

DS #: 5319

APN: 124-18.410.009

PROJECT: UHS P Decatur S. Elkhorn  
(Project in CNLV for CLV Concurrence)

SUBMITTAL: 1st

SCANNED BY/DATE:

CHECKED BY/DATE:



|                                                                                                                       |                                         |                                                                                                   |
|-----------------------------------------------------------------------------------------------------------------------|-----------------------------------------|---------------------------------------------------------------------------------------------------|
| <b>CITY OF LAS VEGAS<br/>INTER-OFFICE MEMORANDUM</b>                                                                  |                                         | <b>DATE:</b><br>August 26, 2020                                                                   |
| <b>TO:</b><br>Land Development Services<br>Department of Building & Safety                                            |                                         | <b>FROM:</b><br>Albert Sung, P.E.<br>Flood Control Project Engineer<br>Department of Public Works |
| <b>SUBJECT:</b><br>Drainage Study for:<br><b>UHS @ Decatur &amp; Elkhorn</b><br>(Project in CNLV for CLV Concurrence) |                                         | <b>COPIES TO:</b><br>Rietz Consulting, Inc.                                                       |
| <b>Cross Streets:</b>                                                                                                 | NEC of Elkhorn Road & Decatur Boulevard | Universal Health Services, Inc.                                                                   |
| <b>File Number:</b>                                                                                                   | F:\Depot\DSMemos\DS5319A.doc            | Bart Anderson, P.E., DevCo                                                                        |
| <b>Parcel Number:</b>                                                                                                 | 124-18-410-009                          | CNLV                                                                                              |
| <b>Zoning Action:</b>                                                                                                 | N/A                                     |                                                                                                   |
| <b>FEMA Flood Zone</b>                                                                                                | YES NO <b>X</b>                         |                                                                                                   |
| <b>Proposed Storm Drain</b>                                                                                           | YES NO <b>X</b>                         |                                                                                                   |

| HISTORY                   | DATE RECEIVED | DATE REVIEWED | COMMENTS                   | REVIEW FEES     | FEES PAID<br>Payment Trn # |
|---------------------------|---------------|---------------|----------------------------|-----------------|----------------------------|
| 1 <sup>st</sup> Submittal | 8/5/2020      | 8/26/2020     | See Comments Below         | \$400.00        | 3943271: \$400             |
|                           |               |               | <b>TOTAL FEES (LDDRS):</b> | <b>\$400.00</b> | ----                       |

#### REMARKS:

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

|          |                                                                                                |
|----------|------------------------------------------------------------------------------------------------|
| <b>X</b> | 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. |

**City of Las Vegas Flood Control** staff has reviewed the Technical Drainage Study, including Addendum #1 for the subject development "**UHS @ Decatur & Elkhorn**" within the jurisdiction of **City of North Las Vegas**. **City of Las Vegas** concurs with the acceptance of the drainage study by the **City of North Las Vegas Public Works Department**. The review of this project was limited to issues of flood control significance to the **City of Las Vegas**.

**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

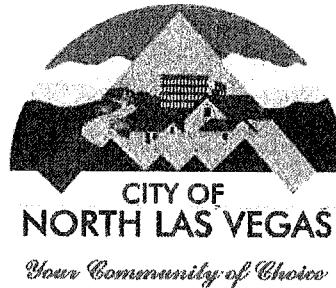
T/R/S: T19S/R61E/18

AREA H-18

Mayor  
**John J. Lee**

Council Members  
**Isaac E. Barron**  
**Pamela A. Goynes-Brown**  
**Scott Black**  
**Richard J. Cherchio**

City Manager  
**Ryann Juden**



**Department of Public Works**

2250 N. Las Vegas Boulevard, Suite 200 • North Las Vegas, Nevada 89030  
Telephone: (702) 633-1200 • Fax: (702) 649-4696 • TDD: (800) 326-6868  
[www.cityofnorthlasvegas.com](http://www.cityofnorthlasvegas.com)

July 30, 2020

Mailed via: E-mail

Mr. Eric J. Rietz, P.E.  
Rietz Consulting, Inc.  
3203 E. Warm Springs Road, # 400  
Las Vegas, NV 89120

RE: **Technical Drainage Study for UHS at Decatur & Elkhorn  
CNLV #177-2020**

Dear Mr. Rietz:

Staff has reviewed the Technical Drainage Study for the UHS at Decatur and Elkhorn, dated May 11, 2020 and Addendum No.1, dated July 22, 2020, and found the hydrological and hydraulic analyses to meet the minimum accepted standards for a technical drainage study. The acceptance of this drainage study is contingent upon the following conditions:

1. Concurrence must be obtained by the Clark County Regional Flood Control District due to the proposed improvements proximity to Regional Flood Control Facilities (LVDE 0027).
2. The site is adjacent to the City of Las Vegas (CLV). Please note that a copy of this study and any addenda must be submitted to CLV for their review and concurrence.
3. The Technical Drainage Study is predicated on full construction of the offsite street improvements and all associated drainage facilities for the following roadways:
  - a. Grand Teton Drive,
  - b. Decatur Boulevard,
  - c. Farm Road,
  - d. Aviary Way, and
  - e. Elkhorn Road

Please note that no onsite development will be allowed until all required interim or the permanent infrastructure facilities are constructed to intercept all offsite flows and protect the proposed onsite improvements.

4. The Technical Drainage Study is predicated on the construction of the CCRFCD facilities in Grand Teton Road and the Park Highlands West Detention Basin associated with the Park Highland West Amendment to the Las Vegas Valley Flood Control Master Plan Update (Figure F-14). Please note that no certificates of occupancy will be issued until the required permanent regional flood control and infrastructure facilities are constructed to intercept all offsite flows and protect the proposed onsite improvements.
5. The Planning Commission hearing is August 12, 2020, therefore copies of the approved zoning/planning conditions associated with this site are not yet available and compliance with the conditions could not be verified. Please be advised that any conditions of approval that would require revision of the site drainage parameters or grading plan will require that the technical drainage study be revised and resubmitted.

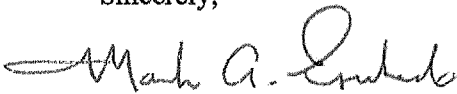
Please be advised that all land surface area disturbances over 1 acre and/or adjacent to a water way must submit a "Notice of Intent" to discharge to the Nevada Division of Environmental Protection, which certifies that a stormwater pollution prevention plan has been developed and is maintained on site. For more information including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm>.

Acceptance of this study does not imply approval of any grading plans associated with the development of this site. A detailed review of any grading plan is performed by staff during the improvement plan review process.

Any future changes in the proposed design (or design assumptions) as outlined in the approved drainage study and the attached preliminary grading plans which affect drainage must be addressed in a drainage study update and accepted by the CNLV Development and 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, CNLV 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 that the Clark County Regional Flood Control District (District) has begun efforts to update the *Hydrological Criteria and Drainage Design Manual* (HCDDM) and is requesting participation from the engineering community. The District is collecting comments and suggestions on errors, clarifications, or changes needed to the current Manual and/or content and usability enhancements to be incorporated into the updated Manual. Additional information on procedures and deadline to provide feedback and comments are available online at (<http://www.ccrfcd.org/hcddmupdate.html>).

Sincerely,



Mark Escobedo, P.E., CFM  
Engineering Associate  
Public Works/Development and Flood Control  
City of North Las Vegas  
(702) 633-1933



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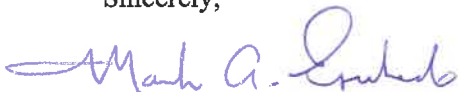
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Sincerely,



Mark Escobedo, P.E., CFM  
Engineering Associate  
Public Works/Development and Flood Control  
City of North Las Vegas  
(702) 633-1933

**ADDENDUM #1**  
**TO THE**  
**TECHNICAL DRAINAGE STUDY**  
**for**  
**UHS @ DECATUR & ELKHORN**

**City of North Las Vegas, Nevada**

Date: July, 2020

**Prepared By:**



Rietz Consulting, Inc.  
3203 E. Warm Springs Road #400  
Las Vegas, Nevada 89120  
Phone: (702) 521-3355

**Prepared For:**

Universal Health Services, Inc.  
367 South Gulph Road  
King of Prussia, PA 19406

# HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

## DRAINAGE STUDY INFORMATION FORM

Name of Development: UHS @ DECATUR & ELKHORN Date: 07/20/2020

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

East/West: ELKHORN ROAD

b) Section: 18 Township: 19 South Range: 61 East

c) APN : 124-18-410-009

Name of Owner: OWNER: GRYESTONE NEVADA LLC DEVELOPER: UHS

Telephone No.: (205) 966-6919 Fax No.: \_\_\_\_\_ E-Mail Address: scott.ricks@uhsinc.com

Address: 367 Gulph Road, PO Box 61558, King of Prussia, PA 19406

Contact Person-Name: Eric Rietz, P.E. Telephone No.: 702-521-3355

\* E-Mail Address: eric.rietz@gmail.com Fax No.: \_\_\_\_\_

Firm: Rietz Consulting, Inc.

Address: 3203 E. Warm Springs Rd., #400, Las Vegas, NV 89120

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 8.08 Being Developed/Disturbed: 2+/-

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

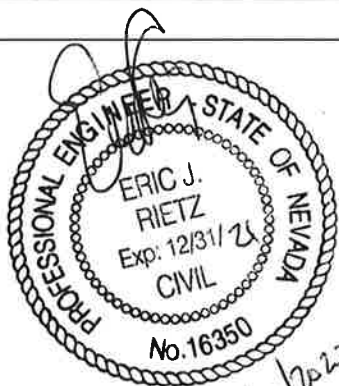
4. Proposed type of development (Residential, Commercial, Etc.): Commercial

5. Approximate upstream land area which drains to the subject site: 0 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: SOUTHEAST CORNER OF SITE, ELKHORN

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



July 20, 2020

Mark Escobedo, P.E., CFM  
Engineering Associate  
Public Works/Development and Flood Control  
2250 N. Las Vegas Boulevard, Suite 200  
North Las Vegas, NV 89030

**RE: Addendum #1 to *Technical Drainage Study for UHS at Decatur & Elkhorn*  
CNLV # 177-2020**

Dear Mr. Escobedo:

Herein please find responses to comments presented in your June 11, 2020 letter in reference to the above-mentioned project. Comments are restated in bold type with an accompanying response.

- 1. Concurrence must be obtained by the Clark County Regional Flood Control District due to the proposed improvements proximity to Regional Flood Control Facilities (LVDE 0027).**

Response: Noted.

- 2. The site is adjacent to the City of Las Vegas (CLV). Please note that a copy of this study and any addenda must be submitted to CLV for their review and concurrence.**

Response: Noted. A copy of the study will be submitted to CLV for their review and concurrence.

- 3. The Technical Drainage Study is predicated on full construction of the offsite street improvements and all associated drainage facilities for the following roadways:**

a) Grand Teton Drive,



- b) Decatur Boulevard,
- c) Farm Road,
- d) Aviary Way, and
- e) Elkhorn Road

Please note that no onsite development will be allowed until all required interim or the permanent infrastructure facilities are constructed to intercept all offsite flows and protect the proposed onsite improvements.

Response: Noted.

4. The technical Drainage Study is predicated on the construction of the CCRFCD facilities in Grand Teton Road and the Park Highlands West Detention Basin associated with the Park Highland West Amendment to the Las Vegas Valley Flood Control Master Plan Update (Figure F-14). Please note that no certificates of occupancy will be issued until the required permanent regional flood control and infrastructure facilities are constructed to intercept all offsite flows and protect the proposed onsite improvements.

Response: Noted.

5. Provide a copy of the approved zoning/planning conditions associated with this site.

Response: The planning commission hearing is August 12<sup>th</sup> 2020 for ZN 8-2020.

6. When referencing other drainage studies, all pertinent information such as approval letters must be included. The reference material to the TDS for Elkhorn and Decatur Multi-Family Condominiums included only the review comment letter associated with Addendum No. 1 to that study. The approval letter was not included.

Response: Noted. Approval letter for CNLV #68029 is attached in this submittal.

7. What is the timing for the development of the remaining portion of the 8.08 acres? The Engineer assumed that the Interim Conditions are the same as the Developed Conditions, however until the entire site develops it appears that on the northwest corner of this project site there is a low area where water will pond and at the northeast corner offsite flow will enter the project site. Are there measures proposed in the interim to route flow around the project site to the existing 4' x 4" drop inlet?

Response: Development of the remainder of the site is not currently planned. It is likely that the site will be subdivided at a future time and commercial/retail development will occur on the currently undeveloped portion of the site. Flow impacting the north edge of the subject site is now collected in a drainage swale and directed to the east side of the site. The subject site has been designed to collect flow from the northern part of the parcel and convey it through the parking lot and drive aisles to the southeast corner of the site where it is collected by the existing 4'x4' drop inlet provided by the adjacent development.

- 8. Technical Drainage Study Updates will be required for the portions of the site not improved with this plan set.**

Response: Noted.

- 9. In Section 4.3 Street Flows, of the TDS, under the discussion regarding the humped driveways to protect the site from the Q100 in the adjacent street, the grade elevations in the TDS do not match the grading plan grade elevations for both access points (Decatur and Elkhorn). Please review and revise accordingly.**

Response: Noted. Grading Plan and TDS has been revised.

- 10. The Street capacity analysis does not appear to account for the requirement that the plant mix bituminous pavement shall be finished to a height of 3/8 inches to 5/8 inches above the lip of gutters and valley gutters. Included the input data and account for the finished height of plant mix bituminous pavement (0.04 feet) above the lip of gutter in the analysis. The cross slope for Decatur Boulevard in the analysis is 1.75% and the cross slope for Elkhorn road is 2.25%. Are these the surveyed cross slope at the section locations? Please review and revise accordingly.**

Response: Analyzed cross sections are taken from site specific topographic information. A half inch vertical elevation difference has been added to the lip of offsite flow sections.

Please also note that onsite flowmaster sections included the correct elevation difference from the AC lip to the flow line of "L" curb or valley gutter. This is standard practice and has been for a number of years.

- 11. For 80-feet wide and greater streets, the actual dry lane determination must be shown on the q10 street capacity calculations. Please provide the dry lane calculations for Decatur Boulevard and Elkhorn Road. Please review and revise accordingly.**

Response: Noted. Dry lane calculations have been revised accordingly.

- 12. For Commercial and industrial developments, landscape areas are not allowed to sheet flow over the sidewalk. On Sheet C3, provide flow lines with grades and sidewalk underdrains for landscape areas draining to the street along the West Elkhorn Road frontage between Decatur Boulevard and the project driveway.**

Response: A flow line between the property and the sidewalk has been added and designed to discharge the flow on West Elkhorn Road through a proposed sidewalk under drain. Please see revised and updated Grading Plan C3 included in this submittal.

- 13. Any area of a surface parking lot that abuts a public street (West Elkhorn Road) shall be screened by perimeter landscaping or a decorative masonry wall with a minimum wall height of three feet above the finished grade of the parking lot where it abuts the**

**landscaping (Title 17. Zoning Ordinance/Chapter 17.24 Development Standards/17.24.060 Landscaping).**

Response: Noted. Perimeter landscaping is proposed around the project site per approved landscape plan.

**14. For 100-year street flows in Decatur Boulevard and Elkhorn Road with depths greater than 0.6' and the velocity is greater than 5 fps, erosion resistance landscaping must be provided.**

Response: The velocity calculated in updated sections "A" and "B" in Decatur Boulevard and Elkhorn Road is less than 5 fps.

**15. In general, on the grading plan, provide proposed spot elevations in sufficient detail to exhibit intended drainage patterns at curb cuts and sidewalks underdrains, and flow lines in commercial driveways.**

Response: Noted. The Grading Plan C3 has been revised and included in this submittal.

**16. There appears to be existing street lights that require relocation in the driveway approaches on Decatur Boulevard and Elkhorn Road that are labeled with the incorrect construction note (Note No. 25 instead of Note No. 26). Please review and revise accordingly.**

Response: Noted. The Grading Plan C3 has been revised and included in this submittal.

**17. Construction Notes No.'s 11, 18, 23, 24, 25 and 26 are not called out on the grading plan and/or the detail sheet.**

Response: Noted. The Grading Plan C3 has been revised and included in this submittal.

**18. Show existing 4' x 4' drop inlet and storm drain in the existing storm drain easement.**

Response: Noted. The Grading Plan C3 has been revised and included in this submittal.

**19. On the Grading Plan, Sheet C3, at the driveway approach on Elkhorn Road, the elevation at the highpoint line on the west side of the approach is labeled TC/LP. It does not appear to be a low point at this location. Please review and revise accordingly.**

Response: Noted. The Grading Plan C3 has been revised and included in this submittal.

**20. On the Detail Sheet, Sheet C4, where the term varies is utilized, provide a minimum and maximum value. Please review and revise accordingly.**

Response: Noted. The Detail Sheet C4 has been revised and included in this submittal.

**21. On the Detail Sheet, Sheet C4, details No. 1 through No. 4 have a building finish floor elevation of 2614.52. The finish floor elevation on the grading plan is 2313.80. Please review and revise accordingly.**

Response: Noted. The Detail Sheet C4 has been revised and included in this submittal.

**22. On the Detail Sheet, Sheet C4, Blow up 3, it appears the curb transition and the 0-inch "A" curb are mislabeled with the incorrect construction call out. Please review and revise accordingly.**

Response: Noted. The Detail Sheet C4 has been revised and included in this submittal.

We hope that this submittal resolves the issues of concern with the project. If you need additional information, please feel free to contact our office if you have any questions.

Sincerely,

Eric Rietz, PE, PLS  
President  
3203 E. Warm Springs Rd., #400  
Las Vegas, NV 89120  
(702) 521.3355  
eric.rietz@rietzconsulting.com

# APPENDIX

**COPY OF COMMENT LETTER**

Mayor  
**John J. Lee**

Council Members  
**Isaac E. Barron**  
**Pamela A. Goynes-Brown**  
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Mailed via: E-mail

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Las Vegas, NV 89120

**RE: Technical Drainage Study for UHS at Decatur & Elkhorn  
CNLV #177-2020**

Dear Mr. Rietz:

Staff has reviewed the Technical Drainage Study for the UHS at Decatur and Elkhorn, dated May 11, 2020 and have the following comments:

1. Concurrence must be obtained by the Clark County Regional Flood Control District due to the proposed improvements proximity to Regional Flood Control Facilities (LVDE 0027).
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12. For Commercial and industrial developments, landscape areas are not allowed to sheet flow over the sidewalk. On Sheet C3, provide flow lines with grades and sidewalk underdrains for landscape areas draining to the street along the West Elkhorn Road frontage between Decatur Boulevard and the project driveway.

13. Any area of a surface parking lot that abuts a public street (West Elkhorn Road) shall be screened by perimeter landscaping or a decorative masonry wall with a minimum wall height of three feet above the finished grade of the parking lot where it abuts the landscaping (Title 17. Zoning Ordinance/Chapter 17.24 Development Standards/17.24.060 Landscaping).
14. For 100-year street flows in Decatur Boulevard and Elkhorn Road with depths greater than 0.6' and the velocity is greater than 5 fps, erosion resistant landscaping must be provided.
15. In general, on the grading plan, provide proposed spot elevations in sufficient detail to exhibit intended drainage patterns at curb cuts and sidewalk underdrains, and flow lines in commercial driveways.
16. There appears to be existing street lights that require relocation in the driveway approaches on Decatur Boulevard and Elkhorn Road that are labeled with the incorrect construction note (Note No. 25 instead of Note No. 26). Please review and revise accordingly.
17. Construction Notes No.'s 11, 18, 23, 24, 25 and 26 are not called out on the grading plan and/or the detail sheet.
18. Show the existing 4' x 4' drop inlet and storm drain in the existing storm drain easement.
19. On the Grading Plan, Sheet C3, at the driveway approach on Elkhorn Road, the elevation at the highpoint line on the west side of the approach is labeled TC/LP. It does not appear to be a low point at this location. Please review and revise accordingly.
20. On the Detail Sheet, Sheet C4, where the term varies is utilized, provide a minimum and maximum value. Please review and revise accordingly.
21. On the Detail Sheet, Sheet C4, details No. 1 through No. 4 have a building finish floor elevation of 2614.52. The finish floor elevation on the grading plan is 2313.80. Please review and revise accordingly.
22. On the Detail Sheet, Sheet C4, Blow Up 3, it appears the curb transition and the 0-inch "A" curb are mislabeled with the incorrect construction call out. Please review and revise accordingly.

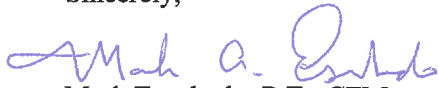
Please be advised that all land surface area disturbances over 1 acre and/or adjacent to a water way must submit a "Notice of Intent" to discharge to the Nevada Division of Environmental Protection, which certifies that a stormwater pollution prevention plan has been developed and is maintained on site. For more information including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm>.

A detailed review of the grading plan will be performed by staff during the improvement plan review process. The City of North Las Vegas, its officials, consultant, or employees assume no liability for information, data, calculations and conclusions presented by the consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review. If you have any questions concerning this matter, please contact me at (702) 633-1933.

Eric J. Rietz, P.E.  
TDS for UHS at Decatur and Elkhorn  
Page 4 of 4  
June 11, 2020

Note that the Clark County Regional Flood Control District (District) has begun efforts to update the *Hydrological Criteria and Drainage Design Manual* (HCDDM) and is requesting participation from the engineering community. The District is collecting comments and suggestions on errors, clarifications, or changes needed to the current Manual and/or content and usability enhancements to be incorporated into the updated Manual. Additional information on procedures and deadline to provide feedback and comments are available online at (<http://www.ccrfed.org/hcddmupdate.html>).

Sincerely,



Mark Escobedo, P.E., CFM  
Engineering Associate  
Public Works/Development and Flood Control  
City of North Las Vegas  
(702) 633-1933

**TDS for ELKHORN and DECATUR  
MULTI-FAMILY  
CONDOMINIUMS APPROVAL  
LETTER CNLV #68029**

Mayor  
**John J. Lee**

Council Members  
**Isaac E. Barron**  
**Pamela A. Goynes-Brown**  
**Scott Black**  
**Richard J. Cherchio**

City Manager  
**Ryann Juden**



**Department of Public Works**

2250 N. Las Vegas Boulevard, Suite 200 • North Las Vegas, Nevada 89030  
Telephone: (702) 633-1200 • Fax: (702) 649-4696 • TDD: (800) 326-6868  
[www.cityofnorthlasvegas.com](http://www.cityofnorthlasvegas.com)

April 15, 2019

Mailed Via: E-mail

Lee L. Gong, P.E.  
Taney Engineering  
6030 S. Jones, Suite 100  
Las Vegas, Nevada 89118

**Re: Supplement #1 to Addendum #1 to the TDS for Elkhorn & Decatur Multi-Family Condominiums**

**(CNLV # 68029)**

Dear Mr. Gong:

The City of North Las Vegas (CNLV) has reviewed the above referenced Technical Drainage Study received on February 26, 2019, Addendum #1 received on March 27, 2019, and Supplement #1 received on April 11, 2019, and found them to meet the minimum accepted standards for a Technical Drainage Study. This acceptance is contingent upon the following conditions:

1. The site is adjacent to an existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the civil improvement plans.
2. The project site is located adjacent to the jurisdiction boundary of City of Las Vegas (CLV). Therefore, CLV concurrence is required prior to final approval of the civil improvement plans.
3. Since this drainage study is relying on protection from the improvement by the Park Highlands West Infrastructure project and the Park Highlands West Detention Basin shown on Figure 8 (Exhibit F), no Final Walk will be performed by CNLV until the infrastructure improvement and the detention basin facility have been built and fully operational.

4. Provide silt trap(s) right at the upstream of the Jensen grate inlet at the southeast corner of basin PON8a to capture the silt generated from the upstream offsite basin for the interim condition before the silt gets into the grate inlets. The silt trap is required to have a minimum depth of one (1) foot and a minimum dimension of ten (10) feet by ten (10) feet with minimum six (6) inches thick riprap on the side and at the bottom before the final approval of the civil plans. Also, provide a swale to connect the grate inlet and Elkhorn Road to convey the overtopping storm flows from the grate inlet.
5. On grading plan G9 and G10 at just south of the project site, there is no sign of constructed Elkhorn Road to the entrance of the project site to provide access to the site. And per the response to Comment #24 in Addendum #1, it mentions that Elkhorn Road is under construction per D.R. Horton, no Final Walk will be performed by CNLV until Elkhorn Road has been built and fully operational.

Please be advised that all land surface area disturbances over 1 acre and/or adjacent to a water way must submit a "Notice of Intent" to discharge to the Nevada Division of Environmental Protection, which certifies that a storm water pollution prevention plan has been developed and is maintained on site. For more information including forms and applications see <http://ndep.nv.gov/bwpc/storm01.htm>.

Acceptance of this drainage study does not imply approval of the grading plan associated with this site. A detailed review of the grading plan will be performed by staff during the improvement plan review process.

Any future changes in the proposed design (or design assumptions) as outlined in the approved drainage study and the attached preliminary grading plans which affect drainage must be addressed in another drainage study update and accepted by the CNLV Development and Flood Control Division. 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, CNLV reserves the right to require additional conditions and/or submission and acceptance of another complete drainage study update prior to further construction of a project.

The City of North Las Vegas, its officials, VTN Nevada, or employees assume no liability for information, data, calculations and conclusions presented by the consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review. If you have any questions concerning this matter, please contact me at (702) 633-1254.

Sincerely,



Simon Luk, P.E.  
Associate Engineer  
Development and Flood Control Division  
Department of Public Works

# REVISED FIGURES AND HEC-1



TOPOGRAPHIC SYMBOLS AND LINETYPES

|     |                               |
|-----|-------------------------------|
| --- | 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 GAS                      |
| --- | EXST WATER LINE               |
| --- | EXST SEWER LINE               |
| --- | EXST STORM DRAIN              |
| --- | EXISTING                      |
| --- | PROPOSED                      |
| --- | METER                         |
| --- | FIRE HYDRANT                  |
| --- | VALVE                         |
| --- | BLOWOFF VALVE                 |
| --- | AIR RELEASE VALVE             |
| --- | BACKFLOW PREVENTER            |
| --- | SWR MANHOLE                   |
| --- | SEWER CLEANOUT                |
| --- | STORM MANHOLE                 |
| --- | TELEPHONE BOX                 |
| --- | TELEPHONE MANHOLE             |
| --- | FIBER BOX                     |
| --- | CABLE TV BOX                  |
| --- | ELECTRICAL MANHOLE            |
| --- | STREET LIGHT BOX              |
| --- | POWER POLE                    |
| --- | SERVICE POLE                  |
| --- | GUY WIRE                      |
| --- | TRANSFORMER                   |
| --- | STREET LIGHT CABINET          |
| --- | STREET LIGHT                  |
| --- | TRAFFIC SIGNAL                |
| --- | TRAFFIC SIGNAL BOX            |
| --- | AREA LIGHT                    |
| --- | "L" TYPE CURB                 |
| --- | "A" TYPE CURB                 |
| --- | EDGE OF SIDEWALK              |
| --- | CHAIN LINK FENCE              |
| --- | WROUGHT IRON FENCE            |
| --- | SWALE FLOW LINE               |
| --- | SAWCUT                        |

**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 32003C1789F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

**BENCHMARK**

CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLV9119N4 RIVET AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

ELEVATION: 899.858 METERS  
ELEVATION: 2295.461 U.S. SURVEY FEET  
NAVD 88

**BASIS OF BEARING**

S01°21'38"E 1355.11'  
PER BOOK 150, PAGE 94 OF PLATS

**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 DO OVERHEAD

1-702-227-2929

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

Call 811

OR

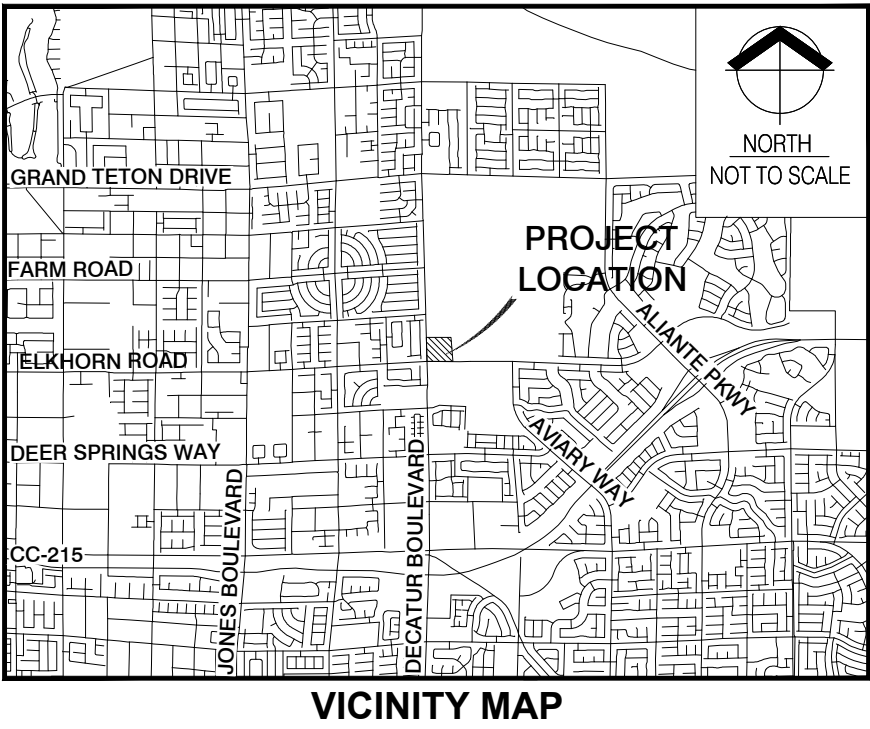
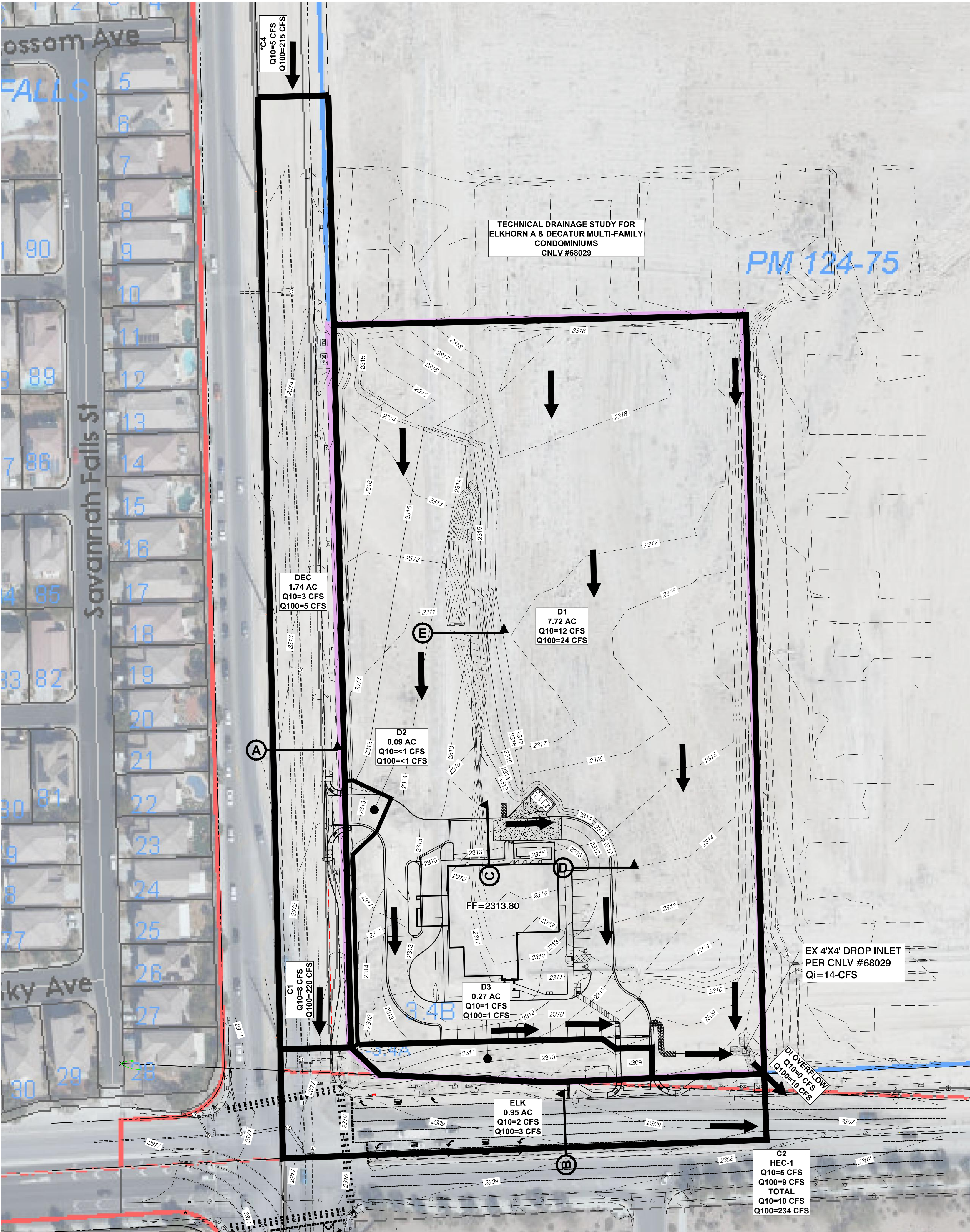
1-800-227-2600

**FAST**

Call before you UnderGround

1-702-432-5300

FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



**LEGEND**

BASIN BOUNDARY LINE

SUB-BASIN LABEL

FLOW CROSS SECTION LOCATION

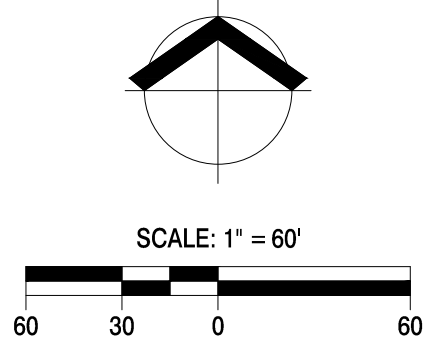
FLOW DIRECTION ARROW

CONCENTRATION POINT LABEL

**BASIN AREA**  
Q10  
Q100

**CP**  
Q10  
Q100

**\*REFERENCED FROM: "TECHNICAL DRAINAGE STUDY FOR ELKHORN & DECATUR MULTI-FAMILY CONDOMINIUMS, CNLV #68029.**



| DEVELOPED CONDITION DRAINAGE SUMMARY TABLE |           |           |            |
|--------------------------------------------|-----------|-----------|------------|
| Basin ID/Concentration Point               | Area (AC) | Q10 (cfs) | Q100 (cfs) |
| D1                                         | 7.72      | 12        | 24         |
| *C4                                        | ---       | 5         | 215        |
| DEC                                        | 1.74      | 3         | 5          |
| D2                                         | 0.09      | <1        | <1         |
| C1 (HEC-1)                                 | ---       | 3         | 5          |
| C1 TOTAL                                   | ---       | 8         | 220        |
| ELK                                        | 0.95      | 2         | 3          |
| D3                                         | 0.27      | 1         | 1          |
| C2 (HEC-1)                                 | ---       | 5         | 9          |
| **C2 TOTAL                                 | ---       | 10        | 234        |

\*C4 Referenced from "Technical Drainage Study for Elkhorn & Decatur Multi-Family Condominiums, CNLV #68029.

