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INFLOW DESIGN FLOOD CONTROL SYSTEM PLAN
FORMER ASH BASIN
POWERTON STATION
MAY 2018

Pursuant to Code of Federal Regulations Title 40, Part 257, Subpart D (40 CFR), herein referred to as the coal combustion residual (CCR) Rule, Section 257.82(c), Geosyntec Consultants (Geosyntec) prepared this Inflow Design Flood Control System Plan for the Former Ash Basin (FAB) at the Powerton Station (Site) in Pekin, Illinois (Figure 1). The Basins are owned and operated by Midwest Generation, LLC (Midwest Generation).

Section 257.82(c) of the CCR Rule requires that operators of every inactive, existing or new CCR surface impoundment design, construct, operate, and maintain an inflow design flood control system that adequately manages flow into the CCR unit during and following the peak discharge of the inflow design flood. The Preamble to the CCR Rule provides guidance on the documentation that should be provided for the inflow design flood control plan.

The FAB has sufficient capacity to handle the flows into the CCR unit from the design storm with a freeboard of greater than one foot. Justification and documentation of the adequacy of the storage capacity of FAB is presented in the sections below. Compliance with the requirements of §257.82 (a)(1) and (2) are provided below:

> *§257.82 (a)(1): The inflow design flood control system must adequately manage flow into the CCR unit during and following the peak discharge of the inflow design flood specified in paragraph (a)(3) of this section.*
>
> FAB Demonstration: The FAB can manage all runon flows during and following the peak discharge of the inflow design flood because the volume of the inflow design flood is contained in the FAB.
>
> *§257.82 (a)(2): The inflow design flood control system must adequately manage flow from the CCR unit to collect and control the peak discharge resulting from the inflow design flood specified in paragraph (a)(3) of this section.*
>
> FAB Demonstration: The FAB has sufficient capacity to store the discharge resulting from the inflow design flood with a freeboard of greater than one foot; therefore, no discharge will occur during the peak discharge event.

The work presented in this report was performed under the direction of Mr. Jesse Varsho, P.E., of Geosyntec in accordance with §257.82(c). Mr. Mike Houlihan reviewed this plan in accordance with Geosyntec's senior review policy.

1. *Basin Design*

The FAB is an inactive surface impoundment with an approximate surface area of 30 acres, located near the Illinois River. A rail road embankment built in 2010 divides the impoundment into North and South Pond as shown on Figure 1. Figure 2 shows existing topography of the FAB and the surrounding areas. Based on current operations at the Powerton station, there is no regular discharge of sluiced ash into the North and South Ponds of the FAB. Impacted water may enter the FAB during extreme events from an emergency overflow structure from the adjacent Ash Basin into South Pond of the FAB as shown on Figure 1. The water level in North and South Ponds fluctuates with the local ground water level, which is influenced by the elevation in the Illinois River

2. *Inflow Design Flood Control Plan Documentation*

Because of the relatively small size and design of the FAB, some of the references and recommended drawings for inclusion in the Inflow Design Flood Control Plan by the Preamble to the CCR Rule (page 21392) are not applicable. Table 1 below provides a summary of the documentation.

Table 1: Recommended Documentation

Documentation	Assessment
Identification of the design storm event for the catchment area and CCR unit	Identification of the design storm event is provided in Section 4 and Appendix A. A drawing of the FAB catchment areas is presented in Figure 2.
Characterization of the rainfall abstractions, including, but not limited to, depression storage and infiltration in the upstream catchment area	Full capture of the design precipitation event was assumed, so rainfall abstractions were assumed to be zero, i.e., 100% of the volume from the design storm was assumed to be held within the FAB.
Selection and basis of the appropriate run-off model or run-off and run-on routing model	A run-on model was not required because full capture within the limited catchment areas was assumed. No discharge from the design event is anticipated so a run-off model was not necessary to demonstrate compliance.
Identification and characterization of any intake or decant structures	No intake or decant structure exist for FAB.
Appropriate characterization and capacity of spillways	No spillway exists for FAB.
Characterization of downstream hydraulic structures	No outflow from the FAB is predicted from the design storm event and therefore downstream hydraulic structures are not required.

3. Catchment Areas

The drainage areas for the North and South Ponds of the FAB were delineated based on the available topographic data. The catchment areas for the North and South Pond are presented in Table 2 and shown in Figure 2.

4. Design Event

The FAB is classified as significant hazard potential surface impoundment (CEC, 2018), and hence the design event is defined as the 1,000-year storm. Total rainfall depth of 9 inches for a 1000-year, 24-hour duration storm was obtained from the National Oceanic and Atmospheric Agency (NOAA) Atlas 14 (Appendix A). Total inflow from the design event is calculated as the depth of precipitation multiplied by the catchment area[1].

5. Freeboard

The measured water level on June 23, 2017 in North and South Ponds of the FAB was 440.1 ft mean sea level (MSL[2]) and 441.7 ft, respectively (CEC, 2018). These elevations were assumed to be normal water level in the ponds of the FAB. The stage-storage curves for North and South Ponds were estimated based on available contour data (see Appendix B). The maximum potential increase in water levels due to the design storm event, based on the stage storage curves, are presented in Table 2. The estimated maximum water levels in the FAB are below the rim elevations of North and South Ponds of the FAB with freeboard values of 7.5 ft and 16.2 ft, respectively.

