

DS #: 4564

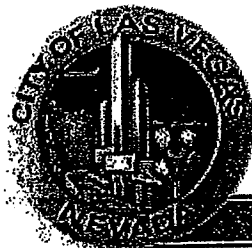
APN: 138-15-201-002

PROJECT: Emergency Operations Center

SUBMITTAL: 1st

SCANNED BY/DATE: _____

CHECKED BY/DATE: _____





CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		July 31, 2012
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. Flood Control Project Engineer Department of Public Works
SUBJECT: Drainage Study for: Emergency Operations Center		COPIES TO: Wright Engineers
Cross Streets:	SEC of Buffalo Drive & Sauer Drive	City of Las Vegas Attn: Sam Tolman
File Number:	F:\Depot\DSMemos\DS4564A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	138-15-201-002	CCRFCD
Zoning Action:	SDR-xxxxx	
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	7/26/2012	7/31/2012	See Comments Below	\$400.00	291145: \$400
			TOTAL FEES (LDDRS):		----

REMARKS:

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

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

1. Provide a copy of the zoning condition (SDR-xxxxx) upon approval for *Flood Control Section's* filing.
2. Provide a 48"x16" block wall opening at the southeast corner of the site where an existing iron fence being replaced by a CMU perimeter wall.

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

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

END OF REMARKS

ays

T/R/S: T20S/R60E/15
AREA L-15

WRIGHT ENGINEERS

TECHNICAL DRAINAGE STUDY UPDATE FOR EMERGENCY OPERATIONS CENTER

CITY OF LAS VEGAS
July 26, 2012



PREPARED FOR:

CITY OF LAS VEGAS
495 S. MAIN STREET
LAS VEGAS, NEVADA 89101



July 26, 2012

CIVIL

STRUCTURAL

MECHANICAL

ELECTRICAL

PLUMBING

SURVEYING

LEED

Albert Sung
Flood Control
City of Las Vegas Public Works
731 S. Fourth Street
Las Vegas, Nevada 89101

**RE: TECHNICAL DRAINAGE STUDY UPDATE FOR EMERGENCY OPERATIONS
CENTER (AKA WEST SERVICE CENTER – BUILDING AND SAFETY
EXPANSION – DS3812)**
Job No. CN112246

Dear Mr. Sung:

Wright Engineers is pleased to submit the Technical Drainage Study (TDS) Update for your review and approval for the above-mentioned project. The site is located in the City of Las Vegas (CLV) and within a portion of APN 138-15-201-002, as recorded on the Clark County Assessor's maps. See *Figure 1, Vicinity Map*.

This update addresses the redesign of the parking lot and the addition of a CMU perimeter wall at the City of Las Vegas Emergency Operations Center to increase security. A future building pad is also proposed. Overall onsite drainage patterns and flow rates will not be changed by the proposed improvements.

The project site was previously analyzed by two drainage studies:

1. TDS for West Service Center – Building and Safety Expansion, prepared by JPL Engineering, Inc. and approved on June 6, 2005 (DS3812).
2. TDS for CLV West Service Center prepared by Harding ESE, Inc., and approved on April 29, 2005 (DS3057).

Any pertinent reference information has been provided in the Appendix C.

The existing 20ft wrought iron fence opening at the southeast corner of the site is being closed off with a CMU block wall. A recent update to West Service Center completed by City of Las Vegas revised the offsite basin south of the project site to drain to an access drive. Therefore the wrought iron fence is no longer required.

Basin B1 has been provided to determine the 100-year flow rate for the northern portion of the site to be enclosed by a perimeter CMU wall. Refer to Figure 5, Basin Map, Appendix A for basin boundaries. Basin B1 has a 100-year peak flow rate of 4.2cfs. Basin B1 drains to three proposed 48"x16" block wall openings. After the block wall openings storm runoff matches existing drainage patterns.

1635 Village Center Cr,
Ste 200
Las Vegas, NV 89134
(p) 702.933.7000
(f) 702.933.7001
800.933.7611
wrightengineers.com

A typical block wall opening calculation has been provided and demonstrates that each 48"x16" block wall opening can by-pass the 100-year flow rate from basin B1. The block wall opening calculation was completed using a broad crested weir calculation, assuming the bottom half of the wall opening is completely clogged. Hydrologic and hydraulic calculations can be found in Appendix B.

Reference basin OND1 from the Building and Safety Expansion TDS (DS3812) indicates a 100-year flow rate of 3.4cfs. Basin OND1 includes the southern parking lot and drains north east to the proposed wrought iron fence near the proposed access gate. After the wrought iron fence storm runoff matches existing drainage patterns.

A finished floor elevation has been established for the future building. Cross section A demonstrates the building has been set a minimum of twice the depth of flow above the adjacent flow line.

The 2008 CCRFCD Master Plan update has been release since the approval of the last drainage study. According to Figure F-25 (Figure 2), no proposed or constructed regional facilities are located adjacent to the project site. Descriptions of nearby facilities are shown on the *Master Plan Update* on Figure 2, *Flood Control Facilities* (Appendix A).

A revised FIRM map has been issued since the last drainage study approval. The revised map 2135, dated November 16, 2011, indicates the project site is still in a Zone "X". A Zone "X" is described as an area determined to be outside the 500-year floodplain. See *Figure 3, FEMA Map*.

If you have any questions or comments regarding this project, please do not hesitate to contact this office at (702) 933-7000.

Sincerely,
Wright Engineers

John M. Walker, P.E.
Project Manager

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Emergency Operations Center Date: July 25, 2012

Location of Development: a) Descriptive (Cross Streets) North/South: Buffalo Dr
East/West: Sauer Dr
b) Section: 15 Township: 20 S Range: 60 E
c) APN: 138-15-201-002

Name of Owner: City of Las Vegas

Telephone No.: 702-229-6011 Facsimile No.: 702-229-6276 Email Address: stolman@lasvegasnevada.gov

Address: 495 S. Main Street Las Vegas NV 89101

Contact Person Name: John Walker, PE Telephone No: (702) 933-7000

E-mail Address: jwalker@wrightengineers.com

Firm: Wright Engineers

Address: 1635 Village Center Circle, Ste 200, Las Vegas, NV 89101

Type of Land Development/Land Disturbance Process:

☐
☐
☐

Rezoning
Parcel Map
Large Parcel Map

☐
☐
☒

Subdivision Map
Planned Unit Development
Building Permit

☐
☐

Clearing and Grading Only
Other (Please specify below)

- Total Owned Land Area: At Site: 161.14 +/- ac Being Developed/Disturbed: 2.3 +/- ac
- Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? YES* ☐ NO ☐
- Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? YES* ☐ NO ☐
- Proposed type of development (Residential, Commercial, Etc.): Commercial - Parking redesign
- Approximate upstream land area which drains to the subject site? <1 +/- ac
- Has the site drainage been evaluated in the past? ☐ YES ☐ NO If yes, please identify documentation:
DS3812 and DS3057
- If known, please briefly identify the proposed discharge point(s) of runoff from the site:
Proposed improvements match existing drainage patterns and drain to Sauer Dr.
- Briefly describe your proposed schedule for the subject project: As soon as possible

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

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

Engineer's Seal

Local Entity File No.

Revision	Date

Reference: Wright Engineers, Inc. Job Number: **CN112246**

STANDARD FORM 1

APPENDIX A

FIGURES

EMERGENCY OPERATIONS CENTER

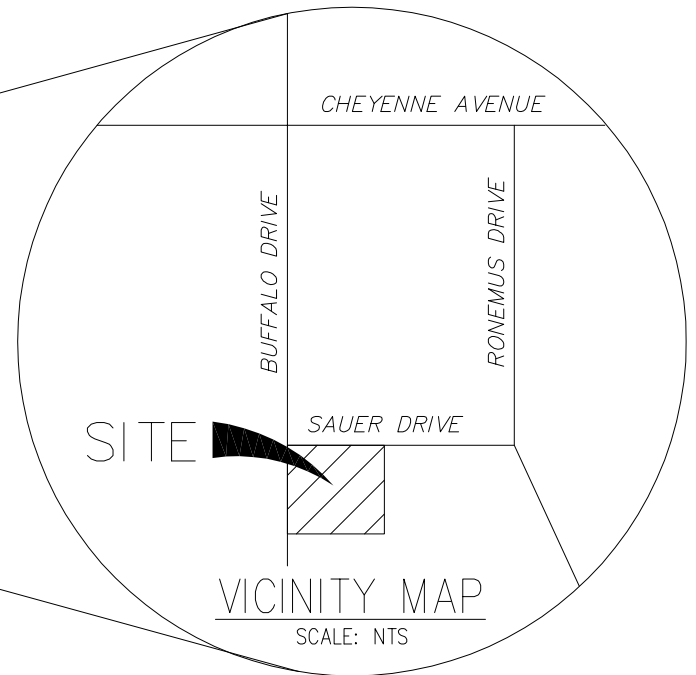
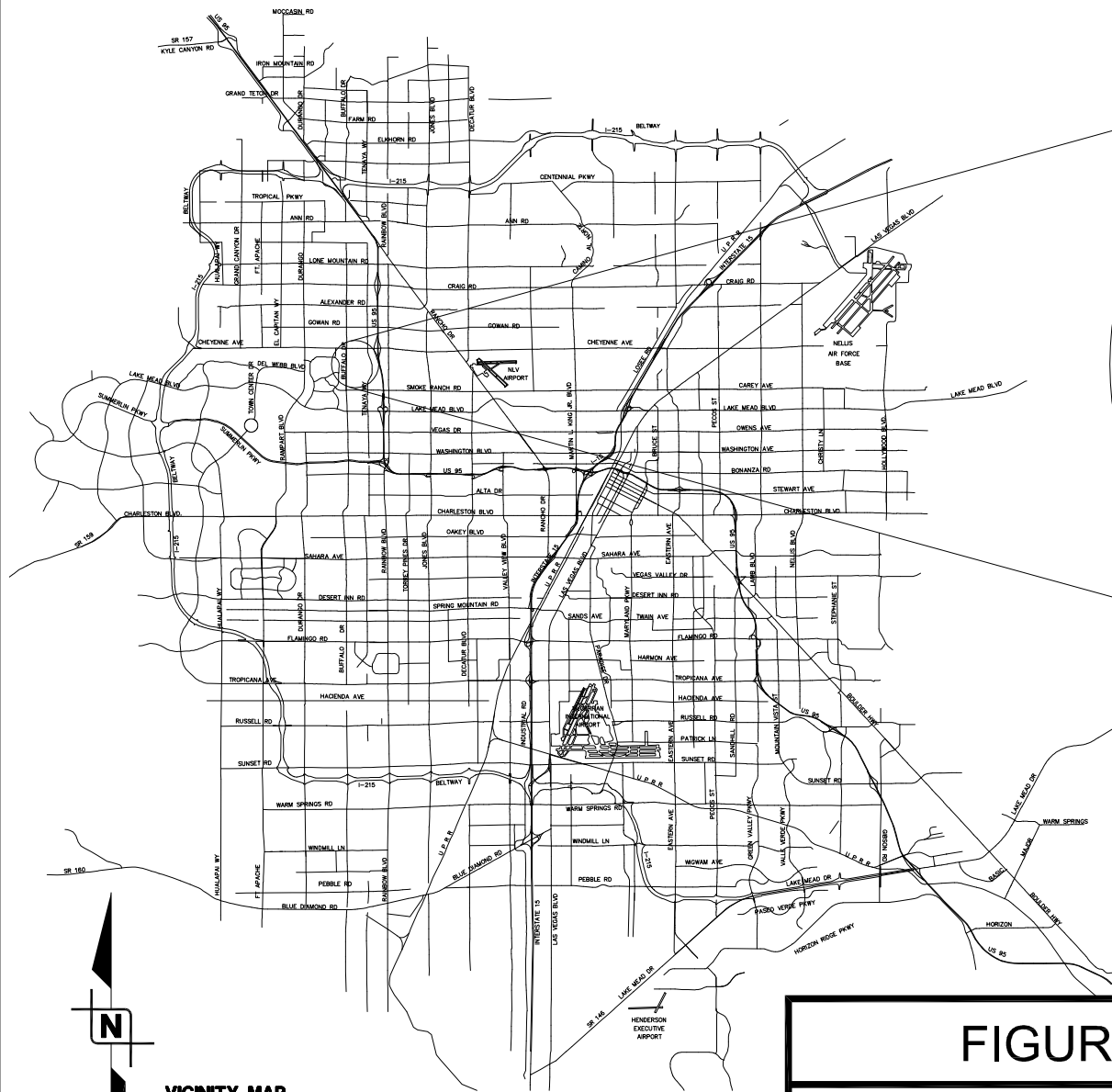


