

DS #: 4704

APN: 125-20-301-028

PROJECT: GOODWILL @ DURANGO & DEER SPRINGS

SUBMITTAL: 1ST

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		November 4, 2014
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:	COPIES TO:
	Goodwill at Durango & Deer Springs	Rietz Consulting, Inc
Cross Streets:	NWC of Durango Road & Echelon Point Dr.	BCP-Deer Springs, LLC
File Number:	F:\Depot\DSMemos\DS4704A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	125-20-301-028	
Zoning Action:	MOD-55735 & SDR-55737	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES X NO	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	10/21/2014	11/3/2014	See Comments Below	\$400.00	374079: \$400
TOTAL FEES (LDDRS):				\$400.00	----

REMARKS:

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

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

1. Provide a copy of the zoning/planning conditions associated with this site (**MOD-55735 & SDR-55737**) with the next submittal to verify compliance with conditions. *Flood Control* will not issue conditional approval of the drainage study without the associated zoning/planning conditions (issued by the *City Council*). Any associated conditions of approval that revise the site drainage parameters will require that the drainage study be revised and resubmitted.
2. Sites with a grade difference of 2 feet above or below existing are required to have approval from the *City Planning and Development Department*. The engineer must submit copies of the grading plans and detail sheet with a letter justifying the grade difference to the *City Planning Department* (229-6301). The engineer must provide Planning approval with the next submittal.
3. The proposed finished floor elevation of the new building does not meet regional criteria as to *Echelon Point Drive*. The corresponding flow line elevation in *Echelon Point Drive* per the high side of the building is 74.62FL, the proposed building is set at F.F. =73.90 which is lower. Without providing twice-the-depth (100-year storm event), an alternative remedy is to provide a hump at the driveway with a minimum of six inches freeboard. However, the proposed TC/HPs in the driveway entrance in *Echelon Point Drive* with $d_{100}=0.60'$ also do not meet the criteria. Review and revise accordingly.
4. Consider getting permission for offsite grading in the adjacent property to the west so as to avoid all the proposed onsite drainage easements and results in a clean onsite drainage pattern.

5. All drainage easements must be public drainage easements to be privately maintained by the property owner to be labeled on the grading plans and to be dedicated as such in the final map or by separate document. The minimum width for a public drainage easement is 10' if the 100-year flow is less than 20 CFS. Revise the grading plan and all pertinent details accordingly.

The proposed public drainage easements must be recorded prior to the final approval of the improvement plans.

6. Provide an exhibit (11" x 17") that shows the overall schematic of the proposed public drainage easements (privately maintained) in the next submittal.
7. Revise all drop inlets to Type "CM" or Neenah Pre-cast inlets. Contact Raul Cruz at 229-3224 for an AutoCAD detail to be included within the improvement plans if Type "CM" drop inlets are used. Note that the lengths of "CM" inlets are in the multiple of 2.5'. Revise all pertinent construction notes and callouts accordingly.
8. It is proposed to connect a new 24"-RCP to an existing 24"-RCP in *Echelon Point Drive*. Provide a connection detail in the next submittal.
9. The drawing number labeled on the grading plan for an existing storm drain system in *Durango Drive* is not correct. Review and revise accordingly in the next submittal.
10. Add a note in all pertinent sheets for the construction of all storm drain drop inlets per a newly adopted USDCCA Drawing No. 421 (*Stormwater Quality Management Stamp and Sign Detail*).

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
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T/R/S: T19S/R60E/20
AREA G-20

Rec'd: 10/21/14

TECHNICAL DRAINAGE STUDY

FOR

DS4704

GOODWILL

G-20

AT

DURANGO & DEER SPRINGS

\$400-

City of Las Vegas, Nevada

OCTOBER 2014

Prepared By:

SDR-55737
MOD-55735



Rietz Consulting, Inc.

3060 E. Post Road, Suite #110; Las Vegas, Nevada 89120

Phone: 702-521-3355 Fax: 702-212-3693

Prepared For:

BCP-DEER SPRINGS, LLC

6725 South Eastern Avenue #2

Las Vegas, NV 89119

Phone: 702-868-7870 Fax 702-868-8215

TECHNICAL DRAINAGE STUDY

FOR

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OCTOBER 2014

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HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Goodwill at Durango and Deer Springs Date: October 2014

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

East/West: Deer Springs

b) Section: 20 Township: 19S Range: 60E

c) APN : 125-20-301-028

Name of Owner: BCP-Deer Springs, LLC

Telephone No.: 702-868-7870 Fax No.: 702-868-8215 E-Mail Address: Asif@activecommercially.com

Address: 6725 South Eastern Avenue #2, Las Vegas, NV 89119

Contact Person-Name: Eric Rietz Telephone No.: 702.521.3355

* E-Mail Address: Eric.rietz@gmail.com Fax No.: _____

Firm: Rietz Consulting, Inc.

Address: 3060 East Post Road, #110, Las Vegas, NV 89120

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		commercial development

1. Total Owned Land Area: At Site: 1.89 Being Developed/Disturbed: 1.89

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

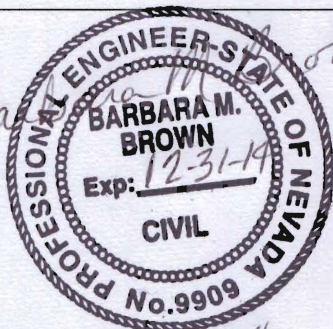
4. Proposed type of development (Residential, Commercial, Etc.): Commercial

5. Approximate upstream land area which drains to the subject site: 16 acres

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

7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: _____
Discharge to fully-improved street section of Durango Drive to the east.

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



Engineer's Seal

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

*New Required Field

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

	Revision	Date
Local Entity File No.		

REFERENCE:

STANDARD FORM 1



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 (CCRFCF) 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 CCRFCF Hydrologic Criteria and Drainage Design Manual (Design Manual).

An appointment must be made to preview this checklist in conjunction with CCRFCF 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.  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	
	X	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.
	X	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.

1. INTRODUCTION

1.1 Project Overview & Study Purpose

The purpose of this Technical Drainage Study for Goodwill at Durango and Deer Springs is to address drainage and grading design of the proposed 1.9-acre commercial development. The development is located in the northwest portion of the Las Vegas Valley, in the City of Las Vegas, Nevada.

This Technical Drainage Study was prepared in accordance with criteria specified in the *Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual* (latest update), which is referred to in this document as the "*Drainage Manual*". All pertinent reference material and calculations is presented in the Appendix of this report.

1.2 Site Description

The subject site is located specifically in the north half (N 2) of the southwest quarter (SW 4) of Section 20, Township 19South (T19S) Range 60 East (R60E), on the northwest corner of Durango Drive and Echelon Point Drive. The subject site is currently undeveloped, and exists in a natural desert terrain condition. The site currently drains by way of many natural braided streams to the east at a slope of approximately 2.9 %.

The site is bordered by Durango Drive (130-foot Right-of-way) on the east, which is currently fully improved with pavement, curb and gutter, sidewalks, streetlights, etc. The elevation of the existing ground of the site is currently approximately 4 to 5 feet above the flow line elevation on the west side of Durango Drive. There is an existing 42-inch storm drain pipe in Durango along the eastern frontage of the subject site. The pipe has a 10-yr design flow rate of $Q(10)=85$ cfs. There are two existing 6' drop inlets located in the flow line along the subject site. The existing inlet is in a proper location and will remain after development of the subject site.

The site is bound by Echelon Point Drive (80-foot Right-of-way) on the south, which currently is unimproved, and lies in a natural desert terrain state.

The site is bordered on the north by the existing Arco AM/PM site, which was constructed very recently (within the past few months).

The site is bordered on the west by undeveloped privately-owned property. See *Figure 1, Vicinity Map*, and *Figure 2, Location Map* in the Appendix of this report.

1.3 FEMA Flood Zone Designation

The subject site is not located within a Federal Emergency Management Association Special Flood Hazard Zone. According to FEMA FIRM Panel 32003C1745F, dated September 27, 2002, the subject site is in a "Zone X" which applies to "Areas determined to be outside the 0.2% annual chance floodplain". The associated FEMA Map Panel has been annotated and included in the appendix of this report.

1.4 CCRFCD Facility Information

Figure F-13, from the 2013 CCRFCD Las Vegas Valley Flood Control Master Plan Update (MPU) shows that the site is not crossed by any existing or planned CCRFCD regional facility. The appropriate figures from the CCRFCD MPU have been annotated and included in the appendix of this report.

1.5 Soils Data

A soils report was downloaded from the USCS Web Soil Survey site, in order to determine the most current rating for Hydrologic Soils Groups (HSG) for the watershed studied in the subject study. The report results in all areas studied being HSG "A", soils map unit 191: Dalian very cobbly fine sandy loam. Since the MPU H-sheets show the entire area to be Hydrologic Soils Group "B", and the referenced studies also have all hydrologic calculations based on HSG "B" HSG B was selected for hydrology in the subject study. This is a conservative approach, since HSG "B" watersheds will likely have higher runoff rates than HSG "A" watersheds. The downloaded soils report is included in the Appendix of this report.

Curve numbers were selected from the *Drainage Manual* as directed, using the land usage and hydrologic condition of each basin studied, for input to the HEC1 hydrologic model. The curve numbers were selected so that they would concur with the referenced material as much as possible.

1.6 Reference Studies

There are two studies on file that are in the vicinity of the subject site. Each study was reviewed and found to be reasonable and acceptable. The studies were each referenced as follows:

1. **Technical Drainage Study for Arco AM/PM at Durango & Deer Springs, by Walker Engineering, LLC, City of Las Vegas #DS4639B.**

The AM/PM study was prepared for the newly-constructed commercial development that borders the subject site on the north. The study gives future conditions peak flow rates in Durango Drive on the west side (site-side) of the crown, of 8 cfs and 18 cfs in the 10- and 100-year storm events respectively. In addition, the 10- and 100-year precipitation depths of 1.60" and 2.86" respectively were directly referenced (same values as the Deer Springs study, below). These data are cited directly from the study for use in the subject study. Reference material from that study has been included in the appendix of this report.

2. **Technical Drainage Study for Deer Springs by DR Horton, by Slater Hanifan Group, Inc., City of Las Vegas #D140311.**

The Deer Springs study was prepared for the residential development which is planned for 40 acres located approximately 330 feet upstream (west of) of the subject site. The development is currently under construction, however, it is assumed to be developed in the subject study. The Deer Springs study gives future conditions peak flow rates in Echelon Point Drive, at their eastern boundary, of 12 cfs and 28 cfs in the 10- and 100-year storm events respectively. In addition, the 10- and 100-year precipitation depths of 1.60" and

2.86" respectively were directly referenced (same values as the AM/PM study, above). These data are cited directly from the study for use in the subject study. It is noted that Echelon Point Drive is an 80-foot right-of-way street, however, dry lane criteria was not required for that study.

3. **Record Drawings for Durango Drive Improvements, by VTN Nevada, 2003, City of Las Vegas #107-V3640**

The record drawings for the SID project Durango Drive Improvements were obtained from the City of Las Vegas and utilized in the subject study for location, size and capacity of the storm drain collection system in Durango Drive adjacent to the site. The drawings show a 42-inch storm drain pipe in Durango Drive, on the west side (site side) of the street. The pipe increases to a 60-inch diameter just downstream (south) of the subject site. The pipe was designed for the 10-year storm event, and there are two existing inlets along the frontage of the subject site. These inlets together collect 6 cfs from the west curb gutter line. There is an existing 24-inch diameter storm drain pipe that exists, with an end cap, extending from the main pipe (42-inch increasing to 60-inch) to the west, in the Echelon Point alignment. The subject project will construct a single inlet, with 24-inch diameter pipe lateral, to collect the 18 cfs that is expected for the storm drain stub. Half-size copies of the record drawings have been copied, annotated and included in the subject study.

2. METHODOLOGY

2.1 Compliance

The methodologies utilized in the preparation of this study are in compliance with the *Drainage Manual* (latest update).

2.2 Hydrologic Modeling

Modeling: The SCS Unit Hydrograph Method (SCS Method) was utilized to determine peak flow rates. The SCS Method utilizes precipitation, drainage area, curve number and lag time parameters to determine peak flow rates. The SCS Method routine within the U.S. Army Corp of Engineers *HEC1* was utilized to model the drainage sub-basins analyzed by this study.

Precipitation: The site is located within the McCarran Rainfall Area, per *Drainage Manual* Figure 513. The precipitation values utilized in the HEC-1 models, which were referenced from the two drainage studies discussed in section 1.60 Reference Studies, are 1.60" and 2.86" for the 10-year and 100-year storm events, respectively. SDN 3 design storm from Table 503 in the *Drainage Manual* has been used for the less than 1-mile square drainage area. Reference tables and figures from the *Drainage Manual* are included in the Appendix.

Curve Number: The SCS curve number loss rate methodology was utilized to approximate infiltration for the drainage sub-basins. As discussed in section 1.5 above, although most current soils data shows the area, having soils Map Unit 191, as HSG "A", the HSG "B" was chosen for all the areas studied in the subject report. This is a more conservative approach, since it will likely result in higher runoff rates. In addition, both referenced studies also used HSG "B" in their analysis.

Lag Time: The lag time is defined as the time measured from the center of mass of effective rainfall to the time to peak of the outflow hydrograph. The lag time is related to the time of concentration as 0.6 times the time of concentration. The time of concentration is defined as the time required for runoff to flow from the hydraulically most distant point of a sub-basin to the outlet point of the sub-basin. Standard Form 4, as outlined in the *Drainage Manual*, was utilized to determine the lag times for sub-basins modeled. A copy of lag time computations is included in the appendix.

2.3 Hydraulic Modeling

Street Flow: Normal depth street flows are analyzed utilizing Flowmaster by Bentley Systems Methods. Echelon Point Drive is an 80-foot right-of-way street, however the distance between back of curbs is 60 feet. 10-year dry lane criteria will be required by the City for the 10-year peak flow rate, when running in the north half of the street. An inlet is planned at the curb return to collect all flow above the 10-year dry-lane criterion in Echelon Point Drive.

Drop Inlet Sizing: Sizing for the drop inlet at the curb return on Echelon Point Drive was calculated with Flowmaster by Bentley Systems Methods, assuming equal grate and opening widths, and 50 % clogging.

Storm Drain Flow: 24-inch diameter storm drain pipe will be extended from the existing stub from the storm drain in Durango Drive to the new collection inlet on Echelon Point Drive. The

hydraulic grade line for the 24-inch pipe was established by calculating normal depth flow with Flowmaster by Bentley Systems Methods.

Hydraulic Sections: Onsite hydraulic sections are analyzed by calculating normal depth flow in the 100-year storm event with Flowmaster by Bentley Systems Methods.

3. EXISTING CONDITIONS DRAINAGE

3.1 On-site Existing Conditions

Referring to *Figure 3, Existing Conditions Drainage Basins*, the subject site is undeveloped and covered with natural desert terrain, having typical scrub brush and creosote vegetation that is native to southern Nevada. The subject site drains to the southeast at a slope of approximately 2.5 %. Basin EON1 discharges runoff flow into the fully-improved street section of Durango Drive, which borders the subject site on the east. Basin EON2 discharges runoff flow into natural braided dry streams toward the Echelon Point Drive alignment, which borders the subject site on the south.

3.3 Offsite Existing Conditions

Again referring to *Figure 3, Existing Conditions Drainage Basins*, the subject site is impacted with runoff flow from offsite along the western boundary. Runoff flow from offsite area EOF2 impacts the western boundary of the existing AM/PM Arco development, which borders the subject site on the north. Runoff from basin EOF2 is directed by way of a graded offsite swale to the south, for combination with runoff flow from offsite area EOF2A at point CP1. At point CP1, runoff flow enters the subject site, along with flow from basin EOF2B, in a natural flow paths, where flow continues flowing easterly, combining with runoff flow from onsite area EON1 at point CP2. From point CP2, runoff flow enters the fully-improved street section of Durango Drive, continuing through street area EDD, combining at point CP3 at the southern boundary of the site at the Echelon Point Drive alignment. At point CP3, flow from the north, referenced from the Technical Drainage Study for AM/PM Arco ($Q_{10}=8$ cfs and $Q_{100}=18$ cfs) is added directly into the (HEC1) calculated peak flow rates at that point.

It is noted that there are two existing drop inlets that capture runoff flow in the western flow line of Durango Drive, just upstream (north of) the Echelon Point Drive intersection. According to the reference material, these inlets both together accept a 10-year peak flow rate of 6 cfs. The existing 42-inch pipe is documented at being designed to convey 85 cfs at the northern boundary and 106 cfs at the southern boundary.

Runoff flow from offsite area EOF2D enters the unimproved alignment of Echelon Point Drive, flowing into unimproved alignment area EEP1, for combination at point CP5. At point CP5, flow from the west, referenced from the Technical Drainage Study for DR Horton ($Q_{10}=12$ cfs and $Q_{100}=28$ cfs), Deer Springs is added directly into the (HEC1) calculated peak flow rates at that point.

Again referring to *Figure 3, Existing Conditions Drainage Basins*, runoff flow from offsite area EOF2C impacts the western boundary of the subject site, where it enters the site, flowing across onsite area EON2 for combination at point CP4, where runoff flow enters the unimproved alignment of Echelon Point Drive. Runoff flowing in the unimproved alignment of Echelon Point Drive combines just upstream of Durango Drive, at point CP6.

From point CP6, all flow enters Durango Drive and continues southerly at point CP7. Results of the hydrologic modeling for existing conditions are shown on *Figure 3, Existing Conditions Drainage Basins*.

4. INTERIM CONDITIONS DRAINAGE

4.1 Onsite Interim Conditions

For interim conditions, the site is assumed to be developed and all offsite areas are assumed to be in existing condition. Refer to Figure 4, *Interim Conditions Drainage Basins*. The grading design of the onsite basins is intended to break the paved areas into the smallest tributary areas possible (Section 1500 of the *Drainage Manual*), directing the runoff flow into BMP (Best Management Practices) landscape swales before entering the street flow line. These areas are intended to help lessen the velocity of the runoff flow and catch sediment.

Runoff flow from onsite areas DON1 (0.80 ac.) and DON3 (0.76 ac) both run through BMP landscape swales before discharging into Durango Drive to the east. Smaller onsite area DON2 (0.22 ac) discharges through the driveway entrance into Durango Drive.

4.2 Offsite Interim Conditions

Referring again to Figure 4, *Interim Conditions Drainage Basins*, offsite flow is accepted onto the subject site by way of four openings to the west at offsite basins EOF2, EOF2A, EOF2B and EOF2C. Note that there is a proposed retaining wall planned along most of the western boundary of the site, and the existing ground outside the western boundary is up to 4 feet higher than the design elevation of the subject site. At basin EOF2, runoff flow is accepted onto the site by means of a 5-foot wide concrete flume, being 0.5 feet below the existing ground to the west. Runoff flow will pass over a concrete curb that will be constructed at the subject site's western boundary, which is about 0.5' high. At offsite basin EOF2A, runoff flow is accepted onto the site by means of a beehive inlet at a notch in the retaining wall at the south boundary line. The beehive grate will be installed just below the existing ground elevation at the property line. Once the flow is captured by the grate, it drops down through a 12" pipe, approximately 4 feet to a 90 degree bend at the elevation of the subject site. At offsite basin EOF2B, runoff flow is accepted onto the site by means of a second beehive inlet, in the same manner as the one at basin EOF2A above. Once accepted onsite, runoff flow is conveyed by on-site 2-foot valley gutter, for combination at point CP1.

Again referring to Figure 4, *Interim Conditions Drainage Basins*, at offsite basin EOF2C, runoff flow is accepted onto the site at the far southwest corner of the site into a 5-foot concrete lined flume. The flow is discharged into the south entrance to the site into Echelon Point Drive.

Runoff flow from EOF2D, EEP1, and from the DR Horton Deer Springs site combines at point CP5, where it enters the north half-street flow line. Runoff flow continues easterly in the half street to point CP6, where it combines with runoff flow from CP5 and EOF2C. An 8.5-foot grated drop inlet with 24-inch pipe lateral connection is proposed for the north side of the street at the curb return on Echelon Point Drive. Connection will be to the existing 24-inch pipe stub to the existing 42-inch storm drain pipe in Durango Drive. Since the 10-year dry lane capacity of Eschelon Point Drive was found to be minimal (<1 cfs), the drop inlet was designed to collect the entire 10-year (future conditions) peak flow rate of 18 cfs. Fortunately, the referenced design drawings for the stub also show collection of 18 cfs, so there is ample capacity in the system.

For Durango Drive, which borders the subject site on the east, no changes are being made to the street section except for curb cuts for the driveway entrances to the subject site, and the curb return for Echelon Point Drive. Runoff flow from onsite and from street area DDD flows in the

western half street of Durango Drive to point CP3, where runoff flow from the north, referenced from the Technical Drainage Study for AM/PM Arco (8 and 18 cfs) is added directly into the (HEC1) calculated peak flow rates at that point. All runoff flow combines at point CP7, where it continues southerly in Durango Drive.

4.3 Interim Conditions Normal Depth Street Flows

Normal depth flow calculations in the adjacent streets have been analyzed to demonstrate conformance to the criteria set forth in the *Drainage Manual*. Since the Future Conditions peak flow rates are higher than interim conditions, street flow calculations were performed only for the controlling condition of Future Conditions. Future conditions street calculations are summarized on *Figure 5, Future Conditions Drainage Basins*.

4.4 Interim Conditions Normal Depth Onsite Flows

Normal depth flow calculations in the onsite drainage pathways have been analyzed to demonstrate conformance to the criteria set forth in the *Drainage Manual*. Since the Future Conditions peak flow rates are higher than interim conditions, normal depth onsite flow calculations were performed only for the controlling condition of Future Conditions. Future conditions onsite normal depth calculations are summarized on *Figure 5, Future Conditions Drainage Basins*.

4.5 Lower Impact Development

Proposed grading design incorporates features intended to conform to section 1500 of the *Drainage Manual*; most specifically the table at the top of page 1516 of the *Drainage Manual*. Impervious areas, pavement and roofs, drain through landscape areas / BMP swales prior to discharge into the public right-of-way. Onsite areas DON1 and DON3 each drain to separate BMP landscape swales before entering public right-of-way.

4.6 Inlet Calculations

Proposed Beehive grated inlets were sized using Figure 814 of the *Drainage Manual*. Curb inlets were sized using the Bentley FlowMaster, which is in concurrence with the HEC22 method. Since the Future Conditions analysis produced the most conservative estimated peak flow rates, inlet calculations were based on future conditions, below.

5. FUTURE CONDITIONS DRAINAGE

5.1 Onsite Future Conditions

For future conditions, the site is assumed to be developed and all offsite areas are assumed to also be in developed condition. For the most conservative calculation, offsite basins are assumed to become developed commercially (CN=92), the same as the onsite areas. Referring to Figure 5, *Future Conditions Drainage Basins*, the grading design of the onsite basins is intended to break the paved areas into the smallest tributary areas possible (Section 1500 of the *Drainage Manual*), directing the runoff flow into BMP (Best Management Practices) landscape swales before entering the street flow line. These areas are intended to help lessen the velocity of the runoff flow and catch sediment.

Runoff flow from onsite areas DON1 (0.80 ac.) and DON3 (0.76 ac) both run through BMP landscape swales before discharging into Durango Drive to the east. Smaller onsite area DON2 (0.22 ac) discharges through the driveway entrance into Durango Drive.

5.2 Offsite Future Conditions

Referring again to Figure 5, *Future Conditions Drainage Basins*, offsite flow is accepted onto the subject site by way of four openings to the west at offsite basins DOF2, DOF2A, DOF2B and DOF2C. These basins are assumed to develop commercially, just as the subject site is developing (CN=92). Note that there is a proposed retaining wall planned along most of the western boundary of the site, and the existing ground outside the western boundary is up to 4 feet higher than the design elevation of the subject site. It is assumed that development of the upstream area will occur at nearly the existing elevation, and inlet points to the subject site will function as well under interim as under future conditions. At basin DOF2, runoff flow is accepted onto the site by means of a 5-foot wide concrete flume, being 0.5 feet below the future developed area to the west. Runoff flow will pass over a concrete curb that will be constructed at the subject site's western boundary, which is about 0.5' high. At offsite basin DOF2A, runoff flow is accepted onto the site by means of a beehive inlet at a notch in the retaining wall at the south boundary line. The beehive grate will be installed just below the existing ground elevation at the property line. Once the flow is captured by the grate, it drops down through a 12" pipe, approximately 4 feet to a 90 degree bend at the elevation of the subject site. At offsite basin DOF2B, runoff flow is accepted onto the site by means of a second beehive inlet, in the same manner as the one at basin DOF2A above. Once accepted onsite, runoff flow is conveyed by on-site 2-foot valley gutter, for combination at point CP1.

Again referring to Figure 5, *Future Conditions Drainage Basins*, at offsite basin DOF2C, runoff flow is accepted onto the site at the far southwest corner of the site into a 5-foot concrete lined flume. The flow is discharged into the south entrance to the site into Echelon Point Drive.

Runoff flow from DOF2D, DEP1, and from the DR Horton Deer Springs (12 and 28 cfs) site combines at point CP5, where it enters the north flow line of Echelon Point Drive. Since all runoff is expected to be on the north side of the crown, only half street improvements were taken into consideration when doing normal depth street calculations. Runoff flow continues easterly in the north half street to point CP6, where it combines with runoff flow from CP5 and

DOF2C. An 8.5-foot grated drop inlet with 24-inch pipe lateral connection is proposed for the north side of the street at the curb return on Echelon Point Drive. Connection will be to the existing 24-inch pipe stub to the existing 42-inch storm drain pipe in Durango Drive. Since the 10-year, half-street, dry lane capacity of Echelon Point Drive was found to be minimal (<1 cfs), the drop inlet was designed to collect the entire 10-year (future conditions) peak flow rate of 18 cfs. Fortunately, the referenced design drawings for the stub also show collection of 18 cfs, so there is ample capacity in the system.

For Durango Drive, which borders the subject site on the east, no changes are being made to the street section except for curb cuts for the driveway entrances to the subject site, and the curb return for Echelon Point Drive. Runoff flow from onsite and from street area DDD flows in the western half street of Durango Drive to point CP3, where runoff flow from the north, referenced from the Technical Drainage Study for AM/PM Arco (8 and 18 cfs) is added directly into the (HEC1) calculated peak flow rates at that point. All runoff flow combines at point CP7, where it continues southerly in Durango Drive.

5.3 Future Conditions Normal Depth Street Flows

Normal depth flow calculations in the adjacent streets have been analyzed to demonstrate conformance to the criteria set forth in the *Drainage Manual*. For Durango Drive on the east side of the site, runoff flow is expected to be only in the west half of the street. 10-year normal depth street calculations were found to be met. This is logical since there is already a 10-year storm drain system already implemented with the SID project in the past. The 100-year flow depth in Durango Drive was found to be 0.65'. Starting with a top of curb elevation of 2567.5 at the center of the building, twice the 100-year flow depth is 2568.3. The proposed finished floor elevation at 2573.9 is adequately above that criterion. The VxD criteria of <6 for the 10-year flow and <8 for the 100-yr flow is also met for Durango Drive at the subject site.

For Echelon Point Drive, all runoff flow is expected to be in the north half of the street, since no drainage areas are readily tributary to the south half of the street. Since the half street is actually only a width of 30 feet from back of curb to centerline, Echelon Point Drive has a very low conveyance capacity, and dry lane capacity is less than 1 cfs. As a result, a single drop inlet, to collect the entire 10-year flow of 18 cfs is proposed for the curb return on the north side of Echelon Point Drive at the Durango Drive intersection. 100-year flow depth in Echelon Point Drive was found to be 0.65. With a top of curb elevation of 2572.4 at the center of the building, twice the 100-year flow depth is elevation 2573.1. Finished floor elevation at 2573.9 is adequately above that criterion. The VxD criteria of <6 for the 10-year flow and <8 for the 100-year flow is also met for Echelon Point Drive at the subject site.

Future conditions street calculations are summarized on *Figure 5, Future Conditions Drainage Basins*.

5.4 Future Conditions Normal Depth Onsite Flows

Normal depth flow calculations in the onsite drainage pathways have been analyzed to demonstrate conformance to the criteria set forth in the *Drainage Manual*. Calculations are included in the Appendix of this report, and are summarized on *Figure 5, Future Conditions Drainage Basins*.

5.5 Lower Impact Development

Proposed grading design incorporates features intended to conform to section 1500 of the Drainage Manual; most specifically the table at the top of page 1516 of the Drainage Manual. Impervious areas, pavement and roofs, drain through landscape areas / BMP swales prior to discharge into the public right-of-way.

5.6 Inlet Calculations

Proposed Beehive grated inlets were sized using Figure 814 of the Drainage Manual. Beehive grated inlets were sized for inflow of 1 cfs each. Calculations are included in the appendix.

The curb inlet was sized using the software, Bentley FlowMaster, which is in concurrence with the HEC22 method. The inlet was sized assuming all flow is in the north half of the street, and 50% clogging as directed in the *Drainage Manual*.

5.7 Storm Drain Calculations

The hydraulic grade line (HGL) for the 24-inch diameter storm drain pipe to the proposed inlet was estimated to be normal depth flowing at the design slope. It is apparent that the peak HGL for the 24-inch pipe is not in sync with the peak HGL in the 42-inch pipe, so downstream HGL was not taken into consideration.

6. CONCLUSIONS & RECOMMENDATIONS

This study and improvement drawings complies with the drainage laws and regulations set forth by the City of Las Vegas and the Clark County Regional Flood Control District.

Development of this site is not expected to have a negative drainage impact on any upstream or downstream properties.

The site is adequately protected from flood damage caused by a 100-year flood or less, as specified by the *CCRFCD Hydrologic Criteria and Drainage Design Manual*.

This site is not within a Special Flood Hazard Zone as designated by FEMA.

The site discharges nuisance runoff flow into BMP drainage swales before discharging to public rights-of-way.

7. REFERENCES

1. **Hydrologic Criteria and Drainage Design Manual**. Clark County Regional Flood Control District, 1990.
2. **USCS Web soil survey <http://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm>**
3. **FlowMaster Version 5.13**, dated 1994-1995. Prepared by Bentley Systems Inc.

