, is an example.

Some surveys include *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Rock outcrop is an example.

Las Vegas Valley Area, Nevada, Part of Clark County

264—Jean very gravelly loamy fine sand, 2 to 4 percent slopes

Map Unit Setting

National map unit symbol: hrbk
Elevation: 2,000 to 3,600 feet
Mean annual precipitation: 4 to 8 inches
Mean annual air temperature: 61 to 64 degrees F
Frost-free period: 220 to 260 days
Farmland classification: Not prime farmland

Map Unit Composition

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

Description of Jean

Setting

Landform: Inset fans
Down-slope shape: Linear
Across-slope shape: Linear
Parent material: Alluvium derived from limestone, sandstone and quartzite

Typical profile

H1 - 0 to 1 inches: very gravelly loamy fine sand
H2 - 1 to 18 inches: loamy fine sand
H3 - 18 to 60 inches: stratified extremely gravelly sand to very gravelly loamy fine sand

Properties and qualities

Slope: 2 to 4 percent
Depth to restrictive feature: More than 80 inches
Natural drainage class: Excessively drained
Runoff class: Very low
Capacity of the most limiting layer to transmit water (Ksat): High to very high (5.95 to 19.98 in/hr)
Depth to water table: More than 80 inches
Frequency of flooding: None
Frequency of ponding: None
Calcium carbonate, maximum in profile: 15 percent
Salinity, maximum in profile: Nonsaline to very slightly saline (0.0 to 2.0 mmhos/cm)
Sodium adsorption ratio, maximum in profile: 5.0
Available water storage in profile: Low (about 3.7 inches)

Interpretive groups

Land capability classification (irrigated): 4s
Land capability classification (nonirrigated): 7s
Hydrologic Soil Group: A
Other vegetative classification: LIMY SAND 5-7" P.Z. (030XB037NV_2)
Hydric soil rating: No

610—Pits, gravel

Map Unit Composition

Pits: 100 percent

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

Description of Pits

Setting

Landform: Hills

Down-slope shape: Linear

Across-slope shape: Convex

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Appendix B –HEC-1 Analyses

- Existing Condition Standard Form 4
- Existing Condition HEC-1 Output
- Proposed Condition Standard Form 4
- Proposed Condition HEC-1 Output

Equations Used...

$$t(t) = 1.8 \times (1.1 - K) \times L^{1/2} / S^{1/3}$$

$$t(t) = L / (60 \times V)$$

$$t(c) = t(t) + t(f)$$

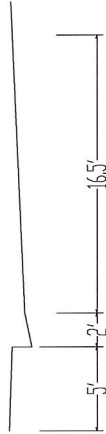
$$K = 0.0132 \times CN - 0.39$$

For Developed Conditions:

Flow depth at top of curb - Velocity = $30.6 \times (\text{Slope})^{1/2}$

$$n = 0.016$$

$$R = (A/P) \sim 0.187 \text{ ft.}$$



For Existing Conditions:

Wide Rectangular - Velocity = $29.4 \times (\text{Slope})^{1/2}$

$$n = 0.040$$

$$R = (A/P) \sim y$$



```

*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
* RUN DATE 19OCT17 TIME 16:25:49
*
*****

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

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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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

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

1

HEC-1 INPUT

PAGE 1

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

```

1 ID
2 ID *****
3 ID * HYDROLOGIC ANALYSIS *
4 ID * FOR *
5 ID * Chik-fil-A @ HWY 95 & LAKE MEAD *
6 ID * EXISTING CONDITION *
7 ID *
8 ID *****
9 ID
10 ID *****
11 ID * 10 & 100 YEAR *
12 ID * STORM EVENT *
13 ID *****
14 ID
    *DIAGRAM
15 IT 5 0 0 300
16 IO 5 0 0
17 IN 5 0 0
18 JR PREC 0.57 1.00

19 KK RNB1
20 KM
21 BA .0015
22 PB 2.77
23 PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130
24 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
25 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
26 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
27 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
28 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
29 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
30 PC .998 .999 1.00
31 LS 0 98
32 UD .0844
    *

33 KK OFF1
34 KM
35 BA .0077
36 LS 0 95
37 UD .1079
    *

38 KK CP1
39 KM
40 HC 2
    *

41 KK RNB2
42 KM
43 BA .0001

```


44 LS 0 98
45 UD .0500
*

1

HEC-1 INPUT

PAGE 2

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

46 KK EX1
47 KM
48 BA .0014
49 LS 0 95
50 UD .0500
*

51 KK CP2
52 KM
53 HC 3
*
54 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

```

19 RNB1
.
.
33 . OFF1
.
.
38 CP1.....
.
.
41 . RNB2
.
.
46 . EX1
.
.
51 CP2.....

```

**LVAC* *MAR*

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 19OCT17 TIME 16:25:49
*

*
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*

* HYDROLOGIC ANALYSIS
* FOR
* Chik-fil-A @ HWY 95 & LAKE MEAD
* EXISTING CONDITION
*

* 10 & 100 YEAR
* STORM EVENT
*

16 IO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT

HYDROGRAPH TIME DATA

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

COMPUTATION INTERVAL .08 HOURS

TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
 NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 .57 1.00

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT +	RNB1	.00	1 FLOW TIME	2. 3.50	3. 3.50
HYDROGRAPH AT +	OFF1	.01	1 FLOW TIME	7. 3.50	14. 3.50
2 COMBINED AT +	CP1	.01	1 FLOW TIME	9. 3.50	17. 3.50
HYDROGRAPH AT +	RNB2	.00	1 FLOW TIME	0. 3.50	0. 3.50
HYDROGRAPH AT +	EX1	.00	1 FLOW TIME	2. 3.50	3. 3.50
3 COMBINED AT +	CP2	.01	1 FLOW TIME	11. 3.50	20. 3.50

$$+ 33/05 + 5/10 = 47/92$$

$$+ 33/05 + 5/10 = 49/95$$

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

Equations Used...

$$t(i) = 1.8 \times (1.1 - K) \times L^{1/2} / S^{1/3}$$

$$t(i) = L / (60 \times V)$$

$$t(c) = t(i) + t(i)$$

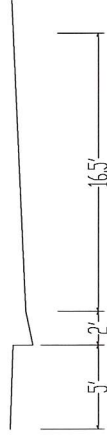
$$K = 0.0132 \times CN - 0.39$$

For Developed Conditions:

Flow depth at top of curb - Velocity = $30.6 \times (\text{Slope})^{1/2}$

$$n = 0.016$$

$$R = (A/P) \sim 0.187 \text{ ft.}$$

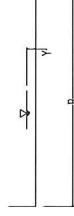


For Existing Conditions:

Wide Rectangular - Velocity = $29.4 \times (\text{Slope})^{1/2}$

$$n = 0.040$$

$$R = (A/P) \sim y$$




```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
*      JUN 1998
*      VERSION 4.1
*
* RUN DATE 31OCT17 TIME 11:28:07
*
*****

```

```

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

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

1

HEC-1 INPUT

PAGE 1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1          ID
2          ID *****
3          ID *      HYDROLOGIC ANALYSIS      *
4          ID *      FOR                      *
5          ID *      Chik-fil-A @ HWY 95 & LAKE MEAD      *
6          ID *      PROPOSED CONDITION              *
7          ID *
8          ID *****
9          ID
10         ID *****
11         ID *      10 & 100 YEAR      *
12         ID *      STORM EVENT        *
13         ID *****
14         ID
15         ID *DIAGRAM
16         IT      5      0      0      300
17         IO      5      0      0
18         IN      5      0      0
19         JR      PREC      0.57      1.00
20
21         KK      RNB1
22         KM
23         BA      .0015
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         LS      0      98
34         UD      .0844
35         *
36
37         KK      OFF1
38         KM
39         BA      .0077
40         LS      0      95
41         UD      .1079
42         *
43
44         KK      CP1
45         KM
46         HC      2
47         *
48
49         KK      RNB2
50         KM
51         BA      .0001

```

44 LS 0 98
45 UD .0500
*

1

HEC-1 INPUT

PAGE 2

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

46 KK PR1
47 KM
48 BA .0014
49 LS 0 95
50 UD .0500
*

51 KK CP2
52 KM
53 HC 3
*
54 ZZ

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

```

19 RNB1
.
.
33 OFF1
.
.
38 CP1.....
.
.
41 RNB2
.
.
46 PR1
.
.
51 CP2.....

```

Handwritten notes: "XLINE" and "MAR" with arrows pointing to the stream network diagram.

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

1

* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 31OCT17 TIME 11:28:07 *
* *****

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

* HYDROLOGIC ANALYSIS *
* FOR *
* Chik-fil-A @ HWY 95 & LAKE MEAD *
* PROPOSED CONDITION *
* *****

* 10 & 100 YEAR *
* STORM EVENT *
* *****

16 IO

OUTPUT CONTROL VARIABLES

IPRNT 5 PRINT CONTROL
IPLOT 0 PLOT CONTROL
QSCAL 0. HYDROGRAPH PLOT SCALE

IT

HYDROGRAPH TIME DATA

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

COMPUTATION INTERVAL .08 HOURS

TOTAL TIME BASE 24.92 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 1.00

1

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1 .57	RATIO 2 1.00
HYDROGRAPH AT +	RNB1	.00	1 FLOW TIME	2. 3.50	3. 3.50
HYDROGRAPH AT +	OFF1	.01	1 FLOW TIME	7. 3.50	14. 3.50
2 COMBINED AT +	CP1	.01	1 FLOW TIME	9. 3.50	17. 3.50
HYDROGRAPH AT +	RNB2	.00	1 FLOW TIME	0. 3.50	0. 3.50
HYDROGRAPH AT +	PR1	.00	1 FLOW TIME	2. 3.50	3. 3.50
3 COMBINED AT +	CP2	.01	1 FLOW TIME	11. 3.50	20. 3.50

$$+ 33/05 + 5/10 = 47/92$$

$$+ 33/05 + 5/10 = 49/95$$

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

Appendix C – Hydraulic Calculations

- Prorated Flow Rate Calculations
- FlowMaster Hydraulic Sections - Streets
- FlowMaster Hydraulic Sections – Onsite
- Block Wall Opening Calculations
- Sidewalk Underdrain Calculations

PRORATED FLOW RATE CALCULATIONS							
BASIN ID	BASIN AREA (ac)	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)	PRORATED BASIN ID	BASIN AREA (ac)	10-YEAR FLOW (cfs)	100-YEAR FLOW (cfs)
PR1	0.91	2	3	PR1-A	0.36	1	1
				PR1-B	0.55	1	2

Worksheet for RNB-1: U/S BLDG Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 1.57000 %
Discharge 47.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1.11
0+00.00	0.61
0+22.00	0.17
0+23.50	0.00
0+23.50	0.50
0+24.00	0.50
0+29.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.11)	(0+00.00, 0.61)	0.013
(0+00.00, 0.61)	(0+22.00, 0.17)	0.017
(0+22.00, 0.17)	(0+29.00, 0.60)	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 0.71 ft
Elevation Range 0.00 to 1.11 ft
Flow Area 8.99 ft²
Wetted Perimeter 29.73 ft

Worksheet for RNB-1: U/S BLDG Q10

Results

Hydraulic Radius	0.30	ft
Top Width	29.00	ft
Normal Depth	0.71	ft
Critical Depth	0.84	ft
Critical Slope	0.51874	%
Velocity	5.23	ft/s
Velocity Head	0.42	ft
Specific Energy	1.14	ft
Froude Number	1.65	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.71	ft
Critical Depth	0.84	ft
Channel Slope	1.57000	%
Critical Slope	0.51874	%

Worksheet for RNB-1: U/S BLDG Q100

Results

Hydraulic Radius	0.45	ft
Top Width	29.00	ft
Normal Depth	0.87	ft
Critical Depth	1.08	ft
Critical Slope	0.45493	%
Velocity	6.82	ft/s
Velocity Head	0.72	ft
Specific Energy	1.59	ft
Froude Number	1.76	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.87	ft
Critical Depth	1.08	ft
Channel Slope	1.57000	%
Critical Slope	0.45493	%

Worksheet for RNB-2: D/S BLDG Q10

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 1.57000 %
Discharge 49.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	1.11
0+00.00	0.61
0+22.00	0.17
0+23.50	0.00
0+23.50	0.50
0+24.00	0.50
0+29.00	0.60

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 1.11)	(0+00.00, 0.61)	0.013
(0+00.00, 0.61)	(0+22.00, 0.17)	0.017
(0+22.00, 0.17)	(0+29.00, 0.60)	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 0.72 ft
Elevation Range 0.00 to 1.11 ft
Flow Area 9.23 ft²
Wetted Perimeter 29.75 ft

Worksheet for RNB-2: D/S BLDG Q10

Results

Hydraulic Radius	0.31	ft
Top Width	29.00	ft
Normal Depth	0.72	ft
Critical Depth	0.85	ft
Critical Slope	0.51443	%
Velocity	5.31	ft/s
Velocity Head	0.44	ft
Specific Energy	1.16	ft
Froude Number	1.66	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.72	ft
Critical Depth	0.85	ft
Channel Slope	1.57000	%
Critical Slope	0.51443	%

Worksheet for RNB-2: D/S BLDG Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 1.57000 %
Discharge 95.00 ft³/s
Section Definitions

Station (ft)

Elevation (ft)

0+00.00	1.11
0+00.00	0.61
0+22.00	0.17
0+23.50	0.00
0+23.50	0.50
0+24.00	0.50
0+29.00	0.60

Roughness Segment Definitions

Start Station

Ending Station

Roughness Coefficient

(0+00.00, 1.11)	(0+00.00, 0.61)	0.013
(0+00.00, 0.61)	(0+22.00, 0.17)	0.017
(0+22.00, 0.17)	(0+29.00, 0.60)	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 0.88 ft
Elevation Range 0.00 to 1.11 ft
Flow Area 13.77 ft²
Wetted Perimeter 30.06 ft

Worksheet for RNB-2: D/S BLDG Q100

Results

Hydraulic Radius	0.46	ft
Top Width	29.00	ft
Normal Depth	0.88	ft
Critical Depth	1.10	ft
Critical Slope	0.45220	%
Velocity	6.90	ft/s
Velocity Head	0.74	ft
Specific Energy	1.62	ft
Froude Number	1.76	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.88	ft
Critical Depth	1.10	ft
Channel Slope	1.57000	%
Critical Slope	0.45220	%

Project Description

Manning Formula

Normal Depth

1.00 ft³/s

Station	Elevation (ft)	Type
0+00	43.00	Ground
0+05	42.85	Ground
0+10	42.70	Ground
0+12	42.65	Ground
0+15	42.55	Ground
0+17	42.35	Ground
0+00	43.00	Proposed
0+05	42.90	Proposed
0+10	42.75	Proposed
0+12	42.65	Proposed
0+15	42.65	Proposed
0+17	42.85	Proposed

FFE CHECK

$$2D = 0.62$$

$$FL = 42.34$$

$$FL + 2D = 42.96$$

$$FFE = 43.00$$

04
3

Worksheet for HS-1 Q100

Results

Critical Depth	0.29	ft
Critical Slope	0.68248	%
Velocity	1.51	ft/s
Velocity Head	0.04	ft
Specific Energy	0.35	ft
Froude Number	0.81	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.31	ft
Critical Depth	0.29	ft
Channel Slope	0.43000	%
Critical Slope	0.68248	%

Worksheet for HS-2 Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.50000 %
Discharge 1.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	43.00
0+05.00	42.85
0+05.50	42.85
0+05.50	42.35
0+29.00	41.83
0+30.50	41.76
0+30.50	42.26
0+31.00	42.26

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 43.00)	(0+05.50, 42.35)	0.013
(0+05.50, 42.35)	(0+29.00, 41.83)	0.017
(0+29.00, 41.83)	(0+31.00, 42.26)	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 0.22 ft
Elevation Range 41.76 to 43.00 ft
Flow Area 0.76 ft²

Worksheet for HS-2 Q100

Results

Wetted Perimeter	8.38	ft
Hydraulic Radius	0.09	ft
Top Width	8.16	ft
Normal Depth	0.22	ft
Critical Depth	0.20	ft
Critical Slope	0.91210	%
Velocity	1.31	ft/s
Velocity Head	0.03	ft
Specific Energy	0.24	ft
Froude Number	0.75	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.22	ft
Critical Depth	0.20	ft
Channel Slope	0.50000	%
Critical Slope	0.91210	%

Cross Section for HS-3 Q100

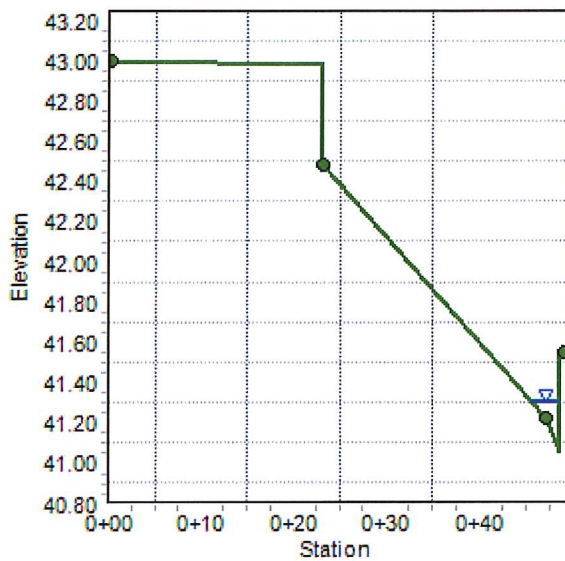
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 2.38000 %
Normal Depth 0.25 ft
Discharge 1.00 ft³/s

Cross Section Image



FFE CHECK

$$\begin{aligned} 2D &= 0.50 \\ FL &= 41.05 \\ FL+2D &= 41.55 \\ FFE &= 43.00 \\ &\text{OK} \\ &\text{Z} \end{aligned}$$

Worksheet for HS-3 Q100

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 2.38000 %
Discharge 1.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	43.00
0+23.20	42.98
0+23.20	42.48
0+47.20	41.22
0+48.70	41.05
0+48.70	41.55
0+49.20	41.55

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 43.00)	(0+23.20, 42.48)	0.017
(0+23.20, 42.48)	(0+47.20, 41.22)	0.013
(0+47.20, 41.22)	(0+49.20, 41.55)	0.017

Options

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

Results

Normal Depth 0.25 ft
Elevation Range 41.05 to 43.00 ft
Flow Area 0.32 ft²
Wetted Perimeter 3.35 ft

Worksheet for HS-3 Q100

Results

Hydraulic Radius	0.10	ft
Top Width	3.09	ft
Normal Depth	0.25	ft
Critical Depth	0.30	ft
Critical Slope	0.75096	%
Velocity	3.14	ft/s
Velocity Head	0.15	ft
Specific Energy	0.41	ft
Froude Number	1.72	
Flow Type	Supercritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.25	ft
Critical Depth	0.30	ft
Channel Slope	2.38000	%
Critical Slope	0.75096	%

Project Description

Manning Formula

Normal Depth

2.00 ft³/s

Profile view graph showing Elevation vs. Station. The y-axis is labeled 'Elevation' and ranges from 41.20 to 43.20. The x-axis is labeled 'Station' and ranges from 0+00 to 1+00. The curve starts at an elevation of approximately 43.00 at station 0+00, drops to a minimum of about 41.35 at station 0+95, and then rises to approximately 41.80 at station 1+00. A blue horizontal line segment is drawn at an elevation of 41.50, intersecting the curve at two points, with a dimension line indicating a length of 7.0.

$$\begin{aligned} 2D &= 0.40 \\ FL &= 41.30 \\ FL + 2D &= 41.70 \\ FFE &= 43.00 \end{aligned}$$

Project Description

Input Data

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

Roughness Segment Definitions

Options

Results

11/1/2017 9:18:09 AM Bentley Systems, Inc. Haestad Methods Solution Center Bentley RevMaster V8i (SELECTseries 1) [08.11.01.03] 27 Siemens Company Drive Suite 200 W Watertown, CT 06795 USA +1-203-755-1666 Page 1 of 2

Worksheet for HS-4 Q100

Results

Flow Area	1.83	ft ²
Wetted Perimeter	21.64	ft
Hydraulic Radius	0.08	ft
Top Width	21.63	ft
Normal Depth	0.20	ft
Critical Depth	0.18	ft
Critical Slope	0.95423	%
Velocity	1.10	ft/s
Velocity Head	0.02	ft
Specific Energy	0.22	ft
Froude Number	0.66	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.20	ft
Critical Depth	0.18	ft
Channel Slope	0.40000	%
Critical Slope	0.95423	%

Appendix D – Reference Materials

- *Technical Drainage Study for Las Vegas Athletic Club Parking Lot Extension including Addenda; Prepared by Red-Rock Engineering & Surveying, Inc. Approved December 19, 2006. DS-4015 "LVAC Study"*
- *Technical Hydrology Update for Marriott Courtyard West including Addenda; Prepared by Hunsaker & Associates Nevada, Inc. Approved November 5, 1997. DS-2156 "Marriott Study"*
- *Technical Hydrology Study Restaurant Row (Formerly Rainbow/Lake Mead) including Addenda; Prepared by Hunsaker & Associates Nevada, Inc. Approved January 29, 1997. DS-1979 "Restaurant Study"*

Project No.: 25120
Date: December 14, 2006

DS 4015
400
12/18/06
L-22

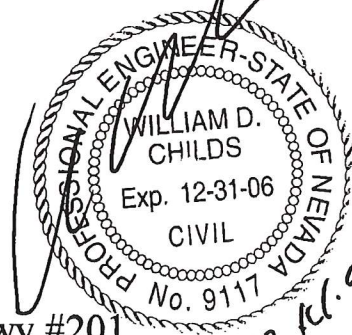
TECHNICAL DRAINAGE STUDY

FOR

Las Vegas Athletic Club Parking Lot Extension

Addendum 2

Prepared for: Jermac
2655 S. Maryland Pkwy #201
Las Vegas, NV 89109-8303



Prepared by: RedRock Engineering & Surveying, Inc.
2001 S Rainbow, Suite K
Las Vegas, NV 89146-0816
(702) 363-8188

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

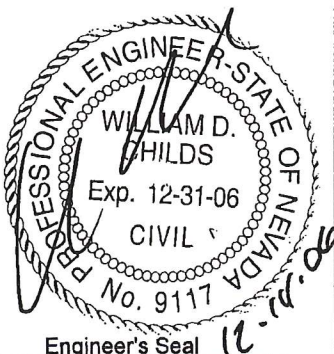
Name of Development Las Vegas Athletic Club DATE 12-14-2006Location of development: a) Descriptive (Cross Streets) N/S Rainbow Blvd E/W Vegas Driveb) Sect. 22 Twn. 20S Rng. 60EName of Owner: Jermac Assessors Parcel No.: 138-22-803-001Telephone No.: 702-277-1914 Facsimile No.: 702-792-8061Address: 1502 Elizabeth Avenue #1Las Vegas, NV 89119Contact Person Name: William D. Childs Telephone No.: (702) 363-8188Firm: RedRock Engineering and Surveying, Inc Facsimile No: (702) 363-3433Address: 2001 S. Rainbow, Ste K, Las Vegas, NV 89146

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site 15.2 Being Developed/Disturbed 2.3 acres2. 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)? Commercial5. Approximate Upstream land area which drains to the subject site N/A6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentationLas Vegas Athletic Club prepared by Orion Engineering, Dated October 18, 2002, ammended December 12 2002

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

Drive at center of site onto Rainbow8. Briefly describe your proposed schedule for the subject project:
ASAP after plan approval

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.

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

Local Entity File No.

Revision	Date

REFERENCE:

STANDARD FORM 1

CITY OF LAS VEGAS			DATE:		
INTER-OFFICE MEMORANDUM			December 19, 2006		
TO: Land Development Services Department of Public Works			FROM: Oh Sang Kwon, P.E.  Flood Control Department of Public Works		
SUBJECT: Drainage Study for: Las Vegas Athletic Club – Parking Lot Extension			COPIES TO: Redrock Engineering & Surveying		
Cross Streets: NWC of Rainbow Boulevard & Vegas Drive			Las Vegas Athletic Club		
File Number: F:\Depot\DSMemos\DS4015C.doc			Bart Anderson, P.E., DevCo		
Parcel Number: 138-22-803-001			NDOT		
Zoning Action: SDR-11443 & TMP-12137					
FEMA Flood Zone		YES	NO	X	
Proposed Storm Drain		YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	5/26/2006	6/9/2006	Not Approved	\$400.00	46320: \$400
2 nd Submittal	6/28/2006	7/12/2006	Approved	\$400.00	48534: \$400
3 rd Submittal	12/18/2006	12/19/2006	See Comments Below	\$400.00	59614: \$400
TOTAL FEES (LDDRS):				\$1200.00	----

REMARKS:

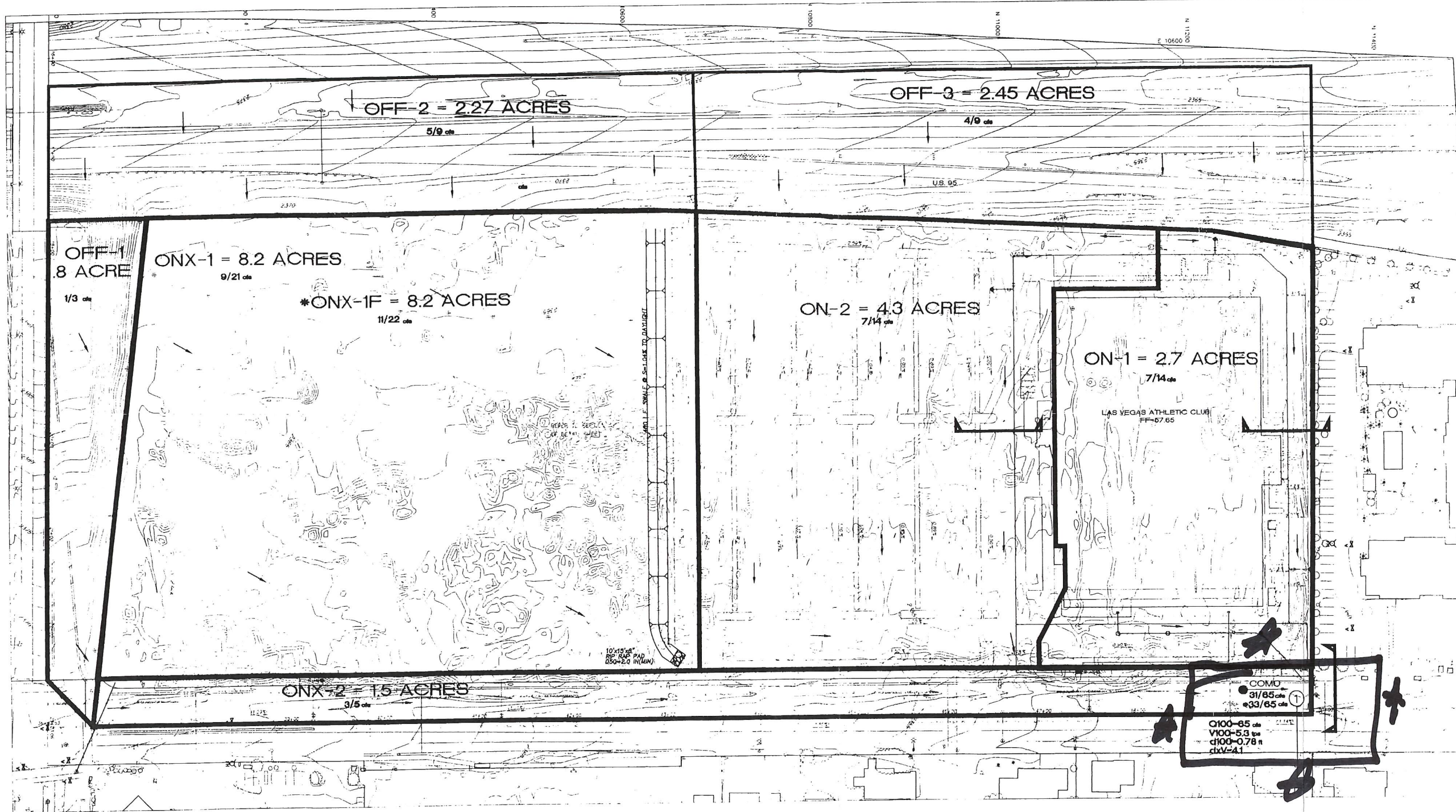
The Drainage Study for the subject project has been reviewed and:

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

1. Detail A/C2: Revise the proposed "A"-curb to "L"-curb to contain and convey flows.
2. Callout/label proposed 2-foot concrete valley on the grading plan.
3. Replace the proposed temporary swale to a concrete U-channel.
4. Provide cross-sections at the south and west project boundary lines.
5. Check the direction of north arrow.

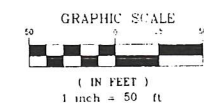
NOTE: Any future changes to the proposed design (or design assumptions) as outlined in the approved drainage study and attached preliminary grading plan which affect drainage must be addressed in a Drainage Study Amendment and accepted by the *City of Las Vegas Flood Control Section*. Additionally, conditional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

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



BASIN NAME	AREA-AC	TOT-CFS	TOT-CF
CFF-1	0.8	1	3
CFF-2	2.27	5	2
CFF-3	2.45	4	2
CW-1	8.2	9	21
CW-2	1.5	3	5
DN-1	2.7	4	9
DN-2	4.3	7	14
DN-3-IF	5.2	11	22
MC		33	65

*BASED UPON FUTURE CONDITIONS. REFER TO HEC
OUTPUT LOCATED IN APPENDIX B



LEGEND

ON-1

This grading plan is a part of drainage study 1015 which was received on 12/14/06 and Approved on 106. Page 2 of 12

PROPOSED DRAINAGE EXHIBIT

LAS VEGAS ATHLETIC CLUB

ORION ENGINEERING AND SURVEYING, INC.
3068 E. SUNSET ROAD, SUITE 9
LAS VEGAS, NEVADA 89120
(702) 739-5921 FAX (702) 739-5929

Crion

FIGURE 6

2156
L22
\$250



TECHNICAL HYDROLOGY UPDATE FOR MARRIOTT COURTYARD WEST

City of Las Vegas

Prepared for:
MARRIOTT INTERNATIONAL, INC.
3130 S. Harbor Blvd., Suite 350
Department 55/83458
Santa Ana, California 92704

Prepared by:
HUNSAKER & ASSOCIATES NEVADA, INC.
401 N. Buffalo Drive, Suite 100
Las Vegas, Nevada 89128
(702) 242-4200
FAX (702) 242-2100

October 1997
HA Project Number 2150-1

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Marriott Courtyard West Date: October 1997

Location of Development: a) Descriptive SW corner of Rainbow Blvd. and Lake Mead Blvd.
b) Sect. 22 Twn. 20S Rng. 60E

Name of Owner: Marriott International Inc. Assessors Parcel No: 138-22-713-006

Contact Person Name: Albert J. Jankowiak, E.I. Telephone No: (702) 242-4200

Firm: Hunsaker & Associates Nevada, Inc.

Address: 401 N. Buffalo Drive, Suite 100, Las Vegas, Nevada 89128

Type of Land Development/Land Disturbance Process:

☐
☐
☐

Rezoning
Parcel Map
Large Parcel Map

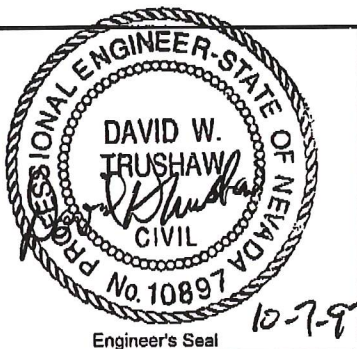
☐
☐
☒

Subdivision Map
Planned Unit Development
Building Permit

☐

Clearing and Grading Only
Other (Please specify below)

- Total Owned Land Area: At Site: 3.23 acres Being Developed/Disturbed: All
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* ☐ NO ☐
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* ☐ NO ☐
- Proposed type of development (Residential, Commercial, Etc.)? Commercial
- Approximate upstream land area which drains to the subject site? 192 acres
- Has the site drainage been evaluated in the past? ☒ YES ☐ NO
If yes, please identify documentation. Conceptual Drainage Study for Restaurant Row
- If known, please briefly identify the proposed discharge point(s) of runoff from the site:
Northeast corner
- Briefly describe your proposed schedule for the subject project:
As soon as possible



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

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

Local Entity File No.

Revision	Date

HA Job Number:

2150-1

STANDARD FORM 1

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: November 5, 1997
TO: Diane Phomninh, P.E. Land Development Services Department of Public Works		FROM: Dennis W. Stransky, P.E. Flood Control Project Manager Department of Public Works
SUBJECT: Drainage Study for: Marriott Courtyard West		COPIES TO: Hunsaker & Associates Marriott International Inc. John McNellis, P.E.
FILE NO. \\khan\flood\Depot\DS\ds2156a.doc		
FEMA Flood Zone	YES	No
Proposed Storm Drain	YES	No

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	10/24/97	11/5/97	See Comments Below	\$250.00
TOTAL FEES				\$250.00

REMARKS:

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

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

1. The grading plan must include a vicinity map and a complete legend.

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

PLANS SENT TO LAND DEVELOPMENT yes *SS* (initial)

END OF REMARKS
dws

T/R/S: 20S/60E/22
AREA L22

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME OF CONCENTRATION

Hunsaker & Associates Nevada
Project No.: 2150-1
File: mar-sf4.xls

DEVELOPMENT: Marriott Courtyard

CALCULATED BY: Albert J. Jankowiak, E.I.

Hunsaker
Planning • Engineering • Surveying
3151 WEST POST ROAD
LAS VEGAS, NEVADA 89118
(702) 897-4333
H&A Associates
Nevada, Inc.
Irvine • San Bernardino • San Diego • Las Vegas

DATE: October 1997

SUB-BASIN DATA				INITIAL / OVERLAND TIME (T)				TRAVEL TIME (T)				Tc	Tc CHECK	FINAL Tc	Tlag	REMARKS
DESIG:	CN	K	AREA (acres)	AREA (mi ²)	LENGTH (ft)	SLOPE (%)	TI (min)	LENGTH (ft)	SLOPE (%)	LAND COVER k	VELOCITY* (fps)	Tt (min)	Tc = Tt + Ti (min)	Tc = (L/100)+10 (min)		
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)	(13)	(14)	(15)	(16)	(17)
ON-1	95.0	0.8640	1.17	0.0018	160	1.0	5.4	300	0.7	N/A	1.7	2.9	8.3	12.6	8.3	0.083
ON-2	95.0	0.8640	0.37	0.0006	80	1.0	3.3	165	1.0	N/A	2.0	1.4	4.7	11.3	4.7	0.047
ON-3	95.0	0.8640	0.52	0.0008	75	1.0	3.7	185	0.7	N/A	1.7	1.8	5.5	11.4	5.5	0.055
ON-4	95.0	0.8640	1.17	0.0018	90	1.0	4.0	280	1.1	N/A	2.1	2.2	6.3	12.1	6.3	0.063

$$T_t = 1.8 (1.1 - K) L^{0.12} / S^{0.13}$$

$$T_c = T_t + T_i$$

$$K = 0.0132 (CN) - 0.39$$

$$T_{lag} = 0.6 T_c$$

* The velocity in column 9 was computed using Figure 602 unless otherwise specified.

REFERENCE :

STANDARD FORM 4