\*\* C2 TOTAL = C2 (HEC-1) + \*C4 + DROP INLET OVERFLOW = 5/9 + 5/215 + 0/10 = 10/234

| DEVELOPED CONDITION FLOW SECTION SUMMARY TABLE |     |       |      |      |      |      |       |        |  |
|------------------------------------------------|-----|-------|------|------|------|------|-------|--------|--|
| Section                                        | Q10 | Q100  | D10  | D100 | V10  | V100 | D*V10 | D*V100 |  |
| A - Decatur Boulevard                          | 8   | 220   | 0.49 | 1.28 | 1.87 | 4.81 | 0.92  | 6.16   |  |
| B - Elkhorn Road                               | 10  | 234   | 0.56 | 1.37 | 2.17 | 4.86 | 1.22  | 6.66   |  |
| C - Onsite Section                             | N/A | 12.00 | N/A  | 0.67 | N/A  | 2.48 | N/A   | 1.66   |  |
| D - Onsite Section                             | N/A | 12.00 | N/A  | 0.71 | N/A  | 2.43 | N/A   | 1.73   |  |
| E - Onsite Section                             | N/A | 12.00 | N/A  | 0.55 | N/A  | 1.48 | N/A   | 0.81   |  |

**RIETZ CONSULTING INC.**

3203 E. WARM SPRINGS RD #400  
LAS VEGAS, NEVADA 89120  
PH: 702.521.3355

**DEVELOPED CONDITION DRAINAGE MAP**

UHS @ DECATUR & ELKHORN  
APN: 124-18-410-009  
NORTH LAS VEGAS, NEVADA

DATE: 07/20/2020  
DRAFTER: JIM  
CHECKED: JG  
SCALE: 1" = 60'

SHEET  
**FIG-6**  
SHEET 6 OF 7 SHEETS



TOPOGRAPHIC SYMBOLS AND LINETYPES

|  |                               |
|--|-------------------------------|
|  | 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 GAS                      |
|  | EXST WATER LINE               |
|  | EXST SEWER LINE               |
|  | EXST STORM DRAIN              |
|  | METER                         |
|  | FIRE HYDRANT                  |
|  | VALVE                         |
|  | BLOWOFF VALVE                 |
|  | AIR RELEASE VALVE             |
|  | BACKFLOW PREVENTER            |
|  | SWR MANHOLE                   |
|  | SEWER CLEANOUT                |
|  | STORM MANHOLE                 |
|  | TELEPHONE BOX                 |
|  | TELEPHONE MANHOLE             |
|  | FIBER BOX                     |
|  | CABLE TV BOX                  |
|  | ELECTRICAL MANHOLE            |
|  | STREET LIGHT BOX              |
|  | POWER POLE                    |
|  | SERVICE POLE                  |
|  | GUY WIRE                      |
|  | TRANSFORMER                   |
|  | STREET LIGHT CABINET          |
|  | STREET LIGHT                  |
|  | TRAFFIC SIGNAL                |
|  | TRAFFIC SIGNAL BOX            |
|  | AREA LIGHT                    |
|  | "L" TYPE CURB                 |
|  | "A" TYPE CURB                 |
|  | EDGE OF SIDEWALK              |
|  | CHAIN LINK FENCE              |
|  | WROUGHT IRON FENCE            |
|  | SWALE FLOW LINE               |
|  | SAWCUT                        |

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**BENCHMARK**

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ELEVATION: 899.858 METERS  
ELEVATION: 2295.461 U.S. SURVEY FEET  
NAVD 88

**BASIS OF BEARING**

S01°21'38"E 1355.11'  
PER BOOK 156, PAGE 94 OF PLATS

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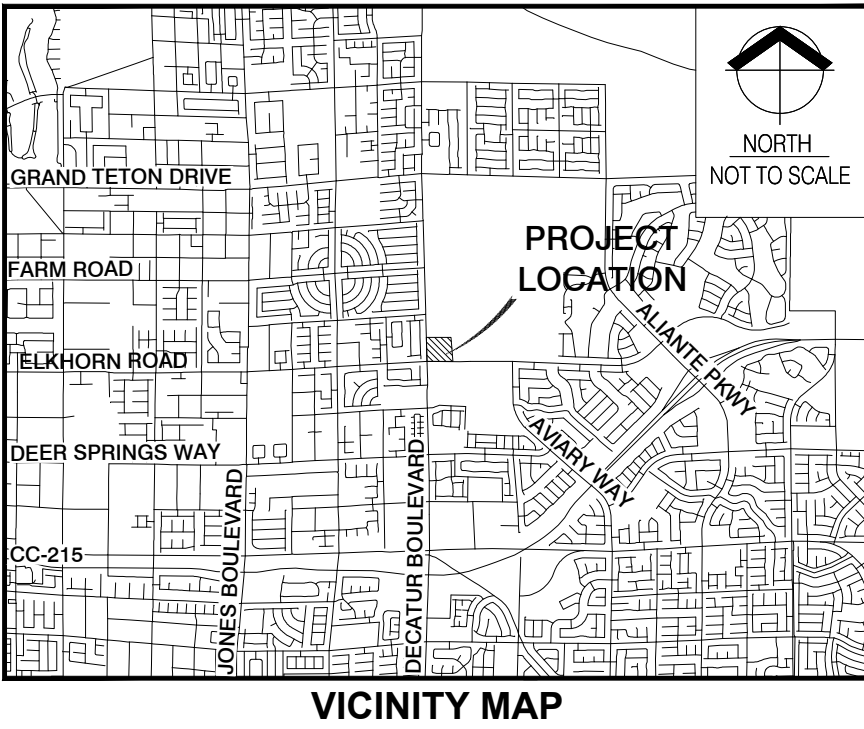
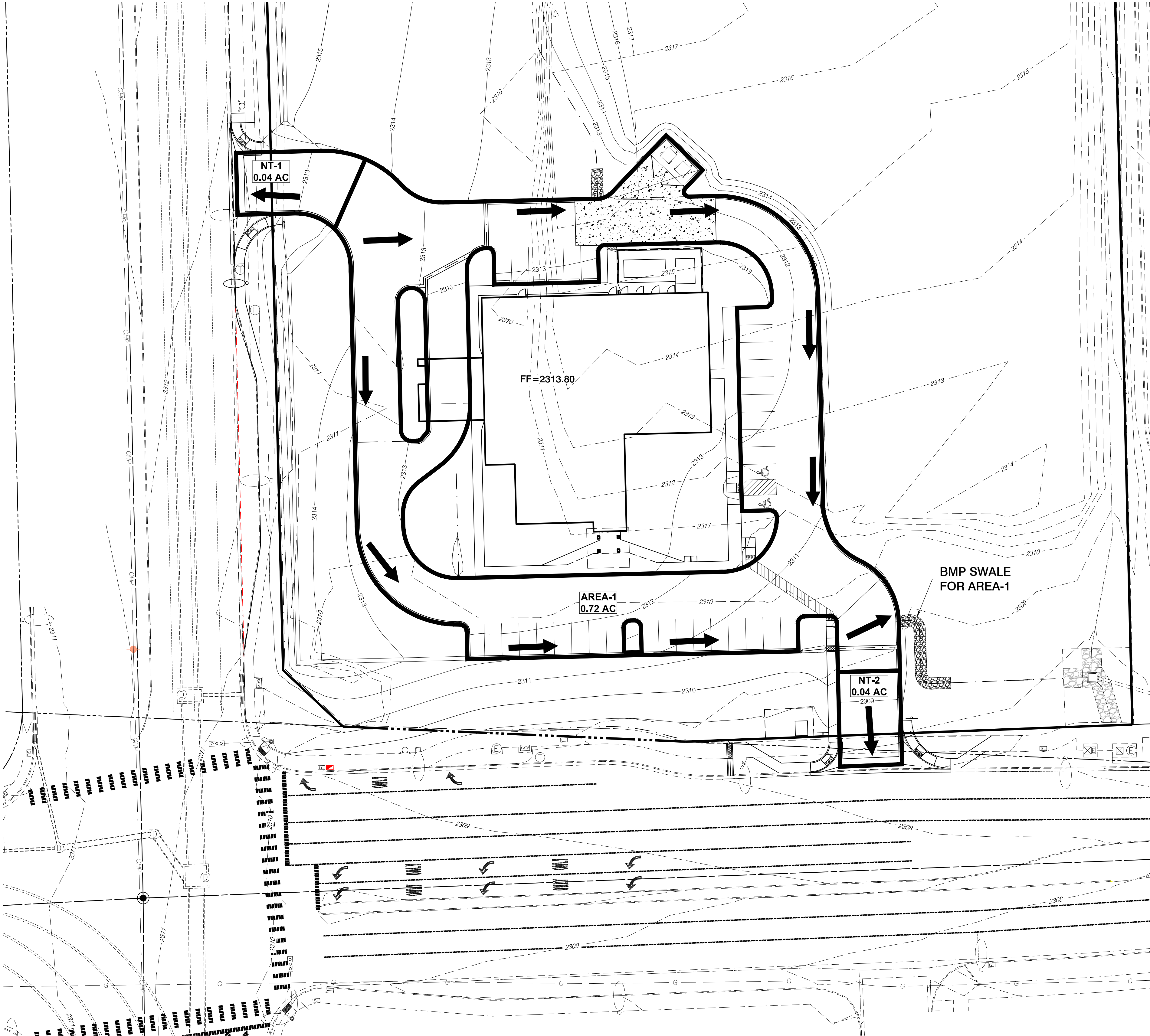
1-800-227-2600

**FAST**

Call before you UnderGround

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FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



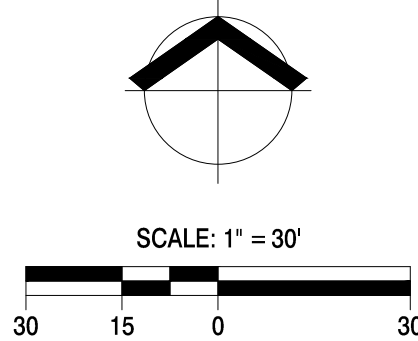
**LEGEND**

BASIN BOUNDARY LINE

SUB-BASIN LABEL

FLOW DIRECTION ARROW

**BASIN AREA**  
Q10  
Q100



| Pavement Area Designation | Area (AC) | Treated |
|---------------------------|-----------|---------|
| AREA-1                    | 0.72      | Y       |
| NT-1                      | 0.04      | N       |
| NT-2                      | 0.04      | N       |
| TOTAL AREA:               | 0.80      |         |
| TOTAL TREATED AREA:       | 0.72      | 90%     |

**RIETZ CONSULTING INC.**

3203 E. WARM SPRINGS RD #400  
LAS VEGAS, NEVADA 89120  
PH: 702.521.3355

**BMP MAP**

UHS @ DECATUR & ELKHORN  
APN: 124-18-410-009  
NORTH LAS VEGAS, NEVADA

|          |            |
|----------|------------|
| DATE:    | 07/20/2020 |
| DRAFTER: | JJM        |
| CHECKED: | JG         |
| SCALE:   | 1" = 30'   |

SHEET

**FIG-7**

SHEET 7 OF 7 SHEETS

P:\UHS Decatur and Elkhorn\DRAINAGE\DWG\10W\DRAINAGE MAP UHS ELKHORN AND DECATUR.dwg - 7/20/2020 8:19 PM

PRECIPITATION, CURVE  
NUMBERS &  
STANDARD FORM 4

## Rainfall and Precipitation Computations

Project Name: UHS @ DECATUR & ELKHORN

By: jg



3203 E. Warm Springs Road #400  
Las Vegas NV 89120 Ph. 702-521-3355

### DATA:

---

Project is located in: Township: 19S Range: 61E

Site is located WITHIN the McCarren Airport Rainfall Area

*Figure 513\**

10-YEAR DEPTH: 1.58 " TABLE 505

100-YEAR DEPTH: 2.77 " TABLE 505

Six Hour Depth Reduction Factors (DARF):

*Table 502\**

Area (gross acres): 10 = 0.016 square miles  
DARF = 1.00

### Calculations:

---

$P_{10} = \underline{1.58}$  10-Year Precipitation (in)

$P_{100} = \underline{2.77}$  100-Year Precipitation (in)

$P_{10}/P_{100} = \underline{0.57}$  HEC-1 Multiple Ratio Value

### Equations:

---

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

## Soil & Curve Number Computations

Project Name: UHS @ DECATUR & ELKHORN

Date: 7/20/2020

By: JG



3203 E. Warm Springs Road #400  
Las Vegas NV 89120 Ph. 702-521-3355

### DATA:

---

| SOIL UNIT | Commercial CN | DESERT SHRUB | IMPERVIOUS<br>/ROW CN |
|-----------|---------------|--------------|-----------------------|
| 305       | 96            | 86           | 98                    |

| Subbasin | AREA | LANDUSE      | Cn   |
|----------|------|--------------|------|
| E1       | 8.08 | DESERT SHRUB | 86.0 |
| DEC      | 1.74 | ROW          | 98.0 |
| ELK      | 0.95 | ROW          | 98.0 |
| D1       | 7.72 | COMMERCIAL   | 96.0 |
| D2       | 0.09 | COMMERCIAL   | 96.0 |
| D3       | 0.27 | COMMERCIAL   | 96.0 |



## TIME OF CONCENTRATION AND HEC-1 INPUT

Project Name: UHS @ DECTUR & ELKHORN

Date: 7/20/2020

By: JG



3203 E. Warm Springs Road #400  
Las Vegas NV 89120 Ph. 702-521-3355

| SUB-BASIN DATA |                      |           |         |                              | INITIAL/OVERLAND TIME (T <sub>i</sub> ) |            |                                | TRAVEL TIME (T <sub>t</sub> ) |            |                                        |                                        |                                | T <sub>c</sub>          | T <sub>c</sub> CHECK (URBANIZED BASINS) |                                  |                |             |
|----------------|----------------------|-----------|---------|------------------------------|-----------------------------------------|------------|--------------------------------|-------------------------------|------------|----------------------------------------|----------------------------------------|--------------------------------|-------------------------|-----------------------------------------|----------------------------------|----------------|-------------|
| KK             |                      |           |         |                              | BA                                      |            |                                |                               |            |                                        |                                        |                                |                         |                                         |                                  | UD             | LS          |
| Desig.         | DEV./EX.<br>(D or E) | K<br>[1]* | AREA ac | AREA MI <sup>2</sup><br>[2]* | INITIAL<br>LENGTH<br>FT                 | SLOPE<br>% | T <sub>i</sub><br>MIN.<br>[3]* | TRAVEL<br>LENGTH<br>FT        | SLOPE<br>% | V <sub>1</sub><br>VEL.<br>FT/S<br>[4]* | V <sub>2</sub><br>VEL.<br>FT/S<br>[5]* | T <sub>t</sub><br>MIN.<br>[6]* | T <sub>c</sub><br>Calc. | TOTAL<br>LENGTH<br>FT<br>[8]*           | T <sub>c</sub><br>Check<br>[13]* | TLAG3<br>[15]* | CN<br>[16]* |
| E1             | E                    | 0.745     | 8.08    | 0.01263                      | 250                                     | 1.0        | 10.10                          | 750                           | 0.6        | 1.15                                   | 2.28                                   | 9.10                           | 19.20                   | 1000                                    | N/A                              | 0.192          | 86.0        |
| DEC            | D                    | 0.904     | 1.74    | 0.00272                      | 50                                      | 2.0        | 1.98                           | 1000                          | 0.4        | 1.28                                   | 1.94                                   | 10.83                          | 12.81                   | 1050                                    | 15.83                            | 0.128          | 98.0        |
| ELK            | D                    | 0.904     | 0.95    | 0.00148                      | 50                                      | 2.0        | 1.98                           | 500                           | 0.5        | 1.43                                   | 2.16                                   | 5.83                           | 7.82                    | 550                                     | 13.06                            | 0.078          | 98.0        |
| D1             | D                    | 0.877     | 7.72    | 0.01206                      | 50                                      | 2.0        | 2.25                           | 750                           | 0.6        | 1.56                                   | 2.37                                   | 7.08                           | 9.33                    | 800                                     | 14.44                            | 0.093          | 96.0        |
| D2             | D                    | 0.877     | 0.09    | 0.00014                      | 25                                      | 2.0        | 1.59                           | 100                           | 0.4        | 1.28                                   | 1.94                                   | 1.30                           | 2.90                    | 125                                     | 10.69                            | 0.050          | 96.0        |
| D3             | D                    | 0.877     | 0.27    | 0.00042                      | 25                                      | 2.0        | 1.59                           | 100                           | 0.6        | 1.56                                   | 2.37                                   | 1.07                           | 2.66                    | 125                                     | 10.69                            | 0.050          | 96.0        |

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



# DEVELOPED CONDITION HEC-1 ANALYSIS

```

ID
ID      TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN
ID      NORTH LAS VEGAS, NEVADA
ID
ID      PREPARED BY:
ID      Rietz Consulting, Inc.
ID      3203 E. WARM SPRINGS #400
ID      LAS VEGAS, NV 89120
ID
ID      FILENAME:UHS-DE-D.TXT
ID
ID
ID      *DIAGRAM
IT      5      0      0      300
IO      5
IN      5
JR      PREC      0.57      1.00
*
KK      D1
KM      BASIN D1 DRAINS TO SOUTHEAST CORNER TO EX DROP INLET
BA.01206
PB      2.77
PC      .000      .020      .057      .070      .087      .108      .124      .130      .130      .130
PC      .130      .130      .130      .133      .140      .142      .148      .158      .172      .181
PC      .190      .197      .199      .200      .201      .204      .214      .229      .241      .249
PC      .251      .256      .270      .278      .281      .283      .295      .322      .352      .409
PC      .499      .590      .710      .744      .781      .812      .819      .835      .851      .856
PC      .860      .868      .876      .888      .910      .926      .937      .950      .970      .976
PC      .982      .985      .987      .989      .990      .993      .993      .994      .995      .998
PC      .998      .999      1.00
LS      0      96.0
UD      0.093
*
KK      DEC
KM      BASIN DEC FOR DECATUR ADJACENT TO SITE
BA.00272
LS      0      98.0
UD      0.128
*
KK      D2
KM      AREA THAT DRAINS TO DECATUR
BA.00014
LS      0      96.0
UD      0.050
*
KK      C1
KM      COMBINE DEC AND D2 IN DECATUR
HC      2
*
KK      ELK
KM      BASIN ELK FOR ELKHORN ADJACENT TO SITE
BA.00148
LS      0      98.0
UD      0.078
*
KK      D3
KM      AREA THAT DRAINS TO ELKHORN
BA.00042
LS      0      96.0
UD      0.050
*
KK      C2
KM      COMBINE C1, D3 AND ELK IN ELKHORN
HC      3
*
ZZ

```

```

1*****
*
*   FLOOD HYDROGRAPH PACKAGE   (HEC-1)
*           JUN   1998
*           VERSION 4.1
*
*   RUN DATE   20JUL20   TIME   09:33:02
*
*****

```

```

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

```

```

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

```

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

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

| LINE | ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10 |
|------|-----------------------------------------------------------------|
| 1    | ID                                                              |
| 2    | ID TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN          |
| 3    | ID NORTH LAS VEGAS, NEVADA                                      |
| 4    | ID                                                              |
| 5    | ID PREPARED BY:                                                 |
| 6    | ID Rietz Consulting, Inc.                                       |
| 7    | ID 3203 E. WARM SPRINGS #400                                    |
| 8    | ID LAS VEGAS, NV 89120                                          |
| 9    | ID                                                              |
| 10   | ID FILENAME:UHS-DE-D.TXT                                        |
| 11   | ID                                                              |
| 12   | ID                                                              |

```

13      *DIAGRAM
14      IT      5      0      0      300
15      IO      5
16      IN      5
16      JR      PREC      0.57      1.00
16      *

17      KK      D1
18      KM      BASIN D1 DRAINS TO SOUTHEAST CORNER TO EX DROP INLET
19      BA      .01206
20      PB      2.77
21      PC      .000      .020      .057      .070      .087      .108      .124      .130      .130      .130
22      PC      .130      .130      .130      .133      .140      .142      .148      .158      .172      .181
23      PC      .190      .197      .199      .200      .201      .204      .214      .229      .241      .249
24      PC      .251      .256      .270      .278      .281      .283      .295      .322      .352      .409
25      PC      .499      .590      .710      .744      .781      .812      .819      .835      .851      .856
26      PC      .860      .868      .876      .888      .910      .926      .937      .950      .970      .976
27      PC      .982      .985      .987      .989      .990      .993      .993      .994      .995      .998
28      PC      .998      .999      1.00
29      LS      0      96.0
30      UD      0.093
30      *

31      KK      DEC
32      KM      BASIN DEC FOR DECATUR ADJACENT TO SITE
33      BA      .00272
34      LS      0      98.0
35      UD      0.128
35      *

36      KK      D2
37      KM      AREA THAT DRAINS TO DECATUR
38      BA      .00014
39      LS      0      96.0
40      UD      0.050
40      *

41      KK      C1
42      KM      COMBINE DEC AND D2 IN DECATUR
43      HC      2
43      *

```

1

HEC-1 INPUT

PAGE 2

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

```

44      KK      ELK
45      KM      BASIN ELK FOR ELKHORN ADJACENT TO SITE
46      BA      .00148
47      LS      0      98.0

```

```

48      UD      0.078
      *
49      KK      D3
50      KM      AREA THAT DRAINS TO ELKHORN
51      BA      .00042
52      LS      0      96.0
53      UD      0.050
      *
54      KK      C2
55      KM      COMBINE C1, D3 AND ELK IN ELKHORN
56      HC      3
      *
57      ZZ

```

1

# SCHEMATIC DIAGRAM OF STREAM NETWORK

```

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

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

17      D1
      .
      .
31      .      DEC
      .      .
      .      .
36      .      .      D2
      .      .      .
      .      .      .
41      .      C1.....
      .      .
      .      .
44      .      .      ELK
      .      .      .
      .      .      .
49      .      .      .      D3
      .      .      .      .
      .      .      .      .
54      .      C2.....

```

(\*\*\*) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
*   FLOOD HYDROGRAPH PACKAGE (HEC-1)
*   JUN 1998
*   VERSION 4.1
*
*   RUN DATE 20JUL20 TIME 09:33:02

```

