Ruggles & Bohm, P.A
Engineering, Surveying, Land Planning
924 N. Main
Wichita, Kansas 67203

MEMO

Date: Wednesday, November 09, 2005

To: Scott Lindebak
City of Wichita

From: Kenneth Lee

Project: Southwest Passage

RB Project No.: 2788E

Other Project Reference No.:

Description:
- ☐ Confirmation
- ☒ Transmittal
- ☐ Transmittal under separate cover by

Purpose:
- ☐ Approval
- ☐ Review & comment
- ☒ Use
- ☐ Other :
- ☒ Distribution
- ☐ Information
- ☐ Record

Enclosures/Attachments:
- ☐ Prints
- ☒ Originals
- ☐ Diskettes containing:
- ☐ Change Order
- ☐ Shop Drawings
- ☐ Other:

Copies	Description
1	Fema Submittal Information

Remarks: Scott,
Attached is the preliminary package that I have put together for the submittal to FEMA for the LOMR
Please take a look therough this and let me know if you have any comments or recommendations.
I will need you to sign the Overview form for submittal to FEMA.

Thank you,

Kenneth Lee

RECEIVED
NOV 09 2005
CITY - ENGINEERING

Copies to:

If checked below, please:
- ☐ Acknowledge receipt of enclosures
- ☐ Return enclosures to us.

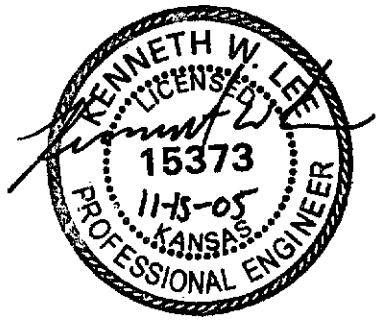
Signed

If Enclosures are not as noted above, please inform us immediately
Phone (316) 264-8008 Fax (316) 264-4621

SOUTHWEST PASSAGE ADDITION

DRAINAGE REPORT

NOVEMBER 2005



Ruggles & Bohm P.A.

Engineering, Surveying, Land Planning

SOUTHWEST PASSAGE ADDITION
WICHITA, SEDGWICK COUNTY, KANSAS
DRAINAGE REPORT
NOVEMBER 2005

INTRODUCTION

The subject property is in southwest Wichita in Sedgwick County, Kansas. The property is located south of Pawnee between 119th and 135th Streets West. It is primarily in the north half of Section 1, Township 28 South, Range 2 West. There is approximately 114 acres in the development that will be subdivided into 218 residential lots in separate phases. The Drainage Plan for this report primarily covers the first phase. Since storm water runoff from future development will be routed into the ponds, the entire preliminary plat was included in the hydrologic calculations of this report. The project is proposed to have one crossing of the primary channel to provide access to the lots in the south half of the addition.

PREDEVELOPED CONDITIONS

The site is currently being used in an agricultural capacity. There are two main channels that affect this site. The larger channel runs east-west through the middle of the site and another channel runs east-west along the south line of the site and then turns north and runs along the east side of the site until it intersects with the other channel. The middle channel is poorly developed and lined with trees in places. The channel is approximately 12 feet across at the bottom, approximately 7 feet deep, with nearly vertical side slopes. The south channel is roughly five feet across, with gently graded side slopes.

The Firm map indicates that a drainage area of approximately 0.65 square miles drains under 23rd Street and across the subject property. A review of site conditions indicates that the street ditch on the north side of Pawnee carries the majority of that flow with only a 50% plugged 24" CMP available to carry water under the roadway. Photographs of that pipe crossing are included in the photo section.

DEVELOPED CONDITIONS

The site will eventually be subdivided into 218 residential lots. There are currently four detention ponds proposed with this project. They will provide detention for on-site flows, but are not large enough to have any impact on 100 year events for the entire basin. These ponds, combined with improving stream channels inside the property, reduce the 100 year water surface 1.5' to 2.5'.

The channels will be improved to a minimum width of 10' with side slopes no steeper than 3:1. Fill will be placed to property lines to bring each lot approximately 1.0' above the anticipated 100 year water surface. Storm Sewers will be installed along

rear lines of lots to provide drainage. An erosion control plan will be prepared prior to construction to limit silt transport.

To provide adequate detention to detain localized storm events, a 2' X 2' notched concrete weir will be constructed on the downstream side of the lower ponds to restrict flows. A wider 29' trapezoidal weir will be provided above the notch to provide capacity for larger flows generated by the larger basins. It will feature a concrete bottom with rip-rap sides laid back at 3:1.

HYDROLOGY & HYDRAULICS

This site is bisected by a major tributary of ~~Dry Creek~~ that has upstream drainage area of 3.6 square miles. In addition to that, the channel along the south line of the site has a drainage area of 2.4 square miles. Due to the large size of these basins, any detention effects for the onsite ponds will be negligible with regards to the 100 year storm. As such, two different scenarios were reviewed when sizing the detention ponds for this project. First, a study was done looking at onsite flows only to verify that the detention ponds would detain a locally concentrated storm to pre-developed runoff levels. Second, the entire basin system was analyzed. HEC-HMS 2.2.2 was used to perform hydrologic modeling of this project. Output is included in the appendix.

Onsite storm sewer has been designed to carry the 100 year storm event. StormCAD output and profiles are included in the appendix of this report. The rational method was used to determine flow rates for each pipe in the system. Please refer to the Drainage Plan for basin and flow information.

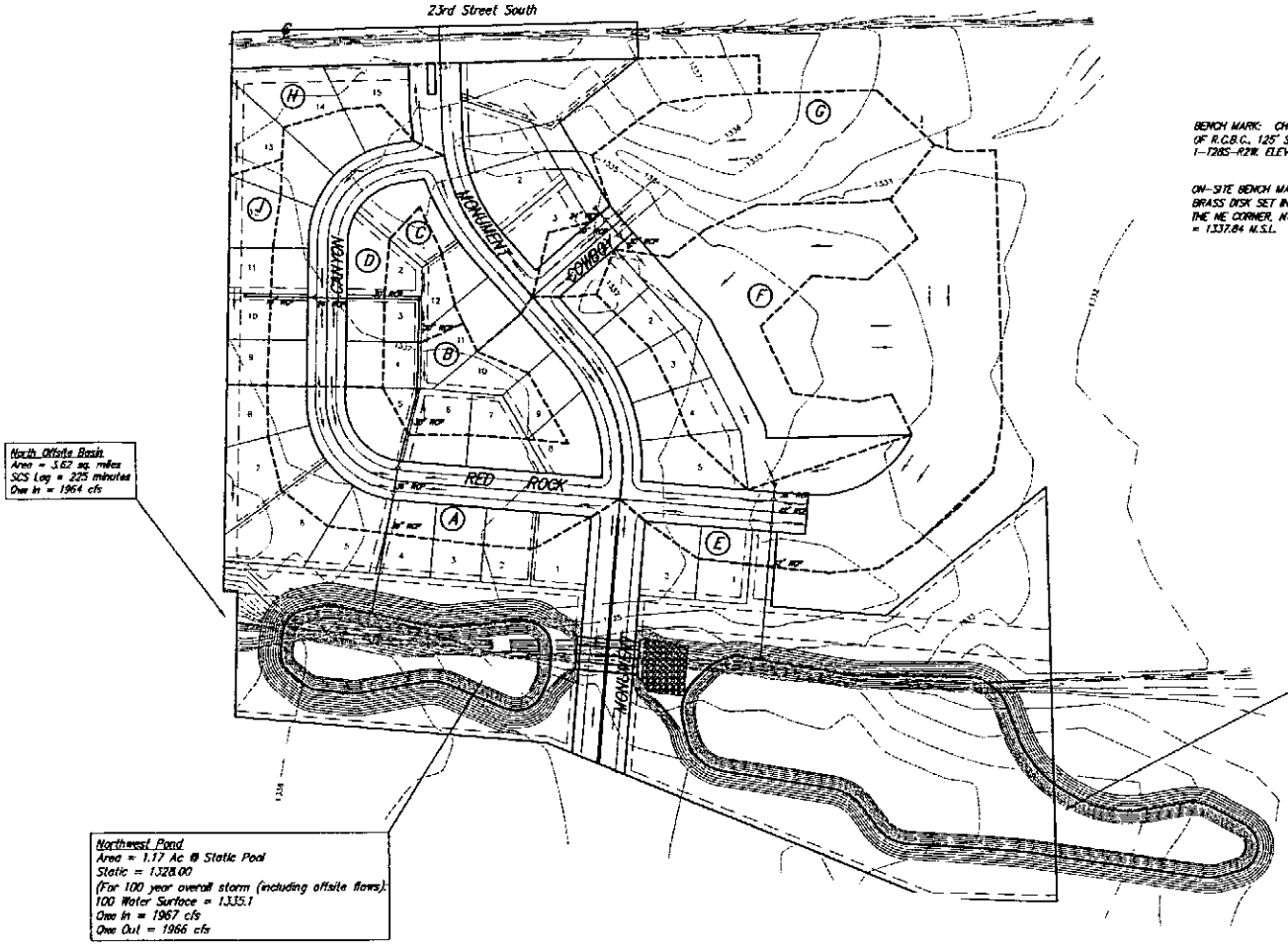
CONCLUSIONS

The detention ponds and storm sewer have been sized to convey and detain the 100 year storm to pre-developed levels. A FEMA C-LOMR application has been filed and will result in a modified SFHA upon approval. All proposed lots will be clear of the Flood Hazard Area upon approval of the application.

One area of particular importance is the contingent street dedication that has been set aside at the south line of the project. It will be critical that the design engineer for that project provide a structure that does not raise the 100 year water surface in that area without doing an extensive study of the developed conditions to verify that no danger is presented to this site.

The onsite ponds will provide adequate detention capacity for on-site storms but will have little affect on peak flows for events that affect the entire drainage basin of each tributary.

DRAINAGE PLAN
SOUTHWEST PASSAGE ADDITION
Wichita, Sedgwick County, Kansas



BENCH MARK: CHISELED "+" ON WEST HUBGUARD OF R.C.B.C., 125' S. OF N.E. CORNER SECTION 1-T28S-R2W. ELEV = 1337.94 M.S.L.

