Culvert Design Calculations

The Point - North / AWH-20000 / April 2023

McAdams

THE POINT – NORTH

(PHASES 11-13)

ROLESVILLE, NORTH CAROLINA

CULVERT DESIGN CALCULATIONS

CONSTRUCTION DRAWINGS

PROJECT NUMBER: **AWH-20000**

DESIGNED BY: **KELLI GARCIA, PE**
SAMANTHA DANIELL, PE

DATE: **APRIL 2023**

MCADAMS
621 HILLSBOROUGH STREET, SUITE 500
RALEIGH, NORTH CAROLINA 27603
NC LIC. # C-0293

THE POINT - NORTH

Culvert Design Calculations

GENERAL DESCRIPTION

The Point is a proposed residential development in Rolesville, North Carolina, located between Highway 401 and East Young Street/Rolesville Road. The development is approximately 300 acres, divided into a northern parcel and a southern parcel. This Stormwater Impact Analysis covers the development of the northern parcel only. Namely, the Northern Development will include 102 single-family lots, three stormwater control measures, sidewalks, roadways, greenway trail, and associated infrastructure.

An unnamed tributary to Harris Creek flows east to west through the project site. The tributary does not have an associated Special Flood Hazard Area (SFHA). A new culvert crossing consisting of one (1) 72" reinforced concrete pipe for main channel flow and (2) 60" reinforced concrete pipes for floodplain relief is proposed to extend the existing Genovesa Drive to the proposed development. This culvert design was selected to ensure there are no increases to the 100-year water surface elevations upstream of the project site.

Additionally, there is an existing culvert crossing consisting of a 60" corrugated metal pipe associated with a recreational trail near the southwestern corner of the project site. This crossing will be modified to serve as a connection between the private greenway on the Point North site and the public greenway west of the tributary. Due to the vertical constraints of the tie-in with the public greenway west of the tributary, it is not possible to raise the embankment of the crossing, nor is it possible to fit a larger culvert while still meeting minimum cover requirements. Instead, the retrofit of this crossing includes minor grading modifications to the embankment and an extension of the existing culvert.

HYDROLOGIC CALCULATION METHODOLOGY

- The SCS Curve Number Method was used to estimate direct runoff. A composite curve number was calculated for each subbasin using soils and land cover data.
- Depth-Duration Frequency (DDF) rainfall data was obtained from NOAA Atlas 14. Synthetic rainfall hyetographs were generated using frequency-based hypothetical storms assuming a storm duration of 1 day, intensity duration of 5 minutes, intensity position of 50%, and a uniform distribution for all subbasins. Rainfall depths were input into the meteorological model within PondPack for peak flow rate calculations. Please reference the rainfall data section within this report for additional information. Please refer to the precipitation information within the Miscellaneous Site Information section of this report for additional information.
- Hydrologic soil groups within each subbasin were determined using NRCS Web Soil Survey.
- Land cover conditions for the pre-development condition were based on survey provided by WithersRavenel and aerial imagery for the site. Land cover conditions for the post-development condition were taken from the proposed layout. Offsite cover conditions were based on survey provided by WithersRavenel, aerial imagery for the site, and Town of Rolesville Official Zoning Map.
- Soil Conservation Service Curve Numbers (SCS CN) most similar to the zoning type or cover condition were selected from Table 2 of the USDA TR-55, Urban Hydrology for Small Watersheds.
- The times of concentration were calculated using SCS TR-55 (Segmental Approach, 1986). The Tc flow path can be divided into multiple segments, as necessary: overland flow, concentrated flow, and channel flow. The travel

time was then computed for each segment, from which the overall time of concentration was determined by taking the sum of each segmental time.

- Existing conditions survey data and proposed grading was used for onsite topography. QL2 LiDAR topography data was obtained from North Carolina Spatial Data Download and used for offsite areas.

- PondPack Version V8i, by Bentley Systems, Inc., was used for the hydrologic calculations for the 10- and 25-, and 100-year storm events to determine the peak flow rates at the proposed Genovesa Drive crossing and the existing greenway crossing. These flows were used to design and evaluate the hydraulic performance of the proposed culvert configurations in HEC-RAS and HY8, respectively.

- For 100-year storm routing calculations, approximately 1-foot of freeboard is provided between the peak elevation during the 100-year storm event and the top of the dam for the proposed facilities.

HYDRAULIC CALCULATION METHODOLOGY

GREENWAY CROSSING

- Hydraulic calculations were performed using the Federal Highway Administration's HY-8 Culvert Hydraulic Analysis Program, version 7.7 to evaluate the performance of the existing culvert crossing and the proposed culvert crossing (with extensions).

GENOVESA DRIVE CROSSING

- A hydraulic model was built for the Tributary to Harris Creek using the United States Army Corps of Engineers' HEC-RAS version 6.3 software. The model was run assuming a steady-state, subcritical flow regime and unobstructed flow through structures. Unobstructed flow occurs when flooding sources flow freely through all bridge and culvert structures. The flood elevations in the models are thus considered valid only if hydraulic structures remain unobstructed, operate properly, and do not fail.

- A composite digital elevation model (DEM) representing the site was created using existing conditions survey data and proposed grading supplemented with QL2 LiDAR topography data obtained from North Carolina Spatial Data Download. Cross section and road deck geometry was extracted from the composite DEM.

- Cross sections were drawn perpendicular to the direction of flow, as indicated by the topography. Cross sections were placed to capture structures (bridges, dams, or culverts), hydraulically significant changes in channel geometry, changes in flow rate, drastic narrowing or widening of the floodplain, prominent terrain features, and changes in channel slope.

- Bank stations were set to best represent the change in conveyance from the overbanks to the main channel.

- The proposed Genovesa Drive roadway crossing was modeled by placing four cross sections in accordance with the HEC-RAS Hydraulic Reference Manual. To represent the contraction and expansion of flow through the structure, the contraction and expansion coefficients were raised on structure cross sections 4, 3, and 2 and ineffective flow areas were added to structure cross sections 3 and 2. Ineffective flow area stationing was determined using a contraction ratio of 1:1 and expansion ratio of 2:1.

- Channel and overbank Manning's n values were assigned based on land cover characteristics as indicated by topographic data, aerial imagery, and the proposed site layout.

- The post-development 10-, 25-, and 100-year flow rates calculated at Genovesa Drive were applied to the HEC-RAS model at river station 2065.

- The normal depth method was used to set the downstream boundary condition for the model. Under the assumption of uniform flow conditions, the friction slope used to calculate normal depth is equal to the bed slope of the channel.

- The calculated water surface elevations were used to design and evaluate the hydraulic performance of the proposed Genovesa Drive culvert configuration.

- The output summary table, profile plot, and Genovesa Drive culvert cross section plots from the HEC-RAS model are provided in Section 8.0.

DISCUSSION OF RESULTS

GREENWAY CROSSING

As shown in Section 6 of this report, the greenway culvert crossing is overtopping in the 25-year storm event in the existing condition by 2.93 feet. Due to the vertical constraints of the tie-in with the public greenway west of the tributary, it is not possible to raise the embankment of the crossing above the 25-year water surface elevation, nor is it possible to fit a larger culvert capable of passing the 25-year flow while still meeting minimum cover requirements. The proposed design includes extending the existing culvert by approximately 13 feet. The change overtopping depth during the 25-year storm event from the pre-development to post-development condition is 0.07 feet, a negligible amount when compared to the 2.93 feet of overtopping already occurring in the existing condition.

GENOVESA DRIVE CROSSING

As shown in Section 8 of this report, the proposed Genovesa Drive culvert configuration consisting of (1) 72" reinforced concrete pipe for main channel flow and (2) 60" reinforced concrete pipes for floodplain relief does not result in an increase in the 100-year water surface elevation on any neighboring properties.

LIMITATIONS

If the development on this tract is built as proposed within this report, then the requirements set forth in the Town of Rolesville regulations will be met. Modifications to the proposed development may require that this analysis be revised. Some modifications that would **require** this analysis to be revised include:

1. The proposed site impervious surface exceeds the amount accounted for in this report.
2. The post-development watershed breaks change significantly from those used to prepare this report.
3. The grading and/or structures proposed adjacent to the stream differs from the grading and/or structures considered in this report.
4. The location or design of stream crossings differ from those considered in this report.

The above modifications may result in the assumptions within this report becoming invalid. The computations within this report will need to be revisited if any of the above conditions become apparent as development of the proposed site moves forward.

SUMMARY OF RESULTS

CULVERT DESIGN CALCULATIONS - PRE DEVELOPMENT

Peak Flows Used for Culvert Sizing:

Q10, Peak =	686.58	cfs
Q25, Peak =	847.78	cfs
Q100, Peak =	1105.06	cfs

Culvert 1 (Main Channel) Specifications:

Number of Barrels =	1	
Pipe Material =	Corrugated Aluminium	
Culvert Diameter =	60	in
US Pipe Invert =	303.18	ft
DS Pipe Invert =	303.16	ft
Pipe Length =	25.00	ft
Embedment =	0.00	ft
Slope =	0.0008	ft/ft

Combined Culvert System Routing:

10-Year Storm

Headwater Elevation =	313.29	ft
Hw/D =	2.0	
Road Crest Elevation =	310.76	ft
Freeboard =	-2.53	ft

25-Year Storm

Headwater Elevation =	313.69	ft
Hw/D =	2.1	
Road Crest Elevation =	310.76	ft
Freeboard =	-2.93	ft

100-Year Storm

Headwater Elevation =	314.24	ft
Hw/D =	2.2	
Road Crest Elevation =	310.76	ft
Freeboard =	-3.48	ft

CULVERT DESIGN CALCULATIONS - POST DEVELOPMENT

Peak Flows Used for Culvert Sizing:

Q10, Peak =	707.13	cfs
Q25, Peak =	868.56	cfs
Q100, Peak =	1125.42	cfs

Culvert 1 (Main Channel) Specifications:

Number of Barrels =	1	
Pipe Material =	Corrugated Aluminium	
Culvert Diameter =	60	in
US Pipe Invert =	303.18	ft
DS Pipe Invert =	303.16	ft
Pipe Length =	37.25	ft
Embedment =	0.00	ft
Slope =	0.0005	ft/ft

Combined Culvert System Routing:

10-Year Storm			***Increase Pre to Post:***	
Headwater Elevation =	313.36	ft	0.07	ft
Hw/D =	2.0			
Road Crest Elevation =	310.76	ft		
Freeboard =	-2.60	ft		

25-Year Storm				
Headwater Elevation =	313.76	ft	0.07	ft
Hw/D =	2.1			
Road Crest Elevation =	310.76	ft		
Freeboard =	-3.00	ft		

100-Year Storm				
Headwater Elevation =	314.29	ft	0.05	ft
Hw/D =	2.2			
Road Crest Elevation =	310.76	ft		
Freeboard =	-3.53	ft		

CULVERT DESIGN CALCULATIONS

Peak Flows Used for Culvert Sizing:

Q10, Peak =	184.92	cfs
Q25, Peak =	224.21	cfs
Q100, Peak =	284.48	cfs

Culvert 1 (Main Channel) Specifications:

Shape:	Circular	
Number of Barrels =	1	
Culvert Diameter =	72	in
US Pipe Invert =	347.00	ft
DS Pipe Invert =	344.18	ft
Pipe Length =	82.00	ft
Embedment =	1.00	ft
Slope =	0.0344	ft/ft

Culvert 2 (Floodplain) Specifications:

Shape:	Circular	
Number of Barrels =	2	
Culvert Diameter =	60	in
US Pipe Invert =	348.51	ft
DS Pipe Invert =	347.44	ft
Pipe Length =	82.00	ft
Embedment =	0.00	ft
Slope =	0.0130	ft/ft

Combined Culvert System Routing:

10-Year Storm

Headwater Elevation =	350.73	ft
Hw/D =	0.5	
Road Crest Elevation =	375.05	ft
Freeboard =	24.32	ft

25-Year Storm

Headwater Elevation =	350.89	ft
Hw/D =	0.6	
Road Crest Elevation =	375.05	ft
Freeboard =	24.16	ft

100-Year Storm

Headwater Elevation =	351.35	ft
Hw/D =	0.7	
Road Crest Elevation =	375.05	ft
Freeboard =	23.70	ft

Velocity Dissipator Specifications:

Length =	24.00	ft
Width =	33.00	ft
Thickness=	27.00	in
Classification=	I	

TABLE 1: EXISTING CONDITIONS VS. PROPOSED CONDITIONS

Cross Section	100yr Water Surface Elevation		
	Existing Conditions	Proposed Conditions	Difference
2,065	359.81	359.81	0.00
1,991	358.79	358.79	0.00
1,950	358.52	358.52	0.00
1,907	358.12	358.12	0.00
1,840	356.89	356.89	0.00
1,738	355.23	355.23	0.00
1,665	354.09	354.09	0.00
1,597	352.57	352.57	0.00
1,557	352.75	352.75	0.00
1,498	351.95	351.94	-0.01
1,440	351.14	351.35	0.21
1,382	GENOVESA DRIVE CULVERT		
1,332	350.25	350.30	0.05
1,239	349.43	349.43	0.00
1,178	348.50	348.50	0.00
1,115	347.99	347.99	0.00
1,041	347.39	347.39	0.00
983	346.90	346.90	0.00
915	345.94	345.94	0.00
845	345.13	345.13	0.00
791	344.13	344.13	0.00
729	342.89	342.89	0.00
668	341.61	341.61	0.00
584	339.07	339.07	0.00
496	338.05	338.05	0.00
437	337.47	337.47	0.00
387	336.93	336.93	0.00
341	335.83	335.83	0.00
298	334.05	334.05	0.00
245	332.50	332.50	0.00
186	329.16	329.16	0.00
131	323.71	323.71	0.00
87	323.23	323.23	0.00

Mitchell F. Rabil Family Property, PIN 1768166987

MISCELLANEOUS SITE INFORMATION

N

0 500 1,000 2,000 Feet

1 inch = 1,000 feet

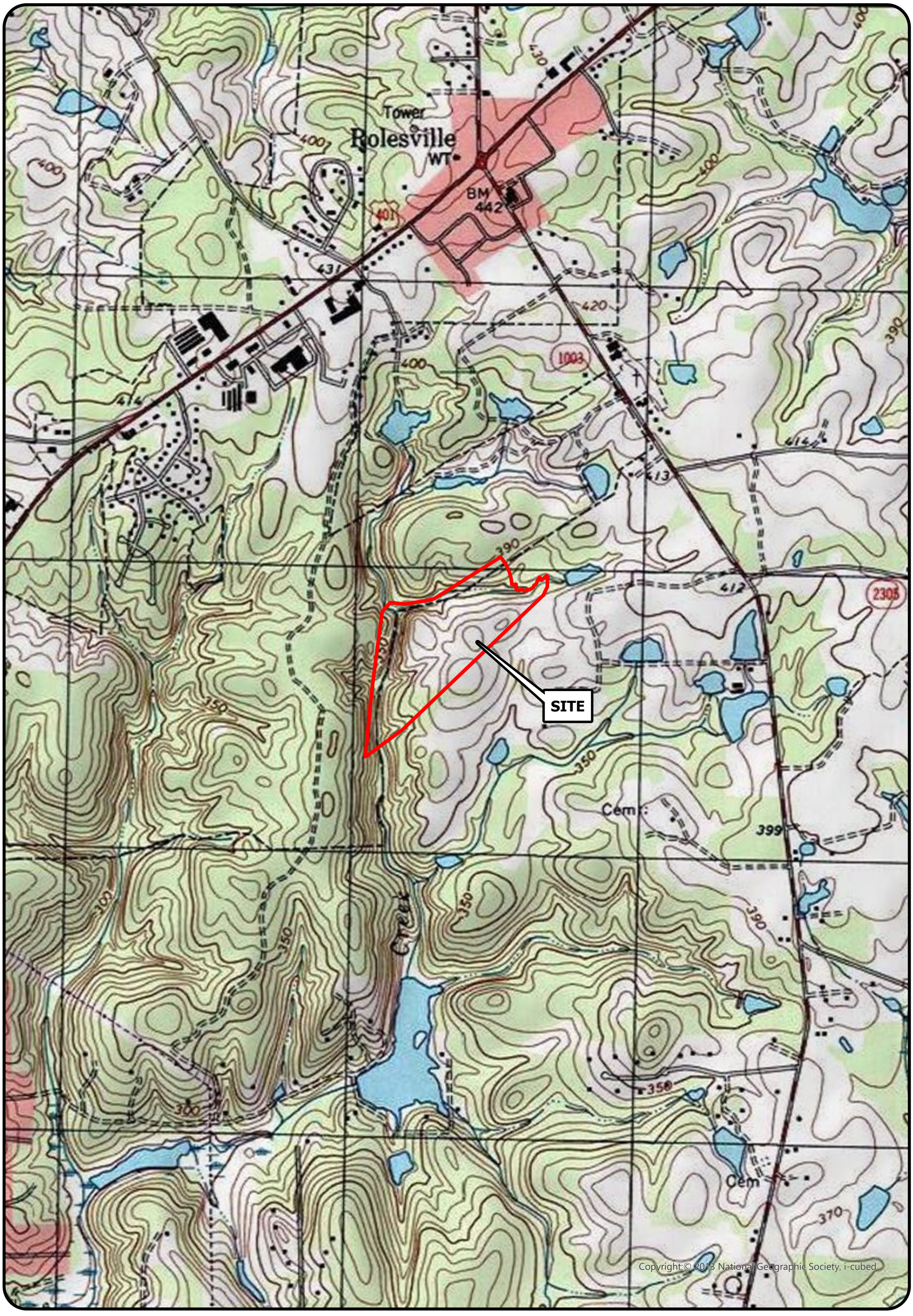
THE POINT - NORTH

SITE AERIAL MAP

PROJECT #: AWH-20000

ROLESVILLE, NORTH CAROLINA

McADAMS



N

0 500 1,000 2,000 Feet

1" = 1,000'

