PREPARED BY:

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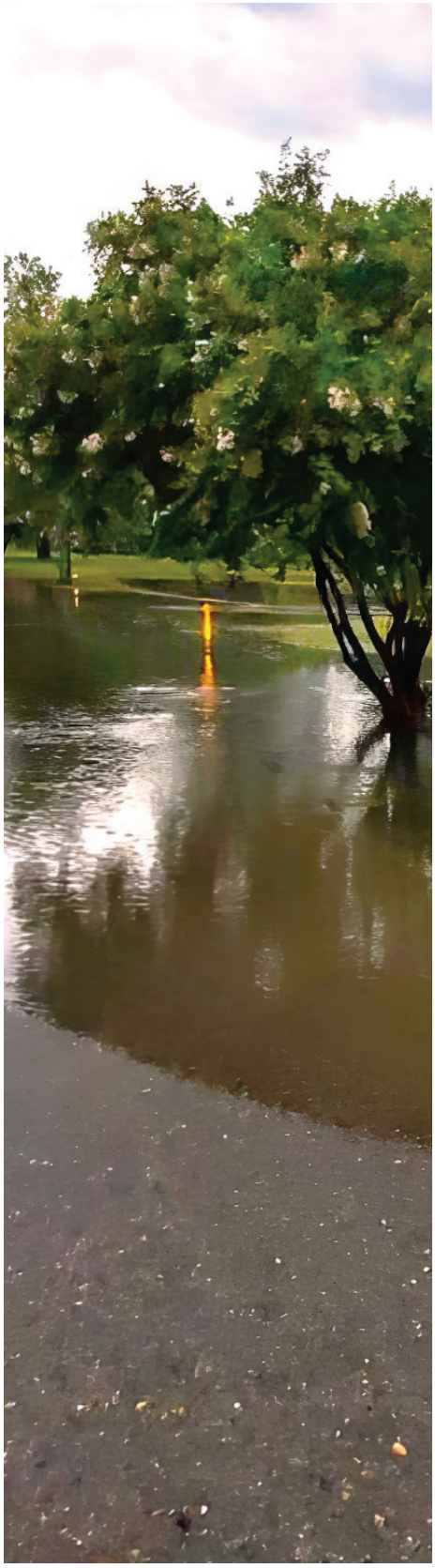

SMITHFIELD
NORTH CAROLINA

REPORT

SMITHFIELD, NC

NOVEMBER 2024

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

SPRING BRANCH RESILIENCY REPORT

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INTRODUCTION

The purpose of the Spring Branch Watershed Resiliency/Planning Study is to create a clear, concise, comprehensive plan that will outline a multi-disciplinary approach to increase the Town's resiliency and pedestrian connectivity within the Spring Branch watershed. This plan will be used as a blueprint for the Town to follow that will not only address flooding, decrease nutrient and sediment loads, and re-establish natural hydrologic connections, but also identify projects that will create a corridor for residents to learn about conservation and the environment, increase economic activity downtown with a direct link to Johnston County Community College, and allow residents and students to experience nature in a way not previously possible within the watershed. This study took a holistic approach that protects infrastructure, enhances ecosystem health, and promotes a healthy and safe community.

To ensure the Spring Branch Corridor Plan aligned with the overarching Town and County Goals, a number of plans and documents were reviewed and incorporated into this resiliency document:

- Johnston County Comprehensive Plan (2009)
- Smithfield Town Plan (2020)
- Town of Smithfield Pedestrian Plan (2022)
- Johnston Couty Natural Resource Initiative: Green Infrastructure Assessment Report (2012)
- Neuse River Trail Feasibility Study (2022)
- Johnston County Parks and Recreation Master Plan (2021)
- Johnston County Resilient Redevelopment Plan (2017)
- Mountains-to-Sea Trail Master Plan (2006)
- Johnston County Land Use Planning Guidance (2016)

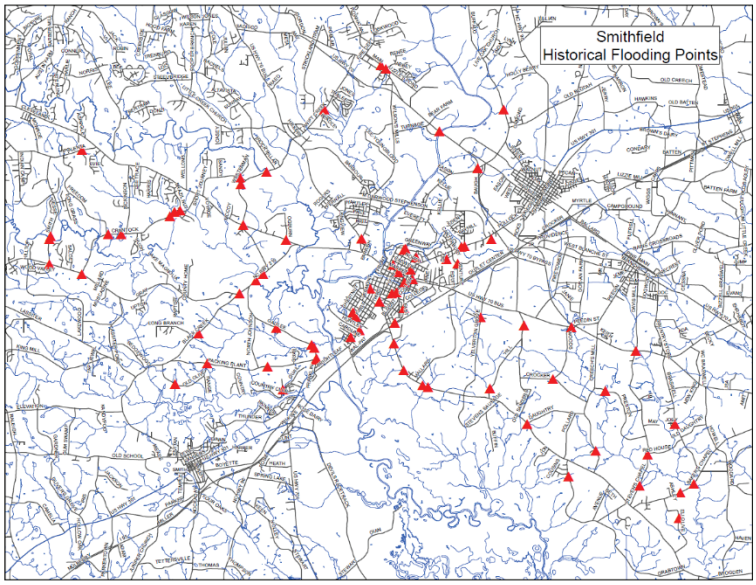
Using the existing studies and reports, supplemented with field data (stream geomorphic measurements, stormwater asset inventories, traffic counts) and stakeholder input, a list of cohesive projects were identified to address the towns flooding and increase connectivity within the Spring Branch watershed. The identified projects are also in compliance with the Neuse Stormwater Rule.

Projects identified focused on:

- Decreasing flooding/flood attenuation along Spring Branch
- Improving water quality
- Stream, floodplain, and wetland restoration/creation
- Incorporating greenways into site plans for greater connectivity and recreational opportunities
- Creating an active and resilient transportation corridor
- Providing education opportunities for local schools and colleges
- Increasing overall quality of life for Town residents

Project cut sheets (project summaries) have been created for each project which include conceptual designs and/or project locations and cost estimates. Also included is a list of potential funding sources and a tentative timeline for implementation of the stormwater and pedestrian projects. Cut sheets are included in ***Appendix C***.

BACKGROUND



Source: Johnston County Emergency Services

Smithfield, North Carolina is located within Johnston County and lies within the Neuse River basin. Around 19% of the land within the Smithfield Municipal limits is in the floodplain or floodway (Smithfield Town Plan 2020) and flooding is a persistent hazard. The town experienced severe flooding during Hurricane Matthew in 2016 which resulted in 26 claims in the Town under the National Flood Insurance Program and eight funded buyouts (Smithfield Town Plan 2020). Smithfield also regularly experiences nuisance flooding during smaller storm events, impacting residents, local businesses and infrastructure. Figure 1. depicts the locations of reported roadway flooding since 2016 from Johnston County Emergency Services.

In 2019, Smithfield adopted their Stormwater Management Program Action Plan to begin to address the wide variety of stormwater-related impacts, challenges, issues, and regulatory requirements. Using public surveys, the Stormwater Management Program Action Plan gathered information from Town staff, elected officials, and interested citizens to form baseline conditions and perceptions within the town on stormwater management. Citizens of Smithfield felt that the Town had numerous drainage problems. Problem, such as roads overtopping and standing water on streets and private property, and there is a general belief that stormwater problems have gotten worse, causing stream banks to erode, widen, and deepen. Smithfield has since been designated a National Pollutant Discharge Elimination System (NPDES) Phase II Stormwater community, and is required by law to comply with the State of North Carolina's Neuse River Basin- Nutrient Sensitive Water Management Strategy (NSWMS), which was recently updated. The stormwater portion

of the NSWMS is referred to as the Neuse Stormwater Rule (NSR). Both the NPDES Program and the NSWMS-NSR place increasing responsibility on the town to further develop their Stormwater Management Program and address drainage and runoff issues.

Several reports have been developed to address the flooding issues in Smithfield. Following Hurricane Matthew, Woolpert published an evaluation study with potential capital improvement projects to alleviate flooding using previous drainage studies and current conditions. Fifteen projects were identified throughout the three main streams that collect runoff in the town: Spring Branch, Meadowbrook, and Buffalo Creek. Most recently a hydrologic and hydraulic modeling and analysis study was completed by NC State and NC SeaGrant for the Neuse River Basin to better understand the flooding issues, identify potential mitigation measures and flood plain ordinance improvements, and improve early warning systems for transportation-related infrastructure (Doll et al. 2020). In Smithfield, potential mitigation measures focused on Spring Branch and Buffalo Creek which are both prone to flash flooding. This study focused on the Spring Branch Watershed.

2.1 SPRING BRANCH WATERSHED

The Spring Branch has been frequently noted by stakeholders and identified in drainage studies as an area of concern for flooding. The Spring Branch watershed is 1.53 sq. miles and includes nearly all of Market Street in the downtown area of Smithfield, and the watershed extends north to North Street, south to Brogden Road, and is bordered to the southeast by Interstate 95. The tributary originates upstream from a stormwater pond and flows northwest through the Town, discharging into the Neuse River. Within the watershed are a number of important community features such as the Downtown Smithfield Historic District, Johnston County Community College, a segment of the Neuse Riverwalk, and numerous parks such as Town Commons, Bob Wallace Jaycee Kiddie Park, 5th Street Community Garden, Smith-Collins Park, and Eva Ennis Park Splash Pad and Walking Trail.

The Spring Branch tributary has been altered substantially from its natural state. The upper section of the Branch is piped underground while the lower reach of the stream has been straightened and armored with concrete. Stakeholders report severe flooding along the stream and flooding within the Spring Branch corridor begins at the 10-year storm in some locations, likely due to a lack of adequate stormwater infrastructure (Doll et al. 2020). According to the North Carolina Climate Science Report (2020), precipitation and storm intensity is likely to increase, exacerbating the town's current drainage issues. While potential drainage and infrastructure improvement projects within the Spring Branch watershed have been mentioned across a number of reports, the corridor itself does not have its own plan for increasing resiliency for the future. To build resilience, it is imperative to develop a cohesive set of projects that expand off of one another to not only mitigate flooding, but improve water quality and protect vital infrastructure, especially in urban stream corridors such as Spring Branch.

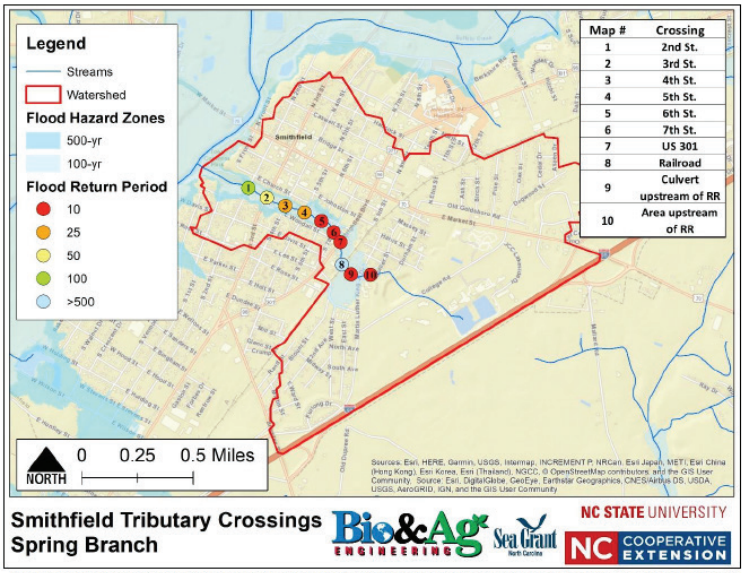


Figure 6-1. Crossing of Spring Branch tributary in Smithfield. The flood return period refers to the lowest return period the HEC-RAS models predicted road overtopping.

STAKEHOLDER COORDINATION AND PUBLIC OUTREACH

To ensure the projects in this study are successful, it is vital to have stakeholders involved in the planning and implementation process. An effective outreach program needs to take into consideration approaches to ensure broad participation, especially among under-served and potentially vulnerable communities and residents. It is important to include those from traditionally disadvantaged populations, to participate in the project process. Taking this into consideration, McCormick Taylor reached out community leaders to create and be apart of a Technical Advisory Committee (TAC).

3.1 TECHNICAL ADVISORY COMMITTEE (TAC)

The Technical Advisory Committee (TAC) was created to help identify stakeholders within the Spring Branch Watershed, to help inform and disseminate information, and to guide the project based on individual feedback. The TAC members consisted of Stephen Wensman (Town of Smithfield Planning), Bill Dreitzler (Town of Smithfield), Lawrence Davis (Town of Smithfield), Donna Taylor (Johnston County), Sandy Wood (Johnston County), James Salmon (NCDOT Division 4/UCPRPO), and Jennifer Collins (NCDOT Div 4). The first TAC meeting was held on August 4th, 2023 to discuss the project scope and approach, gain insight from the TAC regarding the need for, and desired outcomes of the study, and discuss existing documentation TAC members recommend be reviewed to guide the planning process. During this initial meeting, the project team asked for suggestions for other groups to be included within the TAC.

The second TAC meeting occurred after the baseline analysis was complete and reviewed and discussed the individual projects identified and the phasing for the projects. Public meeting materials were also reviewed by the TAC.

The third and final TAC correspondence served as a final review of all public comments heard to date, as well as a review of the completed Draft Final Report. This final feedback was utilized to revise the Final Report.

3.2 PUBLIC OUTREACH

Stakeholders were encouraged to be involved throughout the entire process of this plan. Initial public outreach began with landowners within the Spring Branch watershed prior to field work gathering existing conditions data. The project team drafted a letter to inform residents about the public meeting for the project, and the Town handed these out directly to residents within the project watershed. Advertising of public meetings was posted to the Town's Facebook page and flyers were also posted in strategic areas around the Town.

These reach outs included an outline of project timeline along with links that showed project updates and the public meeting date and time to make the project as transparent as possible and allow residents time to plan so they could attend this meeting to be able to review the project progress, review identified projects within the watershed and voice concerns/opinions of the plan.

A public meeting occurred on April 30th, 2024 at the Smithfield Town Hall Council Chambers, located at 350 East Market Street. This meeting was attended by three residents of the Town. In this meeting, McCormick Taylor presented the identified project within the Spring Branch watershed, gave cost estimates and a projected timeline for implementation. Project prioritization was also presented to the community with large poster boards showing details throughout the corridor. These boards contain the information included on the project cut sheets in Appendix C.

A 30-day comment period after this meeting was given to the community to ensure an appropriate amount of time for comments and suggestions. Only one comment was received from the community. This comment read:

"I would like to say that it is always good to keep the public informed. And a shame that people don't show up to hear what is happening in their neighborhood. Great presentation and answered questions very well. Let's take on the river!!"

H&H METHODS

4.1 EXISTING CONDITIONS

FIELD OBSERVATIONS

McCormick Taylor conducted a site visit on September 22nd, 2023 to verify existing crossing data used in the Spring Branch HEC-RAS model (from the FRIS website), as well as collect additional field data to serve as an existing conditions baseline. Upon evaluation, each crossing size, type, and condition in the FRIS HEC-RAS model was confirmed. It was field verified that the College Pond does not have a riser structure. The pond has a 24" outlet pipe, and three inflows: a 4' x 5' box structure on the east side of the pond, and two 48" culverts crossing College Road south of the pond. It was field verified the I-95 Pond outflows to College Pond, with a 30" outlet pipe and level spreader for overflow.

HYDROLOGY

McCormick Taylor delineated a drainage subarea (SA) to seven points of investigation (POIs) within the larger watershed. These SAs were selected to demonstrate the effectiveness of localized improvements on the overall watershed. From downstream to upstream: POI 1 is located at the outlet of Spring Branch into the Neuse River. POI 2 is located at the downstream end of the existing 5.42' x 4' culvert crossing on 5th Street. POI 3 is located upstream of the railroad crossing, north of the existing baseball field in Smith-Collins Park. POI 4 is located at the intersection of West Street and E Lee St, south of the same baseball field previously mentioned. POI 5 is located downstream of the existing College Pond, located on Johnston Community College campus north of College Road. POI 6 is located downstream of the existing I-95 Pond, south of Jaguar Drive and north of Interstate 95. POI 7 is located east of Harris Street, where the open channel portion of the Spring Branch tributary transitions to being piped underground.

Land use and soil type was analyzed to determine a weighted curve number representative of each drainage SA, as shown in ***Table 1***.

Table 1: Existing Conditions Land Use and Soil Type

Drainage Subarea	Area (Ac)	Weighted Curve Number	Dominant Land Use	Dominant Hydrologic Soil Group
SA 1	98.73	74	Residential, Urban	A
SA 2	114.78	82	Residential, Urban	A
SA 3	81.41	86	Residential, Urban	A, D
SA 4	81.39	89	Residential, Urban	A, D
SA 5	53.09	92	Residential, Urban	D
SA 6	95.43	95	Urban	D
SA 7	183.51	89	Residential, Urban	D

Using data from the desktop analysis and field reconnaissance, a WinTR-20 hydrologic model was developed to determine the peak discharges in existing conditions for the 2-, 10-, 25-, 50-, and 100-year storm events. NOAA Atlas 14-point precipitation frequency estimates were utilized in the WinTR-20 model. SA 2 is routed through SA 1, the most downstream SA. SA 3 is routed through SA 2 and SA 1. SA 4 is routed through SA 3, SA 2, and SA 1. SA 5 is routed through the College Pond, SA 3, SA 2, and SA 1. SA 6 is routed through the I-95 pond, SA 5, the College Pond, SA 3, SA 2, and SA 1. SA 7 is routed through the College Pond, SA 3, SA 2, and SA 1. Representative cross section data from field observations and contours from Johnston County GIS database were imported into the WinTR-20 model for each reach.

Existing conditions peak discharges, shown in ***Table 2***, were imported into the existing HEC-RAS model. The WinTR-20 computations are included in ***Appendix A***.

Table 2: Peak Discharges from the Existing Conditions WinTR-20 Model

POI	HEC-RAS Cross Section - Flow Change	Peak Discharge (cfs)				
		2-Year	10-Year	25-Year	50-Year	100-Year
OUTLET	2729	345.6	602.5	761.1	896.7	1033.7
REACH 1 DS	4524	312	536.1	664.8	772.1	901.5
REACH 2	4632	228.7	369.8	447.3	633.4	824.4
REACH 3.5 DS	5729	121.8	224	387.7	544	691.9

HYDRAULICS

Hydraulic analyses were performed using the US Army Corps. of Engineers HEC-RAS computer modeling program version 6.4.1. The original FEMA hydraulic model was obtained from the North Carolina Flood Risk-Information System (FRIS). This hydraulic model was run and checked against the published Flood Insurance Study (FIS) and was determined to accurately reflect the published water surface elevations (WSE). From this, a corrected effective model was created. This included updated structure information based on field verified structure measurements obtained by McCormick Taylor on September 22nd, 2023. Manning "n" values remained the same between models, as well as blocked obstructions, streambank stations, ineffective flow areas, and contraction/expansion coefficients. The hydraulic model is run in subcritical, steady flow conditions and contains four flow change locations referenced in Table 1 above. Flow change locations were updated from the original FRIS HEC-RAS model to best represent a relative comparison to proposed conditions.

Existing conditions were run with no backwater and backwater from the Neuse River to determine how far upstream backwater would affect the hydraulic modeling. Based on the published WSE's from the FIS, backwater from the Neuse River affects WSE's all the way upstream to the 4th St. structure. Once the existing conditions model was deemed acceptable, proposed alternatives were created.

4.2 PROPOSED PROJECTS

The approach taken during project identification and prioritization included increasing conveyance capacity and water storage without increasing flooding effects downstream or upstream of the projects.

Nine (9) proposed projects were identified using previous studies and our analysis to address flooding concerns observed in the baseline existing conditions analysis. These projects include a combination of conveyance improvements, flood storage improvements, and stream restorations. The conveyance projects provide more efficient movement of runoff through the constrained, currently undersized roadway crossings. Conveyance improvements were closely analyzed as discussed in the prioritization section to determine the potential impact of improved conveyance on the downstream floodplain. Flood storage projects provide temporary detention of flood flows to reduce peak discharges that are released downstream. The conceptual details of the proposed projects are described below, listed based on project location from downstream to upstream.

2nd Street Culvert Replacement

This proposed project would replace the existing 5'diameter CMP culvert (which transitions to an arch culvert somewhere beneath the roadway), with a 10'x 8'concrete box culvert to improve the conveyance capacity. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream.

The 10'x 8'culvert sizing was conceptually selected as it provides freeboard for a 100-yr storm through the crossing while maintaining a relatively small footprint; alternative crossing sizes and a small bridge were evaluated, to arrive at the 10'x 8'sizing. Further design should consider utility crossings, private property impacts, and connections to the stream.

2nd to 3rd Street Stream Restoration

This stream restoration between 2nd and 3rd street would realign the existing stream channel to provide more a sinuous, natural flow path, and maintain stream and floodplain grading to allow floodplain access during larger storm events. Restoration of this existing concrete lined channel would provide significant ecological enhancement and aesthetic benefits, as well as some minor storage within the expanded floodplain for small storm events. The restoration approach would be similar to that employed at the Spring Branch Community Restoration Project funded by the North Carolina Attorney General's Environmental Enhancement Grant (EEG) and the North Carolina Land and Water Fund (NCLWF) constructed in 2023.

4th Street Culvert Replacement

This proposed project would replace the existing 6' x 4.3' culvert with a 10' x 5' concrete box culvert to improve the conveyance capacity. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. Along the upstream and downstream banks, 50' retaining walls will also be placed. Further design should consider utility crossings, private property impacts, and connections to the stream.

5th Street Culvert Replacement

This proposed project would replace the existing 6'x 5' culvert with a 10'x 5' concrete box culvert to improve conveyance capacity. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. Further design should consider utility crossings, private property impacts, and connections to the stream.

301 Bypass Culvert

This proposed project would place a 48" RCP adjacent to the existing 48" RCP underneath US 301. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. This bypass culvert would be set at the same invert elevation as the existing culvert and be routed around the existing ABC Store along US 301 to best avoid utility conflicts. The resulting bypass culvert is proposed to be 455' in length with two manholes for maintenance access. This project will help reduce the likelihood of US 301 overtopping. Further design should consider utility conflicts, private property impacts, and potential flooding impacts on the downstream crossings.

College Pond Retrofit

Retrofit of the existing College Pond on Johnston Community College campus includes installation of a riser control structure enabled with continued monitoring and adaptive controls (CMAC). This fully automated control structure leverages weather forecasts to predictively drain the pond in advance of inclement weather via solar or line power. Additional retrofits include replacement of the existing 24" outlet pipe, and regrading of the existing emergency spillway. This combination of retrofit efforts will maximize stormwater storage and flood relief, particularly for the more frequent nuisance flooding produced by the 1- and 2-year storms. Additional costs beyond project construction include maintenance and software subscription services. Further design should consider funding options.

I-95 Pond Retrofit

Retrofit of the existing I-95 Pond south of Jaguar Drive includes retrofit of the existing riser control structure to enable continued monitoring and adaptive controls (CMAC). This fully automated control structure leverages weather forecasts to predictively drain the pond in advance of inclement weather via solar or line power. The CMAC technology will maximize stormwater storage and flood relief, particularly for the more frequent nuisance flooding produced by the 1- and 2-year storms. Additional costs beyond project construction include maintenance and software subscription services. Further design should consider funding options.

Underground Storage Facility – UG-1

This proposed project includes construction of an underground stormwater detention facility northeast of the existing College Pond on Johnston Community College's campus. This facility will divert flows from the existing open drainage channel into an underground vault, where flow can be slowly released to mitigate peak discharges into the downstream College Pond. High flows will be diverted to a proposed overflow bypass swale and outfall to College Pond. This proposed underground stormwater detention facility has a footprint of 95,958 ft2 and will store 915,489 ft3 of stormwater. Preliminary hydrologic modelling of the facility provides reductions in peak discharges downstream of the facility for the 2- 10-, 25-, and 100-year storm. The storage vault will be completely underground and traffic bearing, minimizing restrictions on future use of the footprint. The design also took into account future State Employees Credit Union (SECU) plans for a connector road between College Road and US 70 Business. Further design should consider access from Johnston Community College, and funding availability as this project is estimated to be the costliest.

Above Ground Flood Attenuation Facility

This proposed project is an alternative to be constructed instead of UG-1, located northeast of the existing College Pond on Johnston Community College's campus. This above ground facility will provide attenuation of high flows from the open drainage channel from US-70 and the Arboretum. High flows in the existing drainage channel will overtop the channel and access a floodplain storage area with a footprint of 76,000 sf and a total storage volume of 532,000 cf. Further design of permanent pools within the floodplain area will provide additional water quality treatment as well. Regulated flows out of the facility will be directed to the College Pond, providing additional capacity in the existing storm drain system along Harris St to the west. Preliminary hydrologic modelling of the facility provides reductions in peak discharges downstream of the facility for the 2- 10-, 25-, and 100-year storm.

OTHER PROJECTS INVESTIGATED, BUT NOT RECOMMENDED FOR IMPLEMENTATION

Underground Storage Facility – UG-2

This proposed project includes construction of an underground stormwater detention facility east of Lee Street in Smith-Collins Park. This facility would divert flows from the existing storm drain system into an underground vault, where flow can be slowly released back into the existing storm drain system. This proposed underground stormwater detention facility has a footprint of 85,880 ft2. Multiple iterations of this facility were investigated: a 2.5 ft deep facility with a storage of 181,043 ft3, and a 11.33 ft deep facility with a storage of 862,260 ft3. Preliminary cost estimation of this proposed facility is more than $6,000,000. Preliminary hydrologic modelling shows negligible benefits to peak flow reduction and floodplain reduction downstream of the proposed facility, and it is therefore not recommended for implementation. .

PROJECT PRIORITIZATION AND SUGGESTED PLANNING

Projects are prioritized based on a number of criteria including conveyance capacity, floodplain reduction, peak flow reduction, cost, construction impacts, private property impacts, and ecological enhancement as shown in Appendix F.

Projects were broken into 3 phases based on hydraulic prioritization, i.e., upsizing culvert infrastructure downstream first will provide the most hydraulic benefits upstream. From there, proposed project phasing should work from downstream to upstream. As shown in the floodplain maps in Appendix E, the greatest reduction in the 2-year floodplain results from Phase 1's projects: the culvert replacements at 2nd Street and 4th Street. The culvert replacements offer a significant increase in conveyance capacity as well. As shown in Appendix F, the 2nd Street culvert replacement provides 69% additional conveyance capacity, and the 4th Street culvert replacement provides 328% additional conveyance capacity.

From there, Phase 2's projects move further upstream and focus on peak flow reduction. While the pond retrofits and flood attenuation facilities (both above ground and underground) provide minimal floodplain reductions, they provide significant reductions in peak discharges downstream, specifically the more frequent nuisance flooding of the 2- and 10-year storm events.

Lastly, Phase 3's projects upgrade existing infrastructure to increase conveyance capacity. However, they offer minimal floodplain reduction. The proposed stream restoration between 2nd and 3rd Street offers ecological and aesthetic benefits for the community, but as stated previously, is not the highest priority in terms of hydraulic benefits.

PEDESTRIAN CONNECTIVITY

Pedestrian connectivity is important to the Town of Smithfield and in 2023, the Town adopted the Smithfield Comprehensive Growth Management and Transportation Plan. The Pedestrian Plan suggested a future trail from the Bob Wallace Jaycee Kiddie Park through Smith-Collins Park to East Market Street at College Road as a potential future connection. This study took this Pedestrian Plan into account and investigated ways to increase connectivity for residents in the watershed to downtown. A traffic study was also completed to determine the best alternative for a pedestrian crossing for US 301, CSX railroad and E. Lee Street, and other potential road crossings/closings for projects related to the study. This traffic study can be found in ***Appendix G***.

Project segments were determined by identifying appropriate beginning locations and project termini. These segments are described below and cut sheets with project locations, cost estimates, and potential funding sources are located in ***Appendix C***.

PROPOSED PROJECTS FOR MULTI-USE PATH CONNECTIVITY

Six (6) proposed projects were identified to address multi-use path connectivity between the Neuse River Trail and Smith-Collins Park. These projects include a clearly marked path, both on and adjacent to the roadway, for the community to use to safely travel over heavily used intersections and through the existing neighborhood surrounding Spring Branch. These projects were broken into segments with definable beginning and end points to properly estimate the projects. The overall project location map can be found in ***Appendix F***.

Segment 1

Segment 1 begins with connecting to the Neuse River trail located within the Bob Wallace Jaycee Kiddie Park. This project includes the retrofit of the existing sidewalk to meet PROWAG requirements. The scope includes approximately 23 ADA ramps, 6 crosswalks (assuming thermoplastic "piano key" crossings) and 19 driveway adjustments along the existing sidewalks on Church Street from 2nd Street from Bob Wallace Jaycee Kiddie Park to the intersection of 5th Street and Church Street. The Smithfield Pedestrian Plan shows the installation of a multi-use path along this corridor,

however currently there is sidewalk along this selected route in the existing condition. Therefore, the estimate includes a concrete sidewalk, which will include instead of a multi-use path. A "share the road" condition is anticipated for bicycle connectivity in this area including sharrow pavement markings and directional signage. The path will turn left out of the park and run northeast along the west side of 2nd street. The path will then turn to the southeast and cross 2nd street running along the south side of E. Church Street. The path will cross 2nd Street and continue along the south side of E. Church Street until the intersection with 5th street. The path will turn southwest on west side of 5th street for a short section, then cross 5th street in a southeast direction, connecting with the east side of 5th street. This will be the segment 1 terminus.

Segment 2

Segment 2 includes the path running through the 5th Street stream restoration that was completed in December of 2023. The segment begins with the segment 1 termini and ends at the southwest corner of E. Church Street and 6th street. This segment will run parallel to E. Church Street for approximately 120 feet, then cross over a floodplain overflow channel using a pedestrian bridge. The path will run along the stream and again cross over the floodplain overflow channel with another pedestrian bridge before terminating at the southwest corner of the E. Church Street and 6th Street intersection.

Segment 3

Segment 3 will begin at the termini with segment 2 at the southwest corner of E. Church Street and 6th Street. This segment includes the installation of a 5' wide sidewalk along 6th Street from the intersection of E. Church Street and 6th Street to E. Davis Street. The path then crosses 6th Street and continues on the southside of E. Davis Street to the western side of US Route 301. The path will then turn south along US 301 to a mid-point between E. Davis Street and E. Lee Street. This sidewalk will be designed to meet PROWAG requirements and includes the installation of approximately 10 ADA ramps at each street corner with street crossings, approximately 11 driveway crossings, utility relocations and temporary easements are anticipated. Segment 3 will end at this midway point between E. Daves Street and E. Lee Street. This project description varies from the proposed pedestrian improvements in the Smithfield Pedestrian Plan which shows the crossover of US Route 301 on E. Lee Street in lieu of E. Davis Street and a multi-use path on 6th Street. A "share the road" condition is anticipated for bicycle connectivity in this area including sharrow pavement markings and directional signage. This decision was made based on the traffic study conducted finding the safest area to cross along US 301, and had the smallest impact on traffic along US 301.

Segment 4

Segment 4 includes the installation of a HAWK (high intensity activated crosswalk) crossing across US 301. The mid-block crossing will originate from E. Davis Street (near 506 S. Brightleaf Boulevard (US 301) – Steve's Carpet and Flooring) and terminating on the opposite side of S. Brightleaf Boulevard (US 301) (near 507 S. Brightleaf Boulevard (US 301) – Wheels and Deals) to meet PROWAG standards. This location is not shown in the current Smithfield Pedestrian Plan, however the traffic study of different alternatives for a US Route 301 crossing showed that this would be a safe alternative with the inclusion of a HAWK. This would create a safe situation whereby vehicular traffic on US Route 301 would stop when the beacon is activated by a pedestrian. There is currently no dedicated pedestrian crossing across US Route 301 in this vicinity. Also included measures are high-visibility pavement markings, additional lighting, warning signs in advance of the crossing, and a pedestrian refuge island.

Segment 5

Segment 5 includes the installation of a 10' multi-use path with a 5' separation from the existing roadway originating from the crossing at US Route 301, running south along US Route 301, turning left onto E. Lee Street, crossing to the CSX railroad crossing, and terminating at Smith-Collins Park, connecting with the existing trail network. The section along US Route 301 is not currently in the Smithfield Pedestrian plan (as the crossing of US Route 301 is currently shown at E. Lee Street). However, the section on E. Lee Street is recommended in the Smithfield Pedestrian Plan. There are currently no dedicated pedestrian or bicycle facilities along US Route 301 or E. Lee Street at this location. Note that NCDOT will require a diagnostic study for the crossing of CSX railroad at this location and the Town will be responsible for the cost of the study. Cost of the diagnostic study is not included in the project cost estimate.

Segment 6

Segment 6 is an optional segment that will coincide with the aforementioned stream restoration project between 2nd and 3rd streets. This segment includes the retrofit of the existing sidewalk to meet PROWAG requirements. However, this would be for approximately 125 feet along the west side of 2nd Street, before crossing 2nd street with 2 ADA ramps and a piano key crossing. The segment will then run along the north side of the completed stream restoration between 2nd and 3rd Street for approximately 475 feet. The path will then turn left and run along the west side of 3rd Street for approximately 300 feet. This section will include a retrofit of the existing sidewalk and 2 driveway adjustments before reconnecting with segment 1.

CONCLUSIONS

PEDESTRIAN

Identified projects connecting the Bob Wallace Jaycee Kiddie Park and Smith-Collins Park utilized the existing Town and County Planning studies and the traffic study performed during this project. The identified multi-use path in this study follows the pedestrian plan with a few exceptions. Segment 2 varies slightly from the Town's pedestrian plan with the multi-use path interacting with the completed stream restoration between 5th and 6th Streets. Segments 3, 4 and 5 divert from the Town's pedestrian plan due to the mid-block HAWK crossing recommended by our traffic study. Alternative 1 of the study recommended a pedestrian refuge island at Lee Street and US 301. However, this would convert one through lane to a shared through lane and turn lane, potentially making traffic operations worse. The selected alternative 2 located a HAWK crossing at the midblock point between E. Davis Street and E. Lee Street. This alternative most closely resembled the existing Town Plan and presented the best traffic option without affecting turning lanes at the E. Lee Street and US 301 intersection. Alternative 3 recommended a crossing on the north Side of Woodall Street. It was not selected as this alternative would eliminate a left turn lane for Woodall street for a pedestrian refuge island.

Segment 5 includes the CSX Railroad crossing on E. Lee Street. NCDOT is currently developing plans to improve the safety of the crossing for vehicles. The crossing currently does not have a pedestrian facility. In discussions with NCDOT rail division, it was stated a diagnostic study would be required at this location before any project could occur per the MUTCD (Manual on Uniform Control Devices). This diagnostic study would be conducted by CSX. NCDOT stated that the Town would be responsible for the cost of the study, which is estimated to be approximately fifteen thousand dollars.

The total cost for full implementation of all six (6) pedestrian projects in this study is $3.9 million.

STORMWATER

Identified stormwater projects within the Spring Branch Watershed will have a reduction of greater than 20% of the FEMA floodplain once all phases of the resiliency plan are implemented. However, this number is significantly reduced once the Neuse River creates a backwater event in Spring Branch. The Neuse has a drainage area of 1,200 square miles at this location, while Spring Branch watershed is one and a half square miles. This substantial difference means that it would need to be two separate major events that hit different parts of North Carolina at the same time. Although a probabilistic analysis was not performed for this study, the coincident, timing of a peak water surface in the Neuse, with a peak water surface in Spring Branch is highly unlikely, and therefore it is expected that for almost all storm events the flood reduction within the Spring Branch watershed will be greater than 20% once all phases are implemented.

Backwatering from the Neuse only impacts Spring Branch downstream of 4th street. Areas upstream of 4th are outside the hydraulic influence of the Neuse backwater and overall floodplain reduction will not be affected. With a backwater condition, the 100yr floodplain area of just the phase 1 projects is reduced by 1.5%; without a backwater condition the Phase 1 projects reduce the 100yr floodplain area by 20%. A backwater condition has the most impact on the 100yr storm and has less of an impact for smaller storms.

Although the flooding within Spring Branch cannot be completely eliminated with the existing infrastructure and location of homes within the floodway, these projects will reduce flooding during higher frequency storms. The overall cost for full implementation of all three phases of the stormwater projects is approximately $12.95 million with an estimated completion date of by the end of 2032. However, prior to the completion of this study the Town of Smithfield received funding from the state of North Carolina to complete Phase 1 of this plan. The Town is currently negotiating with a contractor for both the 2nd and 4th street culvert replacements and work has begun on Phase 1. Further, a grant application has been submitted for the College Pond Retrofit Project within Phase 2 of this Resiliency Plan. The overall total is now reduced to $10.98 million with Phase 1 being funded by the state of North Carolina. The majority of this cost is UG-1, which is estimated to cost $6.73 million. This overall cost will largely be offset by grant funding programs previously identified and also throughout the implementation process. The completion date may be affected by the availability of these grants and available required matching funds available from the Town, which will be determined on a yearly basis.

REFERENCES

APPENDIX A

HYDROLOGIC MODELING

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

APPENDIX A.1

HYDROLOGIC MODELING

Existing Conditions

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

WinTR-20 Printed Page File Beginning of Input Data List
C:\Users\calutz\Desktop\Smithfield TR20 CAL.inp

WinTR-20: Version 3.30 0 0 0.01 0 ,

Smithfield Resiliency Plan
Existing Conditions

SUB-AREA:

SA1	Outlet	0.15426	74.	0.306
SA2	Reach1	0.17934	82.	0.571
SA3	Reach3.5	0.127196	86.	0.812
SA4	Reach3	0.12716	89.	0.655
SA5	Reach5	0.082954	92.	0.914
SA7	Reach6	0.28673	89.	1.076
SA6	Reach8	0.14911	95.	0.948

STREAM REACH:

Reach1	Outlet	XS1		2700.
Reach2	Reach1	XS2		1775.
Reach3	Reach2	XS3		1100.
Reach4	Reach3.5	XS4		1500.
Reach5	Reach4		CollegePon	
Reach6	Reach5	XS6		1500.
Reach7	Reach5	XS7		1400.
Reach8	Reach7		I95Pond	
Reach3.5	Reach2	XS2		1.

STORM ANALYSIS:

1_yr_sm	2.960	1_yr_sm	2	3.600
2_yr_sm	3.600	2_yr_sm	2	
5_yr_sm	4.620	5_yr_sm	2	
10_yr_sm	5.450	10_yr_sm	2	
25_yr_sm	6.630	25_yr_sm	2	

50_yr_sm			7.610	50_yr_sm	2
100_yr_sm			8.650	100_yr_sm	2
200_yr_sm			9.770	200_yr_sm	2

STREAM CROSS SECTION:

XS1	107.		105.		
	105.	0.	0.	0.	0.003
	105.25	0.47	0.7	4.75	0.003
	105.5	2.35	2.4	8.5	0.003
	105.75	6.3	5.	12.25	0.003
	106.	12.89	8.5	16.	0.003
	106.25	22.66	13.	19.75	0.003
	106.5	36.06	18.4	23.5	0.003
	106.75	53.56	24.7	27.25	0.003
	107.	75.57	32.	31.	0.003
	107.5	129.19	50.8	44.	0.003
	108.	213.22	76.	57.	0.003
	109.	469.27	177.	145.	0.003
	110.	1189.26	344.5	190.	0.003
	111.	2296.08	557.5	236.	0.003
XS2	128.		130.5		
	128.	0.	0.	0.	0.01
	128.25	1.75	1.1	5.5	0.01
	128.5	6.63	2.8	8.	0.01
	128.75	15.27	5.1	10.5	0.01
	129.	28.38	8.0	13.	0.01
	129.25	44.64	11.8	17.5	0.01
	129.5	68.64	16.8	22.	0.01
	129.75	101.52	22.8	26.5	0.01
	130.	144.40	30.0	31.	0.01
	130.25	191.70	38.7	38.25	0.01
	130.5	254.75	49.1	45.5	0.01
	131.	433.96	75.5	60.	0.01
	132.	1722.72	243.7	249.67	0.01
	133.	4164.78	529.	339.	0.01
XS3	136.		134.		
	134.	0.	0.	0.	0.01
	134.25	0.27	1.4	8.5	0.01
	134.5	1.19	4.3	14.	0.01
	134.75	2.98	8.4	19.5	0.01
	135.	5.87	14.	25.	0.01
	135.25	9.97	21.	31.25	0.01
	135.5	15.63	29.6	37.5	0.01
	135.75	23.05	39.8	43.75	0.01
	136.	32.43	51.5	50.	0.01
	136.5	48.6	99.	140.	0.01
	137.	104.86	191.5	230.	0.01
	138.	370.34	560.	507.	0.01
	139.	1126.24	1109.5	592.	0.01

```
                140.      2144.77   1751.5    692.      0.01
          XS4   139.                133.
                133.      0.        0.        0.        0.005
                133.5     4.19      1.67      5.        0.005
                134.      11.99     5.        5.        0.005
                134.5     21.57     7.5       5.        0.005
                135.      32.2      10.       5.        0.005
                135.5     43.54     12.5      5.        0.005
                136.      55.37     15.       5.        0.005
                136.5     67.56     17.5      5.        0.005
                137.      80.01     20.       5.        0.005
                137.5     92.68     22.5      5.        0.005
                138.      105.5     25.       5.        0.005
                138.5     118.45    27.5      5.        0.005
                139.      131.52    30.       5.        0.005
                141.      419.97    375.      340.      0.005
                142.      1226.44   715.      340.      0.005
                143.      2336.36   1055.     340.      0.005
                144.      3707.38   1395.0    340.      0.005
          XS6   136.                142.
                136.      0.        0.        0.        0.005
                136.5     5.12      3.        6.        0.005
                137.      14.87     6.        6.        0.005
                138.      40.68     12.       6.        0.005
                139.      70.81     18.       6.        0.005
                140.      103.2     24.       6.        0.005
                141.      136.94    30.       6.        0.005
                142.      171.55    36.       99.       0.005
                144.      280.45    234.      192.      0.005
                145.      695.21    472.5     285.      0.005
                146.      1396.72   804.      378.      0.005
                147.      2645.56   1182.     378.      0.005
          XS7   143.                140.
                140.      0.        0.        0.        0.005
                141.      6.41      3.        3.        0.005
                142.      16.25     6.        3.        0.005
                143.      27.02     9.        3.        0.005
                144.      51.84     70.3      119.67    0.005
                145.      269.62    248.3     236.33    0.005
                146.      760.1     543.      353.      0.005
                147.      1744.82   896.      353.      0.005
                148.      3023.76   1249.0    353.      0.005


STRUCTURE RATING:
          I95Pond   140.5
                140.5     0.        0.
                143.1     5.        22.276
                143.16    10.       22.982
                143.27    20.       24.087
```

	144.	30.	32.269
	145.02	40.	44.999
	145.03	50.	45.137
	145.04	60.	45.278
	145.05	70.	45.422
	145.06	80.	45.569
	145.07	90.	45.719
	145.08	100.	45.871
	145.09	110.	46.027
	145.1	130.	46.185
	145.11	140.	46.346
	145.12	160.	46.509
	145.13	170.	46.676
	145.14	190.	46.845
	145.15	210.	47.017
	145.16	220.	47.192
	145.17	240.	47.370
	145.18	260.	47.551
	145.19	280.	47.734
	145.2	300.	47.920
	145.21	320.	48.109
	145.22	340.	48.301
	145.23	360.	48.496
	145.24	370.	48.693
CollegePon	137.		
	137.	0.	0.
	138.22	5.	9.267
	138.8	10.	13.799
	142.08	20.	40.845
	142.21	30.	41.969
	142.31	40.	42.837
	142.39	50.	43.534
	142.46	60.	44.145
	142.53	70.	44.758
	142.59	80.	45.284
	142.65	90.	45.811
	142.7	100.	46.252
	142.76	110.	46.781
	142.81	120.	47.223
	142.86	130.	47.665
	142.9	140.	48.02
	142.95	150.	48.464
	142.99	160.	48.819
	143.04	170.	49.265
	143.08	180.	49.622
	143.12	190.	49.98
	143.16	200.	50.339
	143.2	210.	50.699
	143.24	220.	51.06
	143.28	230.	51.422

143.31	240.	51.694
143.35	250.	52.057
143.39	260.	52.421
143.42	270.	52.694
143.46	280.	53.060
143.49	290.	53.335
143.53	335.92	53.702
143.56	354.97	53.978
143.59	377.23	54.254
143.63	408.90	54.623
143.66	430.62	54.901
143.69	452.91	55.179
143.72	472.48	55.458
143.75	492.36	55.737
143.78	515.98	56.016
143.81	536.53	56.296
143.84	557.37	56.576
143.92	608.73	57.327
143.99	661.56	57.986
144.04	703.11	58.459
144.07	740.82	58.745
144.1	778.78	59.032
144.13	812.57	59.32
144.15	846.46	59.513
144.18	885.01	59.804
144.19	897.29	59.901

RAINFALL DISTRIBUTION:

1_yr_sm	0.1			
0.0	0.000659	0.00131	0.00197	0.00264
0.00332	0.00401	0.00471	0.00542	0.00614
0.00687	0.00761	0.00836	0.00911	0.00988
0.01066	0.01145	0.01224	0.01305	0.01386
0.01469	0.01552	0.01637	0.01722	0.01809
0.01896	0.01984	0.02074	0.02164	0.02255
0.02347	0.02440	0.02534	0.02629	0.02726
0.02823	0.02921	0.03019	0.03119	0.03220
0.03322	0.03425	0.03529	0.03633	0.03739
0.03846	0.03953	0.04062	0.04171	0.04282
0.04393	0.04506	0.04619	0.04734	0.04849
0.04965	0.05082	0.05201	0.05320	0.05440
0.05561	0.05686	0.05815	0.05948	0.06084
0.06225	0.06369	0.06517	0.06669	0.06825
0.06985	0.07148	0.07316	0.07487	0.07662
0.07841	0.08024	0.08211	0.08401	0.08596
0.08794	0.08996	0.09202	0.09412	0.09626
0.09844	0.10065	0.10291	0.10520	0.10753

	0.10990	0.11242	0.11510	0.11793	0.12092
	0.12406	0.12736	0.13081	0.13441	0.13817
	0.14209	0.14616	0.15038	0.15476	0.15929
	0.16398	0.16928	0.17520	0.18173	0.18888
	0.19664	0.20559	0.21575	0.22710	0.23965
	0.25338	0.27323	0.29413	0.32489	0.37132
	0.46107	0.62868	0.67511	0.70587	0.72677
	0.74662	0.76035	0.77290	0.78425	0.79441
	0.80336	0.81112	0.81827	0.82480	0.83072
	0.83602	0.84071	0.84524	0.84962	0.85384
	0.85791	0.86183	0.86559	0.86919	0.87264
	0.87594	0.87908	0.88207	0.88490	0.88758
	0.89010	0.89247	0.89480	0.89709	0.89935
	0.90156	0.90374	0.90588	0.90798	0.91004
	0.91206	0.91404	0.91599	0.91789	0.91976
	0.92159	0.92338	0.92513	0.92684	0.92852
	0.93015	0.93175	0.93331	0.93483	0.93631
	0.93775	0.93916	0.94052	0.94185	0.94314
	0.94439	0.94560	0.94680	0.94799	0.94918
	0.95035	0.95151	0.95266	0.95381	0.95494
	0.95607	0.95718	0.95829	0.95938	0.96047
	0.96154	0.96261	0.96367	0.96471	0.96575
	0.96678	0.96780	0.96881	0.96981	0.97079
	0.97177	0.97274	0.97370	0.97466	0.97560
	0.97653	0.97745	0.97836	0.97926	0.98016
	0.98104	0.98191	0.98278	0.98363	0.98448
	0.98531	0.98614	0.98695	0.98776	0.98855
	0.98934	0.99012	0.99089	0.99164	0.99239
	0.99313	0.99386	0.99458	0.99529	0.99599
	0.99668	0.99736	0.99803	0.99869	0.999341
	1.0				
2_yr_sm		0.1			
	0.0	0.000689	0.00137	0.00207	0.00277
	0.00348	0.00420	0.00494	0.00568	0.00643
	0.00719	0.00797	0.00875	0.00954	0.01034
	0.01116	0.01198	0.01281	0.01365	0.01450
	0.01536	0.01624	0.01712	0.01801	0.01891
	0.01982	0.02074	0.02167	0.02261	0.02356
	0.02452	0.02550	0.02648	0.02747	0.02847
	0.02948	0.03050	0.03153	0.03257	0.03362
	0.03468	0.03575	0.03683	0.03792	0.03902
	0.04013	0.04124	0.04237	0.04351	0.04466
	0.04582	0.04699	0.04817	0.04936	0.05056
	0.05176	0.05298	0.05421	0.05545	0.05670
	0.05796	0.05925	0.06059	0.06197	0.06338
	0.06484	0.06634	0.06787	0.06945	0.07106
	0.07272	0.07441	0.07615	0.07792	0.07973
	0.08159	0.08348	0.08541	0.08738	0.08939
	0.09144	0.09354	0.09567	0.09784	0.10005
	0.10230	0.10458	0.10691	0.10928	0.11169

	0.11414	0.11674	0.11950	0.12241	0.12548
	0.12870	0.13208	0.13561	0.13930	0.14314
	0.14713	0.15129	0.15559	0.16005	0.16467
	0.16944	0.17482	0.18081	0.18741	0.19462
	0.20244	0.21148	0.22172	0.23318	0.24585
	0.25972	0.27984	0.30102	0.33152	0.37679
	0.46334	0.62321	0.66848	0.69898	0.72016
	0.74028	0.75415	0.76682	0.77828	0.78852
	0.79756	0.80538	0.81259	0.81919	0.82518
	0.83056	0.83533	0.83995	0.84441	0.84871
	0.85287	0.85686	0.86070	0.86439	0.86792
	0.87130	0.87452	0.87759	0.88050	0.88326
	0.88586	0.88831	0.89072	0.89309	0.89542
	0.89770	0.89995	0.90216	0.90433	0.90646
	0.90856	0.91061	0.91262	0.91459	0.91652
	0.91841	0.92027	0.92208	0.92385	0.92559
	0.92728	0.92894	0.93055	0.93213	0.93366
	0.93516	0.93662	0.93803	0.93941	0.94075
	0.94204	0.94330	0.94455	0.94579	0.94702
	0.94824	0.94944	0.95064	0.95183	0.95301
	0.95418	0.95534	0.95649	0.95763	0.95876
	0.95987	0.96098	0.96208	0.96317	0.96425
	0.96532	0.96638	0.96743	0.96847	0.96950
	0.97052	0.97153	0.97253	0.97352	0.97450
	0.97548	0.97644	0.97739	0.97833	0.97926
	0.98018	0.98109	0.98199	0.98288	0.98376
	0.98464	0.98550	0.98635	0.98719	0.98802
	0.98884	0.98966	0.99046	0.99125	0.99203
	0.99281	0.99357	0.99432	0.99506	0.99580
	0.99652	0.99723	0.99793	0.99863	0.999310
	1.0				
5_yr_sm		0.1			
	0.0	0.000742	0.00147	0.00221	0.00296
	0.00372	0.00449	0.00527	0.00606	0.00686
	0.00767	0.00849	0.00933	0.01017	0.01102
	0.01188	0.01276	0.01364	0.01453	0.01544
	0.01635	0.01728	0.01821	0.01916	0.02012
	0.02108	0.02206	0.02305	0.02404	0.02505
	0.02607	0.02710	0.02814	0.02919	0.03025
	0.03132	0.03240	0.03349	0.03459	0.03570
	0.03682	0.03795	0.03910	0.04025	0.04141
	0.04259	0.04377	0.04496	0.04617	0.04738
	0.04861	0.04984	0.05109	0.05235	0.05361
	0.05489	0.05618	0.05747	0.05878	0.06010
	0.06143	0.06280	0.06421	0.06566	0.06716
	0.06869	0.07027	0.07189	0.07355	0.07525
	0.07699	0.07878	0.08060	0.08247	0.08438
	0.08633	0.08832	0.09035	0.09242	0.09454
	0.09669	0.09889	0.10113	0.10341	0.10573
	0.10810	0.11050	0.11295	0.11543	0.11796

	0.12053	0.12327	0.12616	0.12922	0.13244
	0.13582	0.13937	0.14307	0.14694	0.15097
	0.15517	0.15952	0.16404	0.16873	0.17357
	0.17857	0.18422	0.19051	0.19743	0.20499
	0.21320	0.22264	0.23331	0.24522	0.25837
	0.27273	0.29342	0.31520	0.34596	0.39016
	0.47010	0.60984	0.65404	0.68480	0.70658
	0.72727	0.74163	0.75478	0.76669	0.77736
	0.78680	0.79501	0.80257	0.80949	0.81578
	0.82143	0.82643	0.83127	0.83596	0.84048
	0.84483	0.84903	0.85306	0.85693	0.86063
	0.86418	0.86756	0.87078	0.87384	0.87673
	0.87947	0.88204	0.88457	0.88705	0.88950
	0.89190	0.89427	0.89659	0.89887	0.90111
	0.90331	0.90546	0.90758	0.90965	0.91168
	0.91367	0.91562	0.91753	0.91940	0.92122
	0.92301	0.92475	0.92645	0.92811	0.92973
	0.93131	0.93284	0.93434	0.93579	0.93720
	0.93857	0.93990	0.94122	0.94253	0.94382
	0.94511	0.94639	0.94765	0.94891	0.95016
	0.95139	0.95262	0.95383	0.95504	0.95623
	0.95741	0.95859	0.95975	0.96090	0.96205
	0.96318	0.96430	0.96541	0.96651	0.96760
	0.96868	0.96975	0.97081	0.97186	0.97290
	0.97393	0.97495	0.97596	0.97695	0.97794
	0.97892	0.97988	0.98084	0.98179	0.98272
	0.98365	0.98456	0.98547	0.98636	0.98724
	0.98812	0.98898	0.98983	0.99067	0.99151
	0.99233	0.99314	0.99394	0.99473	0.99551
	0.99628	0.99704	0.99779	0.99853	0.999258
	1.0				
10_yr_sm		0.1			
	0.0	0.000735	0.00146	0.00220	0.00295
	0.00371	0.00448	0.00525	0.00605	0.00685
	0.00766	0.00848	0.00931	0.01015	0.01101
	0.01187	0.01275	0.01363	0.01453	0.01543
	0.01635	0.01728	0.01822	0.01917	0.02012
	0.02109	0.02207	0.02307	0.02407	0.02508
	0.02610	0.02713	0.02818	0.02923	0.03030
	0.03137	0.03246	0.03355	0.03466	0.03578
	0.03691	0.03804	0.03919	0.04035	0.04152
	0.04270	0.04389	0.04510	0.04631	0.04753
	0.04877	0.05001	0.05126	0.05253	0.05380
	0.05509	0.05639	0.05769	0.05901	0.06034
	0.06168	0.06306	0.06448	0.06595	0.06746
	0.06901	0.07060	0.07223	0.07391	0.07563
	0.07739	0.07919	0.08104	0.08293	0.08486
	0.08683	0.08884	0.09090	0.09300	0.09514
	0.09732	0.09955	0.10182	0.10413	0.10648
	0.10887	0.11131	0.11379	0.11631	0.11887

	0.12148	0.12425	0.12718	0.13028	0.13354
	0.13697	0.14056	0.14432	0.14824	0.15233
	0.15658	0.16100	0.16558	0.17033	0.17524
	0.18031	0.18603	0.19240	0.19942	0.20709
	0.21540	0.22500	0.23587	0.24802	0.26145
	0.27615	0.29742	0.31982	0.35082	0.39455
	0.47219	0.60545	0.64918	0.68018	0.70258
	0.72385	0.73855	0.75198	0.76413	0.77500
	0.78460	0.79291	0.80058	0.80760	0.81397
	0.81969	0.82476	0.82967	0.83442	0.83900
	0.84342	0.84767	0.85176	0.85568	0.85944
	0.86303	0.86646	0.86972	0.87282	0.87575
	0.87852	0.88113	0.88369	0.88621	0.88869
	0.89113	0.89352	0.89587	0.89818	0.90045
	0.90268	0.90486	0.90700	0.90910	0.91116
	0.91317	0.91514	0.91707	0.91896	0.92081
	0.92261	0.92437	0.92609	0.92777	0.92940
	0.93099	0.93254	0.93405	0.93552	0.93694
	0.93832	0.93966	0.94099	0.94231	0.94361
	0.94491	0.94620	0.94747	0.94874	0.94999
	0.95123	0.95247	0.95369	0.95490	0.95611
	0.95730	0.95848	0.95965	0.96081	0.96196
	0.96309	0.96422	0.96534	0.96645	0.96754
	0.96863	0.96970	0.97077	0.97182	0.97287
	0.97390	0.97492	0.97593	0.97693	0.97793
	0.97891	0.97988	0.98083	0.98178	0.98272
	0.98365	0.98457	0.98547	0.98637	0.98725
	0.98813	0.98899	0.98985	0.99069	0.99152
	0.99234	0.99315	0.99395	0.99475	0.99552
	0.99629	0.99705	0.99780	0.99854	0.999265
	1.0				
25_yr_sm		0.1			
	0.0	0.000796	0.00158	0.00237	0.00317
	0.00398	0.00480	0.00563	0.00648	0.00733
	0.00820	0.00907	0.00996	0.01086	0.01177
	0.01269	0.01362	0.01456	0.01551	0.01647
	0.01745	0.01843	0.01943	0.02043	0.02145
	0.02247	0.02351	0.02456	0.02562	0.02669
	0.02777	0.02887	0.02997	0.03108	0.03221
	0.03334	0.03449	0.03564	0.03681	0.03799
	0.03918	0.04038	0.04159	0.04281	0.04404
	0.04529	0.04654	0.04781	0.04908	0.05037
	0.05167	0.05297	0.05429	0.05562	0.05696
	0.05831	0.05967	0.06105	0.06243	0.06382
	0.06523	0.06668	0.06817	0.06970	0.07128
	0.07290	0.07457	0.07627	0.07802	0.07982
	0.08165	0.08353	0.08546	0.08742	0.08943
	0.09148	0.09358	0.09572	0.09790	0.10012
	0.10239	0.10470	0.10706	0.10946	0.11190
	0.11438	0.11691	0.11948	0.12209	0.12475

0.12745 0.13032 0.13335 0.13656 0.13993
0.14347 0.14718 0.15106 0.15510 0.15932
0.16370 0.16825 0.17297 0.17786 0.18291
0.18814 0.19402 0.20056 0.20777 0.21563
0.22415 0.23394 0.24501 0.25735 0.27096
0.28582 0.30721 0.32973 0.36051 0.40306
0.47600 0.59694 0.63949 0.67027 0.69279
0.71418 0.72904 0.74265 0.75499 0.76606
0.77585 0.78437 0.79223 0.79944 0.80598
0.81186 0.81709 0.82214 0.82703 0.83175
0.83630 0.84068 0.84490 0.84894 0.85282
0.85653 0.86007 0.86344 0.86665 0.86968
0.87255 0.87525 0.87791 0.88052 0.88309
0.88562 0.88810 0.89054 0.89294 0.89530
0.89761 0.89988 0.90210 0.90428 0.90642
0.90852 0.91057 0.91258 0.91454 0.91647
0.91835 0.92018 0.92198 0.92373 0.92543
0.92710 0.92872 0.93030 0.93183 0.93332
0.93477 0.93618 0.93757 0.93895 0.94033
0.94169 0.94304 0.94438 0.94571 0.94703
0.94833 0.94963 0.95092 0.95219 0.95346
0.95471 0.95596 0.95719 0.95841 0.95962
0.96082 0.96201 0.96319 0.96436 0.96551
0.96666 0.96779 0.96892 0.97003 0.97113
0.97223 0.97331 0.97438 0.97544 0.97649
0.97753 0.97855 0.97957 0.98057 0.98157
0.98255 0.98353 0.98449 0.98544 0.98638
0.98731 0.98823 0.98914 0.99004 0.99093
0.99180 0.99267 0.99352 0.99437 0.99520
0.99602 0.99683 0.99763 0.99842 0.999204
1.0

50_yr_sm 0.1
0.0 0.000790 0.00157 0.00236 0.00316
0.00397 0.00479 0.00563 0.00647 0.00733
0.00819 0.00907 0.00996 0.01086 0.01177
0.01270 0.01363 0.01457 0.01553 0.01650
0.01747 0.01846 0.01946 0.02047 0.02150
0.02253 0.02357 0.02463 0.02570 0.02677
0.02786 0.02896 0.03007 0.03119 0.03233
0.03347 0.03463 0.03579 0.03697 0.03816
0.03936 0.04057 0.04179 0.04302 0.04427
0.04552 0.04679 0.04806 0.04935 0.05065
0.05196 0.05328 0.05462 0.05596 0.05731
0.05868 0.06006 0.06144 0.06284 0.06425
0.06568 0.06714 0.06865 0.07020 0.07180
0.07345 0.07513 0.07686 0.07864 0.08046
0.08232 0.08423 0.08619 0.08818 0.09023
0.09231 0.09444 0.09662 0.09884 0.10110
0.10341 0.10576 0.10816 0.11060 0.11308
0.11561 0.11818 0.12080 0.12347 0.12617

0.12892 0.13185 0.13494 0.13821 0.14165
0.14526 0.14905 0.15300 0.15713 0.16143
0.16590 0.17055 0.17537 0.18036 0.18552
0.19085 0.19686 0.20355 0.21091 0.21895
0.22766 0.23770 0.24906 0.26174 0.27575
0.29106 0.31319 0.33648 0.36758 0.40944
0.47892 0.59056 0.63242 0.66352 0.68681
0.70894 0.72425 0.73826 0.75094 0.76230
0.77234 0.78105 0.78909 0.79645 0.80314
0.80915 0.81448 0.81964 0.82463 0.82945
0.83410 0.83857 0.84287 0.84700 0.85095
0.85474 0.85835 0.86179 0.86506 0.86815
0.87108 0.87383 0.87653 0.87920 0.88182
0.88439 0.88692 0.88940 0.89184 0.89424
0.89659 0.89890 0.90116 0.90338 0.90556
0.90769 0.90977 0.91182 0.91381 0.91577
0.91768 0.91954 0.92136 0.92314 0.92487
0.92655 0.92820 0.92980 0.93135 0.93286
0.93432 0.93575 0.93716 0.93856 0.93994
0.94132 0.94269 0.94404 0.94538 0.94672
0.94804 0.94935 0.95065 0.95194 0.95321
0.95448 0.95573 0.95698 0.95821 0.95943
0.96064 0.96184 0.96303 0.96421 0.96537
0.96653 0.96767 0.96881 0.96993 0.97104
0.97214 0.97323 0.97430 0.97537 0.97643
0.97747 0.97850 0.97953 0.98054 0.98154
0.98253 0.98350 0.98447 0.98543 0.98637
0.98730 0.98823 0.98914 0.99004 0.99093
0.99181 0.99267 0.99353 0.99437 0.99521
0.99603 0.99684 0.99764 0.99843 0.999210
1.0