```

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

```



\*  
\*\*\*\*\*

\*  
\*\*\*\*\*

TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN  
NORTH LAS VEGAS, NEVADA

PREPARED BY:  
Rietz Consulting, Inc.  
3203 E. WARM SPRINGS #400  
LAS VEGAS, NV 89120

FILENAME:UHS-DE-D.TXT

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

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

          COMPUTATION INTERVAL    .08 HOURS  
          TOTAL TIME BASE    24.92 HOURS

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

JP        MULTI-PLAN OPTION  
          NPLAN            1   NUMBER OF PLANS

JR        MULTI-RATIO OPTION

RATIOS OF PRECIPITATION  
 .57 1.00

1

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

| OPERATION     | STATION | AREA | PLAN | RATIOS APPLIED TO PRECIPITATION |         |      |
|---------------|---------|------|------|---------------------------------|---------|------|
|               |         |      |      | RATIO 1                         | RATIO 2 |      |
|               |         |      |      | .57                             | 1.00    |      |
| HYDROGRAPH AT |         |      |      |                                 |         |      |
| +             | D1      | .01  | 1    | FLOW                            | 12.     | 24.  |
|               |         |      |      | TIME                            | 3.50    | 3.50 |
| HYDROGRAPH AT |         |      |      |                                 |         |      |
| +             | DEC     | .00  | 1    | FLOW                            | 3.      | 5.   |
|               |         |      |      | TIME                            | 3.58    | 3.58 |
| HYDROGRAPH AT |         |      |      |                                 |         |      |
| +             | D2      | .00  | 1    | FLOW                            | 0.      | 0.   |
|               |         |      |      | TIME                            | 3.50    | 3.50 |
| 2 COMBINED AT |         |      |      |                                 |         |      |
| +             | C1      | .00  | 1    | FLOW                            | 3.      | 5.   |
|               |         |      |      | TIME                            | 3.58    | 3.50 |
| HYDROGRAPH AT |         |      |      |                                 |         |      |
| +             | ELK     | .00  | 1    | FLOW                            | 2.      | 3.   |
|               |         |      |      | TIME                            | 3.50    | 3.50 |
| HYDROGRAPH AT |         |      |      |                                 |         |      |
| +             | D3      | .00  | 1    | FLOW                            | 1.      | 1.   |
|               |         |      |      | TIME                            | 3.50    | 3.50 |
| 3 COMBINED AT |         |      |      |                                 |         |      |
| +             | C2      | .00  | 1    | FLOW                            | 5.      | 9.   |
|               |         |      |      | TIME                            | 3.50    | 3.50 |

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

# REVISED SECTIONS AND. DRY LANE CALCULATION

## Worksheet for SECTION A 10-YR

### 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      | 2313.35        |
| 0+06.45      | 2313.35        |
| 0+06.95      | 2313.35        |
| 0+06.95      | 2312.78        |
| 0+53.06      | 2312.08        |
| 0+53.06      | 2312.04        |
| 0+54.56      | 2311.92        |
| 0+54.56      | 2312.42        |
| 0+55.06      | 2312.42        |
| 0+67.06      | 2312.66        |

$$S = \frac{(2312.08 - 2312.78) \times 100}{(53.06 - 6.95)}$$

$$S = -1.52\%$$

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2313.35) | (0+67.06, 2312.66) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.49    ft  
Elevation Range                                              2311.92 to 2313.35 ft  
Flow Area                                                      4.29    ft²

---

## Worksheet for SECTION A 10-YR

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 23.93       | ft    |
| Hydraulic Radius | 0.18        | ft    |
| Top Width        | 23.39       | ft    |
| Normal Depth     | 0.49        | ft    |
| Critical Depth   | 0.46        | ft    |
| Critical Slope   | 0.00701     | ft/ft |
| Velocity         | 1.87        | ft/s  |
| Velocity Head    | 0.05        | ft    |
| Specific Energy  | 0.55        | ft    |
| Froude Number    | 0.77        |       |
| 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        | 0.49     | ft    |
| Critical Depth      | 0.46     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00701  | ft/ft |

## Cross Section for SECTION A 10-YR

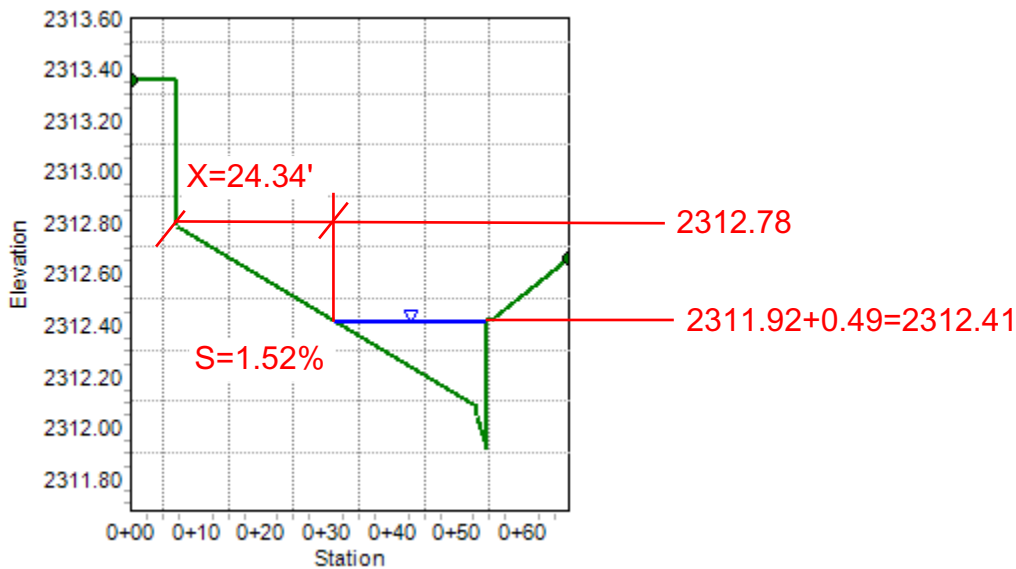
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.00400    ft/ft  
Normal Depth                              0.49       ft  
Discharge                                  8.00       ft<sup>3</sup>/s

### Cross Section Image



$$X = \frac{(2312.78 - 2312.41) \times 100}{1.52\%} = 24.34'$$



## Worksheet for SECTION A 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                220.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2313.35        |
| 0+06.45      | 2313.35        |
| 0+06.95      | 2313.35        |
| 0+06.95      | 2312.78        |
| 0+53.06      | 2312.08        |
| 0+53.06      | 2312.04        |
| 0+54.56      | 2311.92        |
| 0+54.56      | 2312.42        |
| 0+55.06      | 2312.42        |
| 0+67.06      | 2312.66        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2313.35) | (0+67.06, 2312.66) | 0.016                 |

### Options

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

### Results

Normal Depth                                              1.28    ft  
Elevation Range                                              2311.92 to 2313.35 ft  
Flow Area                                                      45.71    ft<sup>2</sup>

---

## Worksheet for SECTION A 100-YR

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 61.62       | ft    |
| Hydraulic Radius | 0.74        | ft    |
| Top Width        | 60.11       | ft    |
| Normal Depth     | 1.28        | ft    |
| Critical Depth   | 1.27        | ft    |
| Critical Slope   | 0.00425     | ft/ft |
| Velocity         | 4.81        | ft/s  |
| Velocity Head    | 0.36        | ft    |
| Specific Energy  | 1.64        | ft    |
| Froude Number    | 0.97        |       |
| 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        | 1.28     | ft    |
| Critical Depth      | 1.27     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00425  | ft/ft |

## Cross Section for SECTION A 100-YR

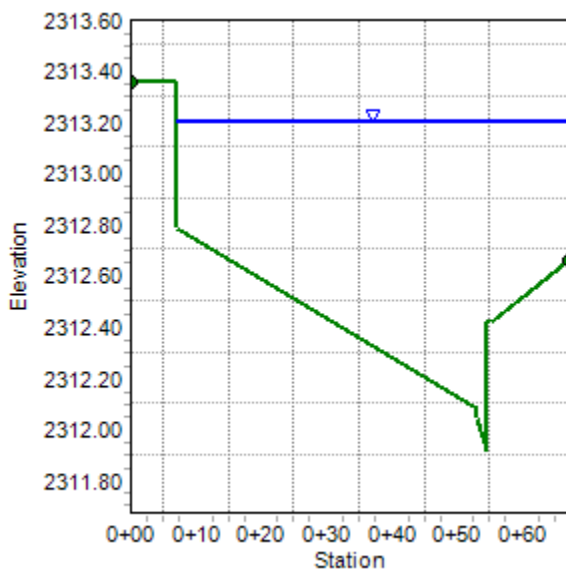
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 1.28    | ft                 |
| Discharge     | 220.00  | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION B 10-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00500    ft/ft  
Discharge                                                      10.00    ft³/s  
Section Definitions

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

|         |         |
|---------|---------|
| 0+00.00 | 2309.89 |
| 0+00.58 | 2309.89 |
| 0+00.58 | 2309.42 |
| 0+56.49 | 2308.22 |
| 0+56.49 | 2308.18 |
| 0+57.97 | 2308.06 |
| 0+57.97 | 2308.56 |
| 0+58.47 | 2308.56 |
| 0+74.97 | 2308.88 |

$$S = \frac{(2308.22 - 2309.42) \times 100}{(56.49 - 00.58)}$$

$$S = -2.15\%$$

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2309.89) | (0+74.97, 2308.88) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.56    ft  
Elevation Range                                              2308.06 to 2309.89 ft  
Flow Area                                                      4.62    ft²  
Wetted Perimeter                                              24.37    ft

---

## Worksheet for SECTION B 10-YR

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.19        | ft    |
| Top Width        | 23.82       | ft    |
| Normal Depth     | 0.56        | ft    |
| Critical Depth   | 0.54        | ft    |
| Critical Slope   | 0.00672     | ft/ft |
| Velocity         | 2.17        | ft/s  |
| Velocity Head    | 0.07        | ft    |
| Specific Energy  | 0.63        | ft    |
| Froude Number    | 0.87        |       |
| 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        | 0.56     | ft    |
| Critical Depth      | 0.54     | ft    |
| Channel Slope       | 0.00500  | ft/ft |
| Critical Slope      | 0.00672  | ft/ft |

## Cross Section for SECTION B 10-YR

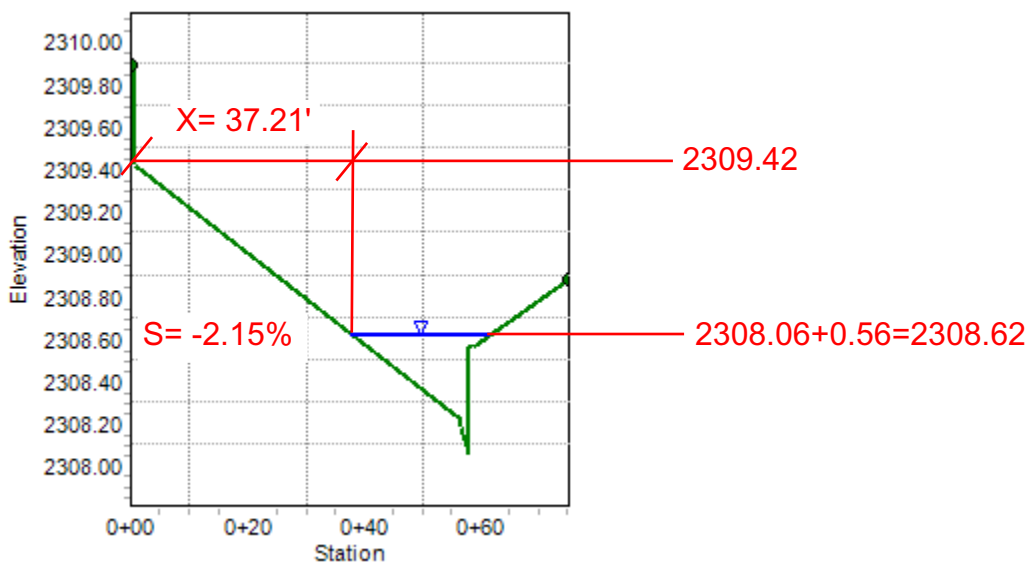
### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                              0.00500    ft/ft  
Normal Depth                              0.56       ft  
Discharge                                  10.00      ft³/s

### Cross Section Image



$$X = \frac{(2309.42 - 2308.62) \times 100}{2.15\%} = 37.21'$$



## Worksheet for SECTION B 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00500    ft/ft  
Discharge                                                 234.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2309.89        |
| 0+00.58      | 2309.89        |
| 0+00.58      | 2309.42        |
| 0+56.49      | 2308.22        |
| 0+56.49      | 2308.18        |
| 0+57.97      | 2308.06        |
| 0+57.97      | 2308.56        |
| 0+58.47      | 2308.56        |
| 0+74.97      | 2308.88        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2309.89) | (0+74.97, 2308.88) | 0.016                 |

### Options

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

### Results

Normal Depth                                              1.37    ft  
Elevation Range                                         2308.06 to 2309.89 ft  
Flow Area                                                 48.11    ft<sup>2</sup>  
Wetted Perimeter                                         75.51    ft

---

## Worksheet for SECTION B 100-YR

---

### Results

|                  |               |       |
|------------------|---------------|-------|
| Hydraulic Radius | 0.64          | ft    |
| Top Width        | 74.39         | ft    |
| Normal Depth     | 1.37          | ft    |
| Critical Depth   | 1.40          | ft    |
| Critical Slope   | 0.00434       | ft/ft |
| Velocity         | 4.86          | ft/s  |
| Velocity Head    | 0.37          | ft    |
| Specific Energy  | 1.74          | ft    |
| Froude Number    | 1.07          |       |
| 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        | 1.37     | ft    |
| Critical Depth      | 1.40     | ft    |
| Channel Slope       | 0.00500  | ft/ft |
| Critical Slope      | 0.00434  | ft/ft |

## Cross Section for SECTION B 100-YR

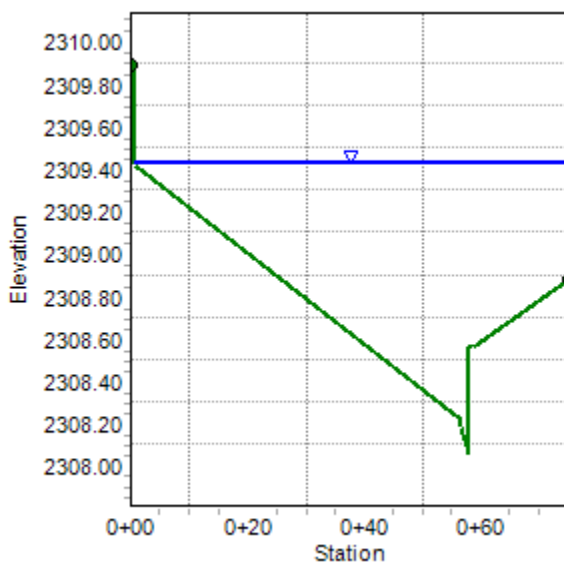
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00500 | ft/ft              |
| Normal Depth  | 1.37    | ft                 |
| Discharge     | 234.00  | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION C 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                12.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2312.92        |
| 0+22.50      | 2312.15        |
| 0+22.50      | 2312.11        |
| 0+24.00      | 2311.99        |
| 0+24.00      | 2312.49        |
| 0+24.50      | 2312.49        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2312.92) | (0+24.50, 2312.49) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.67    ft  
Elevation Range                                              2311.99 to 2312.92 ft  
Flow Area                                                      4.85    ft<sup>2</sup>  
Wetted Perimeter                                              17.71    ft  
Hydraulic Radius                                              0.27    ft  
Top Width                                                      16.98    ft  
Normal Depth                                              0.67    ft

---

## Worksheet for SECTION C 100-YR

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Critical Depth  | 0.63        | ft    |
| Critical Slope  | 0.00616     | ft/ft |
| Velocity        | 2.48        | ft/s  |
| Velocity Head   | 0.10        | ft    |
| Specific Energy | 0.77        | ft    |
| Froude Number   | 0.82        |       |
| 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        | 0.67     | ft    |
| Critical Depth      | 0.63     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00616  | ft/ft |

## Cross Section for SECTION C 100-YR

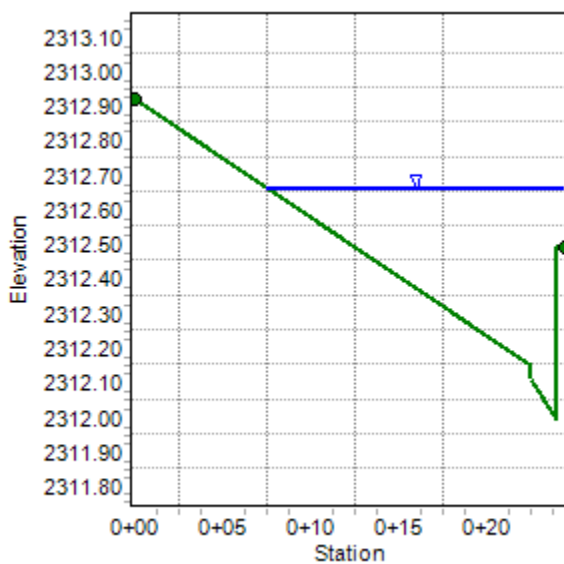
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 0.67    | ft                 |
| Discharge     | 12.00   | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION D 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                12.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2312.94        |
| 0+00.50      | 2312.94        |
| 0+00.50      | 2312.44        |
| 0+23.00      | 2311.58        |
| 0+23.00      | 2311.54        |
| 0+24.50      | 2311.41        |
| 0+24.50      | 2311.91        |
| 0+25.00      | 2311.91        |
| 0+28.00      | 2312.91        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2312.94) | (0+25.00, 2311.91) | 0.016                 |
| (0+25.00, 2311.91) | (0+28.00, 2312.91) | 0.030                 |

### Options

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

### Results

Normal Depth                                              0.71    ft  
Elevation Range                                              2311.41 to 2312.94 ft  
Flow Area                                                      4.94    ft<sup>2</sup>



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## Worksheet for SECTION D 100-YR

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### Results

|                  |             |       |
|------------------|-------------|-------|
| Wetted Perimeter | 17.32       | ft    |
| Hydraulic Radius | 0.29        | ft    |
| Top Width        | 16.73       | ft    |
| Normal Depth     | 0.71        | ft    |
| Critical Depth   | 0.66        | ft    |
| Critical Slope   | 0.00666     | ft/ft |
| Velocity         | 2.43        | ft/s  |
| Velocity Head    | 0.09        | ft    |
| Specific Energy  | 0.80        | ft    |
| Froude Number    | 0.79        |       |
| 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        | 0.71     | ft    |
| Critical Depth      | 0.66     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00666  | ft/ft |

## Cross Section for SECTION D 100-YR

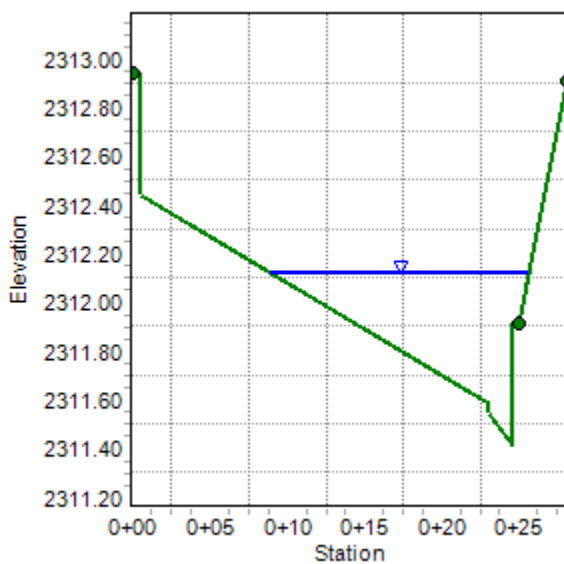
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 0.71    | ft                 |
| Discharge     | 12.00   | ft <sup>3</sup> /s |

### Cross Section Image



## Project Description

## Input Data

Station (ft)

Elevation (ft)

## Roughness Segment Definitions

Start Station

Ending Station

### Roughness Coefficient

(0+00.00, 2314.50)

 $(1+26.49, 2316.54)$ 

0.030

## Options

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

## Results

|                  |                       |       |
|------------------|-----------------------|-------|
| Normal Depth     | 0.55                  | ft    |
| Elevation Range  | 2312.58 to 2316.54 ft |       |
| Flow Area        | 8.12                  | ft²   |
| Wetted Perimeter | 29.67                 | ft    |
| Hydraulic Radius | 0.27                  | ft    |
| Top Width        | 29.64                 | ft    |
| Normal Depth     | 0.55                  | ft    |
| Critical Depth   | 0.41                  | ft    |
| Critical Slope   | 0.02219               | ft/ft |
| Velocity         | 1.48                  | ft/s  |

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## Worksheet for SECTION E 100-YR

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### Results

|                 |             |    |
|-----------------|-------------|----|
| Velocity Head   | 0.03        | ft |
| Specific Energy | 0.58        | ft |
| Froude Number   | 0.50        |    |
| 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        | 0.55     | ft    |
| Critical Depth      | 0.41     | ft    |
| Channel Slope       | 0.00500  | ft/ft |
| Critical Slope      | 0.02219  | ft/ft |

## Cross Section for SECTION E 100-YR

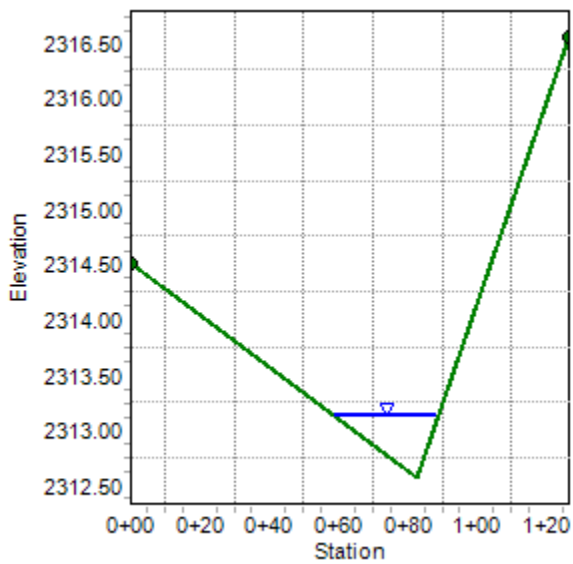
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00500 | ft/ft              |
| Normal Depth  | 0.55    | ft                 |
| Discharge     | 12.00   | ft <sup>3</sup> /s |

### Cross Section Image



# REVISED GRADING PLANS AND DETAILS



|                |                               |
|----------------|-------------------------------|
| =====          | PROPERTY BOUNDARY             |
| -----          | RIGHT-OF-WAY                  |
| -----          | PROPERTY LINE                 |
| -----          | CENTER LINE                   |
| -----          | EASEMENT                      |
| -----          | EXST "L" TYPE CURB            |
| -----          | EXST "A" TYPE CURB            |
| -----1900----- | EXST MAJOR CONTOUR LINE       |
| -----1901----- | EXST MINOR CONTOUR LINE       |
| =====          | EXST SCREEN WALL AS INDICATED |
| -----          | EXST EDGE OF PAVEMENT         |
| -----          | EXST EDGE OF SIDEWALK         |
| -----UGP-----  | EXST UNDERGROUND POWER        |
| -----FO-----   | EXST FIBER OPTICS             |
| -----G-----    | EXST GAS                      |
| -----W-----    | EXST WATER LINE               |
| -----SS-----   | EXST SEWER LINE               |
| -----SD-----   | EXST STORM DRAIN              |

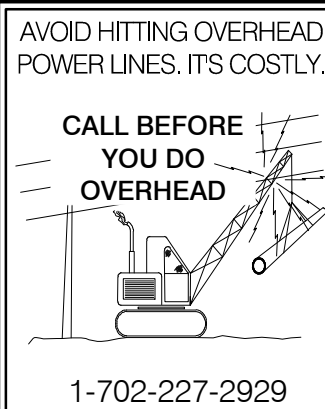
|                                                                                   |                      |
|-----------------------------------------------------------------------------------|----------------------|
|  | STORM MANHOLE        |
|  | TELEPHONE BOX        |
|  | TELEPHONE MANHOLE    |
|  | FIBER BOX            |
|  | CABLE TV BOX         |
|  | ELECTRICAL MANHOLE   |
|  | STREET LIGHT BOX     |
|  | POWER POLE           |
|  | SERVICE POLE         |
|  | GUY WIRE             |
|  | 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               |

| 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      |
|                       |                  | $\frac{00.00}{TB}$  | TOP OF BERM      |

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 32003C1765F E. CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

SOUTH 87°29'39" EAST, BEING THE SOUTH LINE OF GOVERNMENT LOT 19 OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M., CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN BY MAP ON FILE IN THE CLARK COUNTY RECORDER'S OFFICE, IN FILE 104, PAGE 61 OF PARCEL MAPS.

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

**Call**  
**811**

OR  
**1-800-227-2600**

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.

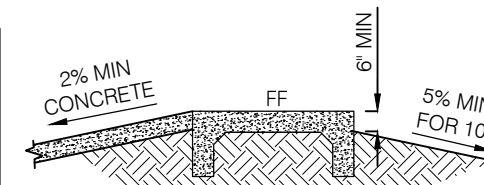
CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLOV9119N4

RIVET AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

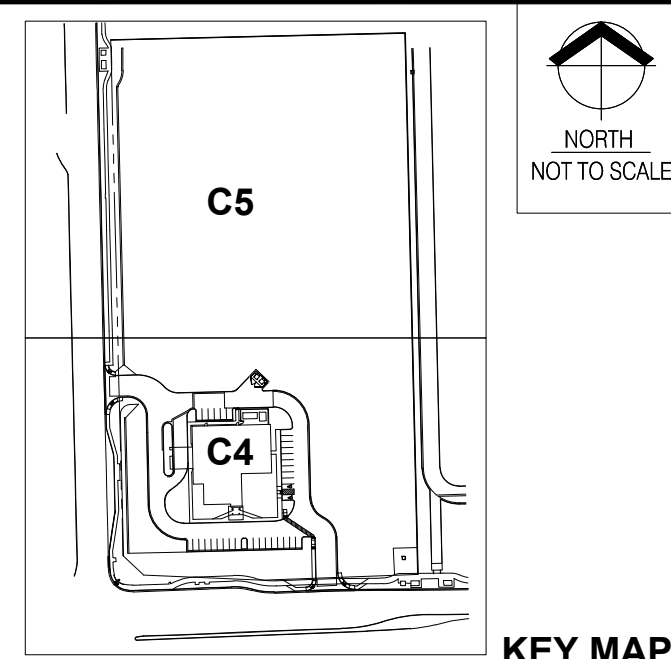
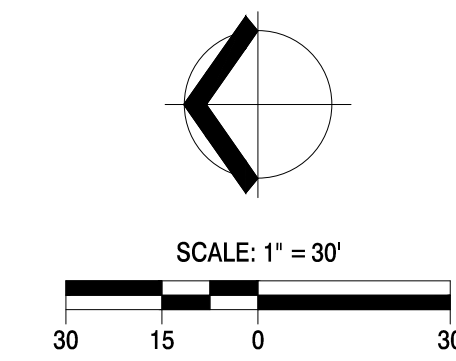
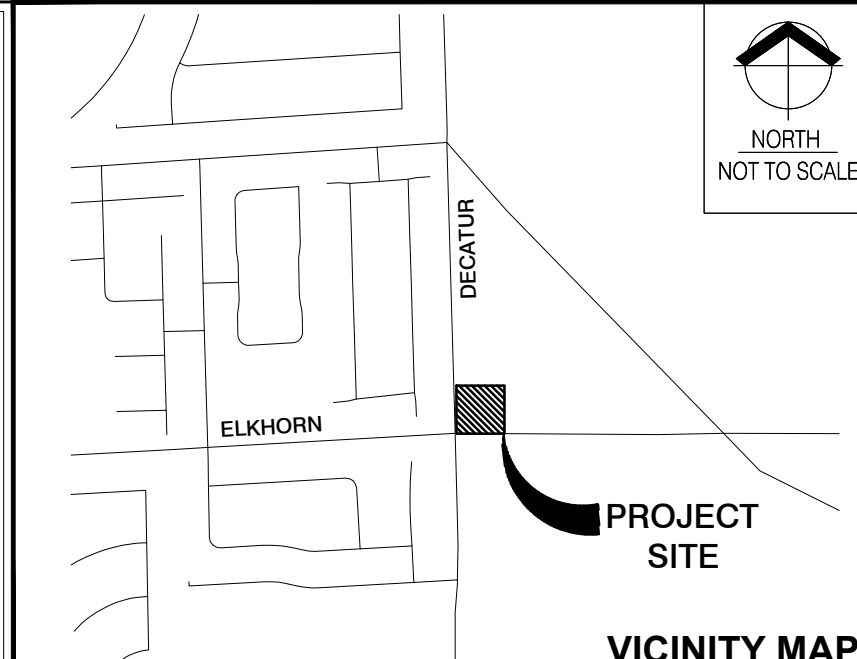
ELEVATION: 699.658 METERS  
ELEVATION: 2265.461 U.S. SURVEY FEET  
NAVD 88

(REQUIRED FOR ALL SITES GREATER THAN 1 ACRE (43,560 SQ.FT.))

1. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATE IN, THE PUBLIC RIGHTS OF WAYS OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNFORESEEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN TITLE 24.40 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION NVW10000, SECTION II.A.5.
4. AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VEHICLE ENTRANCE AND EXIT LOCATIONS AND ALL BMPs WEEKLY, AND WITHIN 24 HOURS AFTER ANY ACTUAL RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION NVW10000, SECTION II.A.12.
5. ACCUMULATED SEDIMENT IN BMPs SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.



## BUILDING SLAB SECTION



|                |          |                                         |        |
|----------------|----------|-----------------------------------------|--------|
| APN No.        | ACREAGE: | AREA OF DISTURBANCE                     | ZONING |
| 124-15-410-009 | 8.08     | 1.94 ACRES ONSITE<br>.07 ACRES OFF SITE | MPC    |

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

ADD 2300.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

CUT= 3,113 CY  
FILL= 8,900 CY  

---

NET= 5,787 CY FILL

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY CNLV #177-2020 FOR THIS SITE ON FILE AT CITY OF NORTH LAS VEGAS FOR THIS PROJECT.

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

DATE \_\_\_\_\_



# MASTER GRADING PLAN

UHS AT ELKHORN AND DECATUR  
CITY OF NORTH LAS VEGAS, NEVADA  
APN: 124-18-410-009

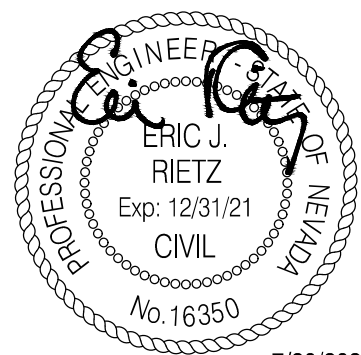
APN: 124-18-410-009

7/20/2020

JM

813

**1" = 30'**



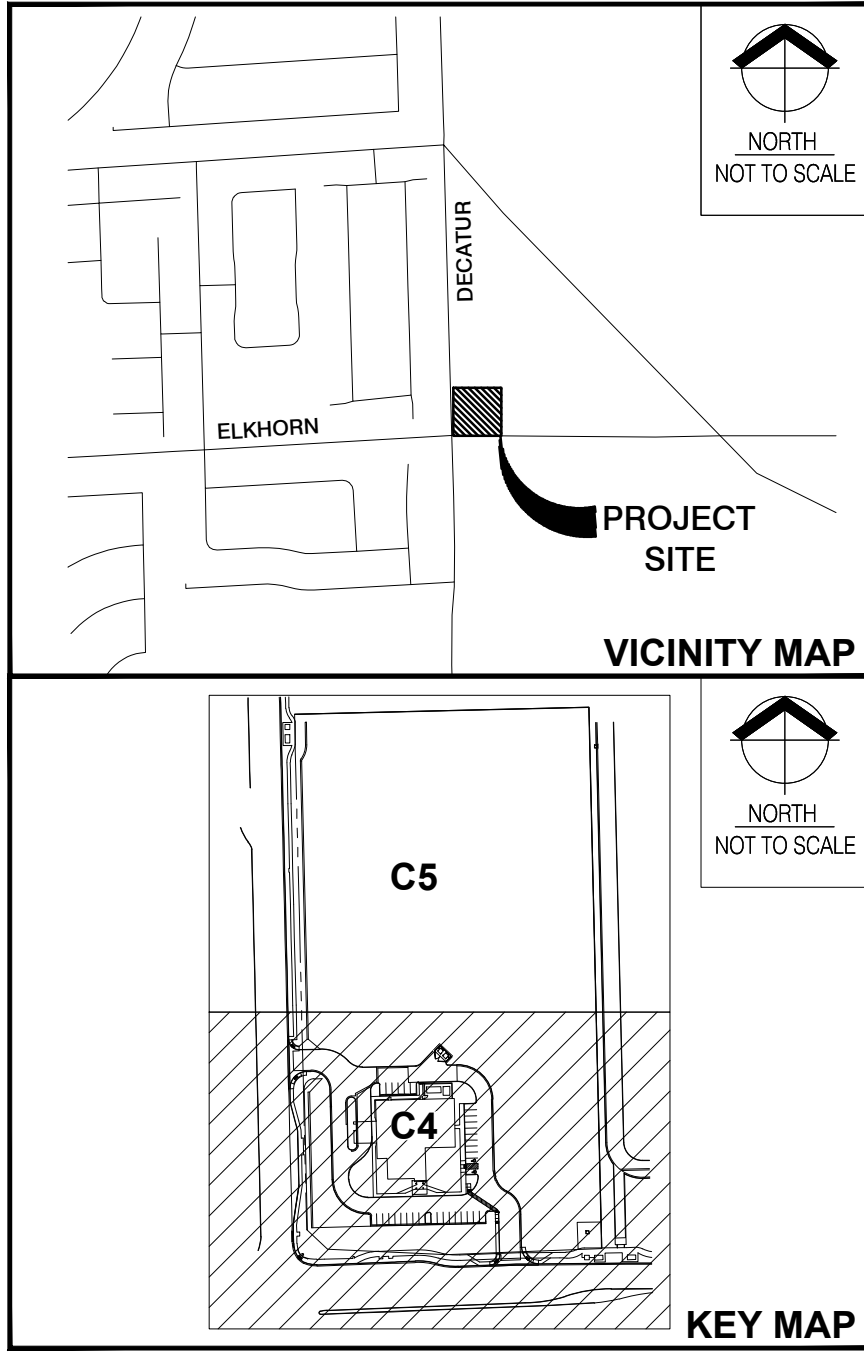
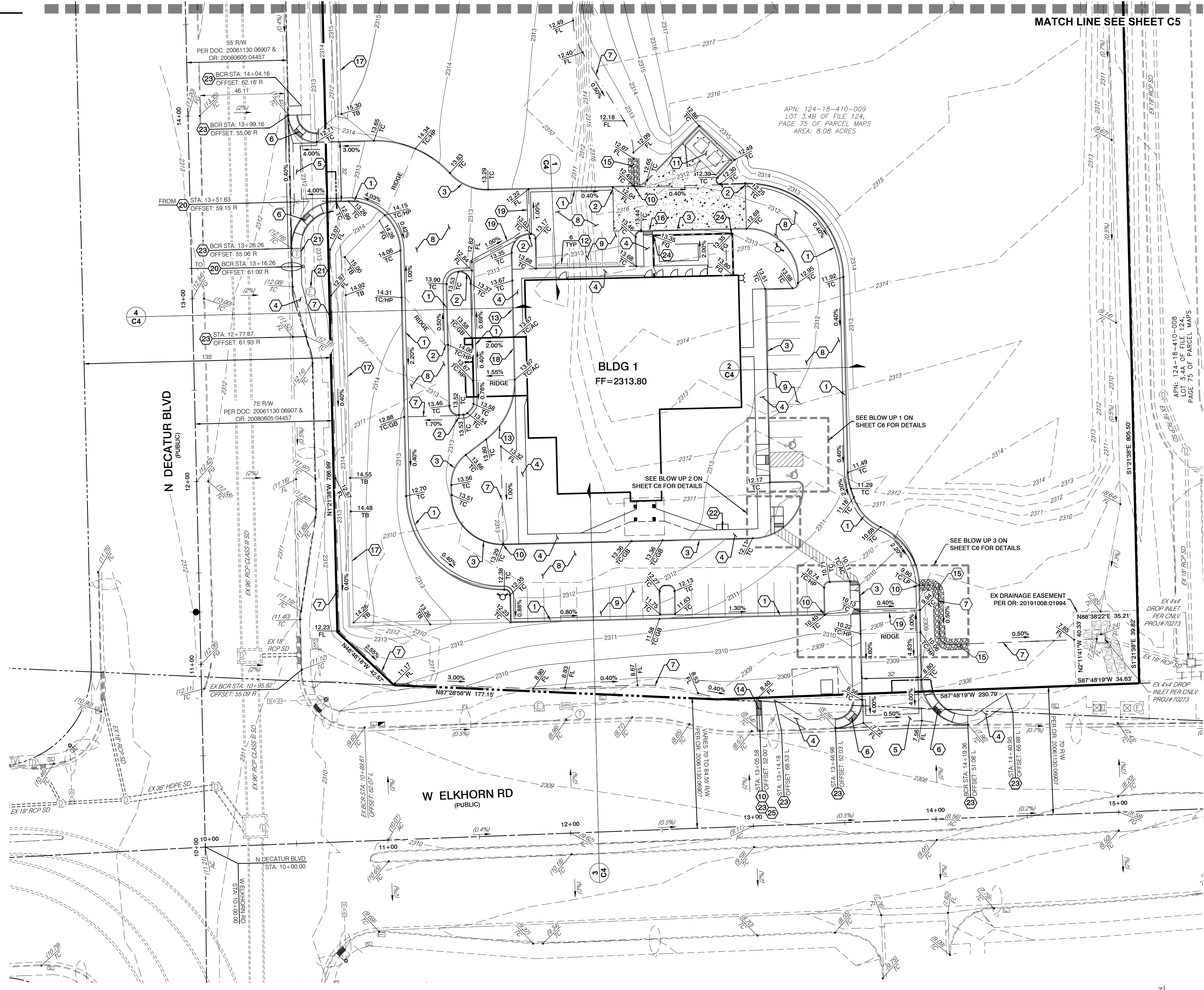
SHEET

**C3**  
SHEET **3** OF **6** SHEETS



# TOPOGRAPHIC SYMBOLS AND LINETYPES

|  |                                |
|--|--------------------------------|
|  | PROPERTY BOUNDARY              |
|  | RIGHT-OF-WAY                   |
|  | PROPERTY LINE                  |
|  | CENTER LINE                    |
|  | EASEMENT                       |
|  | EXIST "L" TYPE CURB            |
|  | EXIST "A" TYPE CURB            |
|  | EXIST MAJOR CONTOUR LINE       |
|  | EXIST MINOR CONTOUR LINE       |
|  | EXIST SCREEN WALL AS INDICATED |
|  | EXIST EDGE OF PAVEMENT         |
|  | EXIST EDGE OF SIDEWALK         |
|  | EXIST UNDERGROUND POWER        |
|  | EXIST FIBER OPTICS             |
|  | EXIST GAS                      |
|  | EXIST WATER LINE               |
|  | EXIST SEWER LINE               |
|  | EXIST STORM DRAIN              |
|  | METER                          |
|  | FIRE HYDRANT                   |
|  | VALVE                          |
|  | BLOWOFF VALVE                  |
|  | AIR RELEASE VALVE              |
|  | BACKFLOW PREVENTER             |
|  | STORM MANHOLE                  |
|  | TELEPHONE BOX                  |
|  | TELEPHONE MANHOLE              |
|  | FIBER BOX                      |
|  | CABLE TV BOX                   |
|  | ELECTRICAL MANHOLE             |
|  | STREET LIGHT BOX               |
|  | POWER POLE                     |
|  | SERVICE POLE                   |
|  | GUY WIRE                       |
|  | 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                         |



| EXISTING | PROPOSED |
|----------|----------|
|          |          |
|          |          |
|          |          |
|          |          |
|          |          |
|          |          |
|          |          |
|          |          |
|          |          |
|          |          |

- GRADING**
- CONSTRUCT "L" CURB AND GUTTER PER CCAUSD #216
  - TURN OUT "L" CURB TO ENSURE POSITIVE DRAINAGE PER DETAIL "C", SHEET C6
  - CONSTRUCT "A" CURB PER CCAUSD #219
  - CONSTRUCT SIDEWALK PER CCAUSD #234
  - CONSTRUCT 32" WIDE COMMERCIAL DRIVEWAY PER CCAUSD #225 & 228
  - CONSTRUCT CASE I SIDEWALK RAMPS USING ARMOR TILE TRUNCATED DOMES OR EQUIV. PER CCAUSD #235 (A & B = 6" UNLESS NOTED)
  - CONSTRUCT FLOW LINE AS SHOWN
  - MAIN CORRIDOR (TRUCK ACCESS) INSTALL 3.5" AC OVER 10.5" TYPE II AGGREGATE BASE
  - AUTOMOBILE ROUTE / PARKING. INSTALL 2.5" AC OVER 10" TYPE II AGGREGATE BASE
  - INSTALL 2" CURB CUT PER DETAIL "D", SHEET C6
  - INSTALL TRASH ENCLOSURE (SEE ARCHITECTURAL PLANS FOR DETAILS)
  - INSTALL BUMPER BLOCK PER CCAUSD #238
  - INSTALL CURB TRANSITION PER DETAIL "F", SHEET C6 (LENGTH PER PLAN)
  - INSTALL 2" SIDEWALK UNDER DRAIN PER CCAUSD #236
  - CONSTRUCT BMP SWALE PER DETAIL "B" SHEET C6
  - INSTALL TRUNCATED DOMES PER CCAUSD #235
  - CONSTRUCT EARTHEN BERM, 2' TOP WIDTH, COMPACTED TO 95%
  - INSTALL "O" FACE CURB PER DETAIL "E", SHEET C6
  - INSTALL 2" VALLEY GUTTER PER DETAIL "A", SHEET C6
  - EXISTING STREET LIGHT TO BE RELOCATED
  - ADJUST EXISTING UTILITIES TO GRADE
  - INSTALL BICYCLE RACKS (SEE ARCHITECTURAL PLANS FOR DETAILS)
  - SAWCUT CLEAN AND REMOVE EXISTING CURB, GUTTER AND SIDEWALK, IN THE EVENT THE A.C. PAVEMENT IS DAMAGED, DEGRADED OR REMOVED IN ANY WAY DURING REMOVAL, THE PAVEMENT SHALL BE REMOVED AND REPLACED BY MECHANICAL MEANS AS REQUIRED BY CNLV CONSTRUCTION SERVICES INSPECTOR
  - PROVIDE WALL OPENING FOR DRAINAGE (SEE ARCHITECTURAL/STRUCTURAL PLANS FOR DETAILS)
  - INSTALL 2" CONCRETE FLUME PER DETAIL "G", SHEET C6

| SITE DATA      |         |                                          |        |
|----------------|---------|------------------------------------------|--------|
| APN No.        | ACREAGE | AREA OF DISTURBANCE                      | ZONING |
| 124-15-410-009 | 8.08    | 1.94 ACRES ON-SITE<br>0.7 ACRES OFF-SITE | MPC    |

**DATUM**

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

ADD 2300.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

| EARTHWORKS |               |
|------------|---------------|
| CUT =      | 3,113 CY      |
| FILL =     | 8,900 CY      |
| NET =      | 5,787 CY FILL |

**DRAINAGE CERTIFICATION**

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY ONLY #177-2020 FOR THIS SITE ON FILE AT CITY OF NORTH LAS VEGAS FOR THIS PROJECT.

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

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

Call  
**811**  
OR  
1-800-227-2600

AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.

CALL BEFORE YOU DO OVERHEAD

1-702-227-2929

**FAST**

Call before you UnderGround

1-702-432-5300  
FREWAY AND ARTERIAL SYSTEM OF TRANSPORTATION

**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 32003C1760F E. CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

**BASIS OF BEARING**

SOUTH 87°29'30" EAST, BEING THE SOUTH LINE OF GOVERNMENT LOT 19 OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M., CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN BY MAP ON FILE IN THE CLARK COUNTY RECORDERS OFFICE, IN FILE 104, PAGE 81 OF PARCEL MAPS.

**DISCLAIMER NOTE:**

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- 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 OBLISCURED DURING CONSTRUCTION.

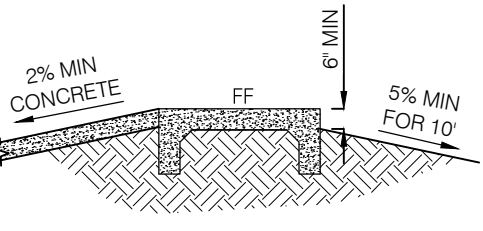
**BENCHMARK**

CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLOV9119N4

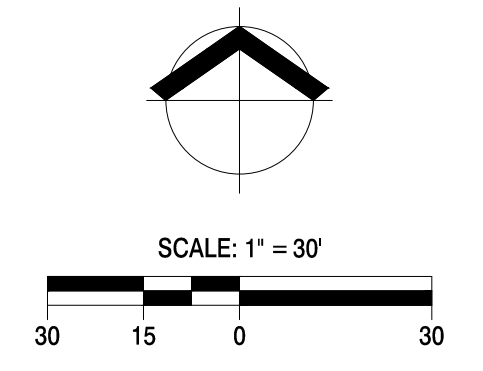
RIETZ AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLOV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

ELEVATION: 699.658 METERS  
ELEVATION: 2285.461 U.S. SURVEY FEET  
NAVD 88

- STORMWATER RUNOFF MANAGEMENT**
- (REQUIRED FOR ALL SITES GREATER THAN 1 ACRE (43,560 SQ.FT.))
- THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATE IN, THE PUBLIC RIGHTS OF WAYS OF CLARK COUNTY AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ENTERING THE STORM SEWER SYSTEM.
  - 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 24.40 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES MANUAL.
  - TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.5.
  - AT A MINIMUM, THE CONTRACTOR OR HIS AGENT SHALL INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, VIDEO ENTRANCE AND EXIT LOCATIONS AND ALL BMPs WEEKLY, AND WITHIN 24 HOURS AFTER ANY ACTUAL RAIN EVENT OF 0.5 INCHES OR MORE. THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS TO WEEKLY INSPECTIONS MAY APPLY, SUCH AS SUSPENSION OF LAND DISTURBANCE ACTIVITIES. REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.
  - ACCUMULATED SEDIMENT IN BMPs SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.



BUILDING SLAB SECTION



**RIETZ CONSULTING INC.**

3203 E. WARM SPRINGS RD #400  
LAS VEGAS, NEVADA 89120  
PH: 702.521.3355

## GRADING PLAN 1

UHS AT ELKHORN AND DECATUR  
CITY OF NORTH LAS VEGAS, NEVADA  
APN: 124-18-410-009

DATE: 7/20/2020  
DRAFTER: JRM  
CHECKED: EJR  
SCALE: 1" = 30'

PROFESSIONAL SEAL  
ERIC J. RIETZ  
Exp: 12/31/21  
CIVIL  
No. 16350  
7/20/2020

SHEET  
**C4**  
4 OF 6 SHEETS



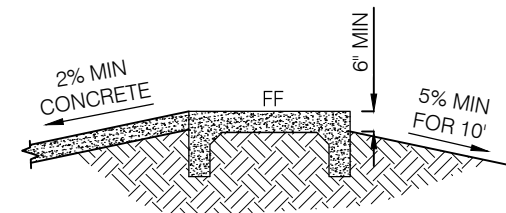
|  |                               |
|--|-------------------------------|
|  | PROPERTY BOUNDARY             |
|  | RIGHT-OF-WAY                  |
|  | PROPERTY LINE                 |
|  | CENTER LINE                   |
|  | EASEMENT                      |
|  | EXST "L" TYPE CURB            |
|  | 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 GAS                      |
|  | EXST WATER LINE               |
|  | EXST SEWER LINE               |
|  | EXST STORM DRAIN              |

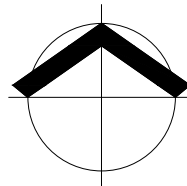
| EXISTING | PROPOSED |                    |
|----------|----------|--------------------|
|          |          | METER              |
|          |          | FIRE HYDRANT       |
|          |          | VALVE              |
|          |          | BLOWOFF VALVE      |
|          |          | AIR RELEASE VALVE  |
|          |          | BACKFLOW PREVENTER |

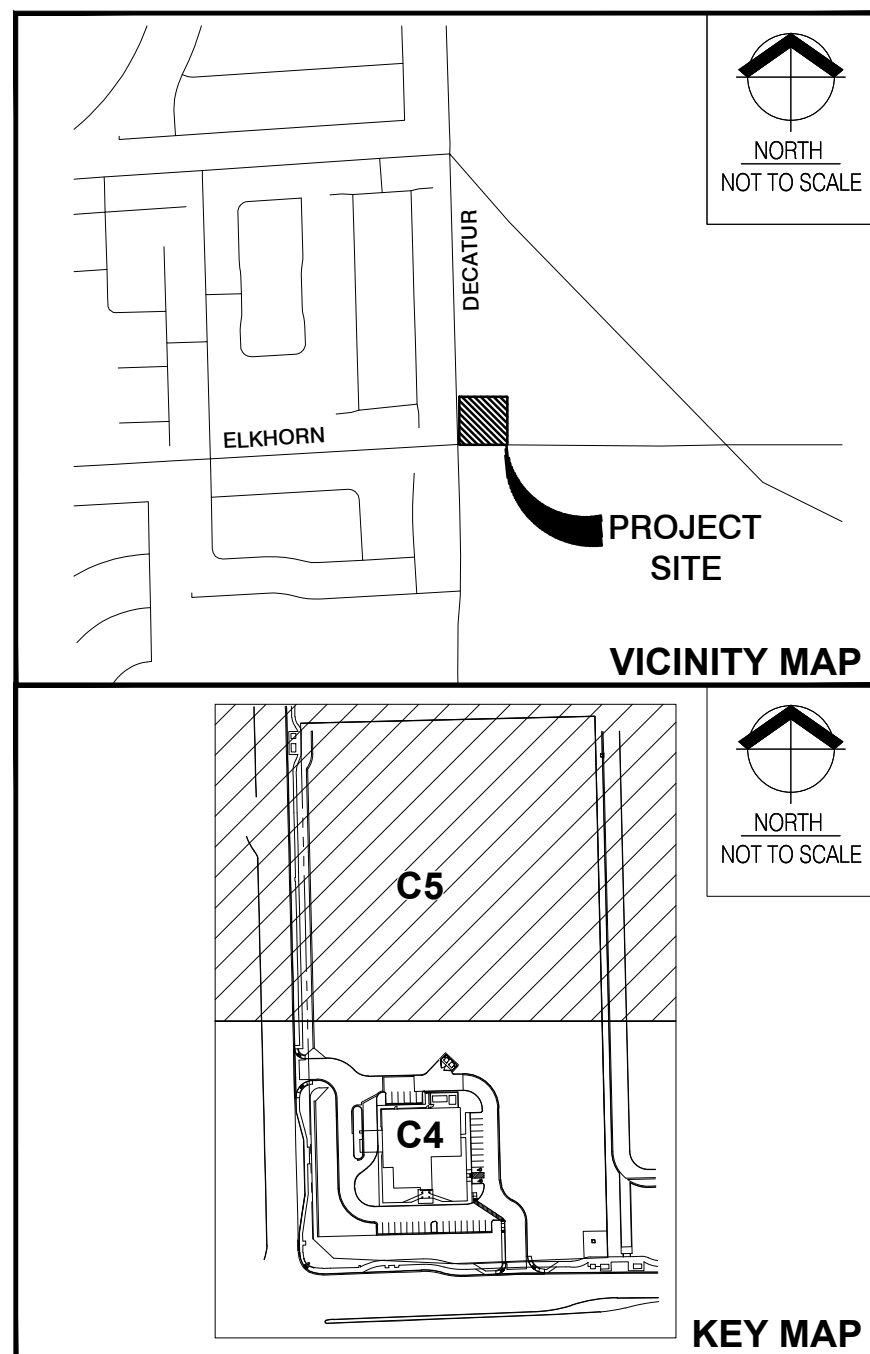
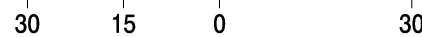
|  |  |                      |
|--|--|----------------------|
|  |  | STORM MANHOLE        |
|  |  | TELEPHONE BOX        |
|  |  | TELEPHONE MANHOLE    |
|  |  | FIBER BOX            |
|  |  | CABLE TV BOX         |
|  |  | ELECTRICAL MANHOLE   |
|  |  | STREET LIGHT BOX     |
|  |  | POWER POLE           |
|  |  | SERVICE POLE         |
|  |  | GUY WIRE             |
|  |  | 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               |



### BUILDING SLAB SECTION



SCALE: 1" = 30'



| EXISTING              |                  | PROPOSED              |                  |
|-----------------------|------------------|-----------------------|------------------|
| <u>(00.00)</u><br>TC  | TOP BACK CURB    | <u>(00.00)</u><br>TC  | TOP BACK CURB    |
| <u>(00.00)</u><br>EG  | EXISTING GROUND  | <u>(00.00)</u><br>FG  | FINISH GRADE     |
| <u>(00.00)</u><br>EP  | EDGE OF PAVEMENT | <u>(00.00)</u><br>EP  | EDGE OF PAVEMENT |
| <u>(00.00)</u><br>FL  | FLOW LINE        | <u>(00.00)</u><br>FL  | FLOW LINE        |
| <u>(00.00)</u><br>AC  | ASPHALT CONCRETE | <u>(00.00)</u><br>AC  | ASPHALT CONCRETE |
| <u>(00.00)</u><br>TRW | TOP OF RET. WALL | <u>(00.00)</u><br>TRW | TOP OF RET. WALL |
| <u>(00.00)</u><br>TF  | TOP OF FOOTER    | <u>(00.00)</u><br>TF  | TOP OF FOOTER    |
|                       |                  | <u>(00.00)</u><br>HP  | HIGH POINT       |
|                       |                  | <u>(00.00)</u><br>GB  | GRADE BREAK      |
|                       |                  | <u>(00.00)</u><br>TB  | TOP OF BERM      |

- 1 CONSTRUCT "L" CURB AND GUTTER PER CCAUSD #216
- 2 TURN OUT "L" CURB TO ENSURE POSITIVE DRAINAGE PER DETAIL "C",
- 3 SHEET C6
- 4 CONSTRUCT "A" CURB PER CCAUSD #219
- 5 CONSTRUCT SIDEWALK PER CCAUSD #234
- 6 CONSTRUCT 32' WIDE COMMERCIAL DRIVEWAY PER CCAUSD #225 & 228
- 7 CONSTRUCT CASE SIDEWALK RAMPS USING ARMOR TILE TRUNCATED
- 8 DOMES OR FLAT, PER CCAUSD #230 (A & B = 8' UNLESS NOTED)
- 9 CONSTRUCT FLOW LINE AS SHOWN
- 10 MAIN CORRIDOR (TRUCK ACCESS) INSTALL 3.5" AC OVER 10.5" TYPE II
- 11 AGGREGATE BASE
- 12 AUTOMOBILE ROUTE (PARKING) INSTALL 2.5" AC OVER 10" TYPE II
- 13 AGGREGATE BASE
- 14 INSTALL 2" CURB OUT PER DETAIL "C", SHEET C6
- 15 INSTALL TRASH ENCLOSURE (SEE ARCHITECTURAL PLANS FOR DETAILS)
- 16 INSTALL BUMPER BLOCK PER CCAUSD #238
- 17 INSTALL CURB TRANSITION PER DETAIL "F", SHEET C6 (LENGTH PER PLAN)
- 18 INSTALL 2" SIDEWALK UNDER DRAIN PER CCAUSD #236
- 19 CONSTRUCT BMP SWALE PER DETAIL "B" SHEET C6
- 20 INSTALL TRUNCATED DOMES PER CCAUSD #235
- 21 CONSTRUCT EARTH BERM, 2' TOP WIDTH, COMPACTED TO 95%
- 22 INSTALL "D" FACE CURB PER DETAIL "E", SHEET C6
- 23 INSTALL 2" VALLEY GUTTER PER DETAIL "A", SHEET C6
- 24 EXISTING STREET LIGHT TO BE RELOCATED
- 25 EXISTING UTILITIES TO GRADE
- 26 ADJUST BICYCLE RACKS (SEE ARCHITECTURAL PLANS FOR DETAILS)
- 27 SAWCUT CLEAN AND REMOVE EXISTING CURB, GUTTER AND SIDEWALK. IN
- 28 THE EVENT THE "C" PAVEMENT IS DAMAGED, DEGRADED OR
- 29 IMPROPERLY CONSTRUCTED, THE PAVEMENT SHALL BE
- 30 REMOVED AND REPLACED BY MECHANICAL MEANS AS REQUIRED BY ONLY
- 31 A QUALIFIED PAVING SERVICES INSPECTOR
- 32 PROVIDE WALL OPENING FOR DRAINAGE (SEE ARCHITECTURAL/STRUCTURAL
- 33 PLANS FOR DETAILS)
- 34 INSTALL 2" CONCRETE FLUME PER DETAIL "G", SHEET C6

|                           |                  |                                                                |               |
|---------------------------|------------------|----------------------------------------------------------------|---------------|
| APN No.<br>124-15-410-009 | ACREAGE:<br>8.08 | AREA OF DISTURBANCE<br>1.94 ACRES ONSITE<br>.07 ACRES OFF SITE | ZONING<br>MPC |
|---------------------------|------------------|----------------------------------------------------------------|---------------|

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

ADD 2300.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE ASSOCIATED DATUM.

CUT= 3,113 CY  
FILL= 8,900 CY  
NET= 5,787 CY FILL

I CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY CNLV #177-2020 FOR THIS SITE ON FILE AT CITY OF NORTH LAS VEGAS FOR THIS PROJECT.

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

DATE \_\_\_\_\_

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OR  
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CALL BEFORE  
YOU DO

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**UnderGround**

**1-702-432-5300**  
**FREEWAY AND ARTERIAL SYSTEM**  
**OF TRANSPORTATION**

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SOUTH 87°29'39" EAST, BEING THE SOUTH LINE OF GOVERNMENT LOT 19 OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M., CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN BY MAP ON FILE IN THE CLARK COUNTY RECORDER'S OFFICE, IN FILE 104, PAGE 61 OF PARCEL MAPS.

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## CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLOV9119N4

RIVET AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

ELEVATION: 699.658 METERS  
ELEVATION: 2265.461 U.S. SURVEY FEET  
NAVD 88

(REQUIRED FOR ALL SITES GREATER THAN 1 ACRE (43,560 SQ.FT.))

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**TECHNICAL DRAINAGE STUDY**  
for  
**UHS @ DECATUR & ELKHORN**

**North Las Vegas, Nevada**

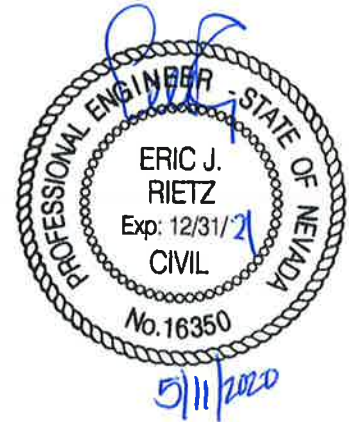
Date: May, 2020

**Prepared By:**

Rietz Consulting, Inc.  
3203 E. Warm Springs Road #400  
Las Vegas, Nevada 89120  
Phone: (702) 521-3355

**Prepared For:**

Universal Health Services, Inc.  
367 South Gulph Road  
King of Prussia, PA 19406





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

Name of Development: UHS @ DECATUR & ELKHORN Date: 5/7/2020  
Location of Development: a) Descriptive (Cross Streets) North/South: DECATUR BOULEVARD  
East/West: ELKHORN ROAD  
b) Section: 18 Township: 19 South Range: 61 East  
c) APN: 124-18-410-009

Name of Owner: OWNER: GRYESTONE NEVADA LLC DEVELOPER: UHS  
Telephone No.: (205) 966-6919 Fax No.: \_\_\_\_\_ E-Mail Address: scott.ricks@uhsinc.com  
Address: 367 Gulph Road, PO Box 61558, King of Prussia, PA 19406

Contact Person-Name: Eric Rietz, P.E. Telephone No.: 702-521-3355  
\* E-Mail Address: eric.rietz@gmail.com Fax No.: \_\_\_\_\_  
Firm: Rietz Consulting, Inc.  
Address: 3203 E. Warm Springs Rd., #400, Las Vegas, NV 89120

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 8.08 Being Developed/Disturbed: 2+/-
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: 0 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: SOUTHEAST CORNER OF SITE, ELKHORN
8. Briefly describe your proposed schedule for the subject project: ASAP



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

**\*New Required Field**

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

| Local Entity File No. | Revision | Date |
|-----------------------|----------|------|
|                       |          |      |
|                       |          |      |
|                       |          |      |

REFERENCE:

STANDARD FORM 1

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## DRAINAGE SUBMITTAL CHECKLIST

Project Name: UHS @ DECATUR & ELKHORN

Map ID:

Firm Name: RIETZ CONSULTING INC.

Engineer: ERIC RIETZ

Address: 3203 E. WARM SPRINGS ROAD #400

City: LAS VEGAS NV 89120 State: Zip:

Phone Number: (702) 521-3355

Fax Number:

Property Owner: OWNER: GREYSTONE NEVADA LLC DEVELOPER: UHS

Address: 367 GULP ROAD, PO BOX 61558

City: KING OF PRUSSIA State: PA Zip: 19406

Reviewed By:

Date Received:

Date Accepted for Review:

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

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

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

### I. GENERAL REQUIREMENT

Yes No

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

X \_\_\_\_\_ Design Manual **Standard Form 4**.

X \_\_\_\_\_ 2 copies of the 24" x 36" Drainage Plan.

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

### II. MAPS AND EXHIBITS

Yes No

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

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

**REFERENCE:**

**STANDARD FORM 2**

## HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

### DRAINAGE SUBMITTAL CHECKLIST

#### II. MAPS AND EXHIBITS (Continued)

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

#### III. DRAINAGE PLAN

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

**REFERENCE:**

**STANDARD FORM 2**

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## DRAINAGE SUBMITTAL CHECKLIST

### III. DRAINAGE PLAN (Continued)

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

**REFERENCE:**

**STANDARD FORM 2**

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## DRAINAGE SUBMITTAL CHECKLIST

### III. DRAINAGE PLAN (Continued)

Yes      No

- |            |       |                                                                                                                                                                                                                |
|------------|-------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>N/A</u> | _____ | For areas in Zone A, AE, AH, and AO, base flood elevations (BFEs) must be shown for each lot; BFEs may be listed on each lot, or in a table. Finish floor elevations must be a minimum of 18 inches above BFE. |
| <u>X</u>   | _____ | Appropriately elevated "humps" 6 inches above the 100 year water surface elevation at site accesses where the intent is to protect the site from the Q <sub>100</sub> flows.                                   |
| <u>X</u>   | _____ | Street slopes for perimeter and interior streets. The minimum slope is 0.4 percent.                                                                                                                            |
| <u>X</u>   | _____ | Location and detail of best management practice (BMP) for parking lots and low impact development (LID) (if required).                                                                                         |