REFERENCED DRAINAGE STUDIES:

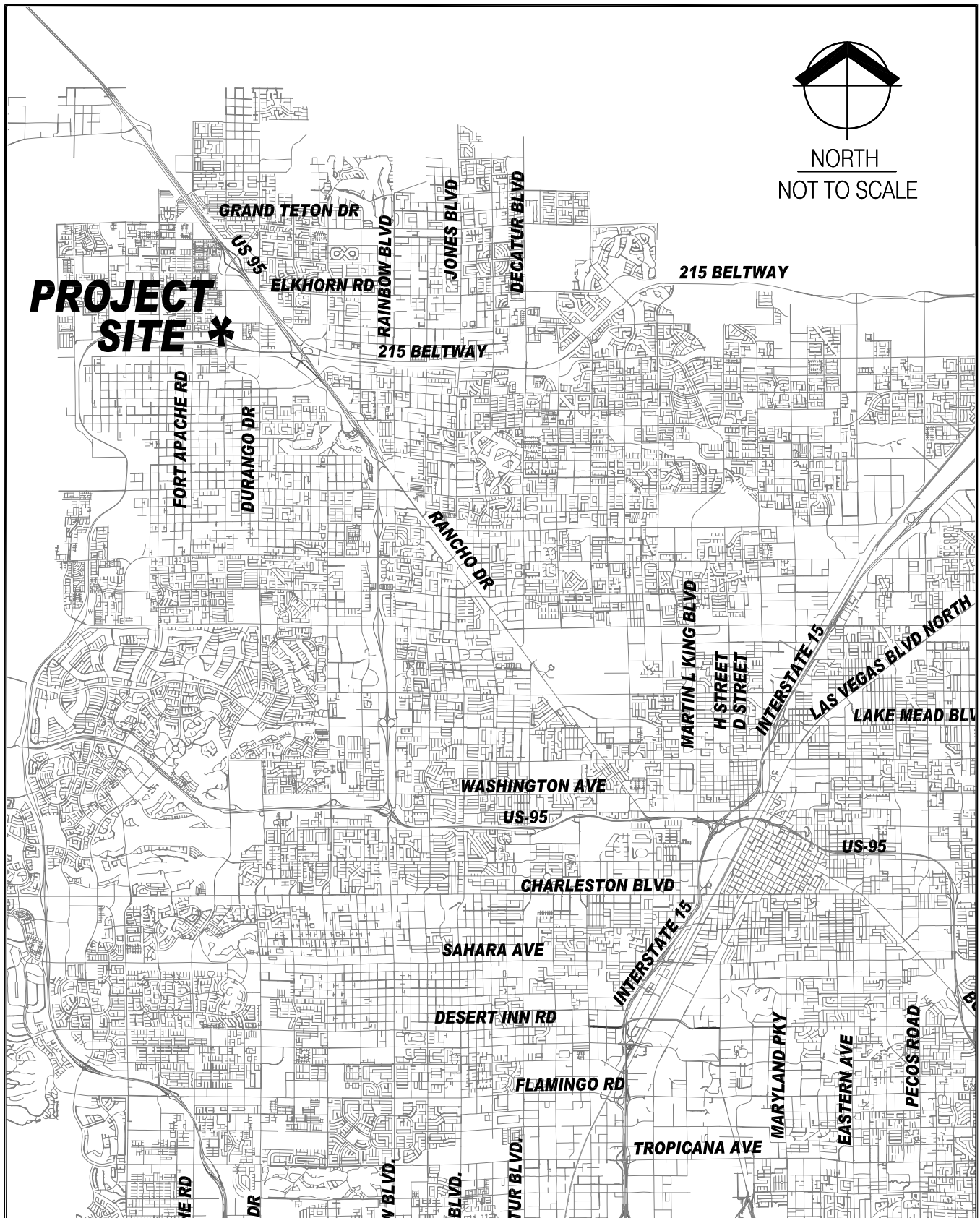
4. **Technical Drainage Study for Arco AM/PM at Durango & Deer Springs**, by Walker Engineering, LLC, City of Las Vegas #DS4639B.
5. **Technical Drainage Study for Deer Springs by DR Horton**, by Slater Hanifan Group, Inc., City of Las Vegas #D140311.



APPENDIX



FIGURES



RIETZ
CONSULTING INC.

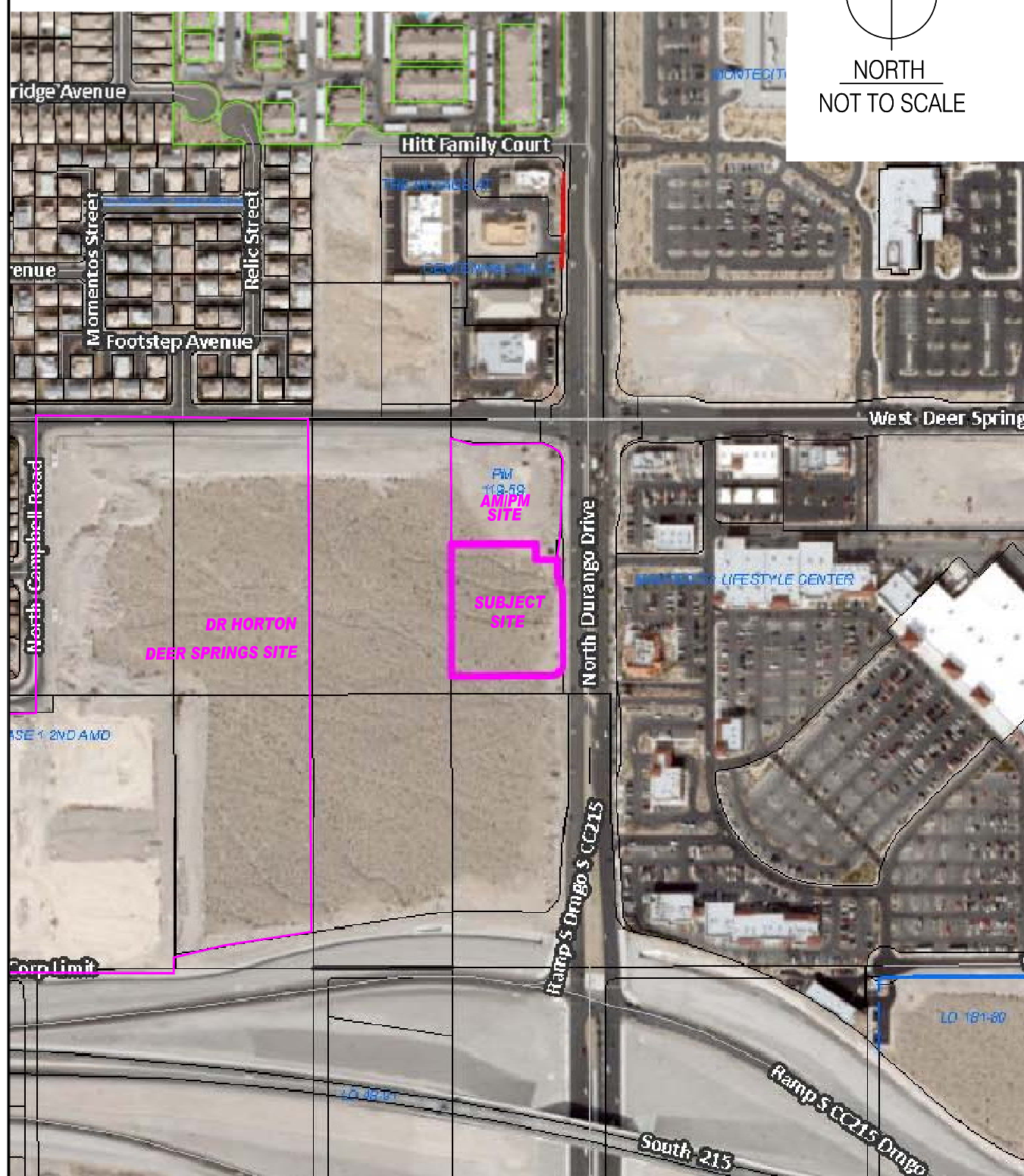
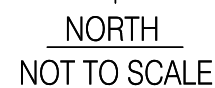
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397

GOODWILL AT
DURANGO & DEER SPRINGS

VICINITY MAP

FIGURE

1



RIETZ
CONSULTING INC.

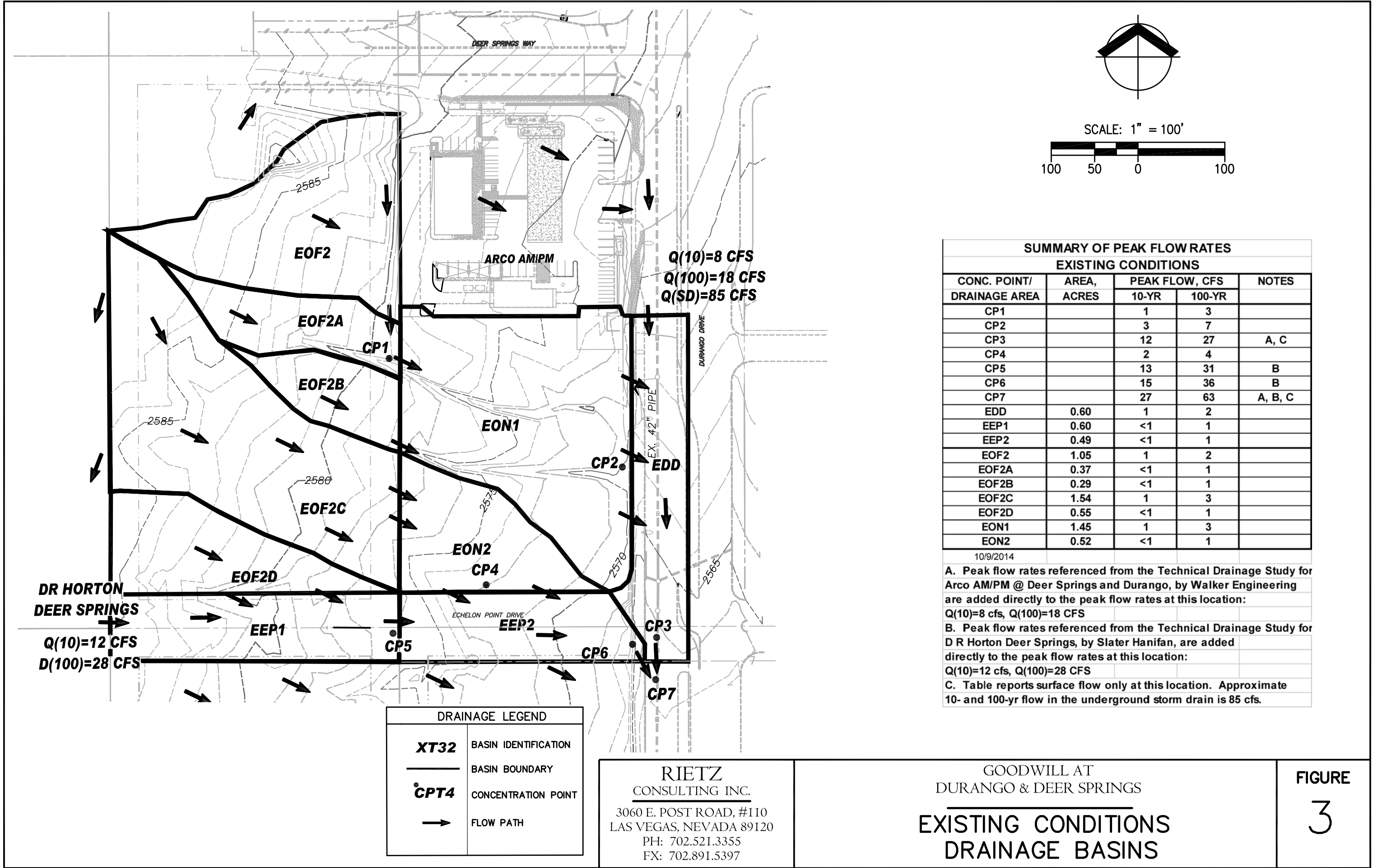
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LAS VEGAS, NEVADA 89120
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GOODWILL AT DURANGO & DEER SPRINGS

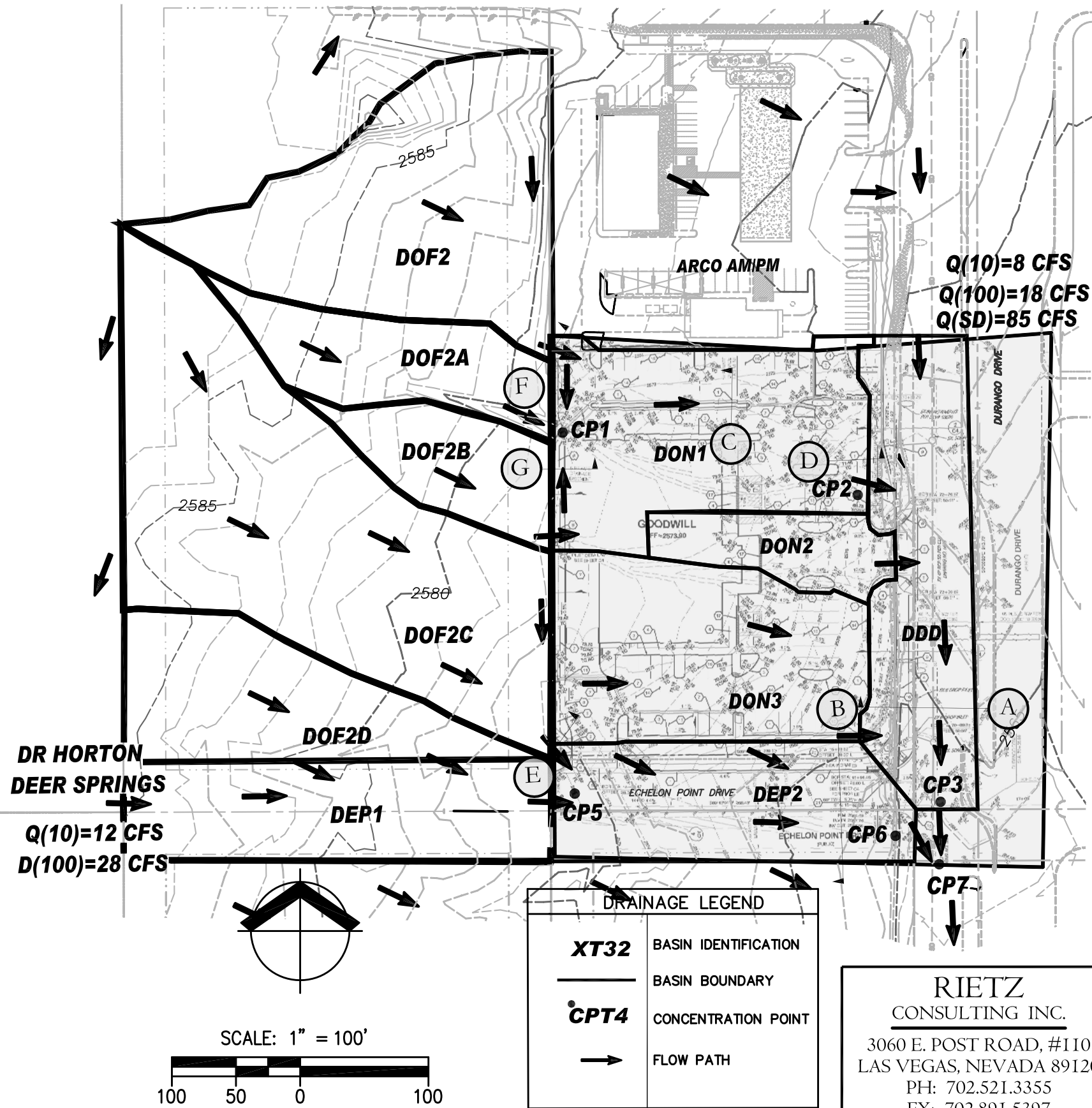
LOCATION MAP

FIGURE

2



NORMAL DEPTH FLOW CALCULATIONS					
FUTURE CONDITIONS					
STREET NAME OR LOCATION	SLOPE, %	Q(10) / Q(100) CFS	D(10) / D(100), FEET	V(10) / V(100), FPS	V(10)*D(10) / V(100)*D(100)
Section A - Durango Drive West half street	1.50	15 / 32	0.53 / 0.65	3.7 / 4.3	2.0 / 2.8
Section B - Echelon Point Drive north half street (30' back of curb to CL)	4.40	18 / 39	0.48 / 0.60	6.0 / 6.7	2.9 / 4.0



SUMMARY OF PEAK FLOW RATES-FUTURE CONDITIONS				
CONC. POINT/ DRAINAGE AREA	AREA, ACRES	PEAK FLOW, CFS		NOTES
		10-YR	100-YR	
CP1		3	6	
CP2		4	8	
CP3		15	32	A, C
CP5		16	37	B
CP6		15	36	B
CP7		32	71	A, B, C
DDD	0.66	1	2	
DEP1	0.60	1	2	
DEP2	0.58	1	2	
DOF2	1.05	2	3	
DOF2B	0.29	<1	1	
DOF2C	1.54	2	5	
DOF2D	0.55	1	2	
DON1	0.80	1	2	
DON2	0.22	<1	1	
DON3	0.76	1	2	
10/9/2014				
A. Peak flow rates referenced from the Technical Drainage Study for Arco AM/PM @ Deer Springs and Durango, by Walker Engineering are added directly to the peak flow rates at this location: $Q(10)=8$ cfs, $Q(100)=18$ CFS				
B. Peak flow rates referenced from the Technical Drainage Study for D R Horton Deer Springs, by Slater Hanifan, are added directly to the peak flow rates at this location: $Q(10)=12$ cfs, $Q(100)=28$ CFS				
C. Table reports surface flow only at this location. Approximate 10- and 100-yr flow in the underground storm drain is 85 cfs.				

MISCELLANEOUS ONSITE FLOW CALCULATIONS					
FUTURE CONDITIONS					
LOCATION	SLOPE, PERCENT	Q ₁₀₀ CFS	D ₁₀₀ NORMAL FEET	VEL. HEAD, FEET	WEIR DEPTH, FEET
Section C - L-curb flowline	0.4	8	0.64	0.09	NA
Section D - L-curb flowline	2.3	8	0.49	0.34	NA
Section E - 5' concrete flume	1.0	5	0.10	0.07	NA
Section F - 5' concrete flume	10.0	3	0.09	0.63	0.34
Section G - 5' concrete flume	0.6	1	0.11	0.05	NA

GOODWILL AT
DURANGO & DEER SPRINGS
**FUTURE CONDITIONS
DRAINAGE BASINS**

**FIGURE
5**



HYDROLOGY



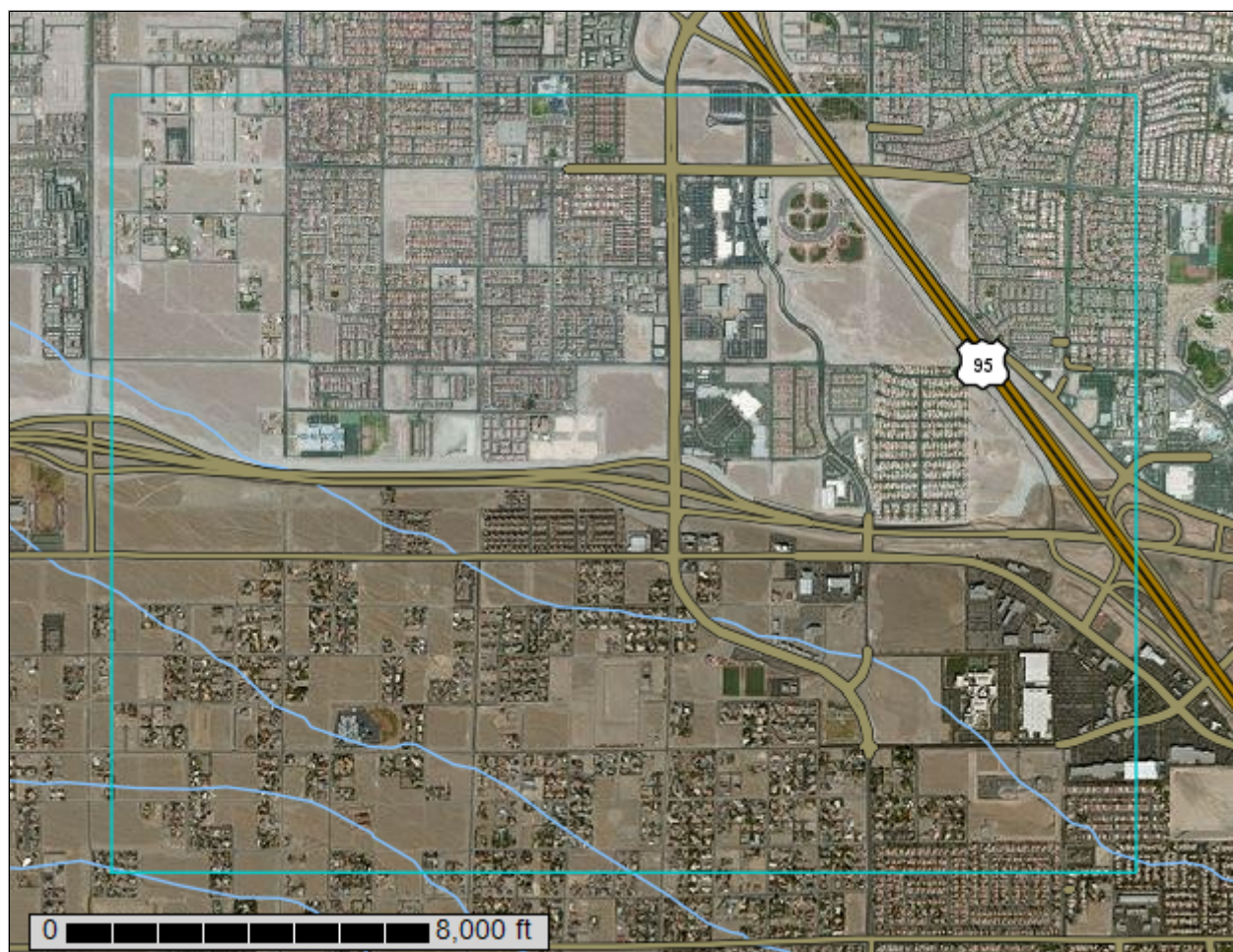
United States
Department of
Agriculture

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 4, 2014

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 (<http://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.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means

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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 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 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 Information for All Uses

Soil Properties and Qualities

The Soil Properties and Qualities section includes various soil properties and qualities displayed as thematic maps with a summary table for the soil map units in the selected area of interest. A single value or rating for each map unit is generated by aggregating the interpretive ratings of individual map unit components. This aggregation process is defined for each property or quality.

Soil Qualities and Features

Soil qualities are behavior and performance attributes that are not directly measured, but are inferred from observations of dynamic conditions and from soil properties. Example soil qualities include natural drainage, and frost action. Soil features are attributes that are not directly part of the soil. Example soil features include slope and depth to restrictive layer. These features can greatly impact the use and management of the soil.

Hydrologic Soil Group (Goodwill Durango & Deer Springs)

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Custom Soil Resource Report

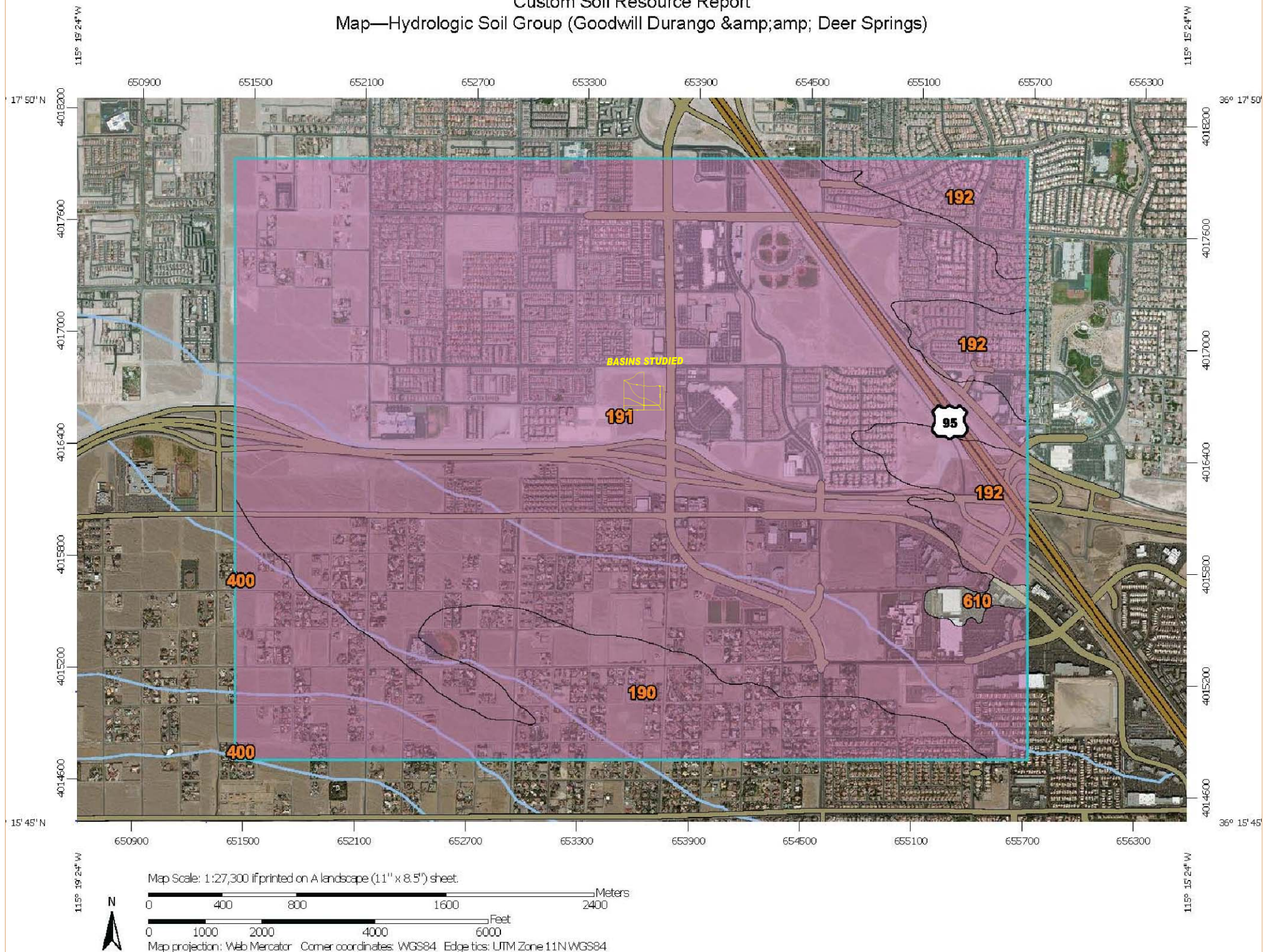
Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Custom Soil Resource Report

Map—Hydrologic Soil Group (Goodwill Durango & Deer Springs)



Custom Soil Resource Report

MAP LEGEND

Area of Interest (AOI)

 Area of Interest (AOI)

Soils

Soil Rating Polygons

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Lines

 A
 A/D
 B
 B/D
 C
 C/D
 D
 Not rated or not available

Soil Rating Points

 A
 A/D
 B
 B/D

 C
 C/D
 D
 Not rated or not available

Water Features

 Streams and Canals

Transportation

 Rails
 Interstate Highways
 US Routes
 Major Roads
 Local Roads

Background

 Aerial Photography

MAP INFORMATION

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

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

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL: <http://websoilsurvey.nrcs.usda.gov>
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 9, Dec 14, 2013

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

Date(s) aerial images were photographed: May 7, 2011—Feb 25, 2014

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

Table—Hydrologic Soil Group (Goodwill Durango & Deer Springs)

Hydrologic Soil Group— Summary by Map Unit — Las Vegas Valley Area, Nevada, Part of Clark County (NV788)				
Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
190	Dalian very gravelly fine sandy loam, 2 to 4 percent slopes	A	566.3	16.6%
191	Dalian very cobbly fine sandy loam, 2 to 8 percent slopes	A	2,565.0	75.1%
192	Dalian-McCullough complex, 0 to 4 percent slopes	A	260.7	7.6%
400	Tencee very gravelly fine sandy loam, 2 to 8 percent slopes	D	1.7	0.0%
610	Pits, gravel		20.4	0.6%
Totals for Area of Interest			3,414.1	100.0%

Rating Options—Hydrologic Soil Group (Goodwill Durango & Deer Springs)

Aggregation Method: Dominant Component

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

TIME OF CONCENTRATION AND HEC-1 INPUT

Project Name: Goodwill Durango & Deer Springs

Date: 9/20/2014

By: BB



3060 E. Post Rd. Suite 110

Las Vegas NV

89120 Ph. 702-521-3355

SUB-BASIN DATA					INITIAL/OVERLAND TIME (T _i)			TRAVEL TIME (T _t)					T _c	T _c CHECK (URBANIZED BASINS)			
KK		BA														UD	LS
Desig.	DEV./EX. (D or E)	K	AREA ac	AREA MI ²	INITIAL LENGTH FT	SLOPE %	T _i MIN.	TRAVEL LENGTH FT	SLOPE %	V ₁ VEL FT/S	V ₂ VEL FT/S	T _t MIN.	T _c Calc.	TOTAL LENGTH FT	T _c Check	TLAG3	CN
		[1]*		[2]*			[3]*			[4]*	[5]*	[6]*		[8]*	[13]*	[15]*	[16]*
DEVELOPED																	
DON1	D	0.824	0.80	0.0013	65	1.0	4.00	360	0.5	1.43	2.16	4.20	8.20	425	N/A	0.082	92
DON2	D	0.824	0.22	0.0003	85	1.0	4.57	105	6.5	5.15	7.80	0.34	4.91	190	N/A	0.050	92
DON3	D	0.824	0.76	0.0012	65	1.0	4.00	340	1.2	2.21	3.35	2.56	6.56	405	N/A	0.066	92
DOF2	D	0.824	1.05	0.0016	50	1.0	3.51	255	3.1	3.56	5.39	1.19	4.70	305	N/A	0.050	92
DOF2A	D	0.824	0.37	0.0006	50	1.0	3.51	250	1.6	2.56	3.87	1.63	5.14	300	N/A	0.051	92
DOF2B	D	0.824	0.29	0.0005	50	1.0	3.51	180	3.0	3.50	5.30	0.86	4.37	230	N/A	0.050	92
DOF2C	D	0.824	1.54	0.0024	50	1.0	3.51	435	2.6	3.26	4.93	2.23	5.73	485	N/A	0.057	92
DOF2D	D	0.824	0.55	0.0009	50	1.0	3.51	290	3.0	3.50	5.30	1.38	4.89	340	11.89	0.050	92
DEP1	D	0.904	0.60	0.0009	33	2.0	1.61	330	2.8	3.38	5.12	1.63	3.24	363	12.02	0.050	98
DEP2	D	0.904	0.58	0.0009	33	2.0	1.61	280	4.4	4.24	6.42	1.10	2.71	313	11.74	0.050	98
EDD	D	0.904	0.60	0.0009	43	2.0	1.84	400	1.5	2.47	3.75	2.69	4.53	443	12.46	0.050	98
DDD	D	0.904	0.66	0.0010	43	2.0	1.84	400	1.5	2.47	3.75	2.69	4.53	443	12.46	0.050	98
EXISTING																	
EOF2	E	0.745	1.05	0.0016	218	2.6	6.86	272	1.0	1.48	2.94	3.06	9.92	490	N/A	0.100	86
EOF2A	E	0.745	0.37	0.0006	100	3.1	4.38	205	3.1	2.61	5.18	1.31	5.69	305	N/A	0.100	86
EOF2B	E	0.745	0.29	0.0004	100	3.0	4.43	130	3.0	2.56	5.09	0.85	5.27	230	N/A	0.100	86
EOF2C	E	0.745	1.54	0.0024	100	2.7	4.59	385	2.6	2.39	4.74	2.69	7.28	485	N/A	0.100	86
EOF2D	E	0.745	0.55	0.0009	100	3.0	4.43	240	3.0	2.56	5.09	1.56	5.99	340	N/A	0.100	86
EON1	E	0.745	1.45	0.0023	100	2.7	4.59	290	2.6	2.39	4.74	2.03	6.61	390	N/A	0.100	86
EON2	E	0.745	0.52	0.0008	100	3.1	4.38	170	3.3	2.69	5.34	1.05	5.43	270	N/A	0.100	86
EEP1	E	0.745	0.60	0.0009	50	2.9	3.17	280	2.8	2.48	4.92	1.88	5.05	330	N/A	0.100	86
EEP2	E	0.745	0.49	0.0008	50	3.8	2.89	230	2.9	2.52	5.01	1.52	4.41	280	N/A	0.100	86

* Clark County Regional Flood Control District - Hydrologic Criteria and Drainage Design Manual

CURVE NUMBER DETERMINATION*

Goodwill Durango and Deer Springs

9/22/2014

BY B.BROWN

BASIN	HYDROLOGIC SOILS GROUP	LAND USE	CURVE NUMBER	PERCENT OF TOTAL	FINAL CN	REMARKS
DON1, DON2, DON3, DOF2 DOF2A, DOF2B, DOF2C, DOF2D	B**	Commercial and business	92	100	92	TABLE 602, 1 of 4 urban districts
DEP1, DEP2 EDD, DDD	ANY	PAVED	98	100	98	Table 602, 1 of 4 Streets and roads
EOF2, EOF2A, EOF2B, EOF2C EOF2D, EON1, EON2, EEP1, EEP2	B	Developing urban areas Newly graded areas	86	100	86	Table 602, 1 of 4 Developing urban

*Based on Clark County Regional Flood Control District Hydrologic Criteria and Drainage Design Manual, Latest update.

