
AMAFCA On-call Engineering Services – Task 3
Proposed KAFB South Detention Pond Analysis

June 15, 2017



Prepared for:



Prepared by:





Introduction

In April of 2017, a technical memorandum entitled Hydraulic Alternatives Analysis and Cost Estimates – Addendum to the Hydraulic Assessment of Gibson Boulevard at Kirtland Air Force Base (KAFB) using HEC-HMS was prepared by WSP (formerly WSP | Parsons Brinckerhoff), in which Option 1, the construction of South Detention Pond, was recommended as a design alternative for alleviating flooding within Gibson Boulevard, downstream of KAFB. AMAFCA is contemplating moving forward with this design alternative and has asked WSP to prepare a stage-storage-discharge table for the proposed outlet structure for this detention pond. Due to the inadequacy of the existing downstream drainage facilities under Gibson Boulevard, AMAFCA has also requested that the discharge out of the pond's outlet structure be limited to 10+/- cfs. As part of this task order, WSP was also asked to assess the capacity of the downstream storm drain system and determine its Hydraulic Grade line (HGL) with the proposed South Detention Pond in place.

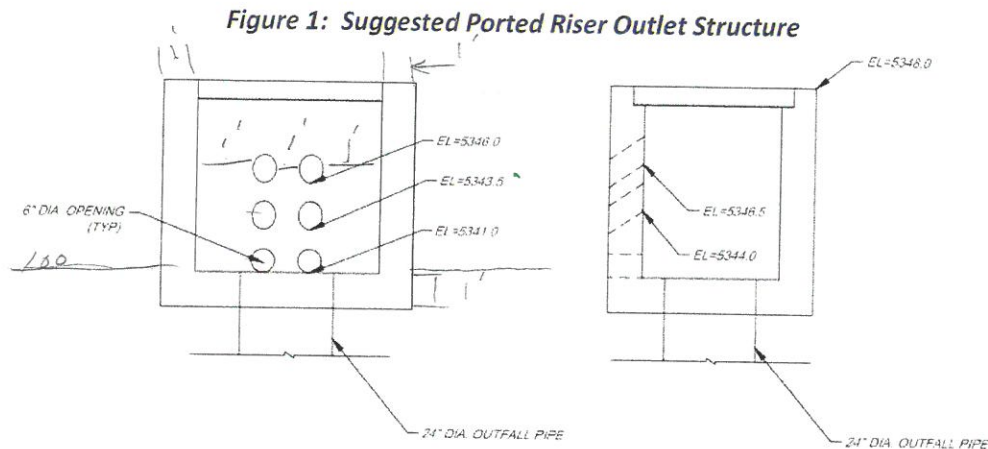
Proposed South Detention Pond Outlet Structure

A revised HEC-HMS model was developed to estimate the total flow that gets to the proposed South Detention Pond. Under this analysis, it was assumed that the entire flow from South Basin 2 would now be diverted westerly to the proposed South Detention Pond and that the existing diversion from South Basin 2 to the north under Gibson Boulevard and eventually into the existing North Detention Pond will no longer be available. The updated analysis shows that a 100-year discharge of 926 cfs reaches the proposed South Detention Pond. The revised HEC-HMS Analysis are attached to this memorandum.

The following data was provided by AMAFCA for the analyses of the South Detention Pond outlet structure:

- The conceptual layout of the proposed detention pond (in AutoCAD format) including the elevations of the top and bottom and side slopes.
- The size of the outlet pipe and its invert elevation at its outlet where it ties into the existing trunk line under Gibson Boulevard.
- The conceptual layout of the proposed channel for the diversion of the flow from South Basin 2 to the proposed South Detention Pond.
- A topographic survey of the KAFB properties where the proposed diversion channel and South Detention Pond will be constructed.

The conceptual layout of the proposed South Detention Pond shows the elevations of the top and bottom of the pond as 5350.0 and 5341.0. This pond provides a maximum storage volume of 66.25 acre-feet at elevation 5350.0. WSP recommends that a ported riser outlet structure with the following characteristics be considered for this pond. The riser should have 3 rows, 2 openings per row, of 6" diameter orifices. The invert of the first row should be set at elevation 5341. The orifices on the first row should not be inverted so that the pond can completely drain. The second and third rows of the orifices should be inverted for water quality and their invert elevations outside of the wall should be set at 5343.5 and 5346.0. The invert elevations for these orifices inside of the wall should be set at 5344.0 and 5346.5. See **Figure 1** below.



