	CLARENDON COUNTY PROCUREMENT REQUEST FOR PROPOSAL ADDENDUM #l	Solicitation Number	**RFP 2024-010- Newman Branch Stream Evaluation and Debris Removal Project** Jeffrey Hyde, CPPB, NIGP-CPP Procurement Director jhyde@clarendoncountvgov.org

November 26, 2024 **Please remember to acknowledge all addendums

NOTE: OUR NEW PROCUREMENT OFFICE LOCATION – 3 SOUTH CHURCH STREET VOTER REGISTRATION and ELECTIONS BUILDING

ADDENDUM #1 -The purpose of this **ADDENDUM** is to provide a copy of the technical memorandum from the 2023 study (8 pages).

QUESTION/ ANSWER

Q: I have reviewed the RFP for the Newman Branch Stream Evaluation and Debris Removal Project and on pg. 4, under the 'Intent' section, it states that a copy of the technical memorandum for the 2023 study has been included.
I cannot find the copy of that document. Can you please provide the technical memorandum for the 2023 study?

A: YES – A copy of the technical memorandum for the 2023 study is included.

All other terms and conditions remain unchanged.

Continue to direct all questions in writing, e-mail is preferred to:jhyde@clarendoncountygov.org

DEADLINE TO SUBMIT PROPOSALS: **REMAINS UNCHANGED**

SUBMIT TO: Jeffrey A Hyde, CPPB, NIGP-CPP
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Phone (803) 433-3240

DAVIS & FLOYD

SINCE 1954

TECHNICAL MEMORANDUM – Hydrologic and Hydraulic Analysis

December 15, 2023 (8/7/2023 TM Amended to include additional analyses)

To: William A. Timmons, PE
Clarendon County Engineer
411 Sunset Drive
Manning, SC 29102

From: Michael V. Horton, PE, CFM, LEED-AP
Chief Engineering Officer
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Charleston, SC 29405

Subject: Walker Gamble Elementary School
Flood Mitigation Project
D|F Job Number: 032021.00

SOUTH CAROLINA CERTIFICATE OF AUTHORIZATION
DAVIS & FLOYD, INC.
No. C00538

GEORGIA CERTIFICATE OF AUTHORIZATION
DAVIS & FLOYD, INC
No. PEF003461

12/15/2023

I. Purpose

The following memorandum will summarize and document the analysis criteria, process, and results for the flood mitigation study conducted for Newman Branch near Walker Gamble Elementary School. Localized flooding has been reported on school property and the analysis documented herein has been performed to determine the degree to which potential improvements to regional drainage may be able to alleviate this flooding. Additionally, this analysis was intended to determine the extent to which groundwater within the vicinity of Newman Branch Swamp may impact the sanitary sewer septic field utilized by the school.

II. Background

Newman Branch Swamp is a tributary to Pudding Swamp located in Clarendon County, approximately 2 miles south of New Zion, SC. In recent years, it has been observed that flooding from the swamp has worsened and has proven a nuisance to properties positioned along it. Walker Gamble Elementary School in particular has experienced more flooding that has threatened the operational capabilities of the school.

The most substantial instances of flooding on school property occurs at the south end of the school's parking lot and renders a significant portion of the lot unusable. In addition to this, the school has begun to experience consistent septic issues that have been speculated to be caused or heavily influenced by the higher flood levels within the adjacent swamp.

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The reach of Newman Branch Swamp assessed for this project is more than two miles in length and stretches between the crossings of SCDOT highway bridges on Hickory Hill Road/Old Manning Road and Walker Gamble Road. This reach is located just upstream of a pond containing two outlet control structures.

III. Field Survey and Data Gathering

Initial survey of Newman Branch Swamp was conducted by Davis & Floyd and included elevation data collection at the elementary school and at bridge crossings within scoped reach. Several elevations were collected within the swamp as well to serve as representative channel geometry for hydraulic modeling. In addition to elevation data, observations were made of the existing conditions of the swamp.

During the site survey, several obstructions were observed within the swamp and evidence of beaver activity was noted. Such evidence included bite marks on trees and several dams. Although these observations were noted, it was difficult to determine the age of the activity.