FIGURE 1

VICINITY MAP

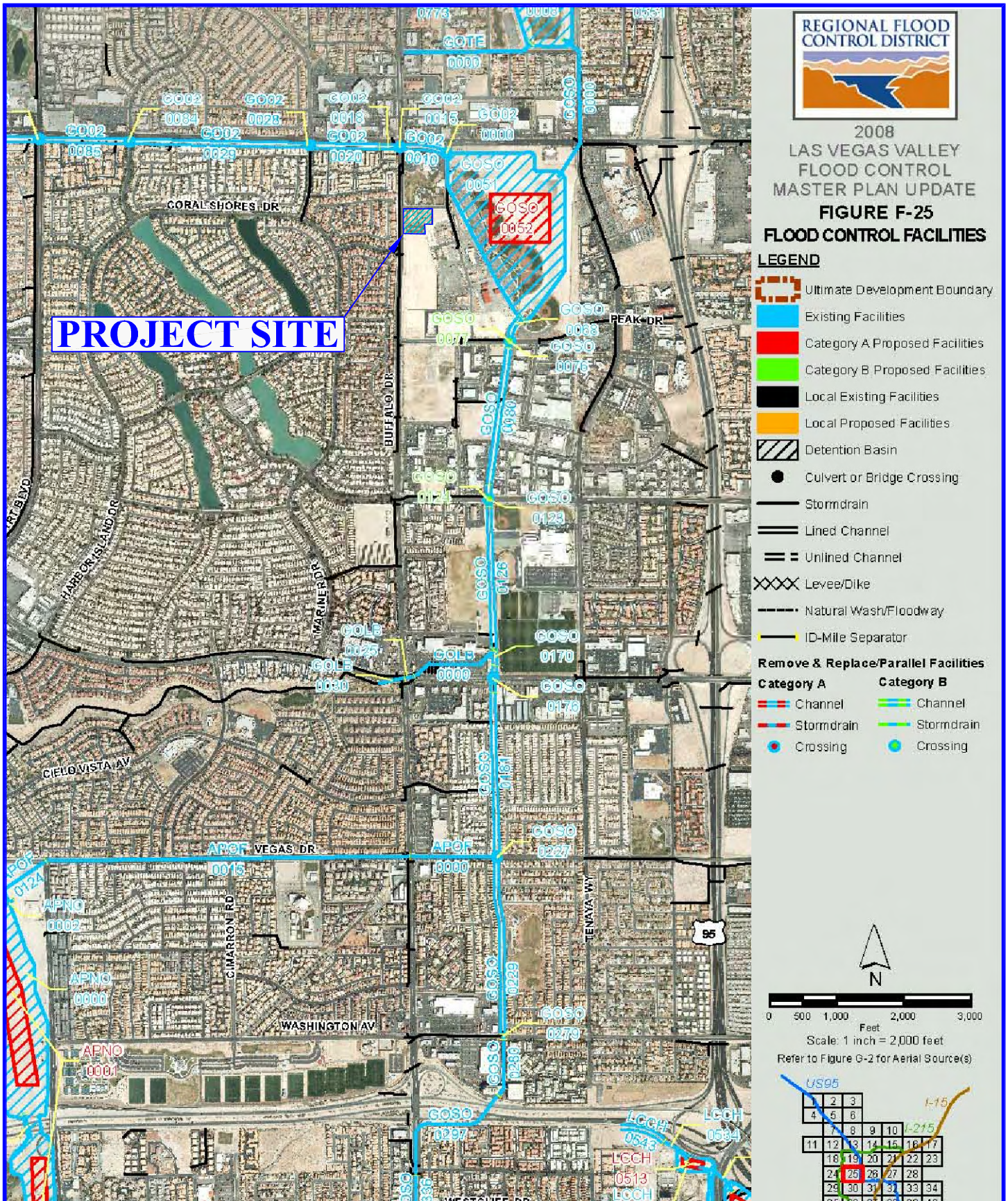


FIGURE 2

FLOOD CONTROL FACILITIES



ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
APMD		ANGEL PARK - MIDDLE BRANCH						
0000	E	Natural Wash	940	6048	C11A-3*	ALLGOW4	11.31	2.90
0027	E	1: 12' X 10' and 2: 12' X 2' RCBC @ Canyon Run	170	6048	C11A-3*	ALLGOW4	11.31	3.00
0030	E	Natural Wash	7000	6048	C11A-3*	ALLGOW4	11.31	3.00
0132	E	2: 12'x10' RCBC @ Hualapai	120	6048	C11A-3*	ALLGOW4	11.31	1.00
APNO		ANGEL PARK NORTH						
0000	E	1,400 ac-ft Angel Park Detention Basin		9199	ANGLPKIN	ALLGOW5	21.99	
0001	P1	Upgrade to 1,512 ac-ft Angel Park Detention Basin		9199	ANGLPKIN	ALLGOW5	21.99	
0002	E	2: 33" & 1: 42" RCP Emergency Outlet	190	406	ANGLPKDB	ALLGOW5	21.99	
0004	E	14' X 12' RCBC Connector Pipe under Summerlin Pkwy	380	9199	ANGLPKIN	ALLGOW5	21.99	1.00
0005	E	Natural Wash	1559	7988	CC3B-2B*	GW3SC	7.68	2.00
0012	E	3: 12' X 10' RCBC @ Rampart	232	7988	CC3B-2B*	GW3SC	7.68	1.00
0013	E	Natural Wash	1283	7988	CC3B-2B	GW3SC	7.68	1.40
0015	E	Two Span Bridge 28' W 14'D @ Summerlin Pkwy	236	7988	CC3B-2B	GW3SC	7.68	1.00
APOF		ANGEL PARK OUTFALL						
0000	E	66" RCP	1297	728	CGD34AC	GW3SC	0.65	1.90
0015	E	60" RCP	5472	454	CGD34AB	ALLGOW5	22.25	2.20
0124	E	54" RCP Outlet	810	406	ANGLPKDB	ALLGOW5	21.99	2.50
APSP		ANGEL PARK - SUMMERLIN PARKWAY						
0000	E	Concrete Chute Drop	103	7988	CC3B-2B	GW3SC	7.68	3.00
0001	E	Unlined Chnl with Gabion Drops 20'W Depth Varies 2:1 SS	3924	2746	C3B-2B	ALLGOW3	2.67	3.00
0002	E	Unlined Chnl with Gabion Drops 50'W 3:1 SS	1424	2746	C3B-2B	ALLGOW3	2.67	3.50
0066	E	5: 8' X 4' RCBC at Town Center Dr.	200	1697	C8B-2	ALLGOW3	1.56	2.40
0069	E	Conc Chnl 10'W 6'D 2:1 SS	3195	1697	C8B-2	ALLGOW3	1.56	2.40
0133	E	3: 9'X4' RCBC @ Crestdale	180	1173	C8B-1	ALLGOW3	1.14	2.33
0135	E	Conc Chnl 10'W 6'D 2:1 SS	2030	1173	C8B-1	ALLGOW3	1.14	2.40
GO02		GOWAN SOUTH FACILITIES (CHEYENNE CHANNEL)						
0000	E	Free Span Bridge 34'W 9.25'D @ Ronemus	100	4978	C16-C	ALLGOW3	7.09	0.50
0010	E	Conc Chnl 30'W 9'D 0:1 SS	600	4978	C16-C	ALLGOW3	7.09	0.50
0015	E	Free Span Bridge 31'W 7.25'D @ Buffalo	102	4978	C16-C	ALLGOW3	7.09	1.40
0018	E	Conc Chnl 30'W 9'D 0:1 SS	250	4978	C16-C	ALLGOW3	7.09	1.50
0020	E	Conc Chnl 10'W 7.25'D 1.5:1 SS	1000	4978	C16-C	ALLGOW3	7.09	1.50
0028	E	Free Span Bridge 35'W 7'D @ Soft Breezes	72	4800	CC7-C	ALLGOW3	6.78	2.20
0029	E	Conc Chnl 10'W 7.25'D 1.5:1 SS	2700	4800	CC7-C	ALLGOW3	6.78	1.50
0084	E	Free Span Bridge 35'W 7'D @ Soaring Gulls	95	4657	CCB-C	ALLGOW3	6.07	1.30
0085	E	Conc Chnl 10'W 7.25'D 1.5:1 SS	1240	4657	CCB-C	ALLGOW3	6.07	1.50
0111	E	Free Span Bridge 35'W 7'D @ Rampart	127	4657	CCB-C	ALLGOW3	6.07	2.90
0112	E	Conc Chnl 10'W 7'D 1.5:1 SS	7640	4225	CC-C	ALLGOW3	5.42	2.30
0257	E	Conc Chnl 10'W 6.75'D 1.5:1 SS	4293	2577	CCJ-C	ALLGOW3	2.97	4.10
GO95		GOWAN OUTFALL - U.S. 95 CHANNEL						
0000	P1	Conc Chnl 12'W 4'D 2:1 SS	2640	299	GD17BG-C	ALLGOW3	0.36	0.30
GODU		GOWAN NORTH - DURANGO BRANCH						
0000	E	12' X 6' RCB	2629	1150	CLV14-C	ALLGOW3	1.40	0.91
0050	E	9' X 6' RCB	865	835	CLV20-C	ALLGOW3	0.97	1.50
GOLB		GOWAN LAKE MEAD-BUFFALO						
0000	E	12' X 6' RCB	1294	1071	CCVILL23	ALLGOW3	1.46	1.50
0025	E	10' X 7' RCB	145	1071	CCVILL23	ALLGOW3	1.46	0.50
0030	E	2: 8' X 4' RCB	408	1071	CCVILL23	ALLGOW3	1.46	0.85
GOLM		GOWAN LONE MOUNTAIN SYSTEM						
0146	E	888 ac-ft Lone Mountain Detention Basin		7252	LMTNIN	GW3SC	6.13	
GONO		GOWAN NORTH SYSTEM						
0000	E	8' X 8' RCB Outlet	184	558	GWNNDB	ALLGOW5	68.49	0.51
0001	E	8' X 8' RCB Outlet	156	558	GWNNDB	ALLGOW5	68.49	0.63
0006	E	30,780 cfs PMF Spillway		30780	GWNNDB	ALLGOW5	68.49	
0008	E	921 ac-ft Gowan North Detention Basin		4937	CCLV43-C*	GW4SC	11.93	
GOOF		GOWAN OUTFALL FACILITIES						
0511	E	8' X 5' RCB	8390	699	CPT6B-C	GW3SC	1.08	0.50
0531	E	8' X 5' RCB	1300	558	GWNNDB	ALLGOW5	68.49	0.50
0551	E	72" RCP	524	558	GWNNDB	ALLGOW5	68.49	0.62
0773	E	60" RCP	803	286	LV30-C	ALLGOW3	0.42	1.40
0775	E	60" RCP	1300	286	LV30-C	ALLGOW3	0.42	1.00
ID / River Mile	Status	Facility Description	Length (ft.)	Flow (cfs)	HEC-1 Node	HEC-1 Model	Tributary Area (sq.mi.)	Channel Slope (%) **
GOSO		GOWAN SOUTH FACILITIES						
0000	E	72" RCP Outlet	2303	454	GWNSDB	GW5SC	12.13	0.53
0050	E	39,030 cfs PMF Spillway		39030	GWNSIN	GW5SC	12.13	
0051	E	624 ac-ft Gowan South Detention Basin		5625	GWNSIN	GW5SC	12.13	
0052	P1	Upgrade to 686 ac-ft Gowan South Detention Basin		5625	GWNSIN	GW5SC	12.13	
0068	E	Conc Chnl 15'W 7'D 2:1 SS	380	3796	CBUF01-C	GW3SC	4.88	0.40
0076	E	2: 10' X 7' RCBC @ Peak Dr	80	2119 [^]	CBUF01-C [^]	GW3SC	4.88	0.56
0077	P0	Add 2: 14' X 7' RCBC @ Peak Dr	80	1677 [^]	CBUF01-C [^]	GW3SC	4.88	0.56
0078	E	Conc Chnl 22'W 10'D 0:1 SS	60	3796	CBUF01-C	GW3SC	4.88	0.56
0080	E	Conc Chnl 12'W 7'D 2:1 SS	2078	3796	CBUF01-C	GW3SC	4.88	0.56
0119	E	Conc Chnl 22'W 10'D 0:1 SS	180	3587	CCCvil23	GW3SC	4.52	0.95
0123	E	2: 10' X 7' RCBC @ Smoke Ranch	100	2229 [^]	CCCvil23 [^]	GW3SC	4.52	0.62
0124	P0	Add 2: 10' X 7' RCBC @ Smoke Ranch	100	1358 [^]	CCCvil23 [^]	GW3SC	4.52	0.62
0125	E	Conc Chnl 22'W 9'D 0:1 SS	50	3587	CCCvil23	GW3SC	4.52	0.62
0126	E	Conc Chnl 12'W 7'D 2:1 SS	2155	3587	CCCvil23	GW3SC	4.52	0.62
0170	E	Conc Chnl 12'W 7'D 2:1 SS	220	2657	CCGD34AC	GW3SC	3.06	0.62
0173	E	Conc Chnl 22'W 7'D 0:1 SS	158	2657	CCGD34AC	GW3SC	3.06	0.62
0176	E	2: 10' X 7' RCBC @ Lake Mead	100	2657	CCGD34AC	GW3SC	3.06	0.62
0178	E	Conc Chnl 22'W 7'D 0:1 SS	150	2657	CCGD34AC	GW3SC	3.06	1.00
0181	E	Conc Chnl 12'W 7'D 2:1 SS	2429	2657	CCGD34AC	GW3SC	3.06	0.58
0227	E	2 : 10' X 7' RCBC @ Vegas Drive	100	2065	CGD34AA	ALLGOW3	2.41	1.36
0229	E	Conc Chnl 12'W 7'D 1:1 SS	2649	2065	CGD34AA	ALLGOW3	2.41	1.36
0279	E	12' X 7' RCB	80	2065	CGD34AA	ALLGOW3	2.41	1.36
0280	E	12' X 8' RCB	875	2065	CGD34AA	ALLGOW3	2.41	0.34
0297	E	12' X 7' RCB	2124	1825	CW1BB-C	ALLGOW3	2.14	1.60
0336	E	12' X 7' RCB	602	1593	C1-WESTC	ALLGOW3	1.84	3.40
0352	E	2: 8' X 5' RCB	2740	1374	C1-DUCHC	ALLGOW3	1.60	0.73
GOTE		GOWAN -TENAYA BRANCH						
0000	E	60" RCP	1954	272	LV29-C	ALLGOW3	0.28	1.30
GOWC		GOWAN SOUTH FACILITIES - WEST CLIFF						
0000	E	24" RCP	5400	257	1-WEST-C	ALLGOW3	0.24	1.67
LCCH		LAS VEGAS CREEK CHANNEL						
0438	E	60" RCP	1090	162	CLC01-C	SW3	1.20	1.60
0458	E	60" RCP	1060	162	CLC01-C	SW3	1.20	1.60
0478	E	60" RCP	1110	162	CLC01-C	SW3	1.20	0.55
0499	E	42" RCP Outlet	660	85	RAINBWDB	SW3	1.11	1.88
0512	E	45 ac-ft Rainbow Detention Basin		970	RAINBWIN	SW3	1.11	
0513	P3	Upgrade to 102 ac-ft Rainbow Detention Basin		970	RAINBWIN	SW3	1.11	
0518	E	60" RCP Connector Pipe Under Rainbow Blvd	670	970	RAINBWIN	SW3	1.11	1.85
0534	E	60" RCP	460	279	AL00A-C	SW3	0.23	5.38
0543	E	Conc Chnl 10'W 4'D 0:1 SS	700	279	AL00A-C	SW3	0.23	1.88
LCLO		LAS VEGAS CREEK - LORENZI						
0000	P3	7' X 6' RCB	445	265	DAL00A	SW3	0.41	3.37
0008	P3	7' X 6' RCB	2415	265	DAL00A	SW3	0.41	0.40
LVLM		LAS VEGAS WASH - LAKE MEAD						
0475	E	48" RCP	2632	235	LM02-C	NW3	0.29	1.24
0525	E	48" RCP	2600	542	CLM01-C	NW3	0.64	1.24
LVOW		OWENS AVENUE SYSTEM						
0460	P1	7' X 6' RCB	2700	616	CVG03-C	NW3	0.95	1.48
LVPK		PEAK DRIVE SYSTEM						
0130	E	7' X 5' RCB	1435	400	CPD01-C	NW3	0.67	0.61
LVSR		LAS VEGAS WASH - SMOKE RANCH						
0496	P1	10' X 7' RCB	2855	1245	CSR02E	NW3	1.64	1.27
0546	P1	8' X 8' RCB	2640	758	CSR00A	NW3	1.01	0.57