**Same Hydrologic Soils Group used in the Walker Engineering AM/PM Arco study, although HSG "A" was determined from the SCS website.

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

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

```

X      X  XXXXXXXX  XXXXXX  X
X      X  X      X      X  XXX
X      X  X      X      X      X
XXXXXXXXXX XXXX  X      XXXXXX  X
X      X  X      X      X      X
X      X  X      X      X      X
X      X  XXXXXXXX  XXXXXX  XXXX

```

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

PAGE 1

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

*DIAGRAM

```
ID  
1 ID  
2 ID EXISTING, INTERIM, AND FUTURE CONDITIONS MODEL  
3 ID GOODWILL DURANGO AND DEER SPRINGS  
4 ID MOMENTUM ENGINEERS FOR RIETZ CONSULTING - B BROWN  
5 ID  
6 ID  
7 ID 6-HOUR STORM DISTRIBUTION #3  
8 ID 10- AND 100-YEAR STORM EVENTS  
9 ID  
10 ID JR CARDS CONTAIN DARE'S BASED ON THE FOLLOWING VALUES:  
11 ID  
12 ID  
13 ID  
14 ID  
15 IT      5          0          0        300  
16 IO      5          0          0  
17 IN      5          0          0  
18 JR     PREC    0.56         1  
  
19 KK      EOF2  
20 KM      <<<<<<<<<<<<<<<<<<BEGIN EX CONDITIONS>>>>>>>>>>>>>>
```


74	KK	CP5
75	HC	2
	*	

```

93      KK      EOF2B
94      BA      0.0004

```

95	LS	0	86
96	UD	0.100	
	*		
97	KK	CP1	
98	HC	3	
	*		
99	KK	DON1	
100	BA	.0013	
101	LS	0	92
102	UD	0.082	
	*		
103	KK	CP2	
104	HC	2	
	*		
105	KK	DON2	
106	BA	.0003	
107	LS	0	92
108	UD	0.050	
	*		

1

HEC-1 INPUT

PAGE 4

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

109	KK	DON3	
110	BA	.0012	
111	LS	0	92
112	UD	0.066	
	*		
113	KK	DDD	
114	BA	0.0010	
115	LS	0	98
116	UD	0.050	
	*		
117	KK	CP3	
118	HC	4	
	*		
119	KK	EOF2C	
120	BA	0.0024	
121	LS	0	86
122	UD	0.100	
	*		
123	KK	EOF2D	
124	BA	0.0009	
125	LS	0	86
126	UD	0.100	
	*		
127	KK	EEP1	
128	BA	0.0009	
129	LS	0	86
130	UD	0.100	

165	UD	0.050	
	*		
166	KK	DON3	
167	BA	.0012	
168	LS	0	92
169	UD	0.066	
	*		
170	KK	DDD	
171	BA	0.0010	
172	LS	0	98
173	UD	0.050	
	*		

1

HEC-1 INPUT

PAGE 6

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

174	KK	CP3	
175	HC	4	
	*		
176	KK	DOF2C	
177	BA	0.0024	
178	LS	0	92
179	UD	0.057	
	*		
180	KK	DOF2D	
181	BA	0.0009	
182	LS	0	92
183	UD	0.050	
	*		
184	KK	DEF1	
185	BA	0.0009	
186	LS	0	98
187	UD	0.050	
	*		
188	KK	CP5	
189	HC	3	
	*		
190	KK	DEF2	
191	BA	.0009	
192	LS	0	98
193	UD	0.050	
	*		
194	KK	CP6	
195	HC	2	
	*		
196	KK	CP7	
197	HC	2	
	*		
198	ZZ		

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE	(V) ROUTING	(--->) DIVERSION OR PUMP FLOW
NO.	(.) CONNECTOR	(<---) RETURN OF DIVERTED OR PUMPED FLOW
19	EOF2	
	.	
34	.	EOF2A
	.	
38	CP1.....	
	.	
40	.	EOF2B
	.	
44	.	EON1
	.	
48	CP2.....	
	.	
50	.	EDD
	.	
54	CP3.....	
	.	
56	.	EOF2C
	.	
60	.	EON2
	.	
64	.	CP4.....
	.	
66	.	EOF2D
	.	
70	.	EEP1
	.	
74	.	CP5.....
	.	
76	.	EEP2
	.	
80	.	CP6.....
	.	
82	CP7.....	
	.	
84	.	EOF2
	.	
	.	

89	.	.	EOF2A	.
	.	.	.	.
93	.	.	.	EOF2B
	.	.	.	.
97	.	CP1.....	.	.
	.	.	.	.
99	.	.	DON1	.
	.	.	.	.
103	.	CP2.....	.	.
	.	.	.	.
105	.	.	DON2	.
	.	.	.	.
109	.	.	.	DON3
	.	.	.	.
113	.	.	.	DDD
	.	.	.	.
117	.	CP3.....	.	.
	.	.	.	.
119	.	.	EOF2C	.
	.	.	.	.
123	.	.	.	EOF2D
	.	.	.	.
127	.	.	.	EEP1
	.	.	.	.
131	.	.	CP5.....	.
	.	.	.	.
133	.	.	.	DEP2
	.	.	.	.
137	.	.	CP6.....	.
	.	.	.	.
139	.	CP7.....	.	.
	.	.	.	.
141	.	.	DOF2	.
	.	.	.	.
146	.	.	.	DOF2A
	.	.	.	.
150	.	.	.	DOF2B
	.	.	.	.
154	.	.	CP1.....	.
	.	.	.	.
	.	.	.	.

```

156      .      .      .      DON1
      .      .      .      .
      .      .      .      .
160      .      .      CP2.....
      .      .      .      .
      .      .      .      .
162      .      .      .      DON2
      .      .      .      .
      .      .      .      .
166      .      .      .      .      DON3
      .      .      .      .      .
      .      .      .      .      .
170      .      .      .      .      .      DDD
      .      .      .      .      .      .
      .      .      .      .      .      .
174      .      .      CP3.....
      .      .      .      .
      .      .      .      .
176      .      .      .      DOF2C
      .      .      .      .
      .      .      .      .
180      .      .      .      .      DOF2D
      .      .      .      .      .
      .      .      .      .      .
184      .      .      .      .      .      DEP1
      .      .      .      .      .      .
      .      .      .      .      .      .
188      .      .      .      CP5.....
      .      .      .      .
      .      .      .      .
190      .      .      .      .      DEP2
      .      .      .      .      .
      .      .      .      .      .
194      .      .      .      CP6.....
      .      .      .      .
      .      .      .      .
196      .      .      CP7.....

```

{***} RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
*
* RUN DATE 20SEP14 TIME 15:54:41 *
*
*****

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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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EXISTING, INTERIM, AND FUTURE CONDITIONS MODEL
GOODWILL DURANGO AND DEER SPRINGS
MOMENTUM ENGINEERS FOR RIETZ CONSULTING - B BROWN

6-HOUR STORM DISTRIBUTION #3

10- AND 100-YEAR STORM EVENTS

JR CARDS CONTAIN DARFS BASED ON THE FOLLOWING VALUES:

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
 .56 1.00

1

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

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION	
					RATIO 1	RATIO 2
					.56	1.00
HYDROGRAPH AT						
+	EOF2	.00	1	FLOW	1.	2.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	EOF2A	.00	1	FLOW	0.	1.
				TIME	3.50	3.50
2 COMBINED AT						

EXISTING

+	CP1	.00	1	FLOW TIME	1. 3.58	3. 3.50
HYDROGRAPH AT						
+	EOF2B	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT						
+	EON1	.00	1	FLOW TIME	1. 3.58	3. 3.50
3 COMBINED AT						
+	CP2	.00	1	FLOW TIME	3. 3.58	7. 3.50
HYDROGRAPH AT						
+	EDD	.00	1	FLOW TIME	1. 3.50	2. 3.50
2 COMBINED AT						
+	CP3	.01	1	FLOW TIME	4. 3.50	9. 3.50
HYDROGRAPH AT						
+	EOF2C	.00	1	FLOW TIME	1. 3.58	3. 3.50
HYDROGRAPH AT						
+	EON2	.00	1	FLOW TIME	0. 3.50	1. 3.50
2 COMBINED AT						
+	CP4	.00	1	FLOW TIME	2. 3.58	4. 3.50
HYDROGRAPH AT						
+	EOF2D	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT						
+	EEP1	.00	1	FLOW TIME	0. 3.50	1. 3.50
2 COMBINED AT						
+	CP5	.00	1	FLOW TIME	1. 3.50	3. 3.50
HYDROGRAPH AT						
+	EEP2	.00	1	FLOW TIME	0. 3.50	1. 3.50
3 COMBINED AT						
+	CP6	.01	1	FLOW TIME	3. 3.58	8. 3.50
2 COMBINED AT						
+	CP7	.01	1	FLOW TIME	7. 3.50	17. 3.50
HYDROGRAPH AT						

EXISTING
CONDITIONS

(FROM
THE N.)

$$CP3 = 4/9 + 8/18 = 12/27$$

(FROM
THE W.)

$$CP5 = 1/3 + 12/28 = 13/31$$

$$CP6 = 3/8 + 12/28 = 15/36$$

$$CP7 = 7/17 + 8/18 + 12/28 = 27/63$$

(N.) (W.)

+	EOF2	.00	1	FLOW TIME	1. 3.50	2. 3.50
HYDROGRAPH AT						
+	EOF2A	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT						
+	EOF2B	.00	1	FLOW TIME	0. 3.50	1. 3.50
3 COMBINED AT						
+	CP1	.00	1	FLOW TIME	1. 3.58	4. 3.50
HYDROGRAPH AT						
+	DON1	.00	1	FLOW TIME	1. 3.50	2. 3.50
2 COMBINED AT						
+	CP2	.00	1	FLOW TIME	2. 3.50	6. 3.50
HYDROGRAPH AT						
+	DON2	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT						
+	DON3	.00	1	FLOW TIME	1. 3.50	2. 3.50
HYDROGRAPH AT						
+	DDD	.00	1	FLOW TIME	1. 3.50	2. 3.50
4 COMBINED AT						
+	CP3	.01	1	FLOW TIME	5. 3.50	12. 3.50
HYDROGRAPH AT						
+	EOF2C	.00	1	FLOW TIME	1. 3.58	3. 3.50
HYDROGRAPH AT						
+	EOF2D	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT						
+	EEP1	.00	1	FLOW TIME	0. 3.50	1. 3.50
3 COMBINED AT						
+	CP5	.00	1	FLOW TIME	2. 3.58	6. 3.50
HYDROGRAPH AT						
+	DEP2	.00	1	FLOW TIME	1. 3.50	2. 3.50
2 COMBINED AT						

INTERIM
CONDITIONS

(FROM
THE N.)

$$CP3 = 5/12 + 8/18 = 13/30$$

(FROM
THE W.)

$$CP5 = 2/6 + 12/28 = 14/34$$

+	CP6	.01	1	FLOW TIME	3. 3.50	8. 3.50
2 COMBINED AT						
+	CP7	.01	1	FLOW TIME	9. 3.50	20. 3.50
HYDROGRAPH AT						
+	DOF2	.00	1	FLOW TIME	2. 3.50	3. 3.50
HYDROGRAPH AT						
+	DOF2A	.00	1	FLOW TIME	1. 3.50	1. 3.50
HYDROGRAPH AT						
+	DOF2B	.00	1	FLOW TIME	0. 3.50	1. 3.50
3 COMBINED AT						
+	CP1	.00	1	FLOW TIME	3. 3.50	6. 3.50
HYDROGRAPH AT						
+	DON1	.00	1	FLOW TIME	1. 3.50	2. 3.50
2 COMBINED AT						
+	CP2	.00	1	FLOW TIME	4. 3.50	8. 3.50
HYDROGRAPH AT						
+	DON2	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT						
+	DON3	.00	1	FLOW TIME	1. 3.50	2. 3.50
HYDROGRAPH AT						
+	DDD	.00	1	FLOW TIME	1. 3.50	2. 3.50
4 COMBINED AT						
+	CP3	.01	1	FLOW TIME	7. 3.50	14. 3.50
HYDROGRAPH AT						
+	DOF2C	.00	1	FLOW TIME	2. 3.50	5. 3.50
HYDROGRAPH AT						
+	DOF2D	.00	1	FLOW TIME	1. 3.50	2. 3.50
HYDROGRAPH AT						
+	DEP1	.00	1	FLOW TIME	1. 3.50	2. 3.50
3 COMBINED AT						

$$CP6 = 3/8 + 12/28 = 15/36 \quad (\text{INTERIM})$$

(FROM THEN.)

$$CP7 = 9/20 + 12/28 + 8/18 = 29/66$$

(FROM THEN.)

↓ BEGIN FUTURE CONDITIONS

$$CP3 = 7/14 + 8/18 = 15/32$$

(FROM THEN.)

+	CP5	.00	1	FLOW TIME	4. 3.50	9. 3.50
HYDROGRAPH AT						
+	DEF2	.00	1	FLOW TIME	1. 3.50	2. 3.50
2 COMBINED AT						
+	CP6	.01	1	FLOW TIME	6. 3.50	11. 3.50
2 COMBINED AT						
+	CP7	.01	1	FLOW TIME	12. 3.50	25. 3.50

FUTURE CONDITIONS =

$$CP5 = 4/9 + 12/28 = 16/37$$

$$CP6 = 6/11 + 12/28 = 18/39$$

$$CP7 = 12/25 + 12/28 + 8/18 = 32/71$$

(W.) (N.)

*** NORMAL END OF REC-1 ***



HYDRAULICS

Worksheet for Sec A - Durango Drive West half 10-yr

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.01500 ft/ft
Discharge 15.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+50.00	1.03

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+50.00, 1.03)	0.016

Options

Current Roughness Weighted Method Improved Lotter's Method
Open Channel Weighting Method Improved Lotter's Method
Closed Channel Weighting Method Horton's Method

Results

Normal Depth 0.53 ft
Elevation Range 0.00 to 1.03 ft
Flow Area 4.02 ft²
Wetted Perimeter 21.37 ft
Hydraulic Radius 0.19 ft
Top Width 21.12 ft
Normal Depth 0.53 ft

Worksheet for 24" storm drain

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.014	
Channel Slope	0.01000	ft/ft
Diameter	2.00	ft
Discharge	18.00	ft ³ /s

Results

Normal Depth	1.43	ft
Flow Area	2.40	ft ²
Wetted Perimeter	4.02	ft
Hydraulic Radius	0.60	ft
Top Width	1.81	ft
Critical Depth	1.53	ft
Percent Full	71.3	%
Critical Slope	0.00846	ft/ft
Velocity	7.51	ft/s
Velocity Head	0.88	ft
Specific Energy	2.30	ft
Froude Number	1.15	
Maximum Discharge	22.60	ft ³ /s
Discharge Full	21.01	ft ³ /s
Slope Full	0.00734	ft/ft
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
Average End Depth Over Rise	0.00	%
Normal Depth Over Rise	71.27	%
Downstream Velocity	Infinity	ft/s

Worksheet for 24" storm drain

GVF Output Data

Upstream Velocity	Infinity	ft/s
Normal Depth	1.43	ft
Critical Depth	1.53	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00846	ft/ft

Worksheet for Combination Inlet -on grade

Project Description

Solve For Curb Opening Length

Input Data

Discharge	18.00	ft ³ /s
Slope	0.04400	ft/ft
Gutter Width	1.50	ft
Gutter Cross Slope	0.09	ft/ft
Road Cross Slope	0.02	ft/ft
Roughness Coefficient	0.013	
Local Depression	2.00	in
Local Depression Width	1.50	ft
Efficiency	45.61	%
Grate Width	1.50	ft
Grate Length	6.00	ft —
Grate Type	P-50 mm (P-1-7/8")	
Clogging	50.00	%

Options

Calculation Option	Use Both
Grate Flow Option	Exclude None

Results

Curb Opening Length	7.30	ft
Intercepted Flow	8.21	ft ³ /s
Bypass Flow	9.79	ft ³ /s
Spread	14.49	ft
Depth	0.39	ft
Flow Area	2.18	ft ²
Gutter Depression	0.11	ft
Total Depression	0.27	ft
Velocity	8.27	ft/s
Splash Over Velocity	9.97	ft/s
Frontal Flow Factor	1.00	
Side Flow Factor	0.04	
Grate Flow Ratio	0.31	
Equivalent Cross Slope	0.07674	ft/ft
Active Grate Length	3.00	ft
Length Factor	0.09	
Total Interception Length	50.01	ft

→ 8.5' CURB OPENING.

Worksheet for Combination Inlet -on grade

Messages

Messages

Grate Length should be within the defined range of HEC-22's Chart 5 (approx. 0.5-4.5 ft / 0.15-1.35 m).

Cross Section for SEC G - Conc flume

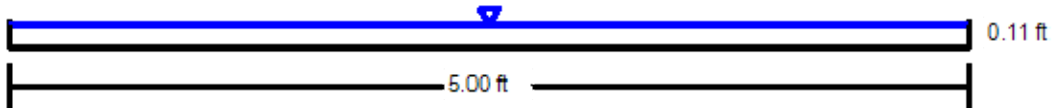
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00600	ft/ft
Normal Depth	0.11	ft
Bottom Width	5.00	ft
Discharge	1.00	ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for SEC G - Conc flume

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.00600	ft/ft
Bottom Width	5.00	ft
Discharge	1.00	ft ³ /s

Results

Normal Depth	0.11	ft
Flow Area	0.57	ft ²
Wetted Perimeter	5.23	ft
Hydraulic Radius	0.11	ft
Top Width	5.00	ft
Critical Depth	0.11	ft
Critical Slope	0.00729	ft/ft
Velocity	1.75	ft/s
Velocity Head	0.05	ft
Specific Energy	0.16	ft
Froude Number	0.91	
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	0.11	ft
Critical Depth	0.11	ft
Channel Slope	0.00600	ft/ft
Critical Slope	0.00729	ft/ft

Worksheet for Sec F - weir depth

Project Description

Solve For Headwater Elevation

Input Data

Discharge		3.00	ft ³ /s
Crest Elevation		0.00	ft
Tailwater Elevation		-0.50	ft
Crest Surface Type	Paved		
Crest Breadth		0.50	ft
Crest Length		5.00	ft

Results

Headwater Elevation	0.34	ft
Headwater Height Above Crest	0.34	ft
Tailwater Height Above Crest	-0.50	ft
Weir Coefficient	3.09	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	3.09	US
Flow Area	1.68	ft ²
Velocity	1.79	ft/s
Wetted Perimeter	5.67	ft
Top Width	5.00	ft

Cross Section for SEC F - Conc flume

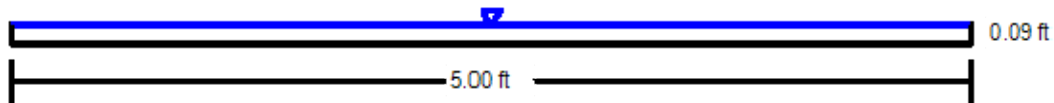
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.10000	ft/ft
Normal Depth	0.09	ft
Bottom Width	5.00	ft
Discharge	3.00	ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for SEC F - Conc flume

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.10000	ft/ft
Bottom Width	5.00	ft
Discharge	3.00	ft ³ /s

Results

Normal Depth	0.09	ft
Flow Area	0.47	ft ²
Wetted Perimeter	5.19	ft
Hydraulic Radius	0.09	ft
Top Width	5.00	ft
Critical Depth	0.22	ft
Critical Slope	0.00605	ft/ft
Velocity	6.35	ft/s
Velocity Head	0.63	ft
Specific Energy	0.72	ft
Froude Number	3.64	
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	0.09	ft
Critical Depth	0.22	ft
Channel Slope	0.10000	ft/ft
Critical Slope	0.00605	ft/ft

Cross Section for Sec E - conc flume

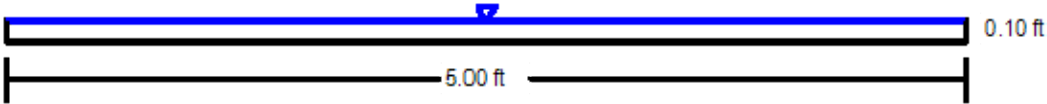
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.01000	ft/ft
Normal Depth	0.10	ft
Bottom Width	5.00	ft
Discharge	1.00	ft ³ /s

Cross Section Image



V: 1
H: 1

Worksheet for Sec E - conc flume

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Roughness Coefficient	0.015	
Channel Slope	0.01000	ft/ft
Bottom Width	5.00	ft
Discharge	1.00	ft ³ /s

Results

Normal Depth	0.10	ft
Flow Area	0.49	ft ²
Wetted Perimeter	5.20	ft
Hydraulic Radius	0.09	ft
Top Width	5.00	ft
Critical Depth	0.11	ft
Critical Slope	0.00730	ft/ft
Velocity	2.05	ft/s
Velocity Head	0.07	ft
Specific Energy	0.16	ft
Froude Number	1.15	
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	0.10	ft
Critical Depth	0.11	ft
Channel Slope	0.01000	ft/ft
Critical Slope	0.00730	ft/ft

Cross Section for Sec D - L-curb flowline onsite

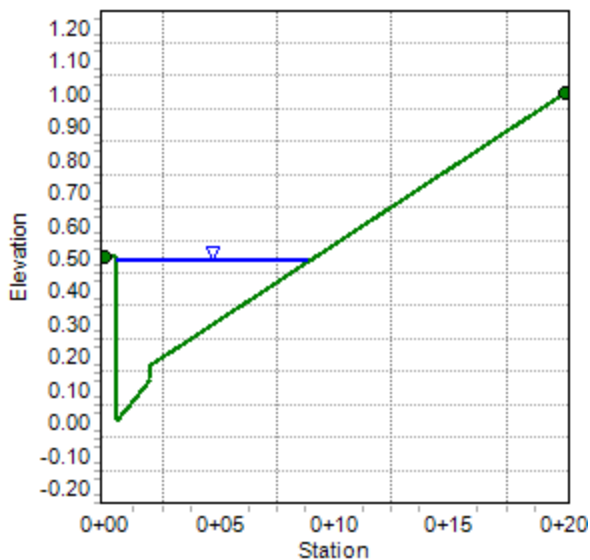
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.02300	ft/ft
Normal Depth	0.49	ft
Discharge	8.00	ft ³ /s

Cross Section Image



Worksheet for Sec D - L-curb flowline onsite

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.02300 ft/ft
Discharge 8.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.50	0.50
0+00.50	0.00
0+02.00	0.13
0+02.00	0.17
0+20.00	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+20.00, 1.00)	0.016

Options

Current Roughness Weighted Method Improved Lotter's Method
Open Channel Weighting Method Improved Lotter's Method
Closed Channel Weighting Method Horton's Method

Results

Normal Depth 0.49 ft
Elevation Range 0.00 to 1.00 ft
Flow Area 1.71 ft²
Wetted Perimeter 8.87 ft
Hydraulic Radius 0.19 ft
Top Width 8.33 ft
Normal Depth 0.49 ft

Worksheet for Sec D - L-curb flowline onsite

Results

Critical Depth	0.60	ft
Critical Slope	0.00638	ft/ft
Velocity	4.69	ft/s
Velocity Head	0.34	ft
Specific Energy	0.83	ft
Froude Number	1.83	
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	0.49	ft
Critical Depth	0.60	ft
Channel Slope	0.02300	ft/ft
Critical Slope	0.00638	ft/ft

Cross Section for Sec C - L-curb flowline onsite

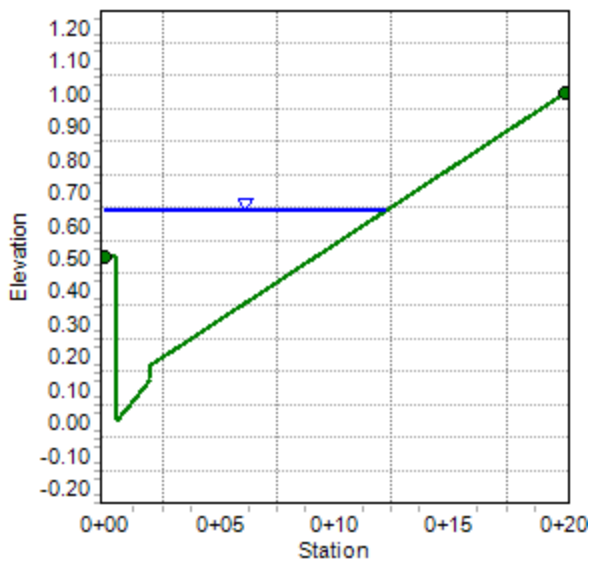
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.00400	ft/ft
Normal Depth	0.64	ft
Discharge	8.00	ft ³ /s

Cross Section Image



Worksheet for Sec C - L-curb flowline onsite

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.00400 ft/ft
Discharge 8.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.50
0+00.50	0.50
0+00.50	0.00
0+02.00	0.13
0+02.00	0.17
0+20.00	1.00

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.50)	(0+20.00, 1.00)	0.016

Options

Current Roughness Weighted Method Improved Lotter's Method
Open Channel Weighting Method Improved Lotter's Method
Closed Channel Weighting Method Horton's Method

Results

Normal Depth 0.64 ft
Elevation Range 0.00 to 1.00 ft
Flow Area 3.35 ft²
Wetted Perimeter 12.93 ft
Hydraulic Radius 0.26 ft
Top Width 12.23 ft
Normal Depth 0.64 ft

Worksheet for Sec C - L-curb flowline onsite

Results

Critical Depth	0.60	ft
Critical Slope	0.00638	ft/ft
Velocity	2.39	ft/s
Velocity Head	0.09	ft
Specific Energy	0.73	ft
Froude Number	0.80	
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	0.64	ft
Critical Depth	0.60	ft
Channel Slope	0.00400	ft/ft
Critical Slope	0.00638	ft/ft

Cross Section for SecB Echelon Point 60' bc 1/2 st 100yr

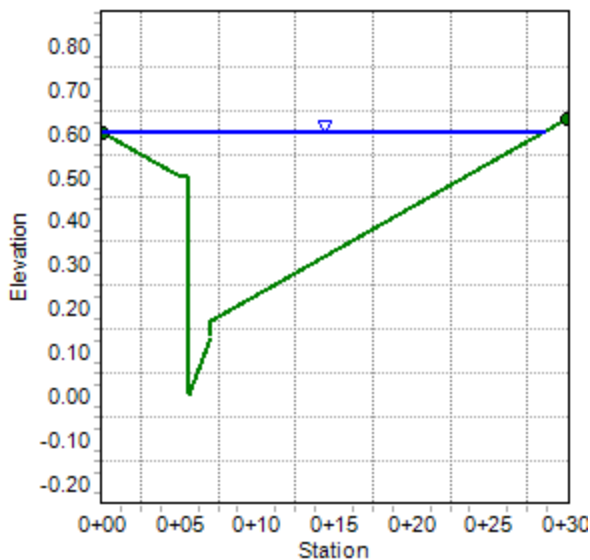
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04400	ft/ft
Normal Depth	0.60	ft
Discharge	39.00	ft ³ /s

Cross Section Image



Worksheet for SecB Echelon Point 60' bc 1/2 st 100yr

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.04400 ft/ft
Discharge 39.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+30.00, 0.63)	0.016

Options

Current Roughness Weighted Method Improved Lotter's Method
Open Channel Weighting Method Improved Lotter's Method
Closed Channel Weighting Method Horton's Method

Results

Normal Depth 0.60 ft
Elevation Range 0.00 to 0.63 ft
Flow Area 5.86 ft²
Wetted Perimeter 29.29 ft
Hydraulic Radius 0.20 ft
Top Width 28.73 ft

Worksheet for SecB Echelon Point 60' bc 1/2 st 100yr

Results

Normal Depth	0.60	ft
Critical Depth	0.78	ft
Critical Slope	0.00538	ft/ft
Velocity	6.66	ft/s
Velocity Head	0.69	ft
Specific Energy	1.29	ft
Froude Number	2.60	
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	0.60	ft
Critical Depth	0.78	ft
Channel Slope	0.04400	ft/ft
Critical Slope	0.00538	ft/ft

Cross Section for SecB Echelon Point 60' bc 1/2 st 10yr

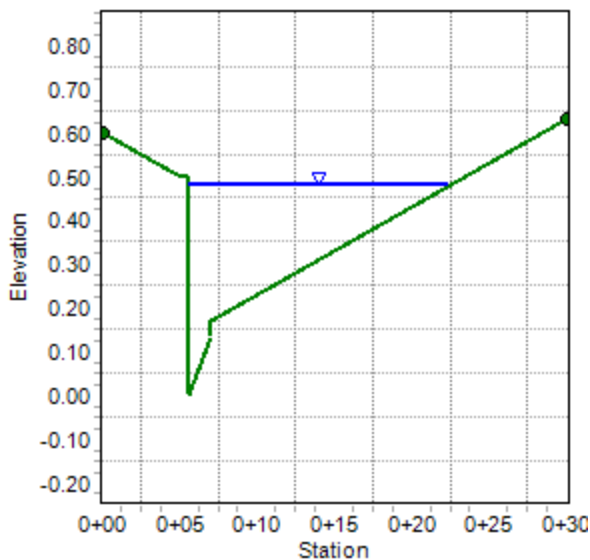
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04400	ft/ft
Normal Depth	0.48	ft
Discharge	18.00	ft ³ /s

Cross Section Image



Project Description

Input Data

Elevation (ft)

Roughness Segment Definitions

Roughness Coefficient

0.016

Options

Results

Page 1 of 2

Worksheet for SecB Echelon Point 60' bc 1/2 st 10yr

Results

Normal Depth	0.48	ft
Critical Depth	0.63	ft
Critical Slope	0.00631	ft/ft
Velocity	6.01	ft/s
Velocity Head	0.56	ft
Specific Energy	1.04	ft
Froude Number	2.52	
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	0.48	ft
Critical Depth	0.63	ft
Channel Slope	0.04400	ft/ft
Critical Slope	0.00631	ft/ft