With full containment of the design event, the North and South Ponds of the FAB maintains water level elevations below rim elevation with a minimum of one foot of freeboard. The inflow design system, as designed and constructed, meets the requirements of §257.82.

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[1] Depression storage or infiltration of stormwater into the embankment crest and other rainfall abstractions are negligible and are not included in inflow volume calculations. Similarly, this calculation does not require the use of a run-on model for the precipitation falling on the drainage areas since it is a conservative estimate of runoff with abstraction assumed zero.

[2] Based on North American Datum (NAD) 83 horizontal and vertical control datum.

Table 2: Inflow Design Volumes and Basin Water Level Estimates

Value	North Pond	South Pond
Catchment Area (acres)	18.5	19.6
Normal Water Elevation (feet, NAD83) *	440.1	441.9
Design Event Inflow (acre-feet)	13.9	14.7
Increased Basin Water Elevation (feet)	7.4	1.9
Estimated Post-Event Water Elevation (feet, NAD83)	447.5	443.8
Rim Elevation (feet, NAD83)	455.0	460.0
Freeboard (feet)	7.5	16.2

6. Plan Amendments and Revisions

In accordance with §257.82(c)(2) and (4), this Inflow Design Flood Control System Plan will be amended or revised whenever there is a change in conditions that would substantially affect the plan or every five years.

7. Limitations and Certification

This inflow design flood control system plan meets the requirements of §257.82(c) of the Code of Federal Regulations Title 40, Part 257, Subpart D, and was prepared in accordance with current practices and the standard of care exercised by scientists and engineers performing similar tasks in the field of civil engineering. The contents of this report are based solely on the observations of the conditions observed by Geosyntec personnel and information provided to Geosyntec by Midwest Generation. Consistent with applicable professional standards of care, our opinions and recommendations were based in part on data furnished by others, which was consistent with other information that we developed in the course of our performance of the scope of services. The information contained in this report is intended for use solely by Midwest Generation and their subconsultants.

Jesse Varsho

Jesse Varsho, P.E.
Illinois Professional Engineer No. 062.059069
License Expires: 11/30/2019

8. References

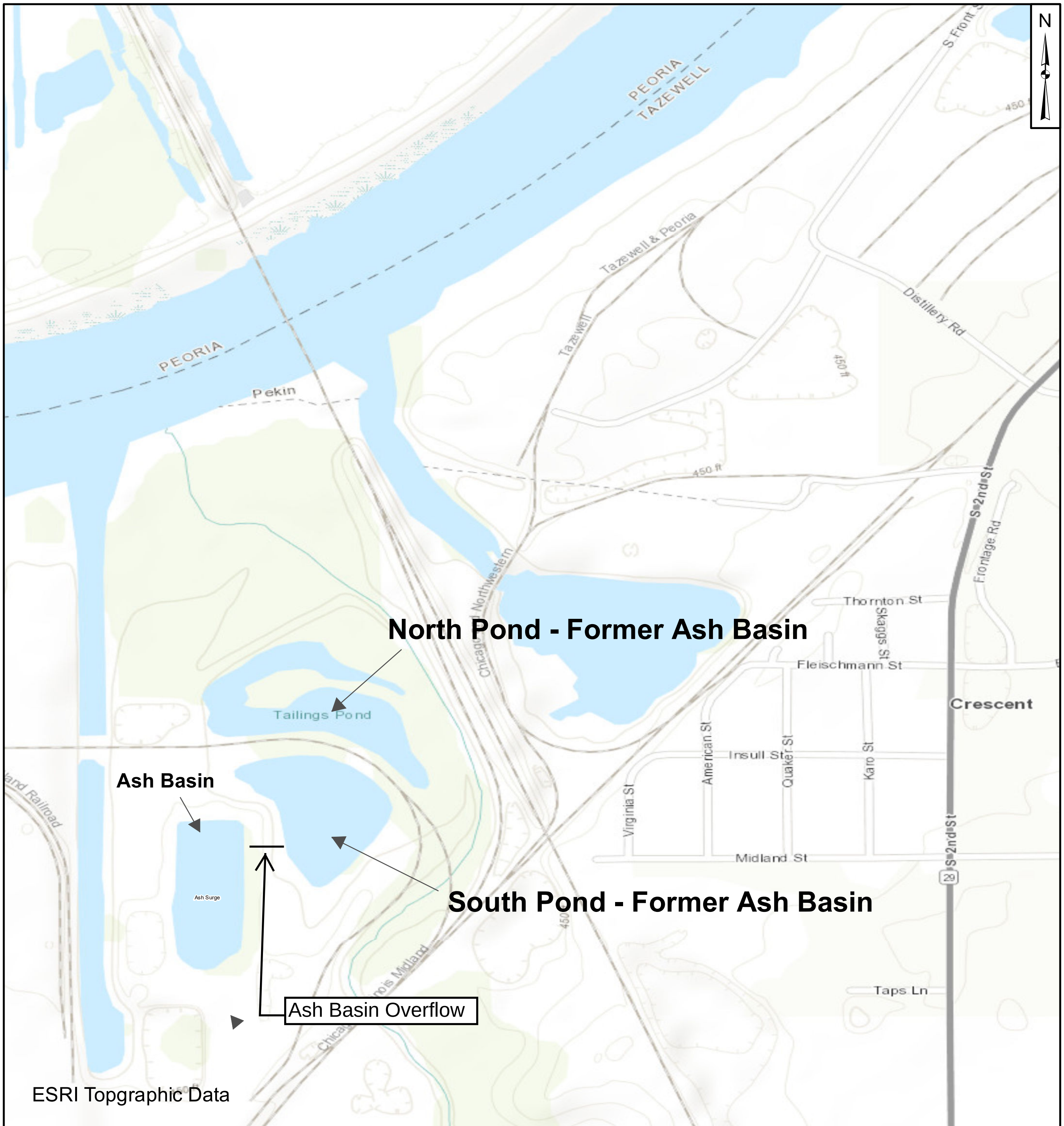
Aero-Metric 2008, Aerial topography dated 06-19-2008, Aero-Metric, Inc.

