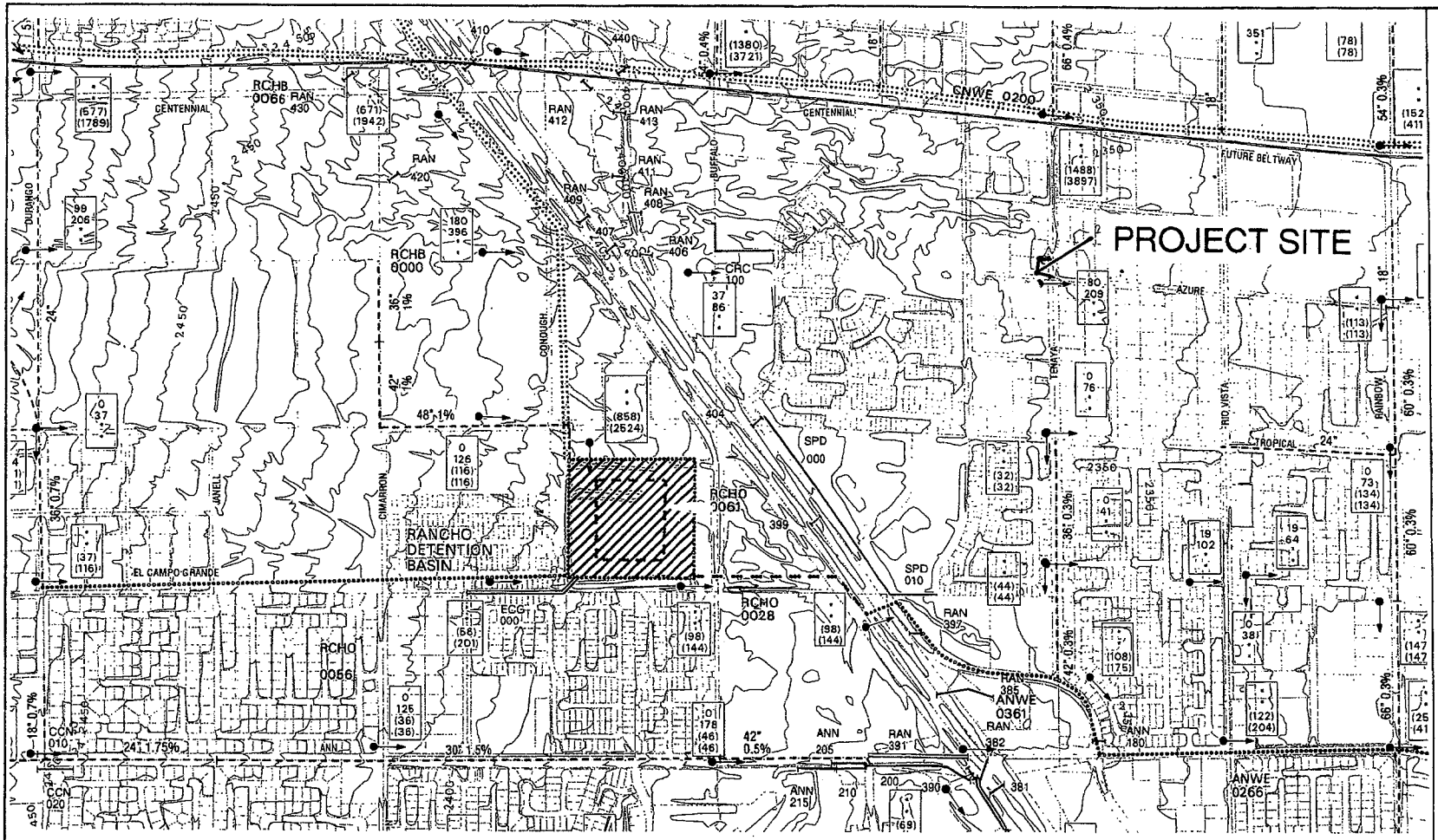


CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

- EXISTING REGIONAL DETENTION BASINS
- PROPOSED REGIONAL DETENTION BASINS
- EXISTING LOCAL DETENTION BASINS
- EXISTING REGIONAL BRIDGES
- PROPOSED REGIONAL BRIDGES
- EXISTING LOCAL BRIDGES
- EXISTING REGIONAL CULVERT
- PROPOSED REGIONAL CULVERT
- EXISTING LOCAL CULVERT
- EXISTING REGIONAL PIPELINE
- PROPOSED REGIONAL PIPELINE
- EXISTING LOCAL PIPELINE
- PROPOSED LOCAL PIPLINE
- EXISTING REGIONAL CHANNEL
- PROPOSED REGIONAL CHANNEL
- EXISTING LOCAL CHANNEL
- PROPOSED REGIONAL PIPELINE (Not Included in 1996 MPU)
- PROPOSED REGIONAL CHANNEL (Not Included in 1996 MPU)
- EXISTING REGIONAL DIKE/LEVEE
- PROPOSED REGIONAL DIKE/LEVEE
- EXISTING LOCAL DIKE/LEVEE
- EXISTING STORM WATER PUMPING STATION
- PROPOSED BELTWAY ALIGNMENT

FIGURE F-5

800 600 400 200 0 400 800

(IN FEET)

SCALE: 1 INCH = 800 FEET

FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
(300)	10-YEAR FACILITY FLOW
(800)	100-YEAR FACILITY FLOW

(FLOWS IN CFS)

NOTE:

Ultimate drainage conditions are based on future CN values with all flood control facilities in place

See the "September 1999 City of Las Vegas Northwest Neighborhood Study Phase 2" for proposed facilities in and north of Elkhorn.

REVISED SEPTEMBER 1999

HUALPAI	PLAYMORE	DURANGO	BUFFALO	RAINBOW	JONES	REGATTA	
1		2			3		ELKHORN
4		5			6		CENTENNIAL
7		8			9		AMY
10		11			12		LONE MOUNTAIN
							ALEXANDER
				13	14		CHEYENNE
				15	16		SAHARA RANCH
				17	18		

FUTURE DRAINAGE CONDITIONS

PBSJ
801 North Green Valley Parkway, Suite 100
Henderson, Nevada 89014-6139
Phone: 702/263-7228
Fax: 702/385-7200
ENGINEERING PLANNING GIS SURVEYING CONSTRUCTION SERVICES

CITY OF LAS VEGAS NEVADA

NORTHWEST NEIGHBORHOOD STUDY

LEGEND

—— SUB-BASIN BOUNDARY

⟶ FLOW ARROW

250	10-YEAR STREET FLOW
500	100-YEAR STREET FLOW
300	10-YEAR FACILITY FLOW
800	100-YEAR FACILITY FLOW

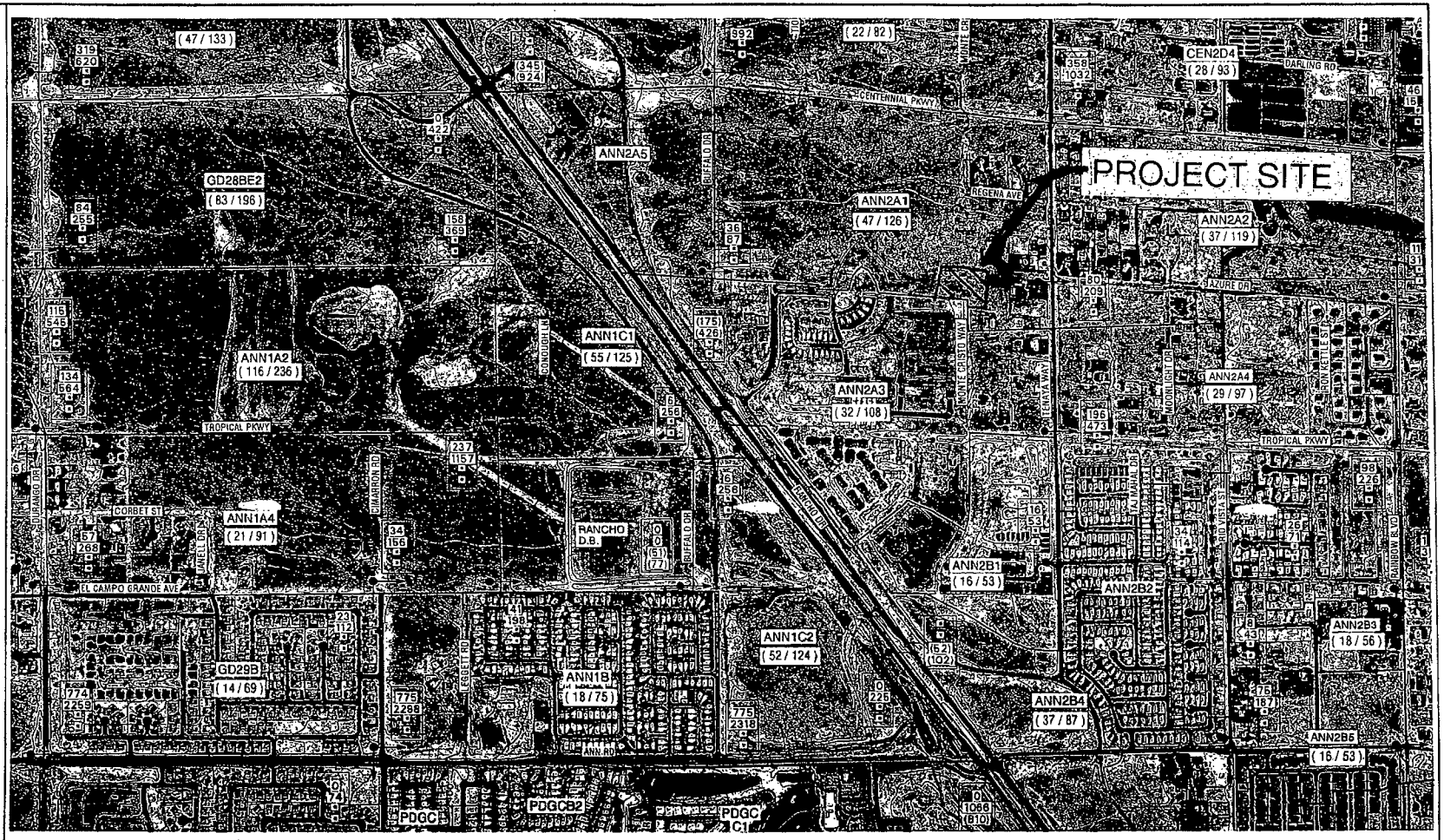
(FLOWS IN CFS)

BWJS ⟶ Basin-ID

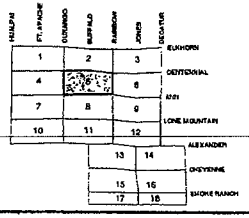
(13 / 59) ⟶ Contributing flow (10-Year / 100-Year) from the basin (cfs)

PHOTO DATE: APRIL 1996

FIGURE E-5



EXISTING DRAINAGE CONDITIONS



POST, BUCKLEY, SCHUH & JERNIGAN, INC.