Cross Section for Sec B Echelon Point 60' bc 1/2 st capacity

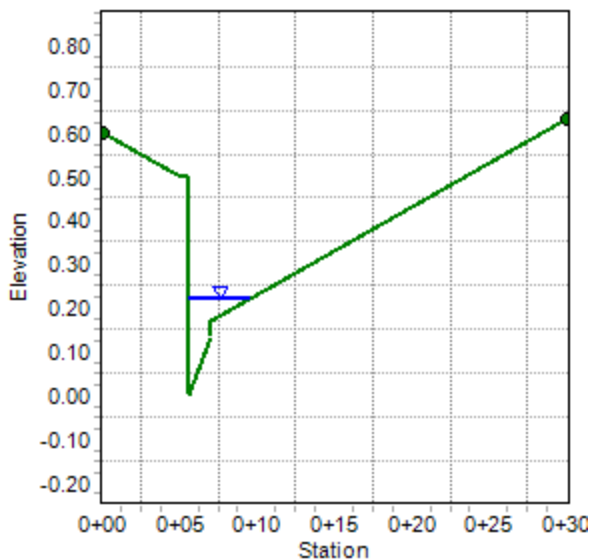
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.04400	ft/ft
Normal Depth	0.22	ft
Discharge	1.00	ft ³ /s

Cross Section Image



Worksheet for Sec B Echelon Point 60' bc 1/2 st capacity

Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.04400 ft/ft
Discharge 1.00 ft³/s
Section Definitions

Station (ft)	Elevation (ft)
0+00.00	0.60
0+05.00	0.50
0+05.50	0.50
0+05.50	0.00
0+07.00	0.13
0+07.00	0.17
0+30.00	0.63

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.00, 0.60)	(0+30.00, 0.63)	0.016

Options

Current Roughness Weighted Method Improved Lotter's Method
Open Channel Weighting Method Improved Lotter's Method
Closed Channel Weighting Method Horton's Method

Results

Normal Depth 0.22 ft
Elevation Range 0.00 to 0.63 ft
Flow Area 0.30 ft²
Wetted Perimeter 4.37 ft
Hydraulic Radius 0.07 ft
Top Width 4.10 ft

Worksheet for Sec B Echelon Point 60' bc 1/2 st capacity

Results

Normal Depth	0.22	ft
Critical Depth	0.28	ft
Critical Slope	0.00893	ft/ft
Velocity	3.30	ft/s
Velocity Head	0.17	ft
Specific Energy	0.39	ft
Froude Number	2.14	
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	0.22	ft
Critical Depth	0.28	ft
Channel Slope	0.04400	ft/ft
Critical Slope	0.00893	ft/ft

Cross Section for Sec A - Durango Drive West half 100-yr

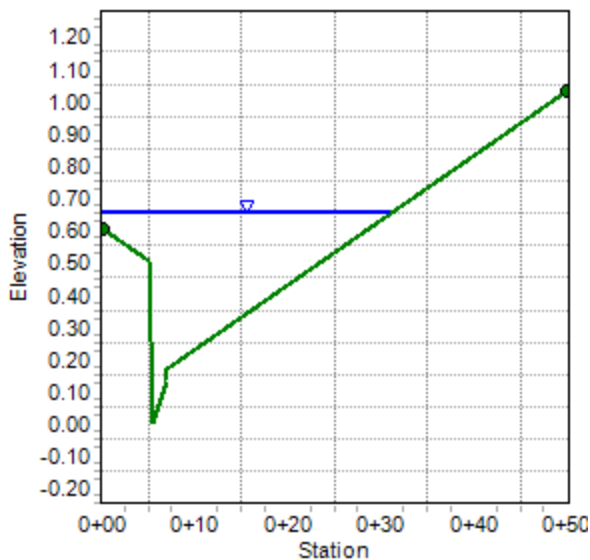
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.01500	ft/ft
Normal Depth	0.65	ft
Discharge	32.00	ft ³ /s

Cross Section Image



Project Description

Input Data

Elevation (ft)

Roughness Segment Definitions

Roughness Coefficient

0.016

Horton's Method

Page 1 of 2

Worksheet for Sec A - Durango Drive West half 100-yr

Results

Critical Depth	0.74	ft
Critical Slope	0.00570	ft/ft
Velocity	4.33	ft/s
Velocity Head	0.29	ft
Specific Energy	0.94	ft
Froude Number	1.57	
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	0.65	ft
Critical Depth	0.74	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00570	ft/ft

Cross Section for Sec A - Durango Drive West half 10-yr

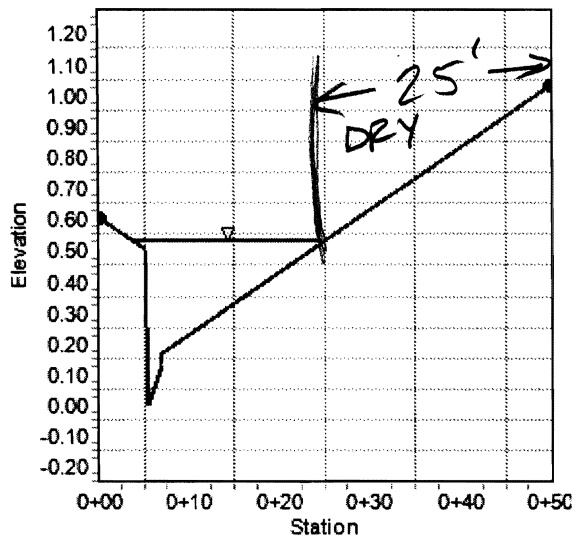
Project Description

Friction Method Manning Formula
Solve For Normal Depth

Input Data

Channel Slope 0.01500 ft/ft
Normal Depth 0.53 ft
Discharge 15.00 ft³/s

Cross Section Image



Worksheet for Sec A - Durango Drive West half 10-yr

Results

Critical Depth	0.60	ft
Critical Slope	0.00640	ft/ft
Velocity	3.73	ft/s
Velocity Head	0.22	ft
Specific Energy	0.74	ft
Froude Number	1.51	
Flow Type	Supercritical	

GVF Input Data

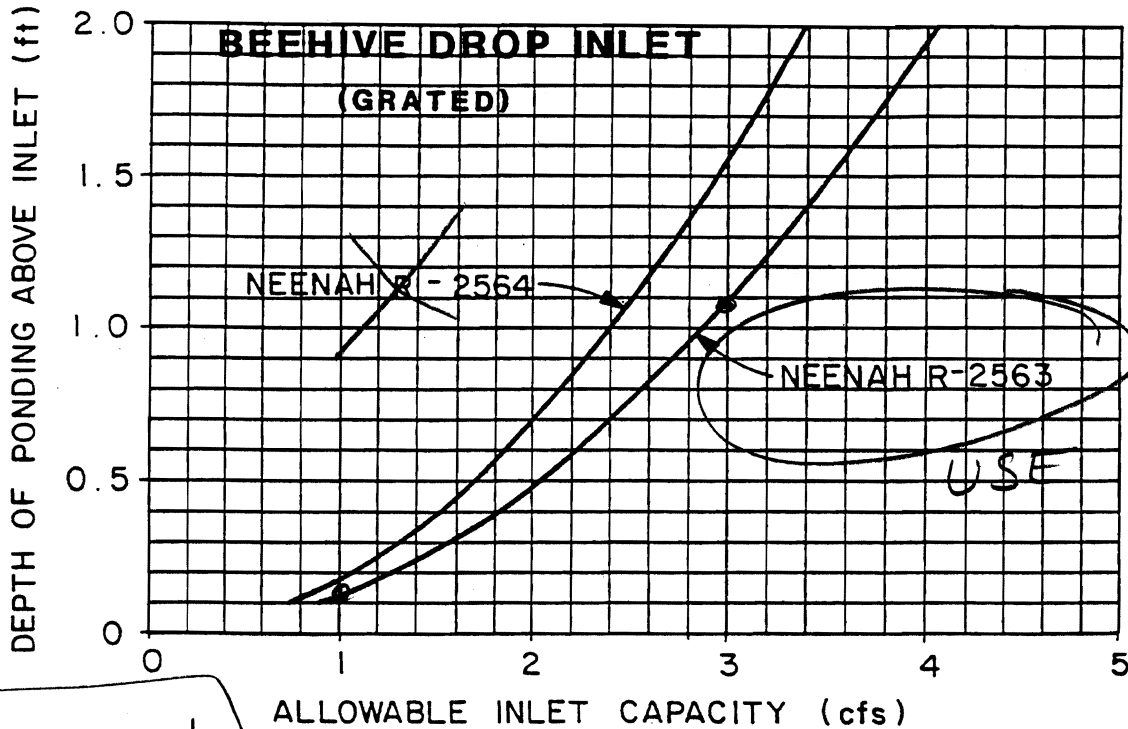
Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

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	0.53	ft
Critical Depth	0.60	ft
Channel Slope	0.01500	ft/ft
Critical Slope	0.00640	ft/ft

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

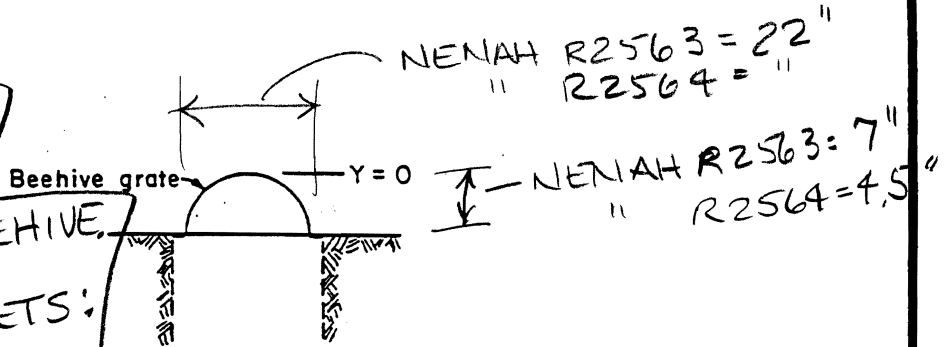
ALLOWABLE INLET CAPACITY SUMP CONDITION



GOING FROM N. TO S.:

1ST INLET - POND TO (30 cfs) 1.1 FEET ABOVE CROWN OF BEEHIVE.

2ND AND 3RD INLETS: POND TO 0.1 FEET ABOVE CROWN OF BEEHIVE.



- NOTES: 1. Includes capacity reduction factor of 0.50 for Beehive Drop Inlet.
2. This inlet shall only be located in a sump condition.

Revision	Date

WRC
ENGINEERING

REFERENCE:

FIGURE 814



REFERENCE MATERIAL

NOTES

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.

MAP LEGEND

PARCEL BOUNDARY

SUB BOUNDARY

PM/LD BOUNDARY

ROAD EASEMENT

MATCH / LEADER LINE

HISTORIC LOT LINE

HISTORIC SUB BOUNDARY

HISTORIC PM/LD BOUNDARY

SECTION LINE

CONDOMINIUM UNIT

AIR SPACE PCL

RIGHT OF WAY PCL

SUB-SURFACE PCL

001

ROAD PARCEL NUMBER

001

PARCEL NUMBER

1.00

ACREAGE

202

PARCEL SUB/SEQ NUMBER

PB 24-45

PLAT RECORDING NUMBER

5

BLOCK NUMBER

5

LOT NUMBER

GL5

GOV. LOT NUMBER

BOOK

T19S R60E

SEC.

20

MAP

N 2 SW 4

125-20-3

099

100

126

125

137

138

Scale: 1" = 200'

Rev: 5/8/2014

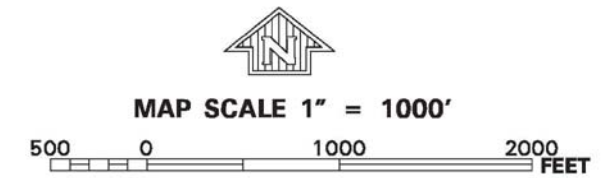
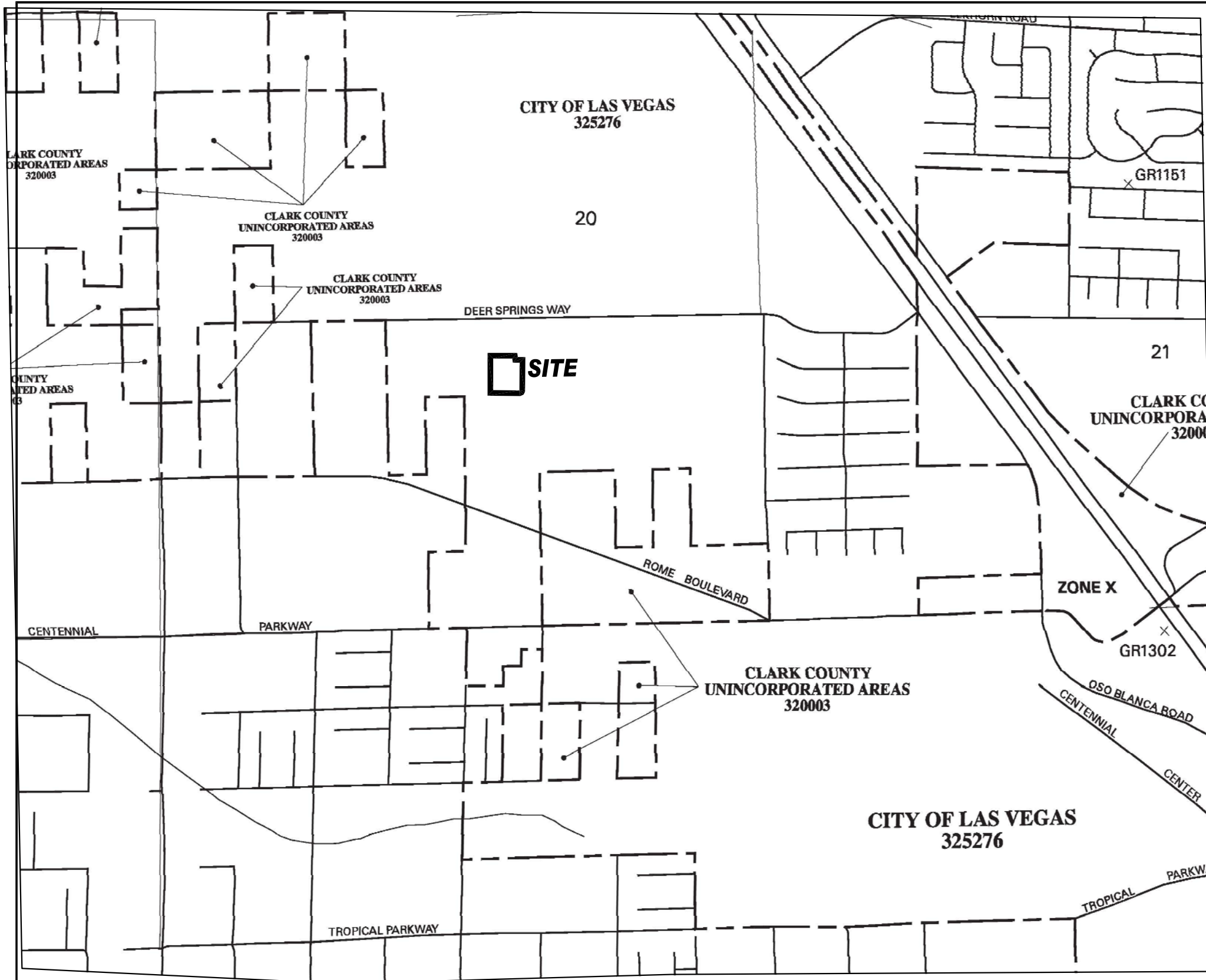
6	5	4	3	2	1
7	8	9	10	11	12
18	17	16	15	14	13
19	20	21	22	23	24
30	29	28	27	26	25
31	32	33	34	35	36

8	4	8	4
5	1	5	1
6	2	6	2
7	3	7	3
8	4	8	4
5	1	5	1

CLARK COUNTY
ASSESSOR
MAPPING DIVISION
NEVADA

The map displays several residential units and parcels. Key features include:

- SIERRA HILLS UNIT 1:** A large area with numerous small parcels, many numbered in red (e.g., 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024, 025, 026, 027, 028, 029, 030, 031, 032, 033, 034, 035, 036, 037, 038, 039, 040, 041, 042, 043, 044, 045, 046, 047, 048, 049, 050, 051, 052, 053, 054, 055, 056, 057, 058, 059, 060, 061, 062, 063, 064, 065, 066, 067, 068, 069, 070, 071, 072, 073, 074, 075, 076, 077, 078, 079, 080, 081, 082, 083, 084, 085, 086, 087, 088, 089, 090, 091, 092, 093, 094, 095, 096, 097, 098, 099, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 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582, 583, 584, 585, 586, 587, 588, 589, 590, 591, 592, 593, 594, 595, 596, 597, 598, 599, 600, 601, 602, 603, 604, 605, 606, 607, 608, 609, 610, 611, 612, 613, 614, 615, 616, 617, 618, 619, 620, 621, 622, 623, 624, 625, 626, 627, 628, 629, 630, 631, 632, 633, 634, 635, 636, 637, 638, 639, 640, 641, 642, 643, 644, 645, 646, 647, 648, 649, 650, 651, 652, 653, 654, 655, 656, 657, 658, 659, 660, 661, 662, 663, 664, 665, 666, 667, 668, 669, 670, 671, 672, 673, 674, 675, 676, 677, 678, 679, 680, 681, 682, 683, 684, 685, 686, 687, 688, 689, 690, 691, 692, 693, 694, 695, 696, 697, 698, 699, 700, 701, 702, 703, 704, 705, 706, 707, 708, 709, 710, 711, 712, 713, 714, 715, 716, 717, 718, 719, 720, 721, 722, 723, 724, 725, 726, 727, 728, 729, 730, 731, 732, 733, 734, 735, 736, 737, 738, 739, 740, 741, 742, 743, 744, 745, 746, 747, 748, 749, 750, 751, 752, 753, 754, 755, 756, 757, 758, 759, 760, 761, 762, 763, 764, 765, 766, 767, 768, 769, 770, 771, 772, 773, 774, 775, 776, 777, 778, 779, 780, 781, 782, 783, 784, 785, 786, 787, 788, 789, 790, 791, 792, 793, 794, 795, 796, 797, 798, 799, 800, 801, 802, 803, 804, 805, 806, 807, 808, 809, 810, 811, 812, 813, 814, 815, 816, 817, 818, 819, 820, 821, 822, 823, 824, 825, 826, 827, 828, 829, 830, 831, 832, 833, 834, 835, 836, 837, 838, 839, 840, 841, 842, 843, 844, 845, 846, 847, 848, 849, 850, 851, 852, 853, 854, 855, 856, 857, 858, 859, 860, 861, 862, 863, 864, 865, 866, 867, 868, 869, 870, 871, 872, 873, 874, 875, 876, 877, 878, 879, 880, 881, 882, 883, 884, 885, 886, 887, 888, 889, 890, 891, 892, 893, 894, 895, 896, 897, 898, 899, 900, 901, 902, 903, 904, 905, 906, 907, 908, 909, 910, 911, 912, 913, 914, 915, 916, 917, 918, 919, 920, 921, 922, 923, 924, 925, 926, 927, 928, 929, 930, 931, 932, 933, 934, 935, 936, 937, 938, 939, 940, 941, 942, 943, 944, 945, 946, 947, 948, 949, 950, 951, 952, 953, 954, 955, 956, 957, 958, 959, 960, 961, 962, 963, 964, 965, 966, 967, 968, 969, 970, 971, 972, 973, 974, 975, 976, 977, 978, 979, 980, 981, 982, 983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000).
- SIERRA HILLS UNIT 2:** A smaller area with fewer parcels, many numbered in red (e.g., 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024, 025, 026, 027, 028, 029, 030, 031, 032, 033, 034, 035, 036, 037, 038, 039, 040, 041, 042, 043, 044, 045, 046, 047, 048, 049, 050, 051, 052, 053, 054, 055, 056, 057, 058, 059, 060, 061, 062, 063, 064, 065, 066, 067, 068, 069, 070, 071, 072, 073, 074, 075, 076, 077, 078, 079, 080, 081, 082, 083, 084, 085, 086, 087, 088, 089, 090, 091, 092, 093, 094, 095, 096, 097, 098, 099, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177, 178, 179, 180, 181, 182, 183, 184, 185, 186, 187, 188, 189, 190, 191, 192, 193, 194, 195, 196, 197, 198, 199, 200, 201, 202, 203, 204, 205, 206, 207, 208, 209, 210, 211, 212, 213, 214, 215, 216, 217, 218, 219, 220, 221, 222, 223, 224, 225, 226, 227, 228, 229, 230, 231, 232, 233, 234, 235, 236, 237, 238, 239, 240, 241, 242, 243, 244, 245, 246, 247, 248, 249, 250, 251, 252, 253, 254, 255, 256, 257, 258, 259, 260, 261, 262, 263, 264, 265, 266, 267, 268, 269, 270, 271, 272, 273, 274, 275, 276, 277, 278, 279, 280, 281, 282, 283, 284, 285, 286, 287, 288, 289, 290, 291, 292, 293, 294, 295, 296, 297, 298, 299, 300, 301, 302, 303, 304, 305, 306, 307, 308, 309, 310, 311, 312, 313, 314, 315, 316, 317, 318, 319, 320, 321, 322, 323, 324, 325, 326, 327, 328, 329, 330, 331, 332, 333, 334, 335, 336, 337, 338, 339, 340, 341, 342, 343, 344, 345, 346, 347, 348, 349, 350, 351, 352, 353, 354, 355, 356, 357, 358, 359, 360, 361, 362, 363, 364, 365, 366, 367, 368, 369, 370, 371, 372, 373, 374, 375, 376, 377, 378, 379, 380, 381, 382, 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983, 984, 985, 986, 987, 988, 989, 990, 991, 992, 993, 994, 995, 996, 997, 998, 999, 1000).
- SIERRA HILLS UNIT 3:** A small area with a few parcels, many numbered in red (e.g., 001, 002, 003, 004, 005, 006, 007, 008, 009, 010, 011, 012, 013, 014, 015, 016, 017, 018, 019, 020, 021, 022, 023, 024, 025, 026, 027, 028, 029, 030, 031, 032, 033, 034, 035, 036, 037, 038, 039, 040, 041, 042, 043, 044, 045, 046, 047, 048, 049, 050, 051, 052, 053, 054, 055, 056, 057, 058, 059, 060, 061, 062, 063, 064, 065, 066, 067, 068, 069, 070, 071, 072, 073, 074, 075, 076, 077, 078, 079, 080, 081, 082, 083, 084, 085, 086, 087, 088, 089, 090, 091, 092, 093, 094, 095, 096, 097, 098, 099, 100, 101, 102, 103, 104, 105, 106, 107, 108, 109, 110, 111, 112, 113, 114, 115, 116, 117, 118, 119, 120, 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 134, 135, 136, 137, 138, 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, 149, 150, 151, 152, 153, 154, 155, 156, 157, 158, 159, 160, 161, 162, 163, 164, 165, 166, 167, 168, 169, 170, 171, 172, 173, 174, 175, 176, 177,



NATIONAL FLOOD INSURANCE PROGRAM

PANEL 1745 E

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

PANEL 1745 OF 4090
(SEE MAP INDEX FOR FIRM PANEL LAYOUT)

COMMUNITY	NUMBER	PANEL	SUFFIX
LAS VEGAS, CITY OF	325276	1745	E
CLARK COUNTY, UNINCORPORATED AREAS	320003	1745	E

Notice to User: The Map Number shown below should be used when placing map orders; the Community Number shown above should be used on insurance applications for the subject community.

MAP NUMBER
32003C1745 E

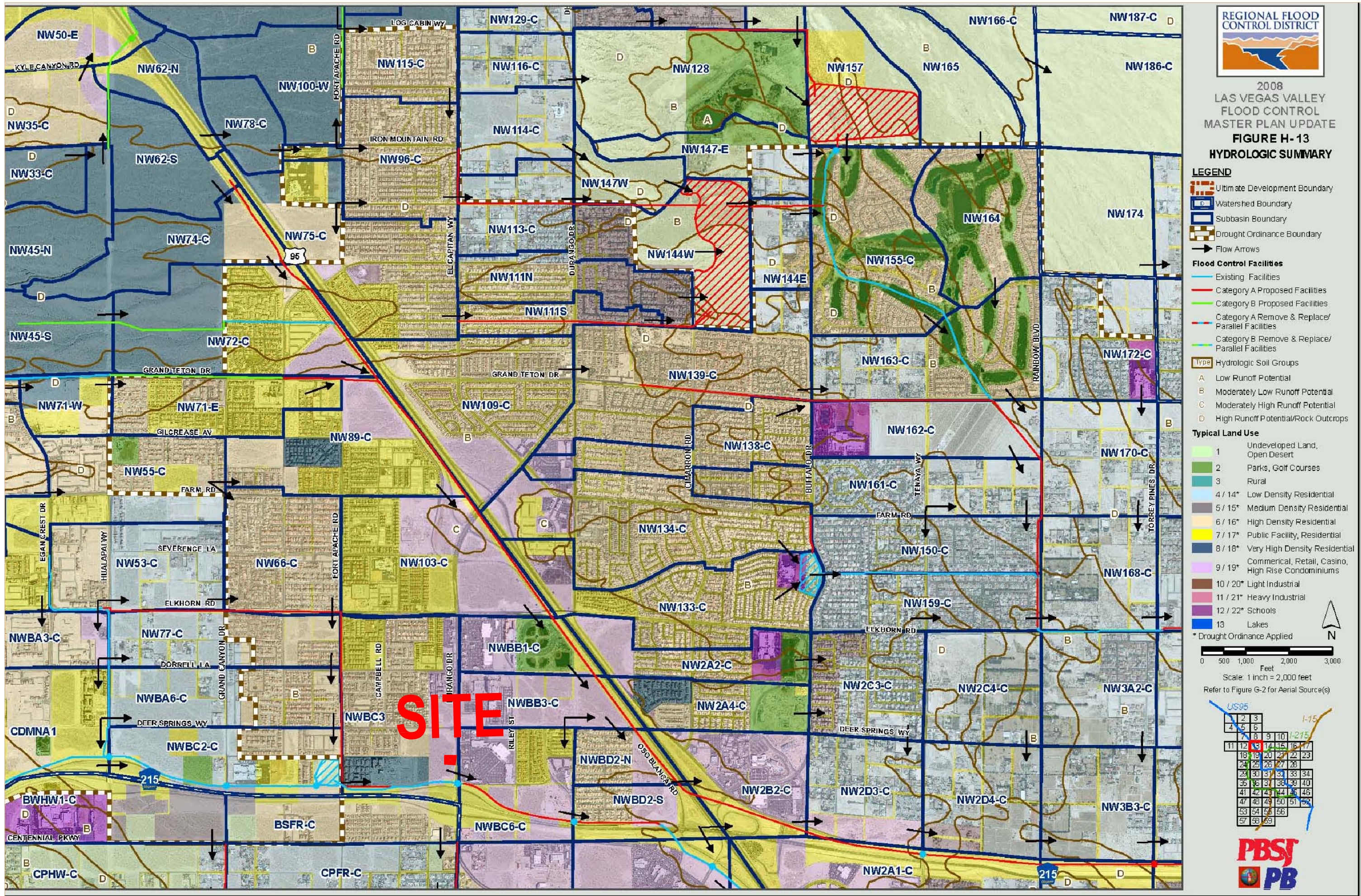
MAP REVISED:
SEPTEMBER 27, 2002

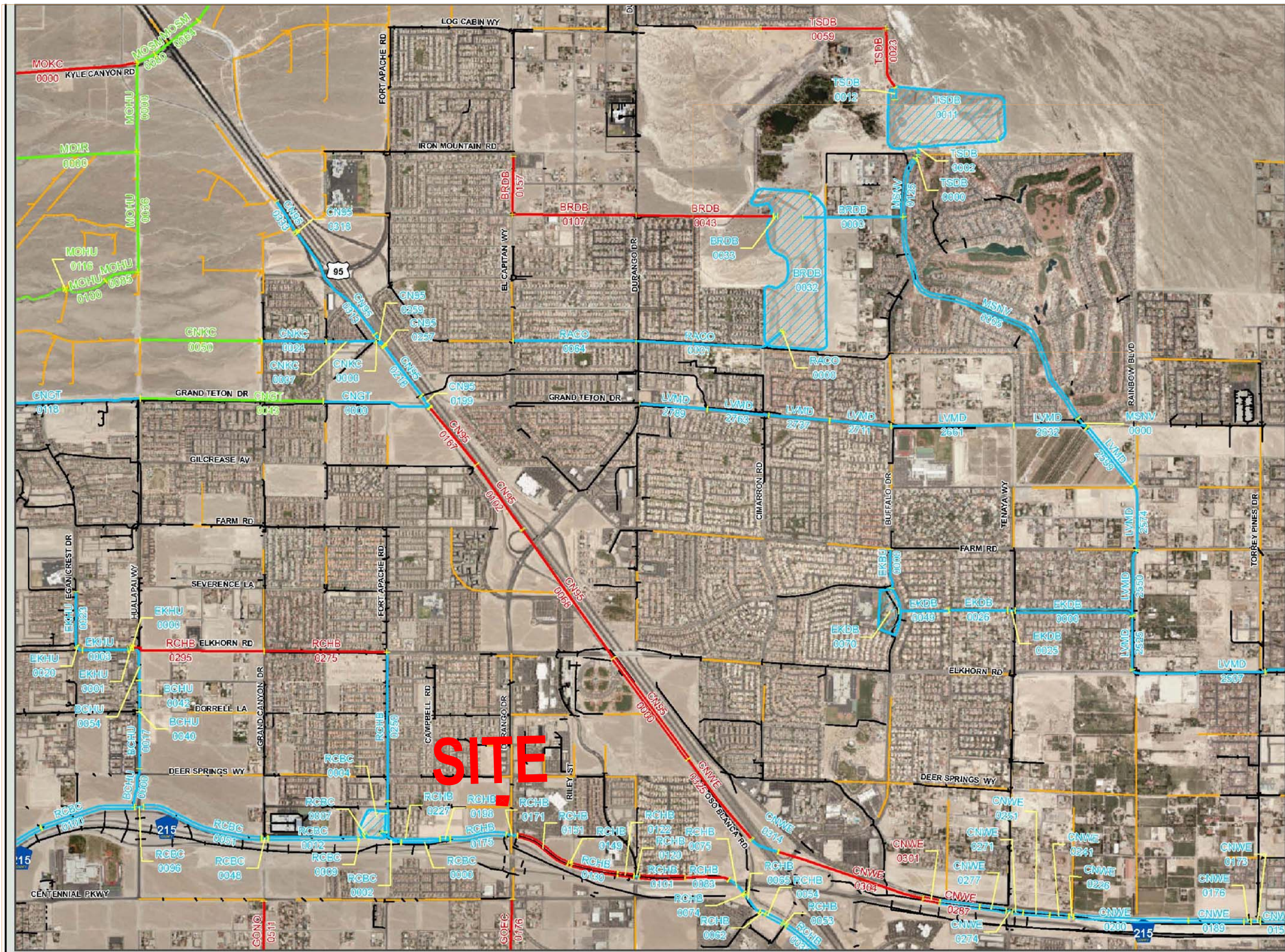
Federal Emergency Management Agency

RIETZ
 CONSULTING INC.
 3060 E. POST ROAD, #110
 LAS VEGAS, NEVADA 89120
 PH: 702.521.3355
 FX: 702.891.5397

GOODWILL
 DURANGO & DEER SPRINGS
 FEMA MAP
 PANEL 1745

FIGURE
 FIRM





2013
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

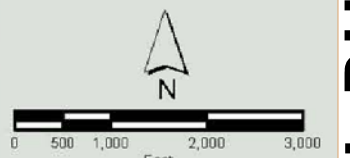
FIGURE F- 13
FLOOD CONTROL FACILITIES

LEGEND

- Ultimate Development Boundary
- Existing Facilities
- Category A Proposed Facilities
- Category B Proposed Facilities
- Local Existing Facilities
- Local Proposed Facilities
- Detention Basin