THE POINT - NORTH

USGS TOPOGRAPHIC MAP

PROJECT #: AWH-20000

TOWN OF ROLESVILLE, WAKE COUNTY, NORTH CAROLINA

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. 0315 NEUSE RIVER BASIN

Name of Stream	Description	Class	Class Date	Index No.
NEUSE RIVER	From a point 0.5 mile upstream of Town of Wake Forest proposed water supply intake to Town of Wake Forest proposed water supply intake	WS-IV;NSW,CA	07/01/04	27-(22)
NEUSE RIVER	From Town of Wake Forest proposed water supply intake to mouth of Beddingfield Creek	C;NSW	08/03/92	27-(22.5)
Smith Creek	From source to a point 0.3 mile downstream of Franklin-Wake County Line	WS-II;HQW,NSW	08/03/92	27-23-(1)
Smith Creek (Wake Forest Reservoir)	From a point 0.3 mile downstream of Franklin-Wake County Line to dam at Wake Reservoir	WS-II;HQW,NSW, CA	08/03/92	27-23-(1.5)
Smith Creek	From dam at Wake Forest Reservoir to Neuse River	C;NSW	05/01/88	27-23-(2)
Austin Creek (Mitchell Pond)	From source to Smith Creek	C;NSW	07/01/96	27-23-3
Hatters Branch	From source to Smith Creek	C;NSW	05/01/88	27-23-4
Spring Branch	From source to Hatters Branch	C;NSW	05/01/88	27-23-4-1
Sanford Creek	From source to Smith Creek	C;NSW	05/01/88	27-23-5
Toms Creek (Mill Creek)	From source to Neuse River	C;NSW	05/01/88	27-24
Perry Creek (Greshams Lake)	From source to dam at Greshams Lake	B;NSW	05/01/88	27-25-(1)
Perry Creek	From dam at Greshams Lake to Neuse River	C;NSW	05/01/88	27-25-(2)
Unnamed Tributary near Neuse	From source to dam at Camp Durant	B;NSW	05/01/88	27-25-3-(1)
Unnamed Tributary near Neuse	From dam at Camp Durant to Perry Creek	C;NSW	05/01/88	27-25-3-(2)
Harris Creek (Peeples Creek) (Wake Crossroads Lake)	From source to Neuse River	C;NSW	05/01/88	27-26
Hodges Mill Creek (Lake Mirl)	From source to water intake at Lake Mirl	B;NSW	05/01/88	27-26-1-(1)
Hodges Mill Creek	From water intake at Lake Mirl to Harris Creek	C;NSW	05/01/88	27-26-1-(2)
Beaverdam Creek (west side of Neuse River)	From source to Neuse River	C;NSW	05/01/88	27-27
Rocky Creek	From source to Neuse River	C;NSW	05/01/88	27-28
Beaverdam Creek (east side of Neuse River) (Neuseco Lake, Beaverdam Lake)	From soruce to Neuse River	C;NSW	05/01/88	27-29
Bridges Creek (Bridges Lake)	From source to Neuse River	C;NSW	05/01/88	27-30
Milburnie Creek (Milburnie Lake)	From source to Neuse River	C;NSW	05/01/88	27-31
Mango Creek	From source to Neuse River	C;NSW	05/01/88	27-32
Crabtree Creek	From source to backwaters of Crabtree Lake	C;NSW	05/01/88	27-33-(1)
Turkey Creek	From source to Crabtree Creek	C;NSW	05/01/88	27-33-2
Coles Branch	From source to Crabtree Creek	C;NSW	05/01/88	27-33-3
South Fork Coles Branch	From source to Coles Branch	C;NSW	05/01/88	27-33-3-1
Crabtree Creek (Crabtree Lake)	From backwaters of Crabtree Lake to mouth of Richlands Creek	B;NSW	04/01/94	27-33-(3.5)

780000 FEET
2160000 FEET
78°27'30"W
78°27'0"W
78°26'30"W
78°26'0"W
2170000 FEET
780000 FEET

NORTH CAROLINA Cooperating Technical State
FEMA'S COOPERATING TECHNICAL PARTNER

This digital Flood Insurance Rate Map (FIRM) was produced through a unique cooperative partnership between the State of North Carolina and the Federal Emergency Management Agency (FEMA). The State of North Carolina has implemented a long term approach to floodplain management to decrease the costs associated with flooding. This is demonstrated by the State's commitment to map flood hazard areas at the local level. As a part of this effort, the State of North Carolina has joined in a Cooperating Technical State agreement with FEMA to produce and maintain this digital FIRM.

FLOOD HAZARD INFORMATION

SEE FIS REPORT FOR ZONE DESCRIPTIONS AND INDEX MAP FOR FIRM PANEL LAYOUT

THE INFORMATION DEPICTED ON THIS MAP AND SUPPORTING DOCUMENTATION ARE ALSO AVAILABLE IN DIGITAL FORMAT AT

HTTPS://FRIS.NC.GOV/FRIS

HTTPS://MSC.FEMA.GOV

SPECIAL FLOOD HAZARD AREAS

- Without Base Flood Elevation (BFE) *Zone A, V, A99*
- With BFE or Depth *Zone AE, AO, AH, VE, AR*
- Regulatory Floodway

OTHER AREAS OF FLOOD HAZARD

- 0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
- Future Conditions 1% Annual Chance Flood Hazard *Zone X*
- Area with Reduced Flood Risk due to Levee See Notes *Zone X*

OTHER AREAS

- Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*

GENERAL STRUCTURES

- Channel, Culvert, or Storm Sewer
- Levee, Dike, or Floodwall

OTHER FEATURES

- 012 — 18.2 — Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
- 8 — Coastal Transect
- Coastal Transect Baseline
- Profile Baseline
- Hydrographic Feature
- Limit of Study
- Jurisdiction Boundary

NOTES TO USERS

For information and questions about this map, available products associated with this FIRM including historic versions of this FIRM, how to order products or the National Flood Insurance Program in general, please call the FEMA Map Information eXchange at 1 877 FEMA MAP (1 877 336 2627) or visit the FEMA Map Service Center website at https://msc.fema.gov. An accompanying Flood Insurance Study report, Letter of Map Revision (LOMR) or Letter of Map Amendment (LOMA) revising portions of this panel, and digital versions of this FIRM may be available. Visit the North Carolina Floodplain Mapping Program website at https://flood.nc.gov/ncflood, or contact the FEMA Map Service Center.

Communities annexing land on adjacent FIRM panels must obtain a current copy of the adjacent panel as well as the current FIRM Index. These may be ordered directly from the Map Service Center at the number listed above.

For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the NCFMP. The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

SCALE

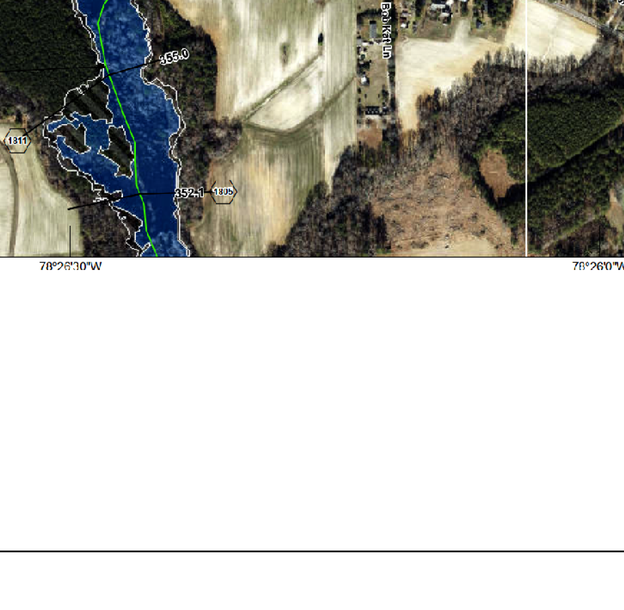
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR



FEMA
National Flood Insurance Program

NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 1768

FEMA

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1768	K
WAKE COUNTY	370368	1768	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720176800K

MAP REVISED
July 19, 2022

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	With BFE or Depth *Zone AE, AO, AH, VE, AR*
	Regulatory Floodway
OTHER AREAS OF FLOOD HAZARD	0.2% Annual Chance Flood Hazard, Areas of 1% Annual Chance Flood with Average Depth Less Than One Foot or With Drainage Areas of Less Than One Square Mile *Zone X*
	Future Conditions 1% Annual Chance Flood Hazard *Zone X*
	Area with Reduced Flood Risk due to Levee See Notes *Zone X*
OTHER AREAS	Areas Determined to be Outside the 0.2% Annual Chance Floodplain *Zone X*
GENERAL STRUCTURES	Channel, Culvert, or Storm Sewer
	Levee, Dike, or Floodwall
OTHER FEATURES	012 — 18.2 Cross Sections with 1% Annual Chance Water Surface Elevation (BFE)
	8 Coastal Transect
	Coastal Transect Baseline
	Profile Baseline
	Hydrographic Feature
	Limit of Study
	Jurisdiction Boundary

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For community and countywide map dates refer to the Flood Insurance Study report for this jurisdiction.

To determine if flood insurance is available in the community, contact your Insurance agent or call the National Flood Insurance Program at 1-800-638-6620.

Flood Insurance Study (FIS) means an examination, evaluation, and determination of flood hazards, corresponding water surface elevations, flood hazard risk zones, and other flood data in a community issued by the North Carolina Floodplain Mapping Program (NCFMP). The Flood Insurance Study (FIS) is comprised of the following products used together: the Digital Flood Hazard Database, the Water Surface Elevation Rasters, the digitally derived, autogenerated Flood Insurance Rate Map and the Flood Insurance Survey Report. A Flood Insurance Survey is a compilation and presentation of flood risk data for specific watercourses, lakes, and coastal flood hazard areas within a community. This report contains detailed flood elevation data, data tables and FIRM indices. When a flood study is completed for the NFIP, the digital information, reports and maps are assembled into an FIS. Information shown on this FIRM is provided in digital format by the NCFMP. Base map information shown on this FIRM was provided in digital format by the NCFMP. The source of this information can be determined from the metadata available in the digital FLOOD database and in the Technical Support Data Notebook (TSDN).

ACCREDITED LEVEE NOTES TO USERS: If an accredited levee note appears on this panel check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

PROVISIONALLY ACCREDITED LEVEE NOTES TO USERS: If a Provisionally Accredited Levee (PAL) note appears on this panel, check with your local community to obtain more information, such as the estimated level of protection provided (which may exceed the 1-percent-annual-chance level) and Emergency Action Plan, on the levee system(s) shown as providing protection for areas on this panel. To maintain accreditation, the levee owner or community is required to submit the data and documentation necessary to comply with Section 65.10 of the NFIP regulations. If the community or owner does not provide the necessary data and documentation or if the data and documentation provided indicate the levee system does not comply with Section 65.10 requirements, FEMA will revise the flood hazard and risk information for this area to reflect de-accreditation of the levee system. To mitigate flood risk in residual risk areas, property owners and residents are encouraged to consider flood insurance and floodproofing or other protective measures. For more information on flood insurance, interested parties should visit the FEMA Website at https://www.fema.gov/national-flood-insurance-program.

LIMIT OF MODERATE WAVE ACTION NOTES TO USERS: For some coastal flooding zones the AE Zone category has been divided by a Limit of Moderate Wave Action (LiMWA). The LiMWA represents the approximate landward limit of the 1.5-foot breaking wave. The effects of wave hazards between the VE Zone and the LiMWA (or between the shoreline and the LiMWA for areas where VE Zones are not identified) will be similar to, but less severe than those in the VE Zone.

Limit of Moderate Wave Action (LiMWA)

SCALE

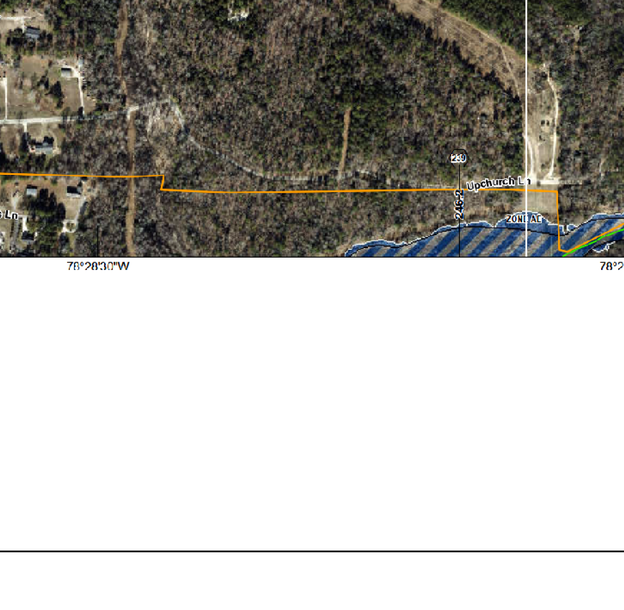
Map Projection:
North Carolina State Plane Projection Feet (Zone 3200)
Datum: NAD 1983 (Horizontal), NAVD 1988 (Vertical)

1 inch = 500 feet 1:6,000

0 250 500 1,000 Feet

0 75 150 300 Meters

PANEL LOCATOR



NORTH CAROLINA FLOODPLAIN MAPPING PROGRAM
NATIONAL FLOOD INSURANCE PROGRAM
FLOOD INSURANCE RATE MAP

NORTH CAROLINA

PANEL 1758

FEMA

National Flood Insurance Program

Panel Contains:

COMMUNITY	CID	PANEL	SUFFIX
ROLESVILLE, TOWN OF	370468	1758	K
WAKE COUNTY	370368	1758	K

VERSION NUMBER
2.3.3.2

MAP NUMBER
3720175800K

MAP REVISED
July 19, 2022

N

0 500 1,000 2,000 Feet

1" = 1,000'

THE POINT - NORTH

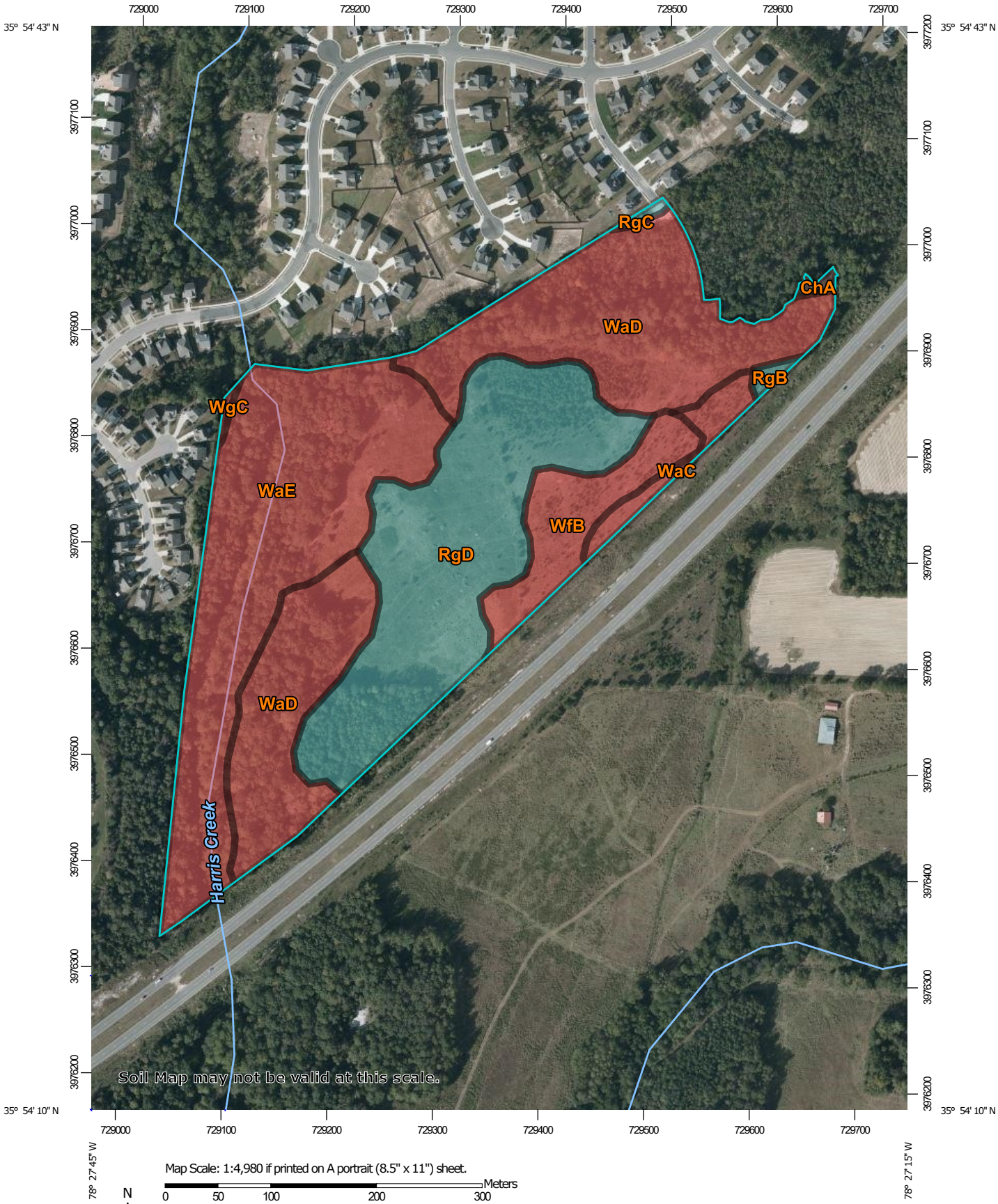
HISTORICAL SOIL SURVEY

PROJECT #: AWH-20000

TOWN OF ROLESVILLE, WAKE COUNTY, NORTH CAROLINA

McADAMS

Hydrologic Soil Group—Wake County, North Carolina
(PropertyLine)



Map Scale: 1:4,980 if printed on A portrait (8.5" x 11") sheet.

N

Meters
0 50 100 200 300

Feet
0 200 400 800 1200

Map projection: Web Mercator Corner coordinates: WGS84 Edge tics: UTM Zone 17N WGS84

MAP LEGEND

Area of Interest (AOI)

Area of Interest (AOI)

Soils

Soil Rating Polygons

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Lines

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Soil Rating Points

A
A/D
B
B/D
C
C/D
D
Not rated or not available

Water Features

Streams and Canals

Transportation

Rails
Interstate Highways
US Routes
Major Roads
Local Roads

Background

Aerial Photography

MAP INFORMATION

The soil surveys that comprise your AOI were mapped at 1:24,000.

Warning: Soil Map may not be valid at this scale.

Enlargement of maps beyond the scale of mapping can cause misunderstanding of the detail of mapping and accuracy of soil line placement. The maps do not show the small areas of contrasting soils that could have been shown at a more detailed scale.

Please rely on the bar scale on each map sheet for map measurements.

