

DS #:

4824

APN:

138-02-713-002

PROJECT:

Craig 9 Ranches Master Drainage Study

SUBMITTAL:

2M

SCANNED BY/DATE:

CHECKED BY/DATE:



CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		October 27, 2016
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT:	Drainage Study for:	COPIES TO:
	Craig & Rancho Master Drainage Study	Lochsa Engineering
Cross Streets:	SEC of Craig Road & Rancho Drive	Pre Rancho Craig LLC
File Number:	F:\Depot\DSMemos\DS4824B.doc	Bart Anderson, P.E., DevCo
Parcel Number:	138-02-713-002	CCRFCFCD
Zoning Action:	N/A	NDOT
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES NO X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	9/7/2016	9/27/2016	Not Approved	\$400.00	457513: \$400
2 nd Submittal	10/17/2016	10/27/2016	See Comments Below	\$400.00	461974: \$400
TOTAL FEES (LDDRS):				\$800.00	----

REMARKS:

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

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

1. The final approval of this master study is for conceptual drainage pattern only. No onsite improvements are being proposed with this master drainage study. No detail site plan had been submitted for site specific drainage analysis. Technical drainage study/studies will be required upon future site specific developments and when final site plans become available.
2. **This drainage study is acceptable in concept**; however, *City of Las Vegas* will not formally accept the study until the *Clark County Regional Flood Control District* (CCRFCFCD) has issued a letter of concurrence. The engineer should contact the CCRFCFCD to confirm that they have begun their review.
3. The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way. The engineer must contact NDOT for encroachment permit for the proposed project.
4. **Sheet C3.01:** Upsize the proposed 18"-lateral to 24"-diameter at the relocated drop inlet near Station 111+00 in *Craig Road*.

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: T20S/R60E/02
AREA L-02

REGIONAL FLOOD CONTROL DISTRICT



Steven C. Parrish, P.E.
General Manager/Chief
Engineer

BOARD OF DIRECTORS

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December 15, 2016

Mr. Oh Sang Kwon, P.E.
City of Las Vegas Department of Public Works
333 North Rancho Drive
Las Vegas, NV 89106

**DISTRICT CONCURRENCE: CRAIG & RANCHO MASTER DRAINAGE STUDY
(DS4824B) (RFCD No. 16-9754)**

Dear Mr. Kwon:

Clark County Regional Flood Control District (District) reviewed Technical Drainage Study dated September 1, 2016, and Addendum No. 1 dated October 17, 2016 for above-mentioned project as submitted by LOCHSA ENGINEERING. In addition, District is in receipt of the Conditional Letter of Acceptance from City of Las Vegas Department of Public Works dated October 27, 2016.

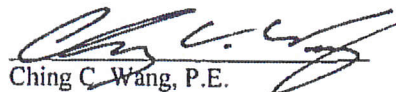
District concurs with acceptance of this Technical Drainage Study by City of Las Vegas Department of Public Works.

District's review of this project was limited to issues of Regional Flood Control Significance as defined in *Uniform Regulations for the Control of Drainage*.

Please be aware that as additional information becomes available and/or restudies of Flood Insurance Studies are performed, information submitted by LOCHSA ENGINEERING may be superseded. Compliance with regulatory elements and design standards specified in *Uniform Regulations for the Control of Drainage* does not imply a guarantee that properties will be free from flooding or flood damage. The District, its officials, or employees assume no liability for information, data, or conclusions presented by consulting engineers. We, therefore, make no warranties, either expressed or implied, in conducting this review.

STEVEN C. PARRISH, P.E.
General Manager/Chief Engineer

BY:


Ching C. Wang, P.E.
Senior Civil Engineer


Abigail Mayrena, P.E., CFM
Principal Civil Engineer

AM:dd

c: Hani M. Nosi, PH.D, P.E., CFM, Lochsa Engineering

P:\Letters and Memos\Local Drainage\Land Development & Drainage\2016\L-16-9754 doc

 *** FAX TX REPORT ***

TRANSMISSION OK

JOB NO. 1980
 DESTINATION ADDRESS 7023659317
 PSWD/SUBADDRESS
 DESTINATION ID
 ST. TIME 10/27 14:33
 USAGE T 00' 36
 PGS. 2
 RESULT OK

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM		DATE: October 27, 2016
TO: Land Development Services Department of Building & Safety		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
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	Craig & Rancho Master Drainage Study	Lochsa Engineering
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	is conditionally approved subject to Clark County Public Works Department concurrence.

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Craig & Rancho Master Drainage Study

(Addendum #1)

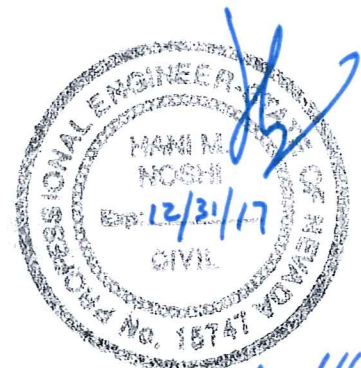
October 2016

Prepared for:

Pre Rancho Craig, LLC
120 Presidential Way
Woburn, MA 01801

Prepared by:

LOCHSA ENGINEERING
6345 South Jones Boulevard, Suite 100
Las Vegas, Nevada 89118
(702) 365-9312



Lochsa Job # 161051

10/17/16

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL
DRAINAGE STUDY INFORMATION FORM

Name of Development: Craig & Rancho Master Drainage Study Date: October 14, 2016

Location of Development: a) Descriptive (Cross Streets) North/South: Jones Boulevard
East/West: Craig Road

b) Section: 2 Township: 20 South Range: 60 East

c) APN : 138-02-713-002

Name of Owner: Pre Rancho Craig LLC (C/O William S. Parris)

Telephone No.: (805) 898 - 2023 Fax No.: (805) 898 - 9913 E-Mail Address: _____

Address: 120 Presidential Way, Woburn, MA 01801

Contact Person-Name: Hani M. Noshi, Ph.D., P.E., CFM Telephone No.: (702) 365-9312

* E-Mail Address: hani@lochsa.com Fax No.: (702) 365-9317

Firm: Lochsa Engineering

Address: 6345 South Jones Boulevard, Suite 100, Las Vegas, Nevada 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 50.14 +/- Acres Being Developed/Disturbed: 0.0 +/- Acres

2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No

3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No

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

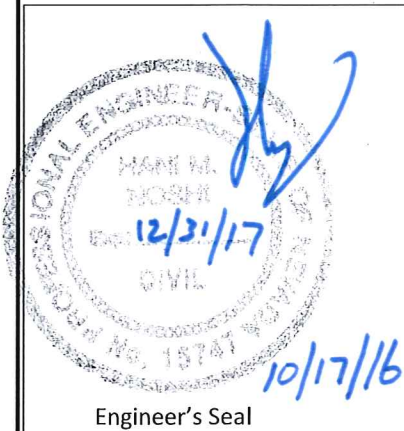
5. Approximate upstream land area which drains to the subject site: 5.0 +/- square miles (mainly conveyed through perimeter streets)

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: _____

Northeasterly towards Craig Road and easterly towards Jones Boulevard. following existing pattern:

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.

Local Entity File No.	Revision	Date

REFERENCE:

STANDARD FORM 1

October 13, 2016

Albert Sung, P.E.
Public Works – Development and Flood Control
333 North Rancho Drive
Las Vegas, Nevada 89106

Subject: Addendum to Craig & Rancho Master Drainage Study
City of Las Vegas DS4824
Lochsa Engineering Project Number: 161051

Dear Mr. Sung,

Lochsa Engineering is in receipt of your comment letter dated September 27, 2016 for the above referenced project. In response to your comments, the following responses are being offered:

1. The final approval of this master study is for conceptual drainage pattern only. No onsite improvements are being proposed with this master drainage study. No detail site plan had been submitted for site specific drainage analysis. Technical drainage study/studies will be required upon future site specific developments and when final site plans become available.

Response 1: Acknowledged.

2. The master study and improvement plans provided in the last submittal, however, proposed mass grading for the overall site. Consult with *City of Las Vegas Land Development Section* and obtain approval prior to the final acceptance of the subject master study and plans.

Response 2: As discussed in a phone conversation with Mr. Albert Sung, PE, no mass grading is being proposed for the site. The previously submitted overall conceptual grading was provided only to demonstrate the anticipated ultimate drainage pattern. Mr. Sung clarified his concern that approval of this subject Master study would be wrongly interpreted as a permission to rough-grade the entire site, without the proper permitting. Thus, it was agreed to eliminate the conceptual overall grading and not include it with any further submittals. The conceptual grading will only be utilized in the drainage exhibit DR2.

3. The site is adjacent to or crosses 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 drainage study.

Response 3: Noted. Copies of the entire study and addendum will be submitted to CCRFCD for concurrence, upon obtaining the conditional approval from the City of Las Vegas.

4. The project proposes to construct facilities and/or increase flows within *Nevada Department of Transportation* (NDOT) right-of-way. The engineer must contact NDOT for encroachment permit for the proposed project.

Response 4: Noted. The project does not introduce increase to flows within Craig Road or Rancho Drive. However, the project proposes to reconstruct medians within Craig Road and construct curb and gutters along portion of Rancho Drive. Thus, we will contact NDOT for encroachment permit.

5. **Sheet DR2:** The 10-yr/25-yr/100-yr flows labeled for Subbasin "ND2" was incorrect. Revise to show 26/34/46 cfs in the next submittal.

Response 5: Drainage exhibit DR2 has been revised to reflect the correct runoff flows for basin ND2(26/34/46cfs, Q10/Q25/Q100).

6. **Sheet C2.01:** It appears that the curb return at the intersection of *Craig Road* and *Rancho Drive* is to be re-constructed. However, this was not addressed in the master drainage study. Review and address in the next submittal.

Response 6: The grading plans for the proposed improvements within Craig Road and Rancho Drive are being submitted with this Addendum. As shown in Sheet C3.01, the improvements to Craig Road are limited to reconfiguration to portion of the existing median and the intersection, additional left-turn through the existing median, and additional turn-right lane. Normal depth calculations were previously provided for the south half of Craig Road at Sections CC and DD. Since the proposed median reconfiguration remain within the existing median, and due to the limited flows conveyed at Sections CC and DD, the previously submitted normal depth calculations represent the existing and proposed conditions.

To accommodate the proposed right-turn lane, the existing 4ft Type C drop inlet near Station 111+00 is relocated to the proposed curb. The existing 18" RCP lateral is extended to the proposed drop inlet location. The previously submitted referenced information for Craig Road storm drain is being resubmitted with this Addendum. As shown in the attached referenced information, the drop inlet was labeled as Drop Inlet (D.I.) #11A in the as-built plans for Craig Road. Due to the minor flows intercepted through D.I. #11A, the referenced Craig Road design information did not include hydraulic capacity calculation for the drop inlet. However, utilizing the same referenced design approach and referenced hydraulic parameters (i.e. street flow depth and slope) from D.I. #13 (approximately 400ft downstream D.I. #11A), illustrates approximately 5.50cfs may be intercepted through D.I. #11A. An inlet-control nomograph is provided with this Addendum to illustrate the sufficient capacity of the existing and extended 18"RCP lateral.

7. **Sheet C2.02:** It also appears that a driveway cut and curb & gutter and sidewalk are proposed in *Rancho Drive*. Review and address in the next submittal.

Response 7: Curb and gutter is being proposed for approximately 500ft of Rancho Drive, up to the proposed driveway entrance. The grading plans for the proposed improvements within Rancho is provided with this Addendum.

Since Rancho Drive is an NDOT right-of-way, it is acknowledged that the proposed curb and gutter represent an obstruction to the flows (from existing condition). Normal depth calculations were previously provided for the east half of Rancho Drive at Sections AA, well downstream of the proposed driveway entrance. The calculations are also being included with this Addendum. The flows near the proposed driveway entrance (i.e. the downstream end of the proposed curb and gutter) are approximately half of the flows at Section AA. Thus, the analysis at Section AA represents a conservative presentation of the flows along the proposed curb and gutter. The 25-year allowable discharge (satisfying the maximum allowable spread) within Rancho Drive near the proposed improvements was determined to be approximately 10cfs. The analysis at Section AA illustrates that the flows are well below the maximum allowable 10-year, 25-year and 100-year flow values. Thus, the flows along the proposed curb and gutter satisfies the NDOT and CLV requirement, and no additional mitigation is required.

8. **Sheet C2.04 and Sheet C2.06:** Provide erosion control measures downstream of each of the Rancho culverts. Provide hydraulic and sizing of riprap calculations in the next submittal.

Response 8: As confirmed in response to Comments No. 1 and 2, no onsite improvements are being proposed and Sheets C2.01 through C.06 have been eliminated. In addition, the proposed curb and gutter along Rancho Drive ends approximately 850ft to the north of the northern Rancho Drive culverts. Thus, no improvements are being proposed near the existing culverts. Riprap sizing is being provided for the future erosion protection at the outlet of the existing culverts. However, the riprap protection will be proposed with later phases of development of the project site.

As discussed in the previous submittal, 100-year flows for the northern and southern 6'x3' RCB culverts across Rancho Drive are determined to be 78cfs and 35cfs, respectively. Excerpts from the previously submitted information for the existing RCBs are being provided with this Addendum. As shown in the attached erosion protection calculations, minimum riprap protection is required at the outlet of the RCBCs. Minimum riprap sizes of D50=6" may be utilized in the future at the outlet of the existing RCBs.

If you have any questions or further comments, please contact our office at your convenience.

Sincerely,
LOCHSA ENGINEERING

Hani M. Noshi, Ph.D., P.E., CFM
Principal



CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM

DATE: *MS*
September 27, 2016

TO:
Land Development Services
Department of Building & Safety

FROM:
Albert Sung, P.E.
Flood Control Project Engineer
Department of Public Works

SUBJECT: Drainage Study for:
Craig & Rancho Master Drainage Study

COPIES TO:
Lochsa Engineering

Cross Streets: SEC of Craig Road & Rancho Drive

Pre Rancho Craig LLC

File Number: F:\Depot\DSMemos\DS4824A.doc

Bart Anderson, P.E., DevCo

Parcel Number: 138-02-713-002

CCRFCD

Zoning Action: N/A

NDOT

FEMA Flood Zone YES NO **X**

Proposed Storm Drain YES NO **X**

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Payment Trn #
1 st Submittal	9/7/2016	9/27/2016	See Comments Below	\$400.00	457513: \$400
			TOTAL FEES (LDDRS):	\$400.00	----

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8. **Sheet C2.04 and Sheet C2.06:** Provide erosion control measures downstream of each of the *Rancho* culverts. Provide hydraulic and sizing of riprap calculations in the next submittal.

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: T20S/R60E/02

AREA L-02

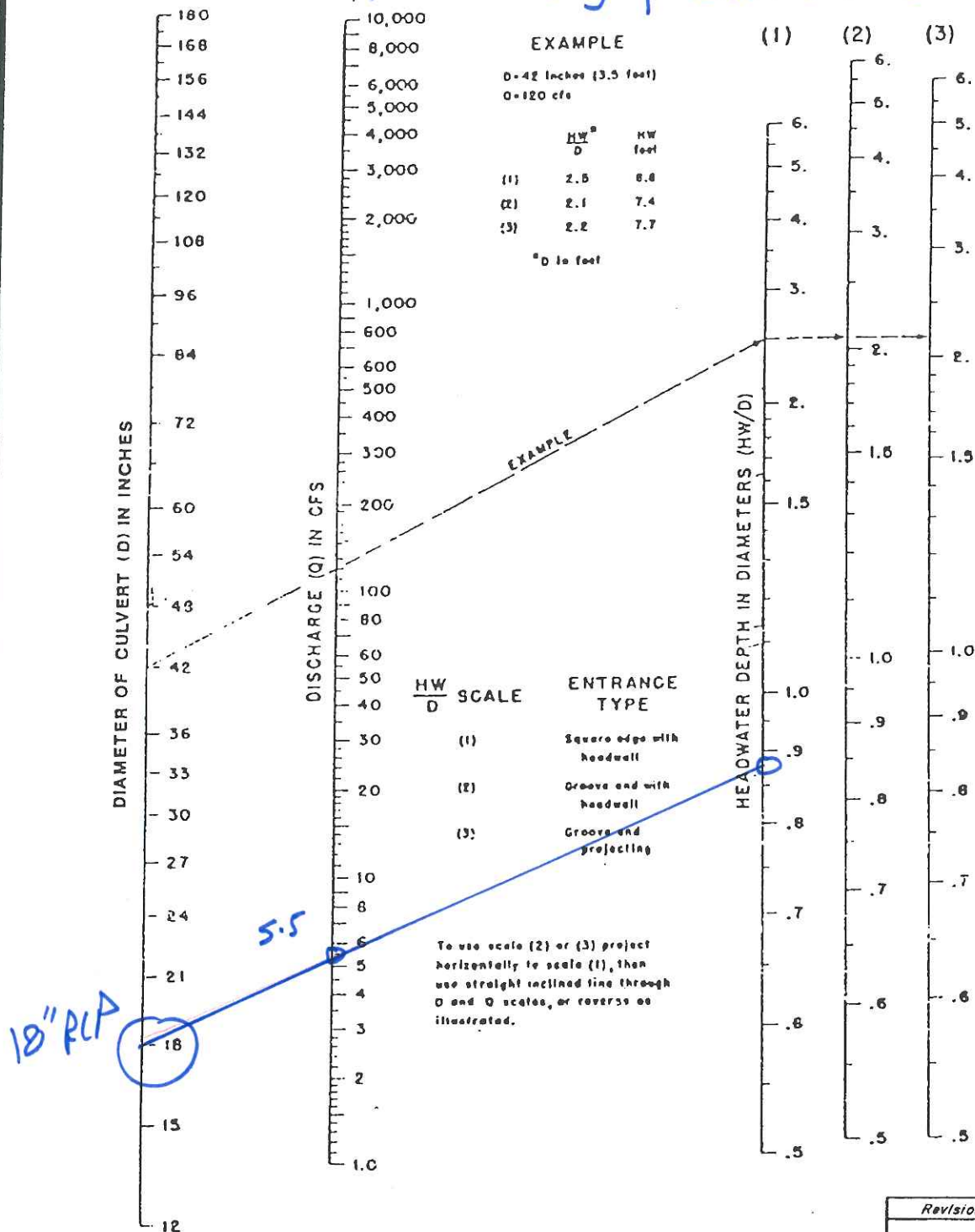
Response to Comment No. 6

Inlet Control Nomograph for the Existing/Proposed 18" RCP lateral

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

NOMOGRAPH - INLET CONTROL RCP

for Existing & extended 18" Lateral



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDOT, FHWA, HDS, No. 5, 1985

FIGURE 1005

Response to Comment No. 6

Relevant Excerpts from Craig Road Hydraulic Calculations and As-built

DS #: 3002

APN: _____

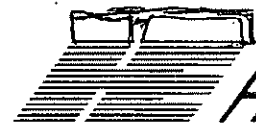
PROJECT: CRAIG ROAD BETWEEN U.S. 95 & DECATUR

SUBMITTAL: 1ST SUBMITTAL

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____





HEFNER ENGINEERING

CITY OF LAS VEGAS

**CRAIG ROAD
BETWEEN
DECATUR AND U.S. 95**

CITY OF LAS VEGAS

**CRAIG ROAD
BETWEEN
DECATUR AND U.S. 95**

HYDRAULIC CALCULATIONS

Prepared for:

**City of Las Vegas
400 East Stewart Avenue
Las Vegas, Nevada 89101**

Prepared By:

**Hefner Engineering
4495 South Polaris Avenue
Las Vegas, Nevada 89103
Telephone: 702-798-1900**



SECTION B

DROP INLET SIZING

CRAIG RD. RANCHO TO JONES - 150 R/W

(59' ISLAND) 2% CROSS SLOPE

MIN. STREET SLOPE 1.00%

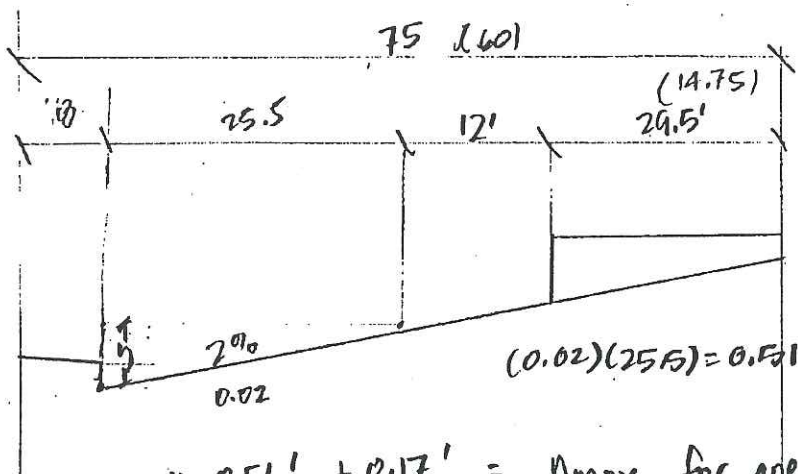
CRAIG RD. JONES TO DECATUR - 120 R/W

(29' ISLAND) 2% CROSS SLOPE

MIN STREET SLOPE 0.30%

REFERENCE SHEET C4.1

SLOPE DRAWINGS FROM ORIGINAL DESIGN PACKAGE.



$y = 0.51' + 0.17' = y_{max}$ for one dry lane = 0.68'

for both 150' and 120' R/W.

Crown

$(25.5 + 12)(0.02) + (0.17) = 0.92'$

To meet
12' Dry
Lane
for
North
half

S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.

Craig Rd. Rancho to Jones. Max allowable street flow

: Input variables:		: Output variables:	
: Flow depth, d	0.68 ft	: Capacity at d	57.18 cfs
: Road width	138.0 ft	: Velocity	3.4 fps
: Crown height	0.92 ft	: Top width	150.0 ft
: Street slope	1.00 %		
: Sidewalk width	6.0 ft	: CAPACITY:	
: Curb height	6 in	: @ top of curb	19.3 cfs
: Median width	59.0 ft	: @ back of walk	34.1 cfs
: Rt back of walk	100.0 %		
: Lt back of walk	100.0 %		

S T R E E T F L O W S

Manning's Equation for flow capacity in a street section.

