LDP02-00992

HYDROLOGY REPORT
for
DOUBLE R BOULEVARD – PHASE I & II
(S. MEADOWS BUS. PARK TO LONGLEY LANE)

Prepared for:
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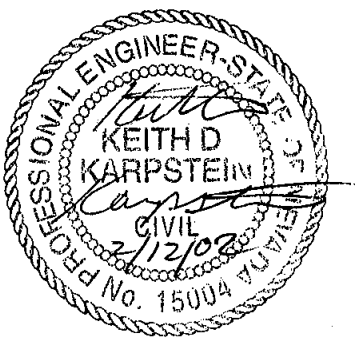
February 11, 2002



PROJECT DESCRIPTION

The proposed project is the extension of Double R Boulevard to Longley Lane. The roadway will begin at the intersection of Longley Lane and Double R Boulevard (a.k.a. Airway Drive) and extend southward to the existing north portion of Double R Boulevard in the South Meadows Business Park. The project vicinity map is included which shows the location of the roadway in relation to the existing developments and roadways in the area. The roadway is proposed to be constructed in two phases. Phase I of the roadway consists of approximately 3,100 feet of alignment at the north end of the project. Phase II consists of nearly 2,400 linear feet of alignment at the south end. The existing Huffaker Hills subdivision is located to the south of the project with undeveloped land between the roadway and subdivision. To the north of the project is undeveloped land up to McCarran Boulevard. There are existing buildings in the vicinity which are located to the south of the phase I portion of the project. The development extends from the existing Innovation Drive roadway to the Huffaker Hills subdivision. The two roadways, Innovation Drive and Meastro Drive, are proposed to tie into the new Double R Boulevard extension as depicted on the vicinity map. The Double R Boulevard extension will provide for the development of the proposed Reno Corporate Center (RCC), which will extend from McCarran Boulevard at the north to the Huffaker Hills subdivision at the south.

EXISTING REFERENCES

The existing drainage report for Park 2001, East Half and Barron Way, dated April 2001, and the drainage report for Huffaker Village – Phase I, dated September 27, 1995, were used as references to determine the allowable discharge from the proposed development and to describe the existing drainage patterns in the area. Copies of the cover sheet for each report are included in the references section of this report.

EXISTING CONDITIONS

The phase I portion of the project is relatively flat and slopes to the north at slopes less than one percent. Phase II of the site includes mountainous and hilly terrain, which will require extensive cuts and fills to construct the roadway. The existing site vegetation consists of native grasses and weeds.

There is an existing system of irrigation ditches that run across the site and flow towards the north and east. The majority of these ditches will be abandoned prior to construction. However, the existing flows which cross Longley Lane will be perpetuated through the project via storm drain. Currently, a portion of the above described flows are conveyed across Longley Lane by a 3' x 5' box culvert just south of the Airway Drive intersection (See Exhibit "A-1" & "A-2"). Adjacent to the box culvert is an additional 24" storm drain, which conveys any spillover from the box culvert across the roadway. The remainder of the flows to the site are carried in an existing ditch that parallels the Huffaker Hills subdivision along the south boundary of the project. This ditch may eventually abandoned, but at this time it is assumed that the flows will be required to

flow through the site. The ditch currently flows to the east along the north property line of the subdivision and turns to the north at the northeast property corner. The flows within the ditch are conveyed across Longley Lane by a 3' x 5' box culvert near the south end of the project. The outlet portion of the culvert is a 42" CMP that discharges into the ditch indicated above (See Exhibit "A-1" & "A-2"). The maximum flows crossing Longley Lane were calculated based on the existing pipe size, slope and maximum allowable headwater at the pipe inlet. The calculations are provided in the calculations section of this report.

There is an existing storm drain that crosses the site from the Huffaker Hills subdivision and drains to the existing channel at the north end of the property. The storm drain is a 54-inch RCP at the south end and a 66-inch RCP at the north end of the proposed RCC project (See Exhibit "A-1"). The storm drain was designed to alleviate flooding within the subdivision. An easement was granted to the city for the installation of the pipe with terms that allow for the developments within the parcel to drain to the storm drain. However, the 100-year storm flows from the development will not be carried within the storm drain due to insufficient capacity, as was determined from the previous drainage report for Park 2001, East Half and Barron Way.

There is an existing detention pond located to the east of the subdivision that catches the runoff from the hillside and detains it with a controlled outlet. The phase II portion of the roadway is expected to impact the capacity of the pond by the encroachment of fill material. However, the fill from the roadway that encroaches into the pond is not expected to negatively impact the purpose of the pond, which is to alleviate the flooding potential from the hillside. This is due to the fact that the roadway will catch all the runoff from the hillside in a roadside ditch and convey it through the proposed drainage system for this development. The only flows which will be discharged to the existing pond are the flows on the downhill side of the roadway.

The majority of the site is designated by FEMA as Flood Zone Unshaded X, described as areas of outside of the 500-year floodplain. A small portion of the site near the channel to the north is located in FEMA Flood Zone A, described as a flood hazard area inundated by 100-year flood with no base flood elevations determined. (Refer to FEMA Attachments)

FUTURE CONDITIONS

The construction of the roadway will provide for the development of the Reno Corporate Center. A 100-year storm drain plan for the full development of the parcel has been incorporated into the construction of the roadway. The controlling factor for the drainage plan is the capacity of the existing channel located at the north end of the project, as determined in the drainage report for Park 2001, East Half and Barron Way. Three detention ponds will be utilized to alleviate flooding of downstream parcels with the development of the site. Two of the ponds will be constructed with phase I of the roadway. The detention ponds will discharge through a culvert outlet with headwall and continue into the proposed drainage system. Some of the developments within the site

will be allowed to drain to the existing Huffaker Hills storm drain, particularly the sites to the west of the storm drain. However, the mass grading of the site must be graded to allow for 100-year storm flows to be conveyed to the proposed storm drain system. It is proposed that none of the developments within the site be required to provide on-site detention. All of the storm drain crossings along Double R Boulevard are designed to convey the 100-year flows from the developed sites to the master drainage system north of and within the roadway.

The existing flows which cross Longley Lane are incorporated into the master drainage plan for the project. These flows are assumed to be irrigation waters, as they consist of continuous flows. The northern most flow that crosses Longley will be piped through the project in a separate system parallel to Longley Lane, where it will eventually drain into the existing channel just south of McCarran Boulevard. The flow that crosses Longley at the south end of the project will be piped through the site adjacent to the existing 54-inch and 66-inch storm drains. A temporary ditch will be provided until the site develops. A portion of this flow may be routed through the storm drain system and detention ponds to create a wetland type environment. This will be accomplished by constructing a concrete manhole structure at the junction point which will control the flows that are routed into the storm drain system as to not exceed the capacity of the proposed system. The remainder of the flows will be carried in the parallel storm drain system and temporary ditch as mentioned previously. Sheet DM of the roadway plan set details the projected storm drain flows and proposed pipe system. Further, the location of the detention ponds are shown on Sheet DM. A copy of the drainage plan for the project is included as Exhibit "B".

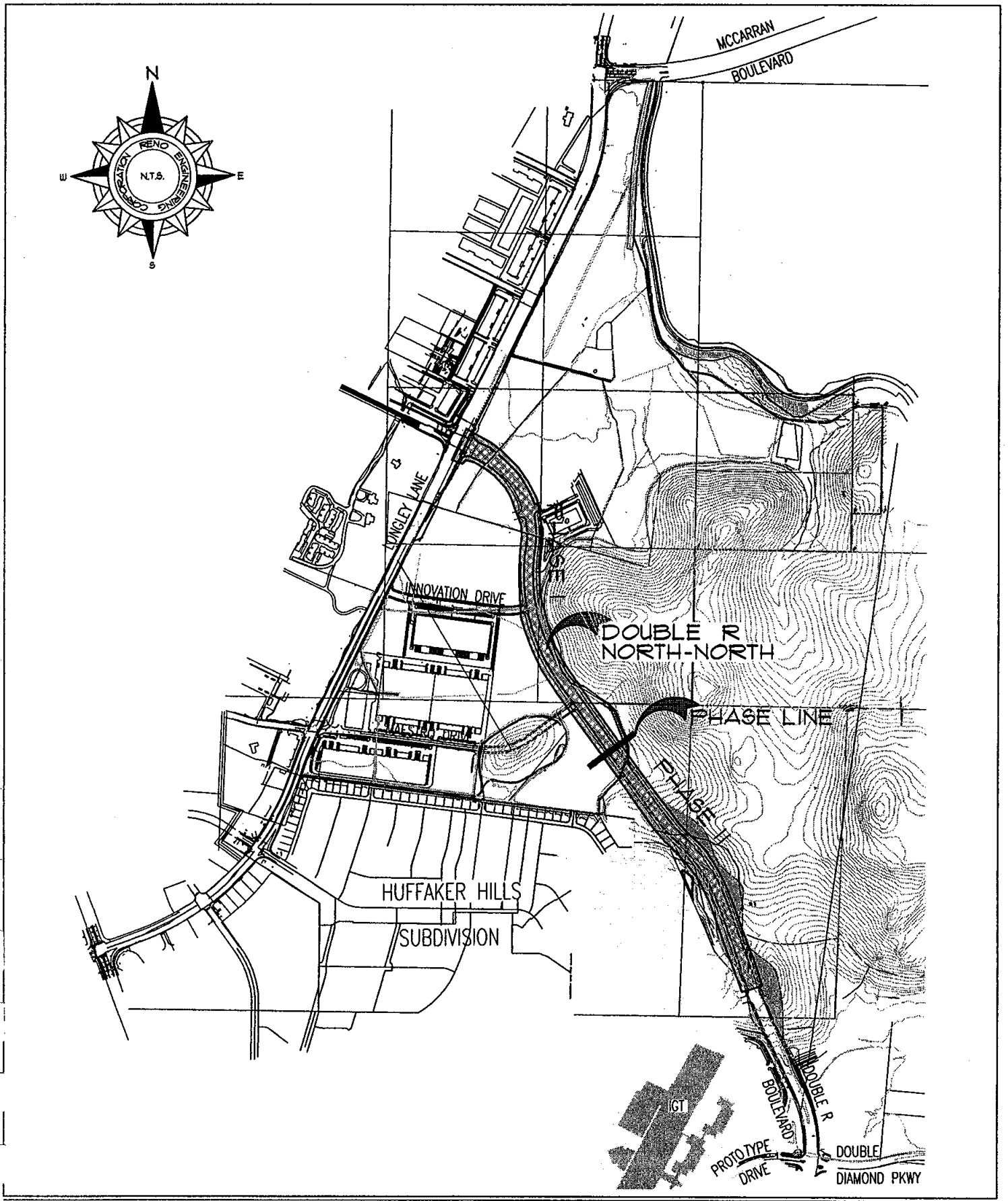
HYDROLOGIC METHOD

The SCS unit hydrograph method (SCSUH) has been employed to estimate the proposed runoff due to development. SCSUH procedure is a principal component of SCS Technical Release 20 (TR-20). HydroCAD stormwater modeling system Version 5 was utilized to calculate the flows which employs SCS TR-20. The SCS 24-hour type II rainfall distribution was incorporated into the calculations for the 100-year storm event. Rainfall data was taken from NOAA Atlas 2 maps for the 24-hour 100-year storm (See NOAA Attachment). The Lag Method was used to determine the time of concentration for each subcatchment. The soil type for each subcatchment was obtained from the USDA SCS Soil Survey of Washoe County, Nevada, South Part, which also assigns each soil type a hydrologic soil group (HSG) for determination of the curve number (CN) (See Soil Survey Attachments). The CN's for each subcatchment are indicated on Exhibit "B". The drainage calculations, which include the routing diagrams, summaries and descriptions of each subcatchment and reach, are included in the calculations section of this report.

CONCLUSIONS

Development of the roadway and surrounding parcels will not affect the downstream developments if the site is constructed with the drainage improvements proposed with this report. The controlling factor for the discharge flows is the existing channel located a the north end of the project. A master drainage plan has been developed as to not exceed the capacity of the channel by incorporating a 100-year detention plan for the development. Individual sites within the proposed development shall not be required to provide on-site detention if the master drainage plan proposed with this report is constructed prior to development of the interior parcels. As noted previously, the existing storm drain which crosses the site can be utilized for the 5-year developed flows from a portion of the site, particularly the sites to the west of the storm drain. However, the entire development shall be graded to allow the 100-year flows to discharge to the proposed drainage system and detention ponds.

EXHIBITS



NOTE: SHOULD ANY PREHISTORIC REMAINS/ARTIFACTS BE DISCOVERED DURING SITE DEVELOPEMENT, WORK SHALL BE HALTED FOR NO MORE THAN TWO (2) WORKING DAYS UNLESS AN EXTENDED PERIOD OF TIME IS AGREED TO BY THE DEVELOPER IN ORDER TO PROVIDE AN OPPORTUNITY FOR THE RECORDING AND PHOTOGRAPHING THE SITE BY THE DIVISION OF HISTORIC PRESERVATION AND ARCHEOLOGY, DEPARTMENT OF CONSERVATION AND NATURAL RECOURCES, STATE OF NEVADA.