* 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.

[^] 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).



2008 LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE

FACILITY INVENTORY
FIGURE F - 25

L
E
G
E
N
D

ID (Facility Identifier)
Parent Stream Name
Stream Name
River Mile
Distance Above Confluence
with Parent Stream (Miles)
Miles in Hundredths

AABB
0000

Existing Facility..... E
Proposed or Modified Facility..... P
Contingency Level
Category B..... P0
Master Plan..... P1
Preliminary Design..... P2
Design..... P3

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

Construction Features
Cast in Place Concrete Pipe..... CIPCP
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
Reinforced Concrete Arch Culvert..... RCAC
Reinforced Concrete Box..... RCB
Reinforced Concrete Box Culvert..... RCBC
Reinforced Concrete Pipe..... RCP
Reinforced Concrete Pipe Culvert..... RCP
Storm Sewer Pipe..... SSP



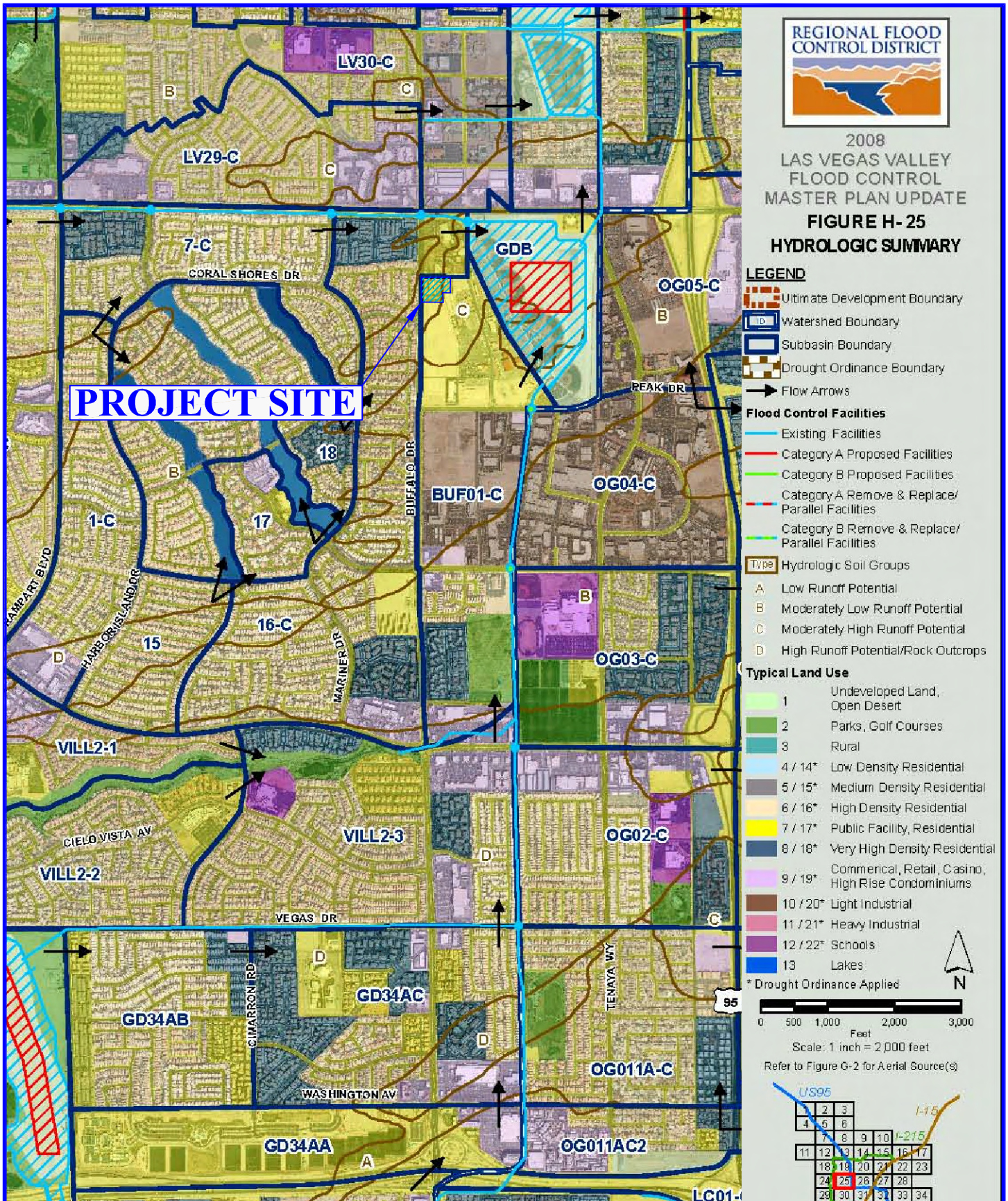
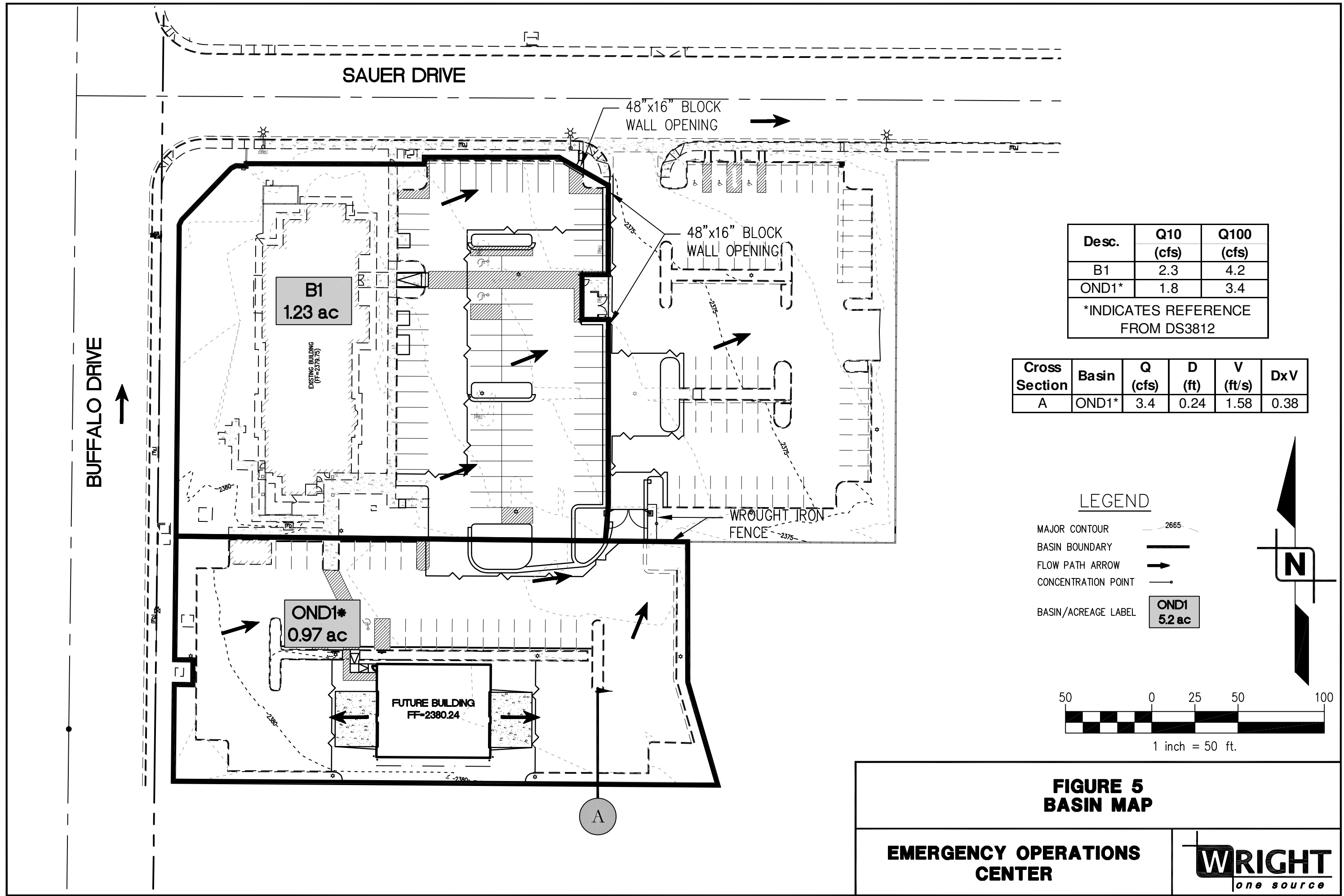


FIGURE 4

SOILS MAP



Desc.	Q10 (cfs)	Q100 (cfs)
B1	2.3	4.2
OND1*	1.8	3.4
*INDICATES REFERENCE FROM DS3812		

Cross Section	Basin	Q (cfs)	D (ft)	V (ft/s)	DxV
A	OND1*	3.4	0.24	1.58	0.38

LEGEND

- MAJOR CONTOUR — 2665
- BASIN BOUNDARY —
- FLOW PATH ARROW —→
- CONCENTRATION POINT —•
- BASIN/ACREAGE LABEL OND1 5.2 ac