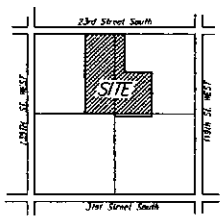
ON-SITE BENCH MARK: TOP OF RUGGLES & BOHM BRASS DISK SET IN CONCRETE 1112' W. & 50' S. OF THE NE CORNER, NW1/4, SECTION 1-T28S-R2W. ELEV = 1337.84 M.S.L.

1" = 100'

SWS BASIN INFORMATION

BASIN	ACRES	C2	C100	I2	I100	C2 a*I	C100 a*I
A	2.62	0.46	0.7	3.73	7.37	4.8	14.5
B	0.82	0.46	0.7	3.73	7.37	1.4	4.2
C	0.43	0.46	0.7	3.73	7.37	0.7	2.2
D	2.57	0.46	0.7	3.73	7.37	4.4	13.3
E	5.19	0.46	0.7	3.73	7.37	8.9	26.8
F	2.80	0.46	0.7	3.73	7.37	5.0	14.9
G	2.50	0.46	0.7	3.73	7.37	4.3	12.9
H	3.03	0.46	0.7	3.73	7.37	5.2	15.6
I	0.56	0.46	0.7	3.73	7.37	1.0	3.0

Tc of 15 minutes used for basin calculations



VICINITY MAP

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HEC-HMS INFORMATION

Drainage Basin Information
Southwest Passage Addition
November 2005

OFFSITE SCS LAG CALCULATIONS

North Offsite

$T_{lag} = L * (1000/(CN - 10) + 1)^{0.7} / (1900 * S^{0.5})$

$T_{lag} = 19744 * (1000/(80 - 10) + 1)^{0.7} / (1900 * (0.61)^{0.5}) = 3.75$ hours = 225 minutes

South Offsite

$T_{lag} = L * (1000/(CN - 10) + 1)^{0.7} / (1900 * S^{0.5})$

$T_{lag} = 15432 * (1000/(80 - 10) + 1)^{0.7} / (1900 * (0.60)^{0.5}) = 3.63$ hours = 216 minutes

EXISTING BASINS

North Onsite

59.4 acres = 0.093 sq. mi.
CN = 80, 0% Impervious
SCS Lag = 25 minutes
7.8" Type II Storm
Q100 = 224.1 cfs

South Onsite

53.7 acres = 0.084 sq. mi.
CN = 80, 0% Impervious
SCS Lag = 21 minutes
7.8" Type II Storm
Q100 = 202.4 cfs

North Offsite

From USGS, 3.62 sq. mi.
CN = 85, 1% Impervious
SCS Lag = 225 minutes
7.8" Type II Storm
Q100 = 1968.1 cfs

South Offsite

From USGS, 2.40 sq. mi.
CN = 80, 0% Impervious
SCS Lag = 216 minutes
7.8" Type II Storm
Q100 = 1218.2 cfs

Total onsite runoff (Existing Onsite model) = 426.5 cfs
Total including offsite (Existing Overall model) = 3204.9 cfs

DEVELOPED BASINS

Northwest Onsite
13.0 acres = 0.020 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 15 minutes
7.8" Type II Storm
Q100 = 68.0 cfs

Northeast Onsite
44.0 acres = 0.069 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 15 minutes
7.8" Type II Storm
Q100 = 234.7 cfs

South Onsite
28.8 acres = 0.045 sq. mi.
CN = 80, 30% Impervious
SCS Lag = 15 minutes
7.8" Type II Storm
Q100 = 255.1 cfs

North Offsite
From USGS, 3.62 sq. mi.
CN = 85, 1% Impervious
SCS Lag = 225 minutes
7.8" Type II Storm
Q100 = 1968.1 cfs

South Offsite
From USGS, 2.40 sq. mi.
CN = 80, 0% Impervious
SCS Lag = 216 minutes
7.8" Type II Storm
Q100 = 1218.2 cfs

Undetained Runoff
27.3 acres = 0.043 sq. mi.
CN = 80, 5% Impervious
SCS Lag = 25 minutes
7.8" Type II Storm
Q100 = 104.9 cfs

Total onsite runoff (Proposed model) = 417.8 cfs < 426.5 cfs **OK**
Total including offsite (Proposed Overall model) = 3202.5 cfs < 3204.9 cfs **OK**

Weir Calculations and Pond Information

$Q = 3.2 H^{1.5}$

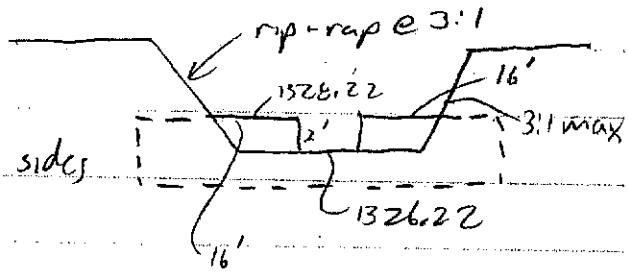
Reservoir 3 (Northwest Pond)

Outlet control 4 x 6' x 12' RCBC w/ 45° wingwalls

Elev	Area	Outflow
1328	1.17	0 cfs
1329	1.27	135 cfs
1330	1.37	375 cfs
1331	1.48	685 cfs
1332	1.58	1050 cfs
1333	1.69	1475 cfs
1334	1.80	1935 cfs
1335	1.92	2325 cfs
1336	2.04	2655 cfs

Reservoir 1 (Northeast Pond)

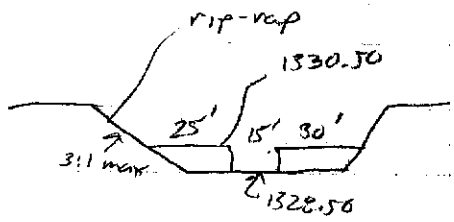
Outlet control 15' weir with rip-rap sides



Elev	Area	Outflow
1326.22	3.46	0
1327	3.61	31
1328	3.81	107
1329	4.01	244
1330	4.22	545
1331	4.43	942
1332	4.64	1463
1333	4.85	2048
1334	5.06	2727

Reservoir 2 (South Pond)

Outlet control 15' weir w/ rip rap sides

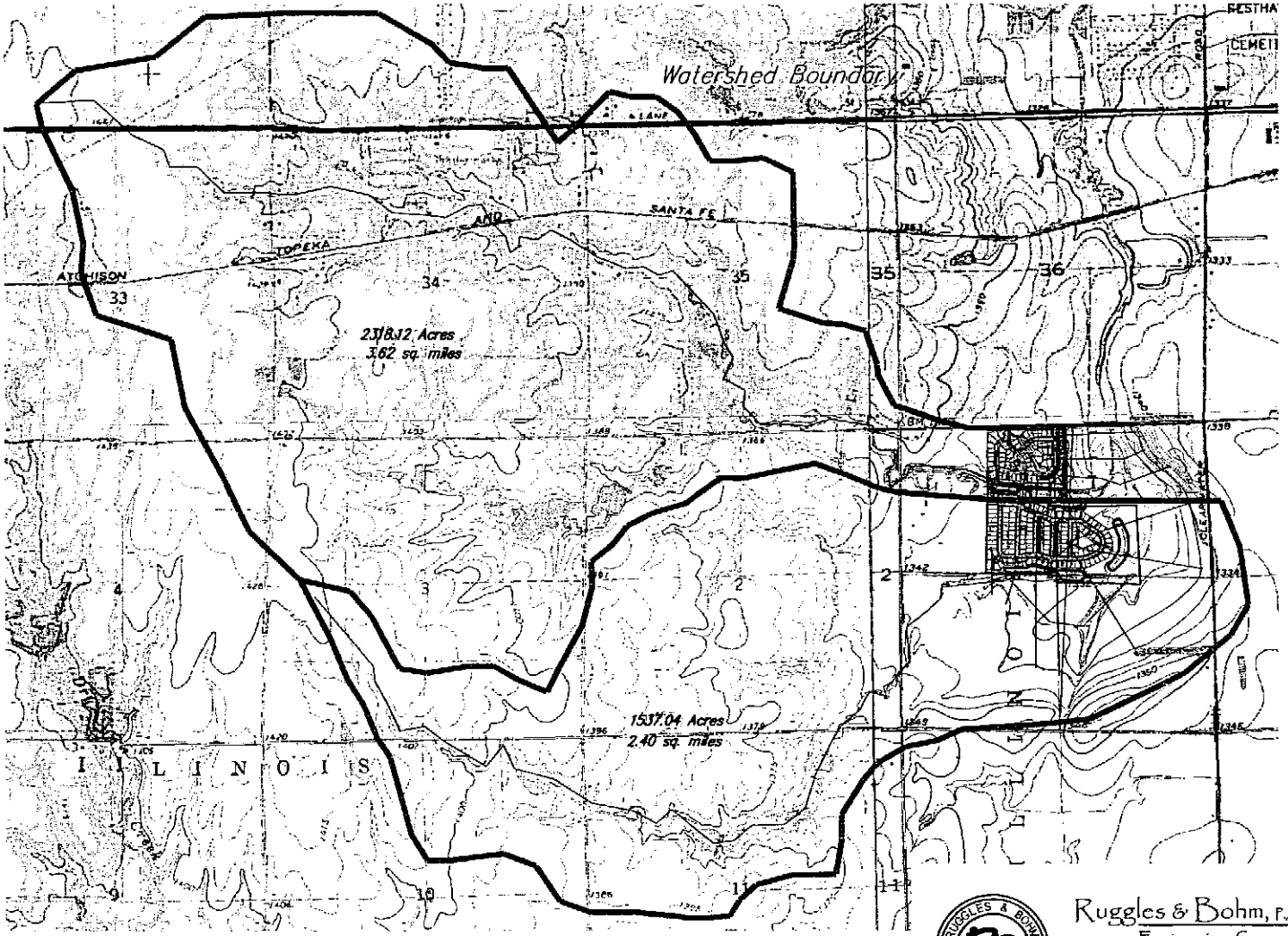


Elev	Area	Outflow
1328.5	3.11	0
1329	3.39	15
1330	3.66	83
1331	3.94	236
1332	4.22	614
1333	4.51	1201
1334	4.90	1935