- Stormdrain
- Lined Channel
- Unlined Channel
- Levee/Dike
- Natural Wash/Floodway
- ID-Mile Separator

- Remove & Replace/Parallel Facilities**
- | Category A | Category B |
|------------|------------|
| Channel | Channel |
| Stormdrain | Stormdrain |



Scale: 1 inch = 2,000 feet
Refer to Figure G-2 for Aerial Source(s)



GOODWILL DURANGO & DEER SPRINGS

ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
BCHU		BELTWAY CHANNEL - HUALAPAI						
0000	E	12' X 5' RCAP	853	501	CBA3-C	WEST3	0.84	1.11
0017	E	8' X 5' RCAP	1216	501	CBA3-C	WEST3	0.84	1.33
0040	E	66" RCP	60	222	DNW26-C	WEST3	0.51	1.04
0042	E	60" RCP	615	222	DNW26-C	WEST3	0.51	1.42
0054	E	54" RCP	770	222	DNW26-C	WEST3	0.51	1.23
BRDB		BRENT DRAINAGE SYSTEM						
0000	E	36" RCP with 18" Orifice Plate	2170	37	BRDB	WEST3	2.48	0.40
0031	E	45,080 cfs PMF Spillway		45080	CBRDB	WEST3	2.48	
0032	E	450 ac-ft South Environmental Enhancement Area		1902	CBRDB	WEST3	2.48	
0033	E	Energy Dissipator	100	957	CNW113-C	WEST3	1.58	
0043	P1	8' X 6' RCB	2920	957	CNW113-C	WEST3	1.58	2.10
0107	P1	8' X 6' RCB	2660	957	CNW113-C	WEST3	1.58	2.40
0157	P1	12' X 6' RCB	1260	741	CNW96-C	WEST3	0.95	0.25
CN95		CENTENNIAL PKWY CHANNEL WEST / U.S 95 BRANCH						
0000	P1	Conc Chnl 22'W 10'D 0:1 SS	2690	3340	CNWBB3-C	WEST3	3.36	2.17
0068	P1	3: 8' X 7" RCB	3380	3216	CNW103-C	WEST3	3.05	2.12
0102	P1	3: 8' X 6' RCB	1710	2888	2CNW89-C	WEST3	2.66	2.09
0167	P1	2: 10' X 6' RCB	1580	2160	2CNW71-E	WEST3	1.64	1.50
0199	E	2: 10' X 6' RCB	320	1423	2CNW72-C	WEST3	1.14	0.82
0218	E	15' X 9' RCB	1127	1423	2CNW72-C	WEST3	1.14	0.82
0257	E	Transition Structure	59	1423	2CNW72-C	WEST3	1.14	0.77
0259	E	15' X 9' RCB	290	653	CNW74-C	WEST3	0.44	0.77
0313	E	10' X 6' RCB	2680	653	CNW74-C	WEST3	0.44	2.50
0318	E	Transition Structure	60	653	CNW74-C	WEST3	0.44	1.50
0333	E	5' X 5' RCB	670	339	NW62-S	WEST3	0.22	1.50
CNGT		CENTENNIAL PKWY CHANNEL WEST / GRAND TETON BRANCH						
0000	E	10' X 5' RCB	2376	600	CNW71-E	WEST3	0.47	2.58
0043	P0	6' X 6' RCB	3980	600	CNW71-E	WEST3	0.47	3.00
0118	E	6' X 5' RCAP	5472	363	KYLEDET*	KYLEDB	57.73	3.72
CNKC		CENTENNIAL PKWY CHANNEL WEST / KYLE CANYON BRANCH						
0000	E	12' X 4' RCB	377	999	CNW72-C	WEST3	0.71	4.58
0007	E	10' X 5' RCB	874	999	CNW72-C	WEST3	0.71	3.28
0024	E	8' X 5' RCB	1385	999	CNW72-C	WEST3	0.71	2.40
0050	P0	84" RCP	2610	854	CNW72-C	WEST3	0.71	3.60
CNWE		CENTENNIAL PKWY CHANNEL WEST						
0150	E	Conc Chnl 40'W 9.5'D 0:1 SS	2279	4233	CNW3B3-C	WEST3	5.64	0.42
0173	E	3: 18' X 8' RCBC @ Torrey Pines	200	4233	CNW3B3-C	WEST3	5.64	0.42
0176	E	Conc Chnl 40'W 9'D 0:1 SS	150	4233	CNW3B3-C	WEST3	5.64	0.41
0189	E	Conc Chnl 36'W 10'D 0:1 SS	1200	4067	CNW2D4-C	WEST3	5.15	0.42
0200	E	Conc Chnl 36'W 9'D 0:1 SS	2470	4067	CNW2D4-C	WEST3	5.15	1.00
0226	E	2: 18' X 8.5' RCBC @ Rio Vista	100	4067	CNW2D4-C	WEST3	5.15	0.51
0241	E	Conc Chnl 36'W 9.5'D 0:1 SS	405	3951	CNW2D3-C	WEST3	4.65	0.51
0251	E	Conc Chnl 36'W 9'D 0:1 SS	575	3951	CNW2D3-C	WEST3	4.65	0.51
0271	E	Conc Chnl 32'W 10'D 0:1 SS	229	3951	CNW2D3-C	WEST3	4.65	0.51
0274	E	32' X 10' RCBC @ Tenaya	142	3951	CNW2D3-C	WEST3	4.65	0.51
0277	E	Conc Chnl 32'W 9'D 0:1 SS	579	3951	CNW2D3-C	WEST3	4.65	0.64
0287	E	Conc Chnl 13'W 10'D 2:1 SS	605	3593	CNW2B2-C	WEST3	3.84	1.19
0301	P2	Conc Chnl 32'W 10'D 0:1 SS	235	3593	CNW2B2-C	WEST3	3.84	1.19
0304	P2	32' X 10' RCB	3259	3593	CNW2B2-C	WEST3	3.84	1.79
0314	E	22' X 7' RCB	785	3593	CNW2B2-C	WEST3	3.84	1.79
0325	P1	32' X 10' RCB	2200	3593	CNW2B2-C	WEST3	3.84	1.75
EKBU		ELKHORN SPRINGS AND BUFFALO						
0000	E	60" RCP	1046	375	NW134-C	WEST3	0.46	1.00
EKDB		ELKHORN SPRINGS DETENTION BASIN						
0000	E	Grass Chnl 15'W 5.8'D 3.5:1 SS	2575	238	CNW150-C	WEST3	1.41	0.39
0025	E	4' X 3' RCB	160	120	ELKBASIN	WEST3	0.84	0.50
0026	E	48" RCP	1270	120	ELKBASIN	WEST3	0.84	1.23
0049	E	60" RCP	1095	120	ELKBASIN	WEST3	0.84	0.13
0070	E	48 ac-ft Elkhorn Springs Detention Basin		629	CNW133-C	WEST3	0.84	
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
EKHU		ELKHORN AND HUALAPAI						
0000	E	6' X 5' RCB Overflow Structure	48	638	CNW26-C	WEST3	0.51	0.91
0001	E	6' X 5' RCAP	72	638	CNW26-C	WEST3	0.51	0.91
0003	E	6' X 4' RCAP	980	638	CNW26-C	WEST3	0.51	3.61
0020	E	6' X 5' RCAP	150	638	CNW26-C	WEST3	0.51	3.61
0023	E	8' X 5' RCAP	1200	638	CNW26-C	WEST3	0.51	0.90
GOEC		GOWAN NORTH - EL CAPITAN BRANCH						
0176	P1	78" RCP	1320	363	CCPFR-C	ALLGOW3	0.46	1.15
GONO		GOWAN NORTH SYSTEM						
0511	P1	7' X 6' RCB	1320	546	CCPHW-C	ALLGOW3	0.60	1.14
LVMD		LAS VEGAS WASH - MIDDLE						
2490	E	2: 13' X 7" RCB	2555	2278	CNW168-C	CWEST3	4.69	0.40
2507	E	2: 13' X 9' RCB	2831	2278	CNW168-C	CWEST3	4.69	0.36
2525	E	24' X 8' RCB	1140	1913	CNW159-C	CWEST3	3.91	0.40
2550	E	24' X 8' RCB	1445	1664	CD161-C	CWEST3	3.41	0.40
2574	E	24' X 8' RCB	1430	1664	CD161-C	CWEST3	3.41	0.40
2599	E	Conc Chnl 24'W 7'D 2:1 SS	1577	1585	CNW162-C	CWEST3	3.08	0.50
2632	E	18' X 8' RCB	1580	968	CNW159-C	WEST3	1.16	0.46
2661	E	18' X 5' RCB	2640	968	CNW138-C	WEST3	1.16	0.46
2711	E	10' X 5' RCB	1320	968	CNW138-C	WEST3	1.16	1.54
2737	E	10' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	2.22
2763	E	6' X 5' RCB	1320	818	CNW139-C	WEST3	0.93	1.79
2789	E	6' X 5' RCB	1470	818	CNW139-C	WEST3	0.93	2.17
MOHU		MOCCASIN - HUALAPAI BRANCH						
0000	P0	14' X 8' RCB	1920	761	2CNW45-N	LOWER3	2.10	0.50
0036	P0	10' X 8' RCB	2590	368	CNW45-N	LOWER3	1.15	0.50
0085	P0	72" RCP	790	368	CNW45-N	LOWER3	1.15	3.00
0100	P0	Natural Wash	850	65	DMODB1	LOWER3	0.81	3.00
0116	P0	60" RCPC	12	65	DMODB1	LOWER3	0.81	3.00
0118	P0	Natural Wash	3485	65	DMODB1	LOWER3	0.81	3.00
MOIR		MOCCASIN - IRON MOUNTAIN BRANCH						
0000	P0	66" RCP	2770	446	2CNW33-C	LOWER3	1.76	3.60
MOKC		MOCCASIN AND KYLE CANYON						
0000	P1	11' X 8' RCB	5450	2662	CNW35-C	LOWER3	2.69	3.40
MOSM		MOCCASIN AND SHEEP MOUNTAIN PARKWAY						
0000	P0	14' X 9' RCB	3370	3778	CNW64-C	LOWER3	5.32	2.40
0064	P0	14' X 8' RCB	880	3505	CNW50-C	LOWER3	4.99	3.00
0080	P0	14' X 8' RCB	710	3325	2CNW35-C	LOWER3	4.80	3.00
MSNV		MOUNTAIN SPA/VISTA RANCH						
0000	E	6: 12' X 5' RCBC @ Grand Teton	273	679	CNW163-C	CWEST3	1.67	0.40
0005	E	Grass Chnl 100'W 4.5'D 10:1 SS	6325	679	CNW163-C	CWEST3	1.67	0.40
0125	E	Grass Chnl 100'W 4.5'D 10:1 SS	1300	116	CNW147E	WEST3	1.54	0.40
RACO		RACEL STREET COLLECTOR						
0000	E	96" RCP Baffled Energy Dissipator	54	497	CNW111S	WEST3	0.55	4.20
0001	E	78" RCP	3245	497	CNW111S	WEST3	0.55	2.46
0064	E	78" RCP	2650	423	DNW111S	WEST3	0.44	2.09
RCBC		RANCHO ROAD SYSTEM - BELTWAY CHANNEL						
0000	E	6' X 5' RCB	1062	222	FADB	WEST3	1.60	1.04
0002	E	54" RCP Outlet with 41" Orifice	503	222	FADB	WEST3	1.60	2.38
0003	E	2,341 cfs PMF Spillway		2341	FADBIN	WEST3	1.60	
0004	E	76 ac-ft Fort Apache Detention Basin		1255	FADBIN	WEST3	1.60	
0007	E	Energy Dissipator	100	1255	FADBIN	WEST3	1.60	
0009	E	12' X 6' RCBC @ Fort Apache Detention Basin	133	1255	FADBIN	WEST3	1.60	1.79
0012	E	Conc Chnl 12'W 6'-7'D 0:1 SS	1937	1255	FADBIN	WEST3	1.60	3.15
0048	E	12' X 6' RCBC @ Grand Canyon	140	1040	CMNA1	WEST3	1.32	3.15
0051	E	Conc Chnl 12'W 6'-8'D 0:1 SS	2660	1040	CMNA1	WEST3	1.32	3.44
0096	E	1: 10' X 6' and 1: 6' X 6' RCBC @ Hualapai Way	190	1040	CMNA1	WEST3	1.32	1.93
0100	E	Conc Chnl 12'W 5.5'D 0:1 SS	2085	598	CDMNA1	WEST3	0.48	2.88
0140	E	Conc Chnl 10'W 5'D 0:1 SS	2155	598	CDMNA1	WEST3	0.48	1.65
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
RCHB		RANCHO ROAD SYSTEM - BELTWAY						
0034	E	Conc Chnl 21'W 8'D 0:1 SS	1000	2631	CNW1C-W	WEST3	4.68	1.19
0053	E	2: 12' X 8' RCBC @ South Ramp Connector	85	2304	CDW1C1	WEST3	4.31	1.40
0054	E	Conc Chnl 21'W 8'D 0:1 SS	432	2304	CDW1C1	WEST3	4.31	1.51
0062	E	Transition Structure	130	2304	CDW1C1	WEST3	4.31	1.51
0065	E	24' X 7' RCB	480	2304	CDW1C1	WEST3	4.31	0.30
0074	E	24' X 6' RCB	50	2226	CNWBC6-C	WEST3	4.17	0.30
0075	E	20' X 6' RCBC @ Beltway	428	2226	CNWBC6-C	WEST3	4.17	2.81
0083	P1	20' X 6' RCB	950	2226	CNWBC6-C	WEST3	4.17	2.49
0101	P1	Conc Chnl 20'W 7'D 0:1 SS	980	2226	CNWBC6-C	WEST3	4.17	2.38
0120	E	20' X 6' RCBC @ Grand Montecito	120	2226	CNWBC6-C	WEST3	4.17	1.00
0122	P1	Conc Chnl 16'-20'W 6'D 0:1 SS	350	2226	CNWBC6-C	WEST3	4.17	1.84
0130	P1	Conc Chnl 16'W 6'D 0:1 SS	1012	2226	CNWBC6-C	WEST3	4.17	2.67
0149	P1	Conc Chnl 16'W 6'-7'D 0:1 SS	87	1888	CNWBC3	WEST3	3.75	2.27
0151	P1	Conc Chnl 16'W 7'D 0:1 SS	1255	1888	CNWBC3	WEST3	3.75	2.65
0171	E	16' X 6' RCBC @ El Capitan Way	234	1888	CNWBC3	WEST3	3.75	1.75
0175	E	Conc Chnl 14'W 7'D 0:1 SS	1220	1888	CNWBC3	WEST3	3.75	2.93
0198	E	Conc Chnl 14'W 7'D 0:1 SS	225	1402	CNWBA6-C	WEST3	3.61	2.93
0227	E	12' X 6' RCB	1885	1402	CNWBA6-C	WEST3	3.61	1.02
0250	E	12' X 6' RCB	3200	1402	CNWBA6-C	WEST3	3.61	1.00
0275	P1	7' X 6' RCB	2650	973	CNW66-C	WEST3	1.75	3.30
0295	P1	7' X 6' RCB	2875	973	CNW66-C	WEST3	1.75	3.30
TSDB		TULE SPRINGS DRAINAGE SYSTEM						
0000	E	2: 10' X 4' RCBC @ Echo Grande	100	26	TULEDB	WEST3	1.35	1.04
0002	E	36" RCP with 22" Orifice Plate	320	26	TULEDB	WEST3	1.35	0.33
0010	E	14,013 cfs PMF Spillway		14013	CTULEDB	WEST3	1.35	
0011	E	117 ac-ft North Environmental Enhancement Area		804	CTULEDB	WEST3	1.35	
0012	E	Energy Dissipator	260	376	CNW148-C	WEST3	0.52	
0023	P1	84" RCP	1320	376	CNW148-C	WEST3	0.52	0.80
0059	P1	78" RCP	2640	376	CNW148-C	WEST3	0.52	1.03

* 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.

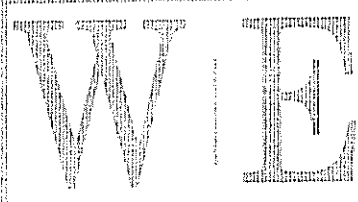
** As-built or design slopes were used when available

5765 South Rainbow Boulevard
Suite 101
Las Vegas, Nevada 89118
T: 702.873.5197
F: 702.873.5346
www.walker-eng.com

WALKER ENGINEERING, LLC

ADDENDUM #1 to the **TECHNICAL DRAINAGE STUDY** for

ARCO AM/PM
@ DURANGO & DEER SPRINGS
Portion of APN: 125-20-301-009
CITY OF LAS VEGAS, NEVADA
DS 4639A



Prepared for:
BENTAR DEVELOPMENT
3030 S. Durango Drive
Las Vegas, Nevada 89117
Tel: 702.366.1605
Fax: 702.387.1008

REFERENCED
INTERIM CONDITIONS
HYDROLOGY FOR
PEAK FLOW RATES
IN DURANGO DRIVE
ADJACENT TO THE
SUBJECT SITE.

Date Prepared:
January 13, 2014

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE:

February 11, 2014

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:

Arco AM/PM @ Durango & Deer Springs

COPIES TO:

Walker Engineering, LLC

Cross Streets:

SWC of Durango Drive & Deer Springs Way

Bentar Development

File Number:

F:\Depot\DSMemos\DS4639B.doc

Bart Anderson, P.E., DevCo

Parcel Number:

125-20-301-009

Zoning Action:

MOD-48831; ZON-50104; SDR-50105;
VAC-50106; SUP-50107-50111

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	11/27/2013	12/17/2013	Not Approved	\$400.00	340741: \$400
2 nd Submittal & Supplement	1/15/2014 & 2/4/2014	2/11/2014	See Comments Below	\$400.00	344888: \$400
TOTAL FEES (LDDRS):				\$800.00	

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.

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

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

END OF REMARKS

ays

T/R/S: T19S/R60E/20

AREA G-20

APPENDIX D – HYDROLOGIC PARAMETERS & ANALYSIS

- Interim Condition Standard Form #4
- Interim Condition HEC-1 Output

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL - STANDARD FORM 4

Development: AM/PM Arco @ Deer Springs & Durango
 Calculated by: JO
 Checked by: DY
 Date: 1/7/2014

TIME OF CONCENTRATION															
SUB-BASIN DATA			INITIAL / OVERLAND TIME: t _i				TRAVEL TIME t _t				CONCENTRATION TIME				
DESIG	AREA Sq. Mi.	EX/DEV EX = 1 DEV = 2	CN	K	LENGTH FL	SLOPE %	t _i Min	LENGTH FL	SLOPE %	VEL FPS	t _t Min	T _c FL	FINAL t _c	(t _c) URBANIZED = (L/100)t+10 Min	t(lag) = (0.6T _c)/60 Hr
PROPOSED CONDITIONS - INTERIM:															
PON1	0.00200	2	92	0.824	200	3.50	4.621	0	0.00	0.0	0.00	200	5.00	11.11	0.0500
PON2	0.00042	2	92	0.824	38	2.60	2.224	195	1.00	3.1	1.0621	233	5.00	11.29	0.0500
EOF1	0.00220	1	86	0.745	49	2.50	3.294	772	2.90	5.0	2.5699	821	10.00	N/A	0.1000
EOF2	0.00164	1	86	0.745	218	2.60	6.857	272	1.00	2.9	1.542	490	10.00	N/A	0.1000
POF3	0.00041	2	98	0.904	45	1.40	2.12	215	2.26	4.6	0.779	260	5.00	11.44	0.0500
POF4	0.00116	2	98	0.904	34	5.90	1.14	433	2.00	4.3	1.6676	467	5.00	12.59	0.0500
EOF5	0.00232	1	86	0.745	267	3.50	6.87	361	2.77	4.9	1.2296	628	10.00	N/A	0.1000

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*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 07JAN14 TIME 08:56:17 *
*****

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

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

THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE. THE DEFINITION OF -RMSKK- 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

HEC-1 INPUT

PAGE 1

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID
3 ID
4 ID
5 ID
6 ID
7 ID
8 ID
9 ID
10 ID
11 ID
12 ID
13 ID
14 IT 5 0 0 300
15 IO 5 0
16 IN 5
17 JR PREC 0.56 1.00
18 KK EOF1
19 KM EXISTING OFFSITE BASIN EOF1
20 BA .0022
21 PB 2.86
22 PC .000 .020 .057 .070 .087 .100 .124 .130 .130 .130
23 PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181
24 PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249
25 PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409
26 PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856
27 PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976
28 PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998
29 PC .998 .999 1.00
30 LS 0 86
31 UD 0.1000
32 KK POF3
33 KM PROPOSED OFFSITE BASIN POF3
34 BA .00041
35 LS 0 98
36 UD .0500
37 KK CP1
38 KM COMBINE EOF1 & POF3
39 HC 2
40 KK PON1
41 KM PROPOSED ONSITE BASIN PON1
42 BA .00200
43 LS 0 92
44 UD .0500

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*** REFERENCED
RAIN FALL
DEPTHS OF
2.86" = D₁₀₀
1.61" = D₁₀

*** FOR CLARITY,
REFERENCED
"B" HYDROLOGIC
SOILS GROUP.

HEC-1 INPUT

PAGE 2

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LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
45 KK PON2
46 KM PROPOSED ONSITE BASIN PON2
47 BA .00042

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INT1292

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48      LS      0      92
49      UD      .0500
      *
50      KK      EOF2
51      RM      EXISTING OFFSITE BASIN EOF2
52      BA      .00164
53      LS      0      86
54      UD      .1000
      *
55      KK      EOF5
56      RM      EXISTING OFFSITE BASIN EOF5
57      BA      .00232
58      LS      0      86
59      UD      .1000
      *
60      KK      POF4
61      RM      PROPOSED OFFSITE BASIN POF4
62      BA      .00116
63      LS      0      98
64      UD      .0500
      *
65      KK      CP2
66      RM      COMBINE CP1, PON1, PON2, EOF2, EOF5, AND POF4
67      HC      6
      *
68      ZZ

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1

SCHEMATIC DIAGRAM OF STREAM NETWORK

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

18      EOF1
32      .      POF3
37      CP1.....
40      .      PON1
45      .      .      PON2
50      .      .      EOF2
55      .      .      EOF5
60      .      .      POF4
65      CP2.....

```

[***] RUNOFF ALSO COMPUTED AT THIS LOCATION

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 07JAN14 TIME 08:56:17 *
*****

```

```

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

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*****
* HYDROLOGIC ANALYSIS *
* FOR *
* ARCO AM/PM @ DURANGO/DEER SPRINGS *
* INTERIM CONDITION *
*****

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

```

```

15 IO      OUTPUT CONTROL VARIABLES
          IPNT      5      PRINT CONTROL
          IPLOT      0      PLOT CONTROL
          QSCAL      0      HYDROGRAPH PLOT SCALE

IT      HYDROGRAPH TIME DATA
          NMIN      5      MINUTES IN COMPUTATION INTERVAL

```


INT1292

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

JF MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
.56 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 .56	RATIO 2 1.00
HYDROGRAPH AT					
+ EOF1	.00	1	FLOW TIME	1. 3.58	3. 3.50
HYDROGRAPH AT					
+ POF3	.00	1	FLOW TIME	1. 3.50	1. 3.50
2 COMBINED AT					
+ CP1	.00	1	FLOW TIME	2. 3.50	4. 3.50
HYDROGRAPH AT					
+ PON1	.00	1	FLOW TIME	2. 3.50	4. 3.50
HYDROGRAPH AT					
+ PON2	.00	1	FLOW TIME	0. 3.50	1. 3.50
HYDROGRAPH AT					
+ EOF2	.00	1	FLOW TIME	1. 3.50	2. 3.50
HYDROGRAPH AT					
+ EOF5	.00	1	FLOW TIME	1. 3.58	3. 3.50
HYDROGRAPH AT					
+ POF4	.00	1	FLOW TIME	2. 3.50	3. 3.50
6 COMBINED AT					
+ CP2	.01	1	FLOW TIME	8. 3.50	18. 3.50

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

← FLOW IN DURANGO
WEST HALF STREET
AT THE NORTHERN
BOUNDARY OF THE
SUBJECT SITE.

TECHNICAL DRAINAGE STUDY

Deer Springs

City of Las Vegas, Nevada

Job No.: DRH1231.003

Date: June 2013

**REFERENCED
FOR PEAK FLOW
RATES IN
ECHEZON POINT
DRIVE**

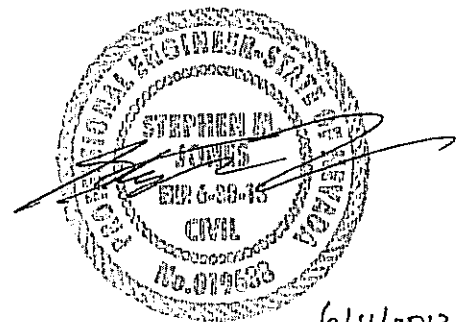
DS140311

Prepared By:

Slater Hanifan Group, Inc.
5740 S. Arville Street, Suite 216
Las Vegas, Nevada 89118
Phone: 702-284-5300 • Fax: 702-284-5399

Prepared For:

D.R. Horton, Inc
330 Carousel Parkway, Suite 140
Henderson, Nevada 89104
Phone: 702-236-3600 • Fax: 702-435-8008



Steve Jones, P.E.
NV Professional Engineer No. 19638

Assisted By: Amy Poechmann, P.E.

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		May 27, 2014 <i>AMS</i>
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	COPIES TO:	
Drainage Study for:	Slater Hanifan Group	
Deer Springs – Update #1	D.R. Horton Inc.	
Cross Streets:	Deer Springs Way & Campbell Road	Bart Anderson, P.E., DevCo
File Number:	F:\Depot\DSMemos\DS4609D.doc	CCRFC
Parcel Number:	125-20-302-001 & more	CCPW
Zoning Action:	SDR-48852; VAC-48854; MOD-48855; TMP-49542 & WVR-49873	
FEMA Flood Zone	YES	NO ☒
Proposed Storm Drain	YES	NO ☒

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	6/4/2013	6/18/2013	Not Approved	\$400.00	321865: \$400
2 nd Submittal & Supplement	1/22/2014 & 2/11/2014	2/25/2014	Conditional Approval	\$400.00	345711: \$400
3 rd Submittal	3/12/2014	3/26/2014	Conditional Approval	\$100.00	350612: \$100
CCRFC	5/14/2014	5/27/2014	Concurrence Recv'd	N/C	N/C
			TOTAL FEES (LDDRS):	\$900.00	****

REMARKS:

3rd Submittal: Update #1 to raise the connection point of the proposed storm drain to the regional channel by six inches (6")

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

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

- The site is adjacent to the Clark County Beltway project. The engineer must coordinate with Clark County Department of Public Works (CCPW) and incorporate any concerns for boundary conditions along the south border. CCPW concurrence is required prior to final acceptance of the study.

The following comments are repeated until they are complete:

2. Sheet G-1:

- Consult with City Land Development Section for an acceptable way of abandoning portion of an existing 18"-storm drain in Echelon Point Drive.