Craig Rd. Jones to Decatur. Max allowable street flow

: Input variables:		: Output variables:	
: Flow depth, d	<u>0.68 ft</u> <i>y = 0.68</i>	: Capacity at d	31.32 cfs
: Road width	<u>108.0 ft</u>	: Velocity	1.9 fps
: Crown height	0.92 ft	: Top width	120.0 ft
: Street slope	<u>0.30 %</u>		
: Sidewalk width	6.0 ft	: CAPACITY:	
: Curb height	6 in	: @ top of curb	10.6 cfs
: Median width	29.0 ft	: @ back of walk	18.7 cfs
: Rt back of walk	100.0 %		
: Lt back of walk	100.0 %		

*To meet
Dry Lane*

STREET FLOWS

Manning's Equation for flow capacity in a street section.
Craig Rd. Rancho to Jones with 24 cfs

Input variables:		Output variables:	
Flow depth, d	0.48 ft	Capacity at d	24.01 cfs
Road width	138.0 ft	Velocity	3.9 fps
Crown height	0.92 ft	Top width	138.0 ft
Street slope	2.00 %		
Sidewalk width	6.0 ft	CAPACITY:	
Curb height	6 in	@ top of curb	27.3 cfs
Median width	59.0 ft	@ back of walk	48.2 cfs
Rt back of walk	100.0 %		
Lt back of walk	100.0 %		

RESULT: DI # 11 $d = 0.48$ $y = 0.66$ 18' C-TYPE = 20.0 cfs
North half

no calcs.
for D.I. # 11A
South Half

STREET FLOWS

Manning's Equation for flow capacity in a street section.
Craig Rd. Rancho to Jones after DI #R1 and with additional 12 cf

Input variables:		Output variables:	
Flow depth, d	0.47 ft	Capacity at d	16.00 cfs
Road width	138.0 ft	Velocity	2.7 fps
Crown height	0.92 ft	Top width	138.0 ft
Street slope	1.00 %		
Sidewalk width	6.0 ft	CAPACITY:	
Curb height	6 in	@ top of curb	19.3 cfs
Median width	59.0 ft	@ back of walk	34.1 cfs
Rt back of walk	100.0 %		
Lt back of walk	100.0 %		

RESULT: DI # 12 $d = 0.47$ $y = 0.64$ 12' A-TYPE = 10.0 cfs

D.I # 13 was Later revised to 12', Type 'A'

STREET FLOWS

Manning's Equation for flow capacity in a street section.
Craig Rd. South Rancho to Jones, with 2.5 cfs

Input variables:		Output variables:	
Flow depth, d	0.29 ft	Capacity at d	2.50 cfs
Road width	138.0 ft	Velocity	1.8 fps
Crown height	0.92 ft	Top width	138.0 ft
Street slope	1.00 %	CAPACITY:	
Sidewalk width	6.0 ft	@ top of curb	19.3 cfs
Curb height	6 in	@ back of walk	34.1 cfs
Median width	59.0 ft		
Rt back of walk	100.0 %		
Lt back of walk	100.0 %		

RESULT: DI#13

d=0.29
y=0.46

A' - L-TYPE = 2.0 cfs.

used for D.I #11A

STREET FLOWS

Manning's Equation for flow capacity in a street section.
Craig Rd. Rancho to Jones, after DI #R2 and 39 cfs

Input variables:		Output variables:	
Flow depth, d	0.64 ft	Capacity at d	44.87 cfs
Road width	138.0 ft	Velocity	3.2 fps
Crown height	0.92 ft	Top width	150.0 ft
Street slope	1.00 %	CAPACITY:	
Sidewalk width	6.0 ft	@ top of curb	19.3 cfs
Curb height	6 in	@ back of walk	34.1 cfs
Median width	59.0 ft		
Rt back of walk	100.0 %		
Lt back of walk	100.0 %		

RESULT:

DI #14

d=0.64
y=0.81

20' L-TYPE = 27.0 cfs.

STREET FLOWS

Manning's Equation for flow capacity in a street section.
Craig Rd. Intersection of Jones, Craig Rd. with 49 cfs

: Input variables:		: Output variables:	
: Flow depth, d	0.65 ft	: Capacity at d	48.98 cfs
: Road width	138.0 ft	: Velocity	3.4 fps
: Crown height	0.92 ft	: Top width	150.0 ft
: Street slope	1.09 %	:	:
: Sidewalk width	6.0 ft	: CAPACITY:	:
: Curb height	6 in	: @ top of curb	20.2 cfs
: Median width	59.0 ft	: @ back of walk	35.6 cfs
: Rt back of walk	100.0 %	:	:
: Lt back of walk	100.0 %	:	:

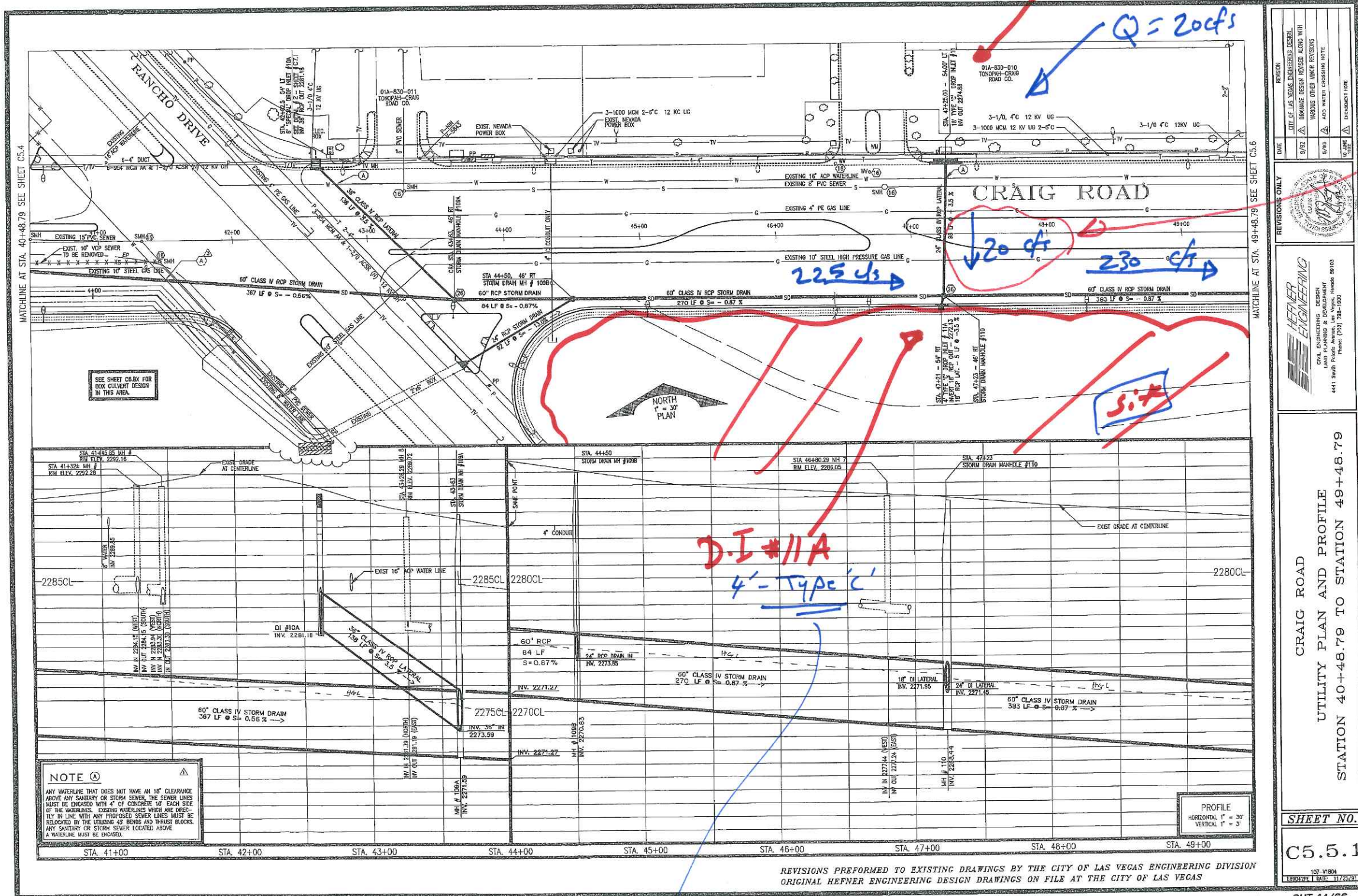
RESULT: $PI \# 15$ (sump cond.) $d=0.65$
 $y=0.62$ 20' C-TYPE = 51.5 cfs

STREET FLOWS

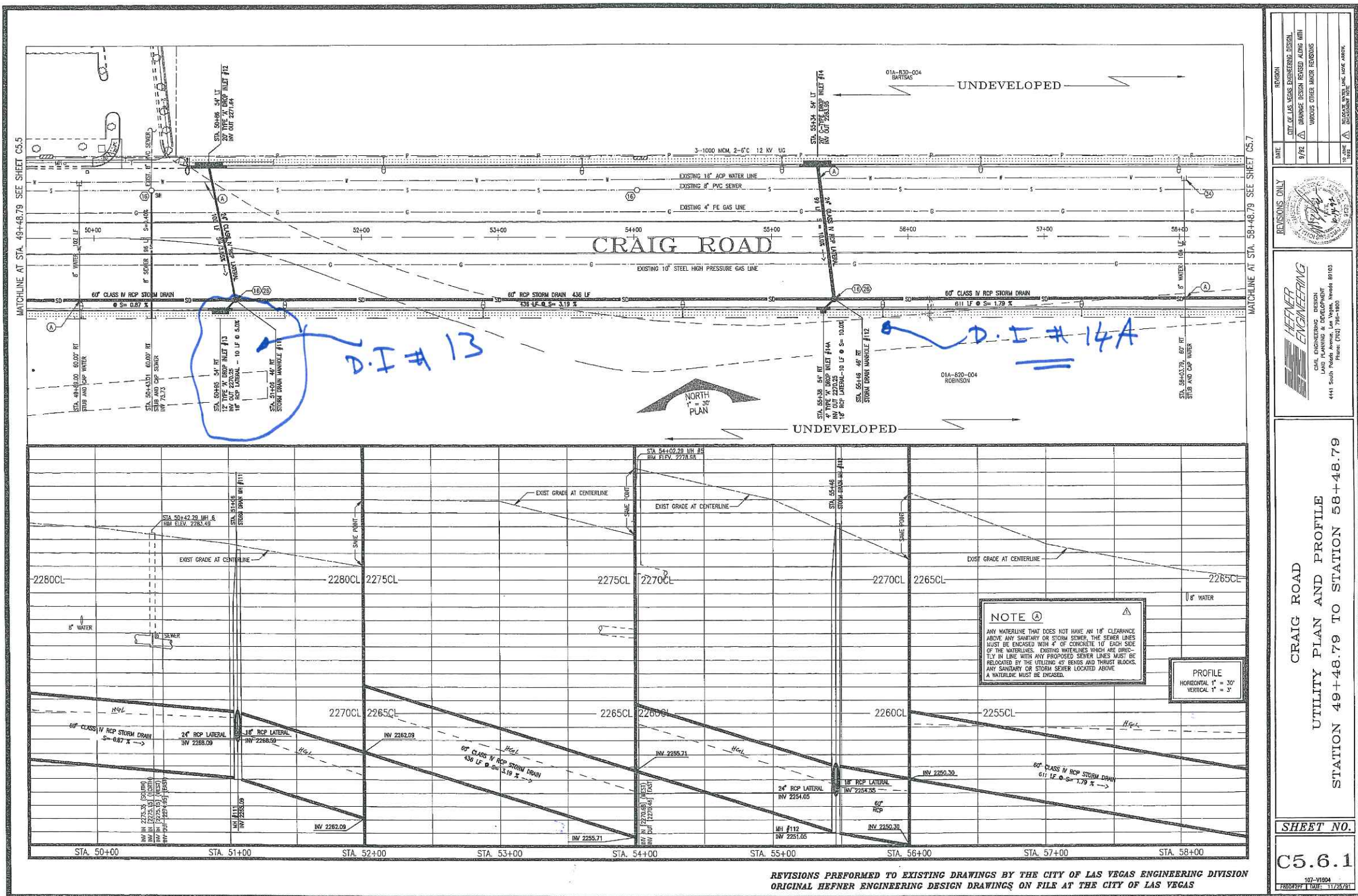
Manning's Equation for flow capacity in a street section.
Craig Rd. South Rancho to Jones with 4 cfs

: Input variables:		: Output variables:	
: Flow depth, d	0.32 ft	: Capacity at d	4.02 cfs
: Road width	138.0 ft	: Velocity	2.0 fps
: Crown height	0.92 ft	: Top width	138.0 ft
: Street slope	1.09 %	:	:
: Sidewalk width	6.0 ft	: CAPACITY:	:
: Curb height	6 in	: @ top of curb	20.2 cfs
: Median width	59.0 ft	: @ back of walk	35.6 cfs
: Rt back of walk	100.0 %	:	:
: Lt back of walk	100.0 %	:	:

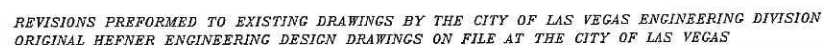
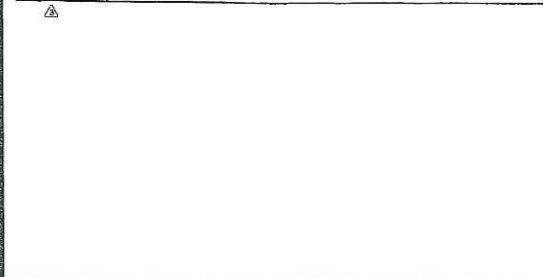
RESULT: $PI \# 16$ $d=0.22$
 $y=0.49$ 4'-A-TYPE = 2.2 cfs



Q Conservatively $\approx 5.5 cfs$
 (but it does not contribute to S.D. Flows,
 as it is local flows within the south
 Half)



SHT. 45/66

[illegible]

DROP INLET SCHEDULE

DROP INLET #	STA / OFFSET	TYPE / SIZE	FLAV. WTD (CFS)
1	6+07.60 LT	12' - C	21.0
2	7+41.87 LT	8' - A	10.0
3	12+63.88 LT	20' - A	18.0
4	17+01.67 LT	6' - A	5.5
5	25+18.22 LT	2.5' - B	12.5
6	25+18.22 RT	2.5' - B	5.0
7	32+94.28 LT	2.5' - B	9.0
8	37+68.66 LT	2.5' - B	11.0
9	37+64.66 RT	6' - A	3.7
10	40+07.55 LT	8' - A	5.0
11	47+23.00 LT	16' - C	20.0
12	50+86.02 LT	12' - A	10.0
13	50+88.00 RT	4' - A	2.0
14	55+33.99 LT	20' - C	28.0
15	61+57.00 LT	20' - C	51.5
16	62+10.00 RT	4' - A	2.2
17	(51+06.95 LT JONES)	20' - C	48.0
19	70+97.00 RT	4' - A	2.3
20A	79+40.92 LT	4' - A	3.3
21	79+40.92 RT	4' - A	2.3
22	88+20.00 RT	4' - A	2.5
23	97+64.56 LT	4' - A	2.9
24	97+65.42 RT	4' - A	3.3
26	107+92.00 LT	20' - A	9.2
27	107+92.00 RT	20' - A	4.5
28	114+71.08 LT	20' - A	1.1

+ 14 A
+ 11 A

→ 4' - Type A
DROP INLET FOR NUISANCE FLAV

18	70+97.00 LT	20' - A
20B	(50+99.91 LT CAM. DEL. DRD)	4' - A
25	103+40.00 RT	20' - A
29	(51+24.96 LT DERATVR)	20' - A
#	12+81.00	2.5' - B

actually
constructed
as 12' Type 'A'

PI #10 5.0 cfs 18" LATERAL

$$\text{MIN} = 94.9 - 2.5 - \frac{18}{12} = 90.9$$

$$\text{MAX} = 92.7 - \frac{18}{12} - 12(0.01) = 91.3$$

$$92.7 - \frac{18}{12} - 65(0.01) = 91.9$$

$$\rightarrow \text{MIN} = 94.9 - 2.0 - \frac{18}{12} = 91.4 \quad (\text{changed cover to } 2.0' \text{ feet})$$

$$94.9 - 1.0 - \frac{18}{12} = 92.4 \quad (\text{changed cover to } 1.0' \text{ feet})$$

PI #11 20.0 cfs 24" LATERAL

$$\text{MIN} = 85.6 - 2.5 - \frac{24}{12} = 81.1$$

$$\text{MAX} = 78.2 - \frac{24}{12} + (100)(0.01) = 77.2$$

PI #12 10.0 cfs 18" LATERAL

$$\text{MIN} = 83.1 - 2.5 - \frac{18}{12} = 79.1$$

$$\text{MAX} = 73.9 - \frac{18}{12} + 100(0.01) = 73.4$$

$$74.0 - \frac{18}{12} + 100(0.01) = 73.5$$

PI #13 2.0 cfs 18" LATERAL

Later revised to 12" Type A

$$\text{MIN} = 83.2 - 2.5 - \frac{18}{12} = 79.2$$

$$\text{MAX} = 73.9 - \frac{18}{12} - 9(0.01) = 72.4$$

$$74.0 - \frac{18}{12} - 9(0.01) = 72.5$$

PI #14 27.0 cfs 30" LATERAL

$$\text{MIN} = 74.6 - 2.5 - \frac{30}{12} = 69.8$$

$$\text{MAX} = 67.5 - \frac{30}{12} + 102(0.01) = 66.1$$

$$67.6 - \frac{30}{12} + 102(0.01) = 66.2$$

PI #15 51.5 cfs 36" LATERAL

$$\text{MIN} = 60.9 - \frac{36}{12} - 2.5 = 55.4$$

$$\text{MAX} = 53.6 - \frac{36}{12} + 100(0.01) = 51.6$$

$$57.6 - \frac{36}{12} + 100(0.01) = 55.6$$

$$57.5 - \frac{36}{12} + 100(0.006) = 55.2$$

DI #16

2.2 cfs 18" LATERAL

$$\text{MIN} = 60.1 - 2.5 - \frac{18}{12} = 56.1$$

$$\text{MAX} = 52.5 - \frac{18}{12} + 8(0.01) = 51.1$$

$$57.1 - \frac{18}{12} + 8(0.01) = 55.52$$

DI #17

48.0 cfs 30" LATERAL

$$\text{MIN} = 59.8 - 2.5 - \frac{30}{12} = 54.3$$

$$59.8 - 1.0 - \frac{30}{12} = 55.8$$

$$\text{MAX} = 51.8 - \frac{30}{12} + 138(0.01) = 50.2$$

$$57.0 - \frac{30}{12} + 138(0.0038) = 54.7$$

DI #18

29.0 cfs 30" LATERAL

$$\text{MIN} = 48.8 - 2.5 - \frac{30}{12} = 43.8$$

$$48.8 - 1.0 - \frac{30}{12} = 45.2$$

$$\text{MAX} = 42.0 - \frac{30}{12} + (100)(0.01) = 40.5$$

$$43.2 - \frac{30}{12} + (100)(0.0034) = 41.0$$

DI #19

2.3 cfs 18" LATERAL

$$\text{MIN} = 52.5 - 2.5 - \frac{18}{12} = 48.5$$

$$\text{MAX} = 42.0 - \frac{18}{12} + (8)(0.01) = 40.6$$

$$48.7 - \frac{18}{12} + 8(0.01) = 47.3$$

DI #20A

7.5 cfs 18" LATERAL

$$\text{MIN} = 37.5 - 2.5 - \frac{18}{12} = 33.5$$

$$\text{MAX} = 28.6 - \frac{18}{12} + (100)(0.01) = 28.1$$

$$22.8 - \frac{18}{12} + (100)(0.01) = 32.3$$

DI #20B

? cfs 18" LATERAL

$$\text{MIN} = 36.7 - 2.5 - \frac{18}{12} = 32.7$$

$$\text{MAX} = 27.9 - \frac{18}{12} + 144(0.01) = 27.8$$

$$31.3 - \frac{18}{12} + 144(0.01) = 31.2$$

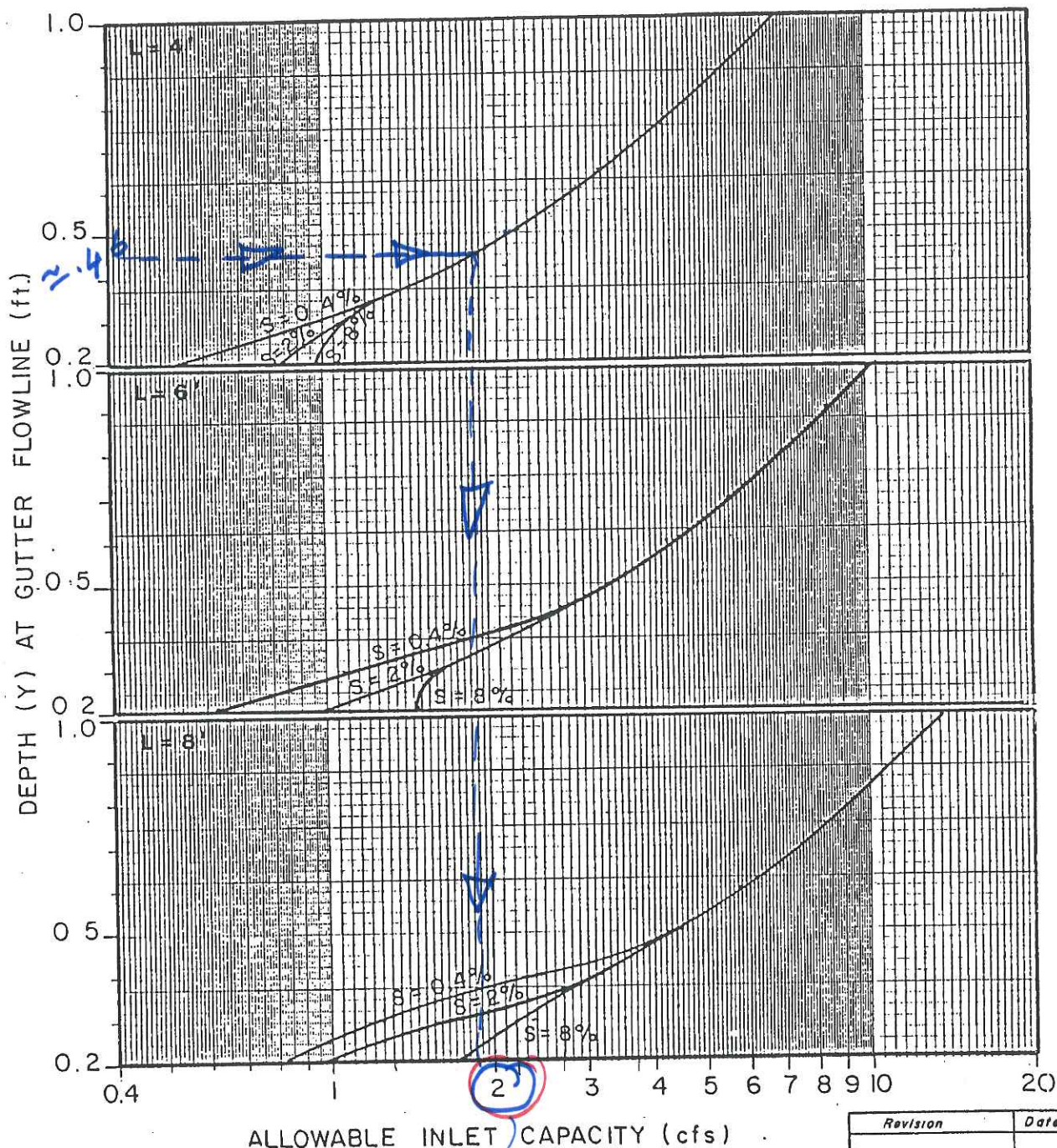


SECTION F

APPENDIX B - FLOOD CONTROL TABLES AND CHARTS

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

ALLOWABLE INLET CAPACITY CONTINUOUS GRADE CONDITION TYPE A INLET $Y \leq 1$ FOOT



NOTES: Includes capacity reduction factor of 0.80.

