HYDROLOGY REPORT

FOR

TRADITIONS AT CAUGHLIN RANCH

UNIT No. 1

A 36 UNIT SINGLE FAMILY
RESIDENTIAL SUBDIVISION

PREPARED FOR

CAUGHLIN CRAFTED HOMES
1010 CAUGHLIN CROSSING
RENO, NEVADA 89509

PREPARED BY

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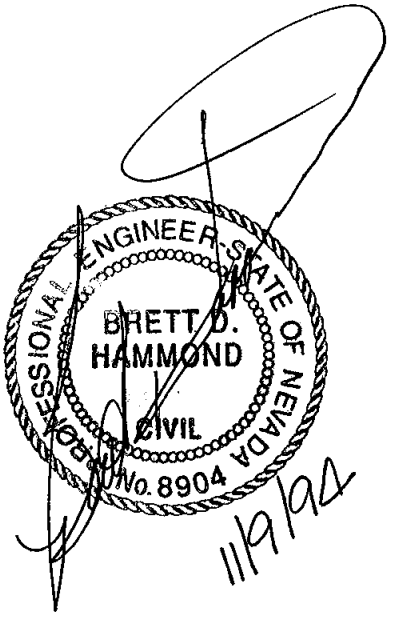
odyssey ENGINEERING INCORPORATED

NOVEMBER 1994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TRADITIONS AT CAUGHLIN RANCH
UNIT NO. 1
DRAINAGE REPORT

INTRODUCTION

This report represents the calculations supporting storm drainage system design for The Traditions at Caughlin Ranch Unit No. 1 Subdivision which consists of 36 single family residential units.

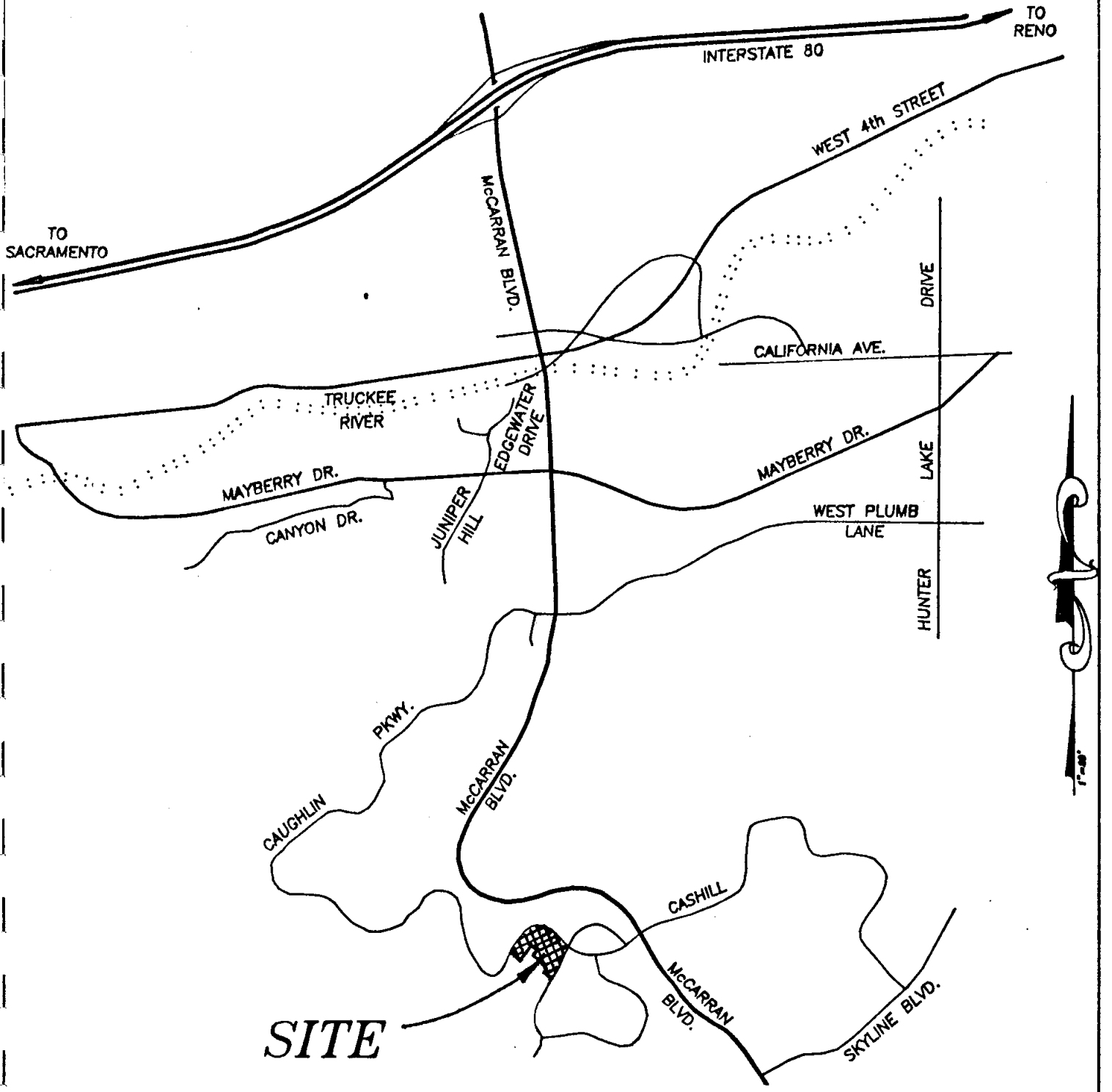
The site is located in the West half of Section 28, Township 19 North, Range 19 East, M.D.M., within the City of Reno, Nevada. The site is bordered on the North by Caughlin Parkway, the South by Alum Creek, the East by Village Green Parkway, and the West by Caughlin Parkway. Both Caughlin Parkway and Village Green Parkway are fully improved with the exception of curb and gutter which will be constructed with the development of the adjacent units of The Traditions at Caughlin Ranch. The entire site is located in a Zone C, area of minimal flooding, as designated on the FEMA flood insurance rate maps.