CEC 2018, Initial Hazard Potential Classification Assessment, Former Ash Basin, Powerton Station, April 2018.

NOAA, 2016, NOAA Atlas 14 Point Precipitation Frequency Estimates: Illinois, available at: http://hdsc.nws.noaa.gov/hdsc/pfds/pfds_map_cont.html

<u>Attachments</u>

Figure 1: Site Location
Figure 2: Basin Topography and Catchment Area
Appendix A: Design Storm Event Depth
Appendix B: Basin Stage Storage Curve



1,250 625 0 1,250 Feet

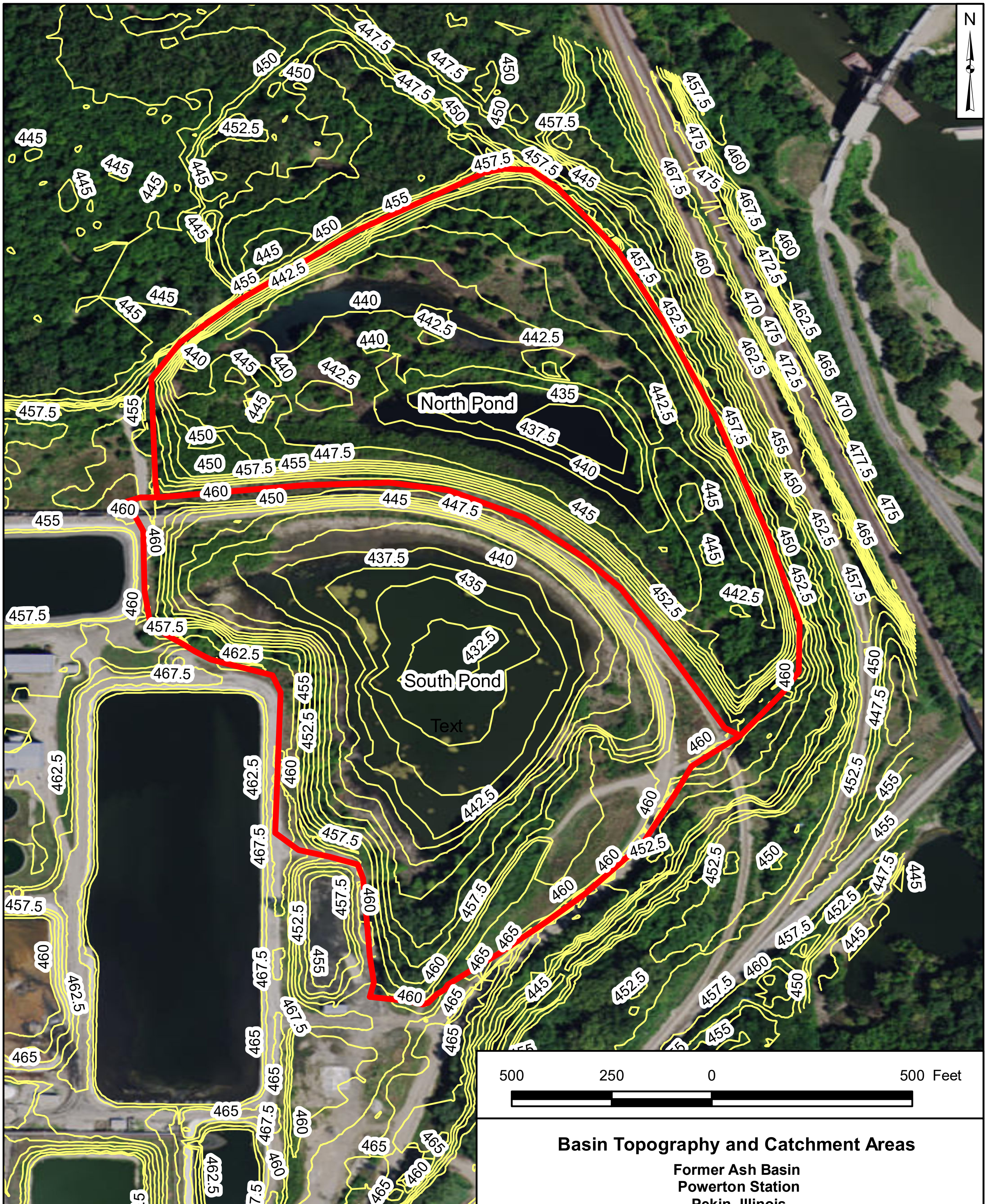
Site Location

Former Ash Basin
Pekin, Illinois

Geosyntec consultants

Figure 1

Oak Brook	May 21 2018



Legend

- CatchmentAreas
- Contours

Basin Topography and Catchment Areas

Former Ash Basin
Powerton Station
Pekin, Illinois

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Oak Brook | May, 2018

Figure **2**

Appendix A

Design Storm Event Depth

NOAA Atlas 14, Volume 2, Version 3
Location name: Pekin, Illinois, US*
Latitude: 40.5434°, Longitude: -89.6779°
Elevation: 466 ft*
* source: Google Maps

POINT PRECIPITATION FREQUENCY ESTIMATES

G.M. Bonnin, D. Martin, B. Lin, T. Parzybok, M.Yekta, and D. Riley

NOAA, National Weather Service, Silver Spring, Maryland

PF_tabular | PF_graphical | Maps_&_aerials

PF tabular

PDS-based point precipitation frequency estimates with 90% confidence intervals (in inches)[1]