REC

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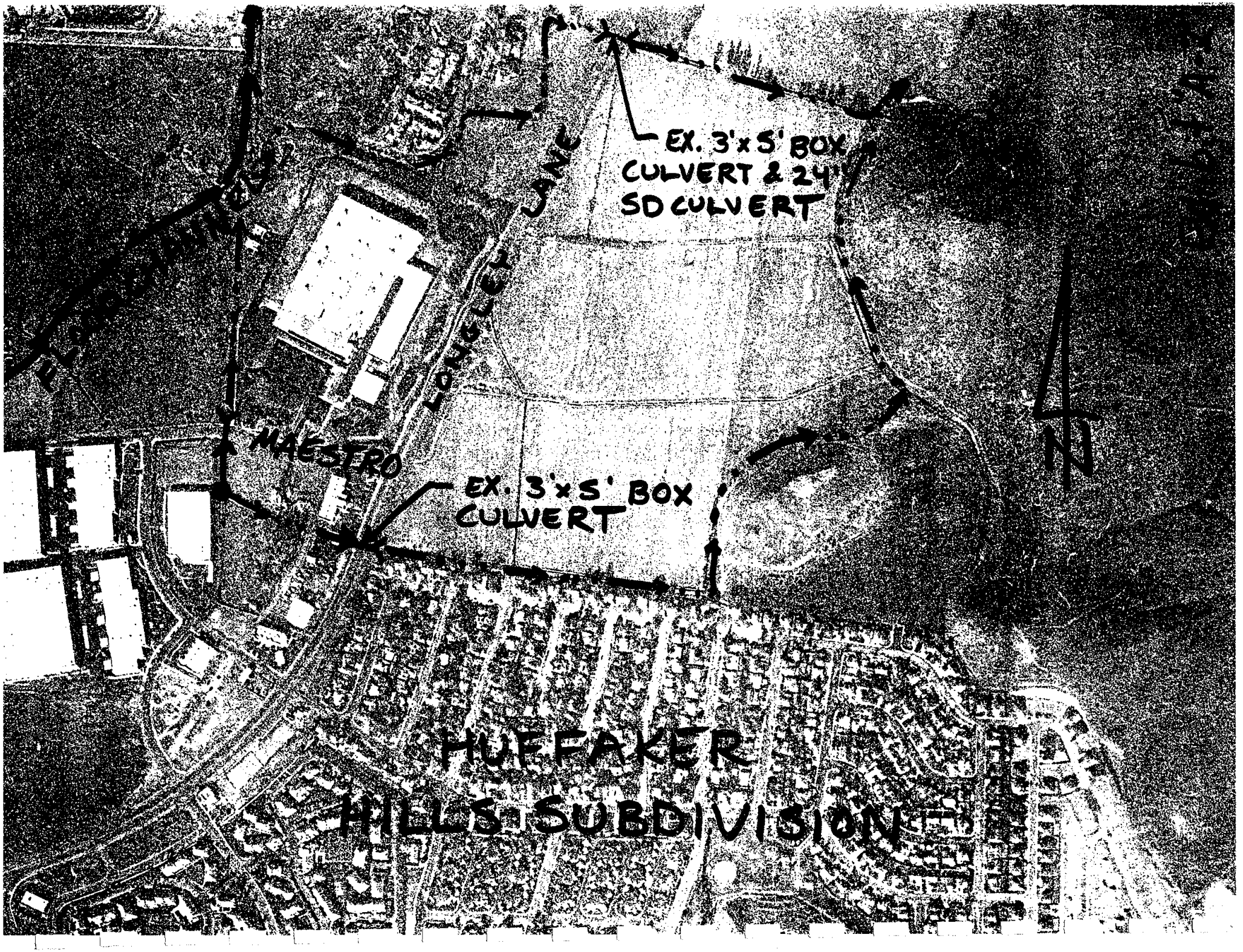
PHONE: (775) 852-5700 FAX: (775) 852-5707

DATE	REVISIONS

VM

VC-MAP | XXX | 2/6/03

DOUBLE R BLVD. EXTENSION
VICINITY MAP


EX. 3'x5' BOX CULVERT & 24" SD CULVERT
JANE
LONE ELM
MAESTRO
EX. 3'x5' BOX CULVERT
N
HUFFAKER HILLS SUBDIVISION

REFERENCES

NATIONAL FLOOD INSURANCE PROGRAM

FIRM

FLOOD INSURANCE RATE MAP

WASHOE COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 3157 OF 3350

(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS:

COMMUNITY	NUMBER	PANEL	SUFFIX
RENO, CITY OF	320020	3157	E
WASHOE COUNTY, UNINCORPORATED AREAS	320019	3157	E

MAP NUMBER
32031C3157 E

EFFECTIVE DATE:
SEPTEMBER 30, 1994

Federal Emergency Management Agency

APPROXIMATE SCALE IN FEET

500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

WASHOE COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 3159 OF 3350
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REVISED TO REFLECT LOMR DATED FEB 05 1997

MAP NUMBER
32031C3159 E

EFFECTIVE DATE:
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Federal Emergency Management Agency

LEGEND

SPECIAL FLOOD HAZARD AREAS INUNDATED BY 100-YEAR FLOOD

ZONE A No base flood elevations determined.

ZONE AE Base flood elevations determined.

ZONE AH Flood depths of 1 to 3 feet (usually areas of ponding); base flood elevations determined.

ZONE AO Flood depths of 1 to 3 feet (usually sheet flow on sloping terrain); average depths determined. For areas of alluvial fan flooding, velocities also determined.

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

astal barrier areas are normally located within or adjacent to Special od Hazard Areas.

Flood Boundary

Floodway Boundary

Zone D Boundary

Boundary Dividing Special Flood Hazard Zones, and Boundary Dividing Areas of Different Coastal Base Flood Elevations Within Special Flood Hazard Zones.

513 — Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

D — D — Cross Section Line

(EL 987) — Base Flood Elevation in Feet Where Uniform Within Zone. See Map Index for Elevation Datum.

RM7 — Elevation Reference Mark

M2 — River Mile

°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

map is for use in administering the National Flood Insurance Program; oes not necessarily identify all areas subject to flooding, particularly from al drainage sources of small size, or all planimetric features outside ecial Flood Hazard Areas.

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MAP REPOSITORY

Refer to Repository Listing on Map Index

EFFECTIVE DATE OF
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N

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500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

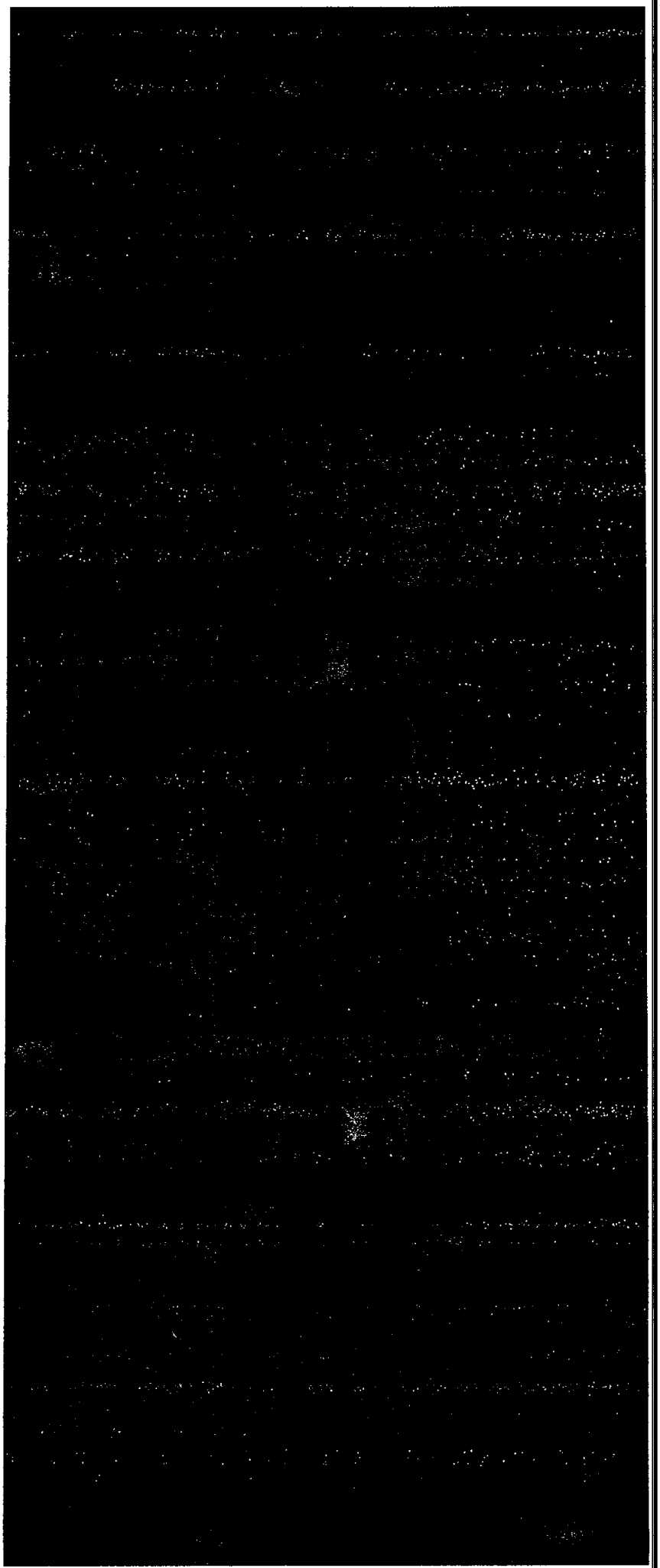

EXHIBIT "B"

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RENO ENGINEERING CORPORATION
CIVIL ENGINEERING • DESIGN • LAND PLANNING

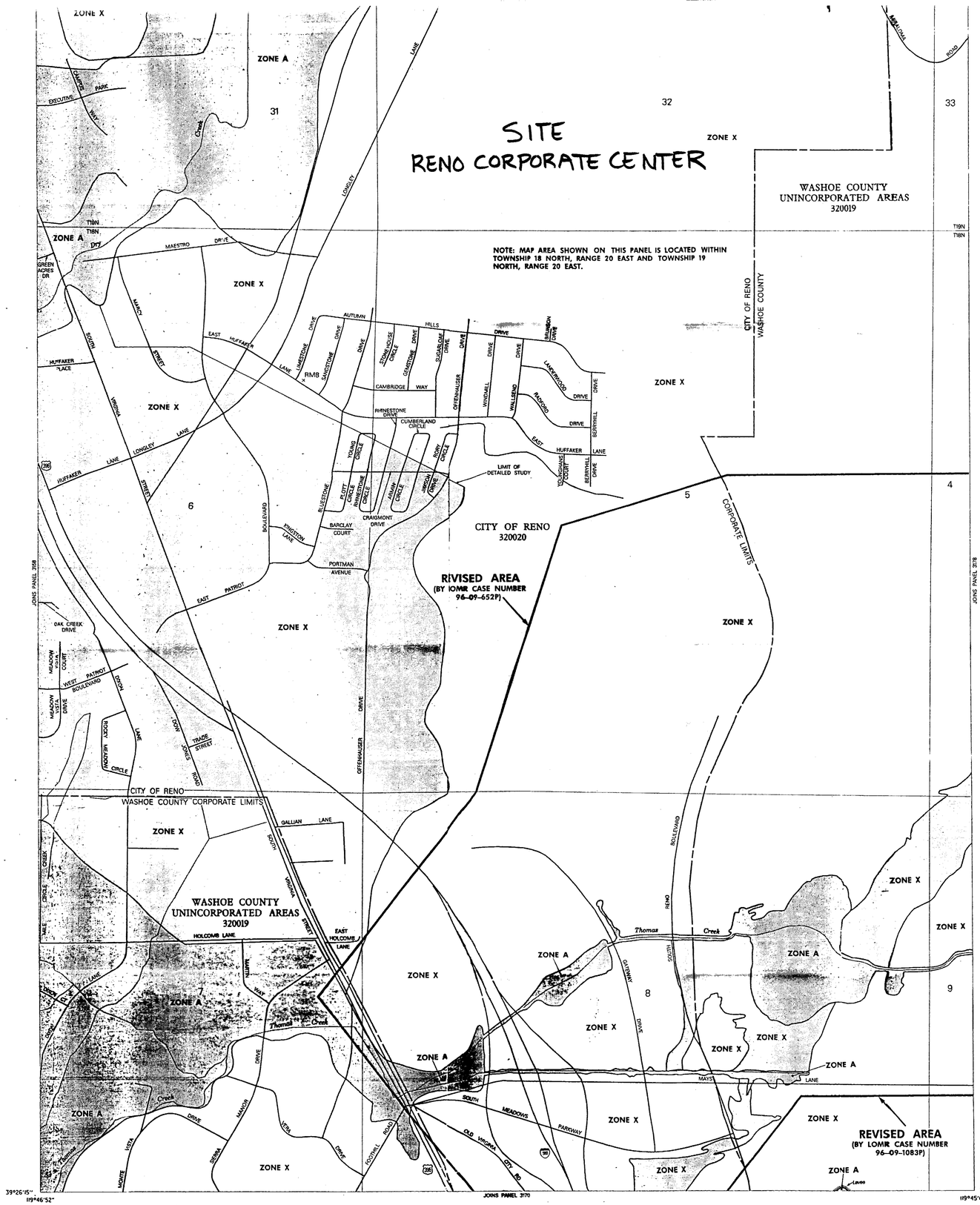
DOUBLE R BOULEVARD - PHASE I & II MASTER DRAINAGE PLAN

DP

J:\DWG-ROAD\double r north\DRAIN-DP.dwg Mon Feb 11 17:20:07 2002 KDK

EXHIBIT "B"

RMB 4459. ... inch diameter steel cap in top of curb at northeast corder of the intersection of Huffaker Lane and Limestone Drive. Stamped with "1346."



FLOOD ZONE DEFINITIONS

ZONE A Areas of 100-year flood; base flood elevations and flood hazard factors not determined.

ZONE AE Areas of 100-year flood; base flood elevations and flood hazard factors determined.

ZONE AH Areas of 100-year shallow flooding; base flood elevations and flood hazard factors determined.

ZONE AO Areas of 100-year shallow flooding; base flood depths and flood hazard factors determined. For areas of alluvial fan flooding, velocities also determined.

ZONE AR To be provided 6 from 100-year flood by Federal flood protection system under construction; no base flood elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

ZONE VE Coastal flood with velocity hazard (wave action); base flood elevations determined.

FLOODWAY AREAS IN ZONE AE

OTHER FLOOD AREAS

ZONE X Areas of 500-year flood; areas of 100-year flood with average depths of less than 1 foot or with drainage areas less than 1 square mile; and areas protected by levees from 100-year flood.

OTHER AREAS

ZONE X Areas determined to be outside 500-year floodplain.

ZONE D Areas in which flood hazards are undetermined.

UNDEVELOPED COASTAL BARRIERS

Identified 1983 | Identified 1990 | Otherwise Protected Areas

Coastal barrier areas are normally located within or adjacent to Special Flood Hazard Areas.

Flood Boundary

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RM7 × — Elevation Reference Mark

M2 — River Mile

97°07'30", 32°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection.

NOTES

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Areas of Special Flood Hazard (100-year flood) include Zones A, AE, AH, AO, A99, V, and VE.

Certain areas not in Special Flood Hazard Areas may be protected by flood control structures.

Boundaries of the floodways were computed at cross sections and interpolated between cross sections. The floodways were based on hydraulic considerations with regard to requirements of the Federal Emergency Management Agency.

Floodway widths in some areas may be too narrow to show to scale. Floodway widths are provided in the Flood Insurance Study Report.

This map may incorporate approximate boundaries of Coastal Barrier Resource System Units and /or Otherwise Protected Areas established under the Coastal Barrier Improvement Act of 1990 (PL 101-591).

Corporate limits shown are current as of the date of this map. The user should contact appropriate community officials to determine if corporate limits have changed subsequent to the issuance of this map.

For community map revision history prior to countywide mapping, see Section 6.0 of the Flood Insurance Study Report.

For adjoining map panels and base map source see separately printed Map Index.

MAP REPOSITORY
Refer to Repository Listing on Map Index

EFFECTIVE DATE OF COUNTYWIDE FLOOD INSURANCE RATE MAP:
SEPTEMBER 30, 1994

EFFECTIVE DATE(S) OF REVISION(S) TO THIS PANEL:

Refer to the FLOOD INSURANCE RATE MAP EFFECTIVE DATE shown on this map to determine when actuarial rates apply to structures in zones where elevations or depths have been established.

To determine if flood insurance is available, contact an insurance agent or call the National Flood Insurance Program at (800) 638-6620.