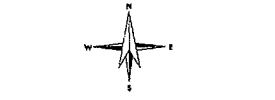
ENGINEERING PLANNING SURVEYING GIS

901, N. Green Valley Pkwy, Ste 100, Henderson NV 89014
Phone: (702) 263-7275 Fax: (702) 263-7200

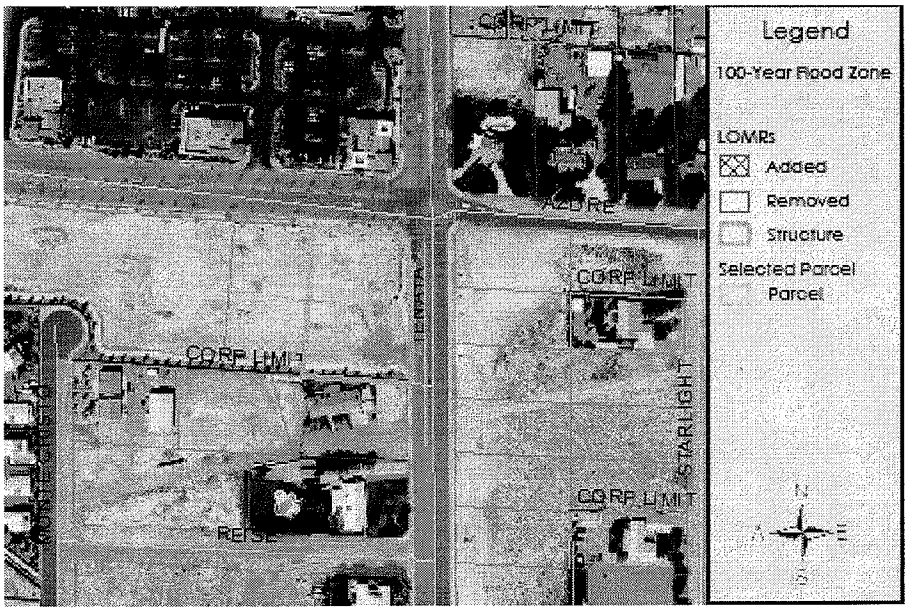
NOTE:

Existing conditions are based on future CN values with only existing local and CCRFCD facilities in place

REVISED SEPTEMBER 1999



SCALE: 1 INCH = 800 FEET



View Printer-Friendly Map

The District makes no warranties concerning the accuracy of this data. View Disclaimer

This parcel IS NOT in a 100-year flood zone.

Parcel	12527222009
Owner	M F E INC
Address	0
Entity	Las Vegas
Contact	702-229-6569
Flood Zone	This parcel IS NOT in a 100-year flood zone.
FIRM Panel	View FIRM Panel (1745)
LOMR	This parcel is not affected by a LOMR

Enter a different address or parcel number

TIME OF CONCENTRATION AND HEC-1 INPUT																
DEVELOPMENT - TENAYA VILLAGE CENTER																
CALCULATED BY - ACE ENGINEERING											DATE - 01/18/2011					
SUB- BASIN DATA				INITIAL/ OVERLAND TIME (ti)			TRAVEL TIME (tt)				(t_c) CHECK URBANIZED BASIN		FINAL	UD LAG TIME - 0.6tc	CN	REMARKS
DESIG.	K	AREA	BA AREA (SQMI)	LENGTH	SLOPE	t_i	LENGTH	SLOPE	t_t	VEL	TOTAL LENGTH	t_c=L/180+10	(t_c)		LS	HEC-1 CARD
		(AC)		FT.	%	MIN.	FT.	%	MIN.	FPS	FT.	MIN.	MIN.	HR		
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	
ON-1E	0.63	0.53	0.0008	40	1	5.39	130	1.9	1.06	2.04	170		6.45	0.06	77	Onsite-1 Existing
ON-2E	0.63	0.59	0.0009	30	1	4.67	190	1.85	1.57	2.01	220		6.24	0.06	77	Onsite-2 Existing
ON-1D	0.82	0.39	0.0006	35	1	2.93	115	1.25	0.85	2.26	150	10.83	5.00	0.05	92	Onsite-1 Developed
ON-2D	0.82	0.73	0.0011	35	1	2.93	185	1.1	1.46	2.12	220	11.22	5.00	0.05	92	Onsite-2 Developed

$$t_i = \frac{1.8(1.1-K)L^{\frac{1}{2}}}{S^{\frac{1}{3}}}$$

tc = tt+ti

K = 0.0132 CN-0.39, $t_c = t_l + t_t$. $V=CS^{1/2}$ - Use C= 14.8 for first travel length of 500 feet of non urbanized basin and 29.4 for length above 500 feet. Use C= 20.2 for first travel length of 500 feet of urbanized basin and 30.6 for length above 500 feet.

Minimum LAG TIME used for basin is 5 minutes for HEC-1 software.

Basin Data – APN – 125-27-222-009

ON-1E
Area – 0.534 Acre
Soil type – B
Travel Length = 130
Overland Length = 40
Travel Slope = 2.5/1.30 = 1.90%
Overland slope = 1.0%
CN - 77

ON-2E
Area – 0.586 Acre
Soil type – B
Travel Length = 190
Overland Length = 30
Travel Slope – 3.5/1.90 = 1.85%
Overland slope = 1.0%
CN-77

ON-1D
Area – 0.388 Acre
Soil type – B
Travel Length = 115
Overland Length = 35
Travel Slope = 1.25%
Overland slope = 1.0%
CN- for Commercial and business area - 92

ON-2D
Area – 0.732 Acre
Soil type – B
Travel Length = 185
Overland Length = 35
Travel Slope = 1.10%
Overland slope = 1.0%
CN- for Commercial and business area- 92

Rainfall Data – McCarran Airport
10- Year - 1.58 inches
100- Year - 2.77 inches

```
1****************************************
****************************************
 *                                      *
 *                                    *
 *   FLOOD HYDROGRAPH PACKAGE (HEC-1)   *
*    U.S. ARMY CORPS OF ENGINEERS     *
 *               JUN   1998             *
*    HYDROLOGIC ENGINEERING CENTER    *
 *            VERSION 4.1               *
*          609 SECOND STREET          *
 *                                      *
*       DAVIS, CALIFORNIA 95616       *
 *  RUN DATE   19JAN11  TIME  00:08:53   *
*           (916) 756-1104             *
 *                                      *
*                                      *
 ****************************************
****************************************
```

```
                                                    X     X  XXXXXXX   XXXXX
X
                                                    X     X  X        X     X
XX
                                                    X     X  X        X
X
                                                    XXXXXXX  XXXX     X
XXXXX   X
                                                    X     X  X        X
X
                                                    X     X  X        X     X
X
                                                    X     X  XXXXXXX   XXXXX
XXX
```

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

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

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

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

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

KINEMATIC WAVE: NEW FINITE DIFFERENCE ALGORITHM

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

              1           ID   TENAYA VILLAGE CENTER
              2           ID   CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
              3           ID   100-YEAR & 10-YEAR,6 HOUR STORM EX. AND DEV.
CONDITION
              4           ID   ACE ENGINEERING    "TENAYA VILLAGE CENTER"
 *** FREE ***
              5           IT      05 18JAN11    2358     100    2000
              6           IO       5       0       0
              7           IN       5
              8           JR    PREC    1.00    0.57
                          *DIAGRAM
 *** FREE ***

              9           KK   ON-1E
             10           KM   LOCAL RUNOFF FOR BASIN
             11           BA   .0008
             12           PB    2.77
             13           PC    0.00    2.00    5.70    7.00    8.70    10.8
12.4    13.0    13.0    13.0
             14           PC    13.0    13.0    13.0    13.3    14.0    14.2
14.8    15.8    17.2    18.1
             15           PC    19.0    19.7    19.9    20.0    20.1    20.4
21.4    22.9    24.1    24.9
             16           PC    25.1    25.6    27.0    27.8    28.1    28.3
29.5    32.2    35.2    40.9
             17           PC    49.9    59.0    71.0    74.4    78.1    81.2
81.9    83.5    85.1    85.6
             18           PC    86.0    86.8    87.6    88.8    91.0    92.6
93.7    95.0    97.0    97.6
             19           PC    98.2    98.5    98.7    98.9    99.0    99.3
99.3    99.4    99.5    99.8
             20           PC    99.8    99.9   100.0
             21           LS       0      77
             22           UD     .06

             23           KK   ON-2E
             24           KM   LOCAL RUNOFF FOR BASIN
             25           BA   .0009
             26           LS       0      77
             27           UD     .06

             28           KK   ON-1D
             29           KM   LOCAL RUNOFF FOR BASIN
             30           BA   .0006
             31           UD     .05

             32           KK   ON-2D
             33           KM   LOCAL RUNOFF FOR BASIN
             34           BA   .0011
             35           UD     .05
             36           ZZ
1
                  SCHEMATIC DIAGRAM OF STREAM NETWORK
 INPUT
  LINE      (V) ROUTING          (--->) DIVERSION OR PUMP FLOW
```

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

     9        ON-1E
                .
                .
    23          .        ON-2E
                .          .
                .          .
    28          .          .        ON-1D
                .          .          .
                .          .          .
    32          .          .          .        ON-2D
```

```
 (***) RUNOFF ALSO COMPUTED AT THIS LOCATION
1****************************************
****************************************
 *                                      *
*                                       *
 *   FLOOD HYDROGRAPH PACKAGE  (HEC-1)   *
*    U.S. ARMY CORPS OF ENGINEERS       *
 *               JUN   1998             *
*    HYDROLOGIC ENGINEERING CENTER      *
 *            VERSION 4.1                *
*          609 SECOND STREET            *
 *                                      *
*       DAVIS, CALIFORNIA 95616         *
 *  RUN DATE   19JAN11  TIME  00:08:53   *
*           (916) 756-1104              *
 *                                      *
*                                       *
 ****************************************
****************************************
```

```
                          TENAYA VILLAGE CENTER
                          CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT
                          100-YEAR & 10-YEAR,6 HOUR STORM EX. AND DEV.
CONDITION
                          ACE ENGINEERING    "TENAYA VILLAGE CENTER"

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

      IT          HYDROGRAPH TIME DATA
                         NMIN          5  MINUTES IN COMPUTATION INTERVAL
```