### IV. HYDROLOGIC ANALYSIS

Yes      No

- |            |       |                                                                                                                                                                              |
|------------|-------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>X</u>   | _____ | Appropriate soil information and Soils Map for existing and future conditions with subbasins and property delineated.                                                        |
| <u>X</u>   | _____ | Input and output information for existing conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.                     |
| <u>X</u>   | _____ | Input and output information for future conditions from computer models (HEC-1 or TR-55). The flow routing diagram must be provided with HEC-1 models.                       |
| <u>X</u>   | _____ | Use of correct precipitation values in and around the McCarran Airport rainfall area.                                                                                        |
| <u>X</u>   | _____ | A discussion in the text of the hydrologic analysis justifying subbasin boundaries and cutoffs, supporting assumptions, and calculations.                                    |
| <u>X</u>   | _____ | A summary table of stormwater flows showing basin area, Q <sub>10</sub> and Q <sub>100</sub> for both individual basins and combined basin flows, where applicable.          |
| <u>X</u>   | _____ | Copies of supporting technical information referenced from a previously approved study and a statement accepting these results.                                              |
| <u>X</u>   | _____ | On-site facilities must perpetuate flows through or around the site without significantly impacting adjacent property owners in accordance with current Nevada Drainage Law. |
| <u>N/A</u> | _____ | Calculation for impervious area for parking lots and LIDs (if required).                                                                                                     |

**REFERENCE:**

**STANDARD FORM 2**



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## DRAINAGE SUBMITTAL CHECKLIST

### V. HYDRAULIC ANALYSIS

| Yes        | No                       |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|------------|--------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <u>N/A</u> | <input type="checkbox"/> | Flow split calculations and supporting documentation or reference for the method of flow split calculations used.                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <u>X</u>   | <input type="checkbox"/> | Normal depth street flow calculations and cross section diagrams for all interior and perimeter streets. Provide "d x v" products for the $Q_{100}$ and $Q_{10}$ flows representing the worst case for interior and all perimeter streets. $Q_{100} d \times v \leq 8$ . $Q_{10} d \times v \leq 6$ and 12 foot dry lane for rights-of-way $\geq 80$ feet. Calculations must be labeled by street name as indicated on the Grading Plan.                                                                                          |
| <u>X</u>   | <input type="checkbox"/> | A summary table of interior and exterior street capacity calculations showing the street name, $Q_{100}$ flow, slope, depth of flow, velocity and depth times velocity product and streets needing to meet 12 foot dry lane criteria.                                                                                                                                                                                                                                                                                             |
| <u>N/A</u> | <input type="checkbox"/> | Appropriate hydraulic calculations for block wall openings assuming a 50 percent vertical clogging factor. (Assume the lower half of the opening is plugged.)                                                                                                                                                                                                                                                                                                                                                                     |
| <u>N/A</u> | <input type="checkbox"/> | Appropriate hydraulic calculations at drainage easement entrance and discharge locations to set finish floor elevations. Hydraulic calculations must include submerged weir, superelevation and tee intersection losses, where appropriate.                                                                                                                                                                                                                                                                                       |
| <u>X</u>   | <input type="checkbox"/> | Provide necessary freeboard requirements to set the finished floor elevations of all proposed buildings, 2 x depth of flow or depth of flow plus 18 inches of freeboard, whichever is less. The minimum requirement is 6 inches above adjacent upstream top of curb. Buildings adjacent to drainage easements must always be provided with 18 inches of freeboard above the $Q_{100}$ weir height or flow depth, whichever is greater.                                                                                            |
| <u>N/A</u> | <input type="checkbox"/> | A complete water surface profile analysis (HEC-2, HEC-RAS, etc.) for channel flows and FEMA Zone A flood zones. <ul style="list-style-type: none"> <li>• Field survey data.</li> <li>• Input and output information.</li> <li>• Plotted cross-sections based on survey with proper encroachments.</li> <li>• A map showing the location of the cross-sections.</li> <li>• Analysis of both sub and super-critical flow segments.</li> <li>• A summary table and a discussion of the results in the text of the report.</li> </ul> |
| <u>N/A</u> | <input type="checkbox"/> | Provide a 50 percent clogging factor in the capacity calculation for drop inlets.                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| <u>N/A</u> | <input type="checkbox"/> | Hydraulic calculations for culverts and storm drains. D-Load calculations must be provided for storm drain pipes in public rights-of-way, including headwater pool inundation.                                                                                                                                                                                                                                                                                                                                                    |
| <u>X</u>   | <input type="checkbox"/> | The mitigation of nuisance water, both during construction and in the fully developed condition, must be addressed.                                                                                                                                                                                                                                                                                                                                                                                                               |
| <u>X</u>   | <input type="checkbox"/> | Provide BMP type, size and supporting calculations for parking lots and LIDs (if required).                                                                                                                                                                                                                                                                                                                                                                                                                                       |

REFERENCE:

STANDARD FORM 2



## Drainage Study Checklist

### Background

The City of North Las Vegas strives to provide the development community with adequate information to ensure the successful completion of any project in the City. To aid in the submittal of a complete, thorough drainage study, the following checklist has been compiled to assist the design engineer. This checklist focuses on requirements specific to the City of North Las Vegas. When preparing a drainage study, the engineer will still be required to adhere to all local criterion and guidelines as set forth in the Clark County Regional Flood Control District (CCRFCD) *Hydrologic Criteria and Drainage Design Manual* (HCDDM) and the *Uniform Standard Drawings for Public Works= Construction Off-site Improvements* for Clark County Area, Nevada. **In order to have a complete drainage study for submittal to the City, this checklist must be completed, signed, and stamped by the engineer in responsible charge for the completion of the drainage.** Incomplete submittals will not be accepted at the front counter.

### Checklist

Provide N/A to an item that is not applicable for the subject site.

| I. General Requirement |    |                                                                                                                                                                                                                                                      |
|------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yes                    | No |                                                                                                                                                                                                                                                      |
| X                      |    | Ensure that the new Standard Form 1 and 2 are utilized for all incoming drainage study submittals. The form can be acquired from the CCRFCD's website at <a href="http://www.ccrfcd.org/engineering.htm">http://www.ccrfcd.org/engineering.htm</a> . |
| X                      |    | Ensure that the new 2008 CCRFCD's Master Plan Update (MPU) is utilized for all incoming drainage study submittals. Both the Flood Control Facilities and Facility Inventory Maps must be included with the drainage study.                           |
| X                      |    | A copy of the approved zoning/planning conditions associated with this site must be included with the initial submittal to verify compliance with conditions.                                                                                        |
|                        | X  | If offsite grading is anticipated, a notarized permission letter to construct from the property owner is required prior to the approval of this technical drainage study.                                                                            |
|                        | X  | If the site is proposing to increase or concentrate storm flow and/or nuisance flows onto the adjacent property. A notarized permission letter to accept from the property owner is required prior to the approval of this technical drainage study. |
|                        | X  | The City of North Las Vegas (CNLV) does not allow valley gutters to be constructed across streets with right-of-way widths of 80 feet or greater.                                                                                                    |
| X                      |    | Provide map pockets in the back of the drainage study in order to keep the improvement plans with the study.                                                                                                                                         |
| X                      |    | Include a CD-ROM that contains a pdf of the entire study, including improvement plans.                                                                                                                                                               |
|                        | X  | When submitting flow split analysis for a site, staff suggests using the Pima County flow split calculations. Make sure to provide all supporting documents.                                                                                         |

|   |   |                                                                                                                                                                                                                                                                                                                                                                                                                            |
|---|---|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | X | The project proposes to construct facilities and/or discharge flows within Nevada Department of Transportation (NDOT) right of way. The engineer must contact NDOT for an encroachment permit for the proposed project and it must be received prior to approval of the improvement plans. NOTE: NDOT does not allow for development to increase the 100-year flow rate into their ROW - onsite detention may be required. |
|   | X | Where right-of-way does not exist, a roadway or drainage easement must be obtained from the adjacent property owner(s) prior to improvement plans approval. Roadway and drainage easement dedication documentation must be processed through the CNLV Real Property Services Division. For more information, please contact Lorena Candelario at 633-2396.                                                                 |
|   | X | This report serves as a master drainage study for the site. A separate technical drainage study will be required by the City of North Las Vegas upon development of areas shown on the conceptual site plan. Each technical drainage study should provide more detailed design information, including final grading plans with corresponding drainage facility details, hydraulic design calculations, etc.                |
| X |   | Ensure that the longitudinal slope used to calculate the 100-year flow depth for a given street matches with the slope indicated on the grading plans.                                                                                                                                                                                                                                                                     |
|   | X | The City of North Las Vegas (CNLV) is a member of the Community Rating System, which requires Base Flood Elevations (BFE's) to be indicated for any structures located within a Special Flood Hazard Area (SFHA) Zone A, AO, AE, etc. Please indicate the extent of the effective regulatory SFHA on the grading plan and show the BFE's of the affected lots.                                                             |
|   | X | If a site is adjacent to a future Clark County Regional Flood Control Facility, the developer is required to construct drop inlets at the site's discharge point along the alignment, which will collect 100% of the site's 100-year discharge.                                                                                                                                                                            |
|   | X | If the proposed development is required to construct flood control facilities that are depicted on the Clark County Regional Flood Control District's Master Plan Update, structural drawings must be submitted with the drainage study for review and approval by the City of North Las Vegas prior to submitting to CCRFCD for concurrence.                                                                              |
|   | X | The City of North Las Vegas North Neighborhood Flood Control Master Plan (NNFCMP) has established centerline intersection grades with corresponding street slopes. Please ensure that the street intersection designs are compatible with the NNFCMP.                                                                                                                                                                      |
|   | X | For rectangular shaped culverts, the minimum shall be 6 feet in height and 5 feet in width.                                                                                                                                                                                                                                                                                                                                |
|   | X | The City of North Las Vegas requires that all local drainage facilities identified on the North Neighborhood Flood Control Master Plan (NNFCMP) to be constructed by the developer for the full frontage of the site.                                                                                                                                                                                                      |
|   | X | This property is adjacent to Unincorporated Clark County. Please note that a copy of this study and any addenda must be submitted to Clark County Development Services for their review and concurrence.                                                                                                                                                                                                                   |
| X |   | This property is adjacent to the City of Las Vegas. Please note that a copy of this study and any addenda must be submitted to City of Las Vegas for their review and concurrence.                                                                                                                                                                                                                                         |
|   | X | Side lot easement for all residential development will need to meet all the requirements as set forth in the City of North Las Vegas Municipal Code under Title 17.24.210.D.4                                                                                                                                                                                                                                              |

|   |   |                                                                                                                                                                                                                                                                                                                                                                                                     |
|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|   | X | "Arizona" style crossing is not permitted within CNLV right-of-way. Culvert crossings, sized to convey the 100-year flow without any backwater effects, must be designed to convey the flow back to its historical path.                                                                                                                                                                            |
|   | X | The minimum pipe diameter to be constructed within public drainage easement or right-of-way shall be 18-inch in reinforced concrete pipe. HDPE pipes are allowed with the caveat that it must be slurry back fill.                                                                                                                                                                                  |
|   | X | Backwater ponding limits that extend outside of the public right-of-way shall be delineated on the grading plans and a public drainage easement or right-of-way be obtained from the property owner. Roadway and drainage easement dedication documentation must be processed through the CNLV Real Property Services Division. For more information, please contact Lorena Candelario at 633-2396. |
| X |   | When referencing other drainage studies, all relevant information such as approval letters, drainage basin maps, HEC-1 analyses, details, plans, etc. must be included with the study. The material being referenced should be highlighted in some manner to indicate what is being referenced.                                                                                                     |
| X |   | Provide a discussion and necessary analyses regarding Best Management Practice per Section 1500 of the Clark County Regional Flood Control District Hydrological Criteria and Drainage Design Manual.                                                                                                                                                                                               |

| II. Grading Plan Information |    |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|------------------------------|----|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yes                          | No |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
| X                            |    | 24"X36" copies of Grading Plans including Detail Sheets. Additionally, Plan and Profile sheets must be provided for all public offsite streets and/or storm drain/channel system improvements. The information provided in profile shall include: stationing, length, slope, size, discharge (Q100), material, class of pipe (Class III, IV, V, etc.), hydraulic grade line, inlet locations, finished grade over the pipe and etc. |
|                              | X  | On a 100' right-of-way street, the developer is required to build their half of the street, the median island, and one lane on the opposite side of the median. Additionally, the median island will be required to be landscaped.                                                                                                                                                                                                  |
| X                            |    | Alignment of all existing, proposed, or future Regional Flood Control Facilities adjacent to the site must be shown on the grading plans.                                                                                                                                                                                                                                                                                           |
| X                            |    | Appropriate elevated "humps" 6 inches above the 100-year water surface elevation at all driveways location where the intent is to protect the site from the Q100 flows.                                                                                                                                                                                                                                                             |
|                              | X  | Erosion protection must be provided at the upstream and downstream terminus of all public roadway improvements.                                                                                                                                                                                                                                                                                                                     |
| X                            |    | Landscape berms used to protect property from flows in the adjacent streets must meet the criterium of being twice the depth of flow above the adjacent flowline up to 18 inches above the adjacent water surface.                                                                                                                                                                                                                  |
|                              | X  | Temporary pavements used to satisfy Clark County PM-10 requirements cannot be used to establish centerline grades for any proposed streets. All proposed street improvements must be designed per the Uniform Standard Drawings for Public Works Construction, Offsite Improvements, Clark County Area, Nevada.                                                                                                                     |
| X                            |    | Show cross sections along all project boundaries showing the elevational relationship, property line, and any existing or proposed walls.                                                                                                                                                                                                                                                                                           |

|   |   |                                                                                                                                                                                                                                                                                                                                                                                         |
|---|---|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X |   | Verify all finished floor elevations of the proposed development meet Section 304.4 of the HCDDM.                                                                                                                                                                                                                                                                                       |
| X |   | All onsite drainage swale must maintain a minimum of 1% slope. If < 1% is anticipated, concrete valley gutter is required.                                                                                                                                                                                                                                                              |
|   | 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.), utilities conflict (if any), design hydraulic grade line (HGL) and the 100 year storm flow. A public drainage easement must be provided over on-site storm drains conveying the off-site flows. |
| X |   | Identify all adjacent parcels with the appropriate assessor parcel number and ownership information.                                                                                                                                                                                                                                                                                    |
| X |   | The Engineer must show existing and proposed development at least 100-feet beyond the project site limits. Finished floor elevations of existing buildings, centerline grades, centerline slopes, and top of existing curb elevations must be shown. Reference all adjacent existing improvements with a CNLV Project #. Ensure that it matches with the approved civil plans.          |
| X |   | Make every effort to provide plan sheets that are clean and clear to review. Be sure to eliminate superimposed text.                                                                                                                                                                                                                                                                    |
|   | X | Due to air quality regulations, all proposed streets must maintain a total of 32' asphalt area. For instance, a 60' half-street improvements will require an additional of 9-foot of overpaving from the centerline.                                                                                                                                                                    |
|   | X | Full intersection designs abutting the proposed development must be provided to ensure that all quadrants of the intersection will drain properly.                                                                                                                                                                                                                                      |
|   | X | Provide slopes of driveway fronting all public right-of-ways. Per CNLV Fire Code, the angles of approach and angles of departure must not exceed 6%.                                                                                                                                                                                                                                    |
|   | X | For commercial and industrial developments, landscape areas are not allowed to sheet flow over the sidewalk. Provide flow lines with grades and sidewalk under drains for all landscape areas draining to the streets.                                                                                                                                                                  |

| III. Hydrologic and Hydraulic Analyzes |    |                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------------------|----|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Yes                                    | No |                                                                                                                                                                                                                                                                                                                                                                                               |
| X                                      |    | Verify that the street capacity calculations for "ABC" and "XYZ" streets were completed for the worst case scenario for both water surface elevation and velocity (flattest and steepest slopes). In the interim condition, provide street capacity calculations for the 100-year event. In the ultimate condition, provide street capacity calculations for the 10-year and 100-year events. |
|                                        | X  | For 100-year street flows with depths greater than 0.6' and velocities higher than 5 fps, erosion resistant landscaping or pony walls at the back of sidewalk (to the height of the flow in the street) must be provided.                                                                                                                                                                     |
|                                        | X  | If a CNLV modified 60' standard street section with offset sidewalk is to be proposed with the development. Ensure that the Flowmaster calculations and improvement drawings are reflected with the correct cross section.                                                                                                                                                                    |
|                                        | X  | For 80' and greater streets, if a median island is proposed with the site, ensure that the street capacity calculations are reflected with a median island.                                                                                                                                                                                                                                   |

|   |   |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|---|---|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| X |   | For 80' and greater streets, the actual 12' dry lane determination must be shown on the Q10 street capacity calculations. CNLV only requires this criterion to be met in the FUTURE condition. Please note that the dual left turn lane and center median island cannot be used to satisfy the 12' dry lane criterion. Therefore, a minimum of 19' on each half of the street must be achieved for the entire stretch of the site.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                   |
|   | X | <p>All drainage studies for sites located within the North Neighborhood Flood Control Master Plan (NNFCMP) area must analyze four (4) separate conditions.</p> <ul style="list-style-type: none"> <li>a. A pure existing condition analysis that quantifies the amount of flow impacting the site in the existing condition. This condition has existing improvements and curve numbers for both onsite and offsite basins. Offsite basins should generally follow contours or existing development drainage patterns.</li> <li>b. An interim condition, where the offsite basins are the same as in the pure existing condition and the onsite basins are developed. The flows in this condition are modeled in the proposed half-streets being constructed with the development and homes/buildings must be at or above the WSE in the street.</li> <li>c. The NNFCMP existing condition flows are analyzed assuming a full street section, the CCRFCD street flow criterion does not need to be met, and the adjacent finished floor elevations must be above the associated WSE.</li> <li>d. The NNFCMP future condition flows are analyzed assuming a full street section, all CCRFCD street flow criteria must be met, and the finished floor elevations must have the required freeboard above the associated WSE.</li> </ul> |
|   | X | For parcels impacted by a FEMA Special Flood Hazard Area, analyses of the floodzone, utilizing the FEMA effective flowrate must be completed for both pre- and post-development cases. The post-development analysis must tie into the effective SFHA in both width and water surface elevation.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|   | X | For proposed storm drain connecting into other existing storm drain system, supporting documents must be provided for the beginning HGL used in the hydraulic modeling.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
|   | X | For the purpose of establishing adequate finished floor elevations for those structures adjacent to the proposed drainage easement, the City requires that submerged weir calculations are submitted. As the sidewalks at the upstream entrance of the drainage easement will effectively act as a broad-crested weir with a submerged tailwater, the water surface elevations at the easement entrances must be calculated as such.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|   | X | The engineer must provide inlet control nomograph (see HCDDM) calculations for all proposed drop inlets to ensure that the storm sewer will have the capacity to convey the anticipated 100-year peak flow.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|   | X | The CNLV requires that all drop inlet sizing to be performed with the HEC-22 software which can be acquired from the Federal Highway Administration's website at <a href="http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm">http://www.fhwa.dot.gov/engineering/hydraulics/software.cfm</a>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|   | X | Concrete headwalls are required at the inlet and outlet of all culvert installations. Flare end sections are acceptable for culvert less than 30-inch.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|   | X | Erosion protection and/or cut off walls may be required at the upstream and downstream of a culvert.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
|   | X | For the ease of maintainability and constructability, all storm drain pipes must be designed with a soffit to soffit connections.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

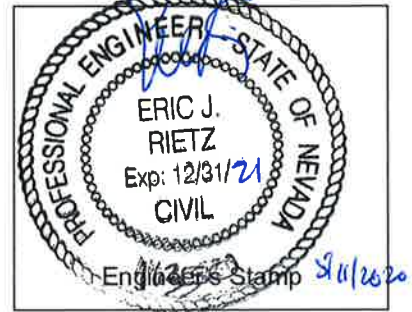
|                                                                          |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|--------------------------------------------------------------------------|----|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|                                                                          | X  | Swales that are designed to carry the 100-year flow must maintain a minimum freeboard of six inches above the depth of flow. Provide hydraulic calculations for verification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                          | X  | For project sites that are 40 acres or greater, flow values must be labeled at the outlet point of each individual drainage basin and concentration points on all drainage basin maps.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |
| X                                                                        |    | The soil's map must include both the off-site and on-site sub-basin delineations for all drainage conditions.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| IV. Local Entity Criteria - City of North Las Vegas - HCDDM Section 1603 |    |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| Yes                                                                      | No |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
|                                                                          | X  | Within the interior streets of a residential subdivision, the depth times velocity for the major storm event shall be less than or equal to 6.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                          | X  | When downstream storm sewer facilities are not available, the City of North Las Vegas requires bubbler laterals for the conveyance of storm water under streets with right-of-way widths greater than or equal to 80 feet. The bubbler laterals must consist of a minimum 18-inch diameter reinforced concrete pipe. To accommodate the draining of the bubbler system prior to future downstream extension of the storm sewer system, a minimum 6-inch diameter PVC pipe must be daylighted downstream.                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|                                                                          | X  | <p>The City of North Las Vegas does not permit the construction of permanent structures within a Federal Emergency Management Agency (FEMA) designated Special Flood Hazard Area (SFHA). Under this policy, any developer/builder proposing to place structures within a SFHA must meet the following requirements prior to the issuance of various permits and certificates-of-occupancy:</p> <ol style="list-style-type: none"> <li>1. Grading and off-site construction permits may be issued by the CNLV Department of Public Works once the improvement plans and drainage study have been approved and a copy of the completed Conditional Letter of Map Revision (CLOMR) application has been submitted to FEMA for processing.</li> <li>2. Building permits can be issued once a favorable CLOMR has been obtained from FEMA.</li> <li>3. Certificates-of-occupancy can be issued once a Letter of Map Revision (LOMR) has been obtained from FEMA.</li> </ol> |