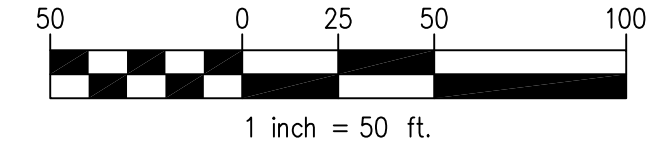


FIGURE 5
BASIN MAP

EMERGENCY OPERATIONS
CENTER



APPENDIX B

HYDROLOGIC AND HYDRAULIC CALCULATIONS

TIME OF CONCENTRATION

STANDARD FORM 4

DEVELOPMENT: Emergency Operations Center

CALCULATED BY: RDH

DATE: 7/25/2012

SUB-BASIN DATA				INITIAL / OVERLAND TIME (t_i)			TRAVEL TIME (t_t)					t_c CHECK (URBANIZED BASINS)		FINAL t_c
DES.	K (C₁₀ from Rational Method)	AREA Ac	AREA Sq Mi	LEN. Ft	SLOPE %	t_i Min	LEN Ft	SLOPE %	VEL (V ₁) fps	VEL (V ₂) fps	t_t Min	TOTAL LENGTH Ft	$t_c=(L/180)$ +10 Min	Min
(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10a)	(10b)	(11)	(12)	(13)	(14)
B1	0.88	1.23	0.0019	50	2.00	2.22	135	1.60	2.56	N/A	0.88	185	11.03	5.00

Travel Time Velocity Formulas*			* - See CCRFCD HC&DDM Sec. 602.
Existing	Developed	For the travel time (T_t) calculations:	
$K = 0.0132 \cdot CN - 0.39$ $t_i = 1.8(1.1 - K)L^{1/2}/S^{1/3}$ Velocity obtained from Manning's Equation		$t_i = t_c \cdot 0.6$ $V_1 = 14.8 \cdot (S/100)^{1/2}$ $V_2 = 29.4 \cdot (S/100)^{1/2}$	V_1 applies to the first 500 feet of travel distance V_2 applies to the remaining travel distance

MODIFIED RATIONAL FORMULA METHOD

$$Q = kCIA$$

DEVELOPMENT: Emergency Operations Center

CALCULATED BY:

RDH

DATE: 7/25/2012

BASIN	LOCAL ADJUSTMENT	RUNOFF COEFFICIENT	AVERAGE INTENSITY OF	BASIN AREA (A) acres	MAX RATE OF RUNOFF (Q) cfs
B1-10yr	0.5	0.88	4.2	1.23	2.27
B1-100yr	0.5	0.89	7.56	1.23	4.14

Sdf-4

K= Flow Resistance Coefficient CCRFCD Table

Modified Rational Formula Method

K= 0.5 Local Adj Factor CCRFCD 604.3

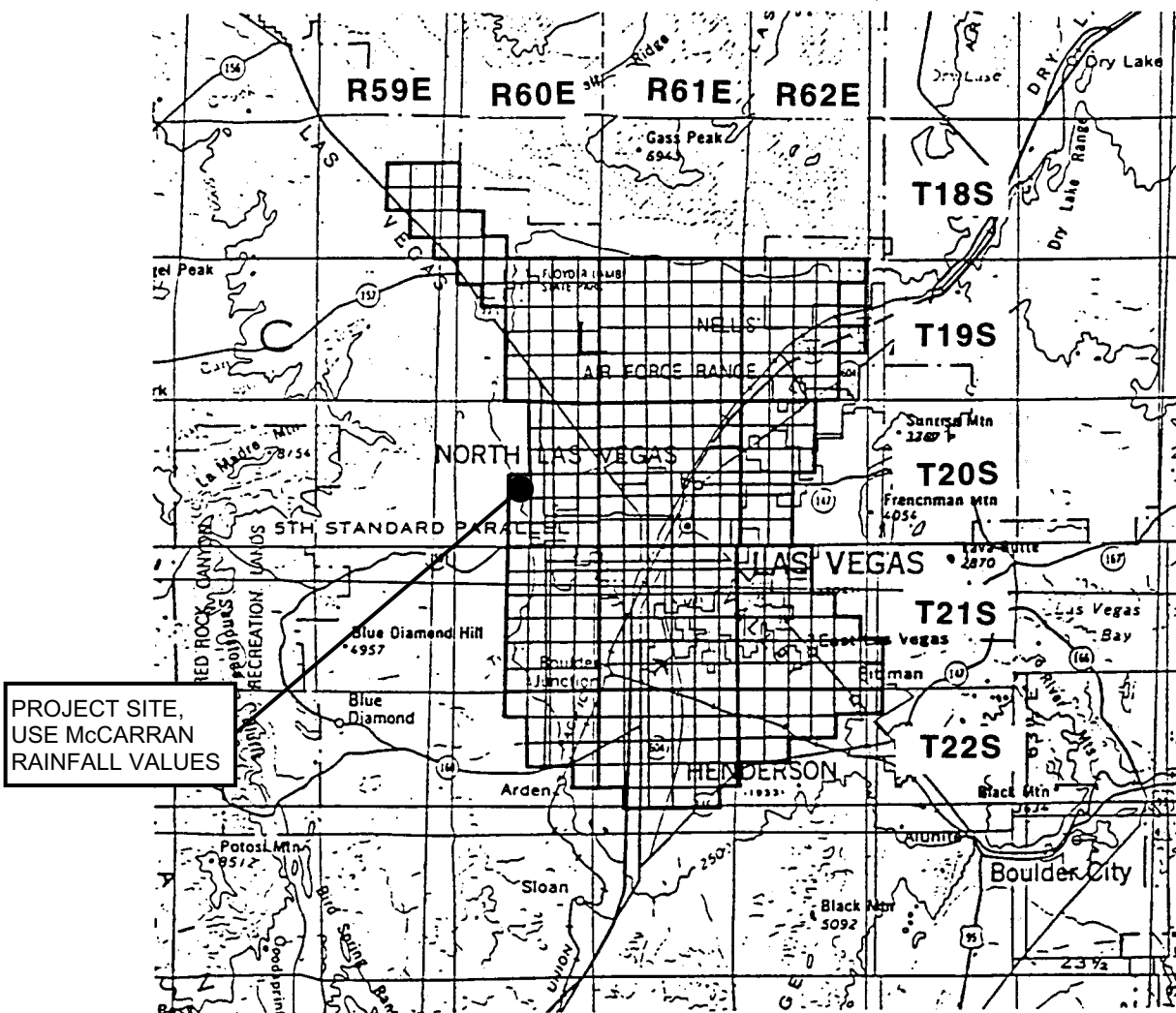
C= Runoff Coefficient CCRFCD Table 601

I= Rainfall Intensity CCRFCD Figure 517



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

WRC
ENGINEERING

REFERENCE:

USACE, Los Angeles District, 1988

FIGURE 513

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

TIME-INTENSITY-FREQUENCY VALUES FOR McCARRAN AIRPORT RAINFALL AREA (IN INCHES PER HOUR)

TIME (min)	RECURRENCE INTERVAL					
	2-YR	5-YR	10-YR	25-YR	50-YR	100-YR
5	1.80	3.24	4.20	5.52	6.48	7.56
10	1.50	2.64	3.42	4.44	5.34	6.12
15	1.32	2.28	2.96	3.88	4.60	5.28
30	0.88	1.56	2.02	2.62	3.10	3.58
60	0.52	0.89	1.15	1.50	1.78	2.06

- NOTE: 1. Refer to Figure 513 for a description and drawing of the area included in the McCarran Airport Rainfall Area.
2. Table 501 adjustments not required.

Revision	Date

**WRC
ENGINEERING**

REFERENCE:

USACE, Los Angeles District, 1988

TABLE 506

HYDROLOGIC CRITERIA AND DRAINAGE DESIGN MANUAL

RATIONAL FORMULA METHOD RUNOFF COEFFICIENTS AND AVERAGE PERCENT IMPERVIOUS AREA

LAND USE OR SURFACE CHARACTERISTICS	AVERAGE PERCENT IMPERVIOUS AREA	RUNOFF COEFFICIENTS			
		10-YEAR		100-YEAR	
		GRASS ¹	DESERT ²	GRASS ¹	DESERT ²
<u>Business and Commercial:</u>					
Downtown Areas	95	.88	.88	.89	.89
Neighborhood Areas	70	.70	.75	.80	.83
<u>Residential</u> (Average Lot Size):					
1/8 Acre or less (Multi-Unit)	65	.68	.73	.78	.80
1/4 Acre	38	.55	.62	.65	.74
1/3 Acre	30	.50	.57	.60	.70
1/2 Acre	25	.45	.53	.55	.67
1 Acre	20	.40	.49	.50	.64
2 Acre	12	.35	.45	.40	.60
<u>Industrial:</u>	72	.72	.76	.82	.84
<u>Open Space:</u> (Lawns, Parks, Golf Courses)	5	.10	-	.30	-
<u>Undeveloped Areas:</u> (Natural Vegetation)	0	-	.25	-	.50

<u>Streets and Roads:</u>					
Paved	100	.90		.93	
Gravel	20	.40		.50	
<u>Drives and Walks:</u>	95	.88		.89	
<u>Roofs:</u>	90	.85		.87	

Notes:

- ¹ Grass - Grassed Landscaping or Irrigated Vegetation
² Desert - Desert Landscaping or Natural Vegetation

Revision	Date

Worksheet for Section A

Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.50000	%
Discharge	3.40	ft ³ /s
Section Definitions		

Station (ft)	Elevation (ft)
0+00.0	78.81
0+00.5	78.81
0+00.5	78.31
0+47.0	78.92
0+47.0	79.42
0+47.5	79.42
0+53.0	79.50

Roughness Segment Definitions

Start Station	Ending Station	Roughness Coefficient
(0+00.0, 78.81)	(0+00.5, 78.31)	0.013
(0+00.5, 78.31)	(0+47.0, 78.92)	0.016
(0+47.0, 78.92)	(0+47.5, 79.42)	0.013
(0+47.5, 79.42)	(0+53.0, 79.50)	0.025

Results

Normal Depth	0.24	ft
Elevation Range	78.31 to 79.50	ft
Flow Area	2.15	ft²
Wetted Perimeter	18.36	ft
Top Width	18.12	ft
Normal Depth	0.24	ft
Critical Depth	0.22	ft
Critical Slope	0.00791	ft/ft

Worksheet for Section A

Results

Velocity	1.58	ft/s
Velocity Head	0.04	ft
Specific Energy	0.28	ft
Froude Number	0.81	
Flow Type	Subcritical	

GVF Input Data

Downstream Depth	0.00	ft
Length	0.00	ft
Number Of Steps	0	

GVF Output Data

Upstream Depth	0.00	ft
Profile Description		
Profile Headloss	0.00	ft
Downstream Velocity	Infinity	ft/s
Upstream Velocity	Infinity	ft/s
Normal Depth	0.24	ft
Critical Depth	0.22	ft
Channel Slope	0.00500	ft/ft
Critical Slope	0.00791	ft/ft

Cross Section for Section A

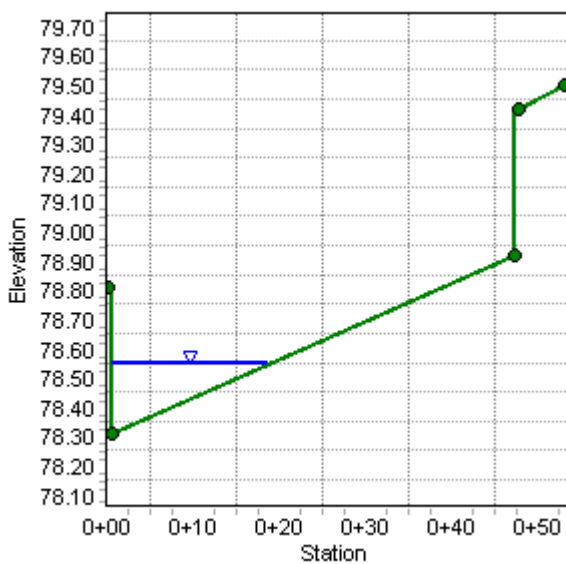
Project Description

Friction Method	Manning Formula
Solve For	Normal Depth

Input Data

Channel Slope	0.50000	%
Normal Depth	0.24	ft
Discharge	3.40	ft ³ /s

Cross Section Image



Worksheet for Typ. Wall Opening - Broad Crested Weir

Project Description

Solve For Headwater Elevation

Input Data

Discharge		4.20	ft ³ /s
Crest Elevation		0.67	ft
Tailwater Elevation		0.50	ft
Crest Surface Type	Paved		
Crest Breadth		1.00	ft
Crest Length		4.00	ft