Southwest Passage

USGS Quad Maps

Wichita West & Goddard



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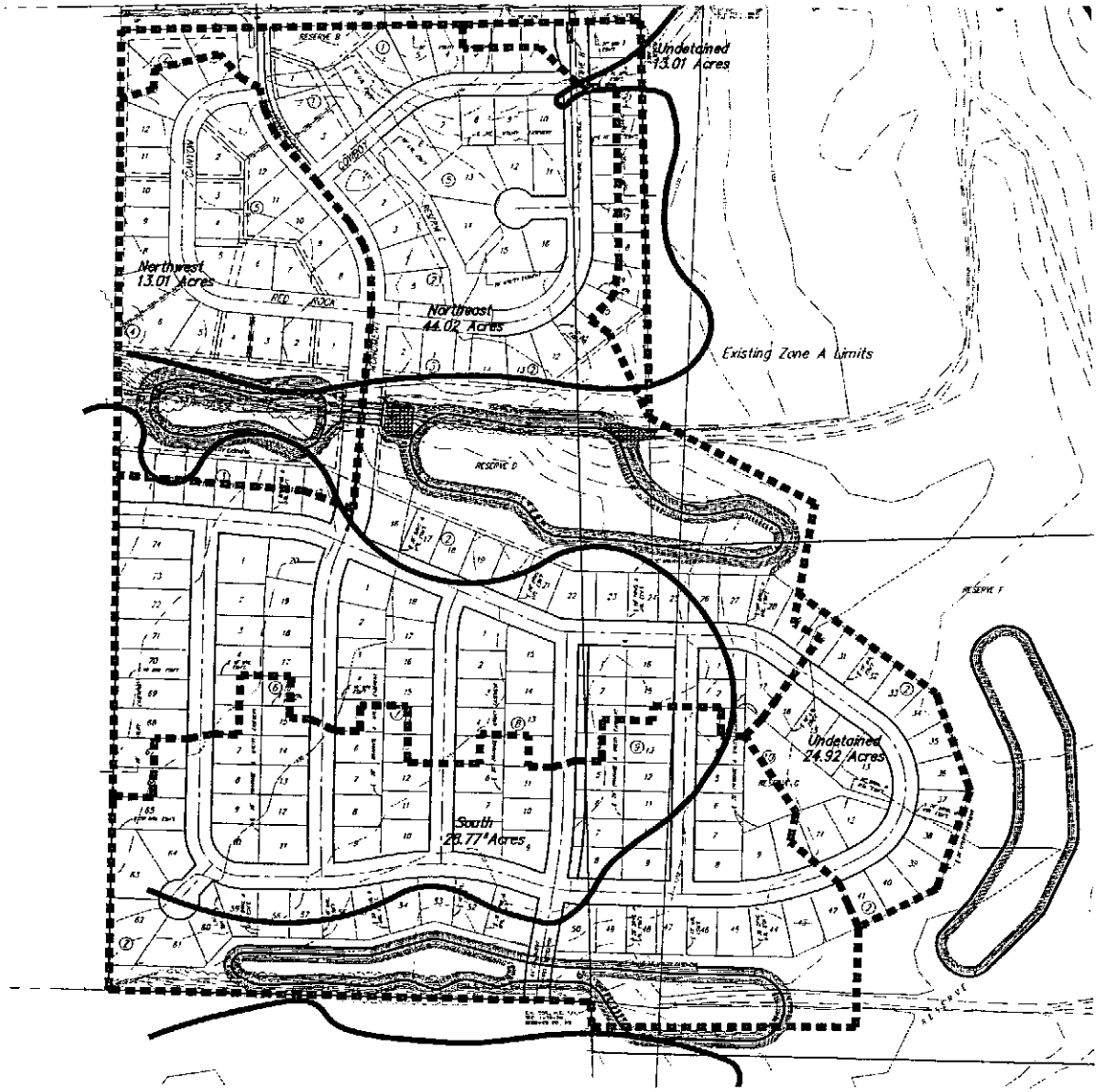
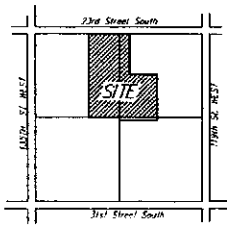
Southwest Passage
Onsite Basin Exhibit



SCALE
1" = 300'



VICINITY MAP

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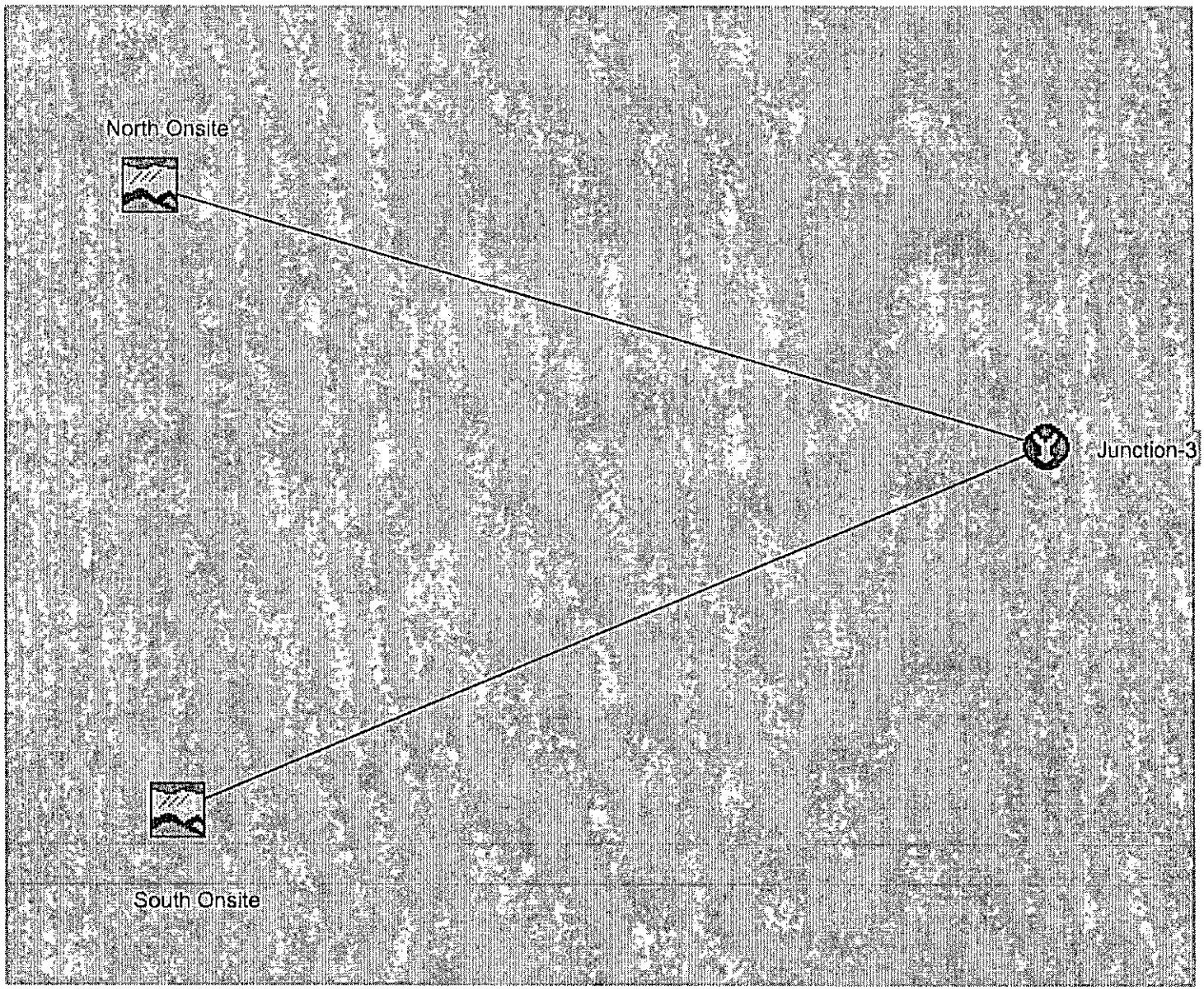

North Onsite
Junction-3
South Onsite

HMS * Summary of Results for North Onsite

Project : SW Passage Run Name : Existing Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Existing Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 224.07 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1215
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.39 (in)
Total Loss	: 2.36 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.44 (in)	Total Discharge	: 5.39 (in)

HMS * Summary of Results for South Onsite

Project : SW Passage Run Name : Existing Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Existing Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 202.38 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1215
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.39 (in)
Total Loss	: 2.36 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.44 (in)	Total Discharge	: 5.39 (in)