|                                                                          | X  | The City of North Las Vegas requires that stormwater drop inlet signage be affixed to any installed drop inlets. The plaque must read "Don't pollute - drains to Lake Mead" in English and Spanish. CNLV Quality Control/Offsite inspectors will verify that the signs are properly installed.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|                                                                          | X  | The City of North Las Vegas requires surface nuisance flows be mitigated for all residential developments. All proposed residential subdivisions greater than 10 acres must disconnect surface nuisance flows through design to minimize impact to the downstream developments. Also nuisance drop inlets must also be sized to match the capacity of the outleting storm drain pipe size.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
|                                                                          | X  | A minimum longitudinal street slope of 0.4 percent (0.004 ft/ft) shall be used. If the Engineer can demonstrate, to the satisfaction and approval of the City Engineer, severe topographic constraints or other mitigating factors, the design of streets with slopes less than 0.4 percent may be permitted.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|                                                                          | X  | Side lot drainage easements are generally discouraged unless the engineer can demonstrate design constraints that render alternative site layout and drainage facility design options as impossible or impractical.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |



|  |   |                                                                                                                                                                                                                                                                                                                                                                                                                                     |
|--|---|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
|  | X | All wall openings must be designed to pass the 100-year storm event flows using the assumption that the bottom 50% of the openings are obstructed.                                                                                                                                                                                                                                                                                  |
|  | X | When a storm drain system is proposed at a sump area, a non-damaging emergency surface flow path must be provided to convey the 100-year flows. Adjacent finished floor elevations must be adequately protected.                                                                                                                                                                                                                    |
|  | X | For any ground-mounted air-conditioning pad that encroaches to within three (3) feet of a property line, the engineer must indicate on the plot plans how lot drainage will be accommodated beneath the pad. This can include, but is not limited to, the placement of a 4-inch diameter PVC pipe, with the inlet and outlet inverts of the pipe constructed to correspond with the flow line of the obstructed lot drainage swale. |

ERIC RIETZ

Engineer in Responsible Charge Name (Printed)



Approved by CNLV Development and Flood Control

Date

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# **1. INTRODUCTION**

## **1.1 Project Overview & Study Purpose**

This study is intended to demonstrate design conformance with Clark County Regional Flood Control Drainage Criteria and City of North Las Vegas flood control and drainage criteria for a 2+/- acre commercial site located at the northeast corner of the intersection of Decatur Boulevard and Elkhorn Road in the City of North Las Vegas, Nevada.

The proposed site will be developed with a single free-standing emergency room. The project is located north of Elkhorn Road and east of Decatur Boulevard. The project site is undeveloped, but has been rough graded. Adjacent offsite improvements for Decatur Boulevard and Elkhorn Road have been designed by others and were under construction at the time of the site-specific topographic survey.

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 in the southwest quarter (SW 4) of the southwest quarter (SW 4) of the southwest quarter (SW 4) of Section 18, Township 19 South (T19S) Range 61 East (R61E), on the north side of Elkhorn Road east of Decatur Boulevard. See *Figure 1, Vicinity Map* in the Appendix of this report.

The existing site is undeveloped and rough graded. Overall area drains from the north to the south at less than 1%.

## **1.3 FEMA Flood Zone Designation**

The subject site is located within a Zone X Federal Emergency Management Association Special Flood Hazard Zone. According to FEMA FIRM Map Index Panel 32003C1765F, dated November 16, 2011, the subject site located within a "Zone X" which applies to "areas outside of 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-12, from the 2018 CCRFCD Las Vegas Valley Flood Control Master Plan Update (MPU) shows that the site is located adjacent to an existing CCRFCD regional facility. Project site is located adjacent to facility id: LVDE 0003, identified as a 96" RCP storm drain with a flow of 704 cfs and a length of 1250-feet. The site is located within sub-basin NN020-C of the Lower Northern Las Vegas Wash Watershed. An excerpt from the W-map is included with the site delineated.

## **1.5 Soils Data**

The USDA NRCS Web Soil Survey site was used to determine the soil constituents of the sub-basins studied in this report. Curve numbers were selected from the *2018 MPU Curve Number Matrix*,

using the land usage and hydrologic condition of each basin studied, for input to the HEC1 hydrologic model. Curve number matrix for soil 305 (1305) shows that a curve number of 96 for commercial land use should be used. A curve number of 86 is used for the existing site to model desert shrub. A curve number of 98 is used for paved roadways.

## 1.6 Reference Studies

“Technical Drainage Study for Elkhorn & Decatur Multi-family Condominiums” was prepared by Taney Engineering in 2019. This study identified storm water runoff flows impacting the upstream and downstream ends of the proposed project site. Supplement #1 to Addendum #1 developed drainage map shows that 5-cfs and 215-cfs of stormwater runoff impacts the east side of Decatur Boulevard in the 10-year and 100-year storm events respectively just upstream of the northern boundary of the subject site. This developed flow is used to conservatively set finished floor elevations and flood protect the subject site. The Condominium study also proposes a drop inlet at the southeast corner of the subject site. The drop inlet is intended to capture all of the subject site’s 10-year runoff; a portion of the subject site’s 100-year runoff will overflow the inlet and discharge to Elkhorn Road according to the Condominium study.

It should be noted that the site is located along a CCRFCD MPU watershed boundary. Decatur Boulevard is identified as the watershed boundary for the Lower Northern Las Vegas Wash Watershed. The Condominium study identified stormwater runoff crossing the watershed boundary from the west. As a conservative measure, the flow is used to determine flood protection along Decatur Boulevard and Elkhorn Road. This stormwater runoff is not identified in the master study for the area.

## 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, per *Drainage Manual* Table 505 are 1.58” and 2.77” inches 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.

**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 Haestad Methods.

**Hydraulic Sections:** Minor hydraulic sections are analyzed by calculating normal depth variables with Flowmaster by Haestad Methods.

## 3. EXISTING CONDITIONS DRAINAGE

### 3.1 On-site Existing Conditions

The subject site is currently undeveloped and rough graded. The existing site drains to the south where it currently discharges to the east adjacent parcel. Proposed improvements by the adjacent Condominium site include a 4'x4' drop inlet in the southeast corner of the subject site's overall parcel. The inlet is intended to capture the majority of the subject site's 100-year flow and the entirety of the subject site's 10-year stormwater runoff. The remainder of the 100-year stormwater runoff discharges to Elkhorn Road as surface flow.

### 3.2 Offsite Existing Conditions

Offsite stormwater runoff in Decatur Boulevard is referenced from the Condominium study. Flow in Decatur Boulevard amounts to 5-cfs and 215-cfs in the 10-year and 100-year storm events respectively.

Table 1, Existing Flow Summary

| Basin ID/Concentration Point | Area (ac) | Q10 (cfs) | Q100 (cfs) |
|------------------------------|-----------|-----------|------------|
| E1                           | 8.08      | 5         | 14         |
| *CP4                         | ---       | 5         | 215        |
| DEC                          | 1.74      | 3         | 5          |
| ELK                          | 0.95      | 2         | 3          |
| C1 (HEC-1)                   | ---       | 4         | 8          |
| C1 (TOTAL = *CP4 + C1)       | ---       | 9         | 223        |

\*CP4 referenced from "Technical Drainage Study for Elkhorn & Decatur Multi-Family Condominiums, CNLV #68029.

## 4. DEVELOPED CONDITION DRAINAGE

### 4.1 Onsite Developed Conditions

The developed site has been graded to drain mainly within the overall parcel following drainage patterns established by neighboring developments. The developed site is divided into three basins. The majority of the developed site is represented by basin D1; Basin D1 discharges to

the existing 4'x4' drop inlet provided by the adjacent Condominium site. The drop inlet is shown to capture 14-cfs total. The remaining flow from Basin D1 overflows the drop inlet and discharges as surface flow to Elkhorn Road. Basin D2 represents the small area of landscape and driveway that drains to Decatur Boulevard. Basin D3 represents the small area of landscape and driveway that drains to Elkhorn Road.

**Table 2, Developed Flow Summary**

| Basin ID/Concentration Point | Area (ac) | Q10 (cfs) | Q100 (cfs) |
|------------------------------|-----------|-----------|------------|
| D1                           | 7.77      | 13        | 24         |
| *C4                          | ---       | 5         | 215        |
| DEC                          | 1.74      | 3         | 5          |
| D2                           | 0.07      | <1        | <1         |
| C1 (HEC-1)                   | ---       | 3         | 5          |
| C1 TOTAL                     | ---       | 8         | 220        |
| ELK                          | 0.95      | 2         | 3          |
| D3                           | 0.23      | <1        | 1          |
| C2 (HEC-1)                   | ---       | 5         | 9          |
| **C2 TOTAL                   | ---       | 10        | 234        |

\*CP4 referenced from "Technical Drainage Study for Elkhorn & Decatur Multi-Family Condominiums, CNLV #68029.

\*\*C2 TOTAL = C2 (HEC-1) + 5/215 + 0/10 = 10/234

## 4.2 Offsite Developed Conditions

Offsite developed conditions are the same as in existing conditions. Flow in Decatur Boulevard is referenced from the adjacent Condominium study.

## 4.3 Street Flows

Street flow calculations have been performed for adjacent roadways. Section A for Decatur Boulevard uses the flow from C1 to determine flood protection depths for the finished floor elevation and driveway from Decatur Boulevard. Section B in Elkhorn Road uses the total flow at C2 to show adequate flood protection for the finished floor. Section C is located on the north side of the subject developed area. Section C uses half the flow from basin D1 to show conformance with onsite flow parameter criteria. Section D also assumes that half of the entire developed D1 stormwater runoff could be conveyed in the drive aisle.

**Table 3, Developed Hydraulic Sections**

| Section               | Q10 | Q100 | D10  | D100 | V10  | V100 | D*V10 | D*V100 |
|-----------------------|-----|------|------|------|------|------|-------|--------|
| A – Decatur Boulevard | 8   | 220  | 0.51 | 1.42 | 1.91 | 5.23 | 0.97  | 7.43   |
| B – Elkhorn Road      | 10  | 234  | 0.51 | 1.49 | 2.24 | 5.18 | 1.14  | 7.72   |
| C – Onsite Section    | N/A | 12   | N/A  | 0.50 | N/A  | 2.06 | N/A   | 1.03   |
| D – Onsite Section    | N/A | 12   | N/A  | 0.71 | N/A  | 2.43 | N/A   | 1.73   |

Finished floor elevations are flood protected from flow within Decatur Boulevard by proposed driveway hump and landscape berm. 100-year stormwater runoff depth of flow in Decatur Boulevard is estimated to be 1.42-ft. This requires that a driveway highpoint must be a minimum of 1.92-ft above adjacent flow line elevations. The high side flow line at the Decatur Boulevard driveway is set at an elevation of 2311.83; the high side top of curb high point elevation is 2314.57 with an adjacent finished grade of 2314.07. This yields a difference in elevation of 2314.07-2311.83=2.24-ft, which is greater than the minimum required difference of 1.92-ft. The low side flow line elevation is 2311.69; low side finished grade high point is set at



2313.94; elevation difference is  $2313.94 - 2311.69 = 2.25$ -ft, which is greater than the required 1.92-ft. The landscape berm along Decatur Boulevard has been designed with a height of 2-ft above adjacent finished grade. This gives an elevation difference of 3.13-ft between the top of berm and flow line at the curb return; the required elevation difference is  $1.42 * 2 = 2.84$ -ft. The southern end of the berm has an elevation of 2313.80 with an adjacent flow line elevation of 2310.98; this gives an elevation difference of  $2313.82 - 2310.98 = 2.84$ -ft. The landscape berm and driveway high point are adequate to flood protect the finished floor elevation from anticipated flooding in Decatur Boulevard.

Elkhorn Road is lower in elevation than the proposed site. The highest adjacent top of curb elevation is 2309.65 with an adjacent flow line elevation of 2309.15. The proposed finished floor elevation is 2313.80. The difference in elevation from the finished floor to the highest adjacent flow line elevation is  $2313.80 - 2309.65 = 4.15$ -ft. This is more than necessary to prevent flooding from the anticipated 1.49-ft depth of flow in Elkhorn Road.

Elkhorn Road driveway highpoint is set to prevent stormwater runoff from entering the site. The high side flow line elevation is set at 2307.92; high side top of curb elevation is set at 2310.70 with an adjacent finished grade of 2310.20. Elevation difference is  $2310.20 - 2307.92 = 2.28$ -ft, which is greater than the required difference of  $1.49 + 0.5 = 1.99$ -ft. The low side flow line elevation is set at 2307.78; low side top of curb high point elevation is 2310.28 with an adjacent flow line elevation of 2309.78. Elevation difference is  $2309.78 - 2307.78 = 2.00$ -ft, which is above the required minimum of 1.99-ft.

#### 4.4 Lower Impact Development

Proposed grading design incorporates features intended to conform to section 1500 of the HCDDM. Impervious areas, pavement and roofs, drain through landscape areas and BMP swales prior to discharge.

One BMP swale is proposed with development of the proposed site. See BMP exhibit for a delineation of proposed BMP contributing areas. The following table presents results of BMP treatment area calculations.

**Table 4, BMP Treatment Summary Table**

| Pavement Area Designation | Area (ac) | Treated |
|---------------------------|-----------|---------|
| AREA-1                    | 0.67      | Y       |
| NT-1                      | 0.04      | N       |
| NT-2                      | 0.04      | N       |
| TOTAL AREA:               | 0.75      |         |
| TOTAL TREATED AREA:       | 0.67      | 89%     |

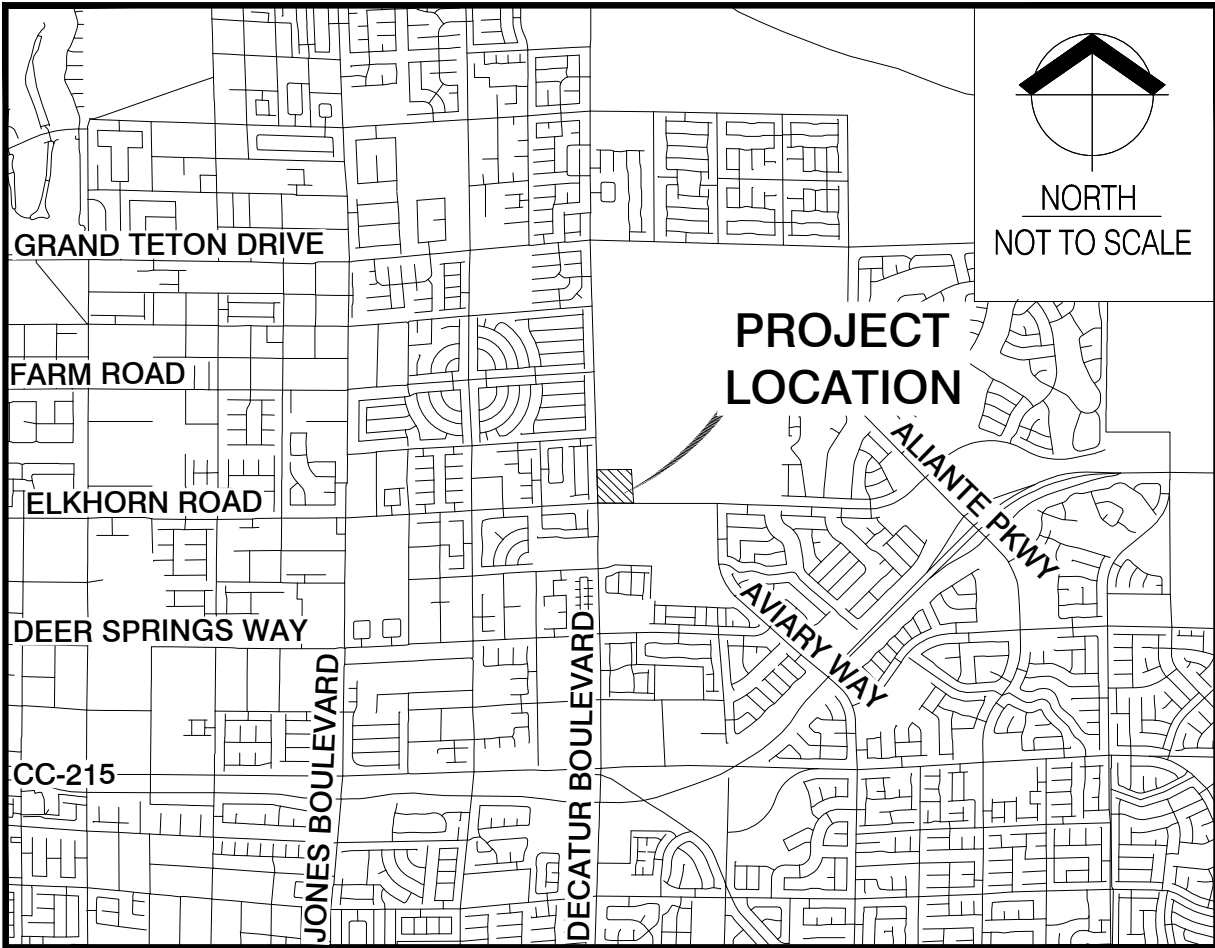
## 5. CONCLUSIONS & RECOMMENDATIONS

The site meets criteria set forth in the Hydrologic Criteria and Drainage Design Manual. Finished floor elevations are adequately flood protected from adjacent roadway and onsite stormwater runoff. Proposed drainage patterns follow previously existing patterns. The design is well prepared and analyses are competently completed; the project should be approved and built based on the information provided herein. Flood protection for the site's proposed finished floor elevation is conservatively determined from adjacent drainage study.

## **6. REFERENCES**

1. **Hydrologic Criteria and Drainage Design Manual**. Clark County Regional Flood Control District, 1990.
2. **Soil Survey of Las Vegas Valley Area**, Nevada. U.S. Department of Agriculture, Soil Conservation Service, July 1985.
3. **FlowMaster Version 8.i**, dated 2009. Prepared by Bentley Systems Inc.
4. HEC1, Hydrologic Engineering Core, ACE
5. Flood Insurance Rate Map #32003C1765F, Clark County Unincorporated Areas, printed November 26, 2011
6. “Technical Drainage Study for Elkhorn & Decatur Multi-Family Condominiums” prepared by Taney Engineering, 2019, CNLV #68029

# FIGURES



**RIETZ**  
CONSULTING INC.

3203 E. WARM SPRINGS RD. #400  
LAS VEGAS, NEVADA 89120  
PH: 702.521.3355

UHS @ DECATUR &  
ELKHORN

**VICINITY MAP**

DATE: 5/4/2020

DRAFTER: JG

CHECKED: JG

CHECKED: EJ R

**FIGURE**

**1**







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



FIGURE 3



## MAP LEGEND

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

## MAP INFORMATION

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

**Warning:** Soil Map may not be valid at this scale.  
Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

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

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

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

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

Soil Survey Area: Las Vegas Valley Area, Nevada, Part of Clark County  
Survey Area Data: Version 14, Sep 16, 2019

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

Date(s) aerial images were photographed: Jul 3, 2016—Oct 1, 2017

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

## Map Unit Legend

| Map Unit Symbol                    | Map Unit Name                                       | Acres in AOI | Percent of AOI |
|------------------------------------|-----------------------------------------------------|--------------|----------------|
| 305                                | Las Vegas-DeStazo complex,<br>0 to 2 percent slopes | 50.7         | 100.0%         |
| <b>Totals for Area of Interest</b> |                                                     | <b>50.7</b>  | <b>100.0%</b>  |



| ID / Mile | Status | Facility Description                          | Length (ft.) | Flow (cfs) | HEC-1 Node | HEC-1 Model | Tributary Area (sq.mi.) | Channel Slope (%) ** |
|-----------|--------|-----------------------------------------------|--------------|------------|------------|-------------|-------------------------|----------------------|
| AVHR      |        | AVIARY AND HORSE SYSTEM                       |              |            |            |             |                         |                      |
| 0000      | P0     | 72" RCP                                       | 1010         | 173        | CGT03CW    | WEST3       | 1.11                    | 0.50                 |
| 0020      | E      | 66" RCP                                       | 1580         | 173        | CGT03CW    | WEST3       | 1.11                    | 0.50                 |
| 0050      | P0     | 78" RCP                                       | 1320         | 173        | CGT03CW    | WEST3       | 1.11                    | 0.50                 |
| 0075      | P0     | 60" RCP                                       | 1010         | 173        | CGT03CW    | WEST3       | 1.11                    | 0.77                 |
| 0094      | P0     | 12" X 3' RCB                                  | 460          | 137        | CDNW205    | WEST3       | 1.03                    | 0.30                 |
| CNDS      |        | CENTENNIAL AND DEER SPRINGS                   |              |            |            |             |                         |                      |
| 0028      | E      | 8' X 6' RCAC                                  | 1355         | 378        | NN078-C    | WEST3       | 0.40                    | 2.28                 |
| 0062      | E      | 12' x 6' RCAC                                 | 786          | 378        | NN078-C    | WEST3       | 0.40                    | 1.33                 |
| CNEA      |        | CENTENNIAL PKWY CHANNEL EAST                  |              |            |            |             |                         |                      |
| 0176      | E      | CONC CHNL 15W 6.5'D 0:1 SS                    | 540          | 1178       | CNN078-C   | WEST3       | 1.35                    | 0.70                 |
| CNWE      |        | CENTENNIAL PKWY CHANNEL WEST                  |              |            |            |             |                         |                      |
| 0005      | E      | 4: 13.5' X 10' RCB                            | 762          | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 1.08                 |
| 0020      | E      | 4: 13' X 10' RCB                              | 310          | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 2.57                 |
| 0026      | E      | 4: 13.5' X 9' RCB                             | 750          | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 0.61                 |
| 0045      | E      | CONC CHNL 56W 8'D 0:1 SS                      | 1575         | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 0.61                 |
| 0071      | E      | 3: 18' X 8' RCBC @ BRADLEY                    | 300          | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 0.61                 |
| 0075      | E      | CONC CHNL 54W 8'D 0:1 SS                      | 775          | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 0.42                 |
| 0110      | E      | CONC CHNL 54W 9'D 0:1 SS                      | 620          | 4145       | CNW3D3-C   | WEST3       | 6.40                    | 0.42                 |
| 0129      | E      | 3: 18' X 8' RCB                               | 2450         | 3994       | 2CW3B4-C   | WEST3       | 6.14                    | 0.42                 |
| 0150      | E      | CONC CHNL 40W 9.5'D 0:1 SS                    | 1279         | 3994       | 2CW3B4-C   | WEST3       | 6.14                    | 0.42                 |
| 0173      | E      | 3: 18' X 8' RCBC @ TORREY PINES               | 200          | 3771       | CNW3B3-C   | WEST3       | 5.64                    | 0.42                 |
| 0176      | E      | CONC CHNL 40W 9'D 0:1 SS                      | 150          | 3771       | CNW3B3-C   | WEST3       | 5.64                    | 0.41                 |
| 0189      | E      | CONC CHNL 36W 10'D 0:1 SS                     | 1200         | 3771       | CNW3B3-C   | WEST3       | 5.64                    | 0.42                 |
| 0195      | E      | CONC CHNL 36W 9'D 0:1 SS                      | 1130         | 3771       | CNW3B3-C   | WEST3       | 5.64                    | 0.60                 |
| EKDB      |        | ELKHORN SPRINGS DETENTION BASIN               |              |            |            |             |                         |                      |
| 0000      | E      | GRASS CHNL 15W 5.8'D 3.5:1 SS                 | 2575         | 221        | CNW150-C   | WEST3       | 1.41                    | 0.39                 |
| EKEA      |        | ELKHORN ROAD CHANNEL EAST                     |              |            |            |             |                         |                      |
| 0124      | E      | CONC CHNL 20W 10'D 0:1 SS                     | 3622         | 2870       | CELK06E    | WEST3       | 6.77                    | 0.66                 |
| 0192      | E      | 20' X 8' RCB                                  | 207          | 2518       | CELK06A    | WEST3       | 5.79                    | 0.60                 |
| 0196      | E      | 22' X 8' RCB                                  | 208          | 2518       | CELK06A    | WEST3       | 5.79                    | 0.60                 |
| 0198      | E      | CONC CHNL 22W 9.5'D 0:1 SS                    | 1691         | 2518       | CELK06A    | WEST3       | 5.79                    | 0.44                 |
| 0231      | E      | CONC CHNL 18W 9.5'D 0:1 SS                    | 247          | 2317       | CELK06D    | WEST3       | 5.47                    | 1.82                 |
| 0234      | E      | CONC CHNL 30W 7'D 0:1 SS                      | 60           | 2317       | CELK06D    | WEST3       | 5.47                    | 0.33                 |
| 0237      | E      | CONC CHNL 16W 7'D 0:1 SS                      | 2012         | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.51                 |
| 0274      | E      | 16' X 7' RCBC @ ALIANTE                       | 439          | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.55                 |
| 0282      | E      | 16' X 7' RCB                                  | 89           | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.92                 |
| 0284      | E      | CONC CHNL 15W 9'D 0:1 SS                      | 343          | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.46                 |
| 0290      | E      | CONC CHNL 27W 9'D 0:1 SS CONFLUENCE STRUCTURE | 147          | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.47                 |
| 0292      | E      | CONC CHNL 15W 9'D 0:1 SS                      | 779          | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.47                 |
| 0307      | E      | CONC CHNL 15W 6'D 0:1 SS                      | 1625         | 1256       | CNN035-C   | WEST3       | 1.47                    | 0.56                 |
| 0338      | E      | 60" RCP                                       | 1259         | 517        | NN021-C    | WEST3       | 0.57                    | 0.76                 |
| GTEA      |        | GRAND TETON DRIVE SYSTEM EAST                 |              |            |            |             |                         |                      |
| 0000      | E      | 12' X 5' RCB                                  | 1860         | 872        | CNN048CE   | WEST3       | 3.59                    | 0.78                 |
| 0038      | E      | 2: 10' X 5' RCB                               | 280          | 872        | CNN048CE   | WEST3       | 3.59                    | 1.50                 |
| 0042      | E      | GRASS CHNL10'W 5'D 3:1 SS                     | 1490         | 872        | CNN048CE   | WEST3       | 3.59                    | 0.60                 |
| 0057      | E      | 5: 6' X 3' RCBC @ LINTWHITE                   | 105          | 652        | CNN048CW   | WEST3       | 3.28                    | 0.50                 |
| 0058      | E      | GRASS CHNL10'W 5'D 3:1 SS                     | 1500         | 652        | CNN048CW   | WEST3       | 3.28                    | 0.50                 |
| 0072      | E      | 14' X 12' RCAC @ BROADWING                    | 75           | 652        | CNN048CW   | WEST3       | 3.28                    | 0.40                 |
| 0073      | E      | GRASS CHNL14'W 5'D 3:1 SS                     | 90           | 652        | CNN048CW   | WEST3       | 3.28                    | 0.50                 |
| 0075      | E      | 14' X 12' RCAC @ ALIANTE                      | 165          | 652        | CNN048CW   | WEST3       | 3.28                    | 0.40                 |
| 0078      | E      | EARTH CHNL 10W 4'D 3:1 SS                     | 1770         | 377        | CNN033-C   | WEST3       | 2.88                    | 0.45                 |
| 0095      | E      | 2: 10' X 5' RCBC @ Night Heron                | 70           | 377        | CNN033-C   | WEST3       | 2.88                    | 0.50                 |
| 0096      | E      | RIPRAP CHNL 20'W 5'D 2.5:1 SS                 | 290          | 377        | CNN033-C   | WEST3       | 2.88                    | 0.50                 |
| 0102      | E      | 10' X 5' RCAP                                 | 1945         | 377        | CNN033-C   | WEST3       | 2.88                    | 0.30                 |
| 0139      | E      | 14' X 5' RCB                                  | 130          | 377        | CNN033-C   | WEST3       | 2.88                    | 0.30                 |
| 0141      | P0     | 72" RCP                                       | 1450         | 233        | PHWDB      | WEST3       | 2.58                    | 0.30                 |
| 0168      | P0     | 1,697 CFS SPILLWAY                            |              | 1697       | CNN032-C   | WEST3       | 2.58                    |                      |
| 0169      | P0     | 137 AC-FT PARK HIGHLANDS WEST DETENTION BASIN |              | 1564       | CNN032-C   | WEST3       | 2.58                    |                      |
| 0192      | P0     | 14' X 7' RCAP                                 | 340          | 1462       | CCGT03BW   | WEST3       | 2.42                    | 0.30                 |
| 0198      | P0     | 12' X 7' RCAP                                 | 1980         | 1299       | CGT03BW    | WEST3       | 2.23                    | 0.48                 |
| 0236      | P0     | 12' X 5' RCB                                  | 750          | 1166       | CNW202-C   | WEST3       | 1.97                    | 1.90                 |

| ID / Mile | Status | Facility Description                                 | Length (ft.) | Flow (cfs)       | HEC-1 Node           | HEC-1 Model | Tributary Area (sq.mi.) | Channel Slope (%) ** |
|-----------|--------|------------------------------------------------------|--------------|------------------|----------------------|-------------|-------------------------|----------------------|
| GTEA      |        | GRAND TETON DRIVE SYSTEM EAST                        |              |                  |                      |             |                         |                      |
| 0250      | P      | 10' X 6' RCB                                         | 2400         | 1166             | CNW202-C             | WEST3       | 1.97                    | 1.50                 |
| 0295      | P      | 10' X 6' RCB                                         | 2500         | 987              | CNW192-C             | WEST3       | 1.72                    | 1.50                 |
| IRMO      |        | IRON MOUNTAIN                                        |              |                  |                      |             |                         |                      |
| 0000      | P      | 8' X 8' RCB                                          | 5200         | 737              | CNW206-C             | WEST3       | 1.36                    | 0.70                 |
| 0098      | P      | 8' X 6' RCB                                          | 2600         | 501              | CNW186-C             | WEST3       | 1.03                    | 0.70                 |
| LV03      |        | CLAYTON STREET CHANNEL                               |              |                  |                      |             |                         |                      |
| 0082      | E      | CONC CHNL 7W 7.1'D 1.5:1 SS                          | 2444         | 817              | CNN054-C             | WEST3       | 0.82                    | 2.80                 |
| 0128      | E      | CONC CHNL 7W 7.1'D 1.5:1 SS                          | 166          | 167 <sup>^</sup> | NN052-C <sup>^</sup> | WEST3       | 0.56                    | 2.80                 |
| 0129      | E      | 2: 10' X 6' RCB                                      | 801          | 390 <sup>^</sup> | NN052-C <sup>^</sup> | WEST3       | 0.56                    | 1.60                 |
| 0131      | E      | 10' X 6' RCB                                         | 665          | 167 <sup>^</sup> | NN052-C <sup>^</sup> | WEST3       | 0.56                    | 1.28                 |
| LVDE      |        | LAS VEGAS WASH - DECATUR                             |              |                  |                      |             |                         |                      |
| 0000      | E      | 7' X 6' RCB                                          | 128          | 704              | CNW198-C             | WEST3       | 0.69                    | 0.78                 |
| 0003      | E      | 96" RCP                                              | 1250         | 704              | CNW198-C             | WEST3       | 0.69                    | 0.46                 |
| 0027      | E      | 84" RCP                                              | 1320         | 502              | CNW200-C             | WEST3       | 0.44                    | 0.50                 |
| LVMD      |        | LAS VEGAS WASH - MIDDLE                              |              |                  |                      |             |                         |                      |
| 2322      | E      | 2: 15' X 9' RCB                                      | 1660         | 2867             | CNW3D4-C             | CWEST3      | 6.62                    | 1.50                 |
| 2324      | E      | 2: 15' X 8' RCB                                      | 4810         | 2748             | CNW3C2-C             | CWEST3      | 6.36                    | 0.53                 |
| 2427      | E      | 2: 13' X 8' RCB                                      | 320          | 2091             | CNW188-C             | CWEST3      | 5.18                    | 1.69                 |
| 2443      | E      | 24' X 8' RCB                                         | 5010         | 2091             | CNW188-C             | CWEST3      | 5.18                    | 0.37                 |
| 2490      | E      | 24' X 8' RCB                                         | 2600         | 1808             | CNW168-C             | CWEST3      | 4.43                    | 0.34                 |
| 2507      | E      | 2: 13' X 9' RCB                                      | 2831         | 1808             | CNW168-C             | CWEST3      | 4.43                    | 0.36                 |
| 2525      | E      | 24' X 8' RCB                                         | 1140         | 1598             | CNW159-C             | CWEST3      | 3.92                    | 0.40                 |
| 2550      | E      | 24' X 8' RCB                                         | 1445         | 1312             | CD161-C              | CWEST3      | 3.42                    | 0.40                 |
| 2574      | E      | 24' X 8' RCB                                         | 1430         | 1312             | CD161-C              | CWEST3      | 3.42                    | 0.41                 |
| 2599      | E      | CONC CHNL 24W 7'D 2:1 SS                             | 1577         | 1268             | CNW162-C             | CWEST3      | 3.10                    | 0.51                 |
| LVMJ      |        | LAS VEGAS WASH - JONES                               |              |                  |                      |             |                         |                      |
| 0000      | E      | 6' X 4' RCB                                          | 1365         | 294              | CNW178-C             | WEST3       | 0.50                    | 0.40                 |
| 0100      | E      | 60" RCP                                              | 1175         | 146              | NW180-C              | WEST3       | 0.30                    | 0.30                 |
| LVSM      |        | LAS VEGAS WASH-SIMMONS                               |              |                  |                      |             |                         |                      |
| 0109      | E      | 48" RCP                                              | 2003         | 240              | NN038-C              | WEST3       | 0.23                    | 1.91                 |
| LVUP      |        | UPPER LAS VEGAS WASH                                 |              |                  |                      |             |                         |                      |
| 0493      | E      | FLOODWAY                                             | 24000        | 3317             | ULWDB*               | SPRINGS     | 199.94                  | 1.04                 |
| 0908      | E      | 182,000 CFS PMF SPILLWAY                             |              | 182000           | ULWIN                | LOWERS      | 200.04                  |                      |
| 0909      | E      | 2: 8' X 8' RCB OUTLET                                | 260          | 3317             | ULWDB                | SPRINGS     | 199.94                  | 1.18                 |
| 0910      | E      | 1,836 AC-FT UPPER LAS VEGAS WASH DETENTION BASIN     |              | 15544            | 2C116-7*             | LOWERS      | 195.05                  |                      |
| 0911      | P0     | UPGRADE TO 2,980 AC-FT UPPER LV WASH DETENTION BASIN |              | 15544            | 2C116-7*             | LOWERS      | 195.05                  |                      |
| 0976      | E      | FLOODWAY                                             | 7000         | 14989            | ULWIN                | LOWERS      | 200.04                  | 0.71                 |

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

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

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



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FLOOD CONTROL  
MASTER PLAN UPDATE  
  
FACILITY INVENTORY  
FIGURE F-12

|   |                                                         |      |
|---|---------------------------------------------------------|------|
| L | ID (Facility Identifier)                                | AABB |
| E | Parent Stream Name                                      |      |
| G | Stream Name                                             |      |
| E | Mile                                                    | 0000 |
| N | Distance Above Confluence<br>with Parent Stream (Miles) |      |
| D | Miles in Hundredths                                     |      |

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

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

Cast in Place Concrete Pipe.....CIPCP  
Corrugated Metal Arch Pipe Culvert.....CMAP  
Corrugated Metal Pipe Culvert.....CMPC  
High Density Polyethylene.....HDPE  
Horizontal Elliptical Reinforced Concrete Pipe.....HERCP  
Reinforced Concrete Arch Pipe.....RCAP

Construction Features

Reinforced Concrete Arch Culvert.....RCAC  
