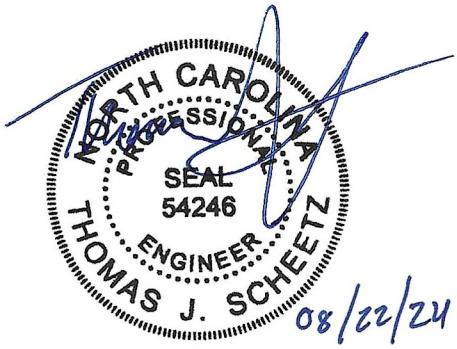
Stormwater Calculations

For

"Kybalion Creek"
St Joseph St 1 ac Tract
Black Lotus Properties, LLC
24-006



08/22/24

Revised 08/28/24 TJS

HEADWATERS ENGINEERING
of the Cape Fear, PLLC

Leland, NC
(910) 465-3304
tscheetz@headwaterscapefear.com

NCBELS License P-2714

Date:	Design:	Headwaters Engineering	Sheet:
8/22/2024	TJS	of the Cape Fear, PLLC Leland, NC	1
Title:		**For:**	**Job #:**
SW Calculations		St Joseph St 1 ac Tract	24-006

Swale

Q 10 = CiA =	155.5	cfs
C =	0.4	
i 10 =	7.61	in/hr
A =	51.10	ac

NOAA Rainfall Data

Average recurrence interval =	10	yrs
Duration =	24	hr
i 10 =	7.61	in/hr

Channel Report

Hydraflow Express Extension for Autodesk® Civil 3D® by Autodesk, Inc. Tuesday, Aug 20 2024

Swale

Triangular

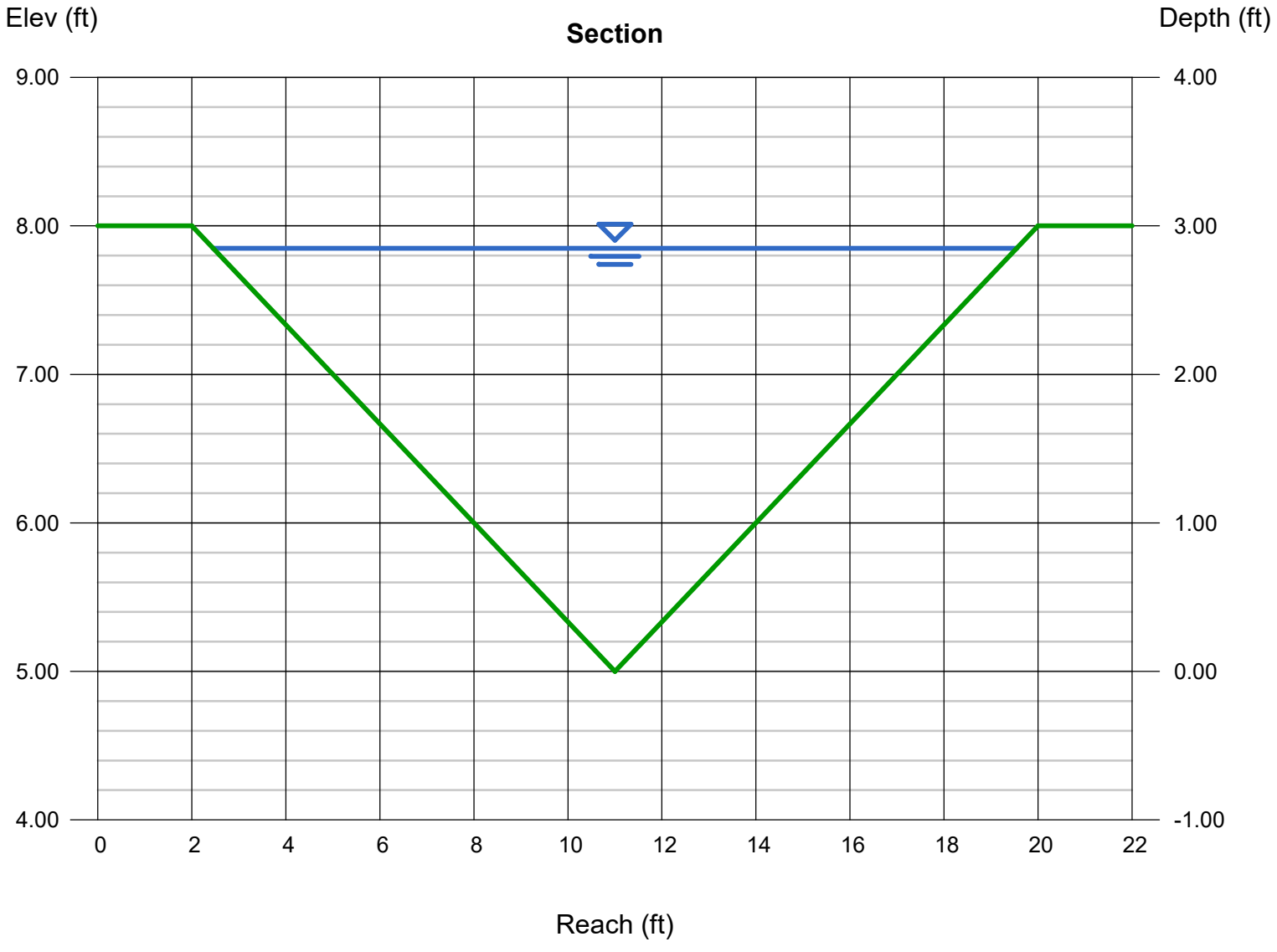
Side Slopes (z:1)	= 3.00, 3.00
Total Depth (ft)	= 3.00
Invert Elev (ft)	= 5.00
Slope (%)	= 0.50
N-Value	= 0.020