100_yr_sm 0.1
0.0 0.000816 0.00162 0.00243 0.00325
0.00409 0.00494 0.00580 0.00666 0.00754
0.00844 0.00934 0.01025 0.01118 0.01212
0.01306 0.01402 0.01499 0.01598 0.01697
0.01797 0.01899 0.02002 0.02105 0.02210
0.02316 0.02424 0.02532 0.02641 0.02752
0.02864 0.02976 0.03090 0.03206 0.03322
0.03439 0.03557 0.03677 0.03798 0.03920
0.04043 0.04167 0.04292 0.04418 0.04546
0.04674 0.04804 0.04935 0.05067 0.05200
0.05334 0.05469 0.05606 0.05743 0.05882
0.06022 0.06163 0.06305 0.06448 0.06593
0.06738 0.06888 0.07043 0.07202 0.07365
0.07533 0.07706 0.07883 0.08064 0.08250
0.08441 0.08636 0.08835 0.09039 0.09248
0.09461 0.09678 0.09900 0.10127 0.10358
0.10593 0.10833 0.11078 0.11327 0.11581
0.11839 0.12101 0.12368 0.12640 0.12916

	0.13197	0.13495	0.13810	0.14143	0.14493
	0.14861	0.15246	0.15649	0.16069	0.16507
	0.16962	0.17435	0.17924	0.18432	0.18957
	0.19499	0.20110	0.20789	0.21536	0.22351
	0.23235	0.24253	0.25403	0.26687	0.28105
	0.29653	0.31888	0.34240	0.37342	0.41449
	0.48104	0.58551	0.62658	0.65760	0.68112
	0.70347	0.71895	0.73313	0.74597	0.75747
	0.76765	0.77649	0.78464	0.79211	0.79890
	0.80501	0.81043	0.81568	0.82076	0.82565
	0.83038	0.83493	0.83931	0.84351	0.84754
	0.85139	0.85507	0.85857	0.86190	0.86505
	0.86803	0.87084	0.87360	0.87632	0.87899
	0.88161	0.88419	0.88673	0.88922	0.89167
	0.89407	0.89642	0.89873	0.90100	0.90322
	0.90539	0.90752	0.90961	0.91165	0.91364
	0.91559	0.91750	0.91936	0.92117	0.92294
	0.92467	0.92635	0.92798	0.92957	0.93112
	0.93262	0.93407	0.93552	0.93695	0.93837
	0.93978	0.94118	0.94257	0.94394	0.94531
	0.94666	0.94800	0.94933	0.95065	0.95196
	0.95326	0.95454	0.95582	0.95708	0.95833
	0.95957	0.96080	0.96202	0.96323	0.96443
	0.96561	0.96678	0.96794	0.96910	0.97024
	0.97136	0.97248	0.97359	0.97468	0.97576
	0.97684	0.97790	0.97895	0.97998	0.98101
	0.98203	0.98303	0.98402	0.98501	0.98598
	0.98694	0.98788	0.98882	0.98975	0.99066
	0.99156	0.99246	0.99334	0.99420	0.99506
	0.99591	0.99675	0.99757	0.99838	0.999184
	1.0				
200_yr_sm		0.1			
	0.0	0.000817	0.00164	0.00248	0.00333
	0.00419	0.00506	0.00594	0.00683	0.00774
	0.00865	0.00958	0.01052	0.01147	0.01244
	0.01341	0.01440	0.01539	0.01640	0.01742
	0.01845	0.01950	0.02055	0.02162	0.02270
	0.02379	0.02489	0.02600	0.02712	0.02826
	0.02940	0.03056	0.03173	0.03291	0.03411
	0.03531	0.03653	0.03775	0.03899	0.04024
	0.04150	0.04278	0.04406	0.04536	0.04667
	0.04799	0.04932	0.05066	0.05201	0.05338
	0.05475	0.05614	0.05754	0.05895	0.06038
	0.06181	0.06326	0.06471	0.06618	0.06766
	0.06915	0.07069	0.07228	0.07391	0.07558
	0.07730	0.07907	0.08088	0.08274	0.08465
	0.08660	0.08860	0.09064	0.09273	0.09487
	0.09705	0.09928	0.10155	0.10387	0.10624
	0.10865	0.11110	0.11361	0.11616	0.11875
	0.12139	0.12408	0.12682	0.12960	0.13242

0.13529 0.13834 0.14157 0.14498 0.14856
0.15232 0.15626 0.16038 0.16467 0.16915
0.17380 0.17863 0.18364 0.18883 0.19419
0.19973 0.20597 0.21290 0.22053 0.22885
0.23786 0.24822 0.25990 0.27292 0.28728
0.30297 0.32526 0.34873 0.37941 0.41952
0.48301 0.58048 0.62059 0.65127 0.67474
0.69703 0.71272 0.72708 0.74010 0.75178
0.76214 0.77115 0.77947 0.78710 0.79403
0.80027 0.80581 0.81117 0.81636 0.82137
0.82620 0.83085 0.83533 0.83962 0.84374
0.84768 0.85144 0.85502 0.85843 0.86166
0.86471 0.86758 0.87040 0.87318 0.87592
0.87861 0.88125 0.88384 0.88639 0.88890
0.89135 0.89376 0.89613 0.89845 0.90072
0.90295 0.90513 0.90727 0.90936 0.91140
0.91340 0.91535 0.91726 0.91912 0.92093
0.92270 0.92442 0.92609 0.92772 0.92931
0.93085 0.93234 0.93382 0.93529 0.93674
0.93819 0.93962 0.94105 0.94246 0.94386
0.94525 0.94662 0.94799 0.94934 0.95068
0.95201 0.95333 0.95464 0.95594 0.95722
0.95850 0.95976 0.96101 0.96225 0.96347
0.96469 0.96589 0.96709 0.96827 0.96944
0.97060 0.97174 0.97288 0.97400 0.97511
0.97621 0.97730 0.97838 0.97945 0.98050
0.98155 0.98258 0.98360 0.98461 0.98560
0.98659 0.98756 0.98853 0.98948 0.99042
0.99135 0.99226 0.99317 0.99406 0.99494
0.99581 0.99667 0.99752 0.99836 0.999183
1.0

500_yr_sm 0.1
0.0 0.000887 0.00177 0.00267 0.00358
0.00450 0.00543 0.00638 0.00734 0.00830
0.00928 0.01028 0.01128 0.01229 0.01332
0.01436 0.01541 0.01647 0.01754 0.01863
0.01973 0.02084 0.02196 0.02309 0.02423
0.02539 0.02656 0.02774 0.02893 0.03013
0.03134 0.03257 0.03381 0.03506 0.03632
0.03759 0.03888 0.04017 0.04148 0.04280
0.04413 0.04547 0.04683 0.04820 0.04957
0.05096 0.05237 0.05378 0.05521 0.05664
0.05809 0.05955 0.06102 0.06251 0.06400
0.06551 0.06703 0.06856 0.07010 0.07166
0.07322 0.07484 0.07650 0.07820 0.07996
0.08176 0.08361 0.08550 0.08744 0.08943
0.09146 0.09355 0.09567 0.09785 0.10007
0.10234 0.10466 0.10702 0.10943 0.11189
0.11439 0.11694 0.11954 0.12219 0.12488
0.12762 0.13040 0.13323 0.13611 0.13904

0.14201 0.14516 0.14849 0.15201 0.15570
0.15957 0.16361 0.16784 0.17225 0.17684
0.18160 0.18655 0.19167 0.19698 0.20246
0.20812 0.21448 0.22153 0.22927 0.23771
0.24684 0.25729 0.26906 0.28215 0.29656
0.31228 0.33453 0.35795 0.38806 0.42653
0.48556 0.57347 0.61194 0.64205 0.66547
0.68772 0.70344 0.71785 0.73094 0.74271
0.75316 0.76229 0.77073 0.77847 0.78552
0.79188 0.79754 0.80302 0.80833 0.81345
0.81840 0.82316 0.82775 0.83216 0.83639
0.84043 0.84430 0.84799 0.85151 0.85484
0.85799 0.86096 0.86389 0.86677 0.86960
0.87238 0.87512 0.87781 0.88046 0.88306
0.88561 0.88811 0.89057 0.89298 0.89534
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0.90854 0.91057 0.91256 0.91450 0.91639
0.91824 0.92004 0.92180 0.92350 0.92516
0.92678 0.92834 0.92990 0.93144 0.93297
0.93449 0.93600 0.93749 0.93898 0.94045
0.94191 0.94336 0.94479 0.94622 0.94763
0.94904 0.95043 0.95180 0.95317 0.95453
0.95587 0.95720 0.95852 0.95983 0.96112
0.96241 0.96368 0.96494 0.96619 0.96743
0.96866 0.96987 0.97107 0.97226 0.97344
0.97461 0.97577 0.97691 0.97804 0.97916
0.98027 0.98137 0.98246 0.98353 0.98459
0.98564 0.98668 0.98771 0.98872 0.98972
0.99072 0.99170 0.99266 0.99362 0.99457
0.99550 0.99642 0.99733 0.99823 0.999113
1.0

GLOBAL OUTPUT:
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STORM 1_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		1.864		12.73	193.8	676.00
Reach6	0.287	Upstream	1.864	142.41	12.73	193.8	676.00
Reach6	0.287	Downstream	1.864	142.40	12.87	193.2	673.84
SA5	0.083		2.123		12.60	70.7	851.83
SA6	0.149		2.410		12.61	137.7	923.43
Reach8	0.149	Upstream	2.410		12.61	137.7	923.43
Reach8	0.149	Downstream	2.405	142.38	18.60	3.6	24.22
Reach7	0.149	Upstream	2.405	140.56	18.60	3.6	24.22
Reach7	0.149	Downstream	2.405	140.56	18.72	3.6	24.22
Reach5	0.519	Upstream	2.061		12.77	255.6	492.68
Reach5	0.519	Downstream	2.060	140.67	17.16	15.7	30.25
Reach4	0.519	Upstream	2.060	134.19	17.16	15.7	30.25
Reach4	0.519	Downstream	2.060	134.19	17.33	15.7	30.25
SA3	0.127		1.628		12.54	90.3	710.08
Reach3.5	0.646	Upstream	1.975	129.68	12.54	93.0	143.92
Reach3.5	0.646	Downstream	1.975	129.68	12.54	93.0	143.92
SA4	0.127		1.864		12.45	118.7	933.53
Reach3	0.127	Upstream	1.864	137.05	12.45	118.7	933.53
Reach3	0.127	Downstream	1.864	137.01	12.94	107.6	846.35
Reach2	0.773	Upstream	1.957	130.16	12.86	175.1	226.44
Reach2	0.773	Downstream	1.957	130.16	12.94	174.8	226.05
SA2	0.179		1.348		12.42	130.3	726.48
Reach1	0.952	Upstream	1.842	108.08	12.57	233.3	244.96

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach1	0.952	Downstream	1.842	108.07	12.86	231.0	242.55
SA1	0.154		0.883		12.25	99.5	644.94
OUTLET	1.107		1.708		12.75	255.2	230.62

STORM 2_yr_sm

Area or Reach	Drainage Area	Rain Gage ID or	Runoff Amount	Peak Flow Elevation	Peak Flow Time	Peak Flow Rate	Peak Flow Rate

Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		2.450		12.73	247.1	861.74
Reach6	0.287	Upstream	2.450	143.39	12.73	247.1	861.74
Reach6	0.287	Downstream	2.450	143.28	13.00	241.2	841.06
SA5	0.083		2.732		12.60	87.6	1056.22
SA6	0.149		3.037		12.64	166.5	1116.43
Reach8	0.149	Upstream	3.037		12.64	166.5	1116.43
Reach8	0.149	Downstream	3.032	142.86	18.68	4.5	30.45
Reach7	0.149	Upstream	3.032	140.71	18.68	4.5	30.45
Reach7	0.149	Downstream	3.032	140.71	18.80	4.5	30.45
Reach5	0.519	Upstream	2.662		12.89	305.0	587.86
Reach5	0.519	Downstream	2.661	141.81	17.62	19.2	36.94
Reach4	0.519	Upstream	2.661	134.37	17.62	19.2	36.94
Reach4	0.519	Downstream	2.661	134.37	17.74	19.2	36.94
SA3	0.127		2.187		12.57	118.0	927.92
Reach3.5	0.646	Upstream	2.568	129.87	12.57	121.8	188.50
Reach3.5	0.646	Downstream	2.568	129.87	12.57	121.8	188.50
SA4	0.127		2.450		12.46	150.0	1179.39
Reach3	0.127	Upstream	2.450	137.17	12.46	150.0	1179.39
Reach3	0.127	Downstream	2.450	137.12	12.91	137.0	1077.00

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach2	0.773	Upstream	2.549	130.40	12.83	228.7	295.83
Reach2	0.773	Downstream	2.549	130.40	12.91	228.4	295.38
SA2	0.179		1.865		12.39	175.6	978.92
Reach1	0.952	Upstream	2.420	108.40	12.53	315.7	331.45
Reach1	0.952	Downstream	2.420	108.39	12.85	312.0	327.56
SA1	0.154		1.309		12.24	146.4	949.06
OUTLET	1.107		2.265		12.78	345.6	312.25

STORM 5_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		3.409		12.73	321.0	1119.63
Reach6	0.287	Upstream	3.409	144.10	12.73	321.0	1119.63
Reach6	0.287	Downstream	3.409	144.06	13.07	306.8	1069.84
SA5	0.083		3.719		12.62	110.1	1327.77
SA6	0.149		4.043		12.61	205.1	1375.79

Reach8	0.149	Upstream	4.043		12.61	205.1	1375.79
Reach8	0.149	Downstream	4.038	143.28	14.77	20.2	135.15
Reach7	0.149	Upstream	4.038	142.36	14.77	20.2	135.15
Reach7	0.149	Downstream	4.038	142.36	14.89	20.1	135.13
Reach5	0.519	Upstream	3.639		12.96	381.2	734.78
Reach5	0.519	Downstream	3.639	142.70	14.52	100.0	192.79
Reach4	0.519	Upstream	3.639	137.79	14.52	100.0	192.79
Reach4	0.519	Downstream	3.639	137.78	14.58	99.9	192.47
SA3	0.127		3.114		12.56	156.2	1227.74
Reach3.5	0.646	Upstream	3.535	130.10	12.56	164.0	253.81

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach3.5	0.646	Downstream	3.535	130.10	12.56	164.0	253.81
SA4	0.127		3.409		12.42	191.4	1505.13
Reach3	0.127	Upstream	3.409	137.33	12.42	191.4	1505.13
Reach3	0.127	Downstream	3.409	137.27	12.88	176.2	1385.32
Reach2	0.773	Upstream	3.515	130.64	12.80	305.5	395.15
Reach2	0.773	Downstream	3.515	130.64	12.88	305.1	394.59
SA2	0.179		2.742		12.39	239.1	1333.19
Reach1	0.952	Upstream	3.369	108.88	12.54	438.4	460.30
Reach1	0.952	Downstream	3.369	108.86	12.86	432.5	454.04
SA1	0.154		2.065		12.25	212.6	1378.10
OUTLET	1.107		3.187		12.79	481.1	434.67

STORM 10_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		4.204		12.74	385.3	1343.94
Reach6	0.287	Upstream	4.204	144.25	12.74	385.3	1343.94
Reach6	0.287	Downstream	4.204	144.21	13.01	369.3	1287.90
SA5	0.083		4.529		12.61	130.2	1569.99
SA6	0.149		4.866		12.61	239.7	1607.57
Reach8	0.149	Upstream	4.866		12.61	239.7	1607.57
Reach8	0.149	Downstream	4.860	143.63	14.71	25.0	167.45
Reach7	0.149	Upstream	4.860	142.81	14.71	25.0	167.45
Reach7	0.149	Downstream	4.860	142.81	14.83	25.0	167.43
Reach5	0.519	Upstream	4.445		12.96	461.6	889.75
Reach5	0.519	Downstream	4.444	143.16	13.94	199.4	384.37

Smithfield Resiliency Plan
Existing Conditions

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach4	0.519	Upstream	4.444	139.47	13.94	199.4	384.37
Reach4	0.519	Downstream	4.444	139.46	14.17	197.8	381.18
SA3	0.127		3.889		12.52	189.3	1488.42
Reach3.5	0.646	Upstream	4.335	130.38	14.11	224.0	346.76
Reach3.5	0.646	Downstream	4.335	130.38	14.11	224.0	346.76
SA4	0.127		4.204		12.46	228.0	1793.11
Reach3	0.127	Upstream	4.204	137.46	12.46	228.0	1793.11
Reach3	0.127	Downstream	4.204	137.40	12.87	210.9	1658.78
Reach2	0.773	Upstream	4.313	130.82	12.79	369.8	478.35
Reach2	0.773	Downstream	4.313	130.82	12.83	369.1	477.38
SA2	0.179		3.485		12.40	294.6	1642.89
Reach1	0.952	Upstream	4.157	109.10	12.55	544.2	571.37
Reach1	0.952	Downstream	4.157	109.09	12.84	536.1	562.80
SA1	0.154		2.728		12.23	273.1	1770.22
OUTLET	1.107		3.958		12.75	602.5	544.36

STORM 25_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		5.347		12.67	463.4	1616.20
Reach6	0.287	Upstream	5.347	144.44	12.67	463.4	1616.20
Reach6	0.287	Downstream	5.347	144.40	13.01	446.3	1556.42
SA5	0.083		5.690		12.61	153.7	1853.32
SA6	0.149		6.038		12.62	280.0	1877.55
Reach8	0.149	Upstream	6.038		12.62	280.0	1877.55
Reach8	0.149	Downstream	6.032	144.14	14.71	31.4	210.70

Smithfield Resiliency Plan
Existing Conditions

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach7	0.149	Upstream	6.032	143.18	14.71	31.4	210.70
Reach7	0.149	Downstream	6.032	143.18	14.89	31.4	210.68

Reach5	0.519	Upstream	5.599		12.96	563.5	1086.25
Reach5	0.519	Downstream	5.597	143.58	13.54	371.9	716.94
Reach4	0.519	Upstream	5.597	140.67	13.54	371.9	716.94
Reach4	0.519	Downstream	5.597	140.50	13.94	347.9	670.66
SA3	0.127		5.011		12.55	229.6	1804.96
Reach3.5	0.646	Upstream	5.482	130.87	13.93	387.7	600.21
Reach3.5	0.646	Downstream	5.482	130.87	13.93	387.7	600.21
SA4	0.127		5.347		12.44	271.1	2131.84
Reach3	0.127	Upstream	5.347	137.63	12.44	271.1	2131.84
Reach3	0.127	Downstream	5.347	137.55	12.86	251.7	1979.37
Reach2	0.773	Upstream	5.459	131.01	12.78	447.3	578.53
Reach2	0.773	Downstream	5.459	131.01	12.82	446.7	577.75
SA2	0.179		4.570		12.38	361.1	2013.29
Reach1	0.952	Upstream	5.292	109.29	12.52	674.5	708.18
Reach1	0.952	Downstream	5.292	109.27	12.81	664.8	697.98
SA1	0.154		3.721		12.23	345.9	2242.28
OUTLET	1.107		5.073		12.70	761.1	687.67

STORM 50_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		6.304		12.72	526.8	1837.44
Reach6	0.287	Upstream	6.304	144.59	12.72	526.8	1837.44
Reach6	0.287	Downstream	6.304	144.55	13.00	509.8	1777.89

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA5	0.083		6.657		12.58	172.6	2080.12
SA6	0.149		7.013		12.64	311.9	2091.94
Reach8	0.149	Upstream	7.013		12.64	311.9	2091.94
Reach8	0.149	Downstream	7.007	144.57	14.73	35.6	238.52
Reach7	0.149	Upstream	7.007	143.34	14.73	35.6	238.52
Reach7	0.149	Downstream	7.007	143.34	15.03	35.6	238.49
Reach5	0.519	Upstream	6.563		12.92	650.5	1253.95
Reach5	0.519	Downstream	6.562	143.78	13.33	515.9	994.41
Reach4	0.519	Upstream	6.562	141.12	13.33	515.9	994.41
Reach4	0.519	Downstream	6.562	141.08	13.73	484.8	934.42
SA3	0.127		5.954		12.54	261.2	2053.24
Reach3.5	0.646	Upstream	6.443	131.09	13.72	544.0	842.04
Reach3.5	0.646	Downstream	6.443	131.09	13.72	544.0	842.04

SA4	0.127		6.304		12.43	304.2	2392.04
Reach3	0.127	Upstream	6.304	137.75	12.43	304.2	2392.04
Reach3	0.127	Downstream	6.304	137.67	12.85	283.6	2230.35
Reach2	0.773	Upstream	6.420	131.15	13.67	633.4	819.21
Reach2	0.773	Downstream	6.420	131.15	13.71	632.3	817.83
SA2	0.179		5.490		12.39	412.8	2301.83
Reach1	0.952	Upstream	6.245	109.43	12.53	781.9	820.94
Reach1	0.952	Downstream	6.245	109.42	12.78	772.1	810.64
SA1	0.154		4.578		12.24	400.0	2592.80
OUTLET	1.107		6.013		12.68	896.7	810.24

STORM 100_yr_sm

Smithfield Resiliency Plan
Existing Conditions

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		7.325		12.71	590.7	2060.13
Reach6	0.287	Upstream	7.325	144.75	12.71	590.7	2060.13
Reach6	0.287	Downstream	7.325	144.71	12.98	573.6	2000.39
SA5	0.083		7.687		12.60	191.8	2311.57
SA6	0.149		8.049		12.60	345.3	2315.72
Reach8	0.149	Upstream	8.049		12.60	345.3	2315.72
Reach8	0.149	Downstream	8.044	145.01	14.82	39.9	267.72
Reach7	0.149	Upstream	8.044	143.52	14.82	39.9	267.72
Reach7	0.149	Downstream	8.043	143.52	15.18	39.9	267.66
Reach5	0.519	Upstream	7.590		12.95	734.4	1415.63
Reach5	0.519	Downstream	7.588	143.96	13.23	639.7	1232.96
Reach4	0.519	Upstream	7.588	141.27	13.23	639.7	1232.96
Reach4	0.519	Downstream	7.588	141.23	13.58	609.3	1174.40
SA3	0.127		6.963		12.54	293.1	2304.59
Reach3.5	0.646	Upstream	7.465	131.20	13.57	691.9	1071.09
Reach3.5	0.646	Downstream	7.465	131.20	13.57	691.9	1071.09
SA4	0.127		7.325		12.43	337.4	2653.72
Reach3	0.127	Upstream	7.325	137.88	12.43	337.4	2653.72
Reach3	0.127	Downstream	7.325	137.79	12.84	315.9	2484.30
Reach2	0.773	Upstream	7.442	131.30	13.46	824.4	1066.25
Reach2	0.773	Downstream	7.442	131.30	13.54	823.8	1065.56
SA2	0.179		6.479		12.38	464.6	2590.53
Reach1	0.952	Upstream	7.261	109.61	13.50	911.8	957.30
Reach1	0.952	Downstream	7.261	109.60	13.71	901.5	946.43
SA1	0.154		5.511		12.22	455.8	2954.57

OUTLET	1.107		7.017		12.67	1033.7	934.03

STORM 200_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA7	0.287		8.429		12.69	652.4	2275.48
Reach6	0.287	Upstream	8.429	144.90	12.69	652.4	2275.48
Reach6	0.287	Downstream	8.429	144.86	12.97	635.6	2216.81
SA5	0.083		8.799		12.62	210.0	2531.11
SA6	0.149		9.166		12.60	377.3	2530.39
Reach8	0.149	Upstream	9.166		12.60	377.3	2530.39
Reach8	0.149	Downstream	9.159	145.10	13.62	131.2	879.62
Reach7	0.149	Upstream	9.159	144.36	13.62	131.2	879.62
Reach7	0.149	Downstream	9.159	144.31	14.10	119.3	800.28
Reach5	0.519	Upstream	8.698		12.90	821.0	1582.49
Reach5	0.519	Downstream	8.697	144.09	13.14	767.6	1479.53
Reach4	0.519	Upstream	8.697	141.43	13.14	767.6	1479.53
Reach4	0.519	Downstream	8.697	141.38	13.42	729.3	1405.84
SA3	0.127		8.056		12.51	324.0	2547.40
Reach3.5	0.646	Upstream	8.570	131.32	13.39	843.0	1304.98
Reach3.5	0.646	Downstream	8.570	131.32	13.39	843.0	1304.97
SA4	0.127		8.429		12.44	369.7	2907.71
Reach3	0.127	Upstream	8.429	138.00	12.44	369.7	2907.71
Reach3	0.127	Downstream	8.429	137.91	12.86	347.2	2730.49
Reach2	0.773	Upstream	8.547	131.46	13.35	1028.2	1329.82
Reach2	0.773	Downstream	8.547	131.46	13.39	1027.5	1329.03
SA2	0.179		7.554		12.38	515.2	2872.51
Reach1	0.952	Upstream	8.360	109.95	13.36	1151.8	1209.30
Reach1	0.952	Downstream	8.360	109.93	13.54	1141.9	1198.91
SA1	0.154		6.535		12.23	510.0	3306.13

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
OUTLET	1.107		8.106		13.50	1206.4	1090.03

Existing Conditions

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 1_yr_sm (cfs)	2_yr_sm (cfs)	5_yr_sm (cfs)	10_yr_sm (cfs)	25_yr_sm (cfs)
SA1	0.154	99.5	146.4	212.6	273.1	345.9
SA2	0.179	130.3	175.6	239.1	294.6	361.1
SA3	0.127	90.3	118.0	156.2	189.3	229.6
SA4	0.127	118.7	150.0	191.4	228.0	271.1
SA5	0.083	70.7	87.6	110.1	130.2	153.7
SA7	0.287	193.8	247.1	321.0	385.3	463.4
SA6	0.149	137.7	166.5	205.1	239.7	280.0
Reach1	0.952	233.3	315.7	438.4	544.2	674.5
DOWNSTREAM		231.0	312.0	432.5	536.1	664.8
Reach2	0.773	175.1	228.7	305.5	369.8	447.3
DOWNSTREAM		174.8	228.4	305.1	369.1	446.7
Reach3	0.127	118.7	150.0	191.4	228.0	271.1
DOWNSTREAM		107.6	137.0	176.2	210.9	251.7
Reach4	0.519	15.7	19.2	100.0	199.4	371.9
DOWNSTREAM		15.7	19.2	99.9	197.8	347.9
Reach5	0.519	255.6	305.0	381.2	461.6	563.5
DOWNSTREAM		15.7	19.2	100.0	199.4	371.9
Reach6	0.287	193.8	247.1	321.0	385.3	463.4
DOWNSTREAM		193.2	241.2	306.8	369.3	446.3
Reach7	0.149	3.6	4.5	20.2	25.0	31.4
DOWNSTREAM		3.6	4.5	20.1	25.0	31.4
Reach8	0.149	137.7	166.5	205.1	239.7	280.0
DOWNSTREAM		3.6	4.5	20.2	25.0	31.4
Reach3.5	0.646	93.0	121.8	164.0	224.0	387.7
DOWNSTREAM		93.0	121.8	164.0	224.0	387.7
OUTLET	1.107	255.2	345.6	481.1	602.5	761.1

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 50_yr_sm (cfs)	100_yr_sm (cfs)	200_yr_sm (cfs)	(cfs)	(cfs)
SA1	0.154	400.0	455.8	510.0		
SA2	0.179	412.8	464.6	515.2		
SA3	0.127	261.2	293.1	324.0		
SA4	0.127	304.2	337.4	369.7		
SA5	0.083	172.6	191.8	210.0		
SA7	0.287	526.8	590.7	652.4		
SA6	0.149	311.9	345.3	377.3		
Reach1	0.952	781.9	911.8	1151.8		
DOWNSTREAM		772.1	901.5	1141.9		
Reach2	0.773	633.4	824.4	1028.2		
DOWNSTREAM		632.3	823.8	1027.5		
Reach3	0.127	304.2	337.4	369.7		
DOWNSTREAM		283.6	315.9	347.2		

Reach4	0.519	515.9	639.7	767.6
DOWNSTREAM		484.8	609.3	729.3
Reach5	0.519	650.5	734.4	821.0
DOWNSTREAM		515.9	639.7	767.6
Reach6	0.287	526.8	590.7	652.4
DOWNSTREAM		509.8	573.6	635.6

Smithfield Resiliency Plan
Existing Conditions

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 50_yr_sm (cfs)	100_yr_sm (cfs)	200_yr_sm (cfs)	(cfs)	(cfs)
Reach7	0.149	35.6	39.9	131.2		
DOWNSTREAM		35.6	39.9	119.3		
Reach8	0.149	311.9	345.3	377.3		
DOWNSTREAM		35.6	39.9	131.2		
Reach3.5	0.646	544.0	691.9	843.0		
DOWNSTREAM		544.0	691.9	843.0		
OUTLET	1.107	896.7	1033.7	1206.4		

APPENDIX A.2

HYDROLOGIC MODELING

Proposed Conditions - Underground Facilities

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

WinTR-20 Printed Page File Beginning of Input Data List
C:\Users\calutz\Desktop\Pr UG1 only Bypass to pond.inp

WinTR-20: version 3.30 0 0 0.01 0 ,

Smithfield Resiliency Plan
Pr Underground Facilities with Ex Ponds - Flowsplitters - UG1 Bypass to Pond

SUB-AREA:

SA1	Outlet	0.15426	74.	0.306
SA2	Reach1	0.17934	82.	0.571
SA3	Reach3.5	0.127196	86.	0.812
SA4	Reach3	0.12716	89.	0.655
SA5	Reach5	0.082954	92.	0.914
SA7	UG1 - FS	0.28673	89.	1.076
SA6	Reach8	0.14911	95.	0.948

STREAM REACH:

Reach1	Outlet	XS1		2700.		
Reach2	Reach1	XS2		1775.		
Reach3	Reach2	XS3		1100.		
Reach4	Reach3.5	XS4		1500.		
Reach5	Reach4		CollegePon			
Reach6	Reach5	XS6		1500.		
Reach7	Reach5	XS7		1400.		
Reach8	Reach7		I95Pond			
UG1	Reach5		UG1			
UG1 - FS	UG1	UG1A Bypas		400.		
	SPLIT FLOW	Reach6		104.	1000.	1.
Reach3.5	Reach2	XS2		1.		

STORM ANALYSIS:

1_yr_sm	2.960	1_yr_sm	2	3.600
2_yr_sm	3.600	2_yr_sm	2	

5_yr_sm			4.620	5_yr_sm	2
10_yr_sm			5.450	10_yr_sm	2
25_yr_sm			6.630	25_yr_sm	2
50_yr_sm			7.610	50_yr_sm	2
100_yr_sm			8.650	100_yr_sm	2
200_yr_sm			9.770	200_yr_sm	2

STREAM CROSS SECTION:

XS1	107.		105.		
	105.	0.	0.	0.	0.003
	105.25	0.47	0.7	4.75	0.003
	105.5	2.35	2.4	8.5	0.003
	105.75	6.3	5.	12.25	0.003
	106.	12.89	8.5	16.	0.003
	106.25	22.66	13.	19.75	0.003
	106.5	36.06	18.4	23.5	0.003
	106.75	53.56	24.7	27.25	0.003
	107.	75.57	32.	31.	0.003
	107.5	129.19	50.8	44.	0.003
	108.	213.22	76.	57.	0.003
	109.	469.27	177.	145.	0.003
	110.	1189.26	344.5	190.	0.003
	111.	2296.08	557.5	236.	0.003
XS2	128.		130.5		
	128.	0.	0.	0.	0.01
	128.25	1.75	1.1	5.5	0.01
	128.5	6.63	2.8	8.	0.01
	128.75	15.27	5.1	10.5	0.01
	129.	28.38	8.0	13.	0.01
	129.25	44.64	11.8	17.5	0.01
	129.5	68.64	16.8	22.	0.01
	129.75	101.52	22.8	26.5	0.01
	130.	144.40	30.0	31.	0.01
	130.25	191.70	38.7	38.25	0.01
	130.5	254.75	49.1	45.5	0.01
	131.	433.96	75.5	60.	0.01
	132.	1722.72	243.7	249.67	0.01
	133.	4164.78	529.	339.	0.01
XS3	136.		134.		
	134.	0.	0.	0.	0.01
	134.25	0.27	1.4	8.5	0.01
	134.5	1.19	4.3	14.	0.01
	134.75	2.98	8.4	19.5	0.01
	135.	5.87	14.	25.	0.01
	135.25	9.97	21.	31.25	0.01
	135.5	15.63	29.6	37.5	0.01
	135.75	23.05	39.8	43.75	0.01
	136.	32.43	51.5	50.	0.01
	136.5	48.6	99.	140.	0.01

	137.	104.86	191.5	230.	0.01
	138.	370.34	560.	507.	0.01
	139.	1126.24	1109.5	592.	0.01
	140.	2144.77	1751.5	692.	0.01
XS4	139.		133.		
	133.	0.	0.	0.	0.005
	133.5	4.19	1.67	5.	0.005
	134.	11.99	5.	5.	0.005
	134.5	21.57	7.5	5.	0.005
	135.	32.2	10.	5.	0.005
	135.5	43.54	12.5	5.	0.005
	136.	55.37	15.	5.	0.005
	136.5	67.56	17.5	5.	0.005
	137.	80.01	20.	5.	0.005
	137.5	92.68	22.5	5.	0.005
	138.	105.5	25.	5.	0.005
	138.5	118.45	27.5	5.	0.005
	139.	131.52	30.	5.	0.005
	141.	419.97	375.	340.	0.005
	142.	1226.44	715.	340.	0.005
	143.	2336.36	1055.	340.	0.005
	144.	3707.38	1395.0	340.	0.005
XS6	136.		142.		
	136.	0.	0.	0.	0.005
	136.5	5.12	3.	6.	0.005
	137.	14.87	6.	6.	0.005
	138.	40.68	12.	6.	0.005
	139.	70.81	18.	6.	0.005
	140.	103.2	24.	6.	0.005
	141.	136.94	30.	6.	0.005
	142.	171.55	36.	99.	0.005
	144.	280.45	234.	192.	0.005
	145.	695.21	472.5	285.	0.005
	146.	1396.72	804.	378.	0.005
	147.	2645.56	1182.	378.	0.005
XS7	143.		140.		
	140.	0.	0.	0.	0.005
	141.	6.41	3.	3.	0.005
	142.	16.25	6.	3.	0.005
	143.	27.02	9.	3.	0.005
	144.	51.84	70.3	119.67	0.005
	145.	269.62	248.3	236.33	0.005
	146.	760.1	543.	353.	0.005
	147.	1744.82	896.	353.	0.005
	148.	3023.76	1249.0	353.	0.005
UG1A Bypas	144.		139.		
	139.	0.	0.	0.	0.01
	140.	23.07	7.2	10.7	0.01
	141.	100.99	21.4	17.7	0.01
	142.	254.37	42.6	24.7	0.01

	143.	501.83	70.8	31.7	0.01
	144.	863.12	105.8	38.3	0.01
	145.	1189.47	157.3	64.6	0.01
	146.	1620.11	266.6	154.	0.01

STRUCTURE RATING:

I95Pond	140.5		
	140.5	0.	0.
	143.1	5.	22.276
	143.16	10.	22.982
	143.27	20.	24.087
	144.	30.	32.269
	145.02	40.	44.999
	145.03	50.	45.137
	145.04	60.	45.278
	145.05	70.	45.422
	145.06	80.	45.569
	145.07	90.	45.719
	145.08	100.	45.871
	145.09	110.	46.027
	145.1	130.	46.185
	145.11	140.	46.346
	145.12	160.	46.509
	145.13	170.	46.676
	145.14	190.	46.845
	145.15	210.	47.017
	145.16	220.	47.192
	145.17	240.	47.370
	145.18	260.	47.551
	145.19	280.	47.734
	145.2	300.	47.920
	145.21	320.	48.109
	145.22	340.	48.301
	145.23	360.	48.496
	145.24	370.	48.693
CollegePon	137.		
	137.	0.	0.
	138.22	5.	9.267
	138.8	10.	13.799
	142.08	20.	40.845
	142.21	30.	41.969
	142.31	40.	42.837
	142.39	50.	43.534
	142.46	60.	44.145
	142.53	70.	44.758
	142.59	80.	45.284
	142.65	90.	45.811
	142.7	100.	46.252
	142.76	110.	46.781

	142.81	120.	47.223
	142.86	130.	47.665
	142.9	140.	48.02
	142.95	150.	48.464
	142.99	160.	48.819
	143.04	170.	49.265
	143.08	180.	49.622
	143.12	190.	49.98
	143.16	200.	50.339
	143.2	210.	50.699
	143.24	220.	51.06
	143.28	230.	51.422
	143.31	240.	51.694
	143.35	250.	52.057
	143.39	260.	52.421
	143.42	270.	52.694
	143.46	280.	53.060
	143.49	290.	53.335
	143.53	335.92	53.702
	143.56	354.97	53.978
	143.59	377.23	54.254
	143.63	408.90	54.623
	143.66	430.62	54.901
	143.69	452.91	55.179
	143.72	472.48	55.458
	143.75	492.36	55.737
	143.78	515.98	56.016
	143.81	536.53	56.296
	143.84	557.37	56.576
	143.92	608.73	57.327
	143.99	661.56	57.986
	144.04	703.11	58.459
	144.07	740.82	58.745
	144.1	778.78	59.032
	144.13	812.57	59.32
	144.15	846.46	59.513
	144.18	885.01	59.804
	144.19	897.29	59.901
UG1	137.		
	137.	0.	0.
	138.32	5.	2.449
	138.94	10.	3.599
	142.29	20.	9.813
	142.68	30.	10.536
	143.14	40.	11.389
	143.68	50.	12.391
	144.32	60.	13.578
	145.06	70.	14.951
	145.9	80.	16.509
	146.84	90.	18.253

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                147.87    100.      20.163
                148.33    104.      21.017
          UG2   132.5
                132.5     0.        0.
                133.63    5.        1.879
                134.15    10.       2.743
                135.      18.95     4.156



RAINFALL DISTRIBUTION:
          1_yr_sm           0.1
                    0.0     0.000659  0.00131   0.00197   0.00264
                    0.00332 0.00401   0.00471   0.00542   0.00614
                    0.00687 0.00761   0.00836   0.00911   0.00988
                    0.01066 0.01145   0.01224   0.01305   0.01386
                    0.01469 0.01552   0.01637   0.01722   0.01809
                    0.01896 0.01984   0.02074   0.02164   0.02255
                    0.02347 0.02440   0.02534   0.02629   0.02726
                    0.02823 0.02921   0.03019   0.03119   0.03220
                    0.03322 0.03425   0.03529   0.03633   0.03739
                    0.03846 0.03953   0.04062   0.04171   0.04282
                    0.04393 0.04506   0.04619   0.04734   0.04849
                    0.04965 0.05082   0.05201   0.05320   0.05440
                    0.05561 0.05686   0.05815   0.05948   0.06084
                    0.06225 0.06369   0.06517   0.06669   0.06825
                    0.06985 0.07148   0.07316   0.07487   0.07662
                    0.07841 0.08024   0.08211   0.08401   0.08596
                    0.08794 0.08996   0.09202   0.09412   0.09626
                    0.09844 0.10065   0.10291   0.10520   0.10753
                    0.10990 0.11242   0.11510   0.11793   0.12092
                    0.12406 0.12736   0.13081   0.13441   0.13817
                    0.14209 0.14616   0.15038   0.15476   0.15929
                    0.16398 0.16928   0.17520   0.18173   0.18888
                    0.19664 0.20559   0.21575   0.22710   0.23965
                    0.25338 0.27323   0.29413   0.32489   0.37132
                    0.46107 0.62868   0.67511   0.70587   0.72677
                    0.74662 0.76035   0.77290   0.78425   0.79441
                    0.80336 0.81112   0.81827   0.82480   0.83072
                    0.83602 0.84071   0.84524   0.84962   0.85384
                    0.85791 0.86183   0.86559   0.86919   0.87264
                    0.87594 0.87908   0.88207   0.88490   0.88758
                    0.89010 0.89247   0.89480   0.89709   0.89935
                    0.90156 0.90374   0.90588   0.90798   0.91004
                    0.91206 0.91404   0.91599   0.91789   0.91976
                    0.92159 0.92338   0.92513   0.92684   0.92852
                    0.93015 0.93175   0.93331   0.93483   0.93631
                    0.93775 0.93916   0.94052   0.94185   0.94314
                    0.94439 0.94560   0.94680   0.94799   0.94918
```

0.95035 0.95151 0.95266 0.95381 0.95494
0.95607 0.95718 0.95829 0.95938 0.96047
0.96154 0.96261 0.96367 0.96471 0.96575
0.96678 0.96780 0.96881 0.96981 0.97079
0.97177 0.97274 0.97370 0.97466 0.97560
0.97653 0.97745 0.97836 0.97926 0.98016
0.98104 0.98191 0.98278 0.98363 0.98448
0.98531 0.98614 0.98695 0.98776 0.98855
0.98934 0.99012 0.99089 0.99164 0.99239
0.99313 0.99386 0.99458 0.99529 0.99599
0.99668 0.99736 0.99803 0.99869 0.999341
1.0

2_yr_sm 0.1
0.0 0.000689 0.00137 0.00207 0.00277
0.00348 0.00420 0.00494 0.00568 0.00643
0.00719 0.00797 0.00875 0.00954 0.01034
0.01116 0.01198 0.01281 0.01365 0.01450
0.01536 0.01624 0.01712 0.01801 0.01891
0.01982 0.02074 0.02167 0.02261 0.02356
0.02452 0.02550 0.02648 0.02747 0.02847
0.02948 0.03050 0.03153 0.03257 0.03362
0.03468 0.03575 0.03683 0.03792 0.03902
0.04013 0.04124 0.04237 0.04351 0.04466
0.04582 0.04699 0.04817 0.04936 0.05056
0.05176 0.05298 0.05421 0.05545 0.05670
0.05796 0.05925 0.06059 0.06197 0.06338
0.06484 0.06634 0.06787 0.06945 0.07106
0.07272 0.07441 0.07615 0.07792 0.07973
0.08159 0.08348 0.08541 0.08738 0.08939
0.09144 0.09354 0.09567 0.09784 0.10005
0.10230 0.10458 0.10691 0.10928 0.11169
0.11414 0.11674 0.11950 0.12241 0.12548
0.12870 0.13208 0.13561 0.13930 0.14314
0.14713 0.15129 0.15559 0.16005 0.16467
0.16944 0.17482 0.18081 0.18741 0.19462
0.20244 0.21148 0.22172 0.23318 0.24585
0.25972 0.27984 0.30102 0.33152 0.37679
0.46334 0.62321 0.66848 0.69898 0.72016
0.74028 0.75415 0.76682 0.77828 0.78852
0.79756 0.80538 0.81259 0.81919 0.82518
0.83056 0.83533 0.83995 0.84441 0.84871
0.85287 0.85686 0.86070 0.86439 0.86792
0.87130 0.87452 0.87759 0.88050 0.88326
0.88586 0.88831 0.89072 0.89309 0.89542
0.89770 0.89995 0.90216 0.90433 0.90646
0.90856 0.91061 0.91262 0.91459 0.91652
0.91841 0.92027 0.92208 0.92385 0.92559
0.92728 0.92894 0.93055 0.93213 0.93366
0.93516 0.93662 0.93803 0.93941 0.94075
0.94204 0.94330 0.94455 0.94579 0.94702

0.94824 0.94944 0.95064 0.95183 0.95301
0.95418 0.95534 0.95649 0.95763 0.95876
0.95987 0.96098 0.96208 0.96317 0.96425
0.96532 0.96638 0.96743 0.96847 0.96950
0.97052 0.97153 0.97253 0.97352 0.97450
0.97548 0.97644 0.97739 0.97833 0.97926
0.98018 0.98109 0.98199 0.98288 0.98376
0.98464 0.98550 0.98635 0.98719 0.98802
0.98884 0.98966 0.99046 0.99125 0.99203
0.99281 0.99357 0.99432 0.99506 0.99580
0.99652 0.99723 0.99793 0.99863 0.999310
1.0

5_yr_sm 0.1
0.0 0.000742 0.00147 0.00221 0.00296
0.00372 0.00449 0.00527 0.00606 0.00686
0.00767 0.00849 0.00933 0.01017 0.01102
0.01188 0.01276 0.01364 0.01453 0.01544
0.01635 0.01728 0.01821 0.01916 0.02012
0.02108 0.02206 0.02305 0.02404 0.02505
0.02607 0.02710 0.02814 0.02919 0.03025
0.03132 0.03240 0.03349 0.03459 0.03570
0.03682 0.03795 0.03910 0.04025 0.04141
0.04259 0.04377 0.04496 0.04617 0.04738
0.04861 0.04984 0.05109 0.05235 0.05361
0.05489 0.05618 0.05747 0.05878 0.06010
0.06143 0.06280 0.06421 0.06566 0.06716
0.06869 0.07027 0.07189 0.07355 0.07525
0.07699 0.07878 0.08060 0.08247 0.08438
0.08633 0.08832 0.09035 0.09242 0.09454
0.09669 0.09889 0.10113 0.10341 0.10573
0.10810 0.11050 0.11295 0.11543 0.11796
0.12053 0.12327 0.12616 0.12922 0.13244
0.13582 0.13937 0.14307 0.14694 0.15097
0.15517 0.15952 0.16404 0.16873 0.17357
0.17857 0.18422 0.19051 0.19743 0.20499
0.21320 0.22264 0.23331 0.24522 0.25837
0.27273 0.29342 0.31520 0.34596 0.39016
0.47010 0.60984 0.65404 0.68480 0.70658
0.72727 0.74163 0.75478 0.76669 0.77736
0.78680 0.79501 0.80257 0.80949 0.81578
0.82143 0.82643 0.83127 0.83596 0.84048
0.84483 0.84903 0.85306 0.85693 0.86063
0.86418 0.86756 0.87078 0.87384 0.87673
0.87947 0.88204 0.88457 0.88705 0.88950
0.89190 0.89427 0.89659 0.89887 0.90111
0.90331 0.90546 0.90758 0.90965 0.91168
0.91367 0.91562 0.91753 0.91940 0.92122
0.92301 0.92475 0.92645 0.92811 0.92973
0.93131 0.93284 0.93434 0.93579 0.93720
0.93857 0.93990 0.94122 0.94253 0.94382

	0.94511	0.94639	0.94765	0.94891	0.95016
	0.95139	0.95262	0.95383	0.95504	0.95623
	0.95741	0.95859	0.95975	0.96090	0.96205
	0.96318	0.96430	0.96541	0.96651	0.96760
	0.96868	0.96975	0.97081	0.97186	0.97290
	0.97393	0.97495	0.97596	0.97695	0.97794
	0.97892	0.97988	0.98084	0.98179	0.98272
	0.98365	0.98456	0.98547	0.98636	0.98724
	0.98812	0.98898	0.98983	0.99067	0.99151
	0.99233	0.99314	0.99394	0.99473	0.99551
	0.99628	0.99704	0.99779	0.99853	0.999258
	1.0				
10_yr_sm		0.1			
	0.0	0.000735	0.00146	0.00220	0.00295
	0.00371	0.00448	0.00525	0.00605	0.00685
	0.00766	0.00848	0.00931	0.01015	0.01101
	0.01187	0.01275	0.01363	0.01453	0.01543
	0.01635	0.01728	0.01822	0.01917	0.02012
	0.02109	0.02207	0.02307	0.02407	0.02508
	0.02610	0.02713	0.02818	0.02923	0.03030
	0.03137	0.03246	0.03355	0.03466	0.03578
	0.03691	0.03804	0.03919	0.04035	0.04152
	0.04270	0.04389	0.04510	0.04631	0.04753
	0.04877	0.05001	0.05126	0.05253	0.05380
	0.05509	0.05639	0.05769	0.05901	0.06034
	0.06168	0.06306	0.06448	0.06595	0.06746
	0.06901	0.07060	0.07223	0.07391	0.07563
	0.07739	0.07919	0.08104	0.08293	0.08486
	0.08683	0.08884	0.09090	0.09300	0.09514
	0.09732	0.09955	0.10182	0.10413	0.10648
	0.10887	0.11131	0.11379	0.11631	0.11887
	0.12148	0.12425	0.12718	0.13028	0.13354
	0.13697	0.14056	0.14432	0.14824	0.15233
	0.15658	0.16100	0.16558	0.17033	0.17524
	0.18031	0.18603	0.19240	0.19942	0.20709
	0.21540	0.22500	0.23587	0.24802	0.26145
	0.27615	0.29742	0.31982	0.35082	0.39455
	0.47219	0.60545	0.64918	0.68018	0.70258
	0.72385	0.73855	0.75198	0.76413	0.77500
	0.78460	0.79291	0.80058	0.80760	0.81397
	0.81969	0.82476	0.82967	0.83442	0.83900
	0.84342	0.84767	0.85176	0.85568	0.85944
	0.86303	0.86646	0.86972	0.87282	0.87575
	0.87852	0.88113	0.88369	0.88621	0.88869
	0.89113	0.89352	0.89587	0.89818	0.90045
	0.90268	0.90486	0.90700	0.90910	0.91116
	0.91317	0.91514	0.91707	0.91896	0.92081
	0.92261	0.92437	0.92609	0.92777	0.92940
	0.93099	0.93254	0.93405	0.93552	0.93694
	0.93832	0.93966	0.94099	0.94231	0.94361

	0.94491	0.94620	0.94747	0.94874	0.94999
	0.95123	0.95247	0.95369	0.95490	0.95611
	0.95730	0.95848	0.95965	0.96081	0.96196
	0.96309	0.96422	0.96534	0.96645	0.96754
	0.96863	0.96970	0.97077	0.97182	0.97287
	0.97390	0.97492	0.97593	0.97693	0.97793
	0.97891	0.97988	0.98083	0.98178	0.98272
	0.98365	0.98457	0.98547	0.98637	0.98725
	0.98813	0.98899	0.98985	0.99069	0.99152
	0.99234	0.99315	0.99395	0.99475	0.99552
	0.99629	0.99705	0.99780	0.99854	0.999265
	1.0				
25_yr_sm		0.1			
	0.0	0.000796	0.00158	0.00237	0.00317
	0.00398	0.00480	0.00563	0.00648	0.00733
	0.00820	0.00907	0.00996	0.01086	0.01177
	0.01269	0.01362	0.01456	0.01551	0.01647
	0.01745	0.01843	0.01943	0.02043	0.02145
	0.02247	0.02351	0.02456	0.02562	0.02669
	0.02777	0.02887	0.02997	0.03108	0.03221
	0.03334	0.03449	0.03564	0.03681	0.03799
	0.03918	0.04038	0.04159	0.04281	0.04404
	0.04529	0.04654	0.04781	0.04908	0.05037
	0.05167	0.05297	0.05429	0.05562	0.05696
	0.05831	0.05967	0.06105	0.06243	0.06382
	0.06523	0.06668	0.06817	0.06970	0.07128
	0.07290	0.07457	0.07627	0.07802	0.07982
	0.08165	0.08353	0.08546	0.08742	0.08943
	0.09148	0.09358	0.09572	0.09790	0.10012
	0.10239	0.10470	0.10706	0.10946	0.11190
	0.11438	0.11691	0.11948	0.12209	0.12475
	0.12745	0.13032	0.13335	0.13656	0.13993
	0.14347	0.14718	0.15106	0.15510	0.15932
	0.16370	0.16825	0.17297	0.17786	0.18291
	0.18814	0.19402	0.20056	0.20777	0.21563
	0.22415	0.23394	0.24501	0.25735	0.27096
	0.28582	0.30721	0.32973	0.36051	0.40306
	0.47600	0.59694	0.63949	0.67027	0.69279
	0.71418	0.72904	0.74265	0.75499	0.76606
	0.77585	0.78437	0.79223	0.79944	0.80598
	0.81186	0.81709	0.82214	0.82703	0.83175
	0.83630	0.84068	0.84490	0.84894	0.85282
	0.85653	0.86007	0.86344	0.86665	0.86968
	0.87255	0.87525	0.87791	0.88052	0.88309
	0.88562	0.88810	0.89054	0.89294	0.89530
	0.89761	0.89988	0.90210	0.90428	0.90642
	0.90852	0.91057	0.91258	0.91454	0.91647
	0.91835	0.92018	0.92198	0.92373	0.92543
	0.92710	0.92872	0.93030	0.93183	0.93332
	0.93477	0.93618	0.93757	0.93895	0.94033

	0.94169	0.94304	0.94438	0.94571	0.94703
	0.94833	0.94963	0.95092	0.95219	0.95346
	0.95471	0.95596	0.95719	0.95841	0.95962
	0.96082	0.96201	0.96319	0.96436	0.96551
	0.96666	0.96779	0.96892	0.97003	0.97113
	0.97223	0.97331	0.97438	0.97544	0.97649
	0.97753	0.97855	0.97957	0.98057	0.98157
	0.98255	0.98353	0.98449	0.98544	0.98638
	0.98731	0.98823	0.98914	0.99004	0.99093
	0.99180	0.99267	0.99352	0.99437	0.99520
	0.99602	0.99683	0.99763	0.99842	0.999204
	1.0				
50_yr_sm		0.1			
	0.0	0.000790	0.00157	0.00236	0.00316
	0.00397	0.00479	0.00563	0.00647	0.00733
	0.00819	0.00907	0.00996	0.01086	0.01177
	0.01270	0.01363	0.01457	0.01553	0.01650
	0.01747	0.01846	0.01946	0.02047	0.02150
	0.02253	0.02357	0.02463	0.02570	0.02677
	0.02786	0.02896	0.03007	0.03119	0.03233
	0.03347	0.03463	0.03579	0.03697	0.03816
	0.03936	0.04057	0.04179	0.04302	0.04427
	0.04552	0.04679	0.04806	0.04935	0.05065
	0.05196	0.05328	0.05462	0.05596	0.05731
	0.05868	0.06006	0.06144	0.06284	0.06425
	0.06568	0.06714	0.06865	0.07020	0.07180
	0.07345	0.07513	0.07686	0.07864	0.08046
	0.08232	0.08423	0.08619	0.08818	0.09023
	0.09231	0.09444	0.09662	0.09884	0.10110
	0.10341	0.10576	0.10816	0.11060	0.11308
	0.11561	0.11818	0.12080	0.12347	0.12617
	0.12892	0.13185	0.13494	0.13821	0.14165
	0.14526	0.14905	0.15300	0.15713	0.16143
	0.16590	0.17055	0.17537	0.18036	0.18552
	0.19085	0.19686	0.20355	0.21091	0.21895
	0.22766	0.23770	0.24906	0.26174	0.27575
	0.29106	0.31319	0.33648	0.36758	0.40944
	0.47892	0.59056	0.63242	0.66352	0.68681
	0.70894	0.72425	0.73826	0.75094	0.76230
	0.77234	0.78105	0.78909	0.79645	0.80314
	0.80915	0.81448	0.81964	0.82463	0.82945
	0.83410	0.83857	0.84287	0.84700	0.85095
	0.85474	0.85835	0.86179	0.86506	0.86815
	0.87108	0.87383	0.87653	0.87920	0.88182
	0.88439	0.88692	0.88940	0.89184	0.89424
	0.89659	0.89890	0.90116	0.90338	0.90556
	0.90769	0.90977	0.91182	0.91381	0.91577
	0.91768	0.91954	0.92136	0.92314	0.92487
	0.92655	0.92820	0.92980	0.93135	0.93286
	0.93432	0.93575	0.93716	0.93856	0.93994

0.94132 0.94269 0.94404 0.94538 0.94672
0.94804 0.94935 0.95065 0.95194 0.95321
0.95448 0.95573 0.95698 0.95821 0.95943
0.96064 0.96184 0.96303 0.96421 0.96537
0.96653 0.96767 0.96881 0.96993 0.97104
0.97214 0.97323 0.97430 0.97537 0.97643
0.97747 0.97850 0.97953 0.98054 0.98154
0.98253 0.98350 0.98447 0.98543 0.98637
0.98730 0.98823 0.98914 0.99004 0.99093
0.99181 0.99267 0.99353 0.99437 0.99521
0.99603 0.99684 0.99764 0.99843 0.999210
1.0

100_yr_sm 0.1
0.0 0.000816 0.00162 0.00243 0.00325
0.00409 0.00494 0.00580 0.00666 0.00754
0.00844 0.00934 0.01025 0.01118 0.01212
0.01306 0.01402 0.01499 0.01598 0.01697
0.01797 0.01899 0.02002 0.02105 0.02210
0.02316 0.02424 0.02532 0.02641 0.02752
0.02864 0.02976 0.03090 0.03206 0.03322
0.03439 0.03557 0.03677 0.03798 0.03920
0.04043 0.04167 0.04292 0.04418 0.04546
0.04674 0.04804 0.04935 0.05067 0.05200
0.05334 0.05469 0.05606 0.05743 0.05882
0.06022 0.06163 0.06305 0.06448 0.06593
0.06738 0.06888 0.07043 0.07202 0.07365
0.07533 0.07706 0.07883 0.08064 0.08250
0.08441 0.08636 0.08835 0.09039 0.09248
0.09461 0.09678 0.09900 0.10127 0.10358
0.10593 0.10833 0.11078 0.11327 0.11581
0.11839 0.12101 0.12368 0.12640 0.12916
0.13197 0.13495 0.13810 0.14143 0.14493
0.14861 0.15246 0.15649 0.16069 0.16507
0.16962 0.17435 0.17924 0.18432 0.18957
0.19499 0.20110 0.20789 0.21536 0.22351
0.23235 0.24253 0.25403 0.26687 0.28105
0.29653 0.31888 0.34240 0.37342 0.41449
0.48104 0.58551 0.62658 0.65760 0.68112
0.70347 0.71895 0.73313 0.74597 0.75747
0.76765 0.77649 0.78464 0.79211 0.79890
0.80501 0.81043 0.81568 0.82076 0.82565
0.83038 0.83493 0.83931 0.84351 0.84754
0.85139 0.85507 0.85857 0.86190 0.86505
0.86803 0.87084 0.87360 0.87632 0.87899
0.88161 0.88419 0.88673 0.88922 0.89167
0.89407 0.89642 0.89873 0.90100 0.90322
0.90539 0.90752 0.90961 0.91165 0.91364
0.91559 0.91750 0.91936 0.92117 0.92294
0.92467 0.92635 0.92798 0.92957 0.93112
0.93262 0.93407 0.93552 0.93695 0.93837

	0.93978	0.94118	0.94257	0.94394	0.94531
	0.94666	0.94800	0.94933	0.95065	0.95196
	0.95326	0.95454	0.95582	0.95708	0.95833
	0.95957	0.96080	0.96202	0.96323	0.96443
	0.96561	0.96678	0.96794	0.96910	0.97024
	0.97136	0.97248	0.97359	0.97468	0.97576
	0.97684	0.97790	0.97895	0.97998	0.98101
	0.98203	0.98303	0.98402	0.98501	0.98598
	0.98694	0.98788	0.98882	0.98975	0.99066
	0.99156	0.99246	0.99334	0.99420	0.99506
	0.99591	0.99675	0.99757	0.99838	0.999184
	1.0				
200_yr_sm		0.1			
	0.0	0.000817	0.00164	0.00248	0.00333
	0.00419	0.00506	0.00594	0.00683	0.00774
	0.00865	0.00958	0.01052	0.01147	0.01244
	0.01341	0.01440	0.01539	0.01640	0.01742
	0.01845	0.01950	0.02055	0.02162	0.02270
	0.02379	0.02489	0.02600	0.02712	0.02826
	0.02940	0.03056	0.03173	0.03291	0.03411
	0.03531	0.03653	0.03775	0.03899	0.04024
	0.04150	0.04278	0.04406	0.04536	0.04667
	0.04799	0.04932	0.05066	0.05201	0.05338
	0.05475	0.05614	0.05754	0.05895	0.06038
	0.06181	0.06326	0.06471	0.06618	0.06766
	0.06915	0.07069	0.07228	0.07391	0.07558
	0.07730	0.07907	0.08088	0.08274	0.08465
	0.08660	0.08860	0.09064	0.09273	0.09487
	0.09705	0.09928	0.10155	0.10387	0.10624
	0.10865	0.11110	0.11361	0.11616	0.11875
	0.12139	0.12408	0.12682	0.12960	0.13242
	0.13529	0.13834	0.14157	0.14498	0.14856
	0.15232	0.15626	0.16038	0.16467	0.16915
	0.17380	0.17863	0.18364	0.18883	0.19419
	0.19973	0.20597	0.21290	0.22053	0.22885
	0.23786	0.24822	0.25990	0.27292	0.28728
	0.30297	0.32526	0.34873	0.37941	0.41952
	0.48301	0.58048	0.62059	0.65127	0.67474
	0.69703	0.71272	0.72708	0.74010	0.75178
	0.76214	0.77115	0.77947	0.78710	0.79403
	0.80027	0.80581	0.81117	0.81636	0.82137
	0.82620	0.83085	0.83533	0.83962	0.84374
	0.84768	0.85144	0.85502	0.85843	0.86166
	0.86471	0.86758	0.87040	0.87318	0.87592
	0.87861	0.88125	0.88384	0.88639	0.88890
	0.89135	0.89376	0.89613	0.89845	0.90072
	0.90295	0.90513	0.90727	0.90936	0.91140
	0.91340	0.91535	0.91726	0.91912	0.92093
	0.92270	0.92442	0.92609	0.92772	0.92931
	0.93085	0.93234	0.93382	0.93529	0.93674

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          0.93819   0.93962   0.94105   0.94246   0.94386
          0.94525   0.94662   0.94799   0.94934   0.95068
          0.95201   0.95333   0.95464   0.95594   0.95722
          0.95850   0.95976   0.96101   0.96225   0.96347
          0.96469   0.96589   0.96709   0.96827   0.96944
          0.97060   0.97174   0.97288   0.97400   0.97511
          0.97621   0.97730   0.97838   0.97945   0.98050
          0.98155   0.98258   0.98360   0.98461   0.98560
          0.98659   0.98756   0.98853   0.98948   0.99042
          0.99135   0.99226   0.99317   0.99406   0.99494
          0.99581   0.99667   0.99752   0.99836   0.999183
          1.0
500_yr_sm           0.1
               0.0  0.000887  0.00177   0.00267   0.00358
          0.00450   0.00543   0.00638   0.00734   0.00830
          0.00928   0.01028   0.01128   0.01229   0.01332
          0.01436   0.01541   0.01647   0.01754   0.01863
          0.01973   0.02084   0.02196   0.02309   0.02423
          0.02539   0.02656   0.02774   0.02893   0.03013
          0.03134   0.03257   0.03381   0.03506   0.03632
          0.03759   0.03888   0.04017   0.04148   0.04280
          0.04413   0.04547   0.04683   0.04820   0.04957
          0.05096   0.05237   0.05378   0.05521   0.05664
          0.05809   0.05955   0.06102   0.06251   0.06400
          0.06551   0.06703   0.06856   0.07010   0.07166
          0.07322   0.07484   0.07650   0.07820   0.07996
          0.08176   0.08361   0.08550   0.08744   0.08943
          0.09146   0.09355   0.09567   0.09785   0.10007
          0.10234   0.10466   0.10702   0.10943   0.11189
          0.11439   0.11694   0.11954   0.12219   0.12488
          0.12762   0.13040   0.13323   0.13611   0.13904
          0.14201   0.14516   0.14849   0.15201   0.15570
          0.15957   0.16361   0.16784   0.17225   0.17684
          0.18160   0.18655   0.19167   0.19698   0.20246
          0.20812   0.21448   0.22153   0.22927   0.23771
          0.24684   0.25729   0.26906   0.28215   0.29656
          0.31228   0.33453   0.35795   0.38806   0.42653
          0.48556   0.57347   0.61194   0.64205   0.66547
          0.68772   0.70344   0.71785   0.73094   0.74271
          0.75316   0.76229   0.77073   0.77847   0.78552
          0.79188   0.79754   0.80302   0.80833   0.81345
          0.81840   0.82316   0.82775   0.83216   0.83639
          0.84043   0.84430   0.84799   0.85151   0.85484
          0.85799   0.86096   0.86389   0.86677   0.86960
          0.87238   0.87512   0.87781   0.88046   0.88306
          0.88561   0.88811   0.89057   0.89298   0.89534
          0.89766   0.89993   0.90215   0.90433   0.90645
          0.90854   0.91057   0.91256   0.91450   0.91639
          0.91824   0.92004   0.92180   0.92350   0.92516
          0.92678   0.92834   0.92990   0.93144   0.93297
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                    0.93449   0.93600   0.93749   0.93898   0.94045
                    0.94191   0.94336   0.94479   0.94622   0.94763
                    0.94904   0.95043   0.95180   0.95317   0.95453
                    0.95587   0.95720   0.95852   0.95983   0.96112
                    0.96241   0.96368   0.96494   0.96619   0.96743
                    0.96866   0.96987   0.97107   0.97226   0.97344
                    0.97461   0.97577   0.97691   0.97804   0.97916
                    0.98027   0.98137   0.98246   0.98353   0.98459
                    0.98564   0.98668   0.98771   0.98872   0.98972
                    0.99072   0.99170   0.99266   0.99362   0.99457
                    0.99550   0.99642   0.99733   0.99823   0.999113
                    1.0



GLOBAL OUTPUT:
          1         1.        .1        YN  N     YN  N



WinTR-20 Printed Page File      End of Input Data List

                          Smithfield Resiliency Plan
  Pr Underground Facilities with Ex Ponds - Flowsplitters - UG1 Bypass to Pond

                        Name of printed page file:
            C:\Users\calutz\Desktop\Pr UG1 only Bypass to pond.out

                                    STORM 1_yr_sm

Area or    Drainage  Rain Gage     Runoff   ------------ Peak Flow ------------
 Reach       Area      ID or       Amount   Elevation   Time      Rate      Rate
Identifier  (sq mi)   Location     (in)      (ft)      (hr)     (cfs)     (csm)

SA6           0.149                2.410              12.61     137.7    923.43
Reach8        0.149  Upstream      2.410              12.61     137.7    923.43
Reach8        0.149 Downstream     2.405    142.38    18.60       3.6     24.22
Reach7        0.149  Upstream      2.405    140.56    18.60       3.6     24.22
Reach7        0.149 Downstream     2.405    140.56    18.72       3.6     24.22
SA5           0.083                2.123              12.60      70.7    851.83
SA7           0.287                1.864              12.73     193.8    676.00
UG1 - FS      0.287  Upstream      1.864    141.61    12.73     193.8    676.00
UG1 - FS        0.0 Downstream   Infinity   141.02    12.33     104.0  Infinity
UG1             0.0  Upstream    Infinity              12.33     104.0  Infinity
```