IDATE	18JAN11	STARTING DATE
ITIME	2358	STARTING TIME
NQ	100	NUMBER OF HYDROGRAPH ORDINATES
NDDATE	19JAN11	ENDING DATE
NDTIME	0813	ENDING TIME
ICENT	19	CENTURY MARK

COMPUTATION INTERVAL .08 HOURS
TOTAL TIME BASE 8.25 HOURS

ENGLISH UNITS

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

JP MULTI-PLAN OPTION
NPLAN 1 NUMBER OF PLANS

JR MULTI-RATIO OPTION
RATIOS OF PRECIPITATION
1.00 .57

1

PEAK FLOW AND STAGE (END-OF-PERIOD) SUMMARY FOR MULTIPLE PLAN-RATIO ECONOMIC COMPUTATIONS

FLOWS IN CUBIC FEET PER SECOND, AREA IN SQUARE MILES

TIME TO PEAK IN HOURS

OPERATION	STATION	AREA	PLAN		RATIOS APPLIED TO PRECIPITATION RATIO 1 1.00	RATIO 2 .57
HYDROGRAPH AT						
+	ON-1E	.00	1	FLOW	1.	0.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-2E	.00	1	FLOW	1.	0.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-1D	.00	1	FLOW	1.	0.
				TIME	3.50	3.50
HYDROGRAPH AT						
+	ON-2D	.00	1	FLOW	1.	0.
				TIME	3.50	3.50

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

EXCERPTS FROM REFERENCE DRAINAGE STUDY

CITY OF LAS VEGAS INTER-OFFICE MEMORANDUM				DATE: February 27, 2007
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: **Tenaya Commercial**			**COPIES TO:** Wood Rodgers, Inc.
Cross Streets:	SWC of Tenaya Way & Azure Drive			O'Connell Commercial, LLC
File Number:	F:\Depot\DSMemos\DS4104B.doc			Bart Anderson, P.E., DevCo
Parcel Number:	125-27-222-013			CCDDS
Zoning Action:	SDR-18372			
FEMA Flood Zone	YES	NO	X	
Proposed Storm Drain	YES	NO	X	

HISTORY	DATE RECEIVED	DATE REVIEWED	COMMENTS	REVIEW FEES	FEES PAID Transaction #
1st Submittal	12/1/2006	12/15/2006	Not Approved	$400.00	58670: $400
2nd Submittal	2/12/2007	2/26/2007	See Comments Below	$400.00	62859: $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:
	is conditionally approved subject to Clark County Regional Flood Control District concurrence.
X	is conditionally approved subject to Clark County Department of Development Services concurrence.

1. The site is adjacent to the jurisdiction of Clark County to the south. The engineer must coordinate with *Clark County Department of Development Services* (CCDDS) and incorporate any concerns for boundary conditions along the south border. CCDDS concurrence is required prior to final acceptance of the study.

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

END OF REMARKS

ays

T/R/S: T19S/R60E/27

AREA G-27

I. INTRODUCTION

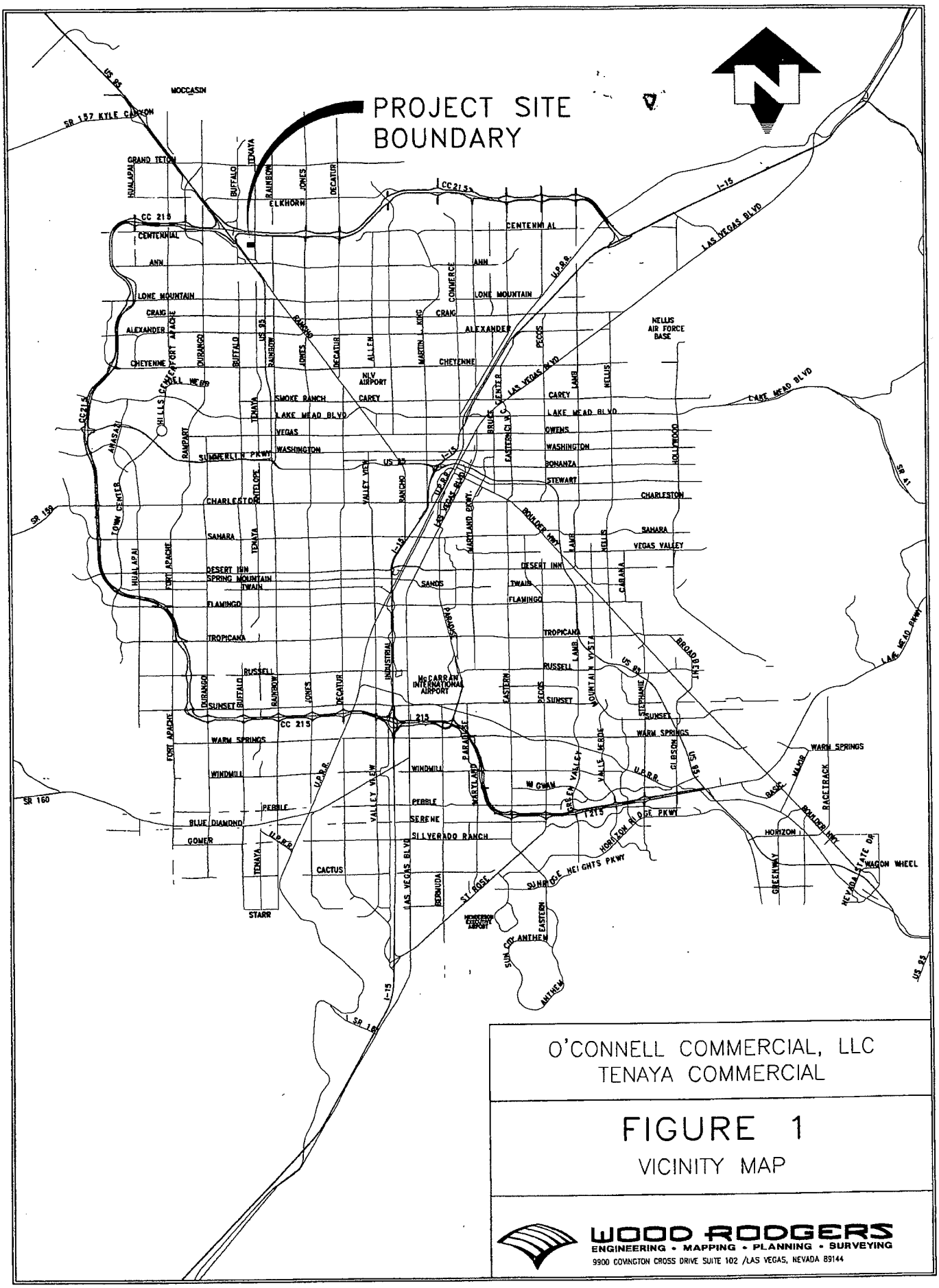
O'Connell Commercial, LLC is proposing to develop Tenaya Commercial as a commercial/retail parcel. The purpose of this report is to accompany the grading plans, to provide detailed hydrological and hydraulic analyses for the site, and to determine adequate protection for the project from offsite and onsite flows. The following tasks were performed in the preparation of this report:

- Identify previous drainage studies for the project site and surrounding areas.
- Identify the FEMA floodplain designation for the project site.
- Identify existing and proposed regional drainage facilities adjacent to the site.
- Estimate runoff generated for the peak offsite and onsite 10-year and 100-year return period storms for existing and ultimate conditions.
- Recommend drainage facilities to protect the project from storm runoff.

II. LOCATION AND DESCRIPTION

The Project is located in Section 27, Township 19 South, Range 60 East, M.D.M., in Las Vegas, Nevada. The site is approximately 350 feet west of Tenaya Avenue and is bordered by Azure Drive on the north, future commercial development on the west, and Ranch House Estates on the south. Please refer to Figures 1 and 2 for the vicinity and location of the project site.

The majority of the 2.34± acre site is presently undeveloped with sparse vegetation. Currently, the southern 0.30± acres of the site consist of landscaping and a 10-foot wide meandering sidewalk path. Existing Azure Drive along the northern border of the site has been fully improved with the Montecito East infrastructure improvements. The proposed development with consist of two commercial buildings with approximately 109 parking spaces.