Reinforced Concrete Box.....RCB  
Reinforced Concrete Box Culvert.....RCBC  
Reinforced Concrete Pipe.....RCP  
Reinforced Concrete Pipe Culvert.....RCPC  
Storm Sewer Pipe.....SSP



FIGURE 4A

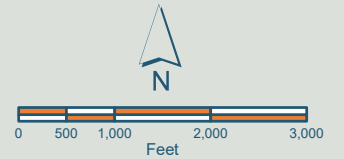




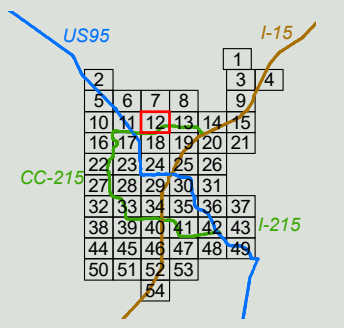
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LAS VEGAS VALLEY  
FLOOD CONTROL  
MASTER PLAN UPDATE

**FIGURE F-12  
FLOOD CONTROL FACILITIES**

- LEGEND**
- Ultimate Development Boundary
  - Existing Facilities
  - Category A Proposed Facilities
  - Category B Proposed Facilities
  - Local Existing Facilities
  - Detention Basin
  - Culvert or Bridge Crossing
  - Stormdrain
  - Lined Channel
  - Unlined Channel
  - Levee/Dike
  - Natural Wash/Floodway
  - ID-Mile Separator
- Remove & Replace/Parallel Facilities**
- | Category A | Category B |
|------------|------------|
| Channel    | Channel    |
| Stormdrain | Stormdrain |
| Crossing   | Crossing   |

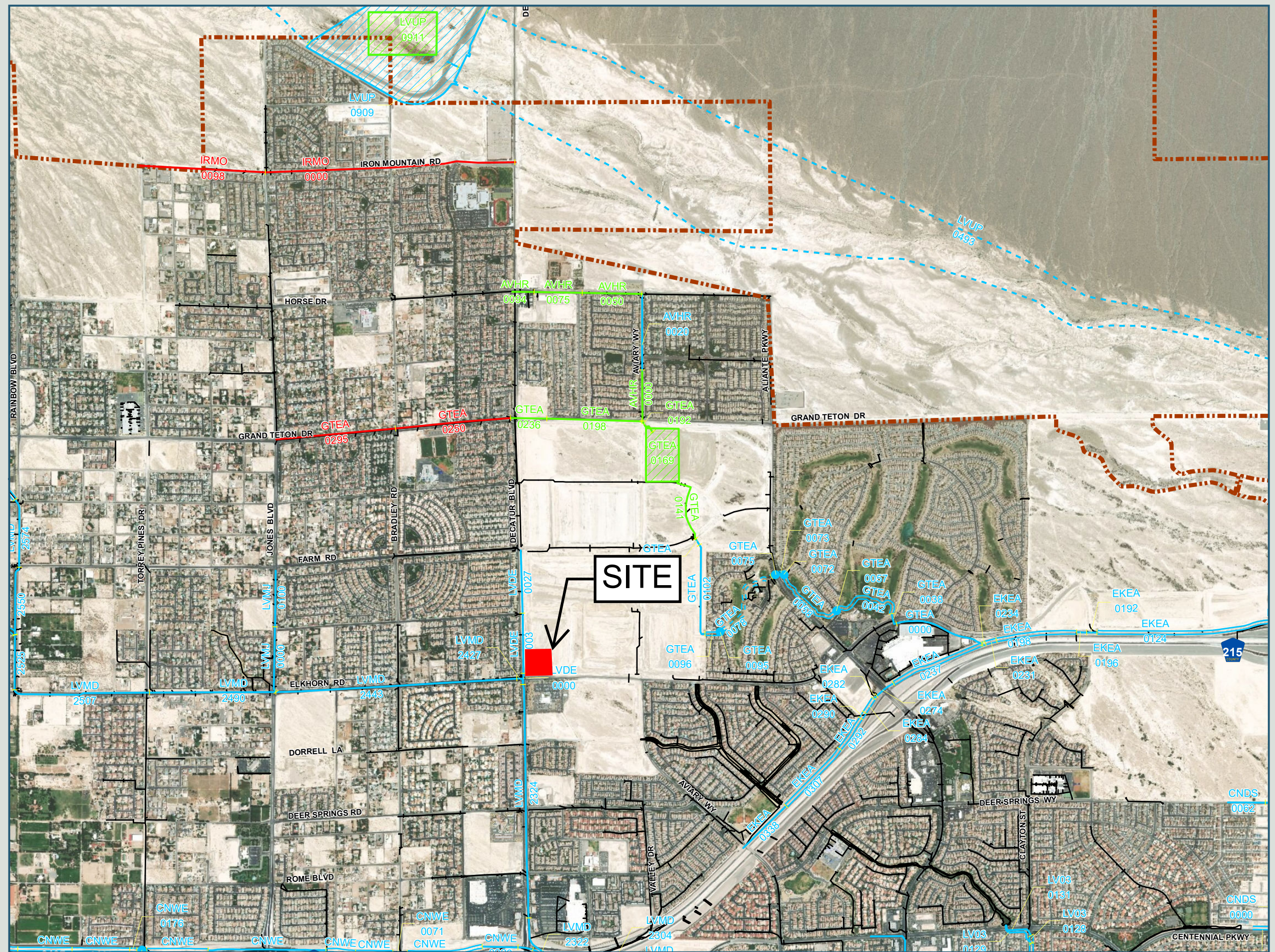


AerialSource:Esri World Imagery 2017



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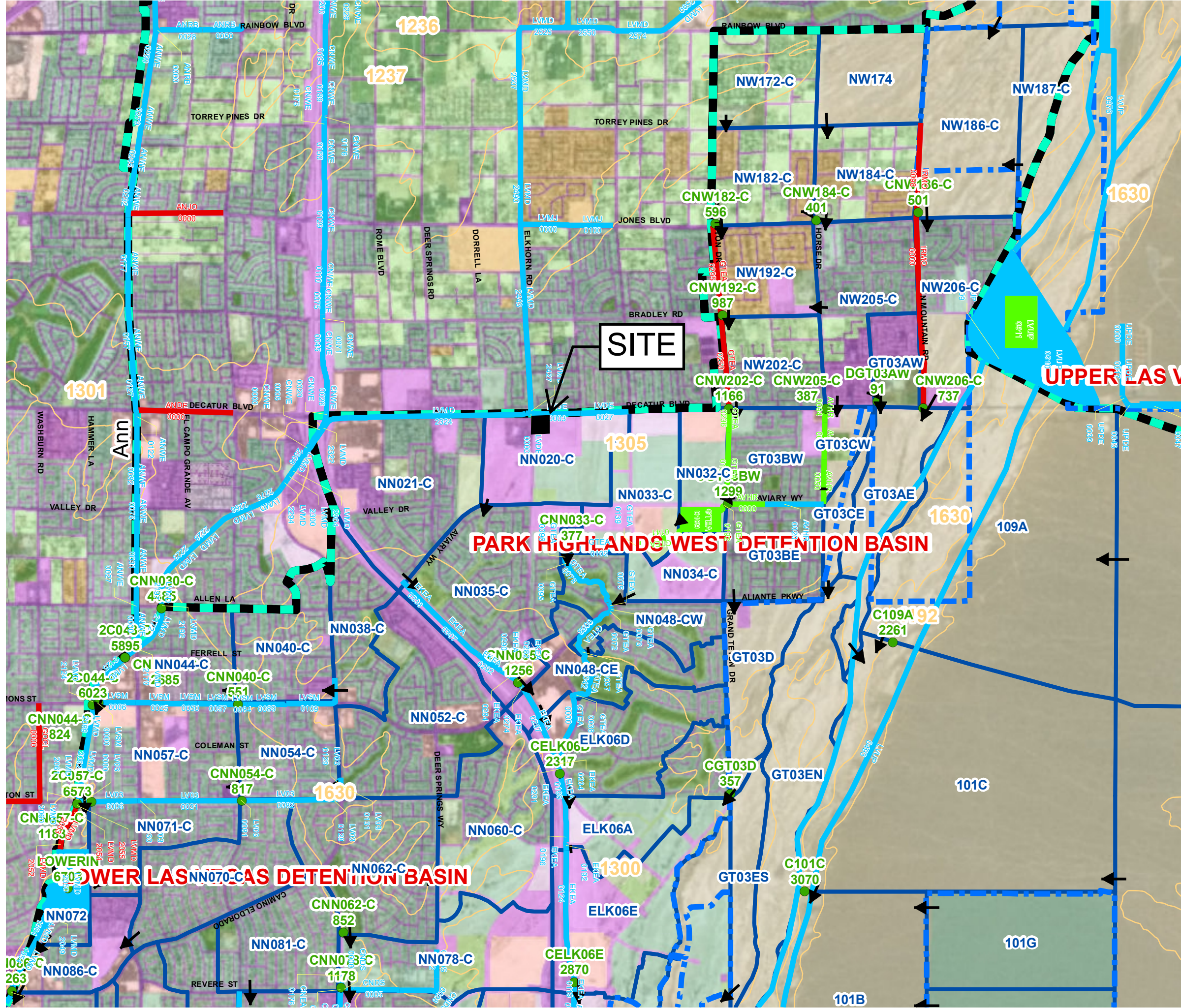
Louis Berger



**FIGURE 4B**



Figure W-3  
Lower Northern Las Vegas Wash  
Watershed



Legend

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

FIGURE 4C

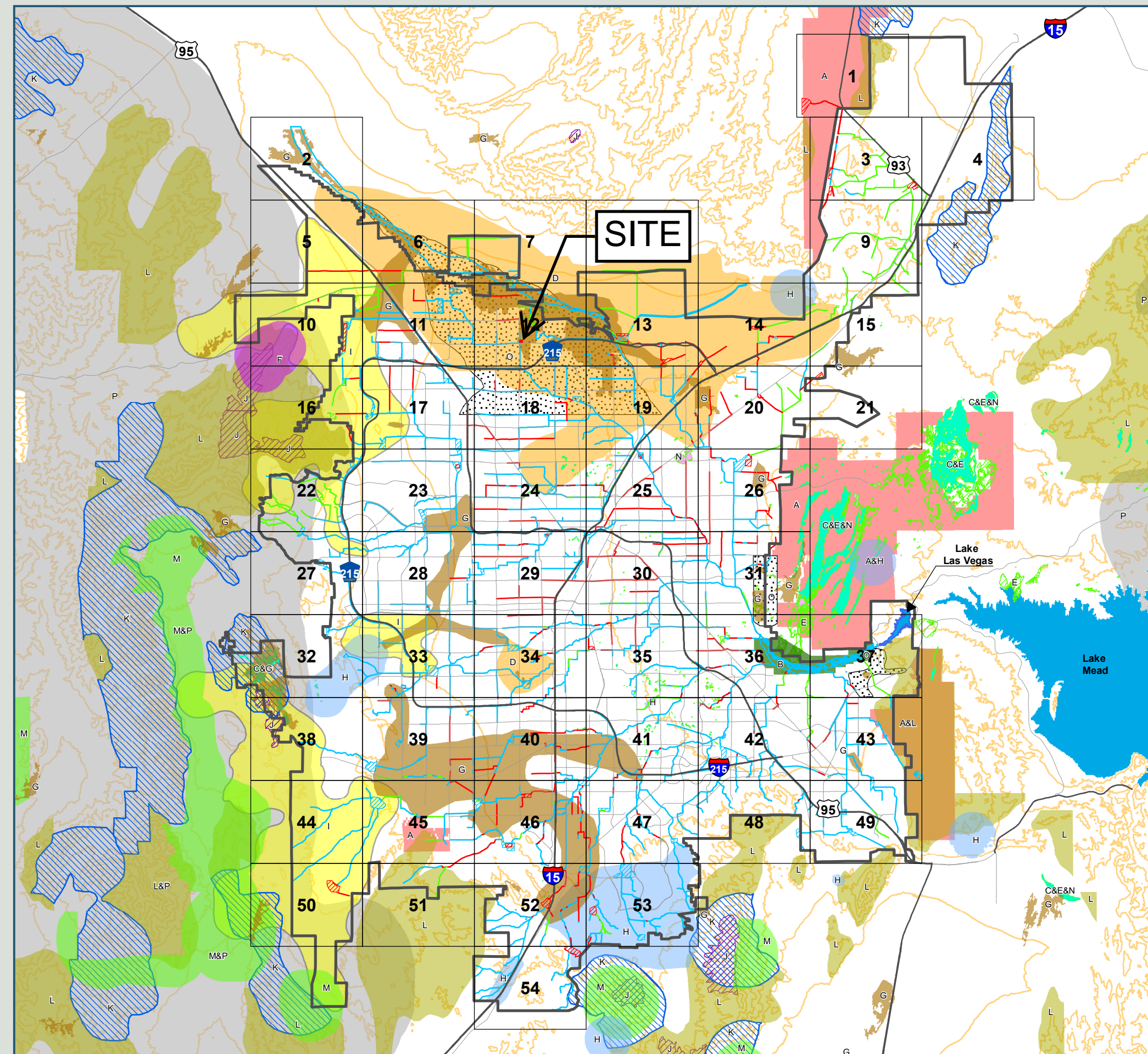




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FIGURE G-2

ENVIRONMENTALLY SENSITIVE AREAS



LEGEND

- Ultimate Development Boundary
- Sheet Index
- Areas of Critical Environmental Concern
- Wetland
- White Bearpoppy
- Las Vegas Buckwheat and Las Vegas Bearpoppy
- Las Vegas Bearpoppy
- Mojave Milkvetch
- Mesquite/Acacia
- Rosy Twtone Beardtongue
- Yellow Twtone Beardtongue
- Bluediamond Cholla
- BLM Crucial Bighorn Habitat
- BLM Bighorn Winter Range
- BLM Quail Habitat
- Las Vegas Buckwheat
- Paleontological Sensitive Area
- BLM Horse and Burro Management Area
- Main Highways
- Major Streets
- 500 ft Contours (USGS)
- Flood Control Facilities
  - Existing Facilities
  - Category A Proposed Facilities
  - Category B Proposed Facilities
  - Category A Remove & Replace/Parallel Facilities
  - Category B Remove & Replace/Parallel Facilities

Information displayed on this map is for general reference only. The environmentally sensitive areas presented on this figure are conservative and do not account for areas that are urbanized. These areas are meant to show only where there is a "potential" for sensitive resources to occur and are not meant to define exact locations. The Bureau of Land Management, U.S. Fish and Wildlife Service, Nevada Department of Wildlife, and the Nevada Natural Heritage Program should be consulted for site specific information. Site-specific investigations and species-specific surveys must be conducted for each project to determine whether sensitive environmental resources occur in a specific project area.

\*Potential habitat exists for the Mojave desert tortoise, western chuckwalla, banded Gila monster, migratory birds, protected bat species, and desert kit fox on undeveloped land throughout the study area.

\*Potential habitat for Gambel's Quail occurs in washes and wetland areas throughout the entire study area.

\*Rosy Twtone Beardtongue habitat also exists southwest of the Ultimate Development Boundary.

\*Cacti and yucca species occur on undeveloped land throughout the study area.

\*Wetlands are known to occur adjacent to the Las Vegas Wash in the eastern portion of the study area.

\*Dry ephemeral washes occur throughout the study area.

\*Sensitive cultural resources may occur throughout the study area.

\*Areas of Critical Environmental Concern (ACEC) are designated by the BLM "to protect and prevent irreparable damage to important historic, cultural, or scenic values, fish and wildlife resources or other natural systems or processes, or to protect life and safety from natural hazards". (Reference: Federal Land Policy And Management Act of 1976, 43 USC Sec. 1702).

SOURCES:

\*Bureau of Land Management (BLM). 2018. Online Geospatial Data. BLM NV Wilderness Study Areas Polygon. [https://navigator.blm.gov/data?keyword=national%20parks&fs\\_publicRegion=Nevada](https://navigator.blm.gov/data?keyword=national%20parks&fs_publicRegion=Nevada). Accessed March.

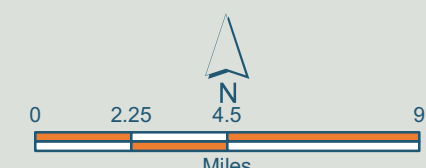
\*BLM. 2018. Online Geospatial Data. BLM NV Designated Areas of Critical Environmental Concern Polygons. [https://navigator.blm.gov/data?keyword=national%20parks&fs\\_publicRegion=Nevada](https://navigator.blm.gov/data?keyword=national%20parks&fs_publicRegion=Nevada). Accessed March.

\*BLM

\*Soils Based Habitat model. Matt Hamilton of EPG, Inc. under contract with BLM Las Vegas Field Office.

\*Gysiferous soils model. TetraSpectra Geomatics for Clark County Desert Conservation Program.

\*PBS&J. Clark County Regional Flood Control District 2008 Las Vegas Flood Control Master Plan Update. September 2008.



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TOPOGRAPHIC SYMBOLS AND LINETYPES

|  |                               |
|--|-------------------------------|
|  | 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 GAS                      |
|  | EXST WATER LINE               |
|  | EXST SEWER LINE               |
|  | EXST STORM DRAIN              |
|  | METER                         |
|  | FIRE HYDRANT                  |
|  | VALVE                         |
|  | BLOWOFF VALVE                 |
|  | AIR RELEASE VALVE             |
|  | BACKFLOW PREVENTER            |
|  | SWR MANHOLE                   |
|  | SEWER CLEANOUT                |
|  | STORM MANHOLE                 |
|  | TELEPHONE BOX                 |
|  | TELEPHONE MANHOLE             |
|  | FIBER BOX                     |
|  | CABLE TV BOX                  |
|  | ELECTRICAL MANHOLE            |
|  | STREET LIGHT BOX              |
|  | POWER POLE                    |
|  | SERVICE POLE                  |
|  | GUY WIRE                      |
|  | TRANSFORMER                   |
|  | STREET LIGHT CABINET          |
|  | STREET LIGHT                  |
|  | TRAFFIC SIGNAL                |
|  | TRAFFIC SIGNAL BOX            |
|  | AREA LIGHT                    |
|  | "L" TYPE CURB                 |
|  | "A" TYPE CURB                 |
|  | EDGE OF SIDEWALK              |
|  | CHAIN LINK FENCE              |
|  | WROUGHT IRON FENCE            |
|  | SWALE FLOW LINE               |
|  | SAWCUT                        |
|  | EXISTING                      |
|  | PROPOSED                      |

**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 32003C1769F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

**BENCHMARK**

CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLV9119N4 RIVET AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

ELEVATION: 899.658 METERS  
ELEVATION: 2295.461 U.S. SURVEY FEET  
NAVD 88

**BASIS OF BEARING**

S01°21'38"E 1395.11'  
PER BOOK 156, PAGE 94 OF PLATS

**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.

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Call 811

OR

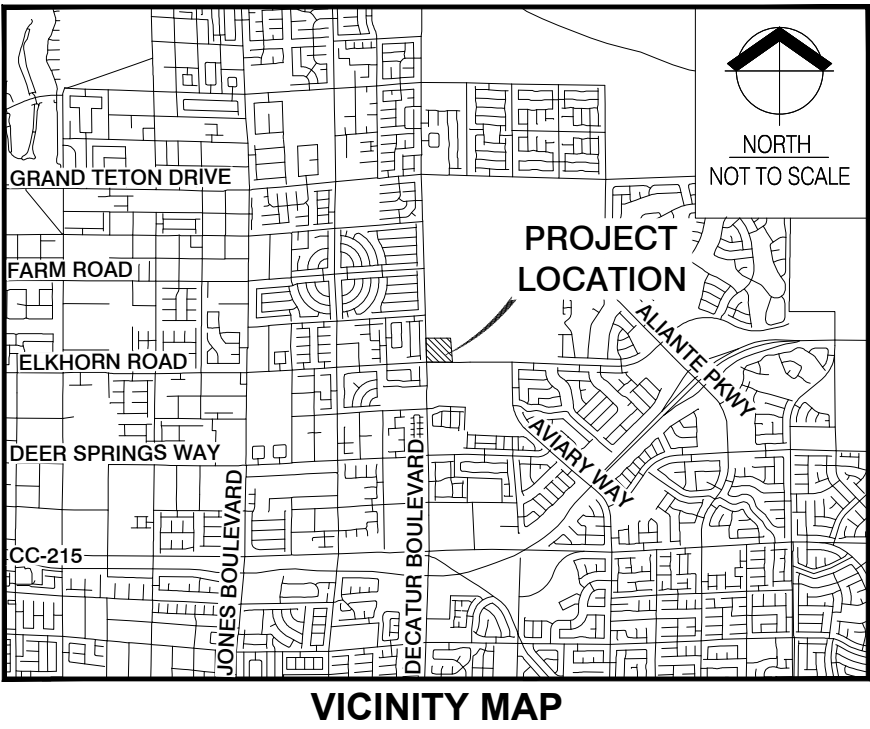
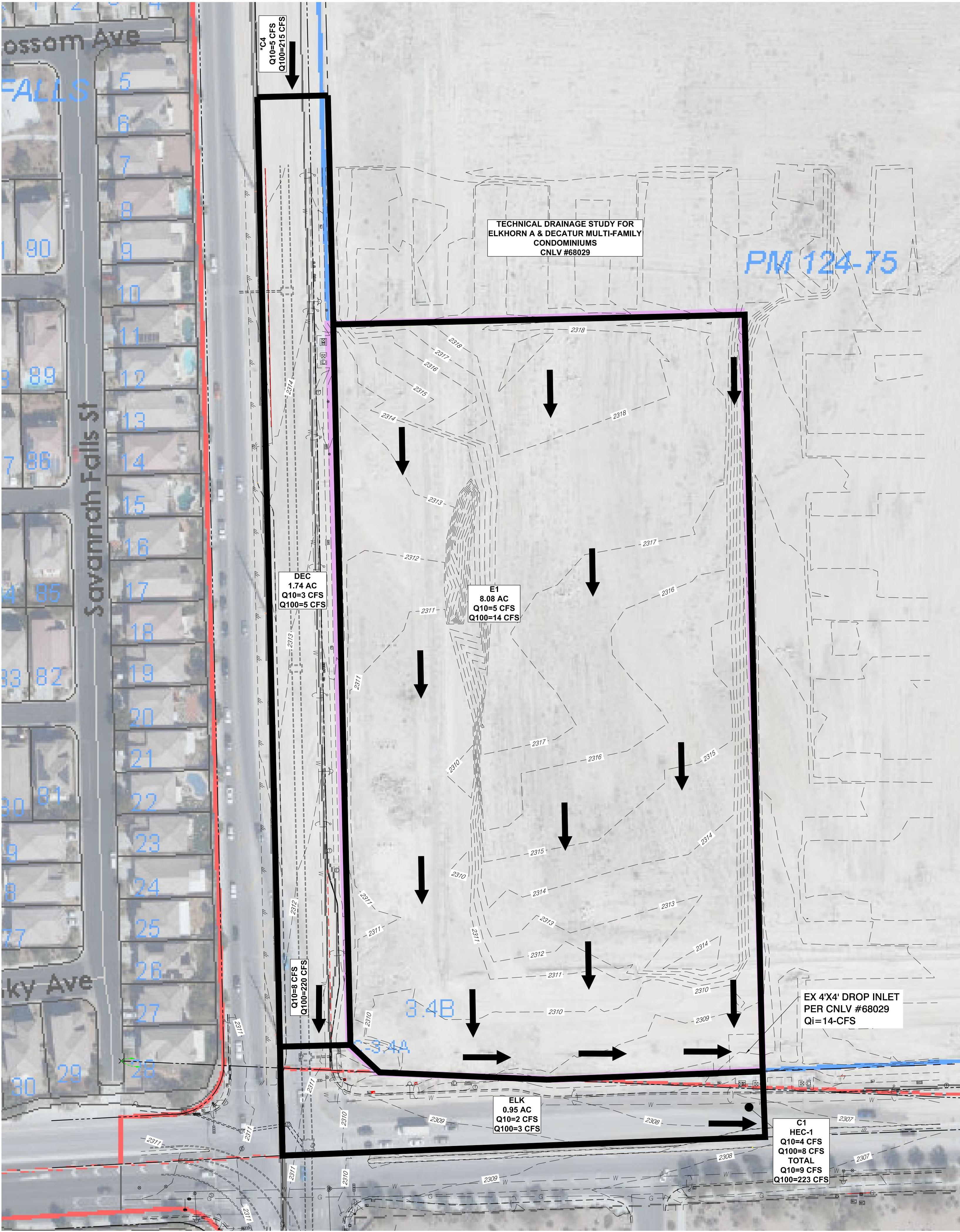
1-800-227-2600

**FAST**

Call before you UnderGround

1-702-432-5300

FREWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



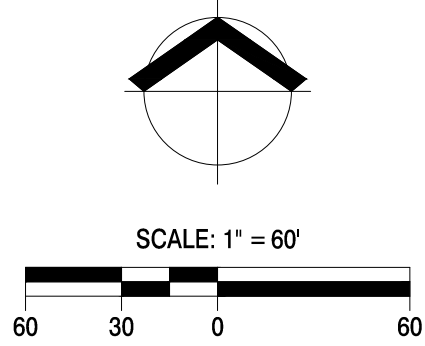
**LEGEND**

|  |                           |
|--|---------------------------|
|  | BASIN BOUNDARY LINE       |
|  | SUB-BASIN LABEL           |
|  | FLOW DIRECTION ARROW      |
|  | CONCENTRATION POINT LABEL |

**BASIN AREA Q10 Q100**

**CP Q10 Q100**

\*REFERENCED FROM: "TECHNICAL DRAINAGE STUDY FOR ELKHORN & DECATUR MULTI-FAMILY CONDOMINIUMS, CNLV #68029.



EXISTING CONDITION DRAINAGE SUMMARY TABLE

| Basin ID/Concentration Point | Area (ac) | Q10 (cfs) | Q100 (cfs) |
|------------------------------|-----------|-----------|------------|
| E1                           | 8.08      | 5         | 14         |
| *CP4                         | ---       | 5         | 215        |
| DEC                          | 1.74      | 3         | 5          |
| ELK                          | 0.95      | 2         | 3          |
| C1 (HEC-1)                   | ---       | 4         | 8          |
| C1 (TOTAL = *CP4 + C1)       | ---       | 9         | 223        |

\*CP4 referenced from "Technical Drainage Study for Elkhorn & Decatur Multi-Family Condominiums, CNLV #68029.

**EXISTING CONDITION DRAINAGE MAP**

**RIETZ CONSULTING INC.**

3203 E. WARM SPRINGS RD #400  
LAS VEGAS, NEVADA 89120  
PH: 702.521.3355

**UHS @ DECATUR & ELKHORN**

APN: 124-18-410-009  
NORTH LAS VEGAS, NEVADA

|                                  |             |             |                 |
|----------------------------------|-------------|-------------|-----------------|
| DATE: 5/5/2020                   | DRAFTER: JG | CHECKED: JM | SCALE: 1" = 60' |
| SHEET <b>FIG-5</b> 5 OF 7 SHEETS |             |             |                 |



TOPOGRAPHIC SYMBOLS AND LINETYPES

|  |                               |
|--|-------------------------------|
|  | 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 GAS                      |
|  | EXST WATER LINE               |
|  | EXST SEWER LINE               |
|  | EXST STORM DRAIN              |
|  | METER                         |
|  | FIRE HYDRANT                  |
|  | VALVE                         |
|  | BLOWOFF VALVE                 |
|  | AIR RELEASE VALVE             |
|  | BACKFLOW PREVENTER            |
|  | SWR MANHOLE                   |
|  | SEWER CLEANOUT                |
|  | STORM MANHOLE                 |
|  | TELEPHONE BOX                 |
|  | TELEPHONE MANHOLE             |
|  | FIBER BOX                     |
|  | CABLE TV BOX                  |
|  | ELECTRICAL MANHOLE            |
|  | STREET LIGHT BOX              |
|  | POWER POLE                    |
|  | SERVICE POLE                  |
|  | GUY WIRE                      |
|  | TRANSFORMER                   |
|  | STREET LIGHT CABINET          |
|  | STREET LIGHT                  |
|  | TRAFFIC SIGNAL                |
|  | TRAFFIC SIGNAL BOX            |
|  | AREA LIGHT                    |
|  | "L" TYPE CURB                 |
|  | "A" TYPE CURB                 |
|  | EDGE OF SIDEWALK              |
|  | CHAIN LINK FENCE              |
|  | WROUGHT IRON FENCE            |
|  | SWALE FLOW LINE               |
|  | SAWCUT                        |

**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 32003C1769F, CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

**BENCHMARK**

CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLV9119N4  
RIVET AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

ELEVATION: 899.858 METERS  
ELEVATION: 2295.461 U.S. SURVEY FEET  
NAVD 88

**BASIS OF BEARING**

S01°21'38"E 1355.11'  
PER BOOK 156, PAGE 94 OF PLATS

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OR

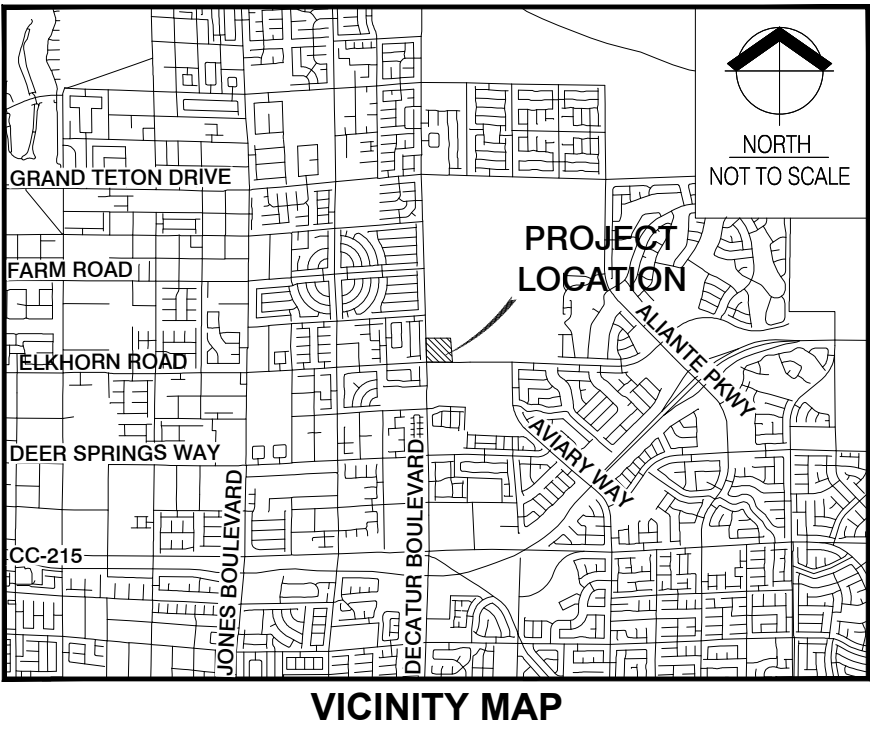
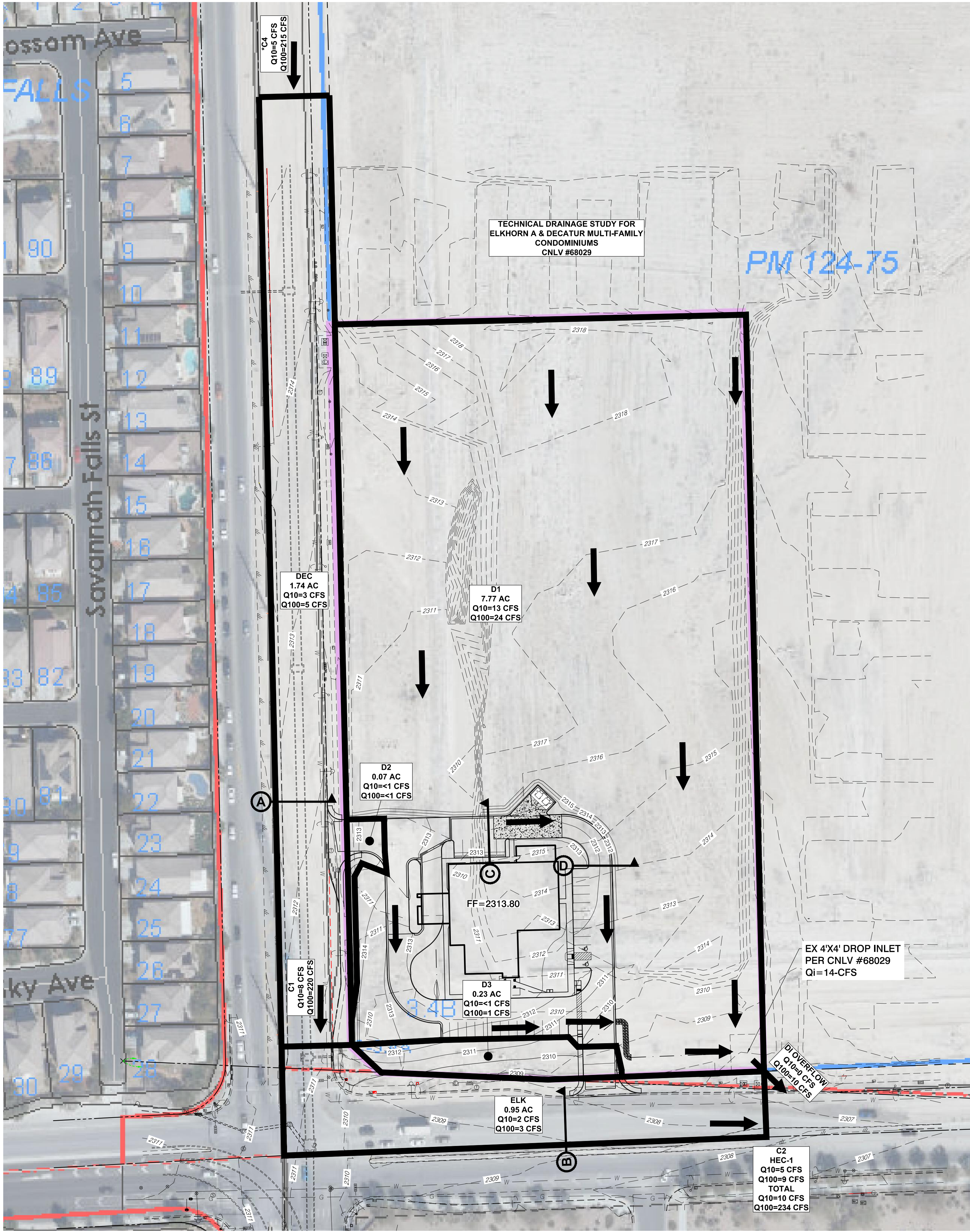
1-800-227-2600

**FAST**

Call before you UnderGround

1-702-432-5300

FREWAY AND ARTERIAL SYSTEM OF TRANSPORTATION



**LEGEND**

BASIN BOUNDARY LINE

SUB-BASIN LABEL

FLOW CROSS SECTION LOCATION

FLOW DIRECTION ARROW

CONCENTRATION POINT LABEL

**\*REFERENCED FROM: "TECHNICAL DRAINAGE STUDY FOR ELKHORN & DECATUR MULTI-FAMILY CONDOMINIUMS, CNLV #68029.**

**DEVELOPED CONDITION DRAINAGE SUMMARY TABLE**

| Basin ID/Concentration Point | Area (ac) | Q10 (cfs) | Q100 (cfs) |
|------------------------------|-----------|-----------|------------|
| D1                           | 7.77      | 13        | 24         |
| *C4                          | ---       | 5         | 215        |
| DEC                          | 1.74      | 3         | 5          |
| D2                           | 0.07      | <1        | <1         |
| C1 (HEC-1)                   | ---       | 3         | 5          |
| C1 TOTAL                     | ---       | 8         | 220        |
| ELK                          | 0.95      | 2         | 3          |
| D3                           | 0.23      | <1        | 1          |
| C2 (HEC-1)                   | ---       | 5         | 9          |
| **C2 TOTAL                   | ---       | 10        | 234        |

\*CP4 referenced from "Technical Drainage Study for Elkhorn & Decatur Multi-Family Condominiums, CNLV #68029.

\*\*C2 TOTAL = C2 (HEC-1) + 5/215 + 0/10 = 10/234

**DEVELOPED CONDITION FLOW SECTION SUMMARY TABLE**

| Section               | Q10 | Q100 | D10  | D100 | V10  | V100 | D*V10 | D*V100 |
|-----------------------|-----|------|------|------|------|------|-------|--------|
| A - Decatur Boulevard | 8   | 220  | 0.51 | 1.42 | 1.91 | 5.23 | 0.97  | 7.43   |
| B - Elkhorn Road      | 10  | 234  | 0.51 | 1.49 | 2.24 | 5.18 | 1.14  | 7.72   |
| C - Onsite Section    | N/A | 12   | N/A  | 0.50 | N/A  | 2.06 | N/A   | 1.03   |
| D - Onsite Section    | N/A | 12   | N/A  | 0.71 | N/A  | 2.43 | N/A   | 1.73   |

RIETZ CONSULTING INC.

3203 E. WARM SPRINGS RD #400  
LAS VEGAS, NEVADA 89120  
PH: 702.521.3355

**DEVELOPED CONDITION DRAINAGE MAP**

UHS @ DECATUR & ELKHORN  
APN: 124-18-410-009  
NORTH LAS VEGAS, NEVADA

DATE: 5/5/2020

DRAFTER: JG

CHECKED: JM

SCALE: 1" = 60'

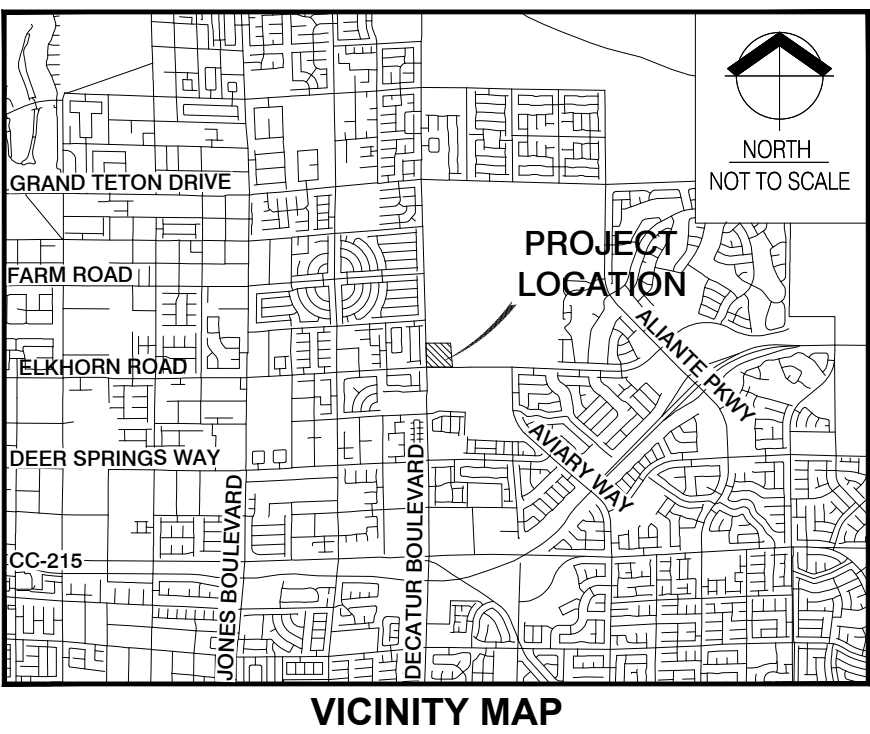
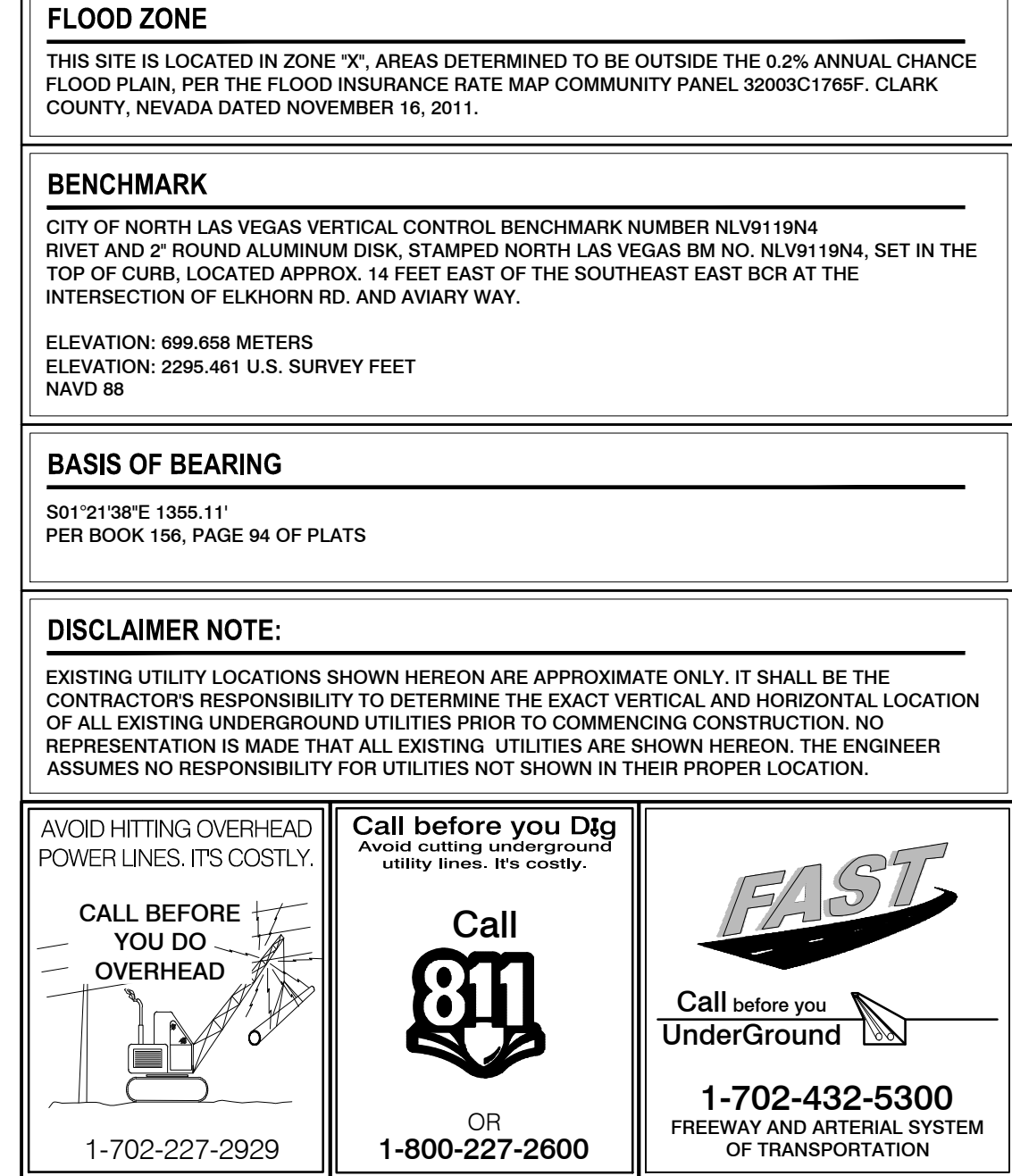
SHEET

**FIG-6**

SHEET 6 OF 7 SHEETS

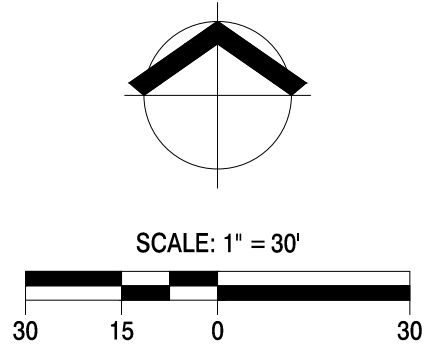


|                   |                               |
|-------------------|-------------------------------|
| =====             | PROPERTY BOUNDARY             |
| -----             | RIGHT-OF-WAY                  |
| =====             | PROPERTY LINE                 |
| -----             | CENTER LINE                   |
| -----             | EASEMENT                      |
| -----             | EXST "L" TYPE CURB            |
| -----             | EXST "A" TYPE CURB            |
| ----- 1900        | EXST MAJOR CONTOUR LINE       |
| ----- 1901        | EXST MINOR CONTOUR LINE       |
| =====             | EXST SCREEN WALL AS INDICATED |
| ----- 77 ----- 77 | EXST EDGE OF PAVEMENT         |
| -----             | EXST EDGE OF SIDEWALK         |
| ----- UGP         | EXST UNDERGROUND POWER        |
| ----- FO          | EXST FIBER OPTICS             |
| ----- G           | EXST GAS                      |
| ----- W           | EXST WATER LINE               |
| ----- SS          | EXST SEWER LINE               |
| ----- SD          | EXST STORM DRAIN              |



The diagram illustrates five symbols used in the model:

- BASIN BOUNDARY LINE:** A thick black horizontal line.
- SUB-BASIN LABEL:** A rectangular box containing the text "BASIN AREA", "Q10", and "Q100" stacked vertically.
- FLOW CROSS SECTION LOCATION:** A circle with the letter "A" inside, followed by a horizontal arrow pointing to the right.
- FLOW DIRECTION ARROW:** A large, thick black arrow pointing to the right.
- CONCENTRATION POINT LABEL:** A rectangular box containing the text "CP", "Q10", and "Q100" stacked vertically.



| Pavement Area Designation | Area (ac) | Treated |
|---------------------------|-----------|---------|
| AREA-1                    | 0.67      | Y       |
| NT-1                      | 0.04      | N       |
| NT-2                      | 0.04      | N       |
| TOTAL AREA:               | 0.75      |         |
| TOTAL TREATED AREA:       | 0.67      | 89%     |

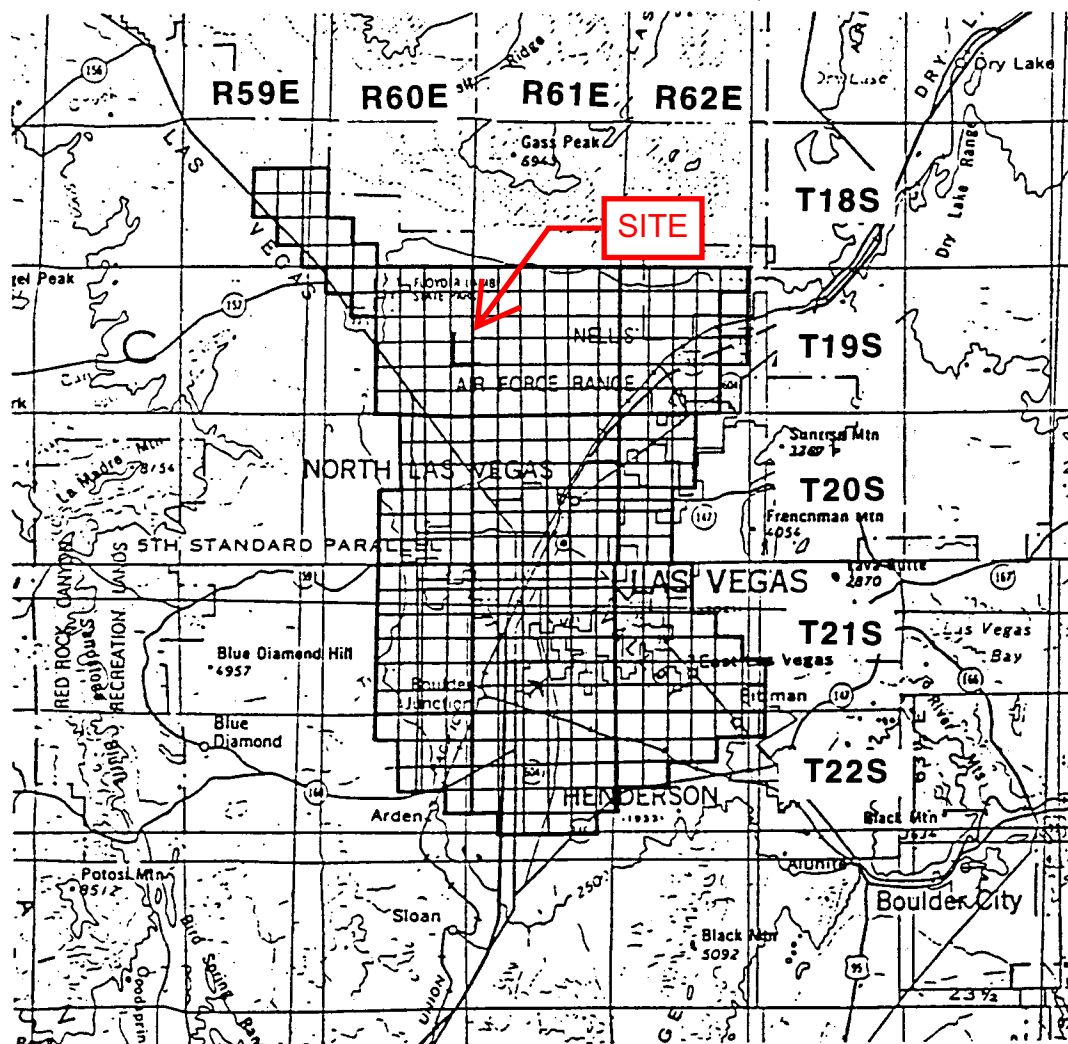


# APPENDIX A: HYDROLOGY

# HCDDM EXCERPTS

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## McCARRAN AIRPORT RAINFALL AREA



TOWNSHIP RANGE SECTIONS

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

TOWNSHIP RANGE SECTIONS

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

Notes:

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

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |

## SIX HOUR DEPTH-AREA REDUCTION FACTORS

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

- NOTES: 1. A graphical representation of these factors is presented in Figure 514.
2. Consult with the local entity and/or the CCRFCD for guidance in using the Depth-Area Reduction Factors for drainage areas greater than 200 square miles.

| <i>Revision</i> | <i>Date</i> |
|-----------------|-------------|
|                 |             |
|                 |             |
|                 |             |
|                 |             |



# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

## SIX-HOUR STORM DISTRIBUTIONS

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

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

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

REFERENCE:

TABLE 503

# HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

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

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

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

| Revision | Date |
|----------|------|
|          |      |
|          |      |
|          |      |
|          |      |

industrial, heavy industrial and commercial areas (land use categories 8 through 11) are assumed 100% fair condition desert shrub for the open space distribution. Parks/golf courses and schools (land use categories 2 and 12) are assumed 70% open landscaping (grass) in good condition and 30% fair condition desert shrub for the open space distribution. This 70%-30% split was determined after reviewing the Spring 2016 aerial imagery.

4. All designated right-of-way areas were categorized as public facility (land use category 7) to be consistent throughout the Las Vegas Valley.

It should be noted that undeveloped land, open desert (land use category 1) will continue to use 100% poor condition desert shrub (<30% ground cover).

The directly connected impervious area percentages and corresponding open space distribution of each land use category is presented in **Table 2-2**:

**Table 2-2 - Land Use Categories**

| Land Use Index | Land Use Description                                               | Impervious* (%) | Open Landscape Good Condition Grass (%) | Open Desert Shrub Fair Condition Natural Desert Landscaping (%) |
|----------------|--------------------------------------------------------------------|-----------------|-----------------------------------------|-----------------------------------------------------------------|
| 1              | Undeveloped Land, Open Desert                                      | 0               | 0                                       | 100**                                                           |
| 2              | Parks, Golf Courses                                                | 5               | 66.5                                    | 28.5                                                            |
| 3              | Rural, 0.5-1 units per acre (uses 1 unit/acre)                     | 20              | 40                                      | 40                                                              |
| 4              | Low-Density Residential, 1-2 units per acre (uses 2 units/acre)    | 25              | 37.5                                    | 37.5                                                            |
| 5              | Medium-Density Residential, 2-4 units per acre (uses 3 units/acre) | 30              | 35                                      | 35                                                              |
| 6              | High-Density residential, 4-8 units per acre (uses 6 units/acre)   | 52              | 24                                      | 24                                                              |
| 7              | Public Facility and Residential, 8-12 units/acre                   | 72              | 14                                      | 14                                                              |
| 8              | Very High-Density Residential, 12 units/acre or more               | 80              | 0                                       | 20                                                              |
| 9              | Commercial, Retail, Casino, High Rise Condominiums                 | 85              | 0                                       | 15                                                              |
| 10             | Light Industrial                                                   | 72              | 0                                       | 28                                                              |
| 11             | Heavy Industrial                                                   | 85              | 0                                       | 15                                                              |
| 12             | Schools                                                            | 50              | 35                                      | 15                                                              |
| 13             | Lakes                                                              | 0               | 0                                       | 0                                                               |

\* Impervious areas are directly connected to the drainage system  
 \*\* Open Desert Shrub Poor Condition is applied for Undeveloped Land, Open Desert (Land Use Index Number 1)

The land use data used with the 2018 MPU is shown on the W-Maps. **Figure 2-1** shows the geographic comparison between the 2018 and 2008 MPU land use coverages in terms of percent imperviousness. The increase or decrease in impervious area represents an increase or decrease, respectively, in the runoff potential for a given area.

Curve Number Matrix

| SOIL<br>MAP<br>UNIT | HYDROLOGIC SOIL GROUP |          |          |          |                 | LAND USE CATEGORY INDEX NUMBER |      |      |      |      |      |      |      |      |      |      |      |      |
|---------------------|-----------------------|----------|----------|----------|-----------------|--------------------------------|------|------|------|------|------|------|------|------|------|------|------|------|
|                     | A                     | B        | C        | D        | ROCK<br>OUTCROP | 1                              | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 10   | 11   | 12   | 13   |
|                     | CN ---->              | CN ----> | CN ----> | CN ----> | CN ---->        |                                |      |      |      |      |      |      |      |      |      |      |      |      |
|                     | %                     | %        | %        | %        | %               |                                |      |      |      |      |      |      |      |      |      |      |      |      |
| 1301                | 0                     | 0        | 0        | 100      | 0               | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 94.0 | 88.0 | 30.0 |
| 1305                | 5                     | 0        | 35       | 60       | 0               | 86.0                           | 79.0 | 83.0 | 84.0 | 85.0 | 89.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 88.0 | 30.0 |
| 1313                | 8                     | 68       | 0        | 24       | 0               | 79.0                           | 68.0 | 75.0 | 76.0 | 78.0 | 84.0 | 90.0 | 93.0 | 94.0 | 91.0 | 94.0 | 82.0 | 30.0 |
| 1314                | 80                    | 5        | 0        | 15       | 0               | 67.0                           | 53.0 | 62.0 | 65.0 | 67.0 | 77.0 | 86.0 | 91.0 | 92.0 | 88.0 | 92.0 | 74.0 | 30.0 |
| 1320                | 0                     | 2        | 0        | 83       | 15              | 88.0                           | 83.0 | 87.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1323                | 0                     | 0        | 0        | 85       | 15              | 88.0                           | 84.0 | 87.0 | 88.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 91.0 | 30.0 |
| 1325                | 100                   | 0        | 0        | 0        | 0               | 63.0                           | 47.0 | 57.0 | 60.0 | 62.0 | 74.0 | 84.0 | 89.0 | 92.0 | 86.0 | 92.0 | 71.0 | 30.0 |
| 1326                | 100                   | 0        | 0        | 0        | 0               | 63.0                           | 47.0 | 57.0 | 60.0 | 62.0 | 74.0 | 84.0 | 89.0 | 92.0 | 86.0 | 92.0 | 71.0 | 30.0 |
| 1340                | 9                     | 0        | 0        | 71       | 20              | 86.0                           | 81.0 | 85.0 | 85.0 | 86.0 | 90.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1341                | 0                     | 100      | 0        | 0        | 0               | 77.0                           | 66.0 | 73.0 | 74.0 | 76.0 | 83.0 | 89.0 | 93.0 | 94.0 | 91.0 | 94.0 | 81.0 | 30.0 |
| 1342                | 0                     | 7        | 0        | 78       | 15              | 88.0                           | 83.0 | 86.0 | 87.0 | 87.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1360                | 15                    | 0        | 0        | 35       | 50              | 85.0                           | 81.0 | 84.0 | 85.0 | 86.0 | 90.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1380                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1390                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1400                | 0                     | 0        | 0        | 100      | 0               | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1415                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1417                | 5                     | 0        | 55       | 10       | 30              | 86.0                           | 80.0 | 84.0 | 85.0 | 86.0 | 89.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1419                | 35                    | 0        | 55       | 10       | 0               | 78.0                           | 67.0 | 74.0 | 75.0 | 77.0 | 83.0 | 89.0 | 93.0 | 94.0 | 91.0 | 94.0 | 82.0 | 30.0 |
| 1440                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1450                | 1                     | 0        | 0        | 89       | 10              | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1484                | 0                     | 0        | 0        | 100      | 0               | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1500                | 60                    | 0        | 0        | 35       | 5               | 73.0                           | 61.0 | 69.0 | 71.0 | 73.0 | 81.0 | 88.0 | 92.0 | 93.0 | 89.0 | 93.0 | 79.0 | 30.0 |
| 1501                | 100                   | 0        | 0        | 0        | 0               | 63.0                           | 47.0 | 57.0 | 60.0 | 62.0 | 74.0 | 84.0 | 89.0 | 92.0 | 86.0 | 92.0 | 71.0 | 30.0 |
| 1502                | 60                    | 0        | 0        | 40       | 0               | 73.0                           | 61.0 | 69.0 | 71.0 | 72.0 | 80.0 | 88.0 | 92.0 | 93.0 | 89.0 | 93.0 | 79.0 | 30.0 |
| 1505                | 55                    | 0        | 0        | 40       | 5               | 74.0                           | 63.0 | 70.0 | 72.0 | 74.0 | 81.0 | 88.0 | 92.0 | 94.0 | 90.0 | 94.0 | 80.0 | 30.0 |
| 1506                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1508                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1510                | 10                    | 0        | 0        | 55       | 35              | 86.0                           | 82.0 | 85.0 | 86.0 | 87.0 | 90.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1540                | 100                   | 0        | 0        | 0        | 0               | 63.0                           | 47.0 | 57.0 | 60.0 | 62.0 | 74.0 | 84.0 | 89.0 | 92.0 | 86.0 | 92.0 | 71.0 | 30.0 |
| 1541                | 4                     | 0        | 0        | 76       | 20              | 87.0                           | 83.0 | 86.0 | 87.0 | 87.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1542                | 60                    | 0        | 30       | 10       | 0               | 72.0                           | 59.0 | 67.0 | 69.0 | 71.0 | 80.0 | 87.0 | 92.0 | 93.0 | 89.0 | 93.0 | 78.0 | 30.0 |
| 1545                | 60                    | 0        | 10       | 30       | 0               | 73.0                           | 60.0 | 68.0 | 70.0 | 72.0 | 80.0 | 88.0 | 92.0 | 93.0 | 89.0 | 93.0 | 78.0 | 30.0 |
| 1600                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1605                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1610                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1615                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1630                | 0                     | 0        | 0        | 100      | 0               | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1635                | 7                     | 0        | 5        | 63       | 25              | 87.0                           | 82.0 | 85.0 | 86.0 | 87.0 | 90.0 | 94.0 | 96.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1640                | 0                     | 0        | 0        | 10       | 90              | 90.0                           | 90.0 | 91.0 | 91.0 | 92.0 | 94.0 | 96.0 | 96.0 | 97.0 | 96.0 | 97.0 | 94.0 | 30.0 |
| 1645                | 0                     | 0        | 100      | 0        | 0               | 85.0                           | 77.0 | 82.0 | 83.0 | 84.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 95.0 | 87.0 | 30.0 |
| 1674                | 27                    | 26       | 0        | 45       | 2               | 78.0                           | 69.0 | 75.0 | 76.0 | 78.0 | 84.0 | 90.0 | 93.0 | 94.0 | 91.0 | 94.0 | 83.0 | 30.0 |
| 1700                | 0                     | 0        | 3        | 93       | 4               | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1710                | 2                     | 89       | 0        | 9        | 0               | 78.0                           | 67.0 | 74.0 | 75.0 | 77.0 | 83.0 | 89.0 | 93.0 | 94.0 | 91.0 | 94.0 | 82.0 | 30.0 |
| 1731                | 10                    | 2        | 0        | 88       | 0               | 85.0                           | 79.0 | 83.0 | 84.0 | 85.0 | 89.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 88.0 | 30.0 |
| 1732                | 3                     | 0        | 0        | 96       | 1               | 87.0                           | 82.0 | 85.0 | 86.0 | 87.0 | 90.0 | 94.0 | 95.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1753                | 0                     | 8        | 0        | 90       | 2               | 87.0                           | 81.0 | 85.0 | 86.0 | 87.0 | 90.0 | 93.0 | 95.0 | 96.0 | 94.0 | 96.0 | 89.0 | 30.0 |
| 1850                | 0                     | 0        | 0        | 94       | 6               | 88.0                           | 83.0 | 86.0 | 87.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 90.0 | 30.0 |
| 1853                | 0                     | 0        | 0        | 85       | 15              | 88.0                           | 84.0 | 87.0 | 88.0 | 88.0 | 91.0 | 94.0 | 96.0 | 96.0 | 95.0 | 96.0 | 91.0 | 30.0 |
| 1871                | 17                    | 0        | 0        | 83       | 0               | 84.0                           | 76.0 | 81.0 | 82.0 | 83.0 | 88.0 | 92.0 | 95.0 | 95.0 | 93.0 | 96.0 | 91.0 | 30.0 |
| 1999                | 100                   | 0        | 0        | 0        | 0               | 63.0                           | 47.0 | 57.0 | 60.0 | 62.0 | 74.0 | 84.0 | 89.0 | 92.0 | 86.0 | 92.0 | 71.0 | 30.0 |



# RAINFALL, CURVE NUMBERS AND STANDARD FORM 4

## Rainfall and Precipitation Computations

Project Name: UHS @ DECATUR & ELKHORN

By: jg



3203 E. Warm Springs Road #400  
Las Vegas NV 89120 Ph. 702-521-3355

### DATA:

Project is located in: Township: 19S Range: 61E

Site is located **WITHIN** the McCarren Airport Rainfall Area

*Figure 513\**

**10-YEAR DEPTH:** 1.58 " TABLE 505

**100-YEAR DEPTH:** 2.77 " TABLE 505

Six Hour Depth Reduction Factors (DARF):

*Table 502\**

Area (gross acres): 10 = 0.016 square miles  
DARF = 1.00

### Calculations:

$P_{10} =$  1.58 10-Year Precipitation (in)

$P_{100} =$  2.77 100-Year Precipitation (in)

$P_{10}/P_{100} =$  0.57 HEC-1 Multiple Ratio Value

### Equations:

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

## Soil & Curve Number Computations

Project Name: UHS @ DECATUR & ELKHORN

Date: 5/5/2020

By: JG



3203 E. Warm Springs Road #400  
Las Vegas NV 89120 Ph. 702-521-3355

### DATA:

---

| SOIL UNIT | Commercial CN | DESERT SHRUB | IMPERVIOUS<br>/ROW CN |
|-----------|---------------|--------------|-----------------------|
| 305       | 96            | 86           | 98                    |

| Subbasin | AREA | LANDUSE      | Cn   |
|----------|------|--------------|------|
| E1       | 8.08 | DESERT SHRUB | 86.0 |
| DEC      | 1.74 | ROW          | 98.0 |
| ELK      | 0.95 | ROW          | 98.0 |
| D1       | 7.77 | COMMERCIAL   | 96.0 |
| D2       | 0.07 | COMMERCIAL   | 96.0 |
| D3       | 0.23 | COMMERCIAL   | 96.0 |

# TIME OF CONCENTRATION AND HEC-1 INPUT

Project Name: UHS @ DECTUR & ELKHORN

Date: 5/5/2020

By: JG



3203 E. Warm Springs Road #400  
Las Vegas NV 89120 Ph. 702-521-3355

| SUB-BASIN DATA |                   |       |         | INITIAL/OVERLAND TIME (T <sub>i</sub> ) |                   |         | TRAVEL TIME (T <sub>t</sub> ) |                  |         |                          | T <sub>c</sub>           | T <sub>c</sub> CHECK (URBANIZED BASINS) |                      |                 |                      |       |       |
|----------------|-------------------|-------|---------|-----------------------------------------|-------------------|---------|-------------------------------|------------------|---------|--------------------------|--------------------------|-----------------------------------------|----------------------|-----------------|----------------------|-------|-------|
| KK             |                   | BA    |         |                                         |                   |         |                               |                  |         |                          |                          |                                         | UD LS                |                 |                      |       |       |
| Desig.         | DEV./EX. (D or E) | K     | AREA ac | AREA MI <sup>2</sup>                    | INITIAL LENGTH FT | SLOPE % | T <sub>i</sub> MIN.           | TRAVEL LENGTH FT | SLOPE % | V <sub>1</sub> VEL. FT/S | V <sub>2</sub> VEL. FT/S | T <sub>t</sub> MIN.                     | T <sub>c</sub> Calc. | TOTAL LENGTH FT | T <sub>c</sub> Check | TLAG3 | CN    |
|                |                   | [1]*  |         | [2]*                                    |                   |         | [3]*                          |                  |         | [4]*                     | [5]*                     | [6]*                                    |                      | [8]*            | [13]*                | [15]* | [16]* |
|                |                   |       |         |                                         |                   |         |                               |                  |         |                          |                          |                                         |                      |                 |                      |       |       |
| E1             | E                 | 0.745 | 8.08    | 0.01263                                 | 250               | 1.0     | 10.10                         | 750              | 0.6     | 1.15                     | 2.28                     | 9.10                                    | 19.20                | 1000            | N/A                  | 0.192 | 86.0  |
| DEC            | D                 | 0.904 | 1.74    | 0.00272                                 | 50                | 2.0     | 1.98                          | 1000             | 0.4     | 1.28                     | 1.94                     | 10.83                                   | 12.81                | 1050            | 15.83                | 0.128 | 98.0  |
| ELK            | D                 | 0.904 | 0.95    | 0.00148                                 | 50                | 2.0     | 1.98                          | 500              | 0.5     | 1.43                     | 2.16                     | 5.83                                    | 7.82                 | 550             | 13.06                | 0.078 | 98.0  |
| D1             | D                 | 0.877 | 7.77    | 0.01214                                 | 50                | 2.0     | 2.25                          | 750              | 0.6     | 1.56                     | 2.37                     | 7.08                                    | 9.33                 | 800             | 14.44                | 0.093 | 96.0  |
| D2             | D                 | 0.877 | 0.07    | 0.00011                                 | 25                | 2.0     | 1.59                          | 100              | 0.4     | 1.28                     | 1.94                     | 1.30                                    | 2.90                 | 125             | 10.69                | 0.050 | 96.0  |
| D3             | D                 | 0.877 | 0.23    | 0.00036                                 | 25                | 2.0     | 1.59                          | 100              | 0.6     | 1.56                     | 2.37                     | 1.07                                    | 2.66                 | 125             | 10.69                | 0.050 | 96.0  |

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



# EXISTING CONDITION HEC-1 ANALYSIS

ID  
 ID TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN  
 ID NORTH LAS VEGAS, NEVADA  
 ID

ID PREPARED BY:  
 ID Rietz Consulting, Inc.  
 ID 3203 E. WARM SPRINGS #400  
 ID LAS VEGAS, NV 89120  
 ID

ID FILENAME:UHS-DE-E.TXT  
 ID

ID  
 ID  
 ID \*DIAGRAM

IT 5 0 0 300

IO 5

IN 5

JR PREC 0.57 1.00

\*

KK E1

KM BASIN E1 DRAINS TO SOUTHEAST CORNER TO EX DROP INLET

BA.01263

PB 2.77

PC .000 .020 .057 .070 .087 .108 .124 .130 .130 .130

PC .130 .130 .130 .133 .140 .142 .148 .158 .172 .181

PC .190 .197 .199 .200 .201 .204 .214 .229 .241 .249

PC .251 .256 .270 .278 .281 .283 .295 .322 .352 .409

PC .499 .590 .710 .744 .781 .812 .819 .835 .851 .856

PC .860 .868 .876 .888 .910 .926 .937 .950 .970 .976

PC .982 .985 .987 .989 .990 .993 .993 .994 .995 .998

PC .998 .999 1.00

LS 0 86.0

UD 0.192

\*

KK DEC

KM BASIN DEC FOR DECATUR ADJACENT TO SITE

BA.00272

LS 0 98.0

UD 0.128

\*

KK ELK

KM BASIN ELK FOR ELKHORN ADJACENT TO SITE

BA.00148

LS 0 98.0

UD 0.078

\*

KK C1

KM COMBINE DEC AND ELK IN ELKHORN

HC 2

\*

ZZ