UG1	0.0	Downstream	Infinity	143.48	13.96	46.3	Infinity
Reach6	0.287	Upstream	0.297	139.59	12.73	89.8	313.29
Reach6	0.287	Downstream	0.297	139.55	12.80	88.7	309.39
Reach5	0.519	Upstream	2.061		12.77	168.3	324.47
Reach5	0.519	Downstream	2.060	140.17	24.60	14.2	27.33
Reach4	0.519	Upstream	2.060	134.11	24.60	14.2	27.33
Reach4	0.519	Downstream	2.060	134.11	24.72	14.2	27.33
SA3	0.127		1.628		12.54	90.3	710.08
Reach3.5	0.646	Upstream	1.975	129.67	12.54	91.6	141.77
Reach3.5	0.646	Downstream	1.975	129.67	12.54	91.6	141.76
SA4	0.127		1.864		12.45	118.7	933.53
Reach3	0.127	Upstream	1.864	137.05	12.45	118.7	933.53
Reach3	0.127	Downstream	1.864	137.01	12.94	107.6	846.35

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach2	0.773	Upstream	1.957	130.15	12.86	171.9	222.33
Reach2	0.773	Downstream	1.957	130.14	12.94	171.7	222.14
SA2	0.179		1.348		12.42	130.3	726.48
Reach1	0.952	Upstream	1.842	108.07	12.57	232.1	243.68
Reach1	0.952	Downstream	1.842	108.06	12.82	229.7	241.11
SA1	0.154		0.883		12.25	99.5	644.94
OUTLET	1.107		1.708		12.75	254.1	229.59

STORM 2_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		3.037		12.64	166.5	1116.43
Reach8	0.149	Upstream	3.037		12.64	166.5	1116.43
Reach8	0.149	Downstream	3.032	142.86	18.68	4.5	30.45
Reach7	0.149	Upstream	3.032	140.71	18.68	4.5	30.45
Reach7	0.149	Downstream	3.032	140.71	18.80	4.5	30.45
SA5	0.083		2.732		12.60	87.6	1056.22
SA7	0.287		2.450		12.73	247.1	861.74
UG1 - FS	0.287	Upstream	2.450	141.95	12.73	247.1	861.74
UG1 - FS	0.0	Downstream	Infinity	141.02	12.25	104.0	Infinity
UG1	0.0	Upstream	Infinity		12.25	104.0	Infinity
UG1	0.0	Downstream	Infinity	144.16	14.02	57.5	Infinity
Reach6	0.287	Upstream	0.563	141.18	12.73	143.1	499.02
Reach6	0.287	Downstream	0.563	141.16	12.80	142.4	496.61

Reach5	0.519	Upstream	2.662		12.77	240.0	462.70
Reach5	0.519	Downstream	2.661	141.21	24.26	17.3	33.42

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach4	0.519	Upstream	2.661	134.28	24.26	17.3	33.42
Reach4	0.519	Downstream	2.661	134.28	24.38	17.3	33.42
SA3	0.127		2.187		12.57	118.0	927.92
Reach3.5	0.646	Upstream	2.568	129.86	12.57	120.2	186.12
Reach3.5	0.646	Downstream	2.568	129.86	12.57	120.2	186.12
SA4	0.127		2.450		12.46	150.0	1179.39
Reach3	0.127	Upstream	2.450	137.17	12.46	150.0	1179.39
Reach3	0.127	Downstream	2.450	137.12	12.91	137.0	1077.00
Reach2	0.773	Upstream	2.548	130.38	12.83	225.7	291.88
Reach2	0.773	Downstream	2.548	130.38	12.91	225.4	291.55
SA2	0.179		1.865		12.39	175.6	978.92
Reach1	0.952	Upstream	2.420	108.39	12.53	314.3	329.98
Reach1	0.952	Downstream	2.420	108.38	12.85	310.5	325.94
SA1	0.154		1.309		12.24	146.4	949.06
OUTLET	1.107		2.265		12.74	344.2	311.02

STORM 5_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		4.043		12.61	205.1	1375.79
Reach8	0.149	Upstream	4.043		12.61	205.1	1375.79
Reach8	0.149	Downstream	4.038	143.28	14.77	20.2	135.15
Reach7	0.149	Upstream	4.038	142.36	14.77	20.2	135.15
Reach7	0.149	Downstream	4.038	142.36	14.89	20.1	135.13
SA5	0.083		3.719		12.62	110.1	1327.77
SA7	0.287		3.409		12.73	321.0	1119.63

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)

UG1 - FS	0.287	Upstream	3.409	142.27	12.73	321.0	1119.63
UG1 - FS	0.0	Downstream	Infinity	141.02	12.12	104.0	Infinity
UG1	0.0	Upstream	Infinity		12.12	104.0	Infinity
UG1	0.0	Downstream	Infinity	145.05	14.09	69.8	Infinity
Reach6	0.287	Upstream	1.008	142.84	12.73	217.0	756.92
Reach6	0.287	Downstream	1.008	142.78	12.93	213.8	745.76
Reach5	0.519	Upstream	3.639		12.91	335.1	645.86
Reach5	0.519	Downstream	3.638	142.45	16.31	58.7	113.13
Reach4	0.519	Upstream	3.638	136.14	16.31	58.7	113.13
Reach4	0.519	Downstream	3.638	136.14	16.43	58.7	113.08
SA3	0.127		3.114		12.56	156.2	1227.74
Reach3.5	0.646	Upstream	3.535	130.08	12.56	160.0	247.63
Reach3.5	0.646	Downstream	3.535	130.08	12.56	160.0	247.63
SA4	0.127		3.409		12.42	191.4	1505.13
Reach3	0.127	Upstream	3.409	137.33	12.42	191.4	1505.13
Reach3	0.127	Downstream	3.409	137.27	12.88	176.2	1385.32
Reach2	0.773	Upstream	3.514	130.63	12.80	302.1	390.75
Reach2	0.773	Downstream	3.514	130.63	12.88	301.6	390.04
SA2	0.179		2.742		12.39	239.1	1333.19
Reach1	0.952	Upstream	3.369	108.87	12.54	435.4	457.17
Reach1	0.952	Downstream	3.369	108.84	12.86	428.8	450.20
SA1	0.154		2.065		12.25	212.6	1378.10
OUTLET	1.107		3.187		12.79	478.1	432.01

STORM 10_yr_sm

Smithfield Resiliency Plan
Pr Underground Facilities with Ex Ponds - Flowsplitters - UG1 Bypass to Pond

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		4.866		12.61	239.7	1607.57
Reach8	0.149	Upstream	4.866		12.61	239.7	1607.57
Reach8	0.149	Downstream	4.860	143.63	14.71	25.0	167.45
Reach7	0.149	Upstream	4.860	142.81	14.71	25.0	167.45
Reach7	0.149	Downstream	4.860	142.81	14.83	25.0	167.43
SA5	0.083		4.529		12.61	130.2	1569.99
SA7	0.287		4.204		12.74	385.3	1343.94
UG1 - FS	0.287	Upstream	4.204	142.53	12.74	385.3	1343.94
UG1 - FS	0.0	Downstream	Infinity	141.02	12.06	104.0	Infinity
UG1	0.0	Upstream	Infinity		12.06	104.0	Infinity
UG1	0.0	Downstream	Infinity	145.57	14.24	76.1	Infinity

Reach6	0.287	Upstream	1.435	144.00	12.74	281.3	981.23
Reach6	0.287	Downstream	1.435	143.73	13.08	265.9	927.22
Reach5	0.519	Upstream	4.444		13.02	405.0	780.70
Reach5	0.519	Downstream	4.444	142.74	14.92	107.1	206.49
Reach4	0.519	Upstream	4.444	138.06	14.92	107.1	206.49
Reach4	0.519	Downstream	4.444	138.06	14.98	107.1	206.39
SA3	0.127		3.889		12.52	189.3	1488.42
Reach3.5	0.646	Upstream	4.335	130.26	12.57	194.3	300.74
Reach3.5	0.646	Downstream	4.335	130.26	12.57	194.3	300.74
SA4	0.127		4.204		12.46	228.0	1793.11
Reach3	0.127	Upstream	4.204	137.46	12.46	228.0	1793.11
Reach3	0.127	Downstream	4.204	137.40	12.87	210.9	1658.78
Reach2	0.773	Upstream	4.313	130.82	12.79	367.7	475.61
Reach2	0.773	Downstream	4.313	130.81	12.87	366.9	474.61
SA2	0.179		3.485		12.40	294.6	1642.89

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach1	0.952	Upstream	4.157	109.10	12.55	540.6	567.60
Reach1	0.952	Downstream	4.157	109.09	12.84	532.4	558.97
SA1	0.154		2.728		12.23	273.1	1770.22
OUTLET	1.107		3.958		12.75	599.0	541.24

STORM 25_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		6.038		12.62	280.0	1877.55
Reach8	0.149	Upstream	6.038		12.62	280.0	1877.55
Reach8	0.149	Downstream	6.032	144.14	14.71	31.4	210.70
Reach7	0.149	Upstream	6.032	143.18	14.71	31.4	210.70
Reach7	0.149	Downstream	6.032	143.18	14.89	31.4	210.68
SA5	0.083		5.690		12.61	153.7	1853.32
SA7	0.287		5.347		12.67	463.4	1616.20
UG1 - FS	0.287	Upstream	5.347	142.84	12.67	463.4	1616.20
UG1 - FS	0.0	Downstream	Infinity	141.02	11.93	104.0	Infinity
UG1	0.0	Upstream	Infinity		11.93	104.0	Infinity
UG1	0.0	Downstream	Infinity	146.18	14.37	83.0	Infinity
Reach6	0.287	Upstream	2.016	144.19	12.74	359.4	1253.49
Reach6	0.287	Downstream	2.016	144.14	13.08	340.1	1186.07
Reach5	0.519	Upstream	5.599		13.02	519.6	1001.47
Reach5	0.519	Downstream	5.598	143.29	13.94	231.9	446.92

Reach4	0.519	Upstream	5.598	139.70	13.94	231.9	446.92
Reach4	0.519	Downstream	5.598	139.67	14.17	228.8	441.03
SA3	0.127		5.011		12.55	229.6	1804.96

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach3.5	0.646	Upstream	5.482	130.52	14.14	261.1	404.20
Reach3.5	0.646	Downstream	5.482	130.52	14.14	261.1	404.20
SA4	0.127		5.347		12.44	271.1	2131.84
Reach3	0.127	Upstream	5.347	137.63	12.44	271.1	2131.84
Reach3	0.127	Downstream	5.347	137.55	12.86	251.7	1979.37
Reach2	0.773	Upstream	5.460	131.01	12.78	444.4	574.78
Reach2	0.773	Downstream	5.460	131.01	12.82	443.6	573.82
SA2	0.179		4.570		12.38	361.1	2013.29
Reach1	0.952	Upstream	5.293	109.28	12.52	669.3	702.66
Reach1	0.952	Downstream	5.293	109.26	12.81	660.0	692.88
SA1	0.154		3.721		12.23	345.9	2242.28
OUTLET	1.107		5.074		12.70	755.7	682.85

STORM 50_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		7.013		12.64	311.9	2091.94
Reach8	0.149	Upstream	7.013		12.64	311.9	2091.94
Reach8	0.149	Downstream	7.007	144.57	14.73	35.6	238.52
Reach7	0.149	Upstream	7.007	143.34	14.73	35.6	238.52
Reach7	0.149	Downstream	7.007	143.34	15.03	35.6	238.49
SA5	0.083		6.657		12.58	172.6	2080.12
SA7	0.287		6.304		12.72	526.8	1837.44
UG1 - FS	0.287	Upstream	6.304	143.07	12.72	526.8	1837.44
UG1 - FS	0.0	Downstream	Infinity	141.02	11.77	104.0	Infinity
UG1	0.0	Upstream	Infinity		11.77	104.0	Infinity

Area or Reach	Drainage Area	Rain Gage ID or	Runoff Amount	Peak Flow Elevation	Peak Flow Time	Peak Flow Rate	Peak Flow Rate

Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
UG1	0.0	Downstream	Infinity	146.57	14.56	87.1	Infinity
Reach6	0.287	Upstream	2.550	144.34	12.72	422.8	1474.72
Reach6	0.287	Downstream	2.550	144.29	13.06	402.1	1402.23
Reach5	0.519	Upstream	6.563		12.98	608.6	1173.13
Reach5	0.519	Downstream	6.563	143.60	13.61	387.0	745.88
Reach4	0.519	Upstream	6.563	140.77	13.61	387.0	745.88
Reach4	0.519	Downstream	6.563	140.59	14.02	361.2	696.15
SA3	0.127		5.954		12.54	261.2	2053.24
Reach3.5	0.646	Upstream	6.443	130.92	13.97	405.6	627.85
Reach3.5	0.646	Downstream	6.443	130.92	13.97	405.6	627.85
SA4	0.127		6.304		12.43	304.2	2392.04
Reach3	0.127	Upstream	6.304	137.75	12.43	304.2	2392.04
Reach3	0.127	Downstream	6.304	137.67	12.85	283.6	2230.35
Reach2	0.773	Upstream	6.420	131.06	12.76	507.2	655.98
Reach2	0.773	Downstream	6.420	131.06	12.80	506.3	654.88
SA2	0.179		5.490		12.39	412.8	2301.83
Reach1	0.952	Upstream	6.245	109.42	12.53	774.8	813.42
Reach1	0.952	Downstream	6.245	109.41	12.78	765.4	803.54
SA1	0.154		4.578		12.24	400.0	2592.80
OUTLET	1.107		6.013		12.68	888.9	803.20

STORM 100_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		8.049		12.60	345.3	2315.72
Reach8	0.149	Upstream	8.049		12.60	345.3	2315.72

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach8	0.149	Downstream	8.044	145.01	14.82	39.9	267.72
Reach7	0.149	Upstream	8.044	143.52	14.82	39.9	267.72
Reach7	0.149	Downstream	8.043	143.52	15.18	39.9	267.66
SA5	0.083		7.687		12.60	191.8	2311.57
SA7	0.287		7.325		12.71	590.7	2060.13
UG1 - FS	0.287	Upstream	7.325	143.25	12.71	590.7	2060.13
UG1 - FS	0.0	Downstream	Infinity	141.02	11.56	104.0	Infinity
UG1	0.0	Upstream	Infinity		11.56	104.0	Infinity
UG1	0.0	Downstream	Infinity	146.90	14.68	90.6	Infinity

Reach6	0.287	Upstream	3.118	144.50	12.71	486.7	1697.42
Reach6	0.287	Downstream	3.118	144.45	12.98	465.2	1622.52
Reach5	0.519	Upstream	7.589		12.95	697.0	1343.54
Reach5	0.519	Downstream	7.590	143.81	13.41	534.8	1030.76
Reach4	0.519	Upstream	7.590	141.14	13.41	534.8	1030.76
Reach4	0.519	Downstream	7.590	141.10	13.81	501.6	966.93
SA3	0.127		6.963		12.54	293.1	2304.59
Reach3.5	0.646	Upstream	7.466	131.10	13.77	566.1	876.27
Reach3.5	0.646	Downstream	7.466	131.10	13.77	566.1	876.27
SA4	0.127		7.325		12.43	337.4	2653.72
Reach3	0.127	Upstream	7.325	137.88	12.43	337.4	2653.72
Reach3	0.127	Downstream	7.325	137.79	12.84	315.9	2484.30
Reach2	0.773	Upstream	7.443	131.17	13.71	658.6	851.86
Reach2	0.773	Downstream	7.443	131.17	13.79	658.4	851.57
SA2	0.179		6.479		12.38	464.6	2590.53
Reach1	0.952	Upstream	7.261	109.58	12.52	883.4	927.48
Reach1	0.952	Downstream	7.261	109.56	12.78	873.7	917.32

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA1	0.154		5.511		12.22	455.8	2954.57
OUTLET	1.107		7.017		12.67	1026.6	927.57

STORM 200_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		9.166		12.60	377.3	2530.39
Reach8	0.149	Upstream	9.166		12.60	377.3	2530.39
Reach8	0.149	Downstream	9.159	145.10	13.62	131.2	879.62
Reach7	0.149	Upstream	9.159	144.36	13.62	131.2	879.62
Reach7	0.149	Downstream	9.159	144.31	14.10	119.3	800.28
SA5	0.083		8.799		12.62	210.0	2531.11
SA7	0.287		8.429		12.69	652.4	2275.48
UG1 - FS	0.287	Upstream	8.429	143.42	12.69	652.4	2275.48
UG1 - FS	0.0	Downstream	Infinity	141.02	11.40	104.0	Infinity
UG1	0.0	Upstream	Infinity		11.40	104.0	Infinity
UG1	0.0	Downstream	Infinity	147.19	14.87	93.4	Infinity
Reach6	0.287	Upstream	3.735	144.65	12.69	548.1	1911.68
Reach6	0.287	Downstream	3.735	144.60	12.97	527.3	1839.04
Reach5	0.519	Upstream	8.698		12.96	787.4	1517.84
Reach5	0.519	Downstream	8.696	144.00	13.31	668.4	1288.44

Reach4	0.519	Upstream	8.696	141.31	13.31	668.4	1288.44
Reach4	0.519	Downstream	8.696	141.27	13.66	634.7	1223.36
SA3	0.127		8.056		12.51	324.0	2547.40
Reach3.5	0.646	Upstream	8.570	131.23	13.59	725.8	1123.60
Reach3.5	0.646	Downstream	8.570	131.23	13.59	725.8	1123.60

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA4	0.127		8.429		12.44	369.7	2907.71
Reach3	0.127	Upstream	8.429	138.00	12.44	369.7	2907.71
Reach3	0.127	Downstream	8.429	137.91	12.86	347.2	2730.49
Reach2	0.773	Upstream	8.547	131.33	13.56	861.8	1114.62
Reach2	0.773	Downstream	8.547	131.33	13.60	861.5	1114.22
SA2	0.179		7.554		12.38	515.2	2872.51
Reach1	0.952	Upstream	8.360	109.72	12.53	989.8	1039.14
Reach1	0.952	Downstream	8.360	109.71	12.74	979.9	1028.73
SA1	0.154		6.535		12.23	510.0	3306.13
OUTLET	1.107		8.106		12.63	1163.3	1051.09

Smithfield Resiliency Plan
Pr Underground Facilities with Ex Ponds - Flowsplitters - UG1 Bypass to Pond

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 1_yr_sm (cfs)	2_yr_sm (cfs)	5_yr_sm (cfs)	10_yr_sm (cfs)	25_yr_sm (cfs)
SA1	0.154	99.5	146.4	212.6	273.1	345.9
SA2	0.179	130.3	175.6	239.1	294.6	361.1
SA3	0.127	90.3	118.0	156.2	189.3	229.6
SA4	0.127	118.7	150.0	191.4	228.0	271.1
SA5	0.083	70.7	87.6	110.1	130.2	153.7
SA7	0.287	193.8	247.1	321.0	385.3	463.4
SA6	0.149	137.7	166.5	205.1	239.7	280.0
Reach1	0.952	232.1	314.3	435.4	540.6	669.3
DOWNSTREAM		229.7	310.5	428.8	532.4	660.0
Reach2	0.773	171.9	225.7	302.1	367.7	444.4
DOWNSTREAM		171.7	225.4	301.6	366.9	443.6
Reach3	0.127	118.7	150.0	191.4	228.0	271.1
DOWNSTREAM		107.6	137.0	176.2	210.9	251.7
Reach4	0.519	14.2	17.3	58.7	107.1	231.9
DOWNSTREAM		14.2	17.3	58.7	107.1	228.8
Reach5	0.519	168.3	240.0	335.1	405.0	519.6
DOWNSTREAM		14.2	17.3	58.7	107.1	231.9
Reach6	0.287	89.8	143.1	217.0	281.3	359.4
DOWNSTREAM		88.7	142.4	213.8	265.9	340.1
Reach7	0.149	3.6	4.5	20.2	25.0	31.4
DOWNSTREAM		3.6	4.5	20.1	25.0	31.4
Reach8	0.149	137.7	166.5	205.1	239.7	280.0
DOWNSTREAM		3.6	4.5	20.2	25.0	31.4
UG1	0.0	104.0	104.0	104.0	104.0	104.0
DOWNSTREAM		46.3	57.5	69.8	76.1	83.0
UG1 - FS	0.0	193.8	247.1	321.0	385.3	463.4
DOWNSTREAM		104.0	104.0	104.0	104.0	104.0
Reach3.5	0.646	91.6	120.2	160.0	194.3	261.1
DOWNSTREAM		91.6	120.2	160.0	194.3	261.1
OUTLET	1.107	254.1	344.2	478.1	599.0	755.7

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 50_yr_sm (cfs)	100_yr_sm (cfs)	200_yr_sm (cfs)	(cfs)	(cfs)

SA1	0.154	400.0	455.8	510.0
SA2	0.179	412.8	464.6	515.2
SA3	0.127	261.2	293.1	324.0
SA4	0.127	304.2	337.4	369.7
SA5	0.083	172.6	191.8	210.0
SA7	0.287	526.8	590.7	652.4
SA6	0.149	311.9	345.3	377.3
Reach1	0.952	774.8	883.4	989.8
DOWNSTREAM		765.4	873.7	979.9
Reach2	0.773	507.2	658.6	861.8
DOWNSTREAM		506.3	658.4	861.5
Reach3	0.127	304.2	337.4	369.7
DOWNSTREAM		283.6	315.9	347.2
Reach4	0.519	387.0	534.8	668.4
DOWNSTREAM		361.2	501.6	634.7

Smithfield Resiliency Plan
Pr Underground Facilities with Ex Ponds - Flowsplitters - UG1 Bypass to Pond

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 50_yr_sm (cfs)	100_yr_sm (cfs)	200_yr_sm (cfs)	(cfs)	(cfs)
Reach5	0.519	608.6	697.0	787.4		
DOWNSTREAM		387.0	534.8	668.4		
Reach6	0.287	422.8	486.7	548.1		
DOWNSTREAM		402.1	465.2	527.3		
Reach7	0.149	35.6	39.9	131.2		
DOWNSTREAM		35.6	39.9	119.3		
Reach8	0.149	311.9	345.3	377.3		
DOWNSTREAM		35.6	39.9	131.2		
UG1	0.0	104.0	104.0	104.0		
DOWNSTREAM		87.1	90.6	93.4		
UG1 - FS	0.0	526.8	590.7	652.4		
DOWNSTREAM		104.0	104.0	104.0		
Reach3.5	0.646	405.6	566.1	725.8		
DOWNSTREAM		405.6	566.1	725.8		
OUTLET	1.107	888.9	1026.6	1163.3		

APPENDIX A.3

HYDROLOGIC MODELING

Proposed Conditions -
Above Ground Facility

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

WinTR-20 Printed Page File Beginning of Input Data List
C:\Users\calutz\Desktop\Smithfield TR20 Proposed - Attenuation Facility.inp

WinTR-20: version 3.30 0 0 0.01 0 ,

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

SUB-AREA:

SA1	Outlet	0.15426	74.	0.306
SA2	Reach1	0.17934	82.	0.571
SA3	Reach3.5	0.127196	86.	0.812
SA4	Reach3	0.12716	89.	0.655
SA5	Reach5	0.082954	92.	0.914
SA7	Attenuatio	0.28673	89.	1.076
SA6	Reach8	0.14911	95.	0.948

STREAM REACH:

Reach1	Outlet	XS1		2700.
Reach2	Reach1	XS2		1775.
Reach3	Reach2	XS3		1100.
Reach4	Reach3.5	XS4		1500.
Reach5	Reach4		CollegePon	
Reach6	Reach5	XS6		1500.
Reach7	Reach5	XS7		1400.
Reach8	Reach7		I95Pond	
Reach3.5	Reach2	XS2		1.
Attenuatio	Reach6		Attenuatio	

STORM ANALYSIS:

1_yr_sm	2.960	1_yr_sm	2	3.600
2_yr_sm	3.600	2_yr_sm	2	
5_yr_sm	4.620	5_yr_sm	2	
10_yr_sm	5.450	10_yr_sm	2	

25_yr_sm	6.630	25_yr_sm	2
50_yr_sm	7.610	50_yr_sm	2
100_yr_sm	8.650	100_yr_sm	2
200_yr_sm	9.770	200_yr_sm	2

STREAM CROSS SECTION:

	XS1	107.		105.	
		105.	0.	0.	0.	0.003
		105.25	0.47	0.7	4.75	0.003
		105.5	2.35	2.4	8.5	0.003
		105.75	6.3	5.	12.25	0.003
		106.	12.89	8.5	16.	0.003
		106.25	22.66	13.	19.75	0.003
		106.5	36.06	18.4	23.5	0.003
		106.75	53.56	24.7	27.25	0.003
		107.	75.57	32.	31.	0.003
		107.5	129.19	50.8	44.	0.003
		108.	213.22	76.	57.	0.003
		109.	469.27	177.	145.	0.003
		110.	1189.26	344.5	190.	0.003
		111.	2296.08	557.5	236.	0.003
	XS2	128.		130.5		
		128.	0.	0.	0.	0.01
		128.25	1.75	1.1	5.5	0.01
		128.5	6.63	2.8	8.	0.01
		128.75	15.27	5.1	10.5	0.01
		129.	28.38	8.0	13.	0.01
		129.25	44.64	11.8	17.5	0.01
		129.5	68.64	16.8	22.	0.01
		129.75	101.52	22.8	26.5	0.01
		130.	144.40	30.0	31.	0.01
		130.25	191.70	38.7	38.25	0.01
		130.5	254.75	49.1	45.5	0.01
		131.	433.96	75.5	60.	0.01
		132.	1722.72	243.7	249.67	0.01
		133.	4164.78	529.	339.	0.01
	XS3	136.		134.		
		134.	0.	0.	0.	0.01
		134.25	0.27	1.4	8.5	0.01
		134.5	1.19	4.3	14.	0.01
		134.75	2.98	8.4	19.5	0.01
		135.	5.87	14.	25.	0.01
		135.25	9.97	21.	31.25	0.01
		135.5	15.63	29.6	37.5	0.01
		135.75	23.05	39.8	43.75	0.01
		136.	32.43	51.5	50.	0.01
		136.5	48.6	99.	140.	0.01
		137.	104.86	191.5	230.	0.01
		138.	370.34	560.	507.	0.01

```
                139.      1126.24   1109.5    592.      0.01
                140.      2144.77   1751.5    692.      0.01
          XS4   139.                133.
                133.      0.        0.        0.        0.005
                133.5     4.19      1.67      5.        0.005
                134.      11.99     5.        5.        0.005
                134.5     21.57     7.5       5.        0.005
                135.      32.2      10.       5.        0.005
                135.5     43.54     12.5      5.        0.005
                136.      55.37     15.       5.        0.005
                136.5     67.56     17.5      5.        0.005
                137.      80.01     20.       5.        0.005
                137.5     92.68     22.5      5.        0.005
                138.      105.5     25.       5.        0.005
                138.5     118.45    27.5      5.        0.005
                139.      131.52    30.       5.        0.005
                141.      419.97    375.      340.      0.005
                142.      1226.44   715.      340.      0.005
                143.      2336.36   1055.     340.      0.005
                144.      3707.38   1395.0    340.      0.005
          XS6   136.                142.
                136.      0.        0.        0.        0.005
                136.5     5.12      3.        6.        0.005
                137.      14.87     6.        6.        0.005
                138.      40.68     12.       6.        0.005
                139.      70.81     18.       6.        0.005
                140.      103.2     24.       6.        0.005
                141.      136.94    30.       6.        0.005
                142.      171.55    36.       99.       0.005
                144.      280.45    234.      192.      0.005
                145.      695.21    472.5     285.      0.005
                146.      1396.72   804.      378.      0.005
                147.      2645.56   1182.     378.      0.005
          XS7   143.                140.
                140.      0.        0.        0.        0.005
                141.      6.41      3.        3.        0.005
                142.      16.25     6.        3.        0.005
                143.      27.02     9.        3.        0.005
                144.      51.84     70.3      119.67    0.005
                145.      269.62    248.3     236.33    0.005
                146.      760.1     543.      353.      0.005
                147.      1744.82   896.      353.      0.005
                148.      3023.76   1249.0    353.      0.005


STRUCTURE RATING:
          I95Pond   140.5
                    140.5     0.        0.
                    143.1     5.        22.276
                    143.16    10.       22.982
```

	143.27	20.	24.087
	144.	30.	32.269
	145.02	40.	44.999
	145.03	50.	45.137
	145.04	60.	45.278
	145.05	70.	45.422
	145.06	80.	45.569
	145.07	90.	45.719
	145.08	100.	45.871
	145.09	110.	46.027
	145.1	130.	46.185
	145.11	140.	46.346
	145.12	160.	46.509
	145.13	170.	46.676
	145.14	190.	46.845
	145.15	210.	47.017
	145.16	220.	47.192
	145.17	240.	47.370
	145.18	260.	47.551
	145.19	280.	47.734
	145.2	300.	47.920
	145.21	320.	48.109
	145.22	340.	48.301
	145.23	360.	48.496
	145.24	370.	48.693
CollegePon	137.		
	137.	0.	0.
	138.22	5.	9.267
	138.8	10.	13.799
	142.08	20.	40.845
	142.21	30.	41.969
	142.31	40.	42.837
	142.39	50.	43.534
	142.46	60.	44.145
	142.53	70.	44.758
	142.59	80.	45.284
	142.65	90.	45.811
	142.7	100.	46.252
	142.76	110.	46.781
	142.81	120.	47.223
	142.86	130.	47.665
	142.9	140.	48.02
	142.95	150.	48.464
	142.99	160.	48.819
	143.04	170.	49.265
	143.08	180.	49.622
	143.12	190.	49.98
	143.16	200.	50.339
	143.2	210.	50.699
	143.24	220.	51.06

	143.28	230.	51.422
	143.31	240.	51.694
	143.35	250.	52.057
	143.39	260.	52.421
	143.42	270.	52.694
	143.46	280.	53.060
	143.49	290.	53.335
	143.53	335.92	53.702
	143.56	354.97	53.978
	143.59	377.23	54.254
	143.63	408.90	54.623
	143.66	430.62	54.901
	143.69	452.91	55.179
	143.72	472.48	55.458
	143.75	492.36	55.737
	143.78	515.98	56.016
	143.81	536.53	56.296
	143.84	557.37	56.576
	143.92	608.73	57.327
	143.99	661.56	57.986
	144.04	703.11	58.459
	144.07	740.82	58.745
	144.1	778.78	59.032
	144.13	812.57	59.32
	144.15	846.46	59.513
	144.18	885.01	59.804
	144.19	897.29	59.901
Attenuatio	139.		
	139.	0.	0.
	139.47	5.	0.147
	139.75	10.	0.370
	139.92	30.	0.562
	140.33	40.	1.104
	140.71	50.	1.617
	141.07	60.	2.107
	141.4	70.	2.561
	141.73	80.	3.019
	142.04	90.	3.453
	142.34	100.	3.877
	142.91	120.	4.692
	143.45	140.	5.563
	144.	160.	6.718
	144.27	188.07	7.366
	144.45	223.07	7.814
	144.57	256.32	8.120
	144.69	289.8	8.431
	144.8	324.78	8.721
	144.9	359.05	8.988
	144.99	394.37	9.233
	145.08	428.31	9.480

145.17	465.49	9.732
145.25	499.68	9.960
145.32	533.09	10.161
145.4	568.41	10.395
145.47	602.84	10.608
145.53	637.74	10.787
145.59	670.01	10.968
145.66	705.77	11.164
145.72	740.35	11.361
145.79	778.69	11.586
145.85	812.38	11.756
145.87	827.59	11.832
145.99	897.91	12.217

RAINFALL DISTRIBUTION:

1_yr_sm	0.1			
0.0	0.000659	0.00131	0.00197	0.00264
0.00332	0.00401	0.00471	0.00542	0.00614
0.00687	0.00761	0.00836	0.00911	0.00988
0.01066	0.01145	0.01224	0.01305	0.01386
0.01469	0.01552	0.01637	0.01722	0.01809
0.01896	0.01984	0.02074	0.02164	0.02255
0.02347	0.02440	0.02534	0.02629	0.02726
0.02823	0.02921	0.03019	0.03119	0.03220
0.03322	0.03425	0.03529	0.03633	0.03739
0.03846	0.03953	0.04062	0.04171	0.04282
0.04393	0.04506	0.04619	0.04734	0.04849
0.04965	0.05082	0.05201	0.05320	0.05440
0.05561	0.05686	0.05815	0.05948	0.06084
0.06225	0.06369	0.06517	0.06669	0.06825
0.06985	0.07148	0.07316	0.07487	0.07662
0.07841	0.08024	0.08211	0.08401	0.08596
0.08794	0.08996	0.09202	0.09412	0.09626
0.09844	0.10065	0.10291	0.10520	0.10753
0.10990	0.11242	0.11510	0.11793	0.12092
0.12406	0.12736	0.13081	0.13441	0.13817
0.14209	0.14616	0.15038	0.15476	0.15929
0.16398	0.16928	0.17520	0.18173	0.18888
0.19664	0.20559	0.21575	0.22710	0.23965
0.25338	0.27323	0.29413	0.32489	0.37132
0.46107	0.62868	0.67511	0.70587	0.72677
0.74662	0.76035	0.77290	0.78425	0.79441
0.80336	0.81112	0.81827	0.82480	0.83072
0.83602	0.84071	0.84524	0.84962	0.85384
0.85791	0.86183	0.86559	0.86919	0.87264
0.87594	0.87908	0.88207	0.88490	0.88758
0.89010	0.89247	0.89480	0.89709	0.89935

```
          0.90156   0.90374   0.90588   0.90798   0.91004
          0.91206   0.91404   0.91599   0.91789   0.91976
          0.92159   0.92338   0.92513   0.92684   0.92852
          0.93015   0.93175   0.93331   0.93483   0.93631
          0.93775   0.93916   0.94052   0.94185   0.94314
          0.94439   0.94560   0.94680   0.94799   0.94918
          0.95035   0.95151   0.95266   0.95381   0.95494
          0.95607   0.95718   0.95829   0.95938   0.96047
          0.96154   0.96261   0.96367   0.96471   0.96575
          0.96678   0.96780   0.96881   0.96981   0.97079
          0.97177   0.97274   0.97370   0.97466   0.97560
          0.97653   0.97745   0.97836   0.97926   0.98016
          0.98104   0.98191   0.98278   0.98363   0.98448
          0.98531   0.98614   0.98695   0.98776   0.98855
          0.98934   0.99012   0.99089   0.99164   0.99239
          0.99313   0.99386   0.99458   0.99529   0.99599
          0.99668   0.99736   0.99803   0.99869   0.999341
          1.0
2_yr_sm             0.1
          0.0       0.000689  0.00137   0.00207   0.00277
          0.00348   0.00420   0.00494   0.00568   0.00643
          0.00719   0.00797   0.00875   0.00954   0.01034
          0.01116   0.01198   0.01281   0.01365   0.01450
          0.01536   0.01624   0.01712   0.01801   0.01891
          0.01982   0.02074   0.02167   0.02261   0.02356
          0.02452   0.02550   0.02648   0.02747   0.02847
          0.02948   0.03050   0.03153   0.03257   0.03362
          0.03468   0.03575   0.03683   0.03792   0.03902
          0.04013   0.04124   0.04237   0.04351   0.04466
          0.04582   0.04699   0.04817   0.04936   0.05056
          0.05176   0.05298   0.05421   0.05545   0.05670
          0.05796   0.05925   0.06059   0.06197   0.06338
          0.06484   0.06634   0.06787   0.06945   0.07106
          0.07272   0.07441   0.07615   0.07792   0.07973
          0.08159   0.08348   0.08541   0.08738   0.08939
          0.09144   0.09354   0.09567   0.09784   0.10005
          0.10230   0.10458   0.10691   0.10928   0.11169
          0.11414   0.11674   0.11950   0.12241   0.12548
          0.12870   0.13208   0.13561   0.13930   0.14314
          0.14713   0.15129   0.15559   0.16005   0.16467
          0.16944   0.17482   0.18081   0.18741   0.19462
          0.20244   0.21148   0.22172   0.23318   0.24585
          0.25972   0.27984   0.30102   0.33152   0.37679
          0.46334   0.62321   0.66848   0.69898   0.72016
          0.74028   0.75415   0.76682   0.77828   0.78852
          0.79756   0.80538   0.81259   0.81919   0.82518
          0.83056   0.83533   0.83995   0.84441   0.84871
          0.85287   0.85686   0.86070   0.86439   0.86792
          0.87130   0.87452   0.87759   0.88050   0.88326
          0.88586   0.88831   0.89072   0.89309   0.89542
```

	0.89770	0.89995	0.90216	0.90433	0.90646
	0.90856	0.91061	0.91262	0.91459	0.91652
	0.91841	0.92027	0.92208	0.92385	0.92559
	0.92728	0.92894	0.93055	0.93213	0.93366
	0.93516	0.93662	0.93803	0.93941	0.94075
	0.94204	0.94330	0.94455	0.94579	0.94702
	0.94824	0.94944	0.95064	0.95183	0.95301
	0.95418	0.95534	0.95649	0.95763	0.95876
	0.95987	0.96098	0.96208	0.96317	0.96425
	0.96532	0.96638	0.96743	0.96847	0.96950
	0.97052	0.97153	0.97253	0.97352	0.97450
	0.97548	0.97644	0.97739	0.97833	0.97926
	0.98018	0.98109	0.98199	0.98288	0.98376
	0.98464	0.98550	0.98635	0.98719	0.98802
	0.98884	0.98966	0.99046	0.99125	0.99203
	0.99281	0.99357	0.99432	0.99506	0.99580
	0.99652	0.99723	0.99793	0.99863	0.999310
	1.0				
5_yr_sm		0.1			
	0.0	0.000742	0.00147	0.00221	0.00296
	0.00372	0.00449	0.00527	0.00606	0.00686
	0.00767	0.00849	0.00933	0.01017	0.01102
	0.01188	0.01276	0.01364	0.01453	0.01544
	0.01635	0.01728	0.01821	0.01916	0.02012
	0.02108	0.02206	0.02305	0.02404	0.02505
	0.02607	0.02710	0.02814	0.02919	0.03025
	0.03132	0.03240	0.03349	0.03459	0.03570
	0.03682	0.03795	0.03910	0.04025	0.04141
	0.04259	0.04377	0.04496	0.04617	0.04738
	0.04861	0.04984	0.05109	0.05235	0.05361
	0.05489	0.05618	0.05747	0.05878	0.06010
	0.06143	0.06280	0.06421	0.06566	0.06716
	0.06869	0.07027	0.07189	0.07355	0.07525
	0.07699	0.07878	0.08060	0.08247	0.08438
	0.08633	0.08832	0.09035	0.09242	0.09454
	0.09669	0.09889	0.10113	0.10341	0.10573
	0.10810	0.11050	0.11295	0.11543	0.11796
	0.12053	0.12327	0.12616	0.12922	0.13244
	0.13582	0.13937	0.14307	0.14694	0.15097
	0.15517	0.15952	0.16404	0.16873	0.17357
	0.17857	0.18422	0.19051	0.19743	0.20499
	0.21320	0.22264	0.23331	0.24522	0.25837
	0.27273	0.29342	0.31520	0.34596	0.39016
	0.47010	0.60984	0.65404	0.68480	0.70658
	0.72727	0.74163	0.75478	0.76669	0.77736
	0.78680	0.79501	0.80257	0.80949	0.81578
	0.82143	0.82643	0.83127	0.83596	0.84048
	0.84483	0.84903	0.85306	0.85693	0.86063
	0.86418	0.86756	0.87078	0.87384	0.87673
	0.87947	0.88204	0.88457	0.88705	0.88950

	0.89190	0.89427	0.89659	0.89887	0.90111
	0.90331	0.90546	0.90758	0.90965	0.91168
	0.91367	0.91562	0.91753	0.91940	0.92122
	0.92301	0.92475	0.92645	0.92811	0.92973
	0.93131	0.93284	0.93434	0.93579	0.93720
	0.93857	0.93990	0.94122	0.94253	0.94382
	0.94511	0.94639	0.94765	0.94891	0.95016
	0.95139	0.95262	0.95383	0.95504	0.95623
	0.95741	0.95859	0.95975	0.96090	0.96205
	0.96318	0.96430	0.96541	0.96651	0.96760
	0.96868	0.96975	0.97081	0.97186	0.97290
	0.97393	0.97495	0.97596	0.97695	0.97794
	0.97892	0.97988	0.98084	0.98179	0.98272
	0.98365	0.98456	0.98547	0.98636	0.98724
	0.98812	0.98898	0.98983	0.99067	0.99151
	0.99233	0.99314	0.99394	0.99473	0.99551
	0.99628	0.99704	0.99779	0.99853	0.999258
	1.0				
10_yr_sm		0.1			
	0.0	0.000735	0.00146	0.00220	0.00295
	0.00371	0.00448	0.00525	0.00605	0.00685
	0.00766	0.00848	0.00931	0.01015	0.01101
	0.01187	0.01275	0.01363	0.01453	0.01543
	0.01635	0.01728	0.01822	0.01917	0.02012
	0.02109	0.02207	0.02307	0.02407	0.02508
	0.02610	0.02713	0.02818	0.02923	0.03030
	0.03137	0.03246	0.03355	0.03466	0.03578
	0.03691	0.03804	0.03919	0.04035	0.04152
	0.04270	0.04389	0.04510	0.04631	0.04753
	0.04877	0.05001	0.05126	0.05253	0.05380
	0.05509	0.05639	0.05769	0.05901	0.06034
	0.06168	0.06306	0.06448	0.06595	0.06746
	0.06901	0.07060	0.07223	0.07391	0.07563
	0.07739	0.07919	0.08104	0.08293	0.08486
	0.08683	0.08884	0.09090	0.09300	0.09514
	0.09732	0.09955	0.10182	0.10413	0.10648
	0.10887	0.11131	0.11379	0.11631	0.11887
	0.12148	0.12425	0.12718	0.13028	0.13354
	0.13697	0.14056	0.14432	0.14824	0.15233
	0.15658	0.16100	0.16558	0.17033	0.17524
	0.18031	0.18603	0.19240	0.19942	0.20709
	0.21540	0.22500	0.23587	0.24802	0.26145
	0.27615	0.29742	0.31982	0.35082	0.39455
	0.47219	0.60545	0.64918	0.68018	0.70258
	0.72385	0.73855	0.75198	0.76413	0.77500
	0.78460	0.79291	0.80058	0.80760	0.81397
	0.81969	0.82476	0.82967	0.83442	0.83900
	0.84342	0.84767	0.85176	0.85568	0.85944
	0.86303	0.86646	0.86972	0.87282	0.87575
	0.87852	0.88113	0.88369	0.88621	0.88869

	0.89113	0.89352	0.89587	0.89818	0.90045
	0.90268	0.90486	0.90700	0.90910	0.91116
	0.91317	0.91514	0.91707	0.91896	0.92081
	0.92261	0.92437	0.92609	0.92777	0.92940
	0.93099	0.93254	0.93405	0.93552	0.93694
	0.93832	0.93966	0.94099	0.94231	0.94361
	0.94491	0.94620	0.94747	0.94874	0.94999
	0.95123	0.95247	0.95369	0.95490	0.95611
	0.95730	0.95848	0.95965	0.96081	0.96196
	0.96309	0.96422	0.96534	0.96645	0.96754
	0.96863	0.96970	0.97077	0.97182	0.97287
	0.97390	0.97492	0.97593	0.97693	0.97793
	0.97891	0.97988	0.98083	0.98178	0.98272
	0.98365	0.98457	0.98547	0.98637	0.98725
	0.98813	0.98899	0.98985	0.99069	0.99152
	0.99234	0.99315	0.99395	0.99475	0.99552
	0.99629	0.99705	0.99780	0.99854	0.999265
	1.0				
25_yr_sm		0.1			
	0.0	0.000796	0.00158	0.00237	0.00317
	0.00398	0.00480	0.00563	0.00648	0.00733
	0.00820	0.00907	0.00996	0.01086	0.01177
	0.01269	0.01362	0.01456	0.01551	0.01647
	0.01745	0.01843	0.01943	0.02043	0.02145
	0.02247	0.02351	0.02456	0.02562	0.02669
	0.02777	0.02887	0.02997	0.03108	0.03221
	0.03334	0.03449	0.03564	0.03681	0.03799
	0.03918	0.04038	0.04159	0.04281	0.04404
	0.04529	0.04654	0.04781	0.04908	0.05037
	0.05167	0.05297	0.05429	0.05562	0.05696
	0.05831	0.05967	0.06105	0.06243	0.06382
	0.06523	0.06668	0.06817	0.06970	0.07128
	0.07290	0.07457	0.07627	0.07802	0.07982
	0.08165	0.08353	0.08546	0.08742	0.08943
	0.09148	0.09358	0.09572	0.09790	0.10012
	0.10239	0.10470	0.10706	0.10946	0.11190
	0.11438	0.11691	0.11948	0.12209	0.12475
	0.12745	0.13032	0.13335	0.13656	0.13993
	0.14347	0.14718	0.15106	0.15510	0.15932
	0.16370	0.16825	0.17297	0.17786	0.18291
	0.18814	0.19402	0.20056	0.20777	0.21563
	0.22415	0.23394	0.24501	0.25735	0.27096
	0.28582	0.30721	0.32973	0.36051	0.40306
	0.47600	0.59694	0.63949	0.67027	0.69279
	0.71418	0.72904	0.74265	0.75499	0.76606
	0.77585	0.78437	0.79223	0.79944	0.80598
	0.81186	0.81709	0.82214	0.82703	0.83175
	0.83630	0.84068	0.84490	0.84894	0.85282
	0.85653	0.86007	0.86344	0.86665	0.86968
	0.87255	0.87525	0.87791	0.88052	0.88309

	0.88562	0.88810	0.89054	0.89294	0.89530
	0.89761	0.89988	0.90210	0.90428	0.90642
	0.90852	0.91057	0.91258	0.91454	0.91647
	0.91835	0.92018	0.92198	0.92373	0.92543
	0.92710	0.92872	0.93030	0.93183	0.93332
	0.93477	0.93618	0.93757	0.93895	0.94033
	0.94169	0.94304	0.94438	0.94571	0.94703
	0.94833	0.94963	0.95092	0.95219	0.95346
	0.95471	0.95596	0.95719	0.95841	0.95962
	0.96082	0.96201	0.96319	0.96436	0.96551
	0.96666	0.96779	0.96892	0.97003	0.97113
	0.97223	0.97331	0.97438	0.97544	0.97649
	0.97753	0.97855	0.97957	0.98057	0.98157
	0.98255	0.98353	0.98449	0.98544	0.98638
	0.98731	0.98823	0.98914	0.99004	0.99093
	0.99180	0.99267	0.99352	0.99437	0.99520
	0.99602	0.99683	0.99763	0.99842	0.999204
	1.0				
50_yr_sm		0.1			
	0.0	0.000790	0.00157	0.00236	0.00316
	0.00397	0.00479	0.00563	0.00647	0.00733
	0.00819	0.00907	0.00996	0.01086	0.01177
	0.01270	0.01363	0.01457	0.01553	0.01650
	0.01747	0.01846	0.01946	0.02047	0.02150
	0.02253	0.02357	0.02463	0.02570	0.02677
	0.02786	0.02896	0.03007	0.03119	0.03233
	0.03347	0.03463	0.03579	0.03697	0.03816
	0.03936	0.04057	0.04179	0.04302	0.04427
	0.04552	0.04679	0.04806	0.04935	0.05065
	0.05196	0.05328	0.05462	0.05596	0.05731
	0.05868	0.06006	0.06144	0.06284	0.06425
	0.06568	0.06714	0.06865	0.07020	0.07180
	0.07345	0.07513	0.07686	0.07864	0.08046
	0.08232	0.08423	0.08619	0.08818	0.09023
	0.09231	0.09444	0.09662	0.09884	0.10110
	0.10341	0.10576	0.10816	0.11060	0.11308
	0.11561	0.11818	0.12080	0.12347	0.12617
	0.12892	0.13185	0.13494	0.13821	0.14165
	0.14526	0.14905	0.15300	0.15713	0.16143
	0.16590	0.17055	0.17537	0.18036	0.18552
	0.19085	0.19686	0.20355	0.21091	0.21895
	0.22766	0.23770	0.24906	0.26174	0.27575
	0.29106	0.31319	0.33648	0.36758	0.40944
	0.47892	0.59056	0.63242	0.66352	0.68681
	0.70894	0.72425	0.73826	0.75094	0.76230
	0.77234	0.78105	0.78909	0.79645	0.80314
	0.80915	0.81448	0.81964	0.82463	0.82945
	0.83410	0.83857	0.84287	0.84700	0.85095
	0.85474	0.85835	0.86179	0.86506	0.86815
	0.87108	0.87383	0.87653	0.87920	0.88182

