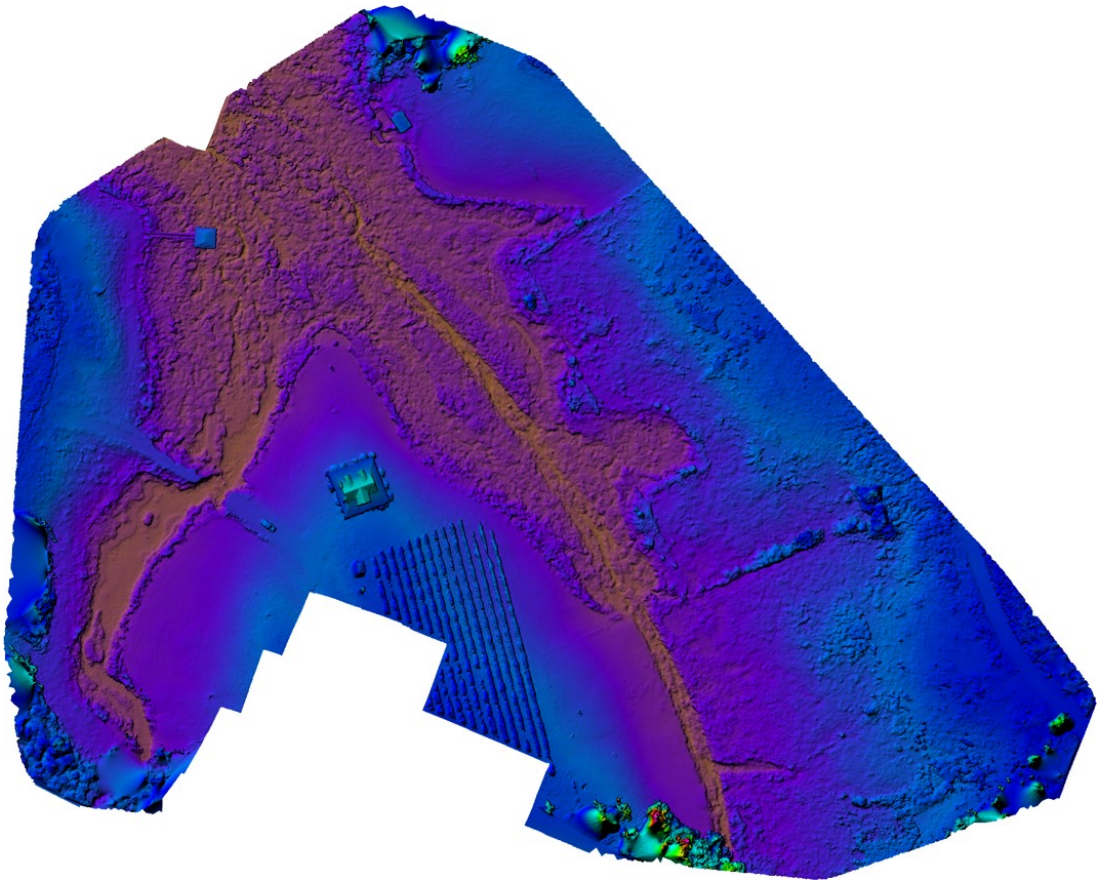
MITIGATION PLAN

SWAMP GRAPE STREAM AND WETLAND MITIGATION SITE

Robeson County, North Carolina

DMS Project ID No. 100115
Full Delivery Contract No. 7869
USACE Action ID No. SAW-2019-01732
DWR Project No. 2019-0675
RFP No. 16-007705

Lumber River Basin
Cataloging Unit 03040204



Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1652

February 2021

Restoration Systems, LLC
1101 Haynes St. Suite 211
Raleigh, North Carolina
Ph: (919) 755-9490
Fx: (919) 755-9492

Response to IRT Comments

Swamp Grape Mitigation Site (DMS ID No. 100115)
Contract No. 0007869
Lumber River Basin 03040204, Robeson County
USACE AID#: SAW-2019-01732
NCDMS #: 100115
IRT Reviewers: Travis Wilson (WRC), Todd Bowers (EPA),

Comments Received (Black Text) & Responses (Blue Text)

WRC Comments, Travis Wilson:

1. The planting plan figure is a good example of what I would like to see in all mit plans moving forward.
   Excellent – we will apply this approach moving forward.

EPA Comments, Todd Bowers:

1. General:
   a. The Geographic Service Area for the credits to be used in has not been explicitly identified in the document. Assuming Lumber 04 for the purposes of this review.
   The Service area is defined in the RFP and by the memorandum of agreement between the USACE, NCDOT, and NCDMS.

   b. Enhancement ratios for EI and EII approach at 2.0 and 3.0 respectively have been noted. This is due to previous IRT comments and concerns.
   Correct.

   c. Livestock exclusion is frequently mentioned in the document to provide functional uplift to the site. The method of exclusion is not provided in the plan. Will the site be fenced either partially, totally or not at all to exclude livestock?
   Areas with livestock will have fence erected/moved to the easement boundary to exclude livestock from the Site.

   d. Recommend expanding the conservation easement where possible to include upland buffers for project wetland assets.
   The easement has been expanded/adjusted where feasible to provide upland buffers adjacent to project wetlands. Specifically, the southern conservation easement boundary was moved away from wetlands. In addition, areas in the upper reaches (where property boundaries do not hinder easement alterations) the conservation easement boundary was adjusted to provide additional upland buffers.

2. Section 4.3/Page 17: Freshwater marsh areas, those expected to be dominated by an open herbaceous community, are not depicted in Figure 9 (Appendix A).
   Construction is anticipated to-be completed in the summer of 2021, observations after construction and into the winter of 2021/2022, will allow for targeted planting within these communities. Freshwater marsh communities will be identified on CCPVs in annual monitoring reports to calculate percent of Site coverage.

3. Table 17/Page 24 and 25: Table errors begin here as the continued Table 17 is listed as Table 18. All tables from this point on are off by one and do not match the mitigation plan narrative in the remainder of document.
   Tables have been corrected.

4. Section 8.5.1/Pages 30-31:
    a. Be sure to inform the IRT if planting is going to occur outside of the time listed. Keep in mind that the growing season starts, and thus the dormant season effectively ends, on March 1. Recently on some projects, planting times have been extended to later in the season due to construction timeframe constraints or plant availability. However, we highly recommend adherence to the timeframe listed in order to conduct vegetation sampling before November 1 in order not to exceed 180 days after planting for inclusion in the Monitoring Year 1 report.

    Understood.

    b. Table 20 should be listed as Table 19 to match the narrative.

    Tables have been corrected.

    c. The general location of the herbaceous dominated wetlands are not depicted in Figure 9 (Appendix A).

    Construction is anticipated to-be completed in the summer of 2021, observations after construction and into the winter of 2021/2022 will allow for targeted planting within these communities. Freshwater marsh communities will be identified on CCPVs in annual monitoring reports to calculate percent of Site coverage.

    d. The streamside assemblage density is actually 680 stems/acre (1904 stems/2.8 acres) according to the Table and not 2720 stems/acre as listed in the ** footnote.

    Planting numbers have been updated to reflect 2770 stems/acre for streamside assemblage.

    e. Recommend adding a few alternate species to the plan in the event that the primary species listed are not available to achieve the density desired.

    12 species should be adequate for contractor selection. If a species is not available a suitable replacement will be selected at that time and will be noted in the as-build report.

5. Section 9.0/Pages 32-33:
    a. Tables 21 and 22 should be 20 and 21 respectively. Continued portion of Table 21 is correct.

    Tables have been corrected.

    b. Recommend denoting how many veg plots will be placed in the two primary vegetation communities to ensure both are adequately sampled. Make a note if the streamside assemblage community is to be sampled or not (assuming not due to width).

    Table 21 Monitoring summary has been adjusted to note that 2 plots will be located in cypress gum swamp and 21 plots will be located in CP small stream swamp. However, as noted in Section 8.5.1 Planting Plan Significant overlap in species for each planting community allows for a broad fringe between the ecological zones.

    c. Recommend listing the number of permanent fixed plots versus the random mobile plots included in the total of 23 plots. Some random plots should be included in monitoring regardless of questionable areas.

    The 23 plots are fixed. Random plots will be conducted as needed to monitor areas outside of the fixed plots.

6. Table "23"/Page 35:
    a. Recommend stating the number of consecutive days in the growing season to meet the hydrology standard of 12%.

    As the growing season can fluctuate (starting no earlier than March 1) the number of consecutive days in the growing season may fluctuate as well. This will be proven by bud burst (two or more species, excluding red maple and Sambucus) and soil temperature probes. The start of each year's growing season will be provided in subject year's monitoring report.

b. Does the monitoring "within planted portions of the site" include the streamside assemblage plant community?

The streamside assemblage plant community is only 15 ft in width from the top of bank. Vegetation plots are 32.8 feet by 32.8 feet. Therefore, vegetation plots frequently extend into the streamside assemblage community, but are not totally contained within the community.

7. Section 9.2.1/Page 36: Is there any contingency plan to deal with beaver that occupy a site outside of the conservation easement that creates inundation or other problems within the project site? Are there any considerations being made to create a site that will have long-term resilience to beaver occupation either within or adjacent to the site?

   There are no mechanisms for controlling beaver outside of the conservation easement/property.

8. Section 9.2.3/Page 37: Provide a minimum monitoring time for supplemental planting before site closeout may be achieved.

   Additional monitoring for supplemental planting is historically dependent upon IRT feedback during the development of a supplemental planting effort and has been dependent upon the total area re-planted, number of species plants, and size of material planted (i.e., bare root, 1-gallon, or 3-gallon trees). We feel it would be presumptuous to define any additional monitoring for supplemental planting at this time.

9. Figure 9/Appendix A:
   a. Recommend adding the vegetation monitoring plots to the planting zone map to ensure each zone is monitored. The inclusion of the veg plots in Figure 10 is good to ensure the all wetland mitigation approaches/treatments are monitored.

   Vegetation Plots have been added to Figure 9.

   b. Table in Figure 9 should be corrected to either increase the density of the streamside assemblage or the footnote should be 680 stems/acre. See previous statement 4.d.

   The planting table has been updated on Figure 9 and in the text of the document.

DWR Comments, Erin Davis:

1. Page 8, Section 2 – Please clarify what is meant by the statement "requiring minimal long-term management" regarding site stream and wetland resources.

   The statement has been removed from Section 2.

2. Page 8, Section 3 – Please include a subsection describing existing vegetation, including any invasive species.

   An Existing Vegetation section has been added to the document. The section describes four vegetative communities that occur on the Site and discusses invasive species.

3. Page 13, Section 3.5.1 (and Section 8.3) – The October 2019 meeting minutes' state that groundwater gauges were agreed to be installed prior to the 2020 growing season. That would have allowed the IRT to review the 2020 spring gauge data in the mitigation plan in support of proposed wetland rehabilitation. Please include the May - October data in final mitigation plan.

   Preconstruction groundwater graphs have been included as Appendix L of the Detailed Plan. Gauge data will be downloaded before construction in the summer of 2021 and will be included in the as-built and yearly monitoring reports.

4. Page 20, Section 6 (and Section 9.1) – DWR appreciates the summary of NC SAM and NC WAM results. However, we would caution it's use in evaluating project goals. The NC SAM manual notes that it "was not developed for determining mitigation success on constructed stream sites".

   NC WAM and NC SAM is appropriate for evaluating project goals. However, NC SAM and NC WAM are not used for success criteria in the existing document.

5. Page 23, Table 16 – Table 24 lists two additional goals under Hydrology. Please make consistent.

   Hydrology goals have been made consistent.

6. Page 26, Section 8.1.1 – Where is Priority ll Restoration proposed?
   Priority II restoration is proposed for a short section of the upper reaches of UT 1 and UT 2. This nomenclature is not exact, because the channels are being brought up to the floodplain but may have some floodplain excavation (or fill along UT 2) for a period adjacent to the channel. Perhaps some other nomenclature may be more appropriate for these reaches. However, currently Priority II restoration seems applicable.

7. Page 29, Section 8.3 –
   a. What "imported elements and compounds" are being referenced?
   Based on NC WAM water quality function is divided into particulate change, soluble change, pathogen change, and physical change for riparian wetlands. Elements and compounds refer to these materials and organisms.

   b. Please include an ephemeral pool design description.
   A description of an ephemeral pool has been added to the text. The description includes the following. ". Ephemeral pools will constitute depressions in the floodplain (less than 9 inches in depth) that are closed in nature which will trap sediment and organic matter. These depressions will be round, or elliptical in size and are expected to fill over time."

   c. Potential grading activities described include stream restoration and ephemeral pools. Please confirm that all ditches and drain tiles will be completely backfilled. Is any other grading proposed in wetland credit areas? Any removal of the sand depositional layer noted during the IRT site visits?
   All ditches will be completely backfilled. Also, drain tiles will be removed. The construction plans show the location of grading areas. Most notably, grading is expected to occur adjacent to UT 2, where a significant amount of spoil material (associated with crossings and sediment deposition) will be required to be moved. In addition, adjacent to UT 3 where sediment dropout has occurred, and the channel is significantly incised at the property line.

8. Page 30, Section 8.4 – Will soil in areas proposed for planting be de-compacted prior to seeding and stem installation? Please describe the method/process.
   Depending on site conditions after construction, it is possible that light disking of upland areas or historically compacted areas will occur. We feel site conditions are such that deep ripping will not be required. Any areas requiring disking will be prepared before seeding/planting.

9. Page 32, Section 9 –
   a. Since the monitoring and success criteria information are solely presented as tables, there are assumptions built in to consolidate the text. DWR recommends adding a sentence to this section stating that success criteria and monitoring will be completed in accordance with the 2016 NCIRT Guidance.
   The guidelines have been added to the first sentence of Section 9 (Monitoring and Success Criteria).

   b. The table references in this section should be Table 21 and Table 22.
   Tables have been corrected.

10. Page 33, Table 22 – DWR prefers the use of pressure transducers over crest gauges to monitor bankfull events.
    The text has been changed to read "Continuous monitoring surface water gauges (pressure transducers) and/or trail camera".

11. Page 34, Table 22 (not 21) –
    a. Should the wetland restoration data reported also be noted as graphic and tabular?
    Graphic and tabular data has been added to the Data Collected/Reported column of Table 22.

b. The vegetation schedule should note between July 1 and leaf drop, and 180 days after planting. Under data collected/reported, please add language regarding areas of concern.

A note has been added to Table 22 with the following text "Note: Vegetation data should be collected between July 1 and leaf drop. In addition, vegetation data will not be collected until 180 days after Site planting." In addition, areas of concern have been added to the data collected/reported.

c. Please add a row for monitoring of the easement boundary. Is the easement proposed to be fenced or just signed? If corn is in the rotation for the adjacent row crop, please consider installing taller sign posts or PVC extensions. If fenced, please include a fencing plan showing existing and proposed fence and approximate locations of gates.

The easement will be appropriately marked. There are only minor areas of the easement that will be fenced (in the upstream areas) were livestock are currently located. These areas will be fenced with appropriate type to isolate the easement from livestock encroachment.

d. Please include fixed photo points at all veg plots and stream cross-sections.

All vegetation plots and stream cross sections have fixed photo points. A note has been added to Table 22 indicating this point.

12. Page 35, Table 23 – DWR requests a species diversity success criterion for areas that establish as freshwater marsh (e.g. minimum of two plots with a three species diversity threshold). This request is based on the concern of allocating wetland credit for a Juncus monoculture.

A row has been added in Table 21 to include herbaceous vegetation plots (5 meters by 2 meters in size) that track the number of herbaceous species in the plot. 3 plots are to be randomly installed in herbaceous dominated vegetation areas of the plot and the number of species in each plot tallied. Table 23 Success Criteria has a line indicating that the plots must have a minimum number of 3 different herbaceous species present.

13. Page 36, Section 9.2.1 – DWR appreciates this contingency discussion. Two comments:
    a. Beaver - Waiting to trap beaver until the following fall/winter could result in significant damage to credit resources during interim.

Our recommended beaver control protocols have been derived from the beaver trappers. Efforts to control beaver are extremely important and will be implemented throughout the monitoring period.

b. Development/Logging - Response to DMS comments note no marsh treatment areas are proposed for this site. Please update.

This section has been updated with the following text. "As the Site is primarily agriculture fields and residential property, logging is not an immediate threat to the mitigation resources. In addition, the location of the mitigation Site is not an area under development pressure. Therefore, development is not a concern for contingency at the Site."

14. Page 37, Section 9.2.3 – Again, DWR appreciates this discussion. We recommend an additional sentence addressing any identified cause for observed veg issue(s) (e.g. beaver trapping, soil amendments, additional signage for encroachments).

A paragraph was added to the document to cover vegetation issues which reads as follows. "If vegetation issues are observed at the Site appropriate actions will be implemented to rectify the vegetation issue at hand and to ensure the issue does not further occur. Issues may include, but may not be limited to beaver, invasive species, encroachment, or poor survivability. Possible rectification may include additional signage installation, fertilization, trapping nuisance species, and spraying invasive species. Coordination with IRT members will be undertaken in extreme conditions and any vegetation action issues will be reported in the annual monitoring report."

15. Page 39, Section 10 - Please specify DMS as the point of contact to notify the IRT of any site issues.

NC DMS has been listed as the point of contact to notify the IRT of any Site issues.

16. Figure 10 – DWR requests three of the groundwater gauges be placed near the upland edge of the proposed wetland reestablishment/rehabilitation areas along UT1, since this is the area DWR is most concerned with meeting the minimum hydroperiod performance standard.
    Two gauges were moved towards the upland boundary and a third was added near the upland boundary in along UT1 reestablishment/rehabilitation areas.

17. Figures – DWR would welcome the inclusion of LiDAR and historic aerial figures, as well as drone and ground photos of existing site conditions. All of these items are helpful in our review.
    A LiDAR figure has been included as Figure 11 of the Appendix. We will provide drone footage of the Site can be made available to the IRT.

18. Appendix B – In the future, DWR would like more detail included in the site soil investigation, including a map indicating all soil check locations.
    Understood.

19. Appendix K – Please include a copy of the May 2019 IRT site visit meeting minutes.
    The May 2019 meeting minutes have been included in Appendix K.

20. Sheet C5.07 – Why is the UT2 restoration stream segment near station 5+00 located at the toe of a steep slope near the CE boundary? What prohibits this segment from being restored within the center of the valley and CE?
    Topographic mapping and ground truthing indicate that the lowest portion of the floodplain is on the right bank valley edge. This is where the current channel is flowing.

21. Sheet C8.05 –
    a. Please confirm the temporary seed species are annual rye and winter wheat.
    This is confirmed.

    b. Under construction sequence note #21, does stabilization include soil de-compaction and topsoil placement?
    Under this note, soil stabilization is an erosion control measure of seed and straw. De-compaction and topsoil placement will be directed as necessary in the field by construction managers.

    c. Please include the permanent seed mixes.
    Permanent Seed mix has been added to Sheet C8.05.

22. Sheet L5.00 –
    a. DWR is ok with the limited species proposed for the Cypress Gum Swamp. However, for the Coastal Plain Small Stream Swamp we request that no species account for more than 20 percent in order to promote diversity, including any construction changes.
    As listed in the planting table, no species accounts for more than 20 percent in the coastal plain small stream swamp planting zone.

    b. DWR appreciated the Section 4.3 freshwater marsh discussion and generally supports mosaic communities, if appropriate for the site and with an area cap (which was noted at 20 percent). Have areas been identified to be seeded with the Coastal Plain Semi- Permanent Impoundment mix? If so, can these areas please be called out on the planting plan (or separate seeding plan). Is there a separate riparian mix for less saturated wetland and upland areas? Based on field observations, some Polygonum species can interfere with woody stem establishment.
    At this time, we do not know where freshwater marsh communities will develop. Species listed in Table 11 have been included in permanent seeding mix to allow for these communities to develop naturally.

23. Detail Sheets – Please add typical details for (1) Bare Root & Live Stake Installations and (2) Channel/Ditch Backfill & Plugs. If partial backfilling is proposed, please specify the max depth from ground surface to fill. For channel plugs, please specify the minimum length.
    A live stake detail sheet was added (L5.02)

24. General design question – Is the reason there are no brush habitat features proposed in the stream or wetlands due to lack of available onsite material?
    It is our belief and observation that brushy material will develop within the channel within 3-years of construction. It is also our belief that brushy material results in scour of the bed and banks prior to vegetation establishment. If brushy material is available on Site it may be placed on the floodplain wetland areas and in select riffles for habitat improvement.

25. DWR appreciates the level of detail provided for the reference forest ecosystems (Section 4.2 & 4.3). Additionally, DWR believes the project has been greatly enhanced by the decisions to relocate utilities and crossings outside of the conservation easement and fully remove both dams.
    Understood. Thank you.

USACE Comments, Kim Browning:

1. Please include groundwater gauge data that shows baseline condition.
   Preconstruction groundwater graphs have been included as Appendix L of the Detailed Plan. Gauge data will be downloaded before construction in the summer of 2021 and will be included in the as-built and yearly monitoring reports.

2. Section 8.3: We question whether it's appropriate to include the areas where the dam currently is and the road that crosses UT2 for wetland reestablishment/enhancement credit because any hydric soils that may have been there are no longer hydric, especially in the core of the dam. While these areas are small, they would be better credited at a 3:1 creation ratio.
   Discussions with IRT members indicate that the dam will be credited at 3:1 as creation. However, the road crossing had subsequent soil borings that indicate the road was not keyed in and was simply fill on existing hydric soils. Therefore, the road crossing will be credited at 1:1 as reestablishment. It should be noted that other portions of the Site that are characterized by more than 1 foot of cut, and that do not have soil boring data indicating existing hydric soil beneath the cut, will be credited at 3:1 as creation. Figures and credit tables have been updated accordingly.

3. It would have been beneficial to capture more upland buffers to prevent erosion concerns with the steep side-slopes and potential impacts from adjacent land use.
   The easement has been expanded/adjusted where feasible to provide upland buffers adjacent to project wetlands. Specifically, the southern conservation easement boundary was moved away from wetlands. In addition, areas in the upper reaches (where property boundaries do not hinder easement alterations) the conservation easement boundary was adjusted to provide additional upland buffers.

4. Please move vegetation plots to capture the area where the dam will be removed and the location of the old road to address compaction concerns.
   Vegetation plots on Figures 9 and 10 have been moved to capture areas of compaction at the pond dam and old road.

5. Are photo-points located at all cross-sections? If so, please also include a photo point of the two culverts at the property boundary.
   A note has been added to Table 22 (Monitoring Summary) that includes the following text. "All vegetation plots and stream cross sections have fixed photo point locations. In addition, fixed photo points will be installed at two culverts entering the Site."

6. It would be beneficial to include the indicator status of the plant species listed in Tables 10 and 11.
   Indicator status has been listed on Tables 10 and 11.

7. Table 16 discusses replacement of a perched culvert. Please note that if a new culvert is being installed in an area that did not previously have a crossing, a Department of the Army Permit may be required for this crossing as it would not be covered under the NWP-27. Please include this in your final impacts and ePCN.
   Each of the crossings are replacements of existing crossings. The crossing on UT 1 will be replaced at the same location. The crossing of UT 2 will be moved slightly upstream (~350-ft) from the existing crossing outside of the conservation easement but within the limits of disturbance. Considering the crossings are being replaced as a part of the project and the project is resulting in a net gain of aquatic resources the use of the NWP-27 seems appropriate from our perspective. If the Corps requires a separate permit for the new location culvert a NWP-40 would be used in addition to the NWP-27. Impacts to WOUS would be 0.009-ac of stream bed and 0.019-ac of wetlands, totaling 0.028-acres. Both amounts are included in the impact totals of the permit application.