APPROXIMATE SCALE IN FEET
500 0 500

NATIONAL FLOOD INSURANCE PROGRAM

FIRM
FLOOD INSURANCE RATE MAP

WASHOE COUNTY, NEVADA AND INCORPORATED AREAS

PANEL 3159 OF 3350
(SEE MAP INDEX FOR PANELS NOT PRINTED)

CONTAINS: COMMUNITY	NUMBER	PANEL	SUFFIX
RENO, CITY OF	320020	3158	E
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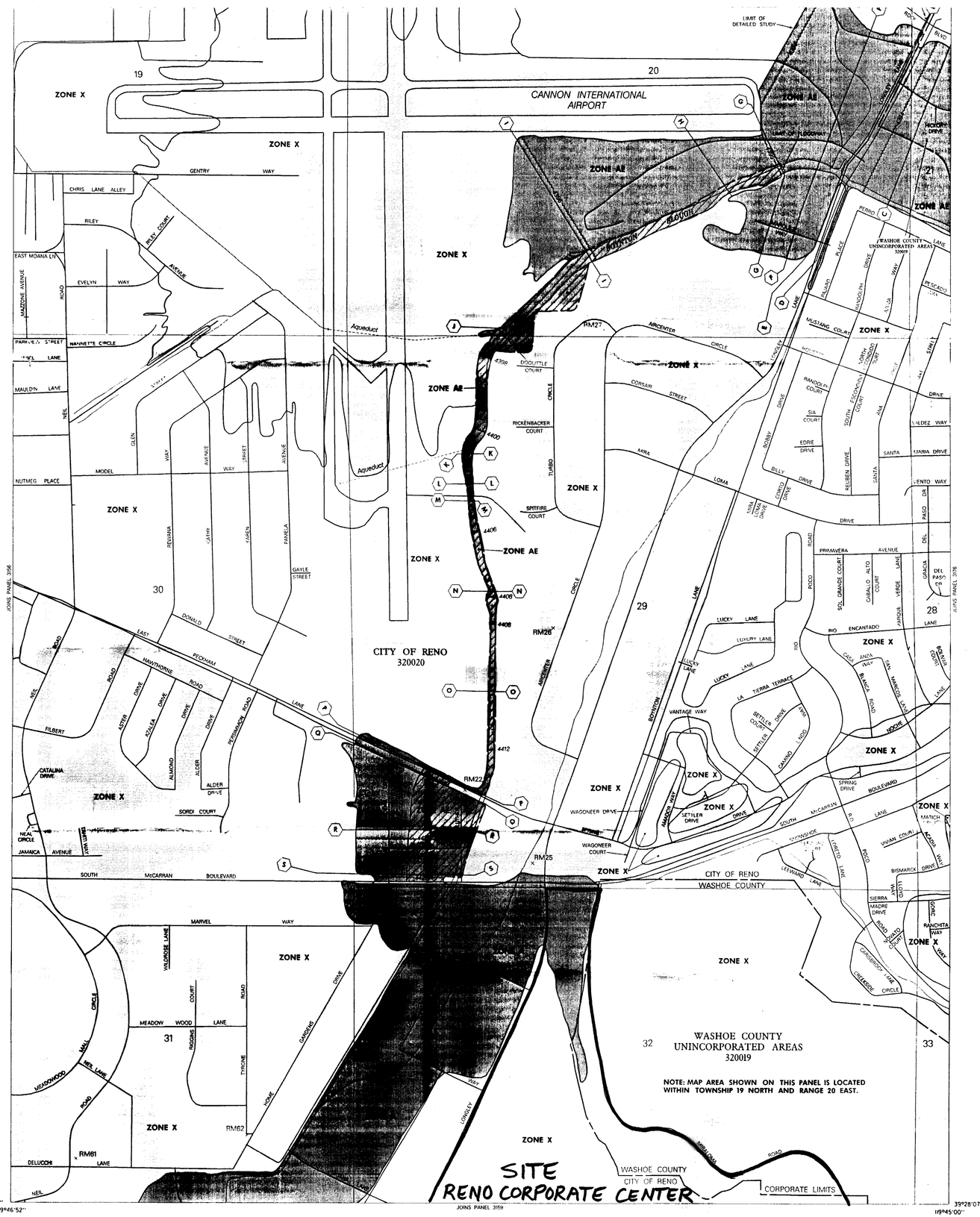
REVISED TO REFLECT LOMR DATED FEB 05 1997

MAP NUMBER 32031C3159 E

EFFECTIVE DATE: SEPTEMBER 30, 1994

Federal Emergency Management Agency

RM24	4421.1	Aluminum spike in power pole number J-53970, approximately 60 feet east of Luther Lane on Peckham Lane. Stamped with "5018M."
RM25	4418.8	City of Reno benchmark approximately 80 feet north of the intersection of McCarran Boulevard and Langley Lane. Nail with washer set in top of curb of north curb return on west side of Langley Lane. Washer stamped with "81480."
RM26	4408.76	1 1/2-inch diameter steel cap in top of curb on the west side of Aircenter Circle, approximately 1,100 feet south of the southerly intersection of Aircenter Circle and Turbo Circle, approximately 75 feet south of light pole number 13670. Stamped with "1547."
RM27	4396.78	1 1/2-inch diameter steel cap in top of southwest curb of northerly intersection of Turbo Circle and Aircenter Circle, approximately 9.5 feet west of handicap ramp. Stamped with "1545."
RM58	4395.12	Nail with washer in light pole base at northwest corner of intersection of Boynton Lane and Rock Boulevard. Remove cover with screwdriver.
RM61	4443.72	1 1/2-inch diameter steel cap in top of curb on the east side of Niel Road, approximately 2.9 feet north of the northeast curb return at Niel Road and DeLucchi Lane. Stamped with "1484."
RM62	4434.96	1 1/2-inch diameter steel cap in top of curb on the west side of Tyrone Road, approximately 2.8 feet southwest of the southwest corner of the intersection of Tyrone Road and Riggins Court. Stamped with "1486."



ZONE DESCRIPTIONS

ZONE A99 To be protected from 100-year flood by Federal flood protection system under construction; no base elevations determined.

ZONE V Coastal flood with velocity hazard (wave action); no base flood elevations determined.

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Base Flood Elevation Line; Elevation in Feet. See Map Index for Elevation Datum.

Cross Section Line

Base Flood Elevation in Feet (EL 987) where Datum is NGVD. See Map Index for Elevation Datum

RM7 × 512 — Elevation Reference Mark

River Mile

97°07'30", 12°22'30" — Horizontal Coordinates Based on North American Datum of 1927 (NAD 27) Projection

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Federal Emergency Management Agency

NOAA ATLAS 2

Precipitation-Frequency Atlas of the Western United States

J. F. Miller, R. H. Frederick, and R. J. Tracey

Volume VII–Nevada

U.S. DEPARTMENT OF COMMERCE
Frederick B. Dent, Secretary

NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION
Robert M. White, Administrator

NATIONAL WEATHER SERVICE
George P. Cressman, Director
Silver Spring, Maryland—1973

Prepared for U.S. Department of Agriculture, Soil Conservation Service, Engineering Division

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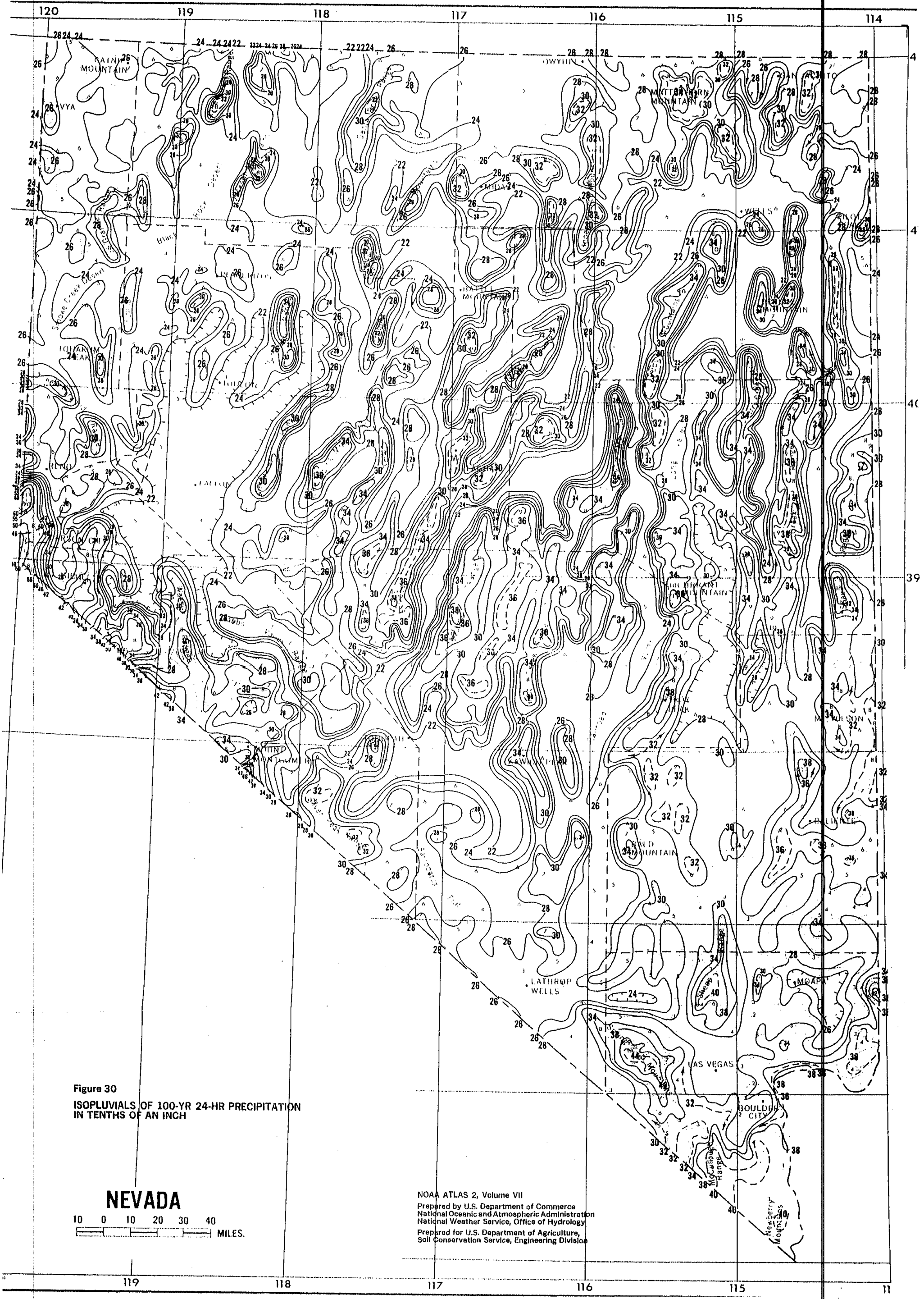


Figure 30

ISOPLUVIALS OF 100-YR 24-HR PRECIPITATION IN TENTHS OF AN INCH

NOAA ATLAS 2, Volume VII

Prepared by U.S. Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service, Office of Hydrology

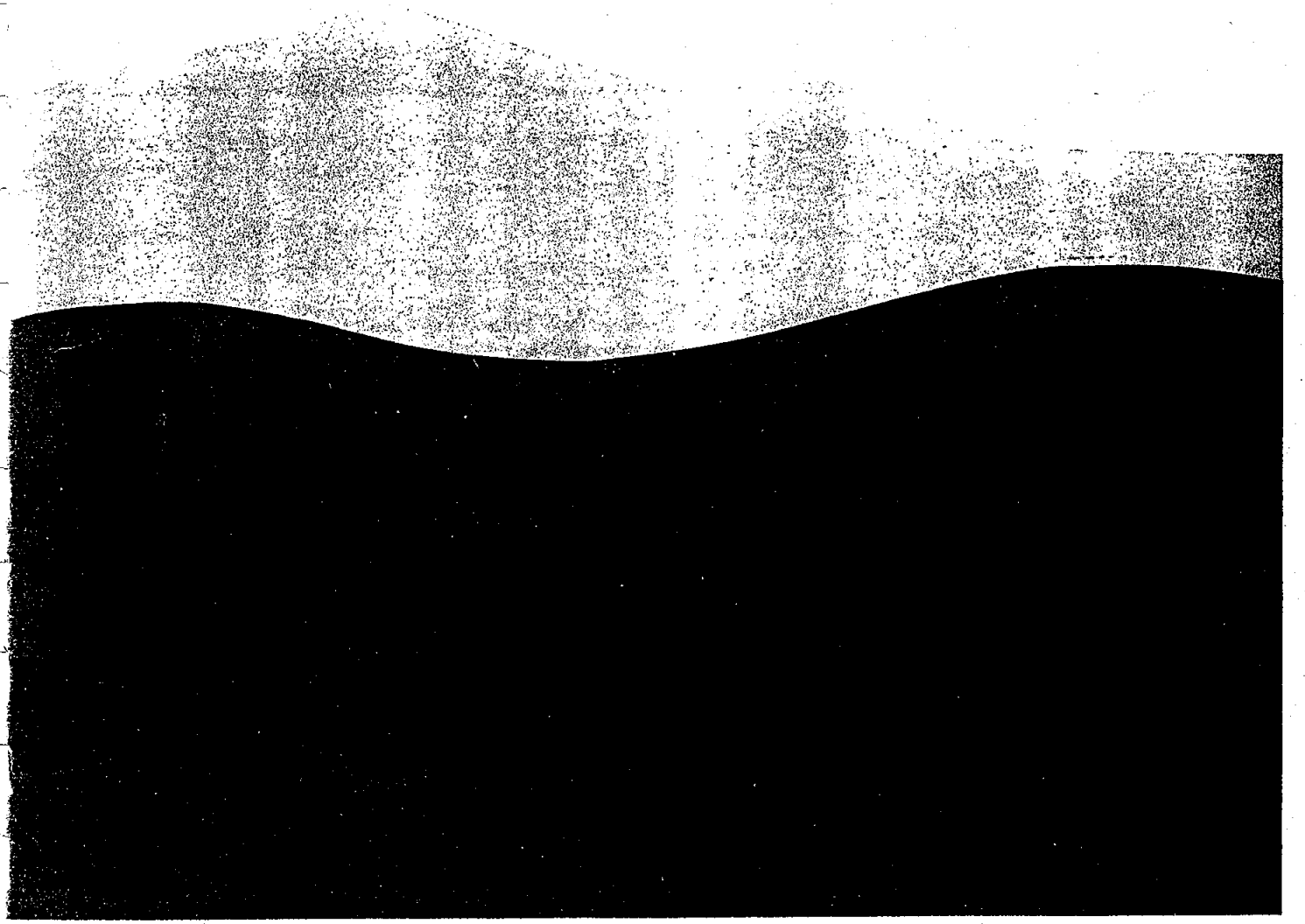
Prepared for U.S. Department of Agriculture,
Soil Conservation Service, Engineering Division

United States Department of Agriculture

Soil Conservation Service

In cooperation with United States Department of Agriculture, Forest Service; United States Department of the Interior, Bureau of Land Management and Bureau of Indian Affairs; and University of Nevada Agricultural Experiment Station