HMS * Summary of Results for Junction-3

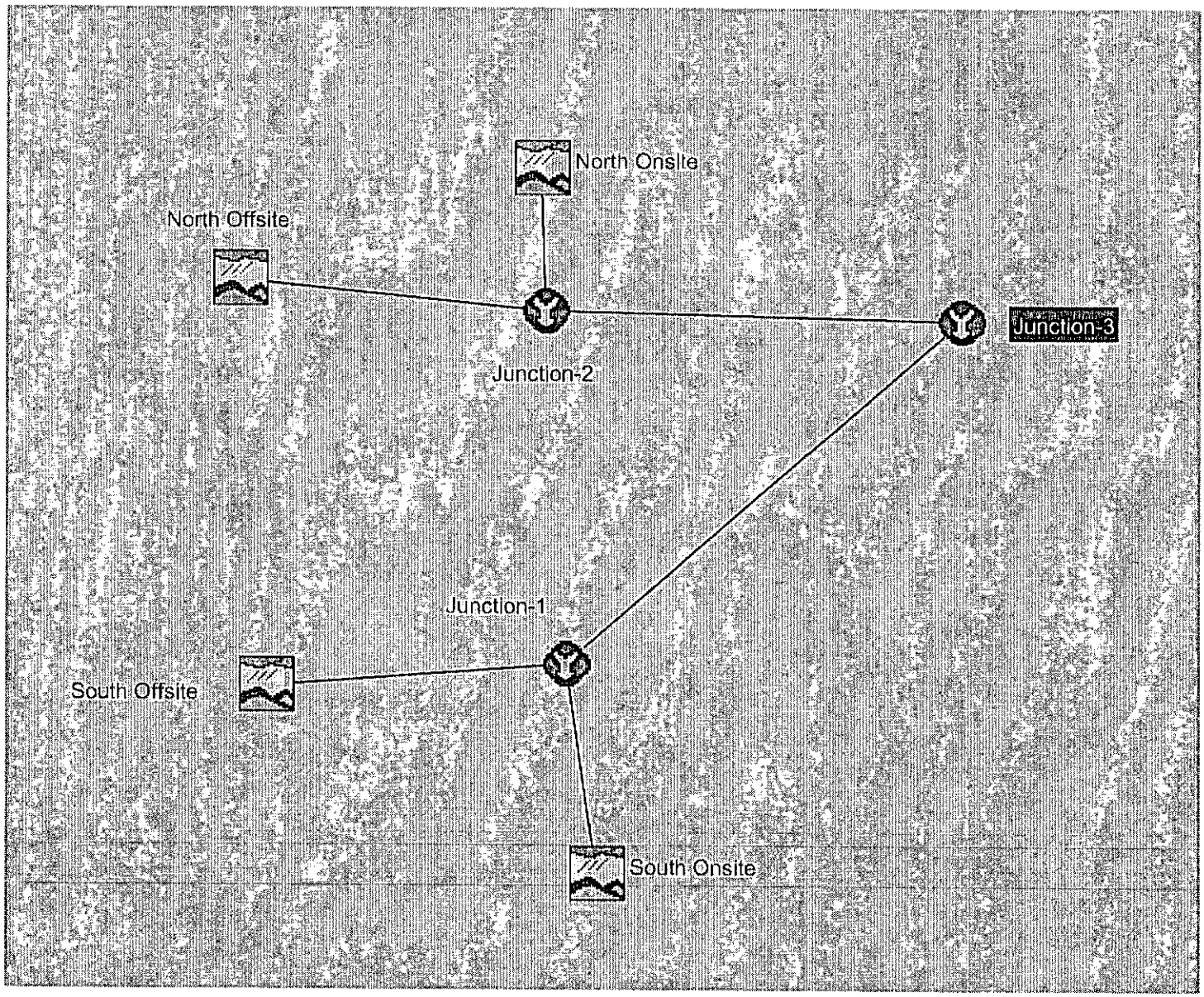
Project : SW Passage Run Name : Existing Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Existing Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Outflow : 426.45 (cfs) Date/Time of Peak Outflow : 31 Oct 05 1215

Total Outflow : 5.39 (in)


North Onsite
North Offsite
Junction-2
Junction-3
Junction-1
South Offsite
South Onsite

HMS * Summary of Results for North Offsite

Project : SW Passage Run Name : Existing Overall

Start of Run	: 31Oct05 0000	Basin Model	: Existing Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0712	Control Specs	: Control 1

Computed Results

Peak Discharge	: 1964.4 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1550
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.46 (in)
Total Loss	: 1.78 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.02 (in)	Total Discharge	: 5.46 (in)

HMS * Summary of Results for South Offsite

Project : SW Passage Run Name : Existing Overall

Start of Run	: 31Oct05 0000	Basin Model	: Existing Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0712	Control Specs	: Control 1

Computed Results

Peak Discharge	: 1218.2 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1545
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 4.93 (in)
Total Loss	: 2.36 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.44 (in)	Total Discharge	: 4.93 (in)

HMS * Summary of Results for North Onsite

Project : SW Passage Run Name : Existing Overall

Start of Run	: 31Oct05 0000	Basin Model	: Existing Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0712	Control Specs	: Control 1

Computed Results

Peak Discharge	: 199.67 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1220
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.38 (in)
Total Loss	: 2.36 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.44 (in)	Total Discharge	: 5.38 (in)

HMS * Summary of Results for South Onsite

Project : SW Passage Run Name : Existing Overall

Start of Run	: 31Oct05 0000	Basin Model	: Existing Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0712	Control Specs	: Control 1

Computed Results

Peak Discharge	: 180.34 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1220
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.38 (in)
Total Loss	: 2.36 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.44 (in)	Total Discharge	: 5.38 (in)

HMS * Summary of Results for Junction-3

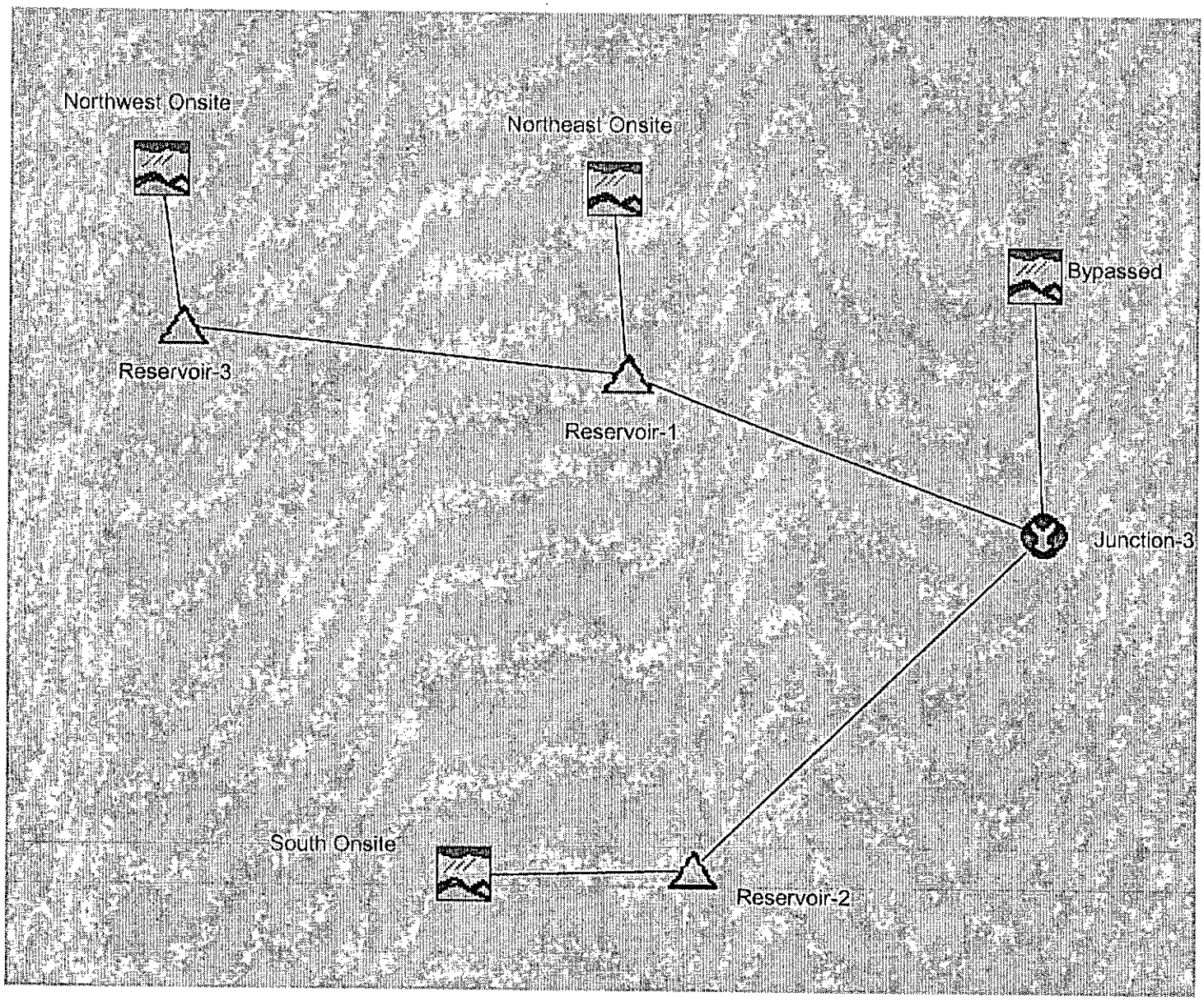
Project : SW Passage Run Name : Existing Overall

Start of Run	: 31Oct05 0000	Basin Model	: Existing Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0712	Control Specs	: Control 1

Computed Results

Peak Outflow : 3204.9 (cfs) Date/Time of Peak Outflow : 31 Oct 05 1545

Total Outflow : 5.25 (in)


Northwest Onsite
Northeast Onsite
Bypassed
Reservoir-3
Reservoir-1
Junction-3
South Onsite
Reservoir-2

HMS * Summary of Results for Northeast Onsite

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Discharge	: 234.71 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1205
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 6.12 (in)
Total Loss	: 1.65 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.15 (in)	Total Discharge	: 6.12 (in)

HMS * Summary of Results for South Onsite

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Discharge	: 255.12 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1205
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 6.12 (in)
Total Loss	: 1.65 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.15 (in)	Total Discharge	: 6.12 (in)

HMS * Summary of Results for Northwest Onsite

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Discharge	: 68.032 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1205
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 6.12 (in)
Total Loss	: 1.65 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.15 (in)	Total Discharge	: 6.12 (in)

HMS * Summary of Results for Bypassed

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Discharge	: 104.94 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1215
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.51 (in)
Total Loss	: 2.24 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.56 (in)	Total Discharge	: 5.51 (in)

HMS * Summary of Results for Reservoir-1

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Inflow	: 292.79 (cfs)	Date/Time of Peak Inflow	: 31 Oct 05 1210
Peak Outflow	: 165.68 (cfs)	Date/Time of Peak Outflow	: 31 Oct 05 1225
Total Inflow	: 6.12 (in)	Peak Storage	: 8.1412(ac-ft)
Total Outflow	: 7.38 (in)	Peak Elevation	: 1328.4(ft)

HMS * Summary of Results for Reservoir-2

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Inflow	: 255.12 (cfs)	Date/Time of Peak Inflow	: 31 Oct 05 1205
Peak Outflow	: 151.36 (cfs)	Date/Time of Peak Outflow	: 31 Oct 05 1220
Total Inflow	: 6.12 (in)	Peak Storage	: 6.8460(ac-ft)
Total Outflow	: 6.00 (in)	Peak Elevation	: 1330.4(ft)

HMS * Summary of Results for Reservoir-3

Project : SW Passage Run Name : Proposed Onsite

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Inflow	: 68.032 (cfs)	Date/Time of Peak Inflow	: 31 Oct 05 1205
Peak Outflow	: 61.083 (cfs)	Date/Time of Peak Outflow	: 31 Oct 05 1215
Total Inflow	: 6.12 (in)	Peak Storage	: 0.55185(ac-ft)
Total Outflow	: 6.11 (in)	Peak Elevation	: 1328.5(ft)