Following initial survey and field observations, further desktop investigations were performed to inform the understanding of the site history and locate any potential obstructions that had not yet been reviewed. In addition to historic aerial imagery, publicly available LiDAR data from 2008 and 2018 were reviewed. During the review of this data, it was noticed that three locations along the study reach showed notable drops in water surface elevation, indicating possible beaver dams. Evidence of these dams was noted in both sets of LiDAR data meaning that they had been in place for more than a decade at least.

During this phase of the project, a preliminary hydrologic analysis was performed to determine the peak discharge rates through this stretch of Newman Branch Swamp. USGS regression equations were used to determine peak discharge for the 2-year, 10-year, 25-year, and 100-year flooding events.

Figure 1 - Beaver dam identified during initial field survey.

A subsequent site visit was completed with Brigman Company, to locate and assess the beaver dams identified during desktop investigations. During this visit, it was noted that water within the swamp appeared to be stagnant and staged up to the point of inundating a large portion of the swamp immediately upstream of dams during normal or base flow conditions. It was also confirmed by the silt buildup and vegetation on the subject dams that they had been well established for years and were a primary reason for stage increases within Newman Branch Swamp.

Figure 2 - Beaver dam downstream of Newman Branch Road identified during second site visit.

IV. Existing Conditions Modeling

The hydraulic analysis of Newman Branch Swamp was conducted using the 2D modeling capabilities within USACE's HEC-RAS software. The existing conditions terrain model used for this analysis was constructed using the LiDAR data gathered during desktop investigations for elevation detail and NRCS land cover data to support assignment of roughness coefficients. Elevation data within the swamp was augmented by the inclusion of representative main channel based on survey data gathered. The 2D mesh for the model was given an upstream limit approximately ½ mile upstream of the Walker Gamble Road bridge and a downstream limit just upstream of the Old Manning Road bridge. This extent would allow for a detailed representation of flooding experienced between Walker Gamble Road and Newman Branch Road, where the school is located, while enabling proposed improvements downstream of the Newman Branch Road to be assessed.

Bridge crossings for Walker Gamble Road and Newman Branch Road were included in the model using bridge geometry and elevation data gathered during the field survey. Furthermore, the three (3) beaver dams identified during the data gathering phase were added to the model as inline weir structures.

Unsteady-state simulations were run using a typical base flow condition with flood event discharges fitted to NOAA B 24-hour storm distribution curves added as inflows at the upstream end of the model. The simulation results provided a representation of maximum inundation expected under base flow, 2-year, 10-year, 25-year, and 100-year flood event conditions given the existing obstructions and terrain.