0.88439 0.88692 0.88940 0.89184 0.89424
0.89659 0.89890 0.90116 0.90338 0.90556
0.90769 0.90977 0.91182 0.91381 0.91577
0.91768 0.91954 0.92136 0.92314 0.92487
0.92655 0.92820 0.92980 0.93135 0.93286
0.93432 0.93575 0.93716 0.93856 0.93994
0.94132 0.94269 0.94404 0.94538 0.94672
0.94804 0.94935 0.95065 0.95194 0.95321
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1.0
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0.00409 0.00494 0.00580 0.00666 0.00754
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0.03439 0.03557 0.03677 0.03798 0.03920
0.04043 0.04167 0.04292 0.04418 0.04546
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0.05334 0.05469 0.05606 0.05743 0.05882
0.06022 0.06163 0.06305 0.06448 0.06593
0.06738 0.06888 0.07043 0.07202 0.07365
0.07533 0.07706 0.07883 0.08064 0.08250
0.08441 0.08636 0.08835 0.09039 0.09248
0.09461 0.09678 0.09900 0.10127 0.10358
0.10593 0.10833 0.11078 0.11327 0.11581
0.11839 0.12101 0.12368 0.12640 0.12916
0.13197 0.13495 0.13810 0.14143 0.14493
0.14861 0.15246 0.15649 0.16069 0.16507
0.16962 0.17435 0.17924 0.18432 0.18957
0.19499 0.20110 0.20789 0.21536 0.22351
0.23235 0.24253 0.25403 0.26687 0.28105
0.29653 0.31888 0.34240 0.37342 0.41449
0.48104 0.58551 0.62658 0.65760 0.68112
0.70347 0.71895 0.73313 0.74597 0.75747
0.76765 0.77649 0.78464 0.79211 0.79890
0.80501 0.81043 0.81568 0.82076 0.82565
0.83038 0.83493 0.83931 0.84351 0.84754
0.85139 0.85507 0.85857 0.86190 0.86505
0.86803 0.87084 0.87360 0.87632 0.87899

```
            0.88161   0.88419   0.88673   0.88922   0.89167
            0.89407   0.89642   0.89873   0.90100   0.90322
            0.90539   0.90752   0.90961   0.91165   0.91364
            0.91559   0.91750   0.91936   0.92117   0.92294
            0.92467   0.92635   0.92798   0.92957   0.93112
            0.93262   0.93407   0.93552   0.93695   0.93837
            0.93978   0.94118   0.94257   0.94394   0.94531
            0.94666   0.94800   0.94933   0.95065   0.95196
            0.95326   0.95454   0.95582   0.95708   0.95833
            0.95957   0.96080   0.96202   0.96323   0.96443
            0.96561   0.96678   0.96794   0.96910   0.97024
            0.97136   0.97248   0.97359   0.97468   0.97576
            0.97684   0.97790   0.97895   0.97998   0.98101
            0.98203   0.98303   0.98402   0.98501   0.98598
            0.98694   0.98788   0.98882   0.98975   0.99066
            0.99156   0.99246   0.99334   0.99420   0.99506
            0.99591   0.99675   0.99757   0.99838   0.999184
            1.0
200_yr_sm             0.1
            0.0       0.000817  0.00164   0.00248   0.00333
            0.00419   0.00506   0.00594   0.00683   0.00774
            0.00865   0.00958   0.01052   0.01147   0.01244
            0.01341   0.01440   0.01539   0.01640   0.01742
            0.01845   0.01950   0.02055   0.02162   0.02270
            0.02379   0.02489   0.02600   0.02712   0.02826
            0.02940   0.03056   0.03173   0.03291   0.03411
            0.03531   0.03653   0.03775   0.03899   0.04024
            0.04150   0.04278   0.04406   0.04536   0.04667
            0.04799   0.04932   0.05066   0.05201   0.05338
            0.05475   0.05614   0.05754   0.05895   0.06038
            0.06181   0.06326   0.06471   0.06618   0.06766
            0.06915   0.07069   0.07228   0.07391   0.07558
            0.07730   0.07907   0.08088   0.08274   0.08465
            0.08660   0.08860   0.09064   0.09273   0.09487
            0.09705   0.09928   0.10155   0.10387   0.10624
            0.10865   0.11110   0.11361   0.11616   0.11875
            0.12139   0.12408   0.12682   0.12960   0.13242
            0.13529   0.13834   0.14157   0.14498   0.14856
            0.15232   0.15626   0.16038   0.16467   0.16915
            0.17380   0.17863   0.18364   0.18883   0.19419
            0.19973   0.20597   0.21290   0.22053   0.22885
            0.23786   0.24822   0.25990   0.27292   0.28728
            0.30297   0.32526   0.34873   0.37941   0.41952
            0.48301   0.58048   0.62059   0.65127   0.67474
            0.69703   0.71272   0.72708   0.74010   0.75178
            0.76214   0.77115   0.77947   0.78710   0.79403
            0.80027   0.80581   0.81117   0.81636   0.82137
            0.82620   0.83085   0.83533   0.83962   0.84374
            0.84768   0.85144   0.85502   0.85843   0.86166
            0.86471   0.86758   0.87040   0.87318   0.87592
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0.89135 0.89376 0.89613 0.89845 0.90072
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0.91340 0.91535 0.91726 0.91912 0.92093
0.92270 0.92442 0.92609 0.92772 0.92931
0.93085 0.93234 0.93382 0.93529 0.93674
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0.94525 0.94662 0.94799 0.94934 0.95068
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0.98659 0.98756 0.98853 0.98948 0.99042
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0.99581 0.99667 0.99752 0.99836 0.999183
1.0

500_yr_sm 0.1

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0.00928 0.01028 0.01128 0.01229 0.01332
0.01436 0.01541 0.01647 0.01754 0.01863
0.01973 0.02084 0.02196 0.02309 0.02423
0.02539 0.02656 0.02774 0.02893 0.03013
0.03134 0.03257 0.03381 0.03506 0.03632
0.03759 0.03888 0.04017 0.04148 0.04280
0.04413 0.04547 0.04683 0.04820 0.04957
0.05096 0.05237 0.05378 0.05521 0.05664
0.05809 0.05955 0.06102 0.06251 0.06400
0.06551 0.06703 0.06856 0.07010 0.07166
0.07322 0.07484 0.07650 0.07820 0.07996
0.08176 0.08361 0.08550 0.08744 0.08943
0.09146 0.09355 0.09567 0.09785 0.10007
0.10234 0.10466 0.10702 0.10943 0.11189
0.11439 0.11694 0.11954 0.12219 0.12488
0.12762 0.13040 0.13323 0.13611 0.13904
0.14201 0.14516 0.14849 0.15201 0.15570
0.15957 0.16361 0.16784 0.17225 0.17684
0.18160 0.18655 0.19167 0.19698 0.20246
0.20812 0.21448 0.22153 0.22927 0.23771
0.24684 0.25729 0.26906 0.28215 0.29656
0.31228 0.33453 0.35795 0.38806 0.42653
0.48556 0.57347 0.61194 0.64205 0.66547
0.68772 0.70344 0.71785 0.73094 0.74271
0.75316 0.76229 0.77073 0.77847 0.78552
0.79188 0.79754 0.80302 0.80833 0.81345
0.81840 0.82316 0.82775 0.83216 0.83639
0.84043 0.84430 0.84799 0.85151 0.85484
0.85799 0.86096 0.86389 0.86677 0.86960

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0.87238   0.87512   0.87781   0.88046   0.88306
0.88561   0.88811   0.89057   0.89298   0.89534
0.89766   0.89993   0.90215   0.90433   0.90645
0.90854   0.91057   0.91256   0.91450   0.91639
0.91824   0.92004   0.92180   0.92350   0.92516
0.92678   0.92834   0.92990   0.93144   0.93297
0.93449   0.93600   0.93749   0.93898   0.94045
0.94191   0.94336   0.94479   0.94622   0.94763
0.94904   0.95043   0.95180   0.95317   0.95453
0.95587   0.95720   0.95852   0.95983   0.96112
0.96241   0.96368   0.96494   0.96619   0.96743
0.96866   0.96987   0.97107   0.97226   0.97344
0.97461   0.97577   0.97691   0.97804   0.97916
0.98027   0.98137   0.98246   0.98353   0.98459
0.98564   0.98668   0.98771   0.98872   0.98972
0.99072   0.99170   0.99266   0.99362   0.99457
0.99550   0.99642   0.99733   0.99823   0.999113
1.0
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WinTR-20 Printed Page File      End of Input Data List
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Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

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STORM 1_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		2.410		12.61	137.7	923.43
Reach8	0.149	Upstream	2.410		12.61	137.7	923.43
Reach8	0.149	Downstream	2.405	142.38	18.60	3.6	24.22
Reach7	0.149	Upstream	2.405	140.56	18.60	3.6	24.22

Reach7	0.149	Downstream	2.405	140.56	18.72	3.6	24.22
SA5	0.083		2.123		12.60	70.7	851.83
SA7	0.287		1.864		12.73	193.8	676.00
Attenuatio	0.287	Upstream	1.864		12.73	193.8	676.00
Attenuatio	0.287	Downstream	1.864	143.49	13.07	141.4	493.01
Reach6	0.287	Upstream	1.864	141.13	13.07	141.4	493.01
Reach6	0.287	Downstream	1.864	141.13	13.14	141.3	492.85
Reach5	0.519	Upstream	2.061		13.00	184.0	354.58
Reach5	0.519	Downstream	2.060	140.67	17.44	15.7	30.25
Reach4	0.519	Upstream	2.060	134.19	17.44	15.7	30.25
Reach4	0.519	Downstream	2.060	134.19	17.56	15.7	30.25
SA3	0.127		1.628		12.54	90.3	710.08
Reach3.5	0.646	Upstream	1.975	129.68	12.54	92.5	143.20
Reach3.5	0.646	Downstream	1.975	129.68	12.54	92.5	143.20
SA4	0.127		1.864		12.45	118.7	933.53
Reach3	0.127	Upstream	1.864	137.05	12.45	118.7	933.53
Reach3	0.127	Downstream	1.864	137.01	12.94	107.6	846.35
Reach2	0.773	Upstream	1.957	130.15	12.86	173.0	223.74
Reach2	0.773	Downstream	1.957	130.15	12.94	172.8	223.55

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA2	0.179		1.348		12.42	130.3	726.48
Reach1	0.952	Upstream	1.842	108.08	12.57	233.0	244.57
Reach1	0.952	Downstream	1.842	108.07	12.82	230.5	242.04
SA1	0.154		0.883		12.25	99.5	644.94
OUTLET	1.107		1.708		12.75	254.9	230.31

STORM 2_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		3.037		12.64	166.5	1116.43
Reach8	0.149	Upstream	3.037		12.64	166.5	1116.43
Reach8	0.149	Downstream	3.032	142.86	18.68	4.5	30.45
Reach7	0.149	Upstream	3.032	140.71	18.68	4.5	30.45
Reach7	0.149	Downstream	3.032	140.71	18.80	4.5	30.45
SA5	0.083		2.732		12.60	87.6	1056.22
SA7	0.287		2.450		12.73	247.1	861.74
Attenuatio	0.287	Upstream	2.450		12.73	247.1	861.74
Attenuatio	0.287	Downstream	2.450	144.26	13.07	187.5	653.78

Reach6	0.287	Upstream	2.450	142.29	13.07	187.5	653.78
Reach6	0.287	Downstream	2.450	142.28	13.21	186.8	651.42
Reach5	0.519	Upstream	2.662		13.12	234.7	452.37
Reach5	0.519	Downstream	2.661	141.81	17.57	19.2	36.98
Reach4	0.519	Upstream	2.661	134.38	17.57	19.2	36.98
Reach4	0.519	Downstream	2.661	134.38	17.68	19.2	36.98
SA3	0.127		2.187		12.57	118.0	927.92
Reach3.5	0.646	Upstream	2.568	129.87	12.57	121.4	188.00

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach3.5	0.646	Downstream	2.568	129.87	12.57	121.4	188.00
SA4	0.127		2.450		12.46	150.0	1179.39
Reach3	0.127	Upstream	2.450	137.17	12.46	150.0	1179.39
Reach3	0.127	Downstream	2.450	137.12	12.91	137.0	1077.00
Reach2	0.773	Upstream	2.549	130.39	12.83	226.9	293.49
Reach2	0.773	Downstream	2.549	130.39	12.91	226.7	293.19
SA2	0.179		1.865		12.39	175.6	978.92
Reach1	0.952	Upstream	2.420	108.40	12.53	315.5	331.23
Reach1	0.952	Downstream	2.420	108.38	12.85	311.6	327.19
SA1	0.154		1.309		12.24	146.4	949.06
OUTLET	1.107		2.265		12.76	345.4	312.04

STORM 5_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		4.043		12.61	205.1	1375.79
Reach8	0.149	Upstream	4.043		12.61	205.1	1375.79
Reach8	0.149	Downstream	4.038	143.28	14.77	20.2	135.15
Reach7	0.149	Upstream	4.038	142.36	14.77	20.2	135.15
Reach7	0.149	Downstream	4.038	142.36	14.89	20.1	135.13
SA5	0.083		3.719		12.62	110.1	1327.77
SA7	0.287		3.409		12.73	321.0	1119.63
Attenuatio	0.287	Upstream	3.409		12.73	321.0	1119.63
Attenuatio	0.287	Downstream	3.409	144.69	12.93	291.2	1015.64
Reach6	0.287	Upstream	3.409	144.03	12.93	291.2	1015.64
Reach6	0.287	Downstream	3.409	143.81	13.27	270.4	942.94

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach5	0.519	Upstream	3.639		13.25	322.8	622.14
Reach5	0.519	Downstream	3.639	142.71	15.04	102.0	196.62
Reach4	0.519	Upstream	3.639	137.86	15.04	102.0	196.62
Reach4	0.519	Downstream	3.639	137.86	15.16	101.9	196.38
SA3	0.127		3.114		12.56	156.2	1227.74
Reach3.5	0.646	Upstream	3.535	130.09	12.56	161.8	250.43
Reach3.5	0.646	Downstream	3.535	130.09	12.56	161.8	250.43
SA4	0.127		3.409		12.42	191.4	1505.13
Reach3	0.127	Upstream	3.409	137.33	12.42	191.4	1505.13
Reach3	0.127	Downstream	3.409	137.27	12.88	176.2	1385.32
Reach2	0.773	Upstream	3.515	130.64	12.80	303.5	392.58
Reach2	0.773	Downstream	3.515	130.63	12.88	303.1	392.02
SA2	0.179		2.742		12.39	239.1	1333.19
Reach1	0.952	Upstream	3.369	108.87	12.54	437.0	458.84
Reach1	0.952	Downstream	3.369	108.85	12.86	430.6	452.07
SA1	0.154		2.065		12.25	212.6	1378.10
OUTLET	1.107		3.187		12.79	479.7	433.43

STORM 10_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		4.866		12.61	239.7	1607.57
Reach8	0.149	Upstream	4.866		12.61	239.7	1607.57
Reach8	0.149	Downstream	4.860	143.63	14.71	25.0	167.45
Reach7	0.149	Upstream	4.860	142.81	14.71	25.0	167.45
Reach7	0.149	Downstream	4.860	142.81	14.83	25.0	167.43

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA5	0.083		4.529		12.61	130.2	1569.99
SA7	0.287		4.204		12.74	385.3	1343.94
Attenuatio	0.287	Upstream	4.204		12.74	385.3	1343.94
Attenuatio	0.287	Downstream	4.204	144.92	12.88	367.6	1282.03

Reach6	0.287	Upstream	4.204	144.21	12.88	367.6	1282.03
Reach6	0.287	Downstream	4.204	144.15	13.22	344.5	1201.62
Reach5	0.519	Upstream	4.445		13.19	419.5	808.60
Reach5	0.519	Downstream	4.444	143.07	14.46	177.0	341.20
Reach4	0.519	Upstream	4.444	139.32	14.46	177.0	341.20
Reach4	0.519	Downstream	4.444	139.31	14.63	176.5	340.15
SA3	0.127		3.889		12.52	189.3	1488.42
Reach3.5	0.646	Upstream	4.335	130.27	12.57	196.8	304.61
Reach3.5	0.646	Downstream	4.335	130.27	12.57	196.8	304.61
SA4	0.127		4.204		12.46	228.0	1793.11
Reach3	0.127	Upstream	4.204	137.46	12.46	228.0	1793.11
Reach3	0.127	Downstream	4.204	137.40	12.87	210.9	1658.78
Reach2	0.773	Upstream	4.313	130.82	12.79	368.6	476.77
Reach2	0.773	Downstream	4.313	130.82	12.83	367.9	475.81
SA2	0.179		3.485		12.40	294.6	1642.89
Reach1	0.952	Upstream	4.157	109.10	12.55	542.8	569.83
Reach1	0.952	Downstream	4.157	109.09	12.84	534.6	561.29
SA1	0.154		2.728		12.23	273.1	1770.22
OUTLET	1.107		3.958		12.75	601.1	543.12

STORM 25_yr_sm

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		6.038		12.62	280.0	1877.55
Reach8	0.149	Upstream	6.038		12.62	280.0	1877.55
Reach8	0.149	Downstream	6.032	144.14	14.71	31.4	210.70
Reach7	0.149	Upstream	6.032	143.18	14.71	31.4	210.70
Reach7	0.149	Downstream	6.032	143.18	14.89	31.4	210.68
SA5	0.083		5.690		12.61	153.7	1853.32
SA7	0.287		5.347		12.67	463.4	1616.20
Attenuatio	0.287	Upstream	5.347		12.67	463.4	1616.20
Attenuatio	0.287	Downstream	5.347	145.14	12.81	452.8	1579.02
Reach6	0.287	Upstream	5.347	144.42	12.81	452.8	1579.02
Reach6	0.287	Downstream	5.347	144.36	13.15	429.8	1498.93
Reach5	0.519	Upstream	5.599		13.13	536.9	1034.81
Reach5	0.519	Downstream	5.598	143.50	13.83	306.2	590.20
Reach4	0.519	Upstream	5.598	140.21	13.83	306.2	590.20
Reach4	0.519	Downstream	5.598	140.12	14.17	292.5	563.76
SA3	0.127		5.011		12.55	229.6	1804.96

Reach3.5	0.646	Upstream	5.483	130.69	14.19	324.2	501.87
Reach3.5	0.646	Downstream	5.483	130.69	14.19	324.2	501.87
SA4	0.127		5.347		12.44	271.1	2131.84
Reach3	0.127	Upstream	5.347	137.63	12.44	271.1	2131.84
Reach3	0.127	Downstream	5.347	137.55	12.86	251.7	1979.37
Reach2	0.773	Upstream	5.460	131.01	12.78	446.1	576.93
Reach2	0.773	Downstream	5.460	131.01	12.82	445.5	576.23
SA2	0.179		4.570		12.38	361.1	2013.29
Reach1	0.952	Upstream	5.293	109.28	12.52	673.3	706.90
Reach1	0.952	Downstream	5.293	109.27	12.81	663.7	696.78

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA1	0.154		3.721		12.23	345.9	2242.28
OUTLET	1.107		5.074		12.70	759.8	686.47

STORM 50_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		7.013		12.64	311.9	2091.94
Reach8	0.149	Upstream	7.013		12.64	311.9	2091.94
Reach8	0.149	Downstream	7.007	144.57	14.73	35.6	238.52
Reach7	0.149	Upstream	7.007	143.34	14.73	35.6	238.52
Reach7	0.149	Downstream	7.007	143.34	15.03	35.6	238.49
SA5	0.083		6.657		12.58	172.6	2080.12
SA7	0.287		6.304		12.72	526.8	1837.44
Attenuatio	0.287	Upstream	6.304		12.72	526.8	1837.44
Attenuatio	0.287	Downstream	6.304	145.29	12.79	518.5	1808.36
Reach6	0.287	Upstream	6.304	144.57	12.79	518.5	1808.36
Reach6	0.287	Downstream	6.304	144.52	13.13	496.9	1733.16
Reach5	0.519	Upstream	6.563		13.04	626.5	1207.68
Reach5	0.519	Downstream	6.563	143.70	13.56	462.1	890.68
Reach4	0.519	Upstream	6.563	141.05	13.56	462.1	890.68
Reach4	0.519	Downstream	6.563	141.02	13.96	433.6	835.81
SA3	0.127		5.954		12.54	261.2	2053.24
Reach3.5	0.646	Upstream	6.443	131.04	13.92	480.5	743.83
Reach3.5	0.646	Downstream	6.443	131.04	13.92	480.5	743.83
SA4	0.127		6.304		12.43	304.2	2392.04
Reach3	0.127	Upstream	6.304	137.75	12.43	304.2	2392.04

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach3	0.127	Downstream	6.304	137.67	12.85	283.6	2230.35
Reach2	0.773	Upstream	6.420	131.09	13.88	546.6	706.93
Reach2	0.773	Downstream	6.420	131.09	13.96	546.1	706.32
SA2	0.179		5.490		12.39	412.8	2301.83
Reach1	0.952	Upstream	6.245	109.43	12.53	779.8	818.65
Reach1	0.952	Downstream	6.245	109.42	12.78	769.9	808.33
SA1	0.154		4.578		12.24	400.0	2592.80
OUTLET	1.107		6.013		12.68	894.4	808.13

STORM 100_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		8.049		12.60	345.3	2315.72
Reach8	0.149	Upstream	8.049		12.60	345.3	2315.72
Reach8	0.149	Downstream	8.044	145.01	14.82	39.9	267.72
Reach7	0.149	Upstream	8.044	143.52	14.82	39.9	267.72
Reach7	0.149	Downstream	8.043	143.52	15.18	39.9	267.66
SA5	0.083		7.687		12.60	191.8	2311.57
SA7	0.287		7.325		12.71	590.7	2060.13
Attenuatio	0.287	Upstream	7.325		12.71	590.7	2060.13
Attenuatio	0.287	Downstream	7.326	145.43	12.78	582.2	2030.43
Reach6	0.287	Upstream	7.326	144.73	12.78	582.2	2030.43
Reach6	0.287	Downstream	7.326	144.68	13.05	563.7	1965.89
Reach5	0.519	Upstream	7.590		13.00	713.1	1374.51
Reach5	0.519	Downstream	7.588	143.89	13.41	591.6	1140.33
Reach4	0.519	Upstream	7.588	141.21	13.41	591.6	1140.33

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Reach4	0.519	Downstream	7.588	141.18	13.75	563.6	1086.39
SA3	0.127		6.963		12.54	293.1	2304.59
Reach3.5	0.646	Upstream	7.465	131.15	13.72	631.5	977.54

Reach3.5	0.646	Downstream	7.465	131.15	13.72	631.5	977.54
SA4	0.127		7.325		12.43	337.4	2653.72
Reach3	0.127	Upstream	7.325	137.88	12.43	337.4	2653.72
Reach3	0.127	Downstream	7.325	137.79	12.84	315.9	2484.30
Reach2	0.773	Upstream	7.442	131.23	13.67	732.8	947.81
Reach2	0.773	Downstream	7.442	131.23	13.75	731.9	946.68
SA2	0.179		6.479		12.38	464.6	2590.53
Reach1	0.952	Upstream	7.261	109.58	12.52	887.0	931.26
Reach1	0.952	Downstream	7.261	109.57	12.78	877.1	920.82
SA1	0.154		5.511		12.22	455.8	2954.57
OUTLET	1.107		7.017		12.67	1030.7	931.26

STORM 200_yr_sm

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
SA6	0.149		9.166		12.60	377.3	2530.39
Reach8	0.149	Upstream	9.166		12.60	377.3	2530.39
Reach8	0.149	Downstream	9.159	145.10	13.62	131.2	879.62
Reach7	0.149	Upstream	9.159	144.36	13.62	131.2	879.62
Reach7	0.149	Downstream	9.159	144.31	14.10	119.3	800.28
SA5	0.083		8.799		12.62	210.0	2531.11
SA7	0.287		8.429		12.69	652.4	2275.48
Attenuatio	0.287	Upstream	8.429		12.69	652.4	2275.48

Area or Reach Identifier	Drainage Area (sq mi)	Rain Gage ID or Location	Runoff Amount (in)	Peak Flow Elevation (ft)	Peak Flow Time (hr)	Peak Flow Rate (cfs)	Peak Flow Rate (csm)
Attenuatio	0.287	Downstream	8.429	145.54	12.76	645.2	2250.36
Reach6	0.287	Upstream	8.429	144.88	12.76	645.2	2250.36
Reach6	0.287	Downstream	8.429	144.84	13.03	627.3	2187.79
Reach5	0.519	Upstream	8.698		12.96	799.2	1540.55
Reach5	0.519	Downstream	8.697	144.06	13.25	723.1	1393.88
Reach4	0.519	Upstream	8.697	141.38	13.25	723.1	1393.88
Reach4	0.519	Downstream	8.697	141.33	13.60	687.1	1324.33
SA3	0.127		8.056		12.51	324.0	2547.40
Reach3.5	0.646	Upstream	8.571	131.27	13.54	782.3	1211.04
Reach3.5	0.646	Downstream	8.571	131.27	13.54	782.3	1211.03
SA4	0.127		8.429		12.44	369.7	2907.71
Reach3	0.127	Upstream	8.429	138.00	12.44	369.7	2907.71
Reach3	0.127	Downstream	8.429	137.91	12.86	347.2	2730.49
Reach2	0.773	Upstream	8.548	131.38	13.52	926.6	1198.51

Reach2	0.773	Downstream	8.547	131.38	13.56	926.1	1197.76
SA2	0.179		7.554		12.38	515.2	2872.51
Reach1	0.952	Upstream	8.360	109.77	13.54	1026.9	1078.10
Reach1	0.952	Downstream	8.360	109.76	13.72	1016.5	1067.21
SA1	0.154		6.535		12.23	510.0	3306.13
OUTLET	1.107		8.106		12.63	1168.0	1055.33

Smithfield Resiliency Plan
Proposed Conditions - Above Ground Flood Attenuation Facility

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 1_yr_sm (cfs)	2_yr_sm (cfs)	5_yr_sm (cfs)	10_yr_sm (cfs)	25_yr_sm (cfs)
SA1	0.154	99.5	146.4	212.6	273.1	345.9
SA2	0.179	130.3	175.6	239.1	294.6	361.1
SA3	0.127	90.3	118.0	156.2	189.3	229.6
SA4	0.127	118.7	150.0	191.4	228.0	271.1
SA5	0.083	70.7	87.6	110.1	130.2	153.7
SA7	0.287	193.8	247.1	321.0	385.3	463.4
SA6	0.149	137.7	166.5	205.1	239.7	280.0
Reach1	0.952	233.0	315.5	437.0	542.8	673.3
DOWNSTREAM		230.5	311.6	430.6	534.6	663.7
Reach2	0.773	173.0	226.9	303.5	368.6	446.1
DOWNSTREAM		172.8	226.7	303.1	367.9	445.5
Reach3	0.127	118.7	150.0	191.4	228.0	271.1
DOWNSTREAM		107.6	137.0	176.2	210.9	251.7
Reach4	0.519	15.7	19.2	102.0	177.0	306.2
DOWNSTREAM		15.7	19.2	101.9	176.5	292.5
Reach5	0.519	184.0	234.7	322.8	419.5	536.9
DOWNSTREAM		15.7	19.2	102.0	177.0	306.2
Reach6	0.287	141.4	187.5	291.2	367.6	452.8
DOWNSTREAM		141.3	186.8	270.4	344.5	429.8
Reach7	0.149	3.6	4.5	20.2	25.0	31.4
DOWNSTREAM		3.6	4.5	20.1	25.0	31.4
Reach8	0.149	137.7	166.5	205.1	239.7	280.0
DOWNSTREAM		3.6	4.5	20.2	25.0	31.4

Reach3.5	0.646	92.5	121.4	161.8	196.8	324.2
DOWNSTREAM		92.5	121.4	161.8	196.8	324.2
Attenuatio	0.287	193.8	247.1	321.0	385.3	463.4
DOWNSTREAM		141.4	187.5	291.2	367.6	452.8
OUTLET	1.107	254.9	345.4	479.7	601.1	759.8

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 50_yr_sm (cfs)	100_yr_sm (cfs)	200_yr_sm (cfs)	(cfs)	(cfs)
SA1	0.154	400.0	455.8	510.0		
SA2	0.179	412.8	464.6	515.2		
SA3	0.127	261.2	293.1	324.0		
SA4	0.127	304.2	337.4	369.7		
SA5	0.083	172.6	191.8	210.0		
SA7	0.287	526.8	590.7	652.4		
SA6	0.149	311.9	345.3	377.3		
Reach1	0.952	779.8	887.0	1026.9		
DOWNSTREAM		769.9	877.1	1016.5		
Reach2	0.773	546.6	732.8	926.6		
DOWNSTREAM		546.1	731.9	926.1		
Reach3	0.127	304.2	337.4	369.7		
DOWNSTREAM		283.6	315.9	347.2		
Reach4	0.519	462.1	591.6	723.1		
DOWNSTREAM		433.6	563.6	687.1		
Reach5	0.519	626.5	713.1	799.2		
DOWNSTREAM		462.1	591.6	723.1		

Area or Reach Identifier	Drainage Area (sq mi)	Peak Flow by Storm 50_yr_sm (cfs)	100_yr_sm (cfs)	200_yr_sm (cfs)	(cfs)	(cfs)
Reach6	0.287	518.5	582.2	645.2		
DOWNSTREAM		496.9	563.7	627.3		
Reach7	0.149	35.6	39.9	131.2		
DOWNSTREAM		35.6	39.9	119.3		
Reach8	0.149	311.9	345.3	377.3		
DOWNSTREAM		35.6	39.9	131.2		
Reach3.5	0.646	480.5	631.5	782.3		
DOWNSTREAM		480.5	631.5	782.3		
Attenuatio	0.287	526.8	590.7	652.4		
DOWNSTREAM		518.5	582.2	645.2		
OUTLET	1.107	894.4	1030.7	1168.0		

APPENDIX B

HYDRAULIC MODELING

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

APPENDIX B.1

HYDRAULIC MODELING

Existing Conditions

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

HEC-RAS River: Spring Branch Reach: Reach-1

Reach	River Sta	Profile	Plan	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)	
Reach-1	5729	2-yr	Existing w backwater	122.00	136.21	140.25	139.33	140.43	0.004415	3.43	36.45	24.80	0.45
Reach-1	5729	2-yr	Existing no backwater	122.00	136.21	140.25	139.33	140.43	0.004415	3.43	36.45	24.80	0.45
Reach-1	5729	10-yr	Existing w backwater	224.00	136.21	141.24	140.06	141.40	0.002435	3.41	92.41	120.69	0.36
Reach-1	5729	10-yr	Existing no backwater	224.00	136.21	141.24	140.06	141.40	0.002435	3.41	92.41	120.69	0.36
Reach-1	5729	25-yr	Existing w backwater	388.00	136.21	141.29	140.98	141.71	0.006732	5.73	97.59	132.06	0.60
Reach-1	5729	25-yr	Existing no backwater	388.00	136.21	141.29	140.98	141.71	0.006732	5.73	97.59	132.06	0.60
Reach-1	5729	50-yr	Existing w backwater	544.00	136.21	141.64	141.64	142.03	0.006385	6.02	181.26	401.73	0.59
Reach-1	5729	50-yr	Existing no backwater	544.00	136.21	141.64	141.64	142.03	0.006385	6.02	181.26	401.73	0.59
Reach-1	5729	100-yr	Existing w backwater	692.00	136.21	141.88	141.88	142.18	0.005327	5.77	268.91	546.57	0.55
Reach-1	5729	100-yr	Existing no backwater	692.00	136.21	141.88	141.88	142.18	0.005327	5.77	268.91	546.57	0.55
Reach-1	5678	2-yr	Existing w backwater	122.00	135.30	140.21	138.38	140.27	0.001141	2.15	84.99	141.80	0.24
Reach-1	5678	2-yr	Existing no backwater	122.00	135.30	140.21	138.38	140.27	0.001141	2.15	84.99	141.80	0.24
Reach-1	5678	10-yr	Existing w backwater	224.00	135.30	141.28	139.17	141.30	0.000289	1.37	355.34	386.84	0.13
Reach-1	5678	10-yr	Existing no backwater	224.00	135.30	141.28	139.17	141.30	0.000289	1.37	355.34	386.84	0.13
Reach-1	5678	25-yr	Existing w backwater	388.00	135.30	141.41	140.43	141.44	0.000692	2.17	404.70	460.69	0.20
Reach-1	5678	25-yr	Existing no backwater	388.00	135.30	141.41	140.43	141.44	0.000692	2.17	404.70	460.69	0.20
Reach-1	5678	50-yr	Existing w backwater	544.00	135.30	141.54	140.66	141.59	0.001009	2.68	465.30	505.14	0.24
Reach-1	5678	50-yr	Existing no backwater	544.00	135.30	141.54	140.66	141.59	0.001009	2.68	465.30	505.14	0.24
Reach-1	5678	100-yr	Existing w backwater	692.00	135.30	141.61	140.85	141.68	0.001407	3.20	495.48	534.42	0.28
Reach-1	5678	100-yr	Existing no backwater	692.00	135.30	141.61	140.85	141.68	0.001407	3.20	495.48	534.42	0.28
Reach-1	5172			Culvert									
Reach-1	4646	2-yr	Existing w backwater	122.00	132.10	139.12	135.24	139.12	0.000000	0.04	4842.85	1668.82	0.00
Reach-1	4646	2-yr	Existing no backwater	122.00	132.10	139.12	135.24	139.12	0.000000	0.04	4842.85	1668.82	0.00
Reach-1	4646	10-yr	Existing w backwater	224.00	132.10	141.29	136.05	141.29	0.000000	0.03	8686.70	1961.05	0.00
Reach-1	4646	10-yr	Existing no backwater	224.00	132.10	141.29	136.05	141.29	0.000000	0.03	8686.70	1961.05	0.00
Reach-1	4646	25-yr	Existing w backwater	388.00	132.10	141.43	136.58	141.43	0.000000	0.06	8967.86	2029.30	0.00
Reach-1	4646	25-yr	Existing no backwater	388.00	132.10	141.43	136.58	141.43	0.000000	0.06	8967.86	2029.30	0.00
Reach-1	4646	50-yr	Existing w backwater	544.00	132.10	141.59	136.85	141.59	0.000000	0.08	9285.23	2084.42	0.01
Reach-1	4646	50-yr	Existing no backwater	544.00	132.10	141.59	136.85	141.59	0.000000	0.08	9285.23	2084.42	0.01
Reach-1	4646	100-yr	Existing w backwater	692.00	132.10	141.66	137.00	141.66	0.000001	0.10	9446.95	2106.80	0.01
Reach-1	4646	100-yr	Existing no backwater	692.00	132.10	141.66	137.00	141.66	0.000001	0.10	9446.95	2106.80	0.01
Reach-1	4632	2-yr	Existing w backwater	229.00	131.97	139.12	134.37	139.12	0.000000	0.06	4083.37	1551.76	0.00
Reach-1	4632	2-yr	Existing no backwater	229.00	131.97	139.12	134.37	139.12	0.000000	0.06	4083.37	1551.76	0.00
Reach-1	4632	10-yr	Existing w backwater	370.00	131.97	141.29	135.07	141.29	0.000000	0.03	12722.14	3117.75	0.00
Reach-1	4632	10-yr	Existing no backwater	370.00	131.97	141.29	135.07	141.29	0.000000	0.03	12722.14	3117.75	0.00
Reach-1	4632	25-yr	Existing w backwater	447.00	131.97	141.43	135.59	141.43	0.000000	0.04	13162.20	3130.22	0.00
Reach-1	4632	25-yr	Existing no backwater	447.00	131.97	141.43	135.59	141.43	0.000000	0.04	13162.20	3130.22	0.00
Reach-1	4632	50-yr	Existing w backwater	633.00	131.97	141.59	136.10	141.59	0.000000	0.05	13646.88	3151.49	0.00
Reach-1	4632	50-yr	Existing no backwater	633.00	131.97	141.59	136.10	141.59	0.000000	0.05	13646.88	3151.49	0.00
Reach-1	4632	100-yr	Existing w backwater	824.00	131.97	141.66	136.52	141.66	0.000000	0.06	13890.22	3154.51	0.00
Reach-1	4632	100-yr	Existing no backwater	824.00	131.97	141.66	136.52	141.66	0.000000	0.06	13890.22	3154.51	0.00
Reach-1	4603			Culvert									
Reach-1	4524	2-yr	Existing w backwater	312.00	131.77	137.81	134.54	137.81	0.000032	0.47	822.45	1748.26	0.04
Reach-1	4524	2-yr	Existing no backwater	312.00	131.77	137.81	134.54	137.81	0.000032	0.47	822.45	1748.26	0.04
Reach-1	4524	10-yr	Existing w backwater	536.00	131.77	138.03	135.26	138.04	0.000071	0.72	942.09	1853.78	0.05
Reach-1	4524	10-yr	Existing no backwater	536.00	131.77	138.03	135.26	138.04	0.000071	0.72	942.09	1853.78	0.05
Reach-1	4524	25-yr	Existing w backwater	665.00	131.77	138.12	135.58	138.13	0.000098	0.85	992.70	1900.97	0.06
Reach-1	4524	25-yr	Existing no backwater	665.00	131.77	138.12	135.58	138.13	0.000098	0.85	992.70	1900.97	0.06
Reach-1	4524	50-yr	Existing w backwater	772.00	131.77	138.21	135.74	138.22	0.000114	0.93	1043.16	1923.06	0.07
Reach-1	4524	50-yr	Existing no backwater	772.00	131.77	138.21	135.74	138.22	0.000114	0.93	1043.16	1923.06	0.07
Reach-1	4524	100-yr	Existing w backwater	902.00	131.77	138.30	135.86	138.31	0.000137	1.03	1092.50	1945.94	0.08
Reach-1	4524	100-yr	Existing no backwater	902.00	131.77	138.30	135.86	138.31	0.000137	1.03	1092.50	1945.94	0.08
Reach-1	4343	2-yr	Existing w backwater	312.00	130.19	137.80	133.37	137.81	0.000006	0.23	1994.11	870.22	0.02
Reach-1	4343	2-yr	Existing no backwater	312.00	130.19	137.80	133.37	137.81	0.000006	0.23	1994.11	870.22	0.02
Reach-1	4343	10-yr	Existing w backwater	536.00	130.19	138.03	134.44	138.03	0.000014	0.35	2177.15	892.10	0.02
Reach-1	4343	10-yr	Existing no backwater	536.00	130.19	138.03	134.44	138.03	0.000014	0.35	2177.15	892.10	0.02
Reach-1	4343	25-yr	Existing w backwater	665.00	130.19	138.12	135.29	138.12	0.000019	0.41	2252.85	904.69	0.03
Reach-1	4343	25-yr	Existing no backwater	665.00	130.19	138.12	135.29	138.12	0.000019	0.41	2252.85	904.69	0.03
Reach-1	4343	50-yr	Existing w backwater	772.00	130.19	138.21	135.64	138.21	0.000023	0.46	2328.95	917.17	0.03
Reach-1	4343	50-yr	Existing no backwater	772.00	130.19	138.21	135.64	138.21	0.000023	0.46	2328.95	917.17	0.03
Reach-1	4343	100-yr	Existing w backwater	902.00	130.19	138.30	136.00	138.30	0.000030	0.52	2403.40	933.42	0.03
Reach-1	4343	100-yr	Existing no backwater	902.00	130.19	138.30	136.00	138.30	0.000030	0.52	2403.40	933.42	0.03
Reach-1	4140			Culvert									
Reach-1	3936	2-yr	Existing w backwater	312.00	129.13	133.02	133.02	133.35	0.007965	5.07	103.49	178.62	0.53
Reach-1	3936	2-yr	Existing no backwater	312.00	129.13	133.02	133.02	133.35	0.007965	5.07	103.49	178.62	0.53
Reach-1	3936	10-yr	Existing w backwater	536.00	129.13	133.38	133.38	133.73	0.009262	5.91	172.81	221.95	0.58
Reach-1	3936	10-yr	Existing no backwater	536.00	129.13	133.38	133.38	133.73	0.009262	5.91	172.81	221.95	0.58
Reach-1	3936	25-yr	Existing w backwater	665.00	129.13	133.50	133.50	133.89	0.010410	6.42	198.52	230.73	0.62
Reach-1	3936	25-yr	Existing no backwater	665.00	129.13	133.50	133.50	133.89	0.010410	6.42	198.52	230.73	0.62
Reach-1	3936	50-yr	Existing w backwater	772.00	129.13	133.60	133.60	134.01	0.010937	6.71	220.29	246.43	0.64
Reach-1	3936	50-yr	Existing no backwater	772.00	129.13	133.60	133.60	134.01	0.010937	6.71	220.29	246.43	0.64
Reach-1	3936	100-yr	Existing w backwater	902.00	129.13	133.71	133.71	134.14	0.011806	7.11	241.89	267.58	0.66
Reach-1	3936	100-yr	Existing no backwater	902.00	129.13	133.71	133.71	134.14	0.011806	7.11	241.89	267.58	0.66
Reach-1	3812	2-yr	Existing w backwater	312.00	126.39	132.35	130.67	132.41	0.001598	2.68	214.39	226.68	0.24
Reach-1	3812	2-yr	Existing no backwater	312.00	126.39	132.35	130.67	132.41	0.001598	2.68	214.39	226.68	0.24
Reach-1	3812	10-yr	Existing w backwater	536.00	126.39	132.56	131.97	132.68	0.003063	3.84	269.88	292.56	0.33
Reach-1	3812	10-yr	Existing no backwater	536.00	126.39	132.56	131.97	132.68	0.003063	3.84	269.88	292.56	0.33
Reach-1	3812	25-yr	Existing w backwater	665.00	126.39	132.67	132.15	132.82	0.003725	4.31	302.98	320.92	0.37
Reach-1	3812	25-yr	Existing no backwater	665.00	126.39	132.67	132.15	132.82	0.003725	4.31	302.98	320.92	0.37
Reach-1	3812	50-yr	Existing w backwater	772.00	126.39	132.76	132.27	132.92	0.004174	4.63	331.16	339.50	0.39

HEC-RAS River: Spring Branch Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	3812	50-yr	Existing no backwater	772.00	126.39	132.76	132.27	132.92	0.004174	4.63	331.16	339.50	0.39
Reach-1	3812	100-yr	Existing w backwater	902.00	126.39	132.87	132.44	133.05	0.004576	4.92	364.65	358.01	0.41
Reach-1	3812	100-yr	Existing no backwater	902.00	126.39	132.87	132.44	133.05	0.004576	4.92	364.65	358.01	0.41
Reach-1	3789	2-yr	Existing w backwater	312.00	126.34	132.29	130.74	132.36	0.002325	2.94	226.19	297.91	0.27
Reach-1	3789	2-yr	Existing no backwater	312.00	126.34	132.29	130.74	132.36	0.002325	2.94	226.19	297.91	0.27
Reach-1	3789	10-yr	Existing w backwater	536.00	126.34	132.44	132.22	132.58	0.004377	4.14	273.99	310.60	0.37
Reach-1	3789	10-yr	Existing no backwater	536.00	126.34	132.44	132.22	132.58	0.004377	4.14	273.99	310.60	0.37
Reach-1	3789	25-yr	Existing w backwater	665.00	126.34	132.54	132.33	132.70	0.005248	4.61	303.31	317.72	0.41
Reach-1	3789	25-yr	Existing no backwater	665.00	126.34	132.54	132.33	132.70	0.005248	4.61	303.31	317.72	0.41
Reach-1	3789	50-yr	Existing w backwater	772.00	126.34	132.62	132.40	132.79	0.005711	4.87	330.18	323.53	0.43
Reach-1	3789	50-yr	Existing no backwater	772.00	126.34	132.62	132.40	132.79	0.005711	4.87	330.18	323.53	0.43
Reach-1	3789	100-yr	Existing w backwater	902.00	126.34	132.72	132.48	132.90	0.006152	5.14	362.03	330.28	0.45
Reach-1	3789	100-yr	Existing no backwater	902.00	126.34	132.72	132.48	132.90	0.006152	5.14	362.03	330.28	0.45
Reach-1	3548			Culvert									
Reach-1	3306	2-yr	Existing w backwater	312.00	125.06	131.41	129.02	131.44	0.000758	1.84	353.70	341.17	0.15
Reach-1	3306	2-yr	Existing no backwater	312.00	125.06	131.41	129.02	131.44	0.000758	1.84	353.70	341.17	0.15
Reach-1	3306	10-yr	Existing w backwater	536.00	125.06	131.12	130.93	131.29	0.004663	4.36	258.39	307.96	0.37
Reach-1	3306	10-yr	Existing no backwater	536.00	125.06	131.12	130.93	131.29	0.004663	4.36	258.39	307.96	0.37
Reach-1	3306	25-yr	Existing w backwater	665.00	125.06	131.33	131.04	131.47	0.004182	4.26	326.27	330.73	0.36
Reach-1	3306	25-yr	Existing no backwater	665.00	125.06	131.33	131.04	131.47	0.004182	4.26	326.27	330.73	0.36
Reach-1	3306	50-yr	Existing w backwater	772.00	125.06	131.48	131.13	131.61	0.003985	4.26	376.67	349.03	0.35
Reach-1	3306	50-yr	Existing no backwater	772.00	125.06	131.48	131.13	131.61	0.003985	4.26	376.67	349.03	0.35
Reach-1	3306	100-yr	Existing w backwater	902.00	125.06	131.64	131.22	131.77	0.004051	4.39	432.06	364.29	0.35
Reach-1	3306	100-yr	Existing no backwater	902.00	125.06	131.64	131.22	131.77	0.004051	4.39	432.06	364.29	0.35
Reach-1	3079	2-yr	Existing w backwater	312.00	123.48	131.38	128.82	131.39	0.000082	0.64	760.21	319.04	0.04
Reach-1	3079	2-yr	Existing no backwater	312.00	123.48	131.38	128.82	131.39	0.000082	0.64	760.21	319.04	0.04
Reach-1	3079	10-yr	Existing w backwater	536.00	123.48	130.96	129.15	130.97	0.000449	1.45	627.69	310.70	0.10
Reach-1	3079	10-yr	Existing no backwater	536.00	123.48	130.96	129.15	130.97	0.000449	1.45	627.69	310.70	0.10
Reach-1	3079	25-yr	Existing w backwater	665.00	123.48	131.13	129.25	131.15	0.000530	1.60	682.07	310.70	0.11
Reach-1	3079	25-yr	Existing no backwater	665.00	123.48	131.13	129.25	131.15	0.000530	1.60	682.07	310.70	0.11
Reach-1	3079	50-yr	Existing w backwater	772.00	123.48	131.25	129.32	131.27	0.000602	1.72	719.31	316.82	0.12
Reach-1	3079	50-yr	Existing no backwater	772.00	123.48	131.25	129.32	131.27	0.000602	1.72	719.31	316.82	0.12
Reach-1	3079	100-yr	Existing w backwater	902.00	123.48	131.37	129.42	131.39	0.000698	1.88	756.35	318.83	0.13
Reach-1	3079	100-yr	Existing no backwater	902.00	123.48	131.37	129.42	131.39	0.000698	1.88	756.35	318.83	0.13
Reach-1	2903	2-yr	Existing w backwater	312.00	123.29	128.54	128.54	130.69	0.070820	11.76	26.54	6.18	1.00
Reach-1	2903	2-yr	Existing no backwater	312.00	123.29	128.54	128.54	130.69	0.070820	11.76	26.54	6.18	1.00
Reach-1	2903	10-yr	Existing w backwater	536.00	123.29	130.73	130.14	130.79	0.003113	3.04	313.72	277.03	0.21
Reach-1	2903	10-yr	Existing no backwater	536.00	123.29	130.73	130.14	130.79	0.003113	3.04	313.72	277.03	0.21
Reach-1	2903	25-yr	Existing w backwater	665.00	123.29	130.87	130.24	130.94	0.003481	3.26	354.43	299.63	0.23
Reach-1	2903	25-yr	Existing no backwater	665.00	123.29	130.87	130.24	130.94	0.003481	3.26	354.43	299.63	0.23
Reach-1	2903	50-yr	Existing w backwater	772.00	123.29	130.96	130.31	131.04	0.003886	3.48	380.87	308.80	0.24
Reach-1	2903	50-yr	Existing no backwater	772.00	123.29	130.96	130.31	131.04	0.003886	3.48	380.87	308.80	0.24
Reach-1	2903	100-yr	Existing w backwater	902.00	123.29	131.03	130.40	131.12	0.004576	3.80	402.05	309.20	0.26
Reach-1	2903	100-yr	Existing no backwater	902.00	123.29	131.03	130.40	131.12	0.004576	3.80	402.05	309.20	0.26
Reach-1	2865			Culvert									
Reach-1	2826	2-yr	Existing w backwater	312.00	122.94	129.83	129.83	130.15	0.011483	5.49	104.83	152.99	0.41
Reach-1	2826	2-yr	Existing no backwater	312.00	122.94	129.83	129.83	130.15	0.011483	5.49	104.83	152.99	0.41
Reach-1	2826	10-yr	Existing w backwater	536.00	122.94	130.21	130.21	130.51	0.013237	6.15	175.82	214.64	0.44
Reach-1	2826	10-yr	Existing no backwater	536.00	122.94	130.21	130.21	130.51	0.013237	6.15	175.82	214.64	0.44
Reach-1	2826	25-yr	Existing w backwater	665.00	122.94	130.32	130.32	130.65	0.015048	6.64	200.09	222.11	0.47
Reach-1	2826	25-yr	Existing no backwater	665.00	122.94	130.32	130.32	130.65	0.015048	6.64	200.09	222.11	0.47
Reach-1	2826	50-yr	Existing w backwater	772.00	122.94	130.40	130.40	130.75	0.016549	7.02	217.60	227.34	0.49
Reach-1	2826	50-yr	Existing no backwater	772.00	122.94	130.40	130.40	130.75	0.016549	7.02	217.60	227.34	0.49
Reach-1	2826	100-yr	Existing w backwater	902.00	122.94	130.49	130.49	130.87	0.017818	7.36	239.22	233.05	0.51
Reach-1	2826	100-yr	Existing no backwater	902.00	122.94	130.49	130.49	130.87	0.017818	7.36	239.22	233.05	0.51
Reach-1	2729	2-yr	Existing w backwater	346.00	122.19	129.37		129.39	0.000436	1.47	391.90	185.00	0.10
Reach-1	2729	2-yr	Existing no backwater	346.00	122.19	129.37		129.39	0.000436	1.47	391.90	185.00	0.10
Reach-1	2729	10-yr	Existing w backwater	603.00	122.19	129.62		129.65	0.000986	2.26	437.99	193.98	0.15
Reach-1	2729	10-yr	Existing no backwater	603.00	122.19	129.62		129.65	0.000986	2.26	437.99	193.98	0.15
Reach-1	2729	25-yr	Existing w backwater	761.00	122.19	129.90		129.95	0.001210	2.57	498.61	220.06	0.17
Reach-1	2729	25-yr	Existing no backwater	761.00	122.19	129.90		129.95	0.001210	2.57	498.61	220.06	0.17
Reach-1	2729	50-yr	Existing w backwater	897.00	122.19	130.13		130.18	0.001320	2.75	551.23	235.88	0.18
Reach-1	2729	50-yr	Existing no backwater	897.00	122.19	130.13		130.18	0.001320	2.75	551.23	235.88	0.18
Reach-1	2729	100-yr	Existing w backwater	1034.00	122.19	130.33		130.39	0.001427	2.91	599.51	249.39	0.19
Reach-1	2729	100-yr	Existing no backwater	1034.00	122.19	130.33		130.39	0.001427	2.91	599.51	249.39	0.19
Reach-1	2552	2-yr	Existing w backwater	346.00	121.48	129.34		129.34	0.000147	0.90	621.38	252.70	0.06
Reach-1	2552	2-yr	Existing no backwater	346.00	121.48	129.34		129.34	0.000147	0.90	621.38	252.70	0.06
Reach-1	2552	10-yr	Existing w backwater	603.00	121.48	129.53		129.55	0.000355	1.43	671.04	256.34	0.09
Reach-1	2552	10-yr	Existing no backwater	603.00	121.48	129.53		129.55	0.000355	1.43	671.04	256.34	0.09
Reach-1	2552	25-yr	Existing w backwater	761.00	121.48	129.80		129.82	0.000418	1.59	741.36	260.34	0.10
Reach-1	2552	25-yr	Existing no backwater	761.00	121.48	129.80		129.82	0.000418	1.59	741.36	260.34	0.10
Reach-1	2552	50-yr	Existing w backwater	897.00	121.48	130.02		130.04	0.000469	1.72	799.22	266.75	0.11
Reach-1	2552	50-yr	Existing no backwater	897.00	121.48	130.02		130.04	0.000469	1.72	799.22	266.75	0.11
Reach-1	2552	100-yr	Existing w backwater	1034.00	121.48	130.21		130.24	0.000516	1.83	849.70	269.02	0.11
Reach-1	2552	100-yr	Existing no backwater	1034.00	121.48	130.21		130.24	0.000516	1.83	849.70	269.02	0.11
Reach-1	2423	2-yr	Existing w backwater	346.00	121.40	126.48	126.48	128.64	0.009842	11.77	29.39	6.81	1.00
Reach-1	2423	2-yr	Existing no backwater	346.00	121.40	126.48	126.48	128.64	0.009842	11.77	29.39	6.81	1.00
Reach-1	2423	10-yr	Existing w backwater	603.00	121.40	128.78	128.78	129.30	0.002461	7.58	255.90	221.50	0.52
Reach-1	2423	10-yr	Existing no backwater	603.00	121.40	128.78	128.78	129.30	0.002461	7.58	255.90	221.50	0.52
Reach-1	2423	25-yr	Existing w backwater	761.00	121.40	128.99	128.99	129.55	0.002810	8.27	303.70	230.22	0.56