WSP's hydrologic analysis shows that the water surface elevation in the proposed South Pond with the referenced outlet structure would reach **5347.9** during the 100-year storm; this would provide 2' of freeboard. At this stage, the storage behind the pond would be 37.2 acre-feet with a discharge out of the ported riser of 10.5 cfs. **Table 1** below shows the stage-storage-discharge for the proposed South Detention Pond. Please note that the proposed ported riser is a suggested outlet structure and other types of the structure can be designed to meet the same stage-storage discharge requirements.

Table 1: Stage-Storage-Discharge (South Detention Pond)

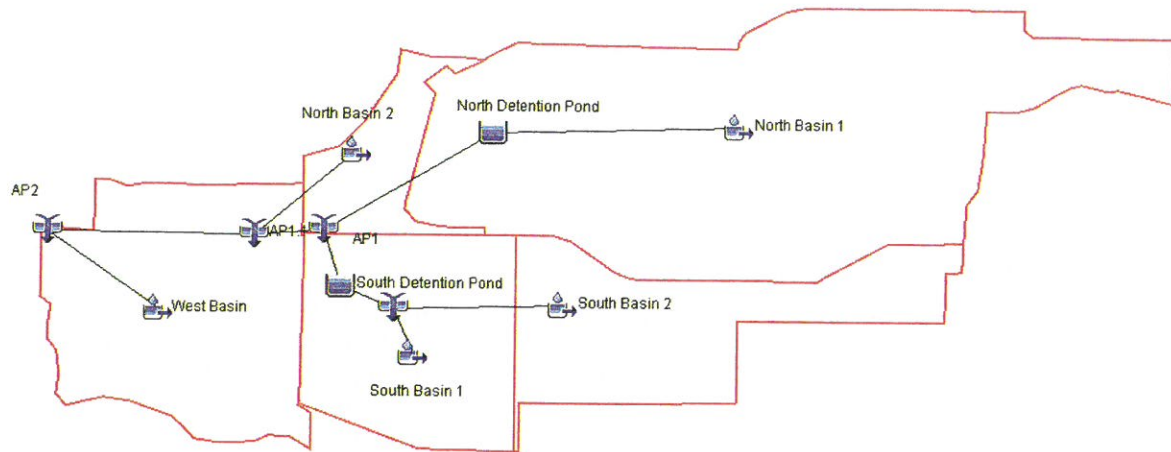
Stage (feet)	Storage (acre-feet)	Discharge (cfs)
5341	0.00	0.0
5342	0.76	1.6
5343	2.75	2.5
5344	6.28	3.1
5345	11.46	5.3
5346	18.48	6.6
5347	27.35	8.6
5348	38.24	10.7
5349	51.16	12.2
5350	66.25	13.5



Downstream Storm Drain Capacity

WSP evaluated the effect of the proposed South Detention Pond on the capacity of the existing downstream trunk line under Gibson Boulevard. The limits of the study extended between the outlet of the proposed South Detention Pond and the intersection of Louisiana Boulevard and Gibson Boulevard. For this analysis, two different scenarios were assessed. Per the Leedshill-Herkenhoff report "Design Analysis Report Sections I-IV, Final Design Analysis Sections V-VI, Kirtland Air Force Detention Basins", the discharge out of the North Pond for the interim conditions is controlled by an 8" diameter orifice and under ultimate conditions the orifice structure can be upsized to a 20" diameter opening. With the 8" orifice structure the discharge from the North Pond is approximately 5 cfs and it would increase to 30 cfs +/- with the larger opening. Since the North Pond has enough capacity to store the runoff with an 8" orifice structure, WSP recommends that the 8" orifice structure remains in place if it has not already been upsized to maintain the existing combined street and storm drain capacity at AP1 of 142 cfs. With both scenarios, an assumption was made that the tailwater in the storm drain system just west of Louisiana is at the top of curb. The conceptual plan and profile for this storm drain have been included as an attachment to this memorandum. The analyses show that the HGL for either of the scenarios stay below the ground.