Source of Map: Natural Resources Conservation Service
Web Soil Survey URL:
Coordinate System: Web Mercator (EPSG:3857)

Maps from the Web Soil Survey are based on the Web Mercator projection, which preserves direction and shape but distorts distance and area. A projection that preserves area, such as the Albers equal-area conic projection, should be used if more accurate calculations of distance or area are required.

This product is generated from the USDA-NRCS certified data as of the version date(s) listed below.

Soil Survey Area: Wake County, North Carolina
Survey Area Data: Version 20, Jun 3, 2020

Soil map units are labeled (as space allows) for map scales 1:50,000 or larger.

Date(s) aerial images were photographed: Oct 11, 2019—Oct 19, 2019

The orthophoto or other base map on which the soil lines were compiled and digitized probably differs from the background imagery displayed on these maps. As a result, some minor shifting of map unit boundaries may be evident.

Hydrologic Soil Group

Map unit symbol	Map unit name	Rating	Acres in AOI	Percent of AOI
ChA	Chewacla and Wehadkee soils, 0 to 2 percent slopes, frequently flooded	B/D	0.1	0.3%
RgB	Rawlings-Rion complex, 2 to 6 percent slopes	C	0.2	0.4%
RgC	Rawlings-Rion complex, 6 to 10 percent slopes	C	0.1	0.2%
RgD	Rawlings-Rion complex, 10 to 15 percent slopes	C	12.6	27.7%
WaC	Wake-Rolesville complex, 6 to 10 percent slopes, very rocky	D	1.1	2.4%
WaD	Wake-Rolesville complex, 10 to 15 percent slopes, very rocky	D	14.6	32.1%
WaE	Wake-Rolesville complex, 15 to 25 percent slopes, very rocky	D	13.4	29.5%
WfB	Wedowee-Saw complex, 2 to 6 percent slopes	D	3.2	7.1%
WgC	Wedowee-Urban land complex, 6 to 15 percent slopes	D	0.1	0.2%
Totals for Area of Interest			**45.4**	**100.0%**

Description

Hydrologic soil groups are based on estimates of runoff potential. Soils are assigned to one of four groups according to the rate of water infiltration when the soils are not protected by vegetation, are thoroughly wet, and receive precipitation from long-duration storms.

The soils in the United States are assigned to four groups (A, B, C, and D) and three dual classes (A/D, B/D, and C/D). The groups are defined as follows:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of clays that have a high shrink-swell potential, soils that have a high water table, soils that have a claypan or clay layer at or near the surface, and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

If a soil is assigned to a dual hydrologic group (A/D, B/D, or C/D), the first letter is for drained areas and the second is for undrained areas. Only the soils that in their natural condition are in group D are assigned to dual classes.

Rating Options

Aggregation Method: Dominant Condition

Component Percent Cutoff: None Specified

Tie-break Rule: Higher

NOAA Atlas 14, Volume 2, Version 3
Location name: Wake Forest, North Carolina, USA*
Latitude: 35.9053°, Longitude: -78.452°
Elevation: 354.67 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	**0.403** (0.369-0.442)	**0.468** (0.429-0.512)	**0.534** (0.489-0.582)	**0.600** (0.548-0.654)	**0.666** (0.606-0.726)	**0.718** (0.651-0.783)	**0.765** (0.690-0.834)	**0.807** (0.723-0.881)	**0.853** (0.758-0.932)	**0.895** (0.789-0.979)
10-min	**0.644** (0.590-0.705)	**0.749** (0.687-0.818)	**0.855** (0.783-0.933)	**0.959** (0.877-1.05)	**1.06** (0.966-1.16)	**1.14** (1.04-1.25)	**1.22** (1.10-1.33)	**1.28** (1.15-1.40)	**1.35** (1.20-1.47)	**1.41** (1.24-1.54)
15-min	**0.806** (0.738-0.882)	**0.942** (0.863-1.03)	**1.08** (0.991-1.18)	**1.21** (1.11-1.32)	**1.35** (1.22-1.47)	**1.45** (1.31-1.58)	**1.54** (1.39-1.68)	**1.61** (1.45-1.76)	**1.70** (1.51-1.86)	**1.77** (1.56-1.94)
30-min	**1.10** (1.01-1.21)	**1.30** (1.19-1.42)	**1.54** (1.41-1.68)	**1.76** (1.61-1.92)	**1.99** (1.81-2.17)	**2.18** (1.98-2.38)	**2.35** (2.12-2.57)	**2.51** (2.25-2.74)	**2.70** (2.40-2.95)	**2.87** (2.52-3.14)
60-min	**1.38** (1.26-1.51)	**1.63** (1.50-1.78)	**1.97** (1.81-2.15)	**2.29** (2.09-2.50)	**2.65** (2.42-2.89)	**2.96** (2.68-3.22)	**3.24** (2.92-3.53)	**3.52** (3.16-3.85)	**3.88** (3.45-4.24)	**4.18** (3.69-4.58)
2-hr	**1.61** (1.46-1.78)	**1.92** (1.75-2.10)	**2.34** (2.13-2.56)	**2.75** (2.49-3.01)	**3.23** (2.91-3.54)	**3.66** (3.28-4.00)	**4.07** (3.63-4.45)	**4.49** (3.98-4.91)	**5.04** (4.42-5.51)	**5.52** (4.80-6.05)
3-hr	**1.71** (1.55-1.89)	**2.03** (1.85-2.24)	**2.49** (2.26-2.74)	**2.94** (2.67-3.24)	**3.50** (3.15-3.84)	**3.99** (3.58-4.39)	**4.49** (3.98-4.92)	**5.00** (4.41-5.48)	**5.69** (4.96-6.24)	**6.32** (5.45-6.95)
6-hr	**2.05** (1.87-2.26)	**2.44** (2.23-2.68)	**2.99** (2.72-3.28)	**3.54** (3.22-3.88)	**4.22** (3.82-4.62)	**4.84** (4.35-5.29)	**5.46** (4.86-5.96)	**6.12** (5.39-6.67)	**7.00** (6.10-7.64)	**7.82** (6.72-8.55)
12-hr	**2.41** (2.21-2.66)	**2.87** (2.64-3.15)	**3.54** (3.24-3.88)	**4.21** (3.84-4.62)	**5.07** (4.59-5.53)	**5.85** (5.26-6.36)	**6.64** (5.91-7.22)	**7.49** (6.59-8.14)	**8.66** (7.50-9.41)	**9.76** (8.32-10.6)
24-hr	**2.86** (2.66-3.08)	**3.46** (3.22-3.73)	**4.35** (4.04-4.69)	**5.06** (4.69-5.44)	**6.02** (5.57-6.49)	**6.80** (6.27-7.32)	**7.60** (6.98-8.19)	**8.43** (7.71-9.09)	**9.58** (8.71-10.3)	**10.5** (9.50-11.3)
2-day	**3.32** (3.09-3.57)	**3.99** (3.72-4.30)	**4.98** (4.64-5.37)	**5.77** (5.35-6.21)	**6.83** (6.32-7.36)	**7.68** (7.09-8.27)	**8.56** (7.87-9.22)	**9.46** (8.66-10.2)	**10.7** (9.74-11.6)	**11.7** (10.6-12.7)
3-day	**3.52** (3.28-3.77)	**4.23** (3.94-4.54)	**5.25** (4.89-5.63)	**6.06** (5.64-6.50)	**7.17** (6.64-7.69)	**8.05** (7.44-8.64)	**8.96** (8.25-9.62)	**9.89** (9.07-10.6)	**11.2** (10.2-12.1)	**12.2** (11.1-13.2)
4-day	**3.72** (3.47-3.98)	**4.46** (4.17-4.77)	**5.52** (5.15-5.90)	**6.35** (5.92-6.79)	**7.50** (6.96-8.01)	**8.42** (7.79-9.00)	**9.36** (8.63-10.0)	**10.3** (9.49-11.1)	**11.7** (10.7-12.5)	**12.7** (11.6-13.7)
7-day	**4.31** (4.04-4.61)	**5.15** (4.82-5.50)	**6.29** (5.88-6.71)	**7.19** (6.72-7.68)	**8.43** (7.85-9.00)	**9.42** (8.75-10.1)	**10.4** (9.66-11.2)	**11.5** (10.6-12.3)	**12.9** (11.8-13.9)	**14.1** (12.8-15.1)
10-day	**4.91** (4.61-5.24)	**5.85** (5.48-6.23)	**7.04** (6.60-7.50)	**7.99** (7.47-8.50)	**9.26** (8.64-9.86)	**10.3** (9.55-10.9)	**11.3** (10.5-12.0)	**12.3** (11.4-13.2)	**13.7** (12.6-14.7)	**14.8** (13.6-15.9)
20-day	**6.59** (6.20-7.02)	**7.79** (7.32-8.29)	**9.23** (8.67-9.81)	**10.4** (9.72-11.0)	**11.9** (11.1-12.7)	**13.1** (12.2-14.0)	**14.3** (13.3-15.3)	**15.6** (14.5-16.6)	**17.3** (16.0-18.5)	**18.6** (17.1-19.9)
30-day	**8.18** (7.72-8.69)	**9.63** (9.08-10.2)	**11.2** (10.6-11.9)	**12.5** (11.7-13.2)	**14.1** (13.2-15.0)	**15.4** (14.4-16.3)	**16.6** (15.5-17.7)	**17.9** (16.7-19.0)	**19.5** (18.1-20.9)	**20.8** (19.3-22.3)
45-day	**10.4** (9.89-11.0)	**12.2** (11.6-12.9)	**14.0** (13.3-14.8)	**15.4** (14.6-16.2)	**17.2** (16.3-18.1)	**18.6** (17.5-19.6)	**19.9** (18.7-21.0)	**21.2** (19.9-22.5)	**23.0** (21.5-24.4)	**24.3** (22.7-25.8)
60-day	**12.5** (11.9-13.1)	**14.6** (13.9-15.4)	**16.6** (15.7-17.4)	**18.1** (17.1-19.0)	**20.0** (19.0-21.1)	**21.5** (20.3-22.6)	**22.9** (21.6-24.1)	**24.2** (22.9-25.6)	**26.0** (24.5-27.5)	**27.4** (25.7-29.0)

[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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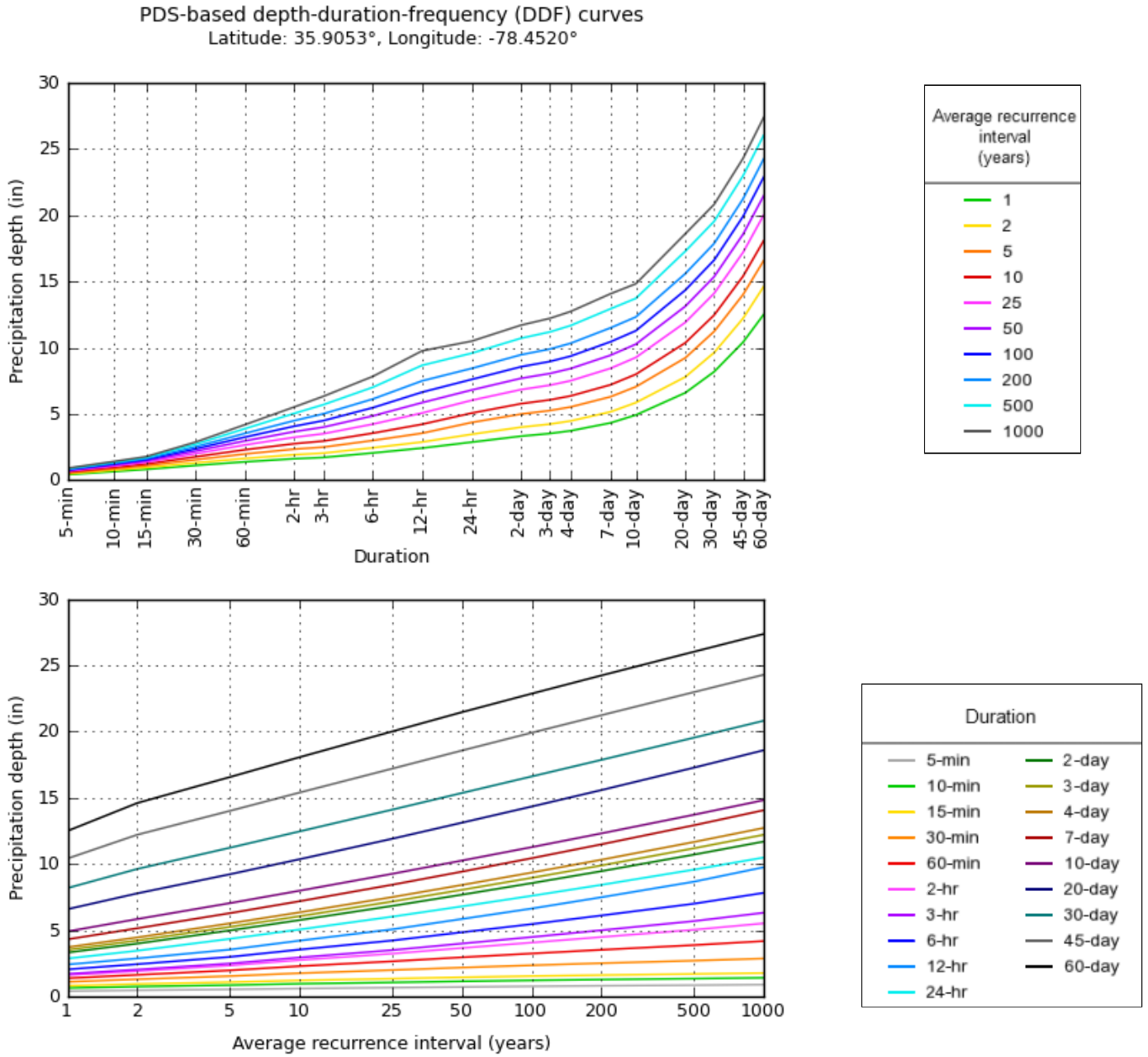
PF graphical



NOAA Atlas 14, Volume 2, Version 3

Created (GMT): Wed Jun 3 19:09:38 2020

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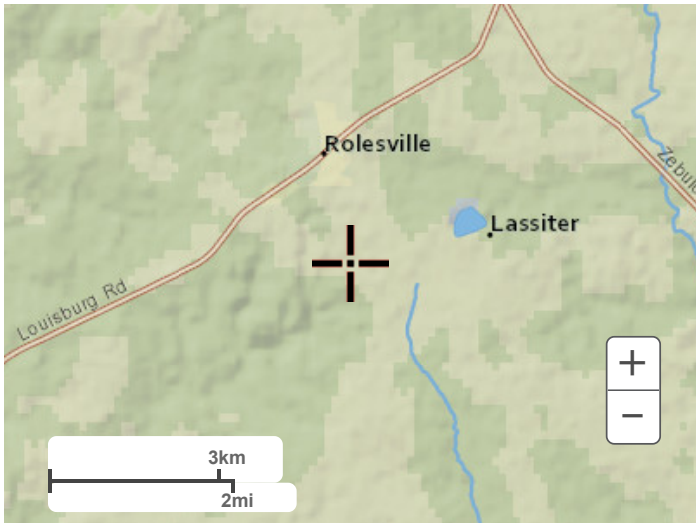
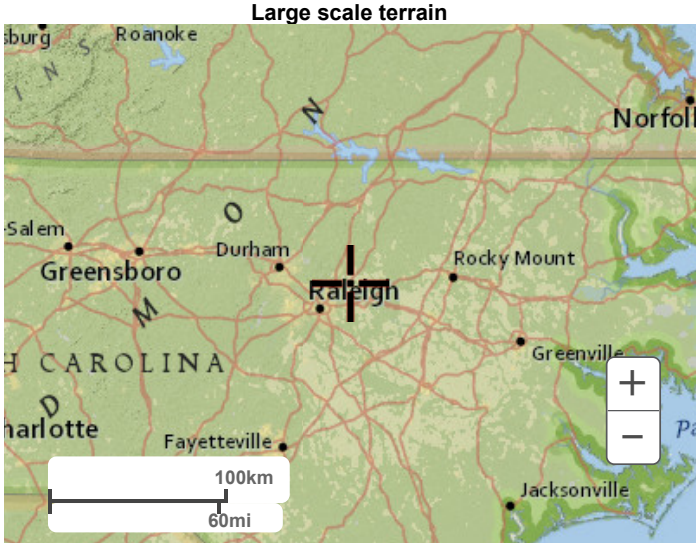
Maps & aerials

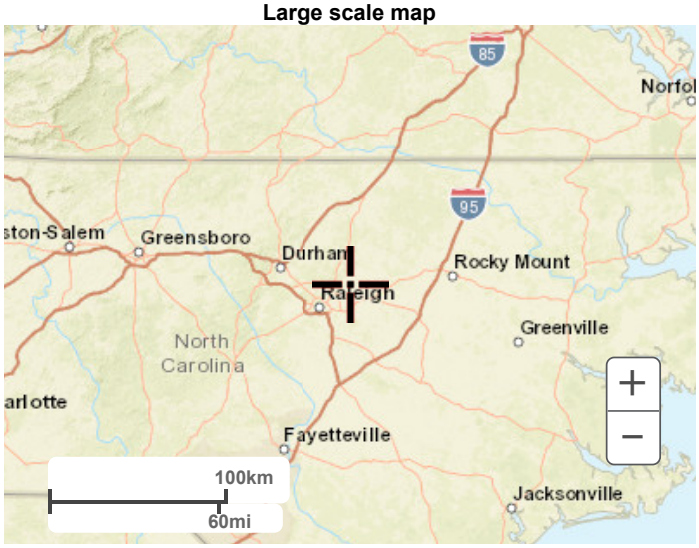
Small scale terrain



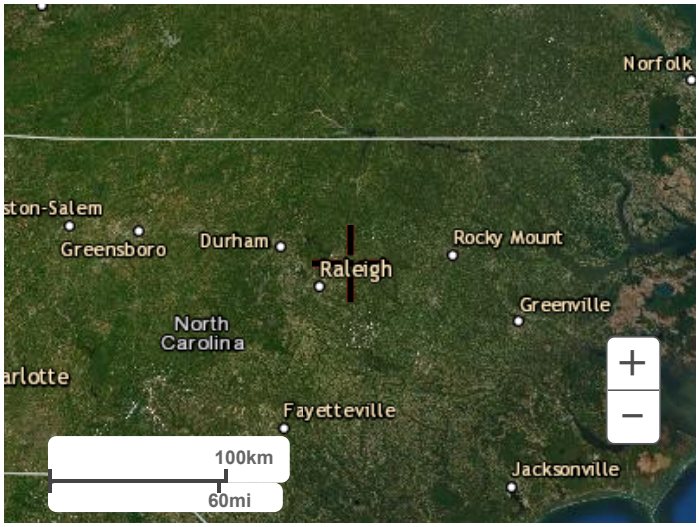
Large scale terrain



Large scale map



Large scale aerial



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US Department of Commerce
National Oceanic and Atmospheric Administration
National Weather Service
National Water Center
1325 East West Highway
Silver Spring, MD 20910
Questions?: HDSC.Questions@noaa.gov