Duration	Average recurrence interval (years)									
	1	2	5	10	25	50	100	200	500	1000
5-min	**0.409** (0.375-0.447)	**0.487** (0.447-0.534)	**0.581** (0.533-0.636)	**0.654** (0.598-0.715)	**0.746** (0.679-0.814)	**0.816** (0.740-0.891)	**0.884** (0.797-0.964)	**0.953** (0.854-1.04)	**1.04** (0.928-1.14)	**1.11** (0.981-1.22)
10-min	**0.635** (0.582-0.695)	**0.760** (0.697-0.834)	**0.903** (0.828-0.989)	**1.01** (0.923-1.10)	**1.14** (1.04-1.25)	**1.24** (1.12-1.35)	**1.33** (1.20-1.45)	**1.42** (1.27-1.55)	**1.53** (1.36-1.68)	**1.62** (1.43-1.77)
15-min	**0.778** (0.714-0.852)	**0.929** (0.853-1.02)	**1.11** (1.02-1.21)	**1.24** (1.14-1.36)	**1.41** (1.28-1.54)	**1.53** (1.39-1.67)	**1.65** (1.49-1.80)	**1.77** (1.59-1.93)	**1.92** (1.70-2.10)	**2.02** (1.78-2.22)
30-min	**1.03** (0.944-1.13)	**1.24** (1.14-1.36)	**1.52** (1.39-1.66)	**1.73** (1.58-1.89)	**1.99** (1.81-2.17)	**2.19** (1.98-2.39)	**2.39** (2.15-2.60)	**2.58** (2.31-2.82)	**2.84** (2.52-3.11)	**3.03** (2.68-3.33)
60-min	**1.26** (1.15-1.38)	**1.53** (1.40-1.67)	**1.91** (1.75-2.09)	**2.19** (2.01-2.40)	**2.58** (2.35-2.82)	**2.88** (2.61-3.15)	**3.19** (2.88-3.48)	**3.50** (3.14-3.83)	**3.92** (3.49-4.30)	**4.26** (3.76-4.67)
2-hr	**1.48** (1.35-1.61)	**1.79** (1.64-1.97)	**2.25** (2.06-2.46)	**2.61** (2.38-2.85)	**3.10** (2.82-3.38)	**3.48** (3.15-3.80)	**3.88** (3.49-4.23)	**4.29** (3.84-4.68)	**4.85** (4.30-5.31)	**5.31** (4.67-5.82)
3-hr	**1.57** (1.45-1.72)	**1.91** (1.75-2.09)	**2.41** (2.21-2.64)	**2.80** (2.56-3.07)	**3.34** (3.04-3.65)	**3.78** (3.42-4.12)	**4.23** (3.81-4.61)	**4.70** (4.20-5.12)	**5.36** (4.74-5.84)	**5.90** (5.17-6.44)
6-hr	**1.86** (1.72-2.04)	**2.26** (2.08-2.48)	**2.85** (2.62-3.12)	**3.31** (3.04-3.62)	**3.96** (3.61-4.31)	**4.48** (4.06-4.87)	**5.03** (4.53-5.46)	**5.60** (5.00-6.08)	**6.41** (5.66-6.98)	**7.06** (6.18-7.71)
12-hr	**2.15** (1.98-2.34)	**2.60** (2.40-2.83)	**3.25** (3.00-3.54)	**3.76** (3.46-4.09)	**4.47** (4.09-4.85)	**5.04** (4.59-5.46)	**5.63** (5.10-6.10)	**6.24** (5.61-6.77)	**7.10** (6.32-7.71)	**7.80** (6.87-8.49)
24-hr	**2.46** (2.29-2.66)	**2.97** (2.76-3.22)	**3.73** (3.46-4.04)	**4.33** (4.01-4.69)	**5.16** (4.76-5.57)	**5.82** (5.35-6.29)	**6.50** (5.96-7.02)	**7.21** (6.59-7.79)	**8.20** (7.45-8.86)	**9.00** (8.13-9.73)
2-day	**2.86** (2.66-3.07)	**3.45** (3.22-3.71)	**4.30** (4.00-4.62)	**4.97** (4.61-5.33)	**5.87** (5.44-6.30)	**6.58** (6.08-7.06)	**7.31** (6.73-7.85)	**8.07** (7.40-8.68)	**9.12** (8.31-9.81)	**9.94** (9.03-10.7)
3-day	**3.03** (2.83-3.25)	**3.65** (3.41-3.92)	**4.54** (4.23-4.87)	**5.23** (4.87-5.61)	**6.16** (5.72-6.60)	**6.90** (6.39-7.39)	**7.64** (7.06-8.19)	**8.41** (7.75-9.02)	**9.46** (8.67-10.2)	**10.3** (9.39-11.1)
4-day	**3.20** (2.99-3.42)	**3.85** (3.60-4.13)	**4.78** (4.47-5.13)	**5.49** (5.13-5.88)	**6.46** (6.01-6.91)	**7.21** (6.70-7.72)	**7.97** (7.39-8.53)	**8.75** (8.09-9.37)	**9.80** (9.02-10.5)	**10.6** (9.75-11.4)
7-day	**3.75** (3.52-3.98)	**4.49** (4.23-4.79)	**5.50** (5.18-5.86)	**6.27** (5.90-6.67)	**7.27** (6.83-7.74)	**8.05** (7.54-8.56)	**8.82** (8.24-9.39)	**9.61** (8.96-10.2)	**10.6** (9.88-11.4)	**11.4** (10.6-12.2)
10-day	**4.25** (4.00-4.51)	**5.09** (4.80-5.42)	**6.19** (5.83-6.59)	**7.01** (6.59-7.45)	**8.09** (7.59-8.60)	**8.91** (8.35-9.47)	**9.73** (9.10-10.4)	**10.5** (9.84-11.2)	**11.6** (10.8-12.4)	**12.5** (11.6-13.3)
20-day	**5.73** (5.38-6.11)	**6.86** (6.46-7.32)	**8.27** (7.77-8.81)	**9.29** (8.72-9.89)	**10.6** (9.94-11.3)	**11.6** (10.9-12.4)	**12.6** (11.8-13.4)	**13.6** (12.6-14.4)	**14.8** (13.8-15.8)	**15.8** (14.6-16.8)
30-day	**7.10** (6.70-7.54)	**8.48** (8.00-9.00)	**10.1** (9.54-10.7)	**11.3** (10.6-12.0)	**12.8** (12.0-13.5)	**13.9** (13.0-14.7)	**15.0** (14.0-15.9)	**16.0** (15.0-17.0)	**17.4** (16.2-18.5)	**18.4** (17.1-19.6)
45-day	**8.91** (8.43-9.41)	**10.6** (10.0-11.2)	**12.5** (11.9-13.2)	**13.9** (13.1-14.7)	**15.6** (14.7-16.5)	**16.9** (15.9-17.8)	**18.1** (17.0-19.1)	**19.3** (18.1-20.3)	**20.8** (19.5-22.0)	**21.9** (20.5-23.1)
60-day	**10.6** (10.1-11.2)	**12.6** (12.0-13.3)	**14.9** (14.1-15.7)	**16.4** (15.5-17.3)	**18.4** (17.3-19.4)	**19.8** (18.7-20.9)	**21.1** (19.9-22.3)	**22.4** (21.1-23.7)	**24.1** (22.6-25.5)	**25.3** (23.7-26.8)

Design Event

[1] Precipitation frequency (PF) estimates in this table are based on frequency analysis of partial duration series (PDS).

Numbers in parenthesis are PF estimates at lower and upper bounds of the 90% confidence interval. The probability that precipitation frequency estimates (for a given duration and average recurrence interval) will be greater than the upper bound (or less than the lower bound) is 5%. Estimates at upper bounds are not checked against probable maximum precipitation (PMP) estimates and may be higher than currently valid PMP values.

Please refer to NOAA Atlas 14 document for more information.