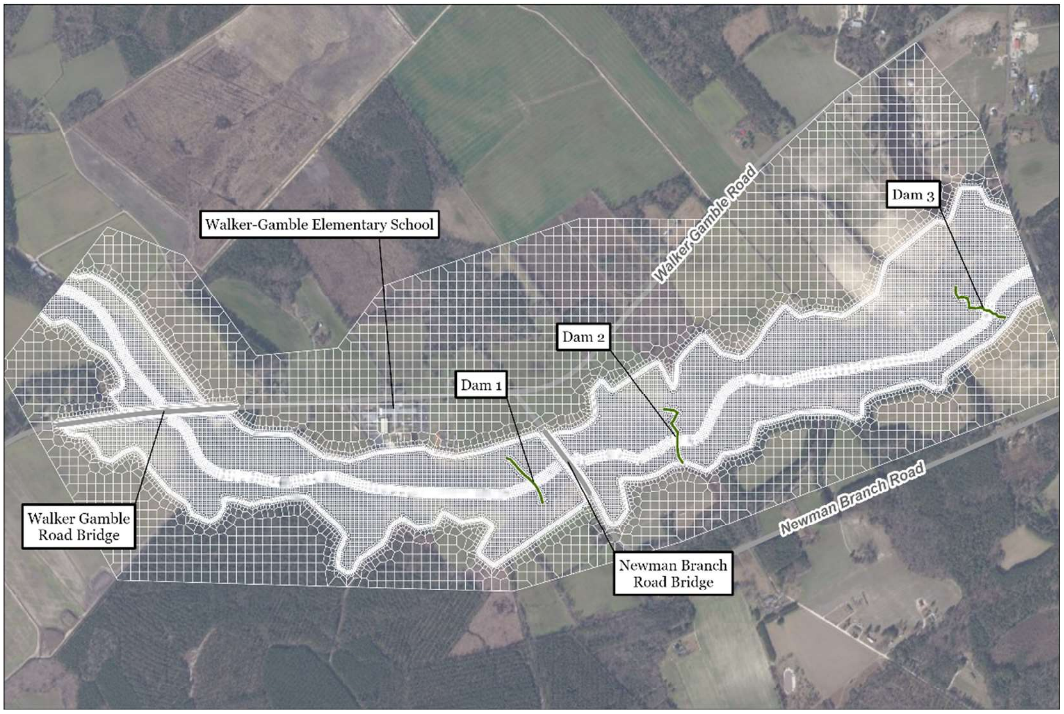

Figure 3 - Existing conditions mesh developed for hydraulic analysis.

In reviewing simulation results, it was found that the bridges along Newman Branch Swamp are adequately sized to provide free-surface flow beneath them and a typical amount of backwater generated during the modeled flood events. Thus, it was determined that improvements to the bridges could be deemed unnecessary and offer little to no appreciable means for flood mitigation. Additionally, the normal stage and flood stages for the swamp were inspected relative to the elevation of the water table near the school's septic field. With an existing normal stage of approximately 90 feet NAVD88 and an estimated water table elevation of approximately 93-94 feet NAVD88, it is not expected that Newman Branch Swamp has an outsized role in any operational issues the school has or has had with the current septic system. This topic is explored in more detail in a separate Technical Memorandum by D|F.

Backwater at each of the dams was noticeable in all modeled flood events (See). It was notable, however, that the effects of the backwater were reduced as the magnitude of the storm / flood event increased. While the backwater may contribute to a higher normal water table on properties adjacent to Newman Branch Swamp, this evidence would suggest that the beaver dams have less impact on the overall flooding (depth and duration) associated with higher magnitude storm / flood events.

Upon further coordination with the contracted natural resources consultant, it was advised that removing the existing beaver dams obstructing flow in the swamp should be the first action taken before considering further improvements. This would also be the least costly mitigation measure for Clarendon County to take before considering more extensive approaches.

V. Proposed Conditions Modeling

Following the existing conditions hydraulic performance assessment for Newman Branch Swamp, four proposed condition alternatives were modeled to review degree to which flooding within the floodplain could be mitigated. Proposed conditions models were constructed to evaluate hydraulic performance within the floodplain under varied main channel geometry. In Proposed Condition #1 (PC-1), the main channel, as modeled within the existing conditions model, was maintained. Proposed Condition #2 (PC-2) assumed a uniform dredged channel to maintain consistent positive drainage within the modeled reach of Newman Branch. Proposed Condition #3 (PC-3) maintained the same dredged channel slope as PC-2, with channel widening efforts to increase bed width to 30-feet – approximately double the width of the existing channel - between Walker Gamble Road and Newman Branch Road. Proposed Conditions #4 (PC-4) carries this channel widening throughout the modeled extent of Newman Branch Swamp. All proposed conditions models assumed the removal of existing in-line beaver dams in their development.