STANDARD FORM 4

Proposed Condition HEC-1

```

*****
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
* RUN DATE 23MAY13 TIME 09:14:27
*****

```

PROP.OUT

```

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

```

```

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

```

THIS PROGRAM REPLACES ALL PREVIOUS VERSIONS OF HEC-1 KNOWN AS HEC1 (JAN 73), HEC1GS, HEC1DB, AND HEC1KW.
 THE DEFINITIONS OF VARIABLES -RTIMP- AND -RTIOR- HAVE CHANGED FROM THOSE USED WITH THE 1973-STYLE INPUT STRUCTURE.
 THE DEFINITION OF -AMSK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION
 NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE, SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,
 DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION
 KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

1

HEC-1 INPUT

PAGE 1

```

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

1 ID DIAGRAM
2 ID SLATER HANIFAN GROUP
3 ID DEER SPRINGS
4 ID D.R. HORTON
5 ID PROPOSED CONDITION
6 ID RETURN PERIOD ----- 100-YR & 10-YR
7 ID DISTRIBUTION ----- 6-HOUR SDN3
8 ID PROJECT NO. ----- DRH1231.003
9 ID FILENAME ----- PROP.H1
10 ID DATE ----- 05/23/2013
11 ID MODELED BY ----- ARP
12 ID
13 ID PRECIPITATION STORM EVENT RATIOS
14 ID STORM EVENT RATIO
15 ID 10-YR 0.52
16 ID
17 IT 5 0 0 300
18 IO 5 0 0
19 IN 5 0 0
20 JR PREC 1.00 0.52

21 KK OFF1
22 KM EXISTING PORTION OF ECHELON
23 BA .0045
24 PB 2.86
25 PC 0 0.020 0.057 0.070 0.087 0.108 0.124 0.130 0.130 0.130
26 PC 0.130 0.130 0.130 0.133 0.140 0.142 0.148 0.158 0.172 0.181
27 PC 0.190 0.197 0.199 0.200 0.201 0.204 0.214 0.229 0.241 0.249
28 PC 0.251 0.256 0.270 0.278 0.281 0.283 0.295 0.322 0.352 0.409
29 PC 0.499 0.590 0.710 0.744 0.781 0.812 0.819 0.835 0.851 0.856
30 PC 0.860 0.868 0.876 0.888 0.910 0.926 0.937 0.950 0.970 0.976
31 PC 0.982 0.985 0.987 0.989 0.990 0.993 0.993 0.994 0.995 0.998
32 PC 0.998 0.999 1
33 LS 0 88.2
34 UD 0.050

35 KK ON30
36 KM DEVELOPED ONSITE BASIN SOUTH OF ECHELON POINT TO WEST
37 BA .0115
38 LS 0 92.2
39 UD 0.080

40 KK ECH1
41 KM DEVELOPED ECHELON POINT STREET BASIN (WEST)
42 BA .0012
43 LS 0 98.0
44 UD 0.050

```

1

HEC-1 INPUT

PAGE 2

```

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

45 KK CAM
46 KM DEVELOPED CAMPBELL STREET BASIN
47 BA .0008
48 LS 0 98.0
49 UD 0.052

50 KK CP1
51 KM COMBINATION POINT FLOWS TO REGIONAL CHANNEL (WEST)
52 HC 4

```

PROP.DUT

```

53      KK  ON2D
54      KM  DEVELOPED ONSITE BASIN SOUTH OF ECHELON POINT TO EAST
55      BA  .0131
56      LS  0      92.2
57      UD  0.078
      *

58      KK  ON1D
59      KM  DEVELOPED ONSITE BASIN NORTH OF ECHELON POINT
60      BA  .0130
61      LS  0      92.2
62      UD  0.086
      *

63      KK  ECH2
64      KM  DEVELOPED ECHELON POINT STREET BASIN (EAST)
65      BA  .0016
66      LS  0      98.0
67      UD  0.050
      *

68      KK  CPE
69      KM  COMBINATION POINT FLOWS SOUTH IN REGIONAL CHANNEL
70      HC  2
      *

71      KK  DER
72      KM  DEVELOPED DEER SPRING STREET BASIN
73      BA  .0010
74      LS  0      98.0
75      UD  0.050
      *

76      ZZ

```

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

```

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

21  OFF1
   .
35  .      ON3D
   .
40  .      .      ECH1
   .      .      .
45  .      .      .      CAM
   .      .      .
50  .      .      .      .
   .      .      .      .
53  .      .      .      .
   .      .      .      .
58  .      .      .      .      ON1D
   .      .      .      .
63  .      .      .      .      .      ECH2
   .      .      .      .
68  .      .      .      .      .      .      CPE
   .      .      .      .
71  .      .      .      .      .      .      .      DER

```

(***) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1 *****
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
* RUN DATE 23MAY13 TIME 09:14:27 *
* *****

```