```

1*****
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* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 10/02/1997 TIME 11:29:58 *
*
*****

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

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X X XXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXX XXXX XXX

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

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

1

HEC-1 INPUT

PAGE 1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1         ID
2         ID   PREPARED FOR:
3         ID     Marriott International Incorporated
4         ID
5         ID
6         ID   DEVELOPED CONDITION
7         ID   @@@@@@@@@@@@@@@@@@
8         ID
9         ID   Project Name: Marriott Courtyard
10        ID   File Name: p:\2150-1\hydro\mar-dev.dat
11        ID   Project Number: 2150-1
12        ID
13        ID   Hunsaker & Associates Nevada
14        ID   401 N. Buffalo Drive, Suite 100
15        ID   Las Vegas, Nevada 89128
16        ID
17        ID   *****
18        ID   * SDN 3 VALUES *
19        ID   *****
20        ID
21        ID   *DIAGRAM
22        IT     5      0      0      300
23        IO     5
24        JR   PREC    0.57    1.00
25
26        KK   ON-1
27        KM   RUNOFF GENERATED BY BASIN ON-1
28        BA   .0018
29        PB   2.77

```

28	PC	.000	.020	.057	.070	.087	.108	.124	.130	.130	.130
29	PC	.130	.130	.130	.133	.140	.142	.148	.158	.172	.181
30	PC	.190	.197	.199	.200	.201	.204	.214	.229	.241	.249
31	PC	.251	.256	.270	.278	.281	.283	.295	.322	.352	.409
32	PC	.499	.590	.710	.744	.781	.812	.819	.835	.851	.856
33	PC	.860	.868	.876	.888	.910	.926	.937	.950	.970	.976
34	PC	.982	.985	.987	.989	.990	.993	.993	.994	.995	.998
35	PC	.998	.999	1.00							
36	LS	0	95								
37	UD	0.083									
38	KK	ON-2									
39	KM	RUNOFF GENERATED BY BASIN ON-2									
40	BA	.0006									
41	LS	0	95								
42	UD	0.047									
43	KK	ON-3									
44	KM	RUNOFF GENERATED BY BASIN ON-3									
45	BA	.0008									
46	LS	0	95								
47	UD	0.055									

1

HEC-1 INPUT

PAGE 2

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

48	KK	ON-4									
49	KM	RUNOFF GENERATED BY BASIN ON-4									
50	BA	.0018									
51	LS	0	95								
52	UD	0.063									
53	KK	COM-1									
54	KM	COMBINE BASINS ON-1, ON-2, ON-3, AND ON-4 AT ENTRANCE									
55	HC	4									
56	ZZ										

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT

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

24	ON-1									
38	ON-2									
43	ON-3									
48	ON-4									
53	COM-1									

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

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1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
*
* RUN DATE 10/02/1997 TIME 11:29:58 *
*

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

```

PREPARED FOR:
Marriott International Incorporated

DEVELOPED CONDITION
@@@@@@@@@@@@@@@@

Project Name: Marriott Courtyard
File Name: p:\2150-1\hydro\mar-dev.dat
Project Number: 2150-1

Hunsaker & Associates Nevada
401 N. Buffalo Drive, Suite 100
Las Vegas, Nevada 89128

* SDN 3 VALUES *

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

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

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.57 1.00

1

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

RATIOS APPLIED TO PRECIPITATION

OPERATION	STATION	AREA	PLAN	RATIO 1 .57	RATIO 2 1.00
-----------	---------	------	------	----------------	-----------------

HYDROGRAPH AT					
+	ON-1	.00	1	FLOW TIME	2. 4. 3.50 3.50

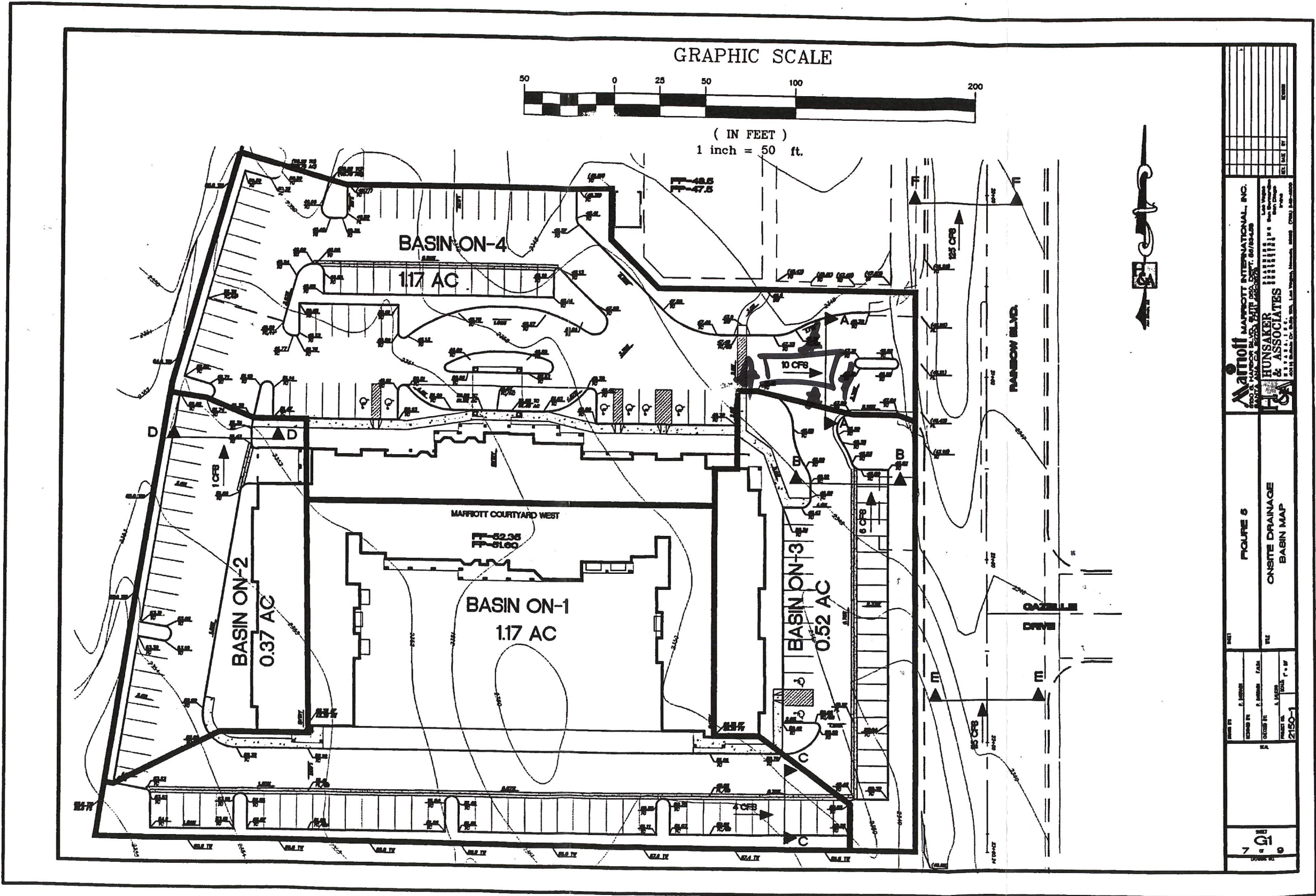
HYDROGRAPH AT					
+	ON-2	.00	1	FLOW TIME	1. 1. 3.50 3.50

HYDROGRAPH AT					
+	ON-3	.00	1	FLOW TIME	1. 2. 3.50 3.50

HYDROGRAPH AT					
+	ON-4	.00	1	FLOW TIME	2. 4. 3.50 3.50

4 COMBINED AT					
+	COM-1	.00	1	FLOW TIME	5. 10. 3.50 3.50

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



1979
L-22
#250

Joel Harris
WLD

DEC 4

CLB
FLC

TECHNICAL HYDROLOGY STUDY FOR RAINBOW LAKE MEAD

#16

Prepared for:
LAURICH PROPERTIES
893 S. RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89128

Prepared by:
HUNSAKER & ASSOCIATES NEVADA, INC.
3151 W. Post Road
Las Vegas, Nevada 89118
(702) 897-4233
FAX (702) 897-2633

November 1996
HA Project Number 1500-16

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Rainbow/Lake Mead Date: November 1996

Location of Development: a) Descriptive SW corner of Rainbow Blvd. and Lake Mead Blvd.
b) Sect. 22 Twn. 20S Rng. 60E

Name of Owner: Laurich Properties Assessor's Parcel No: 138-22-703-002

Contact Person Name: Albert J. Jankowiak Telephone No: (702) 887-4233

Firm: Hunsaker & Associates Nevada, Inc.

Address: 3161 W. Post Road, Las Vegas, Nevada 89118

Type of Land Development/Land Disturbance Process:

☐
☒
☐

Rezoning
Parcel Map
Large Parcel Map

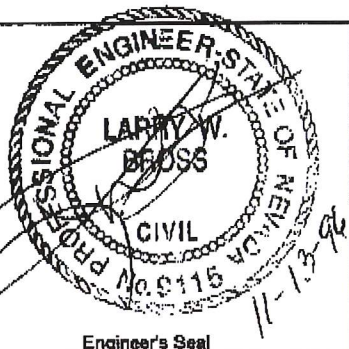
☐
☐
☐

Subdivision Map
Planned Unit Development
Building Permit

☐

Clearing and Grading Only
Other (Please specify below)

- Total Owned Land Area: At Site: 9.918 acres Being Developed/Disturbed: All
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* ☐ NO ☐
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* ☐ NO ☐
- Proposed type of development (Residential, Commercial, Etc.)? Commercial
- Approximate upstream land area which drains to the subject site? 192 acres
- Has the site drainage been evaluated in the past? ☒ YES ☐ NO
If yes, please identify documentation: Conceptual Drainage Study for Restaurant Row
- If known, please briefly identify the proposed discharge point(s) of runoff from the site:
East boundary of site
- Briefly describe your proposed schedule for the subject project:
As soon as possible



Engineer's Seal

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

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

Local Entity File No. _____

Revision	Date

HA Job Number: 1500-16

STANDARD FORM 1

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: January 29, 1997
TO: Joel Harris Land Development Services Department of Public Works		FROM: Dennis W. Stronsky, P.E. Flood Control Project Manager Department of Public Works
SUBJECT: Drainage Study for: Restaurant Row and (Joe's Crab Shack) Formerly Rainbow/Lake Mead		COPIES TO: Hunsaker & Associates Laurich Properties John McNellis, P.E. NDOT
FILE NO. H:\DEPOT\DS\DS1979B.DOC		
FEMA Flood Zone	YES No X	
Proposed Storm Drain	YES No X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES
1st Submittal	12/05/96	12/12/96	Not Accepted	\$250.00
2nd Submittal	1/24/97	1/29/97	See Below	\$250.00
TOTAL FEES				\$500.00

REMARKS:

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

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

- The off-site improvements on Rainbow Boulevard, the overflow channel and the flood wall approved with the Conceptual Drainage Study for Restaurant Row must be constructed with the first project to develop on the site.
- A technical update to the study must be provided for the Future Buildings as they develop.
- The following comments pertain to the grading plan:
 - A detail/cross section of the landscape area adjacent to Rainbow Boulevard must be provided. The flow in Rainbow Boulevard is above the back of the sidewalk. Erosion protection must be provided to protect the landscaped area behind the sidewalk.

END OF REMARKS

dws

T/R/S: 20 S/ 60 E/ 22
AREA L22

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* SEPTEMBER 1990 *
* VERSION 4.0 *
* RUN DATE 12/07/1996 TIME 15:15:22 *
*****

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*****
* 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 X
XXXXXXXX XXXX X XXXXX X
X X X X X X
X X X X X X
X X XXXXXXX XXXXX XXX

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC10S, HEC1DE, AND HEC1KW.