On February 8, 1994, The Reno City Council granted the following approvals in connection with The Traditions at Caughlin Ranch:

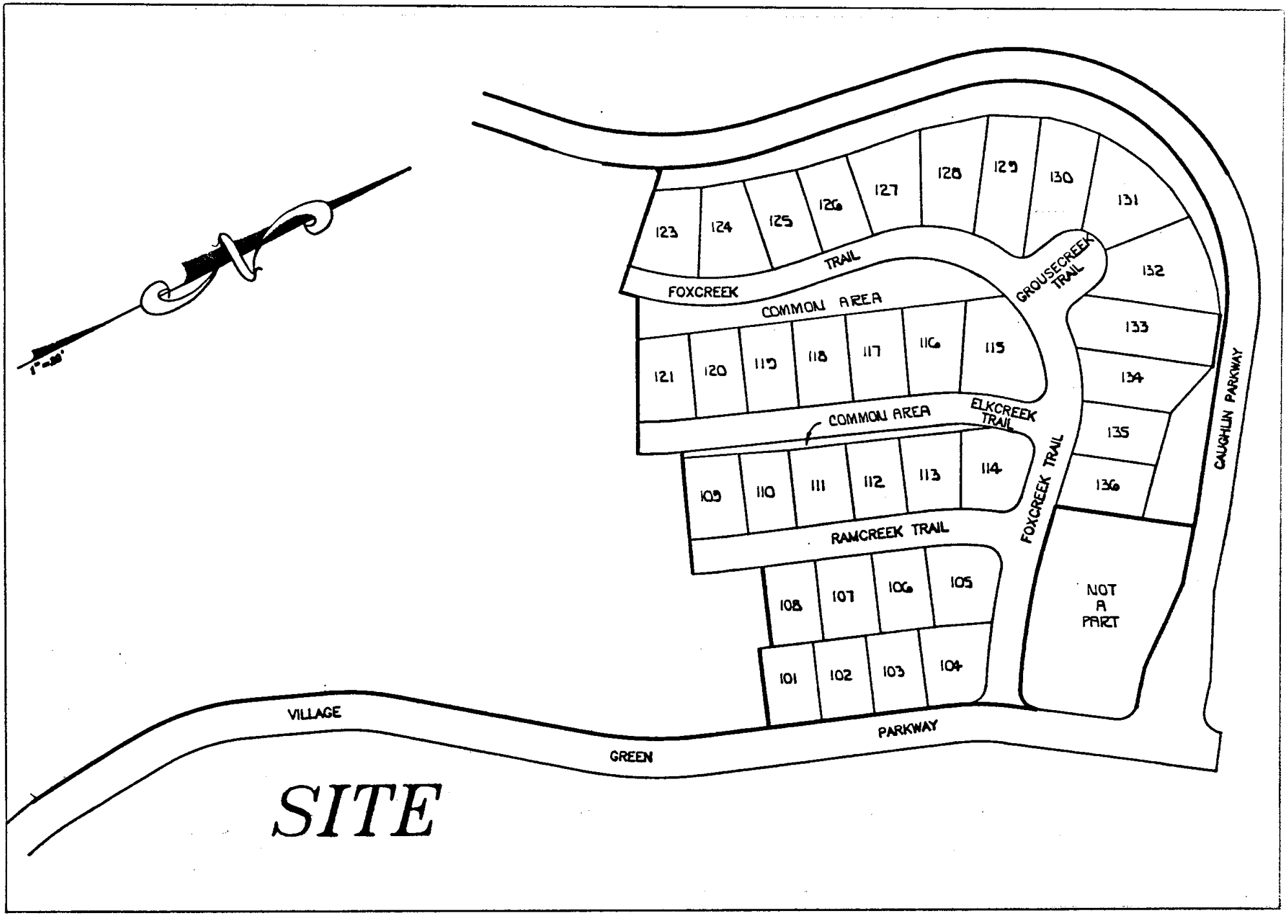
A. Annexation of 110.05 acres by ordinance;

B. A zoning map amendment from LLR-1 upon annexation to P.U.D. on 10.05 acres, subject to certification by Council and the existing standards contained in the Caughlin Ranch Development Standards Handbook;

C. An amendment to the Caughlin Ranch P.U.D. to add +/- 10.05 acres to the existing +/- 2,307 acre site,subject to certification by Council and the existing standards contained in the Caughlin Ranch Development Standards Handbook;



VICINITY MAP


123
124
125
126
127
128
129
130
131
132
133
134
135
136
FOXCREEK TRAIL
COMMON AREA
GROUSECREEK TRAIL
121
120
119
118
117
116
115
COMMON AREA
ELKCREEK TRAIL
109
110
111
112
113
114
FOXCREEK TRAIL
RAMCREEK TRAIL
108
107
106
105
NOT A PART
101
102
103
104
CAUGHLIN PARKWAY
VILLAGE GREEN PARKWAY
SITE

D. A tentative map to develop, in 14 phases, a 307 lot single family residential subdivision on 123.2 acres located along the North and South sides of Caughlin Parkway, West of it's intersection with Village Green Parkway, subject to conditions; and

E. A special use permit to allow fills in excess of ten feet and cuts in excess of twenty feet.

Traditions at Caughlin Ranch Unit No. 1 will be the first final map of this subdivision.