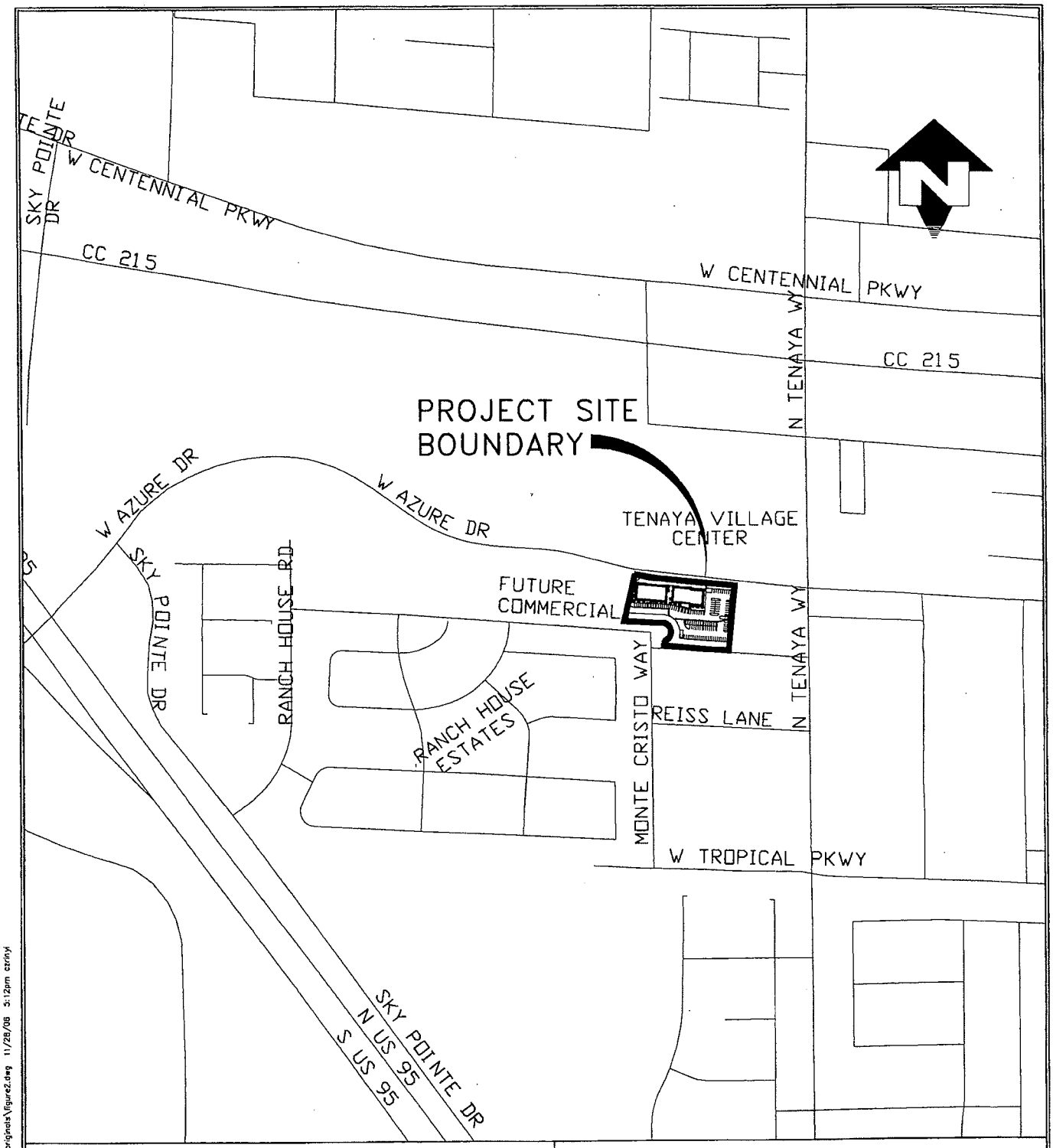
O'CONNELL COMMERCIAL, LLC
TENAYA COMMERCIAL

FIGURE 1

VICINITY MAP

WOOD RODGERS
ENGINEERING • MAPPING • PLANNING • SURVEYING
9900 COVINGTON CROSS DRIVE SUITE 102 /LAS VEGAS, NEVADA 89144

J:\Jobs\1943_TenayaCommercial\Civil\Docs\Studies\Drain\Figures\originals\Figure1.dwg 11/09/06 2:38pm nappuglise



GRAPHIC SCALE

600 0 300 600

(IN FEET)

1 inch = 600 ft.

O'CONNELL COMMERCIAL, LLC
TENAYA COMMERCIAL

FIGURE 2

LOCATION MAP

WOOD RODGERS
ENGINEERING • MAPPING • PLANNING • SURVEYING
9900 COVINGTON CROSS DRIVE SUITE 102 /LAS VEGAS, NEVADA 89144

J:\Jobs\1943_TenayaCommercial\Civil\Docs\Studies\Drain\Figures\originals\Figure2.dwg 11/28/06 5:12pm ctrinyl

III. FEDERAL EMERGENCY MANAGEMENT AGENCY (FEMA) FLOOD HAZARD ANALYSIS

Figure 3 was reproduced from the Federal Emergency Management Agency (FEMA) Flood Insurance Rate Map (FIRM) containing Community Panel Number 32003C1745 E, dated September 27, 2002. Review of the FIRM shows that the project is currently located within a Zone X. Therefore, the project is not located within a FEMA-designated Special Flood Hazard Area (SFHA).

IV. CLARK COUNTY REGIONAL FLOOD CONTROL DISTRICT (CCRFCD) FACILITIES

Figure 4 is reproduced from Figure F-8 of the 2002 *Clark County Regional Flood Control District (CCRFCD) Master Plan Update* (Reference 1, hereinafter referred to as the 2002 MPU). This figure depicts the project site in relation to existing and proposed CCRFCD facilities. As shown on the figure, the site is not located adjacent to any existing or proposed CCRFCD facilities. Therefore, CCRFCD concurrence will not be required.

V. HYDROLOGY

The methodology presented in this study is in compliance with the *CCRFCD Hydrologic Criteria and Drainage Design Manual* (Reference 2, hereinafter referred to as the Manual).

Model Description - The watersheds were modeled using the SCS Unit Hydrograph method within the U.S. Army Corps of Engineers *HEC-1 Flood Hydrograph Package* (Reference 3).

Precipitation - The project site and tributary drainage areas lie within the McCarran Rainfall Area as identified in the Manual on Figure 513. Rainfall depths for the project site were referenced from Table 505 of the Manual. The point precipitation values are 2.77 inches for a 100-year storm event and 1.58 inches for a 10-year storm event. This equates to a 0.57 ratio between the 10-year and 100-year storm events. (See Appendix A)

Since the drainage area for the project will be less than 8 square miles, an SDN 3 design storm distribution per Table 503 of the Manual was selected for use in the HEC-1 computer model.

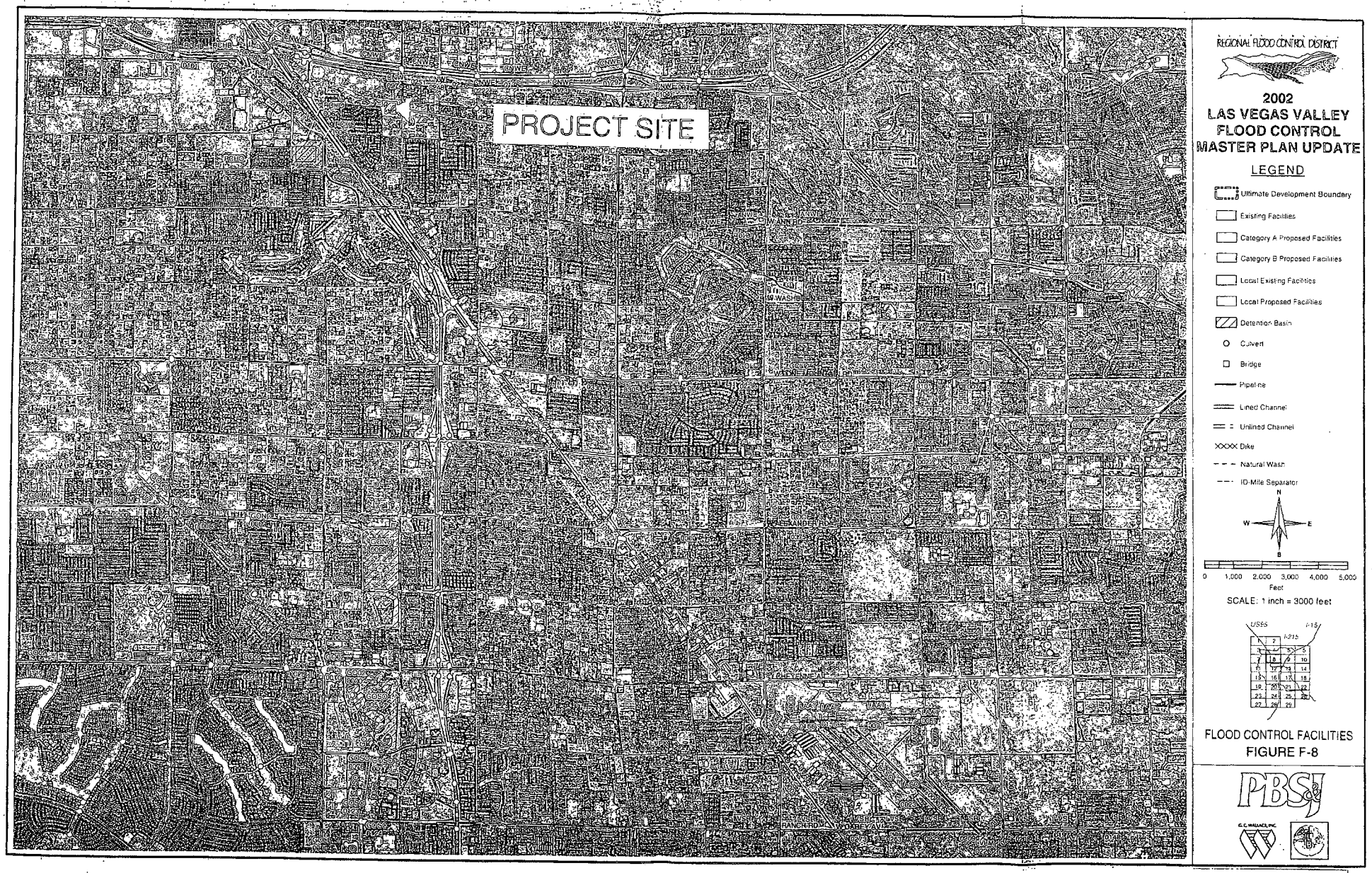

PROJECT SITE
REGIONAL FLOOD CONTROL DISTRICT
2002
LAS VEGAS VALLEY
FLOOD CONTROL
MASTER PLAN UPDATE
LEGEND
Ultimate Development Boundary
Existing Facilities
Category A Proposed Facilities
Category B Proposed Facilities
Local Existing Facilities
Local Proposed Facilities
Detention Basin
Culvert
Bridge
Pipeline
Lined Channel
Unlined Channel
Dike
Natural Wash
10-Mile Separator
N
W
E
S
0 1,000 2,000 3,000 4,000 5,000
Feet
SCALE: 1 inch = 3000 feet
US95
I-15
I-215
FLOOD CONTROL FACILITIES
FIGURE F-8
PBS&J
C.C. WALLACE, INC.

FIGURE 4

Curve Numbers (CN) – The soils information for the subject property was obtained from GIS data distributed with the 2002 MPU. The GIS soil coverage delineates families of soil types and the hydrologic soil group (HSG) of each family. The project area and offsite subbasins are comprised of soil types 192 and 305. The 2002 MPU GIS soil coverage delineates soil type 192 as HSG "B". The hydrologic characteristics of soil type 305 consist of HSG "D" and HSG "B". The 2002 MPUGIS Soil Coverage delineates soil type 305 as HSG "C". The majority of the site lies within soil type 305 with the western portion of the site being soil type 192.