WRC
ENGINEERING

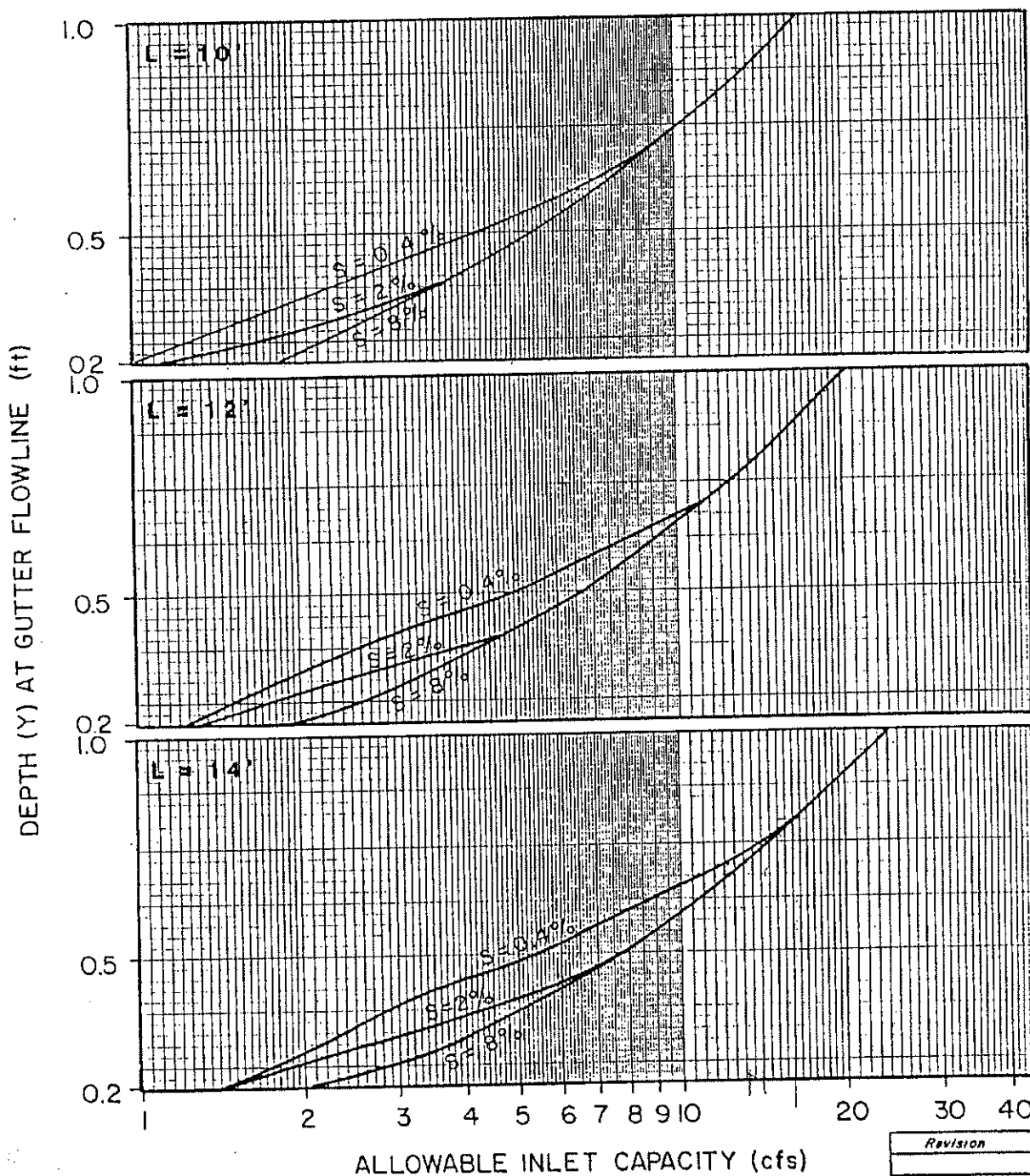
REFERENCE:

FIGURE 804
1 OF 3

+ 35 cfs from Grate

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

ALLOWABLE INLET CAPACITY CONTINUOUS GRADE CONDITION TYPE A INLET - $Y \leq 1$ FOOT



Revision	Date

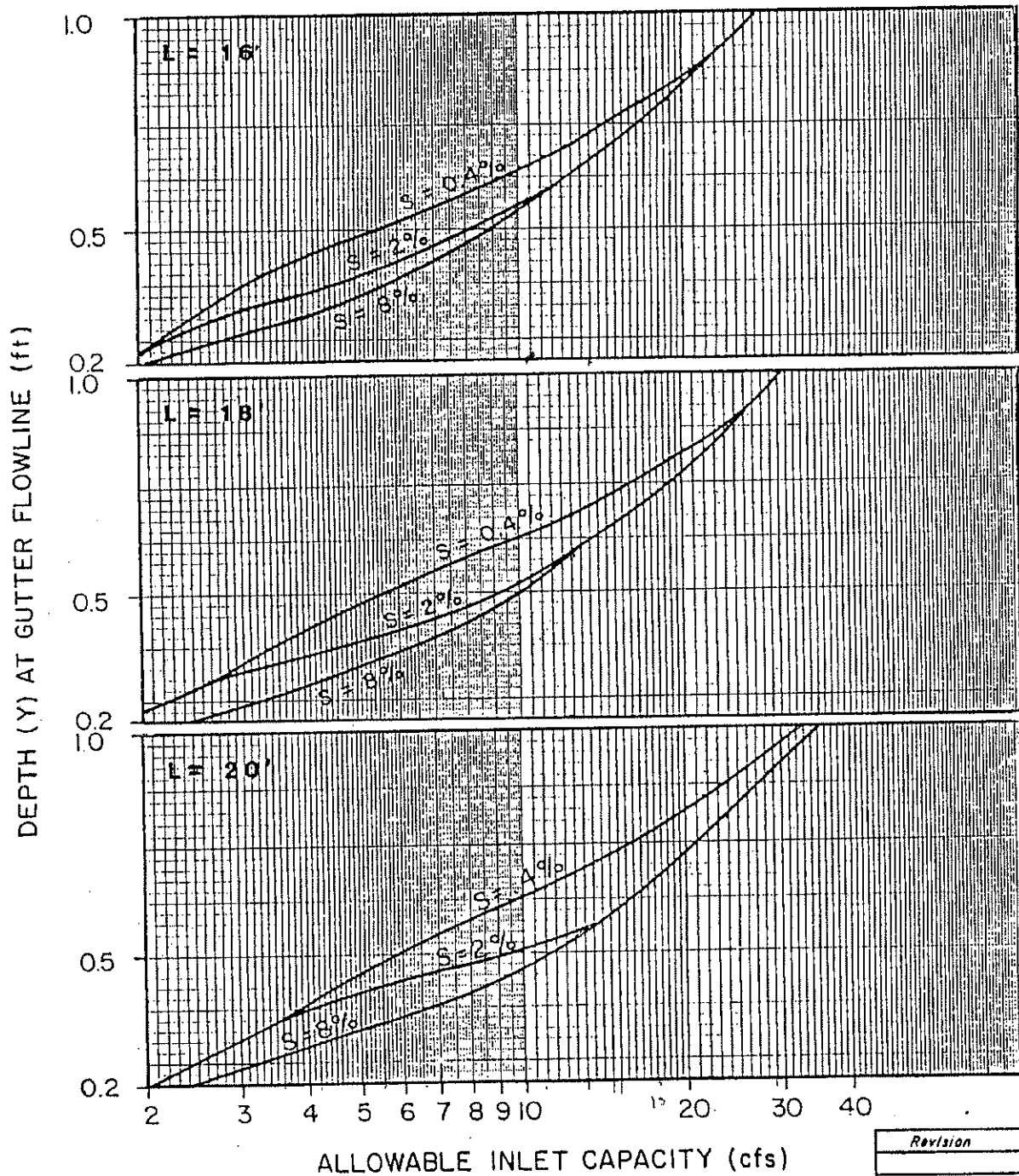
WRC
ENGINEERING

REFERENCE:

FIGURE 804
2 OF 3

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

ALLOWABLE INLET CAPACITY CONTINUOUS GRADE CONDITION TYPE A INLET - $Y \leq 1$ FOOT



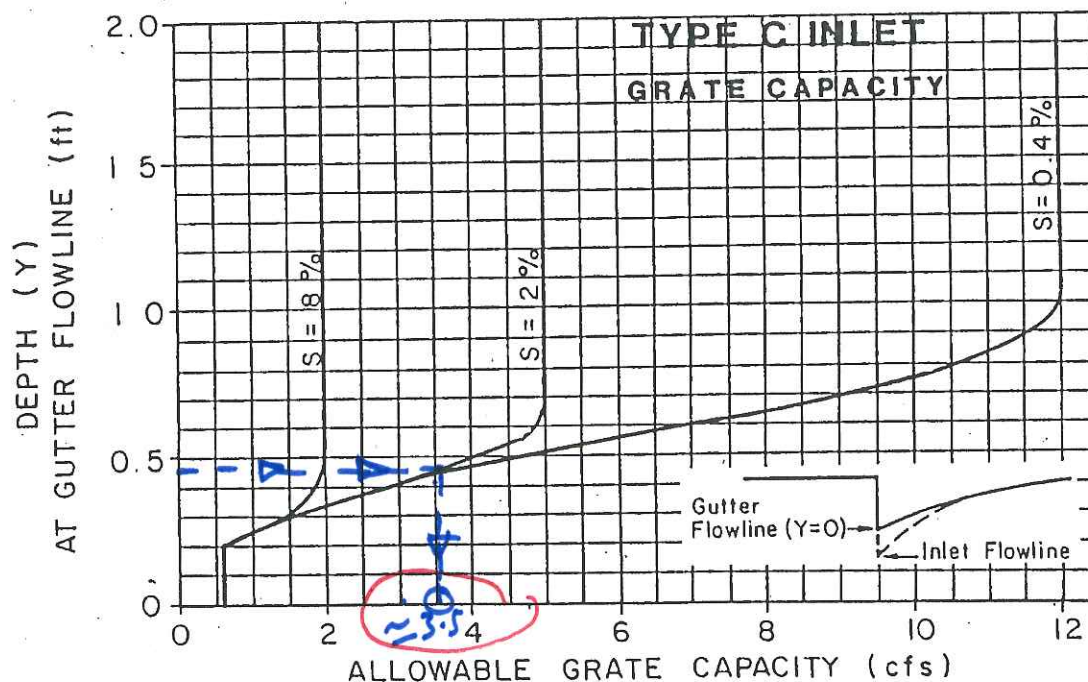
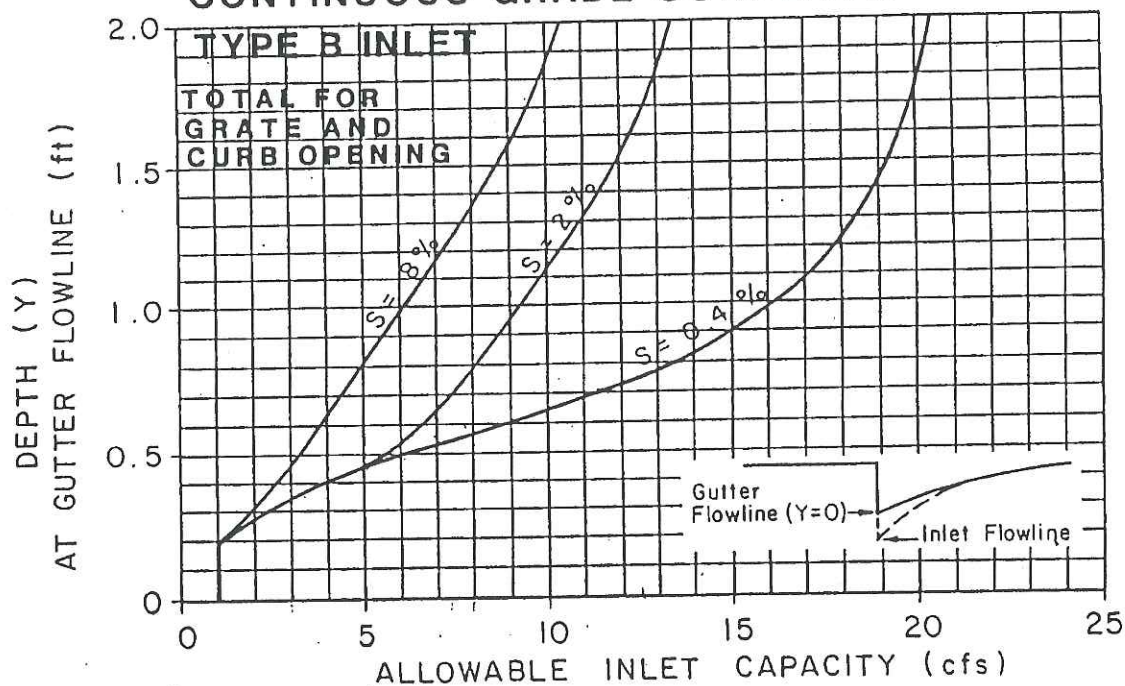
Revision	Date

WRC
ENGINEERING

REFERENCE:

FIGURE 804
3 OF 3

ALLOWABLE INLET CAPACITY CONTINUOUS GRADE CONDITION



- NOTES: 1. Type C Inlet: Add the grate capacity from this graph to curb opening capacity from Type A Inlet-Continuous Grade graphs to obtain Total Inlet Capacity.
2. Type C Inlet: Grate Capacity includes a reduction factor of 0.70.
3. Type B Inlet: Capacity includes a reduction factor of 0.70 applied to grate capacity and 0.80 applied to curb opening capacity.

Revision	Date

DS #: 4496

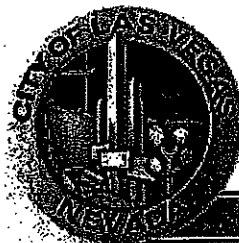
APN: _____

PROJECT: Hydrology Study for Craig Road between US. 95 and Decatur Blv.

SUBMITTAL: 1st Submittal

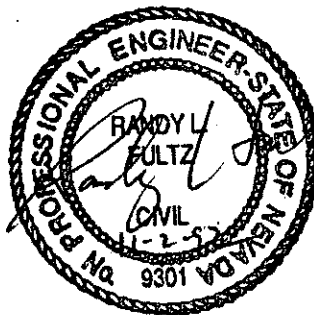
SCANNED BY/DATE: _____

CHECKED BY/DATE: _____



CLV
Mark Sorensen

**HYDROLOGY STUDY
FOR
CRAIG ROAD BETWEEN U.S.95
AND DECATUR BOULEVARD**



PREPARED BY:

**CITY OF LAS VEGAS
DEPARTMENT OF PUBLIC WORKS
FLOOD CONTROL SECTION
LAS VEGAS, NV 89128
229-6276**

November 2, 1992

CRAIG ROAD DRAINAGE STUDY

PURPOSE

The purpose of this study is to present hydrology and design assumptions for the Craig Road Street Improvement Project. The design adequacy will be evaluated based on (1) the Regional Transportation Commission (RTC) design criteria to collect and convey the 10-year stormwater flow as outlined in the Clark County Regional Flood Control District (CCRFCD) Hydrologic Criteria and Drainage Design Manual (2) its ability to reduce flooding along Rancho Drive and (3) does it perpetuate the historical flow thereby not adversely impacting other areas.

BACKGROUND

The RTC Craig Road Project extends from U.S. 95 to Decatur Boulevard. The design was started and largely finished by Hefner Engineering. However, it became necessary for the City of Las Vegas (CLV) to finish the design and bid the project. Final CLV review resulted in concerns regarding drainage design and are listed below:

- o Diverting the majority of the stormwater flows south along Rancho Drive at Craig Road would perpetuate existing flooding problems along Rancho Drive at the two intersections south of Craig Road at Alexander Road and Jones Boulevard.
- o Is the most direct or efficient route to the Gowan Outfall being implemented?
- o Why collect the Q10 flow and discharge the majority of it south along Rancho Boulevard when the original undeveloped contours conveyed runoff in a predominately west to east direction?
- o Why was the 50-year frequency flow being intercepted at U.S.95 instead of the 10-year frequency and why was the Gowan North Channel assumed to be in-place?
- o A Q10 stormwater diversion at Lone Mountain Road and Jones Boulevard of 120 cfs (Q100 = 240 cfs) was not included in the stormwater design.

- o The culvert diversions along Rancho Drive did not allow for a lower backwater elevation for the 10-year flows. Therefore, significantly less stormwater runoff would be reaching the Rancho/Craig intersection.
- o How will the 78 cfs that is conveyed across Rancho Drive draining along Craig Road be handled in the future?

The Hefner design required about 400 LF of 3-3'x7' box culverts at the Rancho/Craig intersection to discharge 468 cfs south into Rancho Drive (See Figure 1). The majority of the stormwater flows at the intersection of Rancho Drive and Craig Road are presently diverted south along Rancho Drive. However, about 78 cfs was conveyed across Rancho Drive in a existing 2'x6' RCB and discharged along the south side of Craig Road in a ditch. As the area develops this flow will remain in the street. As a minimum, this flow should have been piped east in Craig Road to Decatur Boulevard into the Gowan Outfall system.

Prior to construction of Rancho Drive, the flow direction along Craig Road was west to east across Rancho Drive. However, when Rancho Drive was constructed a low point or sump area was created forcing stormwater flows south along Rancho Drive.

Near the time the 7-11 Store was constructed, on the northwest corner of the Craig/Rancho intersection, the sump area in Craig Road created by Rancho Drive was moved to the west about 150 feet from Rancho Drive. This sump area was required in Craig Road because the 7-11 site was filled to a level that cut off the historical flow path on the west side of Rancho Drive across the 7-11 Store property. It was understood that Hefner Engineering approached NDOT with the proposal to extend the Craig Road drainage system north along the west side of Rancho Drive to intercept the flows that were conveyed along Rancho Drive prior to construction of the 7-11 Store. We understand that NDOT would not allow a storm sewer in Rancho Drive.

Since the contours in the undeveloped area were originally west to east, it is believed most of the flow would have been conveyed across Rancho Drive prior to construction. It is believed a similar portion of the 100-year flow (Q100) should be conveyed across Rancho Drive with a underground piping system into the Gowan Outfall at Decatur Boulevard. The proposed design will convey the 10-year flow (Q10) across Rancho Drive.

This would relieve the flooding problems south of Craig Road at the two intersections of (1) Rancho Drive and Alexander Road and (2) Jones Boulevard and Rancho Drive. Both of these intersections will need significant future RTC funds for flood control improvements to alleviate flooding if the Craig Road Project does not convey a portion of the flow east.

Previous studies in the project area include the following:

- o August 1988 G.C. Wallace Inc., Gowan Detention Basin Predesign Report.
- o December 1988 G.C. Wallace Inc., Decatur Boulevard Street Improvement Project Design Report.
- o 1989 G.C. Wallace Inc., Drainage Study for U.S.95 Interchanges Between Smoke Ranch and Lone Mountain.
- o May 1990 VTN-Nevada, Design Report for Gowan Detention Basin Outfall Structure.
- o November 1990 Hefner Engineering, Design Report for Craig Road Between Decatur and U.S. 95.

The November 1990 Hefner Engineering Report used information presented in the above studies to design the storm sewer system for Craig Road from U.S.95 to Decatur Boulevard. The RTC criteria allows for funding drainage improvements for the 10-year flow with a 12-foot dry lane in each direction and 6-inch depth (curb height) at major intersections.

OBJECTIVES

This study will prepare hydrology and hydraulic calculations for design which convey the 10-year flow in Craig easterly across Rancho Drive. A hydrologic analysis for the 10 and 100-year frequency events for existing and future conditions will be prepared. The hydraulic characteristics through culverts along U.S.95 and Rancho Drive were modified to reflect lower backwater elevations for a 10-year frequency. The results of this analysis will be compared to the Hefner Engineering Design Report.

into S.D.

APPENDIX E

HYDRAULIC GRADE LINE ANALYSIS

- A. Allowable Street Capacity Calculation
- B. Gowan Outfall 10-Year Depth of Flow
- C. Hydraulic Grade Line Calculations

PROJECT: CRAIG ROAD - WEST REACH
 File No.: s:\home\com\3\data\dnwgwstrtc
 DATE: 10/28/92

Manning's Roughness 0.013

***** MINOR LOSSES *****														
DATE :	STATION DESCRIPTION	FINISH GRADE	INV. ELEV.	PIPE DIA (IN)	LENGTH (FT)	Q (CFS)	friction head loss	band Hb	manhole Hmh	transn Ht	junction Hj	HGL ELEV.	EGL ELEV.	pressure velocity
	51+08	2282.60	2265.09	60	383.00	230	2.97	0.00	0.11	0.00	0.09	2268.63	2275.44	11.7
1	47+23	2285.90	2268.44	60	273.00	225	2.03	0.00	0.10	0.00	0.09	2272.44	2275.44	11.5
2	44+50	2288.20	2270.83	60	87.00	220	0.62	0.00	0.10	0.00	0.09	2274.53	2277.77	11.5
3	43+63	2289.50	2271.59	60	369.00	210	2.39	0.00	0.09	0.00	0.17	2275.29	2278.39	11.2
4	39+94	2291.70	2273.66	60	119.00	210	0.77	0.00	0.09	0.00	0.00	2275.56	2278.37	10.7
5	38+75	2292.90	2274.32	48	108.20	94	0.46	0.00	0.09	0.00	0.91	2278.98	2280.75	10.7
6	37+66.80	2293.90	2274.93	48	372.80	94	1.59	0.10	0.04	0.00	0.00	2279.06	2280.84	10.7
7	33+94	2300.00	2291.20	48	110.00	94	0.47	0.10	0.04	0.00	0.00	2281.61	2282.70	10.7
8	32+84.38	2299.80	2293.58	48	383.00	94	1.63	0.00	0.04	0.00	0.00	2280.92	2283.16	7.5
9	29+01.03	2307.10	2296.28	48	383.08	94	1.63	0.00	0.04	0.00	0.04	2282.33	2283.20	7.5
10	25+18.22	2310.60	2298.41	48	500.22	92	2.04	0.00	0.04	0.00	0.00	2292.60	2301.53	7.5
11	20+18	2313.73	2301.19	42	272.00	92	0.37	0.00	0.00	0.00	0.00	2292.74	2301.67	7.5
12	17+46	2314.50	2302.69	42	45.00	92	0.37	0.00	0.00	0.00	0.00	2295.52	2300.09	7.5
13	17+01	2314.70	2302.94	42	183.00	92	1.52	0.00	0.00	0.00	0.00	2298.92	2300.69	7.5
14	15+17.78	2315.40	2303.67	42	123.00	90	0.98	0.00	0.00	0.00	0.00	2298.96	2300.74	7.5
15	13+95	2315.80	2304.35	42	75.00	90	0.60	0.00	0.00	0.00	0.00	2301.29	2302.75	7.5
16	13+20	2316.10	2304.76	42	52.00	90	0.41	0.00	0.00	0.00	0.00	2301.37	2302.83	7.3
17	12+68	2316.20	2305.05	42	170.00	90	1.35	0.00	0.00	0.00	0.00	2303.99	2305.48	7.3
18	10+98	2316.70	2306.29	42	433.00	90	3.45	0.00	0.07	0.00	0.00	2304.68	2306.11	9.6
19	8+65	2318.10	2308.68	42	21.00	90	0.17	0.19	0.07	0.00	0.00	2306.95	2308.37	9.6
20		2318.70	2308.85	42		90				0.00	0.00	2307.33	2308.75	9.6
										0.00	0.00	2307.33	2308.75	9.6
										0.07	0.00	2308.85	2310.27	9.6
										0.00	0.00	2308.99	2310.41	9.4
										0.00	0.00	2310.03	2311.39	9.4
										0.00	0.00	2310.62	2311.98	9.4
										0.00	0.00	2311.04	2312.40	9.4
										0.00	0.00	2311.04	2312.40	9.4
										0.00	0.00	2312.39	2313.75	9.4
										0.00	0.00	2312.46	2313.82	9.4
										0.00	0.00	2315.90	2317.26	9.4
										0.00	0.00	2316.16	2317.52	9.4
										0.00	0.00	2316.33	2317.69	9.4