HMS * Summary of Results for Junction-3

Project : SW Passage Run Name : Proposed Onsite

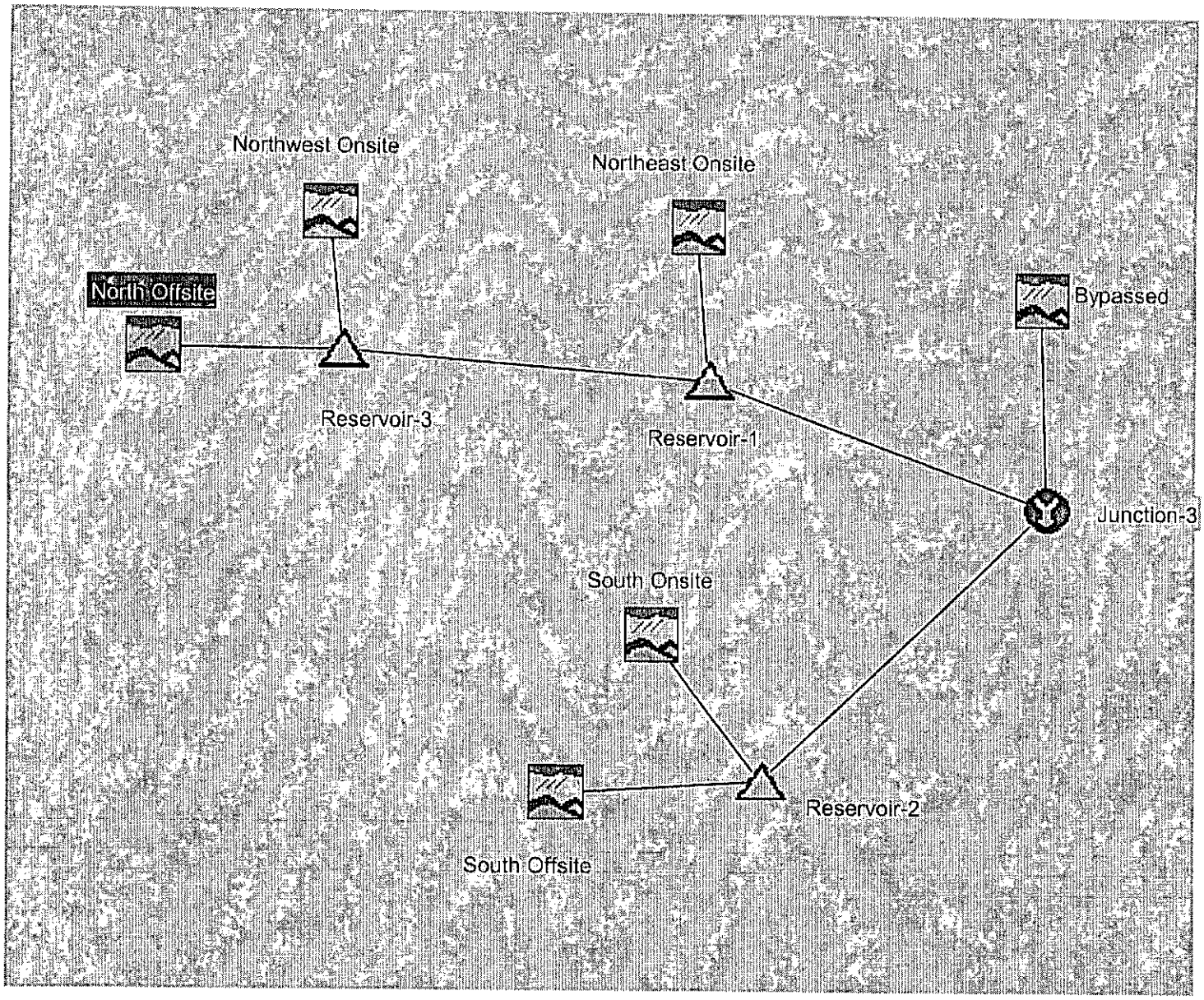
Start of Run	: 31Oct05 0000	Basin Model	: Proposed Onsite
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0713	Control Specs	: Control 1

Computed Results

Peak Outflow : 417.78 (cfs) Date/Time of Peak Outflow : 31 Oct 05 1220

Total Outflow : 6.49 (in)

HEC-HMS Project: SW Passage Basin Model: Proposed



HMS * Summary of Results for Northeast Onsite

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 234.71 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1205
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 6.12 (in)
Total Loss	: 1.65 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.15 (in)	Total Discharge	: 6.12 (in)

HMS * Summary of Results for South Onsite

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 255.12 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1205
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 6.12 (in)
Total Loss	: 1.65 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.15 (in)	Total Discharge	: 6.12 (in)

HMS * Summary of Results for Northwest Onsite

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 68.032 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1205
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 6.12 (in)
Total Loss	: 1.65 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.15 (in)	Total Discharge	: 6.12 (in)

HMS * Summary of Results for Bypassed

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 104.94 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1215
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.51 (in)
Total Loss	: 2.24 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.56 (in)	Total Discharge	: 5.51 (in)

HMS * Summary of Results for North Offsite

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 1964.4 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1550
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 5.46 (in)
Total Loss	: 1.78 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 6.02 (in)	Total Discharge	: 5.46 (in)

HMS * Summary of Results for South Offsite

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Discharge	: 1218.2 (cfs)	Date/Time of Peak Discharge	: 31 Oct 05 1545
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 4.93 (in)
Total Loss	: 2.36 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 5.44 (in)	Total Discharge	: 4.93 (in)

HMS * Summary of Results for Reservoir-1

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Inflow	: 1975.0 (cfs)	Date/Time of Peak Inflow	: 31 Oct 05 1555
Peak Outflow	: 1973.3 (cfs)	Date/Time of Peak Outflow	: 31 Oct 05 1600
Total Inflow	: 5.46 (in)	Peak Storage	: 27.489(ac-ft)
Total Outflow	: 5.43 (in)	Peak Elevation	: 1332.9(ft)

HMS * Summary of Results for Reservoir-2

Project : SW Passage Run Name : Proposed Overall

Start of Run : 31Oct05 0000 Basin Model : Proposed Overall

End of Run : 31Oct05 2400 Met. Model : Met 1

Execution Time : 15Nov05 0720 Control Specs : Control 1

Computed Results

Peak Inflow : 1227.9 (cfs) Date/Time of Peak Inflow : 31 Oct 05 1545

Peak Outflow : 1226.9 (cfs) Date/Time of Peak Outflow : 31 Oct 05 1550

Total Inflow : 4.97 (in) Peak Storage : 17.557(ac-ft)

Total Outflow : 4.90 (in) Peak Elevation : 1333.0(ft)

HMS * Summary of Results for Reservoir-3

Project : SW Passage Run Name : Proposed Overall

Start of Run	: 31Oct05 0000	Basin Model	: Proposed Overall
End of Run	: 31Oct05 2400	Met. Model	: Met 1
Execution Time	: 15Nov05 0720	Control Specs	: Control 1

Computed Results

Peak Inflow	: 1966.9 (cfs)	Date/Time of Peak Inflow	: 31 Oct 05 1550
Peak Outflow	: 1966.5 (cfs)	Date/Time of Peak Outflow	: 31 Oct 05 1555
Total Inflow	: 5.46 (in)	Peak Storage	: 9.0232(ac-ft)
Total Outflow	: 5.45 (in)	Peak Elevation	: 1334.1(ft)

HMS * Summary of Results for Junction-3

Project : SW Passage Run Name : Proposed Overall

Start of Run : 31Oct05 0000 Basin Model : Proposed Overall

End of Run : 31Oct05 2400 Met. Model : Met 1

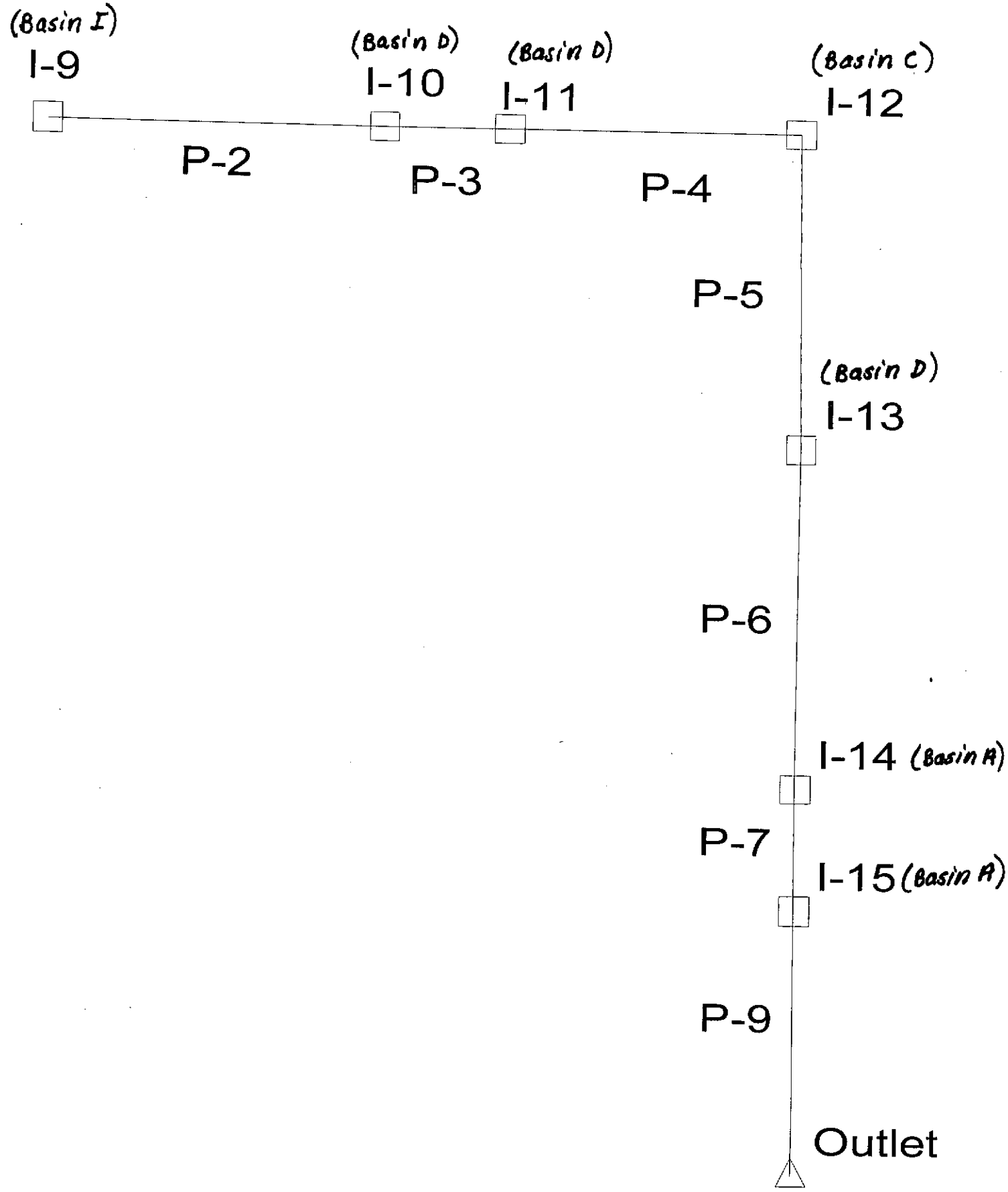
Execution Time : 15Nov05 0720 Control Specs : Control 1