   Further, the stream bed loss is below the SAW NWP 2021 Regional Condition 7 (0.02-ac or 150-lft) that triggers mitigation. Likewise, the total WOUS impacts including wetlands is below the 0.10-ac threshold for the 2021 NWP-40 that triggers mitigation. We acknowledge that the Corps can still require mitigation regardless of the amount of impact, but we are hopeful to avoid mitigation for the relocated crossing given the net gain of function to aquatic resources and that the project results in the removal of two crossings.

8. Section 6 and Tables 14 and 15 discuss the functional uplift potential and references NCSAM/WAM, including the physiochemical and habitat uplift. These are benefits that are presumed and will not be measured by monitoring. Unless you intend to demonstrate actual uplift in these areas, I recommend that this section be reworded. The same is true for the project goals (Table 16), which state that water quality and habitat processes will be improved; however, there is no proposal to actually measure or demonstrate this to be the case.
   Table 16 has been updated to depict goals and objectives that can be measured for success. Other functional uplift metrics are described as academically likely areas of functional uplift and are not tied to goals, monitoring, or success criteria.

9. Table 19: It would be beneficial to add some coarse woody debris to the depressional areas in the buffers and throughout the adjacent wetlands for habitat, and to help store sediment, increase water storage/infiltration, and absorb water energy during overbank events. I was pleased to see the inclusion of wood in the stream design for habitat.
   Woody debris will be left on the floodplain for habitat, where feasible.

10. Ephemeral/vernal pools should be 8-14" depressions that dry up yearly so that predatory species cannot colonize, and should not be so numerous that trees do not grow in large areas of the buffer. Additionally, please indicate the number and location of these areas.
    Construction is anticipated to-be completed in the summer of 2021, observations after construction and into the winter of 2021/2022 will allow for targeted planting within these communities. Freshwater marsh communities will be identified on CCPVs in annual monitoring reports to calculate percent of Site coverage.

11. Table 23: Please propose a performance standard for the herbaceous dominated wetland areas, perhaps a minimum percent cover and a diversity of at least 4 species.
    A row has been added in Table 21 to include herbaceous vegetation plots (5 meters by 2 meters in size) that track the number of herbaceous species in the plot. 3 plots are to be randomly installed in herbaceous dominated vegetation areas of the plot and the number of species in each plot tallied. Table 23 Success Criteria has a line indicating that the plots must have a minimum number of 3 different herbaceous species present.

12. Table 24: Shouldn't one of the goals be to enhance/restore wetland functions?
    Wetland functions are identified in Table 24 and include Connect stream to functioning wetland system, remove nutrients and pollutant contributions, and streamside habitat.

13. I really appreciate the thought that went into Section 9.2. Please include something similar in future mitigation plans.
    Understood

14. Please include a figure that depicts the different areas of grading with regard to depth. The amount of excavation is not clear. Several sand deposits were noted near the confluence of all the channels and the depth of site grading was not discussed in Section 8.3. Additionally, please list the amount of the site to be graded greater than 12 inches.
    Sheet C3.00 was added and details areas of cut greater than 12 inches.

15. Please move one of the wetland gauges in the re-establishment area higher up the slope to capture the edge of jurisdiction. Suggest moving the one in the south-east portion of the project between the existing ditches that form a Y.
    The gauge has been moved up the slope.

Ray Holz

From: Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>
Sent: Friday, January 22, 2021 12:26 PM
To: Browning, Kimberly D CIV USARMY CESAW (USA); Ray Holz; Haywood, Casey M CIV (USA)
Cc: Alex Baldwin; Grant Lewis (glewis@axiomenvironmental.org); Worth Creech; John Hamby
Subject: RE: Swamp Grape - Call to Discuss a Comment

Thanks for the info Ray. I appreciate your making the effort to provide the additional information and respond to our concerns. I think the approach you describe in your email sounds reasonable both for the dam area and the road over UT-2, and I also concur with Kim's comments below. Let me know if you need anything else from us.

Have a great weekend,
Todd

-----Original Message-----
From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Thursday, January 21, 2021 10:10 AM
To: Ray Holz <rholz@restorationsystems.com>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>
Cc: Alex Baldwin <abaldwin@restorationsystems.com>; Grant Lewis (glewis@axiomenvironmental.org) <glewis@axiomenvironmental.org>; Worth Creech <worth@restorationsystems.com>; John Hamby <jhamby@restorationsystems.com>
Subject: RE: Swamp Grape - Call to Discuss a Comment

Thanks for the follow-up Ray. I appreciate the transparency with the findings near the dam. Regarding the road/crossing on UT-2 and given the soil profiles you provided, I think re-establishment credit would be appropriate, but compaction continues to be a concern. I would definitely want a veg plot in both the dam area and the road area. Also, I don't recall if the mit plan discussed the extent of earth moving involved with the dam removal or the road fill material, but it will be important to describe that more, and what you plan to do with all the fill material being removed. I think it will be helpful to provide this type of information up front for future projects.

Todd is having some VPN/email connection issues this week, so he may not be able to reply for a minute.
Thanks,
Kim

Kim Browning
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers

-----Original Message-----
From: Ray Holz <rholz@restorationsystems.com>
Sent: Wednesday, January 20, 2021 9:22 AM
To: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>
Cc: Alex Baldwin <abaldwin@restorationsystems.com>; Grant Lewis (glewis@axiomenvironmental.org) <glewis@axiomenvironmental.org>; Worth Creech <worth@restorationsystems.com>; John Hamby <jhamby@restorationsystems.com>
Subject: [Non-DoD Source] RE: Swamp Grape - Call to Discuss a Comment

Kim / Todd - Following our call to discuss the crediting of the dam footprint and the failed road across UT-2 at Swamp Grape, Alex, JD, and I and visited the site on the 12th. Immediately adjacent to the dam's failure, we found clear evidence that the dam was keyed-in with clay when it was constructed or repaired. Though we probed the margins of the dam's footprint elsewhere, our borings were inconclusive about the extent of the keyed-in area - that is, we could not tell if the whole dam or just the area around the failure had been keyed-in. Regardless, given our conversation and our findings, we concur with your comment and will credit the dam's footprint as creation at 3:1. This area measures 0.500 ac. (left dam = 0.343 ac. and right dam = 0.157 ac.).

Regarding the road crossing over UT-2, we conducted four soil profiles, two within the dam's footprint, one immediately below, and one within the eroded bank where the road failed. None of our profiles indicated the road was keyed-in below the natural grade. All exhibited strong evidence that construction of the road resulted from fill material being place directly on top of the historic wetland. We observed historic tree material (cut stumps and large roots) along the crossing at the historic soil surface, with fill material immediately above. Alex prepared four soil profile descriptions, which I have attached with a context map and additional images showing the historic tree material observed.

Our phone call made it clear to us how the IRT approaches wetland crediting in areas where hydric soils were removed to construct a dam/road - we're on board with that and will apply it moving forward. However, given the observed conditions of UT2's crossing, we feel the historic wetland soil and its structure remain relatively undisturbed. Given our construction approach of removing the fill and returning the area to its natural grade, is this a situation where re-establishment credit is possible? The remaining crossing measures are 0.093 ac. I intend to let the contractor know to keep stumps in the ground to limit disturbance during construction.

Thank you again for the time. This has been very productive for us. I'm happy to discuss this on a call if needed.

Sincerely,
Raymond H.

--- --- ---
Raymond J. Holz | Restoration Systems, LLC
1101 Haynes St. Suite 211 | Raleigh, NC 27604
tel: 919.334.9122 | cell: 919.604.9314 | fax: 919.755.9492
email: rholz@restorationsystems.com

-----Original Message-----
From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Thursday, January 07, 2021 3:54 PM
To: Ray Holz <rholz@restorationsystems.com>; Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>
Cc: Alex Baldwin <abaldwin@restorationsystems.com>
Subject: Swamp Grape - Call to Discuss a Comment

Let's plan to have a call tomorrow, January 8, at 10:00.

Here is the info:
Call in: 844-800-2712
Access Code: 1999024831

Thanks
Kim

Kim Browning

Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers

-----Original Message-----
From: Ray Holz <rholz@restorationsystems.com>
Sent: Thursday, January 07, 2021 1:07 PM
To: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Cc: Alex Baldwin <abaldwin@restorationsystems.com>
Subject: [Non-DoD Source] SAW-2019-01732 - Swamp Grape - Call to Discuss a Comment

Hey Kim - I'm hoping we can set up a time tomorrow (Friday, Jan. 8th) before noon or early next week to discuss your second comment (listed below) on our Swamp Grape Mitigation Plan.

KB - Comment #2. Section 8.3: We question whether it's appropriate to include the areas where the dam currently is and the road that crosses UT2 for wetland re-establishment/enhancement credit because any hydric soils that may have been there are no longer hydric, especially in the core of the dam. While these areas are small, they would be better credited at a 3:1 creation ratio.

We've discussed with DMS and internally, and we believe the proposed work in these areas does constitute wetland re-establishment and should be credited as proposed at 1:1. Particularly given the definition of re-establishment under 40 CFP § 230.92 - Definitions, which reads "Re-establishment means the manipulation of the physical, chemical, or biological characteristics of a site with the goal of returning natural/historic functions to a former aquatic resource. Re-establishment results in rebuilding a former aquatic resource and results in a gain in aquatic resource area and functions." Also, it should be noted the definition of establishment (creation), which is, "Establishment (creation) means the manipulation of the physical, chemical, or biological characteristics present to develop an aquatic resource that did not previously exist at an upland site. Establishment results in a gain in aquatic resource area and functions."

It is our thought that regardless of the current amount of fill at the two locations, there are hydric soils beneath associated with historic wetlands that were impacted/filled - confirmed with soil work above and below the subject areas. Removing the fill and planting the area is the re-establishment of a former aquatic resource. We fully agree that the wetland function is currently lost due to the fill, but both those areas were wetlands before, and the hydric soil is still there. We do not plan to excavate below the natural grade, nor do we plan on bringing hydric soil in to fill the area. If we were to do these actions, I would agree that the area should be credited as creation.

In my mind, this work is very similar to Alliance Headwaters, where we removed fill that was placed on top of hydric soils from the creation of farm ponds. In some cases, 2+ feet of fill was removed, and we received re-establishment credit 1:1 (a figure is set attached for reference). We also received wetland re-establishment credit at Major Hill under the footprint of an earthen impoundment that was removed and graded to match the existing grade below the former impoundment (a figure is attached for reference).

Perhaps we need to do a better job explaining the proposed mitigation action in the report, but none the less, I think it is prudent for us to discuss before we finalize our response and resubmit the mitigation plan and permit package. Let us know what time works best, and we can set up a Teams meeting, or Alex and I can simply call you on your cell.

All the best,

Raymond H.

----- ------ ------

Raymond J. Holz | Restoration Systems, LLC

1101 Haynes St. Suite 211 | Raleigh, NC 27604

tel: 919.334.9122 | cell: 919.604.9314 | fax: 919.755.9492

email: rholz@restorationsystems.com <mailto:rholz@restorationsystems.com>

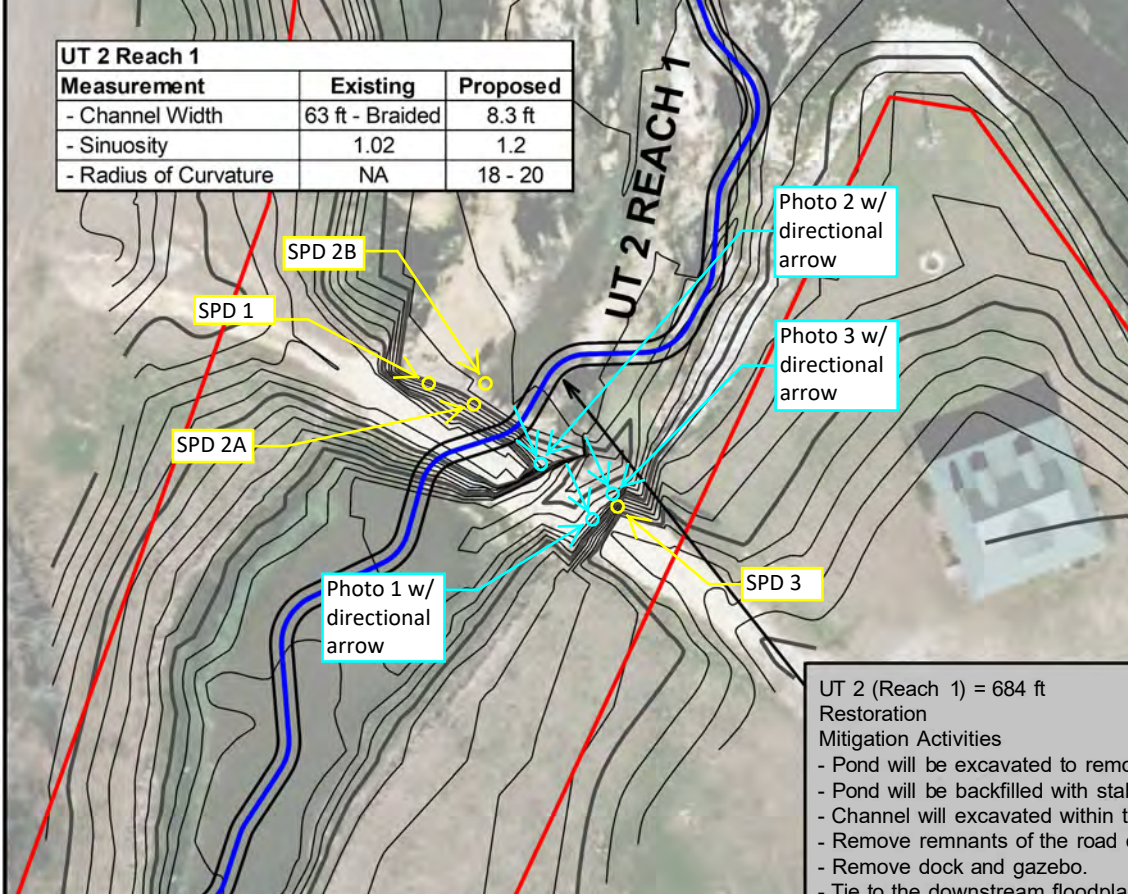

UT 2 Reach 1
Measurement | Existing | Proposed
- Channel Width | 63 ft - Braided | 8.3 ft
- Sinuosity | 1.02 | 1.2
- Radius of Curvature | NA | 18 - 20
UT 2 REACH 1
SPD 2B
SPD 1
SPD 2A
SPD 3
Photo 1 w/ directional arrow
Photo 2 w/ directional arrow
Photo 3 w/ directional arrow
UT 2 (Reach 1) = 684 ft
Restoration
Mitigation Activities
- Pond will be excavated to remo
- Pond will be backfilled with stal
- Channel will excavated within t
- Remove remnants of the road
- Remove dock and gazebo.
- Tie to the downstream floodpla

Photo 1.) UT-2 Failed Crossing – Historic floodplain elevation with historic tree roots visible at break between historic floodplain and fill material

Photo 2.) UT-2 Failed Crossing – Historic floodplain elevation with historic tree roots visible at break between historic floodplain and fill material

Photo 3.) UT-2 Failed Crossing – Historic floodplain elevation with historic tree roots visible at break between historic floodplain and fill material

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #1

NAME: Alex Baldwin DATE: January 12, 2021

PROJECT NUMBER/NAME: Swamp Grape Stream and Wetland Mitigation Project

LOCATION: Robeson County, NC: 34.563000°, -79.349378°

WEATHER: Mostly Cloudy, 45°

LANDSCAPE POSITION: Floodplain of UT2 SLOPE (%): 0

VEGETATION/CROP: Dormant volunteer herbaceous, mostly dog fennel and juncus

SOIL MAP UNIT: BB – Bibb HYDRIC SOIL FIELD INDICATOR: S7 (hydric indicator affected by dam fill)

DEPTH TO WATER: 28-in DEPTH TO SHWT: 15-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE	NOTES
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%		
0-15	10YR 5/6	40	RC/M	10YR 5/8	20	SL/SCL	Dam Fill Material
	10YR 5/3	40					
15-25	10YR 4/2	95	OM/M	10YR 2/1	5	SL with C pockets	Dam Fill Material
25-28+	10YR 3/1	90	OM/M	10YR 2/1	10	SL	Historic soil surface
			MS/M	10YR 2/1	70		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains, OM=Organic Material. [2]Location: PL=Pore Lining, M=Matrix.

NOTES: SPD is on downstream left bank of UT2 along base of remnant dam/crossing, ~20-ft west of plastic culvert. Auger refusal at 28-in encountered tree stump.

Photo 1 – Full soil profile

Photos 2, 3, & 4 – Detailed full soil profile

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #2A

NAME: Alex Baldwin DATE: January 12, 2021

PROJECT NUMBER/NAME: Swamp Grape Stream and Wetland Mitigation Project

LOCATION: Robeson County, NC: 34.562984°, -79.349351°

WEATHER: Mostly Cloudy, 45°

LANDSCAPE POSITION: Floodplain of UT2 SLOPE (%): 0

VEGETATION/CROP: Dormant volunteer herbaceous, mostly dog fennel and juncus

SOIL MAP UNIT: BB – Bibb HYDRIC SOIL FIELD INDICATOR: S7 (hydric indicator affected by dam fill)

DEPTH TO WATER: 18-in DEPTH TO SHWT: 0-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE	NOTES
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%		
0-21	10YR 5/8	45	RD/M	N 8/	10	SCL with C pockets	Dam Fill Material
	10YR 5/4	45					
21-27	2.5Y 6/3	70	RC/M	10YR 6/8	15	SL with C pockets	Dam Fill Material
			RD/M	10YR 6/4	15		
27-35+	10YR 3/1	90	OM/M	10YR 2/1	10	L-SL	Historic soil surface
			MS/M	10YR 2/1	70		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains, OM=Organic Material. [2]Location: PL=Pore Lining, M=Matrix.

NOTES: SPD is on downstream left bank of UT2 along base of remnant dam/crossing, ~10-ft west of plastic culvert. Auger refusal at 35-in encountered tree stump.

Photo 1 – Full soil profile

Photos 2, 3, & 4 – Detailed full soil profile

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #2B

NAME: Alex Baldwin DATE: January 12, 2021

PROJECT NUMBER/NAME: Swamp Grape Stream and Wetland Mitigation Project

LOCATION: Robeson County, NC: 34.562994°, -79.349340°

WEATHER: Mostly Cloudy, 45°

LANDSCAPE POSITION: Floodplain of UT2 SLOPE (%): 0

VEGETATION/CROP: Dormant volunteer herbaceous, mostly dog fennel and juncus

SOIL MAP UNIT: BB – Bibb HYDRIC SOIL FIELD INDICATOR: S7 (hydric indicator affected by dam fill)

DEPTH TO WATER: 7-in DEPTH TO SHWT: 6-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE	NOTES
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%		
0-6	2.5Y 6/4	75				SL-SCL	Dam Fill Material
	10YR 6/8	25					
6-10+	10YR 3/1	90	OM/M	10YR 2/1	10	L-SL	Historic soil surface
			MS/M	10YR 2/1	70		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains, OM=Organic Material. [2]Location: PL=Pore Lining, M=Matrix.

NOTES: SPD is on downstream left bank of UT2 along base of remnant dam/crossing, ~10-ft downstream from SPD #2A. Soil profile was completed using a sharpshooter shovel.

Photo 1 – Overview of soil profile

Photos 2 & 3 – Detailed full soil profile

SOIL PROFILE DESCRIPTION FORM **PROFILE ID:** SPD #3

NAME: Alex Baldwin DATE: January 12, 2021

PROJECT NUMBER/NAME: Swamp Grape Stream and Wetland Mitigation Project

LOCATION: Robeson County, NC: 34.562857° , -79.349208°

WEATHER: Mostly Cloudy, 45°

LANDSCAPE POSITION: Floodplain of UT2 SLOPE (%): 0

VEGETATION/CROP: Dormant volunteer herbaceous, mostly dog fennel and juncus

SOIL MAP UNIT: BB – Bibb HYDRIC SOIL FIELD INDICATOR: S7 (hydric indicator affected by dam fill)

DEPTH TO WATER: 26-in DEPTH TO SHWT: 0-in

DEPTH (inches)	MATRIX		REDOXIMORHPIC FEATURES			TEXTURE	NOTES
	COLOR	%	TYPE[1]/LOCATION[2]	COLOR	%		
0-12	10YR 2/1	85	OM/M	10YR 2/1	15	SL	Tree material observed at the historic soil surface
			MS/M	10YR 2/1	80		
12-18	10YR 4/1	90	RC/M	7.5YR 3/4	10	L-SL	
18-27+	10YR 6/2	70	RC/M	7.5YR 4/6	20	SL	
			RC/M	7.5YR 3/4	10		

[1]Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains, OM=Organic Material. [2]Location: PL=Pore Lining, M=Matrix.

NOTES: SPD is on the right bank of UT2 at the cut associated with the breach in the crossing. There is approximately 6.5-7 feet of dam fill material above the historic soil surface. The SPD is of the historic soil only and does not include the fill material.

Photo 1 – Soil profile with fill

Photos 2, 3, & 4 – Detailed full soil profile

MITIGATION PLAN

SWAMP GRAPE STREAM AND WETLAND MITIGATION SITE

Robeson County, North Carolina

DMS Project ID No. 100115
Full Delivery Contract No. 7869
USACE Action ID No. SAW-2019-01732
RFP No. 16-007705
DWR Project No. 2019-0675

Lumber River Basin
Cataloging Unit 03040204

Prepared for:

NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES
1652 MAIL SERVICE CENTER
RALEIGH, NORTH CAROLINA 27699-1652

Prepared by:

Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, North Carolina 27604
Contact: Raymond Holz
919-755-9490 (phone)
919-755-9492 (fax)

And

Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603
Contact: Grant Lewis
919-215-1693 (phone)

February 2021

This mitigation plan has been written in conformance with the requirements of the following:

- Federal rule for compensatory mitigation project sites as described in the Federal Register Title 33 Navigation and Navigable Waters Volume 3 Chapter 2 Section § 332.8 paragraphs (c)(2) through (c)(14).
- NCDEQ Division of Mitigation Services In-Lieu Fee Instrument signed and dated July 28, 2010

These documents govern NCDMS operations and procedures for the delivery of compensatory mitigation

This document was assembled using the June 2017 DMS Stream and Wetland Mitigation Plan Template and Guidance and the October 24, 2016 NC Interagency Review Team Wilmington District Stream and Wetland Compensatory Mitigation Update.

TABLE OF CONTENTS

TABLES

APPENDICES

APPENDICES CONTINUED

1 PROJECT INTRODUCTION

The Swamp Grape Stream & Wetland Mitigation Site (hereafter referred to as the "Site") encompasses 24.7 acres of a breached agriculture pond, disturbed forest, horse pasture, and row crops along unnamed tributaries to Wilkinson Creek. The Site is located approximately 4 miles northwest of Rowland and 2.5 miles southwest of Alfordsville along the southwest edge of Robeson County near the North Carolina and South Carolina border (Figures 1 and 2, Appendix A).

1.1 Directions to Site

Directions to the Site from Raleigh, North Carolina.

- Follow I-40 for 29 miles,
- Take exit 328A to merge onto I-95 South,
- After 79 miles, take exit 2 toward Rowland and turn right onto NC-130 West,
- After 2.5 miles, turn left onto Ashpole Church Road, then right onto Persimmon Road,
- After 2 miles, turn left onto Kitchen Street,
- The Site is on the right after approximately 0.5 mile and can be accessed from Rhein Drive.
    - Site Latitude, Longitude
      34.5639ºN, -79.3490ºW (WGS84)

1.2 USGS Hydrologic Unit Code and NCDWR River Basin Designation

The Site is located within **Targeted Local Watershed (TLW) 03040204048010** (North Carolina Division of Water Resources [NCDWR] subbasin number 03-07-55. The Site is not located in a Local Watershed Plan (LWP), Regional Watershed Plan (RWP), or Targeted Resource Area (TRA) [Figures 1 and 2, Appendix A]). Site hydrology drains to unnamed tributaries to Wilkinson Creek (Stream Index Number 14-34-11), which has been assigned a Best Usage Classification of **C, Sw** (NCDWR 2013). Wilkinson Creek is not listed on the NCDENR draft 2018 or final 2016 303(d) lists (NCDEQ 2018a, NCDEQ 2018b).