Disclaimer

GREENWAY PRE-DEVELOPMENT HYDROLOGIC CALCULATIONS

The Point - North
AWH-20000

OFFSITE CURVE NUMBERS - ZONING

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Zoning	Right-Of-Way	90	83	89	93	91	93
	High Density Residential	30	57	72	86	82	86
	Medium Density Residential	25	54	70	85	80	85
	Low Density Residential	20	51	68	84	79	84
	Commercial	85	89	92	95	94	95
	Mixed Use Neighborhood	65	72	85	92	90	92
	Business Park	85	89	92	95	94	95
	Preserved Open	0	39	61	80	74	80
	Town Center	85	89	92	95	94	95
	School	72	75	88	93	91	93

ONSITE CURVE NUMBERS - LAND COVER

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Land Cover	Open Space, Good Condition	0	39	61	80	74	80
	Woods, Good Condition	0	30	55	77	70	77
	Road	100	98	98	98	98	98
	Sidewalk	100	98	98	98	98	98
	Dirt Path	0	72	82	89	87	89
	Pond	100	100	100	100	100	100
	Crops	0	67	78	89	85	89

ONSITE CURVE NUMBERS - LOTS

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Lot Type	45' Lot	57	73	82	90	88	90

Impervious Assumptions					
Lot Type	Impervious Assumption (sf)	Total Lot Count	Total Impervious Area	Total Lot Area	Percent Impervious (%)
45' Lot	3,279.2	94	308,245	540,354	57

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
Commercial	C	94	0.00	85	0.00
Commercial	D	95	3.37	85	2.86
Dirt Path	C	87	0.43	0	0.00
Dirt Path	D	89	1.35	0	0.00
High Density Residential	C	82	15.37	30	4.61
High Density Residential	D	86	49.79	30	14.94
Low Density Residential	C	79	3.97	20	0.79
Low Density Residential	D	84	28.31	20	5.66
Mixed Use Neighborhood	C	90	3.82	65	2.48
Mixed Use Neighborhood	D	92	32.73	65	21.27
Open Space, Good Condition	C	74	40.53	0	0.00
Open Space, Good Condition	D	80	28.39	0	0.00
Pond	C	100	0.47	100	0.47
Pond	D	100	10.22	100	10.22
Road	C	98	9.20	100	9.20
Road	D	98	39.27	100	39.27
Sidewalk	C	98	0.14	100	0.14
Sidewalk	D	98	0.07	100	0.07
Town Center	C	94	0.00	85	0.00
Town Center	D	95	0.47	85	0.40
Woods, Good Condition	C	70	55.53	0	0.00
Woods, Good Condition	D	77	100.01	0	0.00

Total Area	423.44	ac
Total Impervious Area	112.40	ac
Percent Impervious	27	%
Composite Curve Number	82	

TIME OF CONCENTRATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	426.50	ft
Bot Elev =	426.00	ft
Height =	0.50	ft
Slope =	0.0050	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	*18.13*	*minutes*

Segment 2: Concentrated Flow

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	367.00	ft
Height =	59	ft
Slope =	0.0232	ft/ft
Paved ? =	No	
Velocity =	2.46	ft/sec
Segment Time =	*17.37*	*minutes*

Segment 3: Pipe Flow

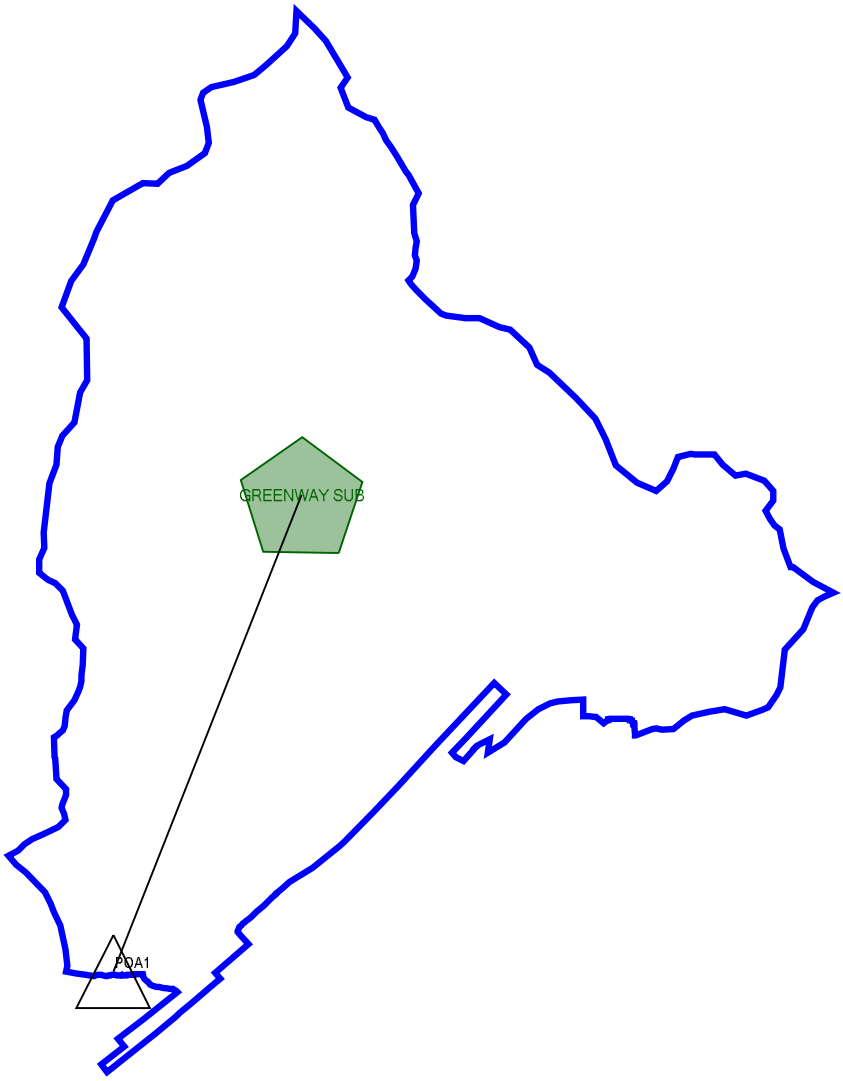
Length =	388	ft
Top Elev =	367.00	ft
Bot Elev =	358.00	ft
Height =	9.00	ft
Slope =	0.0232	ft/ft
Manning's n =	0.013	concrete pipe
Pipe Diameter=	10.00	ft
Flow Area =	100.00	sf (assume 10' x 10' box culvert)
Wetted Perimeter =	14.00	lf (assume full flow depth)
Velocity =	64.74	ft/sec
Segment Time =	***0.10***	***minutes***

Segment 4: Channel Flow

Length =	3580	ft
Top Elev =	358.00	ft
Bot Elev =	305.00	ft
Height =	53	ft
Slope =	0.0148	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	4.00	sf (assume 6' x 4' channel)
Wetted Perimeter =	6.00	lf (assume 6' x 4' channel)
Channel Velocity =	3.07	ft/sec
Segment Time =	***19.41***	***minutes***

Time of Concentration =	55.01	minutes
SCS Lag Time =	33.01	minutes (SCS Lag = 0.6* Tc)
Time Increment =	9.57	minutes (= 0.29*SCS Lag)

Scenario: Pre-Development



FlexTable: Catchment Table (AWH20000 - Greenway.ppc)

Current Time: 0.00 min

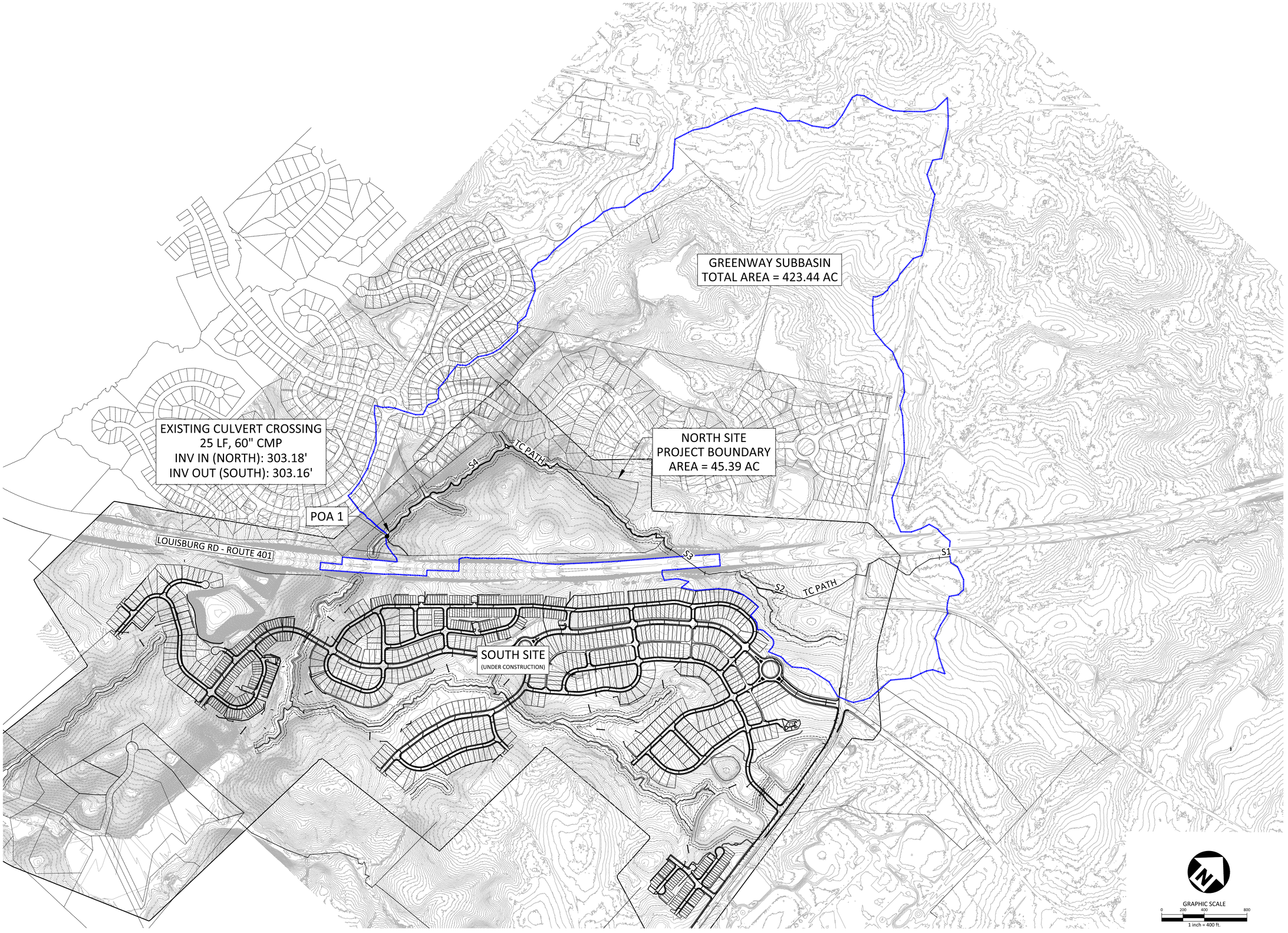
Label	Outflow Node	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
GREENWAY SUB	POA1	18,444,895	82	55.01	PRE

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
GREENWAY SUB	Pre-Dev 10-yr	10	108.915	756.00	686.58
GREENWAY SUB	Pre-Dev 25-yr	25	139.469	755.00	847.78
GREENWAY SUB	Pre-Dev 100-yr	100	191.461	755.00	1,105.06

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA1	Pre-Dev 10-yr	10	108.915	756.00	686.58
POA1	Pre-Dev 25-yr	25	139.469	755.00	847.78
POA1	Pre-Dev 100-yr	100	191.461	755.00	1,105.06



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ASHTON WOODS

THE POINT
PHASES 11-13
CONSTRUCTION DRAWINGS
EAST YOUNG STREET
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP,
WAKE COUNTY, NORTH CAROLINA

CD 22-05

REVISIONS

NO.	DATE	
1	12. 12. 2022	REV PER TOWN AND CITY COMMENTS
2	01. 11. 2023	REV PER WAKE COUNTY COMMENTS
3	04. 21. 2023	REV PER WAKE COUNTY COMMENTS

PLAN INFORMATION

PROJECT NO.	AWH-20000
FILENAME	AWH-20000 CULVERT
CHECKED BY	KEG
DRAWN BY	SDD
SCALE	1" = 400'
DATE	04.24.2023

SHEET

PRE DEVELOPMENT
HYDROLOGY MAP

PRE-GREENWAY

FINAL DRAWING - NOT RELEASED FOR CONSTRUCTION

M:\Projects\AWH\AWH-20000\04-Production\Water Resources\North Site\Culvert Sizing\Current Drawings\AWH20000x - CULVERT.dwg, 4/24/2023 1:12:07 PM, Samantha Daniell

GREENWAY POST-DEVELOPMENT HYDROLOGIC CALCULATIONS

The Point - North
AWH-20000

OFFSITE CURVE NUMBERS - ZONING

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Zoning	Right-Of-Way	90	83	89	93	91	93
	High Density Residential	30	57	72	86	82	86
	Medium Density Residential	25	54	70	85	80	85
	Low Density Residential	20	51	68	84	79	84
	Commercial	85	89	92	95	94	95
	Mixed Use Neighborhood	65	72	85	92	90	92
	Business Park	85	89	92	95	94	95
	Preserved Open	0	39	61	80	74	80
	Town Center	85	89	92	95	94	95
	School	72	75	88	93	91	93

ONSITE CURVE NUMBERS - LAND COVER

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Land Cover	Open Space, Good Condition	0	39	61	80	74	80
	Woods, Good Condition	0	30	55	77	70	77
	Road	100	98	98	98	98	98
	Sidewalk	100	98	98	98	98	98
	Dirt Path	0	72	82	89	87	89
	Pond	100	100	100	100	100	100
	Crops	0	67	78	89	85	89

ONSITE CURVE NUMBERS - LOTS

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Lot Type	45' Lot	57	73	82	90	88	90

Impervious Assumptions					
Lot Type	Impervious Assumption (sf)	Total Lot Count	Total Impervious Area	Total Lot Area	Percent Impervious (%)
45' Lot	3,279.2	94	308,245	540,354	57

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
45' Lot	C	88	6.80	57	3.88
45' Lot	D	90	5.61	57	3.20
Commercial	C	94	0.00	85	0.00
Commercial	D	95	3.37	85	2.86
High Density Residential	C	82	15.37	30	4.61
High Density Residential	D	86	49.79	30	14.94
Low Density Residential	C	79	3.97	20	0.79
Low Density Residential	D	84	28.31	20	5.66
Mixed Use Neighborhood	C	90	3.82	65	2.48
Mixed Use Neighborhood	D	92	32.73	65	21.27
Open Space, Good Condition	C	74	35.63	0	0.00
Open Space, Good Condition	D	80	32.83	0	0.00
Pond	C	100	0.49	100	0.49
Pond	D	100	10.77	100	10.77
Road	C	98	10.86	100	10.86
Road	D	98	40.63	100	40.63
Sidewalk	C	98	0.75	100	0.75
Sidewalk	D	98	0.93	100	0.93
Town Center	C	94	0.00	85	0.00
Town Center	D	95	0.47	85	0.40
Woods, Good Condition	C	70	51.78	0	0.00
Woods, Good Condition	D	77	88.54	0	0.00

Total Area	423.44	ac
Total Impervious Area	124.53	ac
Percent Impervious	29	%
Composite Curve Number	83	

TIME OF CONCENTRATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	426.50	ft
Bot Elev =	426.00	ft
Height =	0.50	ft
Slope =	0.0050	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	*18.13*	*minutes*

Segment 2: Concentrated Flow

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	367.00	ft
Height =	59	ft
Slope =	0.0232	ft/ft
Paved ? =	No	
Velocity =	2.46	ft/sec
Segment Time =	*17.37*	*minutes*

Segment 3: Pipe Flow

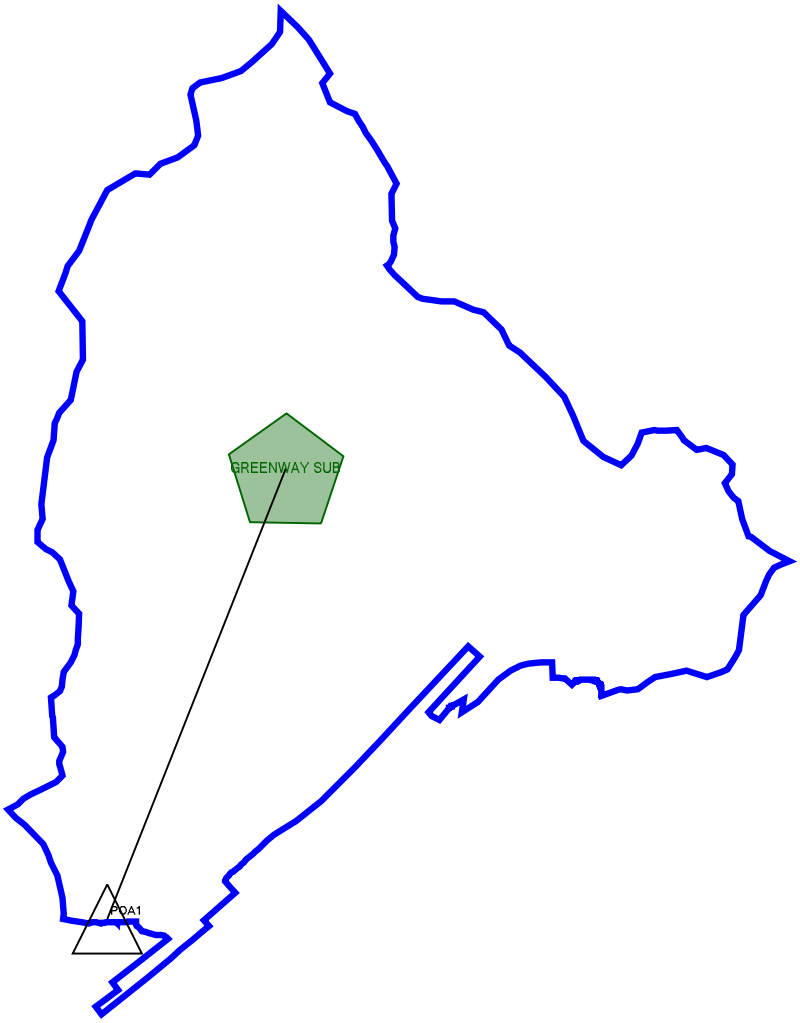
Length =	388	ft
Top Elev =	367.00	ft
Bot Elev =	358.00	ft
Height =	9.00	ft
Slope =	0.0232	ft/ft
Manning's n =	0.013	concrete pipe
Pipe Diameter=	10.00	ft
Flow Area =	100.00	sf (assume 10' x 10' box culvert)
Wetted Perimeter =	14.00	lf (assume full flow depth)
Velocity =	64.74	ft/sec
Segment Time =	***0.10***	***minutes***