Calculations

Compute by:	Known Q
Known Q (cfs)	= 155.50

Highlighted

Depth (ft)	= 2.85
Q (cfs)	= 155.50
Area (sqft)	= 24.37
Velocity (ft/s)	= 6.38
Wetted Perim (ft)	= 18.02
Crit Depth, Yc (ft)	= 2.79
Top Width (ft)	= 17.10
EGL (ft)	= 3.48



Basic Map

An Interactive Map of New Hanover County, NC

Measurement

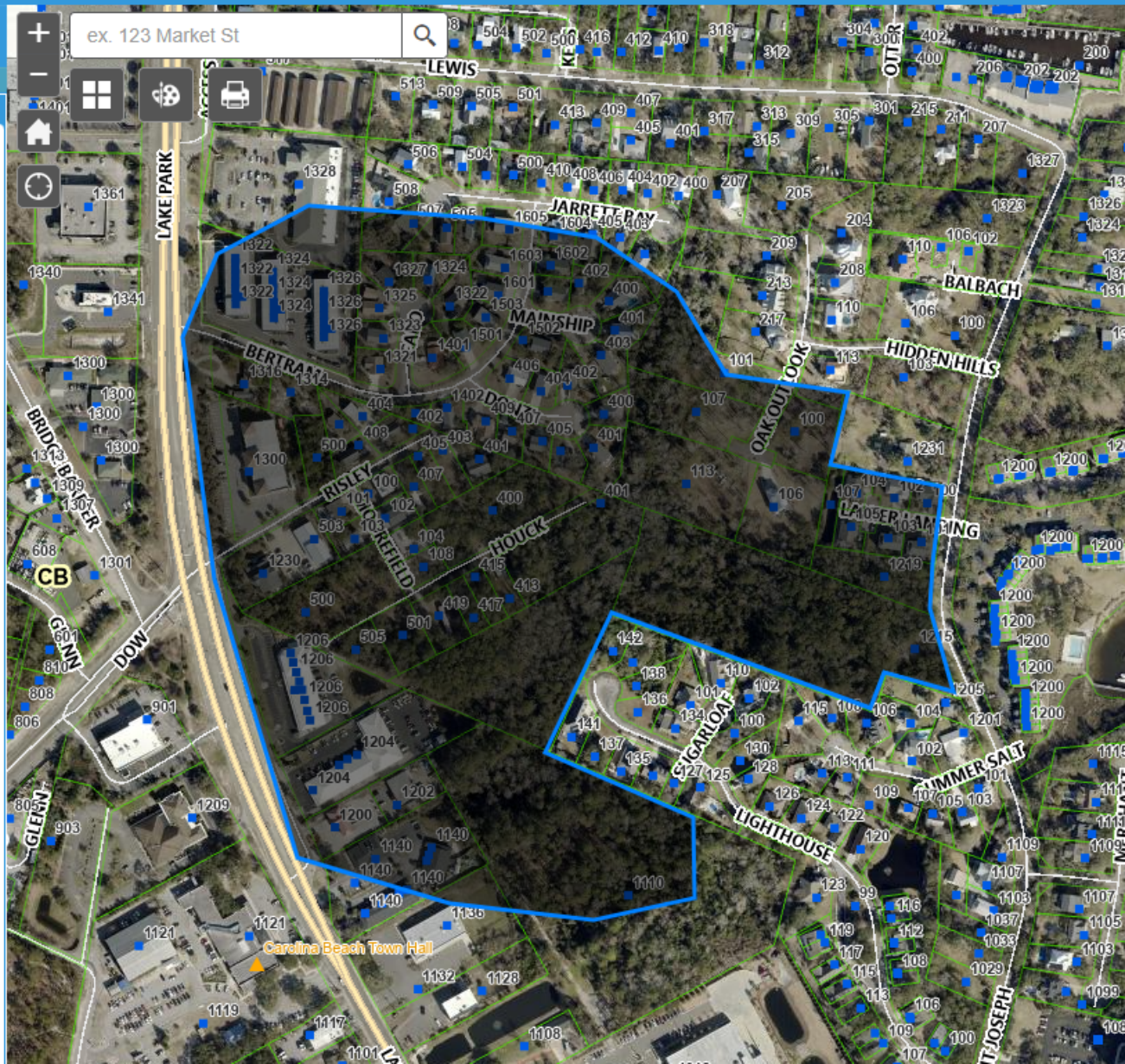
Acres

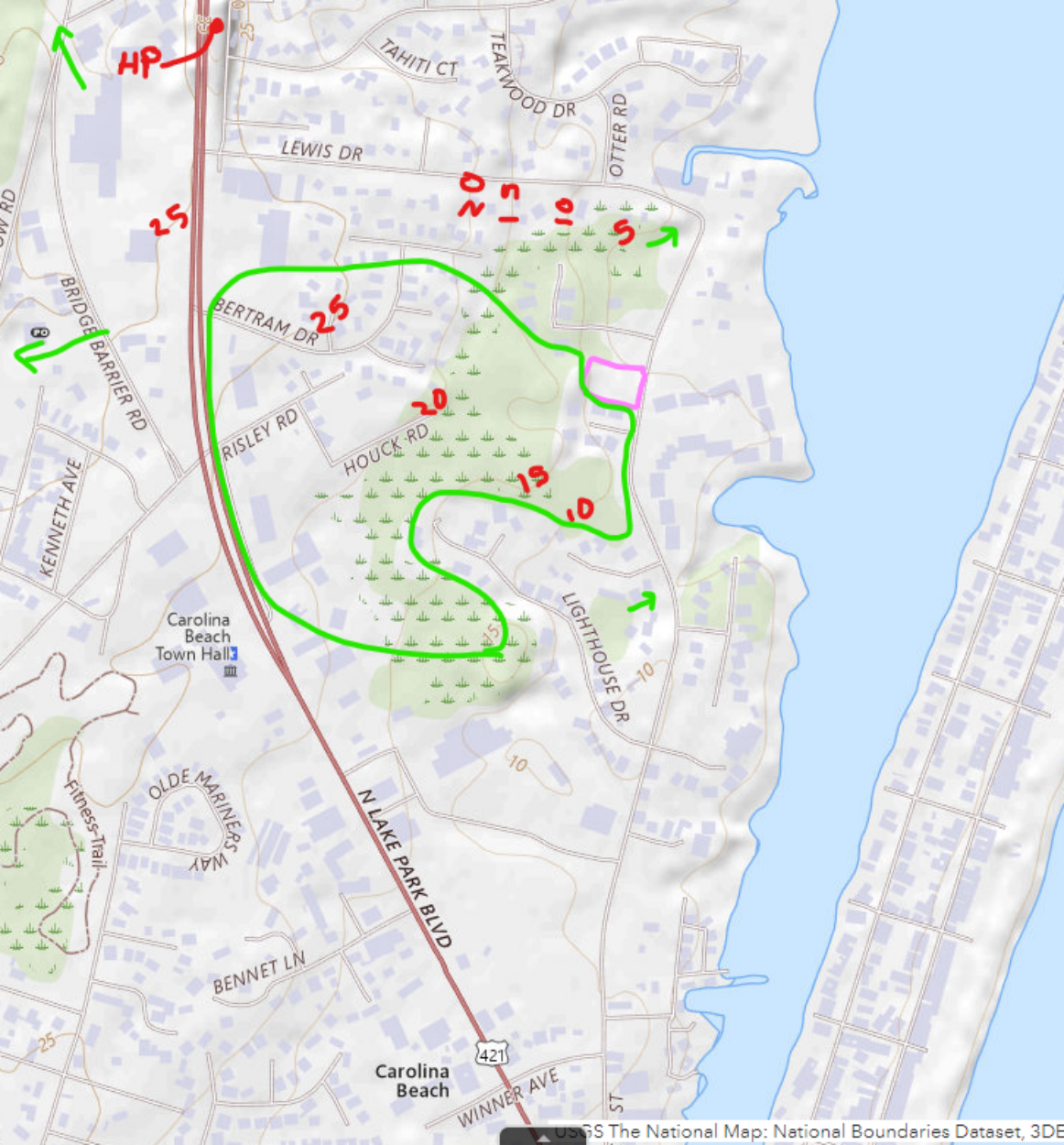
Measurement Result

51.1 Acres

Clear

Press CTRL to enable snapping




HP
TAHITI CT
TEAKWOOD DR
OTTER RD
LEWIS DR
BRIDGE BARRIER RD
BERTRAM DR
RISLEY RD
HOUCK RD
KENNETH AVE
LIGHTHOUSE DR
Carolina Beach Town Hall
OLDE MARINERS WAY
Fitness Trail
N LAKE PARK BLVD
BENNET LN
421
Carolina Beach
WINNER AVE
25
20
15
10
5
USGS The National Map: National Boundaries Dataset, 3DE

NOAA Atlas 14, Volume 2, Version 3
Location name: Carolina Beach, North Carolina, USA*
Latitude: 34.0486°, Longitude: -77.8936°
Elevation: 6 ft**
* source: ESRI Maps
** source: USGS