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

HEC-1 INPUT

PAGE 1

```

LINE      ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1         ID
2         ID   PREPARED FOR:
3         ID   LAURICH PROPERTIES
4         ID
5         ID   PROJECT:
6         ID   RAINBOW/LAKE MEAD
7         ID
8         ID   DEVELOPED CONDITIONS
9         ID   #####
10        ID
11        ID   file name: Raindev.dal
12        ID   Project Number: 1500-16
13        ID
14        ID   Hunsaker & Associates Nevada
15        ID   401 N. Buffalo Drive, Suite 100
16        ID   Las Vegas, Nevada 8 9128
17        ID
18        ID   *****
19        ID   *      SDN 3  VALUES      *
20        ID   *****
21        ID
22        ID   *DIAGRAM
23        ID   IT      5      0      0      300
24        ID   IO      5
25        ID   JR      PREC      0.57      1.0
26
27        KK      ON-1
28        KM      RUNOFF FROM BASIN ON-1
29        BA      .0037
30        PB      2.77
31        PC      .000      .020      .057      .070      .087      .108      .124      .130      .130      .130
32        PC      .130      .130      .130      .133      .140      .142      .148      .158      .172      .181
33        PC      .190      .197      .199      .200      .201      .204      .214      .229      .241      .249
34        PC      .251      .256      .270      .278      .281      .283      .295      .322      .352      .409
35        PC      .499      .590      .710      .744      .781      .812      .819      .835      .851      .856
36        PC      .860      .868      .876      .888      .910      .926      .937      .950      .970      .976
37        PC      .982      .985      .987      .989      .990      .993      .993      .994      .995      .998
38        PC      .998      .999      1.00
39        LS      0      95
40        UD      0.091
41
42        KK      ON-2
43        KM      RUNOFF FROM BASIN ON-2
44        BA      .0030
45        LS      0      95
46        UD      .065
47
48        KK      ON-3
49        KM      RUNOFF FROM BASIN ON-3
50        BA      .0032
51        LS      0      95
52        UD      .094

```


HEC-1 INPUT

PAGE 2

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

49	KK	ON-4	
50	KM	RUNOFF FROM BASIN ON-4	
51	BA	.0029	
52	LS	0	95
53	UD	.080	
54	KK	ON-5	
55	KM	RUNOFF FROM BASIN ON-5	
56	BA	.0018	
57	LS	0	95
58	UD	.060	
59	ZZ		

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

25	ON-1				
	.				
39	.	ON-2			
	.	.			
44	.	.	ON-3		
	.	.	.		
49	.	.	.	ON-4	
	.	.	.	.	
54	.	.	.	.	ON-5

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

 FLOOD HYDROGRAPH PACKAGE (HEC-1)
 SEPTEMBER 1990
 VERSION 4.0

RUN DATE: 12/27/1996 TIME 15:15:22

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

PREPARED FOR:
 LAURICH PROPERTIES

PROJECT:
 RAINBOW/LAKE MEAD

DEVELOPED CONDITIONS
 @@@@@@@@@@@@@@@@@@

File name: Raindev.dat
 Project Number: 1500-16

Hunsaker & Associates Nevada
 401 N. Buffalo Drive, Suite 100
 Las Vegas, Nevada 8 9128

 * SDN 3 VALUES *

23 10 OUTPUT CONTROL VARIABLES
 IPRINT 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

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

OPERATION	STATION	AREA	PLAN	RATIOS APPLIED TO PRECIPITATION	
				RATIO 1	RATIO 2
				.57	1.00
HYDROGRAPH AT	ON-1	.00	1 FLOW TIME	4. 3.50	7. 3.50
HYDROGRAPH AT	ON-2	.00	1 FLOW TIME	3. 3.50	6. 3.50
HYDROGRAPH AT	ON-3	.00	1 FLOW TIME	3. 3.50	6. 3.50
HYDROGRAPH AT	ON-4	.00	1 FLOW TIME	3. 3.50	6. 3.50
HYDROGRAPH AT	ON-5	.00	1 FLOW TIME	2. 3.50	4. 3.50

** NORMAL END OF HEC-1 **

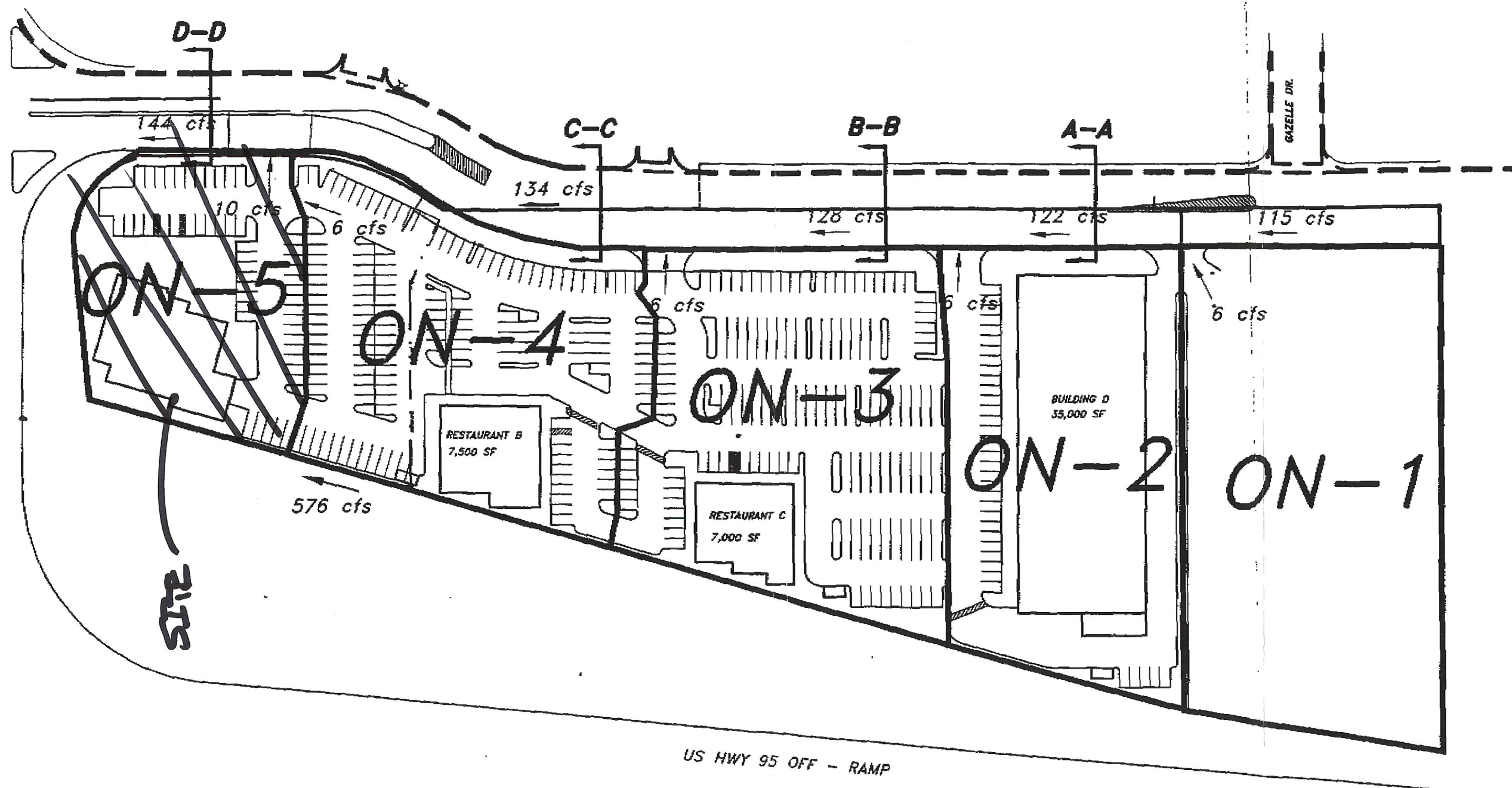


FIGURE 5
DRAINAGE BASIN MAP

Appendix E – Plans

- EX-1 - Existing Condition Basin Map
- PR-1 - Proposed Condition Basin Map
- C0.1 - Cover Sheet
- C0.2 - General Notes & Quantities
- C2.1 - On-site Grading & Paving Plan
- C4.1 - Typical Cross Sections
- C4.2 - Typical Details

Plotted By: Beck, Cody Sheet Set: KHA Layout: EX1 December 13, 2017 03:47:29pm K:\LAV_Civil\092908004-Chick-fil-A Hwy 95 at Lake Mead\04198\Drainage\CADD\DWG\092908004-EX BASIN MAP.dwg
This document, together with the concepts and designs presented herein, is intended only for the specific purpose and client for which it was prepared. Reuse of and improper reliance on this document without written authorization and adaptation by Kimley-Horn and Associates, Inc. shall be without liability to Kimley-Horn and Associates, Inc.



RUNOFF SUMMARY			
BASIN	BASIN AREA (ACRES)	10-YEAR FLOW (CFS)	100-YEAR FLOW (CFS)
*LVAC	-	33	65
*MAR	-	5	10
RNB1	0.94	2	3
OFF1	4.95	7	14
CP1	-	47	92
EX1	0.91	2	3
CP2	-	49	95

* REFERENCED FROM DS-4015
^ REFERENCED FROM DS-2156

XX

XX-X

CP1

BASIN ID

BASIN AREA

BASIN BOUNDARY

FLOW ARROW

FLOW PATH

CONCENTRATION POINT

NORTH

0

25

50

100

1" = 50'

GRAPHIC SCALE IN FEET

Chick-fil-A HWY 95
AT LAKE MEAD

EXISTING CONDITION
BASIN MAP

KHA PROJECT
092908004

DATE
12/12/17

SCALE AS SHOWN

DESIGNED BY
CB

DRAWN BY
TW

CHECKED BY

092908004-EX BASIN MAP.dwg

092908004-EX BASIN MAP.dwg

Kimley»Horn

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6871 LAS VEGAS BLVD. S. SUITE 320, LAS VEGAS, NV 89119
PHONE: 702-862-3600
WWW.KIMLEY-HORN.COM

1 OF 1 SHEETS

EX-1

CITY OF LAS VEGAS

NV

REVISIONS

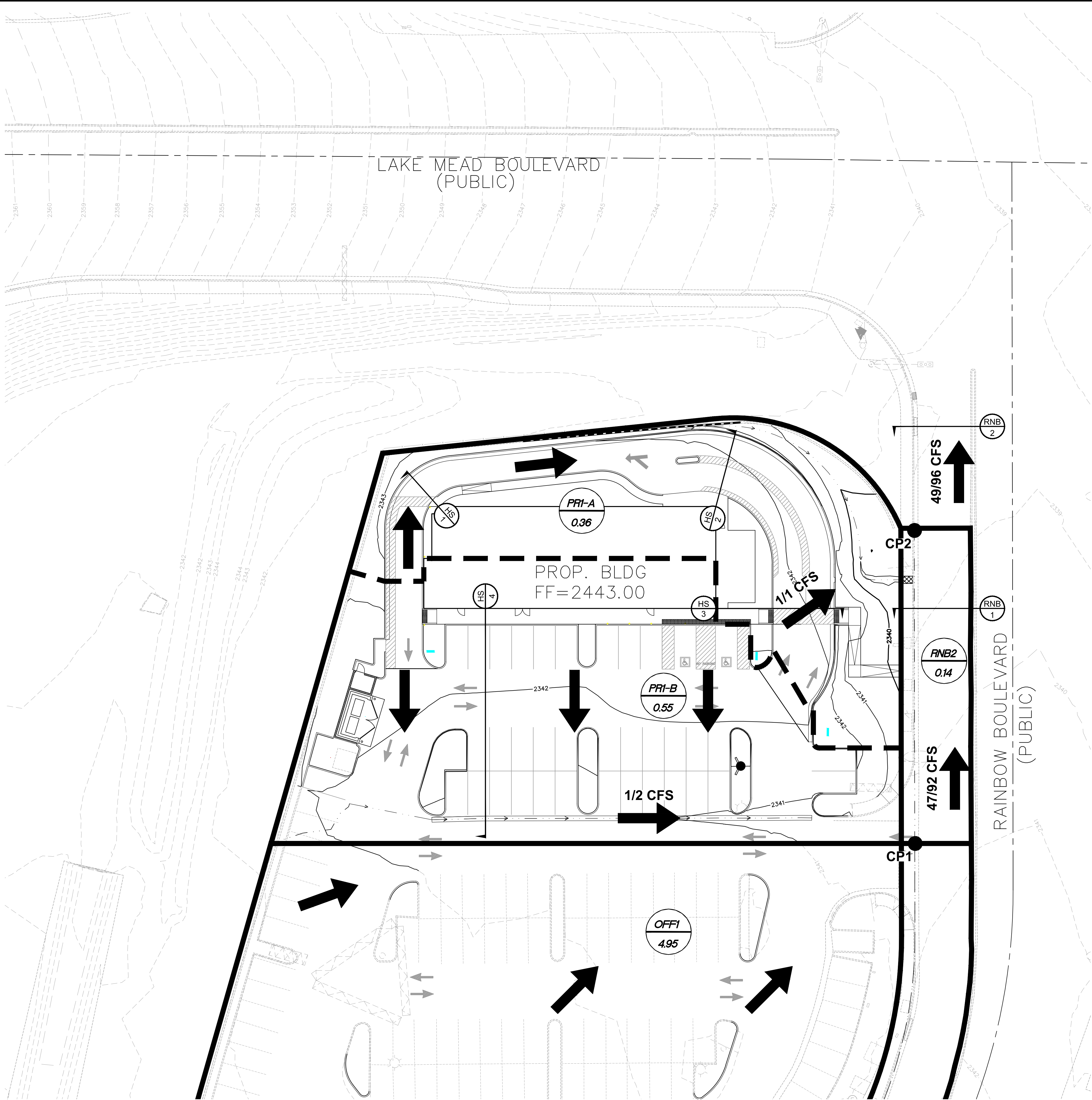
No.

DATE

BY

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LEGEND

XX

XX-X

CP1

BASIN ID

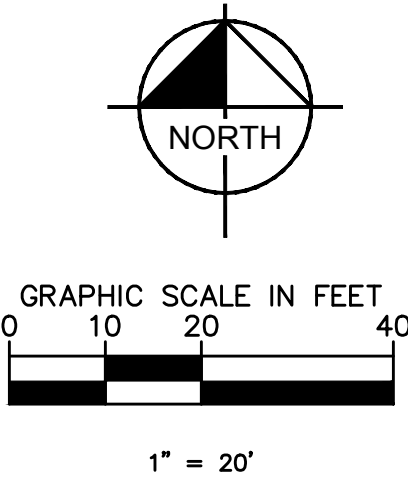
BASIN AREA

BASIN BOUNDARY

FLOW ARROW

FLOW PATH

CONCENTRATION POINT



RUNOFF SUMMARY

BASIN	BASIN AREA (ACRES)	10-YEAR FLOW (CFS)	100-YEAR FLOW (CFS)
*LVAC	-	33	65
*MAR	-	5	10
RNB1	0.94	2	3
OFF1	4.95	7	14
CP1	-	47	92
PR1	0.91	2	3
CP2	-	49	95

* REFERENCED FROM DS-4015
^ REFERENCED FROM DS-2156

STREET HYDRAULIC SUMMARY

SECTION NAME	SLOPE	Q10 (CFS)	FLOW DEPTH (FT)	V10 (FPS)	DV	Q100 (CFS)	FLOW DEPTH (FT)	V100 (FPS)	DV	DRY LANE
RNB-1	1.57	47	0.71	5.23	3.71	92	0.87	6.82	5.93	NO
RNB-2	1.57	49	0.72	5.31	3.82	95	0.88	6.90	6.07	NO

ONSITE HYDRAULIC SUMMARY

SECTION NAME	SLOPE	Q100 (CFS)	FLOW DEPTH (FT)	V100 (FPS)	2*D (ft)	FLOW LINE (ft)	FLOW LINE + 2D	FFE BLDG (ft)	FFE CHECK
HS-1	0.43	1	0.31	1.51	0.62	42.34	42.96	43.00	OK
HS-2	0.50	1	0.22	1.31	0.44	41.76	42.20	43.00	OK
HS-3	2.38	1	0.25	3.14	0.50	41.05	41.55	43.00	OK
HS-4	0.40	2	0.20	1.10	0.40	41.30	41.70	43.00	OK

HTE: TBD

SIGHT VISIBILITY ZONES NOTE

NO WALLS, FENCES, SHRUBS, UTILITY APPURTENANCES OR ANY OTHER OBJECT, OTHER THAN TRAFFIC CONTROL DEVICES, FIRE HYDRANTS, TREES, AND STREET LIGHT POLES MAY BE CONSTRUCTED OR INSTALLED WITHIN THE SIGHT VISIBILITY ZONE UNLESS SAID OBJECT IS MAINTAINED LESS THAN 24 INCHES IN HEIGHT MEASURED FROM TOP OF CURB, OR WHERE NO CURB EXISTS, A HEIGHT OF 27 INCHES MEASURED FROM THE TOP OF ADJACENT ASPHALT, GRAVEL, OR PAVEMENT STREET SURFACE. THIS RESTRICTION EXTENDS ALONG THE SIGHT VISIBILITY LINE THROUGH LANDSCAPED MEDIANS.

BENCHMARK

7LV00 23W4: A RIVET AND PLATE IN THE TOP OF CURB AT THE NORTHEAST CORNER OF LAKE MEAD BOULEVARD AND RAINBOW BOULEVARD = 711.858m = 2,335.498ft (NAD83).

BASIS OF BEARING

SOUTH 00°05'50" EAST, BEING THE EAST LINE OF THE NORTHEAST QUARTER (NE 1/4) OF THE SOUTHEAST QUARTER (SE 1/4) SECTION 22, TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M., CITY OF LAS VEGAS, STATE OF NEVADA, AS SHOWN BY THE MAP RECORDED IN BOOK 78 OF PLATS, PAGE 93 IN THE OFFICE OF THE CLARK COUNTY, NEVADA RECORDER.

LEGEND & ABBREVIATIONS

SEE SHEET C0.3 FOR MASTER LEGEND AND ABBREVIATIONS.

LEGAL DESCRIPTION

SEE COVER SHEET FOR FULL LEGAL DESCRIPTION

NOTES:

ALL DIMENSIONS ARE TO BACK OF CURB UNLESS OTHERWISE NOTED.

OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED, OR OBSCURED DURING CONSTRUCTION.

ELEVATIONS NOTE:

ADD 2300 FEET TO ALL SPOT ELEVATIONS, EXCEPT FINISHED FLOOR ELEVATION AND CONTOURS.

EASEMENT WITH TREES, SHRUBS, DECORATIVE ROCKS, BLOCK WALL OR FENCE

TREES, SHRUBS, OR DECORATIVE ROCKS, AND ANY BLOCK WALL OR OTHER FENCE MATERIAL SHALL BE DESIGNED AND CONSTRUCTED AROUND THE EASEMENT(S) TO ALLOW THE DISTRICT DIRECT ACCESS TO THE VAULT(S), BACKFLOW ASSEMBLIES, AND PIPING FROM THE ADJACENT RIGHT-OF-WAY.

EARTHWORK QUANTITIES

CUT	FILL	NET
95 CY	853 CY	758 CY (FILL)*

*RAW NUMBERS; HAVE NOT BEEN ADJUSTED FOR SOIL TYPE

CONSTRUCTION NOTES

- CONSTRUCT "L" TYPE CURB & GUTTER PER DETAIL 17, SHEET C4.2
- CONSTRUCT "A" TYPE CURB PER DETAIL 8, SHEET C4.1
- CONSTRUCT SIDEWALK PER DETAIL 11, SHEET C4.1
- CONSTRUCT CONCRETE PAVING DRIVE-THRU LANE PER SOILS REPORT BY TERRACON CONSULTANTS. SEE DETAIL 25, SHEET C4.3
- CONSTRUCT STANDARD AC PAVEMENT PER SOILS REPORT BY TERRACON CONSULTANTS. SEE DETAIL 21, SHEET C4.3
- CONSTRUCT CONCRETE APRON @ TRASH ENCLOSURE PER SOILS REPORT BY TERRACON CONSULTANTS SEE DETAIL 24, SHEET C4.2
- CONSTRUCT RETURNED CURB ACCESSIBLE RAMP PER DETAIL 9, SHEET C4.1
- CONSTRUCT TRUNCATED DOMES PER DETAIL 10, SHEET C4.1
- DRIVE-THRU ISOMETRIC PLAN VIEW PER DETAILS 13 & 14, SHEET C4.2
- SAWOUT NEAT & MATCH EXISTING
- CONSTRUCT 0" CURB
- CONSTRUCT 2.0' WIDE CURB OPENING PER DETAIL 27, SHEET C4.3
- CONSTRUCT TRANSVERSE AND LONGITUDINAL DOWELED CONSTRUCTION JOINT PER DETAIL 23, AND BUTT JOINT PER DETAIL 23A ON SHEET C4.3
- DRIVE-THRU POINT ISLAND CURB PER DETAIL 34, SHEET C4.4
- CONSTRUCT 0" TO 6" TRANSITION PER DETAIL 18 ON SHEET C4.2
- CONSTRUCT 2' VALLEY GUTTER PER DETAIL 38 ON SHEET C4.4
- CONSTRUCT CONCRETE/AC EDGE PER DETAIL 21A, SHEET C4.3
- CONSTRUCT 2' MAX HEIGHT RETAINING WALL PER S.N.B.O.R.S. B-100-2. SEE DETAIL 37 ON SHEET C4.4
- CONSTRUCT 2' SCREEN WALL PER S.N.B.O.R.S. B-100-1. SEE DETAIL 38 ON SHEET C4.4
- CONSTRUCT CONTRACTION JOINT (CJ) PER DETAIL 22, SHEET C4.3
- CONSTRUCT EXPANSION JOINT (EJ) PER DETAIL 26, SHEET C4.3
- CONSTRUCT SIDEWALK WITH 0" CURB SECTION PER DETAIL 7 ON SHEET C4.1
- CONSTRUCT SIDEWALK WITH 6" CURB SECTION PER DETAIL 12 ON SHEET C4.1
- CONSTRUCT TRASH ENCLOSURE UPDATE FOUNDATION PER DETAIL 19 ON SHEET C4.2
- PROPOSED LANDSCAPING PER SEPARATE LANDSCAPE PLANS
- MATCH EXISTING

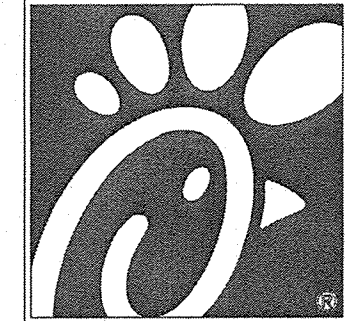
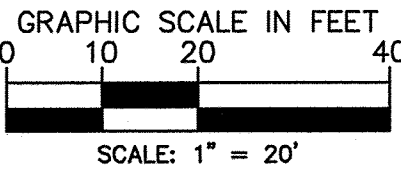
LEGEND

	RIGHT-OF-WAY
	PROPERTY LINE
	GRADE BREAK
	PR SAWCUT LINE
	PR RETAINING WALL
	PR SWALE/FLOW LINE
	PR TYPE 'L' CURB & GUTTER
	PR TYPE 'A' CURB
	EX FENCE
	EX STORM DRAIN
	EX STREETLIGHT
	SIGHT VISIBILITY ZONE (SVZ)
	PR PAVEMENT

ENGINEER'S NOTES:

- ALL WORK SHALL CONFORM TO THE SOILS REPORT PREPARED BY TERRACON, DATED SEPTEMBER 25, 2017, PROJECT NO. 64175087.
- ALL OFF-SITE IMPROVEMENT CONSTRUCTION SHALL CONFORM TO THE "UNIFORM STANDARD SPECIFICATIONS FOR PUBLIC WORKS CONSTRUCTION, OFF-SITE IMPROVEMENTS, CLARK COUNTY AREA, NEVADA", LATEST EDITION.
- FINAL ASPHALTIC CONCRETE (AC) PAVEMENT SURFACES SHALL BE ONE-HALF INCH ABOVE THE TOP OF THE GUTTER (INCLUDING OPEN GRADE).
- CONTRACTOR IS RESPONSIBLE FOR DUST AND EROSION CONTROL DURING CONSTRUCTION
- THIS PLAN SHALL NOT, IN PART OR IN WHOLE, BE USED FOR CONSTRUCTION UNTIL APPROVED AND SIGNED BY ALL APPLICABLE GOVERNMENT AGENCIES.
- ENGINEER TO BE NOTIFIED OF ANY DISCREPANCIES IMMEDIATELY.
- MATCH ELEVATIONS SHOWN TO BE VERIFIED BY CONTRACTOR PRIOR TO CONSTRUCTION.
- THIS PROJECT IS NOT PART OF AN EXISTING COMMERCIAL SUBDIVISION.
- PROPERTY OWNER IS RESPONSIBLE TO MAINTAIN THE BEST MANAGEMENT PRACTICES SUCH AS BUT NOT LIMITED TO THE REMOVAL OF ACCUMULATED SEDIMENT AND DEBRIS AND CARE OF THE VEGETATION.
- CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE WITH CITY OF LAS VEGAS FOR THIS PROJECT, DS xxxx.