Results

Headwater Elevation	1.16	ft
Headwater Height Above Crest	0.49	ft
Tailwater Height Above Crest	-0.17	ft
Weir Coefficient	3.09	US
Submergence Factor	1.00	
Adjusted Weir Coefficient	3.09	US
Flow Area	1.95	ft ²
Velocity	2.15	ft/s
Wetted Perimeter	4.97	ft
Top Width	4.00	ft

1.16' = 13.9"
13.9" < 16"
OK

APPENDIX C

REFERENCE MATERIAL

TECHNICAL DRAINAGE STUDY

for

WEST SERVICE CENTER-BUILDING AND SAFETY EXPANSION

@

East of Buffalo Drive and approximately 245ft south of Sauer Drive

May 2005

Prepared for:

City Of Las Vegas – Department of Public Works
400 Stewart Avenue
Las Vegas Nevada 89101
Phone: (702) 229-6535

Prepared by:

JPL Engineering, Inc.
8620 South Eastern Avenue, Suite 8
Las Vegas, NV 89123
On behalf of:

Malpass Design Group, LLC
2340 Corporate Circle, Suite 140
Henderson, Nevada 89074
Phone: (702) 401-4999

DS 3812
400-
L-15
5/19/05

CITY OF LAS VEGAS		DATE:
INTER-OFFICE MEMORANDUM		June 6, 2005
TO: Land Development Services Department of Public Works		FROM: Albert Sung, P.E. <i>AS</i> Flood Control Project Engineer Department of Public Works
SUBJECT: Drainage Study for: West Service Center – Building & Safety Expansion		COPIES TO: JPL Engineering
Cross Streets:	Buffalo & Sauer	CLV - Patrick Batte, OAS
File Number:	F:\Depot\DSMemos\DS3812A.doc	Bart Anderson, P.E., DevCo
Parcel Number:	13815201002	Malpass Design Group
Zoning Action:	SDR 5937	
FEMA Flood Zone	YES NO X	
Proposed Storm Drain	YES X NO	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1 st Submittal	5/19/2005	6/6/2005	See Comments Below	\$400.00	22154: \$400
TOTAL FEES (LDDRS):				\$400.00	----

REMARKS:

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

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

1. Provide a detail of the drive cross section at the 12-inch drainage culvert. The shallow culvert cover may require additional protection for the pipe.
2. Provide detailed grading with a swale cross section for the drainage (29 cfs) entering the southeast corner of the site. Provide the size & type of material to be used within the drainage swale.
3. The proposed screen wall along Buffalo Drive is required to be 8-inch CMU solid grouted for flood protection to a minimum depth of 18-inches above the adjacent Buffalo Drive top of curb grades. Show the limits of the wall and where the flood protection wall transitions.
4. Revise Section 6 on Sheet C8.01 to reflect the 8-inch CMU solid grouted for flood protection to a minimum depth of 18-inches above the adjacent Buffalo Drive top of curb grades
5. The 20-foot wrought iron fence proposed on the southeast side of the site must utilize Detail 421B. Contact Rosa Cortez at 229-6171 for the AutoCAD details (421 series) to be included with the improvement plans.
6. Provide the standard drainage study note on the grading plan. *I CERTIFY THAT THIS GRADING PLAN IS IN CONFORMANCE WITH THE APPROVED DRAINAGE STUDY ON FILE AT THE CITY OF LAS VEGAS FOR THIS PROJECT (DS3812).*
7. Provide a cross section at the south property line. Typical sections are to extend through a building finish floor, parking, drive isle, landscape area, perimeter wall, and property line. Show the existing and proposed improvements in the sections.

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.

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

END OF REMARKS
PBJ

T/R/S: T20S/R60E/15
AREA L-15

DRAINAGE STUDY INFORMATION FORM

Name of Development: West Service Center Building and Safety Expansion Date: 5/5/05
Location of Development: a) Descriptive (Cross Street) North/South Buffalo Drive East/West Sauer Drive
b) Section: 15 Township: 20 South Range: 60 EAST

Name of Owner: City of Las Vegas - Dept of Public Works Assessors Parcel No.: 138-15-201-002
Telephone No: 702-229-6535 (Contact Person: Pat Batter - Ext 1046) Facsimile No. _____
Address: 400 Stewart Avenue
Las Vegas, NV 89101

Contact Person Name: Shiau-Ching Low Telephone No. (702) 898-6269
Firm: JPL Engineering, Inc.
Address: 8620 South Eastern Ave, Suite 8
Las Vegas, NV 89123

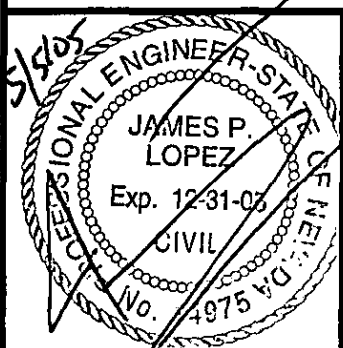
Type of Land Development/Land Disturbance Process:

☐ 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: 162.51 ± AC Being Developed/Disturbed: 1.05 ± AC
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.)? Parking Lots
5. Approximate upstream land area which drains to the subject site? South of the subject site
6. Has the site been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation:
Technical Drainage Study for City of Las Vegas West Service Center (DS3057)

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

8. Briefly describe your proposed schedule for the subject project: AS SOON AS POSSIBLE



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

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

Local Entity File No. _____

Revision	Date

REFERENCE:

STANDARD FORM 1

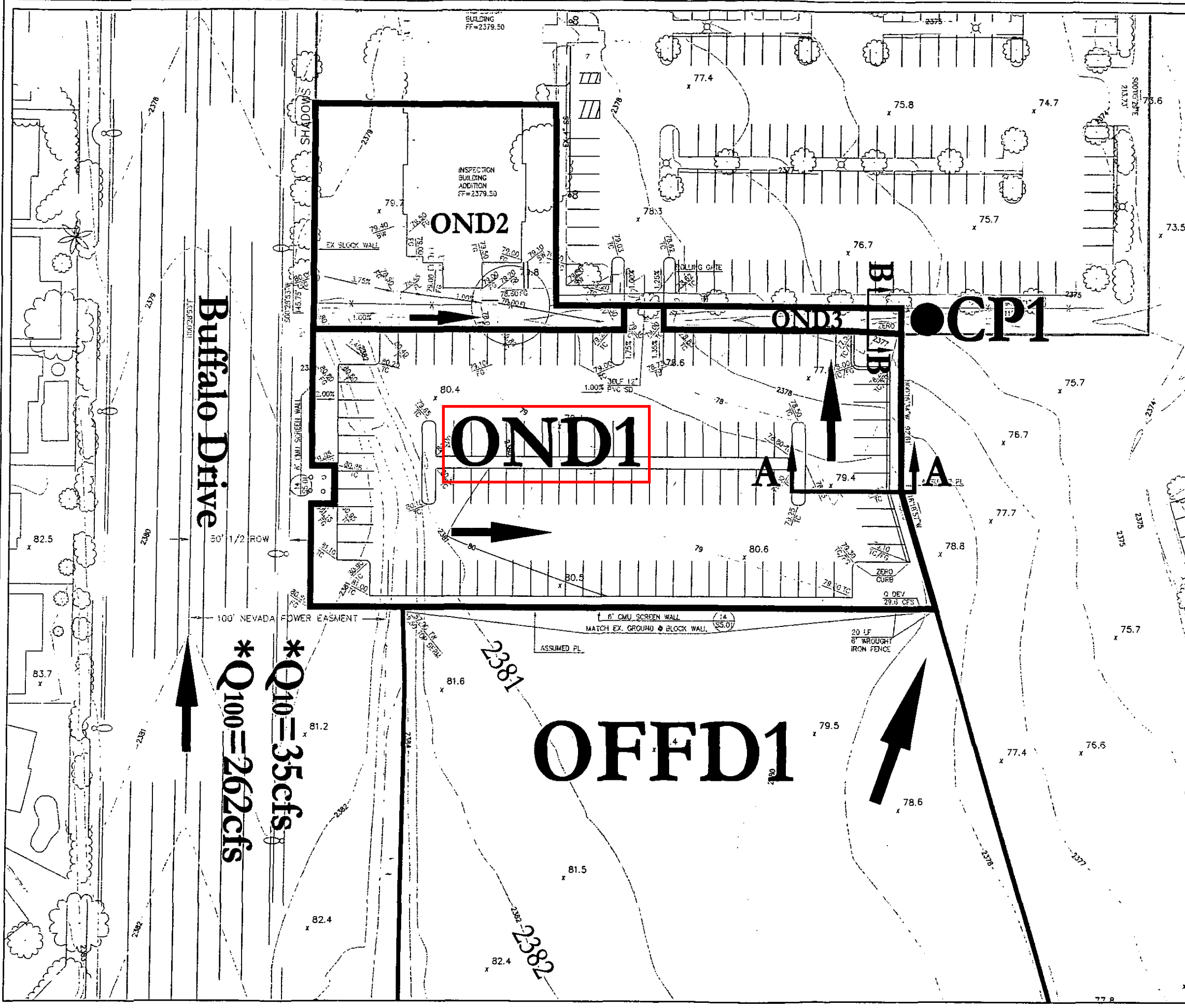
2.3 Developed Conditions

Offsite Developed Drainage Conditions Under developed conditions the offsite is assumed to be fully developed with commercial building. For the worse case scenario, runoff coefficient of $C_{10}=0.90$ and $C_{100}=0.93$ (Street and Roads: Paved) were used for the Rational Formula Calculation. Basin OFFD1 (15.8cfs/29.6cfs) generally drain east to the existing wall and convey north along the west side of the wall. Flow from Basin OFFD1 will drain through the 20ft wrought iron opening and continue to drain north through the depress curd of the subject site. The weir calculation with 50% clogging factor is provided in Appendix B. Please refer to the Developed Conditions Drainage Basin Exhibit.

Onsite Developed Drainage Conditions Under developed conditions the site consists of parking lots and three basins (OND1, OND2 and OND3). Flow from basin OND1 (1.8cfs/3.4cfs) general drains east and convey north to the existing swale. The weir calculation for 33cfs (combination of OFFD1 and OND1) with 50% clogging factor for the depress curb is provided in Appendix B. Basin OND2 (0.6cfs/1.2cfs) and Basin OND3 (0.1cfs/0.1cfs) generally drain east to the existing swale. A 12" PVC pipe is proposed for the negligible flow generated by basin OND2. CP1 (18.3cfs/34.3cfs) is the combination point of OFFD1, OND1, OND2 and OND3. CP1 will continue to drain east within the existing swale. Please refer to Appendix B for the FlowMaster calculation for the Cross Section calculations. A summary of the developed condition flows is given below. See the Developed Conditions Drainage Basin Exhibit provided at the rear of the text.

Drainage Basin	Area (Acres)	Q_{10} (cfs)	Q_{100} (cfs)	V_{100} Fps
OND1	0.97	1.8	3.4	2.05
OND2	0.33	0.6	1.2	3.08
OND3	0.03	0.1	0.1	1.65
OFFD1	10.61	15.8	29.6	4.58
CP1	NA	18.3	34.3	NA

$$CP1 = OFFD1 + OND1 + OND2 + OND3$$



BASIN / COMB PT	BASIN AREA (acres)	VELOCITY (fps)	Q ₁₀ (cfs)	Q ₁₀₀ (cfs)
OND1	0.97	2.05	1.8	3.4
OND2	0.33	3.08	0.6	1.2
OND3	0.03	1.65	0.1	0.1
OFFD1	10.61	4.58	15.8	29.6
CP1	NA	NA	18.3	34.3

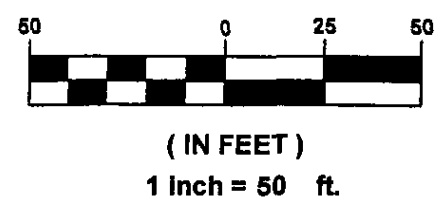
LEGEND

- ONEX Basin Name
- ➔ Flow Arrow
- Description Arrow
- ▬ Basin Boundary
- CP1 Combination Point
- ▬ Cross Section

Note: 1. See detail from the Grading Plan.
 2. * Reference from "Technical Drainage Study for WSC Customer Service Center".
 3. CP1 = OND1 + OND2 + OND3 + OFFD1