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	**0.540** (0.502-0.584)	**0.644** (0.598-0.695)	**0.751** (0.696-0.810)	**0.834** (0.772-0.900)	**0.941** (0.866-1.01)	**1.02** (0.937-1.10)	**1.10** (1.01-1.19)	**1.19** (1.07-1.28)	**1.30** (1.16-1.40)	**1.39** (1.23-1.51)
10-min	**0.863** (0.803-0.933)	**1.03** (0.956-1.11)	**1.20** (1.12-1.30)	**1.33** (1.23-1.44)	**1.50** (1.38-1.61)	**1.63** (1.49-1.75)	**1.76** (1.60-1.89)	**1.88** (1.70-2.03)	**2.05** (1.84-2.22)	**2.18** (1.94-2.37)
15-min	**1.08** (1.00-1.17)	**1.29** (1.20-1.40)	**1.52** (1.41-1.64)	**1.69** (1.56-1.82)	**1.90** (1.75-2.05)	**2.06** (1.89-2.22)	**2.22** (2.02-2.39)	**2.37** (2.15-2.56)	**2.58** (2.31-2.79)	**2.74** (2.43-2.98)
30-min	**1.48** (1.38-1.60)	**1.79** (1.66-1.93)	**2.16** (2.00-2.33)	**2.44** (2.26-2.64)	**2.82** (2.59-3.03)	**3.10** (2.84-3.34)	**3.40** (3.09-3.66)	**3.70** (3.34-3.99)	**4.11** (3.68-4.45)	**4.44** (3.94-4.82)
60-min	**1.84** (1.72-1.99)	**2.24** (2.08-2.42)	**2.77** (2.57-2.99)	**3.18** (2.94-3.44)	**3.75** (3.45-4.04)	**4.20** (3.85-4.53)	**4.68** (4.26-5.04)	**5.18** (4.69-5.60)	**5.89** (5.28-6.38)	**6.48** (5.75-7.04)
2-hr	**2.19** (2.02-2.39)	**2.68** (2.47-2.93)	**3.40** (3.13-3.71)	**3.99** (3.66-4.36)	**4.84** (4.42-5.28)	**5.56** (5.05-6.06)	**6.34** (5.72-6.92)	**7.20** (6.44-7.84)	**8.45** (7.48-9.23)	**9.54** (8.37-10.4)
3-hr	**2.33** (2.14-2.57)	**2.85** (2.62-3.14)	**3.64** (3.33-4.00)	**4.30** (3.93-4.73)	**5.29** (4.80-5.81)	**6.15** (5.54-6.74)	**7.10** (6.34-7.77)	**8.14** (7.22-8.91)	**9.73** (8.51-10.7)	**11.1** (9.62-12.2)
6-hr	**2.94** (2.69-3.25)	**3.59** (3.29-3.98)	**4.59** (4.19-5.08)	**5.45** (4.96-6.02)	**6.72** (6.07-7.40)	**7.82** (7.02-8.62)	**9.06** (8.07-9.97)	**10.4** (9.20-11.5)	**12.6** (10.9-13.8)	**14.4** (12.4-15.9)
12-hr	**3.44** (3.12-3.84)	**4.21** (3.82-4.69)	**5.42** (4.91-6.04)	**6.47** (5.83-7.20)	**8.04** (7.18-8.92)	**9.42** (8.36-10.4)	**11.0** (9.65-12.2)	**12.7** (11.1-14.1)	**15.4** (13.2-17.1)	**17.9** (15.1-19.8)