1.3 Physiography and Land Use

The Site is in the Atlantic Southern Loam Plains portion of the Southeastern Plains ecoregion of North Carolina. Regional physiography is characterized by dissected, smooth and irregular plains; broad interstream divides; Carolina bays; and mostly gentle side slopes dissected by many small, low to moderate gradient sandy-bottomed streams (Griffith et al. 2002). Onsite elevations range from a high of 140 feet National Geodetic Vertical Datum (NGVD) at the upper reaches to a low of approximately 115 feet NGVD at the Site outfall (USGS Rowland, North Carolina 7.5-minute topographic quadrangle) (Figure 3, Appendix A).

The Site provides water quality functions to watersheds ranging from approximately 0.41 square mile (263 acres) on UT2 to 1.53 square miles (977 acres) at the outfall (Figure 3, Appendix A). The watershed is dominated by agricultural land, forest, and sparse residential development. Impervious surfaces account for less than 2 percent of the upstream watershed land surface.

Land use at the Site is characterized by a breached agriculture ponds, row crops, livestock pasture, and disturbed forest. The agriculture ponds were breached in August 2018 during hurricane Florence and were in the process of being repaired for irrigation purposes when the site was identified for mitigation. Row crops are currently soybeans, but other crops are rotated regularly. Livestock including horses, donkeys and goats graze fields along the northern and eastern boundaries of the breached agriculture pond and have unrestricted access to the streams.

1.4 Project Components and Structure

The Site encompasses 24.7 acres of drained pond, disturbed forest, and livestock pasture along unnamed tributaries to Wilkinson Creek. In its current state, the Site includes 3941 linear feet of degraded stream channel (based on the approved PJD), 15.9 acre of degraded wetland, 5.4 acres of drained, or otherwise impacted hydric soil (Figure 4, Appendix A).

Proposed Site restoration activities include the construction of meandering, E/C-type stream channel resulting in 2403 linear feet of stream restoration, 1494 linear feet of stream enhancement (Level I), 235 linear feet of stream enhancement (Level II), 4.47 acres of riparian wetland re-establishment, 2.67 acres of riparian wetland rehabilitation , 12.25 acre of riparian wetland enhancement, and 1.00 acres of wetland creation (Table 1) (Figures 6 and 6A-6D, Appendix A).

Completed project activities, reporting history, completion dates, project contacts, and background information are summarized in Tables 1-4.

Table 1. Project Components and Mitigation Credits

Swamp Grape Mitigation Site

Project Segment	Existing Footage/ Acreage	Mitigation Plan Footage/ Acreage	Mitigation Category	Restoration Level	Mitigation Ratio*	Mitigation Credits	Comment
UT 1 Reach 1	278	297	Warm	EI	2.000	148.500	
UT 1 Reach 2	1063	1215	Warm	R	1.000	1215.000	
UT 1 Reach 3	640	546	Warm	EI	2.000	273.000	
UT 1 Reach 4	250	235	Warm	EII	3.000	78.333	
UT 1 Reach 5	238	230	Warm	R	1.000	230.000	
UT 1 Reach 6	170	165	Warm	EI	2.000	82.500	
UT 1 Reach 7	239	206	Warm	R	1.000	206.000	
UT 1 Reach 8	88	87	Warm	EI	2.000	43.500	
UT 2 Reach 1	633	684	Warm	R	1.000	684.000	
UT 2 Reach 2	193	266	Warm	EI	2.000	133.000	
UT 3 Reach 1	149	133	Warm	EI	2.000	66.500	
UT 3 Reach 2	NA	68	Warm	R	1.000	68.000	
Wetland Reestablish	--	4.470	NA	Reestablish	1.000	4.470	
Wetland Rehabilitation	2.671	2.671	NA	Rehabilitation	1.500	1.781	
Wetland Enhancement	12.244	12.244	NA	Enhancement	2.000	6.122	
Wetland Creation	0.000	0.997	NA	Creation	3:100	0.332	

*Ratios for Stream Enhancement (Level I and II) have been adjusted down to account for IRT concerns about existing function at the Site. Stream Enhancement (Level I) is proposed to be credited at a ratio of 2:1 and Stream Enhancement (Level II) is proposed to be credited at a ratio of 3:1 to account for existing stream function exhibited within the Site.

Table 1. Project Credits (continued)
Swamp Grape Mitigation Site

Restoration Level	Stream			Riparian Wetland		Non-riparian wetland	Coastal Marsh
	Warm	Cool	Cold	Riverine	Nonriverine		
Restoration	2403.000	--	--	--	--	--	--
Re-establishment	--	--	--	4.470	--	--	--
Rehabilitation	--	--	--	1.781	--	--	--
Enhancement	--	--	--	6.122	--	--	--
Enhancement I	747.000	--	--	--	--	--	--
Enhancement II	78.333	--	--	--	--	--	--
Creation	--	--	--	0.332	--	--	--
Preservation	--	--	--	--	--	--	--
Totals	**3228.333**	**--**	**--**	**12.705**	**--**	**--**	**--**

Table 2. Project Activity and Reporting History
Swamp Grape Mitigation Site

Activity or Deliverable	Data Collection Complete	Completion or Delivery
Technical Proposal	January 2019	January 2019
Institution Date	--	April 18, 2019
Mitigation Plan	--	February 2021
Construction Plans	--	February 2021

Table 3. Project Contacts Table
Swamp Grape Mitigation Site

Role	Firm
Full Delivery Provider, Planting Contractor, General Contractor Restoration Systems 1101 Haynes Street, Suite 211 Raleigh, North Carolina 27604 Raymond Holz 919-755-9490	**Designer** Axiom Environmental, Inc. 218 Snow Avenue Raleigh, NC 27603 Grant Lewis 919-215-1693
Engineer The John R. McAdams Company, Inc. 2905 Meridian Parkway Durham, NC 27713 Rebecca Stubbs 336-339-1648	**Surveyor** k2 Design Group 5688 U.S. Hwy. 70 East Goldsboro, NC 27534 John Rudolph (L-4194) 919-394-2547

Table 4. Project Attribute Table

Swamp Grape Mitigation Site

Project Information				
Project Name	Swamp Grape Mitigation Site			
Project County	Robeson County, North Carolina			
Project Area (acres)	24.7			
Project Coordinates (latitude & latitude)	34.5639, -79.3490			
Planted Area (acres)	22.5			
Project Watershed Summary Information				
Physiographic Province	Atlantic Southern Loam Plains			
Project River Basin	Lumber			
USGS HUC for Project (14-digit)	03040204048010			
NCDWR Sub-basin for Project	03-07-55			
Project Drainage Area (acres)	977.0			
Percentage of Project Drainage Area that is Impervious	<2%			
CGIA Land Use Classification	Managed Herbaceous Cover & Hardwood Swamps			
Reach Summary Information				
Parameters	UT 1 Upstream	UT 1 Downstream	UT 2	UT 3
Length of reach (linear feet)	1293	1673	826	149
Valley Classification & Confinement	Wide and flat alluvial valley			
Drainage Area (acres)	192	977	263	392
NCDWR Stream ID Score	--	--	--	--
Perennial, Intermittent, Ephemeral	Perennial	Perennial	Perennial	Perennial
NCDWR Water Quality Classification	C, Sw			
Existing Morphological Description (Rosgen 1996)	F 5	Eg 5	Cg 5	Eg 5
Proposed Stream Classification (Rosgen 1996)	Ce 5	Ce 5	Ce 5	Ce 5
Existing Evolutionary Stage (Simon and Hupp 1986)	III/IV	V	V	III/IV
Underlying Mapped Soils	Bibb Soils			
Drainage Class	Poorly drained			
Hydric Soil Status	Hydric			
Valley Slope	0.0062	0.0036	0.0042	0.0125
FEMA Classification	NA	Zone AE	NA	NA
Native Vegetation Community	Cypress-Gum Swamp (Brownwater Subtype) and Coastal Plain Small Stream Swamp (Brownwater Subtype)			
Watershed Land Use/Land Cover (Site)	15% agriculture land, 84% disturbed swamp forest, <1% low density residential/impervious surface			
Watershed Land Use/Land Cover (McRae and Jordan Cr Reference Channel)	McRae - 40% agriculture, 35% forest, 5% low density residential/impervious surface Jordan Cr - 70% agriculture, 28% forest, 2% low density residential/impervious surface			
Percent Composition of Exotic Invasive Vegetation	<5%			

Table 4. Project Attribute Table (continued)
Swamp Grape Mitigation Site

Wetland Summary Information			
Parameters	**Wetlands**		
Wetland acreage	5.32 acre drained/impacted & 15.07 acre degraded		
Wetland Type	Riparian riverine		
Mapped Soil Series	Bibb		
Drainage Class	Poorly drained		
Hydric Soil Status	Hydric		
Source of Hydrology	Groundwater, stream overbank		
Hydrologic Impairment	Impoundment, incised streams, compacted soils, livestock, ditches		
Native Vegetation Community	Cypress-Gum Swamp (Brownwater Subtype) and Coastal Plain Small Stream Swamp (Brownwater Subtype)		
% Composition of Exotic Invasive Vegetation	<5%		
Restoration Method	Hydrologic, vegetative, livestock		
Enhancement Method	Vegetative, livestock		
Regulatory Considerations			
Regulation	**Applicable?**	**Resolved?**	**Supporting Documentation**
Waters of the United States-Section 401	Yes	Yes	Section 401 Certification
Waters of the United States-Section 404	Yes	Yes	Section 404 Permit
Endangered Species Act	Yes	Yes	CE Document (App E)
Historic Preservation Act	Yes	Yes	CE Document (App E)
Coastal Zone Management Act	No	--	NA
FEMA Floodplain Compliance	Yes	Yes	DMS FEMA Checklist (App F)
Essential Fisheries Habitat	No	--	NA

2 WATERSHED APPROACH AND SITE SELECTION

Primary considerations for Site selection included the potential for improvement of water quality within a region of North Carolina under livestock/agricultural pressure. More specifically, considerations included: desired aquatic resource functions; hydrologic conditions; soil characteristics; aquatic habitat diversity; habitat connectivity; compatibility with adjacent land uses; reasonably foreseeable effects the mitigation project will have on ecologically important aquatic and terrestrial resources; and potential development trends and land use changes.

Currently, the proposed Site is characterized as a drained pond surrounded by disturbed forest and livestock pasture. A summary of existing Site characteristics in favor of proposed stream and wetland activities include the following.

- Streams and wetlands are accessible to livestock
- Streams and wetlands subject to ditching/dredging and incision
- Streams and wetlands have been cleared of forest vegetation
- Streams and wetlands were impounded
- Site receives nonpoint source inputs including agricultural chemicals and livestock waste
- Wetland soils have been compacted by livestock and agricultural equipment

- Wetland hydrology has been removed by stream channel entrenchment

In addition to the opportunity for ecological improvements at the Site, the use of the particular mitigation activities and methods proposed in the Design Approach & Mitigation Work Plan (Section 8.0) are expected to produce naturalized stream and wetland resources that will be ecologically self-sustaining.

The *Lumber River Basin Restoration Priorities 2008* (RBRP) report (NCEEP 2008) documents restoration goals developed for the Lumber River Basin. The RBRP report documents restoration goals for the 03040204 catalog unit include buffering waterways and implementation of stormwater and agricultural BMPs. Site specific mitigation goals and objectives have been developed through the use of North Carolina Stream Assessment Method (NC SAM) and North Carolina Wetland Assessment Method (NC WAM) and are discussed further in Section 6.0 (Functional Uplift and Project Goals/Objectives).

3 BASELINE AND EXISTING CONDITIONS

3.1 Soils and Land Form

Soils that occur within the Site, according to the *Web Soil Survey* (USDA 2020) are described in Table 5.

Table 5. Web Soil Survey Soils Mapped within the Site

Map Unit Symbol	Map Unit Name (Classification)	Hydric Status	Description
AyA	Aycock very fine sandy loam (Typic Paleudults)	Non-hydric	This series consists of well-drained soils found on broad interstream divides and flats on marine terraces with 0-2 percent slopes. The parent material is loamy and silty marine deposits. Depth to the water table is 48-72 inches. Depth to restrictive features is more than 80 inches.
BB	Bibb soils (Typic Fluvaquents)	Hydric	This series consists of poorly drained soils found on floodplains with 0-2 percent slopes. The parent material is sandy and loamy alluvium. Depth to the water table is 0-12 inches. Depth to restrictive features is more than 80 inches.
FaB	Faceville fine sandy loam (Typic Kandiudults)	Non-hydric	This series consists of well-drained soils found on ridges on marine terraces with 2-6 percent slopes. The parent material is clayey marine deposit. Depth to the water table and depth to the restrictive features is more than 80 inches.
WaB, WaC	Wagram loamy sand (Arenic Kandiudults)	Non-hydric	This series consists of well-drained soils found on broad interstream divides and ridges on marine terraces with 0-10 percent slopes. The parent material is loamy marine deposits. Depth to the water table is 60-80 inches. Depth to restrictive features is more than 80 inches.

The Web Soil Survey (USDA 2020) indicates the Site is mapped as Bibb soils with Wagram soils on the Side slopes. The Web Soil Survey mapping depicts the Site as impounded; however, the impoundment was breached during past hurricanes. Floodplain portions of the Site were confirmed as Bibb soils with impacts from sediment deposition in the pond and liquification/sloughing along side-slopes of the historic

impoundment. Seepage slopes encroach upon the Wagram soils which indicate that Bibb soils, or other hydric unmapped soils extend up the valley walls. These soils have been present for some time, as evidenced by drain tile extending up to agriculture fields.

Detailed soil profiles collected by a licensed soil scientist appear to confirm that Site soils are hydric in nature and are characterized by F3 (depleted matrix) hydric soil indicators. The F3 indicator includes soils with 60 percent or more chroma 2 or less within the upper 6 inches or starting within the upper 10 inches of the soil profile.

3.2 Existing Vegetation

The Site is characterized by four distinct vegetative communities including swamp forest associated with Wilkinson Creek, herbaceous successional wetland in the historic pond bottom, grassed areas along the margins of the pond and upland forest in the upstream drained reaches of UT 1.

Swamp forest of Wilkinson Creek is characterized by species associated with Cypress-Gum Swamp (Brownwater Subtype) and or Coastal Plain Small Stream Swamp and includes bald cypress (*Taxodium distichum*), various gums (*Nyssa aquatica* and *N. biflora*), along with various oaks (*Quercus michauxii*, *Q. shumardii, Q. pagoda, Q. laurifolia, and Q. nigra*), hackberry (*Celtus laevigata*), tulip poplar (*Liriodendron tulipifera*), American sycamore (*Platanus occidentalis*) and river birch (*Betula nigra*).

The historic pond bottom is largely a monoculture of sedges and rushes (*Carex* spp.) and (*Juncus effuses*) with flat sedge (*Cyperus cyperinus*) and cattail (*Typha latifolia*) in wetter areas and dog fennel (*Eupatorium capillifolium*) in dryer areas.

Grassy areas adjacent to the historic pond bed cover several distinct environs including fescue areas adjacent to agriculture row crops and maintained lawns adjacent to a house/vineyard. These areas a dominated by fescue (*Festuca* sp.) with common weedy species like dandelion (*Taraxacum officinale*), broomsedge (*Andropogon virginicus*), crabgrass (*Digitaria* sp.), Bermuda grass (*Cynodon* sp.) and dog fennel. Other grassy areas a located further upstream and are grazed by livestock. Livestock areas are predominantly underlain by hydric soils that have been drained by ditches, drain tile, and/or incised stream channels. These areas also have fescue but have a larger population of hydrophytic vegetation including sedges and rushes, lizard's tail (*Saururus cernuus*), Ironweed (*Vernonia* sp.), broomsedge, and false nettle (*Boehmeria cylindrica*).

Upstream wooded areas are characterized by drained hydric soils with mature trees and a dense understory. Several nice specimens of oak and hickory (*Carya* spp.) are present intermixed with loblolly pine (*Pinus taeda*). The understory is dense in areas and disturbed by livestock in others.

Relatively few invasive species are present in the Site. Most areas are heavily maintained or were recently ponded. Invasive species identified at the Site include Chinese privet (*Ligustrum sinense*) and fescue.

3.3 Sediment Model

Sediment load modeling was performed using methodologies outlined in A Practical Method of Computing Streambank Erosion Rate (Rosgen 2009) along with Estimating Sediment Loads using the Bank Assessment of Non-point Sources Consequences of Sediment (Rosgen 2011). These models provide a quantitative prediction of streambank erosions by calculating Bank Erosion Hazard Index (BEHI) and Near-Bank Stress (NBS) along each Site reach. The resulting BEHI and NBS values are then compared to

streambank erodibility graphs prepared for North Carolina by the NC Stream Restoration Institute and NC Sea Grant.

Streambank characteristics involve measurements of bank height, angles, materials, presence of layers, rooting depth, rooting density, and percent of the bank protected by rocks, logs, roots, or vegetation. Site reaches have been measured for each BEHI and NBS characteristic and predicted lateral erosion rate, height, and length to calculate a cubic volume of sediment contributed by the reach each year. Data forms for the analysis are available upon request and the data output is presented in Appendix B. Results of the model are presented in Table 6.

Table 6. BEHI and NBS Modeling Summary

Stream Reach	Proposed Mitigation Treatment	Predicted Sediment Contribution (tons/year)
UT 1	Restoration and Enhancement (Level I and II)	241.0
UT 2	Restoration and Enhancement (Level I and II)	2.0
UT 3	Restoration and Enhancement (Level I and II)	1.1
Total Sediment Contribution (tons/year)		**244.0**

Based on this analysis, mitigation of Site streams will reduce streambank erosion and subsequent pollution of receiving waters.

3.4 Nutrient Model

Nutrient modeling was conducted using a method developed by North Carolina Division of Mitigation Services (NCDMS) (NCDMS 2016) to determine nutrient and fecal coliform reductions from exclusion of livestock from the buffer.

The equation for nutrient reduction for this model includes the following:

TN reduction (lbs/yr) = 51.04 (lbs/ac/yr) x Area (ac)
TP reduction (lbs/yr) = 4.23 (lbs/ac/yr) x Area (ac)

Where:
- TN – total nitrogen;
- TP – total phosphorus; and
- Area – total area of restored riparian buffers inside of livestock exclusion fences.

Equations for fecal coliform reduction for this model include the following.
Fecal coliform reduction (col) = 2.2×10^{11} (col/AU/day) x AU x 0.085

Where:
- Col - quantities of Fecal Coliform bacteria
- AU - animal unit (1000 lbs of livestock)

Results of the NCDMS analysis indicate approximately 5 acres of easement are grazed by livestock, which contribute 255.2 lbs/yr of nitrogen, 21.2 lbs/yr of phosphorus, and 0.1×10^{11} col of fecal coliform/day that will be reduced due to exclusion of livestock from the easement area. Fecal coliform values have been based on two goats, a small donkey, and a horse.

3.5 Project Site Streams

Streams targeted for restoration include unnamed tributaries to Wilkinson Creek, which have been cleared, impounded, dredged and straightened, trampled by livestock, eroded vertically and laterally, and receive extensive sediment and nutrient inputs from agriculture activities. Approximately 38 percent of the existing stream channel has been degraded contributing to sediment export from the Site resulting from mechanical processes from ditching of streams, clearing of vegetation, and liquification from impoundment. In addition, streamside wetlands have been cleared and drained by channel downcutting, drain tile installation, and land uses. Current Site conditions have resulted in degraded water quality, a loss of aquatic habitat, reduced nutrient and sediment retention, and unstable channel characteristics (loss of horizontal flow vectors that maintain pools and an increase in erosive forces to channel bed and banks). Site restoration activities including re-establishing buffers, excluding livestock, and restoring stream channels will restore riffle-pool morphology, aid in energy dissipation, increase aquatic habitat, stabilize channel banks, and greatly reduce sediment loss from channel banks.

3.5.1 Existing Conditions Survey

Site stream dimension, pattern, and profile were measured to characterize existing channel conditions. Locations of existing stream reaches are depicted in Figure 4 (Appendix A). Stream geometry measurements under existing conditions are summarized in Table 7 (Essential Morphology Parameters) and presented in detail in Table B1 (Appendix B).

Table 7. Essential Morphology Parameters

Parameter	Existing			Reference		Proposed		
	UT 1	UT 2	UT3	Jordan Cr	McRea Land Co.	UT 1	UT 2	UT3
Valley Width (ft)	100-150	150	150	250	75	100-150	150	150
Contributing Drainage Area (sq. mi.)	1.53	0.41	0.61	16.9	0.20	1.53	0.41	0.61
Channel/Reach Classification	Eg5 – F5	Cg5	Eg5	E5	E5	Ce 5	Ce 5	Ce 5
Design Discharge Width (ft)	5.2-20.3	6.9-7.9	6.8-8.8	20.1-21.5	5.4-6.6	6.8-14.4	7.7-8.9	8.9-10.3
Design Discharge Depth (ft)	0.2-1.3	0.6-0.7	0.7-1.0	2.1-2.2	0.8	0.5-1.0	0.6	0.6-0.7
Design Discharge Area (ft^2)	3.9-12.9	4.9	6.6	44.9	4.8	3.9-12.9	4.9	6.6
Design Discharge Velocity (ft/s)	0.9	0.9	0.9	1.0	0.9	0.9	0.9	0.9
Design Discharge (cfs)	3.5-12.1	4.5	6.1	44.3	4.3	3.5-12.1	4.5	6.1
Water Surface Slope	0.0028-0.0061	0.0041	0.0077	0.0008	0.0077	0.0031-0.0054	0.0035	0.0039
Sinuosity	1.01-1.3	1.02	1.17	1.60	1.13	1.15	1.15	1.15
Width/Depth Ratio	6.5-88	9.9-13.2	6.8-12.6	9.1-10.2	6.8-8.3	14.0	14.0	14.0
Bank Height Ratio	1.0-6.6	1.1-1.4	1.4-1.7	1.0	1.0	1.0	1.0	1.0
Entrenchment Ratio	1.0-14.7	6.7-10.9	3.1-5.1	11.6-12.4	11.4-13.9	7.3-19.0	13-22.6	11.2-19.5
Substrate	Sand	Sand	Sand	Sand	Sand	Sand	Sand	Sand

3.5.2 Channel Classification and Morphology

Stream geometry and substrate data have been evaluated to classify existing stream conditions based on a classification utilizing fluvial geomorphic principles (Rosgen 1996). Existing Site reaches are classified as unstable F, Eg-, and Cg-type streams with variable sinuosity. Existing Site reaches are characterized by sand substrate.

3.5.3 Channel Evolution

Site streams targeted for restoration have been cleared of forest vegetation, channelized, and impounded resulting primarily in channels classified as channelized (Class III), degraded (Class IV), and aggraded and widened (Class V) channels throughout the Site (Simon and Hupp 1986).

3.5.4 Valley Classification

Site Streams are characterized by moderately sized, second order, wide and flat alluvial valley with approximately 100-foot floodplain valley width. Valley slopes are typical for the Coastal Plain region and range from 0.0036 to 0.0062. UT 3 has a short valley that is characterized by a slope of 0.0125; however, this is artificially elevated by a combination of short reach, an offsite dam, and sediment deposits on the breached pond margins. Valley slopes in UT 3 should not hinder proposed water surface slopes, which are expected to be 0.0039 upon completion of the project.

3.5.5 Discharge

This hydrophysiographic region is characterized by moderate rainfall with precipitation averaging approximately 45.6 inches per year (USDA 1987). Drainage basin sizes range from 0.41-square mile on UT2, and 1.53 square miles at the Site outfall.