EXISTING STORM DRAIN SYSTEM

The existing topography of the site traverses down in a Northwesterly direction, and the ground cover consists of sagebrush and native grasses. As mentioned previously, Caughlin Parkway is fully improved with storm drain facilities. This roadway splits the site into two separate drainage basins. The Northern basin drains toward and under McCarran Boulevard into Caughlin Creek. The Southern basin drains toward Alum Creek. (ref. figure 1) Referencing the Master Hydrology Report for Caughlin Ranch, prepared by Codega & Fricke, Inc., dated June, 1991, of which this 120 acre site is a part of, Caughlin Parkway is the dividing line between the Alum Creek And Caughlin Creek drainage basins. The existing basins include only the portion of the site to be developed and the acreage used in the calculations reflect only those portions.

Westgate Detention Pond: Village Green Parkway bound the Traditions Unit No. 1 on the East side. Within Village Green Parkway, existing storm drainage facilities carry drainage from the Village Green Unit No. One subdivision, Caughlin Ranch Elementary School, and a future day care center site down Village Green Parkway, to discharge into the Westgate Detention Pond. This pond is located at the Southwest corner of the intersection of Caughlin Parkway and Village Green Parkway, which is the Northeast corner of the Traditions at Caughlin Ranch Unit No. 1. With development of the Tradition Unit No. 1 project, a minimal amount of grading will be placed within the existing detention pond. Since the volume of material is minimal, no provisions have been made for additional storage within the pond. The pond discharges into Caughlin Parkway via a 36" diameter storm drain main, and ultimately discharges into the Westpoint Detention Pond located North of McCarran Boulevard. Per the previously mentioned Codega & Fricke report, the 5 year and 100 year flow rates entering and exiting the Westgate Detention pond are: Q5 in = 18 cfs - Q5 out = 5.9cfs Q100 in = 42 cfs -Q100 out = 9.7 cfs.

Caughlin Parkway: With reference to the improvement plans entitled "STREET IMPROVEMENTS - CAUGHLIN PARKWAY", Prepared by Codega & Fricke, Inc., dated July 1989, A 24" diameter storm drain main begins at Station CP 135+77.20, and continues up Caughlin Parkway to Station CP 145+40.22.

At this point a 24" diameter main is stubbed into the Traditions site. All storm drainage improvements in the proposed Traditions Units 1, 2, & 3 will connect to this 24" stub. The minimum slope of this existing 24" diameter main is 6.5%, yielding a capacity of 60 cfs under free flow condition. This 24" diameter storm drain discharges into an existing 30" storm drain which ultimately discharges into Alum Creek. With total development of the Traditions Units 1, 2, & 3, 100 year storm drain discharge rates were calculated to be approximately 55.83 cfs. Existing 100 year discharge within Caughlin Parkway which contribute to the existing 24" diameter main were determined to be approximately 8.52 cfs, bringing the total 100 year flow to approximately 64.35 cfs. All other drainage within Caughlin Parkway is discharged at a low point located at it's intersection with the Alum Creek bridge crossing.

PROPOSED STORM DRAIN SYSTEM

The proposed storm drain system throughout Tradition No. 1 is designed to perpetuate flows through the project, and to maintain existing floe patterns. All storm water flows from Unit No. 1 were calculated using the Rational Method. The flow rates listed a Q5 year and Q100 year as shown on the improvement plan, represent final developed conditions. The flow rates shown as Q5 and Q100 at each catch basin are flow rates for that particular subarea, while the flows shown as Q5 and Q100 at each storm drain main represent flows within the pipe at ultimate buildout of Units 1, 2, & 3.

The storm drain system was designed to carry all 100 year flows within the pipe systems, meaning there will be no 100 year overland flow. All 100 year flows and 100 year catch basin capacities are shown on the plans. The 100 year flows in Units 1, 2, & 3 will discharge a low point in Fox Creek Trail and will connect to the existing 24" diameter stub in Caughlin Parkway which was discussed previously.

Stepped Lot Drainage: Since there are several houses within this development that will be constructed with walkout basements, several design parameters were considered. With development of Unit No. 1, lots 115 through 136 have walkout basements. For lots 115 through 121, the drainage will discharge into the common area, which will ultimately be contained by catch basins 6 and 7. For lots 122 through 129, a 3 foot wide by 0.50 foot deep concrete drainage swale will be constructed at the rear property line between Unit No. 1 and the common area along Caughlin Parkway. This swale will intercept the flows from the rear of these lots and discharge into catch basin No.9. For lots 131 through 133, the drainage will discharge into the common area along Caughlin Parkway, and will be contained by existing catch basins located in Caughlin Parkway. For lots 134 through 136, the drainage will discharge into the existing Westgate Detention Pond.