For the given soils, CN values were determined from the appropriate columns of Table 602 and 602A of the Manual. The undeveloped subbasins were modeled using desert shrub in poor condition per Table 602 of the Manual. Developed subbasins were modeled using commercial or paved roadways per Table 602 of the MANUAL. Curve number calculations have been included in Appendix A. The majority of the offsite subbasins were referenced from adjacent approved drainage studies as shown in Appendix A on the CN calculation sheet.

Drainage Areas and Flow Patterns - The onsite subbasins and flow patterns used in the hydrologic modeling were determined from the grading plans for The Project. The majority of the offsite subbasins and flow patterns used in the hydrologic modeling were referenced from the following approved drainage studies:

- Technical Drainage Study for Findlay-Shack Honda by Hamilton Engineers (Reference 4, herein after referred to as the Honda study)
- Technical Drainage Study for Shea Commercial-Tenaya by Kimley-Horn and Associates, Inc. (Reference 5, herein after referred to as the Shea Commercial study)
- Technical Drainage Study for Tenaya Village Phase 1 Mini Storage by Tetra Tech, Inc. (Reference 6, herein after referred to as the Tenaya Village study).

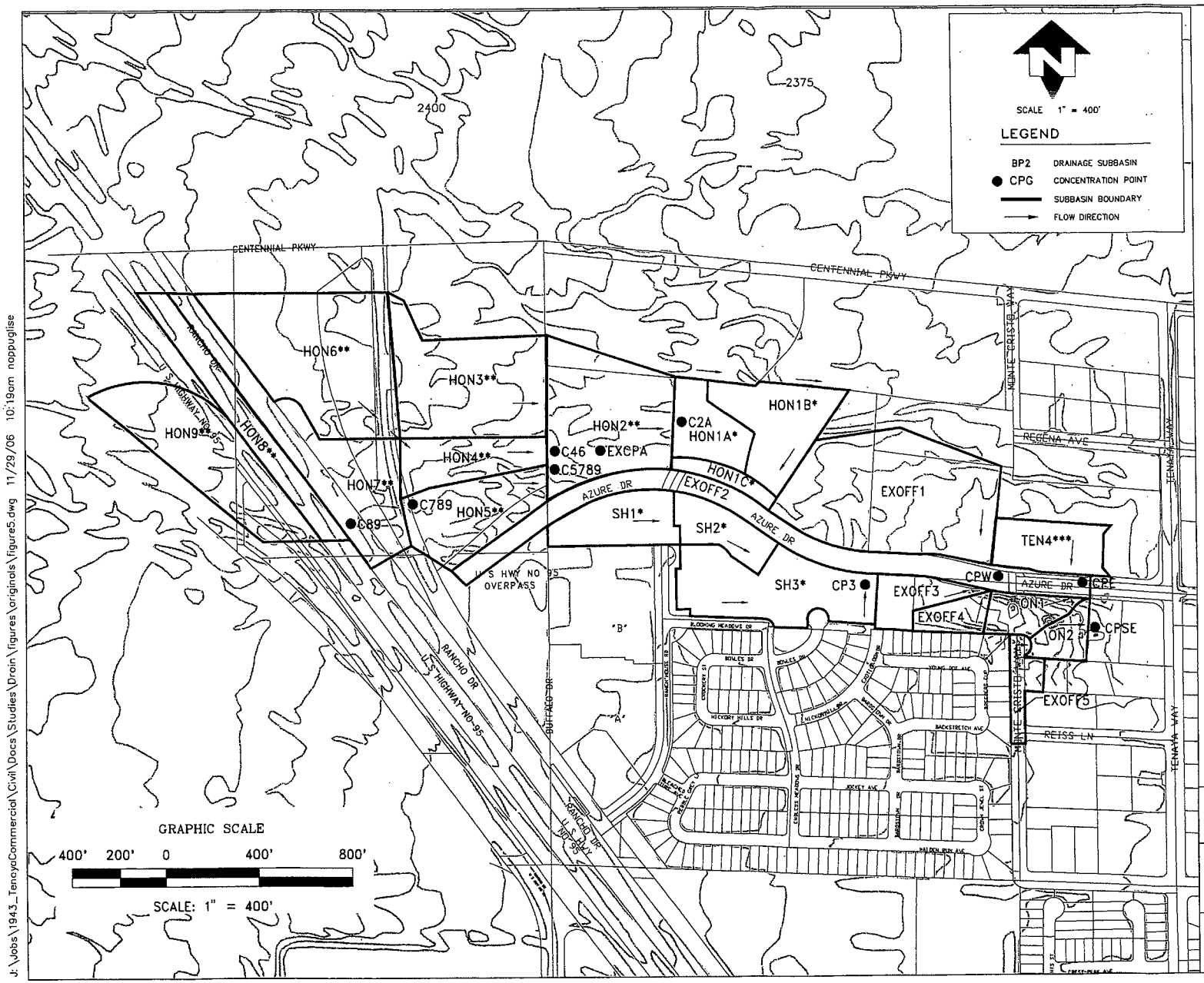
Offsite subbasins not covered by the referenced studies were determined from GIS Aerial topography with a 5-foot contour interval.

Lag Time - The lag time (TLAG) is described as the time between the center of mass of rainfall and the time of peak discharge from a basin. Lag time can be related to time of concentration (Tc) by the following relationship: TLAG = 0.6 (Tc). The time of concentration (Tc) is defined as the time required for runoff to flow from the most remote part of the basin area to the outlet of the basin or a design point under consideration. The procedure for calculating Tc is outlined in Section 602 of the Manual. Lag time calculations for the drainage subbasins have been included in Appendix A on Standard Form 4.

VI. EXISTING CONDITIONS

The project site lies within the area known as Montecito East. A technical drainage study was approved in January 2000 for this master planned commercial subdivision entitled Tropical Parkway (AKA Montecito East) by Primas & Associates (Reference 7, hereinafter referred to as the Montecito East study). Since that time, several developments have been constructed that changed the assumptions as presented in the Montecito East study. Therefore, the flow rates in Azure Drive adjacent to the site were reanalyzed in this study based on the hydrology presented in the Shea Commercial, Tenaya Village, and Honda studies. The existing condition HEC-1 model includes KM cards noting that the subbasin input was referenced and what study it was referenced from. Figure 5 depicts the subbasins and drainage patterns used in the existing conditions hydrological analysis.

The Findlay-Shack Honda site located northwest of the proposed Project will be constructed in two phases. Phase 1 (Subbasins HON1A, HON1B & HON1C) is currently under construction and will be considered as being developed under existing conditions. Phase 2 (Subbasin HON2) is not under construction and will be considered as desert shrub. Phase 2 drains into Phase 1, then flows south to Azure Drive and continues east toward Tenaya Way. The CN calculations sheet in Appendix A shows a correlation from the Honda Study subbasins to subbasins used in this study. The developed Phase 1 subbasin is referenced as an existing commercial site, while the Phase 2 subbasin will be undeveloped desert shrub (poor condition) for the existing conditions model. Offsite Subbasins HON3 through HON9 input parameters and boundaries were referenced from the existing conditions HEC-1 model from the Honda Study. These subbasins have been denoted with the HON designation as shown on Figure 5. Pertinent excerpts from the referenced materials have been included in Appendix C.



SUMMARY OF FLOWS

BASIN OR LOCATION	Q100 (CFS)	Q10 (CFS)
HON1A**	9	5
HON1B**	12	7
HON1C**	1	1
HON2**	13	5
HON3**	15	6
HON4**	5	2
HON6**	21	8
C46**	26	10
HON7**	16	6
HON8**	8	3
HON9**	14	5
C89**	21	8
C789**	37	14
HON5**	8	3
C5789**	44	16
EXCPA**	85	31
C2A**	97	35
SH1*	7	3
SH2*	6	3
SH3*	13	6
CP3***	26	12
EXOFF1	14	4
EXOFF3	3	1
EXOFF2	18	10
CPW	169	70
EXOFF4	1	0
ON1	2	1
TEN4***	6	3
CPE	179	74
ON2	2	1
EXOFF5	3	1
CPSE	5	2

*OFFSITE SUBBASIN
REFERENCED FROM SHEA COMMERCIAL-TENAYA
**OFFSITE SUBBASIN
REFERENCED FROM FINDLAY-SHACK HONDA
***OFFSITE SUBBASIN
REFERENCED FROM TENAYA VILLAGE PHASE 1