HEC-RAS River: Spring Branch Reach: Reach-1 (Continued)

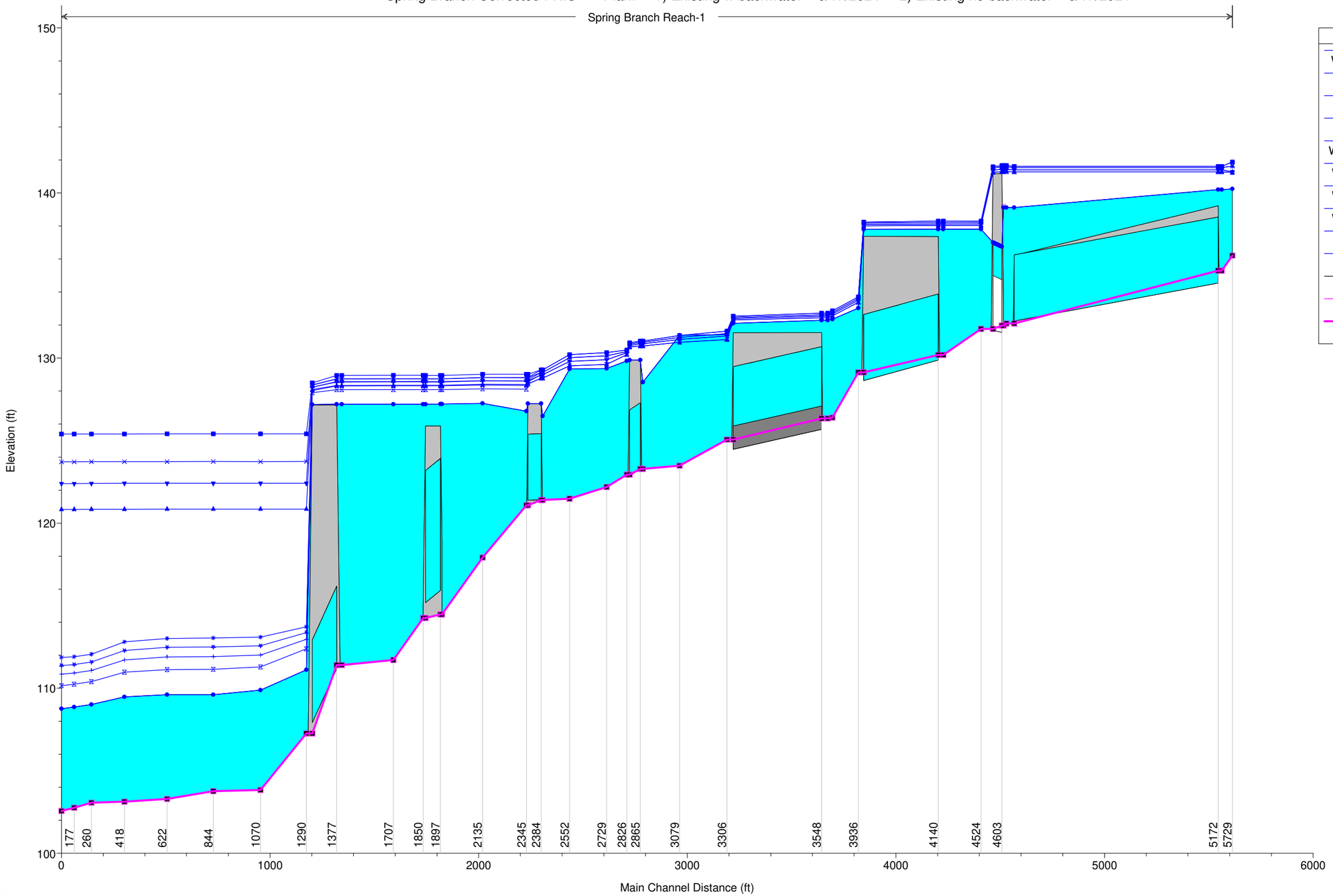
Reach	River Sta	Profile	Plan	Q Total	Min Ch El	W.S. Elev	Crit W.S.	E.G. Elev	E.G. Slope	Vel Chnl	Flow Area	Top Width	Froude # Chl
				(cfs)	(ft)	(ft)	(ft)	(ft)	(ft/ft)	(ft/s)	(sq ft)	(ft)	
Reach-1	2423	25-yr	Existing no backwater	761.00	121.40	128.99	128.99	129.55	0.002810	8.27	303.70	230.22	0.56
Reach-1	2423	50-yr	Existing w backwater	897.00	121.40	129.13	129.13	129.74	0.003181	8.92	336.86	238.52	0.60
Reach-1	2423	50-yr	Existing no backwater	897.00	121.40	129.13	129.13	129.74	0.003181	8.92	336.86	238.52	0.60
Reach-1	2423	100-yr	Existing w backwater	1034.00	121.40	129.29	129.29	129.92	0.003401	9.36	374.63	247.79	0.62
Reach-1	2423	100-yr	Existing no backwater	1034.00	121.40	129.29	129.29	129.92	0.003401	9.36	374.63	247.79	0.62
Reach-1	2384			Culvert									
Reach-1	2345	2-yr	Existing w backwater	346.00	121.08	126.78	126.09	127.81	0.003993	8.74	51.75	108.57	0.68
Reach-1	2345	2-yr	Existing no backwater	346.00	121.08	126.78	126.09	127.81	0.003993	8.74	51.75	108.57	0.68
Reach-1	2345	10-yr	Existing w backwater	603.00	121.08	128.35	127.29	128.46	0.000833	4.43	404.83	230.48	0.30
Reach-1	2345	10-yr	Existing no backwater	603.00	121.08	128.12	127.29	128.27	0.001074	4.96	357.86	198.24	0.34
Reach-1	2345	25-yr	Existing w backwater	761.00	121.08	128.62	127.29	128.75	0.000979	4.87	467.21	249.88	0.33
Reach-1	2345	25-yr	Existing no backwater	761.00	121.08	128.40	127.29	128.57	0.001247	5.43	417.03	234.43	0.37
Reach-1	2345	50-yr	Existing w backwater	897.00	121.08	128.81	127.50	128.95	0.001118	5.26	510.98	261.25	0.35
Reach-1	2345	50-yr	Existing no backwater	897.00	121.08	128.61	127.50	128.79	0.001373	5.77	465.17	249.31	0.39
Reach-1	2345	100-yr	Existing w backwater	1034.00	121.08	129.02	127.68	129.17	0.001193	5.49	562.35	268.85	0.36
Reach-1	2345	100-yr	Existing no backwater	1034.00	121.08	128.82	127.68	129.01	0.001463	6.01	514.63	261.79	0.40
Reach-1	2135	2-yr	Existing w backwater	346.00	117.91	127.25		127.26	0.000059	0.73	745.47	204.56	0.05
Reach-1	2135	2-yr	Existing no backwater	346.00	117.91	127.25		127.26	0.000059	0.73	745.47	204.56	0.05
Reach-1	2135	10-yr	Existing w backwater	603.00	117.91	128.36		128.37	0.000081	0.93	1000.34	269.13	0.05
Reach-1	2135	10-yr	Existing no backwater	603.00	117.91	128.14		128.15	0.000095	0.99	943.05	254.94	0.06
Reach-1	2135	25-yr	Existing w backwater	761.00	117.91	128.63		128.64	0.000108	1.09	1074.54	278.82	0.06
Reach-1	2135	25-yr	Existing no backwater	761.00	117.91	128.42		128.43	0.000124	1.16	1016.48	271.78	0.07
Reach-1	2135	50-yr	Existing w backwater	897.00	117.91	128.81		128.82	0.000133	1.23	1125.34	284.50	0.07
Reach-1	2135	50-yr	Existing no backwater	897.00	117.91	128.62		128.64	0.000150	1.29	1073.03	278.65	0.07
Reach-1	2135	100-yr	Existing w backwater	1034.00	117.91	129.02		129.03	0.000155	1.35	1184.56	290.98	0.08
Reach-1	2135	100-yr	Existing no backwater	1034.00	117.91	128.83		128.84	0.000175	1.41	1129.73	284.98	0.08
Reach-1	1940	2-yr	Existing w backwater	346.00	114.47	127.22	119.30	127.24	0.000153	1.31	418.25	193.29	0.08
Reach-1	1940	2-yr	Existing no backwater	346.00	114.47	127.22	119.30	127.24	0.000153	1.31	418.25	193.29	0.08
Reach-1	1940	10-yr	Existing w backwater	603.00	114.47	128.32	120.86	128.34	0.000176	1.51	657.43	229.75	0.08
Reach-1	1940	10-yr	Existing no backwater	603.00	114.47	128.09	120.86	128.12	0.000216	1.65	605.30	228.83	0.09
Reach-1	1940	25-yr	Existing w backwater	761.00	114.47	128.58	121.61	128.60	0.000226	1.74	717.88	237.78	0.10
Reach-1	1940	25-yr	Existing no backwater	761.00	114.47	128.36	121.61	128.39	0.000271	1.88	666.10	230.65	0.10
Reach-1	1940	50-yr	Existing w backwater	897.00	114.47	128.75	122.19	128.78	0.000272	1.93	758.88	245.88	0.10
Reach-1	1940	50-yr	Existing no backwater	897.00	114.47	128.55	122.19	128.59	0.000321	2.07	711.41	236.90	0.11
Reach-1	1940	100-yr	Existing w backwater	1034.00	114.47	128.94	122.72	128.98	0.000307	2.08	808.04	252.04	0.11
Reach-1	1940	100-yr	Existing no backwater	1034.00	114.47	128.74	122.72	128.78	0.000364	2.23	757.49	245.70	0.12
Reach-1	1897			Culvert									
Reach-1	1850	2-yr	Existing w backwater	346.00	114.25	127.21	119.09	127.21	0.000020	0.54	985.92	251.03	0.03
Reach-1	1850	2-yr	Existing no backwater	346.00	114.25	127.21	119.09	127.21	0.000020	0.54	985.92	251.03	0.03
Reach-1	1850	10-yr	Existing w backwater	603.00	114.25	128.32	120.98	128.32	0.000031	0.72	1318.30	338.44	0.04
Reach-1	1850	10-yr	Existing no backwater	603.00	114.25	128.09	120.98	128.09	0.000035	0.76	1243.61	319.76	0.04
Reach-1	1850	25-yr	Existing w backwater	761.00	114.25	128.58	121.79	128.59	0.000042	0.85	1412.96	366.73	0.04
Reach-1	1850	25-yr	Existing no backwater	761.00	114.25	128.35	121.79	128.35	0.000048	0.90	1328.92	342.52	0.05
Reach-1	1850	50-yr	Existing w backwater	897.00	114.25	128.75	122.31	128.76	0.000053	0.96	1474.38	373.00	0.05
Reach-1	1850	50-yr	Existing no backwater	897.00	114.25	128.55	122.31	128.56	0.000059	1.01	1401.98	365.60	0.05
Reach-1	1850	100-yr	Existing w backwater	1034.00	114.25	128.96	122.67	128.97	0.000062	1.05	1552.37	380.82	0.05
Reach-1	1850	100-yr	Existing no backwater	1034.00	114.25	128.74	122.67	128.75	0.000070	1.11	1472.29	372.78	0.06
Reach-1	1707	2-yr	Existing w backwater	346.00	111.71	127.21		127.21	0.000003	0.25	1938.30	314.91	0.01
Reach-1	1707	2-yr	Existing no backwater	346.00	111.71	127.21		127.21	0.000003	0.25	1938.30	314.91	0.01
Reach-1	1707	10-yr	Existing w backwater	603.00	111.71	128.32		128.32	0.000006	0.37	2302.77	339.06	0.02
Reach-1	1707	10-yr	Existing no backwater	603.00	111.71	128.09		128.09	0.000006	0.38	2226.42	333.00	0.02
Reach-1	1707	25-yr	Existing w backwater	761.00	111.71	128.58		128.59	0.000008	0.45	2394.16	346.76	0.02
Reach-1	1707	25-yr	Existing no backwater	761.00	111.71	128.35		128.35	0.000009	0.46	2313.32	339.96	0.02
Reach-1	1707	50-yr	Existing w backwater	897.00	111.71	128.75		128.75	0.000011	0.52	2452.06	351.55	0.02
Reach-1	1707	50-yr	Existing no backwater	897.00	111.71	128.55		128.56	0.000012	0.53	2383.71	345.89	0.02
Reach-1	1707	100-yr	Existing w backwater	1034.00	111.71	128.96		128.96	0.000014	0.58	2525.53	359.70	0.03
Reach-1	1707	100-yr	Existing no backwater	1034.00	111.71	128.74		128.75	0.000015	0.60	2450.01	351.38	0.03
Reach-1	1460	2-yr	Existing w backwater	346.00	111.40	127.20	115.25	127.21	0.000016	0.64	582.05	293.85	0.03
Reach-1	1460	2-yr	Existing no backwater	346.00	111.40	127.20	115.25	127.21	0.000016	0.64	582.05	293.85	0.03
Reach-1	1460	10-yr	Existing w backwater	603.00	111.40	128.31	116.53	128.32	0.000007	0.45	1892.86	324.15	0.02
Reach-1	1460	10-yr	Existing no backwater	603.00	111.40	128.09	116.53	128.09	0.000007	0.46	1838.00	321.62	0.02
Reach-1	1460	25-yr	Existing w backwater	761.00	111.40	128.58	117.10	128.58	0.000010	0.55	1957.25	327.09	0.03
Reach-1	1460	25-yr	Existing no backwater	761.00	111.40	128.34	117.10	128.35	0.000011	0.56	1900.03	324.48	0.03
Reach-1	1460	50-yr	Existing w backwater	897.00	111.40	128.75	117.54	128.75	0.000013	0.63	1997.45	329.48	0.03
Reach-1	1460	50-yr	Existing no backwater	897.00	111.40	128.55	117.54	128.55	0.000014	0.65	1949.57	326.74	0.03
Reach-1	1460	100-yr	Existing w backwater	1034.00	111.40	128.95	117.94	128.96	0.000016	0.71	2048.26	335.01	0.03
Reach-1	1460	100-yr	Existing no backwater	1034.00	111.40	128.74	117.94	128.74	0.000017	0.73	1995.65	329.28	0.03
Reach-1	1377			Culvert									
Reach-1	1290	2-yr	Existing w backwater	346.00	107.26	111.12	111.12	112.34	0.022110	8.87	39.01	16.03	1.00
Reach-1	1290	2-yr	Existing no backwater	346.00	107.26	111.12	111.12	112.34	0.022110	8.87	39.01	16.03	1.00
Reach-1	1290	10-yr	Existing w backwater	603.00	107.26	120.85	112.39	120.86	0.000047	1.13	786.28	170.35	0.06
Reach-1	1290	10-yr	Existing no backwater	603.00	107.26	112.39	112.39	113.77	0.020132	9.41	64.09	23.29	1.00
Reach-1	1290	25-yr	Existing w backwater	761.00	107.26	122.42	112.96	122.43	0.000039	1.13	1081.03	196.72	0.06
Reach-1	1290	25-yr	Existing no backwater	761.00	107.26	112.96	112.96	114.43	0.019386	9.73	78.19	26.51	1.00
Reach-1	1290	50-yr	Existing w backwater	897.00	107.26	123.73	113.37	123.74	0.000032	1.08	1351.45	217.70	0.05
Reach-1	1290	50-yr	Existing no backwater	897.00	107.26	113.37	113.37	114.93	0.018979	10.01	89.60	28.87	1.00
Reach-1	1290	100-yr	Existing w backwater	1034.00	107.26	125.41	113.72	125.42	0.000022	0.98	1733.88	238.51	0.04
Reach-1	1290	100-yr	Existing no backwater	1034.00	107.26	113.72	113.72	115.39	0.018206	10.34	100.24	31.25	0.99
Reach-1	1070	2-yr	Existing w backwater	346.00	103.84	109.88		110.01	0.000952	2.92	151.71	59.58	0.25

HEC-RAS River: Spring Branch Reach: Reach-1 (Continued)

Reach	River Sta	Profile	Plan	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)	
Reach-1	1070	2-yr	Existing no backwater	346.00	103.84	109.88		110.01	0.000952	2.92	151.71	59.58	0.25
Reach-1	1070	10-yr	Existing w backwater	603.00	103.84	120.85		120.85	0.000013	0.79	1943.20	281.71	0.04
Reach-1	1070	10-yr	Existing no backwater	603.00	103.84	111.29		111.47	0.001011	3.64	249.38	89.98	0.27
Reach-1	1070	25-yr	Existing w backwater	761.00	103.84	122.42		122.42	0.000012	0.83	2412.61	314.57	0.04
Reach-1	1070	25-yr	Existing no backwater	761.00	103.84	112.00		112.21	0.000992	3.90	327.55	116.00	0.27
Reach-1	1070	50-yr	Existing w backwater	897.00	103.84	123.73		123.74	0.000011	0.83	2842.12	339.35	0.03
Reach-1	1070	50-yr	Existing no backwater	897.00	103.84	112.57		112.78	0.000951	4.04	395.28	123.30	0.27
Reach-1	1070	100-yr	Existing w backwater	1034.00	103.84	125.41		125.41	0.000009	0.80	3428.04	352.60	0.03
Reach-1	1070	100-yr	Existing no backwater	1034.00	103.84	113.09		113.30	0.000919	4.16	461.24	129.73	0.27
Reach-1	844	2-yr	Existing w backwater	346.00	103.76	109.61		109.74	0.001493	2.96	137.48	103.52	0.30
Reach-1	844	2-yr	Existing no backwater	346.00	103.76	109.61		109.74	0.001493	2.96	137.48	103.52	0.30
Reach-1	844	10-yr	Existing w backwater	603.00	103.76	120.85		120.85	0.000005	0.46	3075.03	376.29	0.02
Reach-1	844	10-yr	Existing no backwater	603.00	103.76	111.14		111.24	0.000792	2.81	371.42	184.45	0.23
Reach-1	844	25-yr	Existing w backwater	761.00	103.76	122.42		122.42	0.000005	0.49	3683.24	395.53	0.02
Reach-1	844	25-yr	Existing no backwater	761.00	103.76	111.91		112.00	0.000607	2.73	518.03	198.04	0.21
Reach-1	844	50-yr	Existing w backwater	897.00	103.76	123.73		123.74	0.000004	0.50	4208.83	403.22	0.02
Reach-1	844	50-yr	Existing no backwater	897.00	103.76	112.50		112.58	0.000523	2.71	639.80	218.47	0.19
Reach-1	844	100-yr	Existing w backwater	1034.00	103.76	125.41		125.41	0.000004	0.50	4905.63	432.88	0.02
Reach-1	844	100-yr	Existing no backwater	1034.00	103.76	113.04		113.12	0.000460	2.69	760.37	226.56	0.19
Reach-1	622	2-yr	Existing w backwater	346.00	103.29	109.61		109.63	0.000161	1.15	356.96	125.31	0.10
Reach-1	622	2-yr	Existing no backwater	346.00	103.29	109.61		109.63	0.000161	1.15	356.96	125.31	0.10
Reach-1	622	10-yr	Existing w backwater	603.00	103.29	120.85		120.85	0.000003	0.41	2463.43	238.28	0.02
Reach-1	622	10-yr	Existing no backwater	603.00	103.29	111.13		111.16	0.000148	1.38	560.83	143.33	0.10
Reach-1	622	25-yr	Existing w backwater	761.00	103.29	122.42		122.42	0.000004	0.46	2843.01	244.78	0.02
Reach-1	622	25-yr	Existing no backwater	761.00	103.29	111.89		111.92	0.000147	1.49	673.20	152.39	0.11
Reach-1	622	50-yr	Existing w backwater	897.00	103.29	123.73		123.73	0.000004	0.49	3168.74	250.61	0.02
Reach-1	622	50-yr	Existing no backwater	897.00	103.29	112.48		112.51	0.000146	1.59	764.78	159.65	0.11
Reach-1	622	100-yr	Existing w backwater	1034.00	103.29	125.41		125.41	0.000004	0.51	3595.63	260.77	0.02
Reach-1	622	100-yr	Existing no backwater	1034.00	103.29	113.02		113.05	0.000147	1.67	852.47	166.20	0.11
Reach-1	418	2-yr	Existing w backwater	346.00	103.13	109.48		109.56	0.000739	2.34	172.60	58.61	0.21
Reach-1	418	2-yr	Existing no backwater	346.00	103.13	109.48		109.56	0.000739	2.34	172.60	58.61	0.21
Reach-1	418	10-yr	Existing w backwater	603.00	103.13	120.84		120.85	0.000011	0.72	2084.58	272.71	0.03
Reach-1	418	10-yr	Existing no backwater	603.00	103.13	110.97		111.09	0.000706	2.85	267.41	69.47	0.22
Reach-1	418	25-yr	Existing w backwater	761.00	103.13	122.41		122.42	0.000011	0.78	2531.46	293.22	0.03
Reach-1	418	25-yr	Existing no backwater	761.00	103.13	111.71		111.86	0.000709	3.12	321.54	76.48	0.22
Reach-1	418	50-yr	Existing w backwater	897.00	103.13	123.73		123.73	0.000011	0.81	2924.74	305.26	0.03
Reach-1	418	50-yr	Existing no backwater	897.00	103.13	112.28		112.44	0.000729	3.36	370.28	93.88	0.23
Reach-1	418	100-yr	Existing w backwater	1034.00	103.13	125.40		125.41	0.000010	0.81	3450.06	321.79	0.03
Reach-1	418	100-yr	Existing no backwater	1034.00	103.13	112.80		112.98	0.000733	3.54	421.29	102.58	0.23
Reach-1	260	2-yr	Existing w backwater	346.00	103.07	109.02	106.88	109.32	0.003454	4.41	78.45	23.03	0.42
Reach-1	260	2-yr	Existing no backwater	346.00	103.07	109.02	106.88	109.32	0.003454	4.41	78.45	23.03	0.42
Reach-1	260	10-yr	Existing w backwater	603.00	103.07	120.84	108.19	120.84	0.000016	0.81	2292.81	271.16	0.04
Reach-1	260	10-yr	Existing no backwater	603.00	103.07	110.40	108.19	110.85	0.003338	5.41	121.07	39.88	0.44
Reach-1	260	25-yr	Existing w backwater	761.00	103.07	122.41	108.81	122.42	0.000016	0.86	2724.23	277.90	0.04
Reach-1	260	25-yr	Existing no backwater	761.00	103.07	111.07	108.81	111.61	0.003331	5.91	151.53	50.12	0.45
Reach-1	260	50-yr	Existing w backwater	897.00	103.07	123.73	109.24	123.73	0.000015	0.89	3093.62	283.70	0.04
Reach-1	260	50-yr	Existing no backwater	897.00	103.07	111.59	109.24	112.19	0.003336	6.28	179.59	58.95	0.45
Reach-1	260	100-yr	Existing w backwater	1034.00	103.07	125.40	109.62	125.41	0.000013	0.89	3569.10	283.70	0.04
Reach-1	260	100-yr	Existing no backwater	1034.00	103.07	112.06	109.62	112.72	0.003378	6.65	210.71	95.12	0.46
Reach-1	177	2-yr	Existing w backwater	346.00	102.76	108.86	106.27	109.10	0.001842	3.99	112.63	44.08	0.33
Reach-1	177	2-yr	Existing no backwater	346.00	102.76	108.86	106.27	109.10	0.001842	3.99	112.63	44.08	0.33
Reach-1	177	10-yr	Existing w backwater	603.00	102.76	120.83	107.56	120.84	0.000028	1.16	1412.14	280.41	0.05
Reach-1	177	10-yr	Existing no backwater	603.00	102.76	110.24	107.56	110.61	0.002117	5.09	181.77	56.00	0.36
Reach-1	177	25-yr	Existing w backwater	761.00	102.76	122.40	108.20	122.41	0.000030	1.26	1645.91	284.74	0.05
Reach-1	177	25-yr	Existing no backwater	761.00	102.76	110.92	108.20	111.35	0.002242	5.62	221.73	61.85	0.38
Reach-1	177	50-yr	Existing w backwater	897.00	102.76	123.71	108.65	123.73	0.000031	1.34	1841.61	289.24	0.05
Reach-1	177	50-yr	Existing no backwater	897.00	102.76	111.44	108.65	111.92	0.002337	6.03	254.86	66.31	0.39
Reach-1	177	100-yr	Existing w backwater	1034.00	102.76	125.40	109.06	125.41	0.000016	1.02	3531.12	297.80	0.04
Reach-1	177	100-yr	Existing no backwater	1034.00	102.76	111.91	109.06	112.45	0.002427	6.40	287.02	70.37	0.41
Reach-1	116	2-yr	Existing w backwater	346.00	102.56	108.76	106.37	108.97	0.002003	3.77	105.08	47.36	0.33
Reach-1	116	2-yr	Existing no backwater	346.00	102.56	108.76	106.37	108.97	0.002003	3.77	105.08	47.36	0.33
Reach-1	116	10-yr	Existing w backwater	603.00	102.56	120.83	107.57	120.84	0.000020	0.95	1559.88	363.91	0.04
Reach-1	116	10-yr	Existing no backwater	603.00	102.56	110.15	107.57	110.46	0.002003	4.61	186.95	69.77	0.35
Reach-1	116	25-yr	Existing w backwater	761.00	102.56	122.40	108.10	122.41	0.000021	1.05	1788.15	369.45	0.04
Reach-1	116	25-yr	Existing no backwater	761.00	102.56	110.85	108.10	111.20	0.002001	5.00	239.10	80.86	0.36
Reach-1	116	50-yr	Existing w backwater	897.00	102.56	123.72	108.54	123.72	0.000010	0.77	3998.09	372.90	0.03
Reach-1	116	50-yr	Existing no backwater	897.00	102.56	111.38	108.54	111.76	0.002000	5.29	284.23	95.65	0.36
Reach-1	116	100-yr	Existing w backwater	1034.00	102.56	125.40	108.94	125.40	0.000009	0.78	4638.01	395.04	0.03
Reach-1	116	100-yr	Existing no backwater	1034.00	102.56	111.86	108.94	112.28	0.002004	5.55	329.42	114.64	0.37

Spring Branch Corrected FRIS Plan: 1) Existing w backwater 6/17/2024 2) Existing no backwater 6/17/2024

Spring Branch Reach-1



Legend

- WS 100-yr - Existing w backwater
- WS 50-yr - Existing w backwater
- WS 25-yr - Existing w backwater
- WS 10-yr - Existing w backwater
- WS 100-yr - Existing no backwater
- WS 50-yr - Existing no backwater
- WS 25-yr - Existing no backwater
- WS 10-yr - Existing no backwater
- WS 2-yr - Existing no backwater
- WS 2-yr - Existing w backwater
- Ground
- Left Levee
- Ground

APPENDIX B.2

HYDRAULIC MODELING

Proposed Conditions

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

HEC-RAS Plan: Phase 1 with backwater River: Spring Branch Reach: Reach-1

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)	
Reach-1	5729	2-yr	122.00	136.21	140.25	139.33	140.43	0.004415	3.43	36.45	24.80	0.45
Reach-1	5729	10-yr	224.00	136.21	141.24	140.06	141.40	0.002435	3.41	92.41	120.69	0.36
Reach-1	5729	25-yr	388.00	136.21	141.29	140.98	141.71	0.006732	5.73	97.59	132.06	0.60
Reach-1	5729	50-yr	544.00	136.21	141.64	141.64	142.03	0.006385	6.02	181.26	401.73	0.59
Reach-1	5729	100-yr	692.00	136.21	141.88	141.88	142.18	0.005327	5.77	268.91	546.57	0.55
Reach-1	5678	2-yr	122.00	135.30	140.21	138.38	140.27	0.001141	2.15	84.99	141.80	0.24
Reach-1	5678	10-yr	224.00	135.30	141.28	139.17	141.30	0.000289	1.37	355.34	386.84	0.13
Reach-1	5678	25-yr	388.00	135.30	141.41	140.43	141.44	0.000692	2.17	404.70	460.69	0.20
Reach-1	5678	50-yr	544.00	135.30	141.54	140.66	141.59	0.001009	2.68	465.30	505.14	0.24
Reach-1	5678	100-yr	692.00	135.30	141.61	140.85	141.68	0.001407	3.20	495.48	534.42	0.28
Reach-1	5172		Culvert									
Reach-1	4646	2-yr	122.00	132.10	139.12	135.24	139.12	0.000000	0.04	4842.85	1668.82	0.00
Reach-1	4646	10-yr	224.00	132.10	141.29	136.05	141.29	0.000000	0.03	8686.70	1961.05	0.00
Reach-1	4646	25-yr	388.00	132.10	141.43	136.58	141.43	0.000000	0.06	8967.86	2029.30	0.00
Reach-1	4646	50-yr	544.00	132.10	141.59	136.85	141.59	0.000000	0.08	9285.23	2084.42	0.01
Reach-1	4646	100-yr	692.00	132.10	141.66	137.00	141.66	0.000001	0.10	9446.95	2106.80	0.01
Reach-1	4632	2-yr	229.00	131.97	139.12	134.37	139.12	0.000000	0.06	4083.37	1551.76	0.00
Reach-1	4632	10-yr	370.00	131.97	141.29	135.07	141.29	0.000000	0.03	12722.14	3117.75	0.00
Reach-1	4632	25-yr	447.00	131.97	141.43	135.59	141.43	0.000000	0.04	13162.20	3130.22	0.00
Reach-1	4632	50-yr	633.00	131.97	141.59	136.10	141.59	0.000000	0.05	13646.88	3151.49	0.00
Reach-1	4632	100-yr	824.00	131.97	141.66	136.52	141.66	0.000000	0.06	13890.22	3154.51	0.00
Reach-1	4603		Culvert									
Reach-1	4524	2-yr	312.00	131.77	137.81	134.54	137.81	0.000032	0.47	822.45	1748.26	0.04
Reach-1	4524	10-yr	536.00	131.77	138.03	135.26	138.04	0.000071	0.72	942.09	1853.78	0.05
Reach-1	4524	25-yr	665.00	131.77	138.12	135.58	138.13	0.000098	0.85	992.70	1900.97	0.06
Reach-1	4524	50-yr	772.00	131.77	138.21	135.74	138.22	0.000114	0.93	1043.16	1923.06	0.07
Reach-1	4524	100-yr	902.00	131.77	138.30	135.86	138.31	0.000137	1.03	1092.50	1945.94	0.08
Reach-1	4343	2-yr	312.00	130.19	137.80	133.37	137.81	0.000006	0.23	1994.11	870.22	0.02
Reach-1	4343	10-yr	536.00	130.19	138.03	134.44	138.03	0.000014	0.35	2177.15	892.10	0.02
Reach-1	4343	25-yr	665.00	130.19	138.12	135.29	138.12	0.000019	0.41	2252.85	904.69	0.03
Reach-1	4343	50-yr	772.00	130.19	138.21	135.64	138.21	0.000023	0.46	2328.95	917.17	0.03
Reach-1	4343	100-yr	902.00	130.19	138.30	136.00	138.30	0.000030	0.52	2403.40	933.42	0.03
Reach-1	4140		Culvert									
Reach-1	3936	2-yr	312.00	129.13	133.02	133.02	133.35	0.007965	5.07	103.49	178.62	0.53
Reach-1	3936	10-yr	536.00	129.13	133.38	133.38	133.73	0.009262	5.91	172.81	221.95	0.58
Reach-1	3936	25-yr	665.00	129.13	133.50	133.50	133.89	0.010410	6.42	198.52	230.73	0.62
Reach-1	3936	50-yr	772.00	129.13	133.60	133.60	134.01	0.010937	6.71	220.29	246.43	0.64
Reach-1	3936	100-yr	902.00	129.13	133.71	133.71	134.14	0.011806	7.11	241.89	267.58	0.66
Reach-1	3812	2-yr	312.00	126.39	132.31	130.67	132.38	0.001732	2.77	205.74	201.64	0.25
Reach-1	3812	10-yr	536.00	126.39	132.56	131.97	132.68	0.003051	3.84	270.41	293.03	0.33
Reach-1	3812	25-yr	665.00	126.39	132.67	132.15	132.82	0.003692	4.29	304.30	322.10	0.36
Reach-1	3812	50-yr	772.00	126.39	132.77	132.27	132.93	0.004131	4.61	332.70	340.07	0.39
Reach-1	3812	100-yr	902.00	126.39	132.86	132.44	133.04	0.004656	4.96	361.94	356.53	0.41
Reach-1	3789	2-yr	312.00	126.34	132.22	130.74	132.32	0.002843	3.21	206.39	292.92	0.30
Reach-1	3789	10-yr	536.00	126.34	132.45	132.22	132.58	0.004328	4.12	275.26	310.93	0.37
Reach-1	3789	25-yr	665.00	126.34	132.55	132.33	132.70	0.005107	4.55	306.63	318.44	0.40
Reach-1	3789	50-yr	772.00	126.34	132.63	132.40	132.80	0.005569	4.82	333.46	324.23	0.42
Reach-1	3789	100-yr	902.00	126.34	132.70	132.48	132.89	0.006437	5.24	355.77	328.97	0.46
Reach-1	3548		Culvert									
Reach-1	3306	2-yr	312.00	125.06	131.41	129.02	131.44	0.000759	1.84	353.62	341.13	0.15
Reach-1	3306	10-yr	536.00	125.06	131.12	130.93	131.29	0.004657	4.36	258.55	307.99	0.37
Reach-1	3306	25-yr	665.00	125.06	131.33	131.04	131.47	0.004182	4.26	326.26	330.72	0.36
Reach-1	3306	50-yr	772.00	125.06	131.48	131.13	131.61	0.003984	4.25	376.70	349.03	0.35
Reach-1	3306	100-yr	902.00	125.06	131.65	131.22	131.78	0.003932	4.33	437.06	365.17	0.35
Reach-1	3079	2-yr	312.00	123.48	131.38	128.82	131.39	0.000082	0.64	760.13	319.03	0.04
Reach-1	3079	10-yr	536.00	123.48	130.96	129.15	130.97	0.000449	1.45	627.89	310.70	0.10
Reach-1	3079	25-yr	665.00	123.48	131.13	129.25	131.15	0.000530	1.60	682.06	310.70	0.11
Reach-1	3079	50-yr	772.00	123.48	131.25	129.32	131.27	0.000602	1.72	719.35	316.82	0.12
Reach-1	3079	100-yr	902.00	123.48	131.39	129.42	131.41	0.000679	1.86	762.82	319.18	0.12
Reach-1	2903	2-yr	312.00	123.29	128.54	128.54	130.69	0.070820	11.76	26.54	6.18	1.00
Reach-1	2903	10-yr	536.00	123.29	130.73	130.14	130.79	0.003113	3.04	313.72	277.03	0.21

HEC-RAS Plan: Phase 1 with backwater River: Spring Branch Reach: Reach-1 (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)	
Reach-1	2903	25-yr	665.00	123.29	130.87	130.24	130.94	0.003481	3.26	354.43	299.63	0.23
Reach-1	2903	50-yr	772.00	123.29	130.96	130.31	131.04	0.003886	3.48	380.87	308.80	0.24
Reach-1	2903	100-yr	902.00	123.29	131.06	130.40	131.16	0.004211	3.66	414.26	309.20	0.25
Reach-1	2865		Culvert									
Reach-1	2826	2-yr	312.00	122.94	129.83	129.83	130.15	0.011483	5.49	104.83	152.99	0.41
Reach-1	2826	10-yr	536.00	122.94	130.21	130.21	130.51	0.013237	6.15	175.82	214.64	0.44
Reach-1	2826	25-yr	665.00	122.94	130.32	130.32	130.65	0.015048	6.64	200.09	222.11	0.47
Reach-1	2826	50-yr	772.00	122.94	130.40	130.40	130.75	0.016549	7.02	217.60	227.34	0.49
Reach-1	2826	100-yr	902.00	122.94	130.49	130.49	130.87	0.018049	7.40	238.01	232.74	0.52
Reach-1	2729	2-yr	346.00	122.19	127.93		128.04	0.003954	3.72	167.54	128.46	0.30
Reach-1	2729	10-yr	603.00	122.19	128.99		129.05	0.002199	3.16	323.37	170.69	0.23
Reach-1	2729	25-yr	761.00	122.19	129.98		130.02	0.001120	2.49	514.99	225.11	0.17
Reach-1	2729	50-yr	897.00	122.19	130.00		130.05	0.001526	2.92	519.12	226.36	0.19
Reach-1	2729	100-yr	1034.00	122.19	130.24		130.29	0.001578	3.03	575.62	242.87	0.20
Reach-1	2552	2-yr	346.00	121.48	126.58	126.21	126.90	0.011449	5.77	100.00	106.21	0.49
Reach-1	2552	10-yr	603.00	121.48	128.78		128.80	0.000908	2.13	483.91	235.30	0.15
Reach-1	2552	25-yr	761.00	121.48	129.89		129.90	0.000384	1.54	762.69	261.54	0.10
Reach-1	2552	50-yr	897.00	121.48	129.87		129.89	0.000544	1.82	757.71	261.26	0.12
Reach-1	2552	100-yr	1034.00	121.48	130.10		130.13	0.000576	1.92	819.88	267.68	0.12
Reach-1	2423	2-yr	346.00	120.40	125.22	123.92	126.07	0.002957	7.42	46.64	10.38	0.62
Reach-1	2423	10-yr	603.00	120.40	126.76	125.45	128.18	0.003850	9.55	65.05	16.07	0.69
Reach-1	2423	25-yr	761.00	120.40	126.29	126.29	128.97	0.007907	13.14	58.17	12.63	0.99
Reach-1	2423	50-yr	897.00	120.40	128.71	128.71	129.53	0.002017	8.26	275.57	218.53	0.52
Reach-1	2423	100-yr	1034.00	120.40	128.94	128.94	129.76	0.002081	8.56	328.24	228.24	0.53
Reach-1	2384		Culvert									
Reach-1	2345	2-yr	346.00	120.39	124.35	123.78	125.51	0.004502	8.67	40.14	15.93	0.79
Reach-1	2345	10-yr	603.00	120.39	125.52	125.34	127.49	0.005874	11.36	56.40	50.07	0.90
Reach-1	2345	25-yr	761.00	120.39	126.10	126.10	128.55	0.006596	12.70	64.52	78.79	0.95
Reach-1	2345	50-yr	897.00	120.39	127.68	126.69	128.23	0.001795	7.44	304.20	157.17	0.49
Reach-1	2345	100-yr	1034.00	120.39	128.29	127.38	128.69	0.001412	6.83	414.98	221.80	0.43
Reach-1	2135	2-yr	346.00	117.91	123.73	123.48	123.97	0.005975	4.93	134.10	142.68	0.42
Reach-1	2135	10-yr	603.00	117.91	126.27		126.29	0.000433	1.80	549.08	189.26	0.12
Reach-1	2135	25-yr	761.00	117.91	127.12		127.14	0.000320	1.67	717.81	203.22	0.11
Reach-1	2135	50-yr	897.00	117.91	127.83		127.85	0.000263	1.61	867.93	228.74	0.10
Reach-1	2135	100-yr	1034.00	117.91	128.38		128.40	0.000236	1.59	1006.13	270.08	0.09
Reach-1	1940	2-yr	346.00	114.47	122.85	119.30	123.11	0.003328	4.08	84.82	17.22	0.32
Reach-1	1940	10-yr	603.00	114.47	125.80	120.86	126.06	0.001944	4.15	152.02	82.84	0.27
Reach-1	1940	25-yr	761.00	114.47	126.88	121.61	127.00	0.001017	3.28	356.36	181.65	0.20
Reach-1	1940	50-yr	897.00	114.47	127.67	122.19	127.75	0.000720	2.92	508.97	226.19	0.17
Reach-1	1940	100-yr	1034.00	114.47	128.26	122.72	128.32	0.000547	2.65	642.84	229.50	0.15
Reach-1	1897		Culvert									
Reach-1	1850	2-yr	346.00	114.25	119.09	119.09	120.68	0.034155	10.12	34.21	10.78	1.00
Reach-1	1850	10-yr	603.00	114.25	122.55	120.98	123.18	0.006668	6.69	102.37	125.94	0.49
Reach-1	1850	25-yr	761.00	114.25	125.38	121.79	125.66	0.001838	4.56	184.39	165.35	0.27
Reach-1	1850	50-yr	897.00	114.25	127.63	122.31	127.65	0.000104	1.26	1104.37	295.87	0.07
Reach-1	1850	100-yr	1034.00	114.25	128.25	122.67	128.27	0.000094	1.25	1297.21	332.17	0.06
Reach-1	1707	2-yr	346.00	111.71	118.26	116.55	118.55	0.004747	4.94	103.33	77.60	0.40
Reach-1	1707	10-yr	603.00	111.71	122.81		122.82	0.000106	1.15	792.71	208.94	0.07
Reach-1	1707	25-yr	761.00	111.71	125.50		125.51	0.000033	0.76	1448.34	270.67	0.04
Reach-1	1707	50-yr	897.00	111.71	127.63		127.64	0.000018	0.62	2076.03	327.41	0.03
Reach-1	1707	100-yr	1034.00	111.71	128.25		128.26	0.000018	0.64	2281.33	337.23	0.03
Reach-1	1460	2-yr	346.00	111.40	116.57	115.25	117.02	0.008128	5.39	64.14	22.63	0.56
Reach-1	1460	10-yr	603.00	111.40	122.72	116.53	122.77	0.000268	1.94	339.89	188.64	0.12
Reach-1	1460	25-yr	761.00	111.40	125.44	117.10	125.48	0.000135	1.69	487.04	271.14	0.09
Reach-1	1460	50-yr	897.00	111.40	127.61	117.54	127.63	0.000050	1.17	1019.29	303.55	0.06
Reach-1	1460	100-yr	1034.00	111.40	128.25	117.94	128.25	0.000021	0.77	1876.38	323.39	0.04
Reach-1	1377		Culvert									
Reach-1	1290	2-yr	346.00	107.26	111.12	111.12	112.34	0.022110	8.87	39.01	16.03	1.00
Reach-1	1290	10-yr	603.00	107.26	120.85	112.39	120.86	0.000047	1.13	786.28	170.35	0.06
Reach-1	1290	25-yr	761.00	107.26	122.42	112.96	122.43	0.000039	1.13	1081.03	196.72	0.06
Reach-1	1290	50-yr	897.00	107.26	123.73	113.37	123.74	0.000032	1.08	1351.45	217.70	0.05

HEC-RAS Plan: Phase 1 with backwater River: Spring Branch Reach: Reach-1 (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)	
Reach-1	1290	100-yr	1034.00	107.26	125.41	113.72	125.42	0.000022	0.98	1733.88	238.51	0.04
Reach-1	1070	2-yr	346.00	103.84	109.88		110.01	0.000952	2.92	151.71	59.58	0.25
Reach-1	1070	10-yr	603.00	103.84	120.85		120.85	0.000013	0.79	1943.20	281.71	0.04
Reach-1	1070	25-yr	761.00	103.84	122.42		122.42	0.000012	0.83	2412.61	314.57	0.04
Reach-1	1070	50-yr	897.00	103.84	123.73		123.74	0.000011	0.83	2842.12	339.35	0.03
Reach-1	1070	100-yr	1034.00	103.84	125.41		125.41	0.000009	0.80	3428.04	352.60	0.03
Reach-1	844	2-yr	346.00	103.76	109.61		109.74	0.001493	2.96	137.48	103.52	0.30
Reach-1	844	10-yr	603.00	103.76	120.85		120.85	0.000005	0.46	3075.03	376.29	0.02
Reach-1	844	25-yr	761.00	103.76	122.42		122.42	0.000005	0.49	3683.24	395.53	0.02
Reach-1	844	50-yr	897.00	103.76	123.73		123.74	0.000004	0.50	4208.83	403.22	0.02
Reach-1	844	100-yr	1034.00	103.76	125.41		125.41	0.000004	0.50	4905.63	432.88	0.02
Reach-1	622	2-yr	346.00	103.29	109.61		109.63	0.000161	1.15	356.96	125.31	0.10
Reach-1	622	10-yr	603.00	103.29	120.85		120.85	0.000003	0.41	2463.43	238.28	0.02
Reach-1	622	25-yr	761.00	103.29	122.42		122.42	0.000004	0.46	2843.01	244.78	0.02
Reach-1	622	50-yr	897.00	103.29	123.73		123.73	0.000004	0.49	3168.74	250.61	0.02
Reach-1	622	100-yr	1034.00	103.29	125.41		125.41	0.000004	0.51	3595.63	260.77	0.02
Reach-1	418	2-yr	346.00	103.13	109.48		109.56	0.000739	2.34	172.60	58.61	0.21
Reach-1	418	10-yr	603.00	103.13	120.84		120.85	0.000011	0.72	2084.58	272.71	0.03
Reach-1	418	25-yr	761.00	103.13	122.41		122.42	0.000011	0.78	2531.46	293.22	0.03
Reach-1	418	50-yr	897.00	103.13	123.73		123.73	0.000011	0.81	2924.74	305.26	0.03
Reach-1	418	100-yr	1034.00	103.13	125.40		125.41	0.000010	0.81	3450.06	321.79	0.03
Reach-1	260	2-yr	346.00	103.07	109.02	106.88	109.32	0.003454	4.41	78.45	23.03	0.42
Reach-1	260	10-yr	603.00	103.07	120.84	108.19	120.84	0.000016	0.81	2292.81	271.16	0.04
Reach-1	260	25-yr	761.00	103.07	122.41	108.81	122.42	0.000016	0.86	2724.23	277.90	0.04
Reach-1	260	50-yr	897.00	103.07	123.73	109.24	123.73	0.000015	0.89	3093.62	283.70	0.04
Reach-1	260	100-yr	1034.00	103.07	125.40	109.62	125.41	0.000013	0.89	3569.10	283.70	0.04
Reach-1	177	2-yr	346.00	102.76	108.86	106.27	109.10	0.001842	3.99	112.63	44.08	0.33
Reach-1	177	10-yr	603.00	102.76	120.83	107.56	120.84	0.000028	1.16	1412.14	280.41	0.05
Reach-1	177	25-yr	761.00	102.76	122.40	108.20	122.41	0.000030	1.26	1645.91	284.74	0.05
Reach-1	177	50-yr	897.00	102.76	123.71	108.65	123.73	0.000031	1.34	1841.61	289.24	0.05
Reach-1	177	100-yr	1034.00	102.76	125.40	109.06	125.41	0.000016	1.02	3531.12	297.80	0.04
Reach-1	116	2-yr	346.00	102.56	108.76	106.37	108.97	0.002003	3.77	105.08	47.36	0.33
Reach-1	116	10-yr	603.00	102.56	120.83	107.57	120.84	0.000020	0.95	1559.88	363.91	0.04
Reach-1	116	25-yr	761.00	102.56	122.40	108.10	122.41	0.000021	1.05	1788.15	369.45	0.04
Reach-1	116	50-yr	897.00	102.56	123.72	108.54	123.72	0.000010	0.77	3998.09	372.90	0.03
Reach-1	116	100-yr	1034.00	102.56	125.40	108.94	125.40	0.000009	0.78	4638.01	395.04	0.03

Spring Branch Corrected FRIS Plan: Phase 1 with backwater 6/17/2024

Spring Branch Reach-1

Legend

- WS 100-yr
- WS 50-yr
- WS 25-yr
- WS 10-yr
- WS 2-yr
- Ground
- Left Levee

Elevation (ft)

150
140
130
120
110
100

177 260 418 622 844 1070 1290 1377 1707 1850 1897 2135 2345 2384 2552 2729 2826 2865 3079 3306 3548 3812 3936 4140 4524 4603 5172 5729

0 1000 2000 3000 4000 5000 6000

Main Channel Distance (ft)

HEC-RAS Plan: Phase 2 with backwater River: Spring Branch Reach: Reach-1

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)	
Reach-1	5729	2-yr	121.00	136.21	140.24	139.30	140.42	0.004427	3.42	36.21	24.67	0.45
Reach-1	5729	10-yr	197.00	136.21	141.25	139.91	141.37	0.001868	2.99	92.90	121.81	0.31
Reach-1	5729	25-yr	324.00	136.21	141.30	140.74	141.59	0.004589	4.74	99.09	135.19	0.49
Reach-1	5729	50-yr	481.00	136.21	141.36	141.36	141.94	0.008966	6.72	108.37	185.67	0.69
Reach-1	5729	100-yr	632.00	136.21	141.83	141.83	142.13	0.005033	5.56	252.19	523.48	0.53
Reach-1	5678	2-yr	121.00	135.30	140.20	138.37	140.26	0.001138	2.14	83.60	133.60	0.24
Reach-1	5678	10-yr	197.00	135.30	141.28	138.99	141.29	0.000226	1.21	353.52	383.28	0.11
Reach-1	5678	25-yr	324.00	135.30	141.38	140.09	141.40	0.000517	1.86	392.59	453.22	0.17
Reach-1	5678	50-yr	481.00	135.30	141.49	140.57	141.54	0.000884	2.49	442.91	492.34	0.22
Reach-1	5678	100-yr	632.00	135.30	141.60	140.81	141.65	0.001208	2.96	489.57	529.70	0.26
Reach-1	5172		Culvert									
Reach-1	4646	2-yr	121.00	132.10	139.10	135.23	139.10	0.000000	0.04	4804.61	1667.63	0.00
Reach-1	4646	10-yr	197.00	132.10	141.29	135.92	141.29	0.000000	0.03	8672.85	1957.90	0.00
Reach-1	4646	25-yr	324.00	132.10	141.39	136.37	141.39	0.000000	0.05	8887.18	2015.78	0.00
Reach-1	4646	50-yr	481.00	132.10	141.53	136.75	141.53	0.000000	0.07	9172.37	2069.63	0.00
Reach-1	4646	100-yr	632.00	132.10	141.65	137.00	141.65	0.000000	0.09	9411.08	2101.71	0.01
Reach-1	4632	2-yr	227.00	131.97	139.10	134.36	139.10	0.000000	0.06	4047.89	1545.15	0.00
Reach-1	4632	10-yr	369.00	131.97	141.29	135.07	141.29	0.000000	0.03	12700.12	3117.37	0.00
Reach-1	4632	25-yr	446.00	131.97	141.39	135.59	141.39	0.000000	0.04	13037.37	3126.61	0.00
Reach-1	4632	50-yr	547.00	131.97	141.53	135.89	141.53	0.000000	0.04	13475.64	3149.36	0.00
Reach-1	4632	100-yr	733.00	131.97	141.65	136.33	141.65	0.000000	0.06	13836.46	3153.84	0.00
Reach-1	4603		Culvert									
Reach-1	4524	2-yr	312.00	131.77	137.81	134.54	137.81	0.000032	0.47	822.45	1748.26	0.04
Reach-1	4524	10-yr	535.00	131.77	138.03	135.25	138.04	0.000071	0.72	941.14	1852.88	0.05
Reach-1	4524	25-yr	664.00	131.77	138.13	135.58	138.14	0.000096	0.85	997.70	1904.03	0.06
Reach-1	4524	50-yr	770.00	131.77	138.20	135.74	138.21	0.000116	0.94	1034.34	1919.46	0.07
Reach-1	4524	100-yr	877.00	131.77	138.28	135.83	138.29	0.000134	1.02	1079.44	1939.07	0.08
Reach-1	4343	2-yr	312.00	130.19	137.80	133.37	137.81	0.000006	0.23	1994.11	870.22	0.02
Reach-1	4343	10-yr	535.00	130.19	138.03	134.44	138.03	0.000014	0.35	2175.72	891.86	0.02
Reach-1	4343	25-yr	664.00	130.19	138.13	135.29	138.13	0.000019	0.41	2260.50	905.95	0.03
Reach-1	4343	50-yr	770.00	130.19	138.19	135.64	138.19	0.000023	0.46	2315.38	914.96	0.03
Reach-1	4343	100-yr	877.00	130.19	138.27	135.94	138.27	0.000029	0.51	2383.43	927.53	0.03
Reach-1	4140		Culvert									
Reach-1	3936	2-yr	312.00	129.13	133.02	133.02	133.35	0.007965	5.07	103.49	178.62	0.53
Reach-1	3936	10-yr	535.00	129.13	133.37	133.37	133.73	0.009317	5.92	172.04	221.69	0.58
Reach-1	3936	25-yr	664.00	129.13	133.51	133.51	133.89	0.010260	6.38	199.51	231.43	0.61
Reach-1	3936	50-yr	770.00	129.13	133.61	133.61	134.01	0.010871	6.69	220.36	246.51	0.63
Reach-1	3936	100-yr	877.00	129.13	133.68	133.68	134.12	0.011704	7.05	237.41	263.21	0.66
Reach-1	3812	2-yr	312.00	126.39	132.31	130.67	132.38	0.001732	2.77	205.74	201.64	0.25
Reach-1	3812	10-yr	535.00	126.39	132.56	131.97	132.68	0.003051	3.83	269.91	292.59	0.33
Reach-1	3812	25-yr	664.00	126.39	132.68	132.15	132.82	0.003652	4.27	305.43	323.10	0.36
Reach-1	3812	50-yr	770.00	126.39	132.75	132.27	132.92	0.004214	4.64	328.96	338.68	0.39
Reach-1	3812	100-yr	877.00	126.39	132.85	132.35	133.02	0.004492	4.86	358.77	354.79	0.40
Reach-1	3789	2-yr	312.00	126.34	132.22	130.74	132.32	0.002843	3.21	206.39	292.92	0.30
Reach-1	3789	10-yr	535.00	126.34	132.44	132.22	132.58	0.004343	4.13	274.44	310.72	0.37
Reach-1	3789	25-yr	664.00	126.34	132.56	132.33	132.71	0.004976	4.50	309.46	319.06	0.40
Reach-1	3789	50-yr	770.00	126.34	132.61	132.40	132.79	0.005870	4.93	325.96	322.63	0.43
Reach-1	3789	100-yr	877.00	126.34	132.70	132.47	132.88	0.006038	5.08	356.84	329.19	0.44
Reach-1	3548		Culvert									
Reach-1	3306	2-yr	312.00	125.06	131.41	129.02	131.44	0.000759	1.84	353.62	341.13	0.15
Reach-1	3306	10-yr	535.00	125.06	131.12	130.93	131.29	0.004611	4.34	259.27	308.15	0.37
Reach-1	3306	25-yr	664.00	125.06	131.33	131.05	131.47	0.004178	4.26	325.97	330.59	0.36
Reach-1	3306	50-yr	770.00	125.06	131.47	131.13	131.60	0.004096	4.31	371.67	347.33	0.35
Reach-1	3306	100-yr	877.00	125.06	131.60	131.20	131.74	0.004156	4.42	418.62	361.94	0.36
Reach-1	3079	2-yr	312.00	123.48	131.38	128.82	131.39	0.000082	0.64	760.13	319.03	0.04
Reach-1	3079	10-yr	535.00	123.48	130.96	129.14	130.97	0.000445	1.44	629.07	310.70	0.10
Reach-1	3079	25-yr	664.00	123.48	131.13	129.24	131.15	0.000529	1.60	681.95	310.70	0.11
Reach-1	3079	50-yr	770.00	123.48	131.23	129.32	131.25	0.000615	1.74	713.31	314.44	0.12
Reach-1	3079	100-yr	877.00	123.48	131.34	129.39	131.36	0.000692	1.86	745.46	318.24	0.12
Reach-1	2903	2-yr	312.00	123.29	128.54	128.54	130.69	0.070820	11.76	26.54	6.18	1.00
Reach-1	2903	10-yr	535.00	123.29	130.74	130.14	130.80	0.003049	3.01	315.75	278.20	0.21

HEC-RAS Plan: Phase 2 with backwater River: Spring Branch Reach: Reach-1 (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)	
Reach-1	2903	25-yr	664.00	123.29	130.87	130.24	130.94	0.003467	3.26	354.59	299.71	0.23
Reach-1	2903	50-yr	770.00	123.29	130.92	130.32	131.01	0.004153	3.58	370.72	306.52	0.25
Reach-1	2903	100-yr	877.00	123.29	130.99	130.38	131.09	0.004692	3.83	390.35	309.20	0.26
Reach-1	2865		Culvert									
Reach-1	2826	2-yr	312.00	122.94	129.83	129.83	130.15	0.011483	5.49	104.83	152.99	0.41
Reach-1	2826	10-yr	535.00	122.94	130.20	130.20	130.51	0.013417	6.19	174.50	214.22	0.44
Reach-1	2826	25-yr	664.00	122.94	130.32	130.32	130.65	0.014984	6.63	200.20	222.14	0.47
Reach-1	2826	50-yr	770.00	122.94	130.39	130.39	130.75	0.016578	7.03	216.98	227.16	0.49
Reach-1	2826	100-yr	877.00	122.94	130.47	130.47	130.85	0.017610	7.30	235.06	231.98	0.51
Reach-1	2729	2-yr	345.00	122.19	127.93		128.04	0.003939	3.71	167.42	128.43	0.29
Reach-1	2729	10-yr	601.00	122.19	128.98		129.04	0.002214	3.16	321.72	170.32	0.23
Reach-1	2729	25-yr	760.00	122.19	129.97		130.01	0.001124	2.50	513.54	224.66	0.17
Reach-1	2729	50-yr	894.00	122.19	129.99		130.04	0.001526	2.91	517.76	225.95	0.19
Reach-1	2729	100-yr	1031.00	122.19	130.23		130.29	0.001573	3.03	575.00	242.69	0.20
Reach-1	2552	2-yr	345.00	121.48	126.57	126.21	126.89	0.011680	5.81	98.54	103.42	0.49
Reach-1	2552	10-yr	601.00	121.48	128.76		128.79	0.000915	2.13	481.27	234.67	0.15
Reach-1	2552	25-yr	760.00	121.48	129.88		129.90	0.000385	1.54	760.89	261.44	0.10
Reach-1	2552	50-yr	894.00	121.48	129.86		129.88	0.000544	1.82	756.15	261.17	0.12
Reach-1	2552	100-yr	1031.00	121.48	130.10		130.12	0.000574	1.91	819.31	267.65	0.12
Reach-1	2423	2-yr	345.00	120.40	125.21	123.92	126.06	0.002953	7.41	46.57	10.38	0.62
Reach-1	2423	10-yr	601.00	120.40	126.77	125.44	128.17	0.003821	9.52	65.08	16.09	0.69
Reach-1	2423	25-yr	760.00	120.40	126.28	126.28	128.96	0.007915	13.14	58.10	12.59	0.99
Reach-1	2423	50-yr	894.00	120.40	128.70	128.70	129.52	0.002012	8.25	274.66	218.36	0.52
Reach-1	2423	100-yr	1031.00	120.40	128.93	128.93	129.76	0.002098	8.59	325.27	227.70	0.53
Reach-1	2384		Culvert									
Reach-1	2345	2-yr	345.00	120.39	124.35	123.77	125.51	0.004469	8.64	40.17	16.03	0.78
Reach-1	2345	10-yr	601.00	120.39	125.51	125.32	127.48	0.005846	11.33	56.36	50.02	0.90
Reach-1	2345	25-yr	760.00	120.39	126.09	126.09	128.54	0.006629	12.72	64.33	77.42	0.96
Reach-1	2345	50-yr	894.00	120.39	127.67	126.68	128.22	0.001803	7.45	302.20	156.56	0.49
Reach-1	2345	100-yr	1031.00	120.39	128.25	127.38	128.67	0.001458	6.93	406.17	215.24	0.44
Reach-1	2135	2-yr	345.00	117.91	123.72	123.48	123.96	0.006118	4.98	132.25	142.35	0.42
Reach-1	2135	10-yr	601.00	117.91	126.26		126.28	0.000434	1.80	547.55	189.07	0.12
Reach-1	2135	25-yr	760.00	117.91	127.11		127.13	0.000320	1.67	716.72	203.16	0.11
Reach-1	2135	50-yr	894.00	117.91	127.82		127.84	0.000263	1.61	865.33	227.42	0.10
Reach-1	2135	100-yr	1031.00	117.91	128.34		128.36	0.000241	1.60	996.19	268.44	0.09
Reach-1	1940	2-yr	345.00	114.47	122.84	119.29	123.10	0.003333	4.08	84.58	17.20	0.32
Reach-1	1940	10-yr	601.00	114.47	125.80	120.84	126.06	0.001938	4.14	151.86	82.75	0.26
Reach-1	1940	25-yr	760.00	114.47	126.88	121.61	127.00	0.001020	3.28	355.24	181.55	0.20
Reach-1	1940	50-yr	894.00	114.47	127.66	122.18	127.74	0.000723	2.93	506.22	225.54	0.17
Reach-1	1940	100-yr	1031.00	114.47	128.21	122.71	128.28	0.000565	2.69	633.52	229.33	0.15
Reach-1	1897		Culvert									
Reach-1	1850	2-yr	345.00	114.25	119.09	119.09	120.67	0.033870	10.08	34.24	10.79	1.00
Reach-1	1850	10-yr	601.00	114.25	122.54	120.95	123.16	0.006691	6.70	101.99	125.69	0.49