Computed Results

Peak Outflow : 3202.5 (cfs) Date/Time of Peak Outflow : 31 Oct 05 1555

Total Outflow : 5.22 (in)

STORMCAD OUTPUT


(Basin I)
I-9
(Basin D)
I-10
(Basin D)
I-11
(Basin C)
I-12
P-2
P-3
P-4
P-5
(Basin D)
I-13
P-6
I-14 (Basin A)
P-7
I-15 (Basin A)
P-9
Outlet

Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-2	I-9	I-10	113.62	15 inch	4.57	4.12	1,334.70	1,334.13	0.005000		3.00
P-3	I-10	I-11	40.68	24 inch	16.00	5.36	1,333.63	1,333.43	0.005000		9.65
P-4	I-11	I-12	127.46	30 inch	29.00	5.72	1,332.93	1,332.29	0.005000		16.30
P-5	I-12	I-13	149.78	30 inch	29.00	6.25	1,332.29	1,331.54	0.005000		18.50
P-6	I-13	I-14	127.80	30 inch	29.00	6.64	1,331.29	1,330.65	0.005000		22.70
P-7	I-14	I-15	40.81	36 inch	47.16	6.46	1,330.40	1,330.20	0.005000		29.95
P-9	I-15	Outlet	197.80	36 inch	97.18	6.38	1,330.20	1,326.00	0.021230		37.20

DOT Report

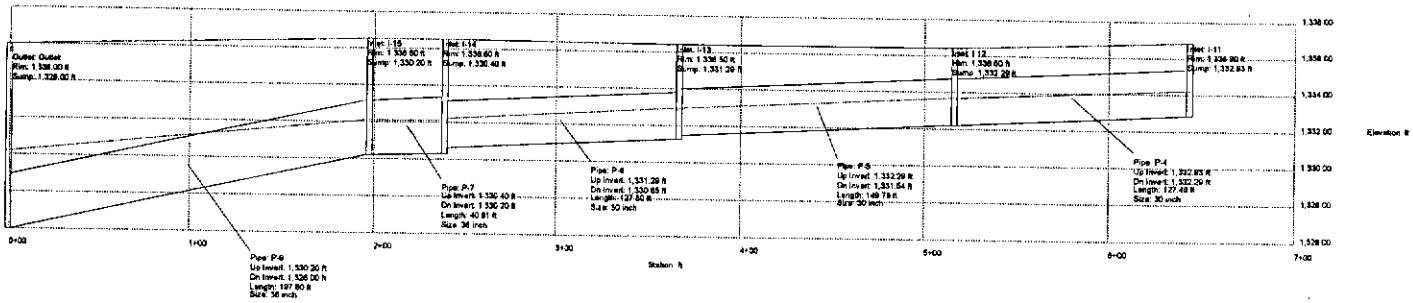
Pipe	-Node- Upstream Downstream	Inlet Area (acres)	Inlet CA (acres)	Total CA (acres)	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Description
P-2	I-9	0.00	0.00	0.00	1,337.20	1,335.44	0.005040	3.00	Circular	113.62	4.12	
	I-10				1,336.90	1,334.83	0.005000	4.57	15 inch			
P-3	I-10	0.00	0.00	0.00	1,336.90	1,334.75	0.005004	9.65	Circular	40.68	5.36	
	I-11				1,336.90	1,334.54	0.005000	16.00	24 inch			
P-4	I-11	0.00	0.00	0.00	1,336.90	1,334.29	0.004914	16.30	Circular	127.46	5.72	
	I-12				1,336.50	1,333.75	0.005000	29.00	30 inch			
P-5	I-12	0.00	0.00	0.00	1,336.50	1,333.75	0.005000	18.50	Circular	149.78	6.25	
	I-13				1,336.50	1,332.99	0.005000	29.00	30 inch			
P-6	I-13	0.00	0.00	0.00	1,336.50	1,332.96	0.005017	22.70	Circular	127.80	6.64	
	I-14				1,336.60	1,332.27	0.005000	29.00	30 inch			
P-7	I-14	0.00	0.00	0.00	1,336.60	1,332.18	0.004009	29.95	Circular	40.81	6.46	
	I-15				1,336.60	1,332.18	0.005000	47.16	36 inch			
P-9	I-15	0.00	0.00	0.00	1,336.60	1,332.18	0.012269	37.20	Circular	197.80	6.38	
	Outlet				1,336.00	1,330.20	0.021230	97.18	36 inch			

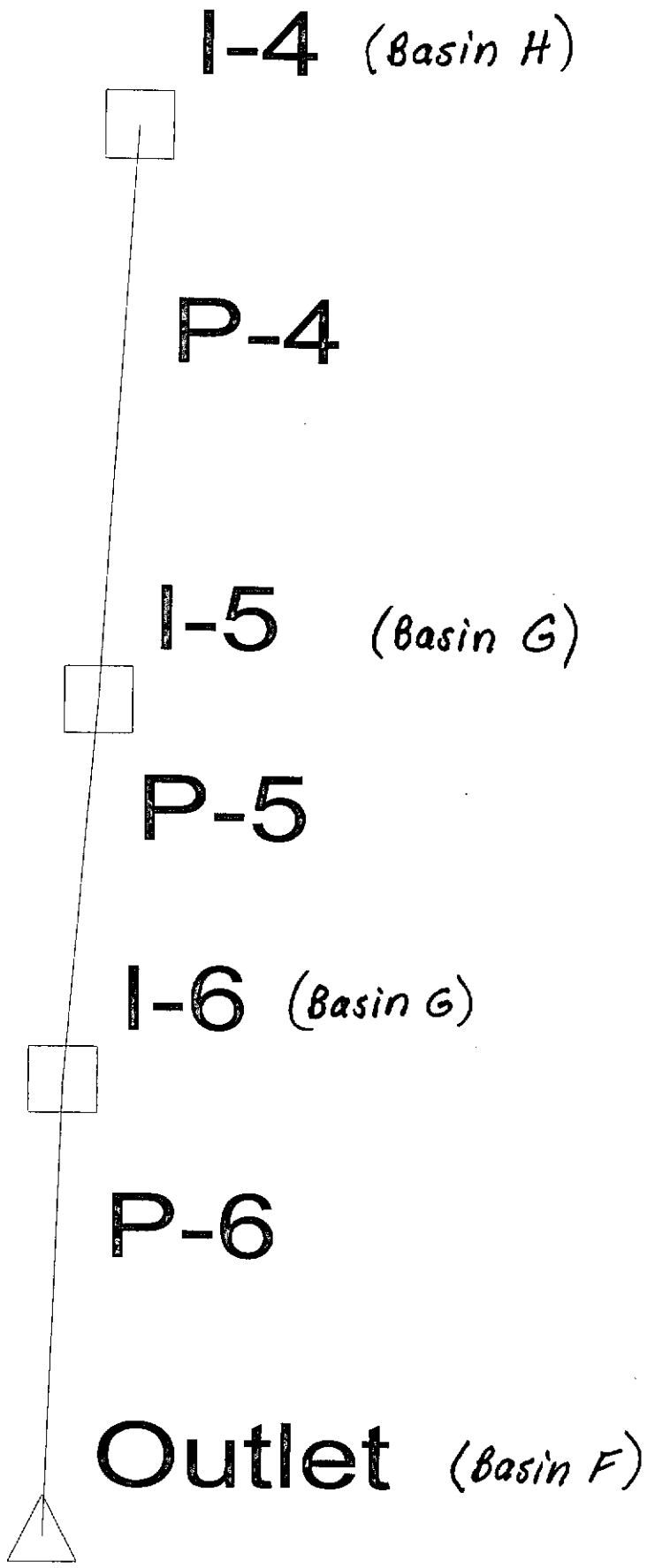
Node Report

Node	Inlet A (acres)	C	Up Flow Time (min)	Sys Flow Time (min)	Q (cfs)	Rim (ft)	Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Sump (ft)	Add. Q (cfs)	Known Flow (cfs)
I-9	0.00	0.00	0.00	0.00	3.00	1,337.20	1,337.20	1,335.44	1,335.44	1,334.70	3.00	0.00
I-10	0.00	0.00	0.46	0.46	9.65	1,336.90	1,336.90	1,334.75	1,334.75	1,333.63	6.65	0.00
I-11	0.00	0.00	0.59	0.59	16.30	1,336.90	1,336.90	1,334.29	1,334.29	1,332.93	6.65	0.00
I-12	0.00	0.00	0.96	0.96	18.50	1,336.50	1,336.50	1,333.75	1,333.75	1,332.29	2.20	0.00
I-13	0.00	0.00	1.36	1.36	22.70	1,336.50	1,336.50	1,332.96	1,332.96	1,331.29	4.20	0.00
I-14	0.00	0.00	1.68	1.68	29.95	1,336.60	1,336.60	1,332.18	1,332.18	1,330.40	7.25	0.00
I-15	0.00	0.00	1.78	1.78	37.20	1,336.60	1,336.60	1,332.18	1,332.18	1,330.20	7.25	0.00
Outlet	N/A	N/A	2.30	2.30	N/A	1,336.00	1,336.00	1,330.20	1,330.20	1,326.00	N/A	N/A

