

**DRAINAGE REPORT
FOR
EMERALD BAY ESTATES
SEDGWICK COUNTY, KANSAS**

NOVEMBER 2005

Drainage Plan – Emerald Bay Estates

Wichita, Kansas
November, 2005

Site Description

The project site is located in northwest Wichita in the east ½ of Sec. 2, 27S, 1W on West Street ¼ north of 21st Street. The site is approximately 155 acres in size and was formerly in use as a sand pit. The sand dredging has ceased but has created a lake of app. 67 acres in the center of the site.

The eastern portion of the site is located within FEMA Flood Zone B, defined as areas protected by levees from the base flood. A portion of FEMA Map Panel 2003210125A, dated June 3, 1986 is attached to this report.

From the **SCS Soil Survey for Sedgwick County, Kansas, 1979**, the predominant soil group is Pc, Pratt, a very sandy soil type. For the analysis of this area, a Hydrological soil group of “A” will be used.

Existing Conditions

The site was originally a very flat, draining generally to the east as demonstrated by the attached USGS map. During the sand dredging operations the overburden was removed and stockpiled around the southern and eastern perimeter of the site. The pond has a normal pool elevation of 1310.0 and the relief point or outlet from the pond is to overtop the southeastern banks at an elevation of approximately 1319.1. The existing pond accepts runoff from almost the entire site, the portions draining offsite are located around the perimeter site where the stockpiles shed the water east to a ditch along West Street or south and southwest to additional sand pits on the adjacent properties. The topography of the site and surrounding area is extremely flat and it is difficult to establish the drainage patterns. However, again from the attached USGS map there is a total offsite area of 158 acres with the potential to drain onto the site from the north and west.

Proposed Conditions

Detention storage analysis is performed using the U.S. Army Corps of Engineers HEC-HMS program, with the various input parameters described in this report. The design rainfall event (7.8 inches) is the 100-year, 24 hour storm as defined by U.S. Weather Bureau Technical Paper 40. The SCS Type II Rainfall distribution is used for the model. Localized drainage basins and conduit sizing shall be based upon the Rational Method. Times of concentration are calculated using the velocity method.

The detention analysis is performed to demonstrate that the existing pond provides enough storage in its natural condition to compensate for any increase caused by development. Offsite areas draining on to the project site are assumed to be fully developed, 1/3 acre single family lots, with no detention provided. The pond is provided with a double 24” outlet pipe at an elevation of 1320.0. The outlet elevation is controlled by the drainage ditch and culverts exiting the site easterly under West Street. The existing drainage ditch travels northeasterly along the toe of the levee of the big ditch. There will be no other relief point for the pond as the storage provided is more than

adequate to contain the 100-year storm as demonstrated by the detention model. The pond water surface elevation will eventually return to normal pool by infiltration of the stored water into the surrounding sandy soils.

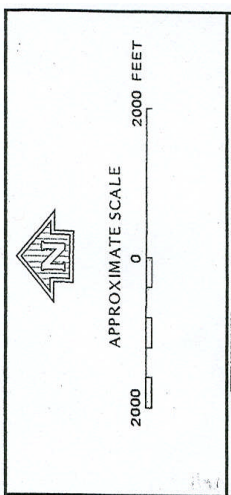
CONCLUSIONS

The HEC-HMS model reveals that the 100-year storm will raise the elevation of the existing pond only 1.3 feet from 1310.0 to 1311.3. The detention volume provided at this elevation is 88.85 acre-feet. The detention volume provided at the outlet elevation of 1320.0 is approximately 715 acre-feet. These calculations indicate it would take over eight consecutive 100-year storms to use all the available storage and to begin flowing out the 2-24" culvert provided at elevation 1320.0. Additionally, a high water mark for the Halloween flood of 1998 was located in the existing sand pit to the southwest of the proposed site was located. The existing water elevation of the southwestern sand pit is approximately 1311.3 and the high water mark was located at an elevation of 1313.0.