MH#10
 for
 existing
 18" RCP
 Lateral

DATE : 11-2-92

PROJECT: CRAIG ROAD - EAST REACH

FILE NAME: 11-2-92-0111.dwg

Manning's Roughness 0.013

MINOR LOSSES													
STATION DESCRIPTION	FINISH GRADE	INV. ELEV.	PIPE DIA. (IN)	LENGTH (FT)	Q (CFS)	friction head loss	band Hb	manhole Hmh	transm Ht	junction Hj	ELEV. HGL	ELEV. EGL	pressure velocity
117+39	2208.90	2191.10	(GOWAN OUTFALL)										
1	2209.00	2191.60	120	100.00	617	0.14	0.00	0.05	0.15	1.63	2196.60	2200.43	7.9
118+39	2209.00	2192.70									2198.43	2202.17	12.6
2	2208.80	2192.80	84	167.00	485	0.96	0.00	0.12	0.00	0.05	2200.66	2203.12	12.6
114+72	2208.80	2192.80									2200.83	2203.30	12.5
3	2209.00	2196.29	84	705.00	480	3.96	0.00	0.12	0.04	0.21	2202.59	2205.28	12.5
107+67	2209.00	2197.29									2202.96	2205.34	11.5
4	2209.00	2197.64	72	96.00	325	0.56	0.00	0.10	0.00	0.06	2203.85	2205.90	11.5
106+71	2209.00	2197.64									2204.02	2206.07	11.3
5	2209.00	2198.26	72	169.00	320	0.96	0.00	0.10	0.00	0.06	2205.04	2207.03	11.3
105+02	2209.00	2198.26									2205.20	2207.19	11.1
6	2209.70	2198.96	72	190.00	315	1.05	0.00	0.00	0.00	0.06	2206.31	2208.24	11.1
103+12	2209.70	2198.96									2206.37	2208.30	11.0
7	2213.00	2200.67	72	462.00	310	2.46	0.00	0.00	0.00	0.06	2208.89	2210.76	11.0
98+50	2213.00	2200.67									2208.95	2210.82	10.8
8	2213.40	2201.03	72	85.00	305	0.44	0.00	0.09	0.00	0.00	2209.45	2211.26	10.8
97+65	2213.40	2201.03									2209.54	2211.35	10.8
9	2216.70	2202.64	72	467.00	305	2.41	0.00	0.09	0.08	0.00	2211.95	2213.75	10.8
92+98	2216.70	2202.74									2212.11	2213.92	12.8
89+70	2219.30	2203.79	66	328.00	305	2.69	0.00	0.13	0.00	0.00	2214.05	2216.61	12.8
10	2219.30	2203.79									2214.18	2216.74	12.8
88+30	2220.30	2204.28	66	140.00	305	1.15	0.00	0.13	0.00	0.07	2215.33	2217.89	12.7
11	2220.30	2204.28									2215.52	2218.08	12.7
84+00	2224.10	2207.50	66	430.00	301	3.44	0.00	0.12	0.12	0.00	2219.03	2221.52	15.3
12	2224.10	2207.50									2219.27	2221.76	15.3
79+61	2237.30	2218.97	60	438.00	301	5.82	0.00	0.18	0.00	0.14	2222.07	2230.67	15.0
13	2237.30	2218.97									2222.40	2231.00	15.0
75+50	2246.80	2226.61	60	411.00	295	5.24	0.00	0.18	0.00	0.00	2230.01	2236.69	15.0
14	2246.80	2226.61									2230.19	2236.87	15.0
70+97	2251.60	2235.27	60	453.00	295	5.78	0.00	0.18	0.00	0.12	2238.67	2245.35	15.0
15	2251.60	2235.27									2238.96	2243.76	14.8
67+00	2255.50	2237.00	60	397.00	290	4.90	0.00	0.17	0.00	0.00	2245.27	2248.65	14.8
16	2255.50	2237.00									2245.44	2248.82	14.8
61+57	2261.00	2240.10	60	543.00	290	6.70	0.00	0.17	0.00	0.23	2252.13	2255.52	14.3
17	2261.00	2240.10									2252.53	2255.92	14.3
55+46	2273.80	2251.05	60	611.00	280	7.02	0.00	0.16	0.00	0.33	2254.35	2260.79	13.5
18	2273.80	2251.05									2254.84	2261.28	13.5
51+06	2282.60	2265.09	60	440.00	265	4.53	0.00	0.14	0.00	0.70	2267.79	2277.11	11.7
19	2282.60	2265.09									2268.63	2277.95	11.7
20	2285.90	2268.44	60	383.00	230	2.97	0.00				2272.24	2275.44	

Response to Comment No. 7

Previously Submitted Normal Flow Depth Calculations for Rancho Drive
(Proposed Condition)

Section AA - Rancho - Q25 Allowable Flow Spread Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho - Q25 Allowable f
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.0000 ft/ft
Discharge	10.00 cfs

Options	
Current Roughness Method	used Lotter's Method
Open Channel Weighting	used Lotter's Method
Closed Channel Weighting	Horton's Method

Results	
Mannings Coefficient	0.015
Water Surface Elev	81.47 ft
Elevation Range	.00 to 82.53
Flow Area	3.4 ft ²
Wetted Perimeter	20.45 ft
Top Width	19.93 ft
Actual Depth	0.47 ft
Critical Elevation	81.51 ft
Critical Slope	0.005990 ft/ft
Velocity	2.97 ft/s
Velocity Head	0.14 ft
Specific Energy	81.61 ft
Froude Number	1.28
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

Notes: * Maximum allowed 25-year flow spread is determined as gutter width (1.5') + Buss Lane (12.5ft from gutter) + 1/2 travel lane (6.0') = a total top width of 20.0ft.

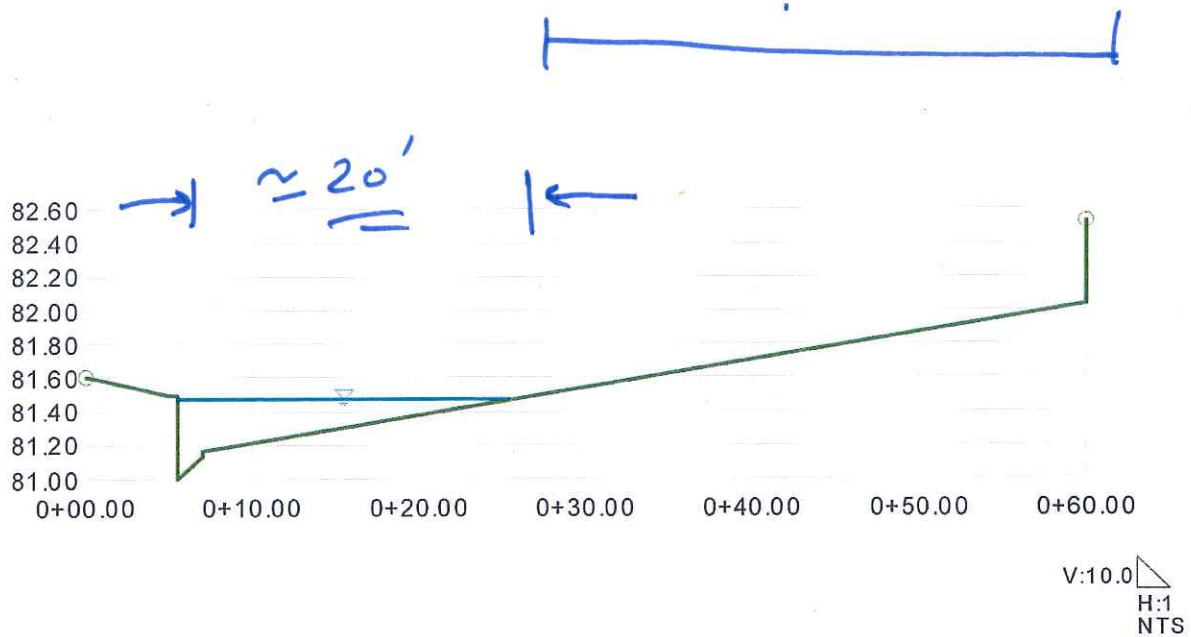
* Allowable 25-year surface discharge is determined as the flows resulting in the maximum allowed flow spread

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section AA - Rancho - Q25 Allowable Flow Spread **Cross Section for Irregular Channel**

Project Description	
Worksheet	Section AA - Rancho - Q25 Allowable I
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.010000 ft/ft
Water Surface Elev	81.47 ft
Elevation Range	.00 to 82.53
Discharge	10.00 cfs



Section AA - Rancho (10-Year, Existing and Future) Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (10-Year, Existing & Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	0.010000 ft/ft
Discharge	4.00 cfs

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

Results	
Mannings Coefficient	0.015
Water Surface Elev	81.37 ft
Elevation Range	.00 to 82.53
Flow Area	1.7 ft ²
Wetted Perimeter	14.18 ft
Top Width	13.76 ft
Actual Depth	0.37 ft
Critical Elevation	81.39 ft
Critical Slope	0.006715 ft/ft
Velocity	2.39 ft/s
Velocity Head	0.09 ft
Specific Energy	81.46 ft
Froude Number	1.21
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

Notes: * Q10/Q25/Q100 = 4/5/7cfs = runoff generated through offsite basin RNCH1(4/5/7cfs).

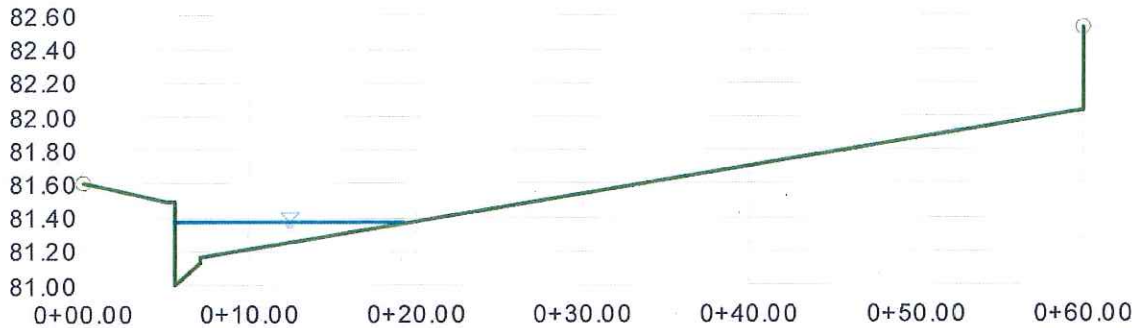
* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section AA - Rancho (10-Year, Existing and Future) **Cross Section for Irregular Channel**

Project Description	
Worksheet	Section AA - Rancho (10-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.010000 ft/ft
Water Surface Elev	81.37 ft
Elevation Range	.00 to 82.53
Discharge	4.00 cfs

→ Dry Lane ≈ 40.74' → 12' 0.8" ←



V:10.0
H:1
NTS

Section AA - Rancho (25-Year, Existing and Future)
Worksheet for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (25-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Slope	010000 ft/ft
Discharge	5.00 cfs

Options	
Current Roughness Method	Used Lotter's Method
Open Channel Weighting	Used Lotter's Method
Closed Channel Weighting	Horton's Method

Results	
Mannings Coefficient	0.015
Water Surface Elev	81.39 ft
Elevation Range	.00 to 82.53
Flow Area	2.0 ft ²
Wetted Perimeter	15.53 ft
Top Width	15.09 ft
Actual Depth	0.39 ft
Critical Elevation	81.41 ft
Critical Slope	0.006519 ft/ft
Velocity	2.52 ft/s
Velocity Head	0.10 ft
Specific Energy	81.49 ft
Froude Number	1.22
Flow Type	Supercritical

Roughness Segments		
Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points	
Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

Notes: * Q10/Q25/Q100 = 4/5/7 cfs = runoff generated through offsite basin RNCH1(4/5/7 cfs).

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

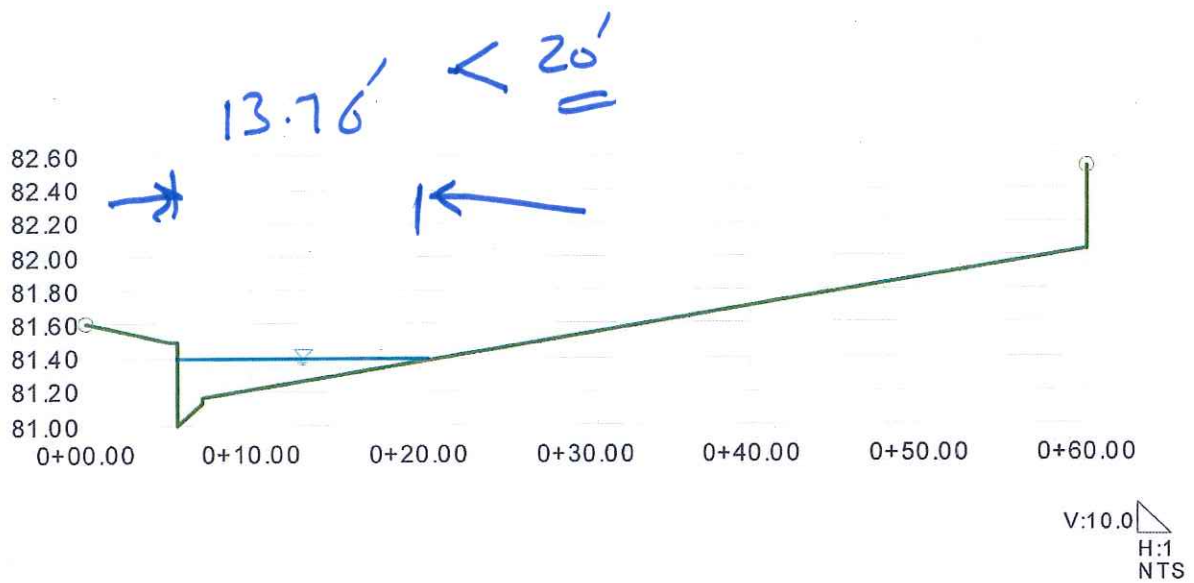
Well Downstream
proposed Driveway Entrance

← Less than 20'

Section AA - Rancho (25-Year, Existing and Future) Cross Section for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (25-Year, Existing a
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.010000 ft/ft
Water Surface Elev	81.39 ft
Elevation Range	.00 to 82.53
Discharge	5.00 cfs



Section AA - Rancho (100-Year, Existing and Future) Worksheet for Irregular Channel

Project Description

Worksheet	Section AA - Rancho (100-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data

Slope	010000 ft/ft
Discharge	7.00 cfs

Options

Current Roughness Method	aved Lotter's Method
Open Channel Weighting Method	aved Lotter's Method
Closed Channel Weighting Method	Horton's Method

Results

Mannings Coefficient	0.015
Water Surface Elev	81.43 ft
Elevation Range	.00 to 82.53
Flow Area	2.6 ft ²
Wetted Perimeter	17.77 ft
Top Width	17.30 ft
Actual Depth	0.43 ft
Critical Elevation	81.45 ft
Critical Slope	0.006233 ft/ft
Velocity	2.73 ft/s
Velocity Head	0.12 ft
Specific Energy	81.54 ft
Froude Number	1.25
Flow Type	Supercritical

Roughness Segments

Start Station	End Station	Mannings Coefficient
0+00.00	0+60.00	0.015

Natural Channel Points

Station (ft)	Elevation (ft)
0+00.00	81.60
0+05.00	81.50
0+05.50	81.50
0+05.50	81.00
0+07.00	81.13
0+07.00	81.17
0+60.00	82.03
0+60.00	82.53

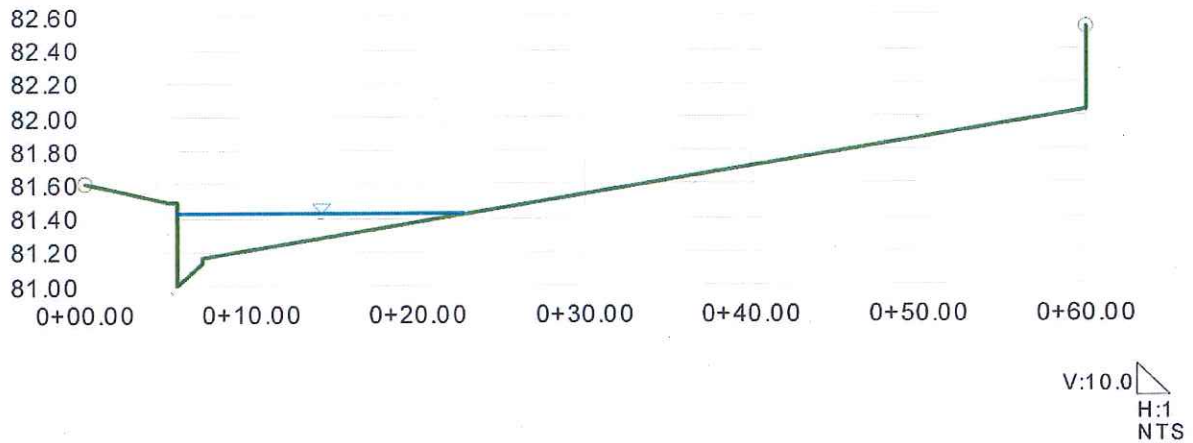
Notes: * Q10/Q25/Q100 = 4/5/7cfs = runoff generated through offsite basin RNCH1(4/5/7cfs).

* Mannings n=0.015 as referenced from NDOT Drainage Manual Section 3.3.2.2, Page 3-6.

Section AA - Rancho (100-Year, Existing and Future) Cross Section for Irregular Channel

Project Description	
Worksheet	Section AA - Rancho (100-Year, Existing and Future)
Flow Element	Irregular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coefficient	0.015
Slope	0.010000 ft/ft
Water Surface Elev	81.43 ft
Elevation Range	.00 to 82.53
Discharge	7.00 cfs



Response to Comment No. 8

Riprap Sizing for the Future Erosion Protection for the 6ft x 3ft RCBCs across
Rancho Drive
(100-year, Existing and Future)

OUTLET PROTECTION FOR BOX CULVERT

Northern 6ft x 3ft RCB across Rancho Drive

Date: October, 2016

Project: Craig and Rancho Master Drainage Study
Job No: 161051

Calculated by: HMN

Section 707.4 of Hydrologic Criteria and Drainage Design Manual (HCDDM)
Equation 761a:

$$(d50/H) (Y_t/H) / (Q/WH^{1.5}) = 0.014 \text{ For } Q/WH^{1.5} < 4$$

$$(d50/H) (Y_t/H)^2 / (Q/WH^{1.5})^{2.5} = 0.0019 \text{ For } Q/WH^{1.5} > 4$$

d50 = Rock size in feet for which 50 percent of the riprap by weight is smaller

H = Height of a rectangular culvert in feet

Ha = Average height used for computation if culvert is not flowing full $\{Da=1/2(H+Y_n)\}$

Yn = Normal depth of supercritical flow in culvert

Yt = Tailwater depth in feet

Q = Design discharge in cubic feet per second (cfs)

Solving equation 733 for d50:

$$d50 = \frac{[0.014 (Q/WH^{1.5})] H}{(Y_t/H)}$$

Computed results
Entered values

Check Figure 713 for Riprap Type: $Q/(W Ha^{0.5}) = 8.60$ <-----
 $Y_t/H_a = 0.40$ <----- Conservatively assuming tailwater only up to top of pipe

From the Graph, Minimum Riprap Protection is Required

W = 6 ft.
Yn = 1.57 ft. <----- from attached FlowMaster
H = 3
Ha = 2.285
Known Yt = - ft. <----- Enter - if Yt is unknown
Yt = 0.914
Q = 78 cfs <----- Q100
 $Q/WH^{1.5} = 3.76$
d50 = 0.30 ft.
3.61 in.

Provide d50 = 6.00 inch <----- 6-inch is conservatively utilized
Thickness = 12.00 inch

Extent of Protection:

Per Section 707.4.4 of HCDDM

Froude Parameter $Q/(W Ha^{1.5}) = 3.76$

$Q/(WH^{1.5}) < 8$ Therefore, Length of Protection shall be between 3H and 10H

From Equation 764: Length of Protection $L = (1/(2\tan\theta))(At/Y_t - W)$

W = Width of the Conduit, in ft

θ = The Expansion Angle of Culvert Flow

At = Required Area of Flow at Allowable Velocity in sq. ft. ($At = Q/V$)

V = Allowable Non-Eroding Velocity in the Downstream Channel in fps

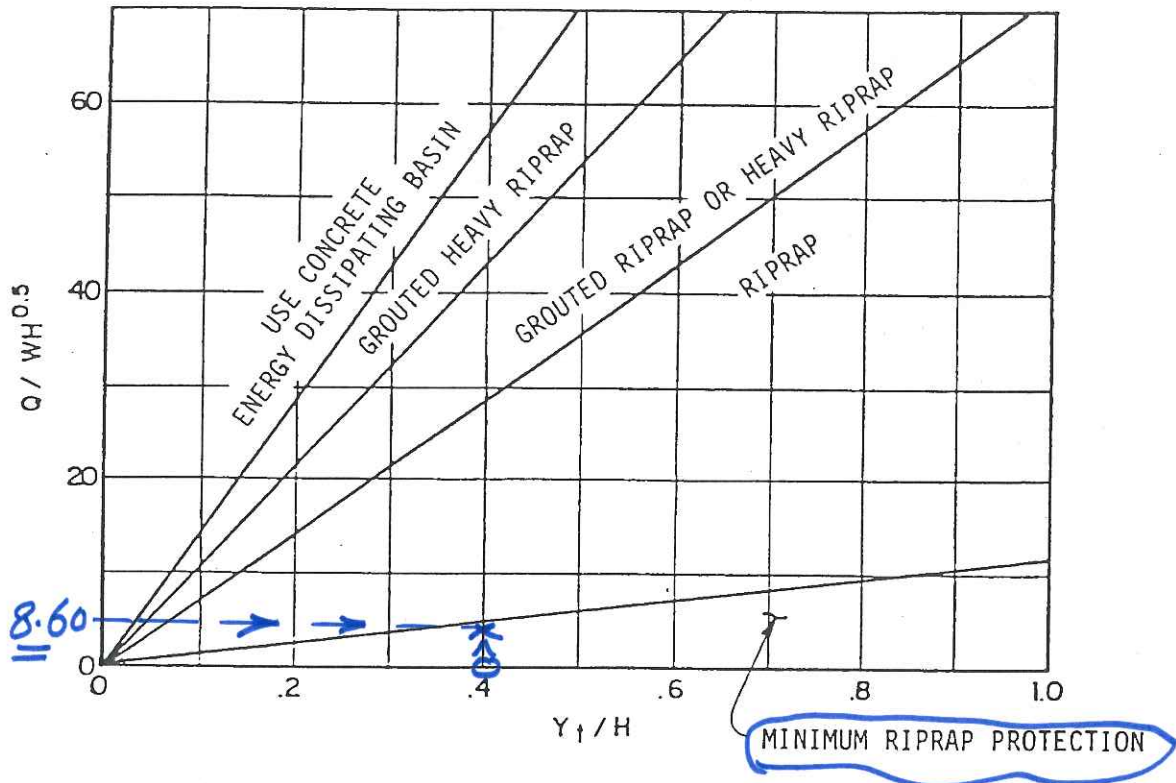
$1/(2\tan\theta) = 2.3$ <----- (From Figure 715)
W = 6 ft.
At = 15.6 sq. ft.
V = 5 fps
Yt = 0.914 ft.
Q = 78 cfs

L = 25.46 <----- However, per Figure 713 (Note 2),
L = 4 x H = 12ft is sufficient for Minimum Riprap

Provide Protection Downstream to a Maximum Length= 12-feet (i.e. 4 x H)

RIPRAP EROSION PROTECTION AT RECTANGULAR CONDUIT OUTLET

6' x 3' RCBL (Northern)



Notes:

1. Use H_a instead of H whenever culvert has supercritical flow in the barrel.

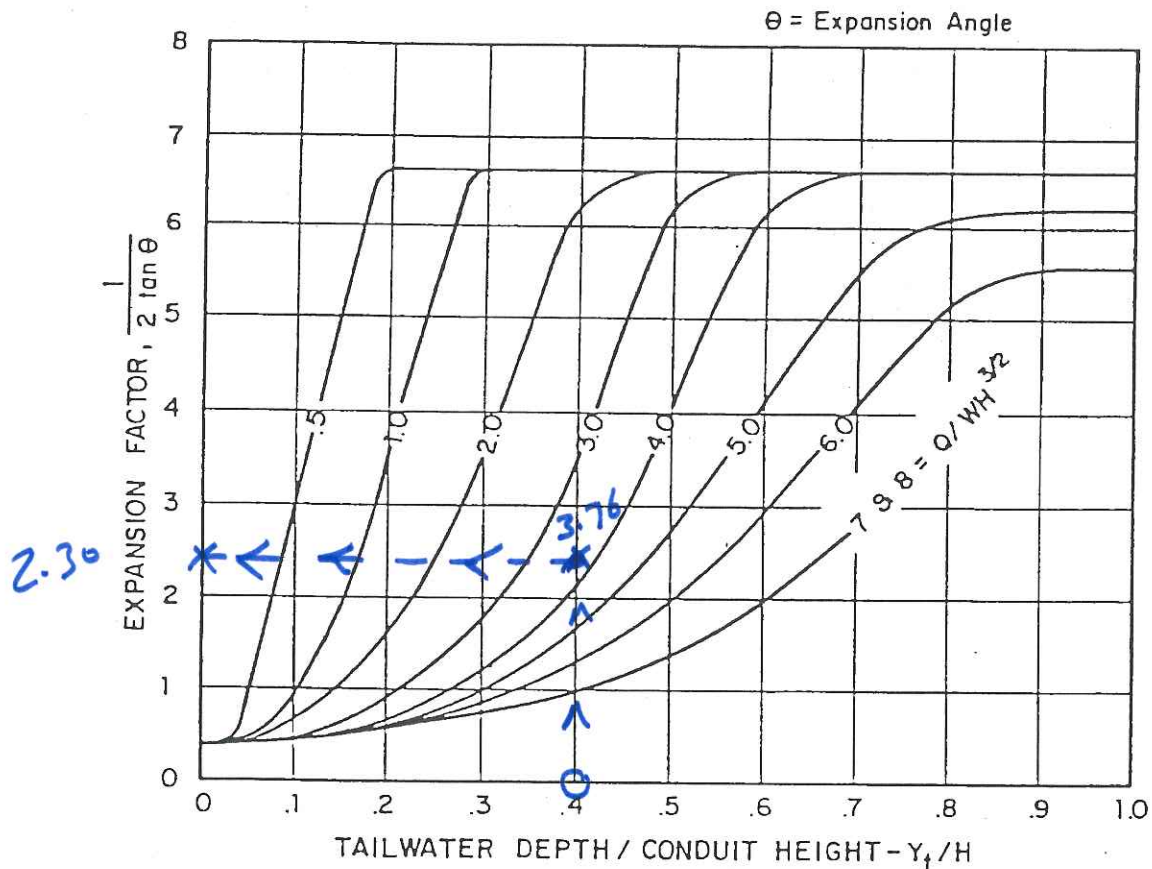
2. Minimum Riprap Protection: Use Riprap for a distance of $3H$ downstream for 18" to 36" equivalent round pipe size and $4D$ downstream for 42" and larger equivalent round pipe size.