GRAPHIC SCALE

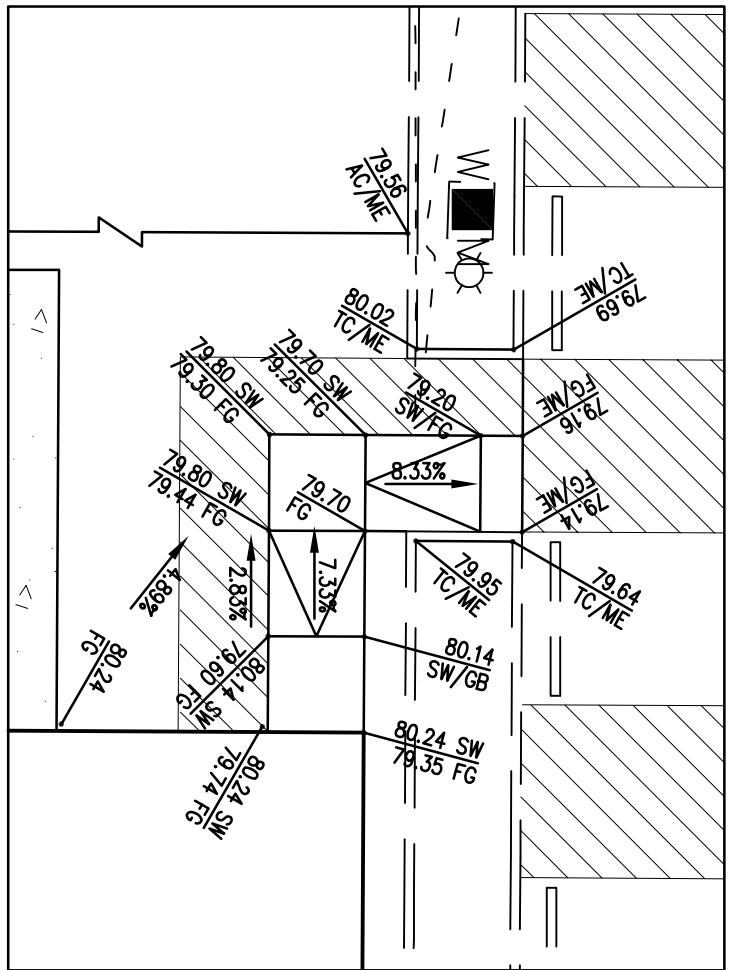
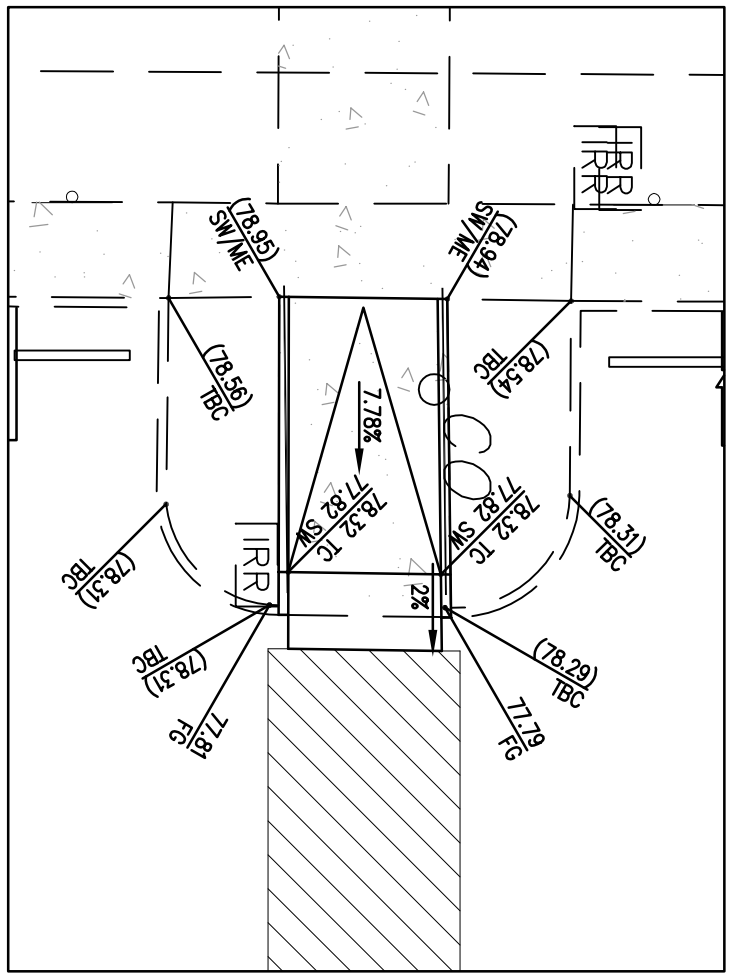
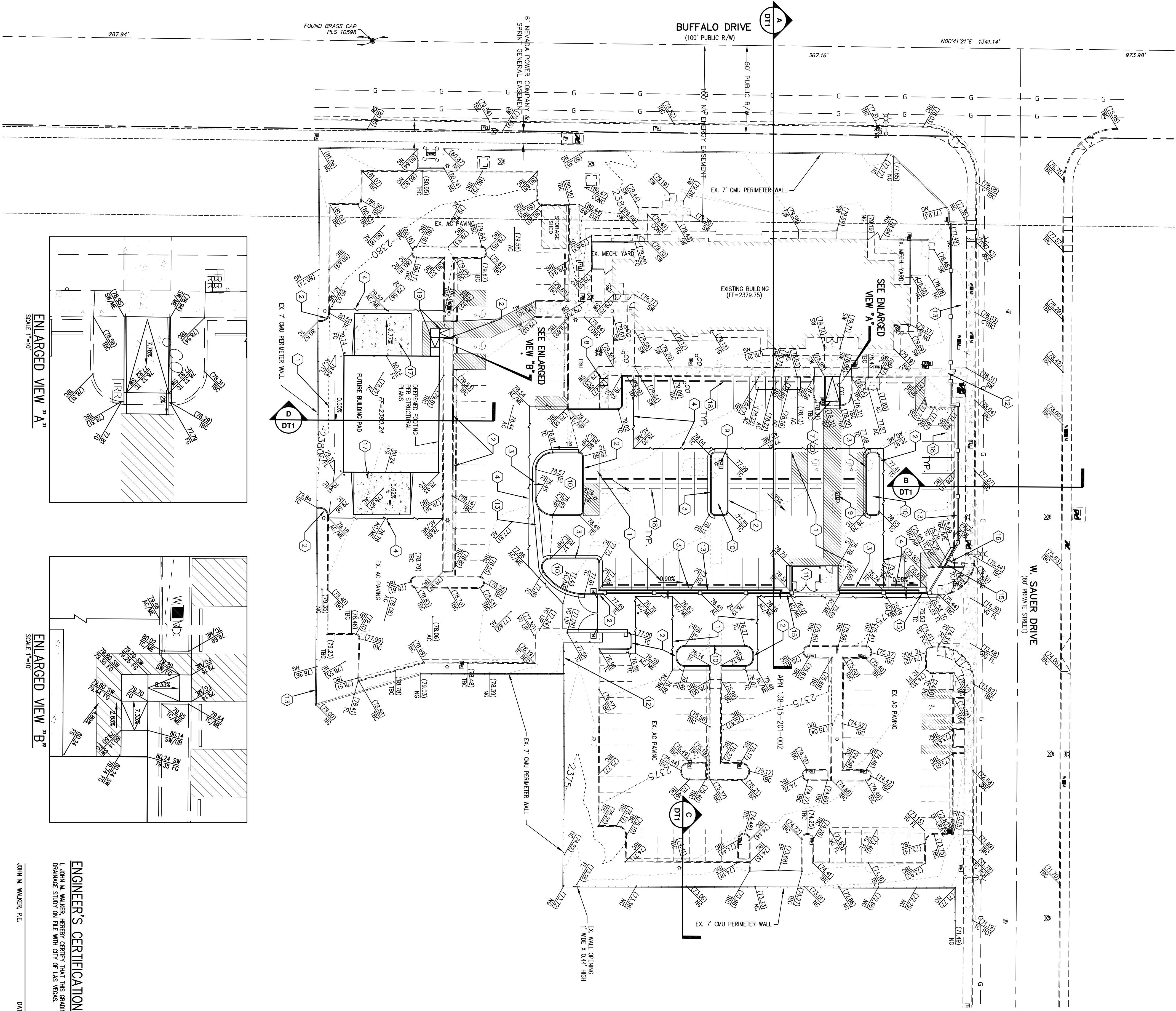


JPL Engineering, Inc.
 8620 S. Eastern Ave Suite 8
 Las Vegas Nevada 89123
 Tel: 702-898-6269
 Fax: 702-898-0647

West Service Center Building and Safety Facility Expansion Developed Conditions Drainage Basin and Cross Section Exhibit

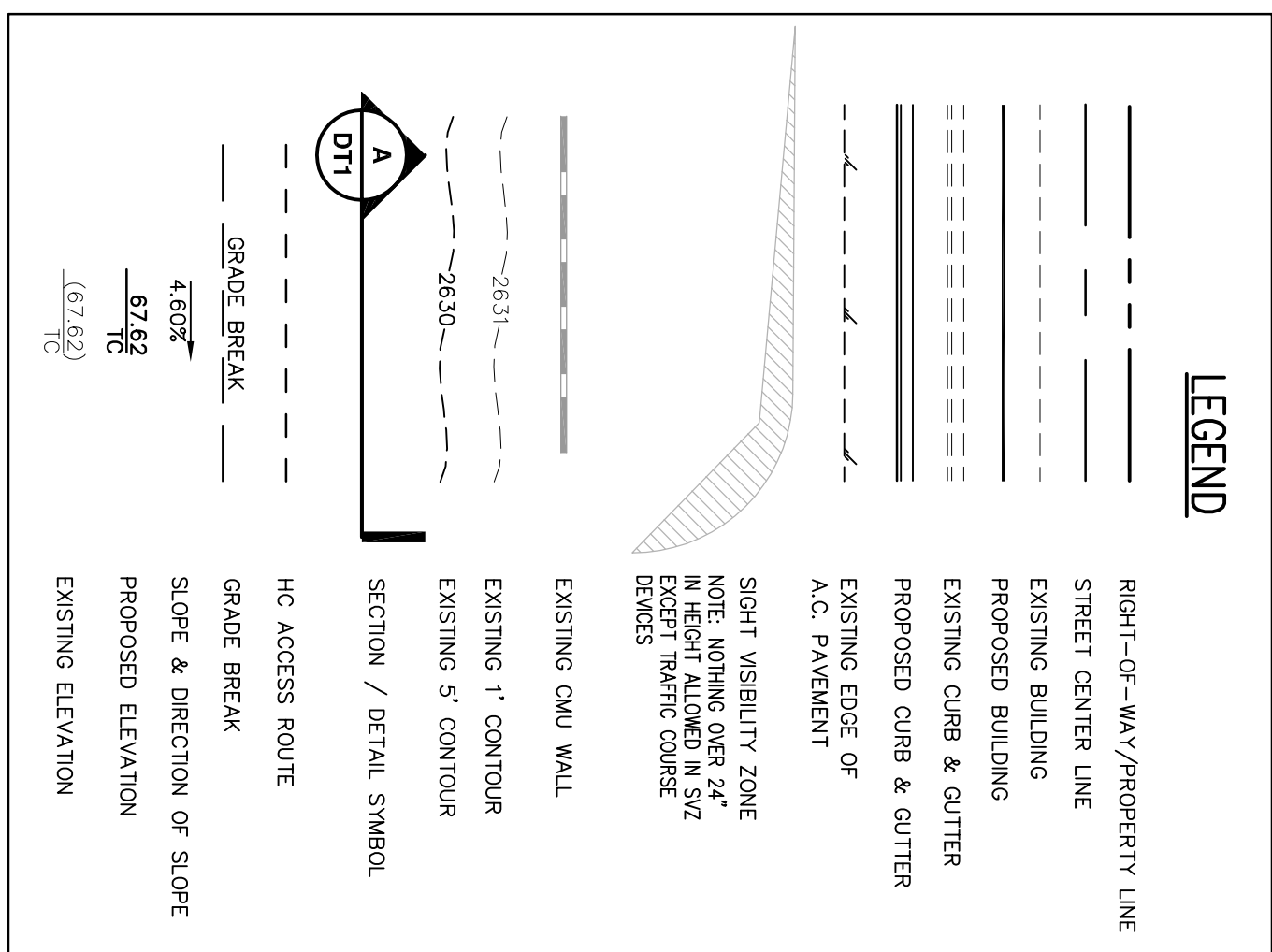
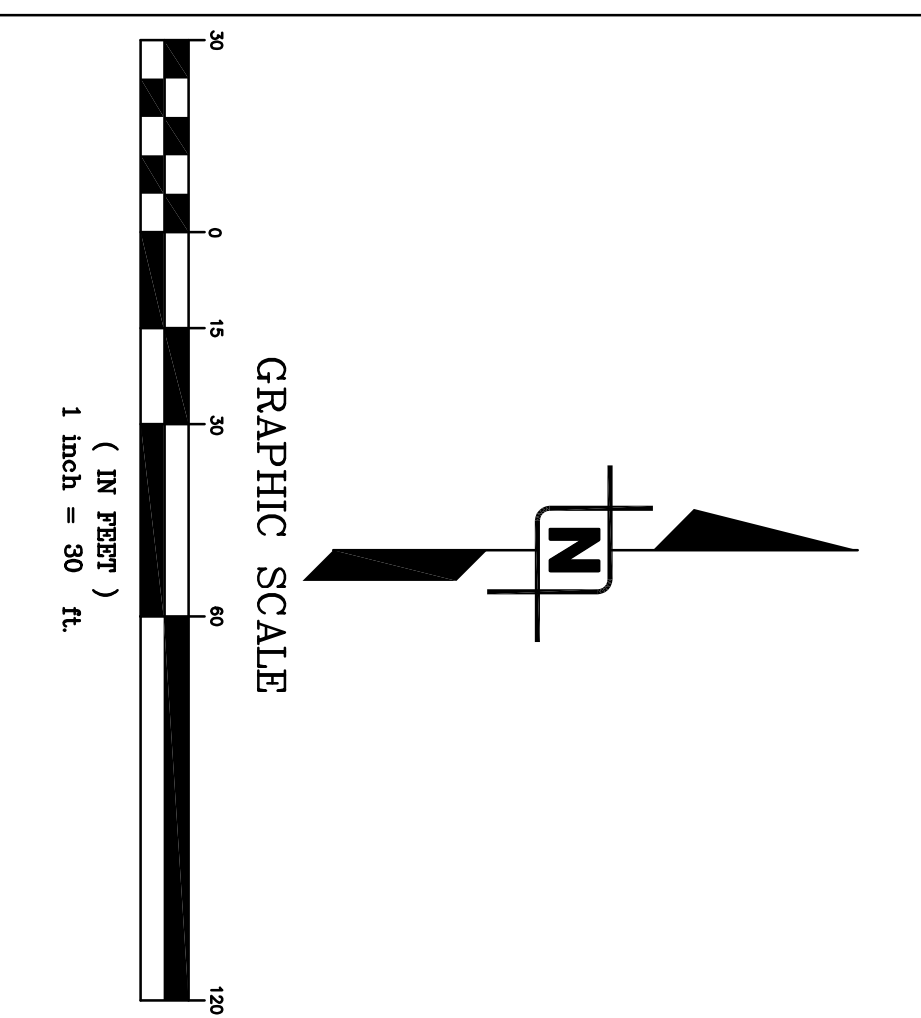
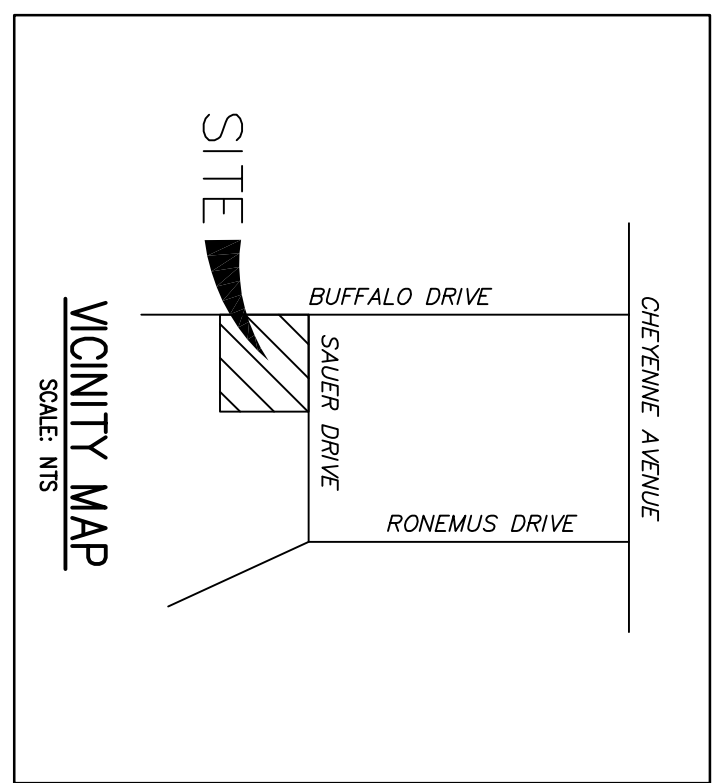
APPENDIX D