The pipe system has been sized for the 100-year storm and will accept the 100-year storm from the offsite areas draining onto the site. Connection points have been provided for the offsite areas to tie into with storm sewer when and if development occurs.

All lots bordering the pond will have a minimum pad elevation. The minimum pad elevations are set at 1321.0, 1.0 foot above the outlet elevation of 1320.0.

**FEMA FLOOD
INSURANCE RATE MAP**



NATIONAL FLOOD INSURANCE PROGRAM


FIRM
FLOOD INSURANCE RATE MAP

SEDGWICK,
COUNTY,
KANSAS
(UNINCORPORATED AREAS)

PANEL 125 OF 300

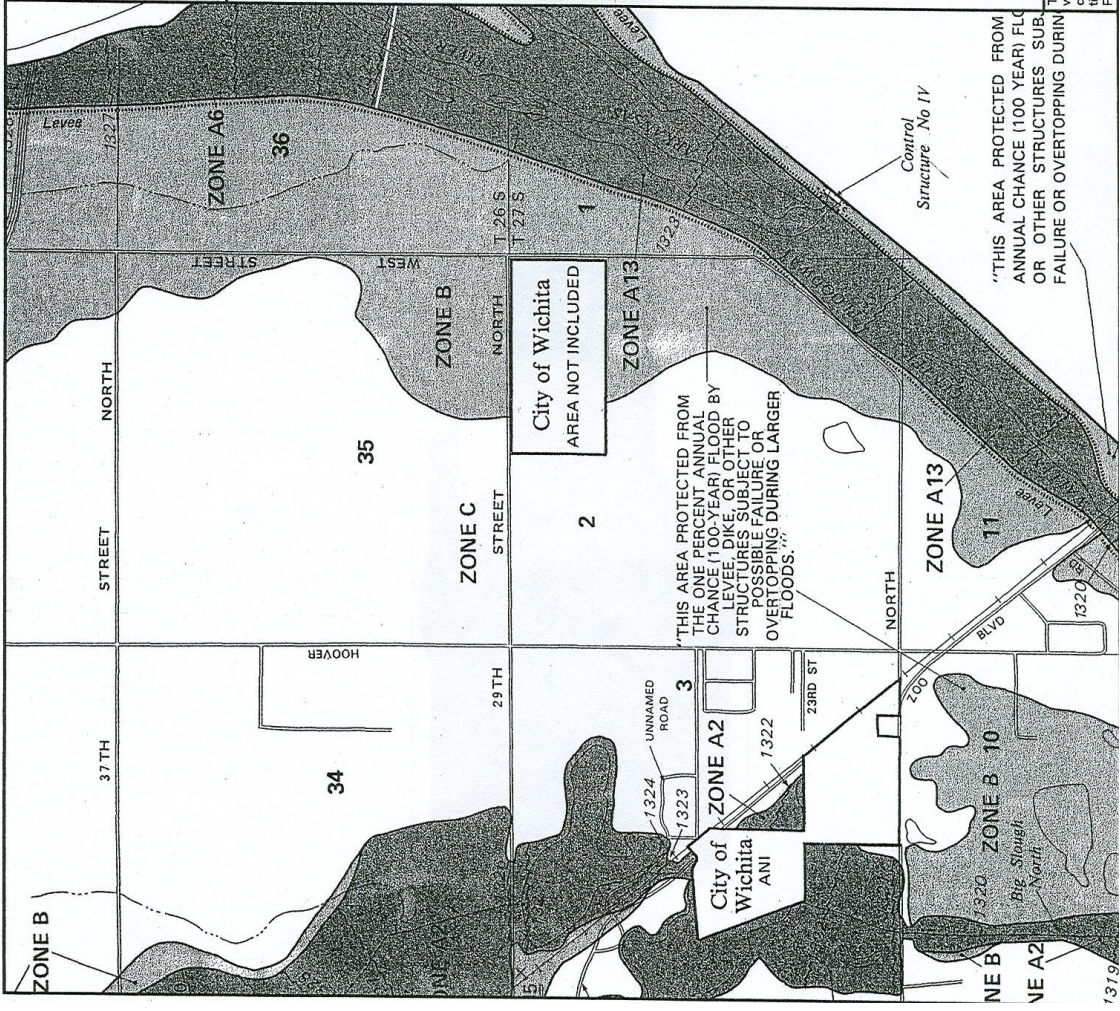
COMMUNITY-PANEL NUMBER
200321 0125 A

EFFECTIVE DATE:
JUNE 3, 1986



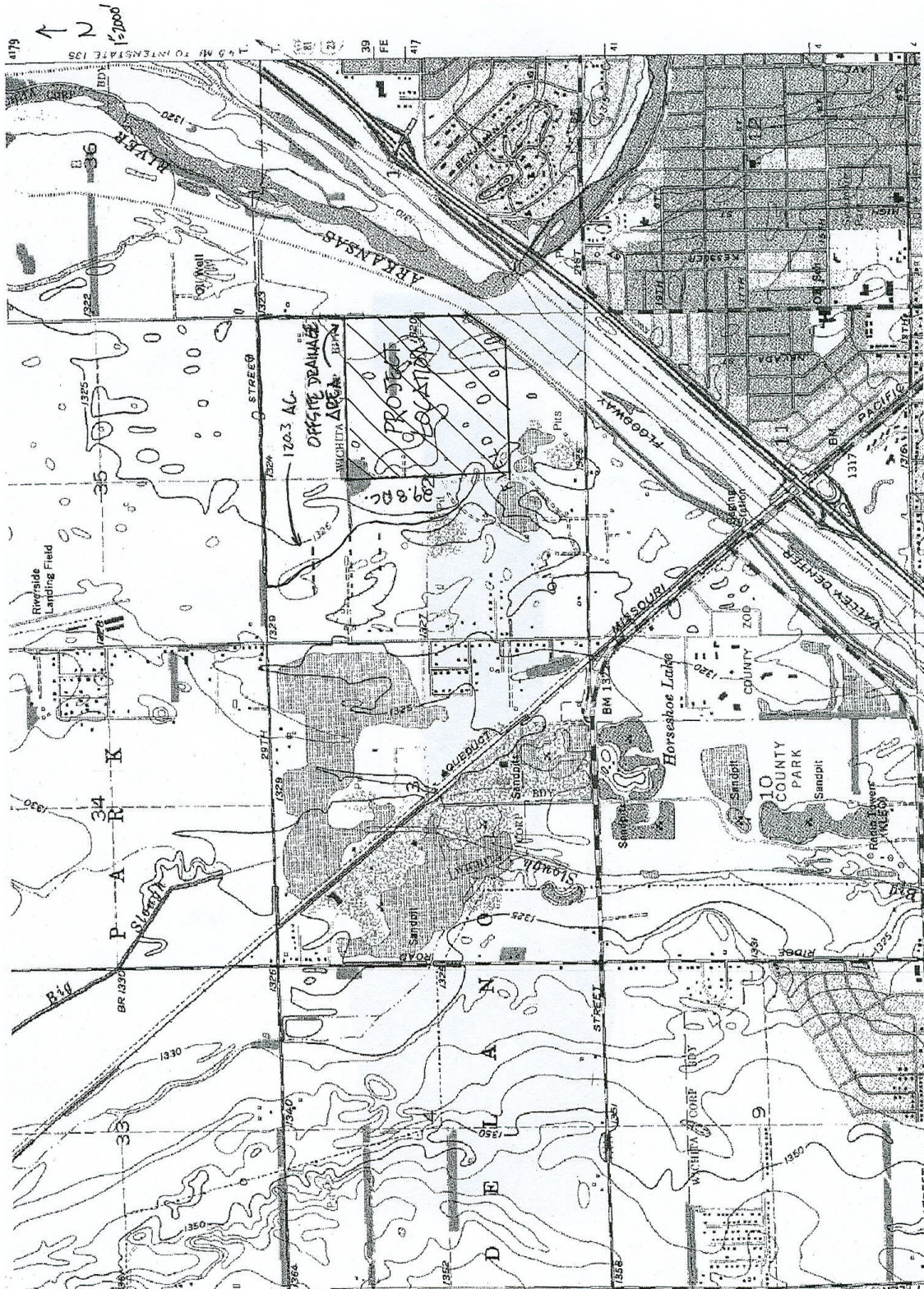
Federal Emergency Management Agency