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TENAYA COMMERCIAL

FIGURE 5
EXISTING CONDITIONS

WOOD RODGERS
ENGINEERING - MAPPING - PLANNING - SURVEYING
6900 COMMISION CROSS DRIVE SUITE 102 /LAS VEGAS, NEVADA 89144

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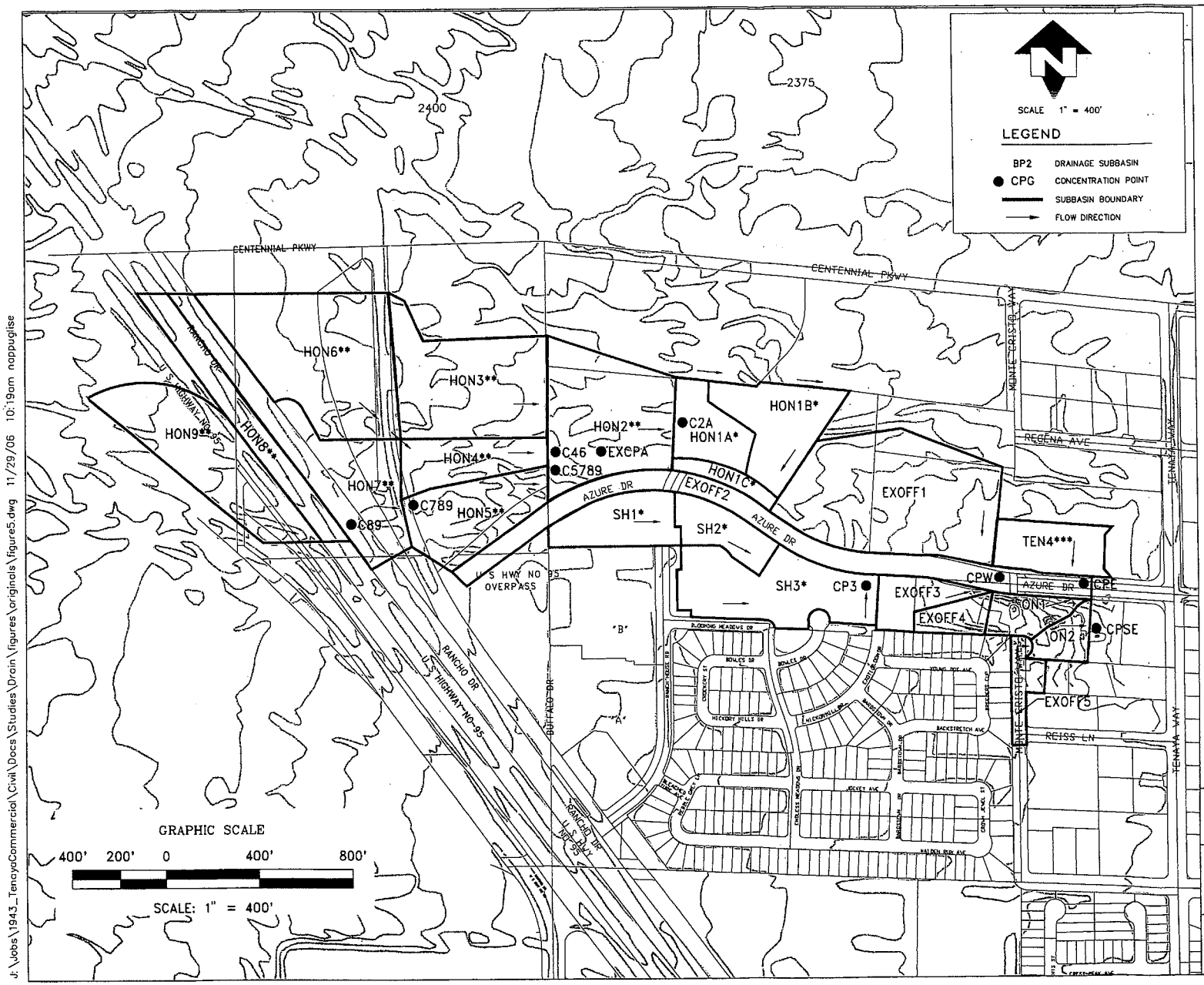

SUMMARY OF FLOWS

BASIN OR LOCATION	Q100 (CFS)	Q10 (CFS)
HON1A**	9	5
HON1B**	12	7
HON1C**	1	1
HON2**	13	5
HON3**	15	6
HON4**	5	2
HON6**	21	8
C46**	26	10
HON7**	16	6
HON8**	8	3
HON9**	14	5
C89**	21	8
C789**	37	14
HON5**	8	3
C5789**	44	16
EXCPA**	85	31
C2A**	97	35
SH1*	7	3
SH2*	6	3
SH3*	13	6
CP3***	26	12
EXOFF1	14	4
EXOFF3	3	1
EXOFF2	18	10
CPW	169	70
EXOFF4	1	0
ON1	2	1
TEN4***	6	3
CPE	179	74
ON2	2	1
EXOFF5	3	1
CPSE	5	2

*OFFSITE SUBBASIN
REFERENCED FROM SHEA COMMERCIAL-TENAYA
**OFFSITE SUBBASIN
REFERENCED FROM FINDLAY-SHACK HONDA
***OFFSITE SUBBASIN
REFERENCED FROM TENAYA VILLAGE PHASE 1

O'CONNELL COMMERCIAL
TENAYA COMMERCIAL

FIGURE 5
EXISTING CONDITIONS

WOOD RODGERS
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9900 COVINGTON CROSS DRIVE, SUITE 102 / LAS VEGAS, NEVADA 89144

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The Shea Commercial site (Subbasins SH1, SH2 & SH3) located west of the site is currently under construction and will be considered fully developed in the existing conditions model for this study. Subbasin input parameters and boundaries were referenced from the developed conditions HEC-1 model from the Shea Commercial Study. These subbasins have been denoted with the SH designation as shown on Figure 5. The CN calculations sheet in Appendix A shows a correlation from the Shea Commercial Study subbasins to subbasins used in this study. Pertinent excerpts from the referenced materials have been included in Appendix C.

The Tenaya Village site located north of Azure Avenue has been completed and will be considered fully developed. Subbasin TEN4 (DEON4) from the Tenaya Village future conditions HEC-1 model was the only subbasin used for this study since the other subbasins flow directly to Tenaya Way to the east, thus not affecting the Project. Subbasin input parameters and boundaries were referenced from the future conditions HEC-1 model from that study.

In addition to the subbasins referenced from the Shea Commercial, Tenaya Village, and Honda studies, five (5) additional offsite subbasins are tributary to Azure Drive and the Project. Subbasin EXOFF1 is undeveloped land located between the Honda and Tenaya Village sites. The northern boundary of this site was established based on 5 foot contours which show the subbasin drains southeast toward Azure Drive. Subbasin EXOFF2 consists of Azure Drive roadway improvements which flow east past the site to Tenaya Way. Subbasin EXOFF3 is partly developed commercial and partly undeveloped desert shrub located east of Shea Commercial. This subbasin flows northeast into Azure Drive. Subbasin EXOFF4 is undeveloped land which also drains directly into Azure Drive. The existing Ranch House Estates development drains to the south away from these subbasins. Subbasin EXOFF5 is located south of the project site and consists of Monte Cristo Way right of way and a ½ acre lot (20,000 square feet) that includes a house but the driveway and landscaping have not been completed. The southern boundary of this subbasin coincides with an existing high point in Monte Cristo Way. This subbasin flows onto the project site through an existing block wall opening along the eastern wall of the cul-de-sac on the north end of Monte Cristo Way. Copies of the improvement plans for Monte Cristo Way showing the high point and wall opening have been included in Appendix C.

The results of the HEC-1 model have been summarized below in Table 1. The project

site consists of two onsite subbasins, ON1 (2 cfs) and ON2 (2 cfs). The site will generate a total of 4 cfs under existing conditions during a 100-year storm event. Of the total flow 2 cfs will be drain north to Azure Drive and 2 cfs will drain east.

TABLE 1
EXISTING CONDITIONS
HEC-1 MODEL SUMMARY

SUBBASIN OR CP*	100 YR (CFS)	10 YR (CFS)
HON1A	9	5
HON1B	12	7
HON1C	1	1
HON2	13	5
HON3	15	6
HON4	5	2
HON6	21	8
C46	26	10
HON7	16	6
HON8	8	3
HON9	14	5
C89	21	8
C789	37	14
HON5	8	3
C5789	44	16
EXCPA	85	31
C2A	97	35
SH1	7	3
SH2	6	3
SH3	13	6
CP3	26	12
EXOFF1	14	4
EXOFF3	3	1
EXOFF2	18	10
CPW	169	70
EXOFF4	1	0
ON1	2	1
TEN4	6	3
CPE	179	74
ON2	2	1
EXOFF5	3	1
CPSE	5	2

*See Figure 5

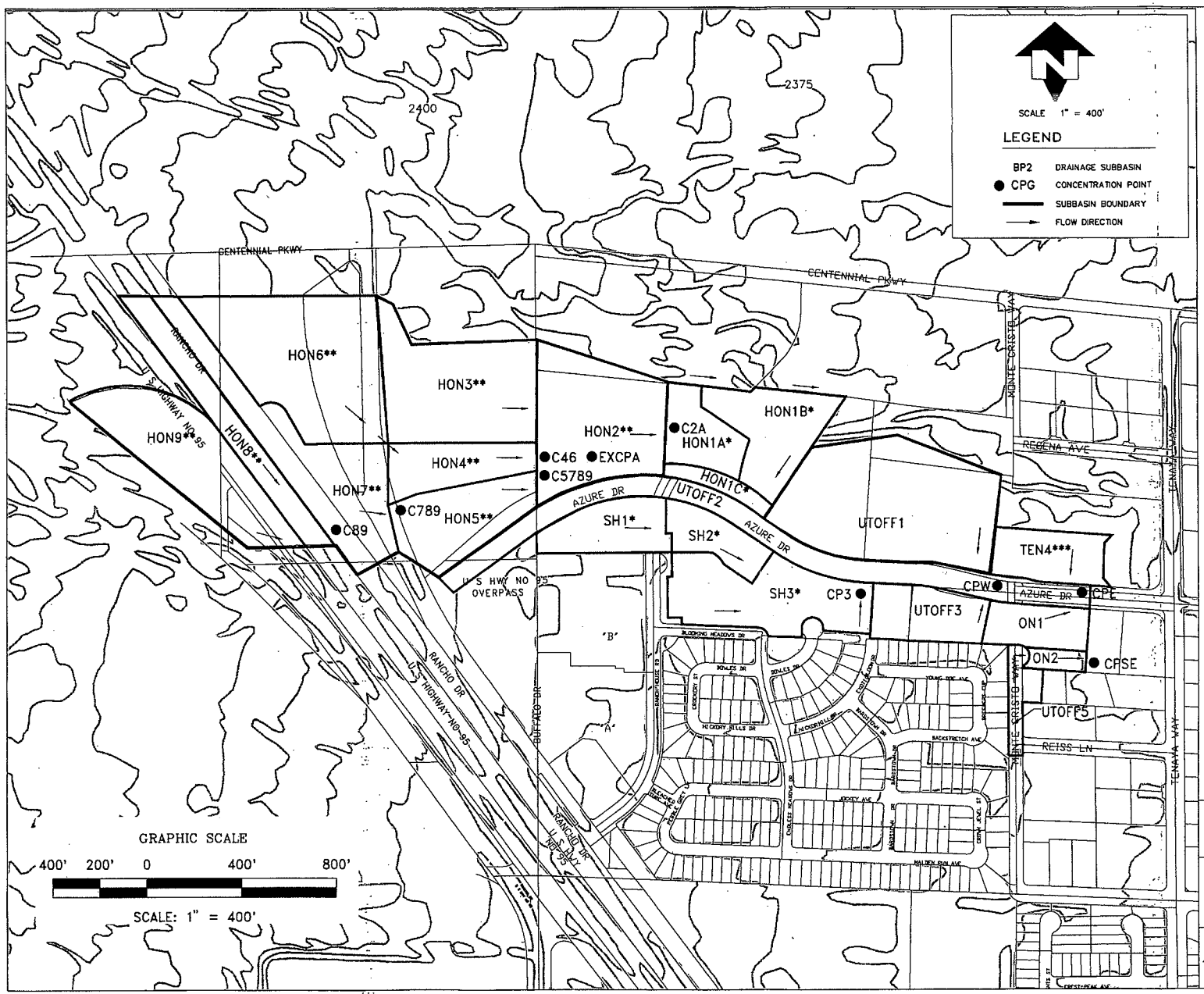
VII. ULTIMATE CONDITIONS

Under ultimate conditions all offsite areas as well as the Project will be fully developed. Figure 6 depicts the subbasins and drainage patterns used in the ultimate conditions hydrological analysis. An ultimate condition HEC-1 model has been included in Appendix A. The results of the HEC-1 model are summarized below in Table 2. For referenced subbasins, the HEC-1 model includes KM cards noting that the subbasin input parameters were referenced and what study they were referenced from.