The Site's discharge is dominated by a combination of upstream basin catchment, groundwater flow, and precipitation. Based on indicators of bankfull at reference reaches and on-Site, the designed channel will equal the channel size indicated by Coastal Plain regional curves (Sweet et al. 2003); this is discussed in Section 5.2 (Bankfull Verification). Based on bankfull studies, the bankfull discharge ranges from 4.5-12.1 cubic feet per second for UT2 and the Site outfall, respectively.

3.6 Project Site Wetlands

Jurisdictional wetlands/hydric soils within the Site were delineated in the field following guidelines set forth in the *Corps of Engineers Wetlands Delineation Manual* and subsequent regional supplements and located using GPS technology with reported submeter accuracy (Environmental Laboratory 1987). A jurisdictional wetland delineation was completed and verbally approved by United States Army Corps of Engineers (USACE) representative Gary Beecher during a field meeting on June 9, 2020. At this time written confirmation of the determination has not been received; however, documentation of the delineation has been included in Appendix D and the package will be updated upon receipt of written confirmation from the USACE. Existing jurisdictional wetlands are depicted in light blue cross hatch and drained hydric soils are depicted in yellow on Figure 4 (Appendix A).

3.6.1 Groundwater Model

For this study, the Boussinesq equation was utilized to predict groundwater impacts associated with stream incision within the middle reaches of UT 1 (Reach 3) and the lower reaches of UT 2 and 3. These reaches are currently incised to a depth of 2.0 to 2.8 feet based on measured cross sectional data. Proposed channel depths are expected to be approximately 0.7 to 1.2 feet.

The Boussinesq equation was applied to Site streams to predict the linear distance of groundwater drawdown that exceeds 1 foot for 12-percent of the growing season. The percentage of the growing season (12 percent) was selected based upon guidance from the *Wilmington District Stream and Wetland Compensatory Mitigation Update* (IRT 2016).

Results from the Boussinesq equation predicted lateral effects; results of the Boussinesq equation are summarized in Table 8.

Table 8. Results for Boussinesq Equation

Soil	Ditch Depth (ft)	Depth to Aquaclude (cm)	Ksat (cm/hr)	Growing Season (hrs)	Drainable Porosity (cm)	Ditch Impact (ft)
Bibb	1	152	5.08	533	0.0433	3
	2	152	5.08	533	0.0433	78
	3	152	5.08	533	0.0433	104
	4	152	5.08	533	0.0433	118
	5	152	5.08	533	0.0433	120

To verify the Bousinesq equation results, groundwater gauges were nested at distances of 10, 20, and 45 feet from the incised channels. These gauges will record groundwater depth for approximately 1 year prior to construction activities. Depth to water table was noted in each gauge boring hole and additional mapping within the reach was conducted to ascertain model accuracy. Field review and boring data indicates the model slightly overpredicts drainage effects, with a 2-foot channel draining approximately 50 feet in the farthest extent. Mapping of the drainage effect was updated and is depicted in Figure 6 (Appendix A).

3.6.2 Hydrological Characterization

Construction activities are expected to reestablish approximately 4.47 acre of drained/impacted riparian hydric soils, rehabilitate 2.67 acres of riparian wetlands, enhance 12.25 acre, and create 1.0 acres of cleared riparian wetlands. Areas of the Site targeted for riparian wetlands will receive hydrological inputs from periodic overbank flooding of restored tributaries, groundwater migration into wetlands, upland/stormwater runoff, and, to a lesser extent, direct precipitation. Hydrological impairment in drained soils has resulted from lateral draw-down of the water table adjacent to existing, incised stream channels, ditches, and/or drain tile installation. Other areas of hydric soil impairment result from overburden from dam, road, or pond construction.

3.6.3 Soil Characterization

Detailed soil mapping conducted by a North Carolina Licensed Soil Scientist (NCLSS) in late 2019 and early 2020 indicate that the Site is currently underlain by hydric soils of the Bibb series (Figure 4, Appendix A). Soils have been disturbed by impoundment, livestock grazing, vegetation clearing, and conversion to pastureland. Soils in the historic impoundment are characterized by sedimentation associated with valley wall liquification and sloughing, as well as from improper sediment transport capacity. Dense herbaceous vegetation is colonizing the historic pond bed and trapping the sediment on the floodplain.

Areas upstream of the historic pond bed have been drained by ditching, drain tile installation, and channel incision. A portion of these soils have been effectively drained; however, seeps and springs (as well as

collapsed drain tile) pockmark the area and are expected to have hydrology enhanced by proposed activities.

Hydric soils within the historic pond bed are experiencing a drainage effect along the newly formed flow path following the breach of the dam. These hydric soils have also been partially buried in some areas as the result of sediment, mostly coarse sand, dropping out as the stream entered the former pond. This is particularly evident along the margins and upper extents of the former pond where streams entered the former pond. The soils in the historic pond are mapped as the Bibb series; however extended inundation has caused a build-up of organic material resulting in a mineral subsoil with a mucky modifier. Likewise the surface horizon in some areas is sand rather than the normally associated sandy loam due to the lack of sediment transport and aggradation from the adjacent stream channel.

Onsite hydric soils are grey to gley in color and are predominantly associated with the F3-Depleted Matrix hydric soil field indicator. Eight detailed soil profiles conducted by a NCLSS are as follows; the location of these profiles are representatives of soils throughout the project (Figure 4 Appendix A).

Table 9. Representative Soil Profile Descriptions

Location	Mitigation Approach	Depth (inches)	Color	Texture
Soil Profile GA-01 from PJD package (area upstream of historic pond)	Rehabilitation	0 - 3	10 YR 3/2	Sandy Loam
		3 - 8	10 YR 4/2 10 YR 3/2 mottles 10 YR 4/6 mottles	Clay loam
		8 – 12+	10 YR 4/1 10 YR 4/6 mottles	Clay
Soil Profile T (Partially buried hydric soil within historic pond bed and subject to drainage effect)	Rehabilitation	0 - 12	10 YR 7/1	Sand
		12 – 20+	10 YR 2/1 10 YR 4/6 mottles N 4/ mottles	Mucky sandy loam
Soil Profile J (Partially buried hydric soil within historic pond bed)	Enhancement	0 - 6	10 YR 7/1	Sand
		6 – 15+	10 YR 2/1 10 YR 4/6 mottles N 4/ mottles	Mucky sandy loam

4 REFERENCE STUDIES

4.1 Reference Streams

Distinct bankfull indicators were present within the reference stream channels. In addition, dimension, pattern, and profile variables have not been altered or degraded, allowing for assistance with the proposed restoration reaches (Figure 5A-B, Appendix A).

4.1.1 McCrea Land Company Reference Reach

4.1.1.1 Watershed Characterization

The McCrea Land Company Reference Site is located in western Robeson County within the same physiographic province and similar landscape position as the Site. The reference reach is approximately 5

miles north of the Site in a topographic crenulation flowing to a significantly larger stream (Heel Creek). Alterations, development, and impervious surfaces within the watershed are minimal.

4.1.1.2 Channel Classification

Stream geometry and substrate data have been evaluated to classify the reference reach based on a classification utilizing fluvial geomorphic principles (Rosgen 1996a). This classification stratifies streams into comparable groups based on pattern, dimension, profile, and substrate characteristics. The reference reach is characterized as an E-type, moderately sinuous (1.13) channel with a sand-dominated substrate. Reference reaches that are characterized by E-type channels typically have a dense herbaceous understory that resists erosive forces associated with deep, sinuous channels.

4.1.1.3 Discharge

The reference stream has an approximately 0.20-square mile watershed and a bankfull discharge of 4.3 cubic feet per second based on bankfull indicators.

4.1.1.4 Channel Morphology

Stream cross-sections and profiles were measured along the reference stream (Figure 5A, Appendix A). The stream reach is transporting its sediment supply while maintaining stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table B1).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 4.8 square feet, a bankfull width of 6.0 feet, a bankfull depth of 0.8 feet, and a width-to-depth ratio of 7.5. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 2.8 square feet for the approximate 0.20-square mile watershed (Sweet and Geratz 2003), above the 4.8-square feet displayed by channel bankfull indicators identified in the field. For a more detailed discussion on bankfull verification see Section 3.5 (Bankfull Verification).

The reference reach exhibits a bank-height ratio averaging 1.0. In addition, the width of the floodprone area is approximately 75 feet giving the channel an entrenchment ratio of 11.4 to 13.9, typical of a stable E-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.13 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio ($L_{p\text{-}p}/W_{bkf}$) of 3.5, a meander wavelength ratio (L_m/W_{bkf}) of 5.9, and a radius of curvature ratio (R_c/W_{bkf}) of 1.1. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0087 (rise/run). Ratios of the reference reach riffle, run, pool, and glide slopes to average water surface slope are 0.30, 0.78, 0.30, and 0.03, respectively.

Substrate: The channel is characterized by a channel substrate dominated by sand-sized particles.

4.1.2 Jordan Creek Reference Reach

4.1.2.1 Watershed Characterization

Jordan Creek is located approximately 17 miles north of the Site, in Central Scotland County. This reference reach is located in the same physiographic province and landscape setting. However, the

channel is significantly larger than Site tributaries. The comparison of a small and large drainage area will assist in development of appropriate Site design parameters using dimensionless ratios (see Table B-1 (Appendix B) Morphological Stream Characteristics. Dimensionless ratios allow for comparison of smaller and larger streams (see ratio variables presented in Table B-1).

4.1.2.2 Channel Classification

The reference reach is characterized as an E-type, high sinuosity (1.60) channel with a sand-dominated substrate.

4.1.2.3 Discharge

The reference stream has an approximately 16.9-square mile watershed and a bankfull discharge of 44.3 cubic feet per second based on bankfull indicators.

4.1.2.4 Channel Morphology

Stream cross-sections and profiles were measured along the reference stream (Figure 5B, Appendix A). The stream reach is transporting its sediment supply while maintaining stable dimension, pattern, and profile. Stream geometry measurements for the reference stream are summarized in the Morphological Stream Characteristics Table (Table B1, Appendix B).

Dimension: Data collected at the reference reach indicates a bankfull cross-sectional area of 44.9 square feet, a bankfull width of 20.8 feet, a bankfull depth of 2.2 feet, and a width-to-depth ratio of 9.7. Regional curves predict that the stream should exhibit a bankfull cross-sectional area of approximately 76.4 square feet for the approximate 16.9-square mile watershed (Sweet and Geratz 2003), below the 44.9-square feet displayed by channel bankfull indicators identified in the field. Low bankfull cross sectional area may result from high bedload and low slope conditions for the Site; however, these conditions appear to be in equilibrium as the channel width-to-depth ratio is typical for the area. For a more detailed discussion on bankfull verification see Section 3.5 (Bankfull Verification).

The reference reach exhibits a bank-height ratio of 1.0, which is representative of a stable E-type channel. In addition, the width of the floodprone area is approximately 250 feet giving the channel an entrenchment ratio of 11.6-12.4, typical of a stable E-type channel.

Pattern: In-field measurements of the reference reach have yielded an average sinuosity of 1.60 (thalweg distance/straight-line distance). Other channel pattern attributes include an average pool-to-pool spacing ratio (L_{p-p}/W_{bkf}) of 4.3, a meander wavelength ratio (L_m/W_{bkf}) of 5.5, and a radius of curvature ratio (R_c/W_{bkf}) of 1.3. These variables were measured within a stable, forested reach, which did not exhibit any indications of pattern instability such as shoot cutoffs, abandoned channels, or oxbows.

Profile: Based on elevational profile surveys, the reference reach is characterized by a valley slope of 0.0013 (rise/run). Ratios of the reference reach riffle, run, pool, and glide slopes to average water surface slope are 1.1, 0.8, 3.5, and 0, respectively.

Substrate: The channel is characterized by a channel substrate dominated by sand-sized particles.

4.2 Reference Forest Ecosystem

A Reference Forest Ecosystem (RFE) is a forested area on which to model restoration efforts at the Site in relation to soils and vegetation. RFEs should be ecologically stable climax communities and should be a

representative model of the Site as it likely existed prior to human disturbances. Data describing plant community composition and structure should be collected at the RFEs and subsequently applied as reference data in an attempt to emulate a natural climax community.

The RFEs for this project are located on the two reference reaches and the downstream floodplain of Wilkinson Creek. The RFEs support plant community and landform characteristics that restoration efforts will attempt to emulate. Tree and shrub species identified within the reference forest and outlined in Table 10 will be used, in addition to other relevant species in appropriate Schafale and Weakley (1990) community descriptions.

Table 10. Reference Forest Ecosystem

Cypress-Gum Swamp (Brownwater Subtype)		Coastal Plain Small Stream Swamp (Brownwater Subtype)	
Nyssa aquatica	OBL	Taxodium distichum	OBL
Nyssa biflora	OBL	Nyssa aquatica	OBL
Taxodium distichum	OBL	Quercus michauxii	FACW
Salix nigra	OBL	Quercus shumardii	FAC
Populus heterophylla	OBL	Quercus pagoda	FACW
Carya aquatica	OBL	Quercus laurifolia	FACW
Fraxinus caroliniana	OBL	Quercus nigra	FAC
		Celtis laevigata	FACW
		Platanus occidentalis	FACW
		Betula nigra	FACW
		Salix nigra	OBL
		Nyssa biflora	OBL
		Liriodendron tulipifera	FACU

The cypress-gum swamp (brownwater subtype) vegetative community is proposed for the downstream areas adjoining the larger floodplain of Wilkinson Creek. These are the lowest and wettest portion of the floodplain. This vegetative community is slow to recover from disturbance and due to inundation and poor nutrients is typically characterized by slow growth of tree species.

This community grades upstream to the Coastal Plain small stream swamp vegetative community, but the boundary is indistinct and arbitrary. The Site should be classified as a blackwater subtype; however, sediment washing from upstream agriculture operations makes the system function more typical of a brownwater subtype community. Significant overlap in these two communities should not pose a problem as species in both communities may be planted in the overlap.

4.3 Freshwater Marsh

Some portions of the Site are expected to be dominated by an open, herbaceous vegetative community characteristic of a Coastal Plain semipermanent impoundment as described in Schafale and Weakley (1990). Overbank flooding appears to occur and may result in extended periods of open water and emergent vegetation. Species listed in Table 11 will be included in permanent seeding mix for stabilization.

Table 11. Freshwater Marsh Ecosystem

Freshwater Marsh – Coastal Plain Semi-Permanent Impoundment			
Poygonum spp.	Varies	Limnobium spongia	OBL
Peltandra virginica	OBL	Nymphoides spp.	OBL
Nymphaea odorata	OBL	Potamogeton spp.	OBL
Nuphar lutea	OBL	Utricularia spp.	OBL
Ceratophyllum spp.	OBL	Pontederia cordata	OBL
Myriophyllum spp.	OBL	Sagittaria spp.	OBL
Lemna spp.	OBL	Cephalanthus occidentalis	OBL
Egeria densa	OBL	Rosa palustris	OBL
Elodea spp.	OBL	Decodon verticillatus	OBL

5 CHANNEL ASSESSMENTS

5.1 Channel Stability Assessment

Channel degradation or aggradation occurs when hydraulic forces exceed or do not approach the resisting forces in the channel. The amount of degradation or aggradation is a function of relative magnitude of these forces over time. The interaction of flow within the boundary of open channels is only imperfectly understood. Adequate analytical expressions describing this interaction have yet to be developed for conditions in natural channels. Thus, means of characterizing these processes rely heavily upon empirical formulas.

Traditional approaches for characterizing stability can be placed in one of two categories: 1) maximum permissible velocity and 2) tractive force, or stream power and shear stress. The former is advantageous in that velocity can be measured directly. Shear stress and stream power cannot be measured directly and must be computed from various flow parameters. However, stream power and shear stress are generally better measures of fluid force on the channel boundary than velocity.

Stream power and shear stress were estimated for 1) existing dredged and straightened reaches, 2) the reference reaches, and 3) proposed Site conditions. Important input values and output results (including stream power, shear stress, and per unit shear power and shear stress) are presented in Table 10. Average stream velocity and bankfull discharge values were calculated for the existing Site stream reaches, the reference reach, and proposed conditions.

In order to maintain sediment transport functions of a stable stream system, the proposed channel should exhibit stream power and shear stress values so the channel is neither aggrading nor degrading. Results of the analysis indicate the proposed channel reaches are expected to maintain stream power as a function of width values of approximately 0.12-0.17 and shear stress values of approximately 0.11-0.16 (Table 12).

Table 12. Stream Power (Ω) and Shear Stress (τ) Values

	Bankfull Discharge (ft^3/s)	Water surface Slope (ft/ft)	Total Stream Power (Ω)	Ω/W	Hydraulic Radius	Shear Stress (τ)	Velocity (v)	τ v	τ_{max}
Existing Conditions									
UT 1 – Upstream	3.5	0.0061	1.33	0.10	4.12	1.57	0.06	0.10	2.35
UT 1 – Downstream	12.1	0.0028	2.11	0.17	1.55	0.27	0.54	0.15	0.41
UT 2	4.5	0.0041	1.15	0.15	0.86	0.22	0.60	0.13	0.33
UT 3	6.1	0.0077	2.93	0.38	0.85	0.41	0.74	0.31	0.62
Reference Conditions									
McRae Land Co.	4.3	0.0077	2.07	0.34	0.63	0.30	0.90	0.27	0.46
Jordan Cr	44.3	0.0008	2.21	0.11	1.78	0.09	0.99	0.09	0.13
Proposed Conditions									
UT 1 – Upstream	3.5	0.0054	1.18	0.16	0.46	0.16	0.90	0.14	0.23
UT 1 – Downstream	12.1	0.0031	2.34	0.17	0.84	0.16	0.94	0.15	0.24
UT 3	4.5	0.0035	0.98	0.12	0.52	0.11	0.92	0.10	0.17
UT 3	6.1	0.0039	1.48	0.15	0.60	0.15	0.92	0.13	0.22

McRae Land Company reference reach values for stream power and shear stress are higher due to steeper valley and water surface slopes resulting in higher stream power and shear stress values. Jordan Creek reference reach values for stream power and shear stress are slightly lower due to flatter valley and water surface slopes resulting in slightly lower stream power and shear stress values.

Existing, Site streams are characterized by a wide range of water surface slopes and varying degrees of degradation. In general, stream power values of existing streams are elevated compared to proposed values. Shear stress values of existing streams are significantly elevated as compared to proposed and reference reach values. Proposed stream power and shear stress values appear adequate to mobilize and transport sediment through the Site, without aggradation or erosion on proposed stream banks.

5.2 Bankfull Verification

Discharge estimates for the Site utilize an assumed definition of "bankfull" and the return interval associated with that bankfull discharge. For this study, the bankfull channel is defined as the channel dimensions designed to support the "channel forming" or "dominant" discharge (Gordon et al. 1992). Current research also estimates a bankfull discharge would be expected to occur approximately every 0.1 to 0.3 years (Geratz et al. 2003). This is much shorter than previous state and nationwide estimates in other ecoregions of approximately every 1.3 to 1.5 years (Rosgen 1996, Leopold 1994). The shortened recurrence interval may be attributed to precipitation inputs onto wide, nearly level land with a large surface storage capacity, an elevated water table, and slow flushing rates (Geratz et al. 2003)

Based on available Coastal Plain regional curves, the predicted bankfull discharge for the McRae Land Company and Jordan Creek Reference Reaches is 2.5 and 75.4 cubic feet per second (cfs) for the reference reaches (Sweet and Geratz 2003).

Field indicators of bankfull, primarily topographic breaks identified on the banks, and riffle cross-sections were utilized to obtain an average bankfull cross-sectional area for the reference reaches. The Coastal

Plain regional curves were then utilized to plot the watershed area and discharge for the reference reach cross-sectional area. Field indicators of bankfull approximate an average discharge of 4.3 and 44.3 cfs, respectively for the for the McRae Land Company and Jordan Creek Reference Reaches, which is 59 and 170 percent of that predicted by the regional curves.

The USGS regional regression equation for the Coastal Plain region indicates that bankfull discharge at a 0.1-0.3 year return interval averages approximately 2-5 and 40-90 cfs, respectively (USGS 2006); similar to that predicted by bankfull indicators.

Based on the above analysis of methods to determine bankfull discharge, proposed conditions at the Site will be based on reference reaches. Indicators of bankfull were used at the reference reaches to compare the bankfull cross-sectional area to that predicted by the curves. The designed onsite channel restoration area has been calculated using field indicators of bankfull at the reference reaches (average value) and bankfull indicators identified at the Site. This analysis indicates that design bankfull cross sectional area will equal 115 percent of the channel size indicated by Coastal Plain regional curves. Table 13 summarizes all methods analyzed for estimating bankfull discharge.

Table 13. Reference Reach Bankfull Discharge Analysis

Method	Watershed Area (square miles)	Return Interval (years)	Discharge (cfs)
McRea Land Company Reference Reach			
Coastal Plain Regional Curves (Sweet and Geratz 2003)	0.2	0.1-0.3	2.5
Coastal Plain Regional Regression Model (USGS 2004)	0.2	0.1-0.3	2-5
Field Indicators of Bankfull (Coastal Plain Regional Curves, Sweet and Geratz 2003)	0.2	0.1-0.3	4.3
Jordan Creek Reference Reach			
Coastal Plain Regional Curves (Sweet and Geratz 2003)	16.9	0.1-0.3	75.4
Coastal Plain Regional Regression Model (USGS 2004)	16.9	0.1-0.3	40-90
Field Indicators of Bankfull (Coastal Plain Regional Curves, Sweet and Geratz 2003)	16.9	0.1-0.3	44.3

6 FUNCTIONAL UPLIFT AND PROJECT GOALS/OBJECTIVES

Project goals are based on the *Lumbar River Basin Restoration Priorities* (RBRP) report (NCEEP 2008) and on-site data collection of channel morphology and function observed during field investigations. The Site is located within **Targeted Local Watershed (TLW) 03040204048010** (Figure 2, Appendix A). The RBRP report documents restoration goals for the 03040204 cataloging unit include buffering waterways and implementation of stormwater and agricultural BMPs.

Site specific mitigation goals and objectives have been developed through the use of North Carolina Stream Assessment Method (NC SAM), North Carolina Wetland Assessment Method (NC WAM) analyses of existing and reference stream systems at the Site, and NC DMS October 2020 guidance (NC SFAT 2015 and NC WFAT 2010). NC SAM and NC WAM rate functional metrics for streams and wetlands as high, medium, or low based on field data collected on forms and transferred into a rating calculator. Using

Boolean logic, the rating calculator assigns a high, medium, or low value for each metric and overall function. Site functional assessment data forms are available upon request and model output is included in Appendix B.

Tables 14 through 16 summarize NC SAM and NC WAM metrics targeted for functional uplift and the corresponding mitigation activities proposed to provide functional uplift. NC SAM and NC WAM metrics are not to be used to prove mitigation success; however, these functions have been academically determined as uplift within the Site. Metrics academically targeted to meet the Site's goals and objectives are depicted in bold.