Segment 4: Channel Flow

Length =	3580	ft
Top Elev =	358.00	ft
Bot Elev =	305.00	ft
Height =	53	ft
Slope =	0.0148	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	4.00	sf (assume 6' x 4' channel)
Wetted Perimeter =	6.00	lf (assume 6' x 4' channel)
Channel Velocity =	3.07	ft/sec
Segment Time =	***19.41***	***minutes***

Time of Concentration =	55.01	minutes
SCS Lag Time =	33.01	minutes (SCS Lag = 0.6* Tc)
Time Increment =	9.57	minutes (= 0.29*SCS Lag)

Scenario: Post-Development



FlexTable: Catchment Table (AWH20000 - Greenway.ppc)

Current Time: 0.00 min

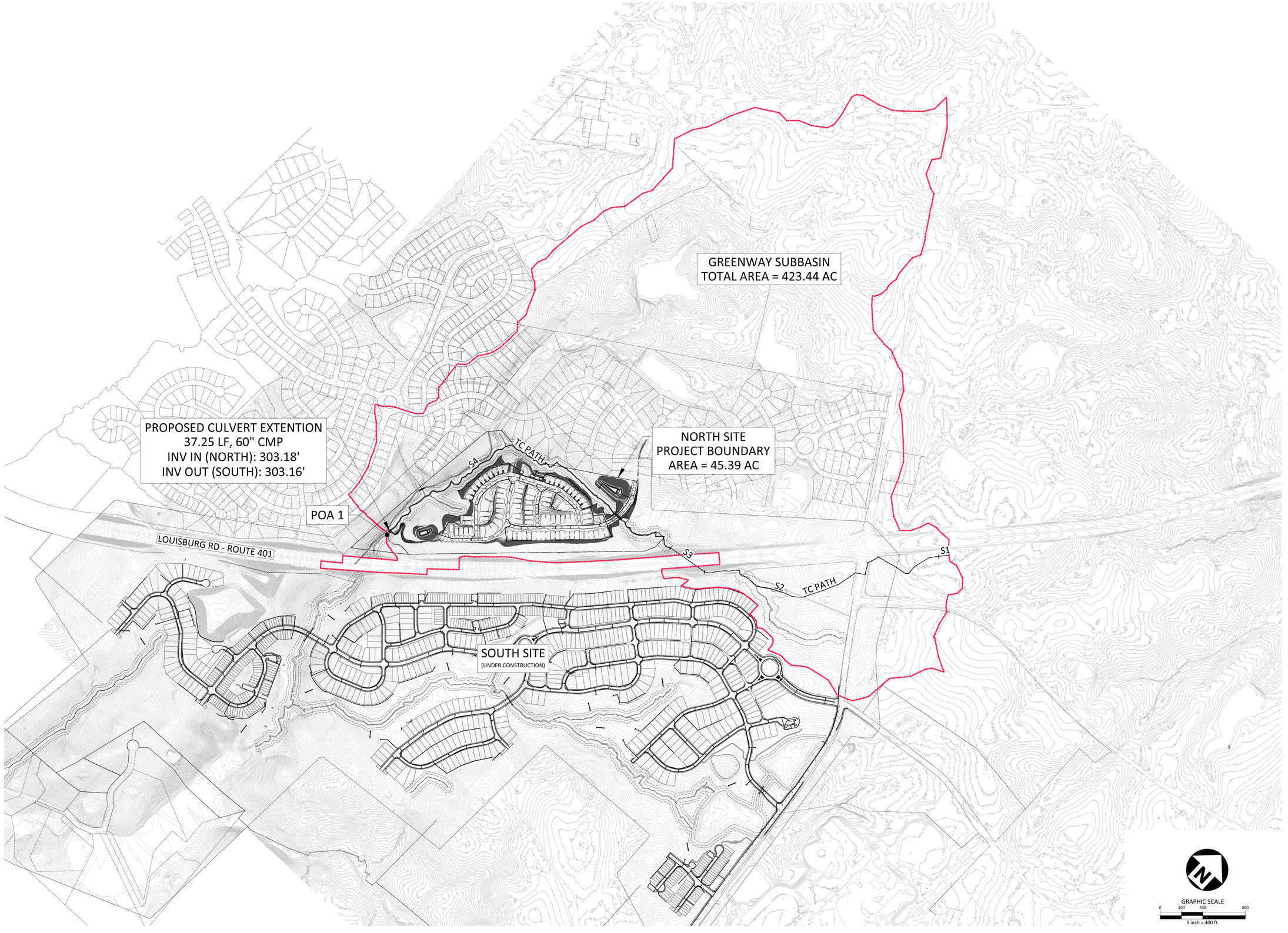
Label	Outflow Node	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
GREENWAY SUB	POA1	18,444,895	83	55.01	POST

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
GREENWAY SUB	Post-Dev 10-yr	10	112.272	755.00	707.13
GREENWAY SUB	Post-Dev 25-yr	25	143.137	755.00	868.56
GREENWAY SUB	Post-Dev 100-yr	100	195.520	755.00	1,125.42

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA1	Post-Dev 10-yr	10	112.272	755.00	707.13
POA1	Post-Dev 25-yr	25	143.137	755.00	868.56
POA1	Post-Dev 100-yr	100	195.520	755.00	1,125.42



FINAL DRAWING - NOT RELEASED FOR CONSTRUCTION

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CD 22-05

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NO.	DATE	
1	12. 12. 2022	REV PER TOWN AND CITY COMMENTS
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PLAN INFORMATION

PROJECT NO.	AWH-20000
FILENAME	AWH-20000 CULVERT
CHECKED BY	KEG
DRAWN BY	SDD
SCALE	1" = 400'
DATE	04.24.2023

SHEET

POST DEVELOPMENT
HYDROLOGY MAP

POST-GREENWAY

M:\Projects\AWH\AWH-20000\04-Production\Water Resources\North Site\Culvert Sizing\Current Drawings\AWH20000- CULVERT.dwg, 4/24/2023 1:17:52 PM, Samantha Daniell

GREENWAY PRE-DEVELOPMENT HYDRAULIC CALCULATIONS

The Point - North
AWH-20000

CULVERT DESIGN CALCULATIONS - PRE DEVELOPMENT

Peak Flows Used for Culvert Sizing:

Q10, Peak =	686.58	cfs
Q25, Peak =	847.78	cfs
Q100, Peak =	1105.06	cfs

Culvert 1 (Main Channel) Specifications:

Number of Barrels =	1	
Pipe Material =	Corrugated Aluminium	
Culvert Diameter =	60	in
US Pipe Invert =	303.18	ft
DS Pipe Invert =	303.16	ft
Pipe Length =	25.00	ft
Embedment =	0.00	ft
Slope =	0.0008	ft/ft

Combined Culvert System Routing:

10-Year Storm

Headwater Elevation =	313.29	ft
Hw/D =	2.0	
Road Crest Elevation =	310.76	ft
Freeboard =	-2.53	ft

25-Year Storm

Headwater Elevation =	313.69	ft
Hw/D =	2.1	
Road Crest Elevation =	310.76	ft
Freeboard =	-2.93	ft

100-Year Storm

Headwater Elevation =	314.24	ft
Hw/D =	2.2	
Road Crest Elevation =	310.76	ft
Freeboard =	-3.48	ft

Culvert Crossing: Pre Development

Crossing Summary Table

Headwater Elevation (ft)	Total Discharge (cfs)	Existing Discharge (cfs)	Roadway Discharge (cfs)	Iterations
313.29	686.58	206.87	479.32	6
313.40	728.43	206.86	521.41	4
313.51	770.28	206.81	563.32	4
313.61	812.12	206.74	605.25	4
313.69	847.78	206.51	641.16	4
313.80	895.82	206.05	689.67	4
313.89	937.67	205.76	731.84	4
313.98	979.52	205.59	773.42	3
314.07	1021.36	205.57	815.37	3
314.16	1063.21	205.54	857.36	3
314.24	1105.06	205.48	899.37	3
310.76	176.86	176.86	0.00	Overtopping

GREENWAY POST-DEVELOPMENT HYDRAULIC CALCULATIONS

The Point - North
AWH-20000

CULVERT DESIGN CALCULATIONS - POST DEVELOPMENT

Peak Flows Used for Culvert Sizing:

Q10, Peak =	707.13	cfs
Q25, Peak =	868.56	cfs
Q100, Peak =	1125.42	cfs

Culvert 1 (Main Channel) Specifications:

Number of Barrels =	1	
Pipe Material =	Corrugated Aluminium	
Culvert Diameter =	60	in
US Pipe Invert =	303.18	ft
DS Pipe Invert =	303.16	ft
Pipe Length =	37.25	ft
Embedment =	0.00	ft
Slope =	0.0005	ft/ft

Combined Culvert System Routing:

10-Year Storm			***Increase Pre to Post:***	
Headwater Elevation =	313.36	ft	0.07	ft
Hw/D =	2.0			
Road Crest Elevation =	310.76	ft		
Freeboard =	-2.60	ft		

25-Year Storm				
Headwater Elevation =	313.76	ft	0.07	ft
Hw/D =	2.1			
Road Crest Elevation =	310.76	ft		
Freeboard =	-3.00	ft		

100-Year Storm				
Headwater Elevation =	314.29	ft	0.05	ft
Hw/D =	2.2			
Road Crest Elevation =	310.76	ft		
Freeboard =	-3.53	ft		

Culvert Crossing: Post Development

Crossing Summary Table

Headwater Elevation (ft)	Total Discharge (cfs)	Existing with Extensions Discharge (cfs)	Roadway Discharge (cfs)	Iterations
313.36	707.13	200.53	506.27	6
313.47	748.96	200.50	548.31	4
313.57	790.79	200.43	590.22	4
313.67	832.62	200.34	632.15	4
313.76	868.56	199.93	668.53	4
313.86	916.28	199.52	716.66	4
313.95	958.10	199.27	758.78	4
314.04	999.93	199.20	800.26	3
314.12	1041.76	199.17	842.21	3
314.21	1083.59	199.13	884.19	3
314.29	1125.42	199.03	926.19	3
310.76	176.84	176.84	0.00	Overtopping

GENOVESA DRIVE POST-DEVELOPMENT HYDROLOGIC CALCULATIONS

The Point - North
AWH-20000

OFFSITE CURVE NUMBERS - ZONING

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Zoning	Right-Of-Way	90	83	89	93	91	93
	High Density Residential	30	57	72	86	82	86
	Medium Density Residential	25	54	70	85	80	85
	Low Density Residential	20	51	68	84	79	84
	Commercial	85	89	92	95	94	95
	Mixed Use Neighborhood	65	72	85	92	90	92
	Business Park	85	89	92	95	94	95
	Preserved Open	0	39	61	80	74	80
	Town Center	85	89	92	95	94	95
	School	72	75	88	93	91	93

ONSITE CURVE NUMBERS - LAND COVER

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Land Cover	Open Space, Good Condition	0	39	61	80	74	80
	Woods, Good Condition	0	30	55	77	70	77
	Road	100	98	98	98	98	98
	Sidewalk	100	98	98	98	98	98
	Dirt Path	0	72	82	89	87	89
	Pond	100	100	100	100	100	100
	Crops	0	67	78	89	85	89

ONSITE CURVE NUMBERS - LOTS

			Hydrologic Soil Group				
		Percent Impervious (%)	A	B	B/D	C	D
Lot Type	45' Lot	57	73	82	90	88	90

Impervious Assumptions					
Lot Type	Impervious Assumption (sf)	Total Lot Count	Total Impervious Area	Total Lot Area	Percent Impervious (%)
45' Lot	3,279.2	94	308,245	540,354	57

CURVE NUMBER CALCULATIONS

Land Use	HSG	CN	Area (ac)	Percent Impervious (%)	Impervious Area (ac)
45' Lot	C	88	0.00	57	0.00
45' Lot	D	90	0.03	57	0.01
High Density Residential	C	82	3.90	30	1.17
High Density Residential	D	86	2.72	30	0.82
Low Density Residential	C	79	0.00	20	0.00
Low Density Residential	D	84	5.08	20	1.02
Mixed Use Neighborhood	C	90	2.20	65	1.43
Mixed Use Neighborhood	D	92	4.05	65	2.63
Open Space, Good Condition	C	74	1.36	0	0.00
Open Space, Good Condition	D	80	15.75	0	0.00
Road	C	98	5.16	100	5.16
Road	D	98	17.18	100	17.18
Sidewalk	C	98	0.14	100	0.14
Sidewalk	D	98	0.07	100	0.07
Woods, Good Condition	C	70	6.61	0	0.00
Woods, Good Condition	D	77	24.53	0	0.00

Total Area	88.77	ac
Composite Curve Number	84	

TIME OF CONCENTRATION

Time of concentration is calculated using the SCS Segmental Approach (TR-55).

Segment 1: Overland Flow

Length =	100	ft
Top Elev =	426.50	ft
Bot Elev =	426.00	ft
Height =	0.50	ft
Slope =	0.0050	ft/ft
Manning's n =	0.17	cultivated soils, residue cover
P (2-year/24-hour) =	3.46	inches (Rolesville, NC)
Segment Time =	*18.13*	*minutes*

Segment 2: Concentrated Flow

Length =	2541	ft
Top Elev =	426.00	ft
Bot Elev =	367.00	ft
Height =	59	ft
Slope =	0.0232	ft/ft
Paved ? =	No	
Velocity =	2.46	ft/sec
Segment Time =	*17.37*	*minutes*

Segment 3: Pipe Flow

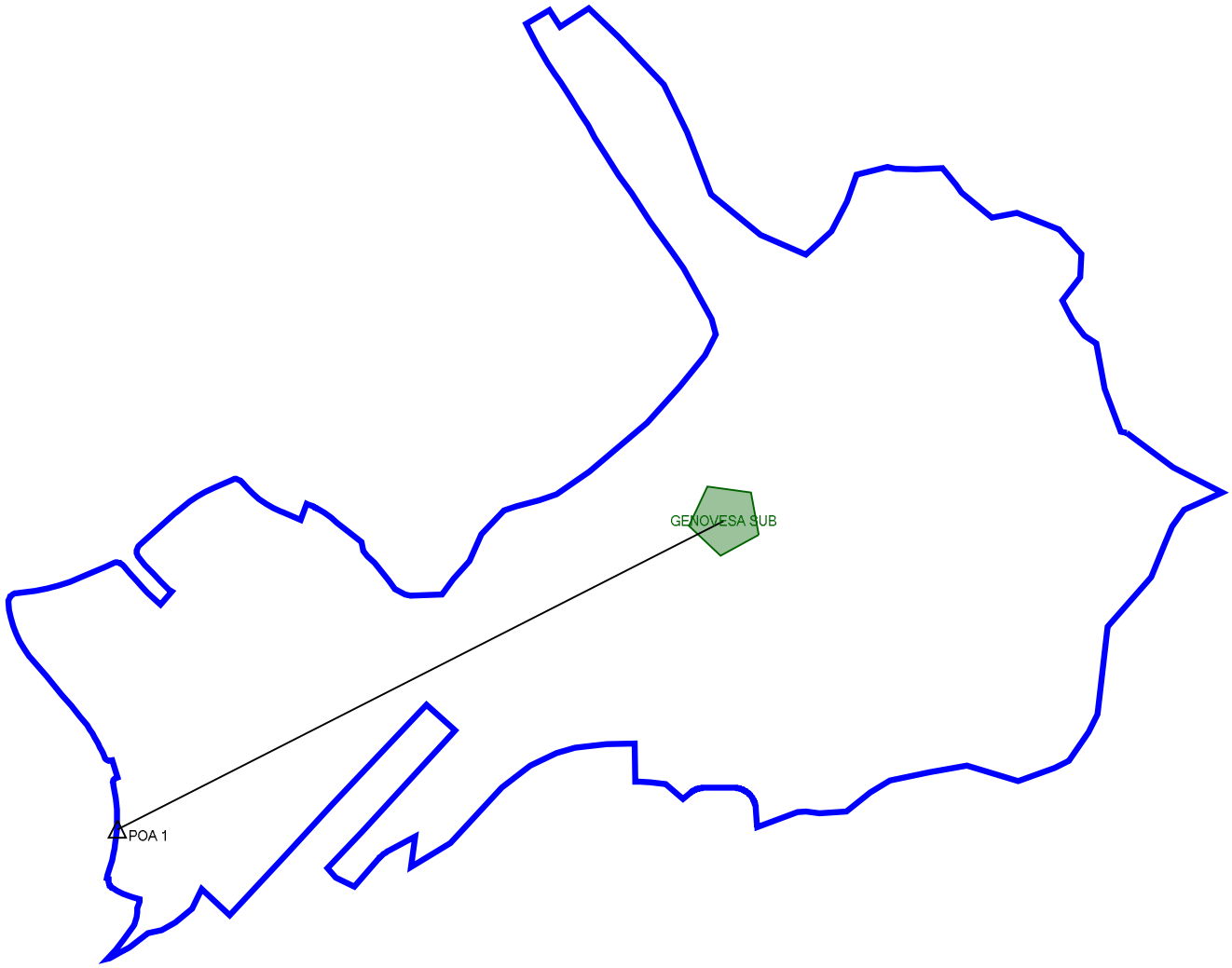
Length =	388	ft
Top Elev =	367.00	ft
Bot Elev =	358.00	ft
Height =	9.00	ft
Slope =	0.0232	ft/ft
Manning's n =	0.013	concrete pipe
Pipe Diameter=	10.00	ft
Flow Area =	100.00	sf (assume 10' x 10' box culvert)
Wetted Perimeter =	14.00	lf (assume full flow depth)
Velocity =	64.74	ft/sec
Segment Time =	***0.10***	***minutes***