TABLE 2
ULTIMATE CONDITIONS HEC-1 MODEL SUMMARY

SB OR CP*	100 YR (CFS)	10 YR (CFS)
HON1A	9	5
HON1B	12	7
HON1C	1	1
HON2	22	12
HON3	25	14
HON4	8	5
HON6	31	17
C46	37	21
HON7	23	13
HON8	8	3
HON9	14	5
C89	21	8
C789	45	21
HON5	12	7
C5789	54	26
EXCPA	112	58
C2A	127	66
SH1	7	3
SH2	6	3
SH3	13	6
CP3	26	12
UTOFF1	26	13
UTOFF3	7	3
UTOFF2	18	10
CPW	224	114
ON1	6	3
TEN4	6	3
CPE	236	120
ON2	2	1
UTOFF5	3	1
CPSE	4	2

*See Figure 6.



SUMMARY OF FLOWS

BASIN OR LOCATION	Q100 (CFS)	Q10 (CFS)
HON1A**	9	5
HON1B**	12	7
HON1C**	1	1
HON2**	22	12
HON3**	25	14
HON4**	8	5
HON6**	31	17
C46**	37	21
HON7**	23	13
HON8**	8	3
HON9**	14	5
C89**	21	8
C789**	45	21
HON5**	12	7
C5789**	54	26
EXCPA**	112	58
C2A**	127	66
SH1*	7	3
SH2*	6	3
SH3*	13	6
CP3***	26	12
UTOFF1	26	13
UTOFF3	7	3
UTOFF2	18	10
CPW	224	114
ON1	6	3
TEN4***	6	3
CPE	236	120
ON2	2	1
UTOFF5	3	1
CPSE	4	2

*OFFSITE SUBBASIN
REFERENCED FROM SHEA COMMERCIAL-TENAYA
**OFFSITE SUBBASIN
REFERENCED FROM FINDLAY-SHACK HONDA
***OFFSITE SUBBASIN
REFERENCED FROM TENAYA VILLAGE PHASE 1

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FIGURE 6
ULTIMATE

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The subbasins boundaries used in the ultimate condition HEC-1 model are generally the same as those used in the existing condition model. Subbasins HON1A, HON1B, HON1C, SH1, SH2, SH3, and TEN4 were all considered developed in the existing conditions model, therefore these subbasins were not revised. The input parameters for Subbasins HON2 through HON9 were previously referenced from the existing conditions HEC-1 model from the Honda Study. Under ultimate conditions these subbasins are developed and have been referenced from the developed conditions HEC-1 model from the Honda Study. Existing Subbasins EXOFF3 and EXOFF4 have been combined to form Subbasin UTOFF3 which is now considered developed as a commercial property. Subbasins EXOFF2, EXOFF1, and EXOFF5 have been revised to developed subbasins and renamed UTOFF2, UTOFF1, and UTOFF5 respectively.

Onsite Subbasins ON1 and ON2 make up the Project and reflect the improvements shown on the proposed grading plan. Subbasin ON1 comprises the north half of the site which drains to Azure Drive through a concrete slot gutter located at the north east corner of the site. During a 100-year storm event Subbasin ON1 will produce 6 cfs of runoff. This is higher than the existing condition flow of 2 cfs. However, the Montecito East Study and all existing storm drain facilities have already been approved based on this site being developed as a commercial property. Therefore, the increase in flow between existing and ultimate conditions has already been accounted for. Runoff from Subbasin ON2 combines with offsite runoff from UTOFF5 at CPSE and drains east onto the adjacent parcel which will direct the flow north into Azure Drive. The total 100-year flow of 4 cfs at CPSE is lower than the existing condition flow of 5 cfs.

Azure Drive includes an existing 36-inch HDPE storm drain that connects into the Tenaya Way storm drain. Adjacent to the Project this storm drain was designed to convey 55 CFS per the referenced plan and profile sheet included in Appendix C. In general, the proposed development of Tenaya Commercial is in conformance with the existing drainage patterns for the site and the overall Montecito East commercial subdivision. Therefore, the proposed project will not result in any adverse impacts on downstream facilities or properties.

VIII. INTERIM CONDITIONS

Under interim conditions the Project will be developed and the offsite subbasins will remain the same as the existing conditions model. The storm drain in Azure Drive is existing and additional offsite storm drains to reduce flow rates or revise subbasin boundaries are not programmed. Therefore, interim conditions flow rates will be lower than or the same as ultimate conditions. Since, ultimate conditions provide for the worst case design flow rates an interim condition analysis and HEC-1 model was not prepared for the site.

The Montecito East commercial subdivision did not include access driveways for each Lot within the commercial subdivision. However, Notes 3 and 4 of the commercial subdivision map (See Appendix C) read as follows:

3. All properties within the site shall have perpetual, unobstructed access to all parking and all driveways servicing this site.
4. All subdivided parcels comprising this commercial subdivision shall provide perpetual intersite common drainage rights across all existing and future parcel limits.

Since, the properties east and west of this site are not developed an interim condition temporary 24 foot access roadway will be placed along the west side of the site. Once the parcels to the east and west of the project site are developed permanent access will be provided through their parking lots.

IX. STREET HYDRAULICS

The site is located within the City of Las Vegas Northwest Neighborhood Study Phase 1. Figures E-5 and F-5 from that study have been included in Appendix B with the site shown thereon. The existing and ultimate condition HEC-1 models and analysis included with this study supercede the flow rates shown in the Northwest Neighborhood Study. However, the flow rates in Azure were checked for a worst case condition. Under ultimate conditions this study calculated a 100-year flow rate of 236 cfs within Azure Drive. The ultimate condition 100-year flow rate in Azure Drive was shown to be 209 cfs per the Northwest Neighborhood Study. Therefore, the flow rates per this study were higher and were used for calculating street characteristics.

The resulting street and parking lot flow data based on the flows established from the ultimate conditions HEC-1 model is presented below in Table 3. Figure 7 shows the locations of the cross sections corresponding to the calculations included in Table 3. Hydraulic calculations have been included in Appendix B.

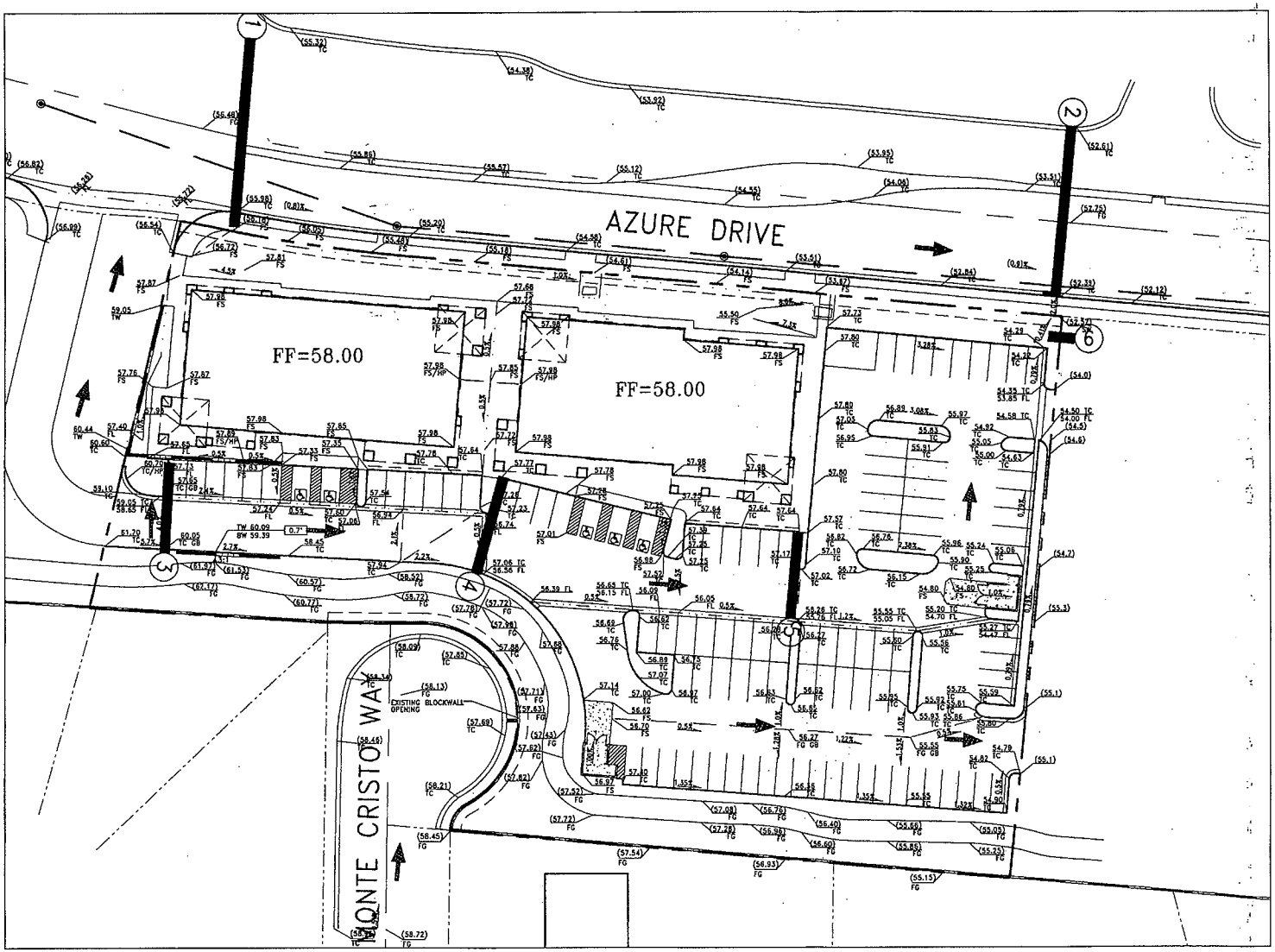
TABLE 3
100-YEAR HYDRAULIC CHARACTERISTICS
ULTIMATE CONDITIONS

Location*	Slope (%)	Q_{100} (cfs)	D_{100} (ft)	V_{100} (ft/sec)	$D*V_{100}$
Section 1	0.8	224-55=169	0.93	4.7	4.4
Section 2	0.9	236-55=181	0.94	5.0	4.7
Section 3	0.5	6	0.30	2.3	0.7
Section 4	0.5	6	0.20	1.6	0.3
Section 5	0.5	6	0.17	3.5	0.6
Section 6	10.4	6	0.24	12.4	N/A

*See Figure 7

Nuisance flows will be directed north into Azure Drive which includes an existing storm drain system. Nuisance flows on the south half of the site would be generated from the existing trail and landscaping. These nuisance flows will be continued east in their historical flow path.