$12' = 4 \times H$ is used

Revision	Date

EXPANSION FACTOR RECTANGULAR CONDUITS

6' x 3' RCBC (Northern)



Revision	Date

WRC
ENGINEERING

REFERENCE:
USDCM, DRCOG, March 1969 (with modifications)

FIGURE 715

OUTLET PROTECTION FOR BOX CULVERT**Southern 6ft x 3ft RCB across Rancho Drive**Date: October, 2016Project: Craig and Rancho Master Drainage Study
Job No: 161051

Calculated by: HMN

Section 707.4 of Hydrologic Criteria and Drainage Design Manual (HCDDM)
Equation 761a:

$$(d50/H) (Yt/H) / (Q/WH^{1.5}) = 0.014 \text{ For } Q/WH^{1.5} < 4$$

$$(d50/H) (Yt/H)^2 / (Q/WH^{1.5})^{2.5} = 0.0019 \text{ For } Q/WH^{1.5} > 4$$

d50 = Rock size in feet for which 50 percent of the riprap by weight is smaller

H = Height of a rectangular culvert in feet

Ha = Average height used for computation if culvert is not flowing full $\{Da = 1/2(H + Yn)\}$

Yn = Normal depth of supercritical flow in culvert

Yt = Tailwater depth in feet

Q = Design discharge in cubic feet per second (cfs)

Solving equation 733 for d50:

$$d50 = \frac{[0.014 (Q/WH^{1.5})] H}{(Yt/H)}$$

Computed results
Entered values

Check Figure 713 for Riprap Type:

$$Q/(W Ha^{0.5}) = 4.17$$

$$Yt/Ha = 0.40$$

Conservatively assuming tailwater only up to top of pipe

From the Graph, Minimum Riprap Protection is Required

W = 6 ft.
 Yn = 0.91 ft. < ----- from attached FlowMaster
 H = 3
 Ha = 1.955
 Known Yt = - ft. < ----- Enter - if Yt is unknown
 Yt = 0.782
 Q = 35 cfs ← Q100
 Q/WH^{1.5} = 2.13
 d50 = 0.15 ft.
 1.75 in.

Provide d50 = **6.00** inch <----- 6-inch is conservatively utilized
 Thickness = **12.00** inch

Extent of Protection:

Per Section 707.4.4 of HCDDM

Froude Parameter $Q/(W H^{1.5}) = 2.13$

 $Q/(WH^{1.5}) < 8$ Therefore, Length of Protection shall be between 3H and 10H

From Equation 764: Length of Protection $L = (1/(2\tan\theta))(At/Yt - W)$

W = Width of the Conduit, in ft

 θ = The Expansion Angle of Culvert FlowAt = Required Area of Flow at Allowable Velocity in sq. ft. ($At = Q/V$)

V = Allowable Non-Eroding Velocity in the Downstream Channel in fps

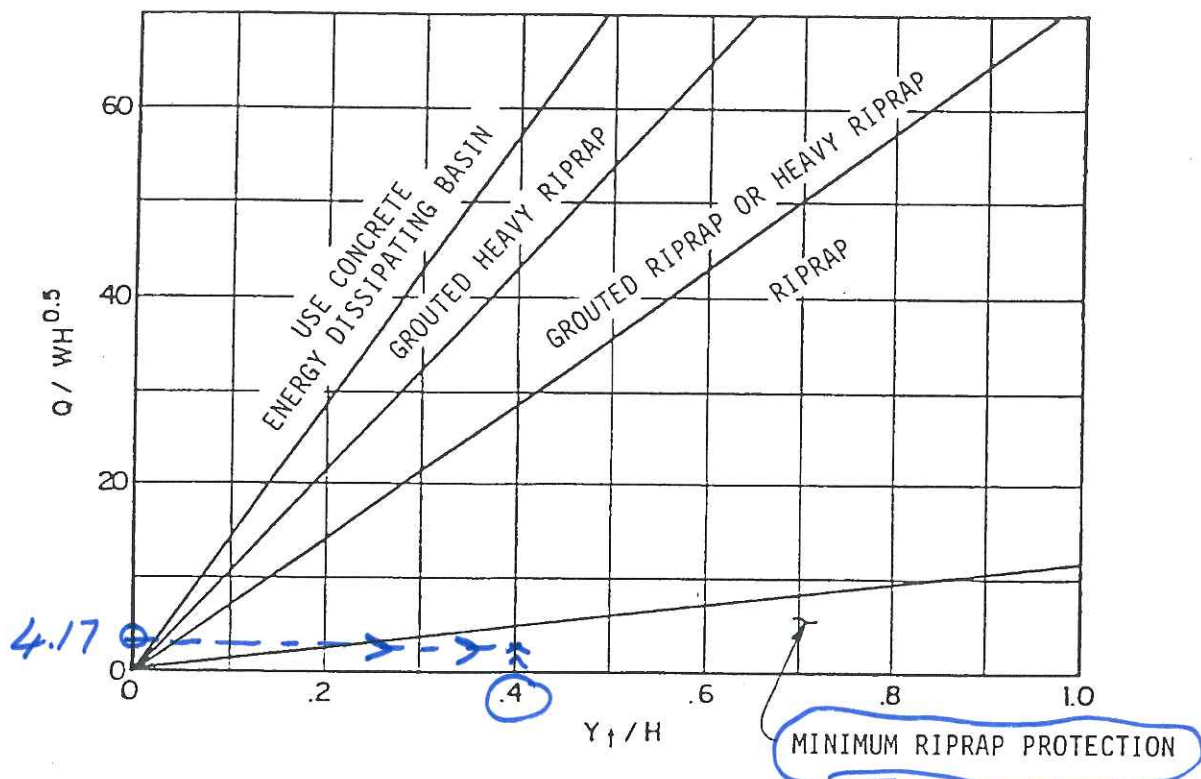
$1/(2\tan\theta) = 6$ < ----- (From Figure 715)
 W = 6 ft.
 At = 7 sq. ft.
 V = 5 fps
 Yt = 0.782 ft.
 Q = 35 cfs

$L = 17.71$ <----- However, per Figure 713 (Note 2),
 $L = 4 \times H = 12\text{ft}$ is sufficient for Minimum Riprap

Provide Protection Downstream to a Maximum Length= 12-feet (i.e. 4 x H)

RIPRAP EROSION PROTECTION AT RECTANGULAR CONDUIT OUTLET

6' x 3' RCBC (Southern)



Notes:

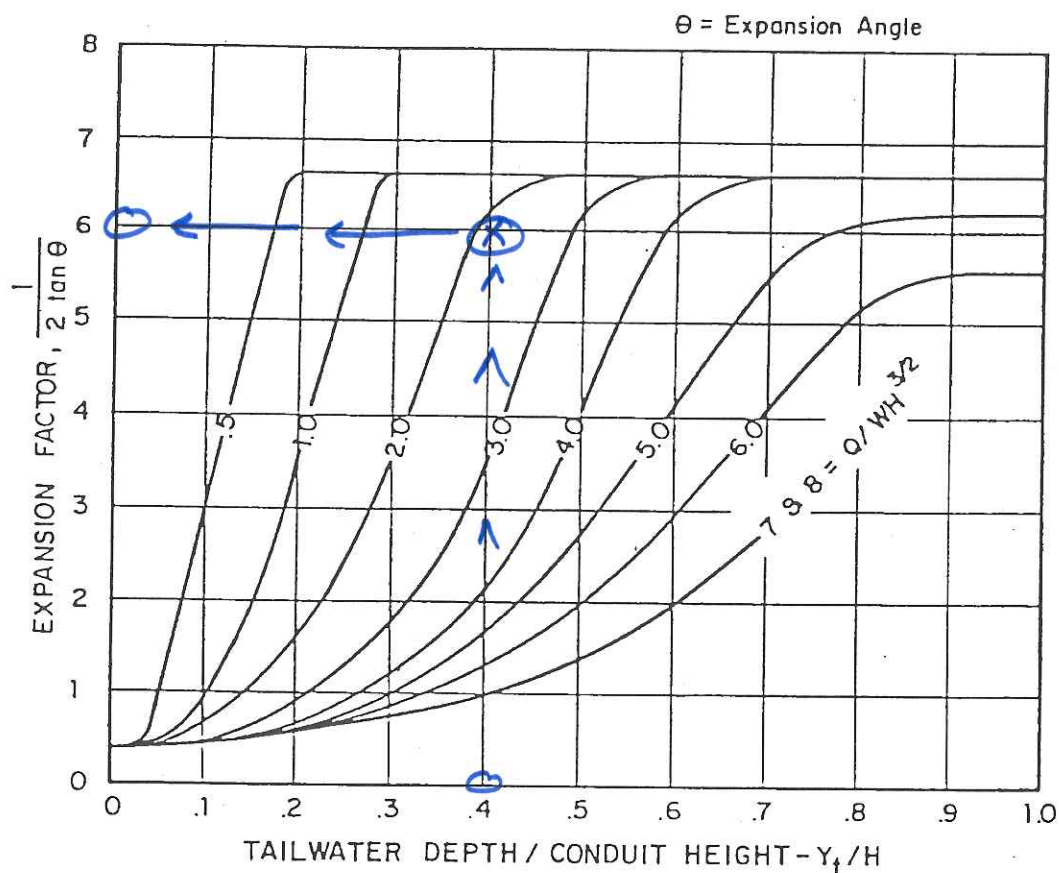
1. Use H_a instead of H whenever culvert has supercritical flow in the barrel.
2. Minimum Riprap Protection: Use Riprap for a distance of $3H$ downstream for 18" to 36" equivalent round pipe size and $4H$ downstream for 42" and larger equivalent round pipe size.

12' = 4H is used

Revision	Date

EXPANSION FACTOR RECTANGULAR CONDUITS

6' x 3' RCBC (Southern)



Revision	Date

WRC
ENGINEERING

REFERENCE:

USDCM, DRCOG, March 1969 (with modifications)

FIGURE 715

Response to Comment No. 8

Previously Submitted Normal Flow Depth Calculations for Existing 6ft x 3ft RCBCs
across Rancho Drive

(100-year, Existing Condition)

Northern RCBC

Existing 6' x 3' RCB through UMC(100-Year)

Worksheet for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through UMC
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeff	0.013
Slope	005000 ft/ft
Bottom Width	6.00 ft
Discharge	78.00 cfs

Results	
Depth	1.57 ft
Flow Area	9.4 ft ²
Wetted Perim	9.15 ft
Top Width	6.00 ft
Critical Depth	1.74 ft
Critical Slope	0.003767 ft/ft
Velocity	8.26 ft/s
Velocity Head	1.06 ft
Specific Energy	2.63 ft
Froude Number	1.16
Flow Type	supercritical

Q_{100}

Y_n

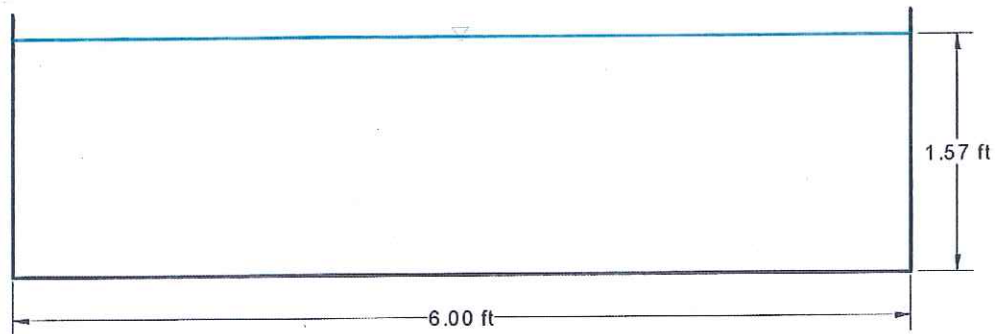
d_c

Notes: * Q_{100} = approximately 78cfs = 100-year flows as determined from the attached inlet nomograph analysis, assuming 3ft of available headwater at the entrance, as adopted from the Rancho/US95 LOMR (i.e. headwater = 2278.18ft (WSE at HEC-RAS Sta:53+82) - 2275.0ft RCBC invert)

Existing 6' x 3' RCB through UMC(100-Year)
Cross Section for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through UMC(
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Section Data	
Mannings Coeffic	0.013
Slope	005000 ft/ft
Depth	1.57 ft
Bottom Width	6.00 ft
Discharge	78.00 cfs



V:1
H:1
NTS

Southern RCBC

Existing 6' x 3' RCB through Pep Boys (100-Year) Worksheet for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through Pep Boys (
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

Input Data	
Mannings Coeffic	0.013
Slope	0.05000 ft/ft
Bottom Width	6.00 ft
Discharge	35.00 cfs

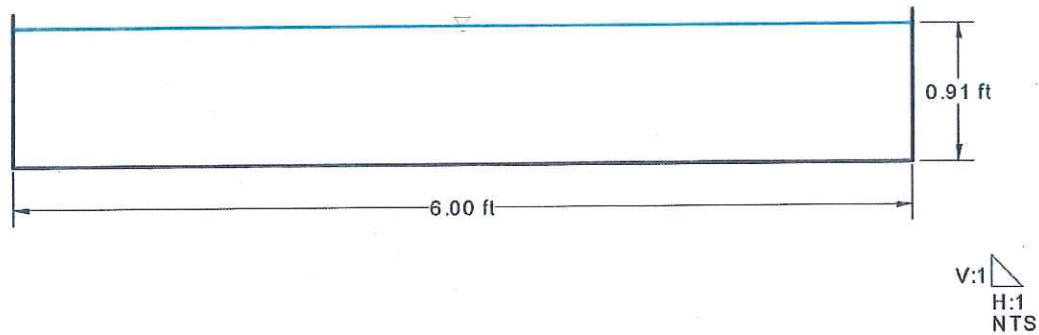
Results	
Depth	0.91 ft
Flow Area	5.5 ft ²
Wetted Perim	7.83 ft
Top Width	6.00 ft
Critical Depth	1.02 ft
Critical Slope	0.003614 ft/ft
Velocity	6.38 ft/s
Velocity Head	0.63 ft
Specific Energ	1.55 ft
Froude Numb	1.18
Flow Type	supercritical

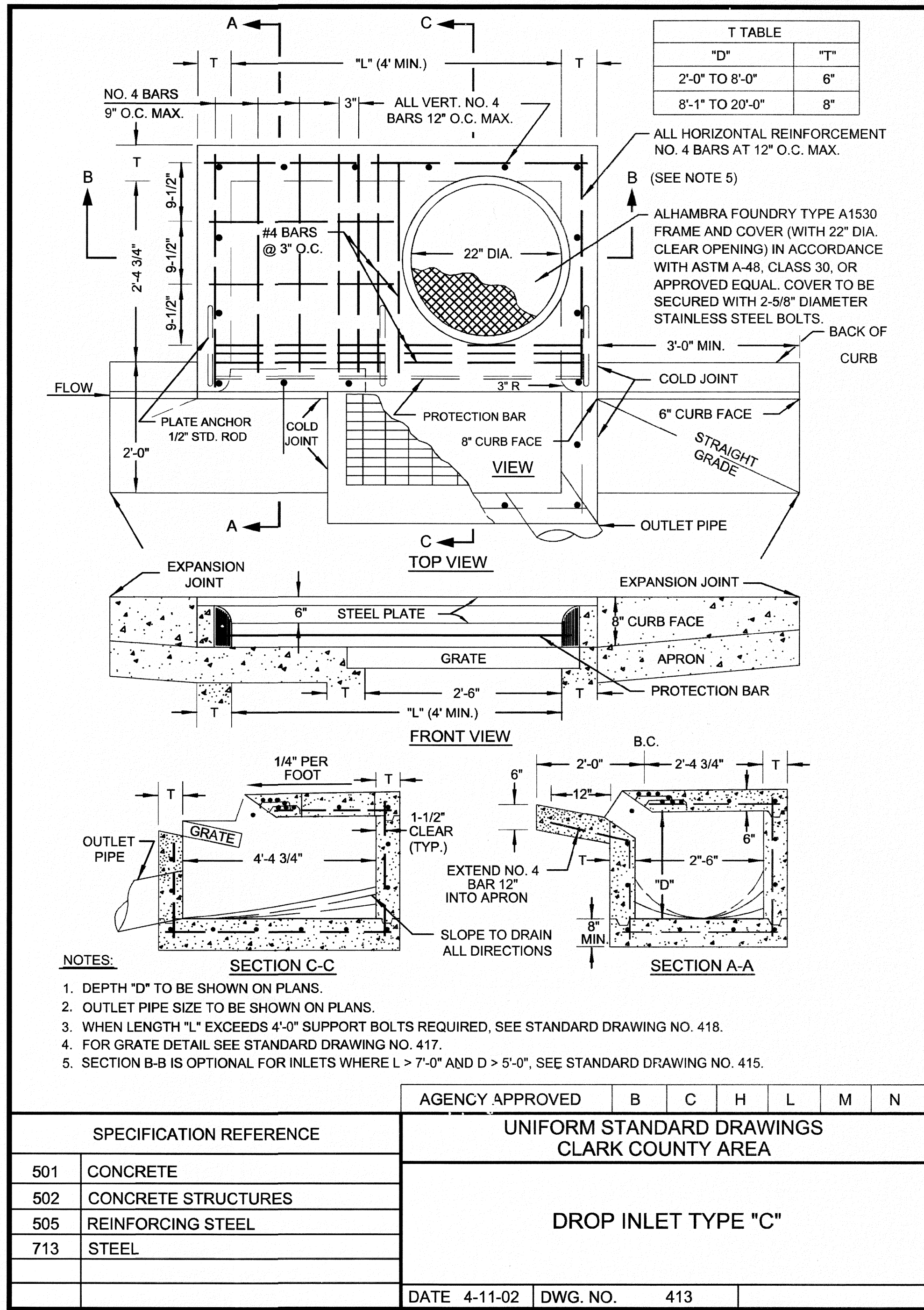
Notes: * Q100 = approximately 35cfs = as determined from the attached inlet control nomograph analysis, assuming 1.76ft of available headwater at the entrance through the 7'x3' RCB storm drain, as analyzed in the Rancho/US95 LOMR

Existing 6' x 3' RCB through Pep Boys (100-Year)
Cross Section for Rectangular Channel

Project Description	
Worksheet	Existing 6' x 3' RCB through Pep Boys (
Flow Element	Rectangular Channel
Method	Manning's Formula
Solve For	Channel Depth

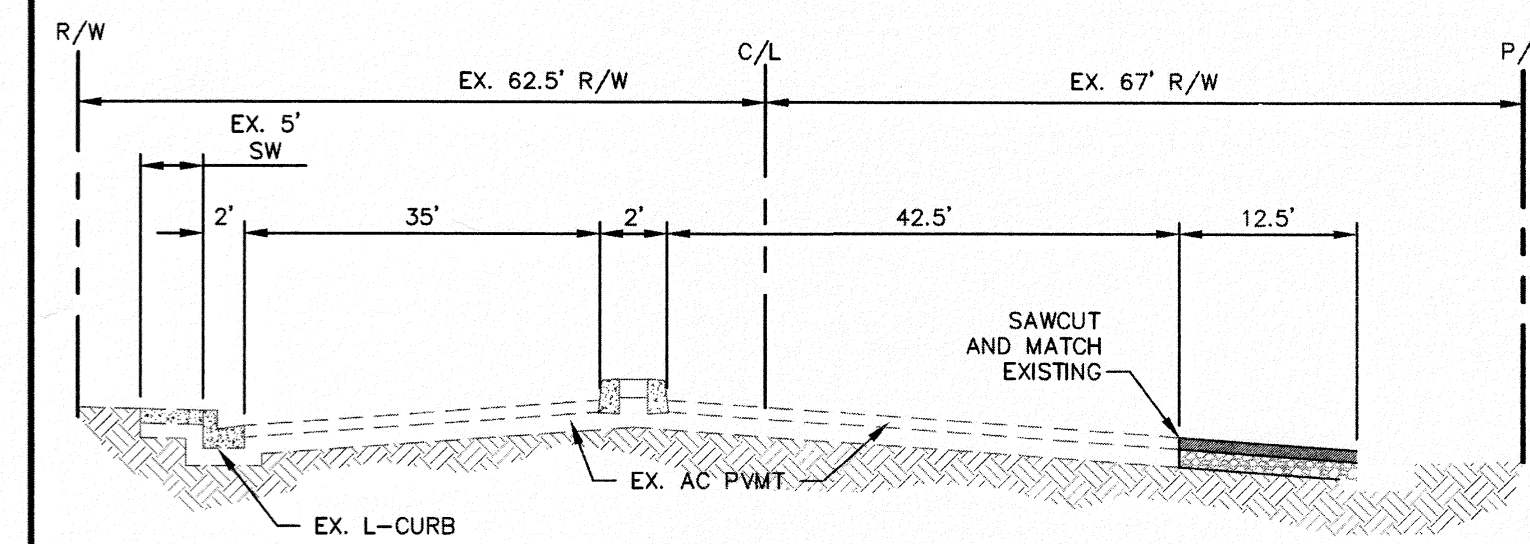
Section Data	
Mannings Coeff	0.013
Slope	005000 ft/ft
Depth	0.91 ft
Bottom Width	6.00 ft
Discharge	35.00 cfs