HEC-HMS Basin Model
Proposed South Detention Pond



HEC-HMS Parameters

Subbasin	Area (Mi2)	CN	Lag Time (min)
North Basin 1	0.764	84	15.6
North Basin 2	0.085	84	7.2
South Basin 1	0.239	92	9.6
South Basin 2	0.244	90	11.4
West Basin	0.327	80	9.6

South Pond Elevation-Storage-Discharge Tables

Select a Paired Data

Select Table Graph

Elevation (FT)	Storage (AC-FT)
5341.0	0.00
5342.0	0.76
5343.0	2.75
5344.0	6.28
5345.0	11.46
5346.0	18.48
5347.0	27.35
5348.0	38.24
5349.0	51.16
5350.0	66.25

Select Apply Cancel

Select a Paired Data

Select Table Graph

Storage (AC-FT)	Discharge (CFS)
0.00	0.00
0.76	1.64
2.75	2.50
6.28	3.14
11.46	5.30
18.48	6.62
27.35	8.62
38.24	10.70
51.16	12.22
66.25	13.54

Select Apply Cancel

North Pond Elevation-Storage Table

<div style="display: inline-block; width: 20px; height: 15px; background-color: #cccccc; border: 1px solid black; margin-right: 5px;"></div> <div style="display: inline-block; border-bottom: 1px solid black; padding: 2px 5px;">Reservoir</div> <div style="display: inline-block; border-bottom: 1px solid black; padding: 2px 5px; margin-left: 10px;">Options</div>	
Basin Name: KAFB Basin South Pond	
Element Name: Reservoir-1	
Description:	North Pond
Downstream:	AP1
Method:	Outflow Curve
Storage Method:	Elevation-Storage-Discharge
*Stor-Dis Function:	North Pond
*Elev-Stor Function:	North Pond
Primary:	Storage-Discharge
Initial Condition:	Storage
*Initial Storage (AC-FT)	0

Select a Paired Data
X

Select

Table

Graph

Elevation (FT)	Storage (AC-FT)
5346.25	0.00
5348.00	0.10
5349.00	0.80
5350.00	2.20
5351.00	5.50
5352.00	13.20
5353.00	24.20
5354.00	36.20
5355.00	48.10
5356.00	60.40
5357.00	73.00
5358.00	86.91

Select

Apply

Cancel

North Pond Storage-Discharge Tables

With an 8" Orifice:

Select a Paired Data

Storage (AC-FT)	Discharge (CFS)
0.00	0.00
0.10	2.20
0.80	2.80
2.20	3.30
5.50	3.70
13.20	4.00
24.20	4.40
36.20	4.70
48.10	5.00
60.40	5.20
73.00	5.50
86.91	754.00

Select Apply Cancel

With a 20" Orifice:

Select a Paired Data

Storage (AC-FT)	Discharge (CFS)
0.00	0.00
0.10	11.40
0.80	15.53
2.20	18.77
5.50	21.53
13.20	23.97
24.20	26.19
36.20	28.23
48.10	30.13
60.40	31.92
73.00	33.62
86.91	754.00

Select Apply Cancel

Meteorological Model

Precipitation

Met Name: 100-yr, 24hr

Probability: 1 Percent ▼

Input Type: Partial Duration ▼

Output Type: Annual Duration ▼

Intensity Duration: 5 Minutes ▼

Storm Duration: 1 Day ▼

Intensity Position: 25 Percent ▼

Storm Area (MI²): 1.659

Curve: Uniform For All Subbasins ▼

Duration	Partial-Duration Depth (IN)
5 Minutes	0.58700
15 Minutes	1.1100
1 Hour	1.8500
2 Hours	2.1200
3 Hours	2.1700
6 Hours	2.3600
12 Hours	2.5100
1 Day	2.7900
2 Days	
4 Days	
7 Days	
10 Days	

HEC-HMS 100yr, 24hr Results with 8" Orifice at the North Pond

Show Elements: All Elements

Volume Units: ☐ IN ☒ AC-FT

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
North Basin 1	0.764	808.9	01Jan2014, 06:19	54.5
North Detention Pond	0.764	5.0	02Jan2014, 00:05	7.3
South Basin 2	0.244	428.6	01Jan2014, 06:13	23.2
South Basin 1	0.239	505.5	01Jan2014, 06:11	24.9
Junction-2	0.483	926.0	01Jan2014, 06:12	48.1
South Detention Pond	0.483	10.5	01Jan2014, 09:19	15.1
AP1	1.247	15.3	01Jan2014, 09:31	22.4
North Basin 2	0.085	135.0	01Jan2014, 06:09	6.1
AP1.1	1.332	142.9	01Jan2014, 06:09	28.4
West Basin	0.327	351.6	01Jan2014, 06:13	19.0
AP2	1.659	484.2	01Jan2014, 06:12	47.4

Summary Results for Reservoir "North Detention Pond"