24-hr	**4.04** (3.70-4.46)	**4.90** (4.50-5.41)	**6.35** (5.81-7.00)	**7.61** (6.95-8.39)	**9.56** (8.64-10.5)	**11.3** (10.1-12.4)	**13.3** (11.7-14.6)	**15.5** (13.5-17.2)	**19.0** (16.2-21.1)	**22.1** (18.5-24.8)
2-day	**4.66** (4.29-5.12)	**5.64** (5.20-6.20)	**7.24** (6.64-7.96)	**8.62** (7.87-9.49)	**10.7** (9.70-11.8)	**12.6** (11.3-13.9)	**14.7** (13.0-16.3)	**17.1** (14.9-19.0)	**20.7** (17.7-23.2)	**23.9** (20.1-27.0)
3-day	**4.90** (4.52-5.36)	**5.92** (5.46-6.48)	**7.54** (6.94-8.27)	**8.94** (8.19-9.81)	**11.0** (10.0-12.1)	**12.9** (11.6-14.2)	**14.9** (13.3-16.5)	**17.2** (15.1-19.1)	**20.8** (17.9-23.2)	**24.0** (20.2-27.1)
4-day	**5.14** (4.75-5.61)	**6.20** (5.73-6.77)	**7.85** (7.24-8.58)	**9.26** (8.50-10.1)	**11.4** (10.3-12.4)	**13.2** (11.9-14.4)	**15.2** (13.6-16.7)	**17.4** (15.4-19.2)	**20.9** (18.1-23.2)	**24.2** (20.3-27.2)
7-day	**5.82** (5.42-6.29)	**7.01** (6.53-7.58)	**8.82** (8.19-9.54)	**10.3** (9.55-11.2)	**12.5** (11.5-13.6)	**14.4** (13.1-15.6)	**16.4** (14.8-17.8)	**18.6** (16.6-20.3)	**21.8** (19.2-24.0)	**24.5** (21.2-27.5)
10-day	**6.54** (6.10-7.04)	**7.83** (7.30-8.43)	**9.70** (9.02-10.5)	**11.3** (10.4-12.1)	**13.5** (12.5-14.6)	**15.4** (14.1-16.7)	**17.4** (15.9-18.9)	**19.7** (17.7-21.4)	**22.9** (20.2-25.1)	**25.5** (22.3-28.3)
20-day	**8.76** (8.22-9.39)	**10.4** (9.79-11.2)	**12.7** (11.9-13.6)	**14.6** (13.6-15.7)	**17.3** (16.0-18.5)	**19.5** (18.0-20.9)	**21.8** (20.0-23.5)	**24.3** (22.0-26.3)	**27.8** (24.9-30.4)	**30.7** (27.1-33.8)
30-day	**10.8** (10.2-11.5)	**12.9** (12.1-13.7)	**15.4** (14.5-16.5)	**17.5** (16.5-18.7)	**20.4** (19.1-21.8)	**22.7** (21.1-24.3)	**25.1** (23.2-26.9)	**27.6** (25.3-29.7)	**31.0** (28.1-33.6)	**33.7** (30.3-36.7)
45-day	**13.6** (12.9-14.4)	**16.1** (15.2-17.1)	**19.1** (18.0-20.3)	**21.5** (20.2-22.8)	**24.8** (23.2-26.4)	**27.5** (25.6-29.2)	**30.2** (27.9-32.2)	**32.9** (30.3-35.3)	**36.7** (33.4-39.6)	**39.7** (35.9-43.1)
60-day	**16.5** (15.6-17.5)	**19.4** (18.4-20.6)	**22.8** (21.5-24.1)	**25.4** (24.0-26.8)	**28.9** (27.2-30.6)	**31.6** (29.7-33.5)	**34.4** (32.1-36.5)	**37.1** (34.4-39.5)	**40.8** (37.5-43.7)	**43.6** (39.8-47.0)