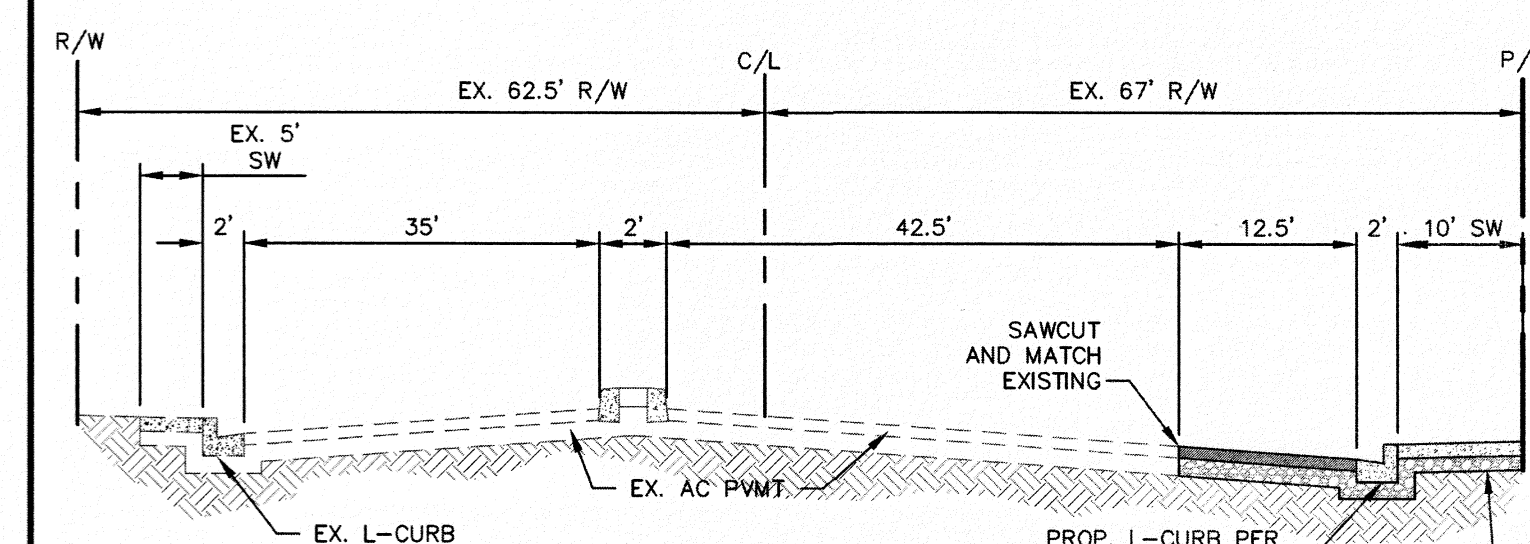
2 'A' CURB DETAIL

NOT TO SCALE



E RANCHO DRIVE

NOT TO SCALE

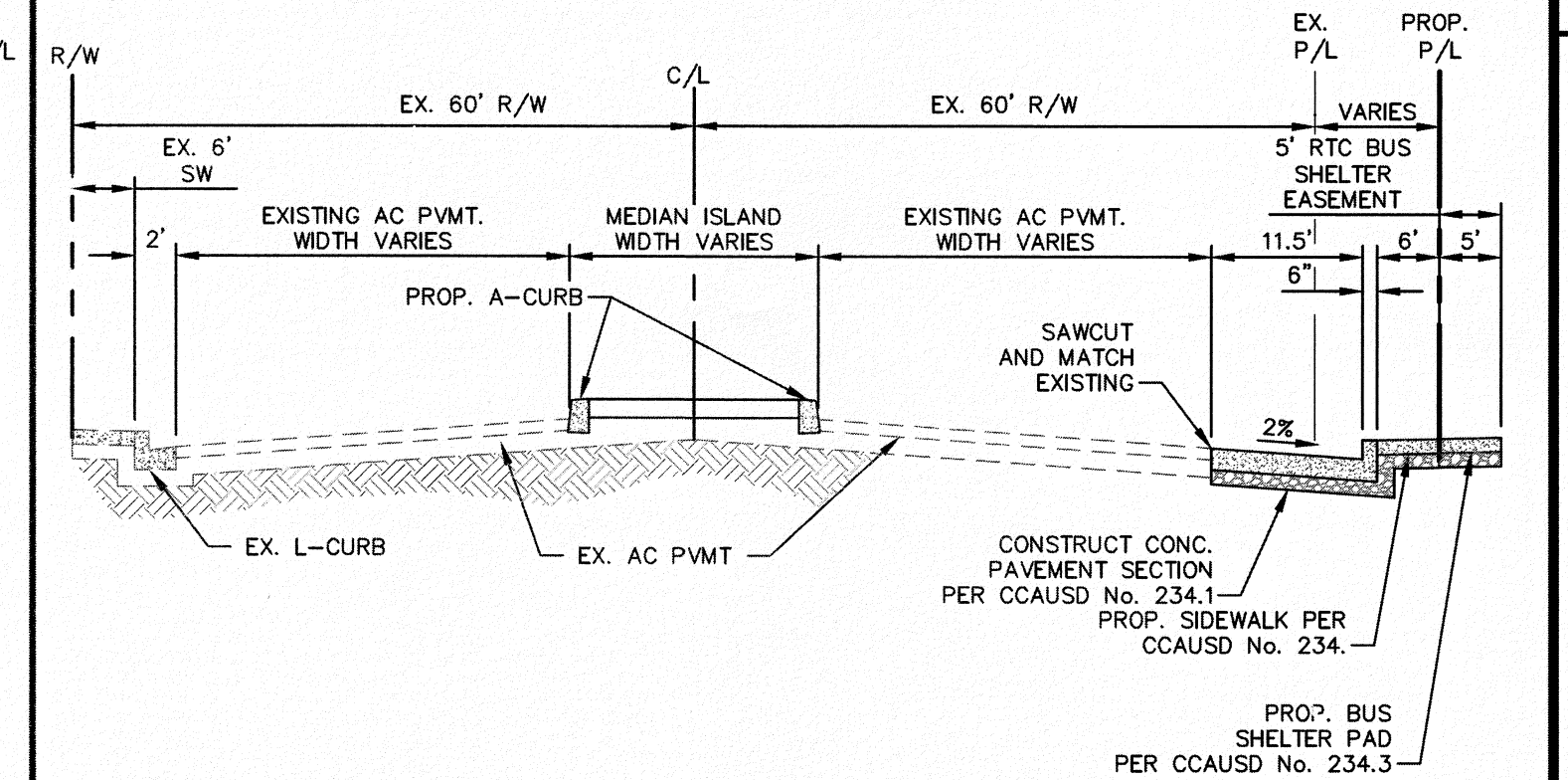


D RANCHO DRIVE

NOT TO SCALE

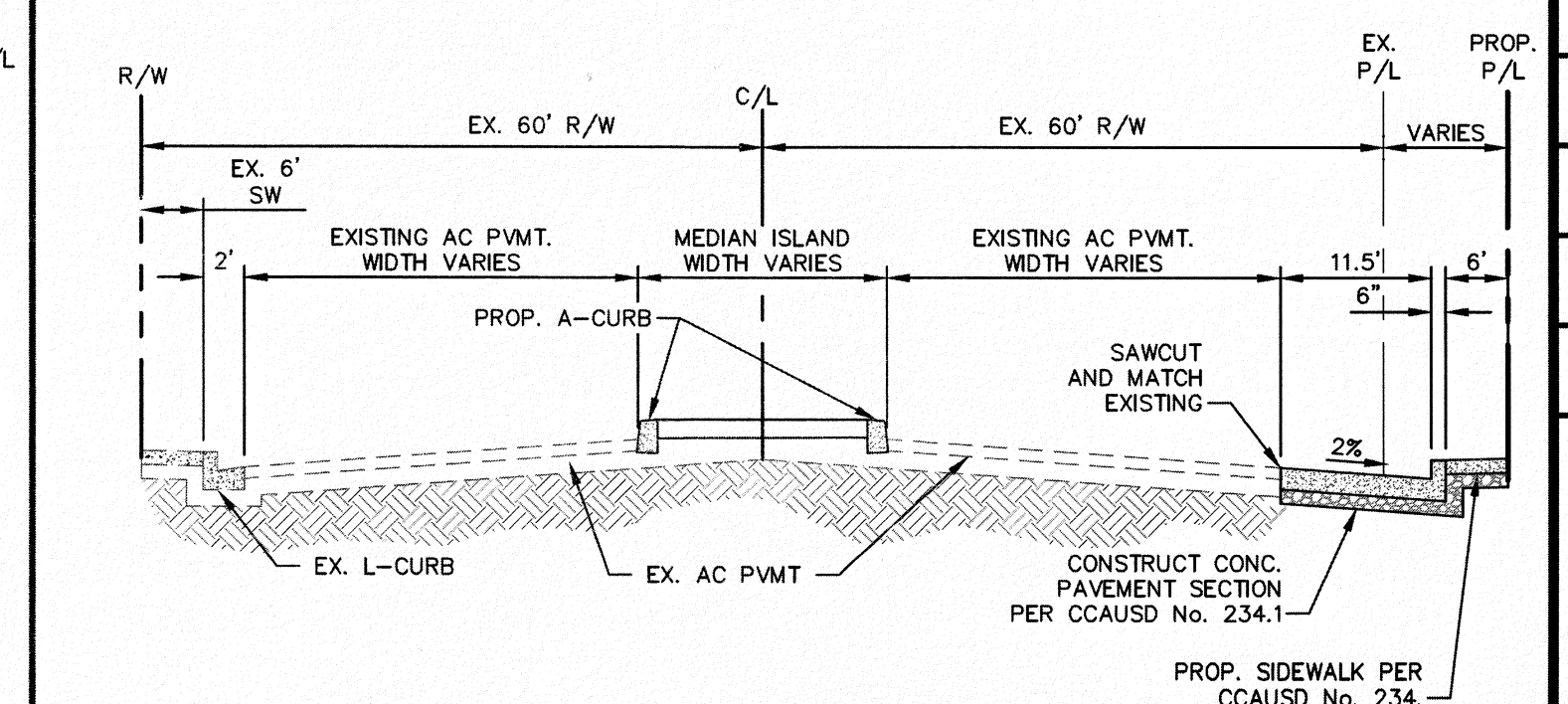
C CRAIG ROAD

NOT TO SCALE



B CRAIG ROAD

NOT TO SCALE

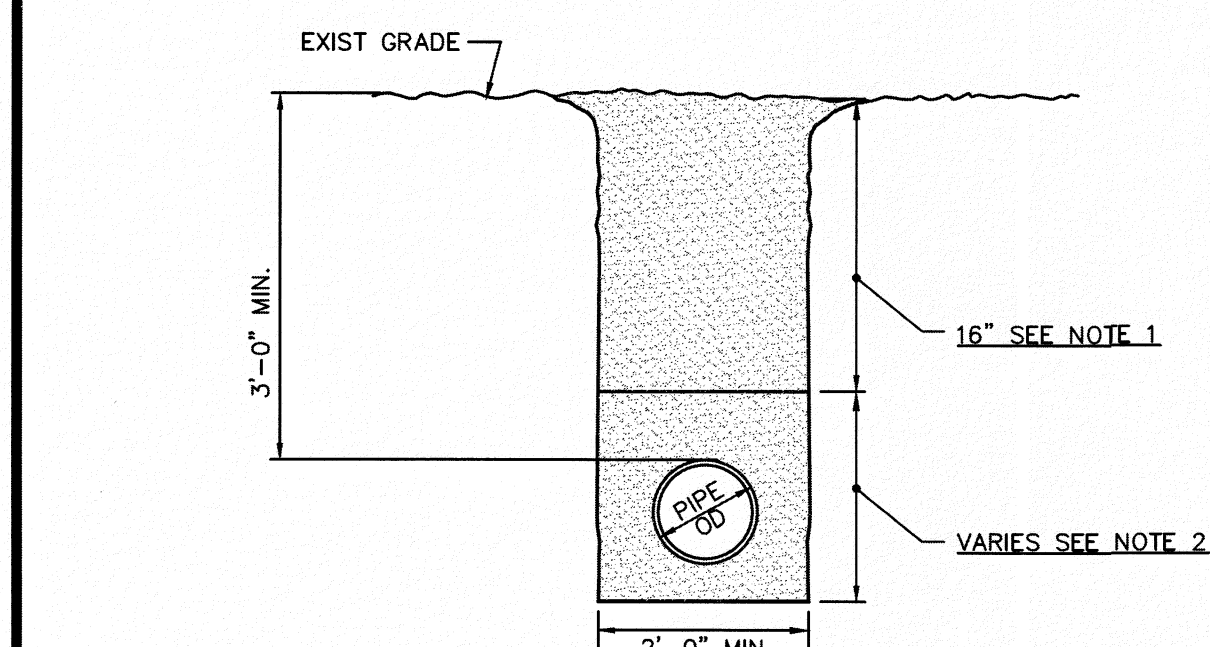


A CRAIG ROAD

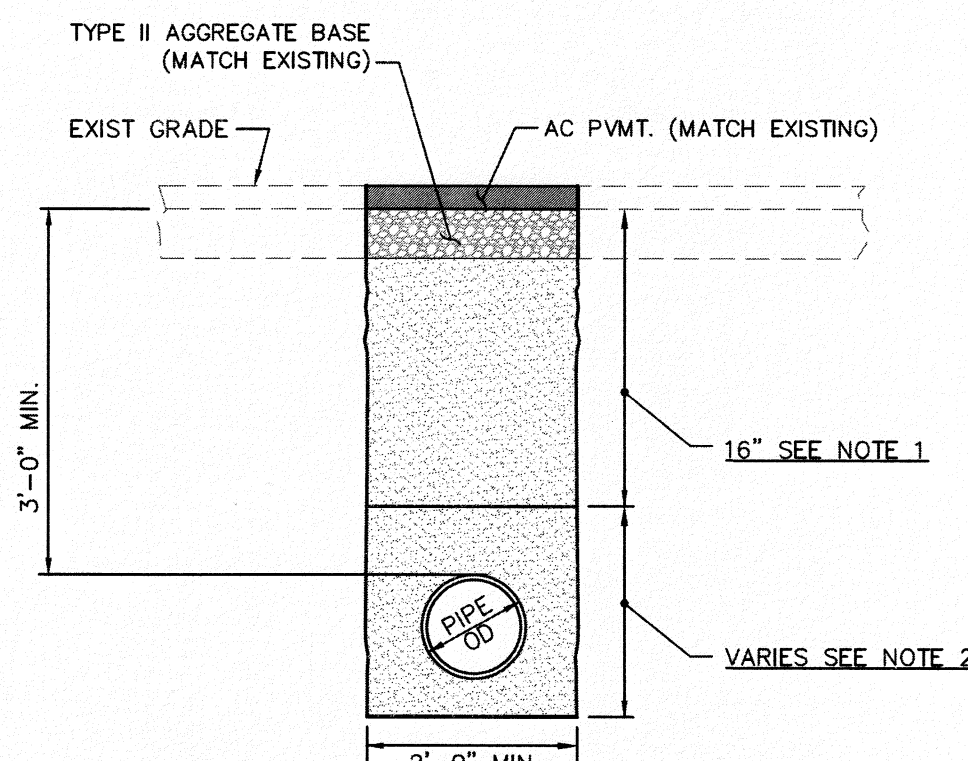
NOT TO SCALE

3 TYPE 'C' MODIFIED DROP INLET DETAIL

NOT TO SCALE



1 NDOT TRENCH SECTION - UNPAVED AREA



2 NDOT TRENCH SECTION - PAVED AREA

NOT TO SCALE

10/13/2016 2:08 PM
T:\CADD\161063\Drawings\Plan\Drawings\161063-500-01.dwg

DETAIL SHEETS
DETAIL SHEET

CRAIG & RANCHO
PHASE 1 & 2 OFF-SITES
IMPROVEMENT PLANS

PROJECT No.: 161063

DATE: 7/12/16

SCALE: N/A

DRAWN BY: JLI

DESIGNED BY: JLI

CHECKED BY: TTE

SEAL
T. T. TTE
REGISTERED PROFESSIONAL ENGINEER - STATE OF TEXAS
No. 11289
09/20/14

SHEET No. C5.01

SHEET 9 OF 9

CLV No. 65704

Lochsa
engineering

6345 South Jones Blvd.
Suite 100
Dallas, Texas 75244
Phone: (772) 365-9312
Fax: (772) 365-9317
www.lochsa.com

DESCRIPTION:

REV. DATE BY:

* Includes referenced flows from the " Rancho/US 95 LOMR"

Peak Flow Summary Future Condition				
HEC-1 I.D.	Area (acres)	100-year Flow (cfs)	25-year Flow (cfs)	10-year Flow (cfs)
2C2B3	-	199	36	20
RC2B3	-	197	35	20
5REMAIN	-	84	0	0
D5RCHO	-	113	35	20
RRNCH1	2.27	7	5	4
RRNCH1	-	7	5	4
ND1	26.52	81	60	45
CMD1	-	86	63	48
RRNCH2	1.94	6	4	3
RRNCH2	-	5	4	3
ND2	14.07	46	34	26
CMD2	-	51	37	28
JONES1	2.2	7	5	4
LOCL-D	-	144	105	80
TOTL-D	-	175	100	71
JONES-SD	-	79	79	71
LOWPNT-D	-	96	21	0
JONES2	2.04	6	4	3
HICKAM-D	-	99	24	3
CRAIG1	1.52	5	3	3
ND3-1	4.96	17	13	10
CRG0-D	-	22	16	12
RCRG0-D	-	21	15	11
CRAIG2	0.95	3	2	2
ND3-2	2.33	8	6	5
CRG1-D	-	33	24	18
ND4	2.35	8	6	4
JONES3	0.71	2	2	1
JON-D	-	10	7	6
CRG2-D	-	43	31	24
NDA*	0.98	4	3	2

Street Flow Summary (Future Condition)							
10-year, 6-hour Storm							
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	10-Year Flow [Q10] (cfs)	10-year Velocity [v] (fps)	10-year Flow Depth [d] (ft)	10-year Velocity x Depth [v x d]	Dry Lane Width (Within 1/2 ROW) (ft)
Rancho Drive	120	AA	4	2.39	0.37	0.88	40.74
Rancho Drive	120	BB	7	1.77	0.41	0.73	23.88
Craig Road	100	CC	1.5	1.85	0.31	0.57	32.88
Craig Road	100	DD	18	4.70	0.47	2.21	18.18
Jones Boulevard	100	EE	47	3.37	0.85	2.86	2.63

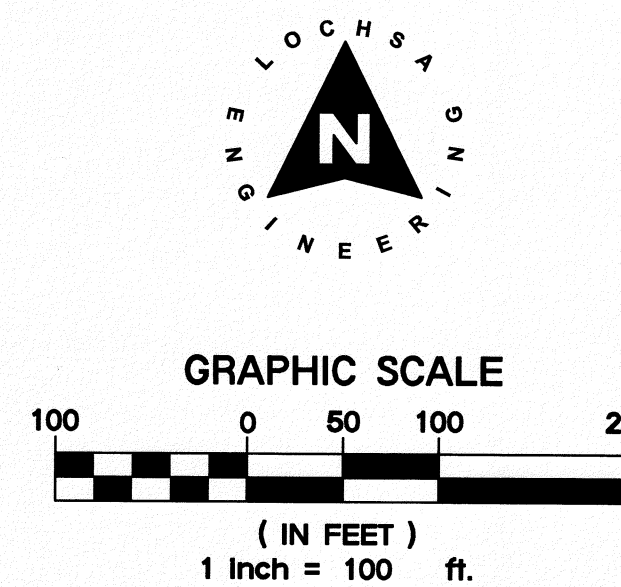
Street Flow Summary (Future Condition)						
100-year, 6-hour Storm						
Street	Right of Way Width (ft)	Hydraulic Cross-Section Identifier	100-Year Flow [Q100] (cfs)	100-year Velocity [v] (fps)	100-year Flow Depth [d] (ft)	100-year Velocity x Depth [v x d]
Rancho Drive	120	AA	7	2.73	0.43	1.17
Rancho Drive	120	BB	13	2.05	0.47	0.96
Craig Road	100	CC	2.5	2.08	0.35	0.73
Craig Road	100	DD	33	5.17	0.56	2.90
Jones Boulevard	100	EE	85	4.15	1.00	4.15

EX. 6'x3' RCB
(Q100 = 78 CFS)
AS REFERENCED FROM
"RANCHO/US 95 LOMR"

EX. 6'x3' RCB
(Q100 = 35 CFS)
AS REFERENCED FROM
"RANCHO/US 95 LOMR"

EX. 3'x7' RCB

EX. 6'x3' RCB



DRAINAGE LEGEND	
ND1	DRAINAGE BASIN LABEL
CMD1	CONCENTRATION POINT
-----	COMBINATION POINT
-----	BASIN BOUNDARY LINE
-----	OFFSITE BASIN BOUNDARY
2 / 3 / 5	Q10/Q25/Q100 FLOW IN CFS
1 (1.0)(1.2)	Q10 (V10)(D10)
1 (1.0)(1.2)	Q100 (V100)(D100)
→	BASIN FLOW DIRECTION
→	COMBINED FLOW DIRECTION
①D	HYDRAULIC CROSS-SECTION
2	[Q10]N
3	[Q100]N
	STORM DRAIN FLOWS IN CFS

ONSITE BASIN MAP
(FUTURE CONDITION)

CRAIG & RANCHO
MASTER DRAINAGE STUDY

PROJECT No.: 161051

DATE: 10/11/16

SCALE: 1"=100'