Project: KAFB Option 1 Final Simulation Run: 100yr, 24hr Option 1
 Reservoir: North Detention Pond

Start of Run: 01Jan2014, 00:00 Basin Model: Option 1
 End of Run: 02Jan2014, 00:05 Meteorologic Model: 100-yr, 24hr
 Compute Time: 14Jun2017, 14:51:26 Control Specifications: 24hr 1min

Volume Units: ☐ IN ☒ AC-FT

Computed Results

Peak Inflow: 808.9 (CFS)	Date/Time of Peak Inflow: 01Jan2014, 06:19
Peak Discharge: 5.0 (CFS)	Date/Time of Peak Discharge: 02Jan2014, 00:05
Inflow Volume: 54.5 (AC-FT)	Peak Storage: 47.2 (AC-FT)
Discharge Volume: 7.3 (AC-FT)	Peak Elevation: 5354.9 (FT)

Summary Results for Reservoir "South Detention Pond"

Project: KAFB Option 1 Final Simulation Run: 100yr, 24hr Option 1
 Reservoir: South Detention Pond

Start of Run: 01Jan2014, 00:00 Basin Model: Option 1
 End of Run: 02Jan2014, 00:05 Meteorologic Model: 100-yr, 24hr
 Compute Time: 14Jun2017, 14:51:26 Control Specifications: 24hr 1min

Volume Units: ☐ IN ☒ AC-FT

Computed Results

Peak Inflow: 926.0 (CFS)	Date/Time of Peak Inflow: 01Jan2014, 06:12
Peak Discharge: 10.5 (CFS)	Date/Time of Peak Discharge: 01Jan2014, 09:19
Inflow Volume: 48.1 (AC-FT)	Peak Storage: 37.2 (AC-FT)
Discharge Volume: 15.1 (AC-FT)	Peak Elevation: 5347.9 (FT)

HEC-HMS 100yr, 24hr Results with 20" Orifice at the North Pond

Show Elements: All Elements

Volume Units: ☐ IN ☒ AC-FT

Sorting: Hydrologic

Hydrologic Element	Drainage Area (MI ²)	Peak Discharge (CFS)	Time of Peak	Volume (AC-FT)
North Basin 1	0.764	808.9	01Jan2014, 06:19	54.5
North Detention Pond	0.764	28.2	01Jan2014, 07:33	39.6
South Basin 2	0.244	428.6	01Jan2014, 06:13	23.2
South Basin 1	0.239	505.5	01Jan2014, 06:11	24.9
Junction-2	0.483	926.0	01Jan2014, 06:12	48.1
South Detention Pond	0.483	10.5	01Jan2014, 09:19	15.1
AP1	1.247	38.6	01Jan2014, 08:45	54.7
North Basin 2	0.085	135.0	01Jan2014, 06:09	6.1
AP1.1	1.332	159.2	01Jan2014, 06:10	60.8
West Basin	0.327	351.6	01Jan2014, 06:13	19.0
AP2	1.659	501.8	01Jan2014, 06:12	79.8

Summary Results for Reservoir "North Detention Pond"

Project: KAFB Option 1 Final Simulation Run: 100yr, 24hr Option 1 20"
Reservoir: North Detention Pond

Start of Run: 01Jan2014, 00:00 Basin Model: Option 1 20" Orifice
End of Run: 02Jan2014, 00:05 Meteorologic Model: 100-yr, 24hr
Compute Time: 14Jun2017, 14:57:20 Control Specifications: 24hr 1min

Volume Units: ☐ IN ☒ AC-FT

Computed Results

Peak Inflow: 808.9 (CFS) Date/Time of Peak Inflow: 01Jan2014, 06:19
Peak Discharge: 28.2 (CFS) Date/Time of Peak Discharge: 01Jan2014, 07:33
Inflow Volume: 54.5 (AC-FT) Peak Storage: 36.2 (AC-FT)
Discharge Volume: 39.6 (AC-FT) Peak Elevation: 5354.0 (FT)

Summary Results for Reservoir "South Detention Pond"

Project: KAFB Option 1 Final Simulation Run: 100yr, 24hr Option 1 20"
Reservoir: South Detention Pond