STORM DRAINAGE CALCULATION METHODOLOGY

As mentioned previously, the Rational Method was use for all flow calculations.

Design flow = Q = CiA

Where: Q = Runoff (cubic feet per second)
C = Runoff Coefficient
i = Rainfall Intensity (inches per hour)
A = Watershed Area (acres)

Since the site land use will be single family residential averaging 3.60 units per acre, a C value of 0.55 was used.

Per the City of Reno Engineering Design Manual, rainfall intensity curves were used to determine the average intensity. The time of concentration with a minimum buildup time of ten minutes is expressed as follows:

Tc = 10 or L/(V x 60) whichever is greater

Where: Tc = Time of Concentration at calculation point (minutes)
L = Length of Watershed (feet)
V = Flow Velocity (feet per second)

Since the time of concentration values calculated were less than 10 minutes in every case, 10 minutes was used. The 5 year storm rainfall intensity is i5 = 1.4 in/hr, and the 100 year intensity is i100 = 3.8 in/hr.

CATCH BASIN ANALYSIS

Utilizing the above calculation method, flows were calculated at each catch basin. Calculated flows and descriptions for each catch basin are listed below.

Catch basin No. 1 is located at the Southeast return of Grousecreek Trail and Foxcreek Trail. The street slope entering this catch basin is 3.5 percent. The 5 year and 100 year flows at this catch basin are 2.12 cfs and 5.75 cfs respectively. This catch basin is a type 4-R with a capacity of 6.3 cfs therefore containing all excess runoff.

Catch basin No. 2 is located at the Southeast return of Elkcreek Trail and Foxcreek Trail. This catch basin is in a sump condition with a headwater depth of 0.2 feet. The 5 year flow at this catch basin is 0.75 cfs. The 100 year flow is 2.03 cfs plus overflow from catch basin No. 3 and the existing catch basin located on Village Green Parkway of 1.2 cfs, bringing the 100 year total to 3.23 cfs. This catch basin is a type 4-R with a capacity of 4.0 cfs, Therefore containing all 100 year storm runoff.

Catch basin No. 3 is located at the Southeast return of Ramcreek Trail and Foxcreek Trail. This catch basin is in a sump condition with a headwater depth of 0.20 feet. The 5 year flow at this catch basin is 1.15 cfs. The 100 year flow at this catch basin is 3.11 cfs plus overflow from Village Green Parkway of 2.09 cfs, making the total 100 year flow 5.2 cfs. This catch basin is a type 4-R with a capacity of 4.0 cfs. The 100 year overflow of 1.2 cfs will travel down Fox Creek Trail where it will be contained in catch basin No. 2.

Catch basin No. 4 and 5 are located at the West low point of Foxcreek Trail. These catch basins are in a sump condition with a headwater depth of 0.5 feet. The 5 year and 100 year flows at these catch basins are 1.94 cfs and 7.0 cfs respectively. These catch basins will be constructed as dual type 4-R's with a capacity of 12.8 cfs, therefore containing all excess runoff from the 100 year storm event.

Catch basins No. 6 & 7 are located at the East low point of Foxcreek Trail. These catch basins are in a sump condition with a headwater depth of 0.5 feet. The 5 year and 100 year flows at these catch basins are 3.37 cfs and 10.08 cfs respectively. These catch basins are dual type 4-R's with a capacity of 12.8 cfs, therefore containing all excess runoff from the 100 year storm event.

There are two existing type 4-R catch basins located on the West side of Village Green Parkway, one of which will be removed due to a driveway conflict. The other is located at the Southwest return of Village Green Parkway and Foxcreek Trail. The existing slope entering this catch basin is approximately 4%. The combined 5 year and 100 year flows at this catch basin are 2.46 cfs and 6.69 cfs respectively. This catch basin is a type 4-R with a capacity of 4.6 cfs. The additional flow of 2.09 cfs will overflow to catch basin N0. 3 of which 1.2 cfs will overflow to catch basin No. 2.

Catch basin No. 8 is located at the Northeast return of Grousecreek Trail and Foxcreek Trail. This catch basin is in a sump condition with a headwater depth of 0.20 feet. The 5 year and 100 year flows at this catch basin are 0.30 cfs and 0.81 cfs respectively. This catch is a type I with a capacity of 1.0 cfs, therefore containing all excess runoff.

Catch basin No. 9 is located at the Southwest rear property corner of lot 122. This catch basin is in a sump condition with a headwater depth of 0.5 feet. This catch basin will contain the flows from the rear yards of lots 122 through 129. The 5 year and 100 year flows at this catch basin are 0.85 cfs and 2.30 cfs respectively. This catch basin is a type 3-R with a capacity of 6.40 cfs, therefore containing all excess runoff.

Concrete drainage swale: As previously mentioned, drainage from lots 122 through 129 will drain to a concrete drainage swale. The minimum slope of this concrete swale is 0.0198 ft/ft and has a capacity of approximately 4.30 cfs. The 5 year and 100 year flow contributing to this swale are 0.85 cfs and 2.30 cfs respectively, therefore containing all excess runoff.

DRAINAGE SUB-AREA DESIGNATION

Drainage Sub-area "A" is 2.75 acres and drains to catch basin N0's. 1 and 8.

Drainage Sub-area "B" is 0.97 acres and drains to catch basin N0. 2.