Pipe Report

Pipe	Up Node	Dn Node	Q (cfs)	Length (ft)	S (ft/ft)	Size	Roughness	Cap (cfs)	Up Invert (ft)	Dn Invert (ft)	Up Cover (ft)	Dn Cover (ft)	Up HGL (ft)	Dn HGL (ft)
P-2	I-9	I-10	3.00	113.62	0.005000	15 inch	0.013	4.57	1,334.70	1,334.13	1.25	1.52	1,335.44	1,334.83
P-3	I-10	I-11	9.65	40.68	0.005000	24 inch	0.013	16.00	1,333.63	1,333.43	1.27	1.47	1,334.75	1,334.54
P-4	I-11	I-12	16.30	127.46	0.005000	30 inch	0.013	29.00	1,332.93	1,332.29	1.47	1.71	1,334.29	1,333.75
P-5	I-12	I-13	18.50	149.78	0.005000	30 inch	0.013	29.00	1,332.29	1,331.54	1.71	2.46	1,333.75	1,332.99
P-6	I-13	I-14	22.70	127.80	0.005000	30 inch	0.013	29.00	1,331.29	1,330.65	2.71	3.45	1,332.96	1,332.27
P-7	I-14	I-15	29.95	40.81	0.005000	36 inch	0.013	47.16	1,330.40	1,330.20	3.20	3.40	1,332.18	1,332.18
P-9	I-15	Outlet	37.20	197.80	0.021230	36 inch	0.013	97.18	1,330.20	1,326.00	3.40	7.00	1,332.18	1,330.20
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A


Outlet: Outlet
Rim: 1,338.00 ft
Sump: 1,328.00 ft
Pipe: P-6
Up Invert: 1,330.20 ft
Dn Invert: 1,326.00 ft
Length: 197.80 ft
Size: 36 inch
Pipe: P-7
Up Invert: 1,330.40 ft
Dn Invert: 1,330.20 ft
Length: 40.81 ft
Size: 36 inch
Pipe: P-8
Up Invert: 1,331.29 ft
Dn Invert: 1,330.85 ft
Length: 127.50 ft
Size: 50 inch
Pipe: P-5
Up Invert: 1,332.29 ft
Dn Invert: 1,331.54 ft
Length: 149.79 ft
Size: 30 inch
Pipe: P-4
Up Invert: 1,332.83 ft
Dn Invert: 1,332.29 ft
Length: 127.40 ft
Size: 30 inch
0+00
1+00
2+00
3+00
4+00
5+00
6+00
7+00
Station, ft
1,338.00
1,336.00
1,334.00
1,332.00
1,330.00
1,328.00
1,326.00
Elevation, ft


I-4 (Basin H)
P-4
I-5 (Basin G)
P-5
I-6 (Basin G)
P-6
Outlet (Basin F)

Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-4	I-4	I-5	21.03	24 inch	16.00	6.28	1,330.55	1,330.44	0.005000		15.60
P-5	I-5	I-6	34.75	30 inch	29.00	5.95	1,329.94	1,329.77	0.005000		22.05
P-6	I-6	Outlet	21.03	30 inch	42.05	7.44	1,329.77	1,329.55	0.010514		28.50

DOT Report

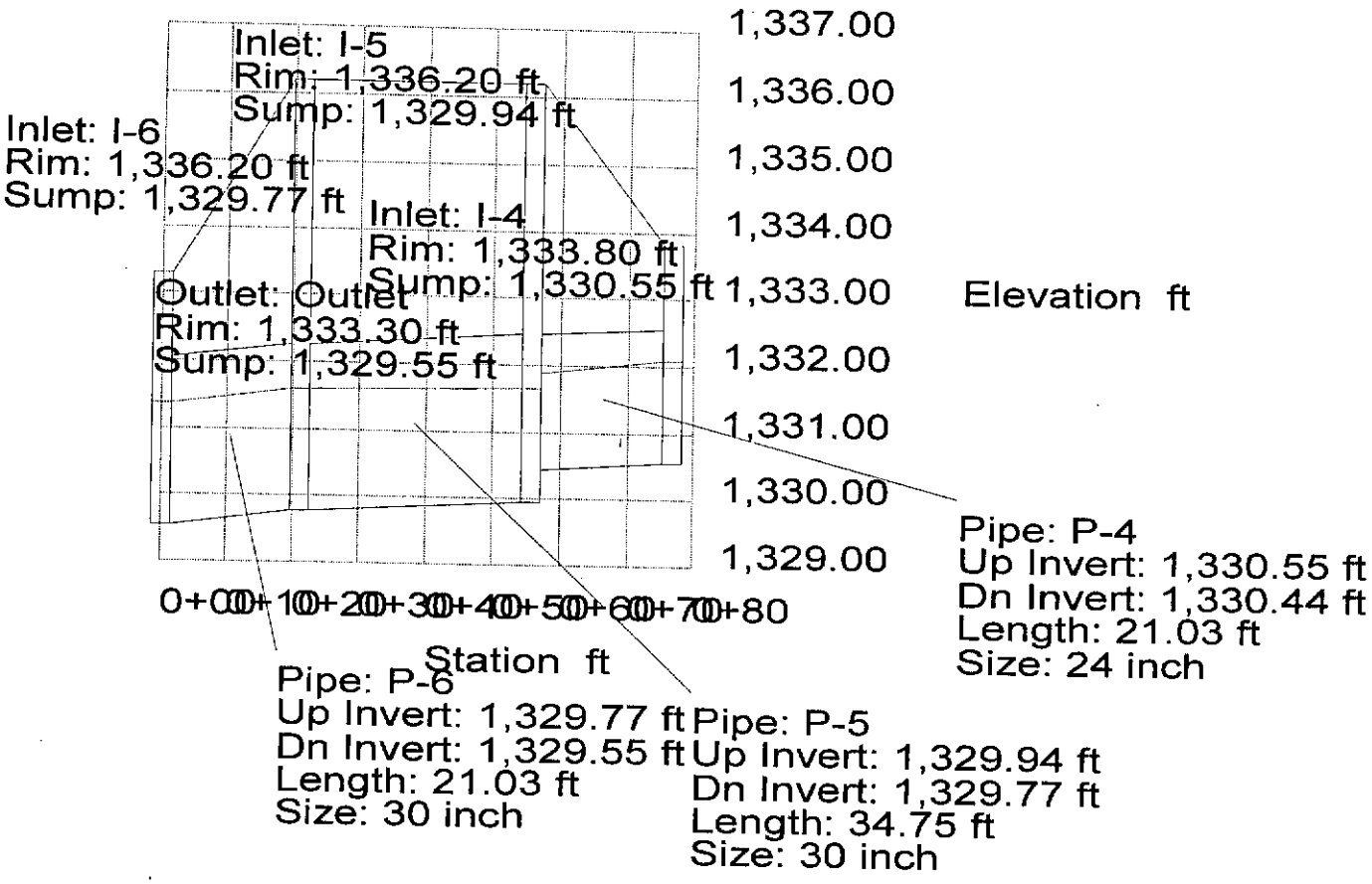
Pipe	-Node- Upstream Downstream	Inlet Area (acres)	Inlet CA (acres)	Total CA (acres)	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Description
P-4	I-4	0.00	0.00	0.00	1,333.80	1,332.08	0.005716	15.60	Circular	21.03	6.28	
	I-5				1,336.20	1,331.87	0.005000	16.00	24 inch			
P-5	I-5	0.00	0.00	0.00	1,336.20	1,331.66	0.004027	22.05	Circular	34.75	5.95	
	I-6				1,336.20	1,331.59	0.005000	29.00	30 inch			
P-6	I-6	0.00	0.00	0.00	1,336.20	1,331.59	0.010514	28.50	Circular	21.03	7.44	
	Outlet				1,333.30	1,331.37	0.010514	42.05	30 inch			

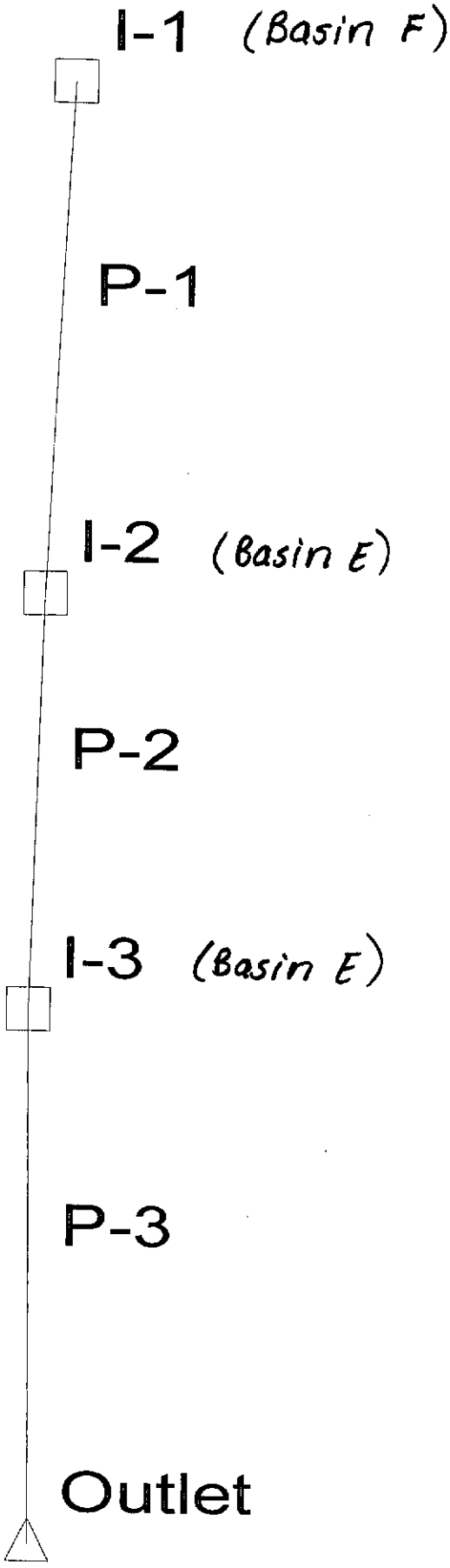
Node Report

Node	Inlet A (acres)	C	Up Flow Time (min)	Sys Flow Time (min)	Q (cfs)	Rim (ft)	Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Sump (ft)	Add. Q (cfs)	Known Flow (cfs)
I-4	0.00	0.00	0.00	0.00	15.60	1,333.80	1,333.80	1,332.08	1,332.08	1,330.55	15.60	0.00
I-5	0.00	0.00	0.06	0.06	22.05	1,336.20	1,336.20	1,331.66	1,331.66	1,329.94	6.45	0.00
I-6	0.00	0.00	0.15	0.15	28.50	1,336.20	1,336.20	1,331.59	1,331.59	1,329.77	6.45	0.00
Outlet	N/A	N/A	0.20	0.20	N/A	1,333.30	1,333.30	1,331.37	1,331.37	1,329.55	N/A	N/A