Segment 4: Channel Flow

Length =	651	ft
Top Elev =	358.00	ft
Bot Elev =	347.00	ft
Height =	11	ft
Slope =	0.0169	ft/ft
Manning's n =	0.045	natural channel
Flow Area =	4.00	sf (assume 6' x 4' channel)
Wetted Perimeter =	6.00	lf (assume 6' x 4' channel)
Channel Velocity =	3.28	ft/sec
Segment Time =	***3.30***	***minutes***

Time of Concentration =	38.91	minutes
SCS Lag Time =	23.35	minutes (SCS Lag = 0.6* Tc)
Time Increment =	6.77	minutes (= 0.29*SCS Lag)

Scenario: Post-Development



MCADAMS

FlexTable: Catchment Table (AWH20000-Genovesa.ppc)

Current Time: 0.00 min

Label	Outflow Node	Area (ft²)	SCS CN	Time of Concentration (min)	Notes
GENOVESA SUB	POA 1	3,866,912	84	38.91	POST

Catchments Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
GENOVESA SUB	Post- 10yr	10	24.352	742.00	184.92
GENOVESA SUB	Post- 25yr	25	30.900	742.00	224.21
GENOVESA SUB	Post- 100yr	100	41.964	742.00	284.48

Node Summary

Label	Scenario	Return Event (years)	Hydrograph Volume (ac-ft)	Time to Peak (min)	Peak Flow (ft^3/s)
POA 1	Post- 10yr	10	24.352	742.00	184.92
POA 1	Post- 25yr	25	30.900	742.00	224.21
POA 1	Post- 100yr	100	41.964	742.00	284.48

PROPOSED GENOVESA DRIVE
CULVERT CROSSING

(1) 82 LF, 72" RCP @ 3.44%
UPSTREAM INV. = 347.00'
DOWNSTREAM INV. = 344.18'
EMBEDMENT DEPTH = 1.00'

(2) 82 LF, 60" RCP @ 1.30%
UPSTREAM INV. = 348.51'
DOWNSTREAM INV. = 347.44'

NORTH SITE
PROJECT BOUNDARY
AREA = 45.39 AC

POA 1

S4

S3

LOUISBURG RD - ROUTE 401

GENOVESA DRIVE
SUBBASIN
AREA = 88.77 AC

S1

TC PATH

S2

TC PATH

ROLESVILLE RD

CENTURY FARM RD

SOUTH SITE
(UNDER CONSTRUCTION)

N

GRAPHIC SCALE
0 60.5 125 250
1 inch = 125 ft.

FINAL DRAWING - NOT RELEASED FOR CONSTRUCTION

M:\Projects\AWH\AWH-20000\04-Production\Water Resources\North Site\Culvert Sizing\Current Drawings\AWH20000x - CULVERT.dwg, 4/24/2023 1:30:55 PM, Samantha Danell

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900 RIDGEFIELD DRIVE, SUITE 335
RALEIGH, NORTH CAROLINA 27609
PHONE: 919. 422. 7663
CONTACT: BOB MISHLER

ASHTON WOODS

THE POINT
PHASES 11-13
CONSTRUCTION DRAWINGS
EAST YOUNG STREET
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP,
WAKE COUNTY, NORTH CAROLINA

CD 22-05

REVISIONS

NO.	DATE	
1	12. 12. 2022	REV PER TOWN AND CITY COMMENTS
2	01. 11. 2023	REV PER WAKE COUNTY COMMENTS
3	04. 21. 2023	REV PER WAKE COUNTY COMMENTS

PLAN INFORMATION

PROJECT NO.	AWH-20000
FILENAME	AWH-20000 CULVERT
CHECKED BY	KEG
DRAWN BY	SDD
SCALE	1" = 125'
DATE	04.24.2023

SHEET

POST DEVELOPMENT
CULVERT HYDROLOGY MAP

POST-GENOVESA

GENOVESA DRIVE POST-DEVELOPMENT HYDRAULIC CALCULATIONS

The Point - North
AWH-20000

CULVERT DESIGN CALCULATIONS

Peak Flows Used for Culvert Sizing:

Q10, Peak =	184.92	cfs
Q25, Peak =	224.21	cfs
Q100, Peak =	284.48	cfs

Culvert 1 (Main Channel) Specifications:

Shape:	Circular	
Number of Barrels =	1	
Culvert Diameter =	72	in
US Pipe Invert =	347.00	ft
DS Pipe Invert =	344.18	ft
Pipe Length =	82.00	ft
Embedment =	1.00	ft
Slope =	0.0344	ft/ft

Culvert 2 (Floodplain) Specifications:

Shape:	Circular	
Number of Barrels =	2	
Culvert Diameter =	60	in
US Pipe Invert =	348.51	ft
DS Pipe Invert =	347.44	ft
Pipe Length =	82.00	ft
Embedment =	0.00	ft
Slope =	0.0130	ft/ft

Combined Culvert System Routing:

10-Year Storm

Headwater Elevation =	350.73	ft
Hw/D =	0.5	
Road Crest Elevation =	375.05	ft
Freeboard =	24.32	ft

25-Year Storm

Headwater Elevation =	350.89	ft
Hw/D =	0.6	
Road Crest Elevation =	375.05	ft
Freeboard =	24.16	ft

100-Year Storm

Headwater Elevation =	351.35	ft
Hw/D =	0.7	
Road Crest Elevation =	375.05	ft
Freeboard =	23.70	ft

Velocity Dissipator Specifications:

Length =	24.00	ft
Width =	33.00	ft
Thickness=	27.00	in
Classification=	I	

TABLE 1: EXISTING CONDITIONS VS. PROPOSED CONDITIONS

Cross Section	100yr Water Surface Elevation		
	Existing Conditions	Proposed Conditions	Difference
2,065	359.81	359.81	0.00
1,991	358.79	358.79	0.00
1,950	358.52	358.52	0.00
1,907	358.12	358.12	0.00
1,840	356.89	356.89	0.00
1,738	355.23	355.23	0.00
1,665	354.09	354.09	0.00
1,597	352.57	352.57	0.00
1,557	352.75	352.75	0.00
1,498	351.95	351.94	-0.01
1,440	351.14	351.35	0.21
1,382	GENOVESA DRIVE CULVERT		
1,332	350.25	350.30	0.05
1,239	349.43	349.43	0.00
1,178	348.50	348.50	0.00
1,115	347.99	347.99	0.00
1,041	347.39	347.39	0.00
983	346.90	346.90	0.00
915	345.94	345.94	0.00
845	345.13	345.13	0.00
791	344.13	344.13	0.00
729	342.89	342.89	0.00
668	341.61	341.61	0.00
584	339.07	339.07	0.00
496	338.05	338.05	0.00
437	337.47	337.47	0.00
387	336.93	336.93	0.00
341	335.83	335.83	0.00
298	334.05	334.05	0.00
245	332.50	332.50	0.00
186	329.16	329.16	0.00
131	323.71	323.71	0.00
87	323.23	323.23	0.00

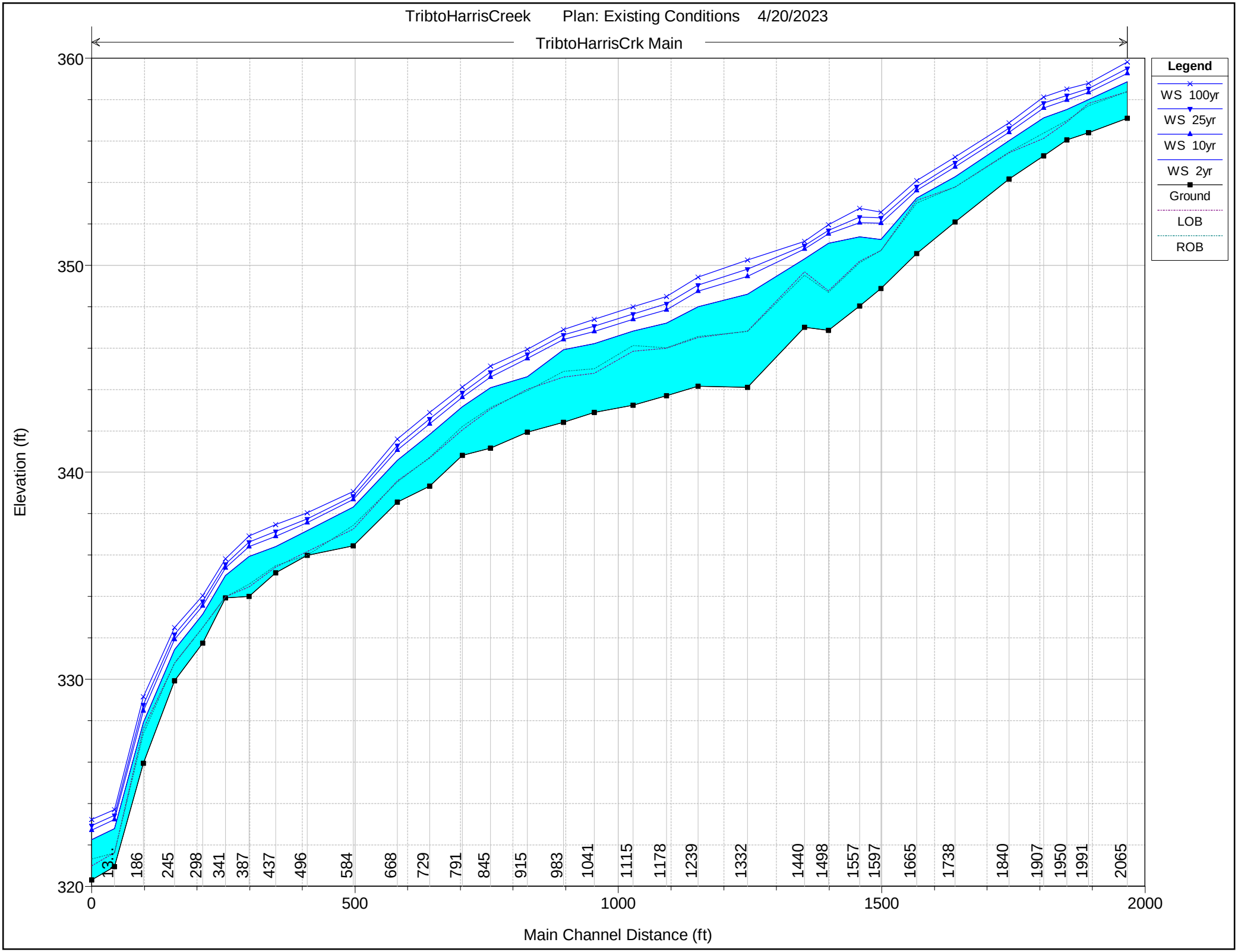
Mitchell F. Rabil Family Property, PIN 1768166987