Soil Survey of Washoe County, Nevada, South Part



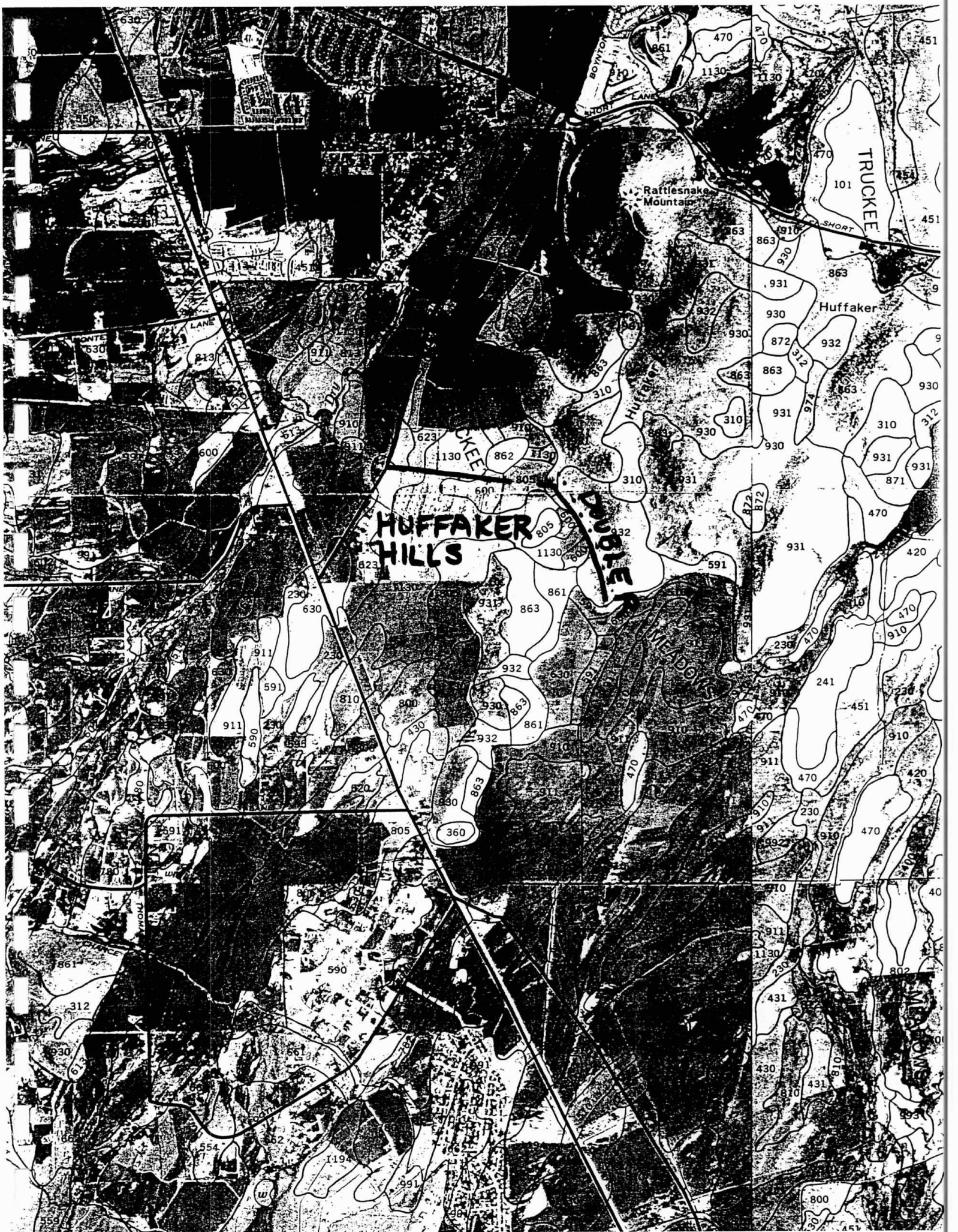

HUFFAKER HILLS
DOUBLE
TRUCKEE
Rattlesnake Mountain
Huffaker
SHORT
LANE
BONTON
MEADOWS

TABLE 15.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
240---------- Updike	D	None----------	---	---	5.0-6.0	Apparent	Feb-May
241---------- Updike	D	Rare----------	---	---	4.0-6.0	Apparent	Mar-Aug
250, 251, 252---------- Cassiro	C	None----------	---	---	>6.0	---	---
260*: Acrelane----------	C	None----------	---	---	>6.0	---	---
Rock outcrop.							
262---------- Acrelane	C	None----------	---	---	>6.0	---	---
280, 281, 282---------- Wedekind	D	None----------	---	---	>6.0	---	---
290, 291---------- Verdico Variant	D	None----------	---	---	>6.0	---	---
300---------- Surgem	C	None----------	---	---	>6.0	---	---
301*, 302*: Surgem----------	C	None----------	---	---	>6.0	---	---
Rock outcrop.							
310*, 311*: Risley----------	D	None----------	---	---	>6.0	---	---
Rock outcrop.							
312, 313---------- Risley	D	None----------	---	---	>6.0	---	---
314*: Risley----------	D	None----------	---	---	>6.0	---	---
Xman----------	D	None----------	---	---	>6.0	---	---
Rock outcrop.							
341---------- Yuko	D	None----------	---	---	>6.0	---	---
342*: Yuko----------	D	None----------	---	---	>6.0	---	---
Reywat----------	D	None----------	---	---	>6.0	---	---
Rock outcrop.							
350---------- Mizel	D	None----------	---	---	>6.0	---	---
351*: Mizel----------	D	None----------	---	---	>6.0	---	---
Skedaddle----------	D	None----------	---	---	>6.0	---	---
Rock outcrop.							

See footnote at end of table.

TABLE 15.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
590, 591, 595---------- Springmeyer	C	None----------	---	---	>6.0	---	---
600, 601---------- Idlewild	D	None----------	---	---	>6.0	---	---
602---------- Idlewild	D	Rare----------	---	---	2.5-5.0	Apparent	Jan-May
612, 613, 614, 615------ Verdico	D	None----------	---	---	>6.0	---	---
620, 621---------- Orr	B	None----------	---	---	>6.0	---	---
622---------- Orr	C	None----------	---	---	>6.0	---	---
623, 624---------- Orr	B	None----------	---	---	>6.0	---	---
630---------- Fleischmann	D	None----------	---	---	>6.0	---	---
631---------- Fleischmann	D	None----------	---	---	>6.0	---	---
632---------- Fleischmann	D	None----------	---	---	>6.0	---	---
640---------- Notus	A	Occasional------	Very brief to brief.	Dec-Apr	4.0-6.0	Apparent	Dec-May
650---------- Chalco	D	None----------	---	---	>6.0	---	---
651, 652, 653---------- Chalco	D	None----------	---	---	>6.0	---	---
654*:							
Chalco----------	D	None----------	---	---	>6.0	---	---
Celeton Variant--------	D	None----------	---	---	>6.0	---	---
660, 661, 662, 663, 664, 668, 669---------- Oest	B	None----------	---	---	>6.0	---	---
670, 671, 673, 674------ Galeppi	B	None----------	---	---	>6.0	---	---
676*:							
Galeppi----------	B	None----------	---	---	>6.0	---	---
Barnard----------	D	None----------	---	---	>6.0	---	---
681, 683---------- Reno	D	None----------	---	---	>6.0	---	---
730, 731---------- Stodick	D	None----------	---	---	>6.0	---	---
740---------- Blackwell	D	Occasional------	Very brief to brief.	Apr-Jun	0.5-2.5	Apparent	Mar-Jul

See footnote at end of table.

TABLE 15.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
752*, 753*: Toiyabe	C	None	---	---	>6.0	---	---
Corbett	B	None	---	---	>6.0	---	---
Rock outcrop.							
754*: Toiyabe	C	None	---	---	>6.0	---	---
Rock outcrop.							
756*: Toiyabe	C	None	---	---	>6.0	---	---
Corbett	B	None	---	---	>6.0	---	---
Haypress	A	None	---	---	>6.0	---	---
772, 775 Booford	C	None	---	---	>6.0	---	---
780, 782 Bieber	D	None	---	---	>6.0	---	---
800 Truckee	C	Rare	---	---	2.5-5.0	Apparent	Dec-Jul
802 Truckee	C	Rare	---	---	2.5-5.0	Apparent	Dec-Jul
805 Truckee	C	Rare	---	---	>6.0	---	---
806 Truckee	C	Rare	---	---	2.5-5.0	Apparent	Dec-Jul
810, 812, 813 Rose Creek	B	Rare	---	---	4.0-6.0	Apparent	Feb-Jul
820, 821 Marla	D	Occasional	Brief	Nov-Apr	1.0-2.0	Apparent	Jan-Jun
830, 831 Fettic	D	Rare	---	---	1.5-3.5	Apparent	Dec-Aug
840*: Temo	C	None	---	---	>6.0	---	---
Witefels	B	None	---	---	>6.0	---	---
Rock outcrop.							
850 Washoe	B	None	---	---	>6.0	---	---
861, 862 Reywat	D	None	---	---	>6.0	---	---
863*: Reywat	D	None	---	---	>6.0	---	---
Rock outcrop.							
870*: Xman	D	None	---	---	>6.0	---	---
Rock outcrop.							

See footnote at end of table.

TABLE 15.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
895*:							
Indiano	C	None	---	---	>6.0	---	---
Zephan	C	None	---	---	>6.0	---	---
Duco	D	None	---	---	>6.0	---	---
900, 901, 903-- Flex	D	None	---	---	>6.0	---	---
910, 911-- Vamp	C	Rare	---	---	2.5-3.5	Apparent	Feb-Jul
930-- Old Camp	D	None	---	---	>6.0	---	---
931*:							
Old Camp-- extremely stony	D	None	---	---	>6.0	---	---
Old Camp-- stony	D	None	---	---	>6.0	---	---
Rock outcrop.							
932-- Old Camp	D	None	---	---	>6.0	---	---
960, 961, 962, 963-- Kayo	B	Rare	---	---	>6.0	---	---
971, 974-- Aladshi	B	Rare	---	---	>6.0	---	---
980, 982-- Koontz	D	None	---	---	>6.0	---	---
990*. Rock outcrop							
991*:							
Xeric Torriorthents.							
Urban land.							
992*. Playas							
993*. Haplaquolls							
994*:							
Badland.							
Chalco	D	None	---	---	>6.0	---	---
Verdico	D	None	---	---	>6.0	---	---
996*:							
Dune land.							
Playas.							
997*. Badland							

See footnote at end of table.

TABLE 15.--WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
					Ft		
998*. Beaches							
1010 Gabica	D	None	---	---	>6.0	---	---
1040, 1041 Orr Variant	B	Rare	---	---	>6.0	---	---
1050, 1051 Waspo	D	None	---	---	>6.0	---	---
1052*: Waspo	D	None	---	---	>6.0	---	---
Rock outcrop.							
1054 Waspo	D	None	---	---	>6.0	---	---
1060*, 1062*: Witefels	B	None	---	---	>6.0	---	---
Rock outcrop.							
1080 Inville Variant	C	Rare	---	---	2.5-3.5	Apparent	Jan-Jun
1090, 1091 Railcity	A	None	---	---	>6.0	---	---
1100*: Graylock	B	None	---	---	>6.0	---	---
Temo	C	None	---	---	>6.0	---	---
Rock outcrop.							
1120, 1121 Apmat	B	None	---	---	>6.0	---	---
1130 Dithod	C	Rare	---	---	4.0-6.0	Apparent	Dec-Aug
1141, 1142, 1143 Bedell	B	Rare	---	---	>6.0	---	---
1160, 1161 Jowec	D	Rare	---	---	>6.0	---	---
1170, 1171, 1172 Wedertz	B	Rare	---	---	>6.0	---	---
1181*, 1182*: Haypress	A	None	---	---	>6.0	---	---
Tanob	B	None	---	---	>6.0	---	---
Rock outcrop.							
1183*: Haypress	A	None	---	---	>6.0	---	---
Rock outcrop.							

See footnote at end of table.

HUFFAKER VILLAGE
PHASE 1

HYDROLOGY

PREPARED FOR: Estate of Thelma Jaksick
Lakeridge Shores
2500 Spinnaker
Reno, NV 89509

PREPARED BY: Shawn K. Gooch, P.E.

JEFF CODEGA
PLANNING/DESIGN, INC.

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433 West Plumb Lane Reno, Nevada 89509 Phone (702) 322-5100 Fax (702) 322-1551

SEPTEMBER 27, 1995

1373.0003

-f 600

HYDROLOGY REPORT

FOR

PARK 2001, EAST HALF

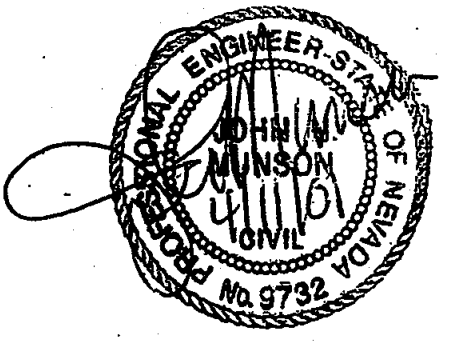
AND

BARRON WAY

prepared by

SUMMIT ENGINEERING CORPORATION
5405 Mae Anne Avenue
Reno, Nevada 89523
(775) 747-8550

April 2001



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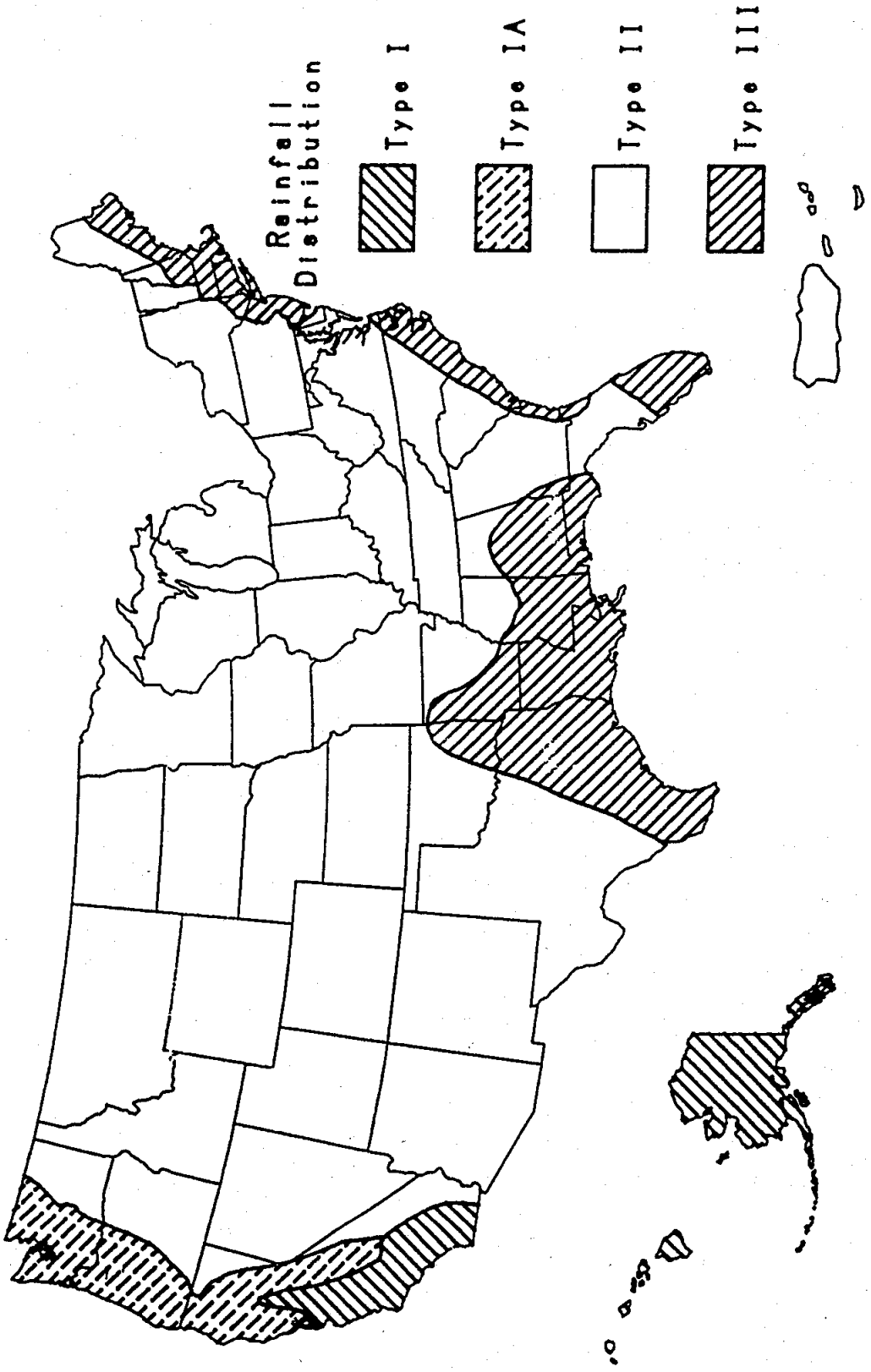


Approximate geographic boundaries for SCS rainfall distributions.