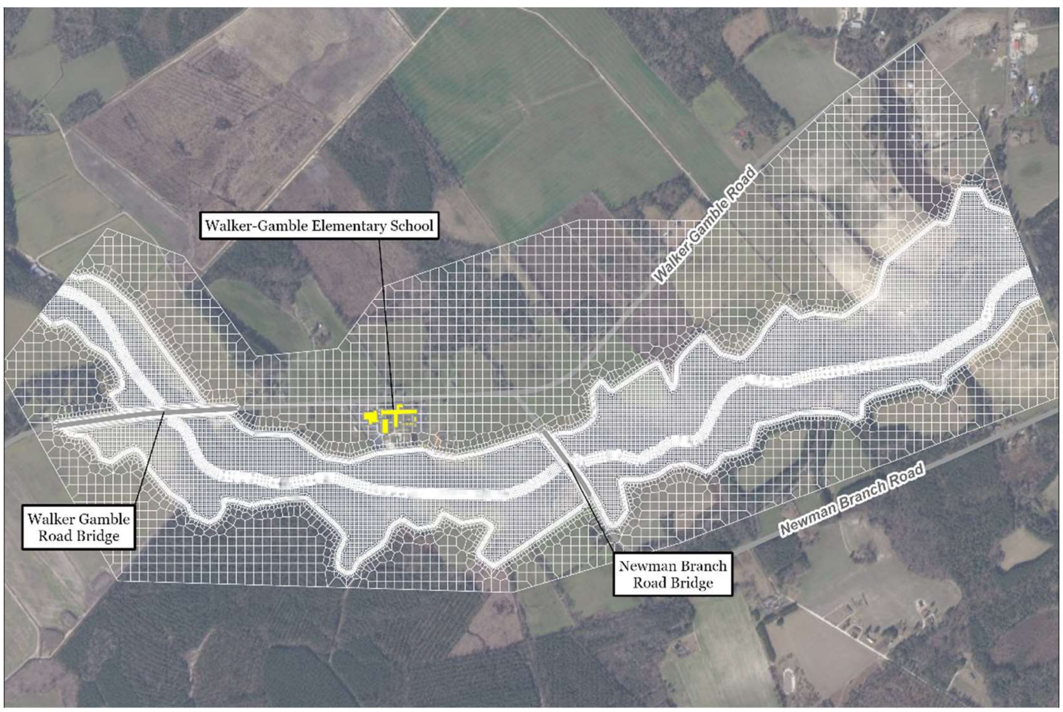

Figure 4 - Proposed conditions mesh developed for hydraulic analysis.

As a means of justifying the established modeling domain, the PC-1 model was used to simulate the 100-year base flood event with downstream boundary condition artificially elevated to match effective FEMA flood mapping. It was found that flood profiles for this simulation and that of the standard 100-year flood event for PC-1 converged downstream of the Walker Gamble Elementary School property, indicating that variations in boundary conditions downstream of the modeled reach will not impact the subject area of concern.

While not presented in subsequent data tables, the flood profile for this simulation can be seen in flood profiles provided in **Appendix B**.

Table 1 shows the local variations in water surface elevation at certain points of interest along the main channel of Newman Branch Swamp. PC-1 results show that the removal of beaver dams alone has potential to decrease the water surface by nearly 2 feet in certain areas of the swamp. The relative impact near Walker Gamble Elementary School, however, is less significant. Near the school property, base flow conditions showed a maximum decrease in relative backwater of approximately 0.6 feet (~7 inches). Subsequent proposed conditions models further decreased water surfaces relative to existing conditions. The results yielded from PC-2, PC-3 and PC-4 simulations showed improvements over that of PC-1, although to a lesser extent than downstream of the school.

***Table 1** – Summary of existing conditions water surface elevations (WSE) and relative proposed conditions reductions.*

		Existing WSE (ft NAVD88)	Δ* (ft)			
			PC-1	PC-2	PC-3	PC-4
Base Flow	Dam 1	88.3	-1.0	-1.8	-2.0	-2.3
	Dam 2	87.6	-1.8	-2.3	-2.3	-2.7
	Dam 3	84.1	-0.6	-0.6	-0.6	-0.7
	School Property	88.6	-0.6	-1.4	-1.8	-1.8
2-Year	Dam 1	88.5	-0.6	-1.0	-0.9	-1.5
	Dam 2	87.7	-1.5	-1.9	-1.8	-2.1
	Dam 3	84.2	-0.6	-0.6	-0.6	-0.8
	School Property	89.0	-0.1	-0.6	-1.0	-1.2
10-Year	Dam 1	88.6	-0.2	-0.5	-0.5	-0.9
	Dam 2	87.9	-1.3	-1.8	-1.6	-1.9
	Dam 3	84.3	-0.4	-0.4	-0.4	-0.6
	School Property	89.5	-0.1	-0.4	-0.7	-0.8
25-Year	Dam 1	88.8	-0.2	-0.4	-0.4	-0.8
	Dam 2	87.9	-1.0	-1.6	-1.5	-1.8
	Dam 3	84.3	-0.3	-0.3	-0.3	-0.4
	School Property	89.7	-0.1	-0.3	-0.6	-0.7
100-Year	Dam 1	89.1	-0.1	-0.3	-0.3	-0.7
	Dam 2	88.0	-0.8	-1.3	-1.3	-1.6
	Dam 3	84.4	-0.2	-0.3	-0.2	-0.3
	School Property	90.0	-0.0	-0.2	-0.5	-0.6