The flow rates for Cross Sections 1 and 2 have been reduced by 55 cfs to account for the flows conveyed by the Azure Drive storm drain. Based on the calculated street flow characteristics, the Manual criteria for depth (D) and velocity times depth (V*D) during the 100-year storm event will be met.



SCALE 1" = 50'

LEGEND

8 — STREET FLOW CALCULATION

1.00% → STREET SLOPE

SUMMARY OF STREET FLOWS

SECTION	Q100 (CFS)	Q10 (CFS)
1*	169	59
2**	181	65
3	6	3
4	6	3
5	6	3
6	6	3

*CPW FLOWS-55 CFS IN AZURE SD
**CPE FLOWS-55 CFS IN AZURE SD

GRAPHIC SCALE

50' 25' 0 50' 100'

SCALE: 1" = 50'

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FIGURE 7
STREET SECTIONS

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The Azure Drive storm drain was designed to convey the 10-year flow per the Montecito East Study. However, approved studies for Shea Commercial, Tenaya Village, and Honda have shown an increase in the Azure Drive flows. Most notably the Honda Study revised on site CN values from a 92 to a 98 to more accurately reflect their site and added additional subbasins (HON 6 to HON9) that were not included with the Montecito East analysis (See Appendix C). Ultimate condition dry lane criteria calculations for Azure Drive have been included for Cross Sections 1 and 2 in Appendix B. Cross Section 1 is at the west edge of the site prior to flows from the site entering Azure Drive. Under ultimate conditions with all off-sites built, dry lane criteria will not be met based on the street depth of 0.69 feet. Cross Section 2 is at the east end of the site and includes the flows generated by the site. The depth at Cross Section two will be increased by 0.01 feet.

Dry lane criteria will not be met prior to site development and the flow depth will not be significantly increased (0.01 feet) after site development. Additionally, this 2.34 acre site only increases the 10-year flow by 2 cfs and it is part of a master planned area that already included storm drain facilities to meet dry lane criteria. Under interim conditions with the off-sites per the existing condition HEC-1 model and the site developed the 10-year flow in Azure Drive would be 20 cfs (74 cfs + 1 cfs more with ON1 developed – 55 cfs in the storm drain). Therefore, Azure Drive would meet dry lane criteria under interim conditions. For the reasons stated above WR believes this deviation is not a site specific problem and should be acceptable.

The proposed site will meet the City of Las Vegas criteria for finished floor elevations for the flow in Azure Drive. The City criteria requires that finished floor elevations are set at a vertical distance above the gutter flow line of at least twice the depth of flow or a minimum of 6-inches above highest adjacent top of curb. Building 1 meets these criteria for Azure Drive but not for the onsite parking lot. The parking lot includes a highpoint in the curb at elevation 60.7 at the south west corner of the building. However, the building includes parking spaces sloped away from the building with a 3-wide valley gutter. Section 3 has been conservatively modeled with 6 cfs generated by the entire onsite. Even with this conservative flow rate the depth of flow would be 0.3 feet in the valley gutter. The FF of Building 1 will be elevated as a minimum to twice this depth of flow.

X. CONCLUSIONS AND RECOMMENDATIONS

1. Methodology used in this report is in compliance with the Clark County Regional Flood Control District (CCRFCD) criteria.

2. The proposed project lies within A FEMA Zone X. Therefore, the project is not currently located in a FEMA-designated Special Flood Hazard Area.

3. The site is not located adjacent to existing or proposed CCRFCD facilities. Therefore, CCRFCD concurrence will not be required.

4. The proposed development does not significantly alter existing peak flows or the character of flows downstream of the development.

5. Buildings to be constructed within this project will have adequate freeboard to be protected from onsite flows and offsite flows within Azure Drive.

XI. REFERENCES

1. Post, Buckley, Schuh & Jernigan Inc., Louis Berger Group, and GC Wallace Inc., *Clark County Regional Flood Control District - The 2002 Master Plan Update of the Las Vegas Valley,* 2003.

2. Clark County Regional Flood Control District *Hydrologic Criteria and Drainage Design Manual*, updated August 1999.

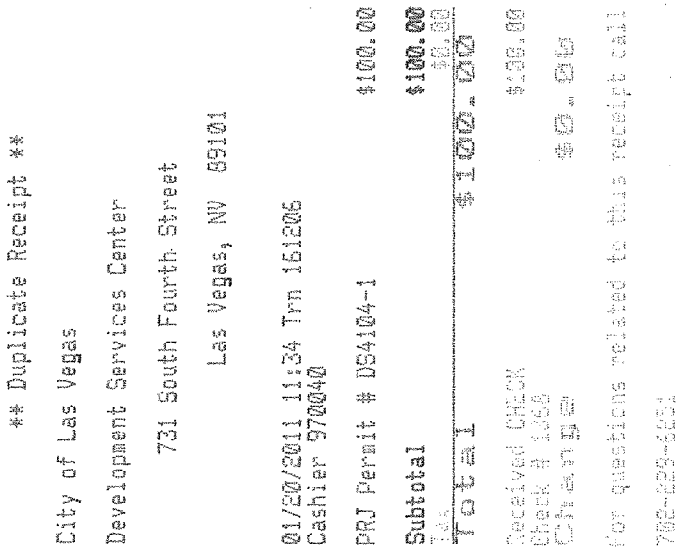
3. U.S. Army Corps of Engineers, *HEC-1 Flood Hydrograph Package,* June 1998.

4. Hamilton Engineers, *Hydrology Study for Findlay-Shack Honda* and all Addenda. March 2006.

5. Kimley-Horn & Associates, *Technical Drainage Study for Shea Commercial-Tenaya* and all Addenda. June 2005.

6. Tetra Tech, Technical *Drainage Study for Tenaya Village Phase 1 Mini Storage* and all Addenda. December 2003.

7. Primas and Associates, *Technical Drainage Study for Tropical Parkway (AKA Montecito East)* and all Addenda. January 2000.



** Duplicate Receipt **

City of Las Vegas
Development Services Center
731 South Fourth Street
Las Vegas, NV 89101

01/20/2011 11:34 Trn 161206
Cashier 970040

PRJ Permit # DS4104-1 $100.00

Subtotal $100.00
Tax $0.00
Total $100.00

Received CHECK $100.00
Check # 1456
Change $0.00

For questions related to this receipt call
702-229-6251

HYDROLOGIC CRITERIA AND DRAINAGE MANUAL

DRAINAGE STUDY INFORMATION FORM

Name of Development: Tenaya Village Center

Location of Development: a) Descriptive (Cross Streets) North/South: N. Tenaya Way Date: 1-20-11

East/West: Azure Drive

b) Section: 27 Township: 19 South Range: 60 East

c) APN: 125-27-222-009

Name of Owner: MFE, Inc.

Telephone No.: (702) 325-7084 Fax No. (702) 452-2058 E-Mail Address: Gulzarkular@aol.com

Address: 955 Temple View Dr Las Vegas, NV 89110

Contact Person-Name: Pat Samson

* E-Mail Address: patrice@aceengineering.us Telephone No. (702) 396-5113

Firm: Ace Engineering Fax No.: (702) 396-5114

Address: 6283 Dean Martin DR Ste B Las Vegas, NV 89118

Type of Land Development/Land Disturbance Process:

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

1. Total Owned Land Area: At Site: 1.1 acre Being Developed/Disturbed: 1.1 acre
2. Is a portion or all of the subject property located in a designated FEMA Flood Hazard Area? ☐ Yes** ☒ No
3. Is the property bordered or crossed by an existing or proposed Clark County Regional Flood Control District Master Planned Facility? ☒ Yes** ☐ No
4. Proposed type of development (Residential, Commercial, Etc.): Commercial
5. Approximate upstream land area which drains to the subject site: Azure Drive
6. Has the site drainage been evaluated in the past? ☒ YES ☐ NO If yes, please identify documentation: Tenaya commercial DS 4104 B
7. If known, please briefly identify the proposed discharge point(s) of runoff from the site: N/A

8. Briefly describe your proposed schedule for the subject project: Submit Drainage update letter 1/20/11. Await approval. Submit civil plans for review. Architect has already submitted & received CLV comments for building plans. Owner hopes to start construction of ARCO AM/PM & C-store in 2 months from now.

PROFESSIONAL ENGINEER - STATE OF NEVADA
JASPAL S. SIDHU
EXP. DATE 05/30/2012
CIVIL
No. 13796

Engineer's Seal

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

*New Required Field

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

Revision	Date

Local Entity File No.

REFERENCE:

STANDARD FORM 1

Updated 05/03/2008

ACE ENGINEERING
6283 Dean Martin Drive, Suite B
Las Vegas, NV 89118
Phone: (702) 396-5113
Fax: (702) 396-5114

Fax

To: Albert Sung P.E. Public Works/Land Dev. From: Pat Samson

Fax: (702) 382-8551 Pages: 2 (inc. cover)

Phone (702) 229-2001 Date: 1.20.11

Re: DRAINAGE STUDY UPDATE – TENAYA VILLAGE CENTER

☒ Urgent ☐ For Review ☐ Please Comment ☐ Please Reply ☐ Please Recycle

Albert,

Here is the Standard Form I for the Drainage Study Update that I submitted to you this morning.

Please let me know if I need to send anything else to you.

Thanks.

Pat Samson
Ace Engineering
(702) 396-5113