Drainage Sub-area "C" is 1.49 acres and drains to catch basin N0. 3.

Drainage Sub-areas "D & E" are 2.37 acres and drain to catch basin N0.s 4, 5 and 9.

Drainage Sub-areas "F & G" are 4.37 acres and drain to catch basin N0.s 6 & 7.

Drainage Sub-area "H" is 3.2 acres and drains to the existing catch basin in Village Green Parkway.

CONCLUSION

With development of The Traditions at Caughlin Ranch Unit No. 1, the proposed storm drainage system is design to carry all 100 year flows which will be generated by development of Units 1, 2, & 3. The proposed mains will connect into existing facilities located within Caughlin Parkway, which are adequate to carry the proposed 100 year developed flows.

The drainage and grading design for this subdivision will provide drainage protection for the homes within the development, and will maintain existing drainage patterns within the watershed area.

TABLE I

TRADITIONS AT CAUGHLIN RANCH UNIT NO. 1
EXISTING CONDITION FLOWS

SUB-AREA	AREA (acres)	C	Tc (min)	i5 (in/hr)	Q5 (cfs)	i100 (in/hr)	Q100 (cfs)
A	2.75	0.55	10	1.4	1.54	3.8	4.18
B	0.97	0.55	10	1.4	0.54	3.8	1.47
C	1.49	0.55	10	1.4	0.83	3.8	2.26
D	1.89	0.55	10	1.4	1.06	3.8	2.87
E	0.62	0.55	10	1.4	0.34	3.8	0.94
F	2.88	0.55	10	1.4	1.61	3.8	4.38
G	1.49	0.55	10	1.4	0.83	3.8	2.26
H	3.20	0.55	10	1.4	1.79	3.8	4.86
TOTALS	15.29				8.54		23.72

TABLE II

TRADITIONS AT CAUGHLIN RANCH UNIT NO. 1
PROPOSED CONDITION FLOWS

SUB-AREA	AREA (acres)	C	Tc (min)	i5 (in/hr)	Q5 (cfs)	i100 (in/hr)	Q100 (cfs)
A	2.75	0.55	10	1.4	2.12	3.8	5.75
B	0.97	0.55	10	1.4	0.75	3.8	2.03
C	1.49	0.55	10	1.4	1.15	3.8	3.11
D	1.89	0.55	10	1.4	1.46	3.8	3.95
E	0.62	0.55	10	1.4	0.48	3.8	1.30
F	2.88	0.55	10	1.4	2.22	3.8	6.01
G	1.49	0.55	10	1.4	1.15	3.8	3.11
H	3.20	0.55	10	1.4	2.46	3.8	6.69
TOTALS	15.29				11.79		31.95