Table 14. NC SAM Summary

NC SAM Function Class Rating Summary	SAM 1 UT 1 (Downstream)	SAM 2 UT 1 (Upstream)	SAM 3 UT 3	SAM 4 UT 2
(1) HYDROLOGY	**LOW**	**LOW**	**LOW**	**LOW**
(2) Baseflow	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(2) Flood Flow	LOW	LOW	LOW	LOW
(3) Streamside Area Attenuation	MEDIUM	LOW	MEDIUM	LOW
(4) Floodplain Access	HIGH	LOW	MEDIUM	LOW
(4) Wooded Riparian Buffer	LOW	MEDIUM	LOW	LOW
(4) Microtopography	LOW	LOW	HIGH	HIGH
(3) Stream Stability	LOW	LOW	LOW	LOW
(4) Channel Stability	LOW	LOW	LOW	LOW
(4) Sediment Transport	LOW	LOW	LOW	LOW
(4) Stream Geomorphology	HIGH	LOW	MEDIUM	MEDIUM
(1) WATER QUALITY	**LOW**	**LOW**	**LOW**	**LOW**
(2) Baseflow	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(2) Stream-side Area Vegetation	MEDIUM	LOW	MEDIUM	MEDIUM
(3) Upland Pollutant Filtration	HIGH	LOW	HIGH	HIGH
(3) Thermoregulation	LOW	MEDIUM	LOW	LOW
(2) Indicators of Stressors	NO	YES	YES	YES
(2) Aquatic Life Tolerance	LOW	LOW	LOW	LOW
(1) HABITAT	**LOW**	**LOW**	**LOW**	**LOW**
(2) In-stream Habitat	LOW	LOW	LOW	LOW
(3) Baseflow	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(3) Substrate	MEDIUM	MEDIUM	MEDIUM	MEDIUM
(3) Stream Stability	LOW	LOW	LOW	LOW
(3) In-Stream Habitat	LOW	LOW	LOW	LOW
(2) Stream-side Habitat	LOW	LOW	LOW	LOW
(3) Stream-side Habitat	LOW	LOW	LOW	LOW
(3) Thermoregulation	LOW	MEDIUM	LOW	LOW
OVERALL	**LOW**	**LOW**	**LOW**	**LOW**

Based on NC SAM output, all three primary stream functional metrics (Hydrology, Water Quality, and Habitat), as well as 20 sub-metrics are under-performing as exhibited by a LOW metric rating (see Figure 4, Appendix A for NC SAM data reaches). LOW performing metrics are to be academically targeted for functional uplift through mitigation activities.

Table 15. NC WAM Summary

NC WAM Sub-function Rating Summary	WAM 1	WAM 2
Wetland Type =	**Bottomland Hardwood Forest**	**Bottomland Hardwood Forest**
(1) HYDROLOGY	**LOW**	**LOW**
(2) Surface Storage & Retention	LOW	LOW
(2) Sub-surface Storage and Retention	LOW	LOW
(1) WATER QUALITY	**LOW**	**MEDIUM**
(2) Pathogen change	LOW	LOW
(2) Particulate Change	LOW	MEDIUM
(2) Soluble change	LOW	MEDIUM
(2) Physical Change	LOW	MEDIUM
(1) HABITAT	**LOW**	**LOW**
(2) Physical Structure	LOW	LOW
(2) Landscape Patch Structure	LOW	MEDIUM
(2) Vegetative Composition	MEDIUM	MEDIUM
OVERALL	**LOW**	**LOW**

NC WAM forms were filled out at two locations in the Site: one upstream of the historic pond bed and one in the pond bed. Typically, NC WAM forms are not filled out in wetland restoration areas. However, the primary functional uplift to wetlands will occur in these areas. Therefore, NC WAM forms were filled out using best professional judgement concerning several sub-functions.

Table 16 outlines stream and wetland functions identified in NC DMS 2020 guidance that will be targeted for functional uplift, restoration goals, and success criteria.

Table 16. Targeted Functions, Goals, Objectives, and Uplift Evaluation

Goal	Objective/Treatment	Likely Functional Uplift	Performance Criteria	Measurement	Cumulative Monitoring Results
Reconnect channels with floodplains and riparian wetlands to allow a natural flooding regime.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain. Remove overburden to reconnect with adjacent wetlands.	Dispersion of high flows on the floodplain, increase in biogeochemical cycling within the system, and recharging of riparian wetlands.	Four bankfull events and within monitoring period.	3 Crest gauges (pressure transducers) on UT 1 and UT 2	To be determined
Improve stability of stream channels.	Construct stream channels that will maintain stable cross- sections, patterns, and profiles over time.	Reduction in sediment inputs from bank erosion, reduction of shear stress, and improved overall hydraulic function.	Bank height ratios remain below 1.2 over the monitoring period. Visual assessments showing progression towards stability.	16 Cross section surveys	To be determined
Restore and enhance native floodplain and streambank vegetation.	Plant native tree and understory species in riparian zones and plant appropriate species on streambanks.	Reduction in floodplain sediment inputs from runoff, increased bank stability, increased LWD and organic material in streams, increased	Survival rate of 320 stems per acre at MY3, 260 planted stems per acre at MY5, and 210 stems per acre at MY7.	23 veg plots and 3 herbaceous plots	To be determined
Restore and enhance groundwater hydrology to drained or impacted hydric soil areas.	Reduce channel depth in incised stream reaches, remove drain tile, fill drainage ditches, and alleviate soil compaction from agriculture activities.	Particulate and pollution conversion, groundwater storage and reduced downstream flooding, habitat diversification, and vegetative composition conversion.	Groundwater saturation within 12 inches of the soil surface for 12 % of the growing season for reestablishment and improvement of hydrology in rehabilitation areas.	16 groundwater gauges	To be determined

Note: Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period.

7 SITE DESIGN AND IMPLEMENTATION CONSTRAINTS

The presence of conditions or characteristics that have the potential to hinder restoration activities on the Site was evaluated. The evaluation focused primarily on the presence of hazardous materials, utilities and restrictive easements, rare/threatened/endangered species or critical habitats, and the potential for hydrologic trespass. Existing information regarding Site constraints was acquired and reviewed. In addition, any Site conditions that have the potential to restrict the restoration design and implementation were documented during the field investigation.

No known Site constraints, that may hinder proposed mitigation activities, were identified during field surveys. Potential constraints reviewed include the following.

7.1 Threatened & Endangered Species

Four federally protected species is listed as occurring in Robeson County as of February 21, 2020 (USFWS 2018); the following table summarizes potential habitat and a preliminary biological conclusion.

Table 17. Endangered Species Act Determinations

Species	Habitat	Potential Habitat at Site	Biological Conclusion
American alligator (Alligator mississippiensis) Threatened due to Similarity of Appearance	The alligator is found rivers, streams, canals, lakes, swamps, and coastal marshes. Adult animals are highly tolerant of salt water, but the young are apparently more sensitive, with salinities greater than 5 parts per thousand considered harmful.	Yes	Not likely to adversely affect
Red-cockaded woodpecker (Picoides borealis) Endangered	The red-cockaded woodpecker (RCW) typically occupies open, mature stands of southern pines, particularly longleaf pine (*Pinus palustris*), for foraging and nesting/roosting habitat. The RCW excavates cavities for nesting and roosting in living pine trees, aged 60 years or older, which are contiguous with pine stands at least 30 years of age to provide foraging habitat. The foraging range of the RCW is normally no more than 0.5 miles.	No	No effect
Bald eagle (Haliaeetus leucocephalus)	Bald eagles typically nest in tall, living trees in a conspicuous location near open water. Eagles forage over large bodies of water and utilize adjacent trees for perching.	Yes	No eagle act permit required
Wood stork (Mycteria americana) Threatened	Wood storks typically construct their nests in medium to tall trees that occur in stands located either in swamps or on islands surrounded by relatively broad expanses of open water. In many areas, bald cypress and red mangrove trees are preferred. During the nonbreeding season or while foraging, wood storks occur in a wide variety of wetland habitats, including freshwater marshes and stock ponds, shallow, seasonally flooded roadside or agricultural ditches, narrow tidal creeks or shallow tidal pools, managed impoundments, and depressions in cypress heads and swamp sloughs. Because of their specialized feeding behavior, the most attractive feeding areas are swamp or marsh depressions where fish become concentrated during dry periods.	Yes	Not likely to adversely affect

Table 17. Endangered Species Act Determinations (continued)

Michaux's sumac (Rhus michauxii) Endangered	Grows in sandy or rocky, open, upland woods on acidic or circumneutral, well-drained sands or sandy loam soils with low cation exchange capacities. The species is also found on sandy or submesic loamy swales and depressions in the fall line Sandhills region as well as in openings along the rim of Carolina bays; maintained railroad, roadside, power line, and utility rights-of way; areas where forest canopies have been opened up by blowdowns and/or storm damage; small wildlife food plots; abandoned building sites; under sparse to moderately dense pine or pine/hardwood canopies; and in and along edges of other artificially maintained clearings undergoing natural succession. In the central Piedmont, it occurs on clayey soils derived from mafic rocks. The plant is shade intolerant and, therefore, grows best where disturbance (e.g., mowing, clearing, grazing, periodic fire) maintains its open habitat.	Yes	Not likely to adversely affect

7.2 Cultural Resources

The term "cultural resources" refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. "Significant" cultural resources are those that are eligible or potentially eligible for inclusion in the National Register of Historic Places. Evaluations of site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO).

Field visits were conducted at the Site in December 2018 and December 2019 to ascertain the presence of structures or other features that may be eligible for inclusion on the National Register of Historic Places. No structures were identified within proposed easement boundaries; however, coordination with SHPO will occur prior to construction activities to determine if any significant cultural resources are present.

7.3 North Carolina Natural Heritage Elements

A query of the North Carolina Natural Heritage Program (NCNHP) database indicates there are no records for rare species, important natural communities, natural areas, or conservation/managed areas within the proposed project boundary. Within a one-mile radius of the project boundary NCNHP lists two state listed species (significantly rare) including the coppery emerald (S*omatochlora georgiana*) and the phantom darter (*Triacanthagyna trifida*). No natural areas or managed areas are documented within a one-mile radius of the Site (Appendix C).

7.4 FEMA

Inspection of the FEMA Flood Insurance Rate Map 3710828800J, Panel 8288, effective January 19, 2005, indicates that downstream of the dam at the Site outfall the floodplain of Wilkinson Creek is mapped as AE floodplain. As the dam historically may have inhibited floodwaters (and therefore the AE floodplain) from extending upstream into the Site, the current breach in the dam may result in the Zone AE floodplain extending into the Site. The Site is not mapped by FEMA as AE floodplain. Correspondence with the local floodplain administrator Dixon Ivey (attached in Appendix F) indicates that no action will be required by FEMA for the project. An EEP floodplain requirement checklist is also include in the Appendix F.

7.5 Utilities

A powerline located parallel to the upper reaches of UT 1 is expected to be moved outside of the proposed conservation easement. This utility is not expected to hinder mitigation activities. No other utilities are located within the proposed conservation easement.

7.6 Air Transport Facilities

No air transport facility is located within 5 miles of the Site.

8 DESIGN APPROACH AND MITIGATION WORK PLAN

8.1 Stream Design

Onsite streams targeted for restoration have endured significant disturbance from land use activities such as impoundment, land clearing, livestock grazing, straightening and rerouting of channels, ditching within the floodplain, and other anthropogenic maintenance. Site streams will be restored to emulate historic conditions at the Site utilizing parameters from nearby, relatively undisturbed reference streams (see Section 4.1 Reference Streams).

Primary activities designed to restore Site streams include 1) stream restoration, 2) stream enhancement (Level I), 3) stream enhancement (Level II), 4) wetland reestablishment, 5) wetland rehabilitation, 6) wetland enhancement, and 7) vegetation planting (Figures 6A-6D, Appendix A).

8.1.1 Stream Restoration

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will be a combination of Priority I and II restoration. Bankfull elevations will be raised to meet the adjacent valley floodplain elevation as soon a tie in elevations may be achieved.

Stream restoration is expected to entail 1) channel excavation, 2) channel stabilization, 3) channel diversion, and 4) channel backfill.

In-stream Structures

In-stream structures will be used for grade control, habitat, and to elevate local water surface profiles in the channel, flattening the water energy slope or gradient and directing stream energy into the center of the channel and away from banks. The structures will consist of log cross-vanes or log j-hook vanes; however, at the discretion of the Engineer, rock cross-vanes or rock j-hook vanes may be substituted if dictated by field conditions. In addition, the structures will be placed in relatively straight reaches to provide secondary (perpendicular) flow cells during bankfull events.

Piped Channel Crossing

Landowner constraints will necessitate the installation of two piped channel crossings upstream, and outside of the easement boundary, to allow access to portions of the property isolated by stream restoration activities Figure 5 (Appendix A). The crossings have been blown out during flooding/dam breach or are currently perched and serve as a barrier to wildlife crossing. The crossings will be constructed with suitable sized pipes to allow for stormwater flows, with adjacent floodplain pipes to allow for overflow discharge onto the floodplain. Materials will include hydraulically stable rip-rap or suitable rock. The crossings will be large enough to handle anticipated vehicular traffic. Approach grades

to the crossings will be at an approximate 10:1 slope and constructed of hard, scour-resistant crushed rock or other permeable material, which is free of fines.

8.1.2 Stream Enhancement (Level I)

Stream enhancement (level I) will entail restoration of stream dimension, installation habitat and grade control structures, easement markers, and planting riparian buffers with native forest vegetation to facilitate stream recovery and prevent further degradation of the stream.

8.1.3 Stream Enhancement (Level II)

Stream enhancement (level II) will entail installation of easement markers and planting riparian buffers with native forest vegetation to facilitate stream recovery and prevent further degradation of the stream.

8.2 Individual Reach Discussions

Mitigation strategies proposed for each reach are presented in Table 19.

Table 18. Individual Reach Descriptions and Functional Uplift

Individual Reach	Mitigation Activities	Functional Uplift Provided for Identified Stressors
UT 1 Upstream	• Install a piped channel crossing at the upper conservation easement boundary to fix the channel elevation and eliminate perched hydrologic step that may hinder wildlife passage. • Tie into upstream property boundary and begin to elevate the stream bed with grade control/habitat structures and contour the channel banks to the appropriate dimension. • Increase sinuosity within the historic channel/new valley. • Elevate the channel to hydrate adjacent wetlands. • Backfill ditches and drain tiles in the adjacent floodplain. • Remove livestock from the property. • Plant a vegetative buffer within the entire floodplain. • Tie into downstream reaches of UT 1 using a series of step-down habitat structures.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Fecal Coliform • Peak Flows • Artificial Barriers • Ditching/Draining • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris
UT-1 Downstream	• Tie into the upper reaches of UT 1 and use a series of stream restoration, enhancement (Level I and II) techniques to develop a channel with the proper dimension, pattern, and profile. • Remove the remnants of the breached dam. • Tie the channel to the downstream property line at the appropriate location and slope. • Remove the dam and sediment plume downstream from the dam to restore wetlands in these areas. • Plant a vegetative buffer within the entire floodplain.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Peak Flows • Artificial Barriers • Habitat Fragmentation • Limited Bedform Diversity • Absence of Large Woody Debris

Table 18. Individual Reach Descriptions and Functional Uplift (continued)

UT-2	• Tie into the upstream property boundary stream elevation. • Remove unconsolidated sediments in the upstream pond and stabilize with suitable material. • Excavate the design channel to the proper dimension, pattern and profile through the reach. • Remove the road crossing/dam from the floodplain. • Restore the stream channel downstream of the impoundment that is currently characterized as a braided stream channel through a sediment wedge. • Remove the gazebo/dock from the banks of the historic pond bed. • Tie into UT 1 across and inner bend at the appropriate elevation. • Plant a vegetative buffer within the entire floodplain.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Artificial Barriers • Peak Flows • Limited Bedform Diversity • Absence of Large Woody Debris
UT-3	• Tie into the upstream property boundary stream elevation. • Contour the channel to the appropriate dimension through the reach using Enhancement (Level I) techniques. • Ease radius of curvatures along the channel. • Tie the lower reaches of the channel into UT 1 across an inner bend. • Plant a vegetative buffer within the entire floodplain.	• Non-functioning riparian buffer/wetland vegetation • Nutrients • Limited Bedform Diversity • Absence of Large Woody Debris

8.3 Wetland Enhancement, Reestablishment, and Rehabilitation

Alternatives for wetland enhancement, reestablishment/rehabilitation are designed to restore a fully functioning wetland system, which will provide surface water storage, nutrient cycling, removal of imported elements and compounds, and will create a variety and abundance of wildlife habitat.

Wetland Enhancement

Wetland enhancement includes areas of existing wetlands (based on the approved PJD) that have been cleared of forest vegetation, have been impounded, or are pasture for livestock grazing. These areas will be planted with native forest vegetation and will have livestock removed/fenced from the area. Planting and livestock removal will enhance 12.25 acres of existing wetland within the Site boundaries.

Wetland Reestablishment

Portions of the Site underlain by hydric soils have been impacted by stream dredging, drain tile installation, vegetative clearing, agriculture grazing, and other land disturbances associated with land use management. Wetland reestablishment options will focus on the restoration of vegetative communities, restoration of stream corridors and historic groundwater tables, as well as the reestablishment of soil structure and microtopographic variations. In addition, the construction of (or provisions for) surface water storage depressions (ephemeral pools) will also add an important component to groundwater restoration activities. Ephemeral pools will constitute depressions in the floodplain (less than 9 inches in depth) that are closed in nature which will trap sediment and organic matter. These depressions will be

round, or elliptical in size and are expected to fill over time. These activities will result in the reestablishment of approximately 4.470 acres of jurisdictional riparian riverine wetlands.

Wetland Rehabilitation

Wetland Rehabilitation will occur in areas of the Site that are currently jurisdictional; however, are currently being affected by groundwater drawdown from ditches, drain tiles, and channel incision. These areas had preconstruction groundwater gauges installed in late May 2020. The location of groundwater gauges are depicted on Figure 4 (Appendix A). Wetland rehabilitation areas should show and improvement in hydrology including increased hydroperiod of the gauge during normal climactic conditions and/or increased stream connectivity from stream overbank flooding. A series of nested groundwater gauges have been installed in the pond bed (Figure 6C, Appendix A). These gauges have been installed at a distance of 10, 20, and 45 feet from the stream top of bank. Nested gauges are installed to show a groundwater drawdown from incised streams in the pond bed. Wetland rehabilitation activities will result in approximately 2.67 acres of improved jurisdiction riparian wetlands. Groundwater gauge data will be included in as-built and annual monitoring reports for comparison to preconstruction gauge data.

8.4 Soil Restoration

Soil grading will occur during stream restoration activities. Topsoil will be stockpiled during construction activities and will be spread on the soil surface once critical subgrade has been established. The replaced topsoil will serve as a viable growing medium for community restoration to provide nutrients and aid in the survival of planted species.

8.5 Natural Plant Community Restoration

Restoration of floodplain forest and stream-side habitat allows for development and expansion of characteristic species across the landscape. Ecotonal changes between community types contribute to diversity and provide secondary benefits, such as enhanced feeding and nesting opportunities for mammals, birds, amphibians, and other wildlife. Reference Forest Ecosystem (RFE) data, onsite observations, and community descriptions from *Classification of the Natural Communities of North Carolina* (Schafale and Weakley 1990) were used to develop the primary plant community associations that will be promoted during community restoration activities.

8.5.1 Planting Plan

Stream-side trees and shrubs include species with high value for sediment stabilization, rapid growth rate, and the ability to withstand hydraulic forces associated with bankfull flow and overbank flood events. Stream-side trees and shrubs will be planted within 15 feet of the channel top of bank throughout the meander belt-width. Shrub elements will be planted along the reconstructed stream banks, concentrated along outer bends. Cypress-Gum Swamp (Brownwater Subtype) is the target community for the lowest portions of the Site with Coastal Plain Small Stream Swamp (Brownwater Subtype) targeted for portions of the Site adjacent. Significant overlap in species for each planting community allows for a broad fringe between the ecological zones.

Table 19 depicts the total number of stems and species distribution within each vegetation association (Figure 9, Appendix A). Planting will be performed between December 1 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season.

Due to floodplain soils being of the Bibb series, scattered openings dominated by herbs and shrubs are likely to develop overtime. These areas are each expected to be less than an acre in size and encompass less than 20% of the Site. The general location of the herbaceous dominated wetlands are depicted on Figure 9 (Appendix A). As the wetland matures, poorly drained soils will make conditions favorable species like those described in a Coastal Plain Semipermanent Impoundment to thrive.

Table 19. Planting Plan

Vegetation Association	**Cypress Gum Swamp***		**Coastal Plain Small Stream Swamp***		**Stream-side Assemblage****		**TOTAL**
Area (acres)	**2.3**		**17.4**		**2.8**		**22.5**
Species	**# planted***	**% of total**	**# planted***	**% of total**	**# planted****	**% of total**	**# planted**
Swamp black gum (*Nyssa biflora)*	391	25	2366	20	776	10	**3533**
Bald cypress (Taxodium distichum)	391	25	2366	20	776	10	**3533**
Tupelo gum (Nyssa aquatica)	391	25	--	--	--	--	**391**
Pond cypress (Taxodium ascendens)	391	25	--	--	--	--	**391**
Water oak (Quercus nigra)	--	--	1775	15	776	10	**2550**
Willow oak (Quercus phellos)	--	--	1775	15	776	10	**2550**
Schumard oak (Quercus schumardii)	--	--	1183	10	776	10	**1959**
American elm (*Ulmus americana*)	--	--	1183	10	776	10	**1959**
Shagbark hickory (*Carya ovata*)	--	--	1183	10	776	10	**1959**
Black willow (*Salix nigra*)	--	--	--	--	776	10	**776**
Tag alder (Alnus serrulata)	--	--	--	--	776	10	**776**
Buttonbush (Cephalanthus occidentalis)	--	--	--	--	776	10	**776**
TOTAL	1564	100	11832	100	7756	100	**21,152**

* Planted at a density of 680 stems/acre.
** Planted at a density of 2720 stems/acre.

8.5.2 Nuisance Species Management

Invasive plant species will be observed and controlled mechanically and/or chemically, as part of this project. No other nuisance species controls are proposed at this time. Inspections for beaver and other potential nuisance species will occur throughout the course of the monitoring period. Appropriate actions may be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis. The presences of nuisance species will be monitored over the course of the monitoring period. Appropriate actions will be taken to ameliorate any negative impacts regarding vegetation development and/or water management on an as-needed basis.

9 MONITORING AND SUCCESS CRITERIA

Monitoring will be conducted by Axiom Environmental, Inc in accordance with 2016 NCIRT Guidelines. Monitoring will occur on the schedule in Table 20. A summary of monitoring is outlined in Table 21 (Figure 10, Appendix A). Annual monitoring reports will be submitted to the NCDMS by Restoration Systems no later than December 31 of each monitoring year data is collected.

Table 20. Monitoring Schedule

Resource	Year 1	Year 2	Year 3	Year 4	Year 5	Year 6	Year 7
Streams	x	x	x		x		x
Wetlands	x	x	x	x	x	x	x
Vegetation	x	x	x		x		x
Visual Assessment	x	x	x	x	x	x	x
Report Submittal	x	x	x	x	x	x	x

Table 21. Monitoring Summary

Stream Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Stream Profile	Full longitudinal survey	As-built (unless otherwise required)	All restored stream channels	Graphic and tabular data.
Stream Dimension	Cross-sections	Years 1, 2, 3, 5, and 7	Total of 16 cross-sections on restored channels	Graphic and tabular data.
Channel Stability	Visual Assessments	Yearly	All restored stream channels	Areas of concern will be depicted on a plan view figure with a written assessment and photograph of the area included in the report.
	Additional Cross-sections	Yearly	Only if instability is documented during monitoring	Graphic and tabular data.
Stream Hydrology	NA	NA	NA	NA
Bankfull Events	Continuous monitoring surface water gauges (pressure transducers) and/or trail camera	Continuous recording through monitoring period	NA	Surface water data for each monitoring period
	Visual/Physical Evidence	Continuous through monitoring period	3 surface water gauges on UT 1 and UT 2	Visual evidence, photo documentation, and/or rain data.

Note: All vegetation plots and stream cross sections have fixed photo point locations. In addition, fixed photo points will be installed at two culverts entering the Site.

Table 21. Monitoring Summary (Continued)

Wetland Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Wetland Restoration	Groundwater gauges	As-built, Years 1, 2, 3, 4, 5, 6, and 7 throughout the year with the growing season defined as March 1-November 6	16 gauges spread throughout restored wetlands	Soil temperature at the beginning of each monitoring period to verify the start of the growing season, groundwater and rain data for each monitoring period. Graphic and tabular data.
Vegetation Parameters				
Parameter	**Method**	**Schedule/Frequency**	**Number/Extent**	**Data Collected/Reported**
Vegetation establishment and vigor	Permanent vegetation plots 0.0247 acre (100 square meters) in size; *CVS-EEP Protocol for Recording Vegetation*, *Version 4.2* (Lee et al. 2008)	As-built, Years 1, 2, 3, 5, and 7	23 plots spread across the Site (2 plots in cypress gum swamp and 21 plots in CP small stream swamp)	Species, height, planted vs. volunteer, stems/acre, areas of concern
	Annual random vegetation plots, 0.0247 acre (100 square meters) in size	As-built, Years 1, 2, 3, 5, and 7	As needed to determine vegetation density in a questionable area	Species and height
	Annual random herbaceous vegetation plots, 0.00247 acre (5 meters by 2 meters) in size	Years 1, 2, 3, 5, and 7	3 plots located in herbaceous dominated vegetation areas	Number of species in plot

Note: Vegetation data should be collected between July 1 and leaf drop. In addition, vegetation data will not be collected until 180 days after Site planting.