* - Assessed relative to existing conditions model at same location

It can be seen from the results of this assessment that beaver dams have the potential to impact flow substantially within the modeled reach. This impact, however, is localized and becomes less significant as storm events increase in magnitude but may prove effective in relieving localized flooding on school property and/or adjacent parcels. Additional mitigation efforts, such as channel dredging and widening, can potentially aid in reducing flood stages further, however, the removal and continued control of obstructions within Newman Branch Swamp is paramount.

It can be observed that water surface elevations and overall floodplain inundation boundaries for existing and proposed conditions begin to more closely compare as flood discharge within the swamp increases. This is illustrated in greater detail in limited inundation maps included in **Appendix A**. It is expected that this trend would hold true for flooding events of greater magnitude. The flooding that resulted from the historic rainfall event that took place in October 2015, for instance, would not be expected to have been impacted or lessened by the removal of beaver dams. That event, which saw an accumulated total rainfall locally of more than 17 inches within a span of three days, exceeded that of the 1000-year flood event.

VI. Conclusions

This memo summarizes the potential causes of increased flooding experienced from Newman Branch Swamp on the Walker Gamble Elementary School property. Obstructions within the swamp, while not limited to such, include beaver dams that are capable of increasing base flow and flood stages.

While backwater effects of dams today do not appear to be far-reaching, they are capable of being compounded depending on the proximity to one another. For this reason, it is recommended that efforts be made to remove these structures where they exist and restore flow to an unobstructed state. Although higher intensity storms will continue to cause similar flooding to what is observed today, removing existing dams within the swamp can provide immediate benefit to nearby properties. Such efforts are likely to alleviate some of the localized nuisance flooding that plagues Walker Gamble Elementary School and other properties along Newman Branch Swamp on a regular basis. Additional mitigation efforts, including dredging and channel widening, can be expected to further mitigate nuisance flooding after existing obstructions within the channel and floodplain are removed.

As sediment transport was not simulated in this assessment, results from PC-1 may not be indicative of long-term mitigation impacts. Should the County remove all existing beaver dams within Newman Branch Swamp and return consistent positive conveyance to the stream, it is important to dedicate a period time following these efforts to monitoring hydraulic performance. The increased efficiency of the system may allow for existing sediment buildup to wear down. This effect could further improve upon flood mitigation up to the extent to which is expected of channel dredging (PC-2).

VII. Recommendations

Davis & Floyd, in coordination with Brigman Company, proposes that Clarendon County consider the following 3-step approach to address the beaver population and their impacts within Newman Branch Swamp.

Step 1) Control current population.

- It is recommended that Clarendon County hire a licensed beaver trapper or wildlife removal service to assess current beaver population within Newman Branch Swamp and begin removal efforts.

Step 2) Remove existing dams.

- Once existing beavers have been removed, an inventory of existing dams should be conducted, and the process of removal can begin. This will likely require different approaches depending on the characteristics of each dam. Hand crews can be used for smaller newer dams, but mechanical means may be needed to remove earthen dams.

Step 3) Establish a maintenance plan.

- To limit risk of this problem returning in the future, it is important to establish a maintenance plan to limit the beaver population and remove dams as they appear moving forward. For example, the Beaver Reduction Program implemented in Horry County outlines a bounty system in which licensed individuals may submit proof of bounty at a predetermined time and location. Following collection, the Horry County Stormwater team evaluates the area for remaining dams and determines if removal will be necessary. Clarendon County can decide on the final format of their respective maintenance plan.

By instituting the actions as outlined above, the beaver population within Newman Branch can be limited to a manageable level. With the population limited and existing dams removed, natural flow can be restored within Newman Branch Swamp and sustained for the foreseeable future.

(End of Technical Memorandum)