[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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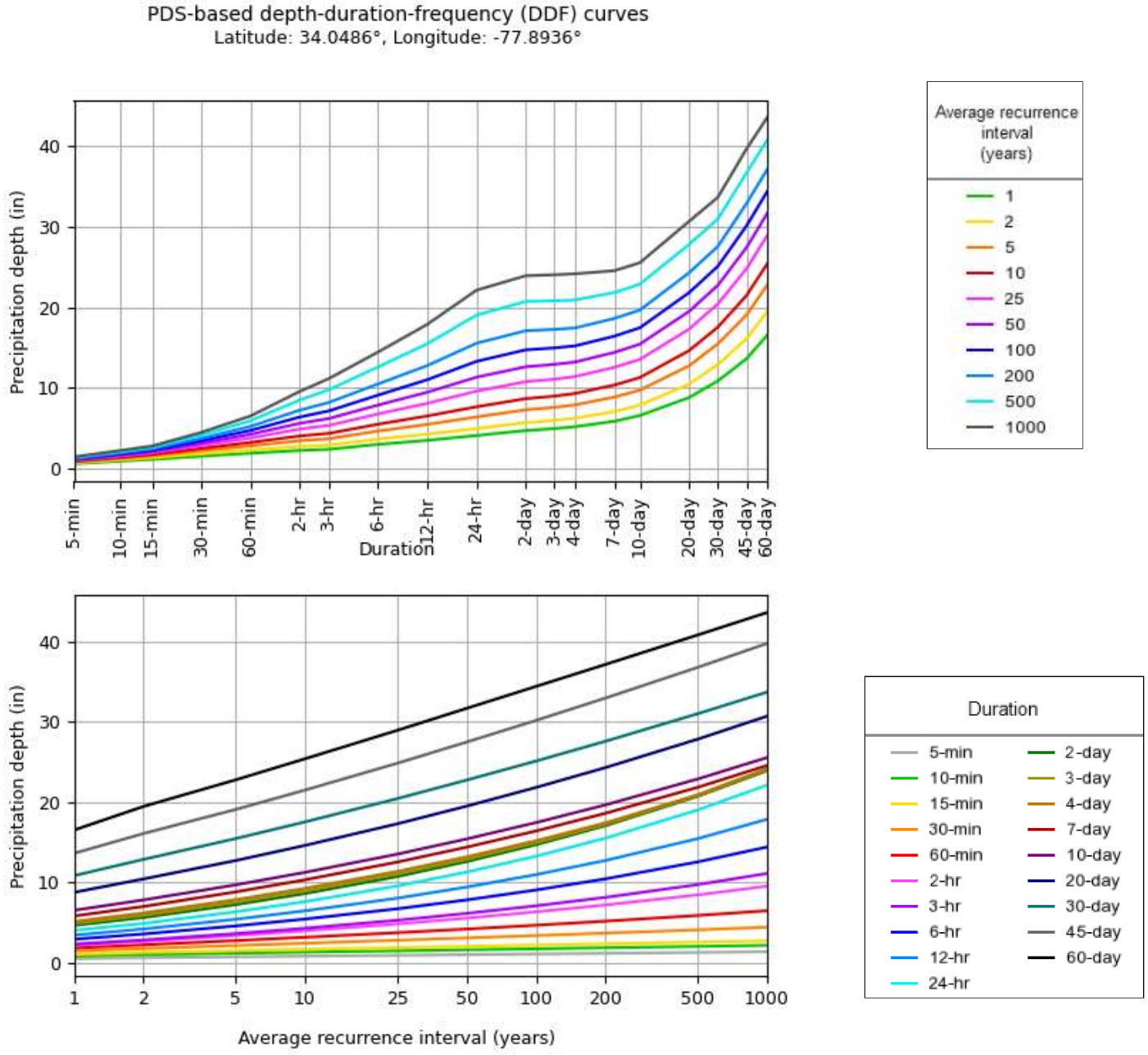
PF graphical