TREASEA WOLF, P.E. No. 17879	DATE
------------------------------	------



5200 Buffington Rd.
Atlanta Georgia,
30349-2998

Revisions:
Mark Date By

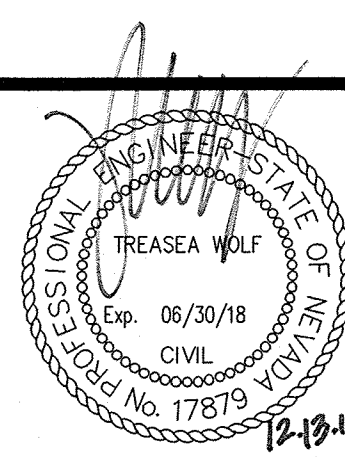
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Mark Date By

△

Mark Date By

△



Kimley»Horn
CHICK-FIL-A
RESTAURANT
NO. 04198

PROJECT NAME
CHICK-FIL-A
RESTAURANT
NO. 04198

STORE
HWY 95 &
LAKE MEAD

HWY 95 @
LAKE MEAD BLVD
LAS VEGAS, NV

SHEET TITLE
GRADING PLAN

VERSION: PRELIM
ISSUE DATE: TBD

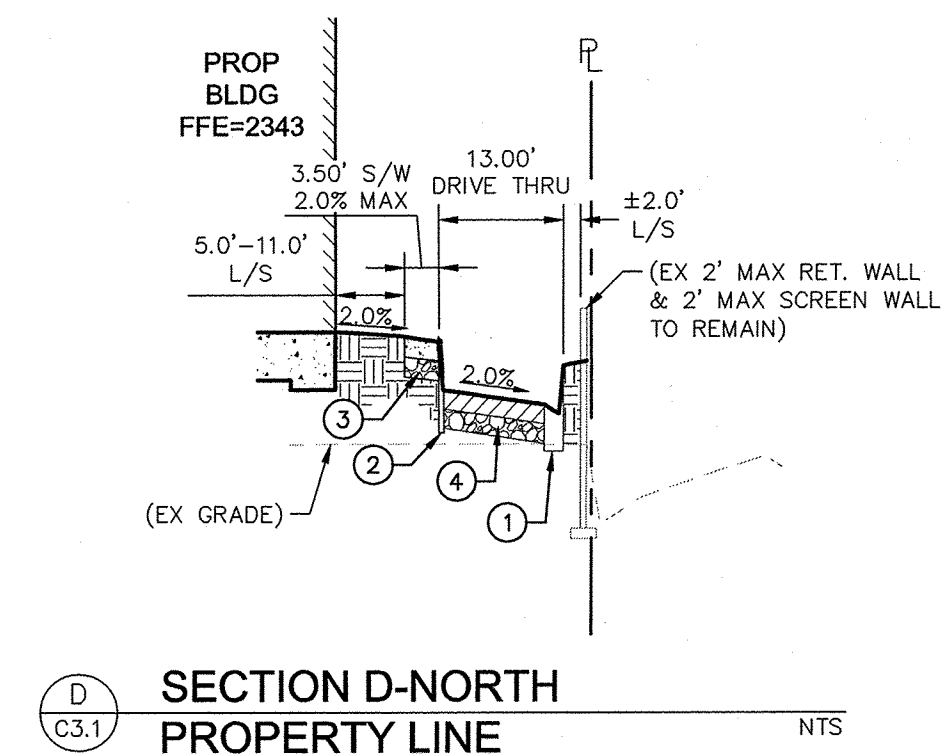
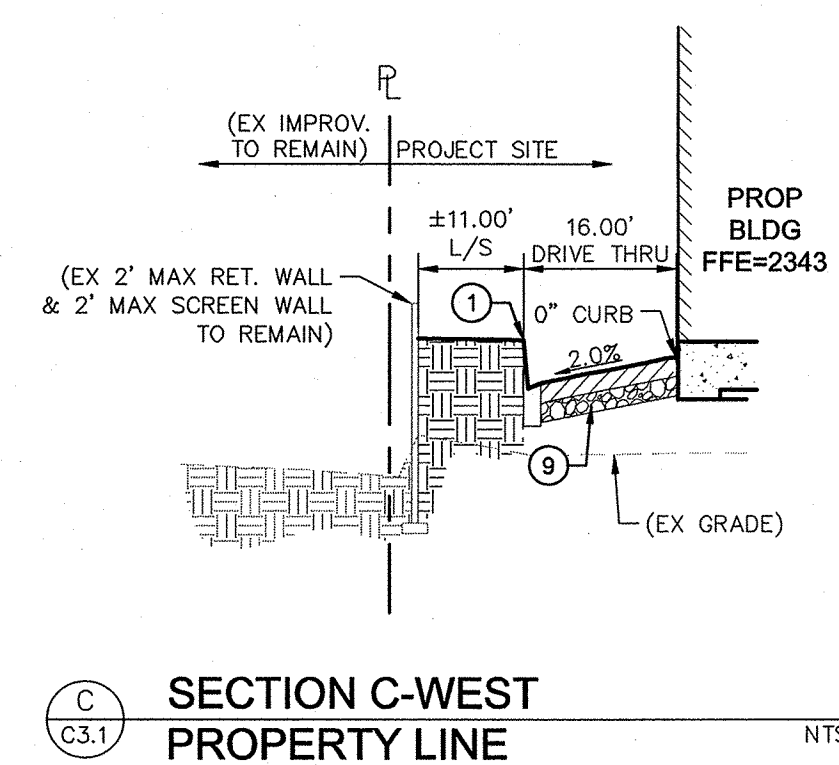
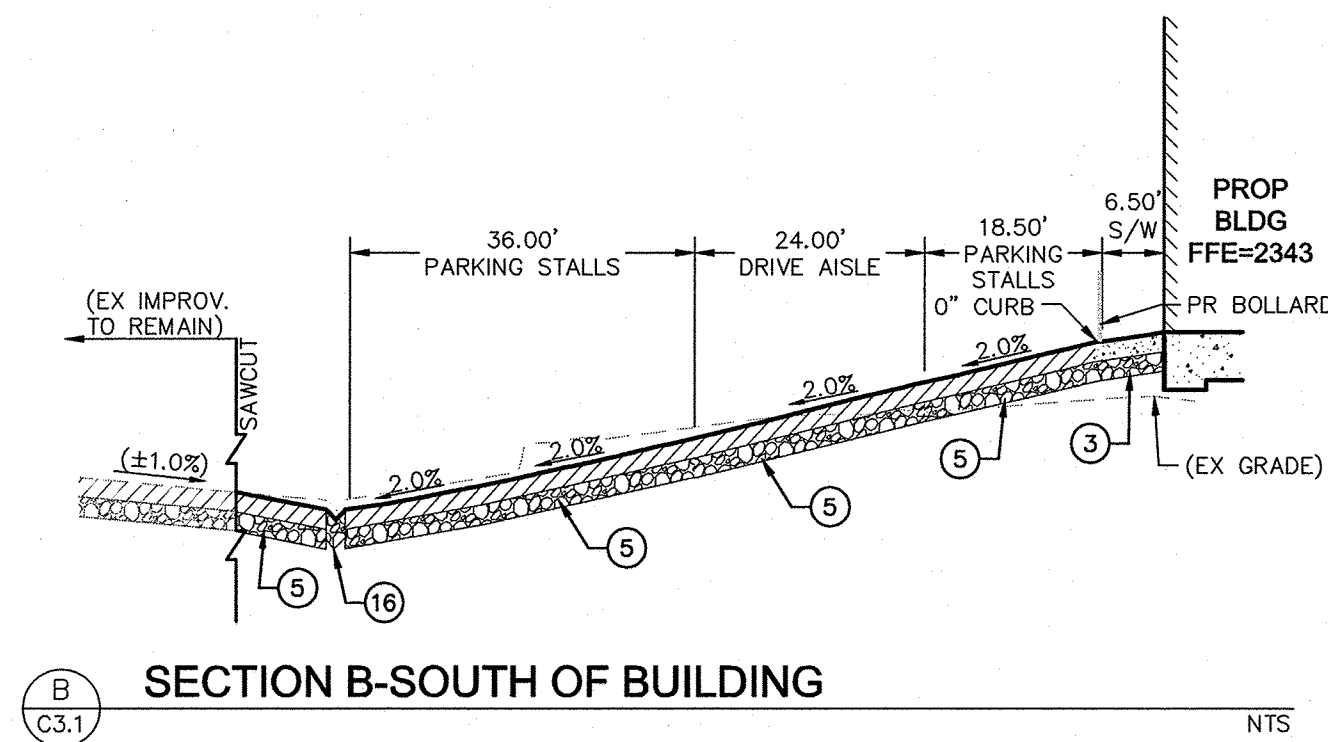
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Date : 12/13/17
Design By : JZ
Drawn By : CT
Checked By : TW

JOB NO.
092908004

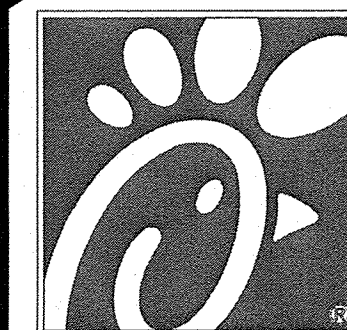
AGENCY NO.
TBD

Sheet
C3.0

6 OF 13 SHEETS



- ① CONSTRUCT "L" TYPE CURB & GUTTER PER DETAIL 17, SHEET C4.2
- ② CONSTRUCT "A" TYPE CURB PER DETAIL 18, SHEET C4.1
- ③ CONSTRUCT SIDEWALK PER DETAIL 11, SHEET C4.1
- ④ CONSTRUCT CONCRETE PAVING DRIVE-THRU LANE PER SOILS REPORT BY XXXX. SEE DETAIL 25, SHEET C4.3
- ⑤ CONSTRUCT STANDARD AC PAVEMENT PER SOILS REPORT BY TERRACON CONSULTANTS. SEE DETAIL 21, SHEET C4.3
- ⑥ DRIVE-THRU ISOMETRIC PLAN VIEW PER DETAILS 13 & 14, SHEET C4.2
- ⑬ CONSTRUCT 2' VALLEY CUTTER PER DETAIL 38 ON SHEET C4.4



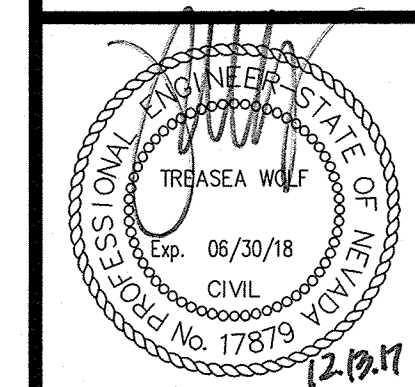

5200 Buffington Rd.
Atlanta Georgia,
30349-2998

Revisions:

Mark _____ Date _____ By _____

Mark _____ Date _____ By _____
△

Mark _____ Date _____ By _____



Kimley»»Horn
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3871 LAS VEGAS BLVD. S., SUITE 320, LAS VEGAS, NV 89119
PHONE: 702-882-3600
WWW.KIMLEY-HORN.COM

PROJECT NAME
CHICK-FIL-A
RESTAURANT
NO. 04198

STORE
HWY 95 &
LAKE MEAD

HWY 95 @
LAKE MEAD BLVD
LAS VEGAS, NV

SHEET TITLE
TYPICAL SECTIONS

VERSION: PRELIM
ISSUE DATE: TBD

Store : 04198
Date : 12/13/17
Design By : JZ
Drawn By : CT
Checked By: TW

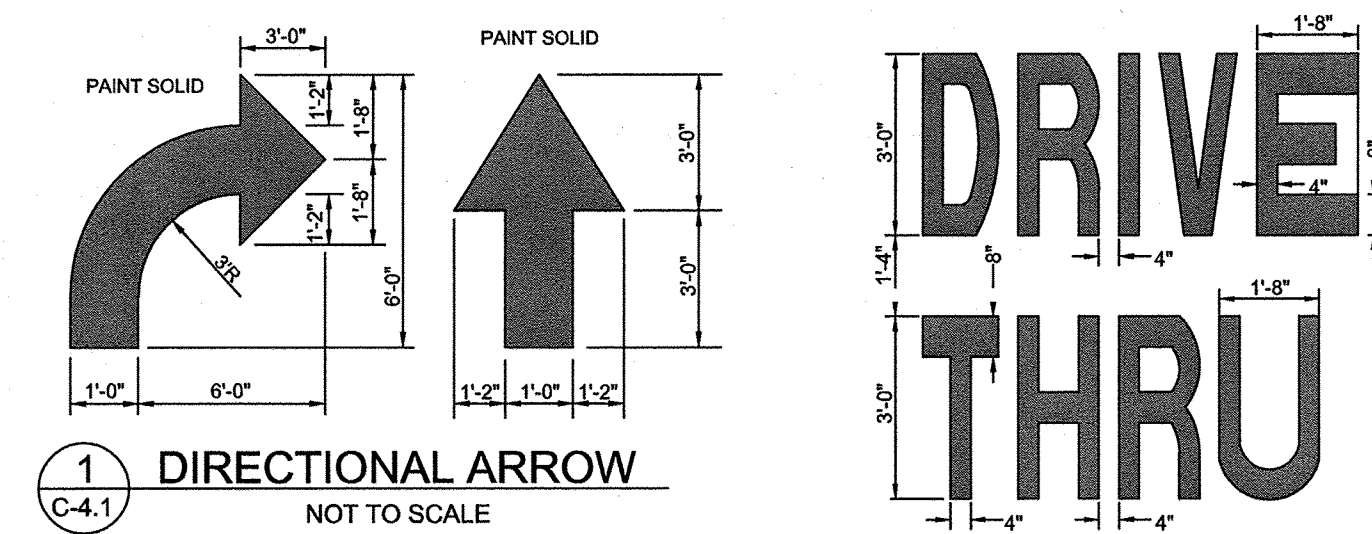
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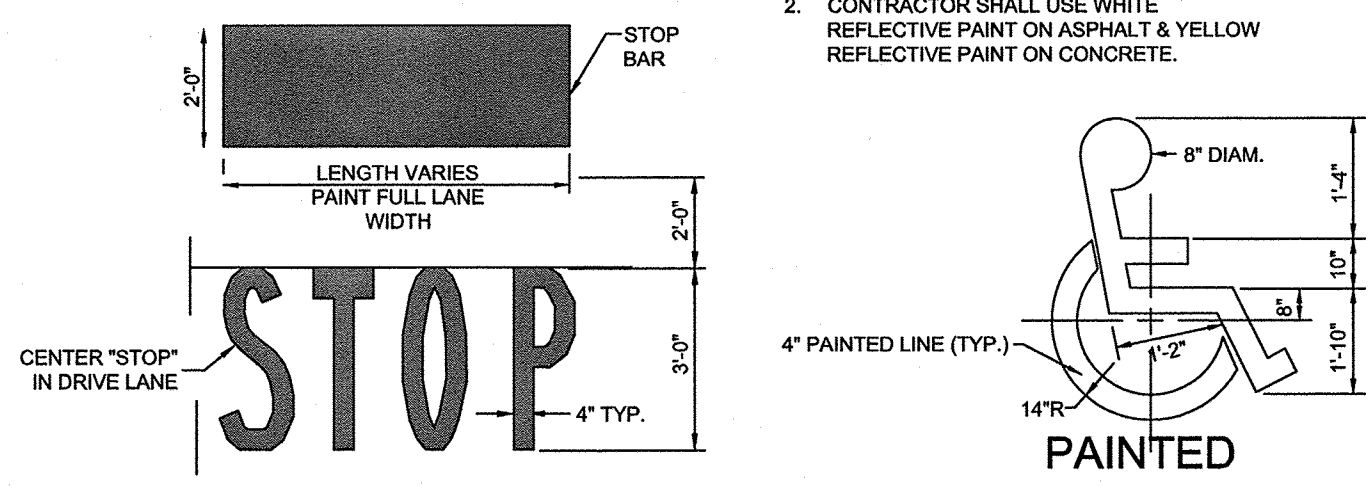
C3.1

7 OF 13 SHEETS



1 DIRECTIONAL ARROW
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.

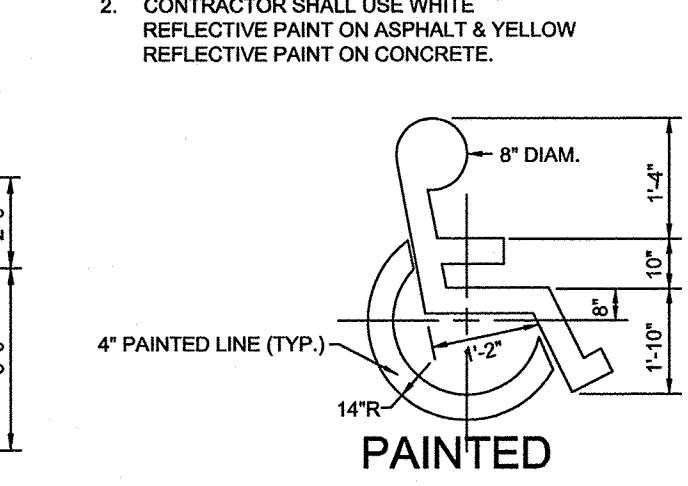


3 STOP LINE GRAPHIC
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.
 3. IF STOP SIGN IS PROPOSED, STOP LINE GRAPHIC IS NOT REQUIRED.

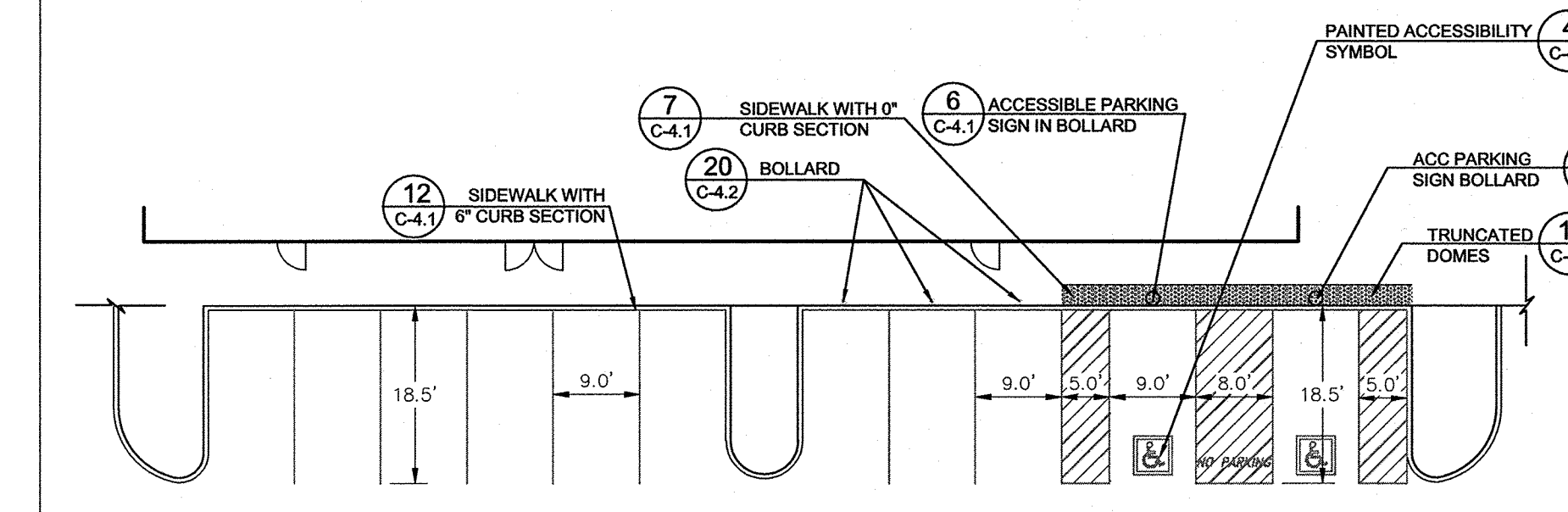
2 DRIVE-THRU GRAPHICS
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.



4 ACCESSIBILITY SYMBOL
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE, UNLESS UPON VERIFICATION BY THE GENERAL CONTRACTOR IT IS DETERMINED THAT LOCAL, STATE, OR ADA CODES DIFFER, IN WHICH CASE THESE CODES SHALL GOVERN.



5 STANDARD PARKING STALL
C-4.1 NOT TO SCALE

- NOTES:
1. ACCESSIBLE PARKING AND ACCESSIBLE AISLES SHALL NOT EXCEED 1.5% IN SLOPE IN ANY DIRECTION. IF ONLY ONE ACCESS AISLE IS INSTALLED, IT IS TO BE A VAN SIZE.
 2. PARKING STALL DIMENSIONING SHALL BE IN ACCORDANCE WITH APPLICABLE GOVERNING AUTHORITY'S AND ADA STANDARDS AND IF DIFFERENT THAN THIS DETAIL SHALL BE THE DIMENSIONING SHOWN ON THE SITE LAYOUT PLAN.
 3. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS.
 4. CONTRACTOR SHALL USE 4" WIDE WHITE REFLECTIVE PAINT FOR STRIPING ON ASPHALT PARKING LOTS.
 5. CONTRACTOR SHALL USE 4" WIDE YELLOW REFLECTIVE PAINT FOR STRIPING ON CONCRETE PARKING LOTS.
 6. NO WHEEL STOPS TO BE INSTALLED WHEN PARKING IS ADJACENT TO SIDEWALK.
 7. ADA SIGNS IN BOLLARDS AND BOLLARDS SHALL BE INSTALLED WHEN PARKING IS ADJACENT TO FLUSH CURB OR A RAMP.

- PARKING LOT STRIPING SPECIFICATIONS:
- STANDARDS:
1. ALWAYS FOLLOW ALL APPLICABLE GOVERNING AUTHORITY'S STANDARDS.
 2. SURFACES SHOULD BE CLEAN, DRY, AND FREE FROM LOOSE OR PEELING PAINT. REMOVE ALL OIL, DUST, GREASE, DIRT, AND OTHER FOREIGN MATERIAL TO ENSURE ADEQUATE ADHESION. DO NOT APPLY WHEN AIR OR SURFACE TEMPERATURES ARE BELOW 40°F.
 3. APPLY SHERWIN-WILLIAMS LANCER PREMIUM ALKYL ZONE MARKING PAINT A300 WHITE OR A303 YELLOW USING EITHER AIRLESS OR CONVENTIONAL LINE STRIPING EQUIPMENT. USE THE FOLLOWING SETTINGS AS A GUIDE-ACTUAL SETTINGS DEPEND ON ATMOSPHERIC CONDITIONS AT THE TIME OF APPLICATION:

- AIRLESS
- PRESSURE 1800-2700 PSI
 - HOSE 1/2" ID
 - TIP 0.015-0.017"
 - FILTER 60 MESH
 - REDUCTION ONLY IF NECESSARY, UP TO 1PT/GAL VMSP NAPTHA R1K3

- CONVENTIONAL
- GUN BLINKS 21 (BLEEDER) OR EQUIVALENT
 - FLUID NOZZLE #68
 - AIR NOZZLE INTERNAL MIX, #709
 - ATOMIZATION PRESSURE 45-60 PSI
 - FLUID PRESSURE 40-70 PSI
 - REDUCTION ONLY IF NECESSARY, UP TO 1PT/GAL VMSP NAPTHA R1K3

- SHERWIN WILLIAMS, H&C SHARK GRIP SLIP RESISTANT ADDITIVE TO BE MEASURED AND ADDED TO ALL PAINT PER MANUFACTURER'S WRITTEN SPECIFICATIONS. MIX THOROUGHLY PER MANUFACTURER'S RECOMMENDATIONS SO THAT NO CLUMPING IS APPARENT AND UNTIL EVEN DISTRIBUTION IS ACHIEVED. MAINTAIN EVEN DISTRIBUTION OF ADDITIVE IN PAINT THROUGHOUT THE APPLICATION PROCESS.