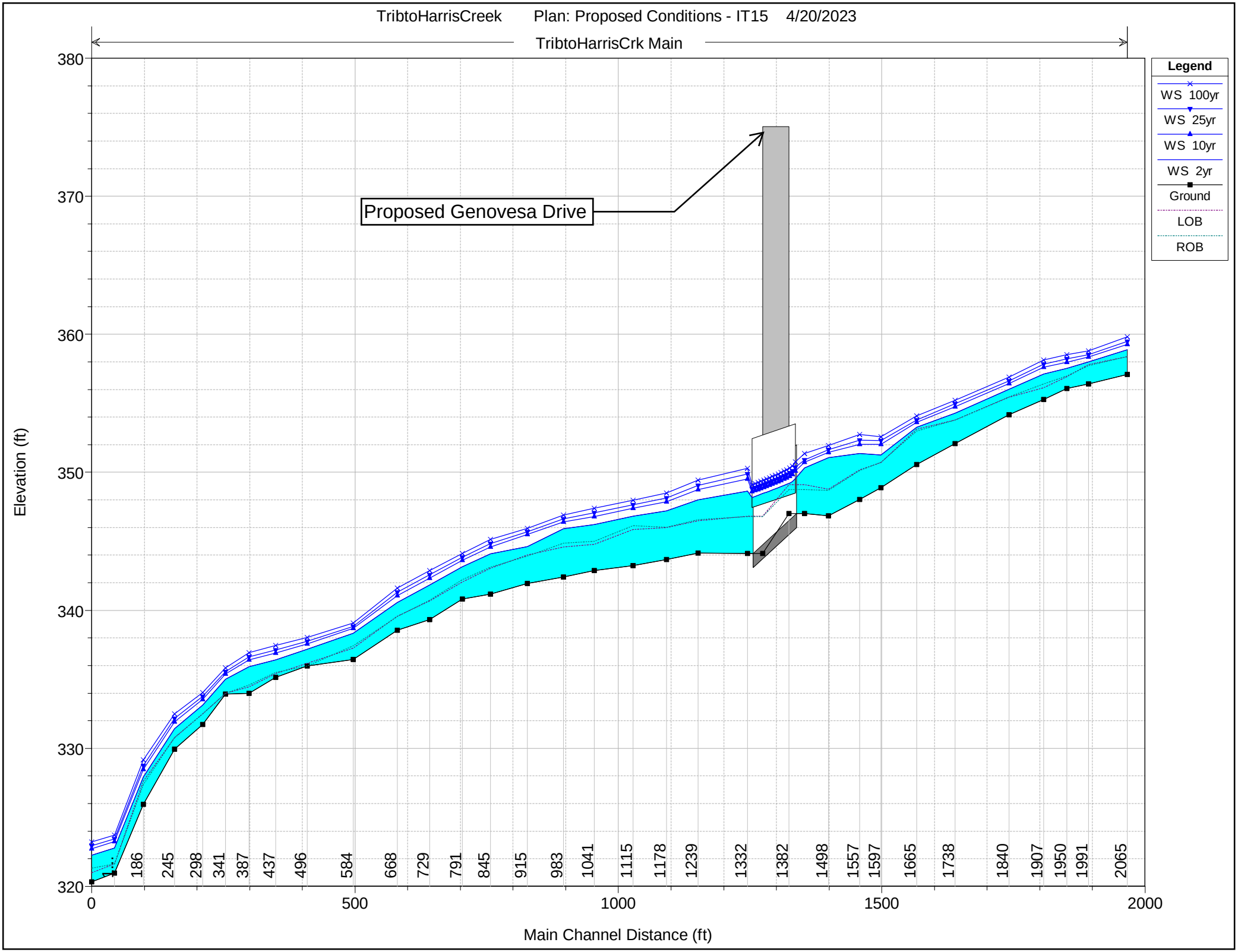
HY-8 Energy Dissipation Results

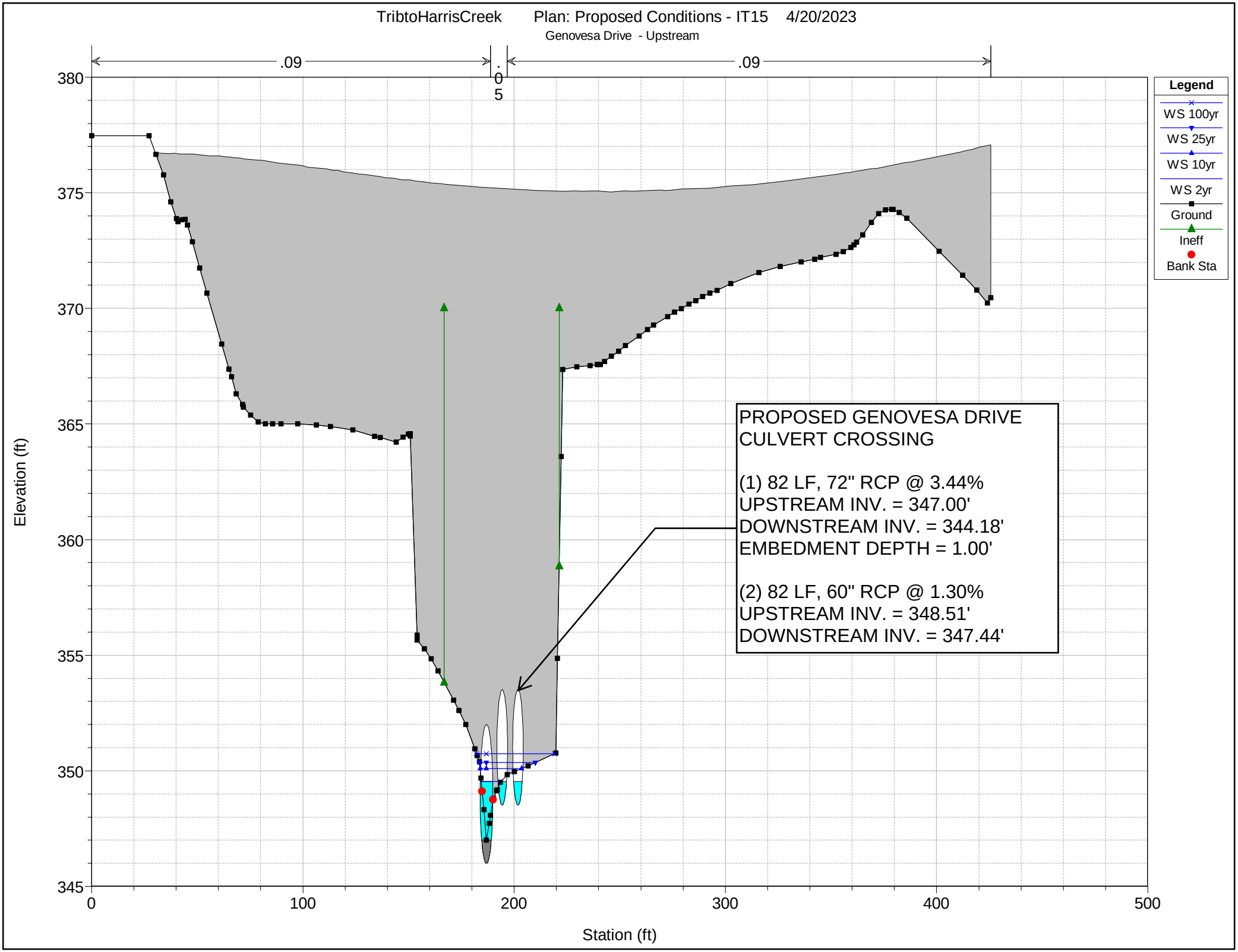
External Energy Dissipator

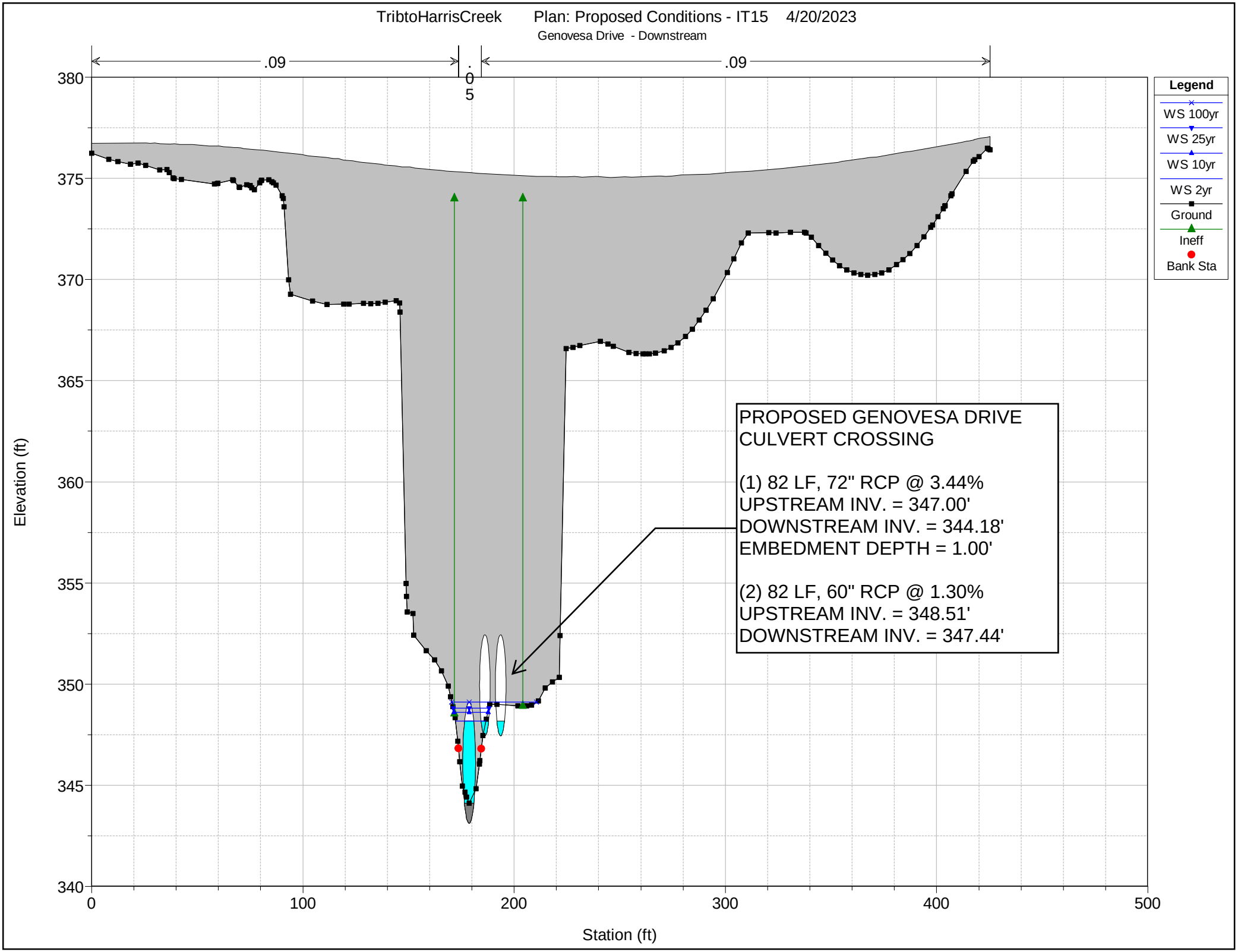
Parameter	Value	Units
Select Culvert and Flow		
Crossing	Genovesa Drive	
Culvert	Main	
Flow	184.92	cfs
Culvert Data		
Culvert Width (including multiple barrels)	6.0	ft
Culvert Height	6.0	ft
Outlet Depth	1.87	ft
Outlet Velocity	16.49	ft/s
Froude Number	2.80	
Tailwater Depth	3.60	ft
Tailwater Velocity	6.18	ft/s
Tailwater Slope (SO)	0.0352	
External Dissipator Data		
External Dissipator Category	Streambed Level Structures	
External Dissipator Type	Riprap Basin	
Restrictions		
Froude Number	<3	
Input Data		
Condition to be used to Compute Basin Outlet Velocity	Best Fit Curve	
D50 of the Riprap Mixture		
Note:	Minimum HS/D50 = 2 is Obtained if D50 = 0.558 ft	
D50 of the Riprap Mixture	0.825	ft
DMax of the Riprap Mixture	1.500	ft
Results		
Brink Depth	1.868	ft
Brink Velocity	16.495	ft/s
Depth (YE)	1.980	ft
Riprap Thickness	2.250	ft
Riprap Foreslope	3.0000	ft
Check HS/D50		
Note:	OK if HS/D50 > 2.0	
HS/D50	0.000	
HS/D50 Check	HS/D50 is NOT OK	
Check D50/YE		
Note:	OK if 0.1 < D50/YE < 0.7	

Check D50/YE	0.417	
D50/YE Check	D50/YE is OK	
Basin Length (LB)	24.000	ft
Basin Width	22.000	ft
Apron Length	6.000	ft
Pool Length	18.000	ft
Pool Depth (HS)	0.000	ft
TW/YE	1.818	
Tailwater Depth (TW)	3.600	ft
Average Velocity with TW	1.230	ft/s
Critical Depth (Yc)	0.993	ft
Average Velocity with Yc	5.431	ft/s
Downstream Riprap for High TW		
Distance: 1 LB		
Velocity	12.192	ft/s
Size	0.969	ft
Distance: 2 LB		
Velocity	6.580	ft/s
Size	0.282	ft
Distance: 3 LB		
Velocity	4.374	ft/s
Size	0.125	ft
Distance: 4 LB		
Velocity	3.274	ft/s
Size	0.070	ft


TribtoHarrisCreek Plan: Existing Conditions 4/20/2023
TribtoHarrisCrk Main
Legend
WS 100yr
WS 25yr
WS 10yr
WS 2yr
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
360
350
340
330
320
0
500
1000
1500
2000
13
186
245
298
341
387
437
496
584
668
729
791
845
915
983
1041
1115
1178
1239
1332
1440
1498
1557
1597
1665
1738
1840
1907
1950
1991
2065


TributoHarrisCreek Plan: Proposed Conditions - IT15 4/20/2023
TributoHarrisCrk Main
Proposed Genovesa Drive
Legend
WS 100yr
WS 25yr
WS 10yr
WS 2yr
Ground
LOB
ROB
Elevation (ft)
Main Channel Distance (ft)
380
370
360
350
340
330
320
0
500
1000
1500
2000
186
245
298
341
387
437
496
584
668
729
791
845
915
983
1041
1115
1178
1239
1332
1382
1498
1557
1597
1665
1738
1840
1907
1950
1991
2065


TribtoHarrisCreek Plan: Proposed Conditions - IT15 4/20/2023
Genovesa Drive - Upstream
.09
.05
.09
Legend
WS 100yr
WS 25yr
WS 10yr
WS 2yr
Ground
Ineff
Bank Sta
PROPOSED GENOVESA DRIVE
CULVERT CROSSING
(1) 82 LF, 72" RCP @ 3.44%
UPSTREAM INV. = 347.00'
DOWNSTREAM INV. = 344.18'
EMBEDMENT DEPTH = 1.00'
(2) 82 LF, 60" RCP @ 1.30%
UPSTREAM INV. = 348.51'
DOWNSTREAM INV. = 347.44'
Elevation (ft)
380
375
370
365
360
355
350
345
0
100
200
300
400
500
Station (ft)


TribtoHarrisCreek Plan: Proposed Conditions - IT15 4/20/2023
Genovesa Drive - Downstream
.09
.05
.09
Legend
WS 100yr
WS 25yr
WS 10yr
WS 2yr
Ground
Ineff
Bank Sta
PROPOSED GENOVESA DRIVE
CULVERT CROSSING
(1) 82 LF, 72" RCP @ 3.44%
UPSTREAM INV. = 347.00'
DOWNSTREAM INV. = 344.18'
EMBEDMENT DEPTH = 1.00'
(2) 82 LF, 60" RCP @ 1.30%
UPSTREAM INV. = 348.51'
DOWNSTREAM INV. = 347.44'
Elevation (ft)
380
375
370
365
360
355
350
345
340
0
100
200
300
400
500
Station (ft)

HEC-RAS Plan: EC River: TributoHarrisCrk Reach: Main

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	2065	10yr	184.92	357.10	359.27	359.27	360.03	0.028458	7.08	28.73	22.43	0.95
Main	2065	25yr	224.21	357.10	359.50	359.50	360.33	0.026683	7.46	34.13	24.40	0.94
Main	2065	100yr	284.48	357.10	359.81	359.81	360.74	0.024901	7.97	42.24	26.96	0.93
Main	1991	10yr	184.92	356.41	358.35		358.57	0.010045	3.81	50.59	41.10	0.56
Main	1991	25yr	224.21	356.41	358.53		358.78	0.009842	4.07	58.17	42.54	0.56
Main	1991	100yr	284.48	356.41	358.79		359.08	0.009561	4.42	69.29	44.44	0.57
Main	1950	10yr	184.92	356.06	357.99		358.18	0.008778	3.68	59.55	54.78	0.53
Main	1950	25yr	224.21	356.06	358.21		358.41	0.007859	3.81	72.86	62.83	0.51
Main	1950	100yr	284.48	356.06	358.52		358.73	0.006800	3.95	93.37	69.65	0.49
Main	1907	10yr	184.92	355.28	357.60		357.83	0.007284	3.94	55.66	41.32	0.50
Main	1907	25yr	224.21	355.28	357.83		358.08	0.007194	4.21	65.30	45.19	0.50
Main	1907	100yr	284.48	355.28	358.12		358.42	0.007166	4.58	79.62	51.24	0.51
Main	1840	10yr	184.92	354.16	356.42	356.33	357.01	0.022735	6.30	34.54	32.65	0.85
Main	1840	25yr	224.21	354.16	356.61	356.57	357.27	0.022447	6.71	41.13	36.65	0.86
Main	1840	100yr	284.48	354.16	356.89	356.86	357.61	0.021459	7.19	52.04	43.12	0.86
Main	1738	10yr	184.92	352.08	354.75		355.17	0.013822	5.31	39.91	30.37	0.68
Main	1738	25yr	224.21	352.08	354.96		355.43	0.013797	5.69	46.63	32.62	0.69
Main	1738	100yr	284.48	352.08	355.23		355.79	0.014313	6.27	55.71	35.44	0.71
Main	1665	10yr	184.92	350.56	353.61		354.05	0.017175	5.33	36.56	28.34	0.73
Main	1665	25yr	224.21	350.56	353.79	353.51	354.30	0.017720	5.79	41.83	30.77	0.75
Main	1665	100yr	284.48	350.56	354.09	353.80	354.67	0.016665	6.21	51.68	34.66	0.75
Main	1597	10yr	184.92	348.88	352.03	352.03	352.76	0.019820	7.17	34.39	30.81	0.81
Main	1597	25yr	224.21	348.88	352.30	352.30	353.05	0.018480	7.42	42.93	32.65	0.80
Main	1597	100yr	284.48	348.88	352.57	352.57	353.42	0.019361	8.10	51.95	33.63	0.83
Main	1557	10yr	184.92	348.03	352.04		352.11	0.001012	2.15	91.97	32.76	0.20
Main	1557	25yr	224.21	348.03	352.33		352.42	0.001129	2.39	101.80	34.48	0.22
Main	1557	100yr	284.48	348.03	352.75		352.86	0.001265	2.71	116.70	37.09	0.23
Main	1498	10yr	184.92	346.85	351.52		351.95	0.006840	5.61	47.59	30.39	0.50
Main	1498	25yr	224.21	346.85	351.69	350.65	352.23	0.008295	6.35	52.99	32.58	0.55
Main	1498	100yr	284.48	346.85	351.95	350.90	352.64	0.010009	7.27	62.08	36.21	0.61
Main	1440	10yr	184.92	347.00	350.78	350.78	351.30	0.042593	6.50	36.60	37.70	0.76
Main	1440	25yr	224.21	347.00	350.95	350.95	351.50	0.042463	6.80	43.04	38.32	0.77
Main	1440	100yr	284.48	347.00	351.14	351.14	351.77	0.045011	7.38	50.74	39.18	0.80
Main	1332	10yr	184.92	344.11	349.47		349.65	0.002402	3.58	69.72	43.33	0.30
Main	1332	25yr	224.21	344.11	349.82		350.02	0.002490	3.83	85.23	45.90	0.31
Main	1332	100yr	284.48	344.11	350.25		350.48	0.002691	4.21	106.29	52.75	0.33
Main	1239	10yr	184.92	344.15	348.75		349.23	0.008932	5.85	42.90	30.13	0.55
Main	1239	25yr	224.21	344.15	349.04	348.17	349.58	0.009261	6.29	52.83	37.66	0.57
Main	1239	100yr	284.48	344.15	349.43	348.83	350.02	0.009385	6.75	69.34	46.89	0.58
Main	1178	10yr	184.92	343.69	347.85	347.52	348.54	0.014464	6.91	36.24	28.70	0.67
Main	1178	25yr	224.21	343.69	348.15	347.94	348.87	0.014417	7.31	45.29	33.35	0.68
Main	1178	100yr	284.48	343.69	348.50	348.37	349.29	0.014755	7.87	58.08	39.05	0.70
Main	1115	10yr	184.92	343.24	347.39		347.78	0.008041	5.10	42.24	30.25	0.52
Main	1115	25yr	224.21	343.24	347.65		348.10	0.008556	5.56	51.56	41.58	0.54
Main	1115	100yr	284.48	343.24	347.99	347.07	348.50	0.008835	6.04	67.02	48.06	0.56
Main	1041	10yr	184.92	342.89	346.80		347.16	0.008691	5.39	54.83	37.96	0.55
Main	1041	25yr	224.21	342.89	347.06		347.44	0.008803	5.73	64.93	41.40	0.56
Main	1041	100yr	284.48	342.89	347.39		347.81	0.008982	6.18	79.61	45.90	0.57
Main	983	10yr	184.92	342.42	346.42		346.71	0.006130	4.60	54.88	37.45	0.47
Main	983	25yr	224.21	342.42	346.63		346.98	0.006773	5.06	63.23	41.25	0.50
Main	983	100yr	284.48	342.42	346.90	346.14	347.33	0.007759	5.71	74.94	46.55	0.54
Main	915	10yr	184.92	341.94	345.50	345.50	346.06	0.015018	6.53	46.02	50.81	0.71

HEC-RAS Plan: EC River: TribtoHarrisCrk Reach: Main (Continued)