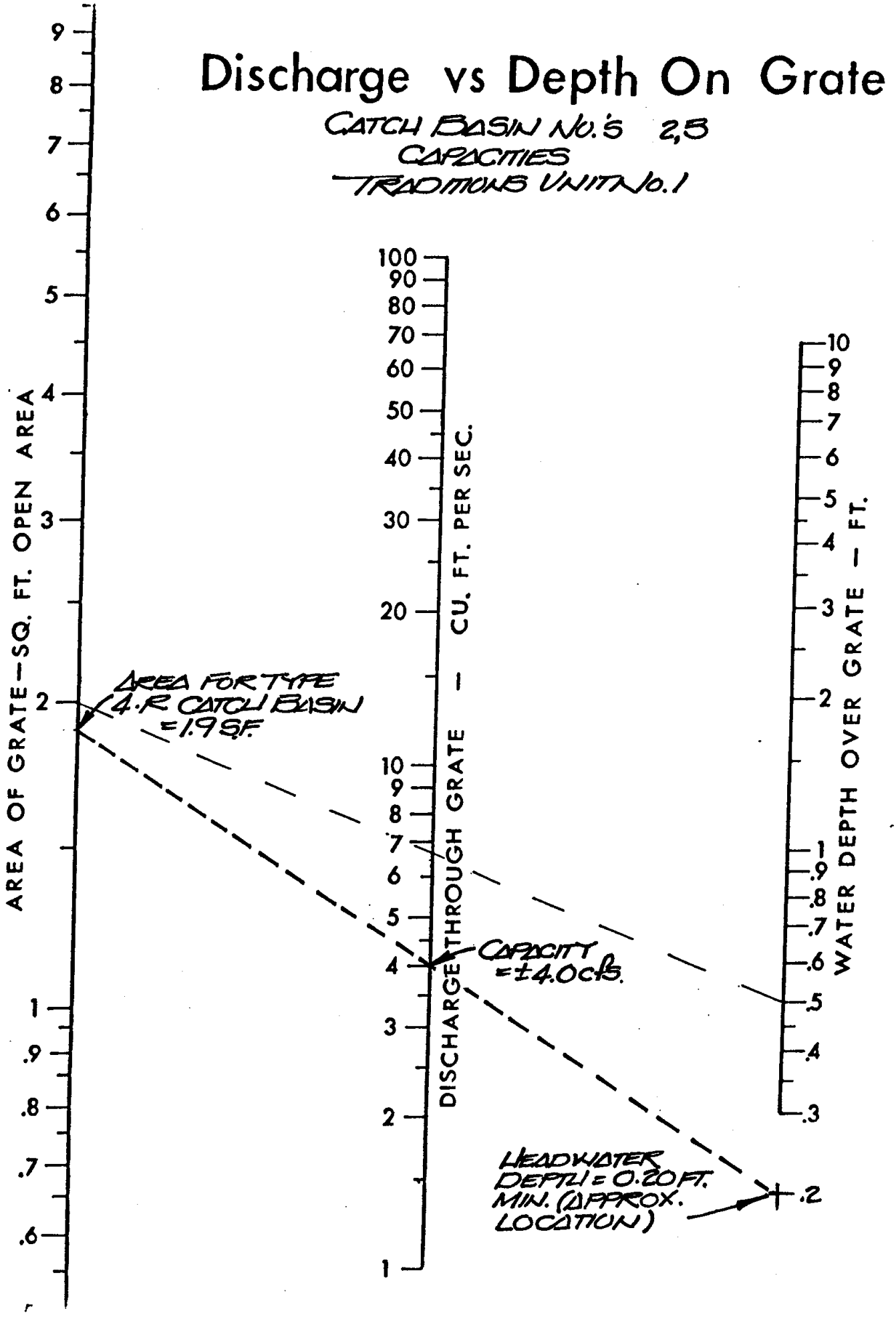
TABLE III

PROPOSED CATCH BASIN CAPACITIES

CATCH BASIN	TYPE	Q100 PROPOSED (cfs)	Q CAPACITY (cfs)
1	4-R	5.75	4.0
2	4-R	2.03	4.0
3	4-R	3.11	4.0
4	4-R	3.95	6.4
5	4-R	1.30	6.4
6	4-R	6.01	6.4
7	4-R	3.11	6.4
EXISTING	4-R	6.69	4.6
8	I	0.81	1.0
9	3-R	2.30	6.4