PLANS



- CONSTRUCTION NOTES:**
1. INSTALL 3" AC PAVING OVER 1" TYPE II AGC BASE COMPARED TO STATE REPORT RECOMMENDATIONS
 2. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216
 3. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216
 4. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216
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 17. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216
 18. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216
 19. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216
 20. INSTALL 1" TYPE CURB AND GUTTER PER CAUSD #216

NOTE:
ALL HANDICAP ACCESS ROUTES ARE AT
2% CROSS SLOPE & 24" MIN. WALKWAY CHANGE.



FLOOD ZONE NOTE:
ACCORDING TO THE FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD INSURANCE RATE MAP (FIRM) 1702-0101-002, THE PROJECT AREA IS NOT IN A FLOOD HAZARD ZONE. THE PROJECT AREA IS NOT IN A FLOOD HAZARD ZONE. THE PROJECT AREA IS NOT IN A FLOOD HAZARD ZONE.

LEGAL DESCRIPTION
APN 138-15-201-002, 1/2 AC. 1/4 SECTION 15, TOWNSHIP 28 NORTH, RANGE 30 EAST, MERIDIAN 11N & 12N.

BASIS OF BEARING
THE BASIS OF BEARINGS IS GRID NORTH AS DEFINED BY THE CENTRAL MEXICAN AMERICAN DIVISION OF THE NATIONAL BUREAU OF SURVEYING, LAS VEGAS, NV. THE BASIS OF BEARINGS IS GRID NORTH AS DEFINED BY THE CENTRAL MEXICAN AMERICAN DIVISION OF THE NATIONAL BUREAU OF SURVEYING, LAS VEGAS, NV.