```

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

```

SLATER HANIFAN GROUP
DEER SPRINGS
D.R. HORTON
PROPOSED CONDITION

RETURN PERIOD ----- 100-YR & 10-YR
DISTRIBUTION ----- 6-HOUR SDN3
PROJECT NO. ----- DRH1231.003
FILENAME ----- PROP.H1
DATE ----- 05/23/2013
MODELED BY ----- ARP

PRECIPITATION STORM EVENT RATIOS
STORM EVENT RATIO
10-YR 0.52

1B 10

OUTPUT CONTROL VARIABLES

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

PROP. OUT

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

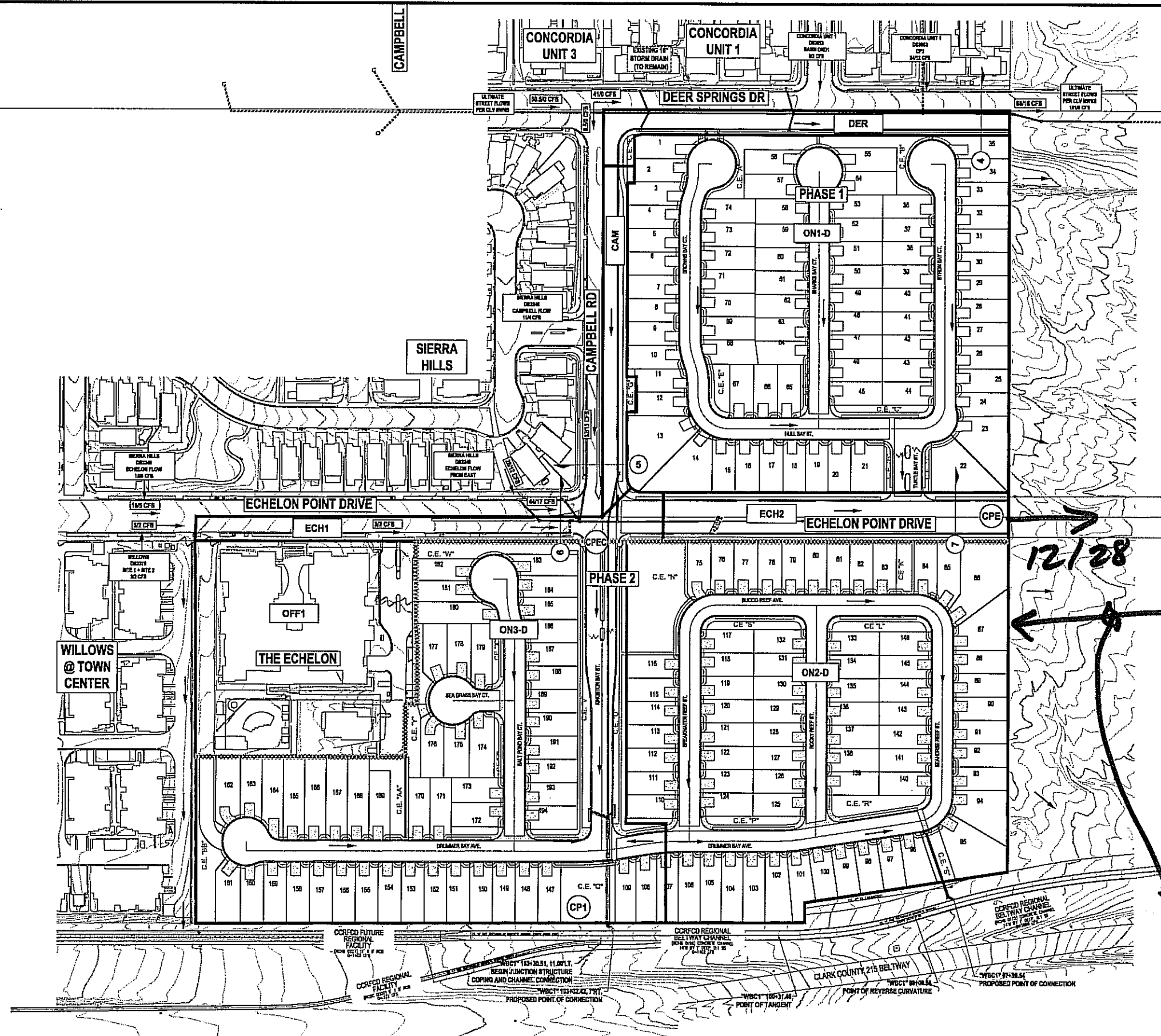
JR MULTI-RATIO OPTION
 RATIOS OF PRECIPITATION
 1.00 .52

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

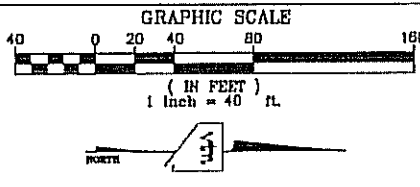
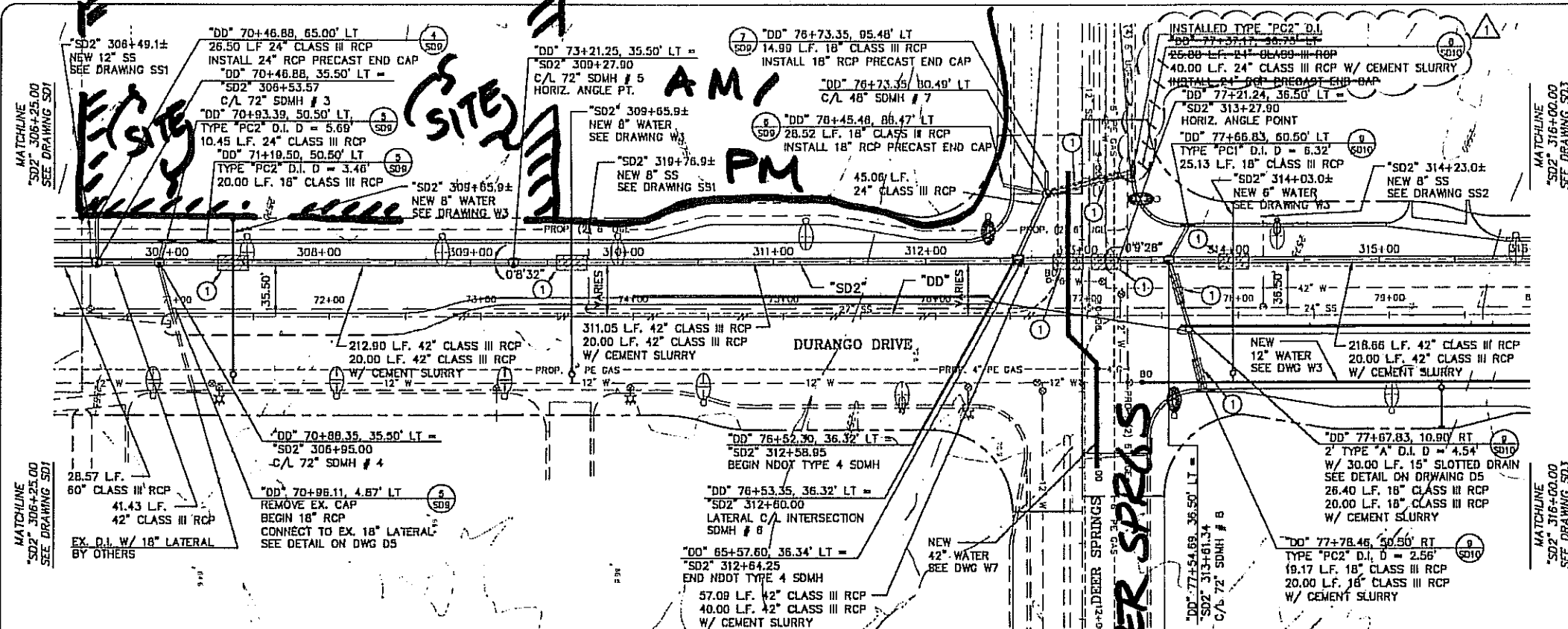
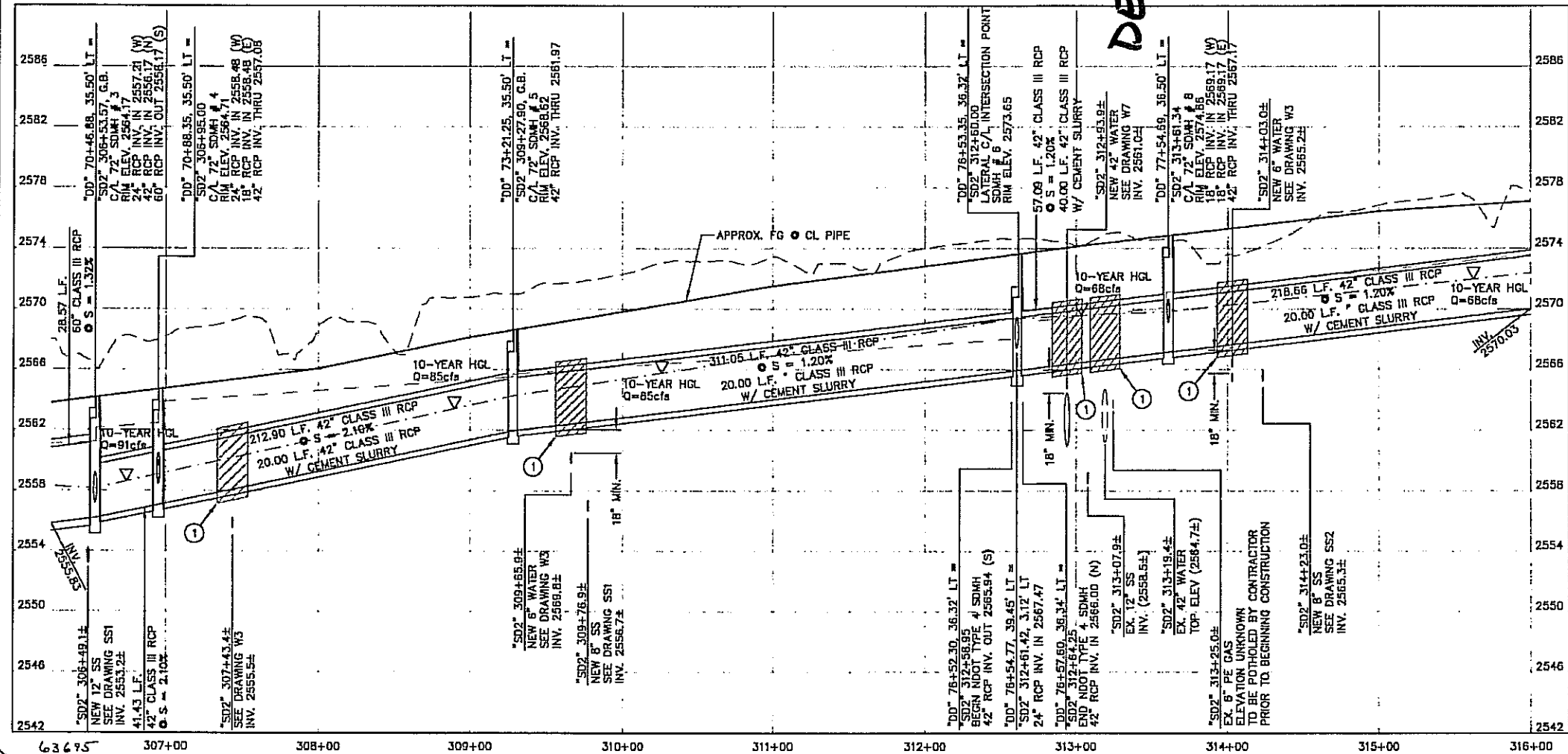
OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION	
					RATIO 1 1.00	RATIO 2 .52
HYDROGRAPH AT +	OFF1	.00	1	FLOW TIME	8. 3.50	3. 3.50
HYDROGRAPH AT +	ON3D	.01	1	FLOW TIME	22. 3.50	9. 3.50
HYDROGRAPH AT +	ECH1	.00	1	FLOW TIME	3. 3.50	1. 3.50
HYDROGRAPH AT +	CAM	.00	1	FLOW TIME	2. 3.50	1. 3.50
4 COMBINED AT +	CP1	.02	1	FLOW TIME	35. 3.50	15. 3.50
HYDROGRAPH AT +	ON2D	.01	1	FLOW TIME	25. 3.50	10. 3.50
HYDROGRAPH AT +	ON1D	.01	1	FLOW TIME	24. 3.50	10. 3.50
HYDROGRAPH AT +	ECH2	.00	1	FLOW TIME	4. 3.50	2. 3.50
2 COMBINED AT +	CPE	.01	1	FLOW TIME	28. 3.50	12. 3.50
HYDROGRAPH AT +	DER	.00	1	FLOW TIME	2. 3.50	1. 3.50

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



Ultimate Condition						
Cross Section	Q ₁₀₀ (cfs)	Slope (%)	Depth (ft)	Velocity (fps)	Dx/V	Dry Lane (ft)
SECTION 4 0+0	8	2.44	0.00	0.00	0.0	30.0
SECTION 5 0+ CAN + 4	5	1.11	0.34	2.29	0.8	15.0
SECTION 6 0+ CAN + 10	20	2.45	0.43	4.73	2.0	15.0
SECTION 7 0+ DE	12	1.95	0.30	3.96	1.5	17.5

PG. 7517, US 7C
C:\ADD\PROJECTS\2019\RECORD\DWG\1-215-20US9



- NOTES:**
- SEE DRAWING 12 FOR GENERAL NOTES.
 - SEE DRAWING D1 FOR STORM DRAIN MANHOLE AND DROP INLET SCHEDULE.
 - CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION.
- CONSTRUCTION NOTE:**
- CEMENT SLURRY ENCASE RCP, 10' (FOOT) MIN EACH SIDE OF WATER LINE, 4" MIN THICKNESS. SEE NOTE NO. 8 ON DWG. W9.

APPROVED
LAS VEGAS VALLEY WATER DISTRICT
DATE

Call before you Dig
1-800-227-2600
Underground Service Alert (USA)

Call before you Overhead
1-702-593-6111
Nevada Power Environmental and Safety Services Department

STORM DRAIN PLAN AND PROFILE
"SD2" 306+25.00 TO "SD2" 316+00.00
DURANGO DRIVE

ORIGINAL CONSTRUCTION
DRAWINGS ARE ON FILE WITH
THE CITY OF LAS VEGAS.
THE DOCUMENTS WERE SEALED ON
12/17/01
BY
KEN D. GILBRETH
UNDER LICENSE NO.
9177

NO. 10. 5878
BY JPL
DATE 11/27/02
SCALE: HORIZ. 1"=40'
VERT. 1"=4'
DRAWING SHEET 47
SD2 80 SHEETS

DEPARTMENT OF PUBLIC WORKS
CITY OF LAS VEGAS

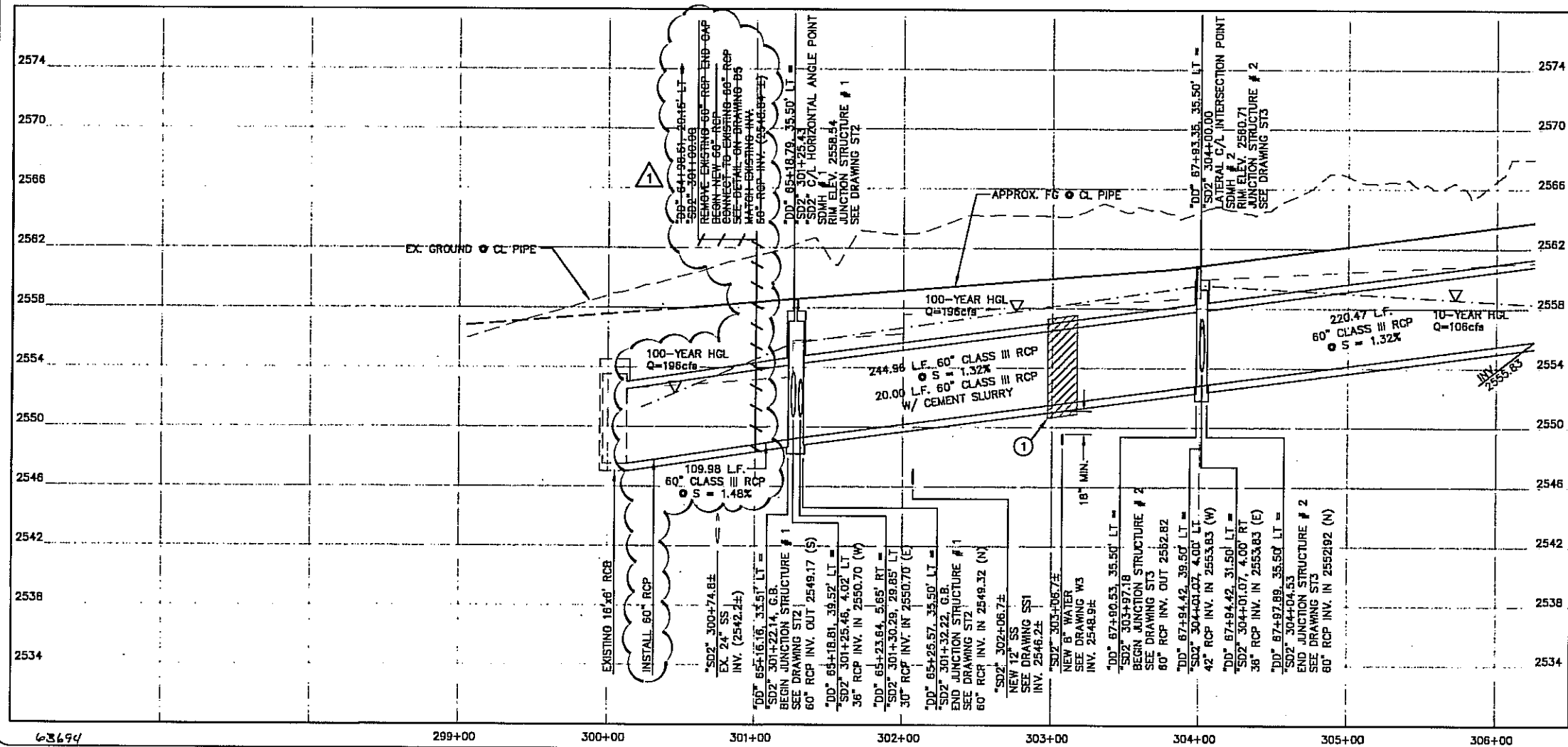
CONSULTING ENGINEERS • PLANNERS • LAND SURVEYORS
2727 SOUTH RAINBOW BOULEVARD
LAS VEGAS, NEVADA 89146-5148 PHONE (702) 873-7550 FAX (702) 352-2597

RECORD DRAWINGS INFORMATION PROVIDED BY MASON VALLEY CONSTRUCTION, INC.

REVISION

NO.	DATE	BY	REV
1	12/15/03	DMT	1

107-V3640



63694

299+00

300+00

301+00

302+00

303+00

304+00

305+00

306+00

- NOTES:**
1. SEE DRAWING 12 FOR GENERAL NOTES.
 2. SEE DRAWING D1 FOR STORM DRAIN MANHOLE AND DROP INLET SCHEDULE.
 3. CONTRACTOR SHALL VERIFY ALL HORIZONTAL AND VERTICAL LOCATIONS OF EXISTING UTILITIES PRIOR TO COMMENCEMENT OF CONSTRUCTION.
- CONSTRUCTION NOTE:**
- ① CEMENT SLURRY ENCASE RCP, 10' (FOOT) MIN EACH SIDE OF WATER LINE, 4" MIN THICKNESS. SEE NOTE NO. 8 ON DWG. W9.

APPROVED

LAS VEGAS VALLEY WATER DISTRICT

DATE

2 working days

Call before you Dig

1-800-227-2600

Underground Service Alert (U.S.A.)

2 working days

Call before you Overhead

1-702-593-6111

Nevada Power Environment and Safety Services Department

STORM DRAIN PLAN AND PROFILE

"SD2" 301+00.00 TO "SD2" 306+25.00

DURANGO DRIVE

I-215 TO US95

SEAL

ORIGINAL CONSTRUCTION DRAWINGS ARE ON FILE WITH THE CITY OF LAS VEGAS. THE DOCUMENTS WERE SEALED ON 12/17/02 BY KEN D. OLBRETH UNDER LICENSE NO. 9177

NO. 101 6878

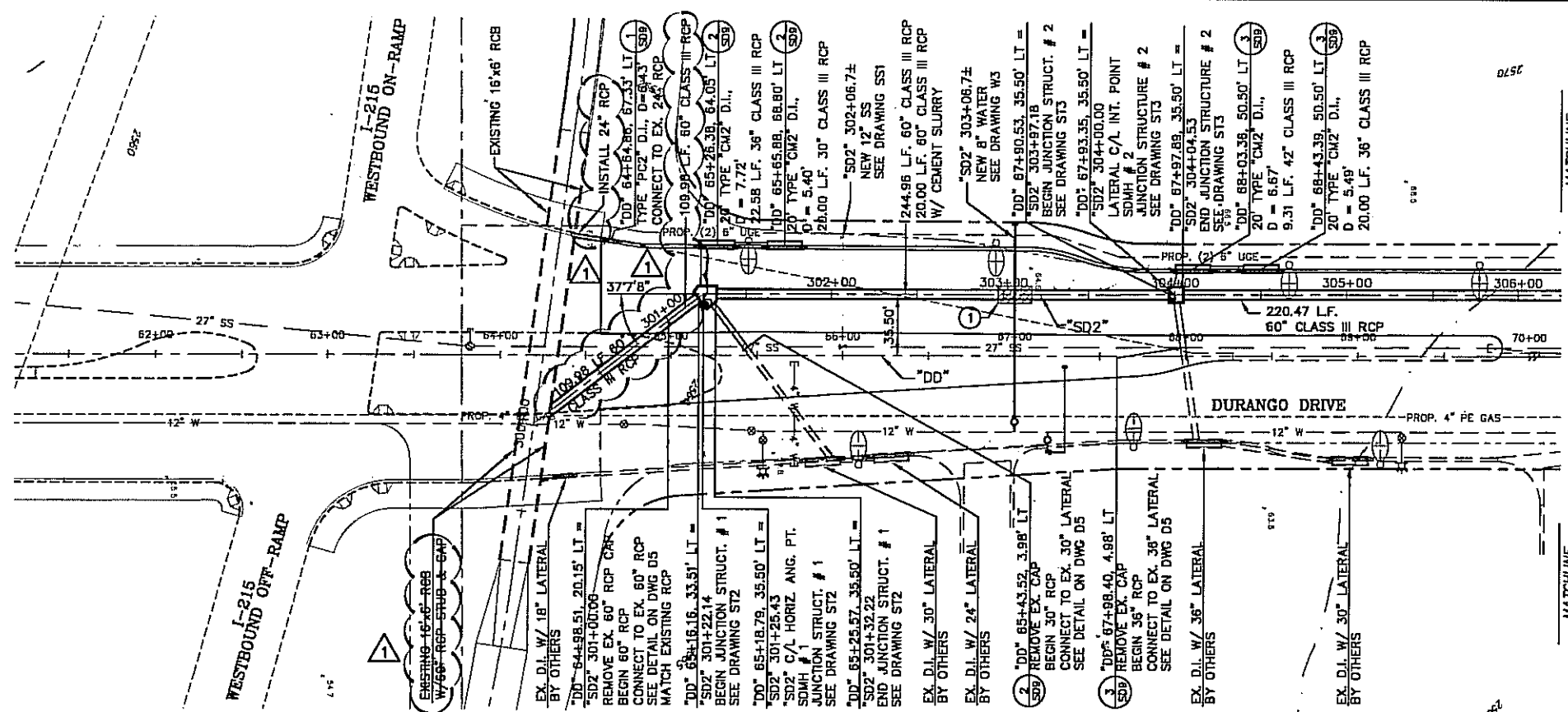
BY JPL

DATE 11/27/02

SCALE: HORIZ. 1"=40' VERT. 1"=4'

DRAWING SHEET 48 OF 80

SD1



GRAPHIC SCALE

40 0 20 40 80 160

(IN FEET)

1 inch = 40 ft.

SUBJ. SITE

MATCHLINE

"SD2" 306+25.00 SEE DRAWING S02

DEPARTMENT OF PUBLIC WORKS

CITY OF LAS VEGAS

CONSULTING ENGINEERS • LAND SURVEYORS

2727 SOUTH RAINBOW BOULEVARD

LAS VEGAS, NEVADA 89146-5148 PHONE (702) 873-7550 FAX (702) 362-2597

vtm nevada



GRADING PLANS

	PROPERTY BOUNDARY
	RIGHT-OF-WAY
	PROPERTY LINE
	CENTER LINE
	EASEMENT
	EXST "L" TYPE CURB
	EXST "A" TYPE CURB
	EXST MAJOR CONTOUR LINE
	EXST MINOR CONTOUR LINE
	EXST SCREEN WALL AS INDICATED
	EXST EDGE OF PAVEMENT
	EXST EDGE OF SIDEWALK
	EXST UNDERGROUND POWER
	EXST FIBER OPTICS
	EXST STORM DRAIN

1. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY CAUSE OR CONTRIBUTE TO POLLUTION OF ANY TYPE, INCLUDING BUT NOT LIMITED TO, EXCESSIVE TURBIDITY, FROM THE PROJECT AREA. THE RIGHTS OF WAYS OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES SHALL BE PROTECTED AND THE PROJECT SHALL BE CONDUCTED IN SUCH A MANNER THAT SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN TITLE 26-40, CHAPTER 26-40.10 LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITIES BEGIN. THE CONTRACTOR SHALL BE RESPONSIBLE FOR ANY DAMAGE CAUSED. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NRP1000000, SECTION III.A.5.
4. AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, EROSION CONTROL, STABILIZATION, AND EROSION PREVENTION THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS AND ALL BMP'S WEEKLY, AND 24 HOURS AFTER ANY ACTUAL RAIN EVENT OF 0.5 INCH OR MORE. THE CONTRACTOR OR HIS AGENT SHALL REPORT ANY EROSION OR STABILIZATION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY. REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NRP1000000, SECTION III.A.12.
5. ACCUMULATED SEDIMENT IN BMP'S SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT. IF THE EROSION CONTROL, STABILIZATION, AND EROSION PREVENTION CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

1. CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING STRUCTURES AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATION AND ELEVATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.
3. OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED OR OBSCURED DURING CONSTRUCTION.

THIS SITE IS LOCATED IN ZONE "X", AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C1745 E. CLARK COUNTY, NEVADA DATED SEPTEMBER 27, 2002.

BEING A RIVET AND ROUND ALUMINUM PLATE, STAMPED CITY OF LAS VEGAS BENCHMARK #6LV90
20N6, IN THE TOP OF CURB AT THE SOUTHWEST CORNER OF THE INTERSECTION OF DURANGO
DRIVE AND DORRELL LANE.
ELEVATION = 2587.82 FEET, REFERENCED TO N.A.V.D. 88 DATUM

SOUTH 89°54'17" WEST, BEING THE BEARING OF THE CENTERLINE OF DEER SPRINGS WAY AS SHOWN
IN FILE 118, PAGE 89 OF SURVEYS AND PARCEL MAP IN FILE 119, PAGE 59 IN THE CLARK COUNTY
RECORDER'S OFFICE, NEVADA

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

Call
811
OR
1-800-227-2600
AND
CLARK COUNTY TRAFFIC
OPERATIONS
1-702-455-7544

Call before you
do UnderGround

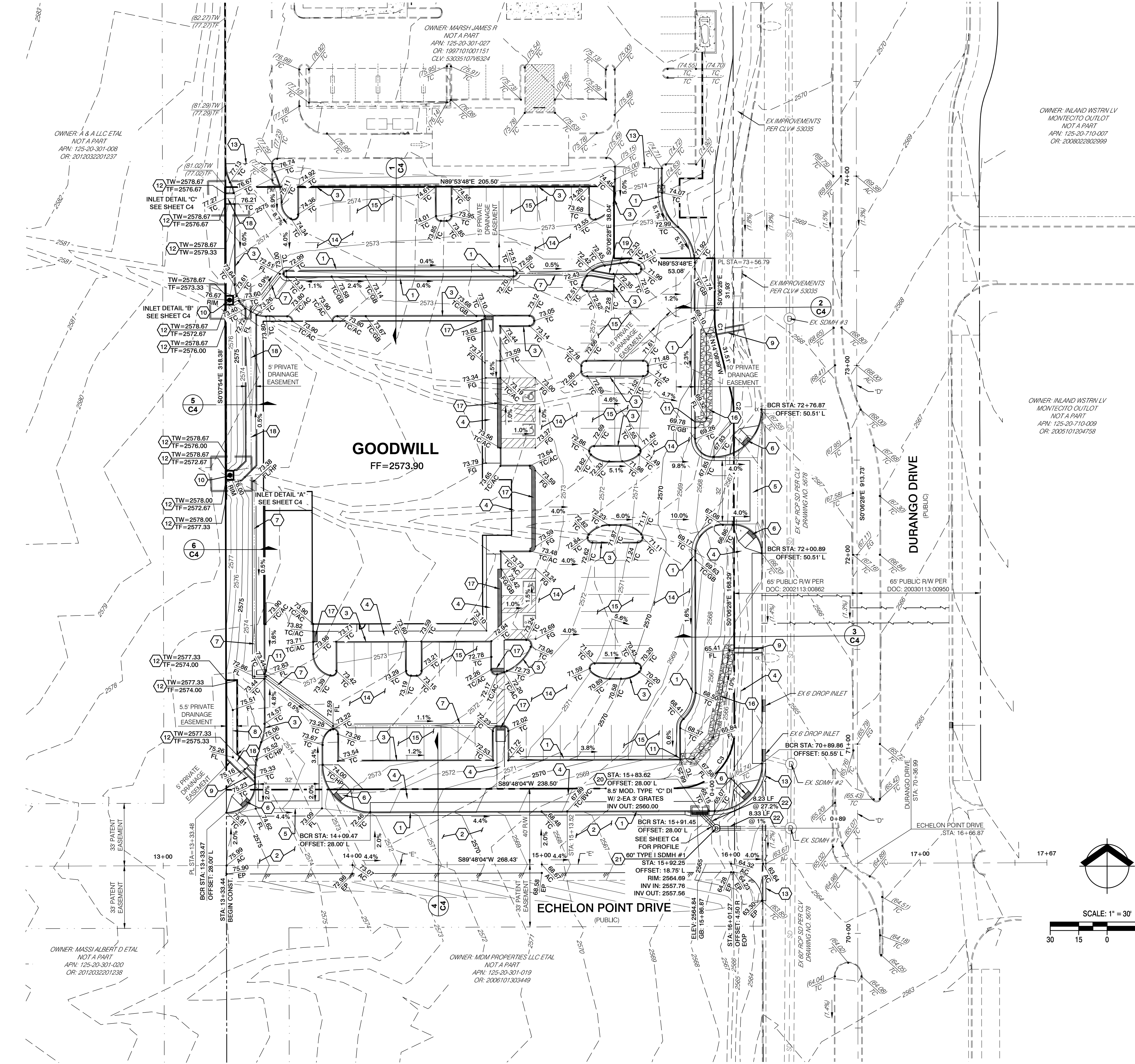
1-702-455-6000

CLARK COUNTY TRAFFIC OPERATION
AND
1-702-432-5300

FREEWAY AND ARTERIAL SYSTEM
OF TRANSPORTATION

<i>EX, SDMH #1</i>	<i>EX, SDMH #2</i>
<i>'D' STA: 70+55.61</i>	<i>'D' STA: 70+89.58</i>
<i>OFFSET: 35.33' L</i>	<i>OFFSET: 35.04' L</i>
<i>RIM: 2564.2±</i>	<i>RIM: 2564.6±</i>
<i>INV IN (24' W): 2557.21</i>	<i>INV IN (24' W): 2558.48</i>
<i>INV IN (42' N): 2556.27</i>	<i>INV IN (18' E): 2558.48</i>
<i>INV OUT (60' S): 2556.17</i>	<i>INV THRU (42'): 2557.0</i>

SDMH 1
60° TYPE I SDMH
SD STA: 0+24.23
"E" STA: 15+92.25
OFFSET: 18.75' L
RIM: 2564.69
INV IN: 2557.76
INV OUT: 2557.56



EXISTING		PROPOSED	
$\frac{(00.00)}{TC}$	TOP BACK CURB	$\frac{00.00}{TC}$	TOP BACK CURB
$\frac{(00.00)}{EG}$	EXISTING GROUND	$\frac{00.00}{FG}$	FINISH GRADE
$\frac{(00.00)}{EP}$	EDGE OF PAVEMENT	$\frac{00.00}{EP}$	EDGE OF PAVEMENT
$\frac{(00.00)}{FL}$	FLOW LINE	$\frac{00.00}{FL}$	FLOW LINE
$\frac{(00.00)}{AC}$	ASPHALT CONCRETE	$\frac{00.00}{AC}$	ASPHALT CONCRETE
$\frac{(00.00)}{TRW}$	TOP OF RET. WALL	$\frac{00.00}{TRW}$	TOP OF RET. WALL
$\frac{(00.00)}{TF}$	TOP OF FOOTER	$\frac{00.00}{TF}$	TOP OF FOOTER
		$\frac{00.00}{HP}$	HIGH POINT
		$\frac{00.00}{GB}$	GRADE BREAK

1	CONSTRUCT 1" CURB AND GUTTER PER CCAUSD #216
2	ECHOLON POINT DRIVE PAVEMENT, INSTALL 4" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
3	CONSTRUCT 7" AC CURB AND GUTTER PER CCAUSD #219
4	CONSTRUCT SIDEWALK PER CCAUSD #234
5	CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #224
6	CONSTRUCT CASE III SIDEWALK RAMPS USING ARMOR TILE TRUNCATED DOMES OR EQUIV. PER CCAUSD #235
7	CONSTRUCT 2" VALLEY GUTTER PER DETAIL 7, SHEET C4
8	CONSTRUCT 5" FLUME ADJACENT TO RETAINING WALL PER DETAIL 8, SHEET C4
9	CONSTRUCT SIDEWALK UNDER DRAIN PER CCAUSD #236
10	INSTALL 24" NYLOPLAST INLINE DRAIN W/ BEE HIVE GRATE, SEE DETAIL 12, SHEET C4
11	CONSTRUCT 2 CURB OPENING
12	CONSTRUCT RETURN WALL, GRADES PER PLAN
13	SAWCUT CLEAN EDGE, MEET AND MATCH EXISTING ASPHALT
14	MAIN CARRIER (TRUCK ACCESS) INSTALL 3" AC OVER 6" TYPE II AGGREGATE BASE PER SOILS REPORT
15	AUTOMOBILE ROUTE / PARKING, INSTALL 2" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