```
1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 05MAY20 TIME 08:43:07
*
*****
*
* U.S. ARMY CORPS OF ENGINEERS
* HYDROLOGIC ENGINEERING CENTER
* 609 SECOND STREET
* DAVIS, CALIFORNIA 95616
* (916) 756-1104
*
*****
```

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X X XXXXXXXX XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X XXXX X
X X X X X X
X X X X X X
X X XXXXXXXX XXXX XXX
```

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

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

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN
3 ID NORTH LAS VEGAS, NEVADA
4 ID
5 ID PREPARED BY:
6 ID Rietz Consulting, Inc.
7 ID 3203 E. WARM SPRINGS #400
8 ID LAS VEGAS, NV 89120
9 ID
10 ID FILENAME:UHS-DE-E.TXT
11 ID
12 ID
```

|    |          |                                                      |      |      |      |      |      |      |
|----|----------|------------------------------------------------------|------|------|------|------|------|------|
| 13 | *DIAGRAM | 5                                                    | 0    | 0    | 300  |      |      |      |
| 14 | IT       | 5                                                    |      |      |      |      |      |      |
| 15 | IO       | 5                                                    |      |      |      |      |      |      |
| 16 | IN       | 5                                                    |      |      |      |      |      |      |
|    | JR       | PREC                                                 | 0.57 | 1.00 |      |      |      |      |
|    | *        |                                                      |      |      |      |      |      |      |
| 17 | KK       | E1                                                   |      |      |      |      |      |      |
| 18 | KM       | BASIN E1 DRAINS TO SOUTHEAST CORNER TO EX DROP INLET |      |      |      |      |      |      |
| 19 | BA       | .01263                                               |      |      |      | .130 | .130 | .130 |
| 20 | PB       | 2.77                                                 |      |      |      |      |      |      |
| 21 | PC       | .000                                                 | .020 | .057 | .070 | .087 | .108 | .124 |
| 22 | PC       | .130                                                 | .130 | .133 | .140 | .140 | .142 | .148 |
| 23 | PC       | .190                                                 | .197 | .199 | .200 | .201 | .204 | .214 |
| 24 | PC       | .251                                                 | .256 | .270 | .278 | .281 | .283 | .295 |
| 25 | PC       | .499                                                 | .590 | .710 | .744 | .781 | .812 | .819 |
| 26 | PC       | .860                                                 | .868 | .876 | .888 | .910 | .926 | .937 |
| 27 | PC       | .982                                                 | .985 | .987 | .989 | .990 | .993 | .993 |
| 28 | PC       | .998                                                 | .999 | 1.00 |      |      |      |      |
| 29 | LS       | 0                                                    | 86.0 |      |      |      |      |      |
| 30 | UD       | 0.192                                                |      |      |      |      |      |      |
|    | *        |                                                      |      |      |      |      |      |      |
| 31 | KK       | DEC                                                  |      |      |      |      |      |      |
| 32 | KM       | BASIN DEC FOR DECATUR ADJACENT TO SITE               |      |      |      |      |      |      |
| 33 | BA       | .00272                                               |      |      |      |      |      |      |
| 34 | LS       | 0                                                    | 98.0 |      |      |      |      |      |
| 35 | UD       | 0.128                                                |      |      |      |      |      |      |
|    | *        |                                                      |      |      |      |      |      |      |
| 36 | KK       | ELK                                                  |      |      |      |      |      |      |
| 37 | KM       | BASIN ELK FOR ELKHORN ADJACENT TO SITE               |      |      |      |      |      |      |
| 38 | BA       | .00148                                               |      |      |      |      |      |      |
| 39 | LS       | 0                                                    | 98.0 |      |      |      |      |      |
| 40 | UD       | 0.078                                                |      |      |      |      |      |      |
|    | *        |                                                      |      |      |      |      |      |      |
| 41 | KK       | C1                                                   |      |      |      |      |      |      |
| 42 | KM       | COMBINE DEC AND ELK IN ELKHORN                       |      |      |      |      |      |      |
| 43 | HC       | 2                                                    |      |      |      |      |      |      |
|    | *        |                                                      |      |      |      |      |      |      |
| 44 | ZZ       |                                                      |      |      |      |      |      |      |

1

SCHEMATIC DIAGRAM OF STREAM NETWORK

INPUT LINE

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

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

17 E1



.  
. .  
31 . DEC  
. .  
. .  
36 . ELK  
. .  
. .  
41 . CI.....

(\*\*\*) RUNOFF ALSO COMPUTED AT THIS LOCATION

1\*\*\*\*\*  
\*  
\* FLOOD HYDROGRAPH PACKAGE (HEC-1) \*  
\* JUN 1998 \*  
\* VERSION 4.1 \*  
\*  
\* RUN DATE 05MAY20 TIME 08:43:07 \*  
\*  
\*\*\*\*\*  
\*  
\* U.S. ARMY CORPS OF ENGINEERS \*  
\* HYDROLOGIC ENGINEERING CENTER \*  
\* 609 SECOND STREET \*  
\* DAVIS, CALIFORNIA 95616 \*  
\* (916) 756-1104 \*  
\*  
\*\*\*\*\*

TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN  
NORTH LAS VEGAS, NEVADA

PREPARED BY: Rietz Consulting, Inc.  
3203 E. WARM SPRINGS #400  
LAS VEGAS, NV 89120

FILENAME:UHS-DE-E.TXT

14 IO OUTPUT CONTROL VARIABLES  
IPRNT 5 PRINT CONTROL  
IPLOT 0 PLOT CONTROL  
QSCAL 0. HYDROGRAPH PLOT SCALE  
  
IT HYDROGRAPH TIME DATA  
NMIN 5 MINUTES IN COMPUTATION INTERVAL  
IDATE 1 0 STARTING DATE  
ITIME 0000 STARTING TIME  
NQ 300 NUMBER OF HYDROGRAPH ORDINATES  
NDDATE 2 0 ENDING DATE  
NDTIME 0055 ENDING TIME

ICENT 19 CENTURY MARK

COMPUTATION INTERVAL .08 HOURS  
TOTAL TIME BASE 24.92 HOURS

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

JP MULTI-PLAN OPTION  
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION  
RATIOS OF PRECIPITATION  
.57 1.00

1

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

| OPERATION          | STATION | AREA | PLAN | RATIOS APPLIED TO PRECIPITATION |                        |
|--------------------|---------|------|------|---------------------------------|------------------------|
|                    |         |      |      | RATIO 1                         | RATIO 2                |
| HYDROGRAPH AT<br>+ | E1      | .01  | 1    | FLOW<br>TIME                    | 5.<br>14.<br>3.67 3.58 |
|                    | DEC     | .00  | 1    | FLOW<br>TIME                    | 3.<br>5.<br>3.58 3.58  |
| HYDROGRAPH AT<br>+ | ELK     | .00  | 1    | FLOW<br>TIME                    | 2.<br>3.<br>3.50 3.50  |
|                    | C1      | .00  | 1    | FLOW<br>TIME                    | 4.<br>8.<br>3.50 3.50  |

2 COMBINED AT  
+  
\*\*\* NORMAL END OF HEC-1 \*\*\*

# DEVELOPED CONDITION HEC-1 ANALYSIS

ID  
 ID TECHNICAL DRAINAGE STUDY FOR UHS @ DECATUR & ELKHORN  
 ID NORTH LAS VEGAS, NEVADA  
 ID

ID PREPARED BY:  
 ID Rietz Consulting, Inc.  
 ID 3203 E. WARM SPRINGS #400  
 ID LAS VEGAS, NV 89120  
 ID

ID FILENAME:UHS-DE-D.TXT  
 ID

ID  
 ID  
 ID \*DIAGRAM

IT 5 0 0 300  
 IO 5  
 IN 5  
 JR PREC 0.57 1.00  
 \*

KK D1  
 KM BASIN D1 DRAINS TO SOUTHEAST CORNER TO EX DROP INLET  
 BA.01214

PB 2.77  

|         |      |      |      |      |      |      |      |      |      |
|---------|------|------|------|------|------|------|------|------|------|
| PC .000 | .020 | .057 | .070 | .087 | .108 | .124 | .130 | .130 | .130 |
| PC .130 | .130 | .130 | .133 | .140 | .142 | .148 | .158 | .172 | .181 |
| PC .190 | .197 | .199 | .200 | .201 | .204 | .214 | .229 | .241 | .249 |
| PC .251 | .256 | .270 | .278 | .281 | .283 | .295 | .322 | .352 | .409 |
| PC .499 | .590 | .710 | .744 | .781 | .812 | .819 | .835 | .851 | .856 |
| PC .860 | .868 | .876 | .888 | .910 | .926 | .937 | .950 | .970 | .976 |
| PC .982 | .985 | .987 | .989 | .990 | .993 | .993 | .994 | .995 | .998 |
| PC .998 | .999 | 1.00 |      |      |      |      |      |      |      |
| LS 0    | 96.0 |      |      |      |      |      |      |      |      |

UD 0.093  
 \*

KK DEC  
 KM BASIN DEC FOR DECATUR ADJACENT TO SITE  
 BA.00272

LS 0 98.0  
 UD 0.128  
 \*

KK D2  
 KM AREA THAT DRAINS TO DECATUR  
 BA.00011

LS 0 96.0  
 UD 0.050  
 \*

KK C1  
 KM COMBINE DEC AND D2 IN DECATUR  
 HC 2

\*

KK ELK  
 KM BASIN ELK FOR ELKHORN ADJACENT TO SITE  
 BA.00148

LS 0 98.0  
 UD 0.078  
 \*

KK D3  
 KM AREA THAT DRAINS TO ELKHORN  
 BA.00036

LS 0 96.0  
 UD 0.050  
 \*

KK C2  
 KM COMBINE C1, D3 AND ELK IN ELKHORN  
 HC 3

\*

ZZ



```
1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1)
* JUN 1998
* VERSION 4.1
*
* RUN DATE 07MAY20 TIME 08:52:10
*
*****
*
*****
*
* 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 XXXX X
X X X X X XX
X X X X X X
XXXXXX XXXX X
X X X X X XXXX
X X X X X X
X X XXXXXXXX XXXX XXX
```

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

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

THE DEFINITION OF -AMSKK- ON RM-CARD WAS CHANGED WITH REVISIONS DATED 28 SEP 81. THIS IS THE FORTRAN77 VERSION

NEW OPTIONS: DAMBREAK OUTFLOW SUBMERGENCE , SINGLE EVENT DAMAGE CALCULATION, DSS:WRITE STAGE FREQUENCY,

DSS:READ TIME SERIES AT DESIRED CALCULATION INTERVAL LOSS RATE:GREEN AND AMPT INFILTRATION

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

```

LINE ID.....1.....2.....3.....4.....5.....6.....7.....8.....9.....10
1 ID
2 ID TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN
3 ID NORTH LAS VEGAS, NEVADA
4 ID
5 ID PREPARED BY:
6 ID Rietz Consulting, Inc.
7 ID 3203 E. WARM SPRINGS #400
8 ID LAS VEGAS, NV 89120
9 ID
10 ID FILENAME:UHS-DE-D.TXT
11 ID
12 ID
```

[illegible]

```

48      UD      0.078
      *
49      KK      D3
50      KM      AREA THAT DRAINS TO ELKHORN
51      BA      .00036
52      LS      0      96.0
53      UD      0.050
      *
54      KK      C2
55      KM      COMBINE C1, D3 AND ELK IN ELKHORN
56      HC      3
      *
57      ZZ

```

SCHEMATIC DIAGRAM OF STREAM NETWORK

| INPUT<br>LINE | (V) ROUTING   | (--->) DIVERSION OR PUMP FLOW            |
|---------------|---------------|------------------------------------------|
| NO.           | (.) CONNECTOR | (<---) RETURN OF DIVERTED OR PUMPED FLOW |
| 17            | D1            |                                          |
| 31            | DEC           |                                          |
| 36            | D2            |                                          |
| 41            | C1.....       |                                          |
| 44            | ELK           |                                          |
| 49            | D3            |                                          |
| 54            | C2.....       |                                          |

(\*\*\*) RUNOFF ALSO COMPUTED AT THIS LOCATION

```

1*****
*
* FLOOD HYDROGRAPH PACKAGE (HEC-1) *
* JUN 1998 *
* VERSION 4.1 *
*
* RUN DATE 07MAY20 TIME 08:52:10 *
*
*****
*
* U.S. ARMY CORPS OF ENGINEERS *
* HYDROLOGIC ENGINEERING CENTER *
* 609 SECOND STREET *
* DAVIS, CALIFORNIA 95616 *
* (916) 756-1104 *
*

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TECHNICAL DRAINAGE STUDY FOR UHS @ DECTUR & ELKHORN  
NORTH LAS VEGAS, NEVADA

PREPARED BY: Rietz Consulting, Inc.  
3203 E. WARM SPRINGS #400  
LAS VEGAS, NV 89120

FILENAME:UHS-DE-D.TXT

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

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

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 1 NUMBER OF PLANS  
NPLAN

JR MULTI-RATIO OPTION

RATIOS OF PRECIPITATION  
.57 1.00

1

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

| OPERATION     | STATION | AREA | PLAN | RATIOS APPLIED TO PRECIPITATION |         |      |  |
|---------------|---------|------|------|---------------------------------|---------|------|--|
|               |         |      |      | RATIO 1                         | RATIO 2 |      |  |
|               |         |      |      | .57                             | 1.00    |      |  |
| HYDROGRAPH AT | D1      | .01  | 1    | FLOW                            | 13.     | 24.  |  |
| +             |         |      |      | TIME                            | 3.50    | 3.50 |  |
| HYDROGRAPH AT | DEC     | .00  | 1    | FLOW                            | 3.      | 5.   |  |
| +             |         |      |      | TIME                            | 3.58    | 3.58 |  |
| HYDROGRAPH AT | D2      | .00  | 1    | FLOW                            | 0.      | 0.   |  |
| +             |         |      |      | TIME                            | 3.50    | 3.50 |  |
| 2 COMBINED AT | C1      | .00  | 1    | FLOW                            | 3.      | 5.   |  |
| +             |         |      |      | TIME                            | 3.58    | 3.58 |  |
| HYDROGRAPH AT | ELK     | .00  | 1    | FLOW                            | 2.      | 3.   |  |
| +             |         |      |      | TIME                            | 3.50    | 3.50 |  |
| HYDROGRAPH AT | D3      | .00  | 1    | FLOW                            | 0.      | 1.   |  |
| +             |         |      |      | TIME                            | 3.50    | 3.50 |  |
| 3 COMBINED AT | C2      | .00  | 1    | FLOW                            | 5.      | 9.   |  |
| +             |         |      |      | TIME                            | 3.50    | 3.50 |  |

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



## APPENDIX B: HYDRAULICS

## Worksheet for SECTION A 10-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                      8.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2313.31        |
| 0+06.42      | 2313.32        |
| 0+06.92      | 2313.32        |
| 0+07.02      | 2312.81        |
| 0+53.12      | 2312.00        |
| 0+54.59      | 2311.84        |
| 0+54.59      | 2312.34        |
| 0+55.09      | 2312.34        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2313.31) | (0+55.09, 2312.34) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.51    ft  
Elevation Range                                              2311.84 to 2313.32 ft  
Flow Area                                                      4.19    ft<sup>2</sup>  
Wetted Perimeter                                              22.58    ft  
Hydraulic Radius                                              0.19    ft

---

## Worksheet for SECTION A 10-YR

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 22.05       | ft    |
| Normal Depth    | 0.51        | ft    |
| Critical Depth  | 0.47        | ft    |
| Critical Slope  | 0.00690     | ft/ft |
| Velocity        | 1.91        | ft/s  |
| Velocity Head   | 0.06        | ft    |
| Specific Energy | 0.57        | ft    |
| Froude Number   | 0.77        |       |
| 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        | 0.51     | ft    |
| Critical Depth      | 0.47     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00690  | ft/ft |

## Cross Section for SECTION A 10-YR

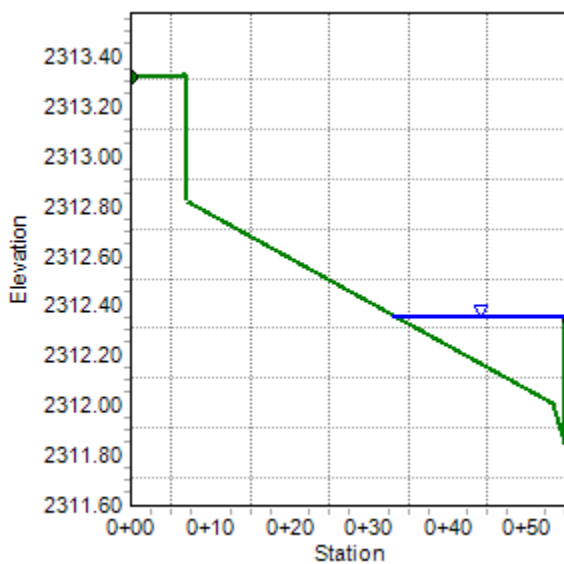
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 0.51    | ft                 |
| Discharge     | 8.00    | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION A 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                 220.00    ft³/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2313.31        |
| 0+06.42      | 2313.32        |
| 0+06.92      | 2313.32        |
| 0+07.02      | 2312.81        |
| 0+53.12      | 2312.00        |
| 0+54.59      | 2311.84        |
| 0+54.59      | 2312.34        |
| 0+55.09      | 2312.34        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2313.31) | (0+55.09, 2312.34) | 0.016                 |

### Options

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

### Results

Normal Depth                                              1.42    ft  
Elevation Range                                              2311.84 to 2313.32 ft  
Flow Area                                                      42.03    ft²  
Wetted Perimeter                                              49.97    ft  
Hydraulic Radius                                              0.84    ft



---

## Worksheet for SECTION A 100-YR

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Top Width       | 48.16       | ft    |
| Normal Depth    | 1.42        | ft    |
| Critical Depth  | 1.42        | ft    |
| Critical Slope  | 0.00411     | ft/ft |
| Velocity        | 5.23        | ft/s  |
| Velocity Head   | 0.43        | ft    |
| Specific Energy | 1.85        | ft    |
| Froude Number   | 0.99        |       |
| 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        | 1.42     | ft    |
| Critical Depth      | 1.42     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00411  | ft/ft |

## Cross Section for SECTION A 100-YR

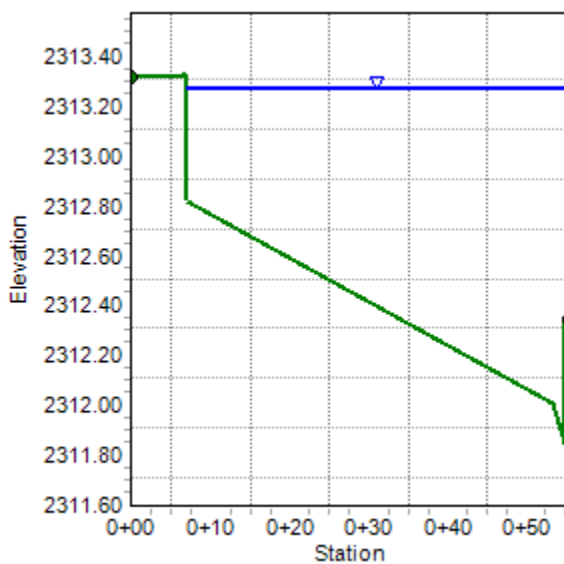
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 1.42    | ft                 |
| Discharge     | 220.00  | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION B 10-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00450    ft/ft  
Discharge                                                 10.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2309.89        |
| 0+00.58      | 2309.89        |
| 0+00.58      | 2309.42        |
| 0+56.49      | 2308.16        |
| 0+57.97      | 2308.06        |
| 0+57.97      | 2308.56        |
| 0+58.47      | 2308.56        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2309.89) | (0+58.47, 2308.56) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.51    ft  
Elevation Range                                              2308.06 to 2309.89 ft  
Flow Area                                                      4.47    ft<sup>2</sup>  
Wetted Perimeter                                              20.82    ft  
Hydraulic Radius                                              0.21    ft  
Top Width                                                      20.30    ft

---

## Worksheet for SECTION B 10-YR

---

### Results

|                 |             |       |
|-----------------|-------------|-------|
| Normal Depth    | 0.51        | ft    |
| Critical Depth  | 0.48        | ft    |
| Critical Slope  | 0.00650     | ft/ft |
| Velocity        | 2.24        | ft/s  |
| Velocity Head   | 0.08        | ft    |
| Specific Energy | 0.59        | ft    |
| Froude Number   | 0.84        |       |
| 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        | 0.51     | ft    |
| Critical Depth      | 0.48     | ft    |
| Channel Slope       | 0.00450  | ft/ft |
| Critical Slope      | 0.00650  | ft/ft |

## Cross Section for SECTION B 10-YR

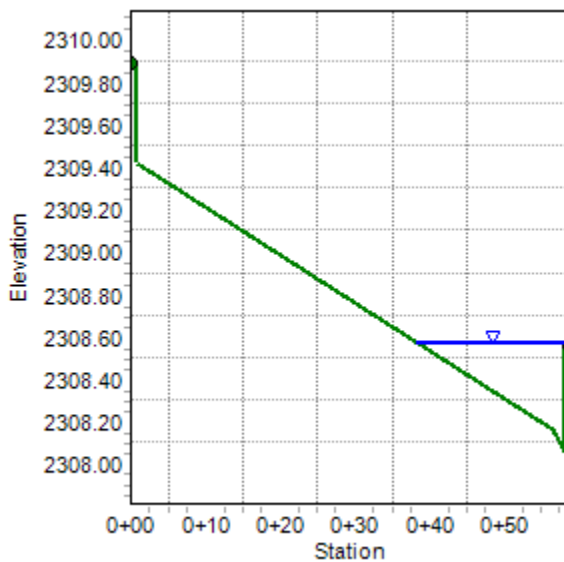
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00450 | ft/ft              |
| Normal Depth  | 0.51    | ft                 |
| Discharge     | 10.00   | ft <sup>3</sup> /s |

### Cross Section Image





## Worksheet for SECTION B 100-YR

## Project Description

| Friction Method | Manning Formula |
|-----------------|-----------------|
|-----------------|-----------------|

Solve For Normal Depth

## Input Data

|               |         |       |
|---------------|---------|-------|
| Channel Slope | 0.00450 | ft/ft |
|---------------|---------|-------|

|           |        |                    |
|-----------|--------|--------------------|
| Discharge | 234.00 | ft <sup>3</sup> /s |
|-----------|--------|--------------------|

## Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2309.89        |
| 0+00.58      | 2309.89        |
| 0+00.58      | 2309.42        |
| 0+56.49      | 2308.16        |
| 0+57.97      | 2308.06        |
| 0+57.97      | 2308.56        |
| 0+58.47      | 2308.56        |

## Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2309.89) | (0+58.47, 2308.56) | 0.016                 |

## Options

Current Roughness weighted      Pavlovskii's Method

Open Channel Weighting Method      Pavlovskii's Method

Closed Channel Weighting Method      Pavlovskii's Method

## Results

Normal Depth 1.49 ft

|                 |                       |
|-----------------|-----------------------|
| Elevation Range | 2308.06 to 2309.89 ft |
|-----------------|-----------------------|

|           |       |                 |
|-----------|-------|-----------------|
| Flow Area | 45.16 | ft <sup>2</sup> |
|-----------|-------|-----------------|

|                  |       |    |
|------------------|-------|----|
| Wetted Perimeter | 59.53 | ft |
|------------------|-------|----|

|                  |      |    |
|------------------|------|----|
| Hydraulic Radius | 0.76 | ft |
|------------------|------|----|

|           |       |    |
|-----------|-------|----|
| Top Width | 57.89 | ft |
|-----------|-------|----|

---

## Worksheet for SECTION B 100-YR

---

### Results

|                 |               |       |
|-----------------|---------------|-------|
| Normal Depth    | 1.49          | ft    |
| Critical Depth  | 1.51          | ft    |
| Critical Slope  | 0.00418       | ft/ft |
| Velocity        | 5.18          | ft/s  |
| Velocity Head   | 0.42          | ft    |
| Specific Energy | 1.91          | ft    |
| Froude Number   | 1.03          |       |
| 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        | 1.49     | ft    |
| Critical Depth      | 1.51     | ft    |
| Channel Slope       | 0.00450  | ft/ft |
| Critical Slope      | 0.00418  | ft/ft |

## Cross Section for SECTION B 100-YR

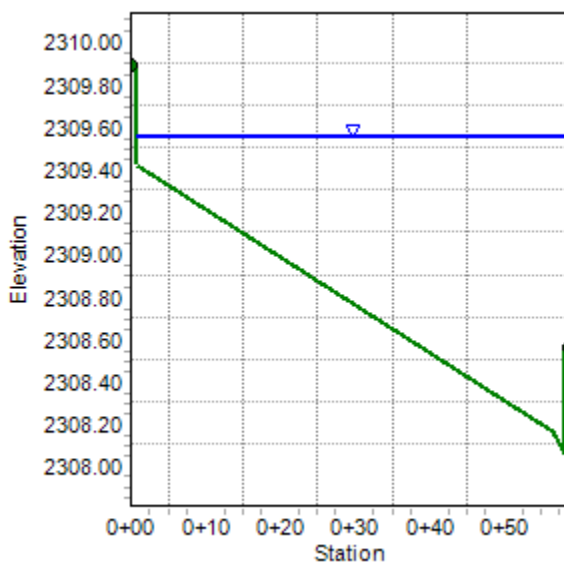
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00450 | ft/ft              |
| Normal Depth  | 1.49    | ft                 |
| Discharge     | 234.00  | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION C 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                12.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2313.80        |
| 0+06.17      | 2313.68        |
| 0+06.67      | 2313.68        |
| 0+06.67      | 2313.18        |
| 0+25.68      | 2312.54        |
| 0+48.18      | 2312.33        |
| 0+49.67      | 2312.16        |
| 0+49.67      | 2312.66        |
| 0+50.17      | 2312.66        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2313.80) | (0+50.17, 2312.66) | 0.016                 |

### Options

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

### Results

Normal Depth                                              0.50    ft  
Elevation Range                                              2312.16 to 2313.80 ft  
Flow Area                                                      5.82    ft<sup>2</sup>  
Wetted Perimeter                                              27.98    ft

---

## Worksheet for SECTION C 100-YR

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.21        | ft    |
| Top Width        | 27.47       | ft    |
| Normal Depth     | 0.50        | ft    |
| Critical Depth   | 0.46        | ft    |
| Critical Slope   | 0.00670     | ft/ft |
| Velocity         | 2.06        | ft/s  |
| Velocity Head    | 0.07        | ft    |
| Specific Energy  | 0.56        | ft    |
| Froude Number    | 0.79        |       |
| 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        | 0.50     | ft    |
| Critical Depth      | 0.46     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00670  | ft/ft |



## Cross Section for SECTION C 100-YR

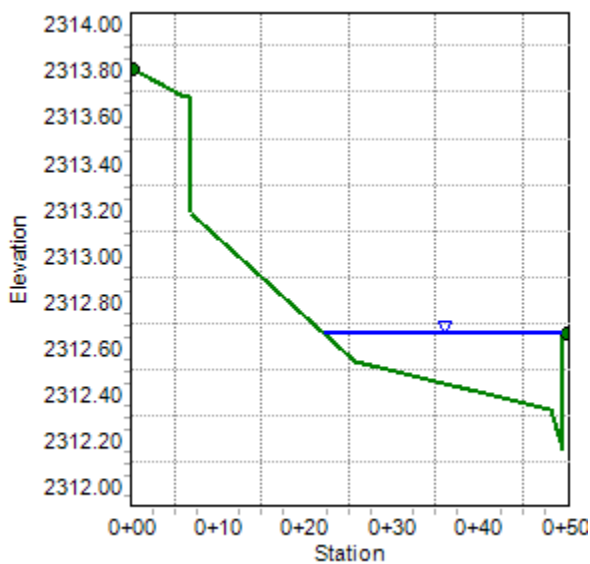
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 0.50    | ft                 |
| Discharge     | 12.00   | ft <sup>3</sup> /s |

### Cross Section Image



## Worksheet for SECTION D 100-YR

### Project Description

Friction Method                      Manning Formula  
Solve For                              Normal Depth

### Input Data

Channel Slope                                              0.00400    ft/ft  
Discharge                                                 12.00    ft<sup>3</sup>/s  
Section Definitions

| Station (ft) | Elevation (ft) |
|--------------|----------------|
| 0+00.00      | 2312.94        |
| 0+00.50      | 2312.94        |
| 0+00.50      | 2312.44        |
| 0+23.00      | 2311.58        |
| 0+24.50      | 2311.41        |
| 0+24.50      | 2311.91        |
| 0+25.00      | 2311.91        |
| 0+28.00      | 2312.91        |

### Roughness Segment Definitions

| Start Station      | Ending Station     | Roughness Coefficient |
|--------------------|--------------------|-----------------------|
| (0+00.00, 2312.94) | (0+25.00, 2311.91) | 0.016                 |
| (0+25.00, 2311.91) | (0+28.00, 2312.91) | 0.030                 |

### Options

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

### Results

Normal Depth                                              0.71    ft  
Elevation Range                                              2311.41 to 2312.94 ft  
Flow Area                                                      4.94    ft<sup>2</sup>  
Wetted Perimeter                                              17.34    ft

---

## Worksheet for SECTION D 100-YR

---

### Results

|                  |             |       |
|------------------|-------------|-------|
| Hydraulic Radius | 0.28        | ft    |
| Top Width        | 16.79       | ft    |
| Normal Depth     | 0.71        | ft    |
| Critical Depth   | 0.66        | ft    |
| Critical Slope   | 0.00665     | ft/ft |
| Velocity         | 2.43        | ft/s  |
| Velocity Head    | 0.09        | ft    |
| Specific Energy  | 0.80        | ft    |
| Froude Number    | 0.79        |       |
| 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        | 0.71     | ft    |
| Critical Depth      | 0.66     | ft    |
| Channel Slope       | 0.00400  | ft/ft |
| Critical Slope      | 0.00665  | ft/ft |

## Cross Section for SECTION D 100-YR

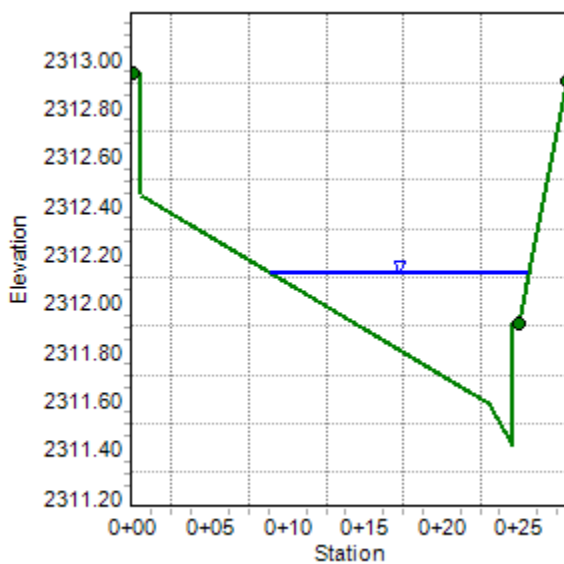
### Project Description

|                 |                 |
|-----------------|-----------------|
| Friction Method | Manning Formula |
| Solve For       | Normal Depth    |

### Input Data

|               |         |                    |
|---------------|---------|--------------------|
| Channel Slope | 0.00400 | ft/ft              |
| Normal Depth  | 0.71    | ft                 |
| Discharge     | 12.00   | ft <sup>3</sup> /s |

### Cross Section Image



# FLOWMASTER SECTIONS



# APPENDIX C: REFERENCE MATERIAL

EXCERPTS FROM: “TECHNICAL  
DRAINAGE STUDY FOR  
ELKHORN & DECATUR MULTI-  
FAMILY CONDOMINIUMS”

**SUPPLEMENT #1**  
TO  
**ADDENDUM #1**  
TO THE  
**TECHNICAL DRAINAGE STUDY**  
FOR  
**ELKHORN & DECATUR**  
**MULTI-FAMILY CONDOMINIUMS**

LEN-18-004

CITY OF NORTH LAS VEGAS

APRIL 2019

Prepared for:

Lennar  
2490 Paseo Verde Pkwy., Suite 120  
Henderson, NV  
(702) 821-4651



Engineer's Seal

3



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**Isaac E. Barron**  
**Pamela A. Goynes-Brown**  
**Scott Black**  
**Richard J. Cherchio**



City Manager  
**Ryann Juden**

**Department of Public Works**

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[www.cityofnorthlasvegas.com](http://www.cityofnorthlasvegas.com)

April 4, 2019

Mailed Via: E-mail

Lee L. Gong, P.E.  
Taney Engineering  
6030 S. Jones, Suite 100  
Las Vegas, Nevada 89118

Re: **Addendum #1 to the TDS for Elkhorn & Decatur Multi-Family Condominiums (CNLV # 68029)**

Department of Public Works staff has reviewed the above referenced study received on March 27, 2019 and offers the following comments:

The following comment(s) will be conditioned with approval:

1. The site is adjacent to an existing or proposed Clark County Regional Flood Control District (CCRFCD) master planned facility. Therefore, CCRFCD concurrence is required prior to final approval of the civil improvement plans.
2. The project site is located adjacent to the jurisdiction boundary of City of Las Vegas (CLV). Therefore, CLV concurrence is required prior to final approval of the civil improvement plans.
3. Since this drainage study is relying on protection from the improvement by the Park Highlands West Infrastructure project and the Park Highlands West Detention Basin shown on Figure 8 (Exhibit F), no Final Walk will be performed by CNLV until the infrastructure improvement and the detention basin facility have been built and fully operational.
4. Provide silt trap(s) right at the upstream of the Jensen grate inlet at the southeast corner of basin PON8a to capture the silt generated from the upstream offsite basin for the interim condition before the silt gets into the grate inlets. The silt trap is required to have a minimum depth of one (1) foot and a minimum dimension of ten (10) feet by ten (10) feet with minimum six (6) inches thick riprap on the side and at the bottom before the final approval of the civil plans. Also, provide a swale to connect the grate inlet and

Elkhorn Road to convey the overtopping storm flows from the grate inlet.

5. On grading plan G9 and G10 at just south of the project site, there is no sign of constructed Elkhorn Road to the entrance of the project site to provide access to the site. And per the response to Comment #24 in Addendum #1, it mentions that Elkhorn Road is under construction per D.R. Horton, no Final Walk will be performed by CNLV until Elkhorn Road has been built and fully operational.

Please address the following comments with a supplement:

6. The response to Comment #8 is insufficient. Some provided plans in Appendix D are illegible and could not be used to establish the relationship of the subject drainage basin and the mentioned 42 in. RCP drainage facility is not found. Also, the engineer needs to use the most updated technical drainage studies as advised in the previous Comment #8 to the initial technical drainage study. Again, please reach out to the City for the approved studies TECHNICAL DRAINAGE STUDY FOR Amber Owl West Residential Development (CNLV 60356), TECHNICAL DRAINAGE STUDY FOR Amber Owl East (Parcel 3.3) Residential Development (CNLV 61011), UPDATE #4 (FOR PARCEL 3.3) TO THE Master Drainage Study for Park Highlands West (CNLV 65535), and the UPDATE #2 (FOR PARCEL 3.3) TO THE TDS for Park Highlands West Infrastructure (CNLV 65537) for reference.
7. The response to Comment #16 on Hydraulic Section M and N should be using about 20% of the worst case of DON2 or DON4 that would be 4 cfs. Please revise.
8. The response to Comment #22 is not sufficient. Besides providing drainage easement at the onsite property, separate public drainage easements with a minimum width of 20 feet is required to cover the proposed or existing swales, the silt traps and the proposed grate inlet at the property to the west where upstream storm flows are being conveyed onto the project site.
9. In the revised drainage study content on page 5 second paragraph sixth line, the mentioned 109 cfs (447 cfs - 338 cfs) cannot be traced in the reference study included in Appendix D. Please provide sufficient and legible reference material with referenced data circled in the next submittal.
10. At the new proposed 4'x4' grate inlet at the southeast corner of basin PON8a, provide a swale with hydraulic analysis to connect the grate inlet and Elkhorn Road to convey the overtopping storm flows from the grate inlet.
11. Additional comments may be generated with each subsequent review.

The following are comment(s) on the civil plans:

12. On grading plan G9 at the new proposed 4'x4' grate inlet at the southeast corner of basin PON8a, provide a swale with hydraulic analysis to connect the grate inlet and Elkhorn Road to convey the overtopping storm flows from the grate inlet.