- MIX PAINT THOROUGHLY BY BOXING, STIRRING, OR POWER AGITATION BEFORE USE. APPLY AT 15 MILS WET TO ACHIEVE A SPREAD RATE OF 400-500 LINEAL FEET OF STANDARD 4" STRIPE PER GALLON. APPLIED AT THIS RATE AT 70 DEGREES F AND 50% RELATIVE HUMIDITY, PAINT WILL DRY WITH NO TRAFFIC PICKUP AFTER 30 MINUTES.

- GENERAL CONTRACTOR TO RE-STRIPE THE LOT 45 DAYS AFTER OPENING.

- CONTRACTOR SHALL USE 4" WIDE WHITE REFLECTIVE PAINT FOR STRIPING ON ASPHALT PARKING LOTS.

- CONTRACTOR SHALL USE 4" WIDE YELLOW REFLECTIVE PAINT FOR STRIPING ON CONCRETE PARKING LOTS.

- NO WHEEL STOPS TO BE INSTALLED WHEN PARKING IS ADJACENT TO SIDEWALK.

- ADA SIGNS IN BOLLARDS AND BOLLARDS SHALL BE INSTALLED WHEN PARKING IS ADJACENT TO FLUSH CURB OR A RAMP.

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- PARKING STALL DIMENSIONING SHALL BE IN ACCORDANCE WITH APPLICABLE GOVERNING AUTHORITY'S AND ADA STANDARDS AND IF DIFFERENT THAN THIS DETAIL SHALL BE THE DIMENSIONING SHOWN ON THE SITE LAYOUT PLAN.

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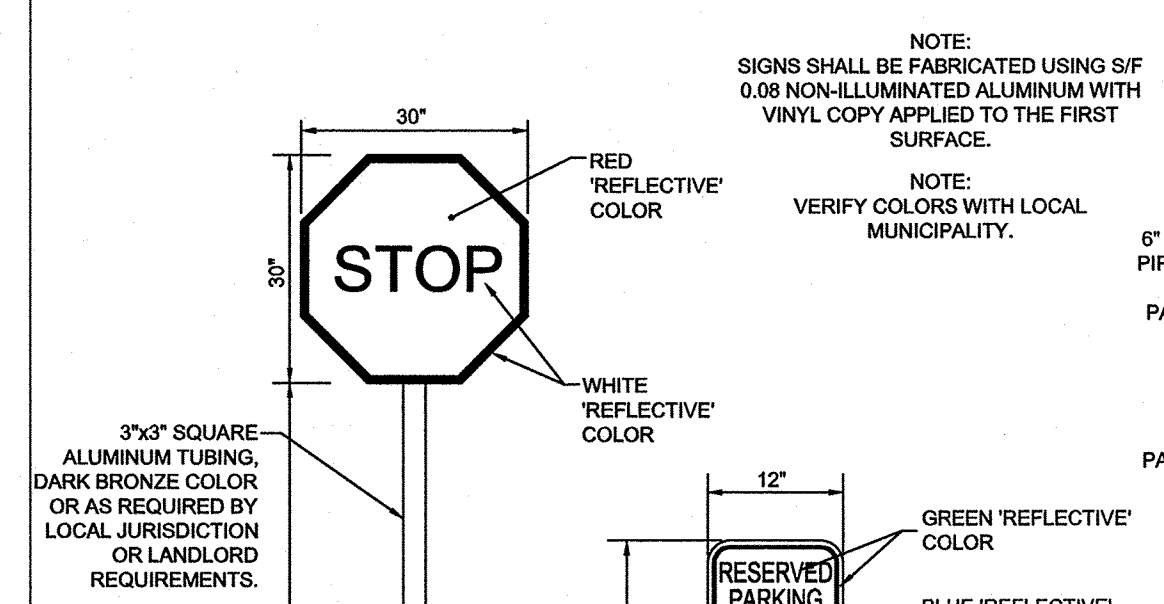
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STOP SIGN & STANDARD MOUNTING POST (MUTCD R 1-1)

- NOTES:
1. SIGNS SHALL BE FABRICATED USING S/F 0.08 NON-ILLUMINATED ALUMINUM WITH VINYL COPY APPLIED TO THE FIRST SURFACE.
 2. VERIFY COLORS WITH LOCAL MUNICIPALITY.

- RESERVED PARKING SIGN (MUTCD R 7-8 AND R 7-8PS)

- ACCESSIBLE PARKING SIGN (MUTCD R 7-8 AND R 7-8PS)

- ONE WAY SIGN (REFER TO SIGN PACKAGE)

- DO NOT ENTER (REFER TO SIGN PACKAGE)

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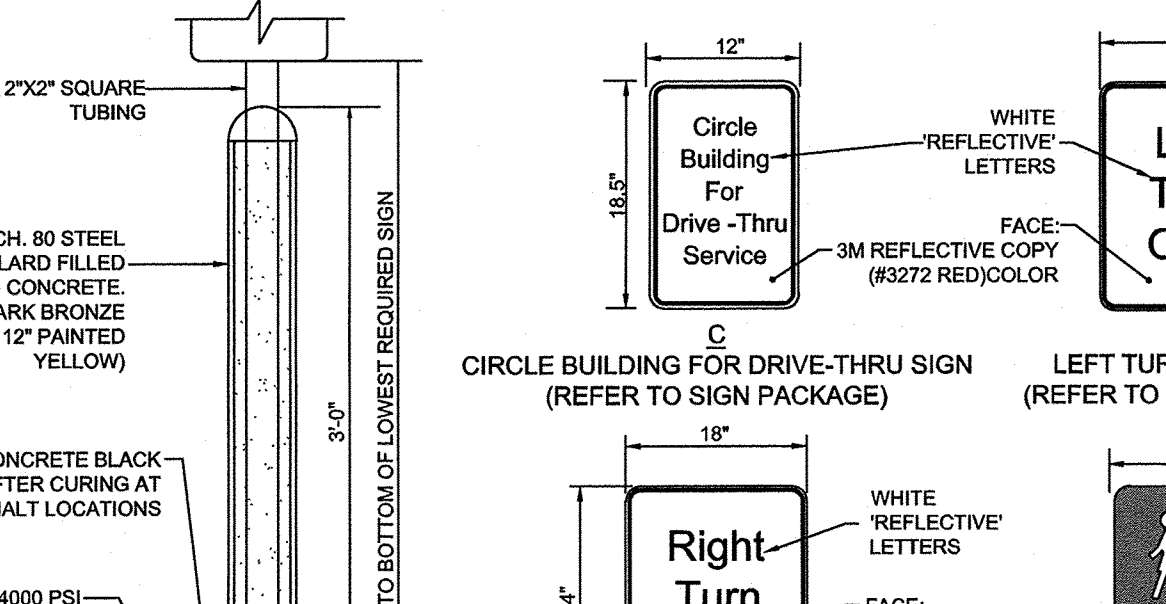
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- ONE WAY SIGN (REFER TO SIGN PACKAGE)



CIRCLE BUILDING FOR DRIVE-THRU SIGN (REFER TO SIGN PACKAGE)

- LEFT TURN ONLY SIGN (REFER TO SIGN PACKAGE)

- RIGHT TURN ONLY SIGN (REFER TO SIGN PACKAGE)

- ONE WAY SIGN (REFER TO SIGN PACKAGE)

- DO NOT ENTER (REFER TO SIGN PACKAGE)

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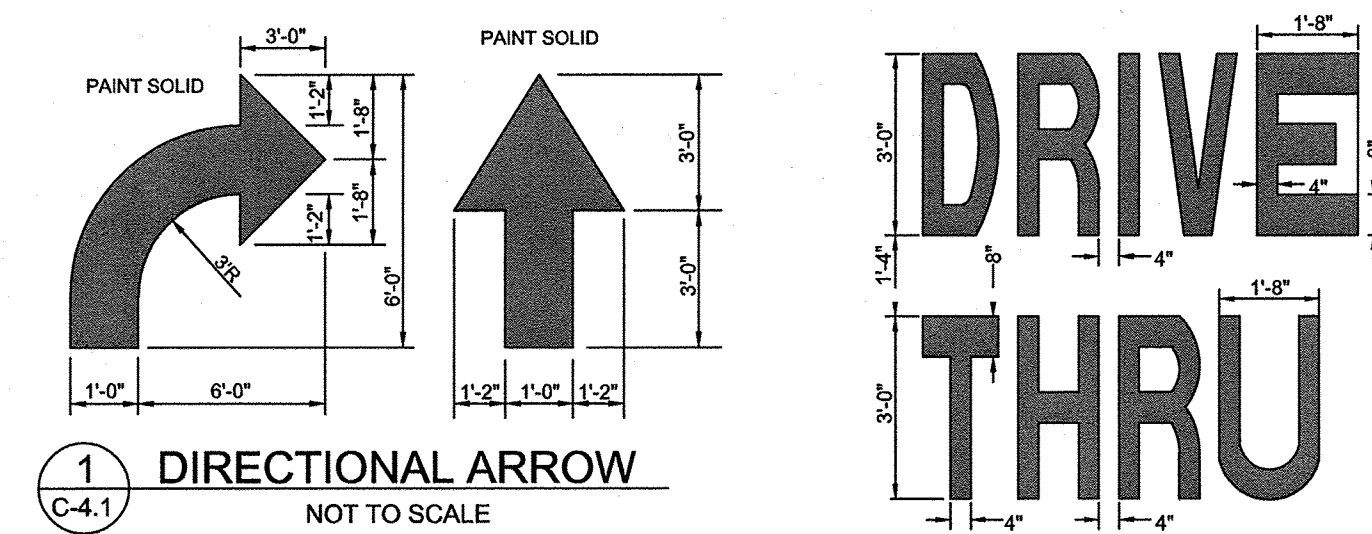
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- ONE WAY SIGN (REFER TO SIGN PACKAGE)

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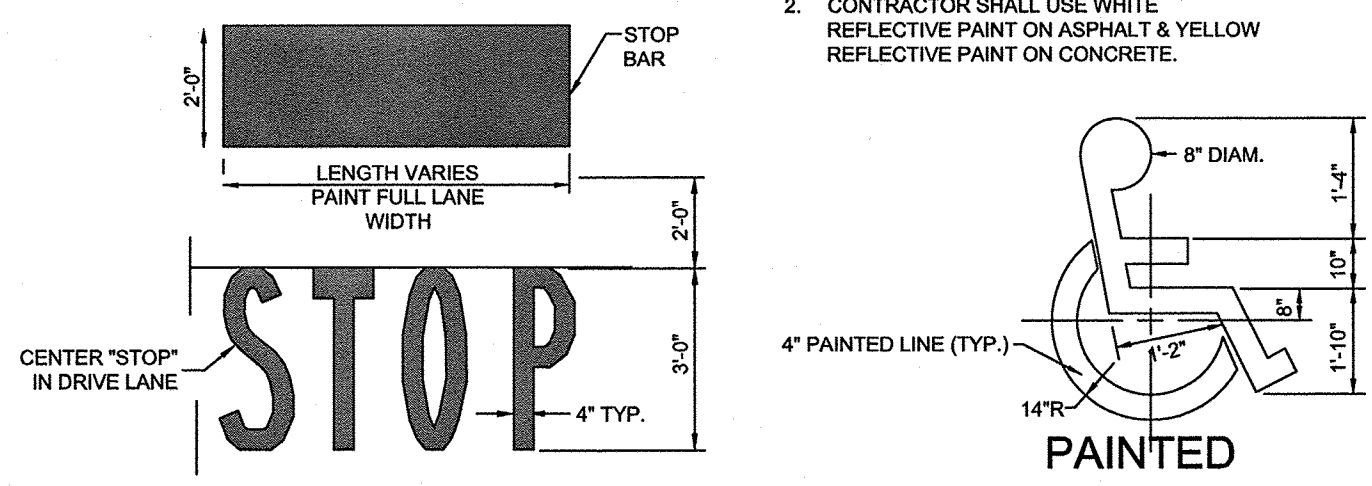
- ONE WAY SIGN (REFER TO SIGN PACKAGE)

- DO NOT ENTER (REFER TO SIGN PACKAGE)



1 DIRECTIONAL ARROW
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.

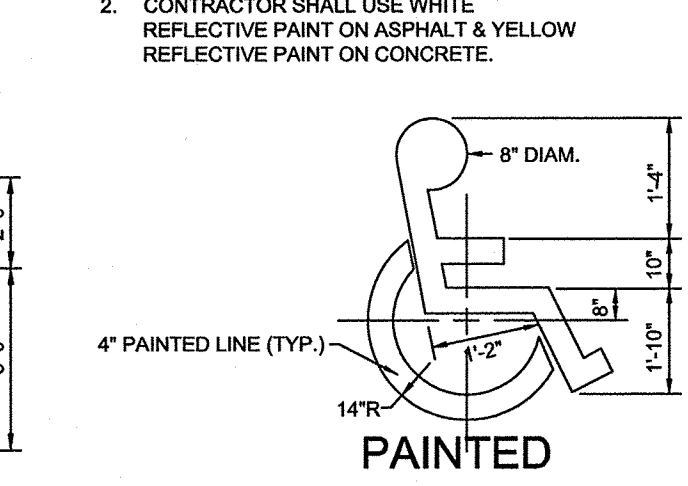


3 STOP LINE GRAPHIC
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.
 3. IF STOP SIGN IS PROPOSED, STOP LINE GRAPHIC IS NOT REQUIRED.

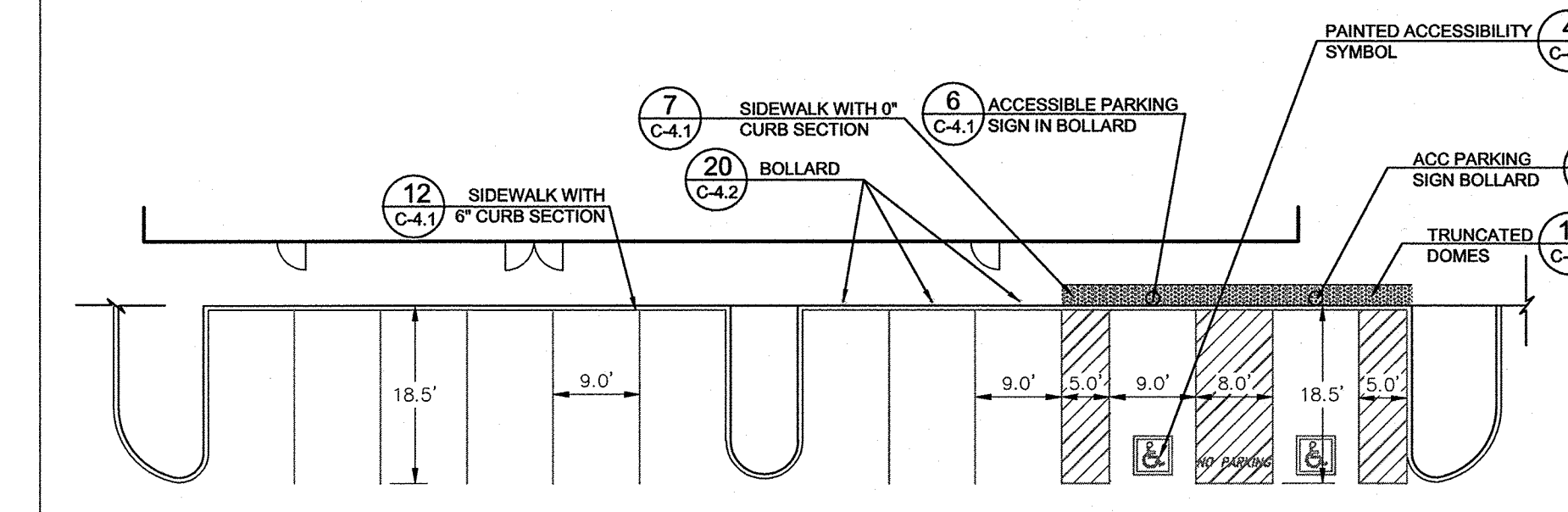
2 DRIVE-THRU GRAPHICS
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.



4 ACCESSIBILITY SYMBOL
C-4.1 NOT TO SCALE

- NOTES:
1. GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 2. CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE, UNLESS UPON VERIFICATION BY THE GENERAL CONTRACTOR IT IS DETERMINED THAT LOCAL, STATE, OR ADA CODES DIFFER, IN WHICH CASE THESE CODES SHALL GOVERN.



5 STANDARD PARKING STALL
C-4.1 NOT TO SCALE

- NOTES:
1. ACCESSIBLE PARKING AND ACCESSIBLE AISLES SHALL NOT EXCEED 1.5% IN SLOPE IN ANY DIRECTION. IF ONLY ONE ACCESS AISLE IS INSTALLED, IT IS TO BE A VAN SIZE.
 2. PARKING STALL DIMENSIONING SHALL BE IN ACCORDANCE WITH APPLICABLE GOVERNING AUTHORITY'S AND ADA STANDARDS AND IF DIFFERENT THAN THIS DETAIL SHALL BE THE DIMENSIONING SHOWN ON THE SITE LAYOUT PLAN.
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 4. CONTRACTOR SHALL USE 4" WIDE WHITE REFLECTIVE PAINT FOR STRIPING ON ASPHALT PARKING LOTS.
 5. CONTRACTOR SHALL USE 4" WIDE YELLOW REFLECTIVE PAINT FOR STRIPING ON CONCRETE PARKING LOTS.
 6. NO WHEEL STOPS TO BE INSTALLED WHEN PARKING IS ADJACENT TO SIDEWALK.
 7. ADA SIGNS IN BOLLARDS AND BOLLARDS SHALL BE INSTALLED WHEN PARKING IS ADJACENT TO FLUSH CURB OR A RAMP.

- PARKING LOT STRIPING SPECIFICATIONS:
- STANDARDS:
1. ALWAYS FOLLOW ALL APPLICABLE GOVERNING AUTHORITY'S STANDARDS.
 2. SURFACES SHOULD BE CLEAN, DRY, AND FREE FROM LOOSE OR PEELING PAINT. REMOVE ALL OIL, DUST, GREASE, DIRT, AND OTHER FOREIGN MATERIAL TO ENSURE ADEQUATE ADHESION. DO NOT APPLY WHEN AIR OR SURFACE TEMPERATURES ARE BELOW 40°F.
 3. APPLY SHERWIN-WILLIAMS LANCER PREMIUM ALKYL ZONE MARKING PAINT A300 WHITE OR A303 YELLOW USING EITHER AIRLESS OR CONVENTIONAL LINE STRIPING EQUIPMENT. USE THE FOLLOWING SETTINGS AS A GUIDE-ACTUAL SETTINGS DEPEND ON ATMOSPHERIC CONDITIONS AT THE TIME OF APPLICATION:

- AIRLESS
- PRESSURE 1800-2700 PSI
 - HOSE 1/2" ID
 - TIP 0.015-0.017"
 - FILTER 60 MESH
 - REDUCTION ONLY IF NECESSARY, UP TO 1PT/GAL VMSP NAPTHA R1K3

- CONVENTIONAL
- GUN BLINKS 21 (BLEEDER) OR EQUIVALENT
 - FLUID NOZZLE #68
 - AIR NOZZLE INTERNAL MIX, #709
 - ATOMIZATION PRESSURE 45-60 PSI
 - FLUID PRESSURE 40-70 PSI
 - REDUCTION ONLY IF NECESSARY, UP TO 1PT/GAL VMSP NAPTHA R1K3

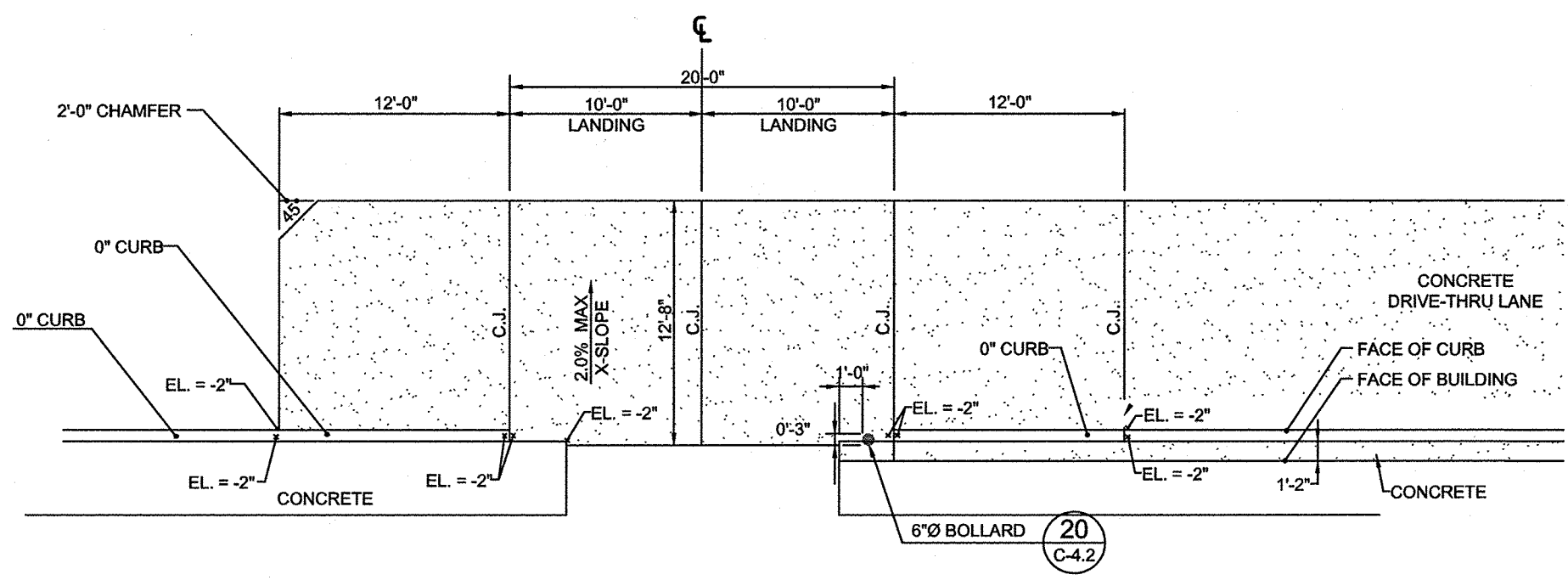
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- MIX PAINT THOROUGHLY BY BOXING, STIRRING, OR POWER AGITATION BEFORE USE. APPLY AT 15 MILS WET TO ACHIEVE A SPREAD RATE OF 400-500 LINEAL FEET OF STANDARD 4" STRIPE PER GALLON. APPLIED AT THIS RATE AT 70 DEGREES F AND 50% RELATIVE HUMIDITY, PAINT WILL DRY WITH NO TRAFFIC PICKUP AFTER 30 MINUTES.