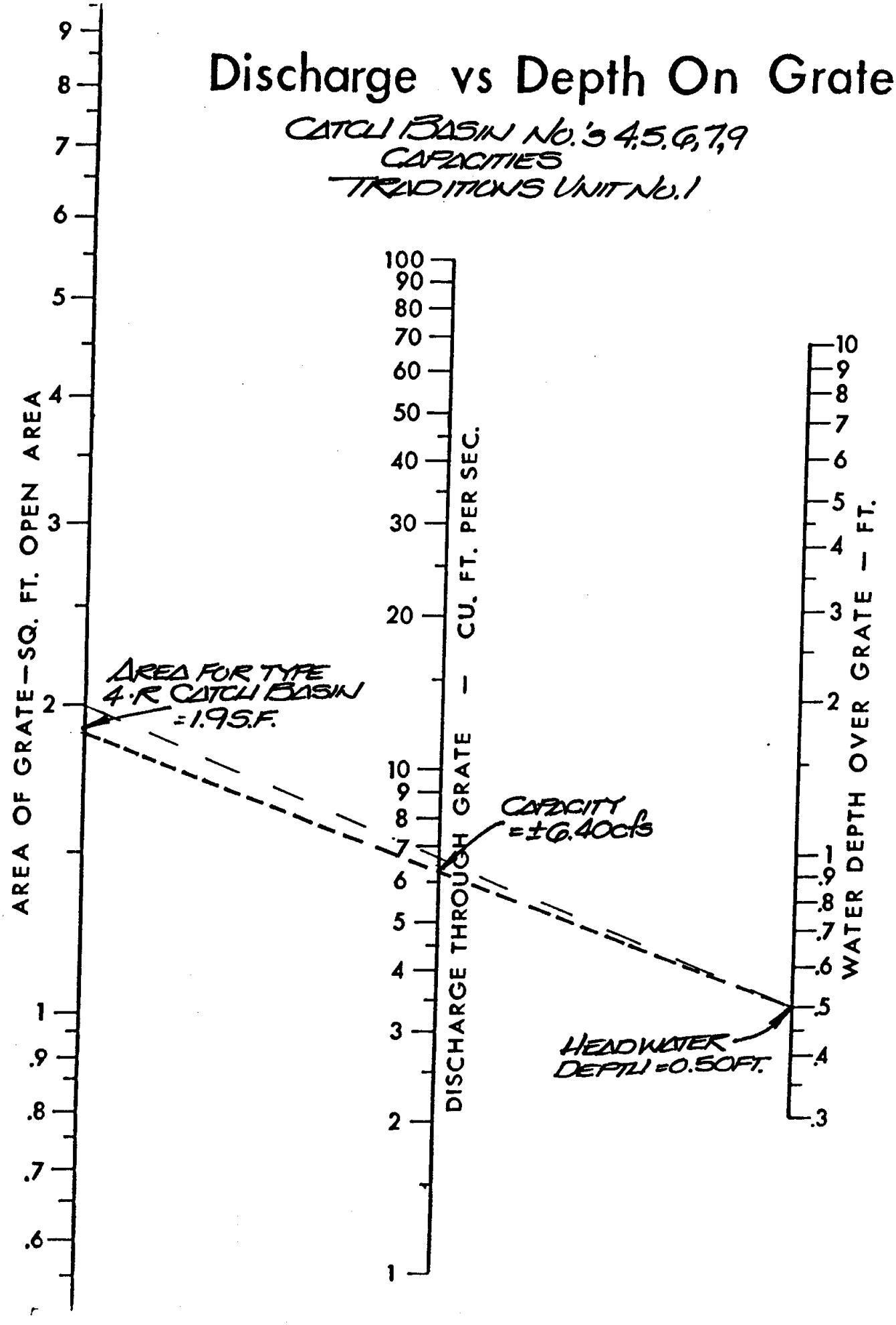
Discharge vs Depth On Grate

CATCH BASIN NO.'S 2,5
CAPACITIES
TRADITIONS UNIT NO.1



Discharge vs Depth On Grate

CATCH BASIN No.'s 4.5.6,7,9
CAPACITIES
TRADITIONS UNIT No.1



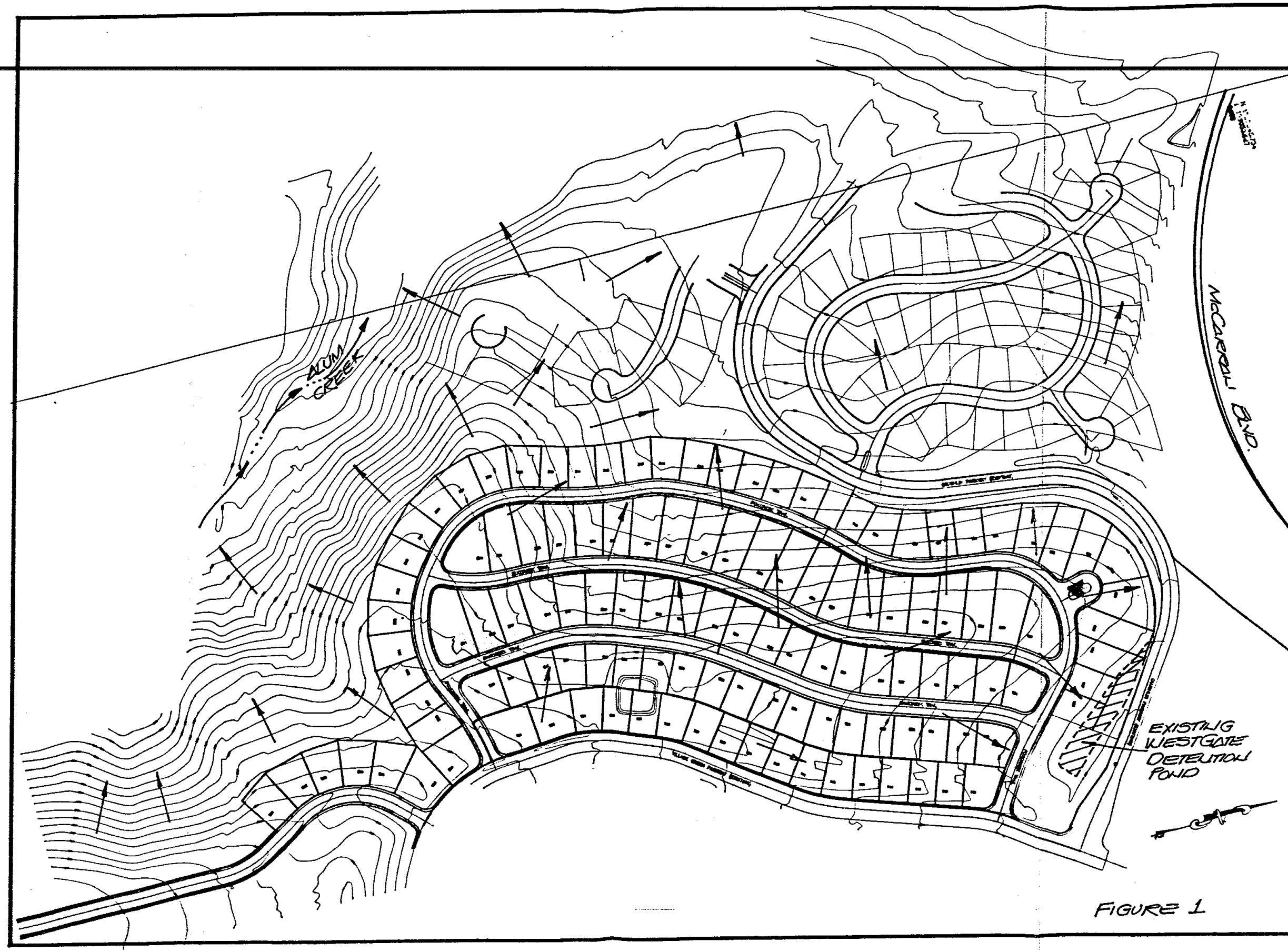


FIGURE 1

TRIBUTARY UNIT NO. 1
EXISTING DRAINAGE PLAN
RENO, WASHOE COUNTY, NEVADA

Odyssey ENGINEERING INCORPORATED

DATE JULY 1991
DRAWN BY D.B.
DESIGNED BY R.H.
CHECKED BY

SCALE
HORIZ.
VERT.
JOB NO.