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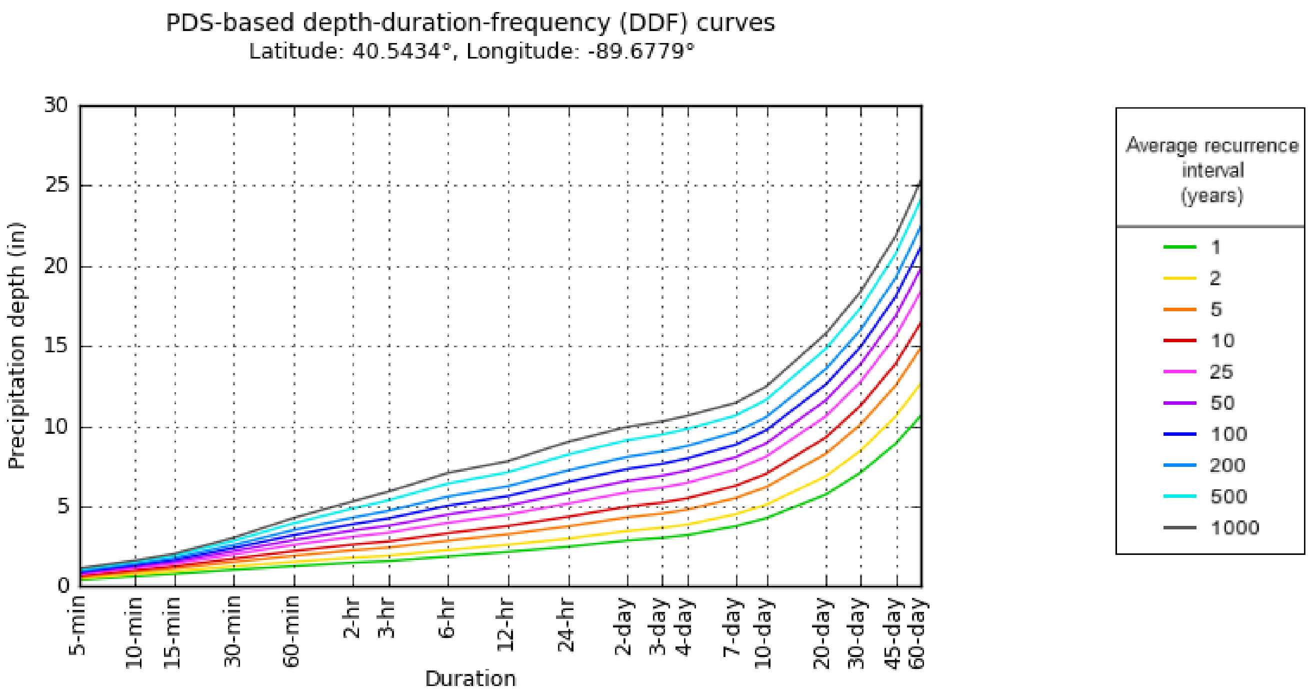
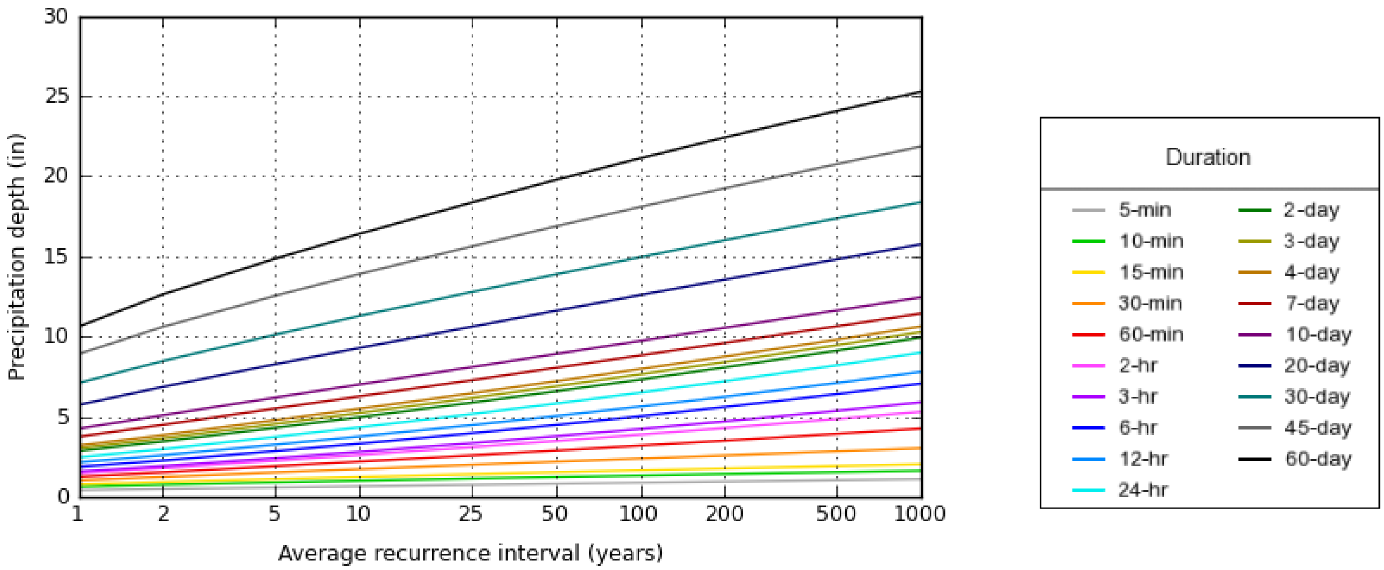
PF graphical