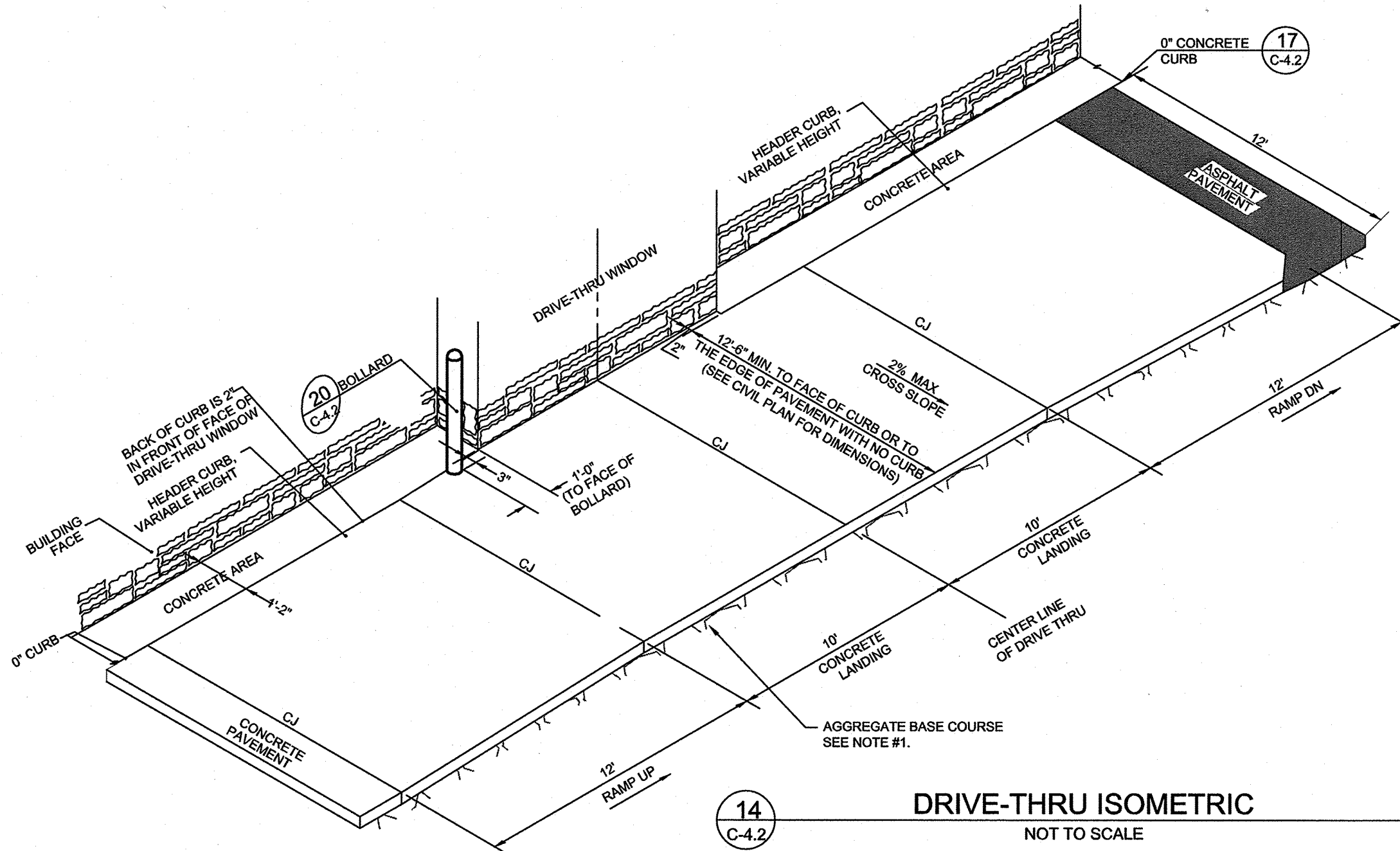
- GENERAL CONTRACTOR TO RE-STRIPE THE LOT 45 DAYS AFTER OPENING.

- CONTRACTOR SHALL USE 4" WIDE WHITE REFLECTIVE PAINT FOR STRIPING ON ASPHALT PARKING LOTS.

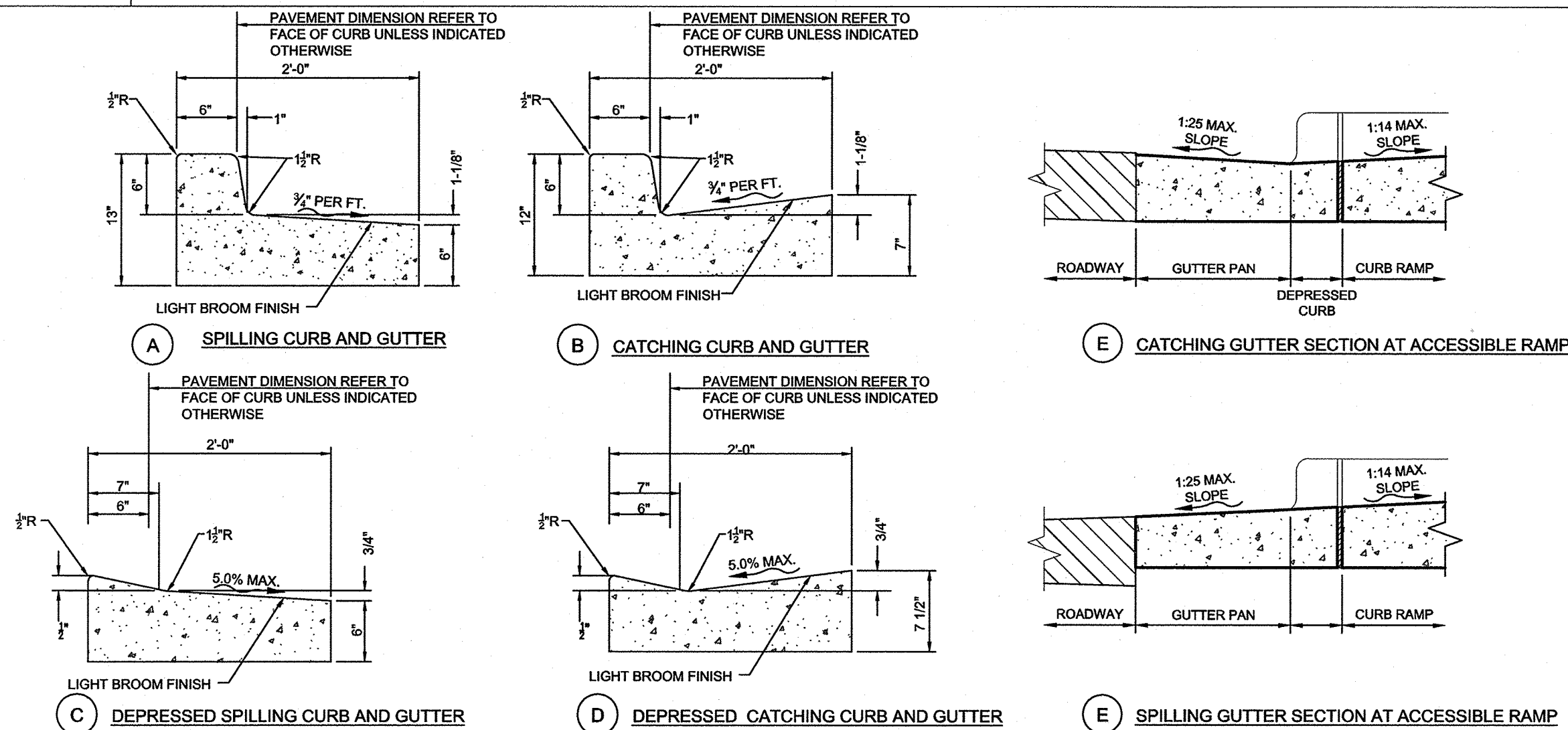
- CONTRACTOR SHALL USE 4" WIDE YELLOW REFLECTIVE PAINT FOR STRIPING ON CONCRETE PARK



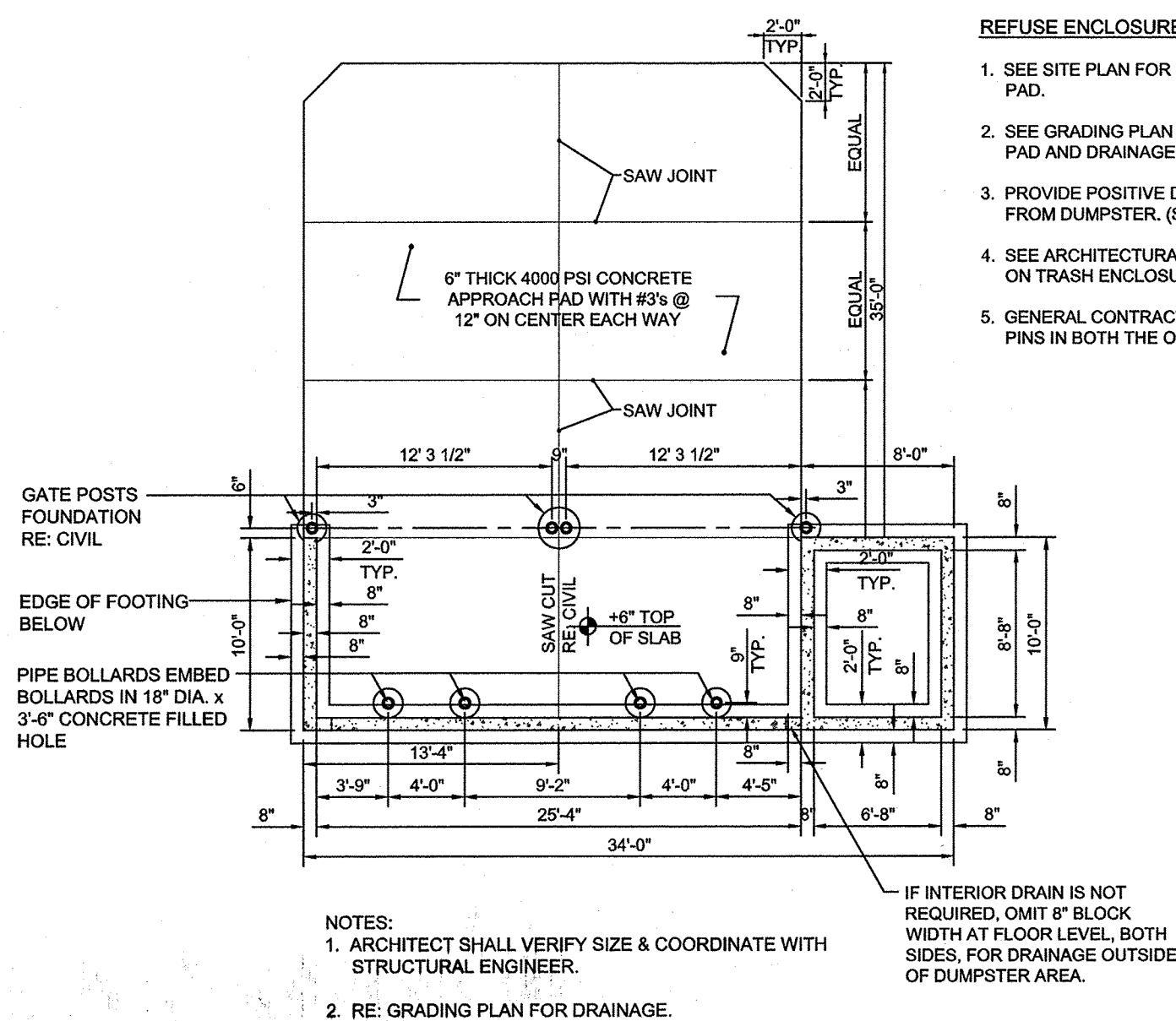
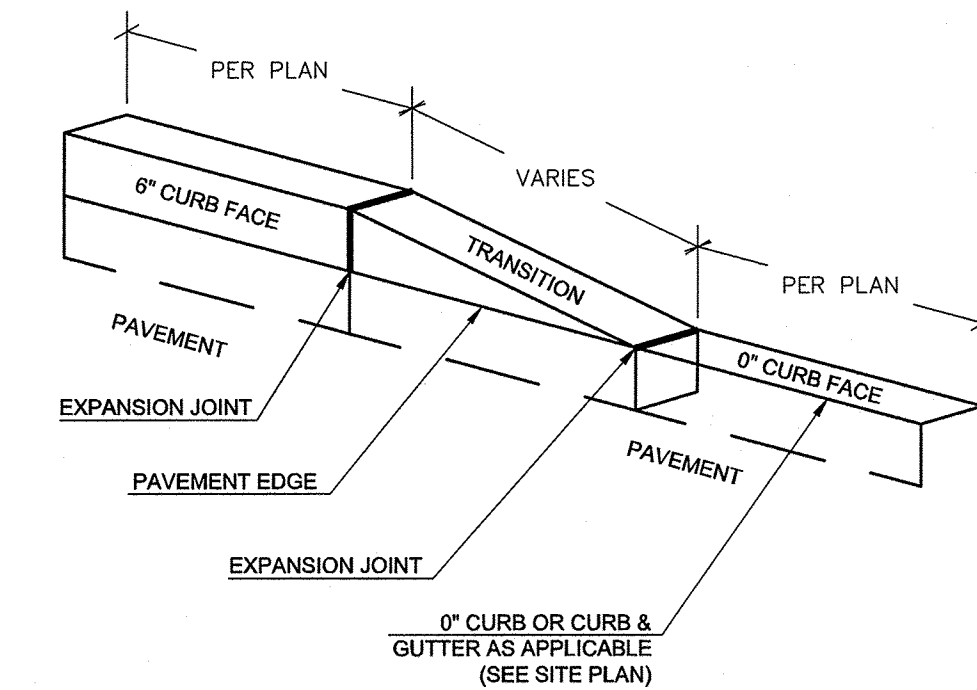
NOTE: ALL ELEVATIONS ON THIS DETAIL ARE RELATIVE TO FFE = 0'



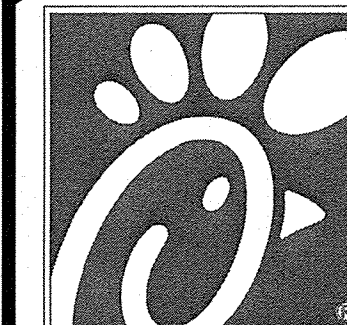
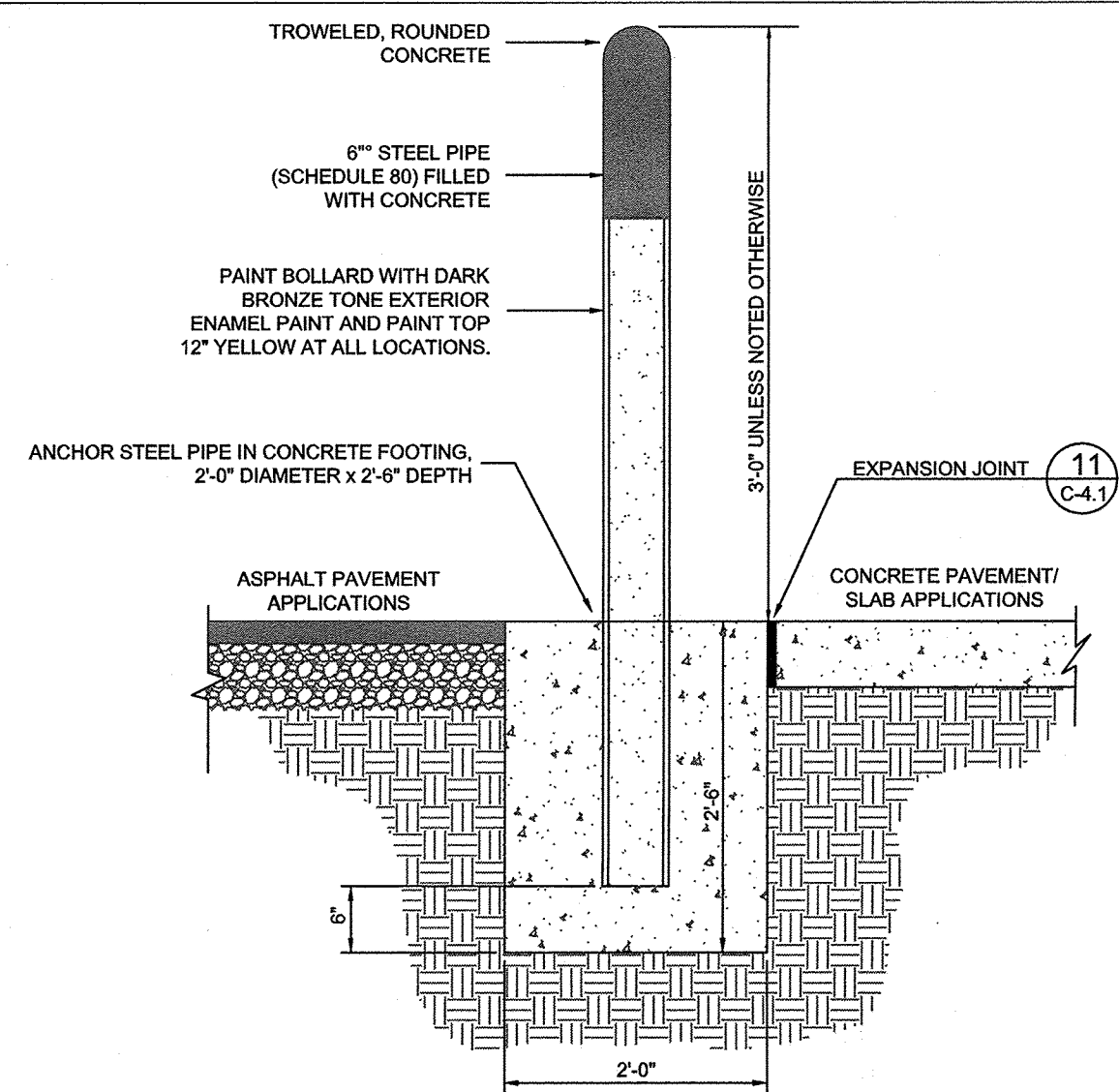
NOTE: 1. GENERAL CONTRACTOR SHALL REFERENCE GEOTECHNICAL REPORT FOR PAVEMENT SECTION REQUIREMENTS.



- NOTES:
1. CONCRETE FOR CURBING SHALL HAVE A MINIMUM COMPRESSIVE STRENGTH OF 3000 P.S.I. AT 28 DAYS.
 2. CONSTRUCTION STAKING FOR CURBING INSTALLATION SHALL BE REFERENCED (CUT OR FILL) TO THE TOP OF CURB.
 3. AT CONTRACTOR'S OPTION THE GUTTER THICKNESS MAY BE INCREASED AT THE EDGE OF PAVEMENT TO MAKE BOTTOM OF GUTTER PARALLEL WITH PAVING OF BASE COURSE.
 4. CONTRACTION JOINTS AT 10'-0" O.C. TOOLED 1/4" (±1/16"-0) WIDE, 1" OR MAX. D/4 DEEP WHICHEVER IS GREATER. EXPANSION JOINTS AT 40' MAX. AND ALL P.C.'S, UNLESS APPROVED OR INDICATED OTHERWISE ON PLAN VIEW JOINT PATTERN.



- REFUSE ENCLOSURE PLAN GENERAL NOTES:
1. SEE SITE PLAN FOR LAYOUT OF CONCRETE LOADING PAD.
 2. SEE GRADING PLAN FOR ELEVATIONS ON DUMPSTER PAD AND DRAINAGE OF INTERIOR TRASH ENCLOSURE.
 3. PROVIDE POSITIVE DRAINAGE ON APPROACH PAD AWAY FROM DUMPSTER. (SEE GRADING PLAN)
 4. SEE ARCHITECTURAL PLANS FOR ADDITIONAL DETAILS ON TRASH ENCLOSURE.
 5. GENERAL CONTRACTOR SHALL DRILL HOLES FOR GATE PINS IN BOTH THE OPEN AND CLOSED POSITION.



Chick-fil-A

5200 Buffington Rd.
Atlanta Georgia,
30349-2998

Revisions:

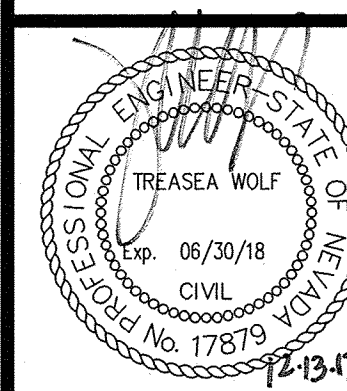
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Kimley-Horn
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6671 LAS VEGAS BLVD., SUITE 200
LAS VEGAS, NV 89119
PHONE: 702-882-3600
WWW.KIMLEY-HORN.COM

PROJECT NAME
CHICK-FIL-A
RESTAURANT
NO. 04198

STORE
HWY 95 &
LAKE MEAD

HWY 95 @
LAKE MEAD BLVD
LAS VEGAS, NV

SHEET TITLE
TYPICAL DETAILS 2

VERSION: PRELIM
ISSUE DATE: TBD

Store : 04198
Date : 12/13/17
Design By : JZ
Drawn By : CT
Checked By : TW

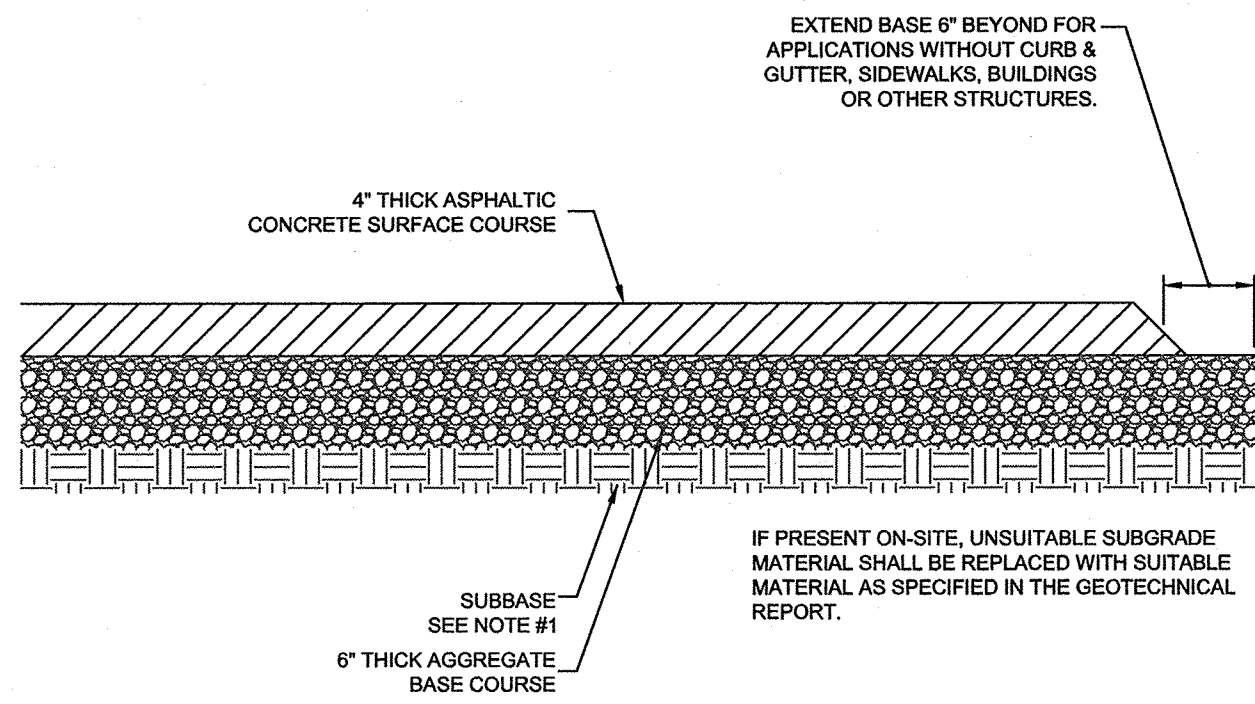
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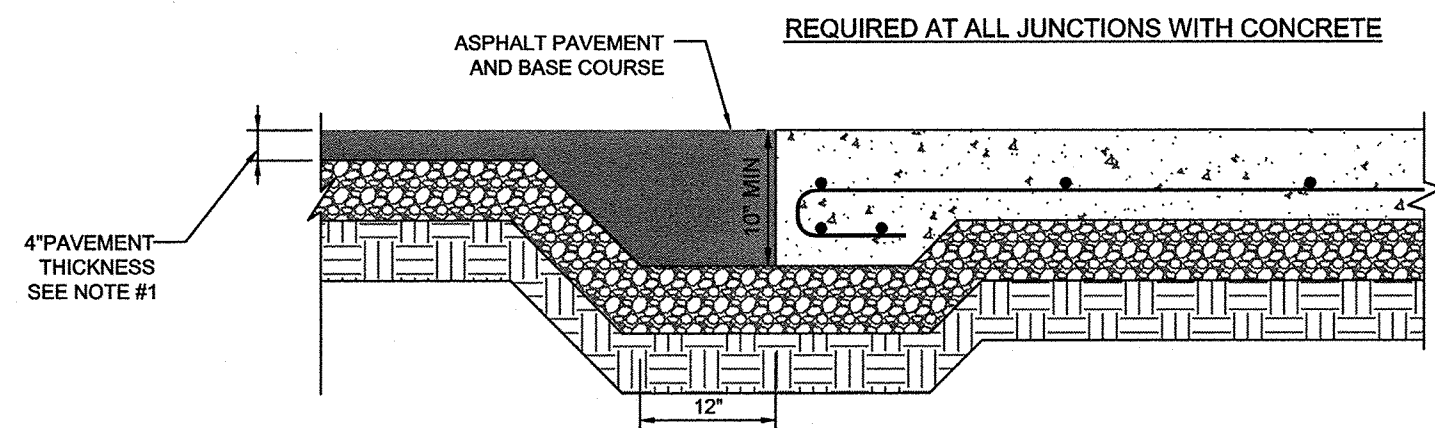
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9 OF 13 SHEETS