DRAWN BY: HMN

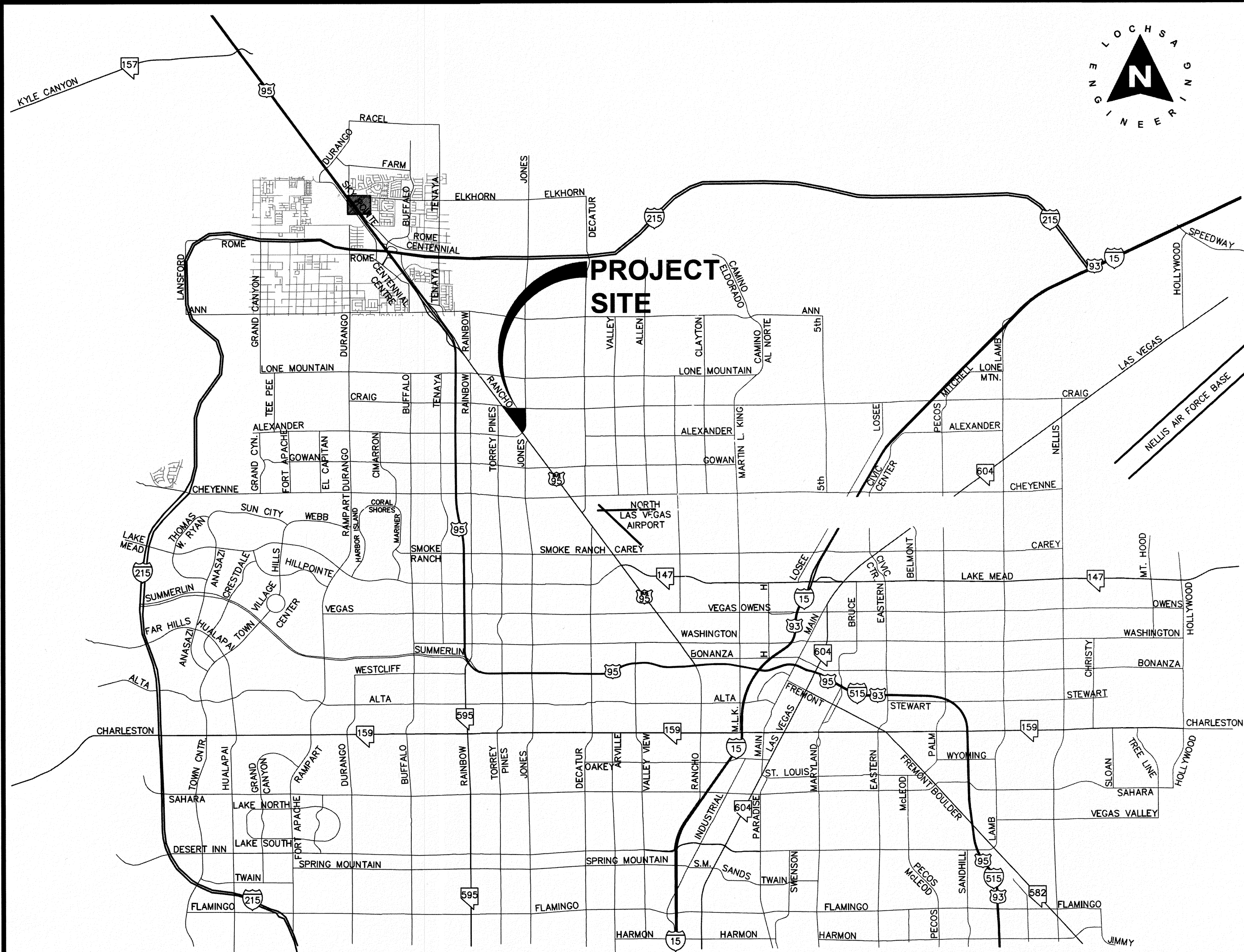
DESIGNED BY: HMN

CHECKED BY: HMN

SHEET No.
DR2

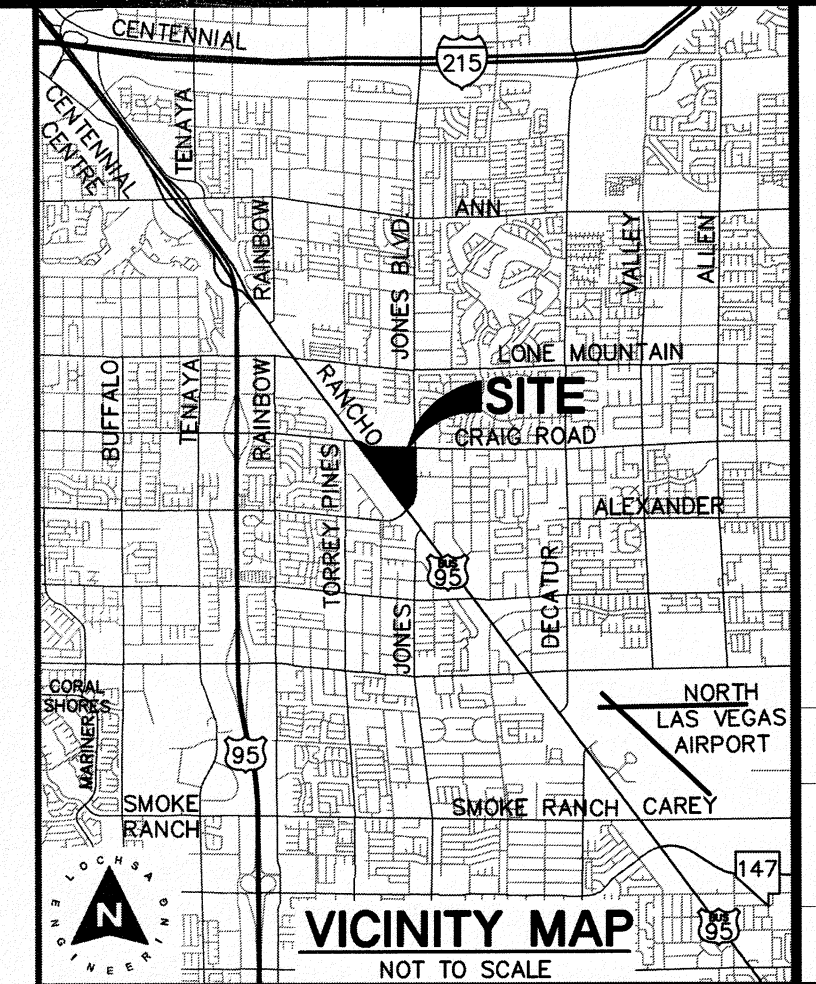
SHEET 2 2

CLV No.



IMPROVEMENT PLANS FOR CRAIG & RANCHO PHASE 1 & 2 OFF-SITES

A PORTION OF THE SOUTHEAST QUARTER (SE 1/4) OF SECTION 2,
TOWNSHIP 20 SOUTH, RANGE 60 EAST, M.D.M, CITY OF LAS VEGAS,
NEVADA.
A.P.N.: 138-02-713-002



6345 South Jones Blvd.
Suite 100
Las Vegas, NV 89118
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Fax (702) 365-9317
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ABBREVIATIONS

ABAN	ABANDON	INV	INVERT
AIF	ABANDON IN PLACE	ISL	ISLAND
AGC	AGGREGATE	JBS	JUNCTION BOX
ALT	ALTERNATE	LOC	LENGTH OF CURB
ACP	ANODE, GAS	LT	LEFT
ACP	ASBESTOS CEMENT PIPE	LF	LINEAR FEET
AVE	ASPHALTIC CONCRETE	LWVD	LAS VEGAS VALLEY WATER DISTRICT
BCR	AVENUE	MH	MANHOLE
BVC	BACK OF CURB	MAX	MAXIMUM
BN	BACK OF CURB RADIUS	MIN	MINIMUM
BVC	BEGINNING OF VERTICAL CURVE	MON	MONOLITHIC
BM	BENCHMARK	N/O	NORTH OF
BN	BOUNDARY LINE	NTS	NOT TO SCALE
CATV	CABLE TELEVISION	OC	ON CENTER
C-C	CENTERLINE	OG	OPEN-GRADED PAVEMENT, ORIGINAL GROUND
CL	CITY OF BOULDER CITY	PVMT	PAVEMENT
CLV	CITY OF LAS VEGAS	PI	POINT OF INTERSECTION
COH	CITY OF HENDERSON	PRC	POINT OF REVERSE CURVE
CM	CITY OF MESQUITE	PC	POINT OF CURVE
ONLV	CITY OF NORTH LAS VEGAS	PT	POINT OF TANGENCY
CC	CLARK COUNTY	PCC	POINT OF COMPOUND CURVE
CCWRD	CLARK COUNTY WATER RECLAMATION DISTRICT	PCC, CONC	PORTLAND CEMENT CONCRETE
CO	CLEAN OUT, SEWER	PP	POWER POLE
COMM	COMMERCIAL	P	POWER
CONC, PCC	CONCRETE	PL	PROPERTY LINE
CONST	CONSTRUCTION OR CONSTRUCT	PROP	PROPOSED
COR	CORNER	PB	PULL BOX
CMP	CORRUGATED METAL PIPE	RP	RADIUS POINT
CSP	CORRUGATED STEEL ARCH PIPE	RR	RADIUS
CSP	CORRUGATED STEEL PIPE	REINF	REINFORCED
C&G	CURB & GUTTER	RC	REINFORCED CONCRETE
CIP	CAST IRON PIPE	RCB	REINFORCED CONCRETE BOX
COL	COLUMN	RCP	REINFORCED CONCRETE PIPE
CU YD, CY	CUBIC YARD	RELOC	RELOCATE
CU FT, CF	CUBIC FOOT	RT	RIGHT
CULV	CULVERT	R/W	RIGHT-OF-WAY
DEPT	DEPARTMENT	SS	SANITARY SEWER
DIA	DIAMETER	SMT	SHEET
DWY	DRIVEWAY	S/O	SOUTH OF
DI	DROP INLET	SO FT, SF	SIDEWALK
ESMT	EASEMENT	SO YD, SY	SQUARE FOOT
E/O	EDGE OF PAVEMENT	STA	STATION
EP	EDGE OF OIL	SD	STEEL HIGH-PRESSURE PIPE
E	ELECTRIC	SHD	STORM DRAIN
EM	ELEVATION	STD	STANDARD
ENVB	EMBANKMENT	STRUCT	STRUCTURAL OR STRUCTURE
ENR	END OF CURB RETURN	SVRY	SURVEY
EC	END OF CURVE	SLT	STREETLIGHT
EB	CATHODE PROTECTION BOND STATION	TL	TEMPORARY
ETS	CATHODE PROTECTION TEST STATION	TEMP	TO BE ADJUSTED
EVC	END OF VERTICAL CURVE	TBR	TO BE REMOVED
EXIST	EXISTING	TC	TOP OF CURB
FT	FEET/FOOT	TOP	TOP OF PIPE
FG	FINISH GRADE	TS	TRAFFIC SIGNAL
FA	FIRE ALARM	TSI	TRAFFIC SIGNAL INTERCONNECT
FH	FIRE HYDRANT	TRANS	TRANSITION
FL	FLOW LINE	TYP	TYPICAL
GLV	GLAVANIZED	UG	UNDERGROUND
GM	GAS METER	VAR	VARIABLE
GR	GAS PRESSURE REGULATOR	VC	VERTICAL CURVE
PL-G	PLASTIC GAS	VG	VERTICAL GUTTER
SG	STEEL GAS	VP	VALLEY GUTTER
GB	GRADE BREAK	W	WATER
GUT	GUTTER	WM	WATER METER
HDWL	HEADWALL	W/O	WEST OF
IN	INCH	YD	YARD
INT	INTERSECTION		

DEVELOPER

PRE RANCHO CRAIG, LLC
120 PRESIDENTIAL WAY, SUITE 300
WOBURN, MA 01801
CONTACT: WILLIAM S. PARRIS
PHONE: (805) 898-2023
FAX: (805) 898-9913

OWNER

PRE RANCHO CRAIG, LLC
120 PRESIDENTIAL WAY, SUITE 300
WOBURN, MA 01801
CONTACT: WILLIAM S. PARRIS
PHONE: (805) 898-2023

UTILITY PROVIDERS

WATER:	LAS VEGAS VALLEY WATER DISTRICT
SEWER:	CITY OF LAS VEGAS
GAS:	SOUTHWEST GAS CORPORATION
ELECTRIC:	NV ENERGY
TELEPHONE:	CENTURYLINK
CABLE TV:	COX COMMUNICATIONS LAS VEGAS, INC.
TRASH:	REPUBLIC SILVER STATE DISPOSAL SERVICE

APPROVALS

ALLEN PAVELKA, P.E., #9029 CITY ENGINEER	DATE
APPROVAL OF THESE PLANS IS LIMITED TO THOSE IMPROVEMENTS CONSTRUCTED IN THE DEDICATED RIGHT-OF-WAY AND/OR DEDICATED EASEMENTS. THIS APPROVAL DOES NOT AUTHORIZE THE CONSTRUCTION OF ANY IMPROVEMENTS THAT DEVIATE FROM ADOPTED STANDARDS AND/OR SPECIFICATIONS, EXCEPT THOSE SPECIFICALLY LISTED UNDER DEVIATIONS FROM STANDARD. THE ENGINEER SHALL RESOLVE ANY DEVIATION OTHER THAN THOSE LISTED IN DEVIATIONS FROM STANDARDS IN FAVOR OF THE UNIFORM STANDARDS DRAWINGS AND SPECIFICATIONS CLARK COUNTY AREA, NEVADA.	
CHRIS KNIGHT, DIRECTOR-BUILDING AND SAFETY	DATE
NOTE: THIS PLAN CONFORMS TO THE APPLICABLE STANDARDS OF THE PLANNING DEPARTMENT.	
LAS VEGAS FIRE AND RESCUE	DATE
LAS VEGAS VALLEY WATER DISTRICT APPROVED FOR CONSTRUCTION	
LAS VEGAS VALLEY WATER DISTRICT ENGINEERING SERVICES MANAGER PROJECT NO. 124388, SHEETS: C1.01, C1.02, C2.01, & C2.02	DATE
SOUTHWEST GAS CORPORATION	DATE
NV ENERGY	DATE
NV ENERGY ACKNOWLEDGES THAT WE HAVE RECEIVED YOUR PLANS AND WILL PROVIDE SERVICE TO ALL ELECTRICAL NEEDS ASSOCIATED WITH THIS PROJECT. NV ENERGY RESERVES THE RIGHT TO ADDRESS ANY EXISTING OR FUTURE CONFLICTS ONCE THE FINAL DESIGN IS COMPLETED. THE NEW SERVICE AND THE RESOLUTION OF ANY CONFLICTS WILL BE ACCOMPLISHED PURSUANT TO THE NEVADA PUBLIC UTILITY COMMISSION'S RULES AND REGULATIONS.	
COX COMMUNICATIONS LAS VEGAS, INC.	DATE
CENTRAL TELEPHONE COMPANY D.B.A. CENTURYLINK	DATE

SHEET INDEX

Drawing Number	Sheet Title	Sheet Number
General		
1	COVER SHEET	C1.01
2	NOTES SHEET	C1.02
Demolition Plans		
3	(SHEET 1 OF 2)	C2.01
4	(SHEET 2 OF 2)	C2.02
Grading Plans		
5	(SHEET 1 OF 2)	C3.01
6	(SHEET 2 OF 2)	C3.02
Horizontal & Traffic Control Plans		
7	(SHEET 1 OF 2)	C4.01
8	(SHEET 2 OF 2)	C4.02
Detail Sheets		
9	DETAIL SHEET	C5.01

GENERAL SITE INFORMATION

NOTE:
LOCHSA ENGINEERING ASSUMES NO RESPONSIBILITY FOR EXISTING UTILITY LOCATIONS AND ELEVATIONS. THE UTILITIES SHOWN ON THIS PLAN ARE FROM THE BEST AVAILABLE INFORMATION. IT IS THE CONTRACTOR'S RESPONSIBILITY TO FIELD VERIFY THE LOCATION AND ELEVATION OF ALL UTILITIES, INCLUDING BUT NOT LIMITED TO, THE WATER, FIRE, SANITARY SEWER, STORM SEWER, TELEPHONE, POWER, GAS, AND IRRIGATION LINES PRIOR TO THE COMMENCEMENT OF CONSTRUCTION. IF CONFLICT EXISTS IN THE FIELD, THE CONTRACTOR IS TO NOTIFY THE PROJECT ARCHITECT, OWNER'S REPRESENTATIVE AND THE PROJECT ENGINEER IMMEDIATELY.

A.P.N.:
138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO. 510022 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

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1-702-432-5300
1-702-227-2929

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Underground

GENERAL COVER SHEET
CRAIG & RANCHO
PHASE 1 & 2 OFF-SITES
IMPROVEMENT PLANS

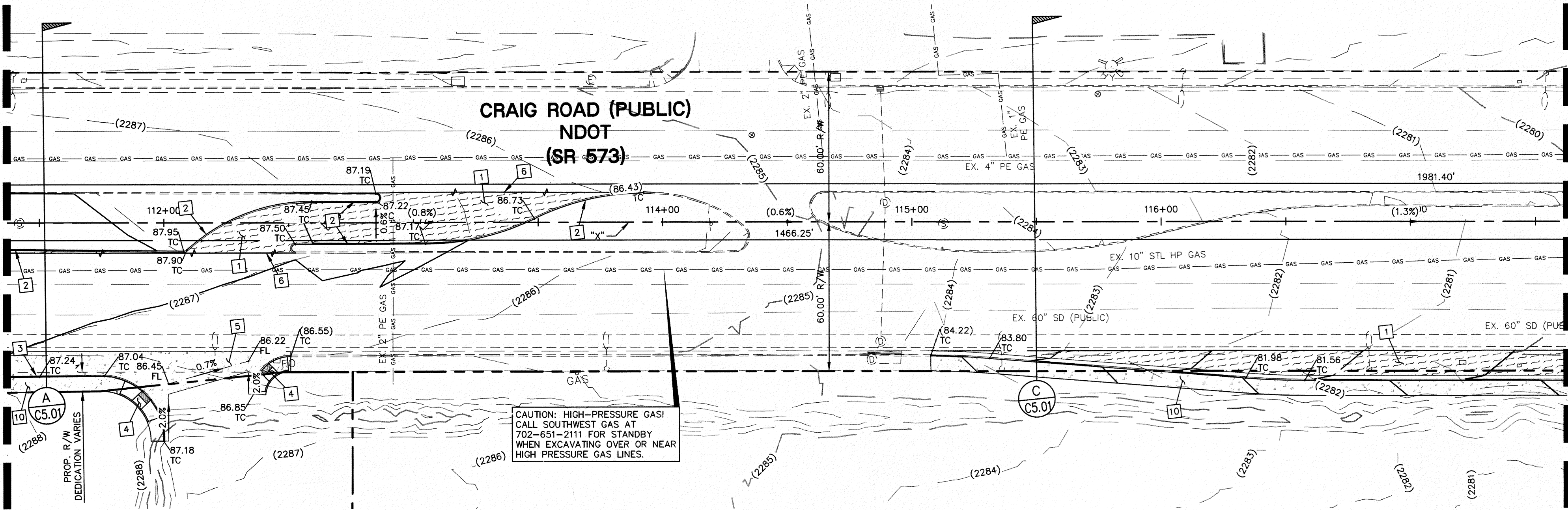
PROJECT NO.: 161063
DATE: 7/12/16
SCALE: N/A
DRAWN BY: JLI
DESIGNED BY: JLI
CHECKED BY: TTE

SEAL
PROFESSIONAL ENGINEER-STATE OF NEVADA
No. 1286
JLI
09/21/16
SHEET NO. C1.01
SHEET 1 OF 9
CLV No. 65704

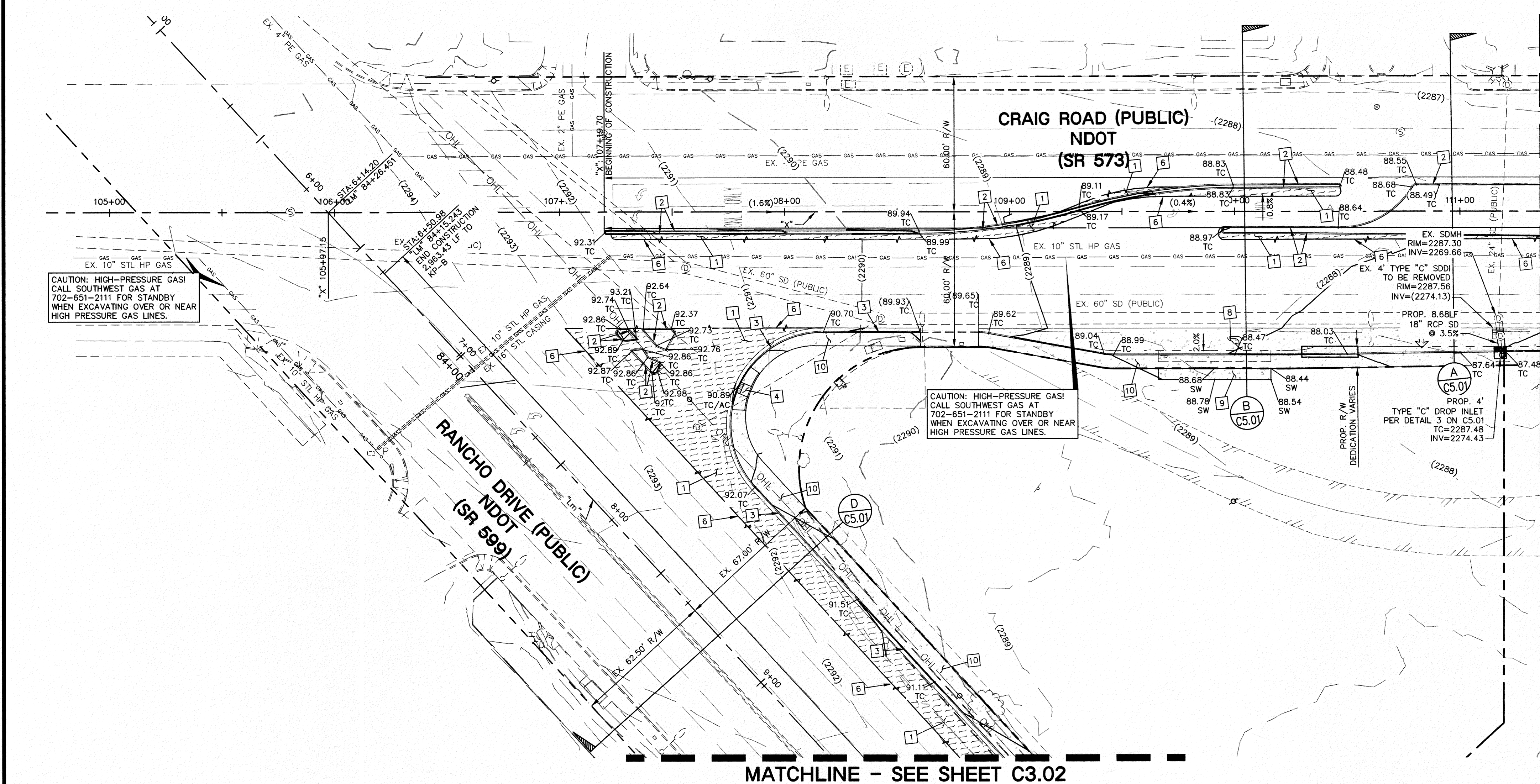
10/17/2016 2:08 PM
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CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100W HPS STREETLIGHTS	150W HPS STREETLIGHTS	200W HPS STREETLIGHTS	250W HPS STREETLIGHTS
CL OR SURVEY LINE	EASEMENT LINE	EXISTING:	---(2210)---	---	---	---	---	---	---	---	(12.34) BC	---	---	① = SANITARY SEWER ② = STORM DRAIN ③ = ELECTRICAL ④ = TELEPHONE	---	---	---	---	---	---	---	---	---	---
PROPERTY LINE	SAWCUT LINE	PROPOSED:	---(2122)---	---	---	---	---	---	---	---	(12.34) BC	---	---	---	---	---	---	---	---	---	---	---	---	---
ROW LINE	SCARP LINE																							