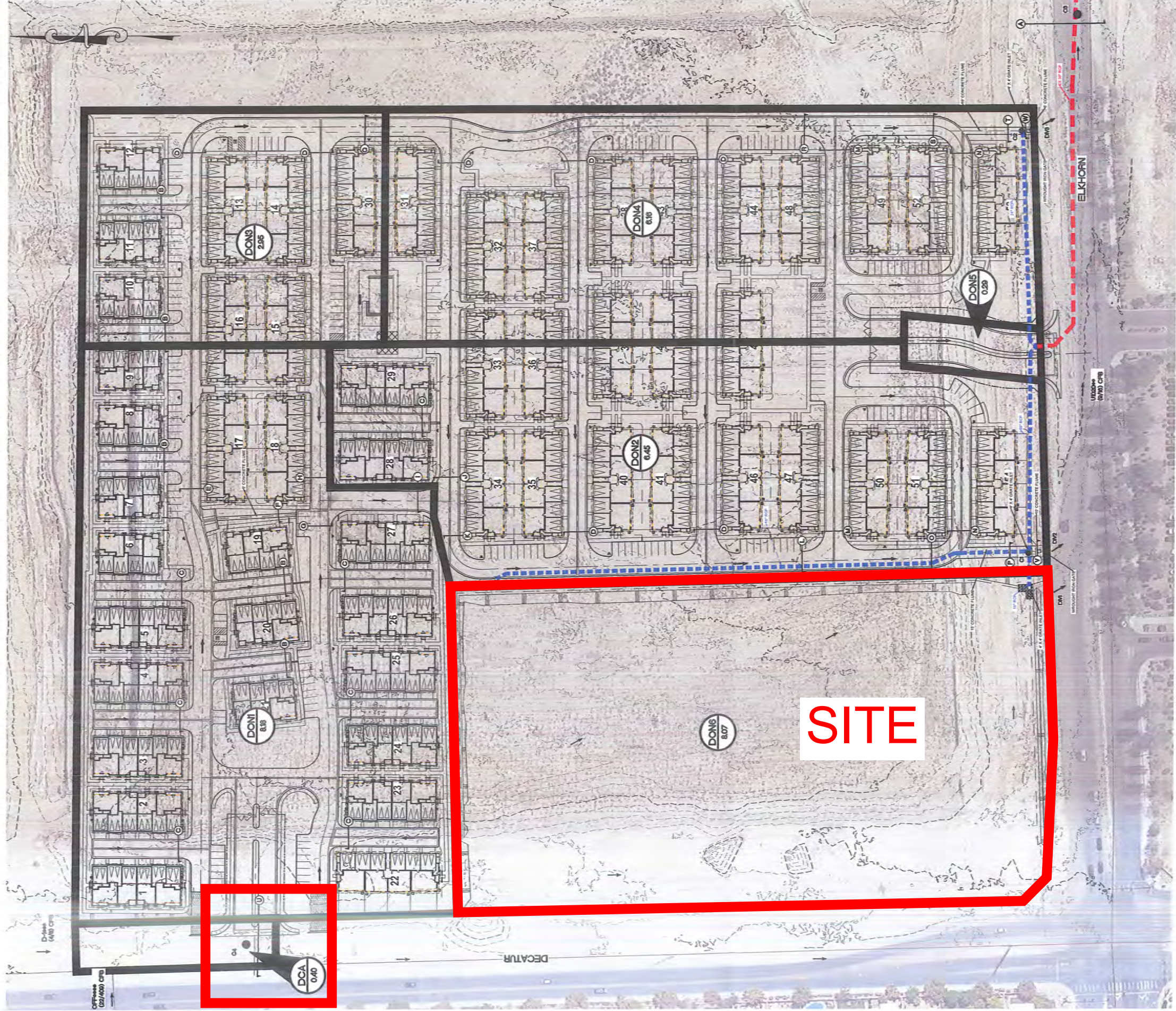
CNLV, its officials, or employees assume no liability for information, data, calculations and conclusions presented by the consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review. If you have any questions concerning this matter, please contact me at (702)-633-1254.

Sincerely,

A handwritten signature in blue ink, appearing to be 'Simon Luk', with a stylized, cursive script.

Simon Luk, P.E.  
Associate Engineer  
Development and Flood Control Division  
Department of Public Works





A 24x36" COPY OF THIS BASIN MAP HAS  
BEEN PROVIDED IN THIS SUPPLEMENT AT  
THE END OF THE REPORT

REFERENCE NOTES:  
\*CALCULATED FROM THE PARK HIGHLANDS WEST INFRASTRUCTURE STUDY, FIGURE F (ONLY 55093)  
\*\*REFERENCED FROM THE MASTER PLAN STUDY FOR PHW, FIGURE N (ONLY 46567)  
\*\*\*REFERENCED FLOW FROM AMBER OVA WEST (PARCEL 3.10) DS, ONLY 60369  
\*\*\*\*CALCULATED FLOW FROM REFERENCED FLOW OF SAVANNAH FALLS DS, D33286 (SEE RESPONSE TO COMMENT 20 ON ADDENDUM #1)

| Cross Section          | Ultimate Condition |         |              |         | Depth<br>(ft) | Velocity<br>(ft/s) | DxV |
|------------------------|--------------------|---------|--------------|---------|---------------|--------------------|-----|
|                        | Description        | Q (cfs) | Slope<br>(%) | Q (cfs) |               |                    |     |
| A - ELKHORN 10 YR      | C3                 | 9       | 0.42         | 0.45    | 1.79          | 0.81               |     |
| A - ELKHORN 100 YR     | C3                 | 55      | 0.42         | 0.76    | 2.77          | 2.11               |     |
| B - 26' Street (1 cfs) | 5%*DON1            | 1       | 1.00         | 0.15    | 1.43          | 0.21               |     |
| C - 26' Street (2 cfs) | 10%*DON1           | 2       | 0.6          | 0.18    | 1.38          | 0.25               |     |
| D - 26' Street (3 cfs) | 15%*DON1           | 3       | 0.73         | 0.21    | 1.51          | 0.32               |     |
| E - 100 YR             | 25%*DON1           | 5       | 0.81         | 0.31    | 4.20          | 1.30               |     |
| F - 5' Flume 100 YR    | 65%*DON1           | 13      | 0.84         | 0.52    | 3.44          | 1.79               |     |
| G - 100 YR             | 5%*DON1            | 1       | 0.73         | 0.29    | 1.58          | 0.46               |     |
| H - 100 YR             | DON1               | 20      | 0.6          | 0.64    | 3.00          | 1.92               |     |
| I - 100 YR             | 20%*DON2           | 3       | 0.74         | 0.20    | 1.64          | 0.33               |     |
| J - 100 YR             | DON1 + 20%*DON2    | 23      | 0.60         | 0.42    | 3.24          | 1.36               |     |
| K - 100 YR             | DON1 + 65%*DON2    | 30      | 0.60         | 0.69    | 3.91          | 2.70               |     |
| L - 100 YR             | 20%*DON2/DON4      | 4       | 0.60         | 0.23    | 1.63          | 0.37               |     |
| M - 100 YR             | 20%*DON2/DON4      | 4       | 0.56         | 0.23    | 1.60          | 0.37               |     |
| N - 100 YR             | DON1 + 80%*DON2    | 33      | 0.58         | 0.71    | 4.01          | 2.85               |     |
| O - 100 YR             | C1                 | 36      | 0.5          | 0.55    | 4.98          | 2.74               |     |
| P - 15' Flume 100 YR   | DON3               | 7       | 0.6          | 0.48    | 2.27          | 1.09               |     |
| Q - 100 YR             | DON3 + 20%*DON4    | 17      | 0.7          | 0.62    | 2.82          | 1.75               |     |
| R - 100 YR             | DON3 + 80%*DON4    | 19      | 0.7          | 0.63    | 3.09          | 1.95               |     |
| S - 100 YR             | C2                 | 22      | 0.5          | 0.53    | 4.81          | 2.55               |     |
| T - 10' Flume 100 YR   | C4                 | 215     | 0.5          | 1.35    | 5.57          | 7.52               |     |
| U - Deatur 100 YR      | DIV2               | 18      | 0.5          | 0.47    | 4.46          | 2.10               |     |
| V - 10' Flume 100YR    | DIV3               | 10      | 1.00         | 0.45    | 5.77          | 2.60               |     |
| W - 5' Flume 100YR     |                    |         |              |         |               |                    |     |

| Ultimate Condition |                 |                           |                            | Ultimate 100YR PROPOSED FLOWS |                 |                           |                            |
|--------------------|-----------------|---------------------------|----------------------------|-------------------------------|-----------------|---------------------------|----------------------------|
| Basin              | Area<br>(Acres) | Q <sub>100</sub><br>(cfs) | Q <sub>100</sub><br>(ft/s) | Basin                         | Area<br>(Acres) | Q <sub>100</sub><br>(cfs) | Q <sub>100</sub><br>(ft/s) |
| C1                 | 1.15            | 36                        | 1.2                        | DON1                          | 8.18            | 30                        | 1.2                        |
| C2                 | 1.1             | 22                        | 1.2                        | DON2                          | 6.45            | 8                         | 1.2                        |
| C3                 | 1.1             | 22                        | 1.2                        | DON3                          | 2.95            | 8                         | 1.2                        |
| C4                 | 1.1             | 215                       | 1.2                        | DON4                          | 6.15            | 8                         | 1.2                        |
| DIV1               | 0               | 0                         | 0                          | DON5                          | 8.07            | 30                        | 1.2                        |
| DIV2               | 0               | 0                         | 0                          |                               |                 |                           |                            |
| DIV3               | 0               | 0                         | 0                          |                               |                 |                           |                            |
| DCA                | 2.6             | 4                         | 8                          |                               |                 |                           |                            |
| D-1***             | 0.40            | 1                         | 2                          |                               |                 |                           |                            |
| OFF****            | -               | 22                        | 409                        |                               |                 |                           |                            |
| U1020*****         | 5.9             | 9                         | 16                         |                               |                 |                           |                            |

| Ultimate 100YR PROPOSED FLOWS |                 |                           |                            | EXHIBIT N |                 |                           |                            |
|-------------------------------|-----------------|---------------------------|----------------------------|-----------|-----------------|---------------------------|----------------------------|
| Basin                         | Area<br>(Acres) | Q <sub>100</sub><br>(cfs) | Q <sub>100</sub><br>(ft/s) | Basin     | Area<br>(Acres) | Q <sub>100</sub><br>(cfs) | Q <sub>100</sub><br>(ft/s) |
| DON1                          | 8.18            | 30                        | 2.5                        | DON1      | 8.18            | 30                        | 2.5                        |
| DON2                          | 6.45            | 8                         | 2.5                        | DON2      | 6.45            | 8                         | 2.5                        |
| DON3                          | 2.95            | 8                         | 2.5                        | DON3      | 2.95            | 8                         | 2.5                        |
| DON4                          | 6.15            | 8                         | 2.5                        | DON4      | 6.15            | 8                         | 2.5                        |
| DON5                          | 8.07            | 30                        | 2.5                        | DON5      | 8.07            | 30                        | 2.5                        |

COMBINATION POINT NOTES:  
C1 = DON1 + DON2  
C2 = DON3 + DON4  
C3 = U1020\*\* + DIV1 + DIV2 + DON5 + DIV3  
C4 = D-1\*\*\* + DCA (10 YR)  
DCA = D-1\*\*\* + DCA (10 YR)  
DIV1 = DON1 + DON2 + DON3 + DON4 (100 YR)  
DIV2 = C1 - 18 CFS (4' X 4' 0")  
DIV3 = C3 - 12 CFS (3' X 3' 0")

| DRAINAGE LEGEND |                        |
|-----------------|------------------------|
|                 | Basin Identification   |
|                 | Basin Area (Acres)     |
|                 | Concentration Point    |
|                 | Flow Path              |
|                 | Project Site           |
|                 | Cross Section          |
|                 | 100YR Daily Flow (CFS) |
|                 | Reference Flow (CFS)   |

ULTIMATE BASIN MAP

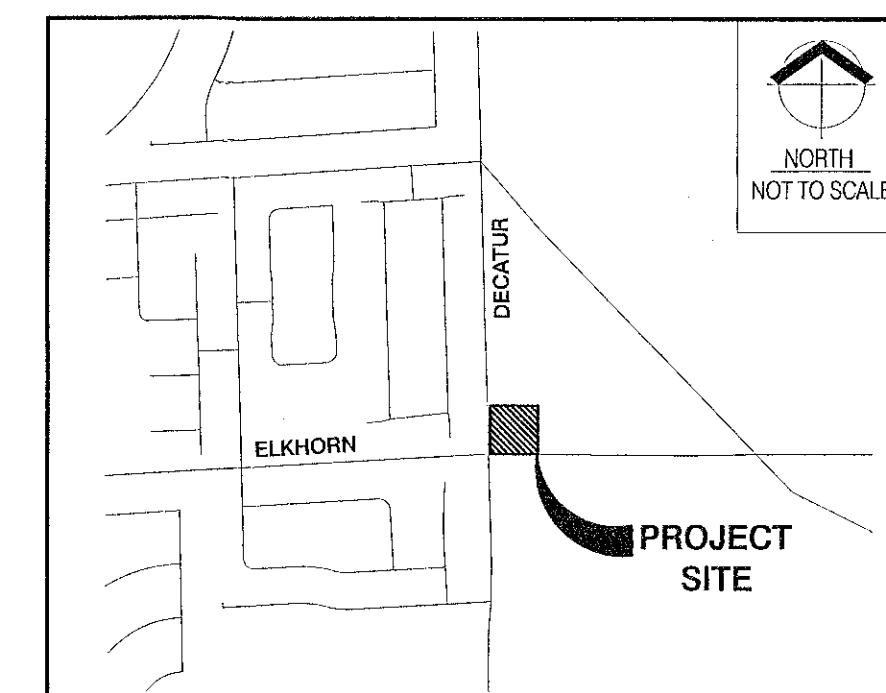
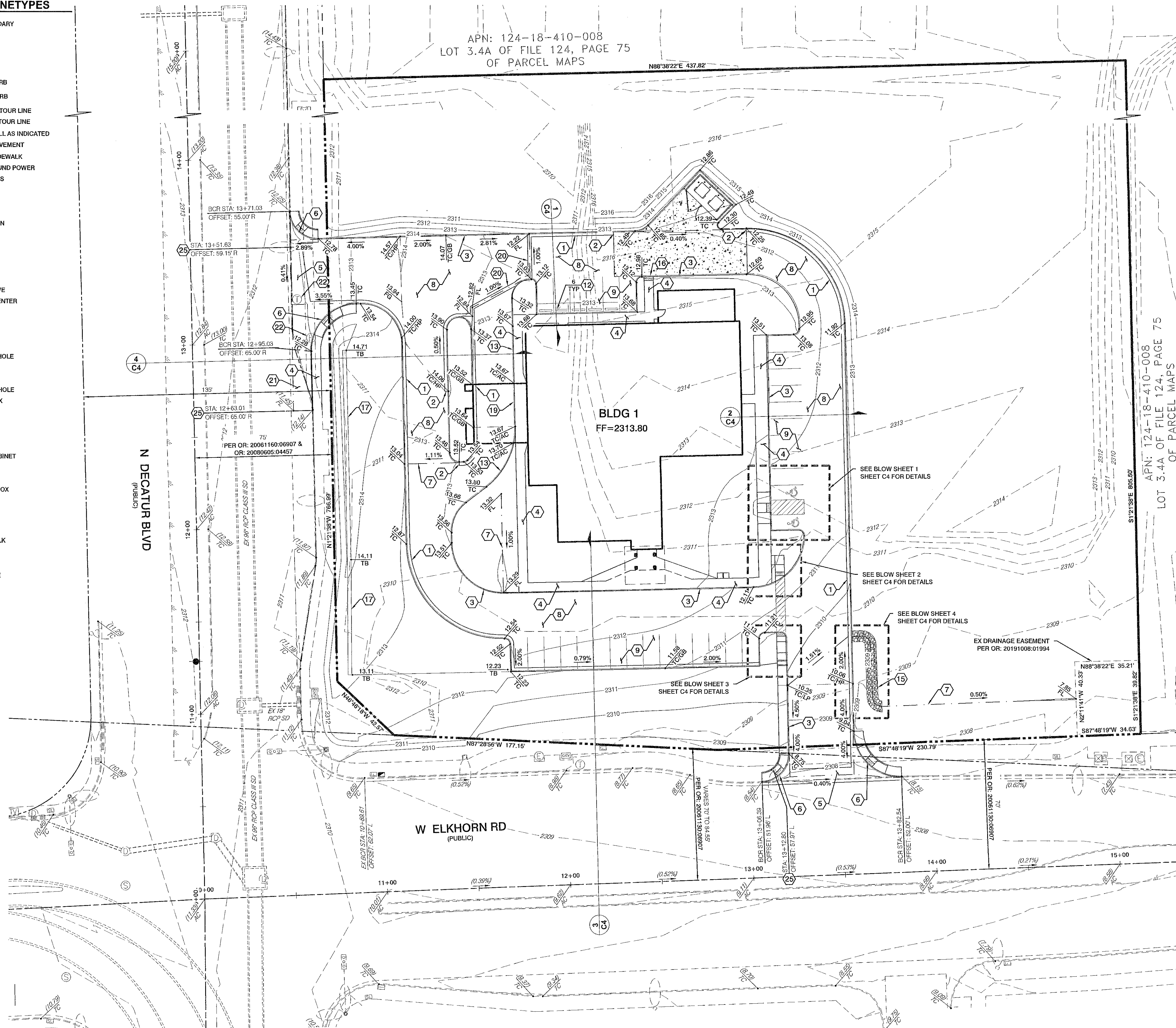
FIGURE 10



# APPENDIX D: PLANS AND DETAILS

|          |          |                           |
|----------|----------|---------------------------|
|          |          | 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 PAVED |
|          |          | EXST EDGE OF PAVEMENT     |
|          |          | EXST EDGE OF SIDEWALK     |
|          |          | EXST UNDERGROUND POWER    |
|          |          | EXST FIBER OPTICS         |
|          |          | EXST GAS                  |
|          |          | EXST WATER LINE           |
|          |          | EXST SEWER LINE           |
|          |          | EXST STORM DRAIN          |
| EXISTING | PROPOSED |                           |
|          |          | METER                     |
|          |          | FIRE HYDRANT              |
|          |          | VALVE                     |
|          |          | BLOWOFF VALVE             |
|          |          | AIR RELEASE VALVE         |
|          |          | BACKFLOW PREVENTER        |
|          |          | STORM MANHOLE             |
|          |          | TELEPHONE BOX             |
|          |          | FIBER BOX                 |
|          |          | CABLE TV BOX              |
|          |          | ELECTRICAL MANHOLE        |
|          |          | STREET LIGHT BOX          |
|          |          | POWER POLE                |
|          |          | SERVICE POLE              |
|          |          | GUY WIRE                  |
|          |          | 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                    |

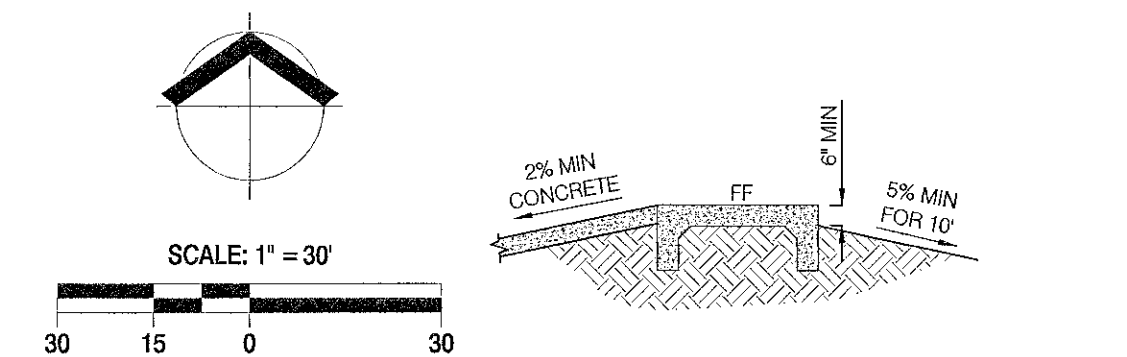
N88°38'22"E 437.82



### 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      |

- 1 CONSTRUCT "L" CURB AND GUTTER PER CCAUSD #216
- 2 TURN OUT "L" CURB TO ENSURE POSITIVE DRAINAGE
- 3 CONSTRUCT "A" CURB AND GUTTER PER CCAUSD #219
- 4 CONSTRUCT SIDEWALK PER CCAUSD #234
- 5 CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD #224
- 6 CONSTRUCT CASE I SIDEWALK RAMPS USING ARMO TILE TRUNCATED DORIES OR EQUIV. PER CCAUSD #235 (A & B = 8' UNLESS NOTED)
- 7 CONSTRUCT FLOW LINE AS SHOWN
- 8 MAIN CORRIDOR (TRUCK ACCESS) INSTALL 3.5" AC OVER 10.5" TYPE II AGGREGATE BASE
- 9 AUTOMOBILE ROUTE / PARKING. INSTALL 2.5" AC OVER 10" TYPE II AGGREGATE BASE
- 10 INSTALL 2' CURB CUT
- 11 INSTALL TRASH ENCLOSURE (SEE ARCHITECTURAL PLANS FOR DETAILS)
- 12 INSTALL BUMPER BUMP PER CCAUSD #238
- 13 INSTALL CURB TRANSITION PER DETAIL F SHEET C4 (LENGTH PER PLAN)
- 14 INSTALL 2' SIDEWALK UNDERDRAIN PER CCAUSD #236
- 15 CONSTRUCT BMP SWALE PER DETAIL "B" SHEET C4
- 16 TRUNCATED DORIES PER CCAUSD #235
- 17 CONSTRUCT EARTHEN BERM
- 18 INSTALL BICYCLE RACKS (SEE ARCHITECTURAL PLANS FOR DETAILS)
- 19 INSTALL 0" "A" CURB PER DETAIL "
- 20 INSTALL 2' VALLEY GUTTER PER DETAIL "A" SHEET C4
- 21 INSTALL 10" 4,000 PSI CONCRETE OVER 6" TYPE II AGGREGATE BASE PER CCAUSD #234-1
- 22 ADJUST EXISTING UTILITIES TO GRADE
- 23 SAWCUT AND REMOVE 110± LF EXISTING CURB AND GUTTER
- 24 SAWCUT AND REMOVE 76± LF EXISTING CURB AND GUTTER
- 25 SAWCUT AND MATCH EXISTING CONCRETE
- 26 EXISTING STREET LIGHT TO BE RELOCATED



| SITE DATA      |          |                     |        |
|----------------|----------|---------------------|--------|
| APN No.        | ACREAGE: | AREA OF DISTURBANCE | ZONING |
| 124-15-410-009 | 8.08     | 1.94 ACRES ONSITE   | MPC    |

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

ADD 2300.00' TO ELEVATIONS SHOWN HEREON TO ADJUST THEM TO THE  
ASSOCIATED DATUM.

CUT = 1,840 CY  
FILL = 3,503 CY  
NET = 1,663 CY FILL

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

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

DATE \_\_\_\_\_



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 32003C1765F E. CLARK COUNTY, NEVADA DATED NOVEMBER 16, 2011.

SOUTH 87°29'39" EAST, BEING THE SOUTH LINE OF GOVERNMENT LOT 19 OF SECTION 18, TOWNSHIP 19 SOUTH, RANGE 61 EAST, M.D.M., CITY OF NORTH LAS VEGAS, CLARK COUNTY, NEVADA, AS SHOWN BY MAP ON FILE IN THE CLARK COUNTY RECORDER'S OFFICE, IN FILE 104, PAGE 61 OF PARCEL MAPS.

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.

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.

CITY OF NORTH LAS VEGAS VERTICAL CONTROL BENCHMARK NUMBER NLOV9119N4

RIVET AND 2" ROUND ALUMINUM DISK, STAMPED NORTH LAS VEGAS BM NO. NLV9119N4, SET IN THE TOP OF CURB, LOCATED APPROX. 14 FEET EAST OF THE SOUTHEAST EAST BCR AT THE INTERSECTION OF ELKHORN RD. AND AVIARY WAY.

ELEVATION: 699.658 METERS  
ELEVATION: 2285.461 U.S. SURVEY FEET  
NAVD 88

(REQUIRED FOR ALL SITES GREATER THAN 1 ACRE (43,560 SQ.FT.))

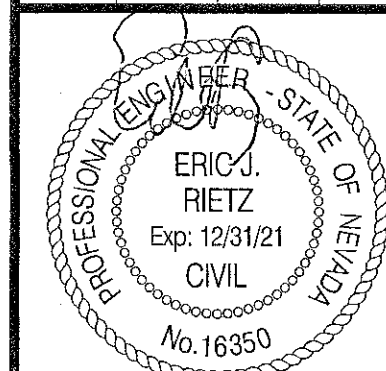
1. THE OWNER, SITE DEVELOPER, CONTRACTOR AND/OR THEIR AUTHORIZED AGENTS SHALL EACH DAY REMOVE ALL SEDIMENT, MUD, CONSTRUCTION DEBRIS, OR OTHER POTENTIAL POLLUTANTS THAT MAY HAVE BEEN DISCHARGED TO, OR ACCUMULATE IN, THE PUBLIC RIGHTS OF WAY OF CLARK COUNTY AS A RESULT OF OTHER CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIALS SHALL BE PREVENTED FROM ACCUMULATING IN THE STORMWATER STORAGE BASIN.
2. ADDITIONAL CONSTRUCTION SITE DISCHARGE BEST MANAGEMENT PRACTICES MAY BE REQUIRED OF THE OWNER AND HIS OR HER AGENTS DUE TO UNPREDENSEN EROSION PROBLEMS OR IF THE SUBMITTED PLAN DOES NOT MEET THE PERFORMANCE STANDARDS SPECIFIED IN TITLE 24.00 AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES MANUAL.
3. TEMPORARY OR PERMANENT STABILIZATION PRACTICES WILL BE INSTALLED ON DISTURBED AREAS AS SOON AS PRACTICABLE AND NO LATER THAN 14 DAYS AFTER THE CONSTRUCTION ACTIVITY IN THAT PORTION OF THE SITE HAS TEMPORARILY OR PERMANENTLY CEASED. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NV100000, SECTION II.A.5.
4. AT A MINIMUM, THE CONTRACTOR, THEIR AGENT, AND INSPECT ALL DISTURBED AREAS, AREAS USED FOR STORAGE OF MATERIALS AND EQUIPMENT THAT ARE EXPOSED TO PRECIPITATION, TYPICAL TYPICAL EXIST LOCATIONS AND ALL BMPs SHALL BE INSPECTED AND WITHIN 24 HOURS AFTER ANY ACTUAL RAIN EVENT OF ONE INCH OR MORE, THE CONTRACTOR OR HIS AGENT SHALL UPDATE OR MODIFY THE STORMWATER POLLUTION PREVENTION PLAN AS NECESSARY. SOME EXCEPTIONS MAY APPLY; REFER TO NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NV100000, SECTION II.A.12.
5. ACCUMULATED SEDIMENT IN BMPs SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

## GRADING PLAN

UHS AT ELKHORN AND DECATUR  
CITY OF NORTH LAS VEGAS, NEVADA  
APN: 124-18-410-009

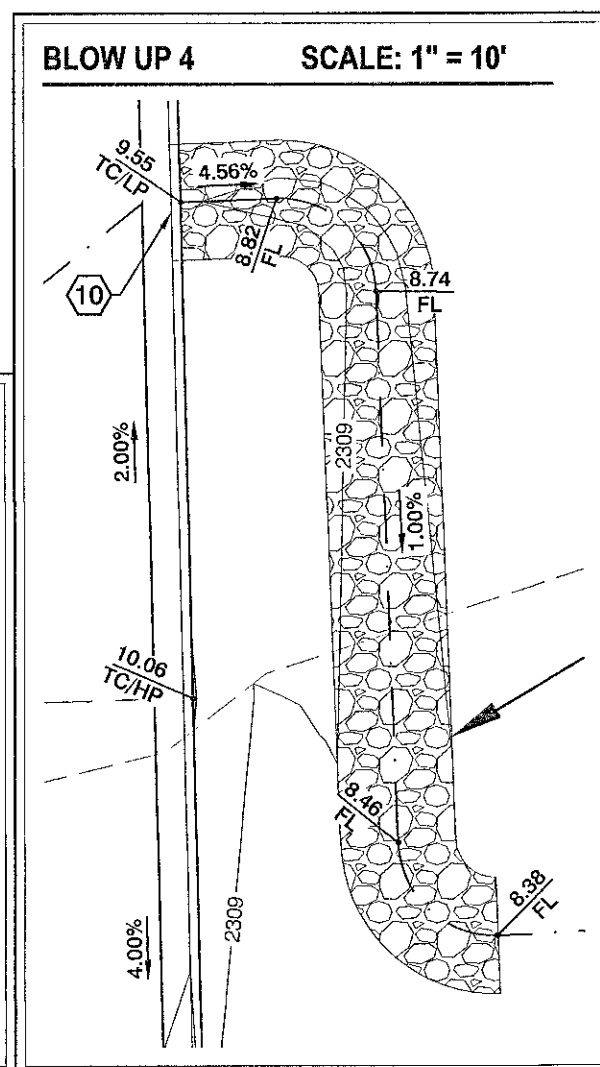
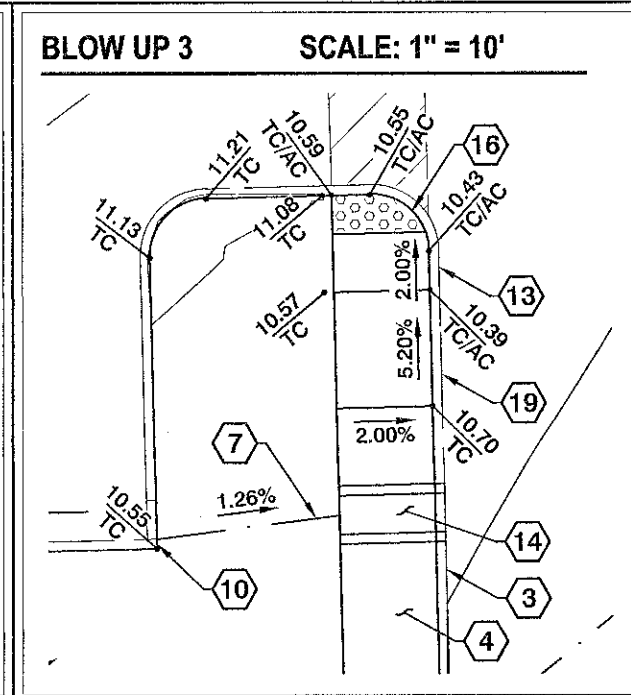
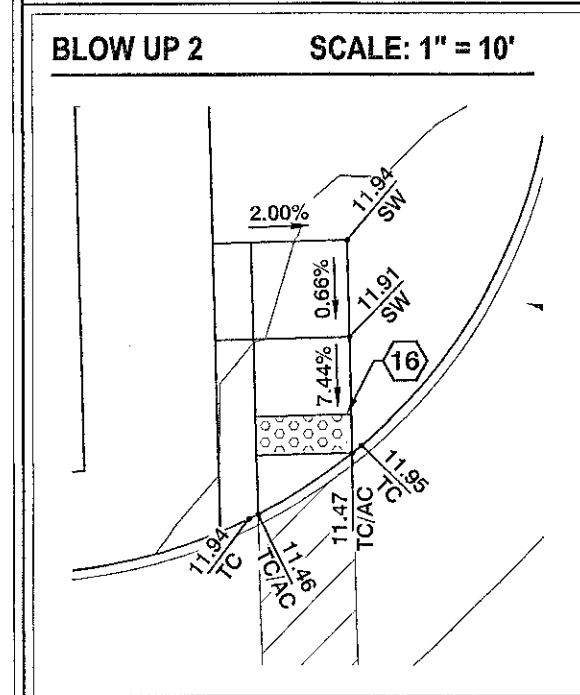
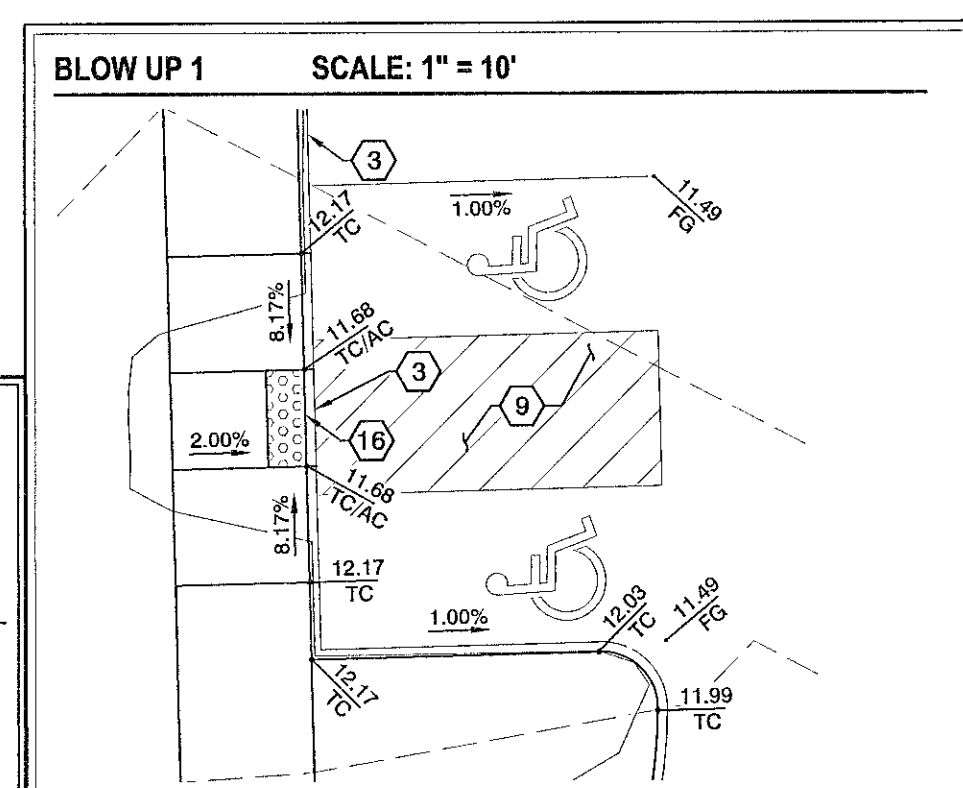
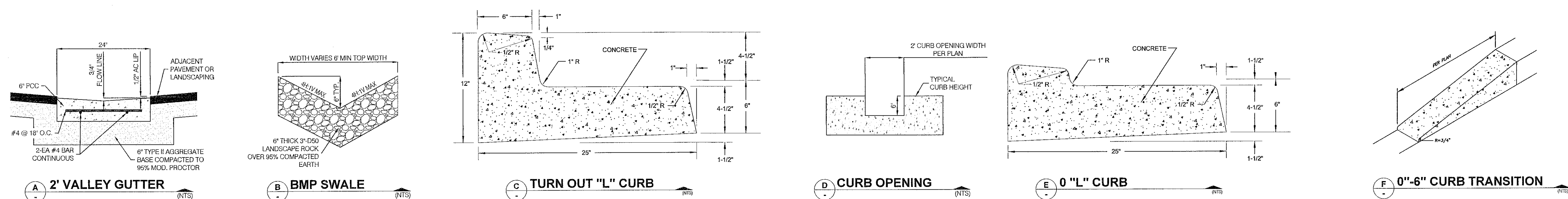
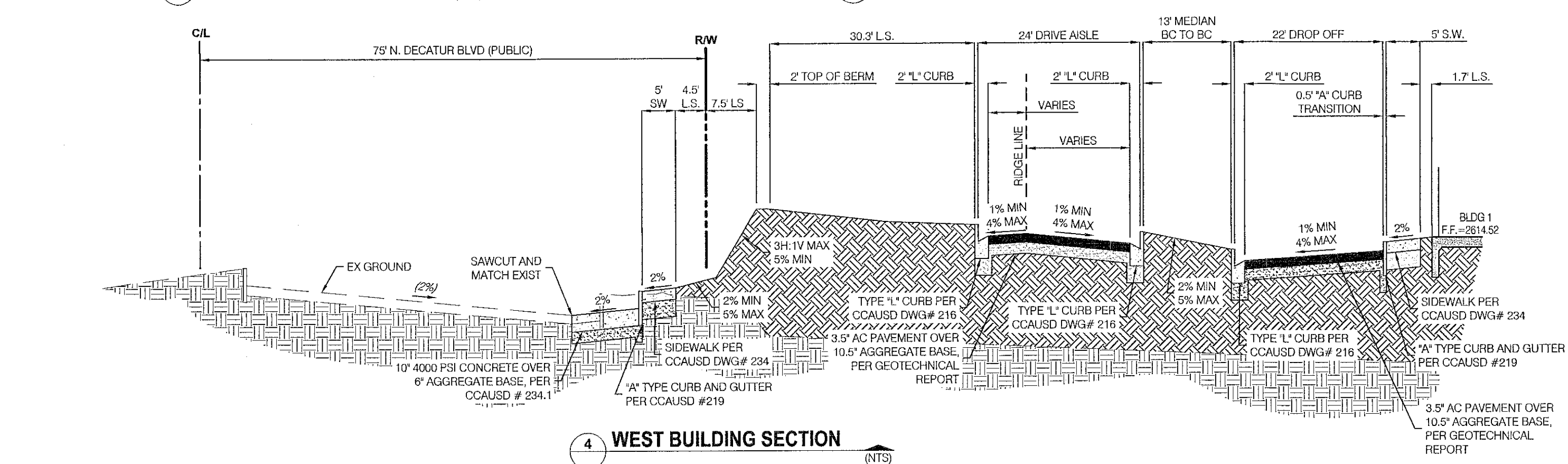
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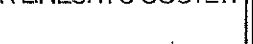
|          |           |
|----------|-----------|
| DATE:    | 5/12/2020 |
| DRAFTER: | BGF       |
| CHECKED: | EJR       |

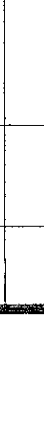


SHEET  
**C3**  
3 OF 6 SHEET  
####





|                                                                                                                                              |                                                                                      |                                                                                                                                                                                                   |
|----------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <p>AVOID HITTING OVERHEAD POWER LINES. IT'S COSTLY.</p>                                                                                      | <p>Call before you Dig<br/>Avoid cutting underground utility lines. It's costly.</p> | <p><b>FAST</b></p>                                                                                                                                                                                |
| <p>CALL BEFORE YOU DO OVERHEAD</p>  <p>1-702-227-2929</p> | <p>Call<br/><b>811</b></p> <p>OR</p> <p>1-800-227-2600</p>                           | <p>Call before you UnderGround</p>  <p>1-702-432-5300</p> <p>FREEWAY AND ARTERIAL SYSTEM OF TRANSPORTATION</p> |

|                                                                                                                                                                                                                                                           |  |                                                                                                                                                                                        |  |                                                                                          |  |                                                                     |  |                                                                     |  |                                                                   |  |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--|------------------------------------------------------------------------------------------|--|---------------------------------------------------------------------|--|---------------------------------------------------------------------|--|-------------------------------------------------------------------|--|
| <div style="text-align: center;">  <p><b>RIETZ<br/>CONSULTING INC.</b></p> <p>3203 E. WARM SPRINGS RD #400<br/>LAS VEGAS, NEVADA 89120<br/>PH: 702.521.3355</p> </div> |  | <div style="text-align: center;"> <p><b>DETAIL SHEET</b></p> <p><b>UHS AT ELKHORN AND DECATUR</b><br/><b>CITY OF NORTH LAS VEGAS, NEVADA</b><br/><b>APN: 124-18-410-009</b></p> </div> |  | <div style="text-align: center;"> <p>5/12/2020</p> <p>DATE:</p> </div>                   |  | <div style="text-align: center;"> <p>BGF</p> <p>DRAFTER:</p> </div> |  | <div style="text-align: center;"> <p>EJR</p> <p>CHECKED:</p> </div> |  | <div style="text-align: center;"> <p>NTS</p> <p>SCALE:</p> </div> |  |
| <div style="text-align: center;">  </div>                                                                                                                              |  | <div style="text-align: center;"> <p>SHEET</p> <p><b>C4</b></p> </div>                                                                                                                 |  | <div style="text-align: center;"> <p>SHEET</p> <p><b>4</b> OF <b>6</b> SHEETS</p> </div> |  | <div style="text-align: center;"> <p>###</p> </div>                 |  | <div style="text-align: center;"> <p>REV. DATE</p> </div>           |  | <div style="text-align: center;"> <p>DESCRIPTION</p> </div>       |  |