9.1 Success Criteria

Monitoring and success criteria for stream restoration should relate to project goals and objectives identified from on-site NC SAM and NC WAM data collection. From a mitigation perspective, several of the goals and objectives are assumed to be functionally elevated by restoration activities without direct measurement. Other goals and objectives will be considered successful upon achieving success criteria. Table 22 summarizes Site success criteria.

Table 22. Success Criteria

Streams
• All streams must maintain an Ordinary High-Water Mark (OHWM), per RGL 05-05. • Bank height ratio (BHR) cannot exceed 1.2 at any measured cross-section. • BHR at any measure riffle cross-section should not change by more than 10% from baseline condition during any given monitoring period. • The stream project shall remain stable and all other performance standards shall be met through four separate bankfull events, occurring in separate years, during the monitoring years 1-7.
Wetland Hydrology
• Saturation or inundation within the upper 12 inches of the soil surface for, at a minimum, 12 percent of the growing season, during average climatic conditions.
Vegetation
• Within planted portions of the site, a minimum of 320 stems per acre must be present at year 3; a minimum of 260 stems per acre must be present at year 5; and a minimum of 210 stems per acre must be present at year 7. • Trees must average 7 feet in height at year 5, and 10 feet in height at year 7 in each plot. • Planted and volunteer stems are counted, provided they are included in the approved planting list for the site; natural recruits not on the planting list may be considered by the IRT on a case-by-case basis. • Herbaceous vegetation plots must have a minimum of three species present.

9.2 Contingency

In the event that stream success criteria are not fulfilled, a mechanism for contingency will be implemented.

9.2.1 Stream Contingency

Stream contingency may include, but may not be limited to 1) structure repair and/or installation; 2) repair of dimension, pattern, and/or profile variables; and 3) bank stabilization. The method of contingency is expected to be dependent upon stream variables that are not in compliance with success criteria. Primary concerns, which may jeopardize stream success, include 1) structure failure, 2) headcut migration through the Site, and/or 3) bank erosion.

Structure Failure

In the event that structures are compromised the affected structure will be repaired, maintained, or replaced. Once the structure is repaired or replaced, it must function to stabilize adjacent stream banks and/or maintain grade control within the channel. Structures which remain intact, but exhibit flow around, beneath, or through the header/footer will be repaired by excavating a trench on the upstream side of the structure and reinstalling filter fabric in front of the pilings. Structures which have been compromised, resulting in shifting or collapse of a header/footer, will be removed and replaced with a structure suitable for Site flows.

Headcut Migration Through the Site

In the event that a headcut occurs within the Site (identified visually or through measurements [i.e. bank-height ratios exceeding 1.4]), provisions for impeding headcut migration and repairing damage caused by the headcut will be implemented. Headcut migration may be impeded through the installation of in-stream grade control structures (rip-rap sill and/or log cross-vane weir) and/or restoring stream geometry variables until channel stability is achieved. Channel repairs to stream geometry may include channel

backfill with coarse material and stabilizing the material with erosion control matting, vegetative transplants, and/or willow stakes.

Bank Erosion

In the event that severe bank erosion occurs within the Site, resulting in incision, lateral instability, and/or elevated width-to-depth ratios locally or systemically, contingency measures to reduce bank erosion and width-to-depth ratio will be implemented. Bank erosion contingency measures may include the installation of log-vane weirs and/or other bank stabilization measures. If the resultant bank erosion induces shoot cutoffs or channel abandonment, a channel may be excavated to reduce shear stress to stable values.

Beaver and other Invasive Species

Indications of beaver establishment will be monitored throughout the 7-year monitoring period. If beaver are identified in the Site, the location of the dam will be depicted on CCPV mapping and the beaver will be trapped during the following fall/winter. Once beaver have been trapped, the dam will be removed. Removal of the dam is expected to occur by hand to minimized disturbance to the adjacent mitigation areas.

When invasive species controls are required by the IRT, species such as multiflora rose (*Rosa multiflora*), Russian olive (*Eleagnus angustifolium*), Chinese privet (*Ligustrum sinense*), and tree of heaven (*Ailanthus altissima*) will be treated by cutting and directly treating the stump with Garlon 4A (or other similar materials) to minimize re-sprouting. Appropriate actions to ameliorate any negative impacts regarding vegetation development and/or water management will occur on an as-needed basis. Additional monitoring, or other contingency measures will be determined by consultation with the IRT.

Road/Culvert Maintenance

Observation of road crossings/culverts will occur during regular monitoring visits conducted at the Site. Culverts will be monitored primarily for blockage; however, if erosion is occurring it will also be noted. Roadbeds, culverts, and crossings will be monitored for the seven-year monitoring period to ensure that no additional sediment deposition is occurring within the Site. Once the seven-year monitoring period has expired, maintenance of the crossing will be the responsibility of the landowner.

Development/Logging

As the Site is primarily agriculture fields and residential property, logging is not an immediate threat to the mitigation resources. In addition, the location of the mitigation Site is not an area under development pressure. Therefore, development is not a concern for contingency at the Site.

Vegetation Issues

If vegetation issues are observed at the Site appropriate actions will be implemented to rectify the vegetation issue at hand and to ensure the issue does not further occur. Issues may include, but may not be limited to beaver, invasive species, encroachment, or poor survivability. Possible rectification may include additional signage installation, fertilization, trapping nuisance species, and spraying invasive species. Coordination with IRT members will be undertaken in extreme conditions and any vegetation action issues will be reported in the annual monitoring report.

9.2.2 Wetland Contingency

Hydrological contingency will require consultation with hydrologists and regulatory agencies if wetland hydrology enhancement is not achieved. Floodplain surface modifications, including construction of ephemeral pools, represent a likely mechanism to increase the floodplain area in support of jurisdictional wetlands. Recommendations for contingency to establish wetland hydrology will be implemented and monitored until Hydrology Success Criteria are achieved.

9.2.3 Vegetation Contingency

If vegetation success criteria are not achieved, supplemental planting may be performed with tree species approved by regulatory agencies. Supplemental planting will be performed as needed until achievement of vegetation success criteria.

9.3 Compatibility with Project Goals

Table 23 (next page) outlines the compatibility of Site performance criteria described above to Site goals and objectives that will be utilized to evaluate if Site goals and objectives are achieved.

10 ADAPTIVE MANAGEMENT PLAN

In the event the mitigation Site or a specific component of the mitigation Site fails to achieve the necessary performance standards as specified in the mitigation plan, the sponsor shall notify NC DMS who is the point of contact for the IRT. NC DMS and the sponsor will work with the IRT to develop contingency plans and remedial actions.

11 LONG-TERM MANAGEMENT PLAN

The Site will be transferred to the NCDEQ Stewardship Program. This party shall serve as conservation easement holder and long-term steward for the property and will conduct periodic inspection of the Site to ensure that restrictions required in the conservation easement are upheld. Funding will be supplied by the responsible party on a yearly basis until such time an endowment is established. The NCDEQ Stewardship Program is developing an endowment system within the non-reverting, interest-bearing Conservation Lands Conservation Fund Account. The use of funds from the Endowment Account will be governed by North Carolina General Statute GS 113A-232(d)(3). Interest gained by the endowment fund may be used for the purpose of stewardship, monitoring, stewardship administration, and land transaction costs, if applicable.

Table 23. Compatibility of Performance Criteria to Project Goals and Objectives

Goals	Objectives	Success Criteria
(1) HYDROLOGY		
• Minimize downstream flooding to the maximum extent possible. • Connect streams to functioning wetland systems.	• Construct new channel at historic floodplain elevation to restore overbank flows and restore jurisdictional wetlands • Plant woody riparian buffer • Remove livestock • Remove a ditch/drain tile network that contributes surface waters directly to the channel • Protect riparian buffers with a perpetual conservation easement	• BHR not to exceed 1.2 • Document four overbank events in separate monitoring years • Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded
• Increase stream stability within the Site so that channels are neither aggrading nor degrading.	• Construct channels with proper pattern, dimension, and longitudinal profile • Remove livestock from the Site • Construct stable channels that do not contribute sediment to downstream receiving waters. • Plant woody riparian buffer	• Cross-section measurements indicate a stable channel with appropriate substrate • Visual documentation of stable channels and structures • BHR not to exceed 1.2 • < 10% change in BHR in any given year • Livestock excluded from the easement • Attain Vegetation Success Criteria
(1) WATER QUALITY		
• Remove direct nutrient and pollutant inputs from the Site and reduce contributions to downstream waters.	• Remove livestock and reduce agricultural land/inputs • Plant woody riparian buffer • Restore/enhance jurisdictional wetlands adjacent to Site streams • Remove a ditch/drain tile network that contributes surface waters directly to the channel • Restore overbank flooding by constructing channels at historic floodplain elevation.	• Livestock excluded from the easement • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria
(1) HABITAT		
• Improve instream and stream-side habitat.	• Construct stable channels with woody debris available as instream habitat • Plant woody riparian buffer to provide organic matter and shade • Construct new channel at historic floodplain elevation to restore overbank flows • Protect riparian buffers with a perpetual conservation easement • Restore/enhance jurisdictional wetlands adjacent to Site streams • Stabilize stream banks • Install in-stream structures	• Cross-section measurement indicate a stable channel with appropriate substrate • Visual documentation of stable channels and in-stream structures. • Attain Wetland Hydrology Success Criteria • Attain Vegetation Success Criteria • Conservation Easement recorded

12 REFERENCES

Environmental Laboratory. 1987. Corps of Engineers Wetlands Delineation Manual. Technical Report Y-87-1. United States Army Engineer Waterways Experiment Station, Vicksburg, Mississippi.

Gordon, N.D., T.A. McMahon, and B.L. Finlayson. 1992. Stream Hydrology: an Introduction for Ecologists. John Wiley & Sons, Ltd. West Sussex, England.

Griffith, G.E., J.M. Omernik, J.A. Comstock, M.P. Schafale, W.H. McNab, D.R. Lenat, T.F. MacPherson, J.B. Glover, and V.B. Shelbourne. 2002. Ecoregions of North Carolina and South Carolina. U.S. Geological Survey, Reston, Virginia.

Lee, M.T., R.K. Peet, S.D. Roberts, and T.R. Wentworth. 2008. CVS-EEP Protocol for Recording Vegetation. Version 4.2. North Carolina Department of Environment and Natural Resources, Ecosystem Enhancement Program. Raleigh, North Carolina.

North Carolina Department of Environmental Quality (NCDEQ). 2018a. Final 2016 Category 5 Assessments -303(d) List (online). Available: https://files.nc.gov/ncdeq/Water%20Quality/Planning/TMDL/303d/2016/2016_NC_Category_5_303d_list.pdf (February 4, 2019).

North Carolina Department of Environmental Quality (NCDEQ). 2018b. Draft 2018 North Carolina 303(d) List (online). Available: https://files.nc.gov/ncdeq/Water%20Quality/Planning/TMDL/303d/2018/2018-DRAFT-NC-303-d--ListwCover.pdf (February 4, 2019).

North Carolina Division of Mitigation Services (NCDMS). 2016. Quantifying Benefits to Water Quality from Livestock Exclusion and Riparian Buffer Establishment for Stream Restoration. June 15, 2016. North Carolina Department of Environmental Quality, Raleigh, North Carolina.

North Carolina Division of Water Resources (NCDWR). 2013. River Basin Classification Schedule: Lumber (online). Available: https://files.nc.gov/ncdeq/Water%20Quality/Planning/CSU/Surface%20Water/River%20Basin%20Water%20Quality%20Classifications%20as%20of%20Dec%209%202013/Lumber_Hydro_order.pdf (December 18, 2019).

North Carolina Ecosystem Enhancement Program (NCEEP 2008). Lumber River Basin Restoration Priorities 2008 (online). Available: https://files.nc.gov/ncdeq/Mitigation%20Services/Watershed_Planning/Lumber_River_Basin/Lumber_RBRP_2008_FINAL.pdf. North Carolina Department of Environment and Natural Resources, Raleigh (December 18, 2018).

North Carolina Stream Functional Assessment Team. (NC SFAT 2015). N.C. Stream Assessment Method (NC SAM) User Manual. Version 2.1.

North Carolina Wetland Functional Assessment Team. (NC WFAT 2010). N.C. Wetland Assessment Method (NC WAM) User Manual. Version 4.1.

Rosgen, D. 1996. Applied River Morphology. Wildland Hydrology (Publisher). Pagosa Springs, Colorado

Rosgen, D. 2009. A Practical Method of Computing Streambank Erosion Rate (online). Available: http://www.u-s-c.org/html/documents/Erosionrates.pdf.

Rosgen, D. 2011. Estimating Sediment Loads using the Bank Assessment of Non-point source Consequences of Sediment (BANCS). Watershed Assessment of River Stability and Sediment Supply (WARSSS). Hagerstown , Maryland.

Schafale, M.P. and A.S. Weakley. 1990. Classification of the Natural Communities of North Carolina: Third Approximation. North Carolina Natural Heritage Program, Division of Parks and Recreation, North Carolina Department of Environment, Health, and Natural Resources. Raleigh, North Carolina.

Schafale, M.P. 2012. Guide to the Natural Communities of North Carolina: Fourth Approximation. North Carolina Natural Heritage Program, North Carolina Department of Environment and Natural Resources. Raleigh, North Carolina.

Simon A, Hupp CR. 1986. Geomorphic and Vegetative Recovery Processes Along Modified Tennessee Streams: An Interdisciplinary Approach to Disturbed Fluvial Systems. Forest Hydrology and Watershed Management. IAHS-AISH Publ.167.

Sweet, W.V. and J.W. Geratz. 2003. Bankfull Hydraulic Geometry Relationships and Recurrence Intervals for North Carolina's Coastal Plain. J. of the American Water Resources Association (JAWRA) 39(4):861-871.

United States Army Corps of Engineers (USACE). 2010. Interim Regional Supplement to the Corps of Engineers Wetland Delineation Manual, Eastern Mountains and Piedmont Region.

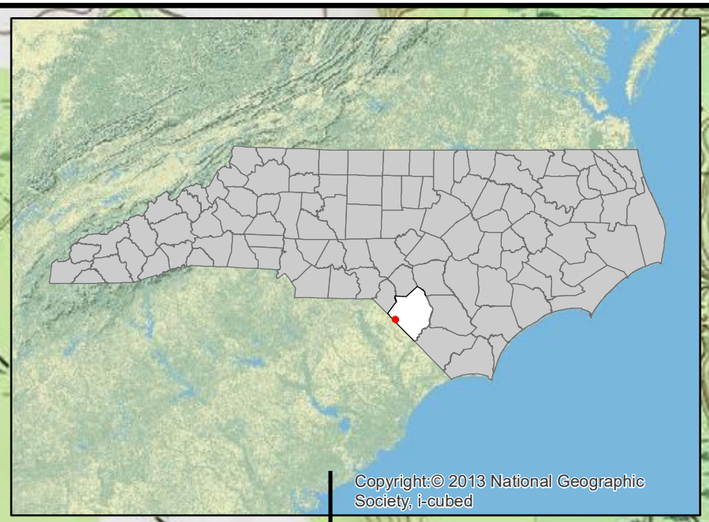
United States Department of Agriculture (USDA). 2020. Web Soil Survey (online). Available: https://websoilsurvey.sc.egov.usda.gov/App/HomePage.htm [February 10, 2020]. United States Department of Agriculture.

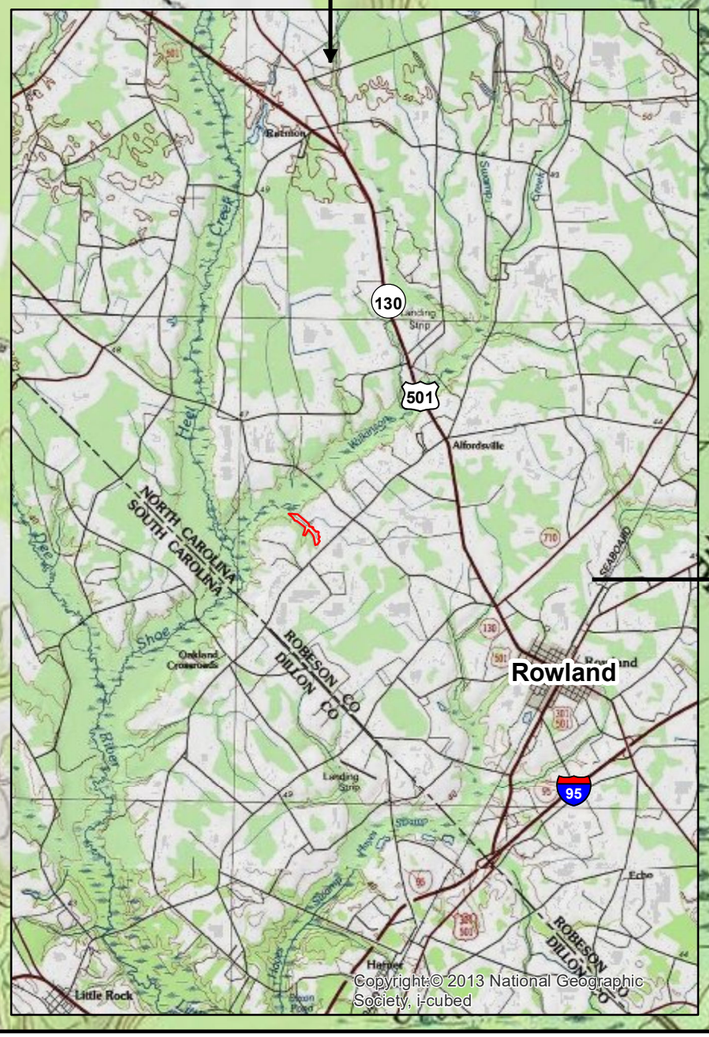
United States Department of Agriculture (USDA). 1987. Soil Survey of Robeson County, North Carolina. Soil Conservation Service.

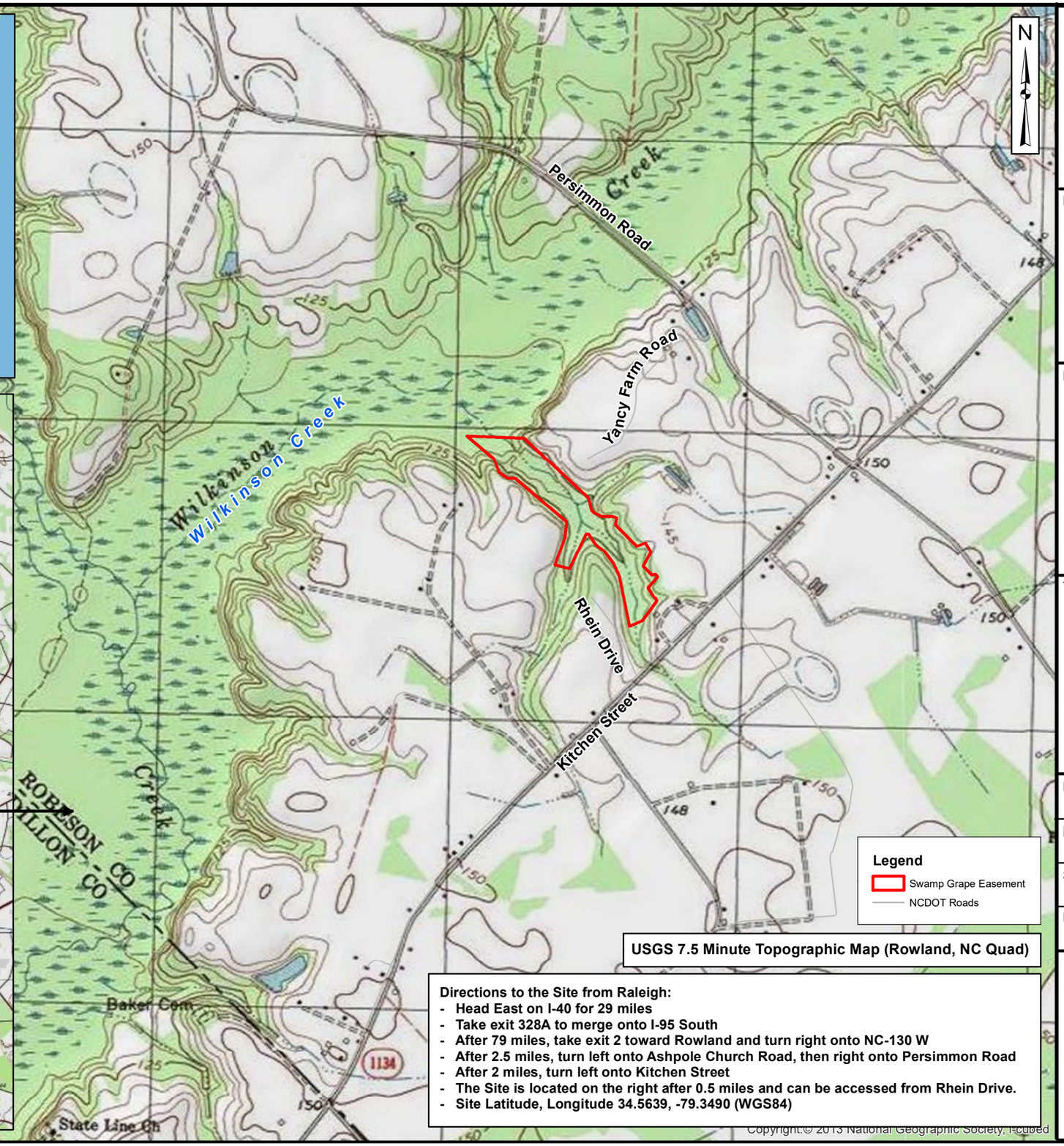
United States Fish and Wildlife Service (USFWS). 2018. Endangered Species, Threatened Species, Federal Species of Concern, and Candidate Species, Robeson County, North Carolina (online). Available: https://www.fws.gov/raleigh/species/cntylist/alamance.html [February 21, 2020].

United States Geological Survey (USGS). 2006. Estimating the Magnitude and Frequency of Floods in Rural Basins of North Carolina – Recompiled. USGS Water-Resources Investigations Report 01-4207. Raleigh, North Carolina.