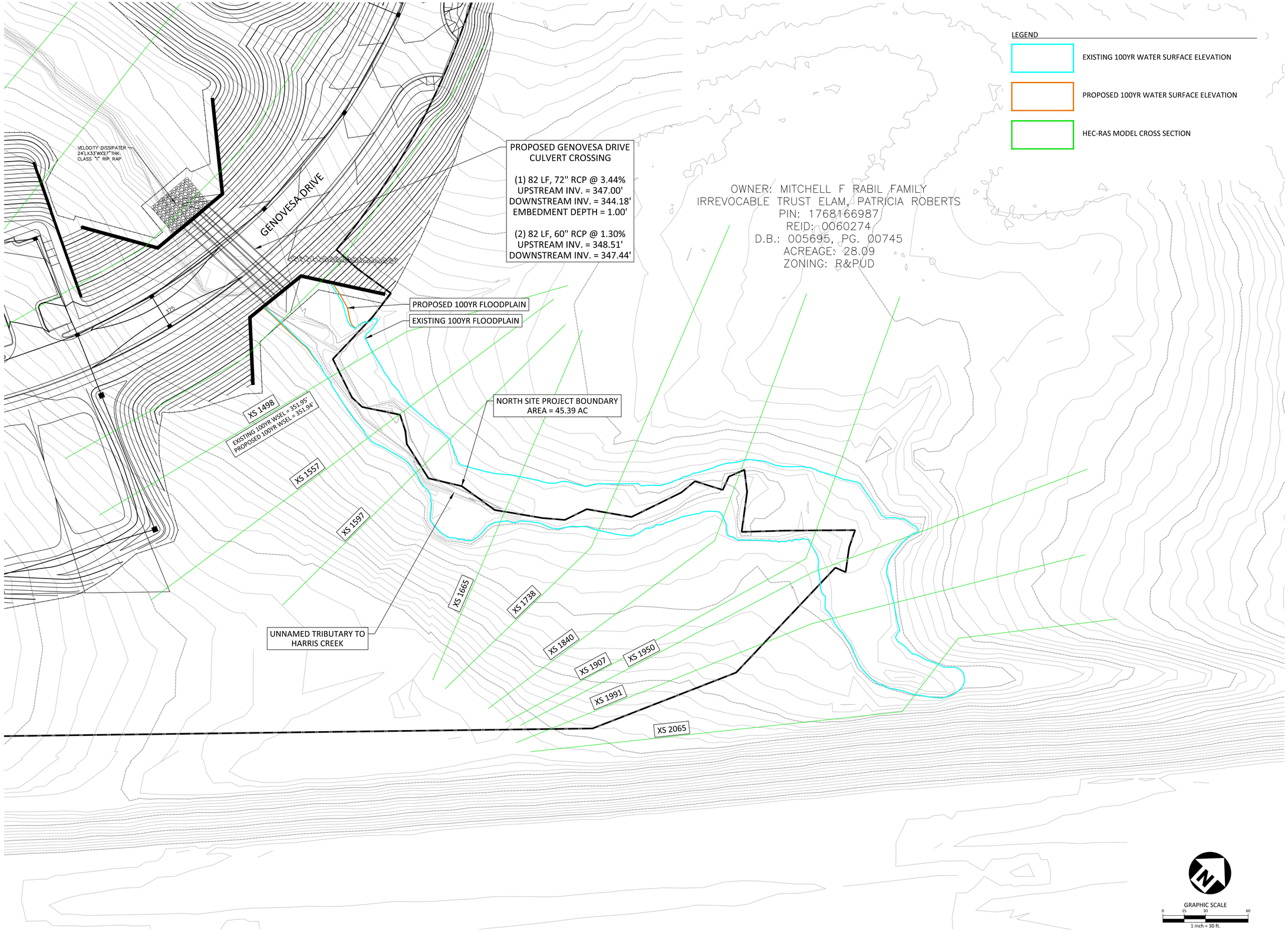
Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	915	25yr	224.21	341.94	345.69	345.69	346.28	0.015403	6.92	55.86	53.51	0.72
Main	915	100yr	284.48	341.94	345.94	345.94	346.57	0.015757	7.41	69.72	56.60	0.74
Main	845	10yr	184.92	341.17	344.60		344.77	0.004404	3.46	70.41	49.66	0.40
Main	845	25yr	224.21	341.17	344.83		345.02	0.004473	3.71	82.25	52.85	0.40
Main	845	100yr	284.48	341.17	345.13		345.35	0.004639	4.06	98.75	56.88	0.42
Main	791	10yr	184.92	340.82	343.63	343.63	344.27	0.022859	7.22	40.97	37.82	0.87
Main	791	25yr	224.21	340.82	343.84	343.84	344.51	0.022259	7.58	49.37	42.04	0.88
Main	791	100yr	284.48	340.82	344.13	344.13	344.84	0.021472	8.04	61.95	47.24	0.88
Main	729	10yr	184.92	339.33	342.34		342.71	0.009729	5.17	46.84	31.64	0.59
Main	729	25yr	224.21	339.33	342.58		343.00	0.009936	5.56	54.66	34.31	0.60
Main	729	100yr	284.48	339.33	342.89		343.38	0.010327	6.10	65.84	37.76	0.62
Main	668	10yr	184.92	338.56	341.08	341.08	341.79	0.024157	7.35	35.60	29.71	0.90
Main	668	25yr	224.21	338.56	341.30	341.30	342.07	0.023484	7.76	42.53	32.59	0.91
Main	668	100yr	284.48	338.56	341.61	341.61	342.44	0.022524	8.27	53.17	36.70	0.91
Main	584	10yr	184.92	336.44	338.69	338.69	339.23	0.023808	6.82	43.57	42.16	0.89
Main	584	25yr	224.21	336.44	338.84	338.84	339.45	0.024505	7.30	50.35	44.25	0.91
Main	584	100yr	284.48	336.44	339.07	339.07	339.75	0.024736	7.88	60.72	47.31	0.93
Main	496	10yr	184.92	335.98	337.56		337.61	0.004387	2.51	123.33	97.67	0.37
Main	496	25yr	224.21	335.98	337.76		337.81	0.004092	2.64	142.74	99.53	0.36
Main	496	100yr	284.48	335.98	338.05		338.11	0.003662	2.79	172.16	101.69	0.35
Main	437	10yr	184.92	335.14	336.90		337.16	0.013145	4.70	57.33	48.74	0.65
Main	437	25yr	224.21	335.14	337.14		337.40	0.011399	4.80	69.35	51.29	0.62
Main	437	100yr	284.48	335.14	337.47		337.75	0.009827	4.97	86.90	54.73	0.59
Main	387	10yr	184.92	334.00	336.40		336.67	0.007493	4.48	55.35	35.50	0.52
Main	387	25yr	224.21	334.00	336.63		336.93	0.007759	4.85	63.45	37.42	0.54
Main	387	100yr	284.48	334.00	336.93		337.29	0.008102	5.34	75.11	39.92	0.56
Main	341	10yr	184.92	333.94	335.39	335.39	336.02	0.032636	6.81	33.99	29.54	1.00
Main	341	25yr	224.21	333.94	335.57	335.57	336.27	0.031356	7.23	39.47	30.85	1.00
Main	341	100yr	284.48	333.94	335.83	335.83	336.62	0.029447	7.74	47.74	32.60	1.00
Main	298	10yr	184.92	331.74	333.55	333.40	334.11	0.022188	6.05	32.66	23.75	0.84
Main	298	25yr	224.21	331.74	333.76	333.60	334.39	0.021444	6.45	37.69	24.55	0.84
Main	298	100yr	284.48	331.74	334.05	333.87	334.78	0.020810	7.00	44.86	25.66	0.85
Main	245	10yr	184.92	329.93	331.92	331.92	332.74	0.028639	7.38	27.57	19.14	0.97
Main	245	25yr	224.21	329.93	332.16	332.16	333.07	0.027213	7.81	32.30	20.40	0.96
Main	245	100yr	284.48	329.93	332.50	332.50	333.53	0.025378	8.35	39.50	21.97	0.95
Main	186	10yr	184.92	325.94	328.49	328.49	329.44	0.029439	7.91	24.78	14.74	0.98
Main	186	25yr	224.21	325.94	328.77	328.77	329.83	0.027718	8.36	29.05	15.77	0.97
Main	186	100yr	284.48	325.94	329.16	329.16	330.36	0.025752	8.95	35.53	17.20	0.96
Main	131	10yr	184.92	320.96	323.24		323.72	0.013516	5.66	36.19	20.76	0.69
Main	131	25yr	224.21	320.96	323.44		324.02	0.014490	6.23	40.44	21.51	0.72
Main	131	100yr	284.48	320.96	323.71		324.43	0.015916	7.02	46.35	22.65	0.77
Main	87	10yr	184.92	320.32	322.72	322.32	323.07	0.014765	5.71	49.53	32.86	0.71
Main	87	25yr	224.21	320.32	322.93	322.50	323.33	0.014763	6.11	56.79	34.10	0.72
Main	87	100yr	284.48	320.32	323.23	322.75	323.69	0.014785	6.64	67.23	35.78	0.73

HEC-RAS Plan: PC - IT15 River: TribtoHarrisCrk Reach: Main

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	2065	10yr	184.92	357.10	359.27	359.27	360.03	0.028458	7.08	28.73	22.43	0.95
Main	2065	25yr	224.21	357.10	359.50	359.50	360.33	0.026683	7.46	34.13	24.40	0.94
Main	2065	100yr	284.48	357.10	359.81	359.81	360.74	0.024901	7.97	42.24	26.96	0.93
Main	1991	10yr	184.92	356.41	358.35		358.57	0.010014	3.80	50.78	41.10	0.56
Main	1991	25yr	224.21	356.41	358.53		358.78	0.009810	4.07	58.37	42.54	0.56
Main	1991	100yr	284.48	356.41	358.79		359.08	0.009527	4.42	69.50	44.45	0.57
Main	1950	10yr	184.92	356.06	357.99		358.18	0.008776	3.67	59.56	54.78	0.53
Main	1950	25yr	224.21	356.06	358.21		358.41	0.007857	3.81	72.87	62.83	0.51
Main	1950	100yr	284.48	356.06	358.52		358.73	0.006796	3.95	93.39	69.66	0.49
Main	1907	10yr	184.92	355.28	357.60		357.83	0.007280	3.94	55.67	41.32	0.50
Main	1907	25yr	224.21	355.28	357.83		358.08	0.007188	4.21	65.32	45.20	0.50
Main	1907	100yr	284.48	355.28	358.12		358.42	0.007159	4.58	79.65	51.26	0.51
Main	1840	10yr	184.92	354.16	356.42	356.33	357.01	0.022798	6.30	34.50	32.62	0.85
Main	1840	25yr	224.21	354.16	356.61	356.57	357.27	0.022512	6.72	41.08	36.62	0.86
Main	1840	100yr	284.48	354.16	356.89	356.86	357.61	0.021520	7.19	51.98	43.09	0.86
Main	1738	10yr	184.92	352.08	354.75		355.17	0.013792	5.30	40.00	30.37	0.68
Main	1738	25yr	224.21	352.08	354.96		355.43	0.013766	5.69	46.72	32.62	0.69
Main	1738	100yr	284.48	352.08	355.23		355.79	0.014279	6.27	55.81	35.44	0.71
Main	1665	10yr	184.92	350.56	353.61		354.05	0.017175	5.33	36.56	28.34	0.73
Main	1665	25yr	224.21	350.56	353.79	353.51	354.30	0.017720	5.79	41.83	30.77	0.75
Main	1665	100yr	284.48	350.56	354.09	353.80	354.67	0.016665	6.21	51.68	34.66	0.75
Main	1597	10yr	184.92	348.88	352.03	352.03	352.76	0.019820	7.17	34.39	30.81	0.81
Main	1597	25yr	224.21	348.88	352.30	352.30	353.05	0.018480	7.42	42.93	32.65	0.80
Main	1597	100yr	284.48	348.88	352.57	352.57	353.42	0.019361	8.10	51.95	33.63	0.83
Main	1557	10yr	184.92	348.03	352.01		352.08	0.001043	2.17	90.99	32.58	0.20
Main	1557	25yr	224.21	348.03	352.32		352.41	0.001145	2.40	101.27	34.38	0.22
Main	1557	100yr	284.48	348.03	352.75		352.86	0.001269	2.72	116.58	37.06	0.23
Main	1498	10yr	184.92	346.85	351.45		351.92	0.007345	5.75	45.70	29.59	0.51
Main	1498	25yr	224.21	346.85	351.65	350.61	352.21	0.008691	6.46	51.63	32.05	0.56
Main	1498	100yr	284.48	346.85	351.94	350.89	352.64	0.010162	7.31	61.56	36.00	0.62
Main	1440	10yr	184.92	347.00	350.73	350.73	351.22	0.044671	6.47	35.06	36.73	0.68
Main	1440	25yr	224.21	347.00	350.89	350.89	351.42	0.045522	6.78	41.03	38.13	0.70
Main	1440	100yr	284.48	347.00	351.35	351.08	351.75	0.028638	5.92	59.04	40.09	0.57
Main	1382		Culvert	Proposed Genovesa Drive								
Main	1332	10yr	184.92	344.11	349.52	347.12	349.71	0.002315	3.54	66.88	43.73	0.29
Main	1332	25yr	224.21	344.11	349.88	347.40	350.08	0.002456	3.83	78.30	46.67	0.31
Main	1332	100yr	284.48	344.11	350.30	347.84	350.55	0.002735	4.28	92.12	53.80	0.33
Main	1239	10yr	184.92	344.15	348.75		349.23	0.008932	5.85	42.90	30.13	0.55
Main	1239	25yr	224.21	344.15	349.04	348.17	349.58	0.009261	6.29	52.83	37.66	0.57
Main	1239	100yr	284.48	344.15	349.43	348.83	350.02	0.009385	6.75	69.34	46.89	0.58
Main	1178	10yr	184.92	343.69	347.85	347.52	348.54	0.014464	6.91	36.24	28.70	0.67
Main	1178	25yr	224.21	343.69	348.15	347.94	348.87	0.014417	7.31	45.29	33.35	0.68
Main	1178	100yr	284.48	343.69	348.50	348.37	349.29	0.014755	7.87	58.08	39.05	0.70
Main	1115	10yr	184.92	343.24	347.39		347.78	0.008041	5.10	42.24	30.25	0.52
Main	1115	25yr	224.21	343.24	347.65		348.10	0.008556	5.56	51.56	41.58	0.54
Main	1115	100yr	284.48	343.24	347.99	347.07	348.50	0.008835	6.04	67.02	48.06	0.56
Main	1041	10yr	184.92	342.89	346.80		347.16	0.008691	5.39	54.83	37.96	0.55
Main	1041	25yr	224.21	342.89	347.06		347.44	0.008803	5.73	64.93	41.40	0.56
Main	1041	100yr	284.48	342.89	347.39		347.81	0.008982	6.18	79.61	45.90	0.57
Main	983	10yr	184.92	342.42	346.42		346.71	0.006130	4.60	54.88	37.45	0.47
Main	983	25yr	224.21	342.42	346.63		346.98	0.006773	5.06	63.23	41.25	0.50
Main	983	100yr	284.48	342.42	346.90	346.14	347.33	0.007759	5.71	74.94	46.55	0.54

HEC-RAS Plan: PC - IT15 River: TribtoHarrisCrk Reach: Main (Continued)

Reach	River Sta	Profile	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
			(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Main	915	10yr	184.92	341.94	345.50	345.50	346.06	0.015018	6.53	46.02	50.81	0.71
Main	915	25yr	224.21	341.94	345.69	345.69	346.28	0.015403	6.92	55.86	53.51	0.72
Main	915	100yr	284.48	341.94	345.94	345.94	346.57	0.015757	7.41	69.72	56.60	0.74
Main	845	10yr	184.92	341.17	344.60		344.77	0.004404	3.46	70.41	49.66	0.40
Main	845	25yr	224.21	341.17	344.83		345.02	0.004473	3.71	82.25	52.85	0.40
Main	845	100yr	284.48	341.17	345.13		345.35	0.004639	4.06	98.75	56.88	0.42
Main	791	10yr	184.92	340.82	343.63	343.63	344.27	0.022859	7.22	40.97	37.82	0.87
Main	791	25yr	224.21	340.82	343.84	343.84	344.51	0.022259	7.58	49.37	42.04	0.88
Main	791	100yr	284.48	340.82	344.13	344.13	344.84	0.021472	8.04	61.95	47.24	0.88
Main	729	10yr	184.92	339.33	342.34		342.72	0.009729	5.17	46.84	31.64	0.59
Main	729	25yr	224.21	339.33	342.58		343.00	0.009936	5.56	54.66	34.31	0.60
Main	729	100yr	284.48	339.33	342.89		343.38	0.010327	6.10	65.84	37.76	0.62
Main	668	10yr	184.92	338.56	341.08	341.08	341.79	0.024157	7.35	35.60	29.71	0.90
Main	668	25yr	224.21	338.56	341.30	341.30	342.07	0.023484	7.76	42.53	32.59	0.91
Main	668	100yr	284.48	338.56	341.61	341.61	342.44	0.022524	8.27	53.17	36.70	0.91
Main	584	10yr	184.92	336.44	338.69	338.69	339.23	0.023812	6.82	43.56	42.15	0.89
Main	584	25yr	224.21	336.44	338.85	338.85	339.45	0.024484	7.30	50.36	44.25	0.91
Main	584	100yr	284.48	336.44	339.07	339.07	339.75	0.024760	7.89	60.69	47.30	0.93
Main	496	10yr	184.92	335.98	337.56		337.61	0.004387	2.51	123.32	97.67	0.37
Main	496	25yr	224.21	335.98	337.76		337.81	0.004092	2.64	142.74	99.53	0.36
Main	496	100yr	284.48	335.98	338.05		338.11	0.003662	2.79	172.16	101.69	0.35
Main	437	10yr	184.92	335.14	336.90		337.16	0.013145	4.70	57.33	48.74	0.65
Main	437	25yr	224.21	335.14	337.14		337.40	0.011399	4.80	69.35	51.29	0.62
Main	437	100yr	284.48	335.14	337.47		337.75	0.009827	4.97	86.90	54.73	0.59
Main	387	10yr	184.92	334.00	336.40		336.67	0.007493	4.48	55.35	35.50	0.52
Main	387	25yr	224.21	334.00	336.63		336.93	0.007759	4.85	63.45	37.42	0.54
Main	387	100yr	284.48	334.00	336.93		337.29	0.008102	5.34	75.11	39.92	0.56
Main	341	10yr	184.92	333.94	335.39	335.39	336.02	0.032636	6.81	33.99	29.54	1.00
Main	341	25yr	224.21	333.94	335.57	335.57	336.27	0.031356	7.23	39.47	30.85	1.00
Main	341	100yr	284.48	333.94	335.83	335.83	336.62	0.029447	7.74	47.74	32.60	1.00
Main	298	10yr	184.92	331.74	333.55	333.40	334.11	0.022188	6.05	32.66	23.75	0.84
Main	298	25yr	224.21	331.74	333.76	333.60	334.39	0.021444	6.45	37.69	24.55	0.84
Main	298	100yr	284.48	331.74	334.05	333.87	334.78	0.020810	7.00	44.86	25.66	0.85
Main	245	10yr	184.92	329.93	331.92	331.92	332.74	0.028639	7.38	27.57	19.14	0.97
Main	245	25yr	224.21	329.93	332.16	332.16	333.07	0.027213	7.81	32.30	20.40	0.96
Main	245	100yr	284.48	329.93	332.50	332.50	333.53	0.025378	8.35	39.50	21.97	0.95
Main	186	10yr	184.92	325.94	328.49	328.49	329.44	0.029439	7.91	24.78	14.74	0.98
Main	186	25yr	224.21	325.94	328.77	328.77	329.83	0.027718	8.36	29.05	15.77	0.97
Main	186	100yr	284.48	325.94	329.16	329.16	330.36	0.025752	8.95	35.53	17.20	0.96
Main	131	10yr	184.92	320.96	323.24		323.72	0.013516	5.66	36.19	20.76	0.69
Main	131	25yr	224.21	320.96	323.44		324.02	0.014490	6.23	40.44	21.51	0.72
Main	131	100yr	284.48	320.96	323.71		324.43	0.015915	7.02	46.35	22.65	0.77
Main	87	10yr	184.92	320.32	322.72	322.32	323.07	0.014765	5.71	49.53	32.86	0.71
Main	87	25yr	224.21	320.32	322.93	322.50	323.33	0.014763	6.11	56.79	34.10	0.72
Main	87	100yr	284.48	320.32	323.23	322.75	323.69	0.014785	6.64	67.23	35.78	0.73



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THE POINT
PHASES 11-13
CONSTRUCTION DRAWINGS
EAST YOUNG STREET
TOWN OF ROLESVILLE, WAKE FOREST TOWNSHIP,
WAKE COUNTY, NORTH CAROLINA

CD 22-05

REVISIONS

NO.	DATE	
1	12. 12. 2022	REV PER TOWN AND CITY COMMENTS
2	01. 11. 2023	REV PER WAKE COUNTY COMMENTS
3	04. 21. 2023	REV PER WAKE COUNTY COMMENTS

PLAN INFORMATION

PROJECT NO.	AWH-20000
FILENAME	AWH-20000 CULVERT
CHECKED BY	KEG
DRAWN BY	SDD
SCALE	1" = 30'
DATE	04.20.2023

SHEET

POST DEVELOPMENT
FLOODPLAIN MAP

POST-GENOVESA

FINAL DRAWING - NOT RELEASED FOR CONSTRUCTION

M:\Projects\AWH\AWH-20000\04-Production\Water Resources\North Site\Culvert Sizing\Current Drawings\AWH20000x - CULVERT.dwg, 4/24/2023 1:46:04 PM, Samantha Daniell