This is an official copy of a portion of the above referenced flood map. It was extracted using FIRM On-Line. This map does not reflect changes in the flood hazard information since the date of the original map. For the latest product information about National Flood Insurance Program flood maps check the FEMA Flood Map Store at www.msc.fema.gov



DRAINAGE PLAN

USGS MAP



HEC-HMS OUTPUT

Emerald Bay
100-yr Design Storm Pond Summary

Existing Condition

Static Water Surface	1310.0
Q ₁₀₀ In	493.0 cfs
Q ₁₀₀ Out	0.0 cfs
100-yr Elevation	1311.3
100-yr Storage	86.75 ac-ft

Proposed Condition

Static Water Surface	1310.0
Q ₁₀₀ In	511.4 cfs
Q ₁₀₀ Out	0.0 cfs
100-yr Elevation	1311.3
100-yr Storage	88.85 ac-ft.

Times of Concentration

NW Offsite:

T₁, Sheet Flow, L = 300', S = 0.5%, V₁ = short grass pasture = 0.20 ft/s
T₁ = 300'/0.20 fps = 25 min.

T₂, Grassed Waterway, L = 2000', S = 0.2%, V₂ = grassed waterway = 0.48 ft/s
T₂ = 2000'/0.48 fps = 69 min.

T₃, Assumed Velocity, L = 1000', V₃ = Assumed Velocity = 3.00 ft/s
T₃ = 1000'/3.0 fps = 6 min.

T_{total} = 99 min.

NE Offsite:

T₁, Sheet Flow, L = 300', S = 0.5%, V₁ = short grass pasture = 0.20 ft/s
T₁ = 300'/0.20 fps = 25 min.

T₂, Grassed Waterway, L = 600', S = 0.5%, V₂ = grassed waterway = 0.77 ft/s
T₂ = 600'/0.77 fps = 13 min.

T₃, Assumed Velocity, L = 600', V₃ = Assumed Velocity = 3.00 ft/s
T₃ = 600'/3.0 fps = 3 min.

T_{total} = 41 min.

West Offsite:

T₁, Sheet Flow, L = 300', S = 0.5%, V₁ = short grass pasture = 0.20 ft/s
T₁ = 300'/0.20 fps = 25 min.