Runoff curve numbers for urban areas[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type and hydrologic condition	Average percent impervious area[2]	A	B	C	D
Fully developed urban areas (vegetation established)					
Open space (lawns, parks, golf courses, cemeteries, etc.)[3]:					
Poor condition (grass cover < 50%)		68	79	86	89
Fair condition (grass cover 50% to 75%)		49	69	79	84
Good condition (grass cover > 75%)		39	61	74	80
Impervious areas:					
Paved parking lots, roofs, driveways, etc. (excluding right-of-way)		98	98	98	98
Streets and roads:					
Paved; curbs and storm sewers (excluding right-of-way)		98	98	98	98
Paved; open ditches (including right-of-way)		83	89	92	93
Gravel (including right-of-way)		76	85	89	91
Dirt (including right-of-way)		72	82	87	89
Western desert urban areas:					
Natural desert landscaping (pervious areas only)[4]		63	77	85	88
Artificial desert landscaping (impervious weed barrier, desert shrub with 1- to 2-inch sand or gravel mulch and basin borders)		96	96	96	96
Urban districts:					
Commercial and business	85	89	92	94	95
Industrial	72	81	88	91	93
Residential districts by average lot size:					
1/8 acre or less (town houses)	65	77	85	90	92
1/4 acre	38	61	75	83	87
1/3 acre	30	57	72	81	86
1/2 acre	25	54	70	80	85
1 acre	20	51	68	79	84
2 acres	12	46	65	77	82
Developing urban areas					
Newly graded areas (pervious areas only, no vegetation)[5]		77	86	91	94
Idle lands (CN's are determined using cover types similar to those in table 2-2c).					

[1]Average runoff condition, and $I_a = 0.2S$.
[2]The average percent impervious area shown was used to develop the composite CN's. Other assumptions are as follows: impervious areas are directly connected to the drainage system, impervious areas have a CN of 98, and pervious areas are considered equivalent to open space in good hydrologic condition. CN's for other combinations of conditions may be computed using figure 2-3 or 2-4.
[3]CN's shown are equivalent to those of pasture. Composite CN's may be computed for other combinations of open space cover type.
[4]Composite CN's for natural desert landscaping should be computed using figures 2-3 or 2-4 based on the impervious area percentage (CN = 98) and the pervious area CN. The pervious area CN's are assumed equivalent to desert shrub in poor hydrologic condition.
[5]Composite CN's to use for the design of temporary measures during grading and construction should be computed using figure 2-3 or 2-4, based on the degree of development (impervious area percentage) and the CN's for the newly graded pervious areas.

This appendix reprinted from S.C.S. TR-55, revised 1986.

Runoff curve numbers for arid and semiarid rangelands[1]

Cover description		Curve numbers for hydrologic soil group—			
Cover type	Hydrologic condition[2]	A[3]	B	C	D
Herbaceous—mixture of grass, weeds, and low-growing brush, with brush the minor element.	Poor		80	87	93
	Fair		71	81	89
	Good		62	74	85
Oak-aspen—mountain brush mixture of oak brush, aspen, mountain mahogany, bitter brush, maple, and other brush.	Poor		66	74	79
	Fair		48	57	63
	Good		30	41	48
Pinyon-juniper—pinyon, juniper, or both; grass understory.	Poor		75	85	89
	Fair		58	73	80
	Good		41	61	71
Sagebrush with grass understory.	Poor		67	80	85
	Fair		51	63	70
	Good		35	47	55
Desert shrub—major plants include saltbush, greasewood, creosotebush, blackbrush, bursage, palo verde, mesquite, and cactus.	Poor	63	77	85	88
	Fair	55	72	81	86
	Good	49	68	79	84

[1]Average runoff condition, and I_a = 0.2S. For range in humid regions, use table 2-2c.

[2]*Poor:* <30% ground cover (litter, grass, and brush overstory).
Fair: 30 to 70% ground cover.
Good: >70% ground cover.

[3]Curve numbers for group A have been developed only for desert shrub.

Section 22 - Determining the Time of Concentration

One of the key elements required for any runoff calculation is the *Time of Concentration*, or T_c. The T_c is commonly defined as the time required for runoff to travel from the most hydrologically distant point of the watershed to the point of collection.

The time of concentration is commonly determined by summing the travel time (T_t) for each consecutive *flow segment* along the subcatchment's hydraulic path. This process requires identification of the type of flow occurring in each segment, and application of the appropriate method for calculating the T_t. Although these segments will occur in a given physical order, the order in which they are used in the program has no effect on the total travel time.

HydroCAD provides a variety of techniques for calculating the T_t, plus other procedures (such as the Curve Number method) which are designed to directly determine the overall T_c. These procedures are discussed below. If necessary, the T_c or T_t may also be determined by other procedures and entered into HydroCAD directly.

The determination of the time of concentration is one of the most widely discussed areas of hydrology. The actual method(s) used on any given project depends upon actual site conditions, regulatory requirements, and sound engineering judgement.

Curve Number Method

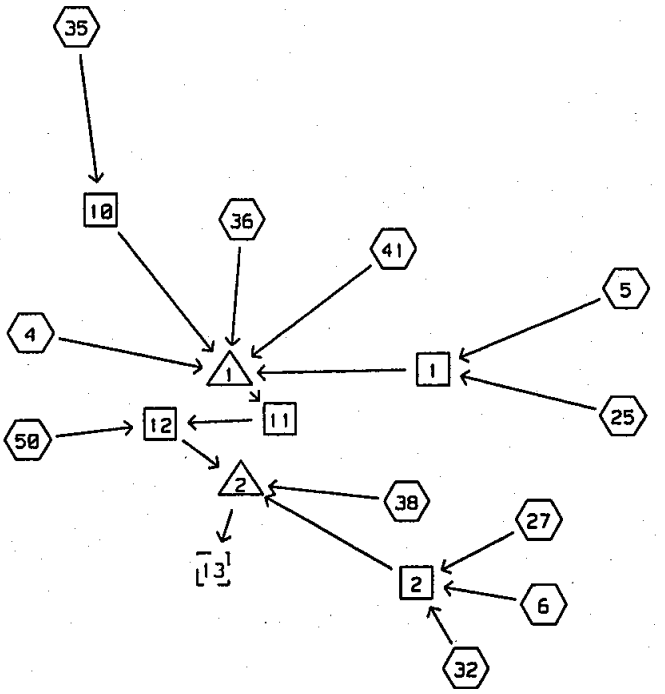
The Curve Number Method [10 p.15-7] was developed to allow calculation of the overall T_c under a wide range of conditions. The method is designed for areas of 2000 acres or less. The calculation is quite simple, but requires a proper understanding of the input requirements:

$$T_c=\frac{L}{.6} \quad \textit{where} \quad L=\frac{l^{.8}\,(s+1)^{.7}}{1900\,Y^{.5}} \quad \textit{and} \quad S=\frac{1000}{CN}-10 \qquad \text{Eq. 7}$$

T_C=Time of concentration [hours]
L=Lag time [hours]
l=Hydraulic length of the watershed [feet]
Y=Average land slope [percent]
S=Potential maximum retention [inches]
CN=Weighted Curve Number (See tables on page 137)

Note the use of the average *land* slope, and not the slope of the hydraulic path. Determining this accurately requires placing a grid over the subcatchment and averaging the slopes for all squares. Although some care is required to determine this value, the Curve Number method has the advantage of using a small number of fairly objective parameters. This provides more consistent results than some other approaches.

WATERSHED ROUTING ==========



*	**SUBCATCHMENT 4**	= AREA 4 (Street)	->	POND 1
	SUBCATCHMENT 5	= AREA 5	->	REACH 1
	SUBCATCHMENT 6	= AREA 6	->	REACH 2
*	**SUBCATCHMENT 25**	= AREA 25 (Street)	->	REACH 1
*	**SUBCATCHMENT 27**	= AREA 27 (Street)	->	REACH 2
*	**SUBCATCHMENT 32**	= AREA 32 (Area 91) (Street)	->	REACH 2
	SUBCATCHMENT 35	= AREA 35	->	REACH 10
	SUBCATCHMENT 36	= AREA 36	->	POND 1
	SUBCATCHMENT 38	= AREA 38	->	POND 2
	SUBCATCHMENT 41	= AREA 41	->	POND 1
*	**SUBCATCHMENT 50**	= STREET SECTION UPSTREAM POND#2 (Area 90) (Street)	->	REACH 12

(2)	**REACH 1**	= STORM DRAIN 1 (2) 30" From Area 5	->	POND 1
(6)	**REACH 2**	= STORM DRAIN 2 (3) 24" From Area 6	->	POND 2
	REACH 10	= CHANNEL 10 (Double R Roadside Ditch)	->	POND 1
(4)	**REACH 11**	= SD TO MH UPSTREAM OF POND#2	->	REACH 12
(5)	**REACH 12**	= SD TO POND#2	->	POND 2
	POND 1	= DETENTION POND 1	->	REACH 11
	~~**POND 1 secondary**~~	~~= DETENTION POND 1~~	~~->~~	~~REACH 11~~
	POND 2	= DETENTION POND 2	->	REACH 13

* Head Losses through catch basins and pipe runs assumed negligible for runoff from street sections.

(#) Reference # for Storm Drain as shown on Exhibit "B" and Table 1 of Drainage Report.

SUBCATCHMENT 4 **AREA 4**

PEAK= 13.90 CFS @ 12.04 HRS, VOLUME= .85 AF

ACRES	CN	
4.98	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 4 FLOWPATH**	15.7
L=2100' s=.03 '/'		

SUBCATCHMENT 5 **AREA 5**

PEAK= 31.79 CFS @ 12.19 HRS, VOLUME= 2.67 AF

ACRES	CN	
17.00	95	INDUSTRIAL DEVELOPMENT

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 5 FLOWPATH**	28.5
L=1170' s=.005 '/'		

SUBCATCHMENT 6 **AREA 6**

PEAK= 21.99 CFS @ 12.14 HRS, VOLUME= 1.67 AF

ACRES	CN	
11.03	94	INDUSTRIAL DEVELOPMENT

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 6 FLOWPATH**	24.2
L=1200' s=.008 '/'		

SUBCATCHMENT 25 **AREA 25**

PEAK= 2.86 CFS @ 12.07 HRS, VOLUME= .19 AF

ACRES	CN	
1.09	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 25 FLOWPATH**	17.9
L=900' s=.006 '/'		

SUBCATCHMENT 27 **AREA 27**

PEAK= .95 CFS @ 11.93 HRS, VOLUME= .04 AF

ACRES	CN	
.25	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 27 FLOWPATH**	5.4
L=200' s=.006 '/'		

SUBCATCHMENT 32 **AREA 32**

PEAK= 4.65 CFS @ 11.99 HRS, VOLUME= .24 AF

ACRES	CN	
1.43	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 32 FLOWPATH**	10.6
L=470' s=.006 '/'		

SUBCATCHMENT 35 **AREA 35**

PEAK= 5.78 CFS @ 11.97 HRS, VOLUME= .28 AF

ACRES	CN	
6.83	70	HSG D, SAGEBRUSH, FAIR COVER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 35 FLOWPATH**	6.9
L=650' s=.1908 '/'		

SUBCATCHMENT 36 **AREA 36**

PEAK= 12.35 CFS @ 12.13 HRS, VOLUME= .99 AF

ACRES	CN	
24.43	70	HSG D, SAGEBRUSH, FAIR COVER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 36 FLOWPATH**	19.9
L=2270' s=.1678 '/'		

SUBCATCHMENT 38 **AREA 38**

PEAK= 8.78 CFS @ 11.95 HRS, VOLUME= .39 AF

ACRES	CN	
9.49	70	HSG D, SAGEBRUSH, FAIR COVER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 38 FLOWPATH**	5.2

L=650' s=.3277 '/'

SUBCATCHMENT 41 **AREA 41**

PEAK= 15.17 CFS @ 11.97 HRS, VOLUME= .72 AF

ACRES	CN	
17.74	70	HSG D, SAGEBRUSH, FAIR COVER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 41 FLOWPATH**	6.7

L=850' s=.3122 '/'

SUBCATCHMENT 50 **STREET SECTION UPSTREAM POND#2**

PEAK= 4.41 CFS @ 11.99 HRS, VOLUME= .23 AF

ACRES	CN	
1.35	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.05 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**STREET SECTION FLOW PATH**	10.4

L=460' s=.006 '/'

REACH 1 **STORM DRAIN 1**

Qin = 33.89 CFS @ 12.18 HRS, VOLUME= 2.85 AF
Qout= 33.73 CFS @ 12.20 HRS, VOLUME= 2.85 AF, ATTEN= 0%, LAG= 1.2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.25	.51	.73
.50	1.40	3.06
.75	2.48	6.84
1.75	7.34	29.23
2.00	8.42	34.12
2.25	9.31	37.20
2.35	9.58	37.55
2.43	9.73	37.20
2.50	9.82	34.91

30" PIPE X 2
n= .014
LENGTH= 135 FT
SLOPE= .0021 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.98 FT
PEAK VELOCITY= 4.0 FPS
TRAVEL TIME = .6 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 2 **STORM DRAIN 2**

Qin = 24.23 CFS @ 12.11 HRS, VOLUME= 1.96 AF
Qout= 24.07 CFS @ 12.14 HRS, VOLUME= 1.95 AF, ATTEN= 1%, LAG= 1.4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.49	.60
.40	1.34	2.53
.60	2.38	5.66
1.40	7.05	24.18
1.60	8.08	28.23
1.80	8.93	30.78
1.88	9.19	31.06
1.94	9.34	30.78
2.00	9.42	28.88

24" PIPE X 3
n= .014
LENGTH= 154 FT
SLOPE= .0021 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.39 FT
PEAK VELOCITY= 3.4 FPS
TRAVEL TIME = .7 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 10 **CHANNEL 10**

Qin = 5.78 CFS @ 11.97 HRS, VOLUME= .28 AF
Qout= 5.24 CFS @ 12.04 HRS, VOLUME= .28 AF, ATTEN= 9%, LAG= 3.9 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.01	.02
.40	.05	.12
.60	.12	.36
.86	.25	.95
1.20	.48	2.31
1.60	.85	4.97
2.00	1.33	9.01

0' x 2' CHANNEL
SIDE SLOPE= 3 '/'
n= .027
LENGTH= 750 FT
SLOPE= .07 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.65 FT
PEAK VELOCITY= 6.0 FPS
TRAVEL TIME = 2.1 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 11 **SD TO MH UPSTREAM OF POND#2**