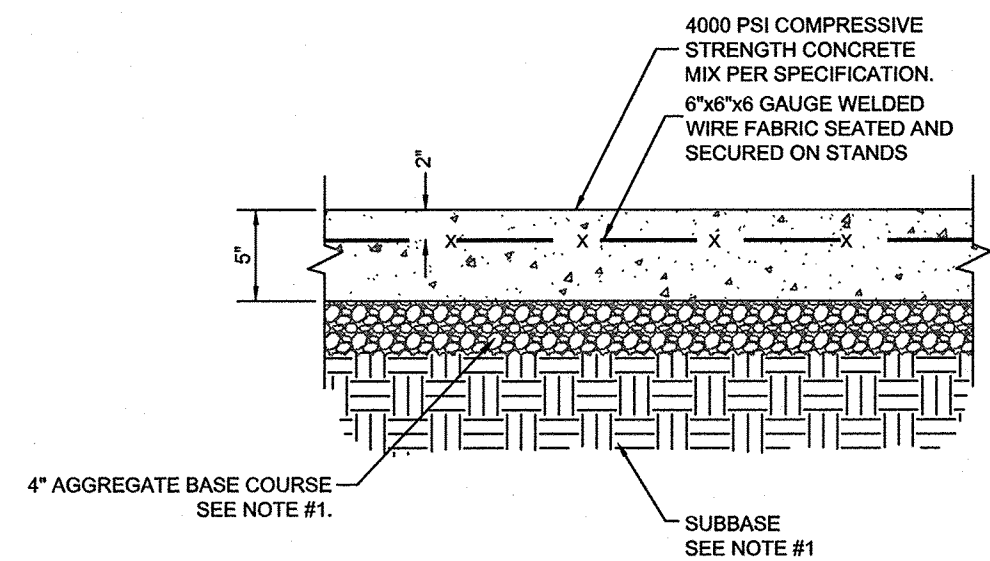
21
C-4.3 **TYPICAL ASPHALT SECTION**
NOT TO SCALE

- NOTE:
1. GENERAL CONTRACTOR SHALL REFERENCE SITE SPECIFIC GEOTECHNICAL REPORT FOR PAVEMENT, AGGREGATE, AND SUBGRADE SECTION REQUIREMENTS.
 2. MINIMUM PAVEMENT THICKNESS SHOULD BE 6\"/>



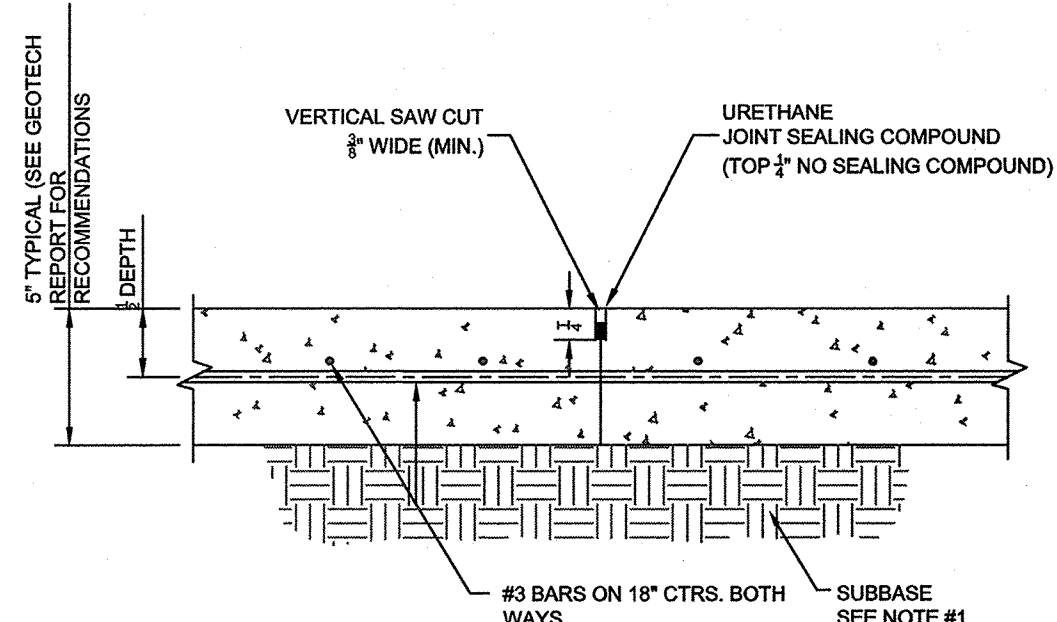
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C-4.3 **PAVEMENT EDGE DETAIL**
NOT TO SCALE

- NOTE:
1. GENERAL CONTRACTOR SHALL REFERENCE GEOTECHNICAL REPORT FOR PAVEMENT SECTION REQUIREMENTS.



25
C-4.3 **CONCRETE PAVING DRIVE-THRU LANE**
NOT TO SCALE

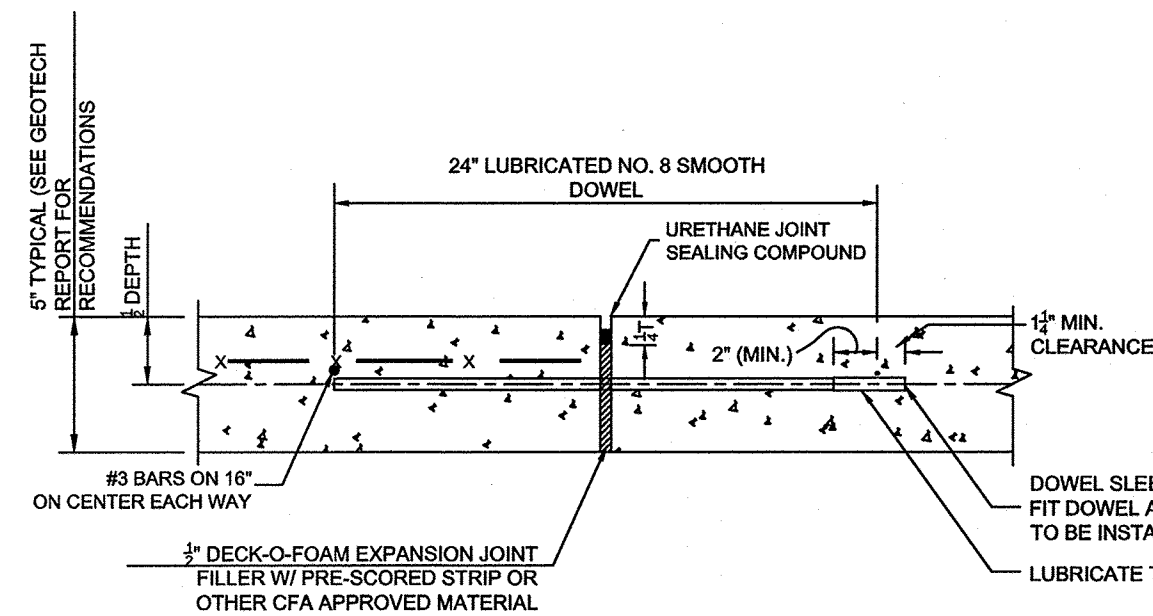
- NOTE:
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 2. MINIMUM PAVEMENT THICKNESS SHALL BE 8\"/>



- NOTES:
1. JOINT SPACING TO BE 12' x 12' WITH EVERY OTHER JOINT BEING AN EXPANSION JOINT.

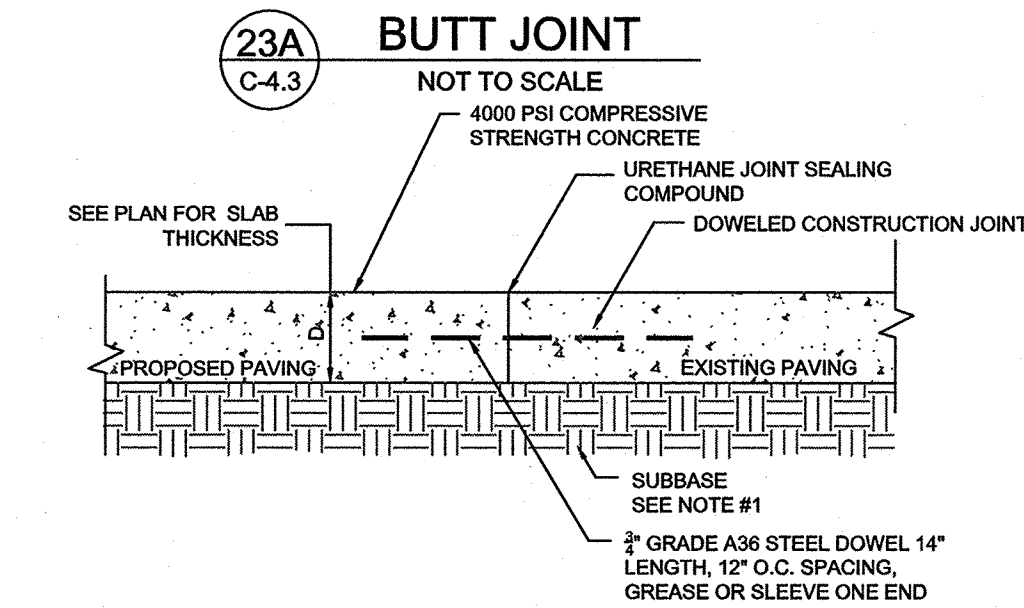
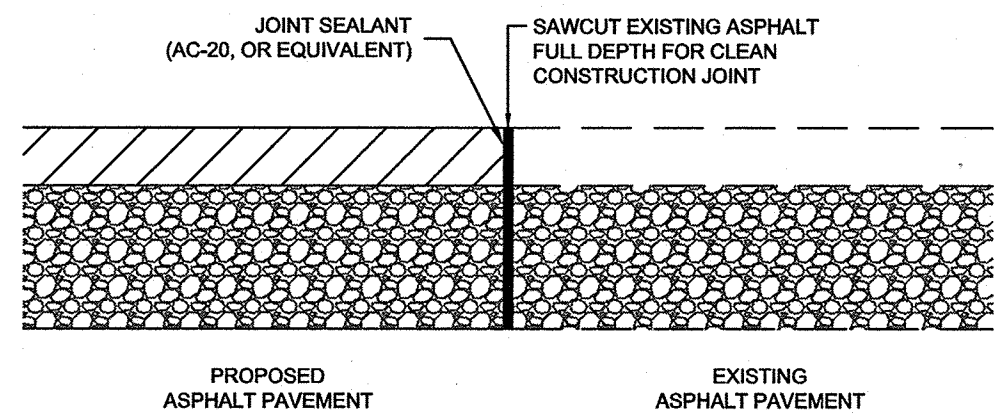
22
C-4.3 **CONTRACTION JOINT**
NOT TO SCALE

- NOTE:
1. GENERAL CONTRACTOR SHALL REFERENCE GEOTECHNICAL REPORT FOR PAVEMENT SECTION REQUIREMENTS.



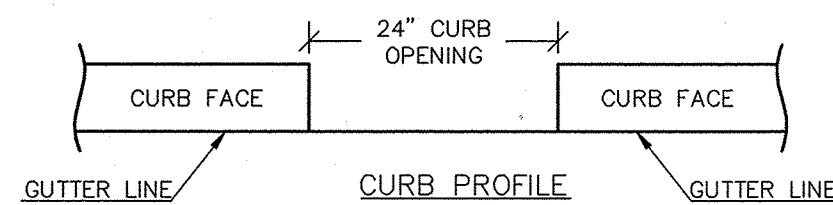
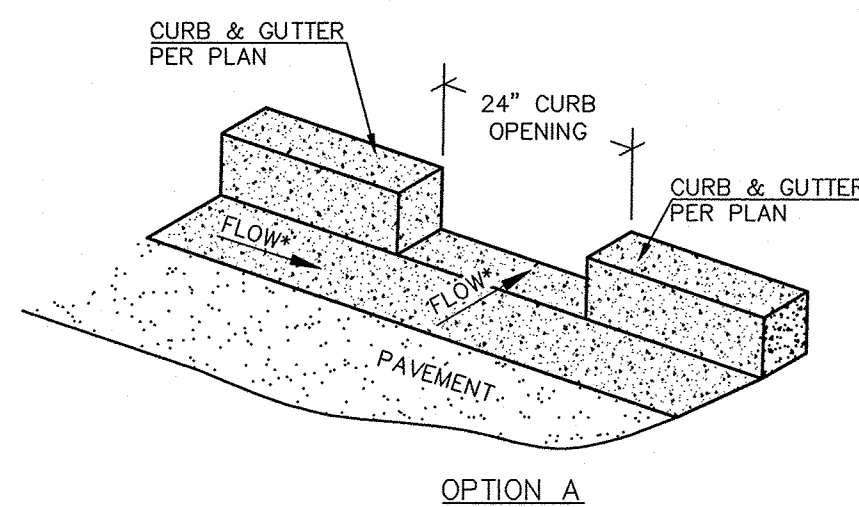
- NOTES:
1. NO. 5 SMOOTH DOWEL BAR MAY BE USED IN 5 INCH AND 6 INCH PAVEMENT THICKNESS.
 2. LONGITUDINAL BUTT CONSTRUCTION MAY BE UTILIZED IN PLACE OF LONGITUDINAL HINGED (KEYWAY) JOINT AT CONTRACTORS OPTION.
 3. DOWEL BARS SHALL BE DRILLED INTO PAVEMENT HORIZONTALLY BY USE OF A MECHANICAL EQUIPMENT.
 4. DRILLING BY HAND IS NOT ACCEPTABLE, PUSHING DOWEL BARS INTO WET CONCRETE NOT ACCEPTABLE.
 5. JOINT SPACING TO BE 24'X24' (EVERY OTHER JOINT)

26
C-4.3 **EXPANSION JOINT**
NOT TO SCALE

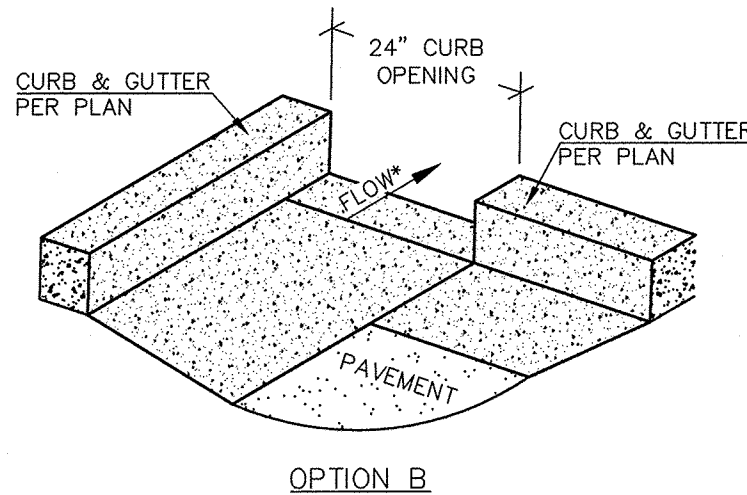


23
C-4.3 **TRANSVERSE AND LONGITUDINAL DOWELED CONSTRUCTION JOINT**
NOT TO SCALE

- NOTE:
1. GENERAL CONTRACTOR SHALL REFERENCE GEOTECHNICAL REPORT FOR PAVEMENT SECTION REQUIREMENTS.



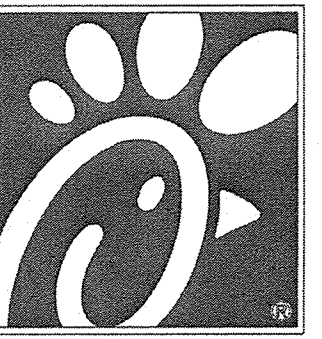
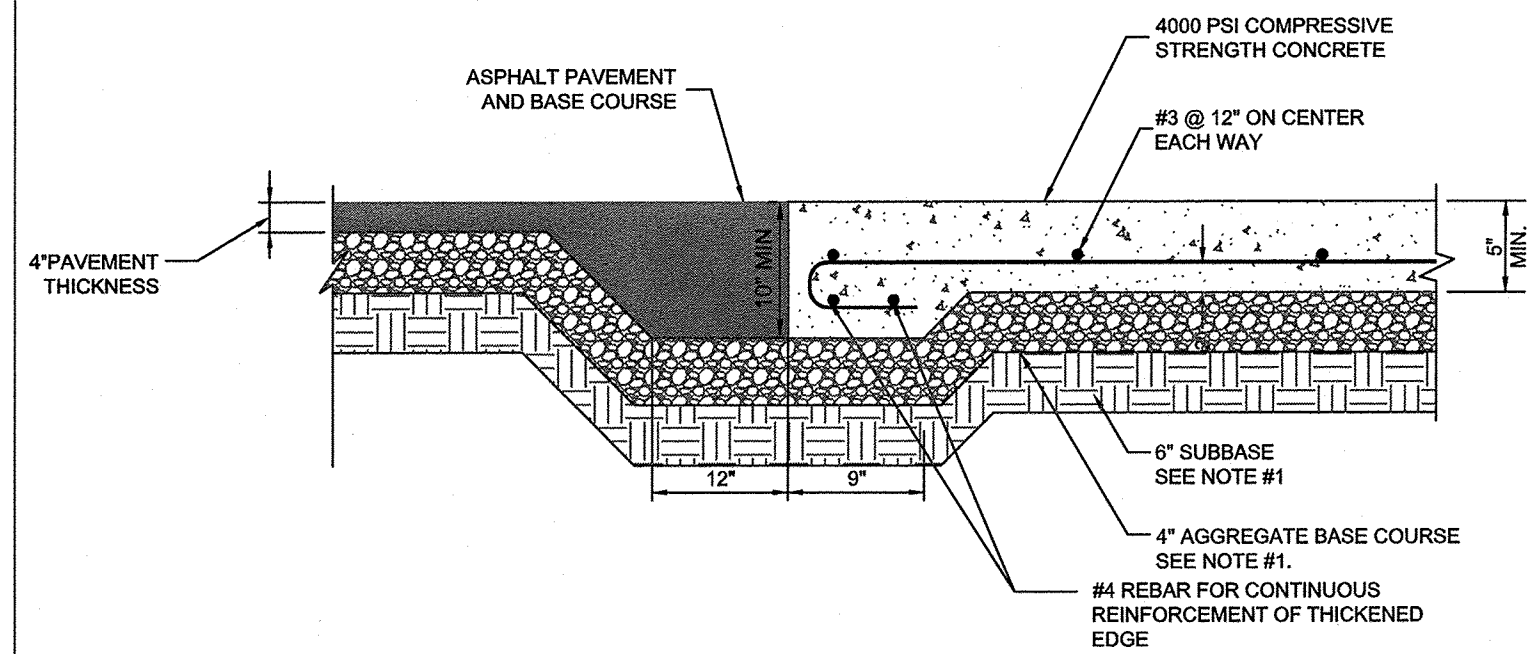
27
C-4.3 **2' WIDE CURB OPENING**
NOT TO SCALE



*COORDINATE WITH LANDSCAPE CONTRACTOR TO ENSURE PROPER DRAINAGE FROM OPENING

24
C-4.3 **CONCRETE APRON @ TRASH ENCLOSURE**
NOT TO SCALE

- NOTE:
1. GENERAL CONTRACTOR SHALL REFERENCE GEOTECHNICAL REPORT FOR PAVEMENT SECTION REQUIREMENTS.



Chick-fil-A

5200 Buffington Rd.
Atlanta Georgia,
30349-2998

Revisions:

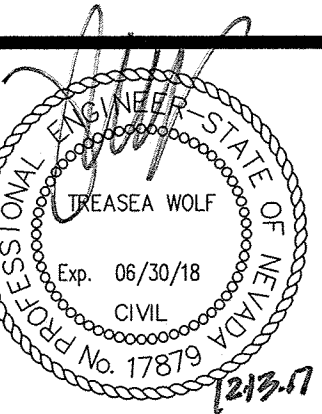
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Kimley»Horn
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6671 LAS VEGAS BLVD S., SUITE 320, LAS VEGAS, NV 89119
PHONE: 702-882-3600
WWW.KIMLEY-HORN.COM

PROJECT NAME
CHICK-FIL-A
RESTAURANT
NO. 04198

STORE
HWY 95 &
LAKE MEAD

HWY 95 @
LAKE MEAD BLVD
LAS VEGAS, NV

SHEET TITLE
TYPICAL DETAILS 3

VERSION: PRELIM
ISSUE DATE: TBD

Store : 04198
Date : 12/13/17
Design By : JZ
Drawn By : CT
Checked By : TW

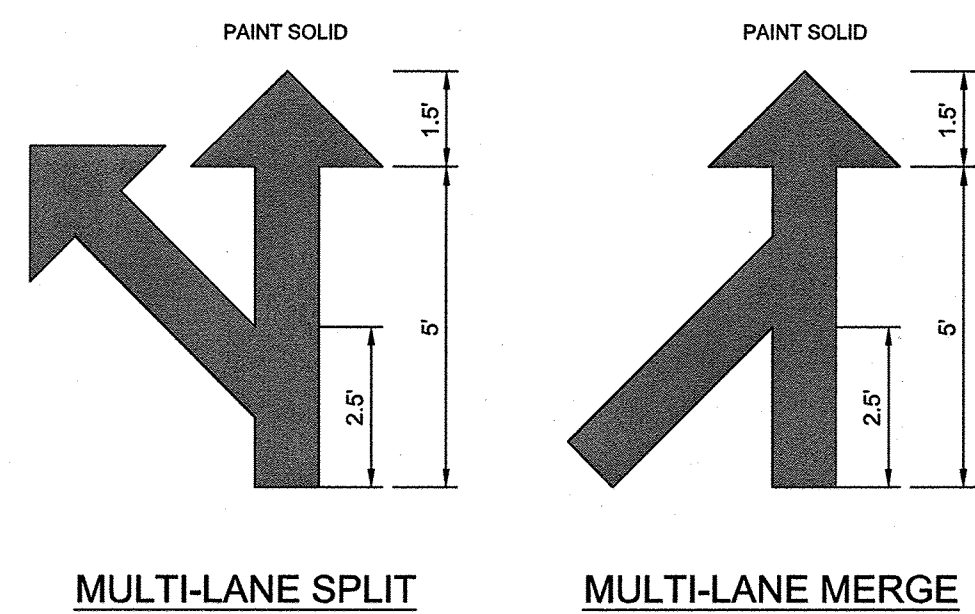
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AGENCY NO.
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C4.3