Reach-1	1850	25-yr	760.00	114.25	125.37	121.79	125.65	0.001840	4.56	184.16	165.25	0.27
Reach-1	1850	50-yr	894.00	114.25	127.62	122.30	127.63	0.000105	1.27	1098.64	295.17	0.07
Reach-1	1850	100-yr	1031.00	114.25	128.25	122.66	128.26	0.000094	1.25	1294.14	331.47	0.06
Reach-1	1707	2-yr	345.00	111.71	118.25	116.54	118.55	0.004759	4.94	102.88	77.38	0.40
Reach-1	1707	10-yr	601.00	111.71	122.80		122.81	0.000106	1.15	790.03	208.57	0.07
Reach-1	1707	25-yr	760.00	111.71	125.49		125.50	0.000033	0.76	1446.15	270.53	0.04
Reach-1	1707	50-yr	894.00	111.71	127.62		127.62	0.000018	0.62	2069.69	327.17	0.03
Reach-1	1707	100-yr	1031.00	111.71	128.24		128.25	0.000018	0.64	2278.21	336.96	0.03
Reach-1	1460	2-yr	345.00	111.40	116.56	115.24	117.01	0.008174	5.40	63.85	22.56	0.57
Reach-1	1460	10-yr	601.00	111.40	122.70	116.53	122.76	0.000268	1.94	339.20	188.40	0.12
Reach-1	1460	25-yr	760.00	111.40	125.43	117.10	125.47	0.000135	1.69	486.60	270.89	0.09
Reach-1	1460	50-yr	894.00	111.40	127.59	117.53	127.61	0.000050	1.16	1016.65	303.07	0.06
Reach-1	1460	100-yr	1031.00	111.40	128.24	117.93	128.24	0.000021	0.77	1874.16	323.29	0.04
Reach-1	1377		Culvert									
Reach-1	1290	2-yr	345.00	107.26	111.12	111.12	112.33	0.021971	8.84	39.02	16.03	1.00
Reach-1	1290	10-yr	601.00	107.26	120.85	112.39	120.86	0.000047	1.12	786.26	170.33	0.06
Reach-1	1290	25-yr	760.00	107.26	122.42	112.95	122.43	0.000039	1.13	1081.02	196.72	0.06
Reach-1	1290	50-yr	894.00	107.26	123.73	113.37	123.74	0.000031	1.08	1351.43	217.70	0.05

HEC-RAS Plan: Phase 2 with backwater River: Spring Branch Reach: Reach-1 (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)	
Reach-1	1290	100-yr	1031.00	107.26	125.41	113.72	125.42	0.000022	0.97	1733.86	238.51	0.04
Reach-1	1070	2-yr	345.00	103.84	109.88		110.00	0.000952	2.92	151.33	59.50	0.25
Reach-1	1070	10-yr	601.00	103.84	120.85		120.85	0.000013	0.79	1943.17	281.71	0.04
Reach-1	1070	25-yr	760.00	103.84	122.42		122.42	0.000012	0.82	2412.60	314.57	0.04
Reach-1	1070	50-yr	894.00	103.84	123.73		123.74	0.000011	0.83	2842.09	339.35	0.03
Reach-1	1070	100-yr	1031.00	103.84	125.41		125.41	0.000009	0.80	3428.02	352.60	0.03
Reach-1	844	2-yr	345.00	103.76	109.60		109.74	0.001497	2.96	136.76	102.60	0.30
Reach-1	844	10-yr	601.00	103.76	120.85		120.85	0.000005	0.45	3074.99	376.28	0.02
Reach-1	844	25-yr	760.00	103.76	122.42		122.42	0.000005	0.48	3683.22	395.53	0.02
Reach-1	844	50-yr	894.00	103.76	123.73		123.74	0.000004	0.50	4208.79	403.22	0.02
Reach-1	844	100-yr	1031.00	103.76	125.41		125.41	0.000004	0.50	4905.60	432.87	0.02
Reach-1	622	2-yr	345.00	103.29	109.60		109.62	0.000161	1.15	356.07	125.24	0.10
Reach-1	622	10-yr	601.00	103.29	120.84		120.85	0.000003	0.41	2463.40	238.28	0.02
Reach-1	622	25-yr	760.00	103.29	122.42		122.42	0.000004	0.46	2842.99	244.78	0.02
Reach-1	622	50-yr	894.00	103.29	123.73		123.73	0.000004	0.49	3168.72	250.61	0.02
Reach-1	622	100-yr	1031.00	103.29	125.41		125.41	0.000004	0.51	3595.62	260.77	0.02
Reach-1	418	2-yr	345.00	103.13	109.47		109.55	0.000739	2.34	172.19	58.57	0.21
Reach-1	418	10-yr	601.00	103.13	120.84		120.85	0.000011	0.72	2084.56	272.71	0.03
Reach-1	418	25-yr	760.00	103.13	122.41		122.42	0.000011	0.78	2531.45	293.22	0.03
Reach-1	418	50-yr	894.00	103.13	123.73		123.73	0.000011	0.81	2924.72	305.26	0.03
Reach-1	418	100-yr	1031.00	103.13	125.40		125.41	0.000010	0.81	3450.05	321.79	0.03
Reach-1	260	2-yr	345.00	103.07	109.01	106.88	109.31	0.003452	4.41	78.30	23.01	0.42
Reach-1	260	10-yr	601.00	103.07	120.84	108.19	120.84	0.000016	0.81	2292.79	271.16	0.04
Reach-1	260	25-yr	760.00	103.07	122.41	108.81	122.42	0.000016	0.86	2724.22	277.90	0.04
Reach-1	260	50-yr	894.00	103.07	123.73	109.23	123.73	0.000015	0.89	3093.60	283.70	0.04
Reach-1	260	100-yr	1031.00	103.07	125.40	109.60	125.41	0.000013	0.89	3569.10	283.70	0.04
Reach-1	177	2-yr	345.00	102.76	108.85	106.27	109.09	0.001840	3.99	112.35	44.02	0.33
Reach-1	177	10-yr	601.00	102.76	120.83	107.53	120.84	0.000028	1.15	1412.14	280.41	0.05
Reach-1	177	25-yr	760.00	102.76	122.40	108.20	122.41	0.000030	1.26	1645.91	284.74	0.05
Reach-1	177	50-yr	894.00	102.76	123.71	108.64	123.73	0.000031	1.33	1841.62	289.24	0.05
Reach-1	177	100-yr	1031.00	102.76	125.40	109.06	125.41	0.000016	1.01	3531.12	297.80	0.04
Reach-1	116	2-yr	345.00	102.56	108.75	106.36	108.97	0.002003	3.76	104.77	47.26	0.33
Reach-1	116	10-yr	601.00	102.56	120.83	107.56	120.84	0.000020	0.95	1559.88	363.91	0.04
Reach-1	116	25-yr	760.00	102.56	122.40	108.10	122.41	0.000021	1.05	1788.15	369.45	0.04
Reach-1	116	50-yr	894.00	102.56	123.72	108.53	123.72	0.000010	0.77	3998.09	372.90	0.03
Reach-1	116	100-yr	1031.00	102.56	125.40	108.94	125.40	0.000009	0.78	4638.01	395.04	0.03

Spring Branch Corrected FRIS Plan: Phase 2 with backwater 6/17/2024

Spring Branch Reach-1

Legend

- WS 100-yr
- WS 50-yr
- WS 25-yr
- WS 10-yr
- WS 2-yr
- Ground
- Left Levee

Elevation (ft)

150
140
130
120
110
100

177 260 418 622 844 1070 1290 1377 1707 1850 1897 2135 2345 2384 2552 2729 2826 2865 3079 3306 3548 3812 3936 4140 4524 4603 5172 5729

0 1000 2000 3000 4000 5000 6000

Main Channel Distance (ft)

HEC-RAS Plan: Phase 3 with backwater River: Spring Branch Reach: Reach-1

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)	
Reach-1	5729	2-yr	121.00	136.21	140.24	139.30	140.42	0.004449	3.43	36.14	24.64	0.45
Reach-1	5729	10-yr	197.00	136.21	141.20	139.91	141.33	0.002033	3.08	87.92	109.85	0.33
Reach-1	5729	25-yr	324.00	136.21	141.35	140.74	141.62	0.004144	4.56	106.74	175.15	0.47
Reach-1	5729	50-yr	481.00	136.21	141.36	141.36	141.94	0.008966	6.72	108.37	185.67	0.69
Reach-1	5729	100-yr	632.00	136.21	141.83	141.83	142.13	0.005033	5.56	252.19	523.48	0.53
Reach-1	5678	2-yr	121.00	135.30	140.20	138.37	140.26	0.001144	2.14	83.20	131.70	0.24
Reach-1	5678	10-yr	197.00	135.30	141.23	138.99	141.25	0.000251	1.26	337.51	364.98	0.12
Reach-1	5678	25-yr	324.00	135.30	141.42	140.09	141.45	0.000463	1.78	412.70	466.65	0.16
Reach-1	5678	50-yr	481.00	135.30	141.49	140.57	141.53	0.000891	2.49	441.38	491.40	0.23
Reach-1	5678	100-yr	632.00	135.30	141.59	140.81	141.65	0.001228	2.98	486.07	526.96	0.27
Reach-1	5172		Culvert									
Reach-1	4646	2-yr	121.00	132.10	138.88	135.23	138.88	0.000000	0.04	4438.50	1646.15	0.00
Reach-1	4646	10-yr	197.00	132.10	141.24	135.92	141.24	0.000000	0.03	8588.52	1936.91	0.00
Reach-1	4646	25-yr	324.00	132.10	141.44	136.37	141.44	0.000000	0.05	8978.23	2031.28	0.00
Reach-1	4646	50-yr	481.00	132.10	141.53	136.75	141.53	0.000000	0.07	9166.02	2068.80	0.00
Reach-1	4646	100-yr	632.00	132.10	141.64	137.00	141.64	0.000000	0.09	9397.62	2099.79	0.01
Reach-1	4632	2-yr	227.00	131.97	138.88	134.36	138.88	0.000000	0.06	3711.09	1502.03	0.00
Reach-1	4632	10-yr	369.00	131.97	141.24	135.07	141.24	0.000000	0.03	12565.17	3115.01	0.00
Reach-1	4632	25-yr	446.00	131.97	141.44	135.59	141.44	0.000000	0.04	13178.20	3130.69	0.00
Reach-1	4632	50-yr	547.00	131.97	141.53	135.89	141.53	0.000000	0.04	13465.99	3149.24	0.00
Reach-1	4632	100-yr	733.00	131.97	141.64	136.33	141.64	0.000000	0.06	13816.25	3153.59	0.00
Reach-1	4603		Culvert									
Reach-1	4524	2-yr	312.00	131.77	137.59	134.54	137.59	0.000045	0.54	717.49	1645.32	0.04
Reach-1	4524	10-yr	535.00	131.77	137.88	135.25	137.89	0.000084	0.77	860.19	1772.07	0.06
Reach-1	4524	25-yr	664.00	131.77	138.03	135.58	138.04	0.000109	0.89	940.59	1852.36	0.07
Reach-1	4524	50-yr	770.00	131.77	138.12	135.74	138.13	0.000132	0.99	990.55	1899.55	0.08
Reach-1	4524	100-yr	877.00	131.77	138.20	135.83	138.21	0.000151	1.07	1034.68	1919.59	0.08
Reach-1	4343	2-yr	312.00	130.19	137.58	133.37	137.58	0.000008	0.26	1815.42	864.02	0.02
Reach-1	4343	10-yr	535.00	130.19	137.88	134.44	137.88	0.000017	0.37	2051.75	875.04	0.03
Reach-1	4343	25-yr	664.00	130.19	138.02	135.29	138.03	0.000021	0.43	2173.34	891.46	0.03
Reach-1	4343	50-yr	770.00	130.19	138.11	135.64	138.12	0.000026	0.48	2248.20	903.92	0.03
Reach-1	4343	100-yr	877.00	130.19	138.19	135.94	138.19	0.000030	0.52	2314.43	914.80	0.04
Reach-1	4140		Culvert									
Reach-1	3936	2-yr	312.00	129.13	133.02	133.02	133.35	0.007965	5.07	103.49	178.62	0.53
Reach-1	3936	10-yr	535.00	129.13	133.37	133.37	133.73	0.009317	5.92	172.04	221.69	0.58
Reach-1	3936	25-yr	664.00	129.13	133.51	133.51	133.89	0.010260	6.38	199.51	231.43	0.61
Reach-1	3936	50-yr	770.00	129.13	133.61	133.61	134.01	0.010871	6.69	220.36	246.51	0.63
Reach-1	3936	100-yr	877.00	129.13	133.68	133.68	134.12	0.011704	7.05	237.41	263.21	0.66
Reach-1	3812	2-yr	312.00	126.39	132.30	130.67	132.37	0.001767	2.80	203.79	199.54	0.25
Reach-1	3812	10-yr	535.00	126.39	132.55	131.97	132.68	0.003082	3.85	268.55	291.40	0.33
Reach-1	3812	25-yr	664.00	126.39	132.68	132.15	132.82	0.003631	4.26	306.31	324.00	0.36
Reach-1	3812	50-yr	770.00	126.39	132.74	132.27	132.91	0.004320	4.69	325.29	337.17	0.39
Reach-1	3812	100-yr	877.00	126.39	132.87	132.35	133.04	0.004316	4.78	364.98	358.19	0.40
Reach-1	3789	2-yr	312.00	126.34	132.20	130.74	132.31	0.002978	3.27	201.92	291.98	0.30
Reach-1	3789	10-yr	535.00	126.34	132.43	132.22	132.57	0.004473	4.18	271.12	309.85	0.38
Reach-1	3789	25-yr	664.00	126.34	132.56	132.33	132.71	0.004906	4.47	311.22	319.44	0.40
Reach-1	3789	50-yr	770.00	126.34	132.57	132.40	132.76	0.006521	5.16	312.68	319.76	0.46
Reach-1	3789	100-yr	877.00	126.34	132.74	132.47	132.90	0.005535	4.89	368.99	331.74	0.42
Reach-1	3548		Culvert									
Reach-1	3306	2-yr	312.00	125.06	130.03	129.02	130.67	0.014013	6.42	51.95	48.34	0.63
Reach-1	3306	10-yr	535.00	125.06	130.93	130.93	131.23	0.007787	5.46	200.79	293.82	0.48
Reach-1	3306	25-yr	664.00	125.06	131.22	131.05	131.41	0.005534	4.82	289.41	314.93	0.41
Reach-1	3306	50-yr	770.00	125.06	131.38	131.13	131.55	0.004956	4.68	343.52	337.62	0.39
Reach-1	3306	100-yr	877.00	125.06	131.54	131.20	131.69	0.004545	4.58	396.11	355.54	0.37
Reach-1	3079	2-yr	312.00	123.48	129.63	128.82	129.66	0.001337	2.15	277.12	227.29	0.16
Reach-1	3079	10-yr	535.00	123.48	130.69	129.14	130.70	0.000698	1.75	544.06	307.54	0.12
Reach-1	3079	25-yr	664.00	123.48	130.96	129.24	130.98	0.000683	1.78	629.50	310.70	0.12
Reach-1	3079	50-yr	770.00	123.48	131.10	129.32	131.13	0.000740	1.88	673.37	310.70	0.13
Reach-1	3079	100-yr	877.00	123.48	131.24	129.39	131.26	0.000792	1.97	714.91	315.11	0.13
Reach-1	2903	2-yr	312.00	122.29	128.89	125.21	129.17	0.004838	4.30	72.57	11.00	0.30
Reach-1	2903	10-yr	535.00	122.29	130.29	126.48	130.44	0.003145	3.83	252.39	222.13	0.24

HEC-RAS Plan: Phase 3 with backwater River: Spring Branch Reach: Reach-1 (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)	
Reach-1	2903	25-yr	664.00	122.29	130.61	127.13	130.74	0.002818	3.72	329.08	260.41	0.23
Reach-1	2903	50-yr	770.00	122.29	130.72	127.63	130.86	0.003127	3.96	359.06	276.22	0.24
Reach-1	2903	100-yr	877.00	122.29	130.84	130.22	130.98	0.003361	4.14	390.96	294.12	0.25
Reach-1	2865		Culvert									
Reach-1	2826	2-yr	312.00	121.86	128.27	124.80	128.58	0.005349	4.47	69.86	10.90	0.31
Reach-1	2826	10-yr	535.00	121.86	129.05	126.08	129.77	0.011659	6.83	78.43	15.15	0.45
Reach-1	2826	25-yr	664.00	121.86	129.97	126.72	130.44	0.007873	6.08	175.15	172.65	0.38
Reach-1	2826	50-yr	770.00	121.86	130.00	127.23	130.62	0.010373	6.99	179.48	182.58	0.43
Reach-1	2826	100-yr	877.00	121.86	130.32	127.72	130.77	0.008355	6.44	246.49	221.92	0.39
Reach-1	2729	2-yr	345.00	122.19	127.93		128.04	0.003939	3.71	167.42	128.43	0.29
Reach-1	2729	10-yr	601.00	122.19	128.98		129.04	0.002214	3.16	321.72	170.32	0.23
Reach-1	2729	25-yr	760.00	122.19	129.97		130.01	0.001124	2.50	513.54	224.66	0.17
Reach-1	2729	50-yr	894.00	122.19	129.99		130.04	0.001526	2.91	517.76	225.95	0.19
Reach-1	2729	100-yr	1031.00	122.19	130.23		130.29	0.001573	3.03	575.00	242.69	0.20
Reach-1	2552	2-yr	345.00	121.48	126.57	126.21	126.89	0.011680	5.81	98.54	103.42	0.49
Reach-1	2552	10-yr	601.00	121.48	128.76		128.79	0.000915	2.13	481.27	234.67	0.15
Reach-1	2552	25-yr	760.00	121.48	129.88		129.90	0.000385	1.54	760.89	261.44	0.10
Reach-1	2552	50-yr	894.00	121.48	129.86		129.88	0.000544	1.82	756.15	261.17	0.12
Reach-1	2552	100-yr	1031.00	121.48	130.10		130.12	0.000574	1.91	819.31	267.65	0.12
Reach-1	2423	2-yr	345.00	120.40	125.21	123.92	126.06	0.002953	7.41	46.57	10.38	0.62
Reach-1	2423	10-yr	601.00	120.40	126.77	125.44	128.17	0.003821	9.52	65.08	16.09	0.69
Reach-1	2423	25-yr	760.00	120.40	126.28	126.28	128.96	0.007915	13.14	58.10	12.59	0.99
Reach-1	2423	50-yr	894.00	120.40	128.70	128.70	129.52	0.002012	8.25	274.66	218.36	0.52
Reach-1	2423	100-yr	1031.00	120.40	128.93	128.93	129.76	0.002098	8.59	325.27	227.70	0.53
Reach-1	2384		Culvert									
Reach-1	2345	2-yr	345.00	120.39	124.35	123.77	125.51	0.004469	8.64	40.17	16.03	0.78
Reach-1	2345	10-yr	601.00	120.39	125.51	125.32	127.48	0.005846	11.33	56.36	50.02	0.90
Reach-1	2345	25-yr	760.00	120.39	126.09	126.09	128.54	0.006629	12.72	64.33	77.42	0.96
Reach-1	2345	50-yr	894.00	120.39	127.67	126.68	128.22	0.001803	7.45	302.20	156.56	0.49
Reach-1	2345	100-yr	1031.00	120.39	128.25	127.38	128.67	0.001458	6.93	406.17	215.24	0.44
Reach-1	2135	2-yr	345.00	117.91	123.72	123.48	123.96	0.006118	4.98	132.25	142.35	0.42
Reach-1	2135	10-yr	601.00	117.91	126.26		126.28	0.000434	1.80	547.55	189.07	0.12
Reach-1	2135	25-yr	760.00	117.91	127.11		127.13	0.000320	1.67	716.72	203.16	0.11
Reach-1	2135	50-yr	894.00	117.91	127.82		127.84	0.000263	1.61	865.33	227.42	0.10
Reach-1	2135	100-yr	1031.00	117.91	128.34		128.36	0.000241	1.60	996.19	268.44	0.09
Reach-1	1940	2-yr	345.00	114.47	122.84	119.29	123.10	0.003333	4.08	84.58	17.20	0.32
Reach-1	1940	10-yr	601.00	114.47	125.80	120.84	126.06	0.001938	4.14	151.86	82.75	0.26
Reach-1	1940	25-yr	760.00	114.47	126.88	121.61	127.00	0.001020	3.28	355.24	181.55	0.20
Reach-1	1940	50-yr	894.00	114.47	127.66	122.18	127.74	0.000723	2.93	506.22	225.54	0.17
Reach-1	1940	100-yr	1031.00	114.47	128.21	122.71	128.28	0.000565	2.69	633.52	229.33	0.15
Reach-1	1897		Culvert									
Reach-1	1850	2-yr	345.00	114.25	119.09	119.09	120.67	0.033870	10.08	34.24	10.79	1.00
Reach-1	1850	10-yr	601.00	114.25	122.54	120.95	123.16	0.006691	6.70	101.99	125.69	0.49
Reach-1	1850	25-yr	760.00	114.25	125.37	121.79	125.65	0.001840	4.56	184.16	165.25	0.27
Reach-1	1850	50-yr	894.00	114.25	127.62	122.30	127.63	0.000105	1.27	1098.64	295.17	0.07
Reach-1	1850	100-yr	1031.00	114.25	128.25	122.66	128.26	0.000094	1.25	1294.14	331.47	0.06
Reach-1	1707	2-yr	345.00	111.71	118.25	116.54	118.55	0.004759	4.94	102.88	77.38	0.40
Reach-1	1707	10-yr	601.00	111.71	122.80		122.81	0.000106	1.15	790.03	208.57	0.07
Reach-1	1707	25-yr	760.00	111.71	125.49		125.50	0.000033	0.76	1446.15	270.53	0.04
Reach-1	1707	50-yr	894.00	111.71	127.62		127.62	0.000018	0.62	2069.69	327.17	0.03
Reach-1	1707	100-yr	1031.00	111.71	128.24		128.25	0.000018	0.64	2278.21	336.96	0.03
Reach-1	1460	2-yr	345.00	111.40	116.56	115.24	117.01	0.008174	5.40	63.85	22.56	0.57
Reach-1	1460	10-yr	601.00	111.40	122.70	116.53	122.76	0.000268	1.94	339.20	188.40	0.12
Reach-1	1460	25-yr	760.00	111.40	125.43	117.10	125.47	0.000135	1.69	486.60	270.89	0.09
Reach-1	1460	50-yr	894.00	111.40	127.59	117.53	127.61	0.000050	1.16	1016.65	303.07	0.06
Reach-1	1460	100-yr	1031.00	111.40	128.24	117.93	128.24	0.000021	0.77	1874.16	323.29	0.04
Reach-1	1377		Culvert									
Reach-1	1290	2-yr	345.00	107.26	111.12	111.12	112.33	0.021971	8.84	39.02	16.03	1.00
Reach-1	1290	10-yr	601.00	107.26	120.85	112.39	120.86	0.000047	1.12	786.26	170.33	0.06
Reach-1	1290	25-yr	760.00	107.26	122.42	112.95	122.43	0.000039	1.13	1081.02	196.72	0.06
Reach-1	1290	50-yr	894.00	107.26	123.73	113.37	123.74	0.000031	1.08	1351.43	217.70	0.05

HEC-RAS Plan: Phase 3 with backwater River: Spring Branch Reach: Reach-1 (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)	
Reach-1	1290	100-yr	1031.00	107.26	125.41	113.72	125.42	0.000022	0.97	1733.86	238.51	0.04
Reach-1	1070	2-yr	345.00	103.84	109.88		110.00	0.000952	2.92	151.33	59.50	0.25
Reach-1	1070	10-yr	601.00	103.84	120.85		120.85	0.000013	0.79	1943.17	281.71	0.04
Reach-1	1070	25-yr	760.00	103.84	122.42		122.42	0.000012	0.82	2412.60	314.57	0.04
Reach-1	1070	50-yr	894.00	103.84	123.73		123.74	0.000011	0.83	2842.09	339.35	0.03
Reach-1	1070	100-yr	1031.00	103.84	125.41		125.41	0.000009	0.80	3428.02	352.60	0.03
Reach-1	844	2-yr	345.00	103.76	109.60		109.74	0.001497	2.96	136.76	102.60	0.30
Reach-1	844	10-yr	601.00	103.76	120.85		120.85	0.000005	0.45	3074.99	376.28	0.02
Reach-1	844	25-yr	760.00	103.76	122.42		122.42	0.000005	0.48	3683.22	395.53	0.02
Reach-1	844	50-yr	894.00	103.76	123.73		123.74	0.000004	0.50	4208.79	403.22	0.02
Reach-1	844	100-yr	1031.00	103.76	125.41		125.41	0.000004	0.50	4905.60	432.87	0.02
Reach-1	622	2-yr	345.00	103.29	109.60		109.62	0.000161	1.15	356.07	125.24	0.10
Reach-1	622	10-yr	601.00	103.29	120.84		120.85	0.000003	0.41	2463.40	238.28	0.02
Reach-1	622	25-yr	760.00	103.29	122.42		122.42	0.000004	0.46	2842.99	244.78	0.02
Reach-1	622	50-yr	894.00	103.29	123.73		123.73	0.000004	0.49	3168.72	250.61	0.02
Reach-1	622	100-yr	1031.00	103.29	125.41		125.41	0.000004	0.51	3595.62	260.77	0.02
Reach-1	418	2-yr	345.00	103.13	109.47		109.55	0.000739	2.34	172.19	58.57	0.21
Reach-1	418	10-yr	601.00	103.13	120.84		120.85	0.000011	0.72	2084.56	272.71	0.03
Reach-1	418	25-yr	760.00	103.13	122.41		122.42	0.000011	0.78	2531.45	293.22	0.03
Reach-1	418	50-yr	894.00	103.13	123.73		123.73	0.000011	0.81	2924.72	305.26	0.03
Reach-1	418	100-yr	1031.00	103.13	125.40		125.41	0.000010	0.81	3450.05	321.79	0.03
Reach-1	260	2-yr	345.00	103.07	109.01	106.88	109.31	0.003452	4.41	78.30	23.01	0.42
Reach-1	260	10-yr	601.00	103.07	120.84	108.19	120.84	0.000016	0.81	2292.79	271.16	0.04
Reach-1	260	25-yr	760.00	103.07	122.41	108.81	122.42	0.000016	0.86	2724.22	277.90	0.04
Reach-1	260	50-yr	894.00	103.07	123.73	109.23	123.73	0.000015	0.89	3093.60	283.70	0.04
Reach-1	260	100-yr	1031.00	103.07	125.40	109.60	125.41	0.000013	0.89	3569.10	283.70	0.04
Reach-1	177	2-yr	345.00	102.76	108.85	106.27	109.09	0.001840	3.99	112.35	44.02	0.33
Reach-1	177	10-yr	601.00	102.76	120.83	107.53	120.84	0.000028	1.15	1412.14	280.41	0.05
Reach-1	177	25-yr	760.00	102.76	122.40	108.20	122.41	0.000030	1.26	1645.91	284.74	0.05
Reach-1	177	50-yr	894.00	102.76	123.71	108.64	123.73	0.000031	1.33	1841.62	289.24	0.05
Reach-1	177	100-yr	1031.00	102.76	125.40	109.06	125.41	0.000016	1.01	3531.12	297.80	0.04
Reach-1	116	2-yr	345.00	102.56	108.75	106.36	108.97	0.002003	3.76	104.77	47.26	0.33
Reach-1	116	10-yr	601.00	102.56	120.83	107.56	120.84	0.000020	0.95	1559.88	363.91	0.04
Reach-1	116	25-yr	760.00	102.56	122.40	108.10	122.41	0.000021	1.05	1788.15	369.45	0.04
Reach-1	116	50-yr	894.00	102.56	123.72	108.53	123.72	0.000010	0.77	3998.09	372.90	0.03
Reach-1	116	100-yr	1031.00	102.56	125.40	108.94	125.40	0.000009	0.78	4638.01	395.04	0.03

Spring Branch Corrected FRIS Plan: Phase 3 with backwater 6/17/2024

Spring Branch Reach-1

Legend

- WS 100-yr
- WS 50-yr
- WS 25-yr
- WS 10-yr
- WS 2-yr
- Ground
- Left Levee

Elevation (ft)

150
140
130
120
110
100

177 260 418 622 844 1070 1290 1377 1707 1850 1897 2135 2345 2384 2552 2729 2826 2865 3079 3306 3548 3812 3936 4140 4524 4603 5172 5729

0 1000 2000 3000 4000 5000 6000

Main Channel Distance (ft)

APPENDIX C

PROJECT CUT SHEETS

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

APPENDIX C.1

PROJECT CUT SHEETS

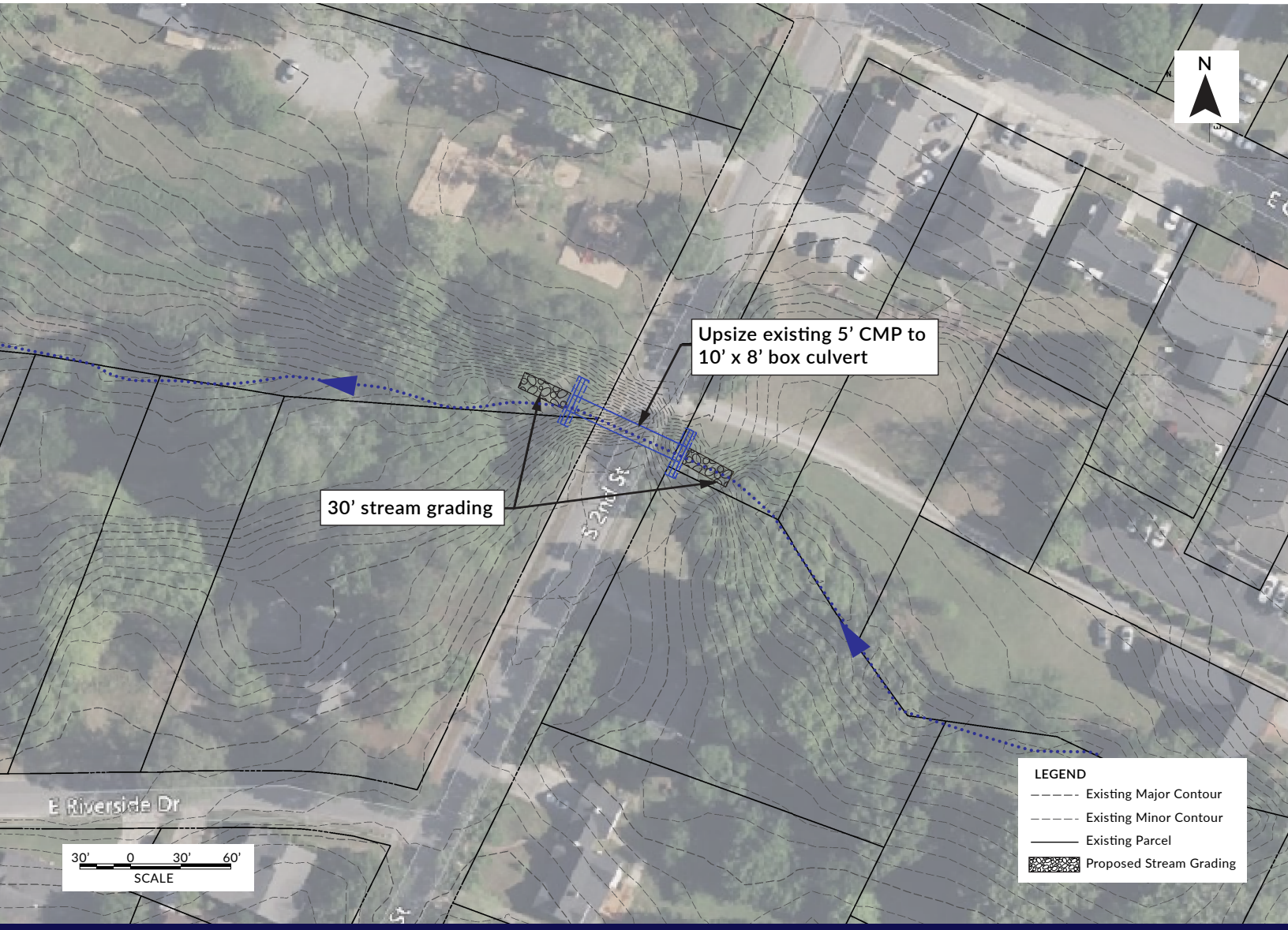
Stormwater Projects

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

PROJECT | 2nd Street Culvert Replacement

PHASE 1

This project is identified as Phase 1, the first priority of proposed projects. Preliminary hydraulic modeling of this upsized culvert reduces both the 2- and 100-year floodplain, as well as the likelihood of overtopping 2nd Street.



This proposed project would replace the existing 5' diameter corrugated metal pipe (CMP) culvert under 2nd Street with a 10' by 8' concrete box culvert to improve the conveyance capacity. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. Further design will consider utility crossings, private property impacts, and connections to the stream.

FUNDING OPTIONS

This project is currently fully funded through state appropriated funds.

TIMELINE

- Request for Proposals - Town is Currently Reviewing *(4/2024)*
- Anticipated Consultant Selection *(6/7/2024)*
- Anticipated Project Completion *(9/2026)* *(From our proposal)*

PROJECT PRIORITY

This project is identified as Phase 1, the first priority of proposed projects. Preliminary hydraulic modeling of this upsized culvert reduces both the 2- and 100-year floodplain, as well as the likelihood of overtopping 2nd Street. Water quality improvements include increased sedimentation of pollutants, decreased turbidity downstream, and an increase in fish passage. While the construction phase will be very visible, it will have minimal impacts on private property.

COST

Design/Permitting:
$169,709

Property/Easement:
Minimal

Construction:
$848,543

TOTAL:
$1,018,252

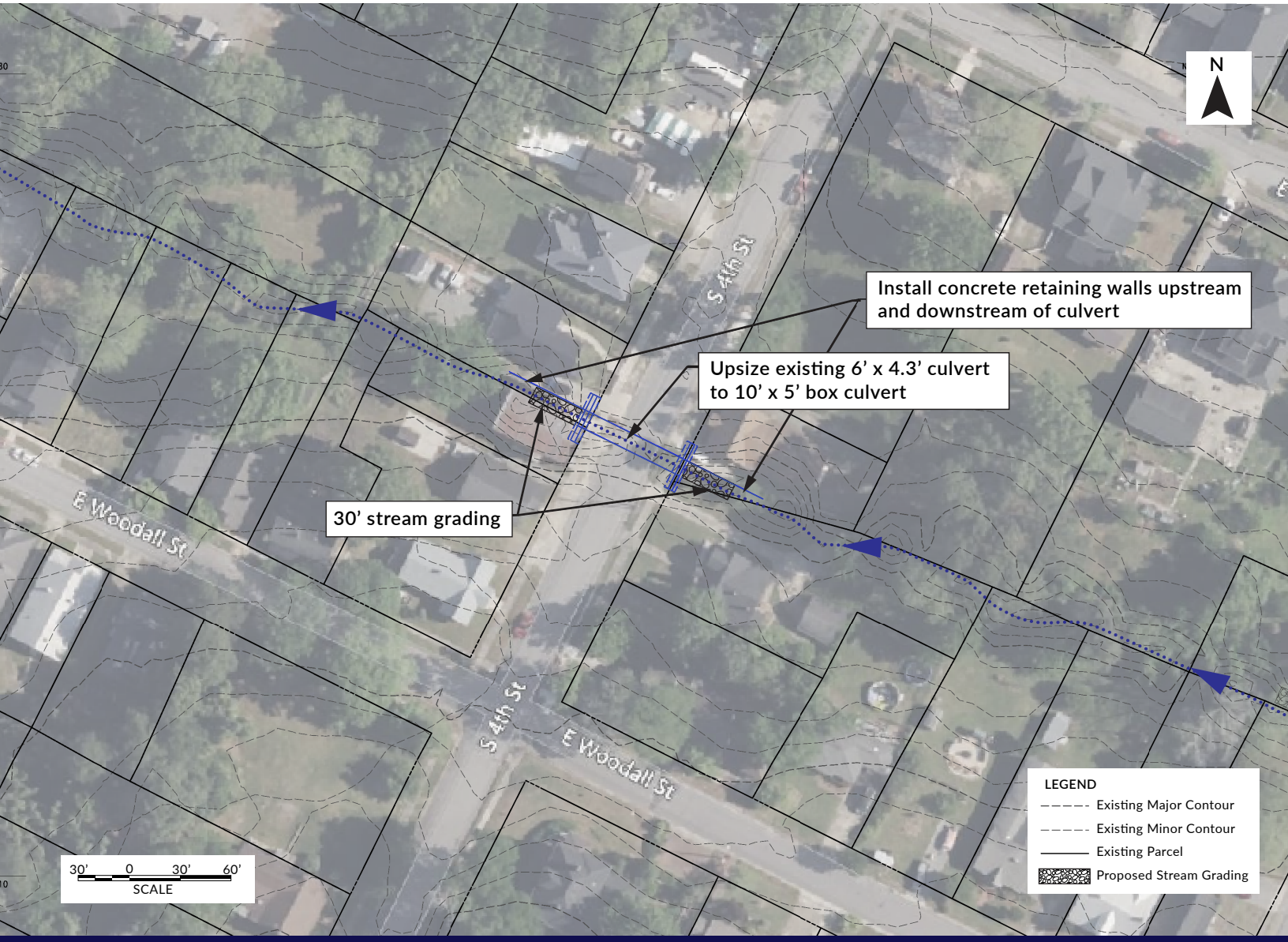
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | 4th Street Culvert Replacement

PHASE 1

This project is identified as Phase 1, the first priority of proposed projects. Preliminary hydraulic modeling of this upsized culvert reduces both the 2- and 100-year floodplain.



This proposed project would replace the existing 6' x 4.3' culvert with a 10' x 5' concrete box culvert to improve the conveyance capacity. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. Upstream and downstream 50' retaining walls will also be placed. Further design will consider utility crossings, private property impacts, and connections to the stream.

FUNDING OPTIONS

This project is currently fully funded through state appropriated funds.

TIMELINE

- Request for Proposals - Town is Currently Reviewing *(4/2024)*
- Anticipated Consultant Selection *(6/7/2024)*
- Anticipated Project Completion *(9/2026)* *(From our proposal)*

PROJECT PRIORITY

This project is identified as Phase 1, the first priority of proposed projects. Preliminary hydraulic modeling of this upsized culvert reduces both the 2- and 100-year floodplain. Water quality improvements include increased sedimentation of pollutants, decreased turbidity downstream, and an increase in fish passage. While the construction phase will be visible with significant impacts to private property, this project is roughly 55% of the cost of the 2nd Street culvert replacement, also in Phase 1.

COST

Design/Permitting:
$111,028

Property/Easement:
To Be Determined

Construction:
$444,112

TOTAL:
$555,140

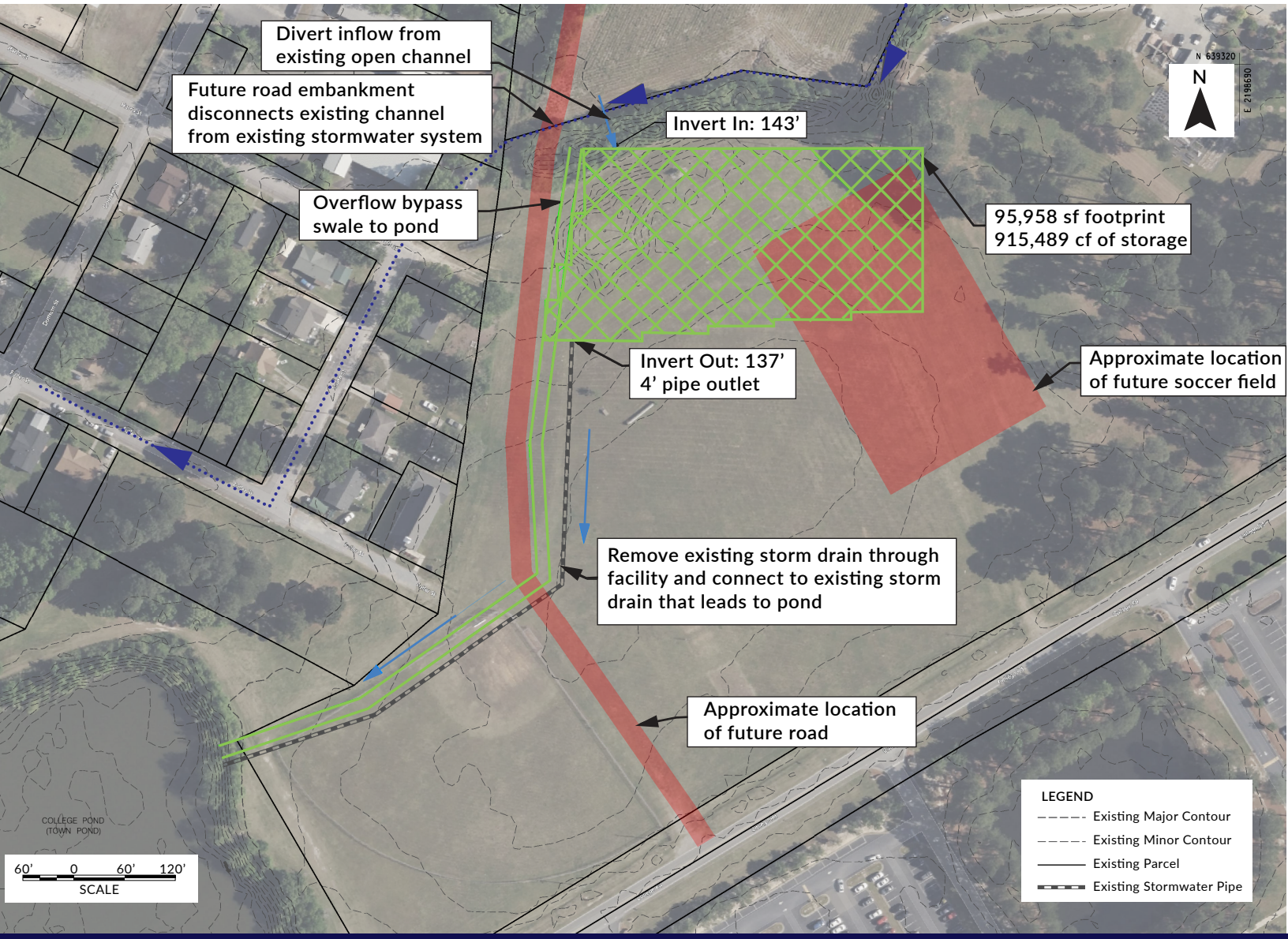
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | Under-Ground Flood Attenuation Facility

PHASE 2

Phase 2 includes construction of an above-ground stormwater detention facility located northeast of the existing College Pond on Johnston Community College campus.



This under ground flood attenuation facility (stormwater management pond) facility will provide attenuation of high flows from the open drainage channel leading from US-70 and the Arboretum. High flows in the existing drainage ditch will overtop the ditch and access a floodplain storage area with a footprint of 95,958 sf and a total storage volume of 915,489 cf. Permanent pools within the floodplain area may provide additional water quality treatment in the future. Regulated flood flows out of the facility will be directed to the College Pond, providing additional capacity in the existing storm drain system along Harris St. to the west.

FUNDING OPTIONS

Grants

Local Assistance for Stormwater Infrastructure Investments (LASII)

- Funding cycle: Spring and Fall funding cycles
- Match: No match required

North Carolina DEQ Water Resources Development Grant Program

- Funding cycle: Two annual cycles: January 1 to June 30 and July 1 to December 31
- Match: Required (50%)

Gold Leaf Foundation Flood Mitigation Program

- Funding cycle: Open through mid-December and early March
- Match: No match required

Low-interest Loans

Clean Water State Revolving Fund

- Funding cycle: Open in March and September
- Match: Required (20%)

State/County/Town Funds

- To be determined

TIMELINE

- Anticipated Grant Funds Available *(1/2026)*
- Anticipated RFQ *(2/2026)*
- Anticipated Selection *(4/2026)*
- Anticipated Project Completion *(10/2028)*

COST

Design/Permitting:
$197,944

Construction:
$2,573,278

TOTAL:
$2,771,222

PROJECT PRIORITY

This project is identified as Phase 2, the second priority of proposed projects. Preliminary hydrologic modeling of this underground facility provides reductions in peak discharges downstream of the facility for the 2-year, 10-year, 25-year, and 100-year storm, as well as downstream floodplain reductions. Water quality improvements include increased sedimentation of pollutants and decreased turbidity downstream. While the construction phase will be very visible and well within the public view, as it is near the community college and the main interstate, once completed it will no longer be visible and will not affect the aesthetics of the area or hinder access to the baseball field. The vault will be completely underground and traffic bearing, therefore not impacting public safety. Potential conflicts include granting access from Johnston Community College to construct a bypass swale and funding availability, as this project will be one of the costliest.

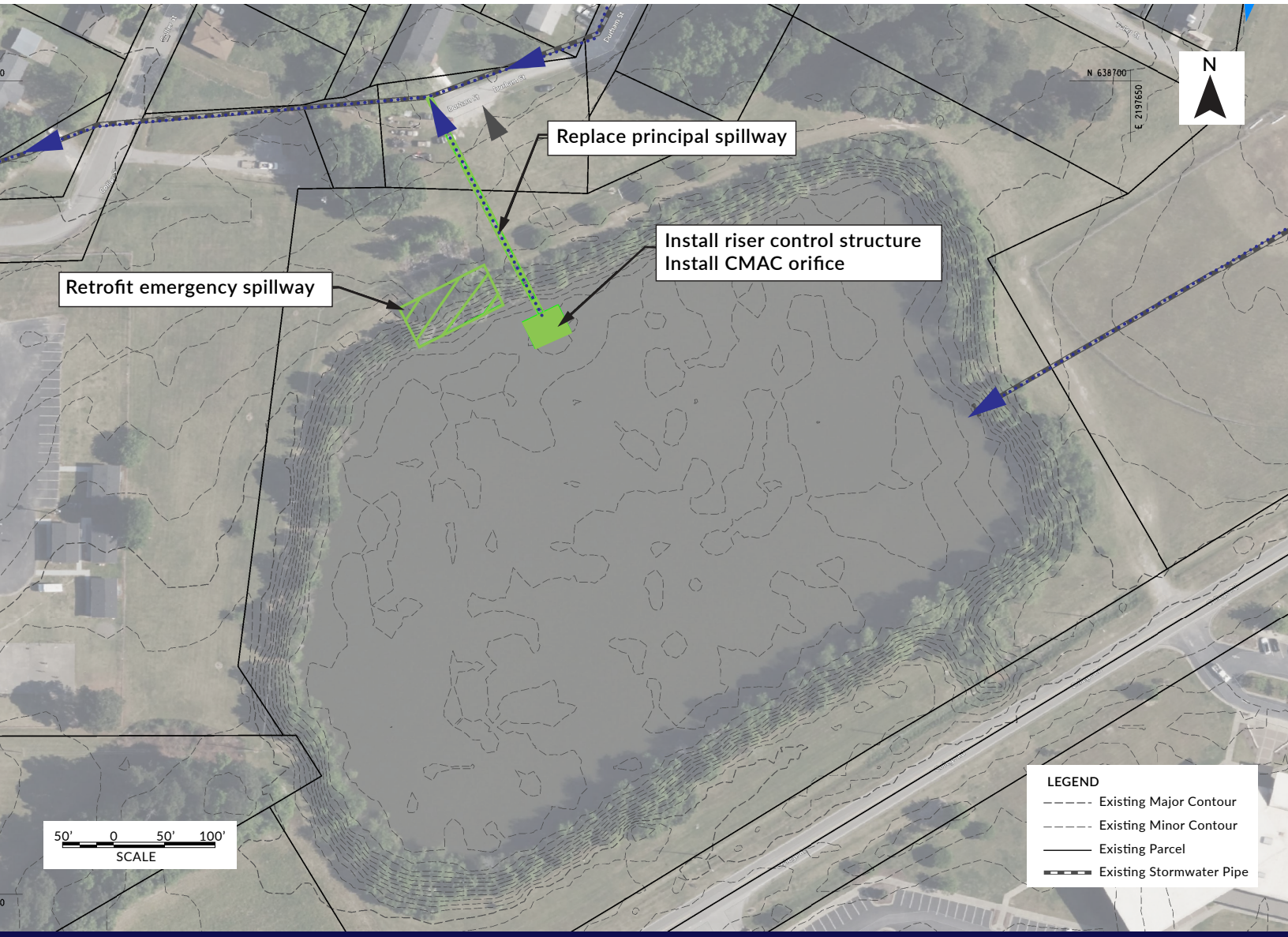
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | College Pond Retrofit

PHASE 2

This project is identified as Phase 2, the second priority of proposed projects. Preliminary hydrologic modeling of this pond retrofit provides reductions in peak discharges downstream of the facility.



Retrofit of the existing College Pond on Johnston Community College campus includes installation of a riser control structure enabled with continued monitoring and adaptive controls (CMAC). This fully automated control structure leverages weather forecasts to predictively drain the pond in advance of inclement weather via solar or line power. Additional retrofits include replacement of the existing 24" outlet pipe, and regrading of the existing emergency spillway to provide a greater drawdown. The combination of retrofit efforts will maximize stormwater storage and flood relief, particularly for the more frequent nuisance flooding produced by the 1- and 2-year storms.

FUNDING OPTIONS

Grants:

Local Assistance for Stormwater Infrastructure Investments (LASII)

- Funding cycle: Spring and fall funding cycles
- Match: No match required

North Carolina DEQ Water Resources Development Grant Program

- Funding cycle: Two annual cycles: January 1 to June 30 and July 1 to December 31.
- Match: Required (50%)

Gold Leaf Foundation Flood Mitigation Program

- Funding Cycle: Open through mid-December and early March
- Match: No match required

Low-interest Loans

Clean Water State Revolving Fund

- Funding cycle: Open in March and September
- Match: Required (20%)

State/County/Town Funds:

- To Be Determined

TIMELINE

- Anticipated Grant Funds Available *(1/2025)*
- Anticipated RFQ *(2/2025)*
- Anticipated Selection *(4/2025)*
- Anticipated Project Completion *(4/2027)*

COST

Design/Permitting:
$58,097

Property/Easement:
To Be Determined

Construction:
$580,965

TOTAL:
$639,062

PROJECT PRIORITY

This project is identified as Phase 2, the second priority of proposed projects. Preliminary hydrologic modeling of this pond retrofit provides reductions in peak discharges downstream of the facility for the 1- and 2-year storms, and matches existing conditions for the 25-, 50- and 100-year storms. Water quality improvements include increased sedimentation of pollutants and decreased turbidity downstream. This project minimally impacts private property. Further design should consider the annual cost of the CMAC subscription.

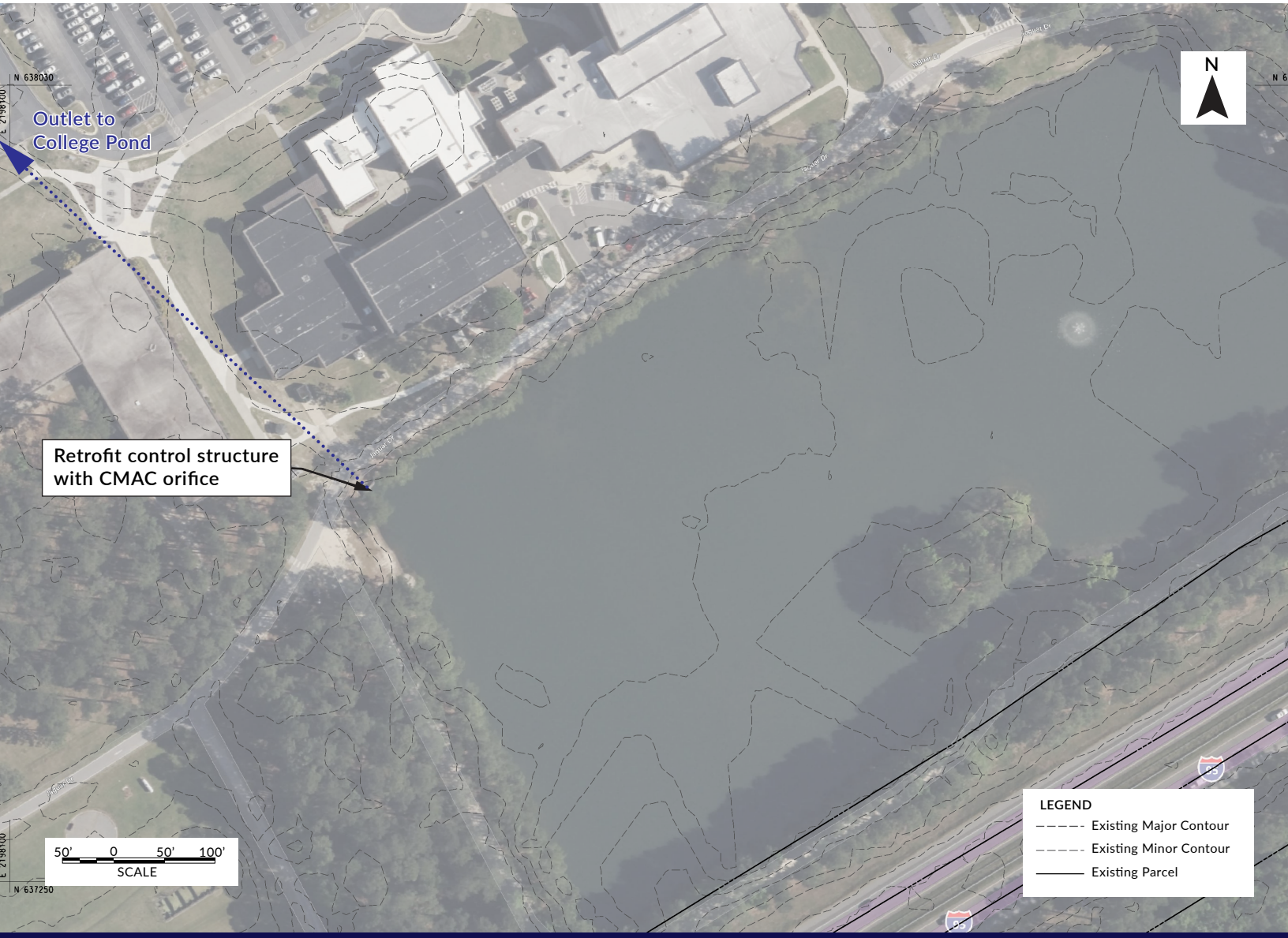
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | I-95 Pond Retrofit

PHASE 2

This project is identified as Phase 2, the second priority of proposed projects. Preliminary hydrologic modeling of this pond retrofit provides reductions in peak discharges downstream of the facility.



Retrofit of the existing I-95 Pond south of Jaguar Drive includes replacement of the existing control structure to enable continued monitoring and adaptive controls (CMAC). This fully automated control structure leverages weather forecasts to predictively drain the pond in advance of inclement weather via solar or line power. The CMAC technology will maximize stormwater storage and flood relief, particularly for the more frequent nuisance flooding produced by the 1- and 2-year storms.

FUNDING OPTIONS

Grants:

Local Assistance for Stormwater Infrastructure Investments (LASII)

- Funding cycle: Spring and fall funding cycles
- Match: No match required

North Carolina DEQ Water Resources Development Grant Program

- Funding cycle: Two annual cycles: January 1 to June 30 and July 1 to December 31.
- Match: Required (50%)

Gold Leaf Foundation Flood Mitigation Program

- Funding Cycle: Open through mid-December and early March
- Match: No match required

Low-interest Loans

Clean Water State Revolving Fund

- Funding cycle: Open in March and September
- Match: Required (20%)

State/County/Town Funds:

- To Be Determined

TIMELINE

- Anticipated Grant Funds Available *(1/2027)*
- Anticipated RFQ *(2/2027)*
- Anticipated Selection *(4/2027)*
- Anticipated Project Completion *(4/2028)*

COST

Design/Permitting:
To Be Determined

Property/Easement:
To Be Determined

Construction:
$168,000

TOTAL:
$168,000

PROJECT PRIORITY

This project is identified as Phase 2, the second priority of proposed projects. Preliminary hydrologic modeling of this pond retrofit provides reductions in peak discharges downstream of the facility for the 1- and 2-year storms, and matches existing conditions for the 25-, 50- and 100-year storms. Water quality improvements include increased sedimentation of pollutants and decreased turbidity downstream. This project provides minimal construction impacts and minimal private property impacts. Further design should consider the annual cost of the CMAC subscription.

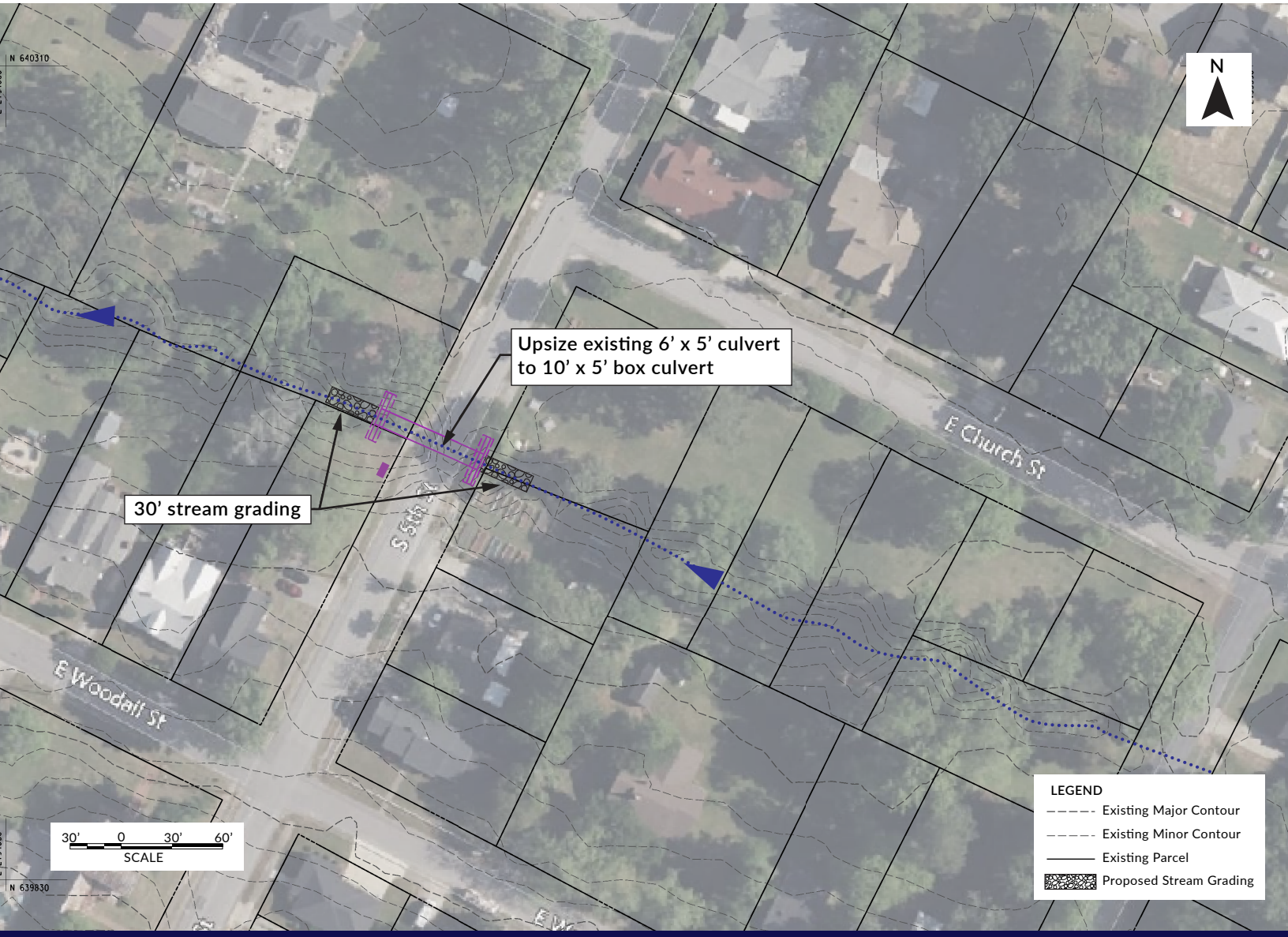
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | 5th Street Culvert Replacement

PHASE 3

This project is identified as Phase 3, the lowest priority of proposed projects. Preliminary hydraulic modeling of this upsized culvert improves conveyance capacity but has minimal impacts on floodplain reductions and 5th Street roadway overtopping.



This proposed project would replace the existing 6' x 5' culvert with a 10' x 5' concrete box culvert to improve conveyance capacity. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. Further design will consider utility crossings, private property impacts, and connections to the stream.

FUNDING OPTIONS

Grants:

Local Assistance for Stormwater Infrastructure Investments (LASII)

- Funding cycle: Spring and fall funding cycles
- Match: No match required

Gold Leaf Foundation Flood Mitigation Program

- Funding Cycle: Open through mid-December and early March
- Match: No match required

North Carolina Land and Water Fund

- Funding cycle: Open mid-January to early March
- Match: No match required

FEMA's Building Resilient Infrastructure and Communities Program (BRIC)

- Funding cycle: Open mid-October to late February
- Match: Required (25%)

Low-interest Loans:

Clean Water State Revolving Fund

- Funding cycle: Open in March and September
- Match: Required (20%)

State/County/Town Funds:

- To Be Determined

TIMELINE

- Anticipated Grant Funds Available *(1/2029)*
- Anticipated RFQ *(2/2029)*
- Anticipated Selection *(4/2029)*
- Anticipated Project Completion *(4/2031)*

COST

Design/Permitting:
$39,261

Property/Easement:
To Be Determined, Minimal

Construction:
$196,304

TOTAL:
$235,565

PROJECT PRIORITY

This project is identified as Phase 3, the lowest priority of proposed projects. Preliminary hydraulic modeling of this upsized culvert improves conveyance capacity but has minimal impacts on floodplain reductions and 5th Street roadway overtopping. Water quality improvements include increased sedimentation of pollutants, decreased turbidity downstream, and an increase in fish passage. While construction impacts of this project are significant, there will be minimal impacts to private property.

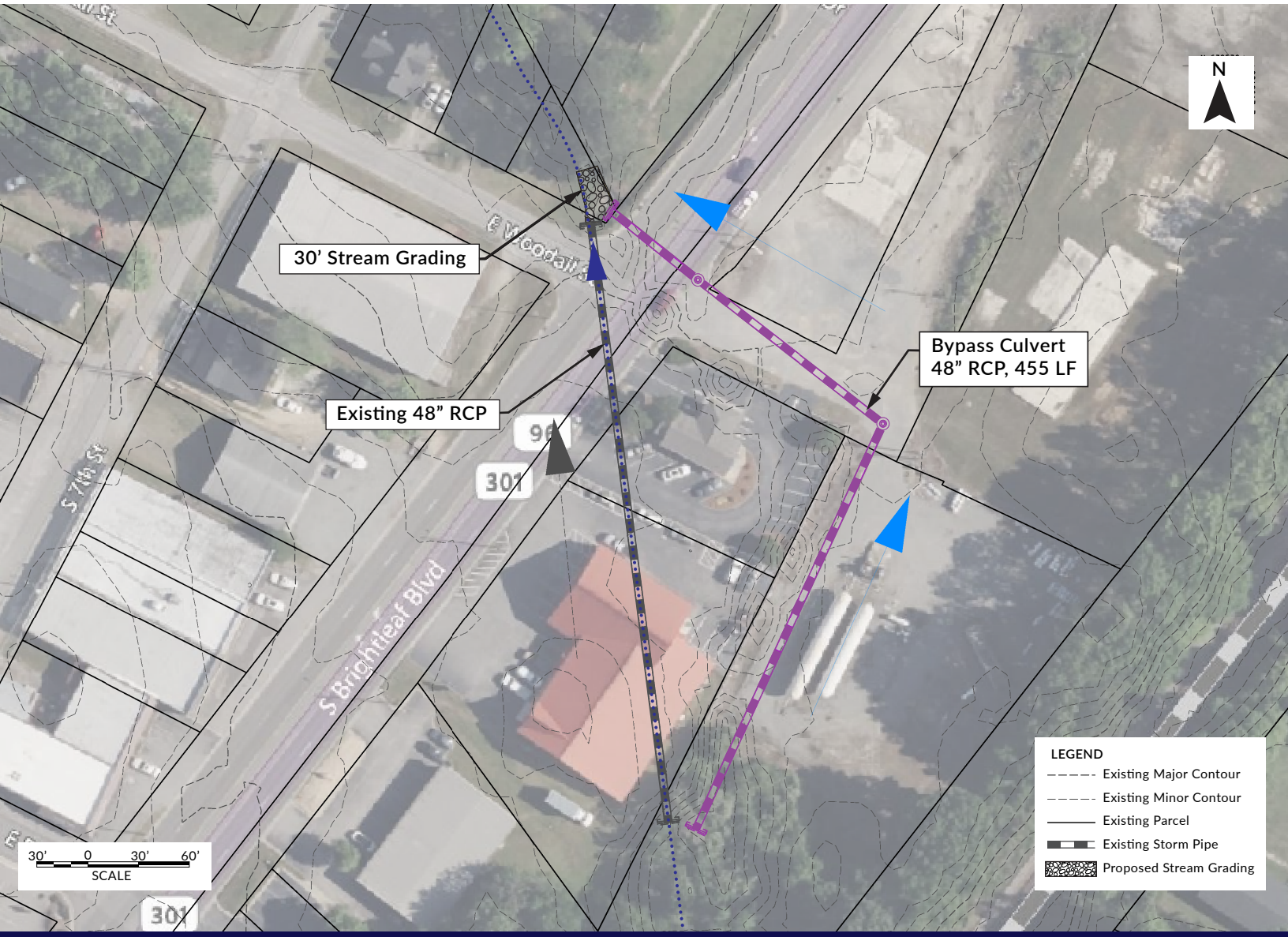
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | SR 301 Bypass Culvert

PHASE 3

This project is identified as Phase 3, the lowest priority of proposed projects.



This proposed project includes installation of a 48" reinforced concrete pipe (RCP) adjacent to the existing 48" RCP underneath SR 301. Upstream and downstream headwalls will be placed along with tie-in grading upstream and downstream to cleanly connect the new crossing into the existing stream. This bypass culvert would be set at the same invert elevations as the existing culvert and be routed around the existing ABC Store along SR 301 to avoid private property conflicts. The resulting bypass culvert is proposed to be 455' in length with two manholes for cleaning access. Further design will consider utility conflicts and potential flooding impacts on the downstream crossings.

FUNDING OPTIONS

Grants:

Local Assistance for Stormwater Infrastructure Investments (LASII)

- Funding cycle: Spring and fall funding cycles
- Match: No match required

Gold Leaf Foundation Flood Mitigation Program

- Funding Cycle: Open through mid-December and early March
- Match: No match required

FEMA's Building Resilient Infrastructure and Communities Program (BRIC)

- Funding cycle: Open mid-October to late February
- Match: Required (25%)

Low-interest Loans

Clean Water State Revolving Fund

- Funding cycle: Open in March and September
- Match: Required (20%)

State/County/Town Funds

- To Be Determined

TIMELINE

- Anticipated Grant Funds Available *(1/2030)*
- Anticipated RFQ *(2/2030)*
- Anticipated Selection *(4/2030)*
- Anticipated Project Completion *(4/2032)*

COST

Design/Permitting:
$58,963

Property/Easement:
To Be Determined, Minimal

Construction:
$294,814

TOTAL:
$353,777

PROJECT PRIORITY

This project is identified as Phase 3, the lowest priority of proposed projects. Preliminary hydraulic modeling of this bypass culvert but has minimal impacts on floodplain reductions and SR 301 overtopping. While construction impacts of this project are significant, there will be minimal impacts to private property.

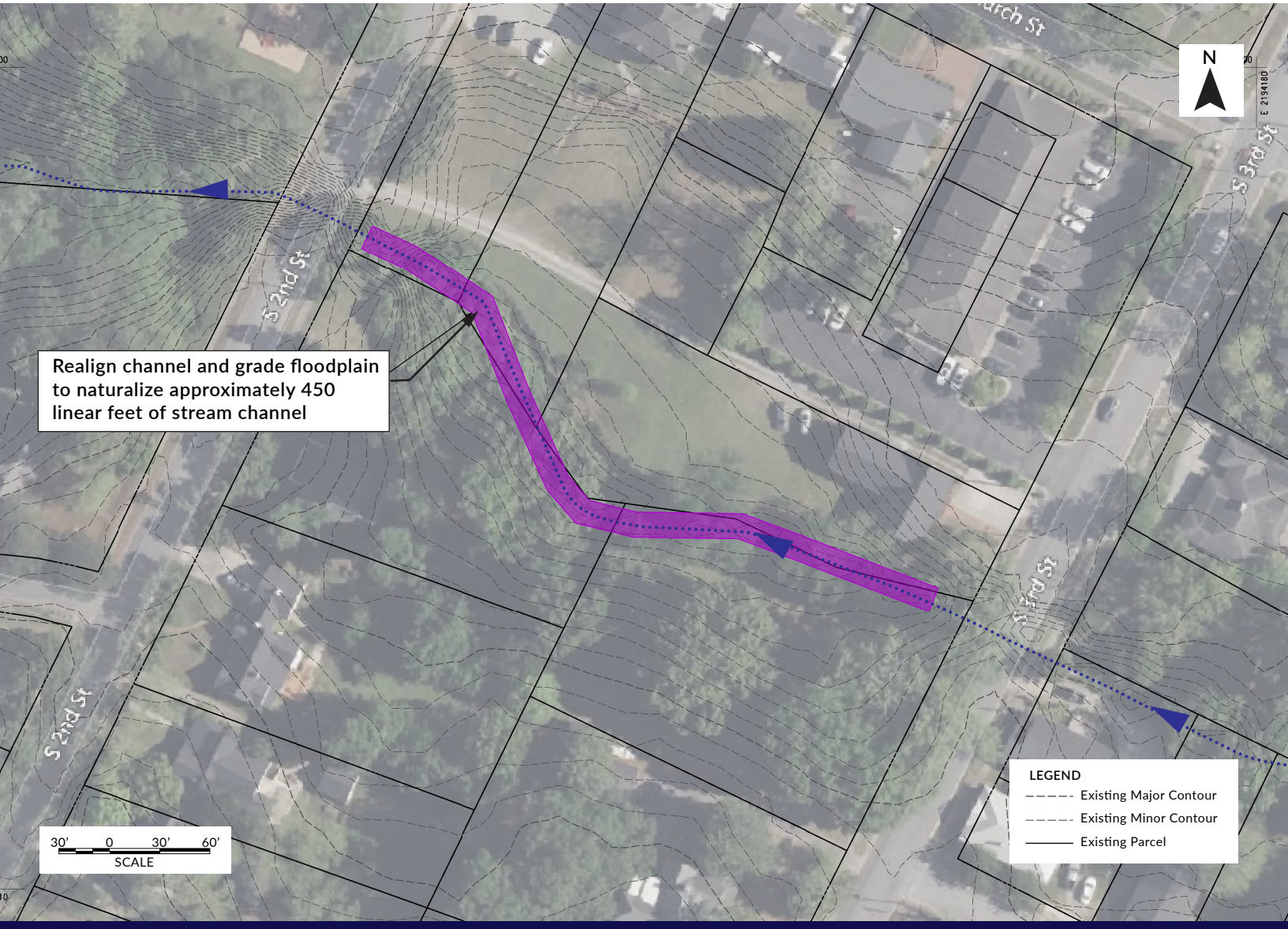
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | 3rd to 2nd Street Stream Restoration

PHASE 3

This project is identified as Phase 3, the lowest priority of proposed projects. Restoration of this existing concrete lined channel would provide significant ecological enhancement and aesthetic benefits for the community.



This stream restoration between 2nd and 3rd street would realign the existing stream channel to provide more a sinuous, natural flow path, and maintain stream and floodplain grading to allow floodplain access during larger storm events. Restoration of this existing concrete lined channel would provide significant ecological enhancement and aesthetic benefits, as well as some minor storage within the expanded floodplain for small storm events. The restoration approach would be similar to that employed at the 5th Street Stream Restoration constructed in 2023.

FUNDING OPTIONS

Grants:

North Carolina Land and Water Fund (NCLWF)

- Funding cycle: April 15th, August 15th, January 15th
- Match: No match required, but encouraged

North Carolina DEQ Water Resources Development Grant Program

- Funding cycle: Two annual cycles: January 1 to June 30 and July 1 to December 31.
- Match: Required (50%)

North Carolina DEQ 319 Grant Program

- Funding cycle: Open mid-February to mid-March
- Match: Required (40%)

NCDOJ Environmental Enhancement Grant Program

- Funding cycle: Open late January to early April
- Match: No

Low-interest Loans:

Clean Water State Revolving Fund

- Funding cycle: Open in March and September
- Match: Required (20%)

State/County/Town Funds:

- To Be Determined

TIMELINE

- Anticipated Grant Funds Available *(1/2028)*
- Anticipated RFQ *(2/2028)*
- Anticipated Selection *(4/2028)*
- Anticipated Project Completion *(10/2029)*

COST

Design/Permitting:
To Be Determined

Property/Easement:
To Be Determined

Construction:
$383,750

TOTAL:
$383,750

PROJECT PRIORITY

This project is identified as Phase 3, the lowest priority of proposed projects. Restoration of this existing concrete lined channel would provide significant ecological enhancement and aesthetic benefits for the community, increasing community green-space and improving downstream water quality. This project will also provide minor storage within the expanded floodplain for small storm events. This project includes minimal construction impacts and minimal private property impacts.

WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

APPENDIX C.2

PROJECT CUT SHEETS

Multi-Use Path Projects

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

PROJECT | 2nd Street to 5th Street Sidewalk Project

SEGMENT 1

This project includes the retrofit of the existing sidewalk to meet PROWAG requirements. The scope includes approximately 23 ADA ramps, 6 crosswalks (assuming thermoplastic "piano key" crossings) and 19 driveway adjustments along the existing sidewalks on Church Street from 2nd Street from Bob Wallace Jaycee Kiddie Park to the intersection of 5th Street and Church Street. The Smithfield Pedestrian Plan shows the installation of a multi-use path along this corridor, however currently there is sidewalk along this selected route in the existing condition. Therefore, the estimate includes a concrete sidewalk, instead of a multi-use path.

FUNDING OPTIONS

Grants:

Active Transportation Infrastructure Investment Program (ATIIP)

- Funding cycle: Opens in March, Closes in June (extended to July 17th in 2024)
- Match: 20% match minimum required

Powell Bill Funds (NCDOT)

- Funding Cycle: Applications due May 1
- Match: 50% match required

Connecting Communities to State Trails Grant

- Funding Cycle: May of each year

Recreational Trails Program Grant

- Funding Cycle: September of each year
- Match: 25% match required

NCDOT Transportation Alternatives Program (TAP)

- Funding cycle: Due in March
- Match: 20% match required

Many other potential programs

State/County/Town Funds

- To Be Determined

TIMELINE

To Be Determined

COST

Design/Permitting:
$33,332

Property/Easement:
None

Construction:
$166,660

TOTAL:
$199,992

PROJECT PRIORITY

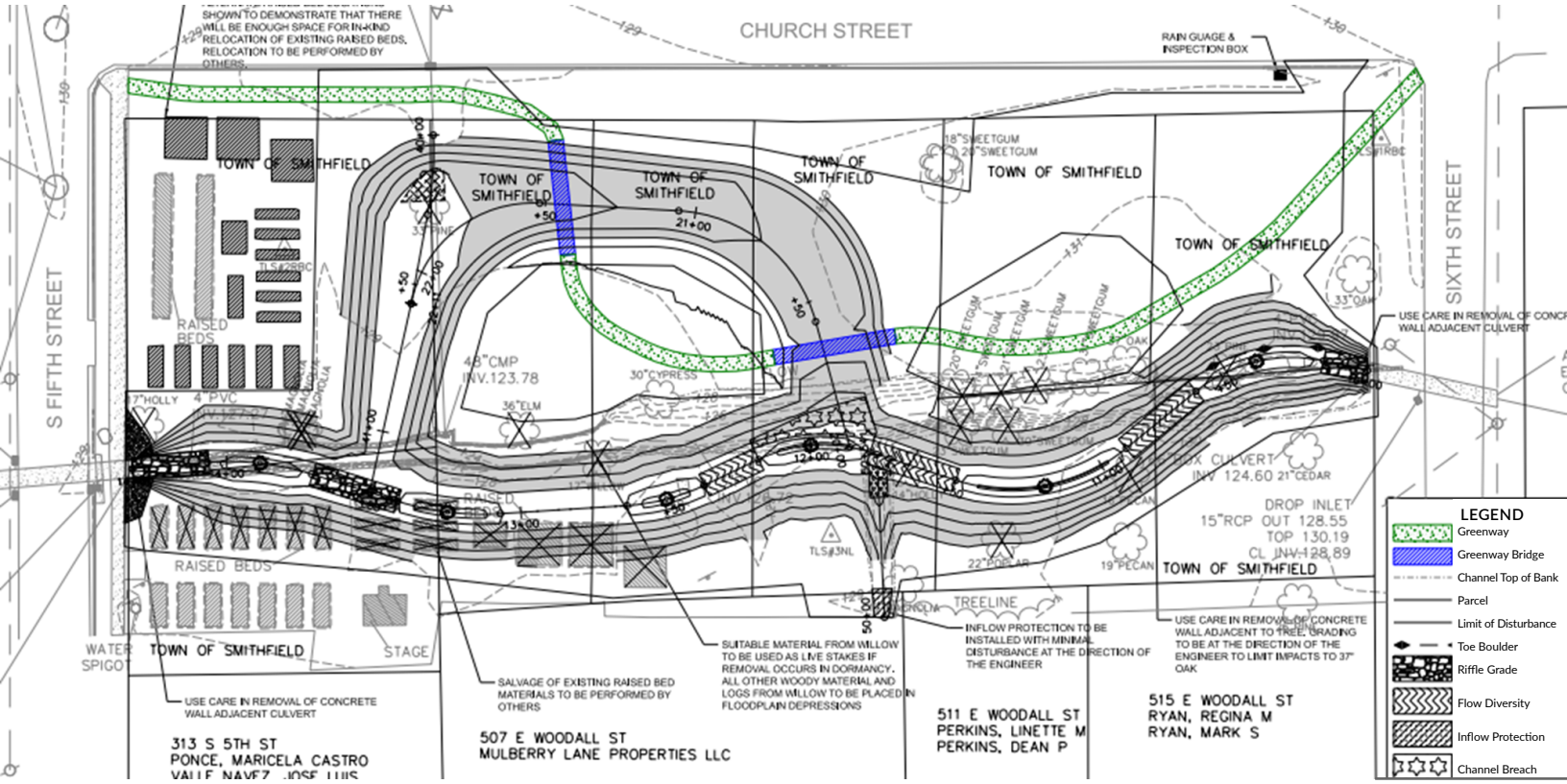
This segment will create a connection between the Bob Wallace Jaycee Kiddie Park and the 5th Street Stream restoration. Although all of these segments could be done at any point funding becomes available or tied in with an associated transportation project, it is recommended this project is first due to increased connectivity to the Neuse River Trail, East Coast Greenway, and future Mountain to Sea Trail.

WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | 5th Street Stream Restoration Greenway Project

SEGMENT 2



This project includes a multi-use path along from the termini of Segment 1, meanders through the 5th Street Stream Project and leads to the southwest corner of Church Street and 6th Street. This segment includes two pedestrian bridges to span over a floodplain overflow area and approximately 480 linear feet of greenway.