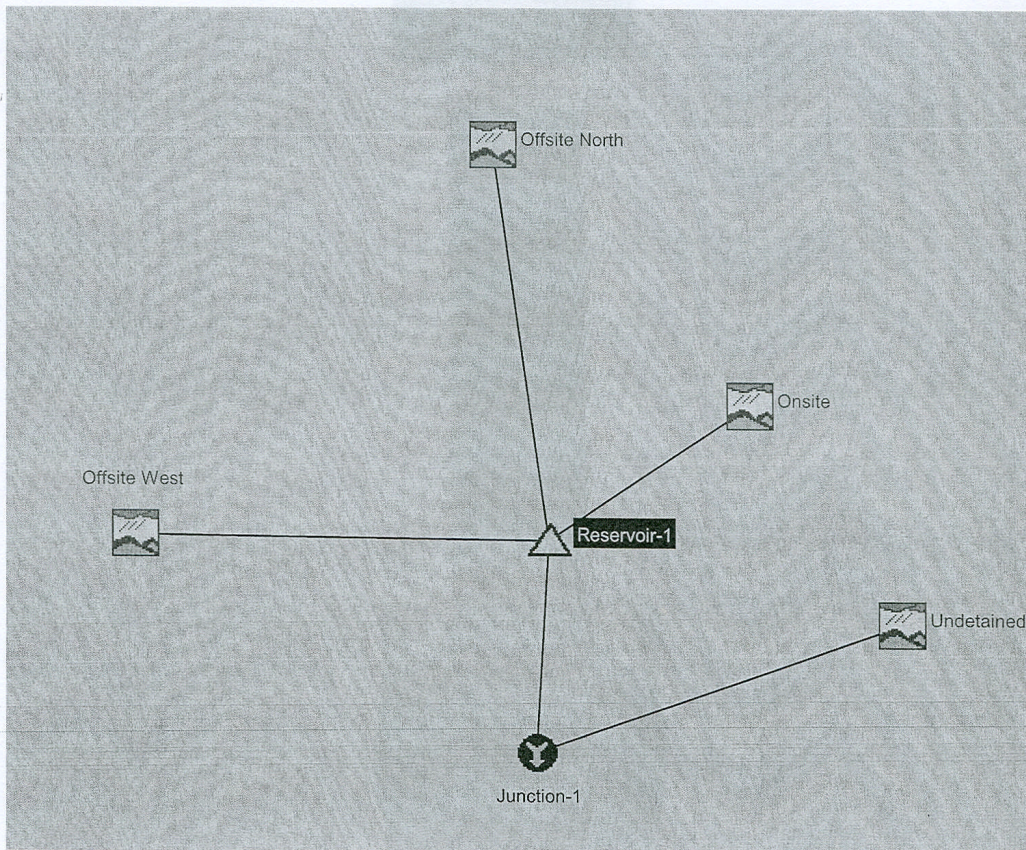
T₂, Grassed Waterway, L = 500', S = 0.5%, V₂ = grassed waterway = 0.77 ft/s
T₂ = 500'/0.77 fps = 11 min.

T₃, Assumed Velocity, L = 400', V₃ = Assumed Velocity = 3.00 ft/s
T₃ = 400'/3.0 fps = 2 min.

T_{total} = 38 min.

Onsite;

T_C for all onsite basins is 15 min. in this analysis.



HMS * Basin Model * Subbasin Editor

Help

Subbasin Name: Area (sq. mi.)

Description:

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious:

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Offsite North

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge	: 100.75 (cfs)	Date/Time of Peak Discharge	: 02 Jan 05 0140
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 3.15 (in)
Total Loss	: 4.51 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 3.29 (in)	Total Discharge	: 3.15 (in)

HMS * Basin Model * Subbasin Editor

Help

Subbasin Name : Area (sq. mi.)

Description :

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious :

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Offsite West

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed

End of Run : 02Jan05 1200 Met. Model : Met 1

Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge	: 61.774 (cfs)	Date/Time of Peak Discharge	: 02 Jan 05 0035
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 3.24 (in)
Total Loss	: 4.51 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 3.29 (in)	Total Discharge	: 3.24 (in)

HMS * Basin Model * Subbasin Editor

Help

Subbasin Name : Area (sq. mi.)

Description : ...

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious :

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Undetained

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge	: 42.256 (cfs)	Date/Time of Peak Discharge	: 02 Jan 05 0010
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 3.27 (in)
Total Loss	: 4.51 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 3.29 (in)	Total Discharge	: 3.27 (in)

HMS * Basin Model * Subbasin Editor

Help

Subbasin Name : Area (sq. mi.)

Description :

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious :

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Onsite

Project : Emerald Bay Run Name : Run 2

Start of Run : 01Jan05 1200 Basin Model : Existing
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 29Nov05 1345 Control Specs : Control 1

Computed Results

Peak Discharge	: 432.63 (cfs)	Date/Time of Peak Discharge	: 02 Jan 05 0010
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 4.94 (in)
Total Loss	: 2.82 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 4.98 (in)	Total Discharge	: 4.94 (in)

HMS * Basin Model * Reservoir Editor

Edit File Help

Reservoir Name:

Description:

Storage Outlet Spillway Overflow Dam Break

Method:

Initial

Elevation (ft)	Area (acres)	Outflow (cfs)
1310.0	67.00	0.0
1311.0	67.65	0.0
1312.0	68.50	0.0
1313.0	69.21	0.0
1314.0	70.00	0.0
1315.0	70.75	0.0
1316.0	71.90	0.0
1317.0	72.90	0.0
1318.0	75.90	0.0
1319.0	76.90	0.0
1320.0	77.50	0.0
1321.0	78.00	9.0

Graph

OK Apply Cancel

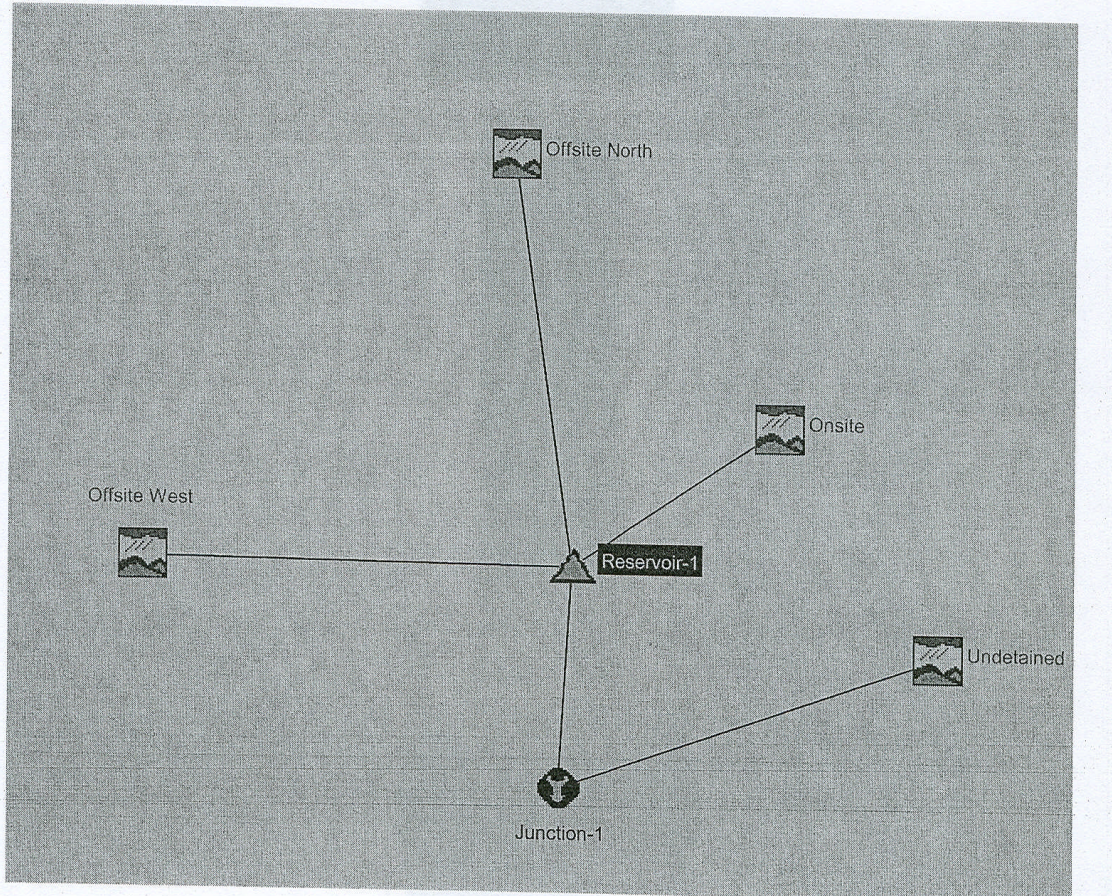
HMS * Summary of Results for Reservoir-1

Project : Emerald Bay Run Name : Run 2

Start of Run : 01Jan05 1200 Basin Model : Existing
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 29Nov05 1345 Control Specs : Control 1

Computed Results

Peak Inflow : 492.95 (cfs) Date/Time of Peak Inflow : 02 Jan 05 0015
Peak Outflow : 0.0 (cfs) Date/Time of Peak Outflow : 01 Jan 05 1200
Total Inflow : 3.90 (in) Peak Storage : 86.747(ac-ft)
Total Outflow : 0.00 (in) Peak Elevation : 1311.3(ft)



HMS * Basin Model * Subbasin Editor

Help

Subbasin Name : Area (sq. mi.)