Qin = 16.10 CFS @ 12.97 HRS, VOLUME= 9.28 AF
Qout= 16.10 CFS @ 13.00 HRS, VOLUME= 9.25 AF, ATTEN= 0%, LAG= 2.3 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.34
.40	.45	1.42
.60	.79	3.19
1.40	2.35	13.62
1.60	2.69	15.90
1.80	2.98	17.34
1.88	3.06	17.50
1.94	3.11	17.34
2.00	3.14	16.27

24" PIPE
n= .014
LENGTH= 350 FT
SLOPE= .006 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.63 FT
PEAK VELOCITY= 5.9 FPS
TRAVEL TIME = 1.0 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 12 **SD TO POND#2**

Qin = 16.35 CFS @ 12.93 HRS, VOLUME= 9.48 AF
Qout= 16.35 CFS @ 12.94 HRS, VOLUME= 9.47 AF, ATTEN= 0%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.20	.16	.58
.40	.45	2.42
.60	.79	5.41
1.40	2.35	23.13
1.60	2.69	27.01
1.80	2.98	29.45
1.88	3.06	29.72
1.94	3.11	29.45
2.00	3.14	27.63

24" PIPE
n= .014
LENGTH= 126 FT
SLOPE= .0173 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.09 FT
PEAK VELOCITY= 9.3 FPS
TRAVEL TIME = .2 MIN
SPAN= 10-20 HRS, dt=.05 HRS

POND 1 **DETENTION POND 1**

Qin = 69.95 CFS @ 12.08 HRS, VOLUME= 10.67 AF, INCL. BASE FLOW= 6 CFS
Qout= 16.10 CFS @ 12.97 HRS, VOLUME= 9.28 AF, ATTEN= 77%, LAG= 53.1 MIN

ELEVATION (FT)	AREA (AC)	INC.STOR (AF)	CUM.STOR (AF)
4437.0	.42	0.00	0.00
4438.0	.48	.45	.45
4439.0	.55	.52	.97
4440.0	.62	.59	1.55
4441.0	.68	.65	2.20
4442.0	.75	.72	2.92
4443.0	.83	.79	3.71
4444.0	.90	.87	4.57

STOR-IND METHOD
PEAK STORAGE = 3.39 AF
PEAK ELEVATION= 4442.6 FT
FLOOD ELEVATION= 4444.0 FT
START ELEVATION= 4437.0 FT
SPAN= 10-20 HRS, dt=.05 HRS
Tdet= 120.2 MIN (9.28 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	4437.0'	**18" CULVERT** n=.014 L=90' S=.003'/' Ke=.5 Cc=.9 Cd=.6

POND 2 **DETENTION POND 2**

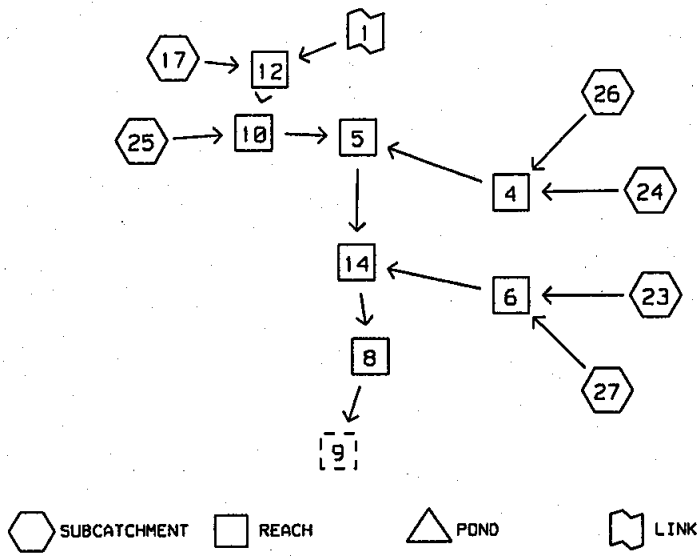
Qin = 39.52 CFS @ 12.10 HRS, VOLUME= 11.81 AF
Qout= 17.16 CFS @ 14.22 HRS, VOLUME= 10.73 AF, ATTEN= 57%, LAG= 126.9 MIN

ELEVATION (FT)	AREA (AC)	INC.STOR (AF)	CUM.STOR (AF)
4431.0	.20	0.00	0.00
4432.0	.28	.24	.24
4433.0	.36	.32	.56
4434.0	.43	.40	.96
4435.0	.51	.47	1.43
4436.0	.60	.55	1.98
4437.0	.68	.64	2.62

STOR-IND METHOD
PEAK STORAGE = 2.04 AF
PEAK ELEVATION= 4436.1 FT
FLOOD ELEVATION= 4437.0 FT
START ELEVATION= 4431.0 FT
SPAN= 10-20 HRS, dt=.05 HRS
Tdet= 74.2 MIN (10.67 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	4431.0'	**21" CULVERT** n=.014 L=189' S=.0021'/' Ke=.5 Cc=.9 Cd=.6

WATERSHED ROUTING ==========



(#) - Reference # for storm drain as shown on Exhibit "B" and Table 1 of Drainage Report.

*	SUBCATCHMENT 17	= STREET SECTION (Area 92) (Street)	->	REACH 12
	SUBCATCHMENT 23	= AREA 23	->	REACH 6
	SUBCATCHMENT 24	= AREA 24	->	REACH 4
*	SUBCATCHMENT 25	= AREA 25 (Area 94) (Street)	->	REACH 10
*	SUBCATCHMENT 26	= AREA 26 (Area 93) (Street)	->	REACH 4
*	SUBCATCHMENT 27	= STREET SECTION (Area 95) (Street)	->	REACH 6
(10)	REACH 4	= STORM DRAIN 4 30" SD From Area 24	->	REACH 5
(12)	REACH 5	= STORM DRAIN 5 42" SD	->	REACH 14
(11)	REACH 6	= STORM DRAIN 6 30" SD From Area 23	->	REACH 14
	REACH 8	= STORM DRAIN 15 48" SD (FUTURE CONNECTION)	->	REACH 9
(9)	REACH 10	= SD 10 30" SD IN STREET TO 42" SD	->	REACH 5
(8)	REACH 12	= SD DOWNSTREAM OF POND#2 & OUTLET	->	REACH 10
(13)	REACH 14	= STORM DRAIN 14 ~~FUTURE~~ NEW 48" SD	->	REACH 8
	LINK 1	= DOUBLE R NORTH 2 - PART A	->	REACH 12

* Head losses through catch basins and pipe runs assumed negligible for runoff from street sections.

SUBCATCHMENT 17 **STREET SECTION**

PEAK= 4.17 CFS @ 11.96 HRS, VOLUME= .23 AF

ACRES	CN	
1.35	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**STREET FLOW PATH**	10.1

L=440' s=.006 '/'

SUBCATCHMENT 23 **AREA 23**

PEAK= 18.66 CFS @ 12.22 HRS, VOLUME= 1.71 AF

ACRES	CN	
11.31	94	INDUSTRIAL DEVELOPMENT

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 23 FLOWPATH**	32.6

L=1300' s=.005 '/'

SUBCATCHMENT 24 **AREA 24**

PEAK= 17.91 CFS @ 12.22 HRS, VOLUME= 1.64 AF

ACRES	CN	
10.85	94	INDUSTRIAL DEVELOPMENT

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 24 FLOWPATH**	32.6

L=1300' s=.005 '/'

SUBCATCHMENT 25 **AREA 25**

PEAK= 1.91 CFS @ 11.94 HRS, VOLUME= .11 AF

ACRES	CN	
.62	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 25 FLOWPATH**	9.2

L=390' s=.006 '/'

SUBCATCHMENT 26 **AREA 26**

PEAK= 1.76 CFS @ 11.94 HRS, VOLUME= .10 AF

ACRES	CN	
.57	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 26 FLOWPATH**	9.2

L=390' s=.006 '/'

SUBCATCHMENT 27 **STREET SECTION**

PEAK= 5.08 CFS @ 11.93 HRS, VOLUME= .27 AF

ACRES	CN	
1.60	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**STREET SECTION 1 FLOW PATH**	8.4

L=350' s=.006 '/'

REACH 4 **STORM DRAIN 4**

Qin = 18.23 CFS @ 12.21 HRS, VOLUME= 1.74 AF
Qout= 18.14 CFS @ 12.22 HRS, VOLUME= 1.74 AF, ATTEN= 0%, LAG= .5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.25	.26	.44
.50	.70	1.83
.75	1.24	4.09
1.75	3.67	17.47
2.00	4.21	20.39
2.25	4.65	22.23
2.35	4.79	22.44
2.43	4.87	22.23
2.50	4.91	20.86

30" PIPE
n= .014
LENGTH= 74 FT
SLOPE= .003 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.81 FT
PEAK VELOCITY= 4.8 FPS
TRAVEL TIME = .3 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 5 **STORM DRAIN 5**

Qin = 32.70 CFS @ 12.21 HRS, VOLUME= 12.74 AF
Qout= 32.61 CFS @ 12.22 HRS, VOLUME= 12.74 AF, ATTEN= 0%, LAG= .5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.35	.50	.76
.70	1.37	3.17
1.05	2.43	7.09
2.45	7.19	30.29
2.80	8.25	35.37
3.15	9.12	38.56
3.29	9.39	38.92
3.40	9.54	38.56
3.50	9.62	36.18

42" PIPE
n= .014
LENGTH= 49 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.61 FT
PEAK VELOCITY= 4.2 FPS
TRAVEL TIME = .2 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 6 **STORM DRAIN 6**

Qin = 19.51 CFS @ 12.20 HRS, VOLUME= 1.99 AF
Qout= 19.36 CFS @ 12.22 HRS, VOLUME= 1.99 AF, ATTEN= 1%, LAG= .7 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.25	.26	.44
.50	.70	1.83
.75	1.24	4.09
1.75	3.67	17.47
2.00	4.21	20.39
2.25	4.65	22.23
2.35	4.79	22.44
2.43	4.87	22.23
2.50	4.91	20.86

30" PIPE
n= .014
LENGTH= 118 FT
SLOPE= .003 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 1.92 FT
PEAK VELOCITY= 4.8 FPS
TRAVEL TIME = .4 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 8 **STORM DRAIN 15**

Qin = 51.64 CFS @ 12.24 HRS, VOLUME= 14.71 AF
Qout= 51.65 CFS @ 12.24 HRS, VOLUME= 14.70 AF, ATTEN= 0%, LAG= .4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	1.28
.80	1.79	5.35
1.20	3.17	11.97
2.80	9.40	51.18
3.20	10.78	59.75
3.60	11.91	65.15
3.76	12.26	65.75
3.88	12.46	65.14
4.00	12.57	61.12

48" PIPE
n= .014
LENGTH= 50 FT
SLOPE= .0021 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.82 FT
PEAK VELOCITY= 5.5 FPS
TRAVEL TIME = .2 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 10 **SD 10**

Qin = 17.35 CFS @ 14.10 HRS, VOLUME= 11.03 AF
Qout= 17.35 CFS @ 14.13 HRS, VOLUME= 11.00 AF, ATTEN= 0%, LAG= 2.0 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.25	.26	.36
.50	.70	1.49
.75	1.24	3.34
1.75	3.67	14.26
2.00	4.21	16.65
2.25	4.65	18.15
2.35	4.79	18.32
2.43	4.87	18.15
2.50	4.91	17.03

30" PIPE
n= .014
LENGTH= 200 FT
SLOPE= .002 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.12 FT
PEAK VELOCITY= 4.0 FPS
TRAVEL TIME = .8 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 12 **SD DOWNSTREAM OF POND#2**

Qin = 17.29 CFS @ 14.14 HRS, VOLUME= 10.96 AF
Qout= 17.29 CFS @ 14.17 HRS, VOLUME= 10.93 AF, ATTEN= 0%, LAG= 1.5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.25	.26	.36
.50	.70	1.49
.75	1.24	3.34
1.75	3.67	14.26
2.00	4.21	16.65
2.25	4.65	18.15
2.35	4.79	18.32
2.43	4.87	18.15
2.50	4.91	17.03

30" PIPE
n= .014
LENGTH= 194 FT
SLOPE= .002 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.11 FT
PEAK VELOCITY= 4.0 FPS
TRAVEL TIME = .8 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 14 **STORM DRAIN 14**

Qin = 51.93 CFS @ 12.21 HRS, VOLUME= 14.72 AF
Qout= 51.64 CFS @ 12.24 HRS, VOLUME= 14.71 AF, ATTEN= 1%, LAG= 1.4 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	1.08
.80	1.79	4.52
1.20	3.17	10.12
2.80	9.40	43.25
3.20	10.78	50.49
3.60	11.91	55.06
3.76	12.26	55.57
3.88	12.46	55.06
4.00	12.57	51.66

48" PIPE
n= .014
LENGTH= 100 FT
SLOPE= .0015 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 3.30 FT
PEAK VELOCITY= 4.7 FPS
TRAVEL TIME = .4 MIN
SPAN= 10-20 HRS, dt=.05 HRS

LINK 1 **DOUBLE R NORTH 2 - PART A**

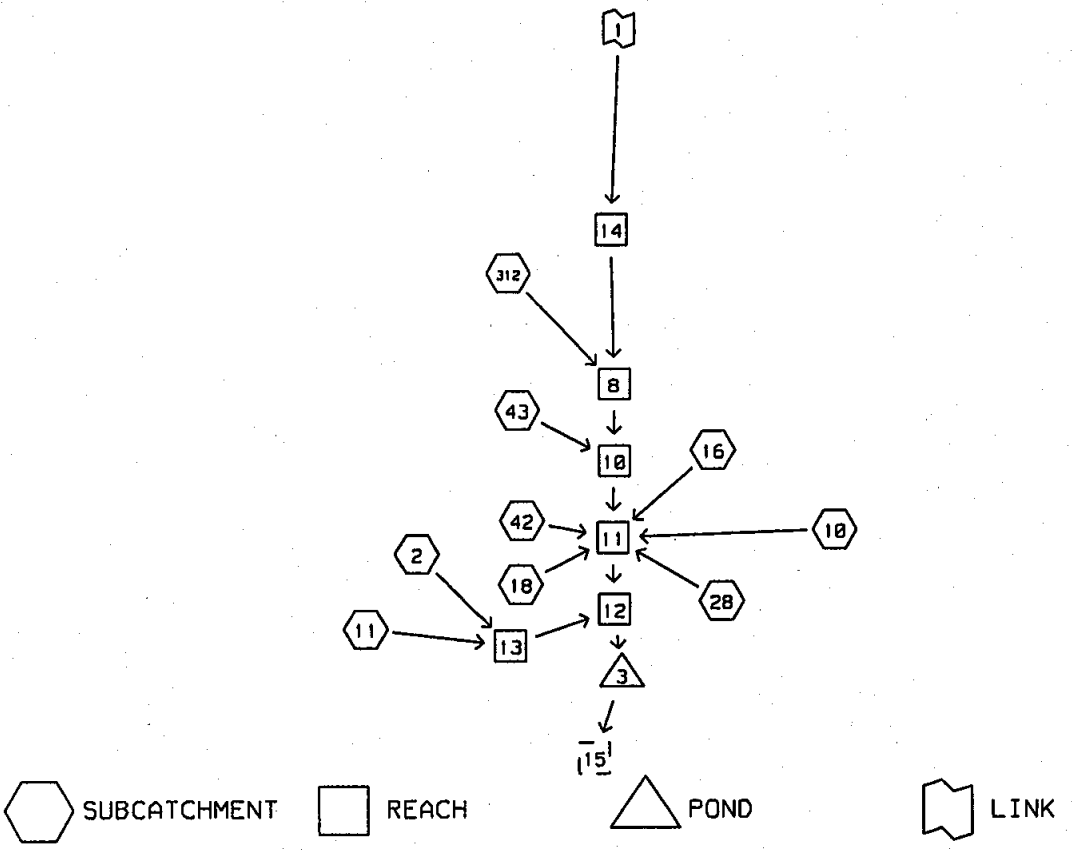
Qout= 17.16 CFS @ 14.22 HRS, VOLUME= 10.73 AF, SPAN= 10-20 HRS, dt=.05 HRS