FUNDING OPTIONS

Grants:

Active Transportation Infrastructure Investment Program (ATIIP)

- Funding cycle: Opens in March, Closes in June (extended to July 17th in 2024)
- Match: 20% match minimum required

Powell Bill Funds (NCDOT)

- Funding Cycle: Applications due May 1
- Match: 50% match required

Connecting Communities to State Trails Grant

- Funding Cycle: May of each year

Recreational Trails Program Grant

- Funding Cycle: September of each year
- Match: 25% match required

NCDOT Transportation Alternatives Program (TAP)

- Funding cycle: Due in March
- Match: 20% match required

Many other potential programs

State/County/Town Funds:

- To Be Determined

TIMELINE

To Be Determined

COST

Design/Permitting:
$25,000

Property/Easement:
None

Construction*:
$185,000

TOTAL:
$210,000

**Construction cost includes two pedestrian bridges, one spanning 40 feet and the other 50 feet and informational placards.*

PROJECT PRIORITY

This segment will create a connection between Segment 1 (2nd to 5th Street Sidewalk project) and Segment 3 (6th and Church Street to US 301). Although all these segments could be done at any point funding becomes available or tied in with an associated transportation project, it is recommended this project is completed after the 2nd to 5th Street Sidewalk project (Segment 1) due to increased connectivity to the Neuse River Trail, East Coast Greenway, and future Mountain to Sea Trail.

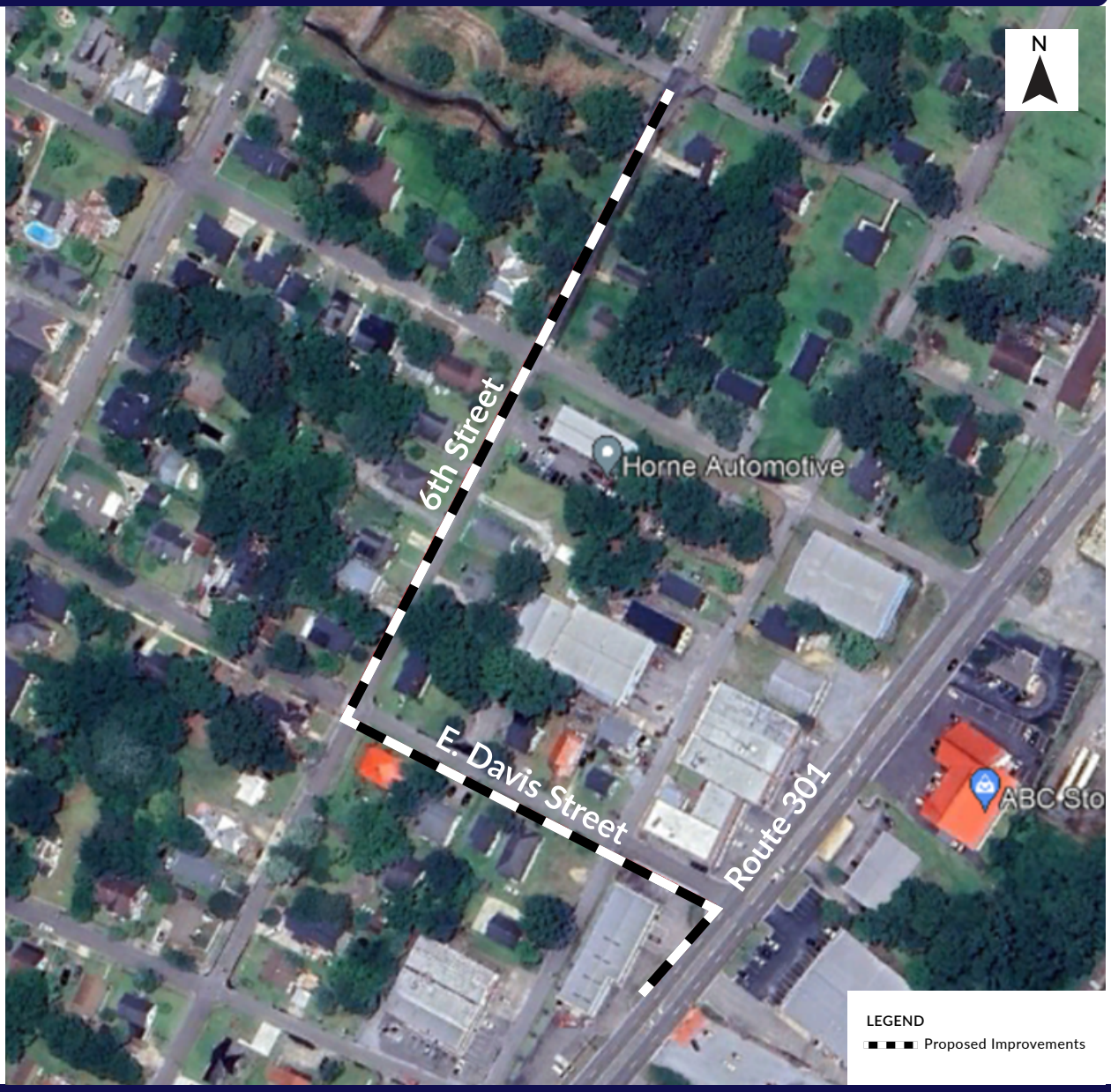
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

SEGMENT 3

PROJECT

6th Street and E. Church Street to U.S. Route 301 Crossing



This project includes the installation of a 5' wide sidewalk along 6th Street from the intersection of E. Church Street and 6th Street to E. Davis Street and continuing to Davis Street to the western side of the U.S. Route 301 crossing. This sidewalk will be designed to meet PROWAG requirements and includes the installation of approximately 10 ADA ramps at each street corner with street crossings, approximately 11 driveway crossings, utility relocations and temporary easements are anticipated. This project description varies from the proposed pedestrian improvements in the Smithfield Pedestrian Plan which shows the crossover of Route 301 on Lee Street in lieu of E. Davis Street and a multi-use path on Sixth Street.

FUNDING OPTIONS

Grants:

Active Transportation Infrastructure Investment Program (ATIIP)

- Funding cycle: Opens in March, Closes in June (extended to July 17th in 2024)
- Match: 20% match minimum required

Powell Bill Funds (NCDOT)

- Funding Cycle: Applications due May 1
- Match: 50% match required

Connecting Communities to State Trails Grant

- Funding Cycle: May of each year

Recreational Trails Program Grant

- Funding Cycle: September of each year
- Match: 25% match required

NCDOT Transportation Alternatives Program (TAP)

- Funding cycle: Due in March
- Match: 20% match required

Many other potential programs

State/County/Town Funds:

- To Be Determined

TIMELINE

To Be Determined

COST

Design/Permitting:
$190,268

Property/Easement:
$28,540

Construction*:
$951,340

TOTAL:
$1,217,715

PROJECT PRIORITY

This segment will create a connection between the 5th Street Stream Restoration and US 301 pedestrian crossing. Although all of these segments could be done at any point funding becomes available or tied in with an associated transportation project, it is recommended this project is completed after the 5th Street Stream Restoration (Segment 2) due to increased connectivity to the Nuese River Trail, East Coast Greenway, and future Mountain to Sea Trail.

WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT | U.S. Route 301 Crossing

SEGMENT 4

Example of Hawk Crossing with pedestrian refuge in Town of Cary

This project includes the installation of a HAWK (high intensity activated crosswalk) crossing across US 301. The mid-block crossing will originate from E. Davis Street (near 506 S. Brightleaf Boulevard (US 301) – Steve's Carpet and Flooring) and terminating on the opposite side of S. Brightleaf Boulevard (US 301) (near 507 S. Brightleaf Boulevard (US 301) – Wheels and Deals) to meet PROWAG standards. This location is not shown in the current Smithfield Pedestrian Plan, however the traffic study of different alternatives for a US Route 301 crossing showed that this would be a safe alternative with the inclusion of a HAWK. This would create a safe situation whereby vehicular traffic on US Route 301 would stop when the beacon is activated by a pedestrian. There is currently no dedicated pedestrian crossing across US Route 301 in this vicinity. Also included measures are high-visibility pavement markings, additional lighting, warning signs in advance of the crossing, and a pedestrian refuge island.

FUNDING OPTIONS

Grants:

Active Transportation Infrastructure Investment Program (ATIIP)

- Funding cycle: Opens in March, Closes in June (extended to July 17th in 2024)
- Match: 20% match minimum required

Highway Safety Improvement program

- Contracted through the state
- Match: 10% match required

Powell Bill Funds (NCDOT)

- Funding Cycle: Applications due May 1
- Match: 50% match required

Connecting Communities to State Trails Grant

- Funding Cycle: May of each year

Recreational Trails Program Grant

- Funding Cycle: September of each year
- Match: 25% match required

NCDOT Transportation Alternatives Program (TAP)

- Funding cycle: Due in March
- Match: 20% match required

Many other potential programs

State/County/Town Funds:

- To Be Determined

TIMELINE

To Be Determined

COST

Design/Permitting:
$156,327

Property/Easement:
$23,449

Construction:
$781,636

TOTAL:
$1,000,494

PROJECT PRIORITY

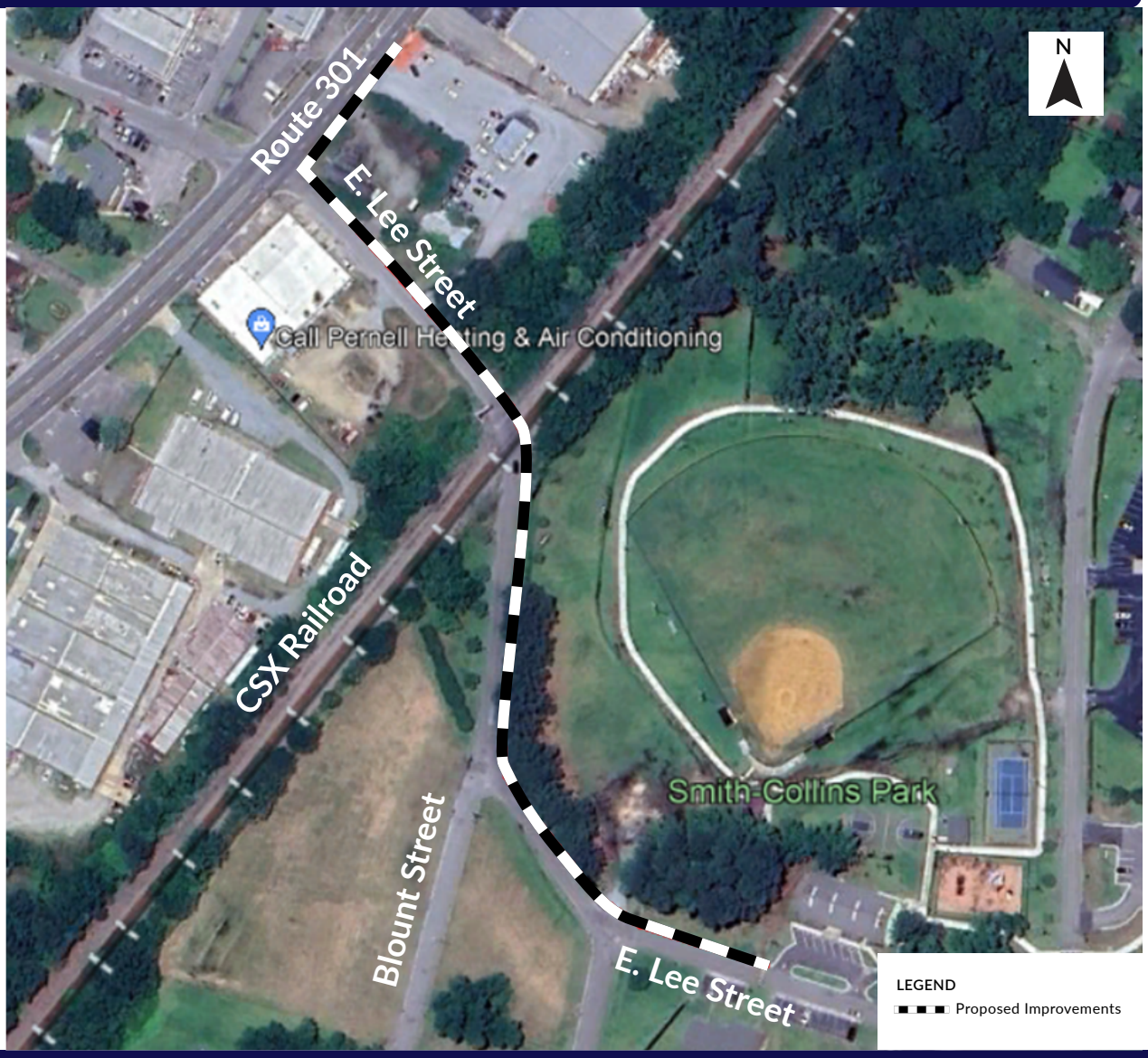
This segment will create a connection between Segment 3 (6th and Church Street to US 301) and Segment 5 (US 301 to Smith-Collins Park). Although all these segments could be done at any point funding becomes available or tied in with an associated transportation project, it is recommended this project is completed after Segment 3 is completed.

WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

SEGMENT 5

PROJECT | From U.S. Route 301 Crossing to Smith-Collins Park



This project includes the installation of a 10' multi-use path with a 5' separation from the existing roadway originating from the crossing at US Route 301, running south along US Route 301, turning left onto E. Lee Street, crossing to the CSX railroad crossing, and terminating at Smith-Collins Park, connecting with the existing trail network. The section along US Route 301 is not currently in the Smithfield Pedestrian plan (as the crossing of US Route 301 is currently shown at E. Lee Street). However, the section on E. Lee Street is recommended in the Smithfield Pedestrian Plan. There are currently no dedicated pedestrian or bicycle facilities along US Route 301 or E. Lee Street at this location. Note that NCDOT will require a diagnostic study for the crossing of CSX railroad at this location and the Town will be responsible for the cost of the study. Cost of the diagnostic study is not included in the project cost estimate.

FUNDING OPTIONS

Grants:

Active Transportation Infrastructure Investment Program (ATIIP)

- Funding cycle: Opens in March, Closes in June (extended to July 17th in 2024)
- Match: 20% match minimum required

Powell Bill Funds (NCDOT)

- Funding Cycle: Applications due May 1
- Match: 50% match required

Connecting Communities to State Trails Grant

- Funding Cycle: May of each year

Recreational Trails Program Grant

- Funding Cycle: September of each year
- Match: 25% match required

NCDOT Transportation Alternatives Program (TAP)

- Funding cycle: Due in March
- Match: 20% match required

Many other potential programs

State/County/Town Funds:

- To Be Determined

TIMELINE

To Be Determined

COST

Design/Permitting:
$130,414

Property/Easement:
$19,562

Construction:
$652,070

TOTAL:
$834,649

PROJECT PRIORITY

This segment will create a connection between the US 301 Crossing and Smith-Collins Park. Although all of these segments could be done at any point funding becomes available or tied in with an associated transportation project, it is recommended this project is first after the 301 crossing is complete to safely move pedestrians across US 301 and finalize the connection to the Neuse River Trail, East Coast Greenway, and future Mountain to Sea Trail.

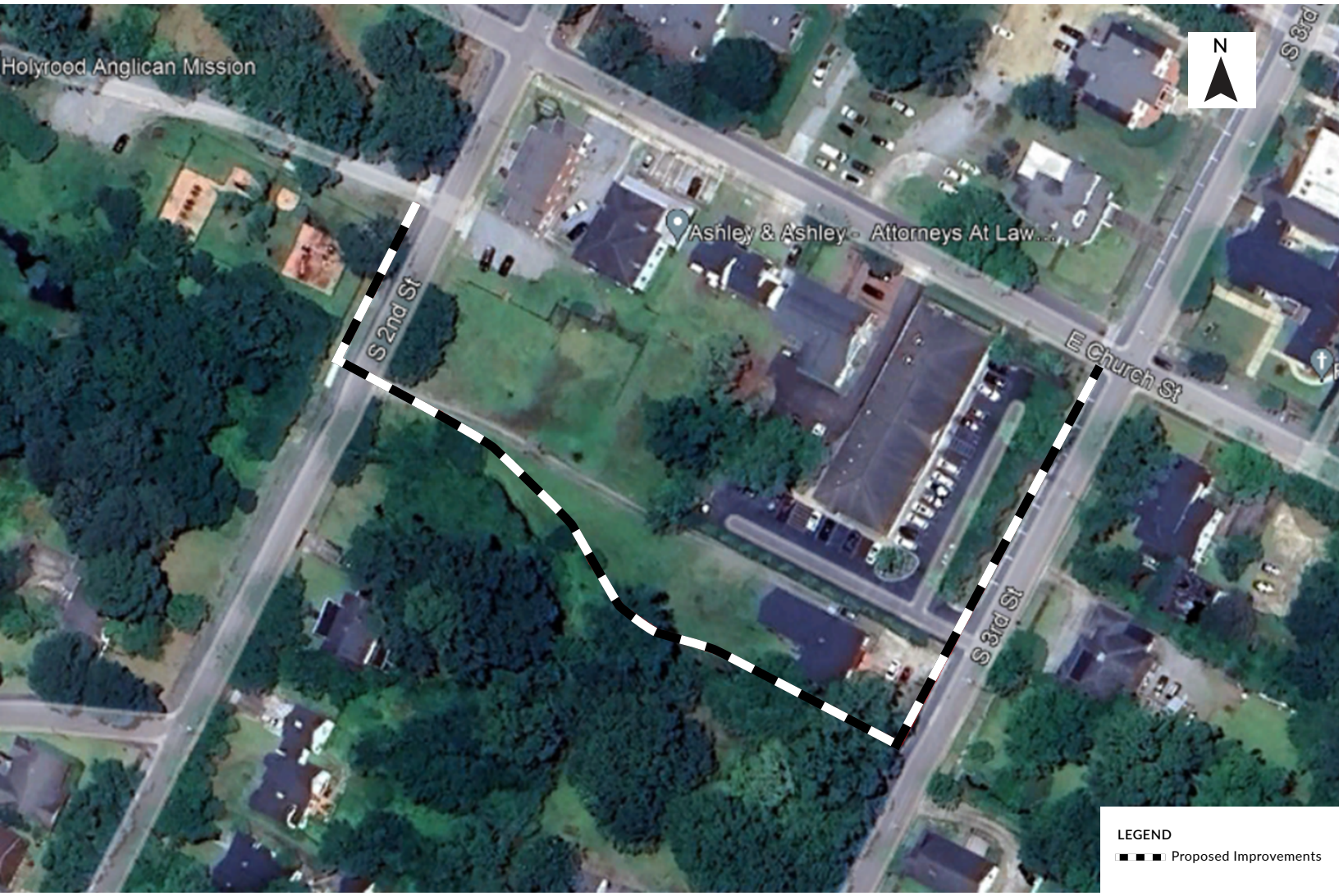
WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

PROJECT

2nd-3rd Street Stream Restoration Greenway Project

SEGMENT 6



Segment 6 is an optional segment that will coincide with a stream restoration project between 2nd and 3rd streets. This segment includes the retrofit of the existing sidewalk to meet PROWAG requirements. However, this would be for approximately 125 feet, before crossing 2nd street with 2 ADA ramps and a piano key crossing. The segment will then run along the north side of the completed stream restoration between 2nd and 3rd Street for approximately 475 feet. The path will then turn left and run along the west side of 3rd Street for approximately 300 feet. This section will include a retrofit of the existing sidewalk and 2 driveway adjustments then, reconnects with segment 1.

FUNDING OPTIONS

Grants:

Active Transportation Infrastructure Investment Program (ATIIP)

- Funding cycle: Opens in March, Closes in June (extended to July 17th in 2024)
- Match: 20% match minimum required

Powell Bill Funds (NCDOT)

- Funding Cycle: Applications due May 1
- Match: 50% match required

Connecting Communities to State Trails Grant

- Funding Cycle: May of each year

Recreational Trails Program Grant

- Funding Cycle: September of each year
- Match: 25% match required

NCDOT Transportation Alternatives Program (TAP)

- Funding cycle: Due in March
- Match: 20% match required

Many other potential programs

State/County/Town Funds:

- To Be Determined

TIMELINE

To Be Determined

COST

Design/Permitting:
$169,709

Property/Easement:
Minimal

Construction:
$848,543

TOTAL:
$1,018,252

PROJECT PRIORITY

This segment will create a connection to the 2nd to 3rd Street Stream Restoration Project. This is an optional segment and therefore, not a priority.

WANT TO LEARN MORE?

Visit the project website to sign up to receive future communications on the project.
www.smithfield-nc.com/page/planning_springbranchproject

APPENDIX D

COST ESTIMATES

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

APPENDIX D.1

COST ESTIMATES

Multi-Use Path Projects

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

					Segment 1		
Project	Estimate Item		Unit	Qty	Unit Cost	Total Cost	
2nd Street to 5th Street - Segment 1	Design		LS	1	$ 25,640.00	$	25,640.00
	2591000000-E	4" Concrete Sidewalk	SY	200	$ 80	$	16,000.00
	2605000000-N	Concrete Curb Ramps	EA	26	$ 3,500	$	91,000.00
	2612000000-E	6" Concrete Driveway	SY	147	$ 120	$	17,600.00
	4726090000-E	Heated-in-place Thermoplastic Pavement Marking Lines (24", 120 Mils)	LF	240	$ 15	$	3,600.00
	Estimated Construction of Segment 1					$	128,200.00
	Estimated Total Cost of Segment 1					$	153,840.00
	30% Contingency					$	38,460.00
	Estimated Total of Project (Design/Construction/Contingency)					$	192,300.00

			Segment 2		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
Stream Restoration Project - Segment 2	Design	LS	1	$ 39,000.00	$ 39,000.00
	Pedestrian Bridges	EA	2	$ 50,000	$ 100,000.00
	10' Multi-Use Path	LF	475	$ 200	$ 95,000.00
	Estimated Construction of Segment 2				$ 195,000.00
	Estimated Total Cost of Segment 2				$ 234,000.00
	30% Contingency				$ 58,500.00
	Estimated Total of Project (Design/Construction/Contingency)				$ 292,500.00

				Segment 3		
Project	Estimate Item		Unit	Qty	Unit Cost	Total Cost
6th Street to Route 301 Crossing - Segment 3	Design		LS	1	$ 146,360.00	$ 146,360.00
	Temporary Easement		LS	1	$ 21,954.00	$ 21,954.00
	Utilities		LS	1	$ 36,590.00	$ 36,590.00
	2591000000-E	4" Concrete Sidewalk	SY	7000	80	$ 560,000.00
	2605000000-N	Concrete Curb Ramps	EA	10	3500	$ 35,000.00
	2612000000-E	6" Concrete Driveway	SY	1100	120	$ 132,000.00
	4726090000-E	Heated-in-place Thermoplastic Pavement Marking Lines (24", 120 Mils)	LF	320	15	$ 4,800.00
	Estimated Construction of Segment 3					$ 731,800.00
	Estimated Total Cost of Segment 3					$ 936,704.00
	30% Contingency					$ 219,540.00
	Estimated Total of Project (Design/Construction/Contingency)					$ 1,156,244.00

				Segment 4				
Project	Estimate Item		Unit	Qty		Unit Cost		Total Cost
6th Street to Route 301 Crossing - Segment 4	Design		LS	1	$	156,731.73	$	156,731.73
	Temporary Easement		LS	1	$	23,509.76	$	23,509.76
	Utilities		LS	1	$	39,182.93	$	39,182.93
	2591000000-E	4" Concrete Sidewalk	SY	7000	$	80	$	560,000.00
	2605000000-N	Concrete Curb Ramps	EA	8	$	3,500	$	28,000.00
	2657000000-E	Monolithic Concrete Median	SY	133	$	80	$	10,666.67
	4726090000-E	Heated-In-Place Thermoplastic Pavement Marking Lines (24", 120 Mils)	LF	144	$	18	$	2,592.00
	Hawk		EA	1	$	150,000	$	150,000.00
	Lighting		LS	1	$	30,000	$	30,000.00
	Signage		EA	12	$	200	$	2,400.00
	Estimated Construction of Segment 4						$	783,658.67
	Estimated Total Cost of Segment 4						$	1,003,083.09
	30% Contingency						$	235,097.60
	Estimated Total of Project (Design/Construction/Contingency)						$	1,238,180.69

			Segment 5		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
From Route 301 Crossing to Smith Collins Park - Segment 5	Design	LS	1	$ 100,318.40	$ 100,318.40
	Temporary Easement	LS	1	$ 15,047.76	$ 15,047.76
	Utilities	LS	1	$ 25,079.60	$ 25,079.60
	2605000000-N Concrete Curb Ramps	EA	10	$ 3,500	$ 35,000.00
	2612000000-E 6" Concrete Driveway	SY	575	$ 120	$ 69,000.00
	4726090000-E Heated-In-Place Thermoplastic Pavement Marking Lines (24", 120 Mils)	LF	144	$ 18	$ 2,592.00
	Lighting	LS	1	$ 40,000	$ 40,000.00
	10' Multi-Use Path	LF	1400	$ 200	$ 280,000.00
	Railroad Crossing Implementation/Study	LS	1	$ 75,000	$ 75,000.00
	Estimated Construction of Segment 5				$ 501,592.00
	Estimated Total Cost of Segment 5				$ 642,037.76
	30% Contingency				$ 150,477.60
	Estimated Total of Project (Design/Construction/Contingency)				$ 792,515.36

			Segment 6		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
Stream Restoration Project - Segment 6	Design	LS	1	$ 21,077.33	$ 21,077.33
	Temporary Easement	LS	1	$ 3,161.60	$ 3,161.60
	Utilities	LS	1	$ 5,269.33	$ 5,269.33
	2591000000-E 4" Concrete Sidewalk	SY	50	80	$ 4,000.00
	2605000000-N Concrete Curb Ramps	EA	2	$ 3,500	$ 7,000.00
	2612000000-E 6" Concrete Driveway	SY	22	$ 120	$ 2,666.67
	4726090000-E Heated-In-Place Thermoplastic Pavement Marking Lines (24", 120 Mils)	LF	40	$ 18	$ 720.00
	10' Multi-Use Path	LF	475	$ 200	$ 95,000.00
	Estimated Construction of Segment 6				$ 105,386.67
	Estimated Total Cost of Segment 6				$ 134,894.93
	30% Contingency				$ 31,616.00
	Estimated Total of Project (Design/Construction/Contingency)				$ 166,510.93

APPENDIX D.2

COST ESTIMATES

Stormwater Projects

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

			Phase 1		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
2nd St Culvert Replacement	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 169,708.56	$ 169,708.56
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 40,407	$ 40,406.80
	Removal of Existing 5' CMP	LS	1	$ 3,000	$ 3,000.00
	Class 3 Excavation	CY	3900	$ 85	$ 331,500.00
	10' x 8' Precast Box Culvert	LF	117	$ 2,100	$ 245,700.00
	Mix 3 Concrete	CY	85	$ 900	$ 76,500.00
	Reinforcement	LB	6800	$ 2	$ 13,600.00
	Roadway/Sidewalk Reconstruction	LS	1	$ 57,400	$ 57,400.00
	MOT (2%)	LS	1	$ 13,406	$ 13,406.00
	Erosion and Sediment Control (10%)	LS	1	$ 67,030	$ 67,030.00
	Estimated Construction of 2nd St Improvement				$ 848,542.80
	Estimated Total Cost of 2nd St Improvement				$ 1,018,251.36
4th St Culvert Replacement	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 111,028.05	$ 111,028.05
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 21,148	$ 21,148.20
	Removal of Existing 6'x4.3' Box Culvert	LS	1	$ 3,000	$ 3,000.00
	Class 3 Excavation	CY	325	$ 150	$ 48,750.00
	Support of Excavation	SF	900	$ 60	$ 54,000.00
	10'x5' Precast Box Culvert	LF	63	$ 1,300	$ 81,900.00
	Mix 3 Concrete	CY	55	$ 900	$ 49,500.00
	Reinforcement	LB	4400	$ 2	$ 8,800.00
	Modular Wall	SF	900	$ 125	$ 112,500.00
	Roadway/Sidewalk Reconstruction	LS	1	$ 21,500	$ 21,500.00
	MOT (2%)	LS	1	$ 7,169	$ 7,169.00
	Erosion and Sediment Control (10%)	LS	1	$ 35,845	$ 35,845.00
	Estimated Construction of 4th St Improvement				$ 444,112.20
	Estimated Total Cost of 4th St Improvement				$ 555,140.25
		Total			$ 1,292,655.00
		30% Contingency			$ 387,796.50
		Estimated Construction of Project Phase			$ 1,680,451.50
		Estimated Total of Project Phase (Design/Construction/Contingency)			$ 1,961,188.11

			Phase 2		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
UG-1	Property/Easement	Acre	2.5	75000	$ 187,500.00
	Design/Permitting	LS	1	$ 190,669.99	$ 190,669.99
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 302,651	$ 302,650.78
	Materials	EA	1	$ 4,750,000	$ 4,750,000.00
	Excavation	CY	46,552	$ 9	$ 418,968.00
	Overdig Excavation	CY	5,057	$ 9	$ 45,513.00
	Installation	DAY	29	$ 10,000	$ 290,000.00
	Sub Grade	CY	1,663	$ 33	$ 54,879.00
	Backfill	CY	5,518	$ 30	$ 165,540.00
	Channel/Floodplain Grading	CY	889	$ 50	$ 44,444.44
	UG Facility Outlet Structure	EA	1	$ 25,000	$ 25,000.00
	UG Facility Inflow Channel (CI Riprap)	SY	22	$ 100	$ 2,222.22
	SWM Flow Splitter	EA	1	$ 8,000	$ 8,000.00
	Inflation Adjustment for Materials, Labor and Freight (4%)	LS	1	$ 190,403	$ 190,403.24
	MOT	LS	0		$ -
	Erosion and Sediment Control (1%)	LS	1	$ 58,046	$ 58,045.67
	Estimated Construction of UG-1				$ 6,355,666.35
	Estimated Total Cost of UG-1				$ 6,733,836.34
College Pond Retrofit	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 58,096.50	$ 58,096.50
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 27,665	$ 27,665.00
	Pond CMAC Valve Retrofit	EA	1	$ 150,000	$ 150,000.00
	Pond Riser/Outlet Structure	EA	1	$ 25,000	$ 25,000.00
	Embankment Reconstruction/Emergency Spillway Retrofit	LS	1	$ 300,000	$ 300,000.00
	CMAC Subscription	EA	1	$ 12,000	$ 12,000.00
	Inspections / Maintenance	EA	1	$ 6,000	$ 6,000.00
	Landscaping	LS	1	$ 10,000	$ 10,000.00
	MOT (0%)	LS	1	$ -	$ -
	Erosion and Sediment Control (10%)	LS	1	$ 50,300	$ 50,300.00
	Estimated Construction of College Pond Retrofit				$ 580,965.00
	Estimated Total Cost of College Pond Retrofit				$ 639,061.50
I-95 Pond Retrofit	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ -	$ -
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ -	$ -
	Pond CMAC Valve Retrofit	EA	1	$ 150,000	$ 150,000.00
	CMAC Subscription	EA	1	$ 12,000	$ 12,000.00
	Inspections / Maintenance	EA	1	$ 6,000	$ 6,000.00
	MOT (2%)	LS	1	$ -	$ -
	Erosion and Sediment Control (10%)	LS	1	$ -	$ -
	Estimated Construction of I-95 Pond Retrofit				$ 168,000.00
	Estimated Total Cost of I-95 Pond Retrofit				$ 168,000.00
	Total Construction				$ 7,104,631.35
	30% Construction Contingency				$ 2,131,389.41
	Estimated Construction of Project Phase				$ 9,236,020.76
	Estimated Total of Project Phase (Design/Construction/Contingency)				$ 9,672,287.25

			Phase 2 (Replacing UG-1)		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
Above Ground Flood Attenuation Facility	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 197,944.44	$ 197,944.44
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 94,259	$ 94,259.26
	SWM Grading / Floodplain Grading	CY	20,000	$ 40	$ 800,000.00
	Emergency Spillway/Swale Grading	CY	7,407	$ 40	$ 296,296.30
	Embankment Construction/Emergency Spillway	LS	1	$ 300,000	$ 300,000.00
	Riprap	SY	22	$ 200	$ 4,444.44
	Concrete End Wall (for 5'x5' Pipe)	EA	1	$ 15,000	$ 15,000.00
	SWM SD (5'x5' box)	LF	400	$ 1,000	$ 400,000.00
	Manhole	EA	1	$ 5,000	$ 5,000.00
	Landscaping	LS	1	$ 20,000	$ 20,000.00
	MOT (0%)	LS	1	$ -	$ -
	Erosion and Sediment Control (10%)	LS	1	$ 44,444	$ 44,444.44
	Estimated Construction of College Pond Retrofit				$ 1,979,444.44
	Estimated Total Cost of College Pond Retrofit				$ 2,177,388.89
	Total Construction				$ 1,979,444.44
	30% Construction Contingency				$ 593,833.33
	Estimated Construction of Project Phase				$ 2,573,277.78
	Estimated Total of Project Phase (Design/Construction/Contingency)				$ 2,771,222.22

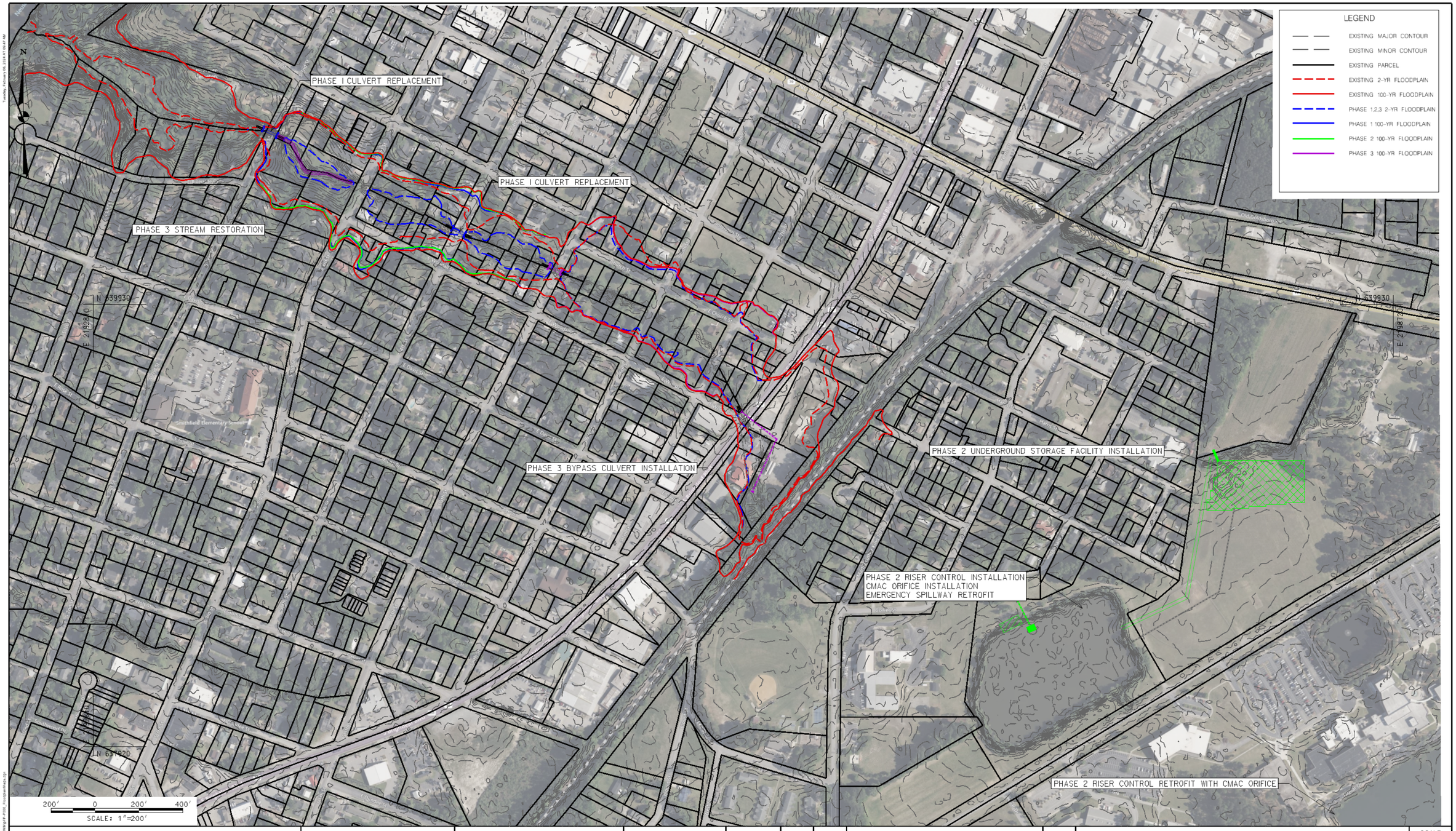
			Phase 3		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
SR 301 Bypass Culvert	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 58,962.75	$ 58,962.75
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 14,039	$ 14,038.75
	Culvert Endwall (For 48" Pipe)	EA	2	$ 10,000	$ 20,000.00
	Manhole	EA	2	$ 6,000	$ 12,000.00
	48 Inch Reinforced Concrete Pipe, Class IV	LF	455	$ 300	$ 136,500.00
	CI Riprap at Culvert Endwall	SY	53	$ 150	$ 8,000.00
	Channel/Floodplain Grading	CY	36	$ 50	$ 1,777.78
	Roadway Reconstruction	LS	1	$ 37,000	$ 37,000.00
	Common Borrow	CY	421	$ 50	$ 21,064.81
	MOT (8%)	LS	1	$ 18,907	$ 18,907.41
	Erosion and Sediment Control (10%)	LS	1	$ 25,525	$ 25,525.00
	Estimated Construction of 301 Bypass Culvert				$ 294,813.75
	Estimated Total Cost of 301 Bypass Culvert				$ 353,776.50
5th St Culvert Replacement	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 39,260.76	$ 39,260.76
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 9,348	$ 9,347.80
	Removal of Existing 6'x5' Culvert	LS	1	$ 3,000.00	$ 3,000.00
	Class 3 Excavation	CY	525	$ 85.00	$ 44,625.00
	10'x5' Precast Box Culvert	LF	51	$ 1,300.00	$ 66,300.00
	Mix 3 Concrete	CY	50	$ 900.00	$ 45,000.00
	Reinforcement	LB	4000	$ 2.00	$ 8,000.00
	MOT (2%)	LS	1	$ 3,339	$ 3,338.50
	Erosion and Sediment Control (10%)	LS	1	$ 16,693	$ 16,692.50
	Estimated Construction of 5th St Culvert Replacement				$ 196,303.80
	Estimated Total Cost of 5th St Culvert Replacement				$ 235,564.56
2nd-3rd St Stream Restoration	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1		$ -
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1		$ -
	Construction	LF	475	$ 650.00	$ 308,750.00
	Design	LS	1		$ -
	ROW	Acre	1	$ 75,000.00	$ 75,000.00
	MOT (2%)	LS	1		$ -
	Erosion and Sediment Control (10%)	LS	1		$ -
	Estimated Construction of Stream Restoration between 2nd and 3rd St				$ 383,750.00
	Estimated Total Cost of Stream Restoration between 2nd and 3rd St				$ 383,750.00
		Total			$ 933,830.30
		30% Contingency			$ 280,149.09
	Estimated Construction of Project Phase				$ 1,213,979.39
	Estimated Total of Project Phase (Design/Construction/Contingency)				$ 1,312,202.90

			Projects Investigated, but not Recommended		
Project	Estimate Item	Unit	Qty	Unit Cost	Total Cost
	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 175,080.63	$ 175,080.63
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 277,906	$ 277,905.76
	Materials	EA	1	$ 4,175,000	$ 4,175,000.00
	Excavation	CY	12,838	$ 9	$ 115,542.00
	Overdig Excavation	CY	415	$ 9	$ 3,735.00
	Installation	DAY	13	$ 10,000	$ 130,000.00
	Concrete Pad	SF	83,192	$ 9	$ 748,728.00
	Backfill	CY	494	$ 30	$ 14,820.00
UG-2 (2'6")	UG Facility Outlet Structure	EA	1	$ 25,000	$ 25,000.00
	UG Facility Inflow Channel (CI Riprap)	SY	102	$ 100	$ 10,222.22
	30" RCP	LF	370	$ 200	$ 74,000.00
	Manhole	EA	1	$ 6,000	$ 6,000.00
	SWM Flow Splitter	EA	1	$ 8,000	$ 8,000.00
	Inflation Adjustment for Materials, Labor and Freight (4%)	LS	1	$ 167,402	$ 167,402.28
	MOT (.5%)	LS	1	$ 26,555	$ 26,555.24
	Erosion and Sediment Control (1%)	LS	1	$ 53,110	$ 53,110.47
	Estimated Construction of UG-2				$ 5,836,020.97
	Estimated Total Cost of UG-2				$ 6,011,101.60
	Property/Easement	LS	1		$ -
	Design/Permitting	LS	1	$ 1,647.52	$ 1,647.52
	Preliminary Items (Mobilization/C&G/Stakeout/etc.) (5%)	LS	1	$ 299,292	$ 299,292.12
	Materials	EA	1	$ 4,475,000	$ 4,475,000.00
	Excavation	CY	41,706	$ 9	$ 375,354.00
	Overdig Excavation	CY	4,354	$ 9	$ 39,186.00
	Installation	DAY	27	$ 10,000	$ 270,000.00
	Sub Grade	CY	1,564	$ 33	$ 51,612.00
	Backfill	CY	5,245	$ 30	$ 157,350.00
UG-2 (11'4")	UG Facility Outlet Structure	EA	1	$ 25,000	$ 25,000.00
	UG Facility Inflow Channel (CI Riprap)	SY	102	$ 100	$ 10,222.22
	30" RCP	LF	370	$ 200	$ 74,000.00
	Manhole	EA	1	$ 6,000	$ 6,000.00
	SWM Flow Splitter	EA	1	$ 8,000	$ 8,000.00
	Inflation Adjustment for Materials, Labor and Freight (4%)	LS	1	$ 180,403	$ 180,403.24
	MOT (0.5%)	LS	1	$ 27,459	$ 27,458.62
	Erosion and Sediment Control (1%)	LS	1	$ 54,917	$ 54,917.24
	Estimated Construction of UG-2				$ 6,053,795.45
	Estimated Total Cost of UG-2				$ 6,055,442.97

APPENDIX E

FLOODPLAIN MAPS

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT



McCORMICK TAYLOR
1501 South Clinton Street
Suite 1150
Baltimore, Maryland 21224
(410) 662-7400

DES: JJJ
DRN: CAL
CHK: ADM
DATE: 1 /23/24

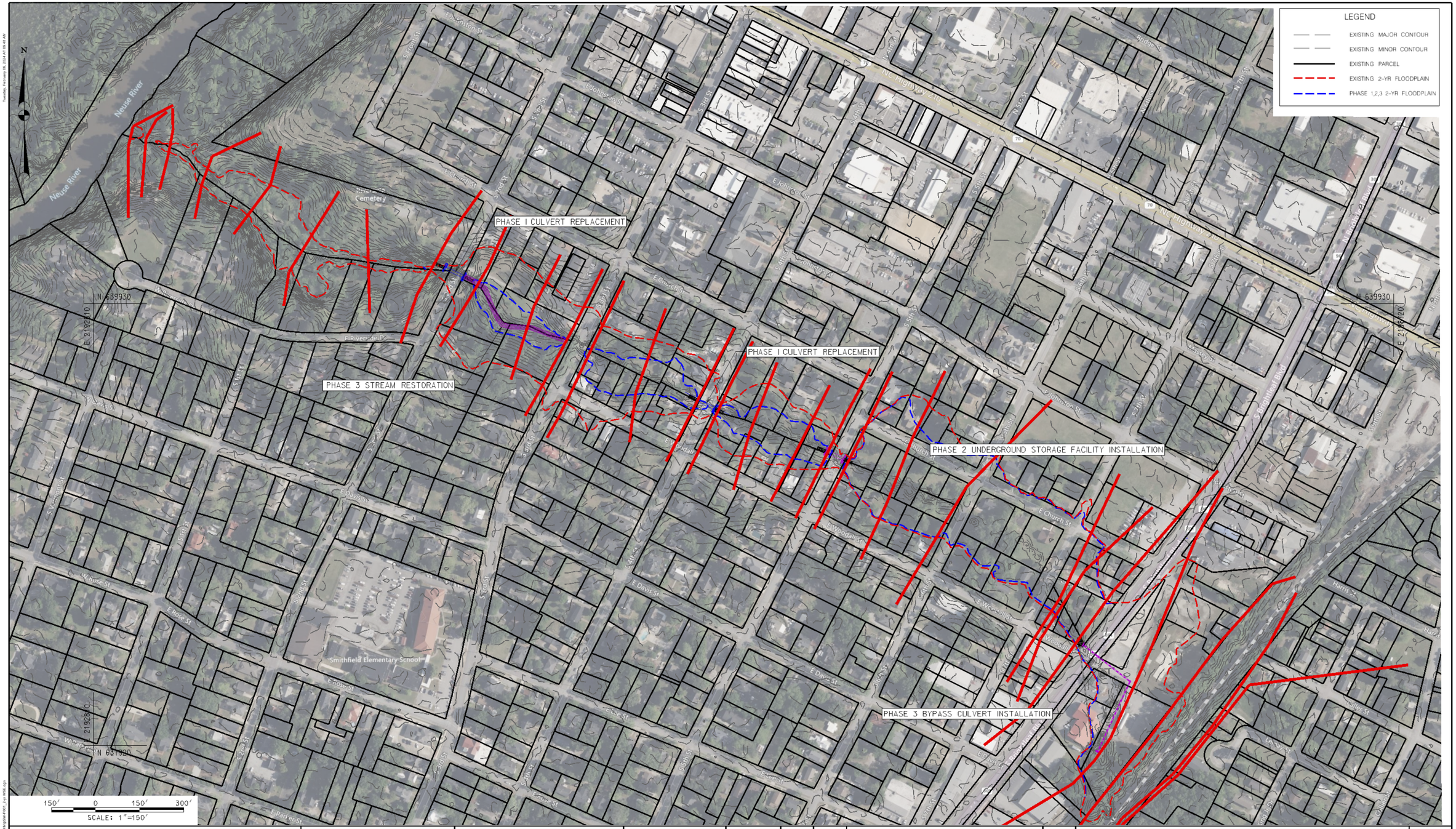
BY	NO.	REVISION	DATE

PROJECT NUMBER: 10621.001
SMITHFIELD RESILIENCY PROJECT
JOHNSTON COUNTY, NORTH CAROLINA

FLOODPLAIN MAP

SCALE
1" = 200'

SHEET
1 OF 3



McCORMICK TAYLOR
1501 South Clinton Street
Suite 1150
Baltimore, Maryland 21224
(410) 662-7400

DES: JJJ
DRN: CAL
CHK: ADM
DATE: 1 /23/24

BY	NO.	REVISION	DATE

PROJECT NUMBER: 10621.001
SMITHFIELD RESILIENCY PROJECT
JOHNSTON COUNTY, NORTH CAROLINA

FLOODPLAIN MAP
2-YR WSEL

SCALE
1" = 150'

SHEET
2 OF 3

McCORMICK TAYLOR
1501 South Clinton Street
Suite 1150
Baltimore, Maryland 21224
(410) 662-7400

DES: JJJ
DRN: CAL
CHK: ADM
DATE: 1 /23/24

BY	NO.	REVISION	DATE

PROJECT NUMBER: 10621.001
SMITHFIELD RESILIENCY PROJECT
JOHNSTON COUNTY, NORTH CAROLINA

FLOODPLAIN MAP
100– YR WSEL

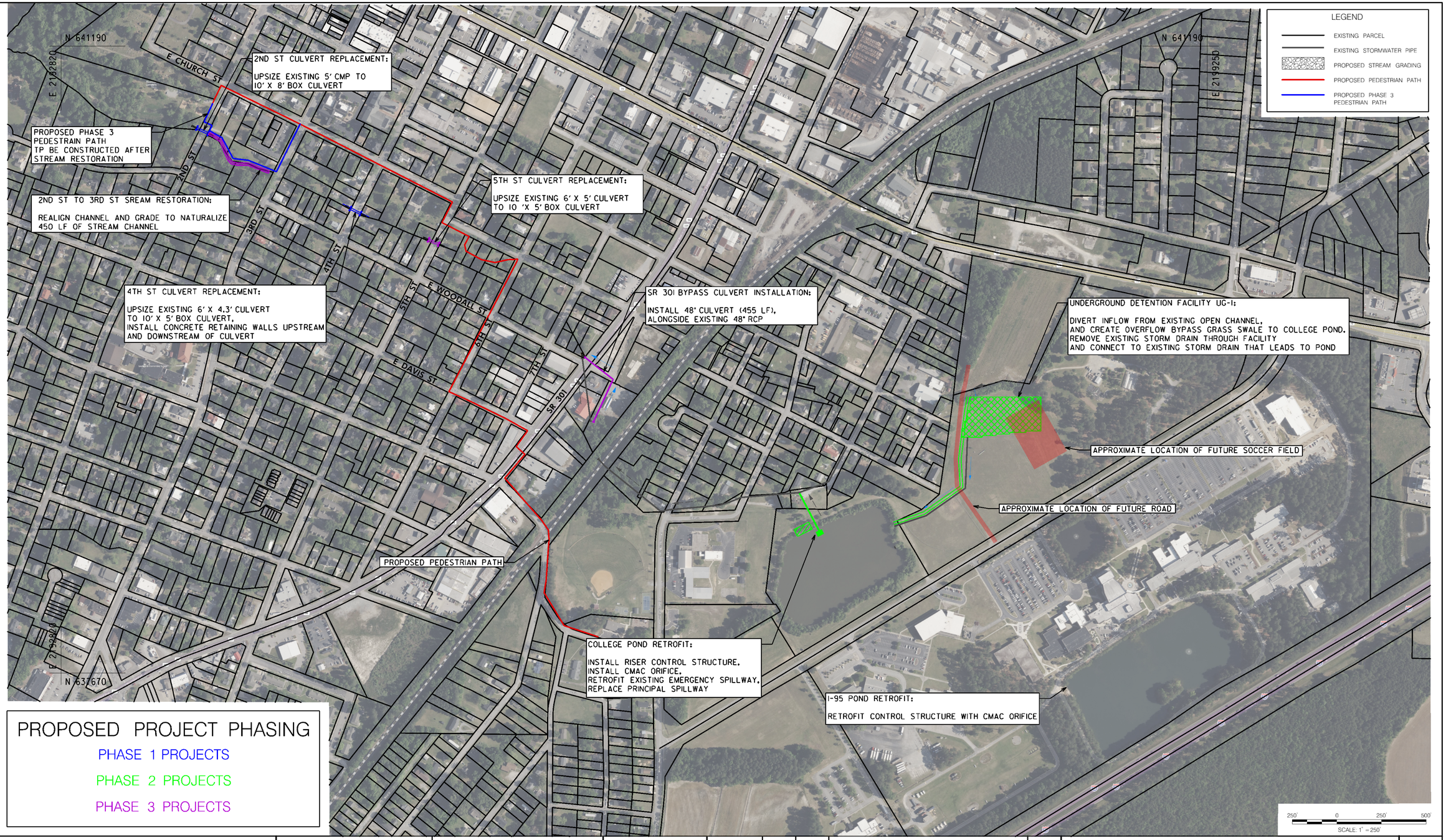
SCALE: 1" = 150'

SHEET: 3 OF 3

APPENDIX F

PROJECT LOCATIONS MAP

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT



PROPOSED PROJECT PHASING

PHASE 1 PROJECTS

PHASE 2 PROJECTS

PHASE 3 PROJECTS

McCORMICK TAYLOR
1501 South Clinton Street
Suite 1150
Baltimore, Maryland 21224
(410) 662-7400

DES: CAL/LLJ					
DRN: CAL					
CHK: ADM					
DATE: 1 /17/24	BY	NO.	REVISION	DATE	

PROJECT NUMBER: 10621.001
SMITHFIELD RESILIENCY PROJECT
JOHNSTON COUNTY, NORTH CAROLINA

CONCEPT SITE PLAN

SCALE: 1" = 250'

SHEET 1 OF 1

APPENDIX G

PROJECT PRIORITY MATRIX

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

			Hydraulic Performance Criteria									Other Project Considerations			
Project Name	**Existing Conditions**	**Proposed Conditions**	**% Additional Conveyance Capacity (10-yr)*** **	**Existing Roadway Overtopping Event**	**Proposed Roadway Overtoppping Event**	**2-yr Floodplain Reduction from Existing Conditions (sf)**	**100-yr Floodplain Reduction from Existing Conditions (sf)**	**2-yr Peak Flow Reduction (%)**	**10-yr Peak Flow Reduction (%)**	**100-yr Peak Flow Reduction (%)**	**Cost ($)**	**Construction Impacts**	**Private Property Impacts**	**Ecological Enhancement & Aesthetic Benefits**	**Suggested Priority**
Phase 1															
2nd Street Culvert Replacement	5' CMP	10' x 8' Culvert	69%	All	50-yr	39%	1%				$ 1,018,251.36	Significant	Minimal	Significant	1
4th Street Culvert Replacement	6' x 4.3' Culvert	10' x 5' Culvert	328%	All	All						$ 555,140.25	Significant	Significant	Significant	2
Phase 2															
UG-1	-	21 Acre-Feet				<1%	1%	21%*	12%*	5%*	$ 6,733,836.34	Significant	Minimal	Minimal	
College Pond Retrofit	-	7 Acre-Feet/1' drawdown				TBD	TBD	56%**	0%**	0%**	$ 639,061.50	Minimal	Minimal	Minimal	3
I-95 Pond Retrofit (JCCC)	-	21 Acre-Feet									$ 168,000.00	Minimal	Minimal	Minimal	4
Phase 3															
5th St Culvert Replacement	6' x 5' Culvert	10' x 5' Culvert	266%	All	All						$ 235,564.56	Significant	Minimal	Minimal	5
2nd-3rd St Stream Restoration	443 LF	465 LF				<1%	1%				$ 383,750.00	Minimal	Minimal	Significant	6
SR 301 Bypass Culvert	-		0%	All	All						$ 353,776.50	Significant	Minimal	N/A	7

*Discharges immediately downstream of the proposed facility, as modelled in WinTR20

**Discharges modelled in HydroCAD by Opti. Peak flow reductions immediately downstream of College Pond.

*** Represents % increase in flowrate through the structure during a 10-year storm event.

APPENDIX H

TRAFFIC REPORT

SPRING BRANCH STORMWATER RESILIENCY AND PLANNING PROJECT

DRMP

PEDESTRIAN CROSSING STUDY

LOCATED

IN

SMITHFIELD, NC

MARCH 2024

DRMP Project No. 23286

Prepared By: JAE

Reviewed By: DC

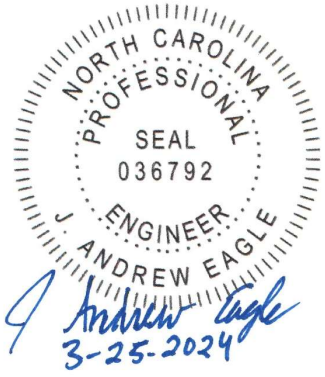
DRMP

PEDESTRIAN

CROSSING STUDY

LOCATED IN

SMITHFIELD, NC



Prepared By:

DRMP, Inc.

License #F-1524

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TECHNICAL APPENDIX

DRMP

PEDESTRIAN CROSSING STUDY

Smithfield, North Carolina

1. INTRODUCTION

The contents of this report present the findings of a pedestrian crossing study on US 301 (Brightleaf Boulevard) in Smithfield, North Carolina. The purpose of this study is to determine if there is an appropriate location for a pedestrian crossing in the area of Lee Street and Woodall Street.

2. EXISTING PLANS

2.1. Lee Street and CSX Railroad Crossing

The North Carolina Department of Transportation (NCDOT) is developing plans to improve the existing railroad crossing on Lee Street, east of US 301. Current plans are to install new highway-rail grade crossing signals. Adding a pedestrian sidewalk crossing the rail line has been considered. NCDOT would require the Town to conduct a feasibility study. If approved, NCDOT and the Town would share the cost of the feasibility study and construction cost.

2.2. Town Plan

Volume 3 of the Smithfield Town Plan addresses transportation. US 301 is a 5-lane minor arterial maintained by NCDOT. Lee Street and Woodall Street are 2-lane local roads maintained by the Town of Smithfield.

The plan categorizes US 301 as a suburban corridor. The following characteristics are listed for this type of facility:

- 40 mph target speed
- High Volume: 20,000 vehicles per day (vpd) or more
- Low to Medium Access Density: 1 to 3 signals per mile OR 400 to 1,000 feet average spacing between access points
- Sidewalk on both sides
- Bicyclists use street, or shared use path.
- Curb and gutter

The section of US 301 between Lee Street and Woodall Street has the following existing conditions:

- 35 mph posted speed limit
- Moderate Volume: 15,000 vpd (2022)
- High Access Density: 3 signals per mile OR less than 400 feet average spacing between access points
- Sidewalk on the east side of US 301 in front of United Community Bank. No other sidewalk present.
- Bicyclists use street
- Curb and gutter

The plan categorizes Lee Street and Woodall Street as urban residential streets west of US 301. The following characteristics are listed for this type of facility:

- 25 mph target speed
- Low Volume: Less than 8,000 vpd
- High Access Density: More than 3 signals per mile OR less than 400 feet average spacing between access points
- Sidewalk on both sides
- Bicyclists use street, or shared lane
- Curb and gutter

Lee Street has the following existing conditions west of US 301:

- No posted speed limit
- Low Volume: Expected based on peak hour turn movements
- High Access Density: More than 3 signals per mile OR less than 400 feet average spacing between access points
- No sidewalk between US 301 and 6th Street. Sidewalk on both sides between 6th Street and 4th Street. Sidewalk on north side between 4th Street and 3rd Street
- Bicyclists use street
- Curb and gutter between US 301 and 7th Street. Grass shoulder between 7th Street and 6th Street. Curb and gutter between 6th Street and 3rd Street

Woodall Street has the following existing conditions:

- No posted speed limit

- Low Volume: Expected based on peak hour turn movements
- High Access Density: More than 3 signals per mile OR less than 400 feet average spacing between access points
- No sidewalk between US 301 and just east of 4th Street. Sidewalk on north side just east of 4th Street to 4th Street. Sidewalk on both sides between 4th Street and 3rd Street.
- Bicyclists use street
- Grass shoulder between US 301 and 5th Street. Curb and gutter between 5th Street and 3rd Street.

The plan categorizes Lee Street as a suburban corridor east of US 301. The following characteristics are listed for this type of facility:

- 25 mph target speed
- Low Volume: Less than 8,000 vpd
- High Access Density: More than 3 signals per mile OR less than 400 feet average spacing between access points
- Sidewalk on both sides
- Bicyclists use shared lane
- Curb and gutter

Lee Street has the following existing conditions east of US 301:

- 25 posted speed limit
- Low Volume: Expected based on peak hour turn movements
- High Access Density: More than 3 signals per mile OR less than 400 feet average spacing between access points
- No sidewalk between US 301 and Blount Street
- Bicyclists use street
- Grass shoulder between US 301 and Blount Street

The Smithfield Town Plan makes recommendations for US 301 and Lee Street. US 301 is recommended to be a 4-lane divided roadway with a landscaped median. This would remove the existing two-way left turn lane. Additional improvements such as turn lanes, driveway consolidation, signal upgrades and re-timing are recommended along the corridor to provide better traffic operations. A sidewalk on one side and a multi-use path on the other side is recommended to provide multi-modal improvements. The plan calls

for modernization of Lee Street. This could include wider travel lanes, paved shoulders, curb and gutter, sidewalks, and other improvements.

2.3. Draft Pedestrian Plan

The draft Pedestrian Plan calls for sidewalk on both sides of US 301. This is slightly different from the Smithfield Town Plan which recommends a sidewalk on one side and a multi-use path on the other side. See Appendix A for the draft Pedestrian Plan.

The draft Pedestrian Plan calls for several improvements on Lee Street. Three pedestrian crossings are proposed on Lee Street at the following locations: US 301, CSX Railroad, and Martin Luther King Jr. Drive. A multi-use path is proposed on Lee Street between 6th Street and Smith-Collins Park. The multi-use path connects the residential area on the west side of US 301 to Smith-Collins Park, the Splash Pad and Sarah Yard Community Center, Innovation Academy at South Campus, and Johnston Community College. Sidewalk is also proposed on the south side of Lee Street starting at US 301 and continuing down Blount Street.

Sidewalk on the north side of Woodall Street is proposed as part of the draft Pedestrian Plan. This would fill in sidewalk gaps between 6th Street and 3rd Street. The plan does not propose sidewalk on Woodall Street between US 301 and 6th Street.

3. CRASH HISTORY

The NCDOT Go!NC Portal was used to review crashes along US 301. This is a planning level review and detailed crash history was not obtained. The NCDOT Bicyclist and Pedestrian Crash Map was reviewed. This map includes bicyclist and pedestrian crashes that occurred in North Carolina from 2007 to 2022.

Two bicyclist crashes were identified in the area. One occurred at the intersection of Davis Street and 5th Street. Alcohol was detected in the bicyclist. This crash resulted in a Type B injury to the bicyclist, which is an evident, but minor injury such as bruises, swelling, or limping. The other occurred on 5th Street near Woodall Street. This resulted in a Type C injury to the bicyclist in which an injury was not visibly evident. This type of injury could include pain or unconsciousness.

Three pedestrian crashes were identified in the area. All three involved a pedestrian crossing US 301. One occurred between 5th Street and Holt Street resulting in a Type C injury of the pedestrian. The vehicle was traveling at 35 mph and turning left. A second crash occurred north of Lee Street resulting in a Type A injury to the pedestrian which is a disabling injury such as broken bones. The most severe crash occurred north of Woodall Street and resulted in a fatality of the pedestrian. The pedestrian was suspected of being impaired by alcohol and failed to yield to the driver.

4. TRAFFIC COUNTS

4.1. Peak Hour Counts

Existing peak hour traffic counts were conducted at two intersections in February of 2024 during typical weekday AM (7:00 AM – 9:00 AM) and PM (4:00 PM – 6:00 PM) peak periods. US 301 at Lee Street and US 301 at Woodall Street were counted.

Bicyclists and pedestrians crossing US 301 at or between Lee Street and Woodall Street were also counted during the weekday AM and PM peak periods. During the total four hours of counts, 1 bicyclist crossed US 301 and 5 pedestrians crossed US 301. A copy of the count data is located in Appendix B of this report.

4.2. 24-Hour Counts

A 24-hour count was performed on US 301 north of Davis Street. The count was performed in February of 2024 during a typical weekday. Vehicle volumes, speeds, and gaps were collected. Table 1 summarizes the data collected.

The total volume on US 301 was 16,468 vpd. The speed limit is 35 mph, but the 85th percentile speeds were 44 mph in the northbound direction and 42 mph in the southbound direction. This indicates speeding is an issue. The gap report recorded the number of seconds between vehicles in each roadway direction. For each roadway direction, the time it takes pedestrians to cross the approach was considered. This was done by measuring the crossing distance and dividing by the Manual on Uniform Traffic Control Devices (MUTCD) specified pedestrian walking speed of 4 feet per second. The percentage of daily traffic volume that provides sufficient gaps for pedestrians to cross was determined by summing the total vehicles providing a sufficient gap and dividing by the total daily traffic volume. It was found that 51% of the vehicles on the northbound approach provide

sufficient gaps for pedestrians to cross the two northbound lanes. Similarly, 34% of the southbound vehicles provide sufficient gaps for pedestrians to cross the two southbound lanes. This does not take into consideration that there is no median or refuge for pedestrians to wait. Pedestrians must find a sufficient gap in both directions before crossing US 301.

Table 1: US 301 Count Data

Approach	Volume (vpd)	85th Percentile Speed (mph)	Percent of Volume that Provides Sufficient Gap
Northbound	**7,987**	**44**	**51%**
Southbound	**8,481**	**42**	**34%**

5. SIGNAL WARRANTS

5.1. Signal Warrant Analysis

The MUTCD provides guidance for evaluation of the need for a traffic signal at intersections. Installation of a traffic signal can provide signalized pedestrian crossings. Warrants 1 through 4 were reviewed for two intersections on US 301; one at Lee Street, and one at Woodall Street.

Warrant 1 requires eight hours of vehicular volumes to meet certain thresholds in order for a signal to be warranted. The volumes on Lee Street and Woodall Street must be at least 150 vehicles per hour (vph) for eight hours of the day in order to meet Warrant 1. For Warrant 2, these minor street volumes must be at least 80 vph for four hours. Warrant 3 requires the minor street volumes to be at least 100 vph for one hour of the day. The highest hourly volume on Lee Street was 63 vph. The highest hourly volume on Woodall Street was 24 vph. Neither intersection meet Warrants 1 through 3.

Warrant 4 is based on pedestrian volumes. It requires at least 53 pedestrians per hour crossing US 301 for four hours, or at least 66 pedestrians crossing US 301 in one hour.