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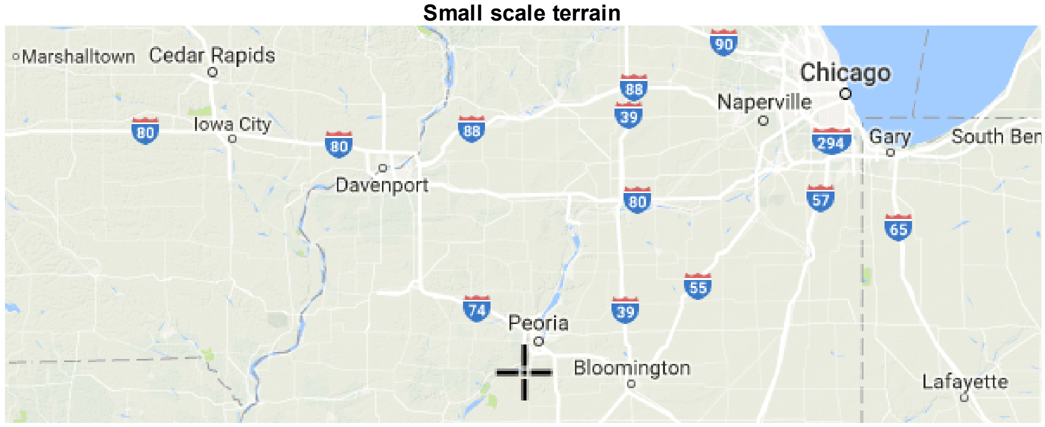
Maps & aerials