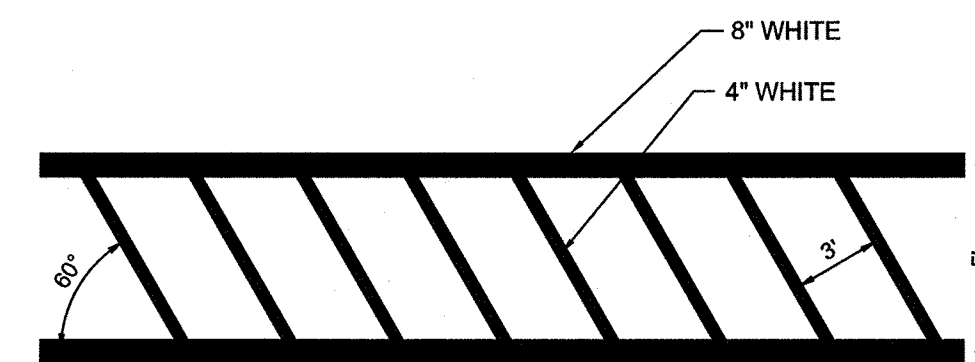
10 OF 13 SHEETS



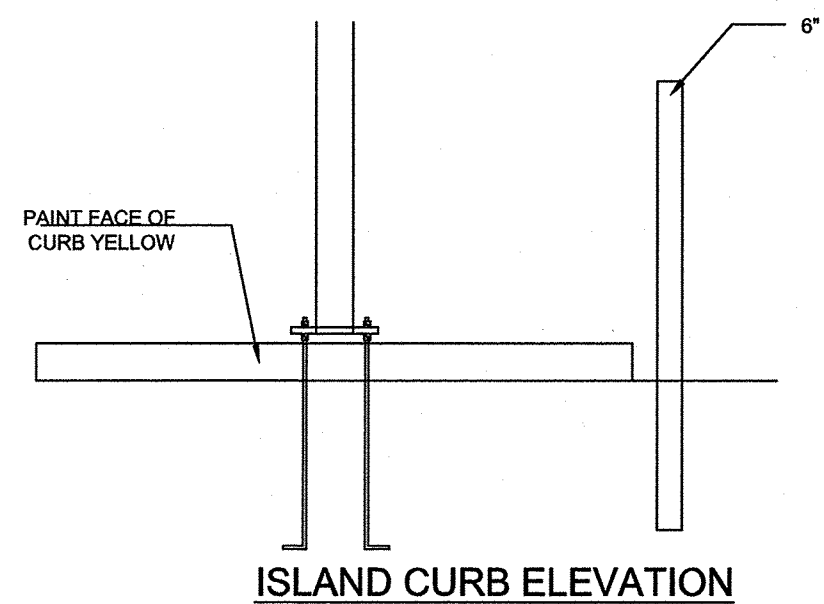
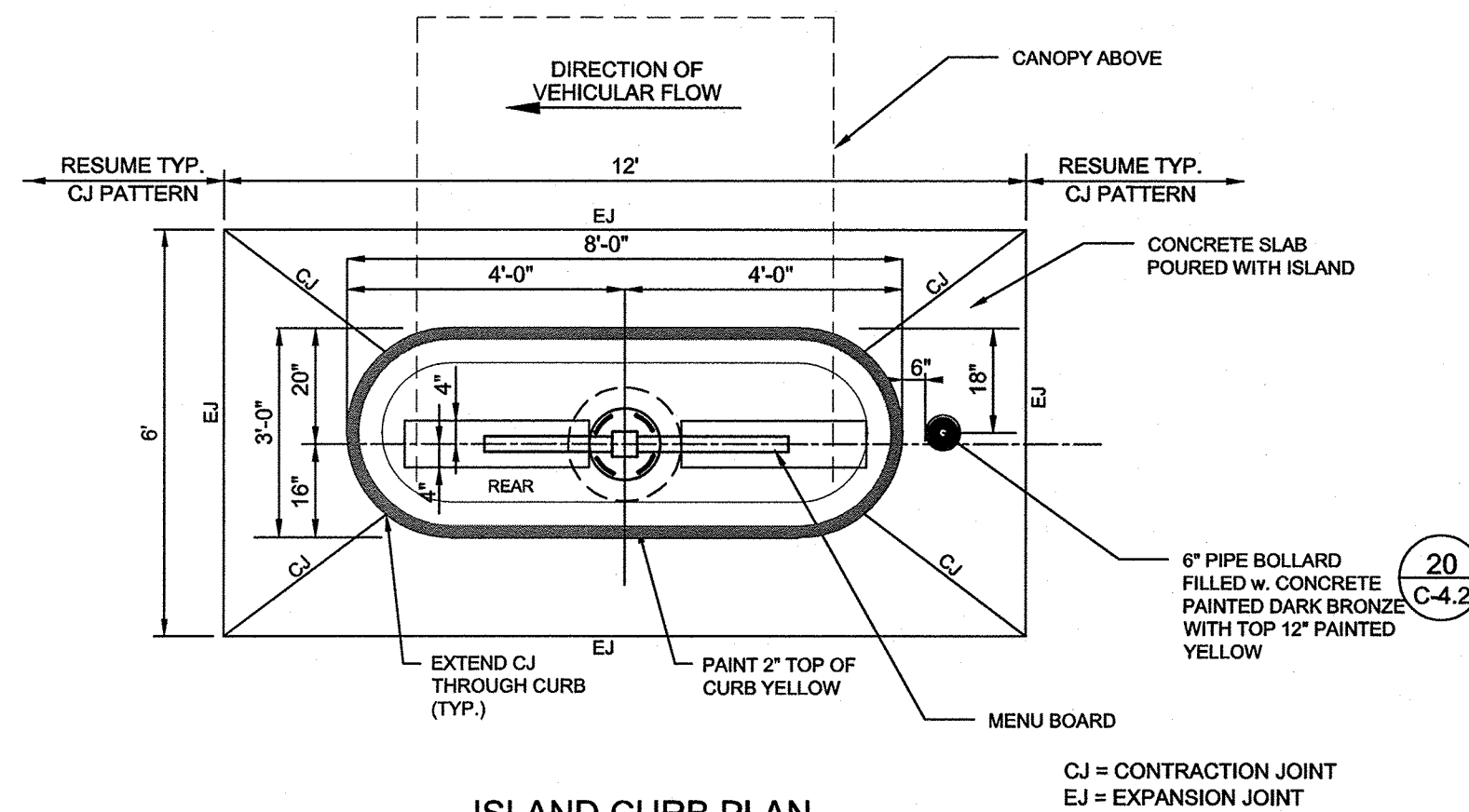
32 C-4.4 MULTI-LANE DIRECTIONAL GRAPHICS

NOT TO SCALE

- NOTES:
- GENERAL CONTRACTOR SHALL REFER TO CHICK-FIL-A PARKING LOT STRIPING SPECIFICATIONS, SEE DETAIL.
 - CONTRACTOR SHALL USE WHITE REFLECTIVE PAINT ON ASPHALT & YELLOW REFLECTIVE PAINT ON CONCRETE.

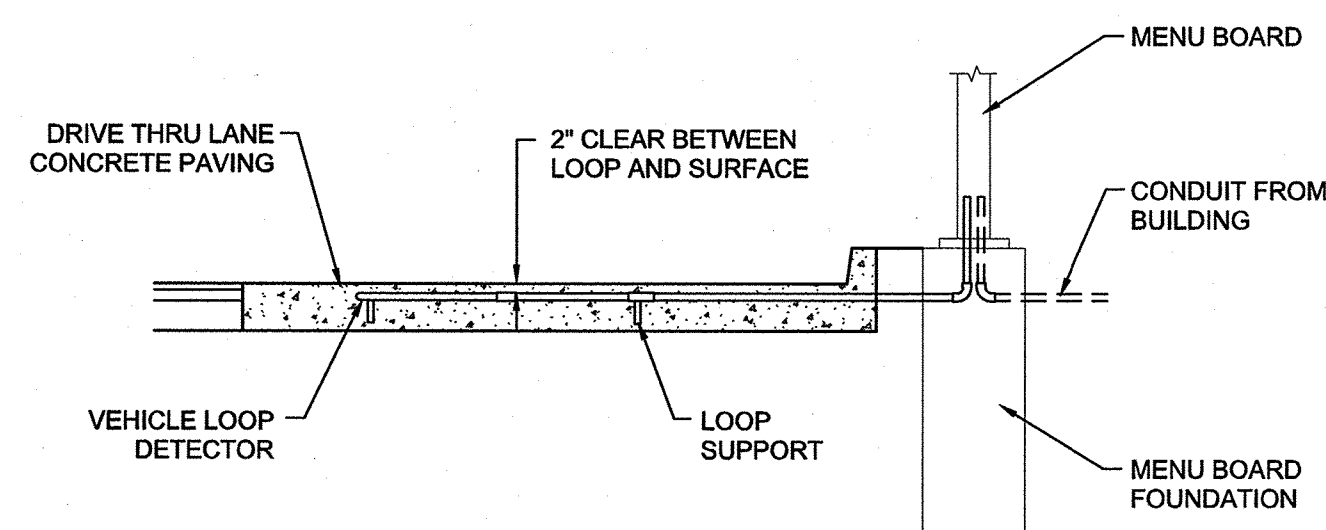
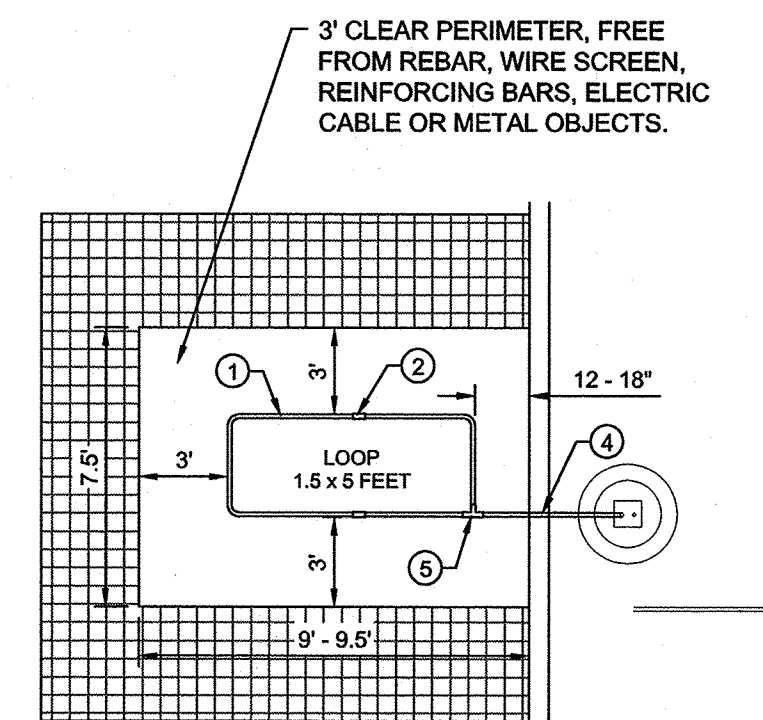


- NOTES:
- REFER TO PARKING LOT STRIPING SPECIFICATION.
 - CROSSWALK ALONG AN ACCESSIBLE ROUTE SHALL MAINTAIN A CROSS SLOPE OF 1.5% MAX AND A RUNNING SLOPE OF 5% MAX.



34 C-4.4 DRIVE THRU ORDER POINT ISLAND CURB

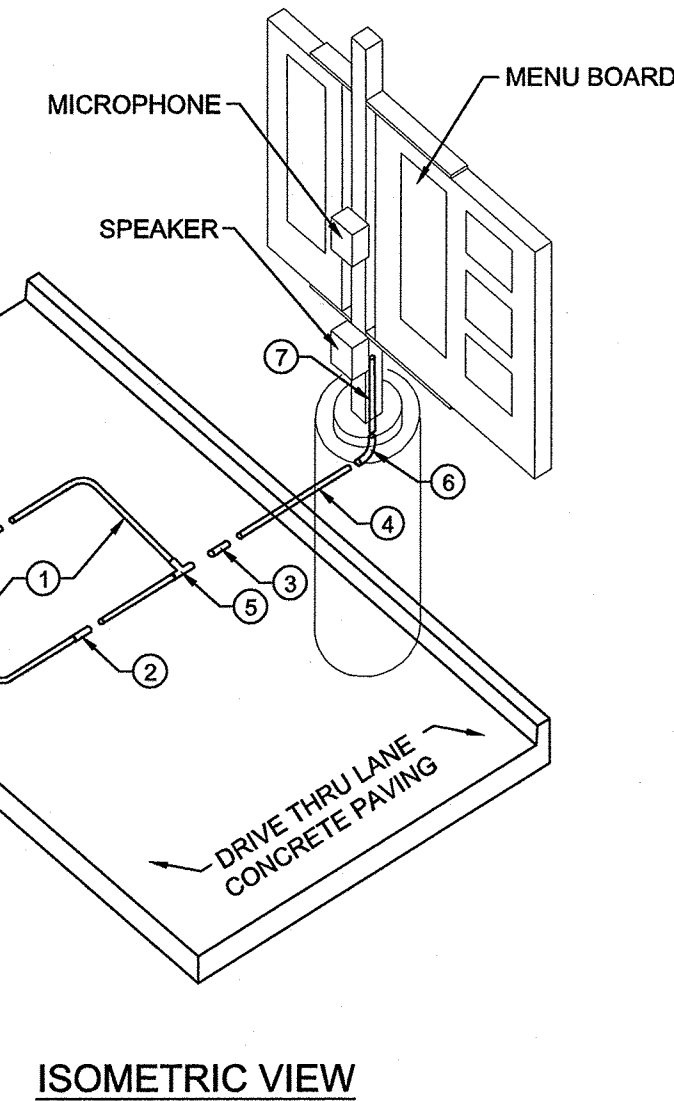
NOT TO SCALE



35 C-4.4 MENU BOARD LOOP DETECTION SYSTEM

NOT TO SCALE

- NOTES:
- LOOP DETECTOR IS MODEL NO. VDL100 VEHICLE DETECTION LOOP MANUFACTURED BY MH ELECTRONICS, INC.
 - FOLLOW MANUFACTURER'S RECOMMENDATIONS FOR INSTALLATION.



- PARTS LIST**
- PREFAB (FOLDED) LOOP (1.5' x 5')
 - 1/2" PVC COUPLING
 - 1/2" PVC SLEEVE COUPLING
 - 1/2" PVC TUBING (3' LENGTH)
 - 1/2" PVC CORNER FITTING
 - 1/2" PVC 90° ELBOW
 - 1/2" PVC TUBING (2' LENGTH)

SOUTHERN NEVADA BUILDING OFFICIALS REGIONAL STANDARDS

B-100-1
7-7-14
PG. 1 OF 2

MASONRY FENCES

Clark County
Dept. of Building & Fire Prevention
4701 W Russell Rd
Las Vegas, NV 89118
(702) 455-3000

Boulder City
Building Department
401 California Avenue
Boulder City, NV 89005
(702) 293-9282

Henderson
Bldg & Fire Safety Dept.
240 Water Street
Henderson, NV 89015
(702) 267-3650

Las Vegas
Building & Safety Dept.
333 N. Rancho Drive
Las Vegas, NV 89106
(702) 229-6251

REQUIRED INSPECTIONS: (SPECIAL INSPECTION - NONE REQUIRED)

- FOUNDATION
- MASONRY PREGROUT
- FINAL

GENERAL NOTES:

- ALL WORK SHALL CONFORM TO THE IBC 2012 EDITION AS AMENDED.
- CONCRETE BLOCK MASONRY SHALL COMPLY WITH THE FOLLOWING:
 - CONCRETE MASONRY SHALL CONFORM TO ASTM C 90, 1"m = 1500 PSI
 - MORTAR TYPE M = 2500 PSI OR TYPE S = 1800 PSI
 - GROUT CONFORMS TO ASTM C 476, MINIMUM 3000 PSI
- THE ULTIMATE COMPRESSIVE STRENGTH REQUIRED FOR FOUNDATION CONCRETE SHALL BE OF 4500 PSI, TYPE V CEMENT, AND 0.45 WATER TO CEMENT RATIO.
- ALL REINFORCING STEEL SHALL BE GRADE 60, ASTM A618, MIN. LAP SPlice = 24" NO WATER COURSE OR NATURAL DRAINAGE SHALL BE OBSTRUCTED.
- FOR RETAINING WALL, PROVIDE 1CF/FT OF CLEAN COARSE GRAVEL WITH 2" DIAMETER WEEP HOLES THROUGH THE WALL AND UNID WITH PVC PIPE AT 8'-0" O.C. ALONG WALL AND PLACED 3" ABOVE THE LOWEST ADJACENT FINISHED GRADE.
- SITE PLAN SHALL BE SUBMITTED FOR REVIEW BEFORE THE PERMIT CAN BE ISSUED WITHIN 16 INCHES OF THE END.
- GROUT ALL CELLS CONTAINING REINFORCEMENT. LOWER STEM IS SOLID GROUTED.
- 3 INCHES COVER FOR ALL REBAR IN FOOTING (TYPICAL).
- WATERPROOF THE INSIDE FACE OF ALL RETAINING WALLS PER 1805.3 OF 2012 IBC.

DESIGN CRITERIA

IBC WITH SO. W. AMENDMENTS

BASIC WIND SPEED = 105 MPH, EXPOSURE C

K_z = 0.95

K_d = 1.0

G_f = 0.95

G_r = 1.4

C_e = 0.95

SEISMIC LOAD

DESIGN SPECTRAL RESPONSE S_{ds} = 0.51g

SEISMIC COEFFICIENTS R_p = 2.5 (ASCE 7-10, T-13.5-1)

T_p = 0.44s

SEISMIC LOAD DUE TO LATERAL EARTH PRESSURE =

15.1M (LESS THE POINT OF APPLICATION IS TAKEN AT 0.4H ABOVE THE BASE OF THE WALL, WHERE H IS THE HEIGHT OF THE BACKFILL)

SITE CLASS = D

ALLOWABLE SOIL BEARING PRESSURE = 1000 PSF

LATERAL EQUIVALENT FLUID PRESSURE OF 45 PS/FT

PASSIVE PRESSURE = 100 PSF

COEFFICIENT OF FRICTION FOR SLIDING = .25

Diagram of a retaining wall cross-section. The wall is shown with a center of wall and a center of the wall. The wall height is indicated as 12'. The wall is reinforced with 1-#4 rebar at the top with a bond beam rebar. The wall is reinforced with (V) rebar w/min. LAP 24". The wall is reinforced with FTG rebar. The wall is reinforced with FTG

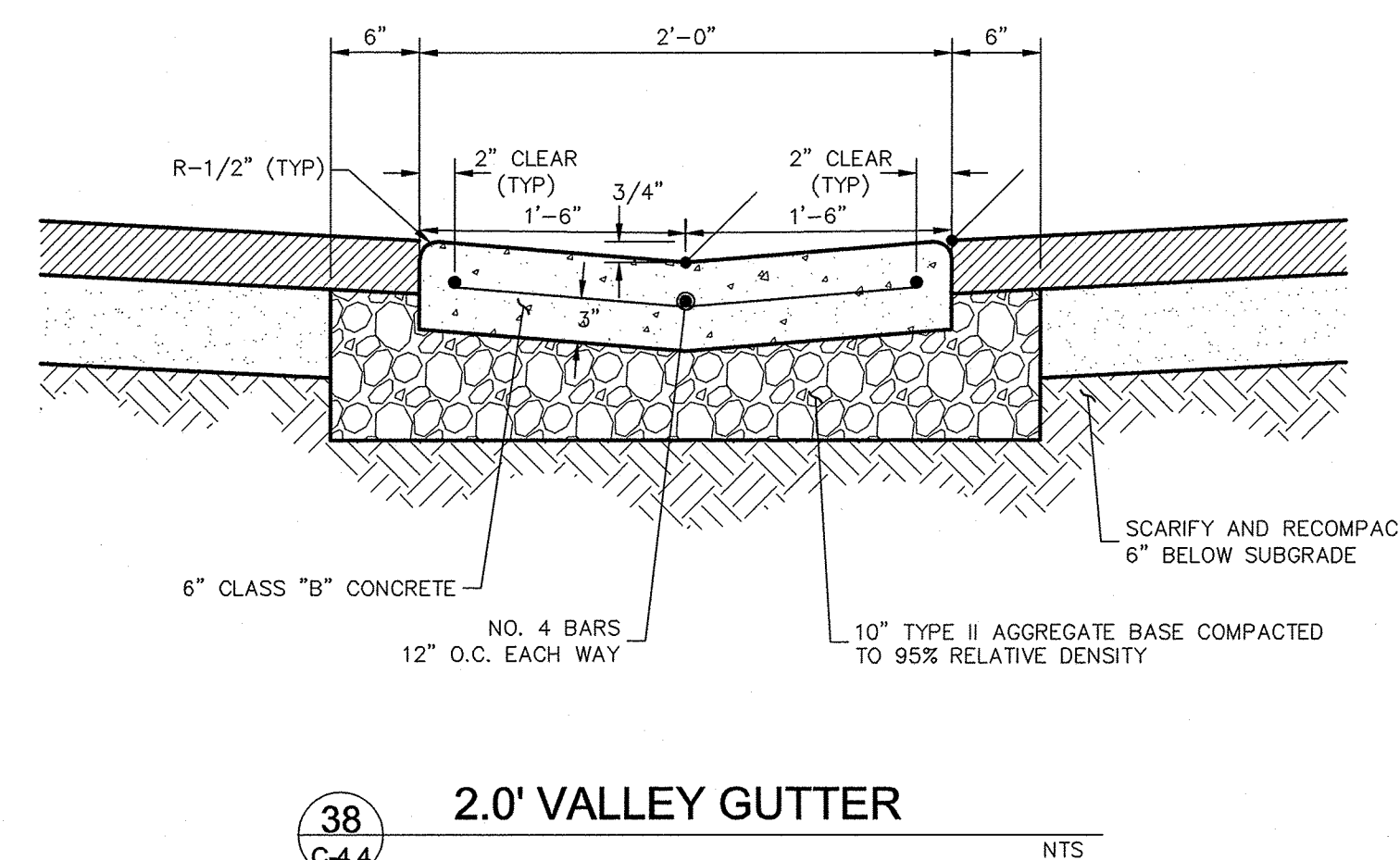
36 C-4.4 SNBORS DETAIL B-100-1

NTS

SOUTHERN NEVADA BUILDING OFFICIALS REGIONAL STANDARDS				B-100-2 7-23-15 PG. 2 OF 2
MASONRY RETAINING WALLS				
Clark County Dept. of Building & Fire Prevention 4701 W Russell Rd Las Vegas, NV 89118 (702) 455-3000	Boulder City Building Department 401 California Avenue Boulder City, NV 89005 (702) 293-9282	Henderson Bldg & Fire Safety Dept. 240 Water Street Henderson, NV 89015 (702) 267-3650	Las Vegas Building & Safety Dept. 333 N. Rancho Drive Las Vegas, NV 89106 (702) 229-6251	
DESIGN CRITERIA IBC WITH SO. W. AMENDMENTS BASIC WIND SPEED = 105 MPH, EXPOSURE C K_z = 0.95 K_d = 1.0 G_f = 0.95 G_r = 1.4 C_e = 0.95 SEISMIC LOAD DESIGN SPECTRAL RESPONSE S_{ds} = 0.51g SEISMIC COEFFICIENTS R_p = 2.5 (ASCE 7-10, T-13.5-1) T_p = 0.44s SEISMIC LOAD DUE TO LATERAL EARTH PRESSURE = 15.1M (LESS THE POINT OF APPLICATION IS TAKEN AT 0.4H ABOVE THE BASE OF THE WALL, WHERE H IS THE HEIGHT OF THE BACKFILL) SITE CLASS = D ALLOWABLE SOIL BEARING PRESSURE = 1000 PSF LATERAL EQUIVALENT FLUID PRESSURE OF 45 PSF/FT PASSIVE PRESSURE = 100 PSF COEFFICIENT OF FRICTION FOR SLIDING = .25				
2' RETAINING WALL 4' RETAINING WALL OPTIONAL FOOTING FOR 2' RETAINING WALL				
North Las Vegas Building Department 2250 Las Vegas Blvd. N N. Las Vegas, NV 89030 (702) 633-1577	Pahrump Building & Fire Safety Dept. 250 N Hwy 160 Subd #3 Pahrump, NV 89060 (775) 751-3373	Clark County School District Building Department 4190 McLeod Drive, 1st Floor Las Vegas, NV 89121 (702) 799-7605		

37 C-4.4 SNBORS DETAIL B-100-2

NTS



38 C-4.4 2.0' VALLEY GUTTER

NTS

5200 Buffington Rd.
Atlanta Georgia,
30349-2998

Revisions:

Mark	Date	By
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Mark Date By

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Mark Date By

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Mark Date By

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Kimley-Horn

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6671 LAS VEGAS BLVD. S., SUITE 320, LAS VEGAS, NV 89119
PHONE: 702-862-3600
WWW.KIMLEY-HORN.COM

PROJECT NAME
CHICK-FIL-A RESTAURANT
NO. 04198

STORE
HWY 95 & LAKE MEAD

HWY 95 @ LAKE MEAD BLVD LAS VEGAS, NV

SHEET TITLE
TYPICAL DETAILS 4

VERSION: PRELIM
ISSUE DATE: TBD

Store : 04198
Date : 12/13/17
Design By : JZ
Drawn By : CT
Checked By : TW

JOB NO.
092908004

AGENCY NO.
TBD

Sheet
C4.4
11 OF 13 SHEETS