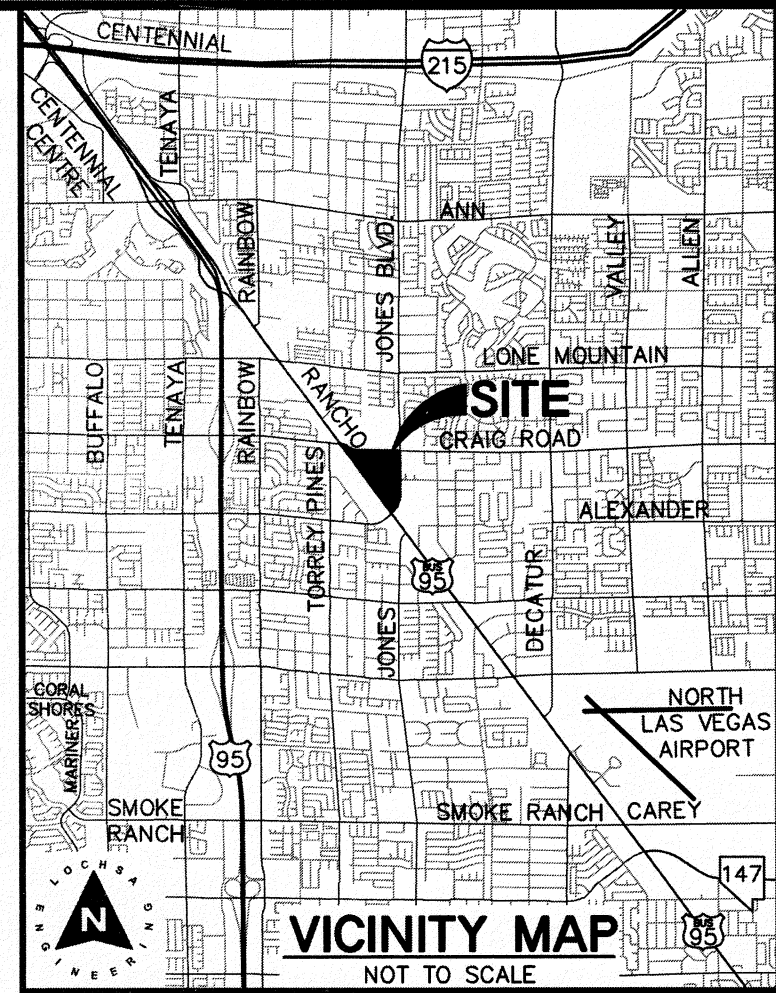
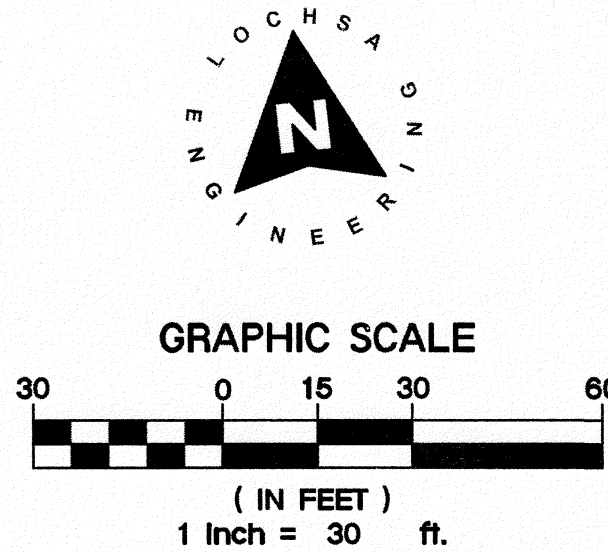
MATCHLINE - SEE ABOVE RIGHT



MATCHLINE - SEE SHEET C3.02



MATCHLINE - SEE BELOW LEFT



LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES GUIDANCE MANUAL SECTION 3.5.1 STANDARD NOTES 1-5

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 ACCUMULATED IN THE PUBLIC RIGHT-OF-WAY OF THE CITY OF LAS VEGAS AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIAL 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 THE CITY OF LAS VEGAS AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE 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 THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.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 RAIN EVENT OR 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 THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR100000, SECTION III.A.12.
5. ACCUMULATED SEDIMENT IN BMP'S SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

GRADING NOTES:

1. SLOPES 4:1 OR STEEPER AND FINE-GRAINED MATERIALS THAT HAVE BEEN DISTURBED (SANDY AND SILTY MATERIALS) SHOULD BE PROTECTED WITH BURLAP OR OTHER EROSION CONTROL FABRIC/MATERIAL, UNLESS OTHERWISE SPECIFIED BY LANDSCAPE DRAWINGS AND SPECIFICATIONS OR THE SOILS REPORT.
2. CONTRACTOR SHALL DETERMINE HIS OWN FOOTING OR BASEMENT EXCAVATION QUANTITIES, EVEN THOUGH SHOWN ON ROUGH GRADING PLANS. ADDITIONALLY, STRUCTURE BACKFILL COSTS DURING CONSTRUCTION SHALL BE THE COST OF THE STRUCTURE, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS.
3. CONTRACTOR SHALL NOTIFY LOCHSA ENGINEERING WITHIN 24 HOURS OF OMISSIONS AND ERRORS DISCOVERED ON PLANS. LOCHSA ENGINEERING WILL NOT BE RESPONSIBLE FOR ANY "CORRECTIVE" WORK DONE BY OTHERS.
4. CONTRACTOR TO ENSURE POSITIVE DRAINAGE, NO PONDING ALLOWED. CONTRACTOR TO FOLLOW RECOMMENDATIONS AS OUTLINED IN THE PROJECT GEOTECHNICAL REPORT, INCLUDING BUT NOT LIMITED TO EXCAVATION, GRADING AND COMPACTION. REFER TO THE REPORT PREPARED BY: UNITED CONSULTING, PROJECT NO. 2015.0502.01, DATED: JULY 23 2015.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO. SLV002E4 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

CONSTRUCTION NOTES:

- ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH "CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.)" LATEST EDITION AND/OR REGULATING ENTITY HAVING JURISDICTION.
- NOT ALL NOTES USED ON THIS SHEET -
1. INSTALL AC PAVEMENT, MATCH EXISTING.
 2. CONSTRUCT "A" TYPE CURB PER DETAIL 2 ON C5.01.
 3. CONSTRUCT "L" TYPE CURB PER CCAUSD No. 216.
 4. CONSTRUCT SIDEWALK RAMP, CCAUSD No. 235 CASE I.
 5. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD No. 222.1. WITH CROSS GUTTER PER CCAUSD No. 228.
 6. SAWCUT AND MATCH EXISTING PAVEMENT.
 7. CONSTRUCT 2" AC PAVEMENT SIDEWALK ON NATIVE.
 8. CONSTRUCT BUS STOP PER CCAUSD No. 234.1.
 9. CONSTRUCT 50'x5' BUS SHELTER PAD PER CCAUSD No. 234.3.
 10. CONSTRUCT CONC. SIDEWALK PER CCAUSD No. 234.

FLOOD ZONE NOTE:

THE PROJECT SITE IS COVERED BY THE FLOOD INSURANCE RATE MAPS (FIRM) FOR THE CLARK COUNTY AND INCORPORATED AREAS, NEVADA, COMMUNITY PANEL NUMBER: 32003C2155F, EFFECTIVE DATE: NOVEMBER 16, 2011. THE SITE FALLS WITHIN ZONE X, DESCRIBED BY FEMA AS: AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN

EXISTING UTILITY NOTE:

CONTRACTOR TO ADJUST ALL EXISTING UTILITIES TO MATCH PROPOSED FINISH GRADE ELEVATIONS.

CUT	FILL
338.38 CY	122.63 CY

NOTE: CUT/FILL QUANTITIES ARE TO FINISHED GRADE & DO NOT INCLUDE MATERIAL THICKNESS'S, FOOTINGS, ETC.

GRADING PLAN CERTIFICATION

NAME: [Signature] PE # 11280 DATE 10/13/16

CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH APPROVED DRAINAGE STUDY FOR THIS SITE ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT.

NOTE:

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GRADING PLANS
(SHEET 1 OF 2)

CRAIG & RANCHO
PHASE 1 & 2 OFF-SITES
IMPROVEMENT PLANS

PROJECT No.: 161063

DATE: 7/12/16

SCALE: 1"=30'

DRAWN BY: JLI

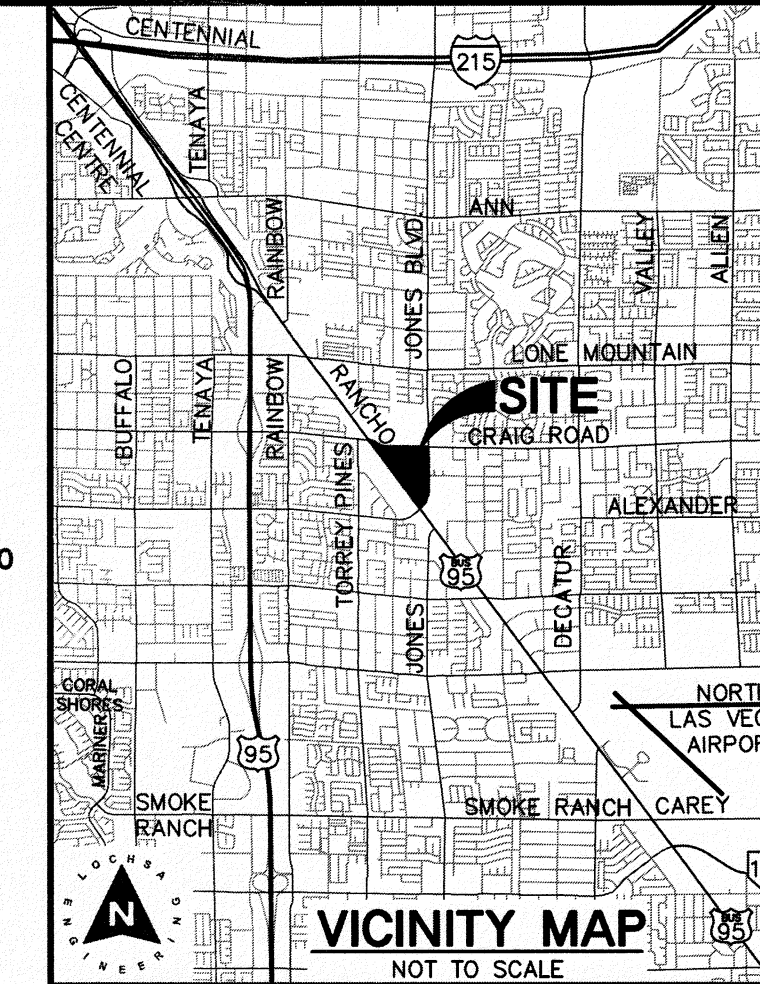
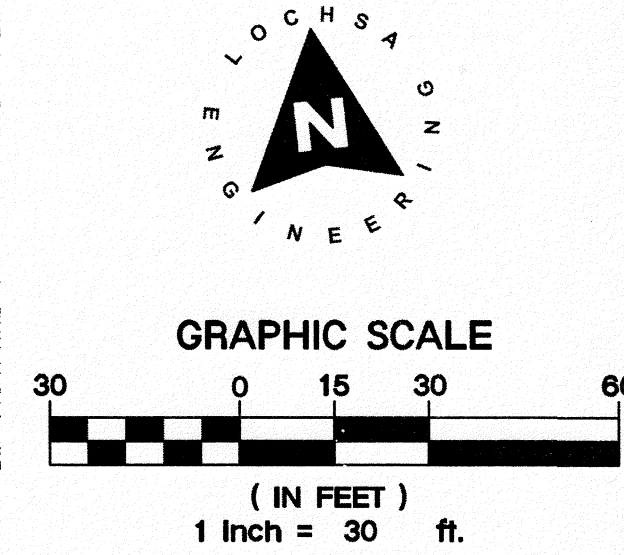
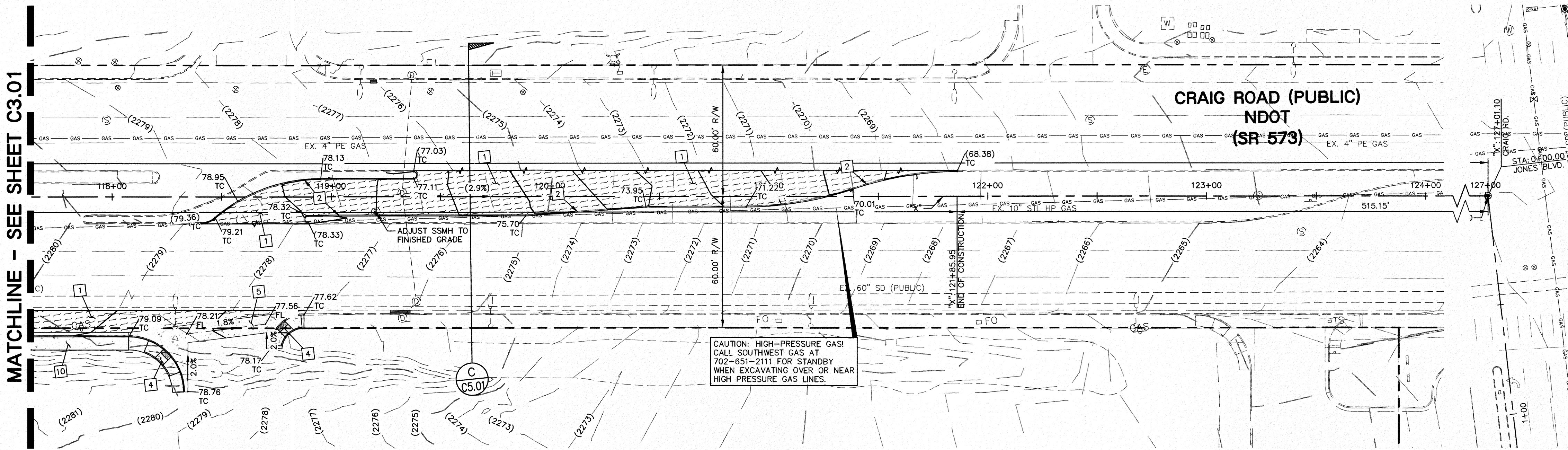
DESIGNED BY: JLI

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SEAL
PROFESSIONAL ENGINEER-STATE OF NEVADA
No. 1286
09/20/2016

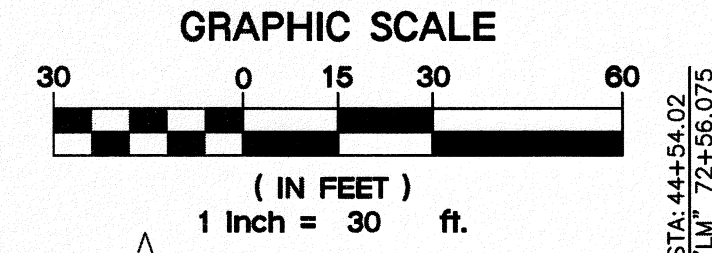
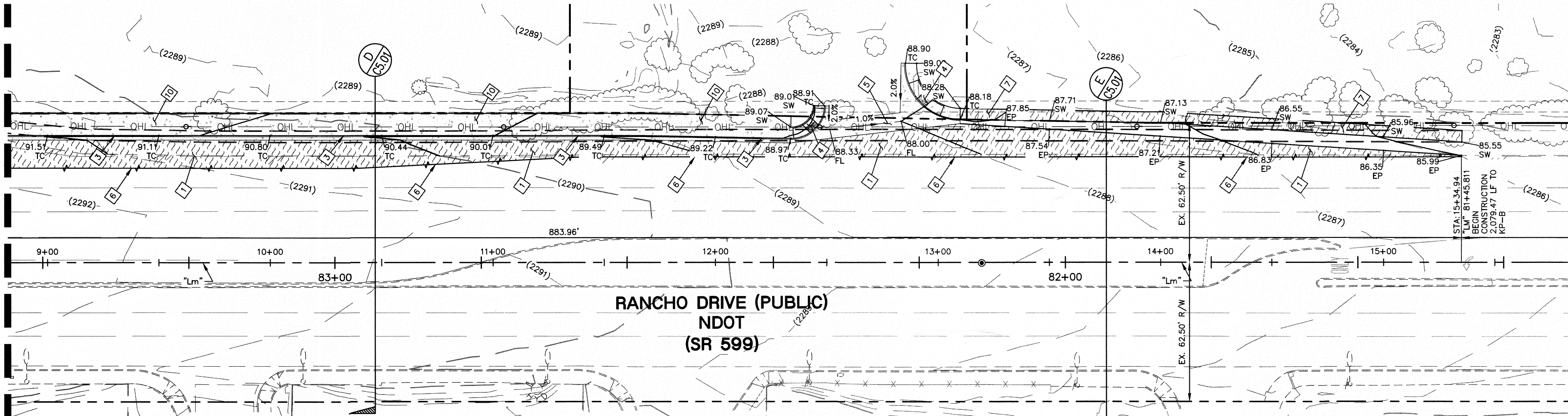
SHEET No.: C3.01
SHEET 6 OF 9
CLV No. 65704

MATCHLINE - SEE SHEET C3.01



- CONSTRUCTION NOTES:**
- ALL CONSTRUCTION TO BE DONE IN ACCORDANCE WITH "CLARK COUNTY AREA UNIFORM STANDARD DRAWINGS (C.C.A.U.S.D.)" LATEST EDITION AND/OR REGULATING ENTITY HAVING JURISDICTION.
- NOT ALL NOTES USED ON THIS SHEET -
1. INSTALL AC PAVEMENT, MATCH EXISTING.
 2. CONSTRUCT "A" TYPE CURB PER DETAIL C ON C5.01.
 3. CONSTRUCT "L" TYPE CURB PER CCAUSD No. 216.
 4. CONSTRUCT SIDEWALK RAMP, CCAUSD No. 235 C&S I.
 5. CONSTRUCT COMMERCIAL DRIVEWAY PER CCAUSD No. 222.1. WITH CROSS GUTTER PER CCAUSD No. 228.
 6. SAWCUT AND MATCH EXISTING PAVEMENT.
 7. CONSTRUCT 2" AC PAVEMENT SIDEWALK ON NATIVE.
 8. CONSTRUCT BUS STOP PER CCAUSD No. 234.1.
 9. CONSTRUCT 50'x5' BUS SHELTER PAD PER CCAUSD No. 234.3.
 10. CONSTRUCT CONC. SIDEWALK PER CCAUSD No. 234.

MATCHLINE - SEE SHEET C3.01



- FLOOD ZONE NOTE:**
- THE PROJECT SITE IS COVERED BY THE FLOOD INSURANCE RATE MAPS (FIRM) FOR THE CLARK COUNTY AND INCORPORATED AREAS, NEVADA, COMMUNITY PANEL NUMBER: 32003C2155F, EFFECTIVE DATE: NOVEMBER 16, 2011. THE SITE FALLS WITHIN ZONE X, DESCRIBED BY FEMA AS: AREAS DETERMINED TO BE OUTSIDE THE 0.2% ANNUAL CHANCE FLOODPLAIN.
- EXISTING UTILITY NOTE:**
- CONTRACTOR TO ADJUST ALL EXISTING UTILITIES TO MATCH PROPOSED FINISH GRADE ELEVATIONS.

CUT	FILL
338.38 CY	122.63 CY

NOTE: CUT/FILL QUANTITIES ARE TO FINISHED GRADE & DO NOT INCLUDE MATERIAL THICKNESS'S, FOOTINGS, ETC.

GRADING NOTES:

1. SLOPES 4:1 OR STEEPER AND FINE-GRAINED MATERIALS THAT HAVE BEEN DISTURBED (SANDY AND SILTY MATERIALS) SHOULD BE PROTECTED WITH BURLAP OR OTHER EROSION CONTROL FABRIC/MATERIAL, UNLESS OTHERWISE SPECIFIED BY LANDSCAPE DRAWINGS AND SPECIFICATIONS OR THE SOILS REPORT.
2. CONTRACTOR SHALL DETERMINE HIS OWN FOOTING OR BASEMENT EXCAVATION QUANTITIES, EVEN THOUGH SHOWN ON ROUGH GRADING PLANS. ADDITIONALLY, STRUCTURE BACKFILL COSTS SHOULD BE INCLUDED IN THE COST OF THE STRUCTURE, UNLESS OTHERWISE SPECIFIED IN THE CONTRACT DOCUMENTS.
3. CONTRACTOR SHALL NOTIFY LOCHSA ENGINEERING WITHIN 24 HOURS OF OMISSIONS AND ERRORS DISCOVERED ON PLANS. LOCHSA ENGINEERING WILL NOT BE RESPONSIBLE FOR ANY "CORRECTIVE" WORK DONE BY OTHERS.
4. CONTRACTOR TO ENSURE POSITIVE DRAINAGE. NO PONDING ALLOWED. CONTRACTOR TO FOLLOW RECOMMENDATIONS AS OUTLINED IN THE PROJECT GEOTECHNICAL REPORT, INCLUDING BUT NOT LIMITED TO EXCAVATION, GRADING AND COMPACTION. REFER TO THE REPORT PREPARED BY: UNION CONSULTING, PROJECT No. 2015.0502.01, DATED: JULY 23 2015.

LAS VEGAS VALLEY CONSTRUCTION SITE BEST MANAGEMENT PRACTICES GUIDANCE MANUAL SECTION 3.5.1 STANDARD NOTES 1-5

1. THE OWNER, SITE DEVELOPER, CONTRACTOR, 4. AT A MINIMUM, THE CONTRACTOR OR HIS 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 ACCUMULATED IN, THE PUBLIC RIGHT-OF-WAY OF THE CITY OF LAS VEGAS AS A RESULT OF CONSTRUCTION ACTIVITIES ASSOCIATED WITH THIS SITE DEVELOPMENT OR CONSTRUCTION PROJECT. SUCH MATERIAL 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 THE CITY OF LAS VEGAS AND THE LAS VEGAS VALLEY CONSTRUCTION SITE BMP GUIDANCE 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 THE NEVADA STORMWATER GENERAL PERMIT FOR CONSTRUCTION ACTIVITY NVR10000, SECTION III.A.5.
5. ACCUMULATED SEDIMENT IN BMP'S SHALL BE REMOVED WITHIN SEVEN DAYS AFTER A STORMWATER RUNOFF EVENT OR PRIOR TO THE NEXT ANTICIPATED STORM EVENT, WHICHEVER IS EARLIER. SEDIMENT MUST BE REMOVED WHEN BMP DESIGN CAPACITY HAS BEEN REDUCED BY 50 PERCENT OR MORE.

A.P.N.:

138-02-713-002

BASIS OF BEARINGS:

THE BASIS OF BEARINGS FOR THIS SURVEY IS THE SOUTHERLY LINE OF THE NORTHEAST QUARTER (NE 1/4) OF SECTION 2, TOWNSHIP 20 SOUTH, RANGE 60 EAST M.D.M. AS SHOWN ON THAT MAP ON FILE IN FILE 192, PAGE 31 OF SURVEYS IN THE CLARK COUNTY RECORDERS OFFICE. SAID LINE BEARS: NORTH 83°42'46" WEST.

BENCHMARK:

BENCHMARK NO. SLV00224 CITY OF LAS VEGAS BENCHMARK. RIVET AND PLATE IN TOP OF CURB AT THE NORTHWEST CORNER OF CRAIG ROAD AND JONES BOULEVARD. ELEVATION=2261.88 FEET / 689.423 METERS (NAVD 88 DATUM)

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utility lines. It's costly.

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before you Dig

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1-702-432-6300
1-702-227-2929

FAST
Call before you Dig
Underground

Call before you Dig
Underground

1-800-227-2800
1-702-432-6300
1-702-227-2929

LEGEND	CL OR SURVEY LINE	EASEMENT LINE	DESCRIPTION:	CONTOUR LINES	EDGE OF PAVEMENT	"A" TYPE CURBS	"L" TYPE CURBS	WALLS	FENCES	AC PAVEMENT	CONCRETE	SPOT ELEVATIONS	SIGNS	MANHOLE W/ DESCRIPTION	MANHOLE DESCRIPTIONS	FIRE HYDRANTS	GATE VALVES	REDUCERS	CLEAN OUTS	UTILITY BOX OR VAULT	BACKWATER VALVES	100W HPS STREETLIGHTS	500W HPS STREETLIGHTS	200W HPS STREETLIGHTS	250W HPS STREETLIGHTS
	PROPERTY LINE	SAWCUT LINE	EXISTING:	(2210)								(12.34) BC		③	③ = SANITARY SEWER ③ = STORM DRAIN ③ = ELECTRICAL ③ = TELEPHONE		⊙	▷	○	□	(BWV) (BWV)				
	ROW LINE	SCARP LINE	PROPOSED:	(2122)								(12.34) BC		③											

GRADING PLANS
(SHEET 2 OF 2)

CRAIG & RANCHO
PHASE 1 & 2 OFF-SITES
IMPROVEMENT PLANS

PROJECT No.: 161063

DATE: 7/12/16

SCALE: 1"=30'

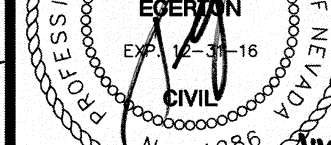
DRAWN BY: JLI

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CHECKED BY: TTE

SHEET No. 6 OF 9

CLV No. 65704



09/20/2016