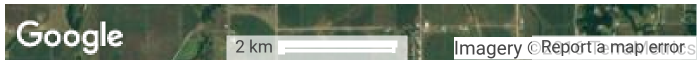
Small scale terrain



Large scale terrain

Large scale map

Large scale aerial



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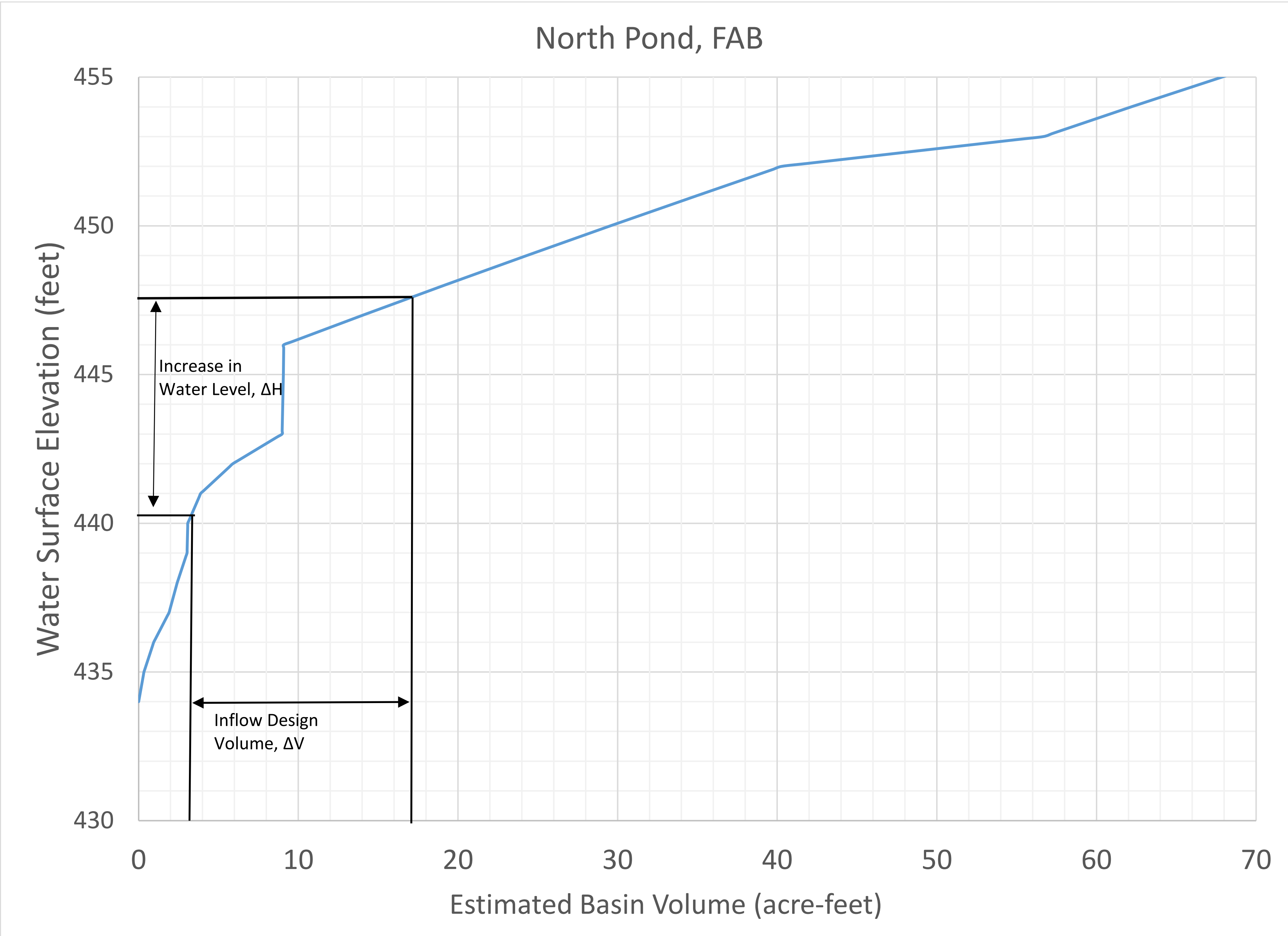
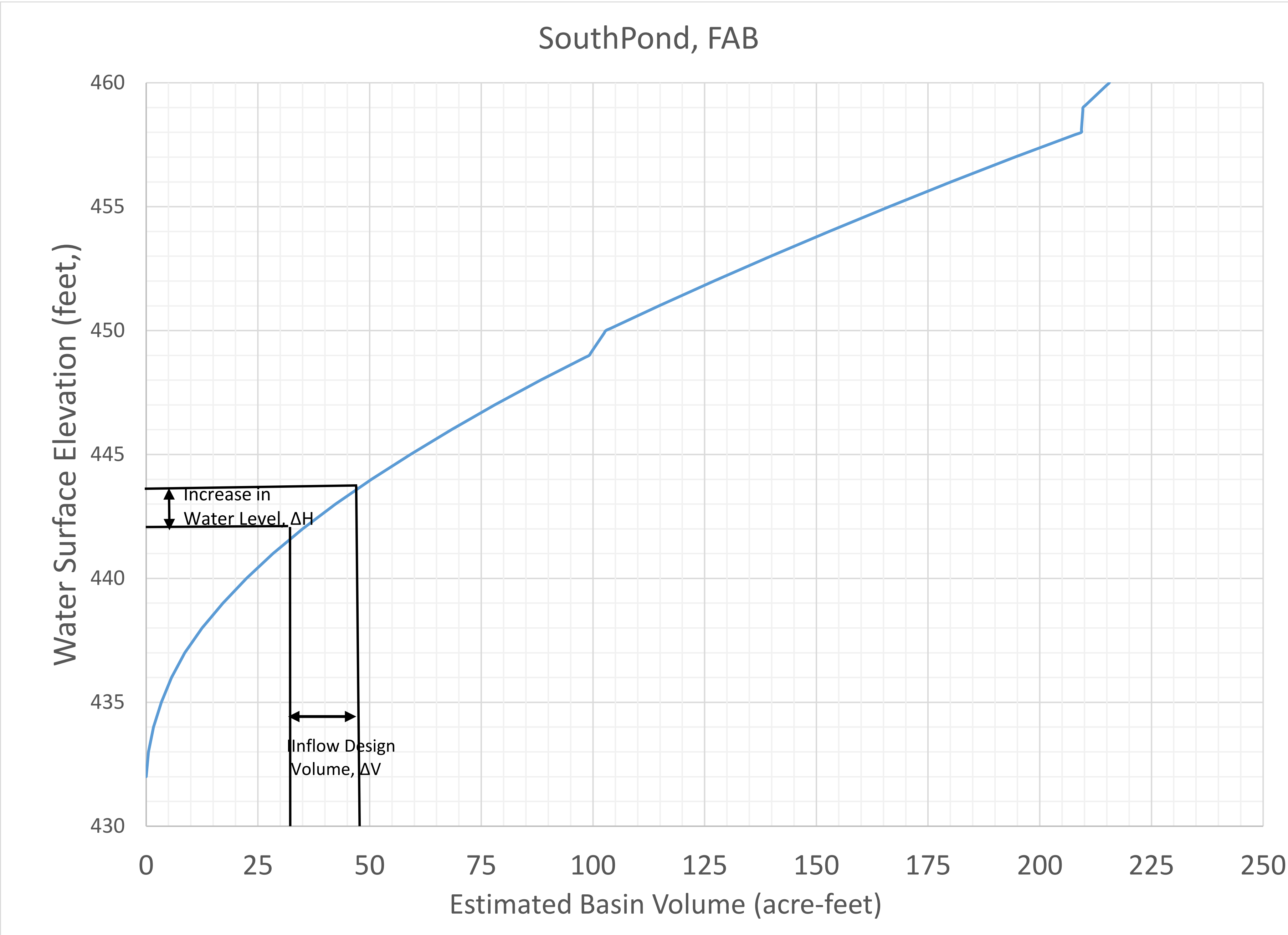
Appendix B

Basin Area Capacity Curves


North Pond, FAB
Water Surface Elevation (feet)
455
450
445
440
435
430
Increase in
Water Level, ΔH
Inflow Design
Volume, ΔV
0
10
20
30
40
50
60
70
Estimated Basin Volume (acre-feet)



SouthPond, FAB
460
455
450
445
440
435
430
0
25
50
75
100
125
150
175
200
225
250
Water Surface Elevation (feet,)
Estimated Basin Volume (acre-feet)
Increase in
Water Level, ΔH
Inflow Design
Volume, ΔV