Description :

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious :

SCS Curve No.:

Subbasin name

HMS * Summary of Results for Offsite North

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed

End of Run : 02Jan05 1200 Met. Model : Met 1

Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge	: 100.75 (cfs)	Date/Time of Peak Discharge	: 02 Jan 05 0140
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 3.15 (in)
Total Loss	: 4.51 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 3.29 (in)	Total Discharge	: 3.15 (in)

HMS * Basin Model * Subbasin Editor

Help

Subbasin Name : Area (sq. mi.)

Description : ...

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious :

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Offsite West

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge : 61.774 (cfs) Date/Time of Peak Discharge : 02 Jan 05 0035
Total Precipitation : 7.80 (in) Total Direct Runoff : 3.24 (in)
Total Loss : 4.51 (in) Total Baseflow : 0.00 (in)
Total Excess : 3.29 (in) Total Discharge : 3.24 (in)

HMS * Basin Model * Subbasin Editor

Help

Subbasin Name : Area (sq. mi.)

Description : ...

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious :

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Undetained

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge	: 42.256 (cfs)	Date/Time of Peak Discharge	: 02 Jan 05 0010
Total Precipitation	: 7.80 (in)	Total Direct Runoff	: 3.27 (in)
Total Loss	: 4.51 (in)	Total Baseflow	: 0.00 (in)
Total Excess	: 3.29 (in)	Total Discharge	: 3.27 (in)

HMS * Basin Model * Subbasin Editor

Help

Subbasin Name: Area (sq. mi.)

Description:

Loss Rate | Transform | Baseflow Method

Method: ▾

Initial Loss (in): % Impervious:

SCS Curve No.:

OK Apply Cancel

Subbasin name

HMS * Summary of Results for Onsite

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed
End of Run : 02Jan05 1200 Met. Model : Met 1
Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Discharge : 452.36 (cfs) Date/Time of Peak Discharge : 02 Jan 05 0010
Total Precipitation : 7.80 (in) Total Direct Runoff : 5.17 (in)
Total Loss : 2.59 (in) Total Baseflow : 0.00 (in)
Total Excess : 5.21 (in) Total Discharge : 5.17 (in)

HMS * Basin Model * Reservoir Editor

Edit File Help

Reservoir Name:

Description:

Storage Outlet Spillway Overflow Dam Break

Method:

Initial

Elevation (ft)	Area (acres)	Outflow (cfs)
1310.0	67.00	0.0
1311.0	67.65	0.0
1312.0	68.50	0.0
1313.0	69.21	0.0
1314.0	70.00	0.0
1315.0	70.75	0.0
1316.0	71.90	0.0
1317.0	72.90	0.0
1318.0	75.90	0.0
1319.0	76.90	0.0
1320.0	77.50	0.0
1321.0	78.00	9.0

Graph

OK Apply Cancel

HMS * Summary of Results for Reservoir-1

Project : Emerald Bay Run Name : Run 1

Start of Run : 01Jan05 1200 Basin Model : Proposed

End of Run : 02Jan05 1200 Met. Model : Met 1

Execution Time : 31Oct05 1701 Control Specs : Control 1

Computed Results

Peak Inflow : 511.38 (cfs) Date/Time of Peak Inflow : 02 Jan 05 0015

Peak Outflow : 0.0 (cfs) Date/Time of Peak Outflow : 01 Jan 05 1200

Total Inflow : 3.99 (in) Peak Storage : 88.854(ac-ft)

Total Outflow : 0.00 (in) Peak Elevation : 1311.3(ft)