NOAA Atlas 14, Volume 2, Version 3

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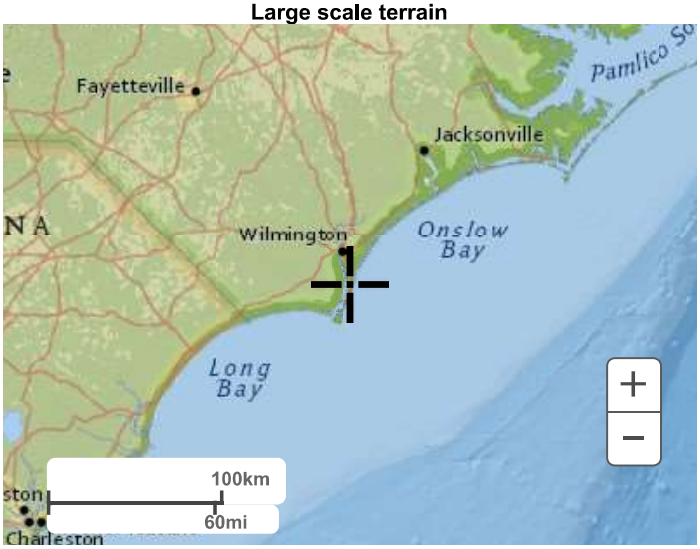
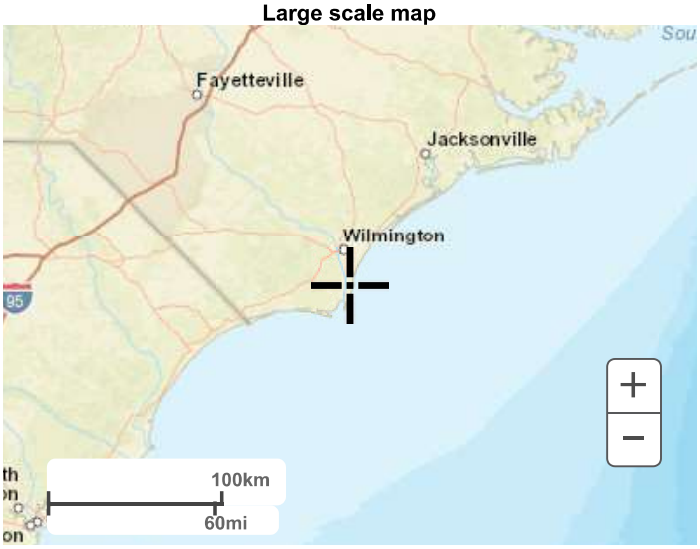
Maps & aerials

Small scale terrain

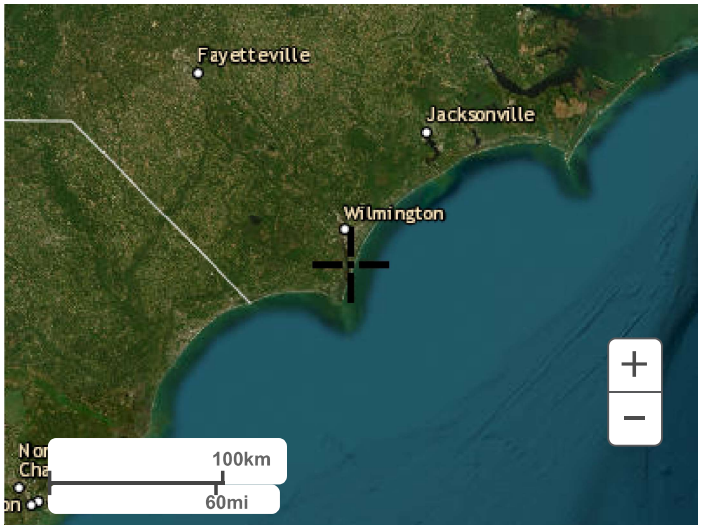
Large scale terrain



Large scale map



Large scale aerial



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