POND 2 from **DOUBLE R NORTH 2 - PART A**
"DETENTION POND 2"

(PRELIMINARY) - Update For Final Design

Data for **DOUBLE R NORTH 2 - PART C DUP1**
TYPE II 24-HOUR RAINFALL= 2.70 IN
Prepared by RENO ENGINEERING 11 Feb 02

WATERSHED ROUTING ==========



	SUBCATCHMENT 2	= AREA 2	-> **REACH 13**
	SUBCATCHMENT 10	= AREA 10 & AREA 9	-> **REACH 11**
	SUBCATCHMENT 11	= AREA 11 & 30	-> **REACH 13**
*	**SUBCATCHMENT 16**	= AREA 16 (Street)	-> **REACH 11**
*	**SUBCATCHMENT 18**	= AREA 18 STREET SECTION (Street)	-> **REACH 11**
*	**SUBCATCHMENT 28**	= AREA 28 STREET SECTION (Street)	-> **REACH 11**
	SUBCATCHMENT 42	= AREA 42	-> **REACH 11**
	SUBCATCHMENT 43	= AREA 43	-> **REACH 10**
	SUBCATCHMENT 312	= AREA 31 & AREA 37	-> **REACH 8**
	REACH 8	= STORM DRAIN 8	-> **REACH 10**
	REACH 10	= STORM DRAIN 10	-> **REACH 11**

REACH 11	= STORM DRAIN TO NORTH CHANNEL	->	REACH 12
REACH 12	= NORTH CHANNEL 2	->	POND 3
REACH 13	= NORTH CHANNEL 1	->	REACH 12
REACH 14	= STORM DRAIN 14	->	REACH 8
POND 3	= DETENTION POND #3	->	REACH 15
LINK 1	= DOUBLE R NORTH 2 - PART B DUP1	->	REACH 14

* Head losses through catch basins and pipe runs assumed negligible for runoff from street section.

SUBCATCHMENT 2 **AREA 2**

PEAK= 37.05 CFS @ 12.56 HRS, VOLUME= 5.75 AF

ACRES	CN	
144.82	70	HSG D, SAGEBRUSH, FAIR COVER

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 2 FLOWPATH**	51.7

L=3500' s=.05 '/'

SUBCATCHMENT 10 **AREA 10 & AREA 9**

PEAK= 32.18 CFS @ 12.11 HRS, VOLUME= 2.40 AF

ACRES	CN	
12.74	94	INDUSTRIAL DEVELOPMENT
18.14	70	HSG D, SAGEBRUSH, FAIR COVER
30.88	80	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 10 FLOWPATH**	21.8

L=2600' s=.0977 '/'

SUBCATCHMENT 11 **AREA 11 & 30**

PEAK= 48.90 CFS @ 11.97 HRS, VOLUME= 2.61 AF

ACRES	CN	
16.09	94	INDUSTRIAL DEVELOPMENT
8.28	70	HSG D, SAGEBRUSH, FAIR COVER
24.37	86	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 11 FLOWPATH**	10.1

L=1600' s=.14 '/'

SUBCATCHMENT 16 **AREA 16**

PEAK= 4.16 CFS @ 12.12 HRS, VOLUME= .33 AF

ACRES	CN	
1.90	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 16 FLOWPATH**	24.7

L=1350' s=.006 '/'

SUBCATCHMENT 18 **AREA 18 STREET SECTION**

PEAK= 4.23 CFS @ 12.08 HRS, VOLUME= .30 AF

ACRES	CN	
1.78	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 18 FLOWPATH**	21.0

L=1100' s=.006 '/'

SUBCATCHMENT 28 **AREA 28 STREET SECTION**

PEAK= 1.46 CFS @ 11.91 HRS, VOLUME= .07 AF

ACRES	CN	
.44	98	STREET SECTION

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 28 FLOWPATH**	7.4

L=300' s=.006 '/'

SUBCATCHMENT 42 **AREA 42**

PEAK= 23.23 CFS @ 12.18 HRS, VOLUME= 2.01 AF

ACRES	CN	
13.27	94	INDUSTRIAL DEVELOPMENT

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 42 FLOWPATH**	29.5

L=1150' s=.005 '/'

SUBCATCHMENT 43 **AREA 43**

PEAK= 25.69 CFS @ 12.16 HRS, VOLUME= 2.14 AF

ACRES	CN	
14.14	94	INDUSTRIAL DEVELOPMENT

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 43 FLOWPATH**	27.5

L=1050' s=.005 '/'

SUBCATCHMENT 312 **AREA 31 & AREA 37**

PEAK= 19.39 CFS @ 11.96 HRS, VOLUME= 1.03 AF

ACRES	CN	
6.06	94	INDUSTRIAL DEVELOPMENT
4.53	70	HSG D, SAGEBRUSH, FAIR COVER
10.59	84	

SCS TR-20 METHOD
TYPE II 24-HOUR
RAINFALL= 2.70 IN
SPAN= 10-20 HRS, dt=.1 HRS

Method	Comment	Tc (min)
CURVE NUMBER (LAG) METHOD	**AREA 31 & 37 FLOWPATH**	9.1

L=1300' s=.1423 '/'

REACH 8 **STORM DRAIN 8**

Qin = 54.75 CFS @ 12.27 HRS, VOLUME= 15.66 AF
Qout= 54.62 CFS @ 12.29 HRS, VOLUME= 15.62 AF, ATTEN= 0%, LAG= 1.5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	1.53
.80	1.79	6.40
1.20	3.17	14.31
2.80	9.40	61.17
3.20	10.78	71.41
3.60	11.91	77.86
3.76	12.26	78.59
3.88	12.46	77.86
4.00	12.57	73.06

48" PIPE
n= .014
LENGTH= 300 FT
SLOPE= .003 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.58 FT
PEAK VELOCITY= 6.4 FPS
TRAVEL TIME = .8 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 10 **STORM DRAIN 10**

Qin = 78.89 CFS @ 12.19 HRS, VOLUME= 17.76 AF
Qout= 78.31 CFS @ 12.22 HRS, VOLUME= 17.70 AF, ATTEN= 1%, LAG= 1.8 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	1.76
.80	1.79	7.39
1.20	3.17	16.52
2.80	9.40	70.63
3.20	10.78	82.46
3.60	11.91	89.91
3.76	12.26	90.74
3.88	12.46	89.91
4.00	12.57	84.36

48" PIPE
n= .014
LENGTH= 600 FT
SLOPE= .004 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 3.06 FT
PEAK VELOCITY= 7.6 FPS
TRAVEL TIME = 1.3 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 11 **STORM DRAIN TO NORTH CHANNEL**

Qin = 137.7 CFS @ 12.14 HRS, VOLUME= 22.81 AF
Qout= 137.6 CFS @ 12.18 HRS, VOLUME= 22.76 AF, ATTEN= 0%, LAG= 2.2 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.55	1.24	3.26
1.10	3.38	13.65
1.65	5.99	30.53
3.85	17.76	130.53
4.40	20.38	152.40
4.95	22.52	166.17
5.17	23.18	167.71
5.34	23.55	166.16
5.50	23.76	155.91

66" PIPE
n= .014
LENGTH= 400 FT
SLOPE= .0025 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 4.05 FT
PEAK VELOCITY= 7.4 FPS
TRAVEL TIME = .9 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 12 **NORTH CHANNEL 2**

Qin = 180.6 CFS @ 12.18 HRS, VOLUME= 31.01 AF
Qout= 178.4 CFS @ 12.25 HRS, VOLUME= 30.84 AF, ATTEN= 1%, LAG= 4.0 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.50	2.63	4.44
1.00	5.50	13.61
1.50	8.63	26.18
2.15	13.06	46.99
3.00	19.50	81.43
4.00	28.00	132.45
5.00	37.50	195.18

5' x 5' CHANNEL
SIDE SLOPE= 2 '/'
n= .025
LENGTH= 700 FT
SLOPE= .0025 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 4.74 FT
PEAK VELOCITY= 5.1 FPS
TRAVEL TIME = 2.3 MIN
SPAN= 10-20 HRS, dt=.05 HRS

REACH 13 **NORTH CHANNEL 1**

Qin = 52.01 CFS @ 11.99 HRS, VOLUME= 8.36 AF
Qout= 43.40 CFS @ 12.16 HRS, VOLUME= 8.26 AF, ATTEN= 17%, LAG= 10.5 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	2.08	3.09
.80	4.32	9.50
1.20	6.72	18.27
1.72	10.08	32.68
2.40	14.88	56.27
3.20	21.12	90.72
4.00	28.00	132.45

5' x 4' CHANNEL
SIDE SLOPE= 2 '/'
n= .025
LENGTH= 1300 FT
SLOPE= .0025 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.01 FT
PEAK VELOCITY= 3.5 FPS
TRAVEL TIME = 6.1 MIN
SPAN= 10-20 HRS, dt=.1 HRS

REACH 14 **STORM DRAIN 14**

Qin = 51.65 CFS @ 12.24 HRS, VOLUME= 14.70 AF
Qout= 51.33 CFS @ 12.29 HRS, VOLUME= 14.63 AF, ATTEN= 1%, LAG= 3.0 MIN

DEPTH (FT)	END AREA (SQ-FT)	DISCH (CFS)
0.00	0.00	0.00
.40	.65	1.25
.80	1.79	5.22
1.20	3.17	11.68
2.80	9.40	49.94
3.20	10.78	58.31
3.60	11.91	63.58
3.76	12.26	64.17
3.88	12.46	63.57
4.00	12.57	59.65

48" PIPE
n= .014
LENGTH= 500 FT
SLOPE= .002 FT/FT

STOR-IND+TRANS METHOD
PEAK DEPTH= 2.87 FT
PEAK VELOCITY= 5.3 FPS
TRAVEL TIME = 1.6 MIN
SPAN= 10-20 HRS, dt=.05 HRS

POND 3 **DETENTION POND #3**

Qin = 178.4 CFS @ 12.25 HRS, VOLUME= 30.84 AF
Qout= 120.4 CFS @ 12.62 HRS, VOLUME= 30.10 AF, ATTEN= 33%, LAG= 22.7 MIN

ELEVATION (FT)	AREA (AC)	INC.STOR (AF)	CUM.STOR (AF)
0.0	.25	0.00	0.00
1.0	.35	.30	.30
2.0	.45	.40	.70
3.0	.55	.50	1.20
4.0	.65	.60	1.80
5.0	.75	.70	2.50

STOR-IND METHOD
PEAK STORAGE = 3.86 AF
PEAK ELEVATION= 6.9 FT
FLOOD ELEVATION= 5.0 FT
START ELEVATION= 0.0 FT
SPAN= 10-20 HRS, dt=.05 HRS
Tdet= 22.9 MIN (30.1 AF)

#	ROUTE	INVERT	OUTLET DEVICES
1	P	0.0'	**48" CULVERT**
			n=.014 L=50' S=.0015'/' Ke=.5 Cc=.9 Cd=.6

LINK 1 **DOUBLE R NORTH 2 - PART B DUP1**

Qout= 51.65 CFS @ 12.24 HRS, VOLUME= 14.70 AF, SPAN= 10-20 HRS, dt=.05 HRS

REACH 8 from **DOUBLE R NORTH 2 - PART B DUP1**
"STORM DRAIN 15"

Double R Blvd. (Extension to Longley)

Existing Storm Drain Capacity Calculations (Crossing Longley Lane)

North Box Culvert (3'x5')

$S =$ 0.0043 ft/ft

$h_{max} =$ 4.33' (From Survey Info.)

$n =$ 0.014

$L =$ 102 ft.

$Q_{max} =$ 116 cfs (See Attached Calcs.)

North SD Culvert (24")

$S =$ 0.0034 ft/ft

$h_{max} =$ 3.48' (From Survey Info.)

$n =$ 0.014

$L =$ 112

$Q_{max} =$ 20.5 cfs (See Attached Calcs.)

* Design Culvert Crossing @ Double R Blvd. for $Q_{max} = 116 + 20.5 =$ 136.5 cfs

∴ Use (2) 48" RCP SD's @ Crossing (Refer to Calc. Sheet Provided)

North Box Culvert @ Longley Lane

BOX CULVERT

Inlet control and outlet control parameters

Input variables:				Output variables:	0		in
ELEVATION OF FLOWLINE	4420.42			OUTLET ELEVATION	4419.98		ELEV.
Box height	3.0	ft	:	INLET CTRL HWo:			
Box width	5.0	ft	:	tapered throat	3.86	ft	4423.84
Number of boxes	1		:	**45 degree bevels**	**4.31**	**ft**	**4424.30**
Slope	0.00430	ft/ft	:	sq edge headwall	4.69	ft	4424.67
Manning's n (Conc	0.014		:	OUTLET CTRL HWo	4.04	ft	4424.02
Culvert length	102	ft	:	Velocity	7.73	fps	
Discharge	→ 116	cfs	:	Critical depth	2.56	ft	4422.54

Notes:

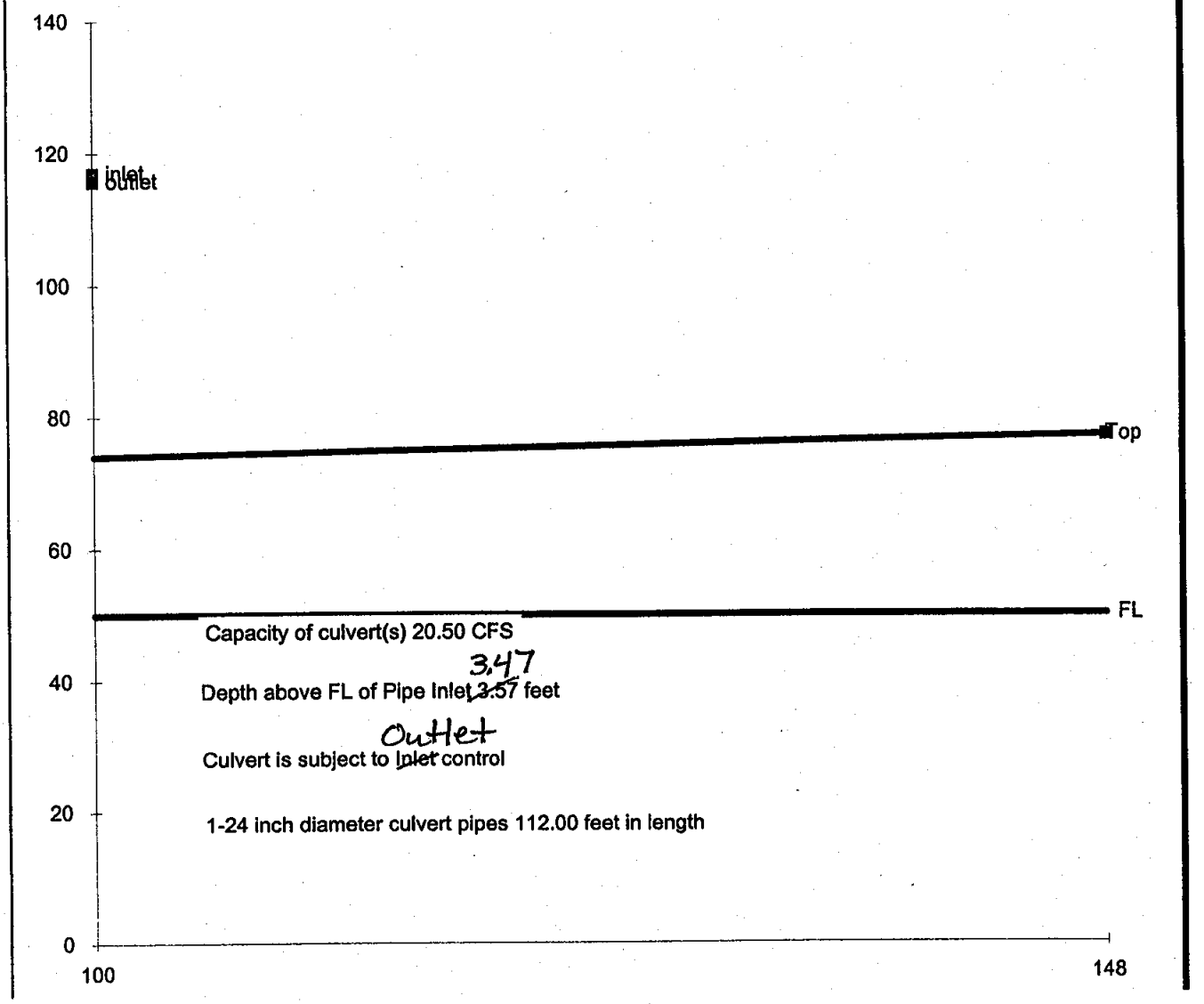
1 Full Flowing Box Assumed.
2. Critical Depth Cannot Exceed
   The Height Of Box Culvert.
3 Water Surface Assumed Equal To Box Depth At Exit
4 Hwo Above Flow Line

North SD Culvert @ Longley Lane

PIPE CULVERT

Inlet control and outlet control parameters

Input variables: *Unsubmerged outlet*			Output variables:		
			INLET CTRL HWo:		
Pipe diameter	24	in	beveled edge	**2.86**	**ft**
Number of pipes	1		sq edge headwall	3.07	ft
Slope	0.003	ft/ft	thin edged proj	3.57	ft
Manning's n	0.014		OUTLET CTRL HWo	3.47	ft
Culvert length	112	ft	velocity	6.5	fps
Discharge →	20.50	cfs	critical depth	1.60	ft
Submerged outlet headwater height above downstream water sur				**1.83**	**ft**

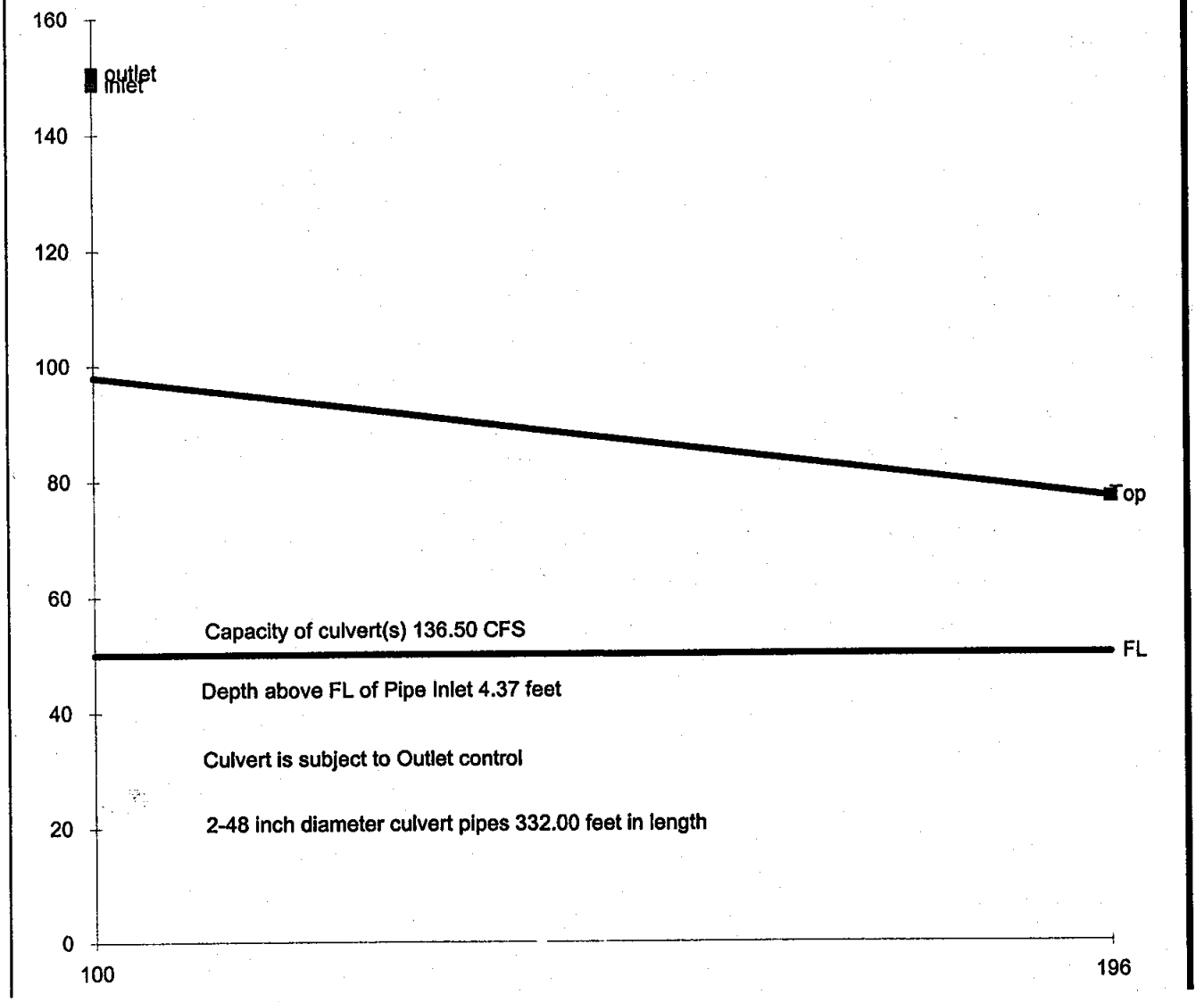


New SD Culvert @ Double R Blvd.

PIPE CULVERT

Inlet control and outlet control parameters

Input variables:			Output variables:		
Unsubmerged outlet					
Pipe diameter	48	in	INLET CTRL HWo:		
Number of pipes	2		beveled edge	3.71	ft
Slope	0.001	ft/ft	sq edge headwall	3.88	ft
Manning's n	0.014		thin edged proj	4.21	ft
Culvert length	332	ft	OUTLET CTRL HWo	4.37	ft
Discharge →	136.50	cfs	velocity	5.4	fps
			critical depth	2.44	ft
Submerged outlet headwater height above downstream water sur				1.40	ft



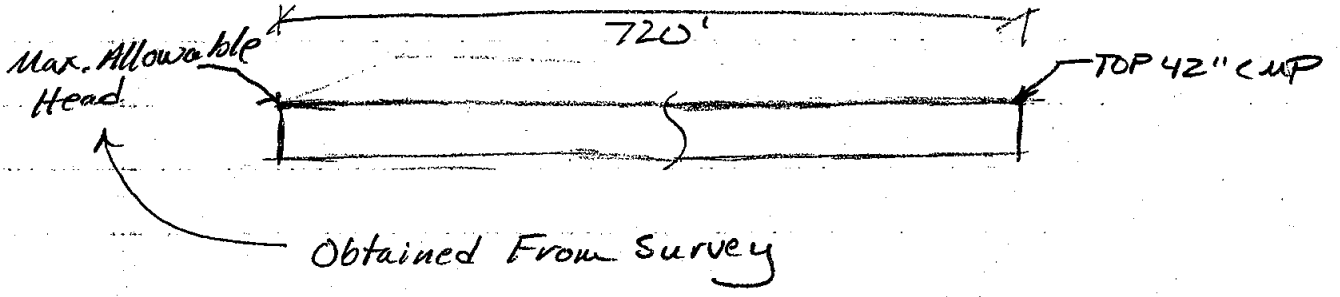
Double R Blvd. (Extension to Longley)

Existing Storm Drain Capacity Calcs.
(Crossing Longley Lane)

South Box Culvert / CMP Pipe

Assumptions: HGL Slope = Slope of SD
42" CMP (SD @ Outlet) Flowing Full
Closed Conduit (No Openings)
Outlet Control due to Length

$S = 0.0027$ = HGL Slope



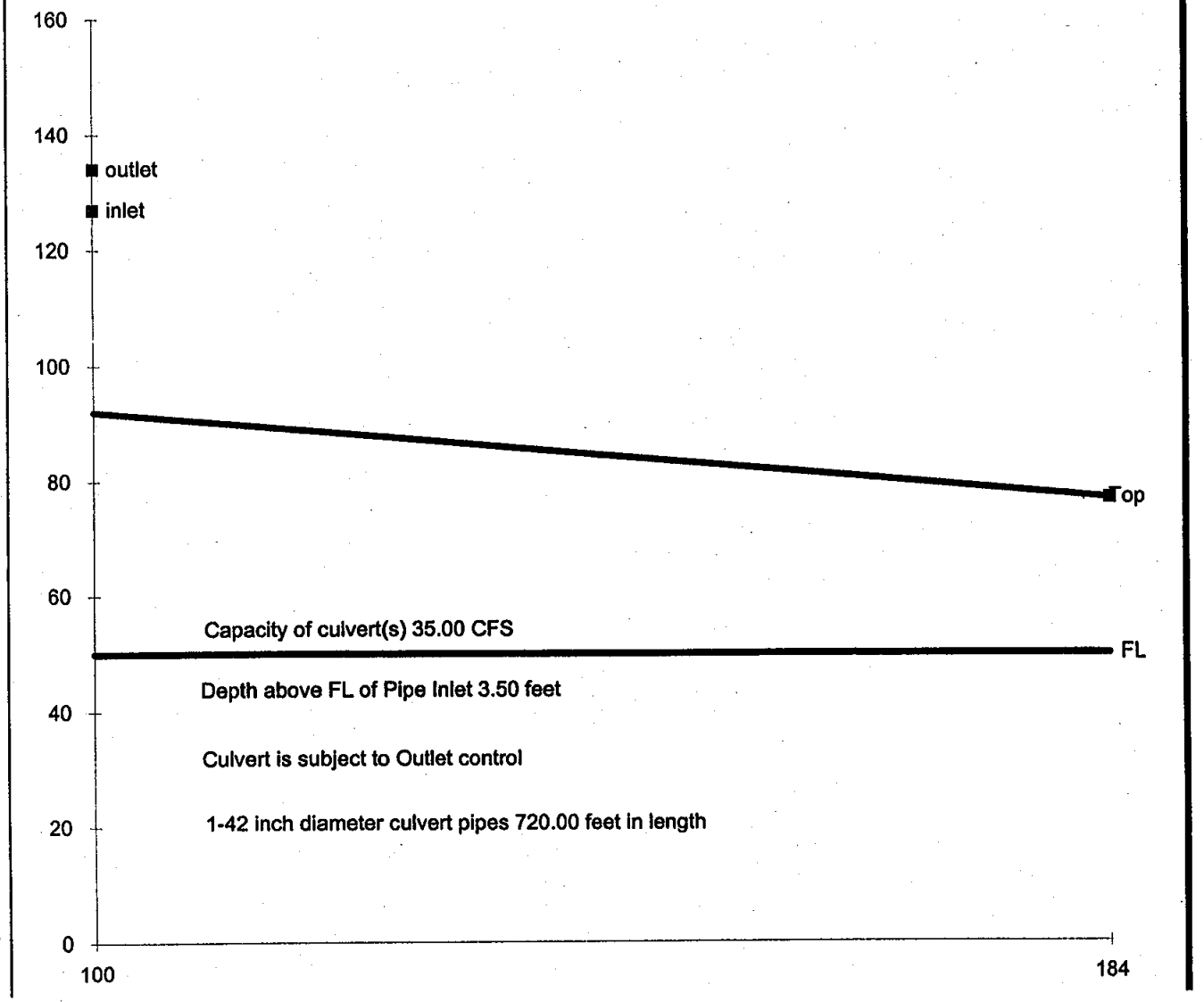
$Q_{max} = 35.00$ cfs (See Attached Calcs.)

EX. 42" CMP @ SOUTH

PIPE CULVERT

Inlet control and outlet control parameters

Input variables:			Output variables:		
Unsubmerged outlet					
			INLET CTRL HWo:		
Pipe diameter	42	in	beveled edge	2.66	ft
Number of pipes	1		sq edge headwall	2.72	ft
Slope	0.003	ft/ft	thin edged proj	2.91	ft
Manning's n	0.022		OUTLET CTRL HWo	3.50	ft
Culvert length	720	ft	velocity	3.6	fps
Discharge →	35.00	cfs	critical depth	1.81	ft
Submerged outlet headwater height above downstream water sur				2.73	ft



Double R Blvd. - Diversion Ditch
(Temporary Channel Parallel to Ex. SD)

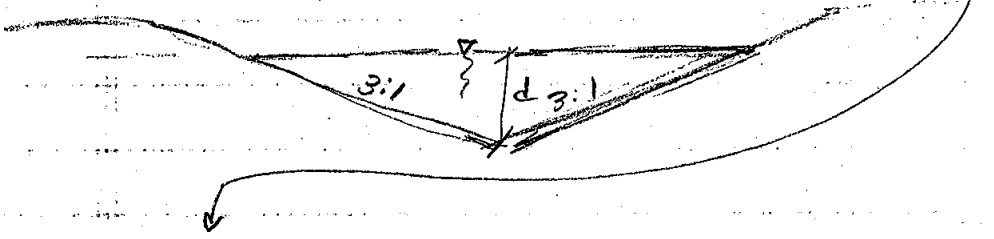
Q_{max} = 35 cfs (See Attached Calcs. & Assumptions) - Prev. Calcs.

Assume: $S = 0.0025$ ft/ft

$n = 0.020$ (Smooth Earth/Graded Ditch)

V-Ditch w/ 3:1 sides

$$Q = \frac{1.49}{n} A R^{2/3} S^{1/2} \longrightarrow AR^{2/3} = \frac{Qn}{1.49 S^{1/2}} = 9.40$$



$$A\left(\frac{A}{P}\right)^{2/3} = 9.40$$

By Trial and Error

d	A	P	$AR^{2/3}$	
2	12	12.65	11.58	←
3	27	18.97	34.16	
1	1.5	6.32	0.57	
1.5	6.75	9.49	5.38	

∴ Use 2' min. depth Channel