16	CONSTRUCT BMP SWALE PER DETAIL 10, SHEET C4
17	PLACE ARMOR TILE TRUNCATED DOMES AR EQUIVALENT
18	CONSTRUCT 5" FLUME PER DETAIL 9, SHEET C4
19	CONSTRUCT 2" CONCRETE FLUME PER DETAIL 11, SHEET C4
20	CONSTRUCT 8.5" MODIFIED TYPE "C" DROP INLET W/ 2-#3 GRATES PER CCAUSD #412.1
21	CONSTRUCT 6" TYPE I MANHOLE PER CCAUSD #401 & 403
22	24" CLASS III RCP, BEDDING PER CCAUSD #503.2

PROPERTY CURVE TABLE			
CURVE #	LENGTH	RADIUS	DELTA
C1	9.68'	39.50'	14°02'11" ⁹⁰

APN No.	ACREAGE:	ZONING
125-20-301-028	1.89	U(TC)

THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION
TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS
OTHERWISE NOTED.

ADD 2500.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

PROJECT No. 4124JD074
DATED: SEPTEMBER 17, 2014
AS PREPARED BY: WESTERN TECHNOLOGIES

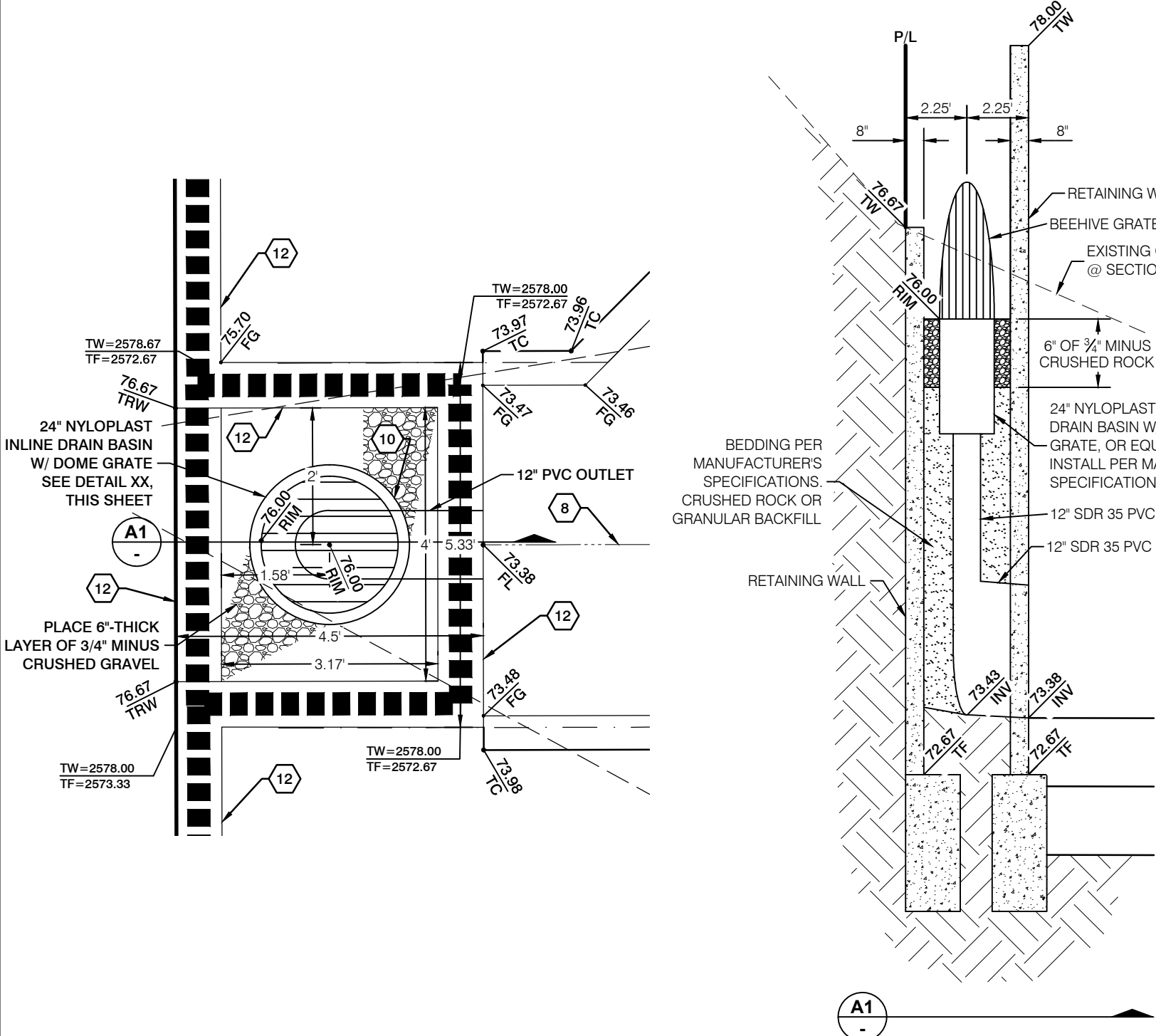
I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY CLV # XXXXXXXX FOR THIS SITE ON FILE AT CITY OF LAS VEGAS FOR THIS PROJECT.

ERIC J. RIETZ, P.E. No. 16350 DATE

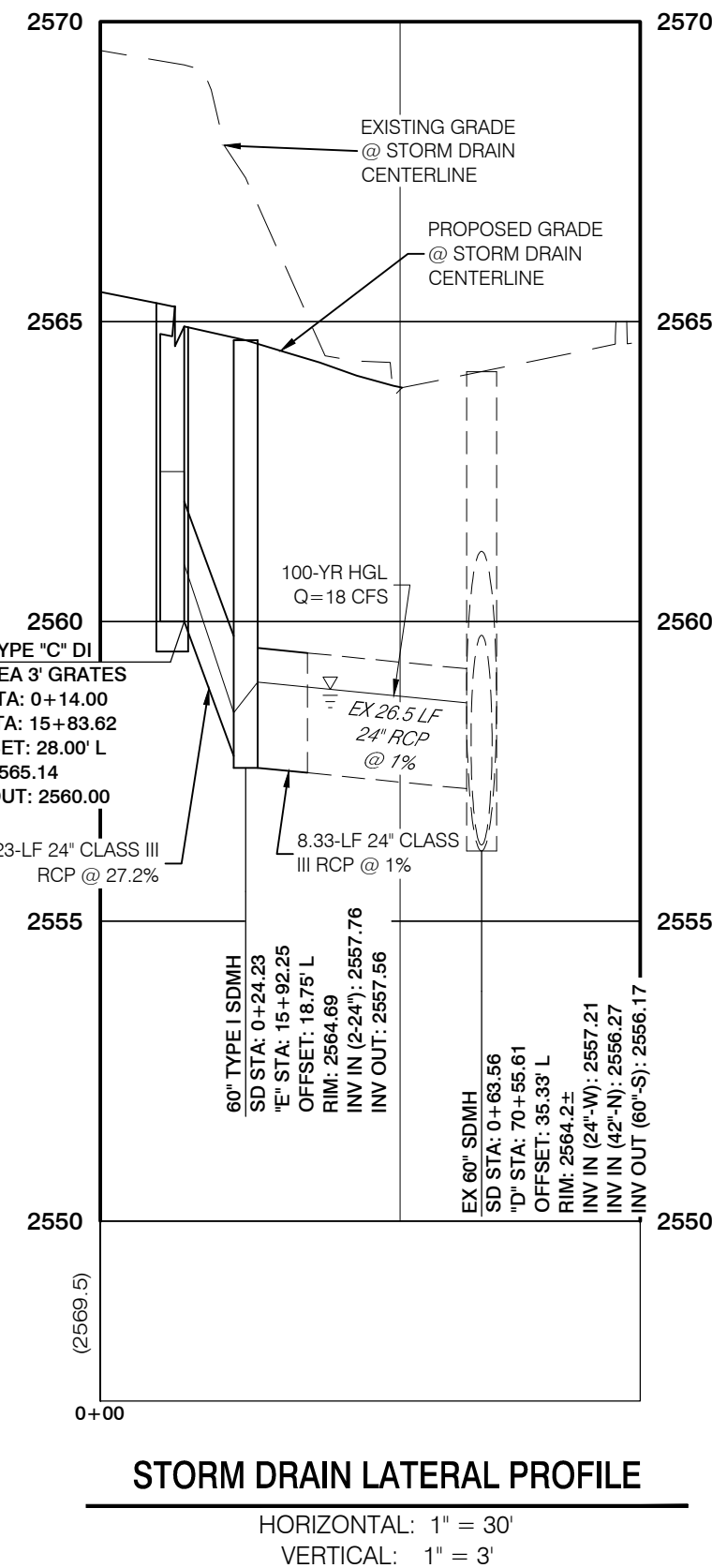
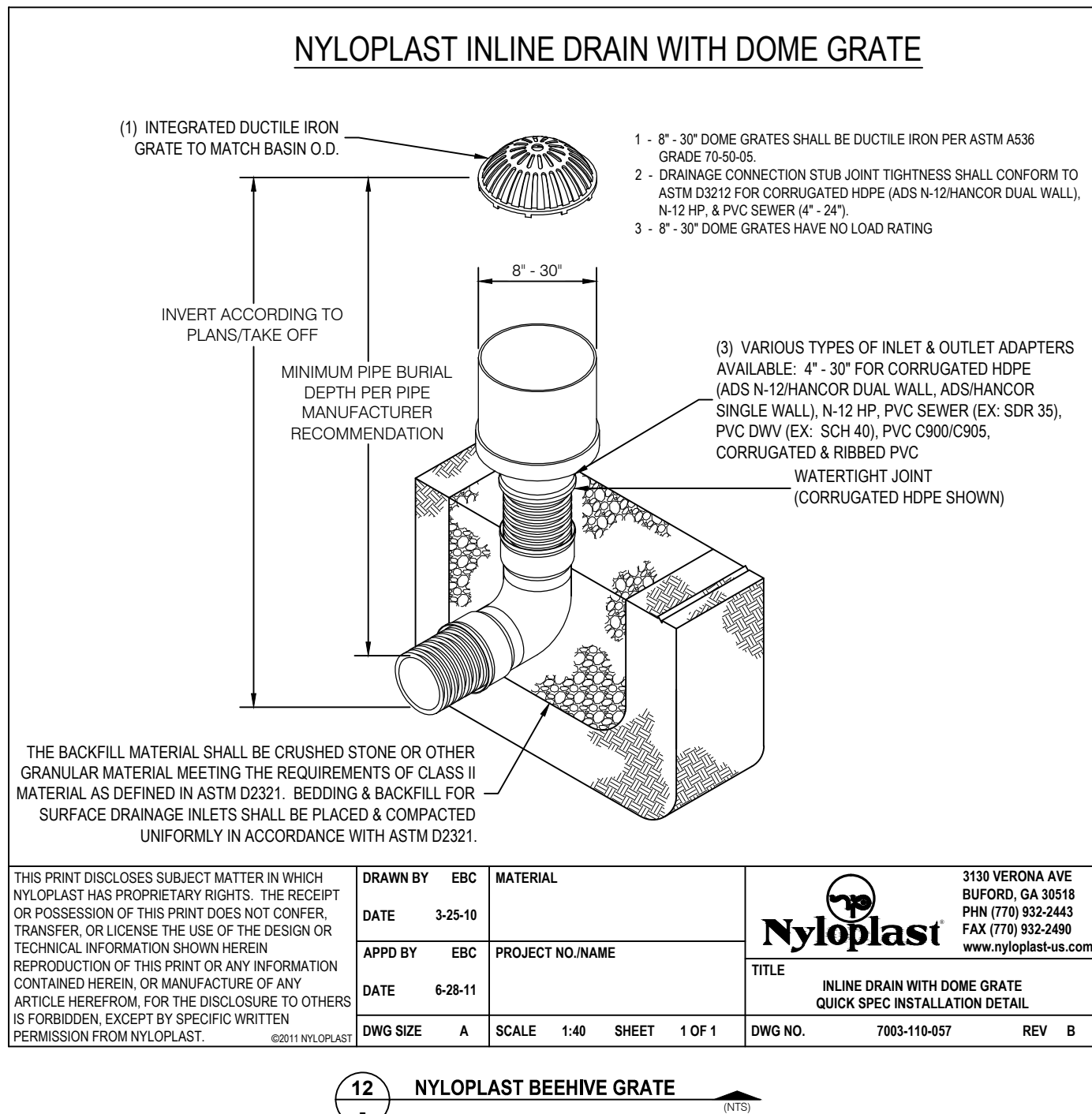
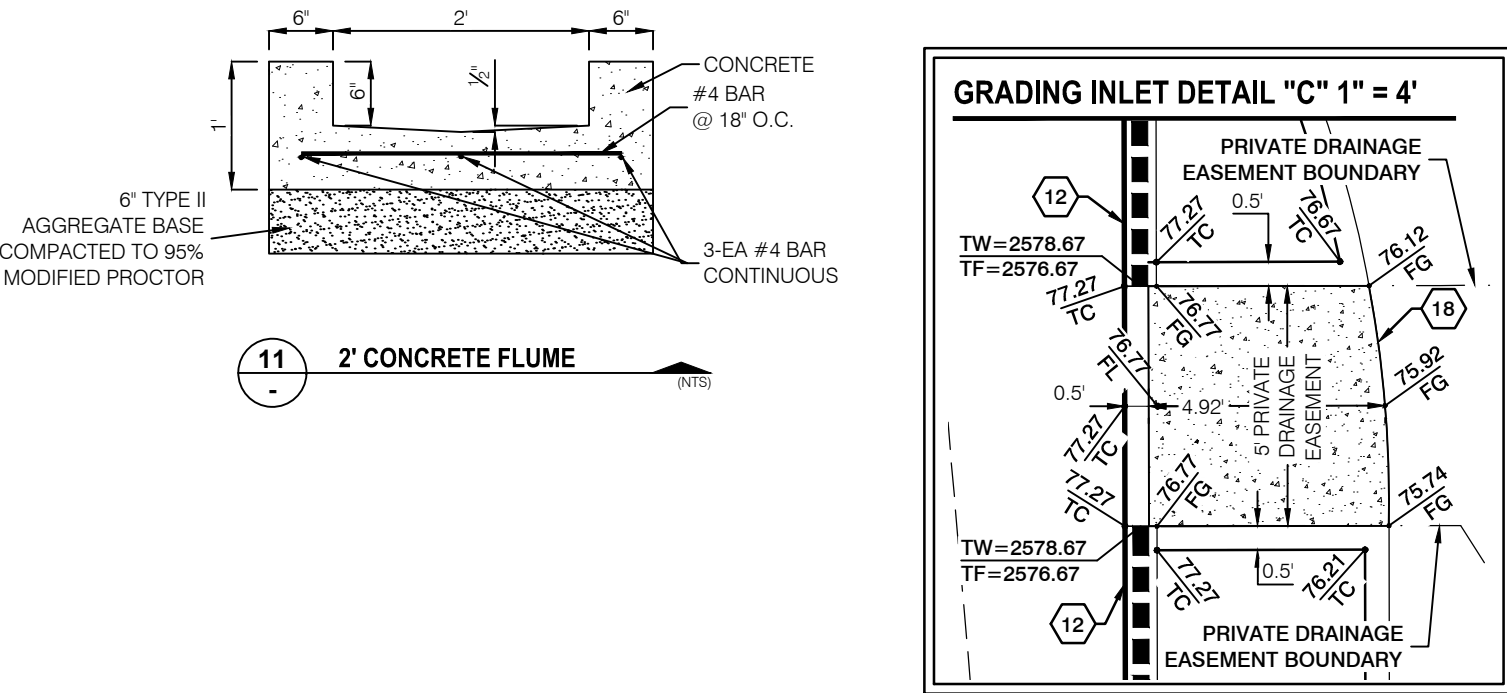
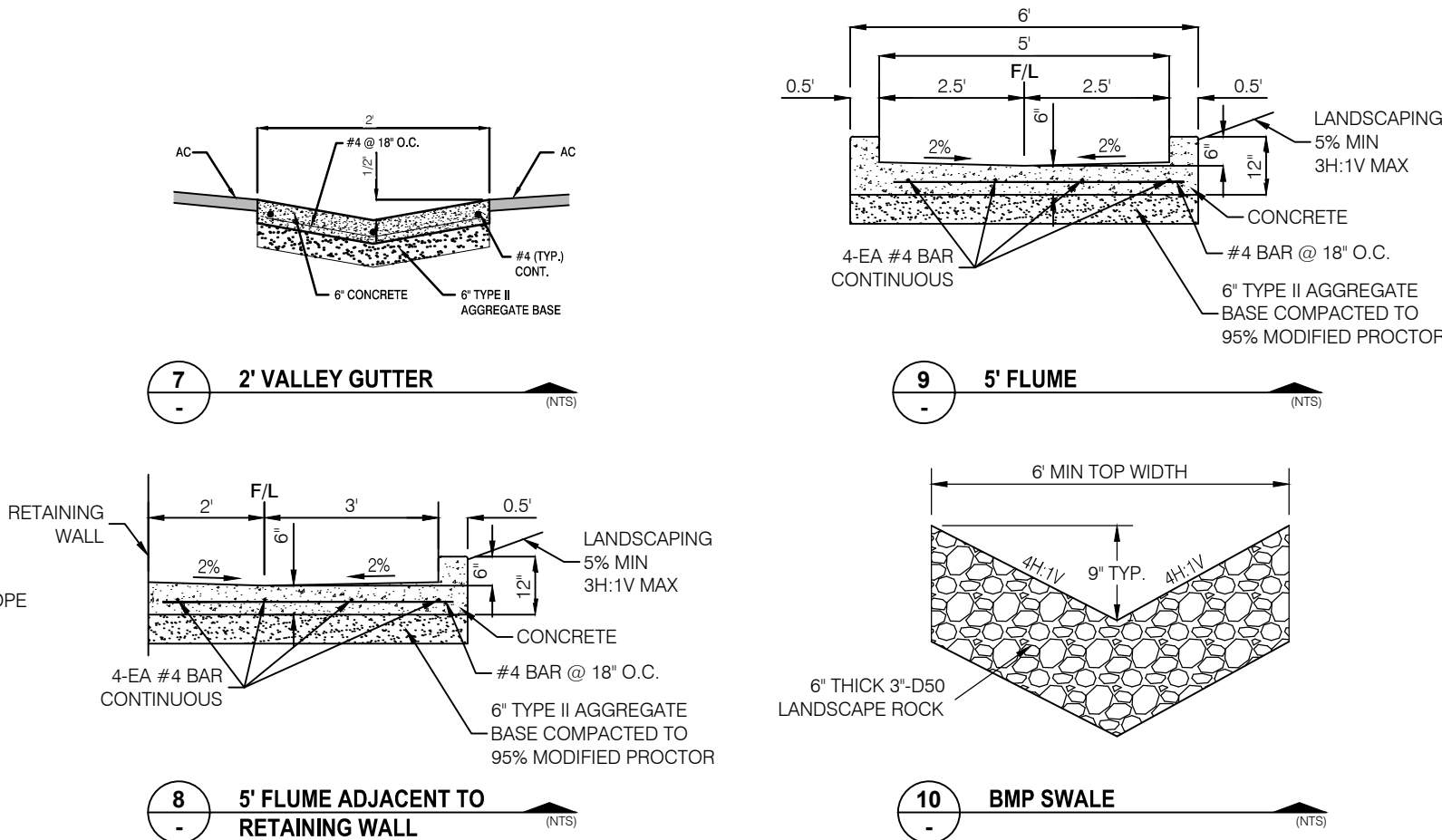
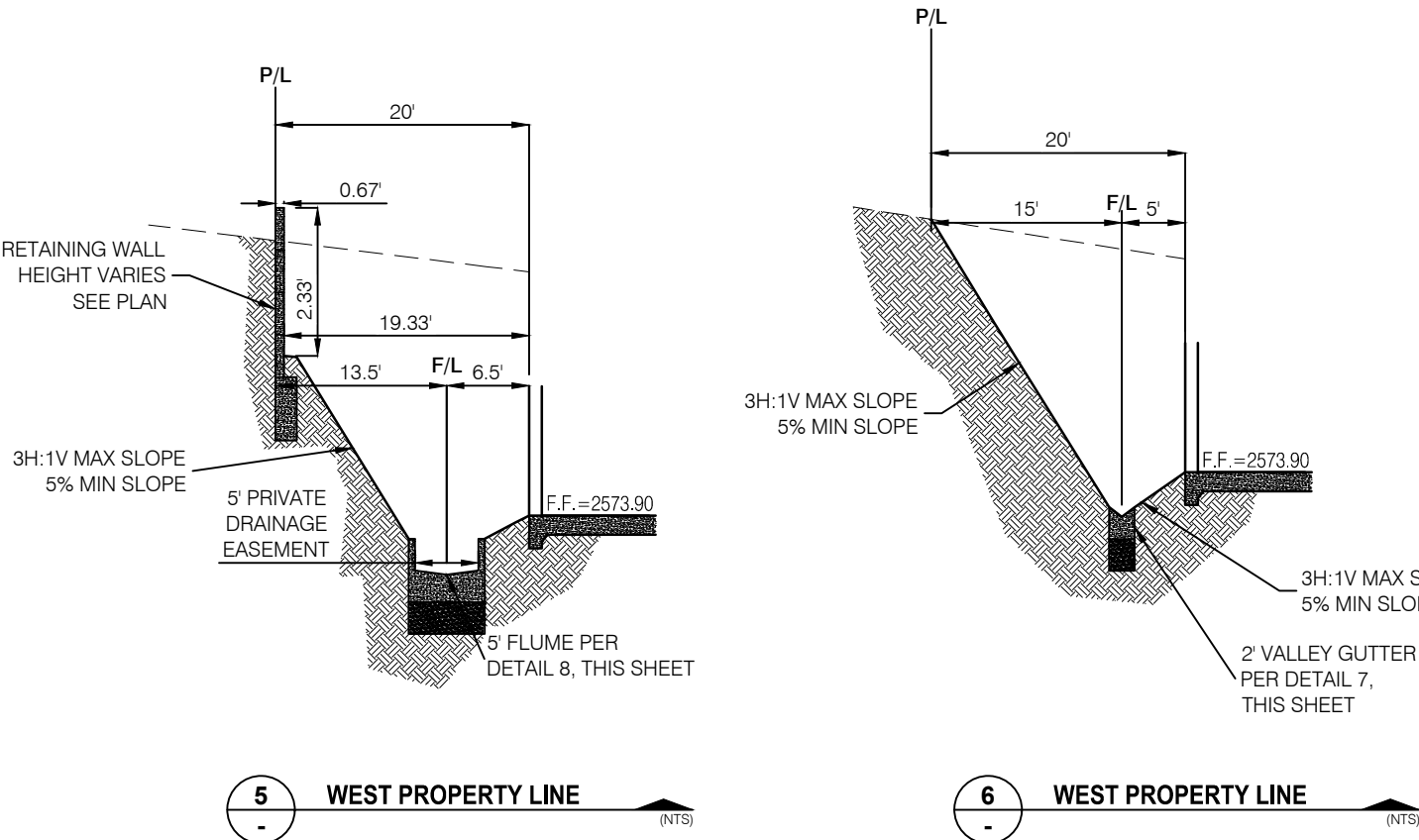
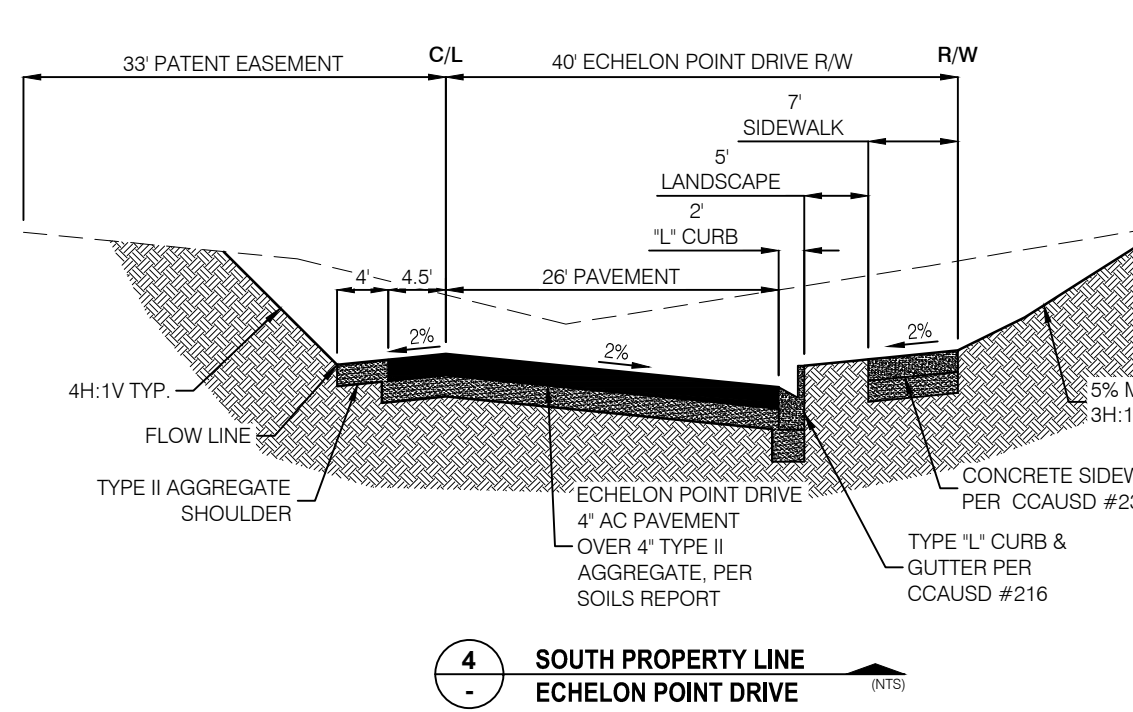
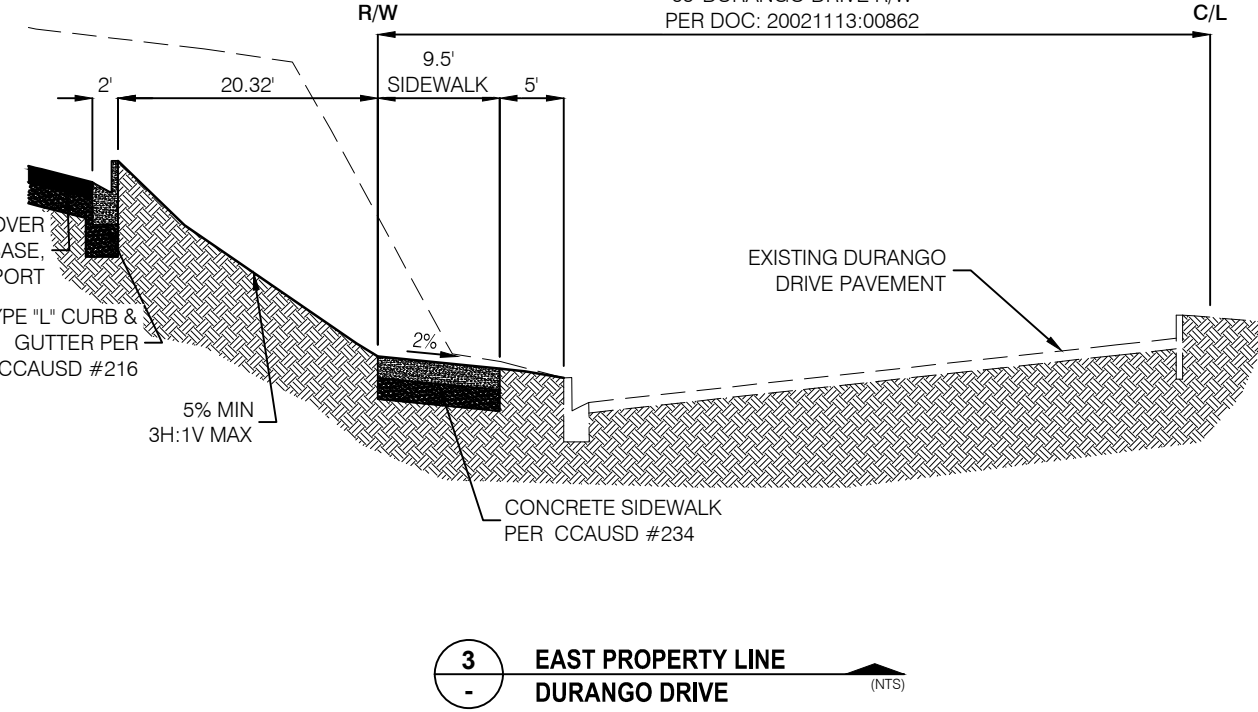
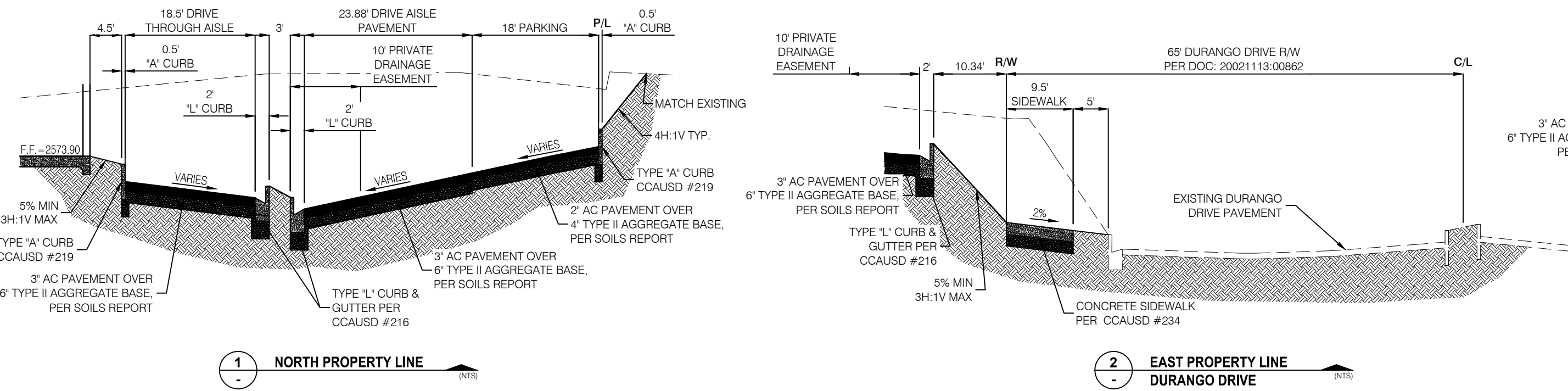
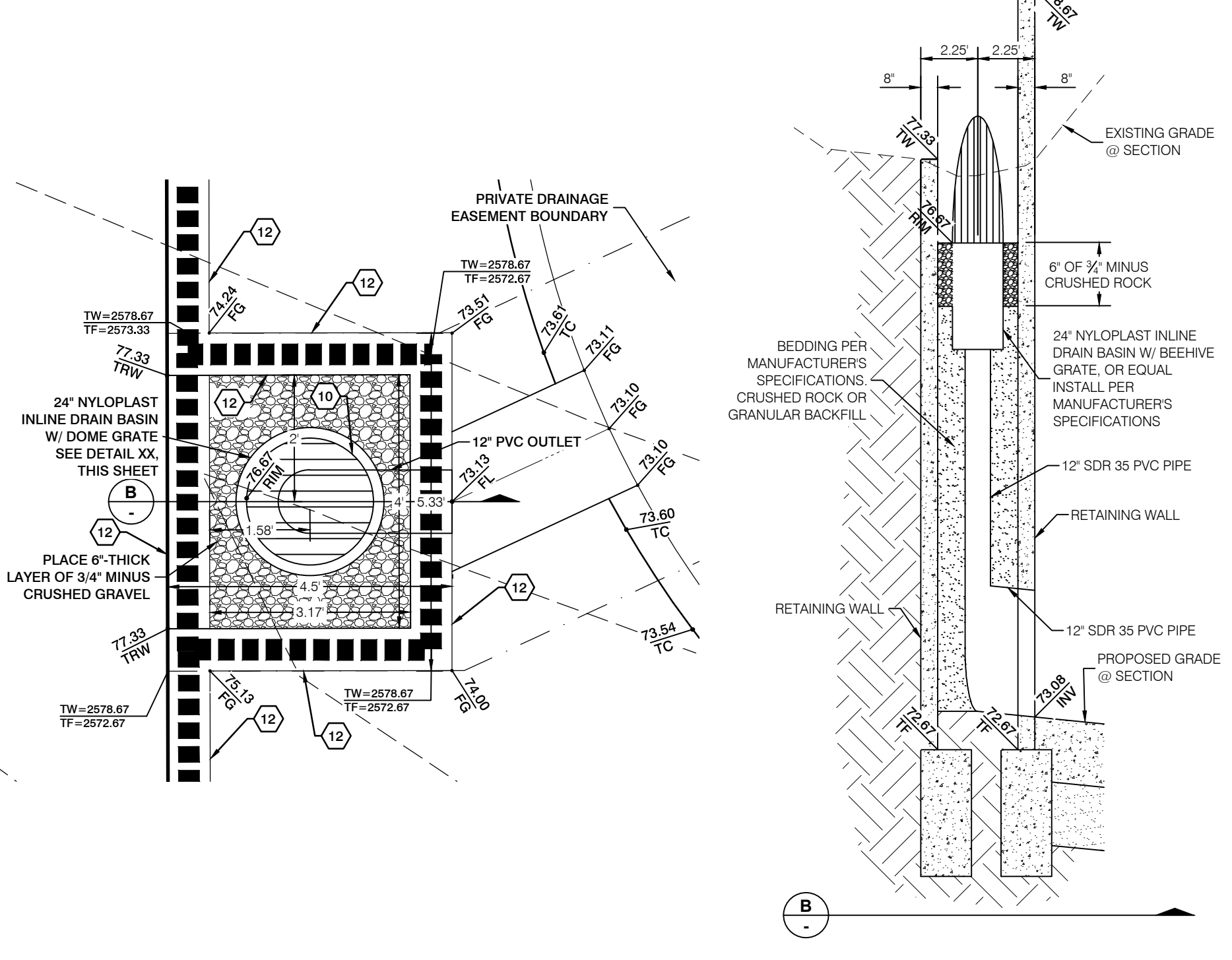
QUANTITIES			
ITEM		PRIVATE	PUBLIC
TYPE 'A' CURB		1380 LF	
TYPE 'A' CURB & GUTTER		644 LF	182 LF
2' VALLEY GUTTER		214 LF	-
2' SIDEWALK UNDER DRAIN		-	1 EA
8.5" MODIFIED TYPE 'C' DROP INLET		-	1 EA
66" TYPE 1 STORM DRAIN MANHOLE		-	1 EA
24" CLASS III RCP		-	17 LF
BMP SWALE		129 LF	-
24" BEEHIVE AREA DRAIN		2 EA	-
5-FT FLUME		143 LF	-
2' AC PAVEMENT		1422 SY	-
3' AC PAVEMENT		3575 SY	-
4' AC PAVEMENT (ECHELON POINT DRIVE)		-	992 SY
SIDEWALK		2511 SF	3393 SF
HANDICAP ACCESSIBLE RAMPS		4 EA	5 EA
COMMERCIAL DRIVEWAY		-	1147 SF
TYPE II AGGREGATE		854 CY	191 CY

P:\Goodwill at durango and deer springs\CD SHEETS\GRADING PLAN.dwg - 10/20/2014 10:47 AM

GRADING INLET DETAIL "A" SCALE: 1" = 2' HORIZONTAL

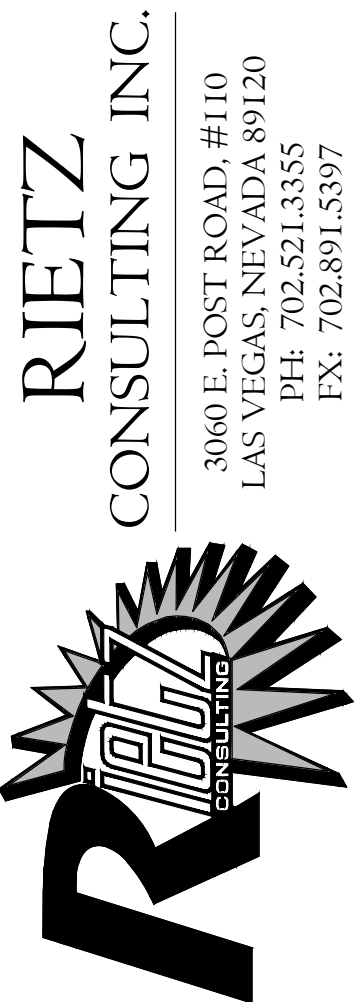
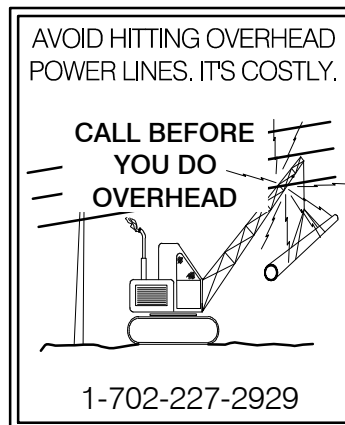


GRADING INLET DETAIL "B" SCALE: 1" = 2' HORIZONTAL



GRADING

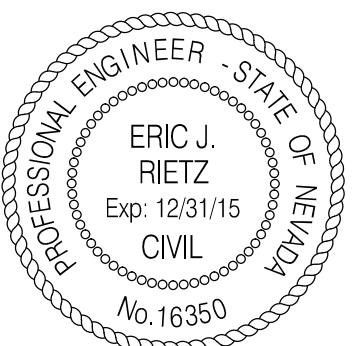
- CONSTRUCT 1" CURB AND GUTTER PER CCAUSD #216
- ECHELON POINT DRIVE PAVEMENT, INSTALL 4" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
- CONSTRUCT 1" CURB AND GUTTER PER CCAUSD #219
- CONSTRUCT SIDEWALK PER CCAUSD #234
- CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #224
- CONSTRUCT CASE III SIDEWALK RAMPS USING ARMOR TILE TRUNCATED DOMES OR EQUIV. PER CCAUSD #235
- CONSTRUCT 2' VALLEY GUTTER PER DETAIL 7, SHEET C4
- CONSTRUCT 5' FLUME ADJACENT TO RETAINING WALL PER DETAIL 8, SHEET C4
- CONSTRUCT SIDEWALK UNDER DRAIN PER CCAUSD #236
- INSTALL 24" NYLOPLAST INLINE DRAIN W/ BEE HIVE GRATE, SEE DETAIL 12, SHEET C4
- CONSTRUCT 2' CURB OPENING
- CONSTRUCT RETAINING WALL, GRADES PER PLAN
- SAWCUT CLEAN EDGE, MEET AND MATCH EXISTING ASPHALT
- MAIN CORRIDOR (TRUCK ACCESS) INSTALL 3" AC OVER 6" TYPE II AGGREGATE BASE PER SOILS REPORT
- AUTOMOBILE ROUTE / PARKING, INSTALL 2" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
- CONSTRUCT BMP SWALE PER DETAIL 10, SHEET C4
- PLACE ARMOR TILE TRUNCATED DOMES AR EQUIVALENT
- CONSTRUCT 5' FLUME PER DETAIL 9, SHEET C4
- CONSTRUCT 2' CONCRETE FLUME PER DETAIL 11, SHEET C4
- CONSTRUCT 8.5' MODIFIED TYPE "C" DROP INLET W/ 2-EA 3' GRATES PER CCAUSD #412.1
- CONSTRUCT 60" TYPE I MANHOLE PER CCAUSD #401 & 403
- 24" CLASS III RCP, BEDDING PER CCAUSD #503.2



GOODWILL @ DURANGO & DEER SPRINGS
LAS VEGAS, NEVADA
APN # 125-20-301-028

DETAIL SHEET

DATE:	10/20/2014	JG	RS	NTS
DRAFTER:				
CHECKED:				
SCALE:				



SHEET
C4
4 OF 5 SHEETS
###

LEGEND

	PROPERTY BOUNDARY
	RIGHT-OF-WAY
	PROPERTY LINE
	CENTER LINE
	EASEMENT
	EXST 'L' TYPE CURB
	EXST 'A' TYPE CURB
	EXST MAJOR CONTOUR LINE
	EXST MINOR CONTOUR LINE
	EXST SCREEN WALL AS INDICATED
	EXST EDGE OF PAVEMENT
	EXST EDGE OF SIDEWALK
	EXST UNDERGROUND POWER
	EXST FIBER OPTICS
	EXST STORM DRAIN
	STORM MANHOLE
	TELEPHONE BOX
	TELEPHONE MANHOLE
	FIBER BOX
	CABLE TV BOX
	ELECTRICAL MANHOLE
	STREET LIGHT BOX
	POWER POLE
	SERVICE POLE
	TRANSFORMER
	STREET LIGHT CABINET
	STREET LIGHT
	TRAFFIC SIGNAL
	TRAFFIC SIGNAL BOX
	AREA LIGHT
	'L' TYPE CURB
	'A' TYPE CURB
	EDGE OF SIDEWALK
	SWALE FLOW LINE
	SAWCUT

EX. STORM DRAIN MANHOLE TABLE

EX. SDMH #1 12" STA: 70+53.61 OFFSET: 35.33 L RIM: 2564.2 INV IN (24" W): 2557.21 INV IN (42" W): 2556.27 INV OUT (24" S): 2556.17	EX. SDMH #2 10" STA: 70+89.58 OFFSET: 35.04 L RIM: 2564.6 INV IN (24" W): 2558.48 INV IN (42" W): 2558.40 INV THRU (42"): 2557.08	EX. SDMH #3 10" STA: 73+24.77 OFFSET: 35.42 L RIM: 2568.1 INV THRU (42"): 2561.97
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STORM DRAIN MANHOLE TABLE

SDMH #1 60" TYPE I SDMH SD STA: 0+24.23 12" STA: 15+92.25 OFFSET: 18.75 L RIM: 2564.69 INV IN: 2557.76 INV OUT: 2557.58
--

PROPERTY CURVE TABLE

CURVE #	LENGTH	RADIUS	DELTA
C1	9.68'	39.50'	14°02'11"
C2	9.68'	39.50'	14°02'11"
C3	47.08'	30.00'	89°54'32"

NOTES

- CONTRACTOR TO VERIFY LOCATION AND ELEVATION OF EXISTING STRUCTURES AND NOTIFY ENGINEER OF ANY DISCREPANCIES PRIOR TO CONSTRUCTION.
- IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY LOCATION AND ELEVATION OF EXISTING UTILITIES PRIOR TO CONSTRUCTION.
- OWNER RESPONSIBLE TO PROVIDE SURVEY MONUMENTATION AS SHOWN AND TO REPLACE ALL SURVEY MONUMENTATION DAMAGED, DISTURBED, DESTROYED OR OBSERVED DURING CONSTRUCTION.

FLOOD ZONE

THIS SITE IS LOCATED IN ZONE "X". AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOOD PLAIN, PER THE FLOOD INSURANCE RATE MAP COMMUNITY PANEL 32003C1745 E. CLARK COUNTY, NEVADA DATED SEPTEMBER 27, 2002.

BENCHMARK

BEING A RIVET AND ROUND ALUMINUM PLATE, STAMPED CITY OF LAS VEGAS BENCHMARK #6LV90 20N6, IN THE TOP OF CURB AT THE SOUTHWEST CORNER OF THE INTERSECTION OF DURANGO DRIVE AND DORRELL LANE. ELEVATION = 2587.82 FEET, REFERENCED TO N.A.V.D. 88 DATUM

BASIS OF BEARING

SOUTH 89°04'17" WEST, BEING THE BEARING OF THE CENTERLINE OF DEER SPRINGS WAY AS SHOWN IN FILE 116, PAGE 89 OF SURVEYS AND PARCEL MAP IN FILE 116, PAGE 59 IN THE CLARK COUNTY RECORDER'S OFFICE, NEVADA

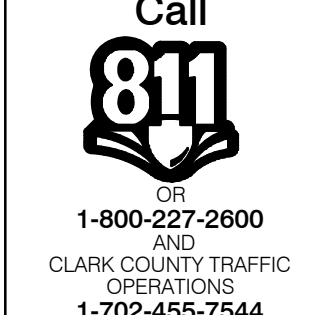
DISCLAIMER NOTE:

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

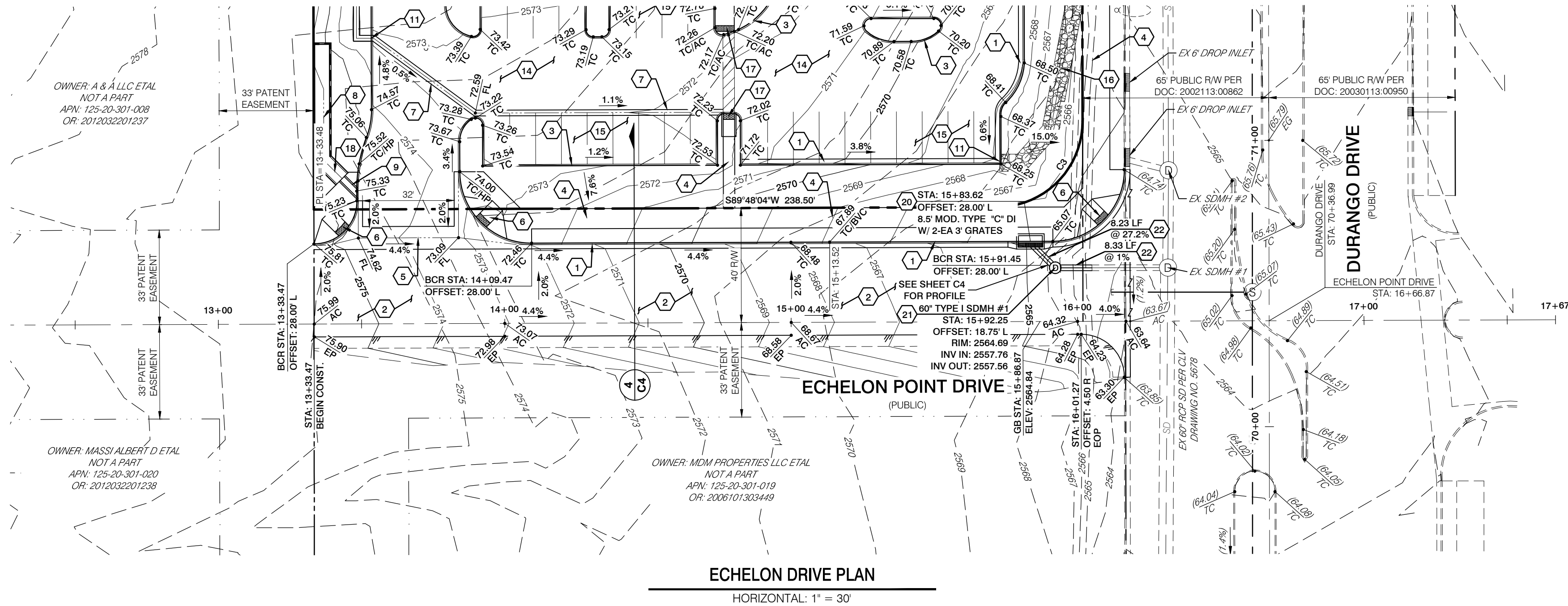
AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.



Call before you Dig
Avoid cutting underground utility lines. It's costly.

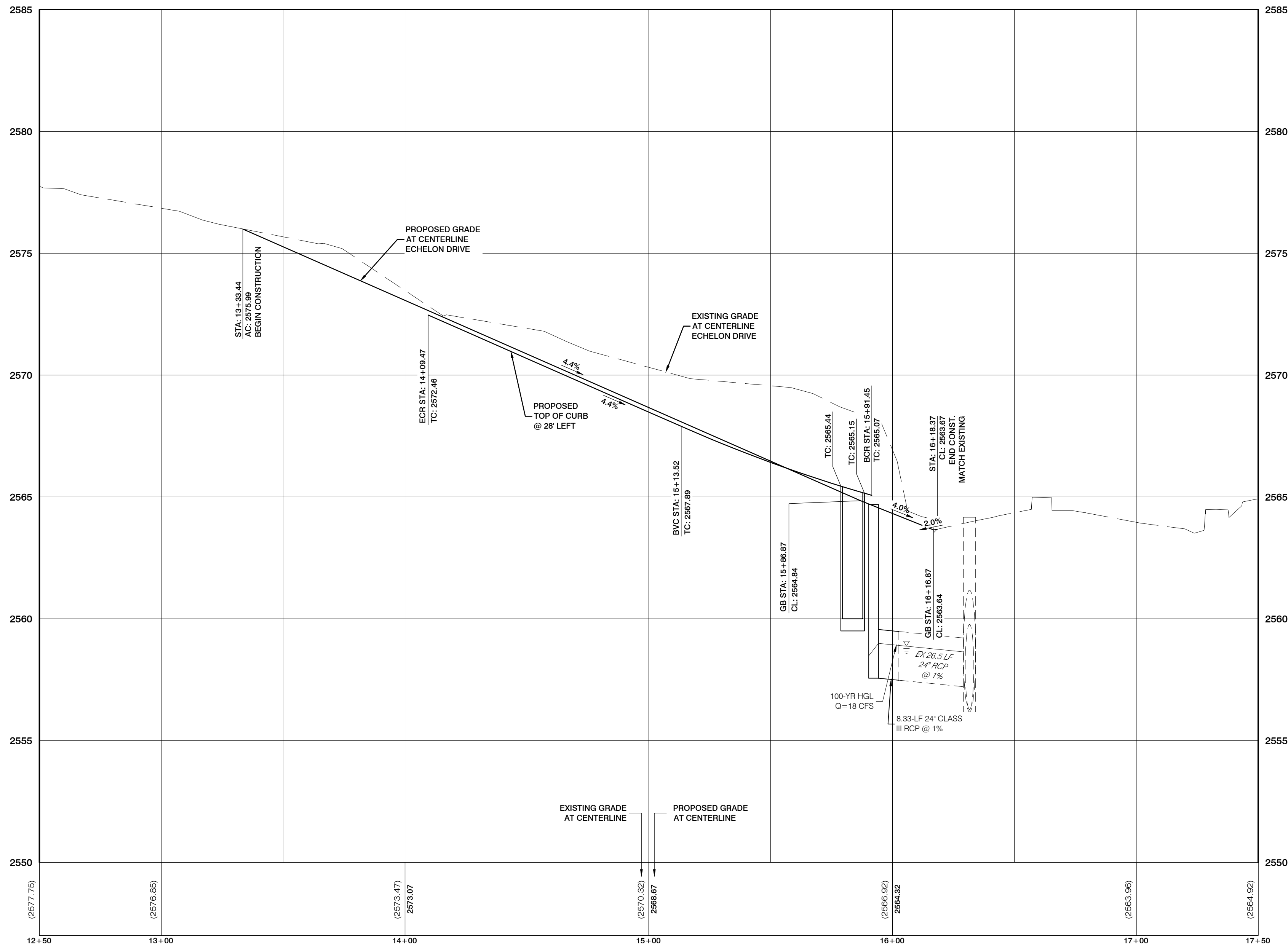


AVOID HITTING UNDERGROUND TRAFFIC SIGNAL SYSTEMS AND STREET LIGHT SYSTEMS AND CONDUITS. IT'S COSTLY.



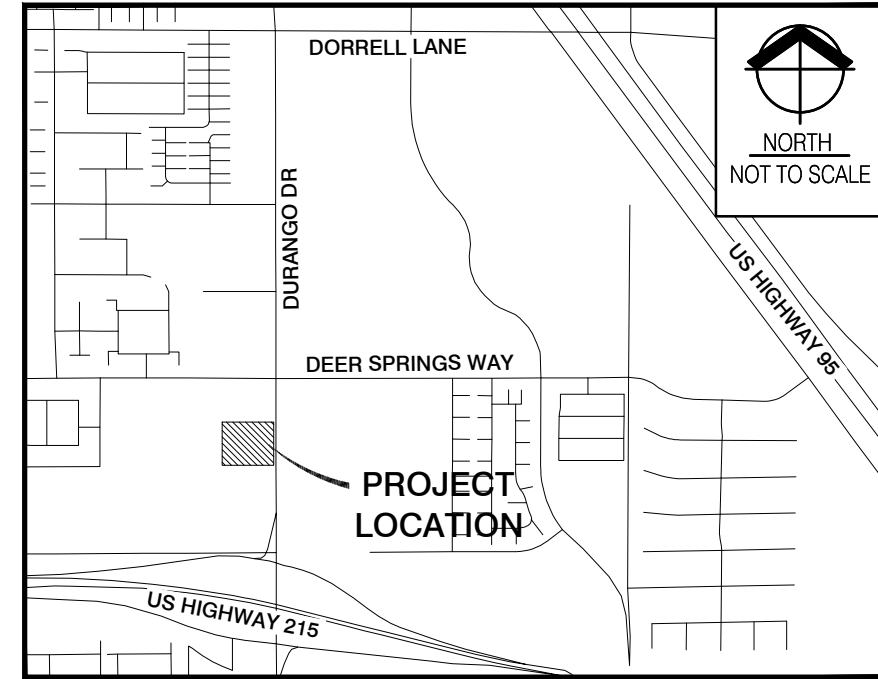
ECHELON DRIVE PLAN

HORIZONTAL: 1" = 30'



ECHELON DRIVE PROFILE

HORIZONTAL: 1" = 30'
VERTICAL: 1" = 3'



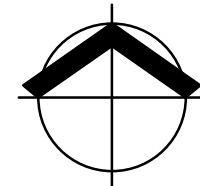
VICINITY MAP

LEGEND

EXISTING	PROPOSED
TOP BACK CURB	TOP BACK CURB
EXISTING GROUND	FINISH GRADE
EDGE OF PAVEMENT	EDGE OF PAVEMENT
FLOW LINE	FLOW LINE
ASPHALT CONCRETE	ASPHALT CONCRETE
TOP OF RET. WALL	TOP OF RET. WALL
TOP OF FOOTER	TOP OF FOOTER
	HIGH POINT
	GRADE BREAK

GRADING

- CONSTRUCT 'L' CURB AND GUTTER PER CCAUSD #216
- ECHELON POINT DRIVE PAVEMENT, INSTALL 4" AC OVER 4" TYPE II AGGREGATE BASE PER SOILS REPORT
- CONSTRUCT 'A' CURB AND GUTTER PER CCAUSD #219
- CONSTRUCT SIDEWALK PER CCAUSD #234
- CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #224
- CONSTRUCT CASE III SIDEWALK RAMPS USING ARMOR TILE TRUNCATED DOMES OR EQUIV. PER CCAUSD #236
- CONSTRUCT 2' VALLEY GUTTER PER DETAIL 7, SHEET C4
- CONSTRUCT 5' FLUME ADJACENT TO RETAINING WALL PER DETAIL 8, SHEET C4
- CONSTRUCT SIDEWALK UNDER DRAIN PER CCAUSD #236
- INSTALL 24" NYLOPLAST INLINE DRAIN W/ BEE HIVE GRATE, SEE DETAIL 12, SHEET C4
- CONSTRUCT 2' CURB OPENING
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- SAWCUT CLEAN EDGE. MEET AND MATCH EXISTING ASPHALT
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- CONSTRUCT BMP SWALE PER DETAIL 10, SHEET C4
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- CONSTRUCT 60" TYPE I MANHOLE PER CCAUSD #401 & 403
- 24" CLASS III RCP, BEDDING PER CCAUSD #503.2



SCALE: 1" = 30'

SITE DATA

APN No. 125-20-301-028 ACREAGE: 1.69 ZONING (UTC)

DATUM

THIS NOTE IS FOR ALL GRADING ELEVATIONS SHOWN HEREON WITH EXCEPTION TO CONTOUR ELEVATIONS, FINISHED FLOORS, AND PAD ELEVATIONS UNLESS OTHERWISE NOTED.

ADD 2500.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

GEOTECHNICAL REPORT

PROJECT No. 4124JD074
DATED: SEPTEMBER 17, 2014
AS PREPARED BY: WESTERN TECHNOLOGIES

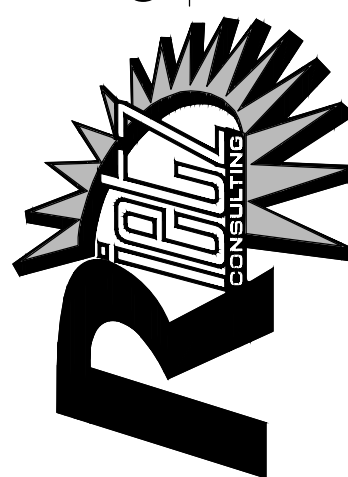
DRAINAGE CERTIFICATION

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY CLV # XXXXXXXX FOR THIS SITE ON FILE AT CITY OF LAS VEGAS FOR THIS PROJECT.

ERIC J. RIETZ, P.E. No. 16350

DATE

RIETZ CONSULTING INC.
3060 E. POST ROAD, #110
LAS VEGAS, NEVADA 89120
PH: 702.521.3355
FX: 702.891.5397



ECHELON POINT DRIVE PLAN AND PROFILE

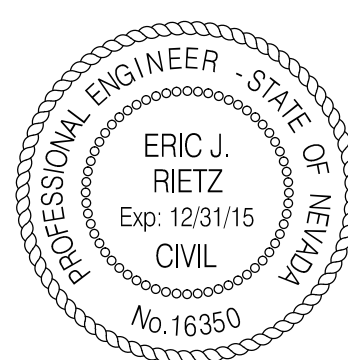
GOODWILL @ DURANGO & DEER SPRINGS
LAS VEGAS, NEVADA
APN # 125-20-301-028

DATE: 10/20/2014

####

RS

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SHEET

C5

SHEET 5 OF 5 SHEETS

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