APPENDIX A - FIGURES







USGS 7.5 Minute Topographic Map (Rowland, NC Quad)

Directions to the Site from Raleigh:
- **Head East on I-40 for 29 miles**
- **Take exit 328A to merge onto I-95 South**
- **After 79 miles, take exit 2 toward Rowland and turn right onto NC-130 W**
- **After 2.5 miles, turn left onto Ashpole Church Road, then right onto Persimmon Road**
- **After 2 miles, turn left onto Kitchen Street**
- **The Site is located on the right after 0.5 miles and can be accessed from Rhein Drive.**
- **Site Latitude, Longitude 34.5639, -79.3490 (WGS84)**

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

SITE LOCATION

Drawn by: KRJ

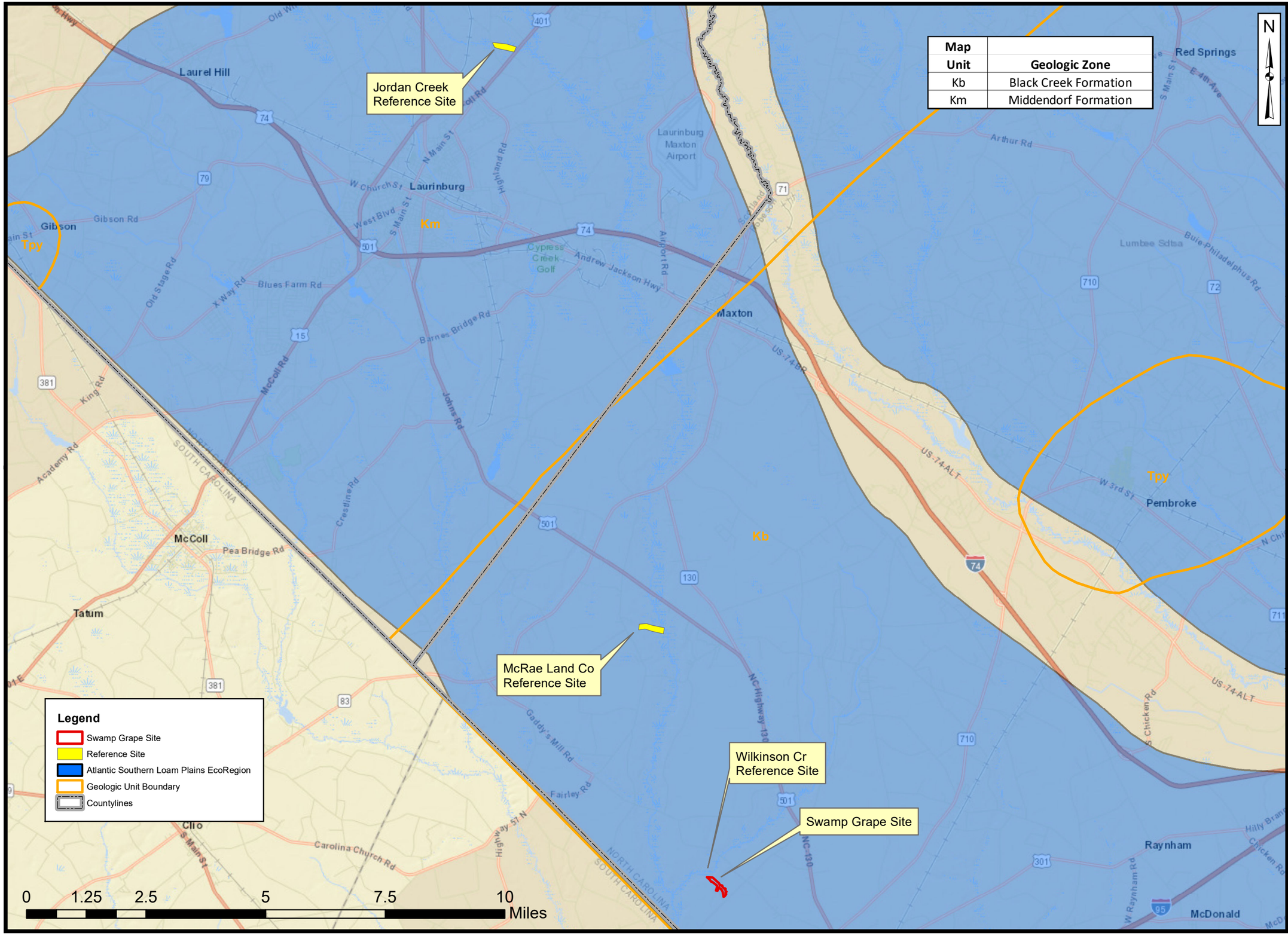
Date: APR 2020

Scale: 1:15,000

Project No.: 20-003

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

REFERENCE SITE LOCATIONS

Drawn by: WGL

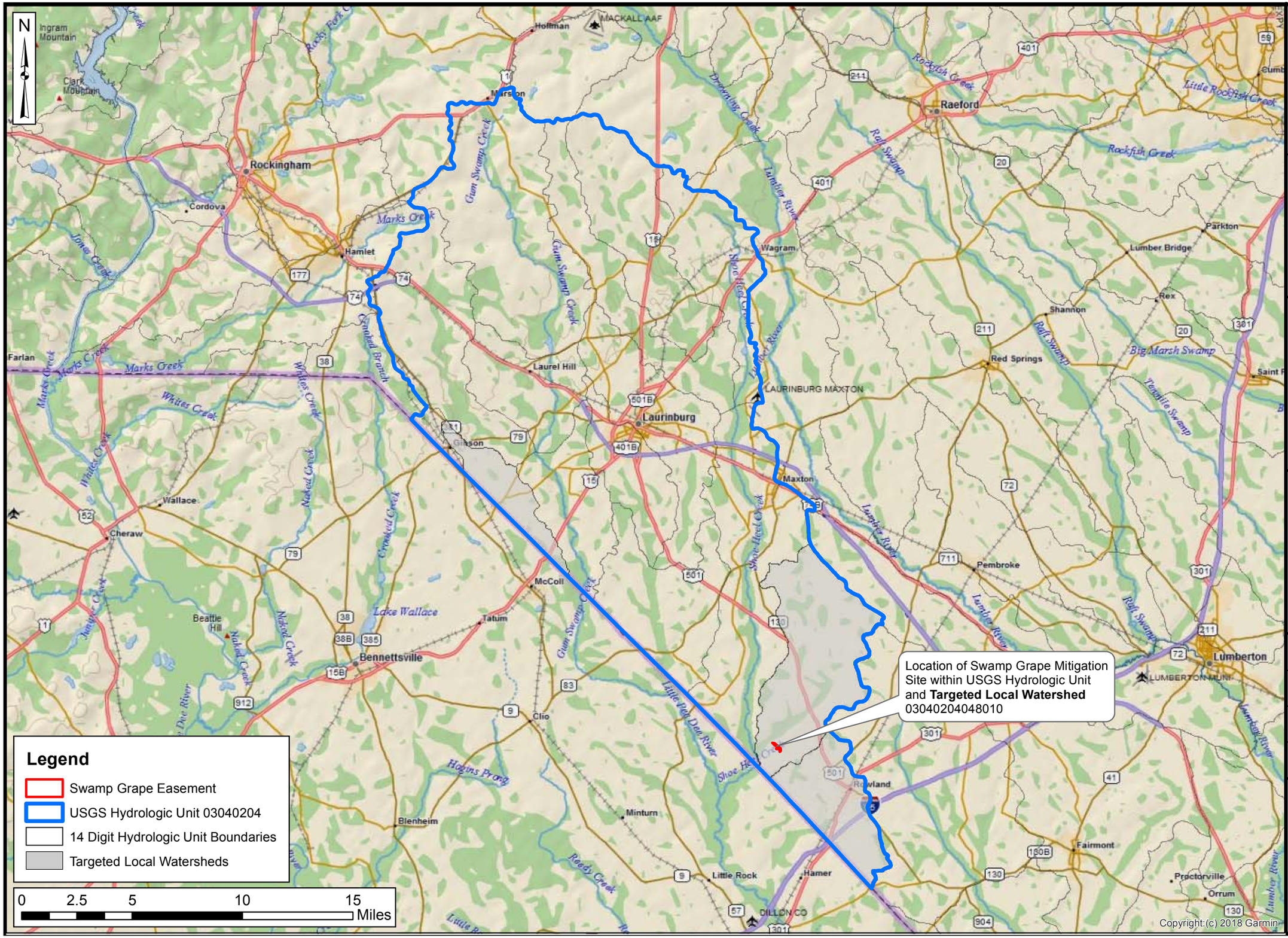
Date: SEPT 2020

Scale: 1:120,000

Project No.: 20-003

FIGURE

1A



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

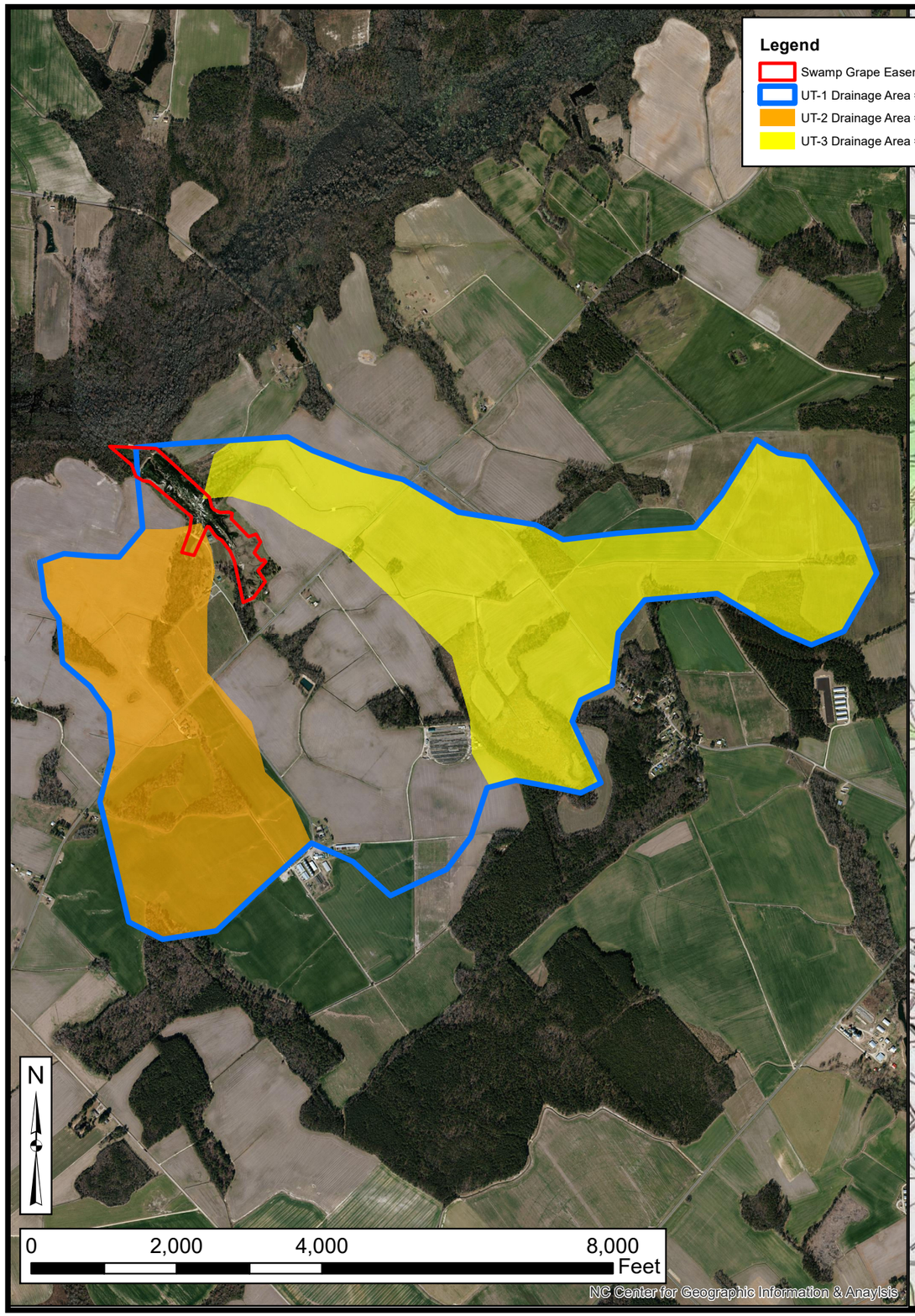
Date: APR 2020

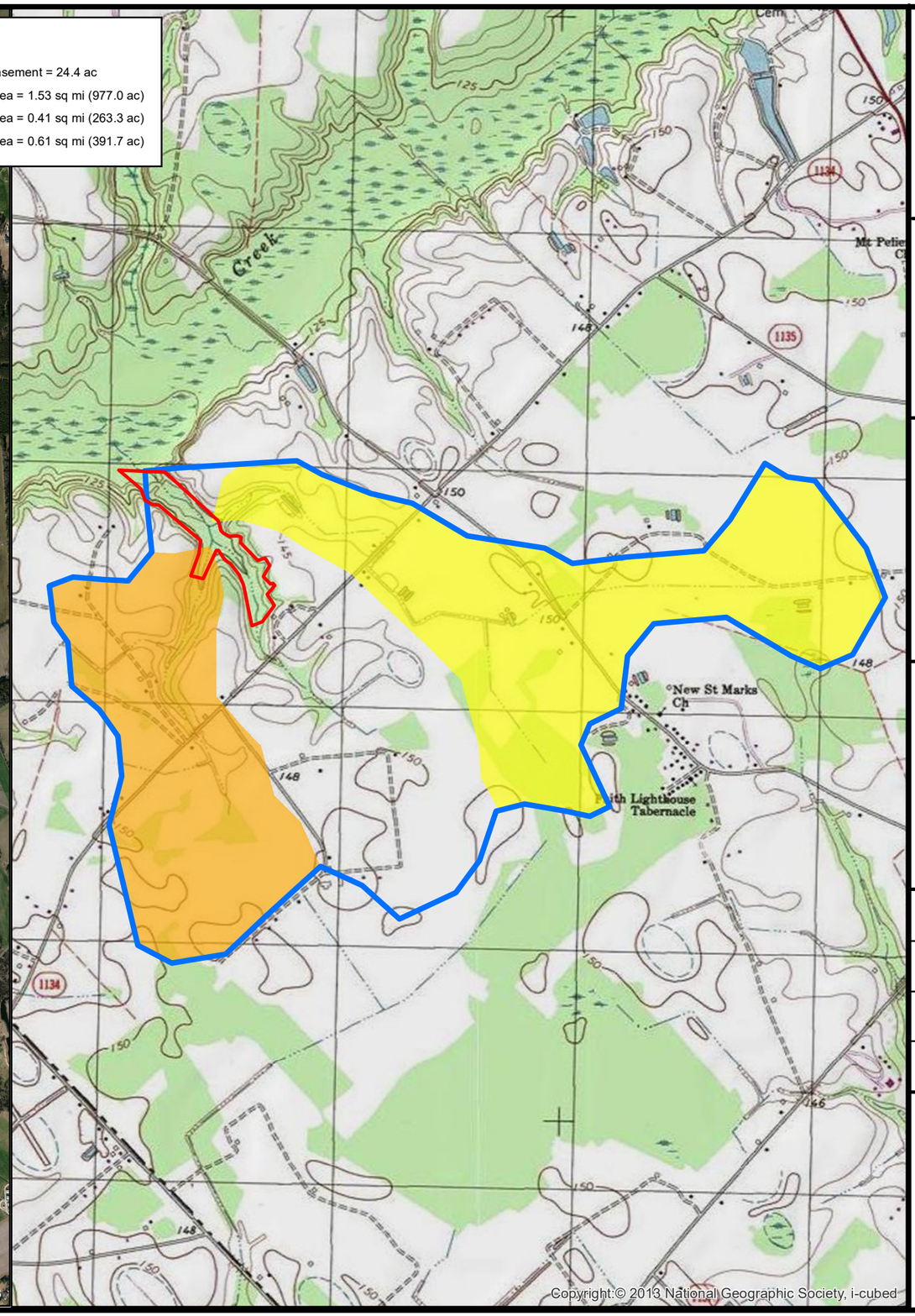
Scale: 1:260,000

Project No.: 20-003

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: KRJ

Date: APR 2020

Scale: 1:21,000

Project No.: 20-003

FIGURE

3

Soil Map Unit	Soil Series
AyA	Aycock very fine sandy loam
BB	Bibb soils
FaB	Faceville fine sandy loam
WaB, WaC	Wagram loamy sand

N

Groundwater Gauges Nested at 10, 20, and 45 ft from Channel.

NCSAM Form #1 Score: Low

NCSAM Form #3 Score: Low

Groundwater Gauges Nested at 10, 20, and 45 ft from Channel.

NCSAM Form #4 Score: Low

NCWAM Form #2 Score: Low

NCSAM Form #2 Score: Low

NCWAM Form #1 Score: Low

UT-1

UT-2

UT-3

GW-01 GW-03 GW-04 GW-06 GW-07 GW-08 GW-09 GW-10 GW-11 GW-12

WaC WaB FaA FaB NoB NoA BB W Tr AyA ExA

Legend

- Swamp Grape Easement = 24.4 ac
- Existing_streams_aerial = 3941 ft
- Existing Wetlands = 15.9 ac
- Hydric_Soil = 5.4 ac
- Existing Ditches
- Drain_Tile
- Existing Foot Path
- Preconstruction Groundwater Gauges
- NC SAM Form
- NC WAM Form
- Soil Boundary
- 2-foot Lidar Contours

0 300 600 Feet

NC Center for Geographic Information & Anaylsis

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

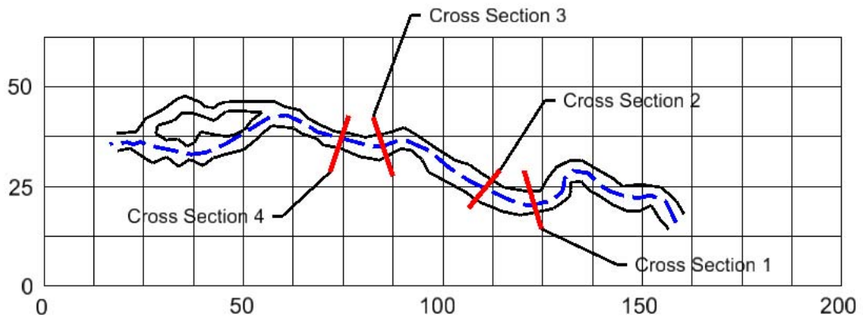
Date: APR 2020

Scale: 1:3200

Project No.: 20-003

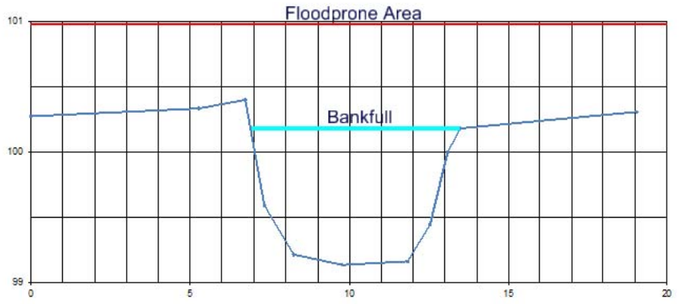
FIGURE

4

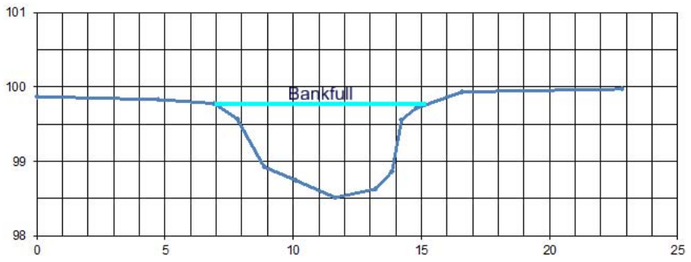


Reference Pattern
Lp-p = 21 (11 - 39) ft
Lm = 35 (23 - 44) ft
Wbelt = 14 (12 - 17) ft
Rc = 7 (5 - 13) ft
Lp-p/Wbkf = 3.5 (1.8 - 6.5)
Lm/Wbkf = 5.9 (3.9 - 7.4)
Wbelt/Wbkf = 2.3 (2.0 - 2.8)
Rc/Wbkf = 1.1 (0.8 - 2.1)
SIN = 1.13

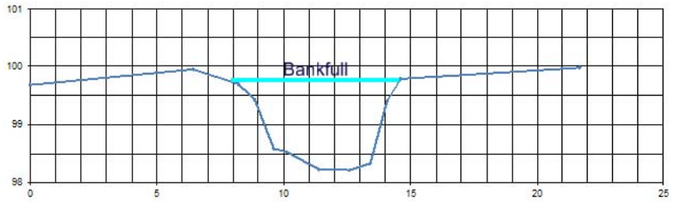
Pattern Legend
- Top of Bank
- Thalweg
- Cross Section



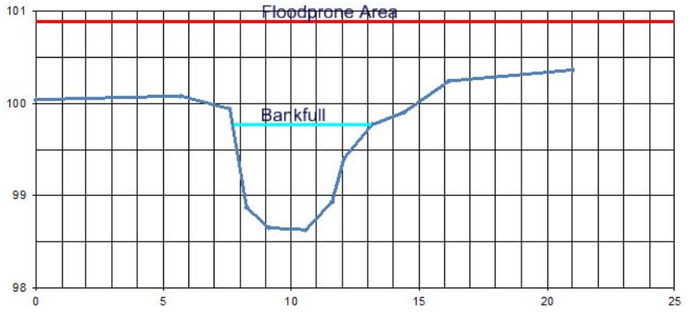
Cross Section 2 - Riffle
Abkf = 5.4 ft
Dave = 0.8 ft
Wbkf = 6.6 ft
Dmax = 1.0 ft
Bank Height = 1.0 ft
Bank Height Ratio = 1.0
W/D = 8.0
FPA = 75
ENT = 11.4
Stream Type = E



Cross Section 3 - Pool
Abkf = 6.5 ft
Wbkf = 8.5 ft
Dmax = 1.3 ft

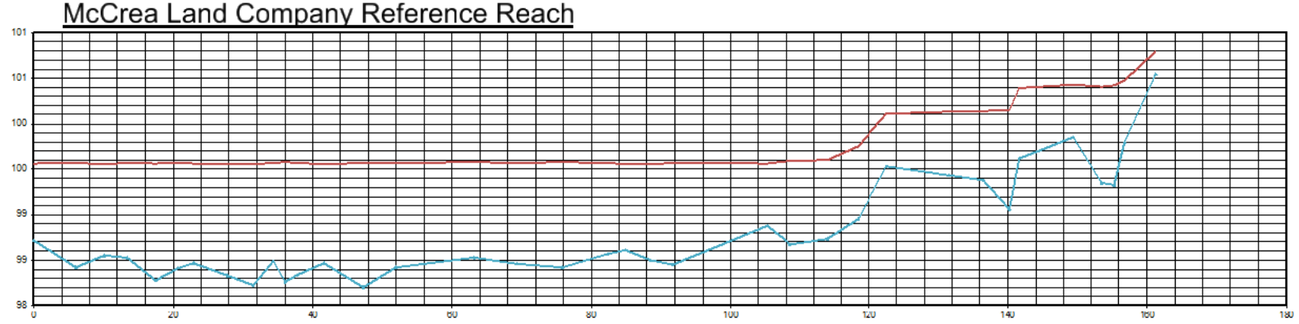


Cross Section 1 - Pool
Abkf = 7.0 ft
Wbkf = 7.1 ft
Dmax = 1.6 ft



Cross Section 4 - Riffle
Abkf = 4.2 ft
Dave = 0.8 ft
Wbkf = 5.4 ft
Dmax = 1.1 ft
Bank Height = 1.1 ft
Bank Height Ratio = 1.0
W/D = 7.0
FPA = 75
ENT = 13.8
Stream Type = E

McCrea Land Company Reference Reach



Profile (Reference Reach)
Save = 0.0077 rise/run
Svalley = 0.0087 rise/run
Sriffle = 0.0026 (0 - 0.0712) rise/run
Spool = 0.0020 (0 - 0.0057) rise/run
Srun = 0.0060 (0 - 0.1700) rise/run
Sglide = 0.0002 (0 - 0.0075) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