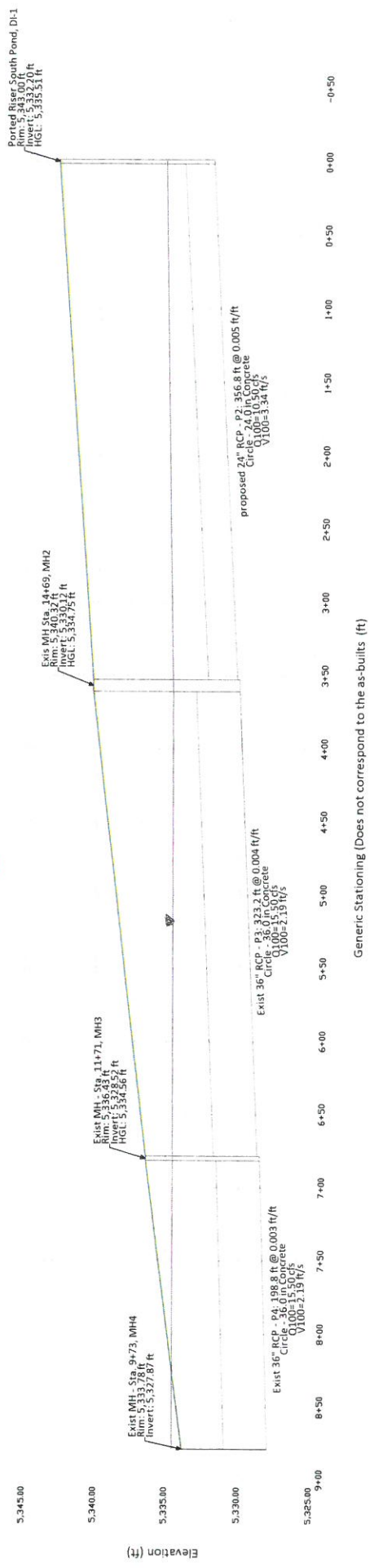
Start of Run: 01Jan2014, 00:00 Basin Model: Option 1 20" Orifice
End of Run: 02Jan2014, 00:05 Meteorologic Model: 100-yr, 24hr
Compute Time: 14Jun2017, 14:57:20 Control Specifications: 24hr 1min

Volume Units: ☐ IN ☒ AC-FT

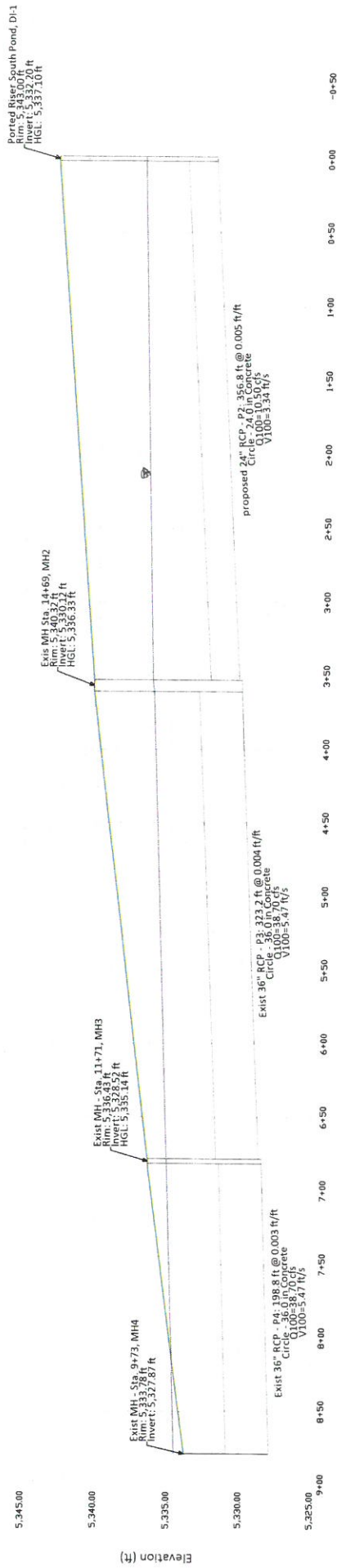
Computed Results

Peak Inflow: 926.0 (CFS) Date/Time of Peak Inflow: 01Jan2014, 06:12
Peak Discharge: 10.5 (CFS) Date/Time of Peak Discharge: 01Jan2014, 09:19
Inflow Volume: 48.1 (AC-FT) Peak Storage: 37.2 (AC-FT)
Discharge Volume: 15.1 (AC-FT) Peak Elevation: 5347.9 (FT)





Profile
(With a 5 cfs discharge from the North Pond controlled with an 8" Orifice)



Profile
 (With a 28.2 cfs discharge from the North Pond controlled with a 20" Orifice)