There were 5 pedestrians that crossed US 301 at or between Lee Street and Woodall Street during the four hours of data collection. Warrant 4 is not met.

5.2. Pedestrian Hybrid Beacon

The MUTCD provides guidance for when a pedestrian hybrid beacon should be considered. A pedestrian hybrid beacon is often referred to as a HAWK signal (High-intensity Activated crossWalK). This type of signal is not illuminated until activated by a pedestrian. When activated, the signal stops vehicular traffic, allowing the pedestrian to cross. The guidelines for this type of signal require at least 20 pedestrians crossing US 301 in one hour. This threshold is not met.

6. Pedestrian Crossing Improvements

The number of pedestrians and frequency of pedestrian related crashes is low on US 301 between Lee Street and Woodall Street. However, the vehicular speeds are higher than the posted speed limit, and there are limited gaps in traffic for pedestrians to cross US 301 safely. Furthermore, this section of US 301 is five lanes wide with no median or refuge for pedestrians. There are improvements that can be made to increase pedestrian safety.

If installed, a crosswalk on US 301 should have high-visibility pavement markings, and be well lit. Warning signs and a yield or stop line should be installed in advance of the crossing. A pedestrian refuge island should be installed so that not all 5 lanes have to be crossed at once.

7. CONCLUSIONS

US 301 (Brightleaf Boulevard) is a 5-lane minor arterial that runs through Smithfield, NC. It carries approximately 15,000 vehicles per day and has a speed limit of 35 mph. Data collection showed that the 85th percentile speed was 44 mph going northbound and 42 mph going southbound. Very few pedestrian crashes were found, and the data collection showed only 5 pedestrians crossing US 301 during a four-hour period. Even though the pedestrian related crash frequency and pedestrian crossings are low, it is important to plan for the future.

The draft Pedestrian Plan recommends sidewalk on the south side of Lee Street and a multi-use path on the north side of Lee Street. The plan does not recommend pedestrian

accommodations on Davis Street or Woodall Street approaching US 301. Three locations on US 301 for a pedestrian crossing have been identified. Each alternative has its benefits and disadvantages. These should be weighed when determining a preferred alternative. Any pedestrian crossing of US 301 should have the following characteristics:

- High-visibility pavement markings
- Sufficient lighting
- Warning signs and a yield or stop line in advance of the crossing
- Pedestrian refuge island

Alternative 1 seeks to follow the draft Pedestrian Plan by locating a crosswalk on the north side of Lee Street. This location follows the proposed multi-use path that connects the residential area on the west side of US 301 to places of interest on the east side of US 301 such as Smith-Collins Park. One of the most important features of a pedestrian crossing on US 301 is a pedestrian refuge island. This is recommended so that pedestrians do not have to cross all 5 lanes at one time. However, providing a pedestrian refuge island at the Alternative 1 location would require the removal of the two-way left turn lane. Instead, vehicles turning left from US 301 would have to do so from a shared left/through lane. This could potentially make vehicular traffic operations worse.

Alternative 2 locates the crossing farther north in front of 506 Brightleaf Boulevard (Steve's Carpet and Flooring) and 507 Brightleaf Boulevard (Wheels and Deals – Smithfield). This midblock crossing is recommended to include a HAWK signal. Some driveways on US 301 could be closed and/or consolidated such that the two-way left turn lane and the pedestrian refuge do not interfere with each other. This alternative would stop vehicles on US 301 and allow pedestrians to cross safely. However, pedestrians would need to walk farther from the side streets to reach the crossing.

Alternative 3 locates the crossing on the north side of Woodall Street. The east leg of this intersection leads to a vacant lot. Removing this leg is recommended so that a southbound US 301 left turn lane is not needed at this intersection. This then provides a good location for a pedestrian refuge island instead of the left turn lane. The vacant lot has additional driveways farther north on US 301. If this alternative is chosen, then it is recommended to revise the Pedestrian Plan to route the proposed multi-use path down Woodall Street towards US 301 instead of down Lee Street.

TECHNICAL APPENDIX

APPENDIX A

DRAFT PEDESTRIAN PLAN

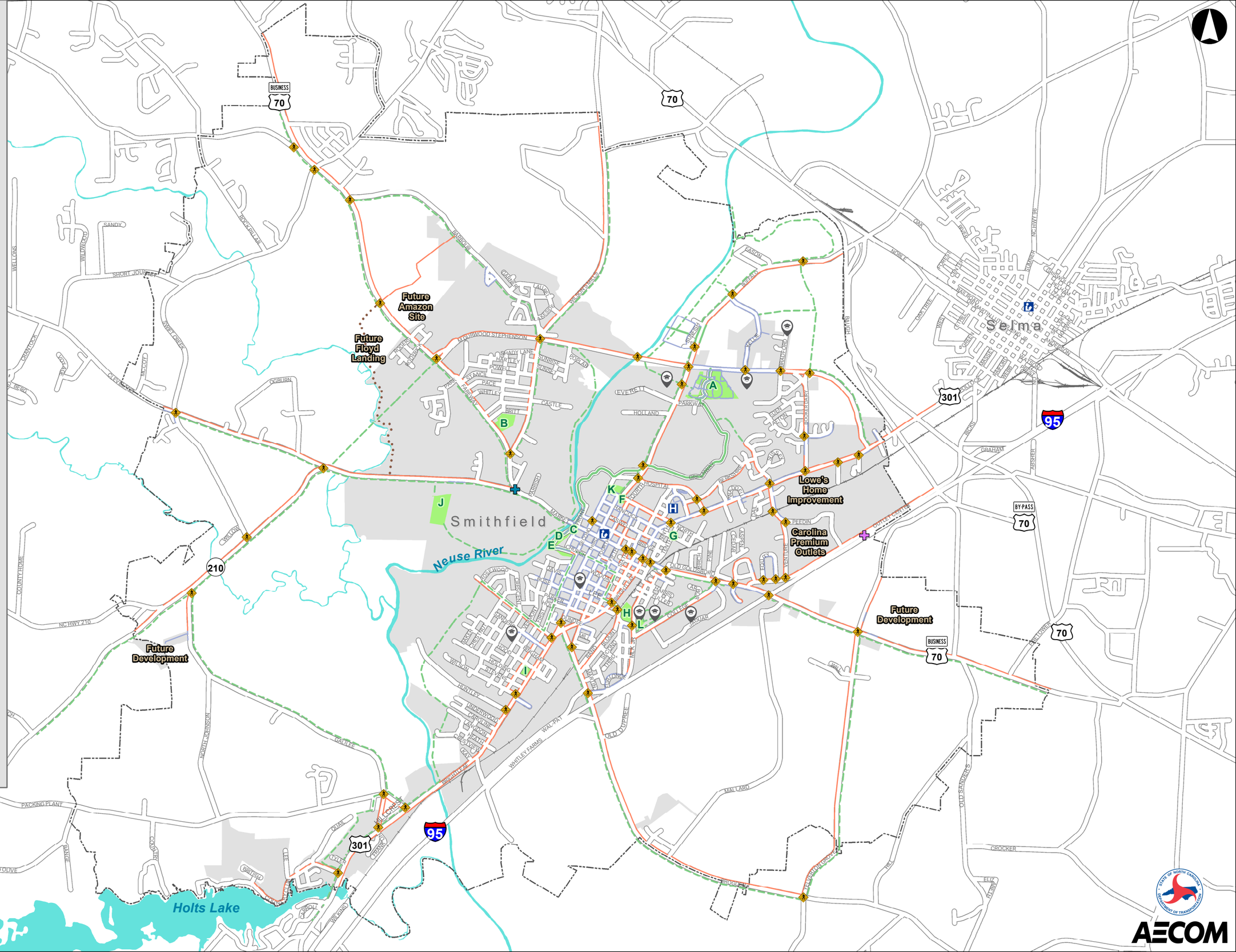
SMITHFIELD
NORTH CAROLINA

Pedestrian Plan

Legend

- Hospital
- Public Library
- School
- Proposed Crosswalk
- Feasibility Study
- Road Diet
- Proposed Sidewalk
- Existing Sidewalk
- Proposed Boardwalk
- Proposed Multiuse Path
- Existing Greenway
- Railroad
- Park Property
- Town of Smithfield
- Smithfield ETJ

Parks:
A. Smithfield Community Park
B. Gertrude B Johnson Park
C. Legion Park
D. Town Commons
E. Bob Wallace and Jacie Kiddie Park
F. Talton Field
G. Burlington Park
H. Smith-Collins Park
I. Civitan Park
J. Future West Smithfield Park
K. Talton Park
L. Splash Pad & Sarah Yard Community Center



AECOM

APPENDIX B

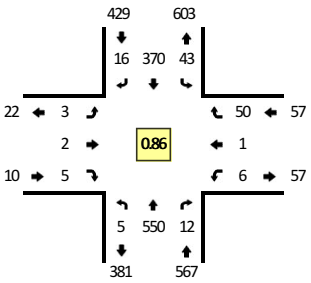
TRAFFIC COUNTS

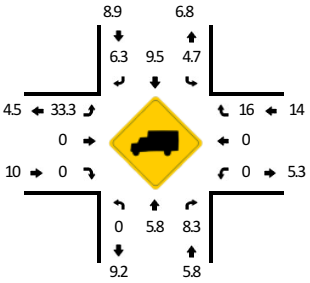
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: US 301 -- Lee St
CITY/STATE: Smithfield, NC

QC JOB #: 16496801
DATE: Thu, Feb 22 2024

Peak-Hour: 8:00 AM -- 9:00 AM
Peak 15-Min: 8:30 AM -- 8:45 AM





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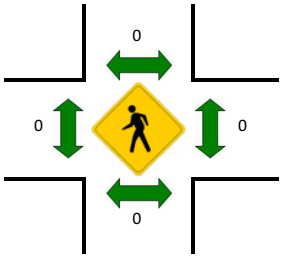
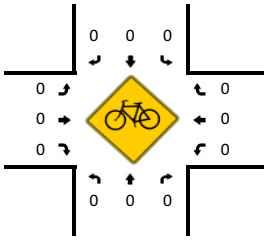
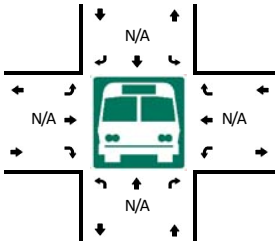
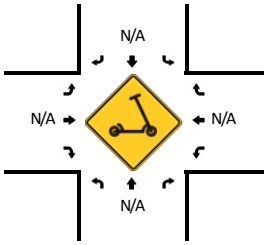








15-Min Count Period Beginning At	US 301 (Northbound)				US 301 (Southbound)				Lee St (Eastbound)				Lee St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	79	2	0	5	53	3	0	2	0	0	0	0	2	7	0	153	
7:15 AM	4	97	1	0	7	51	1	0	2	2	2	0	2	0	9	0	178	
7:30 AM	0	126	0	0	6	78	2	0	2	3	0	0	1	0	7	0	225	
7:45 AM	0	148	3	0	11	66	5	0	0	0	1	0	0	0	5	0	239	795
8:00 AM	2	110	2	0	10	63	4	0	0	0	1	0	1	0	8	0	201	843
8:15 AM	0	136	5	0	12	95	2	0	0	0	2	0	3	1	16	0	272	937
8:30 AM	0	161	3	0	12	102	6	0	2	1	1	0	1	0	20	0	309	1021
8:45 AM	3	143	2	0	9	110	4	0	1	1	1	0	1	0	6	0	281	1063

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	644	12	0	48	408	24	0	8	4	4	0	4	0	80	0	1236
Heavy Trucks	0	32	0		0	32	0		0	0	0		0	0	12		76
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

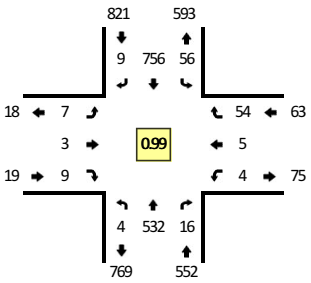
Comments: Need vehicles, bikes, and pedestrians. - Record 6am to 7pm, but process 7:00-9:00am and 4:00-6:00pm. Save video in case we need to process more hours.

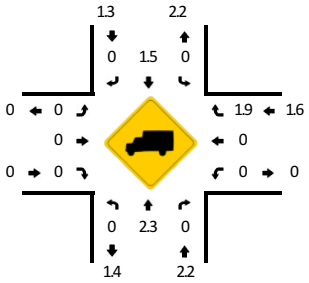
Report generated on 2/26/2024 11:37 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

LOCATION: US 301 -- Lee St | **QC JOB #:** 16496802
CITY/STATE: Smithfield, NC | **DATE:** Thu, Feb 22 2024

Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:00 PM -- 5:15 PM





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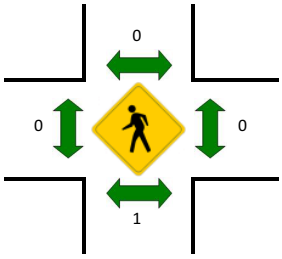
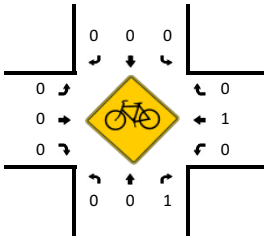
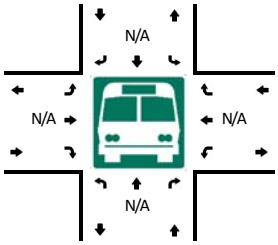
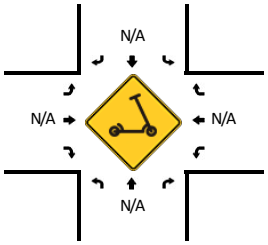








15-Min Count Period Beginning At	US 301 (Northbound)				US 301 (Southbound)				Lee St (Eastbound)				Lee St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	151	6	0	14	164	4	0	1	0	1	0	4	1	10	0	357	
4:15 PM	0	147	2	0	16	156	5	0	4	1	2	0	1	0	9	0	343	
4:30 PM	1	139	5	0	10	176	7	0	5	0	3	0	1	1	9	0	357	
4:45 PM	1	132	5	0	14	185	3	0	4	1	0	0	0	2	15	0	362	1419
5:00 PM	0	131	4	0	13	202	0	0	2	1	4	0	1	2	9	0	369	1431
5:15 PM	2	134	3	0	15	187	2	0	0	1	2	0	2	0	15	0	363	1451
5:30 PM	1	135	4	0	14	182	4	0	1	0	3	0	1	1	15	0	361	1455
5:45 PM	0	103	4	0	8	175	3	0	0	0	1	0	3	0	14	0	311	1404

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	524	16	0	52	808	0	0	8	4	16	0	4	8	36	0	1476
Heavy Trucks	0	4	0		0	8	0		0	0	0		0	0	0		12
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

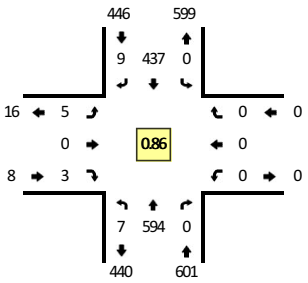
Comments: Need vehicles, bikes, and pedestrians. - Record 6am to 7pm, but process 7:00-9:00am and 4:00-6:00pm. Save video in case we need to process more hours.

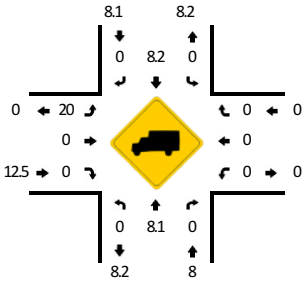
Report generated on 2/26/2024 11:37 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

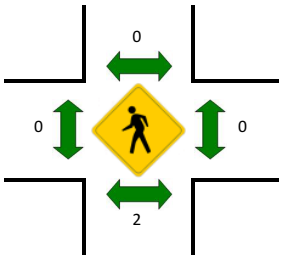
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

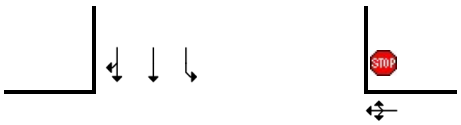
LOCATION: US 301 -- Woodall St | **QC JOB #:** 16496803
CITY/STATE: Smithfield, NC | **DATE:** Thu, Feb 22 2024

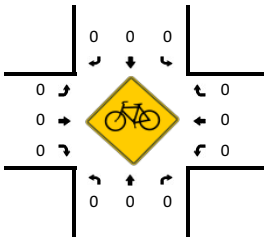
Peak-Hour: 8:00 AM -- 9:00 AM
Peak 15-Min: 8:30 AM -- 8:45 AM

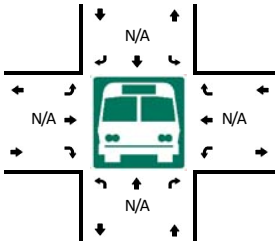


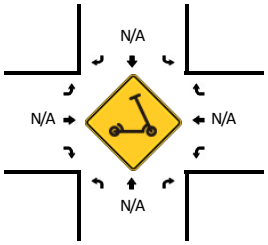












15-Min Count Period Beginning At	US 301 (Northbound)				US 301 (Southbound)				Woodall St (Eastbound)				Woodall St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
7:00 AM	0	87	0	0	0	64	2	0	1	0	0	0	0	0	0	0	154	
7:15 AM	1	109	0	0	0	63	0	0	0	0	0	0	0	0	0	0	173	
7:30 AM	0	135	0	0	0	89	2	0	1	0	0	0	0	0	0	0	227	
7:45 AM	1	149	0	0	0	82	1	0	1	0	0	0	0	0	0	0	234	788
8:00 AM	2	114	0	0	0	78	3	0	1	0	1	0	0	0	0	0	199	833
8:15 AM	1	149	0	0	0	111	2	0	1	0	0	0	0	0	0	0	264	924
8:30 AM	3	178	0	0	0	124	2	0	1	0	0	0	0	0	0	0	308	1005
8:45 AM	1	153	0	0	0	124	2	0	2	0	2	0	0	0	0	0	284	1055

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	12	712	0	0	0	496	8	0	4	0	0	0	0	0	0	0	1232
Heavy Trucks	0	52	0		0	32	0		0	0	0		0	0	0		84
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

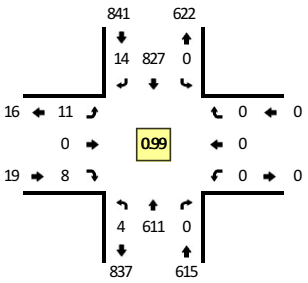
Comments: Need vehicles, bikes, and pedestrians. - Record 6am to 7pm, but process 7:00-9:00am and 4:00-6:00pm. Save video in case we need to process more hours.

Report generated on 2/26/2024 11:37 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

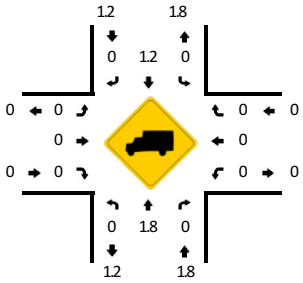
Type of peak hour being reported: Intersection Peak | Method for determining peak hour: Total Entering Volume

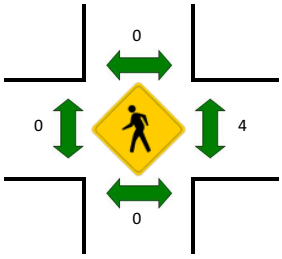
LOCATION: US 301 -- Woodall St | **QC JOB #:** 16496804
CITY/STATE: Smithfield, NC | **DATE:** Thu, Feb 22 2024

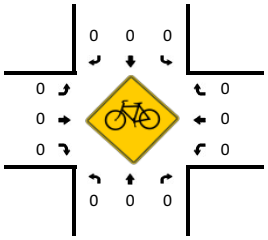
Peak-Hour: 4:45 PM -- 5:45 PM
Peak 15-Min: 5:00 PM -- 5:15 PM

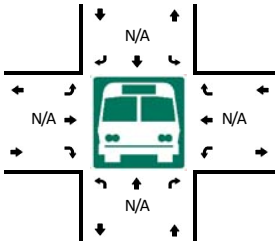


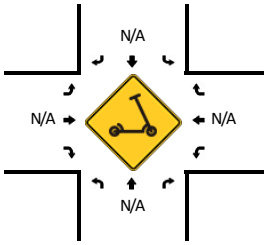
TRUE DATA TO IMPROVE MOBILITY











15-Min Count Period Beginning At	US 301 (Northbound)				US 301 (Southbound)				Woodall St (Eastbound)				Woodall St (Westbound)				Total	Hourly Totals
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U		
4:00 PM	1	178	0	0	0	187	0	0	2	0	3	0	0	0	0	0	371	
4:15 PM	3	171	0	0	0	190	1	0	4	0	1	0	0	0	0	0	370	
4:30 PM	0	157	0	0	0	204	1	0	1	0	1	0	0	0	0	0	364	
4:45 PM	1	156	0	0	0	204	4	0	2	0	0	0	0	0	0	0	367	1472
5:00 PM	0	152	0	0	0	215	2	0	3	0	1	0	0	0	0	0	373	1474
5:15 PM	0	152	0	1	0	201	2	0	2	0	5	0	0	0	0	0	363	1467
5:30 PM	1	151	0	1	0	207	6	0	4	0	2	0	0	0	0	0	372	1475
5:45 PM	3	131	0	0	0	182	3	0	4	0	3	0	0	0	0	0	326	1434

Peak 15-Min Flowrates	Northbound				Southbound				Eastbound				Westbound				Total
	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	Left	Thru	Right	U	
All Vehicles	0	608	0	0	0	860	8	0	12	0	4	0	0	0	0	0	1492
Heavy Trucks	0	4	0		0	8	0		0	0	0		0	0	0		12
Buses																	
Pedestrians		0				0				0				0			0
Bicycles	0	0	0		0	0	0		0	0	0		0	0	0		0
Scooters																	

Comments: Need vehicles, bikes, and pedestrians. - Record 6am to 7pm, but process 7:00-9:00am and 4:00-6:00pm. Save video in case we need to process more hours.

Report generated on 2/26/2024 11:37 AM | SOURCE: Quality Counts, LLC (http://www.qualitycounts.net) 1-877-580-2212

QUALITY COUNTS REPORT
====================

Intersection:	US 301	Lee St
City/State:	Smithfield	NC
QCJobNo:	16496801	
ClientID:		
Date:	2/22/2024	
Comments:	Need vehicles, bikes, and pedestrians.- Recor	
Latitude/Longitude	35.50332	-78.344
PEAK HOUR START	8:00 AM	
PEAK HOUR END	9:00 AM	
PEAK 15-MIN START	8:30 AM	
PEAK 15-MIN END	8:45 AM	
PHF	0.86	

Lane Configuration:

		SBLane1	SBLane2	SBLane3	SBLane4	SBLane5	SBLane6	SBLane7		
		TR	T	L						STOP
EBLane7									LTR	WBLane1
EBLane6										WBLane2
EBLane5										WBLane3
EBLane4										WBLane4
EBLane3										WBLane5
EBLane2										WBLane6
EBLane1	LTR									WBLane7
STOP						L	T	TR		
		NBLane7	NBLane6	NBLane5	NBLane4	NBLane3	NBLane2	NBLane1		

PEAK-HOUR VOLUMES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEnterin	SBEntering	EBEntering	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
	5	550	12	43	370	16	3	2	5	6	1	50	567	429	10	57	603	381	57	22

PERCENT HEAVY VEHICLES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEnterin	SBEntering	EBEntering	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
HEAVY VEHICLES	0	5.8	8.3	4.7	9.5	6.3	33.3	0	0	0	0	16	5.8	8.9	10	14	6.8	9.2	5.3	4.5
BUSES																				

PEAK-HOUR VOLUMES - PEDESTRIANS

Leg/Crosswalk	South	North	West	East
	0	0	0	0

PEAK-HOUR VOLUMES - MICROMOBILITY

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0
Scooters												

PEAK 15-MIN FLOWRATES

VehicleType	NBLeft	NBThru	NBRight	NBU-Turn	NBRTOR	SBLeft	SBThru	SBRight	SBU-Turn	SBRTOR	EBLeft	EBThru	EBRight	EBU-Turn	EBRTOR	WBLeft	WBThru	WBRight	WBU-Turn	WBRTOR	Total
All Vehicles	0	644	12	0	0	48	408	24	0	0	8	4	4	0	0	4	0	80	0	0	1236
Heavy Trucks	0	32	0			0	32	0			0	0	0			0	0	12			76
Buses																					
Pedestrians		0					0					0					0				0
Bicycles	0	0	0			0	0	0			0	0	0			0	0	0			0
Scooters																					

ALL-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	NB U-Turn	NB RTOR	SB Left	SB Thru	SB Right	SB U-Turn	SB RTOR	EB Left	EB Thru	EB Right	EB U-Turn	EB RTOR	WB Left	WB Thru	WB Right	WB U-Turr	WB RTOR	Total	Hourly Tot	Minor Street Hourly
7:00 AM	0	79	2	0		5	53	3	0		2	0	0	0		0	2	7	0		153		
7:15 AM	4	97	1	0		7	51	1	0		2	2	2	0		2	0	9	0		178		
7:30 AM	0	126	0	0		6	78	2	0		2	3	0	0		1	0	7	0		225		
7:45 AM	0	148	3	0		11	66	5	0		0	0	1	0		0	0	5	0		239	795	33
8:00 AM	2	110	2	0		10	63	4	0		0	0	1	0		1	0	8	0		201	843	33
8:15 AM	0	136	5	0		12	95	2	0		0	0	2	0		3	1	16	0		272	937	42
8:30 AM	0	161	3	0		12	102	6	0		2	1	1	0		1	0	20	0		309	1021	55
8:45 AM	3	143	2	0		9	110	4	0		1	1	1	0		1	0	6	0		281	1063	57

HEAVY-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM	0	4	1	1	6	0	0	0	0	0	0	0	12
7:15 AM	0	7	0	1	5	0	0	0	0	0	0	0	13
7:30 AM	0	7	0	0	8	0	0	0	0	0	0	0	15
7:45 AM	0	7	0	1	7	1	0	0	0	0	0	0	16
8:00 AM	0	6	0	1	11	0	0	0	0	0	0	0	18
8:15 AM	0	11	1	1	6	0	0	0	0	0	0	3	22
8:30 AM	0	8	0	0	8	0	0	0	0	0	0	3	19

8:45 AM	0	7	0	0	10	1	1	0	0	0	0	2	21

BUS VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM													
7:15 AM													
7:30 AM													
7:45 AM													
8:00 AM													
8:15 AM													
8:30 AM													
8:45 AM													

PEDESTRIAN VOLUMES

Time Period	South Leg	North Leg	West Leg	East Leg	Total
7:00 AM	0	0	0	0	0
7:15 AM	0	0	0	1	1
7:30 AM	0	0	0	0	0
7:45 AM	0	0	0	0	0
8:00 AM	0	0	0	0	0
8:15 AM	0	0	0	0	0
8:30 AM	0	0	0	0	0
8:45 AM	0	0	0	0	0

BICYCLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0

SCOOTER VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM													
7:15 AM													
7:30 AM													
7:45 AM													
8:00 AM													
8:15 AM													
8:30 AM													
8:45 AM													

QUALITY COUNTS REPORT
==========

Intersection:	US 301	Lee St		Lane Configuration:																					
City/State:	Smithfield	NC										SBLane1	SBLane2	SBLane3	SBLane4	SBLane5	SBLane6	SBLane7							
QCJobNo:	16496802											TR	T	L								STOP			
ClientID:				EBLane7																LTR		WBLane1			
Date:	2/22/2024			EBLane6																		WBLane2			
Comments:	Need vehicles, bikes, and pedestrians.- Recor			EBLane5																		WBLane3			
Latitude/Longitude	35.503318	-78.344		EBLane4																		WBLane4			
PEAK HOUR START	4:45 PM			EBLane3																		WBLane5			
PEAK HOUR END	5:45 PM			EBLane2																		WBLane6			
PEAK 15-MIN START	5:00 PM			EBLane1	LTR																	WBLane7			
PEAK 15-MIN END	5:15 PM			STOP												L	T	TR							
PHF	0.99											NBLane7	NBLane6	NBLane5	NBLane4	NBLane3	NBLane2	NBLane1							

PEAK-HOUR VOLUMES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEnterin	SBEnterin	EBEnterin	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
	4	532	16	56	756	9	7	3	9	4	5	54	552	821	19	63	593	769	75	18

PERCENT HEAVY VEHICLES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEnterin	SBEnterin	EBEnterin	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
HEAVY VEHICLES	0	2.3	0	0	1.5	0	0	0	0	0	0	1.9	2.2	1.3	0	1.6	2.2	1.4	0	0
BUSES																				

PEAK-HOUR VOLUMES - PEDESTRIANS

Leg/Crosswalk	South	North	West	East
	1	0	0	0

PEAK-HOUR VOLUMES - MICROMOBILITY

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
Bicycles	0	0	1	0	0	0	0	0	0	0	1	0
Scooters												

PEAK 15-MIN FLOWRATES

VehicleType	NBLeft	NBThru	NBRight	NBU-Turn	NBRTOR	SBLeft	SBThru	SBRight	SBU-Turn	SBRTOR	EBLeft	EBThru	EBRight	EBU-Turn	EBRTOR	WBLeft	WBThru	WBRight	WBU-Turn	WBRTOR	Total
All Vehicles	0	524	16	0	0	52	808	0	0	0	8	4	16	0	0	4	8	36	0	0	1476
Heavy Trucks	0	4	0			0	8	0			0	0	0			0	0	0			12
Buses																					
Pedestrians		0					0					0					0				0
Bicycles	0	0	0			0	0	0			0	0	0			0	0	0			0
Scooters																					

ALL-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	NB U-Turn	NB RTOR	SB Left	SB Thru	SB Right	SB U-Turn	SB RTOR	EB Left	EB Thru	EB Right	EB U-Turn	EB RTOR	WB Left	WB Thru	WB Right	WB U-Turr	WB RTOR	Total	Hourly Totals	Minor Street Hourly Volume
4:00 PM	1	151	6	0		14	164	4	0		1	0	1	0		4	1	10	0		357		
4:15 PM	0	147	2	0		16	156	5	0		4	1	2	0		1	0	9	0		343		
4:30 PM	1	139	5	0		10	176	7	0		5	0	3	0		1	1	9	0		357		
4:45 PM	1	132	5	0		14	185	3	0		4	1	0	0		0	2	15	0		362	1419	53
5:00 PM	0	131	4	0		13	202	0	0		2	1	4	0		1	2	9	0		369	1431	50
5:15 PM	2	134	3	0		15	187	2	0		0	1	2	0		2	0	15	0		363	1451	57
5:30 PM	1	135	4	0		14	182	4	0		1	0	3	0		1	1	15	0		361	1455	63
5:45 PM	0	103	4	0		8	175	3	0		0	0	1	0		3	0	14	0		311	1404	63

HEAVY-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM	0	8	0	1	0	0	0	0	0	0	0	0	9
4:15 PM	0	5	0	0	1	1	0	0	1	0	0	0	8
4:30 PM	0	6	1	0	5	0	0	0	0	0	0	0	12
4:45 PM	0	9	0	0	6	0	0	0	0	0	0	0	15
5:00 PM	0	1	0	0	2	0	0	0	0	0	0	0	3
5:15 PM	0	1	0	0	2	0	0	0	0	0	0	1	4
5:30 PM	0	1	0	0	1	0	0	0	0	0	0	0	2

5:45 PM	0	3	0	0	4	0	0	0	0	0	0	0	7

BUS VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM													
4:15 PM													
4:30 PM													
4:45 PM													
5:00 PM													
5:15 PM													
5:30 PM													
5:45 PM													

PEDESTRIAN VOLUMES

Time Period	South Leg	North Leg	West Leg	East Leg	Total
4:00 PM	0	0	0	0	0
4:15 PM	0	0	0	0	0
4:30 PM	0	0	0	0	0
4:45 PM	1	0	0	0	1
5:00 PM	0	0	0	0	0
5:15 PM	0	0	0	0	0
5:30 PM	0	0	0	0	0
5:45 PM	0	0	0	0	0

BICYCLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM	0	0	1	0	0	0	0	0	0	0	0	0	1
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	1	0	1
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	1	0	0	0	0	0	0	0	0	0	1
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0

SCOOTER VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM													
4:15 PM													
4:30 PM													
4:45 PM													
5:00 PM													
5:15 PM													
5:30 PM													
5:45 PM													

QUALITY COUNTS REPORT
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Intersection:	US 301	Woodall St	Lane Configuration:										
City/State:	Smithfield	NC			SBLane1	SBLane2	SBLane3	SBLane4	SBLane5	SBLane6	SBLane7		
QCJobNo:	16496803				TR	T	L						STOP
ClientID:			EBLane7									LTR	WBLane1
Date:	2/22/2024		EBLane6										WBLane2
Comments:	Need vehicles, bikes, and pedestrians.- Recor		EBLane5										WBLane3
Latitude/Longitude	35.505094	-78.3422	EBLane4										WBLane4
PEAK HOUR START	8:00 AM		EBLane3										WBLane5
PEAK HOUR END	9:00 AM		EBLane2										WBLane6
PEAK 15-MIN START	8:30 AM		EBLane1	LTR									WBLane7
PEAK 15-MIN END	8:45 AM		STOP						L	T	TR		
PHF	0.86				NBLane7	NBLane6	NBLane5	NBLane4	NBLane3	NBLane2	NBLane1		

PEAK-HOUR VOLUMES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEntering	SBEntering	EBEntering	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
	7	594	0	0	437	9	5	0	3	0	0	0	601	446	8	0	599	440	0	16

PERCENT HEAVY VEHICLES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEntering	SBEntering	EBEntering	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
HEAVY VEHICLES	0	8.1	0	0	8.2	0	20	0	0	0	0	0	8	8.1	12.5	0	8.2	8.2	0	0
BUSES																				

PEAK-HOUR VOLUMES - PEDESTRIANS

Leg/Crosswalk	South	North	West	East
	2	0	0	0

PEAK-HOUR VOLUMES - MICROMOBILITY

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0
Scooters												

PEAK 15-MIN FLOWRATES

VehicleType	NBLeft	NBThru	NBRight	NBU-Turn	NBRTOR	SBLeft	SBThru	SBRight	SBU-Turn	SBRTOR	EBLeft	EBThru	EBRight	EBU-Turn	EBRTOR	WBLeft	WBThru	WBRight	WBU-Turn	WBRTOR	Total
All Vehicles	12	712	0	0	0	0	496	8	0	0	4	0	0	0	0	0	0	0	0	0	1232
Heavy Trucks	0	52	0			0	32	0			0	0	0			0	0	0			84
Buses																					
Pedestrians		0					0					0					0				0
Bicycles	0	0	0			0	0	0			0	0	0			0	0	0			0
Scooters																					

ALL-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	NB U-Turn	NB RTOR	SB Left	SB Thru	SB Right	SB U-Turn	SB RTOR	EB Left	EB Thru	EB Right	EB U-Turn	EB RTOR	WB Left	WB Thru	WB Right	WB U-Turr	WB RTOR	Total	Hourly Totals	Minor Street Hourly
7:00 AM	0	87	0	0		0	64	2	0		1	0	0	0		0	0	0	0		154		
7:15 AM	1	109	0	0		0	63	0	0		0	0	0	0		0	0	0	0		173		
7:30 AM	0	135	0	0		0	89	2	0		1	0	0	0		0	0	0	0		227		
7:45 AM	1	149	0	0		0	82	1	0		1	0	0	0		0	0	0	0		234	788	3
8:00 AM	2	114	0	0		0	78	3	0		1	0	1	0		0	0	0	0		199	833	4
8:15 AM	1	149	0	0		0	111	2	0		1	0	0	0		0	0	0	0		264	924	5
8:30 AM	3	178	0	0		0	124	2	0		1	0	0	0		0	0	0	0		308	1005	5
8:45 AM	1	153	0	0		0	124	2	0		2	0	2	0		0	0	0	0		284	1055	8

HEAVY-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM	0	5	0	0	8	0	0	0	0	0	0	0	13
7:15 AM	0	8	0	0	6	0	0	0	0	0	0	0	14
7:30 AM	0	7	0	0	7	0	0	0	0	0	0	0	14
7:45 AM	0	11	0	0	8	0	0	0	0	0	0	0	19
8:00 AM	0	9	0	0	11	0	1	0	0	0	0	0	21
8:15 AM	0	13	0	0	7	0	0	0	0	0	0	0	20
8:30 AM	0	13	0	0	8	0	0	0	0	0	0	0	21

8:45 AM	0	13	0	0	10	0	0	0	0	0	0	23

BUS VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM													
7:15 AM													
7:30 AM													
7:45 AM													
8:00 AM													
8:15 AM													
8:30 AM													
8:45 AM													

PEDESTRIAN VOLUMES

Time Period	South Leg	North Leg	West Leg	East Leg	Total
7:00 AM	0	0	0	0	0
7:15 AM	0	0	0	1	1
7:30 AM	0	0	0	0	0
7:45 AM	0	0	0	0	0
8:00 AM	0	0	0	0	0
8:15 AM	0	0	0	0	0
8:30 AM	0	0	0	0	0
8:45 AM	2	0	0	0	2

BICYCLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
7:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:15 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:30 AM	0	0	0	0	0	0	0	0	0	0	0	0	0
8:45 AM	0	0	0	0	0	0	0	0	0	0	0	0	0

SCOOTER VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
7:00 AM													
7:15 AM													
7:30 AM													
7:45 AM													
8:00 AM													
8:15 AM													
8:30 AM													
8:45 AM													

QUALITY COUNTS REPORT
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Intersection:	US 301	Woodall St
City/State:	Smithfield	NC
QCJobNo:	16496804	
ClientID:		
Date:	2/22/2024	
Comments:	Need vehicles, bikes, and pedestrians.- Recor	
Latitude/Longitude	35.50509	-78.3422
PEAK HOUR START	4:45 PM	
PEAK HOUR END	5:45 PM	
PEAK 15-MIN START	5:00 PM	
PEAK 15-MIN END	5:15 PM	
PHF	0.99	

Lane Configuration:

		SBLane1	SBLane2	SBLane3	SBLane4	SBLane5	SBLane6	SBLane7		
		TR	T	L						STOP
EBLane7									LTR	WBLane1
EBLane6										WBLane2
EBLane5										WBLane3
EBLane4										WBLane4
EBLane3										WBLane5
EBLane2										WBLane6
EBLane1	LTR									WBLane7
STOP						L	T	TR		
		NBLane7	NBLane6	NBLane5	NBLane4	NBLane3	NBLane2	NBLane1		

PEAK-HOUR VOLUMES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEnterin	SBEntering	EBEntering	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
	4	611	0	0	827	14	11	0	8	0	0	0	615	841	19	0	622	837	0	16

PERCENT HEAVY VEHICLES

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight	NBEnterin	SBEntering	EBEntering	WBEnterin	NBLeaving	SBLeaving	EBLeaving	WBLeaving
HEAVY VEHICLES	0	1.8	0	0	1.2	0	0	0	0	0	0	0	1.8	1.2	0	0	1.8	1.2	0	0
BUSES																				

PEAK-HOUR VOLUMES - PEDESTRIANS

Leg/Crosswalk	South	North	West	East
	0	0	0	4

PEAK-HOUR VOLUMES - MICROMOBILITY

	NBLeft	NBThru	NBRight	SBLeft	SBThru	SBRight	EBLeft	EBThru	EBRight	WBLeft	WBThru	WBRight
Bicycles	0	0	0	0	0	0	0	0	0	0	0	0
Scooters												

PEAK 15-MIN FLOWRATES

VehicleType	NBLeft	NBThru	NBRight	NBU-Turn	NBRTOR	SBLeft	SBThru	SBRight	SBU-Turn	SBRTOR	EBLeft	EBThru	EBRight	EBU-Turn	EBRTOR	WBLeft	WBThru	WBRight	WBU-Turn	WBRTOR	Total
All Vehicles	0	608	0	0	0	0	860	8	0	0	12	0	4	0	0	0	0	0	0	0	1492
Heavy Trucks	0	4	0			0	8	0			0	0	0			0	0	0			12
Buses																					
Pedestrians		0					0					0					0				0
Bicycles	0	0	0			0	0	0			0	0	0			0	0	0			0
Scooters																					

ALL-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	NB U-Turn	NB RTOR	SB Left	SB Thru	SB Right	SB U-Turn	SB RTOR	EB Left	EB Thru	EB Right	EB U-Turn	EB RTOR	WB Left	WB Thru	WB Right	WB U-Turn	WB RTOR	Total	Hourly Totals	Minor Street Hourly Volume
4:00 PM	1	178	0	0		0	187	0	0		2	0	3	0		0	0	0	0		371		
4:15 PM	3	171	0	0		0	190	1	0		4	0	1	0		0	0	0	0		370		
4:30 PM	0	157	0	0		0	204	1	0		1	0	1	0		0	0	0	0		364		
4:45 PM	1	156	0	0		0	204	4	0		2	0	0	0		0	0	0	0		367	1472	14
5:00 PM	0	152	0	0		0	215	2	0		3	0	1	0		0	0	0	0		373	1474	13
5:15 PM	0	152	0	1		0	201	2	0		2	0	5	0		0	0	0	0		363	1467	15
5:30 PM	1	151	0	1		0	207	6	0		4	0	2	0		0	0	0	0		372	1475	19
5:45 PM	3	131	0	0		0	182	3	0		4	0	3	0		0	0	0	0		326	1434	24

HEAVY-VEHICLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM	0	9	0	0	1	0	0	0	0	0	0	0	10
4:15 PM	0	6	0	0	2	0	0	0	0	0	0	0	8
4:30 PM	0	5	0	0	6	0	0	0	0	0	0	0	11
4:45 PM	0	7	0	0	6	0	0	0	0	0	0	0	13
5:00 PM	0	1	0	0	2	0	0	0	0	0	0	0	3
5:15 PM	0	2	0	0	1	0	0	0	0	0	0	0	3
5:30 PM	0	1	0	0	1	0	0	0	0	0	0	0	2

5:45 PM	0	3	0	0	5	0	0	0	0	0	0	0	8

BUS VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM													
4:15 PM													
4:30 PM													
4:45 PM													
5:00 PM													
5:15 PM													
5:30 PM													
5:45 PM													

PEDESTRIAN VOLUMES

Time Period	South Leg	North Leg	West Leg	East Leg	Total
4:00 PM	0	0	0	0	0
4:15 PM	0	0	0	0	0
4:30 PM	0	0	0	0	0
4:45 PM	0	0	0	4	4
5:00 PM	0	0	0	0	0
5:15 PM	0	0	0	0	0
5:30 PM	0	0	0	0	0
5:45 PM	0	0	0	0	0

BICYCLE VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
4:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
4:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
4:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5:00 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5:15 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5:30 PM	0	0	0	0	0	0	0	0	0	0	0	0	0
5:45 PM	0	0	0	0	0	0	0	0	0	0	0	0	0

SCOOTER VOLUMES

Time Period	NB Left	NB Thru	NB Right	SB Left	SB Thru	SB Right	EB Left	EB Thru	EB Right	WB Left	WB Thru	WB Right	Total
4:00 PM													
4:15 PM													
4:30 PM													
4:45 PM													
5:00 PM													
5:15 PM													
5:30 PM													
5:45 PM													

Type of report: Tube Count - Volume Data

LOCATION: US 301 north of Davis St
QC JOB #: 16496805
SPECIFIC LOCATION:
DIRECTION: NB
CITY/STATE: Smithfield, NC
DATE: Feb 22 2024 - Feb 22 2024

Start Time	Mon	Tue	Wed	Thu 22 Feb 24	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM				18		18			18	
01:00 AM				15		15			15	
02:00 AM				5		5			5	
03:00 AM				8		8			8	
04:00 AM				46		46			46	
05:00 AM				143		143			143	
06:00 AM				322		322			322	
07:00 AM				458		458			458	
08:00 AM				**579**		**579**			**579**	
09:00 AM				552		552			552	
10:00 AM				558		558			558	
11:00 AM				565		565			565	
12:00 PM				531		531			531	
01:00 PM				548		548			548	
02:00 PM				558		558			558	
03:00 PM				592		592			592	
04:00 PM				**624**		**624**			**624**	
05:00 PM				565		565			565	
06:00 PM				486		486			486	
07:00 PM				298		298			298	
08:00 PM				251		251			251	
09:00 PM				140		140			140	
10:00 PM				75		75			75	
11:00 PM				50		50			50	
Day Total				7987		7987			7987	
% Weekday Average				100%						
% Week Average				100%		100%				
AM Peak Volume				8:00 AM 579		8:00 AM 579			8:00 AM 579	
PM Peak Volume				4:00 PM 624		4:00 PM 624			4:00 PM 624	

Comments:

Report generated on 2/26/2024 11:41 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Volume Data

LOCATION: US 301 north of Davis St
QC JOB #: 16496805
SPECIFIC LOCATION:
DIRECTION: SB
CITY/STATE: Smithfield, NC
DATE: Feb 22 2024 - Feb 22 2024

Start Time	Mon	Tue	Wed	Thu 22 Feb 24	Fri	Average Weekday Hourly Traffic	Sat	Sun	Average Week Hourly Traffic	Average Week Profile
12:00 AM				36		36			36	
01:00 AM				11		11			11	
02:00 AM				8		8			8	
03:00 AM				6		6			6	
04:00 AM				24		24			24	
05:00 AM				77		77			77	
06:00 AM				160		160			160	
07:00 AM				284		284			284	
08:00 AM				419		419			419	
09:00 AM				429		429			429	
10:00 AM				514		514			514	
11:00 AM				**545**		**545**			**545**	
12:00 PM				602		602			602	
01:00 PM				630		630			630	
02:00 PM				687		687			687	
03:00 PM				739		739			739	
04:00 PM				738		738			738	
05:00 PM				**803**		**803**			**803**	
06:00 PM				611		611			611	
07:00 PM				482		482			482	
08:00 PM				326		326			326	
09:00 PM				190		190			190	
10:00 PM				102		102			102	
11:00 PM				58		58			58	
Day Total				8481		8481			8481	
% Weekday Average				100%						
% Week Average				100%		100%				
AM Peak Volume				11:00 AM 545		11:00 AM 545			11:00 AM 545	
PM Peak Volume				5:00 PM 803		5:00 PM 803			5:00 PM 803	

Comments:

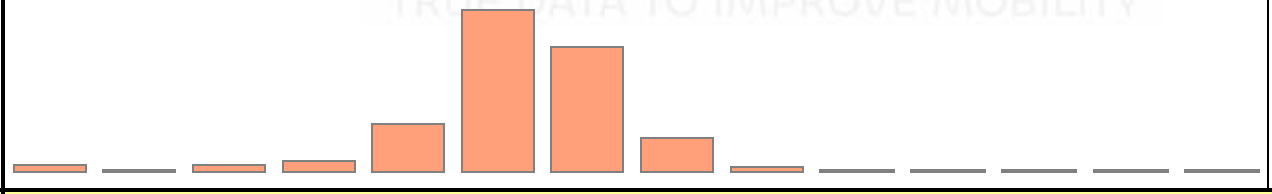
Report generated on 2/26/2024 11:41 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

LOCATION: US 301 north of Davis St
QC JOB #: 16496805
SPECIFIC LOCATION:
DIRECTION: NB
CITY/STATE: Smithfield, NC
DATE: Feb 22 2024

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	0	2	4	9	3	0	0	0	0	0	0	0	18	31-40	13
01:00 AM	0	0	0	3	2	3	3	4	0	0	0	0	0	0	15	41-50	7
02:00 AM	0	0	0	0	1	2	2	0	0	0	0	0	0	0	5	36-45	4
03:00 AM	0	0	0	0	2	2	3	1	0	0	0	0	0	0	8	36-45	5
04:00 AM	0	0	1	1	5	20	10	8	1	0	0	0	0	0	46	36-45	30
05:00 AM	1	0	3	2	11	51	60	11	4	0	0	0	0	0	143	36-45	111
06:00 AM	1	0	6	3	28	107	119	53	5	0	0	0	0	0	322	36-45	226
07:00 AM	4	0	1	3	22	142	184	**91**	**10**	1	0	0	0	0	458	36-45	326
08:00 AM	6	1	1	9	45	218	**231**	61	6	1	0	0	0	0	**579**	36-45	449
09:00 AM	3	2	7	8	57	202	204	55	10	**4**	0	0	0	0	552	36-45	406
10:00 AM	**10**	2	**10**	**21**	61	235	175	37	5	2	0	0	0	0	558	36-45	410
11:00 AM	3	**4**	5	11	**64**	**251**	168	54	4	1	0	0	0	0	565	36-45	419
12:00 PM	11	**7**	13	13	60	207	163	48	**8**	1	0	0	0	0	531	36-45	370
01:00 PM	11	2	8	13	67	239	169	34	5	0	0	0	0	0	548	36-45	408
02:00 PM	9	1	6	16	**82**	240	166	30	5	**3**	0	0	0	0	558	36-45	406
03:00 PM	12	3	8	15	81	239	184	45	4	1	0	0	0	0	592	36-45	423
04:00 PM	**18**	3	**16**	17	76	**264**	173	**51**	6	0	0	0	0	0	**624**	36-45	437
05:00 PM	8	0	14	**29**	71	205	**198**	33	5	2	0	0	0	0	565	36-45	403
06:00 PM	6	2	8	18	65	225	137	19	5	1	0	0	0	0	486	36-45	362
07:00 PM	5	0	5	11	48	155	61	12	1	0	0	0	0	0	298	36-45	216
08:00 PM	3	3	5	18	53	109	57	3	0	0	0	0	0	0	251	36-45	166
09:00 PM	0	0	0	1	29	67	38	5	0	0	0	0	0	0	140	36-45	105
10:00 PM	0	0	0	2	22	33	15	3	0	0	0	0	0	0	75	31-40	55
11:00 PM	0	0	0	1	8	23	9	7	2	0	0	0	0	0	50	36-45	32
Day Total	111	30	117	217	964	3248	2532	665	86	17	0	0	0	0	7987	36-45	5780
Percent	1.4%	0.4%	1.5%	2.7%	12.1%	40.7%	31.7%	8.3%	1.1%	0.2%	0%	0%	0%	0%			
AM Peak	10:00 AM	11:00 AM	10:00 AM	10:00 AM	11:00 AM	11:00 AM	8:00 AM	7:00 AM	7:00 AM	9:00 AM	12:00 AM	12:00 AM	12:00 AM	12:00 AM	8:00 AM		
Volume	10	4	10	21	64	251	231	91	10	4	0	0	0	0	579		
PM Peak	4:00 PM	12:00 PM	4:00 PM	5:00 PM	2:00 PM	4:00 PM	5:00 PM	4:00 PM	12:00 PM	2:00 PM	12:00 PM	12:00 PM	12:00 PM	12:00 PM	4:00 PM		
Volume	18	7	16	29	82	264	198	51	8	3	0	0	0	0	624		



Comments:

Report generated on 2/26/2024 11:41 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

SUMMARY - Tube Count - Speed Data

LOCATION: US 301 north of Davis St
SPECIFIC LOCATION:
CITY/STATE: Smithfield, NC

QC JOB #: 16496805
DIRECTION: NB
DATE: Feb 22 2024

Speed Range	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total	111	30	117	217	964	3248	2532	665	86	17	0	0	0	0	7987	36-45	5780
Percent	1.4%	0.4%	1.5%	2.7%	12.1%	40.7%	31.7%	8.3%	1.1%	0.2%	0%	0%	0%	0%			
Cumulative Percent	1.4%	1.8%	3.2%	5.9%	18%	58.7%	90.4%	98.7%	99.8%	100%	100%	100%	100%	100%			

ADT
7987

85th Percentile: 44 MPH
Mean Speed(Average): 38 MPH
Median: 38 MPH
Mode: 38 MPH

Comments:

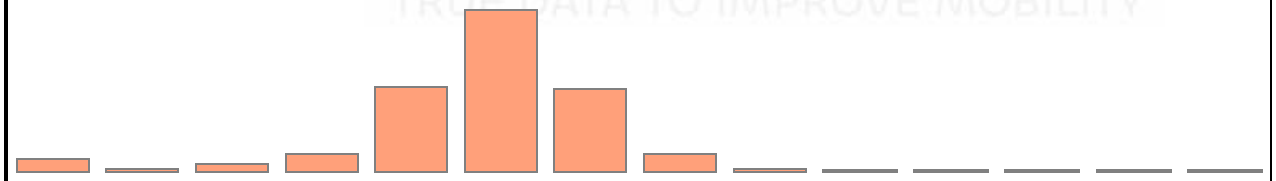
Report generated on 2/26/2024 11:41 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

LOCATION: US 301 north of Davis St
QC JOB #: 16496805
SPECIFIC LOCATION:
DIRECTION: SB
CITY/STATE: Smithfield, NC
DATE: Feb 22 2024

Start Time	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
12:00 AM	0	0	1	1	11	16	5	1	0	0	1	0	0	0	36	31-40	27
01:00 AM	0	0	0	0	3	8	0	0	0	0	0	0	0	0	11	31-40	11
02:00 AM	0	0	0	0	2	4	1	1	0	0	0	0	0	0	8	31-40	6
03:00 AM	0	0	0	0	3	3	0	0	0	0	0	0	0	0	6	31-40	6
04:00 AM	0	0	0	3	1	12	6	1	1	0	0	0	0	0	24	36-45	18
05:00 AM	0	0	1	1	12	29	22	8	1	**1**	**2**	0	0	0	77	36-45	51
06:00 AM	2	0	0	2	21	70	41	22	2	0	0	0	0	0	160	36-45	111
07:00 AM	2	0	0	3	34	97	108	28	**9**	1	0	**1**	0	**1**	284	36-45	205
08:00 AM	9	0	1	10	46	166	145	34	7	0	1	0	0	0	419	36-45	311
09:00 AM	11	2	4	13	61	167	**148**	19	3	1	0	0	0	0	429	36-45	315
10:00 AM	**19**	**5**	**7**	19	85	207	126	**39**	6	0	0	0	**1**	0	514	36-45	333
11:00 AM	18	4	7	**23**	**111**	**247**	103	28	3	1	0	0	0	0	**545**	31-40	358
12:00 PM	24	1	9	26	125	250	133	30	3	**1**	0	0	0	0	602	36-45	383
01:00 PM	14	3	11	43	152	275	114	13	**4**	1	0	0	0	0	630	31-40	427
02:00 PM	19	11	**26**	47	163	261	134	21	4	1	0	0	0	0	687	31-40	424
03:00 PM	**32**	3	10	20	155	312	**171**	**33**	3	0	0	0	0	0	739	36-45	483
04:00 PM	25	5	24	**52**	178	277	145	27	4	1	0	0	0	0	738	31-40	455
05:00 PM	31	**14**	14	40	**198**	**332**	147	23	3	1	0	0	0	0	**803**	31-40	530
06:00 PM	25	6	18	42	164	263	73	15	4	0	0	0	**1**	0	611	31-40	427
07:00 PM	22	7	8	14	133	218	72	6	1	1	0	0	0	0	482	31-40	351
08:00 PM	4	3	7	12	95	141	55	7	0	0	**2**	0	0	0	326	31-40	236
09:00 PM	1	0	1	5	52	89	39	3	0	0	0	0	0	0	190	31-40	141
10:00 PM	1	0	0	2	28	53	14	3	1	0	0	0	0	0	102	31-40	81
11:00 PM	1	2	1	2	15	24	11	0	1	1	0	0	0	0	58	31-40	39
Day Total	260	66	150	380	1848	3521	1813	362	60	11	6	1	2	1	8481	31-40	5369
Percent	3.1%	0.8%	1.8%	4.5%	21.8%	41.5%	21.4%	4.3%	0.7%	0.1%	0.1%	0%	0%	0%			
AM Peak	10:00 AM	10:00 AM	10:00 AM	11:00 AM	11:00 AM	11:00 AM	9:00 AM	10:00 AM	7:00 AM	5:00 AM	5:00 AM	7:00 AM	10:00 AM	7:00 AM	11:00 AM		
Volume	19	5	7	23	111	247	148	39	9	1	2	1	1	1	545		
PM Peak	3:00 PM	5:00 PM	2:00 PM	4:00 PM	5:00 PM	5:00 PM	3:00 PM	3:00 PM	1:00 PM	12:00 PM	8:00 PM	12:00 PM	6:00 PM	12:00 PM	5:00 PM		
Volume	32	14	26	52	198	332	171	33	4	1	2	0	1	0	803		



Comments:

Report generated on 2/26/2024 11:41 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Type of report: Tube Count - Speed Data

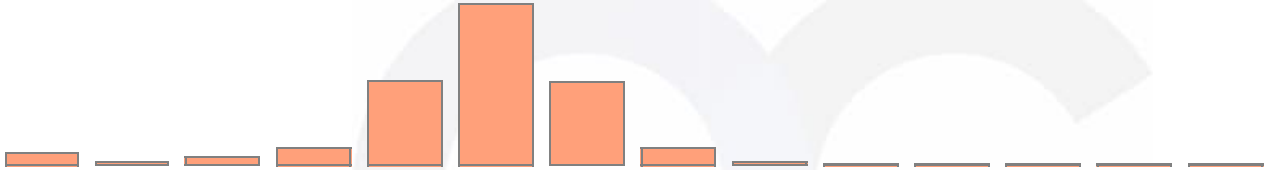
SUMMARY - Tube Count - Speed Data

LOCATION: US 301 north of Davis St
SPECIFIC LOCATION:
CITY/STATE: Smithfield, NC

QC JOB #: 16496805
DIRECTION: SB
DATE: Feb 22 2024

Speed Range	1 15	16 20	21 25	26 30	31 35	36 40	41 45	46 50	51 55	56 60	61 65	66 70	71 75	76 999	Total	Pace Speed	Number in Pace
Grand Total	260	66	150	380	1848	3521	1813	362	60	11	6	1	2	1	8481	31-40	5369
Percent	3.1%	0.8%	1.8%	4.5%	21.8%	41.5%	21.4%	4.3%	0.7%	0.1%	0.1%	0%	0%	0%			
Cumulative Percent	3.1%	3.8%	5.6%	10.1%	31.9%	73.4%	94.8%	99%	99.8%	99.9%	100%	100%	100%	100%			

ADT
8481



85th Percentile: 42 MPH
Mean Speed(Average): 37 MPH
Median: 37 MPH
Mode: 38 MPH

Comments:

Report generated on 2/26/2024 11:41 AM

SOURCE: Quality Counts, LLC (http://www.qualitycounts.net)

Location: **US 301 north of Davis Street**
Direction: **Northbound**

Crossing Distance (ft): 22
Pedestrian Speed (ft/s): 4
Time it Takes Pedestrian to Cross Approach (s): 5.5

Date	Time	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-999
3/1/2023	12:00 AM	1	0	1	2	0	0	1	0	0	0	0	0	0	13
3/1/2023	01:00 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	14
3/1/2023	02:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	5
3/1/2023	03:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	8
3/1/2023	04:00 AM	2	2	1	2	4	2	1	0	2	2	0	0	1	27
3/1/2023	05:00 AM	14	10	9	15	7	12	2	7	2	5	4	5	4	47
3/1/2023	06:00 AM	88	38	32	28	28	13	11	17	7	9	5	5	8	33
3/1/2023	07:00 AM	142	81	54	42	36	19	18	12	8	6	14	3	6	17
3/1/2023	08:00 AM	212	118	74	52	31	19	18	10	6	8	10	4	4	13
3/1/2023	09:00 AM	184	117	75	40	34	24	20	12	16	7	6	4	0	13
3/1/2023	10:00 AM	188	113	76	56	37	19	17	12	9	7	3	6	4	11
3/1/2023	11:00 AM	218	106	67	49	28	25	12	12	11	10	4	5	1	17
3/1/2023	12:00 PM	178	106	64	41	41	21	23	13	12	6	5	5	1	15
3/1/2023	01:00 PM	186	109	77	57	27	19	17	11	8	9	6	3	6	13
3/1/2023	02:00 PM	206	103	70	46	26	32	11	15	13	9	9	6	2	10
3/1/2023	03:00 PM	207	118	76	66	44	24	11	10	6	6	3	8	3	10
3/1/2023	04:00 PM	240	114	82	60	34	29	13	15	7	7	10	3	2	8
3/1/2023	05:00 PM	191	122	81	41	33	31	12	11	11	6	5	3	4	14
3/1/2023	06:00 PM	132	99	62	53	37	21	18	14	13	8	5	5	6	13
3/1/2023	07:00 PM	52	38	42	32	20	20	15	7	11	7	11	10	5	28
3/1/2023	08:00 PM	46	26	30	34	18	7	14	12	4	8	4	7	2	39
3/1/2023	09:00 PM	11	12	7	14	7	7	4	6	9	3	3	2	2	53
3/1/2023	10:00 PM	3	4	5	1	1	2	3	3	4	3	2	2	0	42
3/1/2023	11:00 PM	1	3	1	4	1	2	2	1	3	1	2	2	1	26
Total		2503	1439	986	735	494	348	243	200	162	127	111	88	62	489
Sufficient Gap		No		Yes											
Total		3942		4045											
% Volume		49%		51%											

Location: **US 301 north of Davis Street**
Direction: **Southbound**

Crossing Distance (ft): 22
Pedestrian Speed (ft/s): 4
Time it Takes Pedestrian to Cross Approach (s): 5.5

Date	Time	1-2	3-4	5-6	7-8	9-10	11-12	13-14	15-16	17-18	19-20	21-22	23-24	25-26	27-999
3/1/2023	12:00 AM	1	1	1	0	0	1	0	0	0	0	2	0	1	29
3/1/2023	01:00 AM	1	0	0	0	0	0	0	0	0	0	0	0	0	10
3/1/2023	02:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	8
3/1/2023	03:00 AM	0	0	0	0	0	0	0	0	0	0	0	0	0	6
3/1/2023	04:00 AM	1	1	0	0	0	2	0	0	0	0	0	0	1	19
3/1/2023	05:00 AM	6	6	6	0	3	5	3	4	2	0	0	1	0	41
3/1/2023	06:00 AM	35	25	8	9	4	5	4	6	3	1	6	2	5	47
3/1/2023	07:00 AM	109	48	17	14	10	10	8	9	4	4	5	2	3	41
3/1/2023	08:00 AM	183	78	34	19	11	11	12	7	7	5	5	7	5	35
3/1/2023	09:00 AM	197	85	25	21	16	9	9	6	6	2	7	7	4	35
3/1/2023	10:00 AM	246	93	51	31	10	9	6	6	11	9	4	7	2	29
3/1/2023	11:00 AM	261	96	53	33	16	13	10	7	9	4	7	4	5	27
3/1/2023	12:00 PM	313	110	44	27	23	10	8	9	8	5	10	4	4	27
3/1/2023	01:00 PM	331	134	48	24	18	7	9	8	10	8	2	1	3	27
3/1/2023	02:00 PM	374	139	57	24	12	16	16	6	5	6	6	3	3	20
3/1/2023	03:00 PM	405	147	70	31	18	13	11	5	3	3	5	2	3	23
3/1/2023	04:00 PM	403	149	64	32	20	15	10	5	0	5	3	5	6	21
3/1/2023	05:00 PM	465	155	64	32	17	8	14	9	9	4	2	1	5	18
3/1/2023	06:00 PM	315	107	56	32	21	11	12	9	8	4	2	3	3	28
3/1/2023	07:00 PM	219	93	41	21	17	12	10	11	6	5	3	6	7	31
3/1/2023	08:00 PM	109	53	29	16	15	5	7	15	10	7	6	1	4	49
3/1/2023	09:00 PM	37	24	15	9	12	5	4	9	4	5	4	6	4	52
3/1/2023	10:00 PM	22	7	5	3	3	1	1	0	1	4	0	1	5	49
3/1/2023	11:00 PM	3	2	2	4	2	3	1	3	0	0	0	4	0	34
Total		4036	1553	690	382	248	171	155	134	106	81	79	67	73	706
Sufficient Gap		No		Yes											
Total		5589		2892											
% Volume		66%		34%											