SHEET 1 OF 1

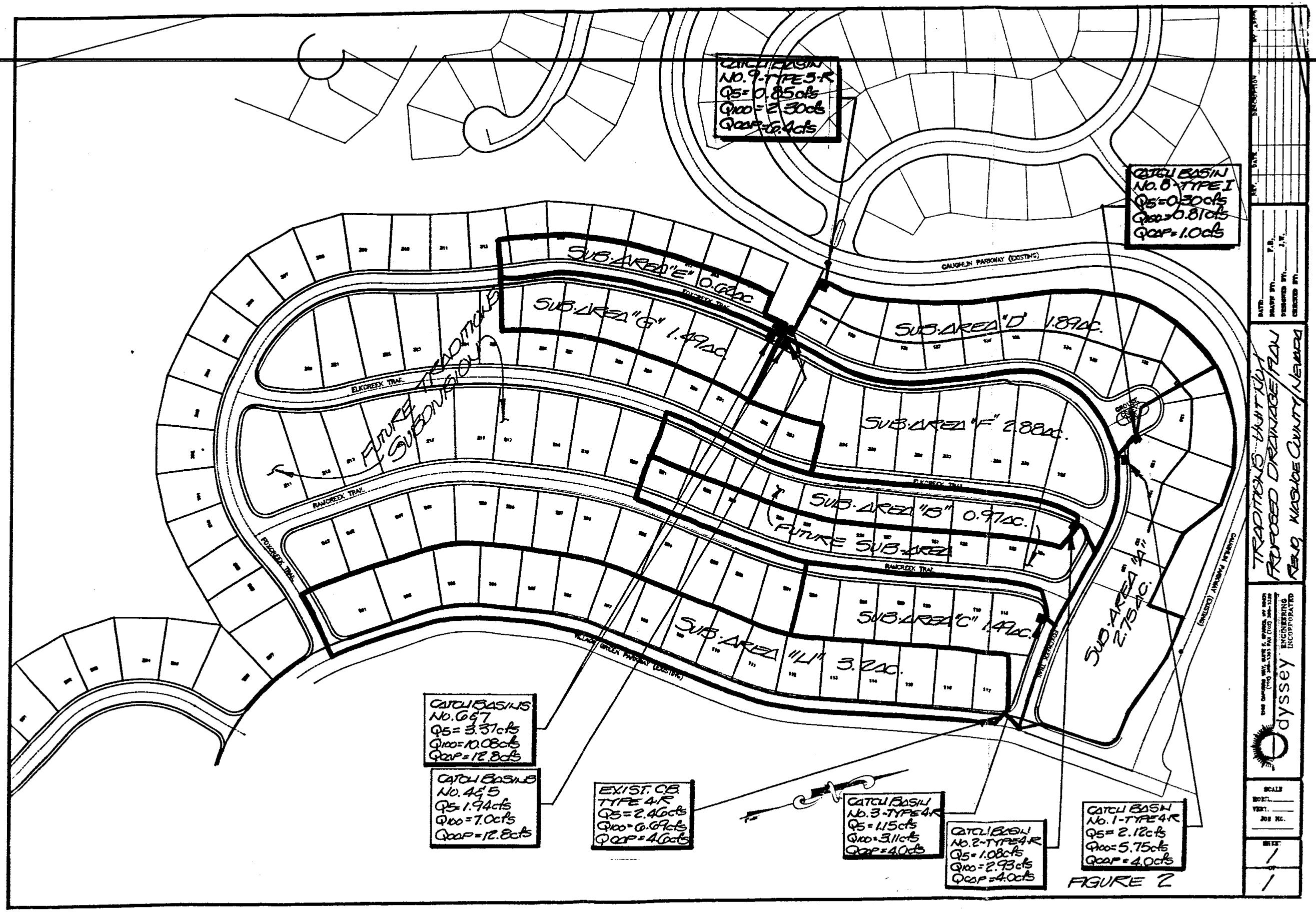

CATCH BASIN NO. 9-TYPE 3-R
Q5=0.85cfs
Q100=2.30cfs
QOAP=6.4cfs
CATCH BASIN NO. 8-TYPE I
Q5=0.30cfs
Q100=0.81cfs
QOAP=1.0cfs
SUB-AREA "E" 0.60ac
SUB-AREA "G" 1.49ac
SUB-AREA "D" 1.89ac.
SUB-AREA "F" 2.88ac.
SUB-AREA "B" 0.97ac.
FUTURE SUB-AREA
SUB-AREA "C" 1.49ac.
SUB-AREA "A" 2.75ac.
SUB-AREA "L" 3.24ac.
FUTURE TRADITIONS SUBDIVISION
ELK CREEK TRAIL
RAMCREEK TRAIL
POWDER CREEK TRAIL
CALIGHLIN PARKWAY (EXISTING)
CATCH BASINS NO. 6&7
Q5=3.37cfs
Q100=10.08cfs
QOAP=12.8cfs
CATCH BASINS NO. 4&5
Q5=1.94cfs
Q100=7.0cfs
QOAP=12.8cfs
EXIST. C.B. TYPE 4-R
Q5=2.46cfs
Q100=6.69cfs
QOAP=4.0cfs
CATCH BASIN NO. 3-TYPE 4-R
Q5=1.15cfs
Q100=3.11cfs
QOAP=4.0cfs
CATCH BASIN NO. 2-TYPE 4-R
Q5=1.08cfs
Q100=2.93cfs
QOAP=4.0cfs
CATCH BASIN NO. 1-TYPE 4-R
Q5=2.12cfs
Q100=5.75cfs
QOAP=4.0cfs
TRADITIONS-UNIT 10
PROPOSED DRAINAGE PLAN
REV'D. KLAMATH COUNTY, OREGON
Odyssey ENGINEERING INCORPORATED
SCALE
HORIZ.
VERT.
JOB NO.
SHEET 1
OF 1

FIGURE 2