Pipe Report

Pipe	Up Node	Dn Node	Q (cfs)	Length (ft)	S (ft/ft)	Size	Roughness	Cap (cfs)	Up Invert (ft)	Dn Invert (ft)	Up Cover (ft)	Dn Cover (ft)	Up HGL (ft)	Dn HGL (ft)
P-4	I-4	I-5	15.60	21.03	0.005000	24 inch	0.013	16.00	1,330.55	1,330.44	1.25	3.76	1,332.08	1,331.87
P-5	I-5	I-6	22.05	34.75	0.005000	30 inch	0.013	29.00	1,329.94	1,329.77	3.76	3.93	1,331.66	1,331.59
P-6	I-6	Outlet	28.50	21.03	0.010514	30 inch	0.013	42.05	1,329.77	1,329.55	3.93	1.25	1,331.59	1,331.37
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A


Inlet: I-5
Rim: 1,336.20 ft
Sump: 1,329.94 ft
Inlet: I-6
Rim: 1,336.20 ft
Sump: 1,329.77 ft
Inlet: I-4
Rim: 1,333.80 ft
Sump: 1,330.55 ft
Outlet: Outlet
Rim: 1,333.30 ft
Sump: 1,329.55 ft
1,337.00
1,336.00
1,335.00
1,334.00
1,333.00
1,332.00
1,331.00
1,330.00
1,329.00
Elevation ft
0+00 0+10 0+20 0+30 0+40 0+50 0+60 0+70 0+80
Station ft
Pipe: P-4
Up Invert: 1,330.55 ft
Dn Invert: 1,330.44 ft
Length: 21.03 ft
Size: 24 inch
Pipe: P-6
Up Invert: 1,329.77 ft
Dn Invert: 1,329.55 ft
Length: 21.03 ft
Size: 30 inch
Pipe: P-5
Up Invert: 1,329.94 ft
Dn Invert: 1,329.77 ft
Length: 34.75 ft
Size: 30 inch


I-1 (Basin F)
P-1
I-2 (Basin E)
P-2
I-3 (Basin E)
P-3
Outlet

Combined Pipe/Node Report

Pipe	Up Node	Dn Node	Length (ft)	Size	Cap (cfs)	V avg (ft/s)	Up Invert (ft)	Dn Invert (ft)	S (ft/ft)	Description	Q (cfs)
P-1	I-1	I-2	20.67	36 inch	47.16	7.86	1,326.75	1,326.65	0.005000		43.40
P-2	I-2	I-3	40.68	42 inch	71.14	7.55	1,326.15	1,325.94	0.005000		56.80
P-3	I-3	Outlet	211.98	42 inch	113.40	9.07	1,325.94	1,323.25	0.012705		70.20

DOT Report

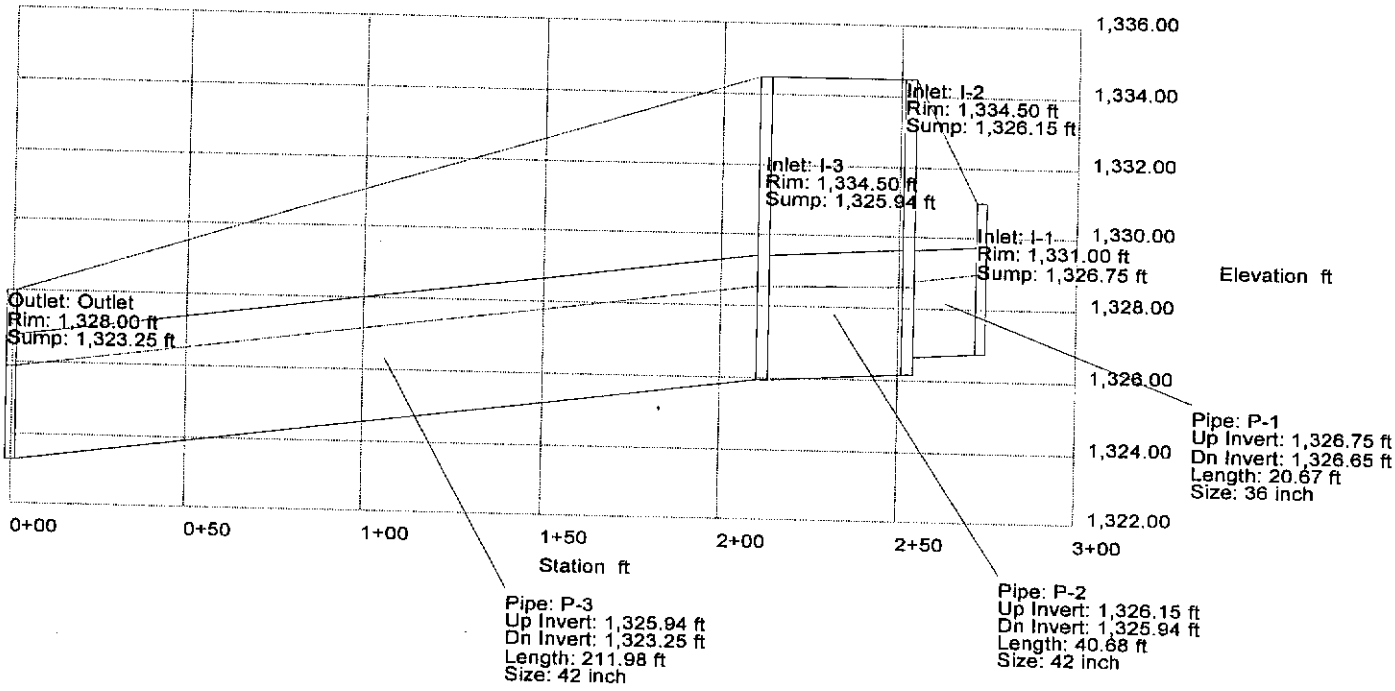
Pipe	-Node- Upstream Downstream	Inlet Area (acres)	Inlet CA (acres)	Total CA (acres)	-Ground- Upstream Downstream (ft)	-HGL- Upstream Downstream (ft)	-Slope- Energy Constructed (ft/ft)	-Section- Discharge Capacity (cfs)	-Section- Shape Size	Length (ft)	Average Velocity (ft/s)	Description
P-1	I-1	0.00	0.00	0.00	1,331.00	1,328.98	0.005320	43.40	Circular	20.67	7.86	
	I-2				1,334.50	1,328.79	0.005000	47.16	36 inch			
P-2	I-2	0.00	0.00	0.00	1,334.50	1,328.64	0.004088	56.80	Circular	40.68	7.55	
	I-3				1,334.50	1,328.57	0.005000	71.14	42 inch			
P-3	I-3	0.00	0.00	0.00	1,334.50	1,328.57	0.012705	70.20	Circular	211.98	9.07	
	Outlet				1,328.00	1,325.88	0.012705	113.40	42 inch			

Node Report

Node	Inlet A (acres)	C	Up Flow Time (min)	Sys Flow Time (min)	Q (cfs)	Rim (ft)	Gr Elev (ft)	HGL In (ft)	HGL Out (ft)	Sump (ft)	Add. Q (cfs)	Known Flow (cfs)
I-1	0.00	0.00	0.00	0.00	43.40	1,331.00	1,331.00	1,328.98	1,328.98	1,326.75	43.40	0.00
I-2	0.00	0.00	0.04	0.04	56.80	1,334.50	1,334.50	1,328.64	1,328.64	1,326.15	13.40	0.00
I-3	0.00	0.00	0.13	0.13	70.20	1,334.50	1,334.50	1,328.57	1,328.57	1,325.94	13.40	0.00
Outlet	N/A	N/A	0.52	0.52	N/A	1,328.00	1,328.00	1,325.88	1,325.88	1,323.25	N/A	N/A

Pipe Report

Pipe	Up Node	Dn Node	Q (cfs)	Length (ft)	S (ft/ft)	Size	Roughness	Cap (cfs)	Up Invert (ft)	Dn Invert (ft)	Up Cover (ft)	Dn Cover (ft)	Up HGL (ft)	Dn HGL (ft)
P-1	I-1	I-2	43.40	20.67	0.005000	36 inch	0.013	47.16	1,326.75	1,326.65	1.25	4.85	1,328.98	1,328.79
P-2	I-2	I-3	56.80	40.68	0.005000	42 inch	0.013	71.14	1,326.15	1,325.94	4.85	5.06	1,328.64	1,328.57
P-3	I-3	Outlet	70.20	211.98	0.012705	42 inch	0.013	113.40	1,325.94	1,323.25	5.06	1.25	1,328.57	1,325.88
	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A


1,336.00
1,334.00
1,332.00
1,330.00
1,328.00
1,326.00
1,324.00
1,322.00
Elevation ft
Inlet: I-2
Rim: 1,334.50 ft
Sump: 1,326.15 ft
Inlet: I-3
Rim: 1,334.50 ft
Sump: 1,325.94 ft
Inlet: I-1
Rim: 1,331.00 ft
Sump: 1,326.75 ft
Outlet: Outlet
Rim: 1,328.00 ft
Sump: 1,323.25 ft
Pipe: P-1
Up Invert: 1,326.75 ft
Dn Invert: 1,326.65 ft
Length: 20.67 ft
Size: 36 inch
0+00
0+50
1+00
1+50
2+00
2+50
3+00
Station ft
Pipe: P-3
Up Invert: 1,325.94 ft
Dn Invert: 1,323.25 ft
Length: 211.98 ft
Size: 42 inch
Pipe: P-2
Up Invert: 1,326.15 ft
Dn Invert: 1,325.94 ft
Length: 40.68 ft
Size: 42 inch