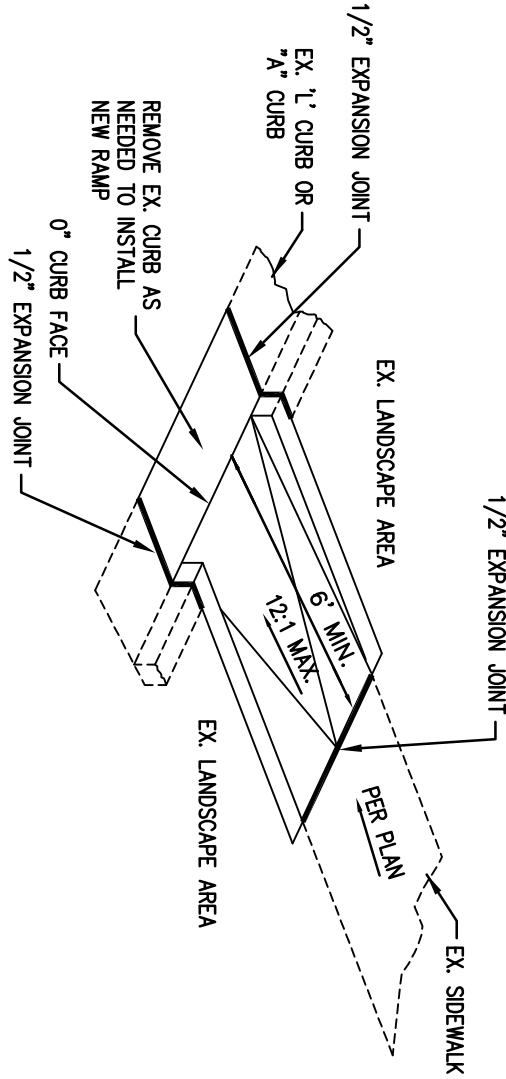
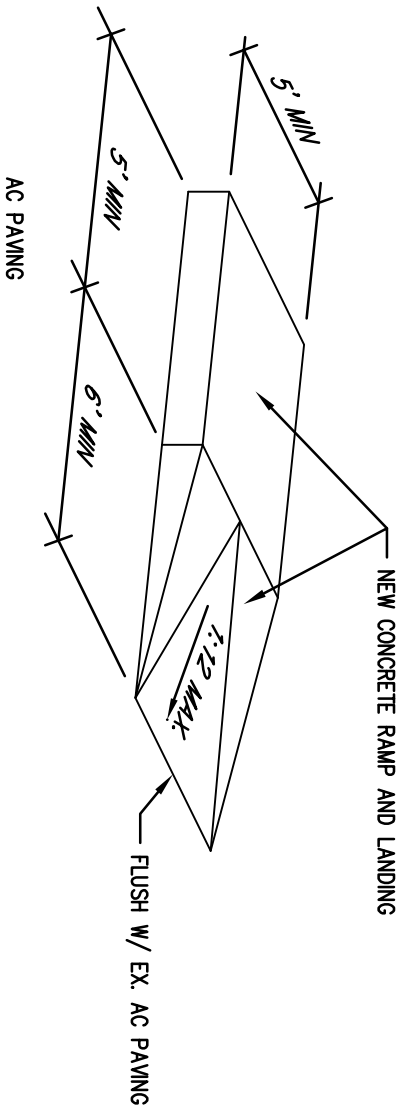
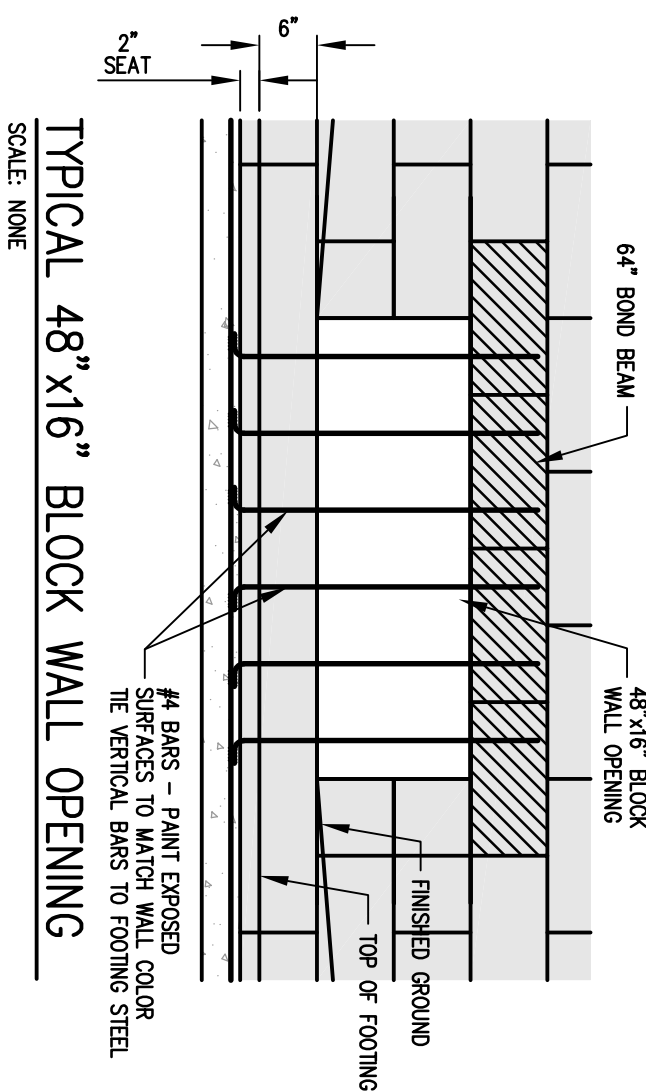
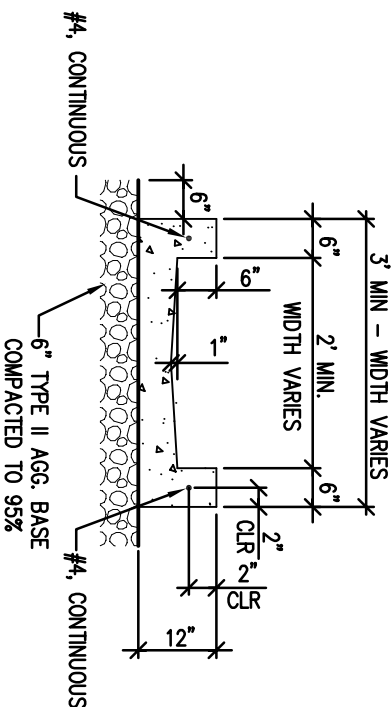
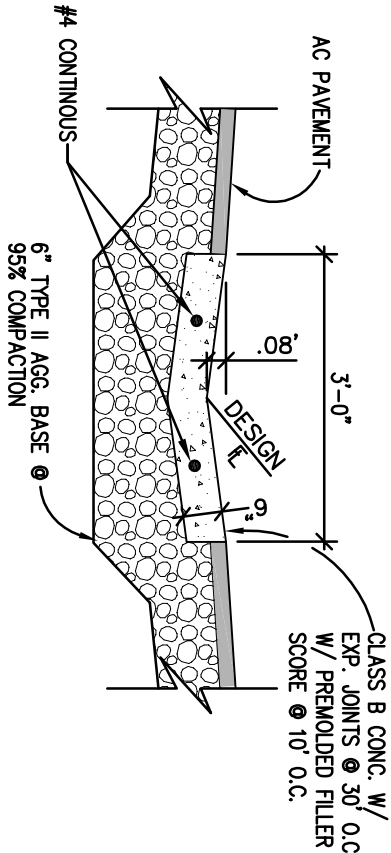
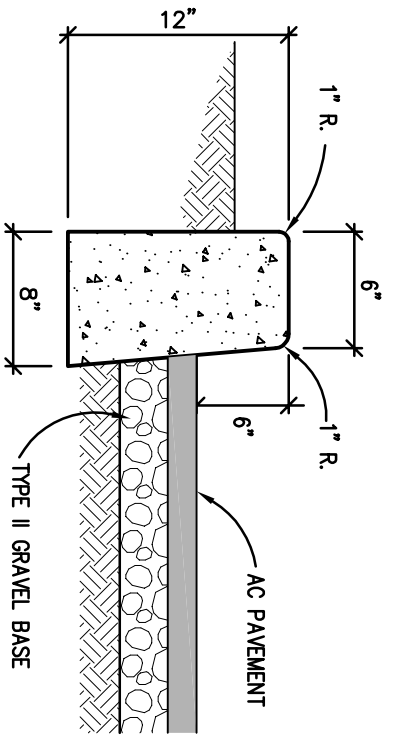
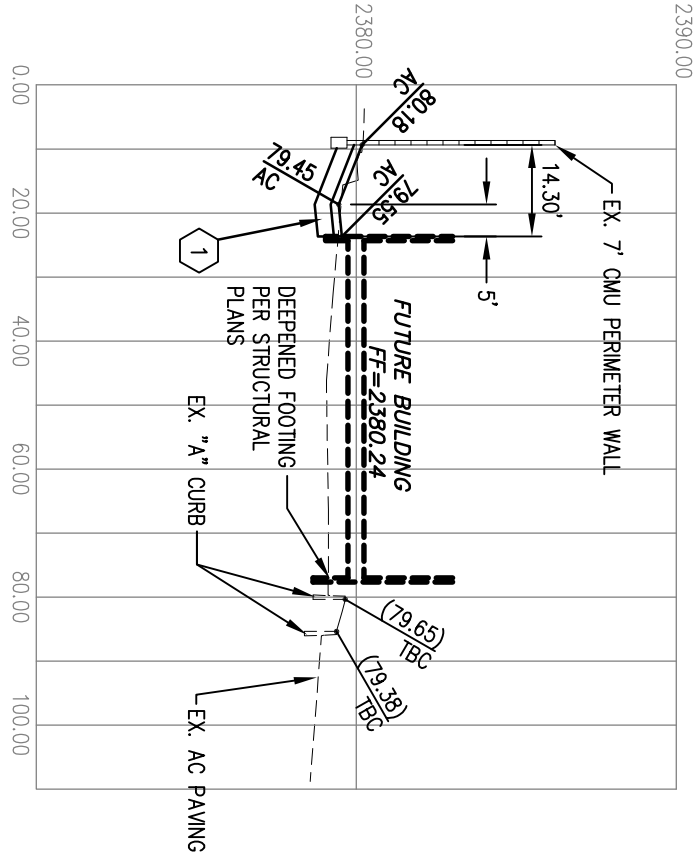
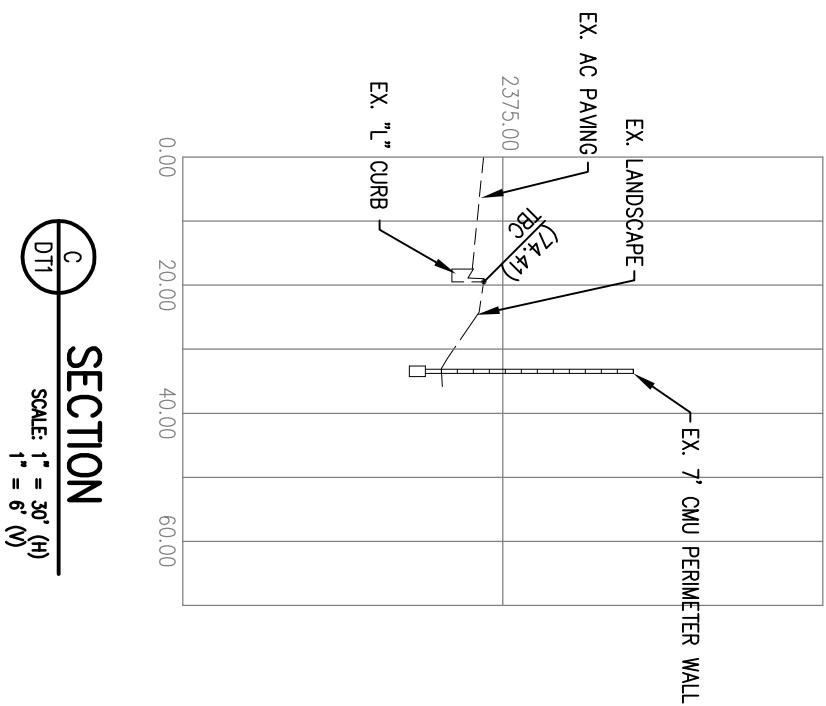
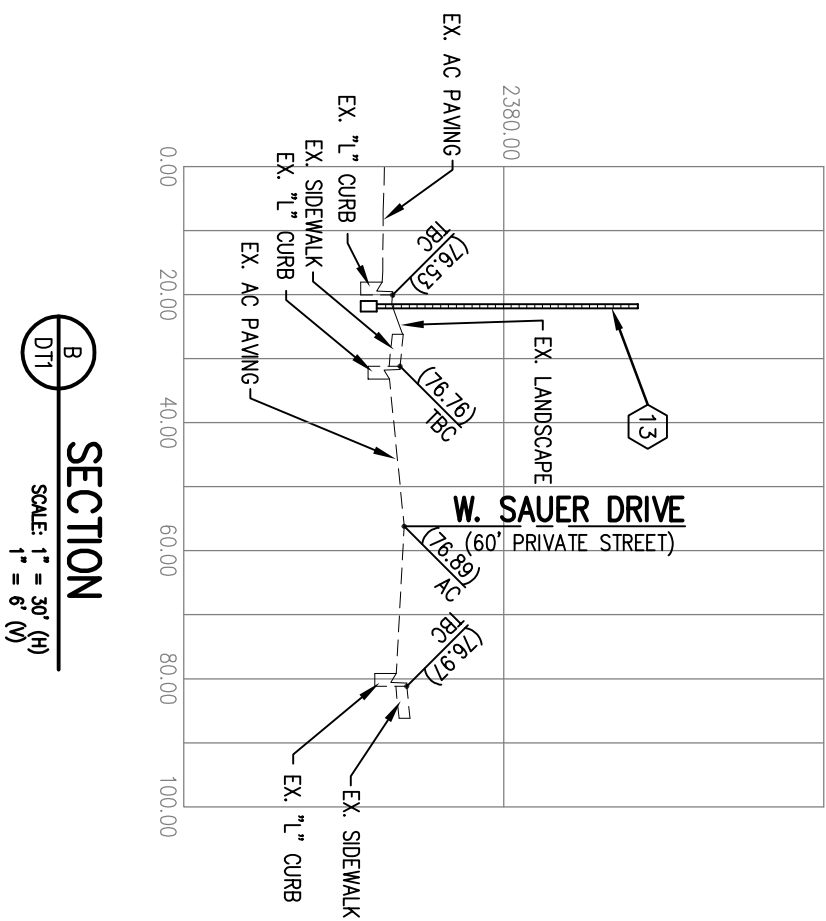
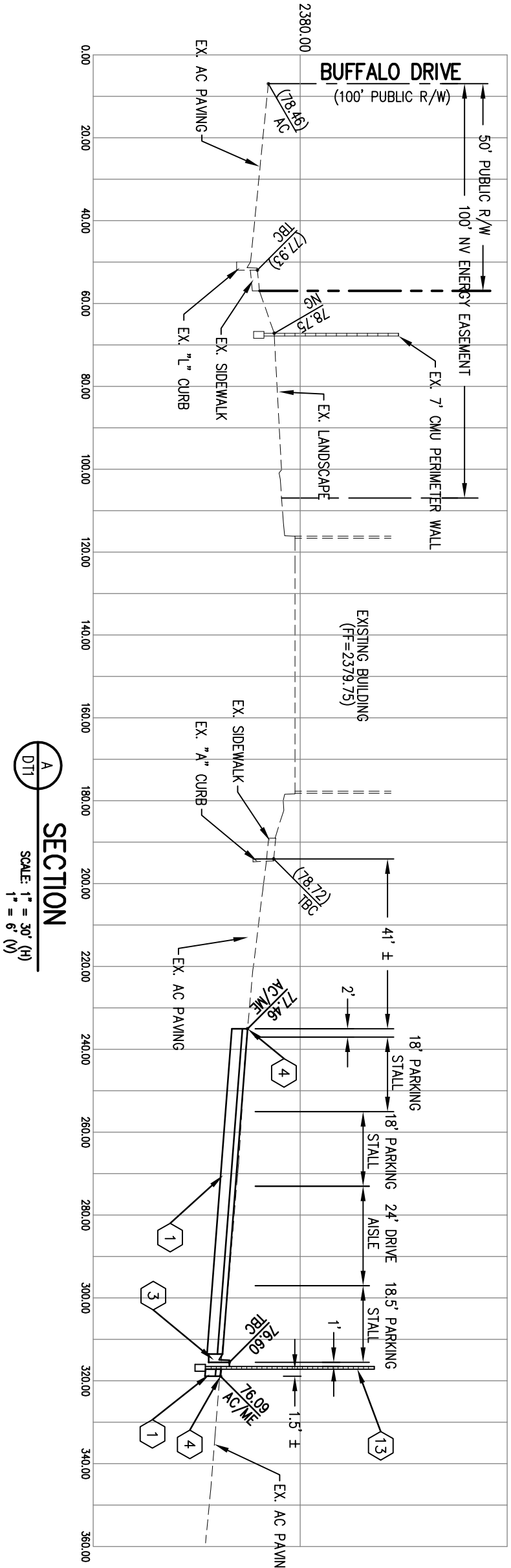
BENCHMARK
ELEVATION: 721.78 (US SURVEY FEET)
NAVD83 ELEVATION: 721.78 (METERS)

ENGINEER'S CERTIFICATION
I, JOHN M. WALKER, HEREBY CERTIFY THAT THIS GRADING PLAN CONFORMS TO THE APPROVED DRAINAGE STUDY ON FILE WITH CITY OF LAS VEGAS.

DISCLAIMER NOTE
EXISTING UTILITY LOCATIONS SHOWN HEREIN ARE APPROXIMATE ONLY. IT IS THE RESPONSIBILITY OF THE USER TO VERIFY THE LOCATION AND DEPTH OF ALL UTILITIES PRIOR TO COMMENCING CONSTRUCTION. NO REPRESENTATION IS MADE THAT ALL EXISTING UTILITIES ARE SHOWN HEREIN. THE ENGINEER HAS CONDUCTED A VISUAL SURVEY OF THE PROJECT AREA. ALL DISCREPANCIES MUST BE IMMEDIATELY REPORTED TO THE ENGINEER.

Call before you dig
1-800-485-5800
1-702-485-5800
LAS VEGAS AREA COMBINED UTILITY SYSTEM

Call before you dig
1-800-227-2800
1-702-593-6111
LAS VEGAS AREA COMBINED UTILITY SYSTEM



CONSTRUCTION NOTES:

1. INSTALL 3" AC PAVING OVER 11" TYPE II AGG. BASE
2. COMPACTED TO SOUS REPORT RECOMMENDATIONS
3. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
4. SAWCUT & MATCH TO EXISTING CONDITION
5. INSTALL BARRIER BLOCKS PER CAUSAL #238
6. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #238
7. HANDRAILS PER ARCHITECTURAL PLANS
8. EXISTING UTILITY WALLS PER CAUSAL #234
9. EXISTING UTILITY WALLS PER CAUSAL #234
10. EXISTING UTILITY WALLS PER CAUSAL #234
11. CONSTRUCT TRASH ENCLOSURE PER ARCHITECTURAL PLANS
12. INSTALL WALKOUT FROM FENCE PER ARCHITECTURAL PLANS
13. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
14. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
15. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
16. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
17. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
18. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
19. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216
20. EXISTING 1" TYPE I CURB AND GUTTER PER CAUSAL #216