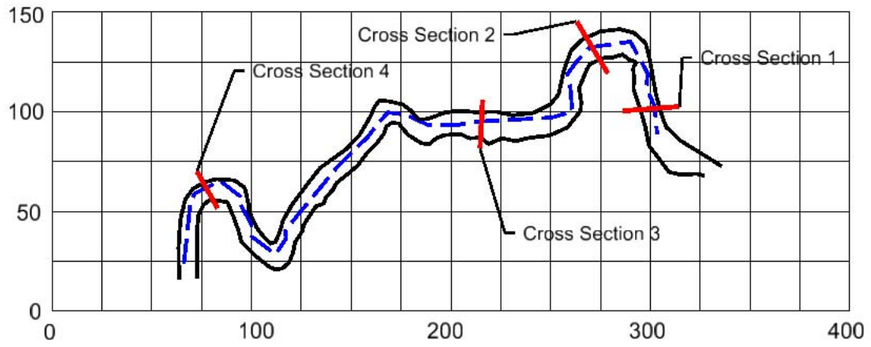
NOTES/REVISIONS

Project:
Swamp Grape Mitigation Site
Robeson County
North Carolina

Title:
McRae Land Company Reference Reach Dimension, Pattern, and Profile

Scale: NA
Date: Feb 2020
Project No.: 20-003

FIGURE NO.
5A

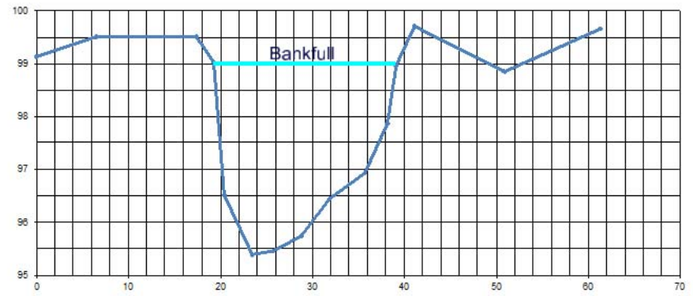


Reference Pattern

Lp-p = 89 (49 - 152) ft
Lm = 115 (63 - 166) ft
Wbelt = 99 (75 - 134) ft
Rc = 26 (13 - 53) ft
Lp-p/Wbkf = 4.3 (2.4 - 7.3)
Lm/Wbkf = 5.5 (3.0 - 8.0)
Wbelt/Wbkf = 4.5 (3.6 - 5.4)
Rc/Wbkf = 1.3 (0.6 - 2.6)
SIN = 1.60

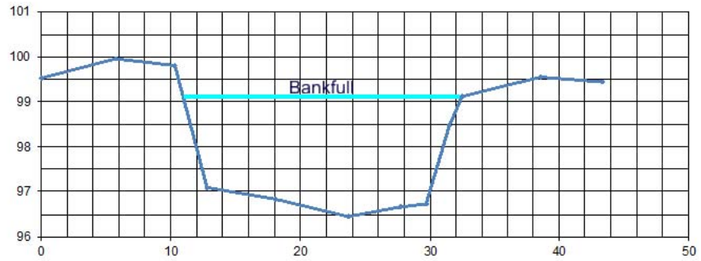
Pattern Legend

- Top of Bank
- Thalweg
- Cross Section



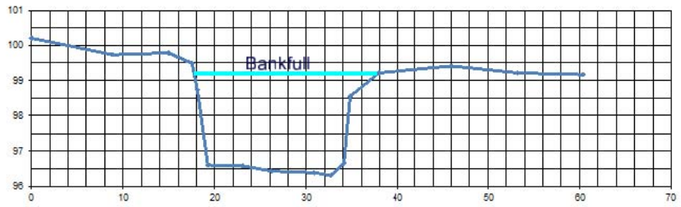
Cross Section 2 - Pool

Abkf = 52.5 ft
Wbkf = 24.4 ft
Dmax = 3.6 ft



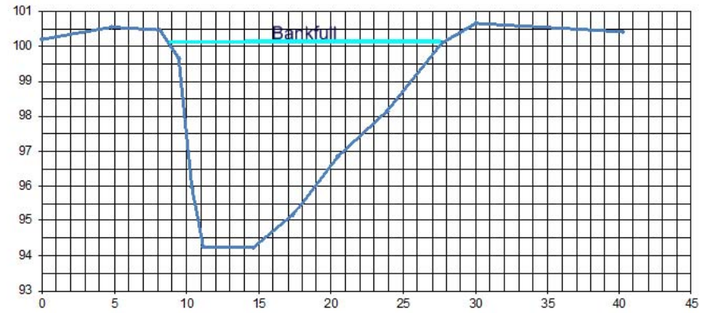
Cross Section 3 - Riffle

Abkf = 45.1 ft
Dave = 2.1 ft
Wbkf = 21.5 ft
Dmax = 2.7 ft
Bank Height = 2.7 ft
Bank Height Ratio = 1.0
W/D = 10.3
FPA = 250
ENT = 11.6
Stream Type = E



Cross Section 1 - Riffle

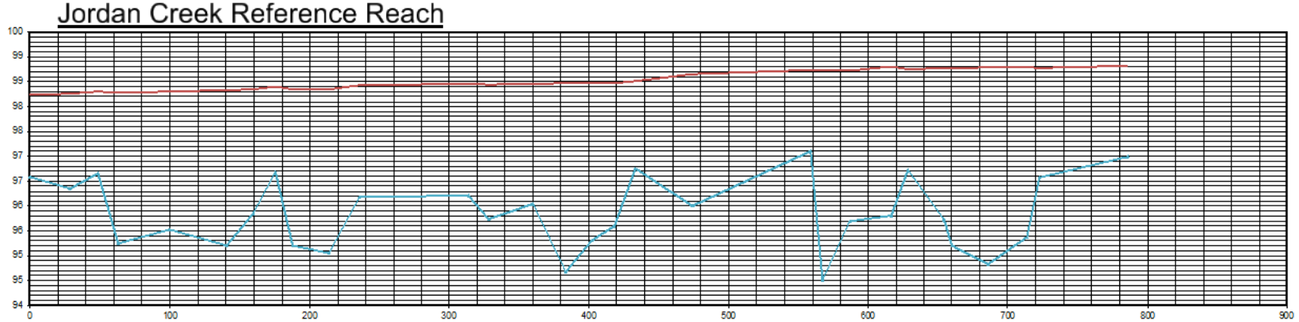
Abkf = 44.6 ft
Dave = 2.2 ft
Wbkf = 20.1 ft
Dmax = 2.9 ft
Bank Height = 2.9 ft
Bank Height Ratio = 1.0
W/D = 9.1
FPA = 250
ENT = 12.4
Stream Type = E



Cross Section 4 - Pool

Abkf = 68.4 ft
Wbkf = 19.6 ft
Dmax = 6.0 ft

Jordan Creek Reference Reach



Profile (Reference Reach)

Save = 0.0008 rise/run
Svalley = 0.0013 rise/run
Sriffle = 0.0008 (0.0003 - 0.0018) rise/run
Spool = 0.0006 (0 - 0.0014) rise/run
Srun = 0.0026 (0 - 0.0038) rise/run
Sglide = 0.0000 (0 - 0.0001) rise/run

- Water Surface
- Channel Bed

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

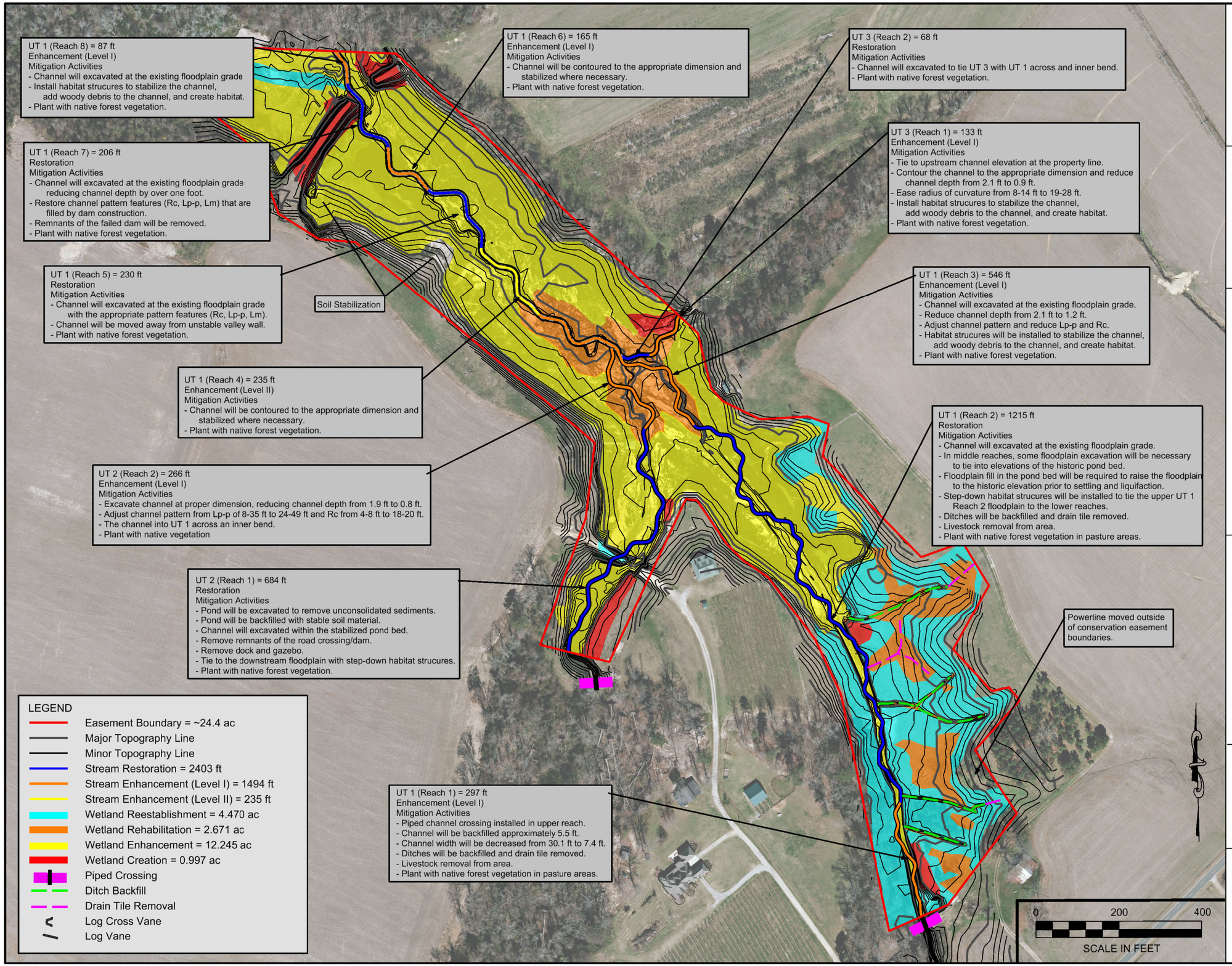
Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:

Jordan Creek Reference Reach Dimension, Pattern, and Profile

Scale:	FIGURE NO.
NA	5B
Date: Feb 2020	
Project No.: 20-003	



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

RESTORATION PLAN

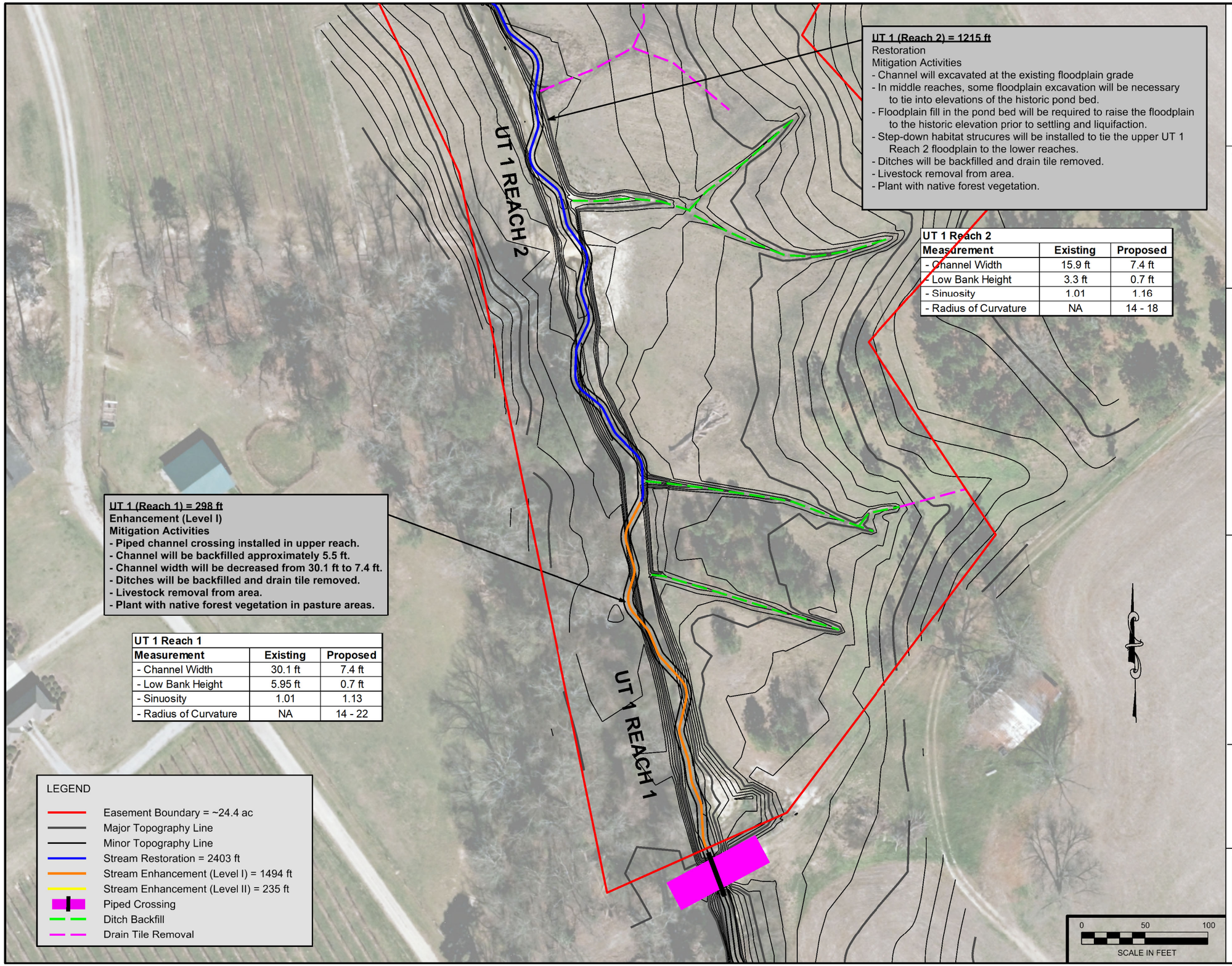
Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

6



UT 1 Reach 2		
Measurement	**Existing**	**Proposed**
- Channel Width	15.9 ft	7.4 ft
- Low Bank Height	3.3 ft	0.7 ft
- Sinuosity	1.01	1.16
- Radius of Curvature	NA	14 - 18

UT 1 Reach 1		
Measurement	**Existing**	**Proposed**
- Channel Width	30.1 ft	7.4 ft
- Low Bank Height	5.95 ft	0.7 ft
- Sinuosity	1.01	1.13
- Radius of Curvature	NA	14 - 22

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

MITIGATION JUSTIFICATION

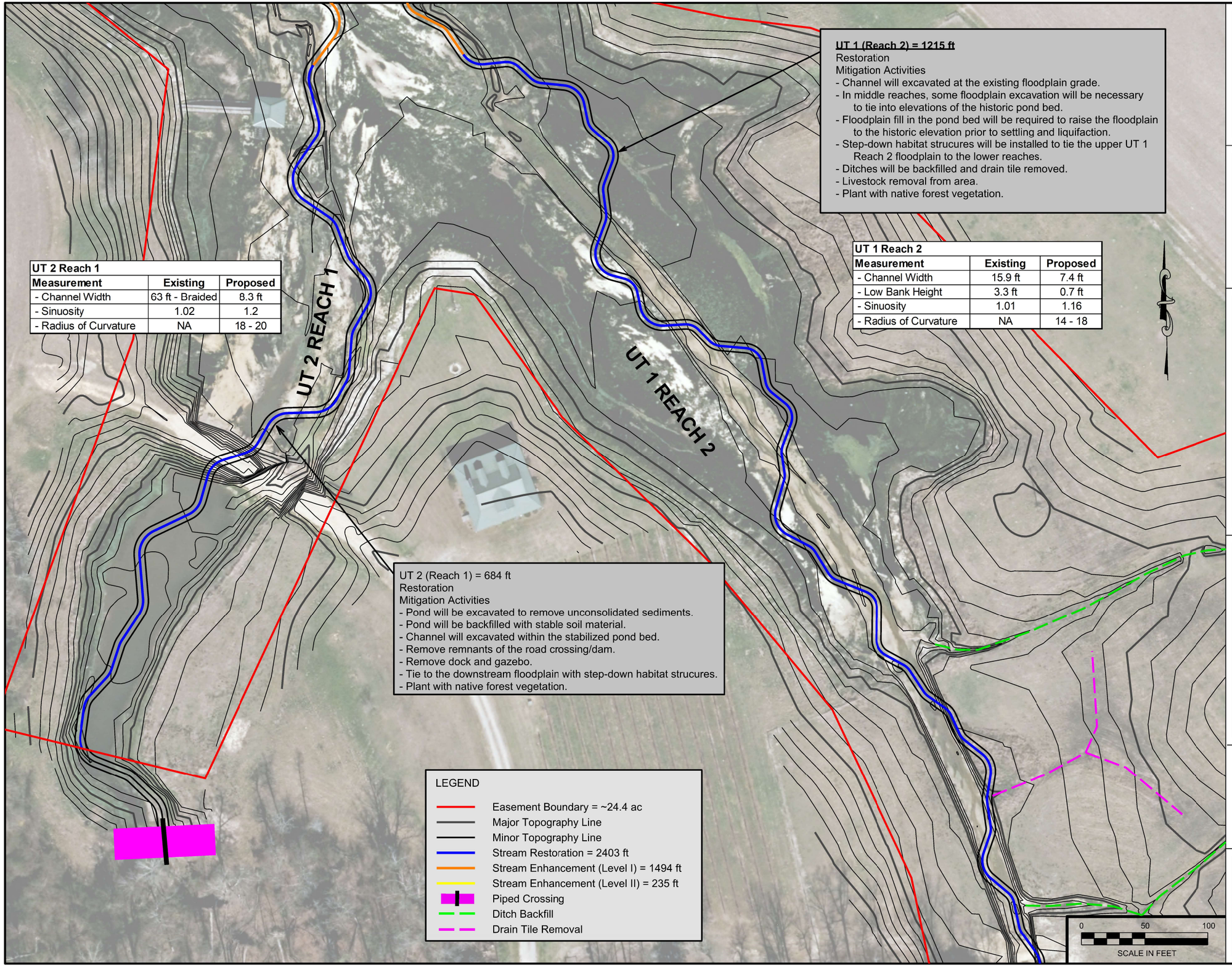
Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

6A



UT 1 (Reach 2) = 1215 ft
Restoration
Mitigation Activities
- Channel will excavated at the existing floodplain grade.
- In middle reaches, some floodplain excavation will be necessary to tie into elevations of the historic pond bed.
- Floodplain fill in the pond bed will be required to raise the floodplain to the historic elevation prior to settling and liquifaction.
- Step-down habitat strucures will be installed to tie the upper UT 1 Reach 2 floodplain to the lower reaches.
- Ditches will be backfilled and drain tile removed.
- Livestock removal from area.
- Plant with native forest vegetation.

UT 2 Reach 1		
Measurement	**Existing**	**Proposed**
- Channel Width	63 ft - Braided	8.3 ft
- Sinuosity	1.02	1.2
- Radius of Curvature	NA	18 - 20

UT 1 Reach 2		
Measurement	**Existing**	**Proposed**
- Channel Width	15.9 ft	7.4 ft
- Low Bank Height	3.3 ft	0.7 ft
- Sinuosity	1.01	1.16
- Radius of Curvature	NA	14 - 18

UT 2 (Reach 1) = 684 ft
Restoration
Mitigation Activities
- Pond will be excavated to remove unconsolidated sediments.
- Pond will be backfilled with stable soil material.
- Channel will excavated within the stabilized pond bed.
- Remove remnants of the road crossing/dam.
- Remove dock and gazebo.
- Tie to the downstream floodplain with step-down habitat strucures.
- Plant with native forest vegetation.

LEGEND
- Easement Boundary = ~24.4 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 2403 ft
- Stream Enhancement (Level I) = 1494 ft
- Stream Enhancement (Level II) = 235 ft
- Piped Crossing
- Ditch Backfill
- Drain Tile Removal

0 50 100
SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

MITIGATION JUSTIFICATION

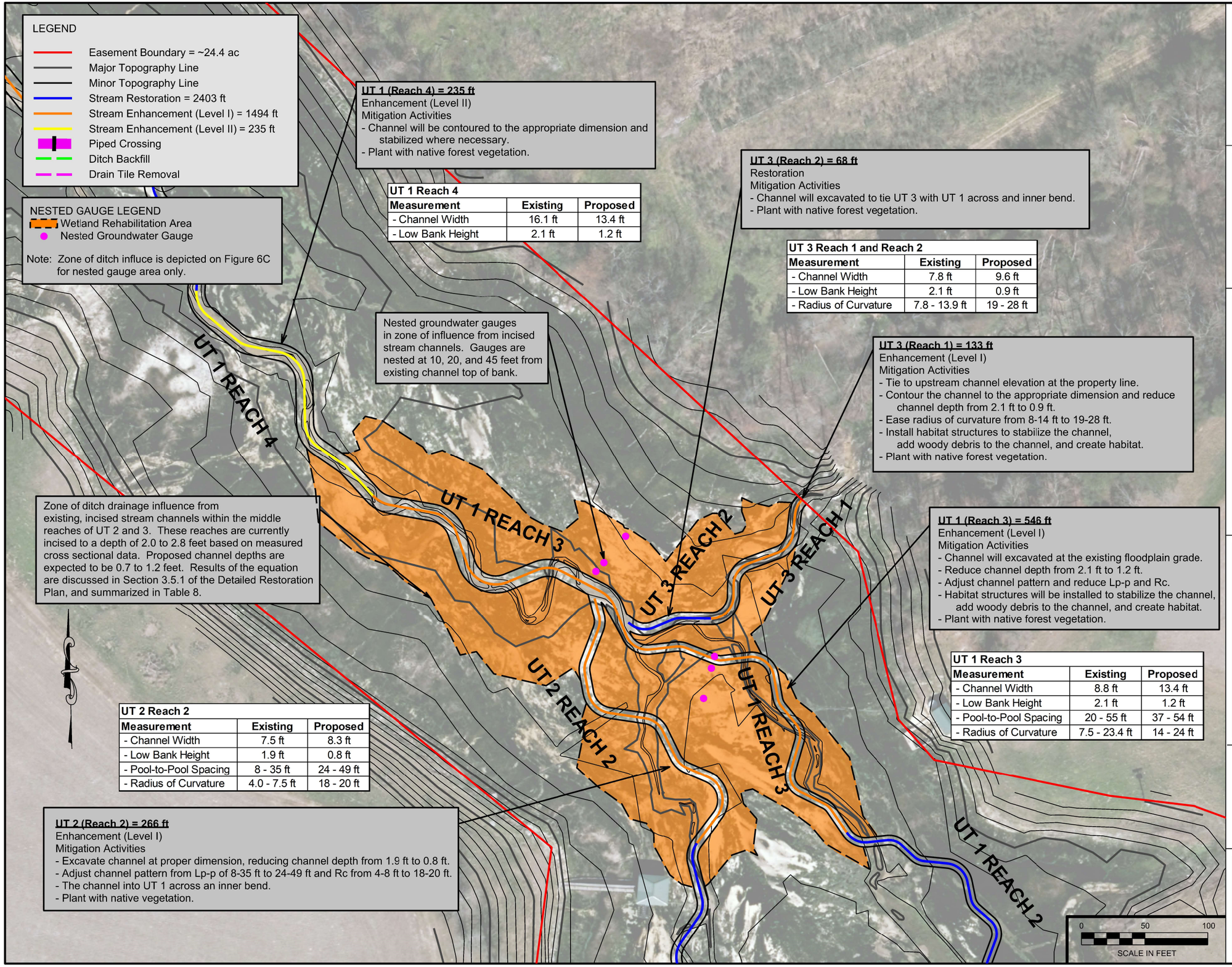
Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

6B



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

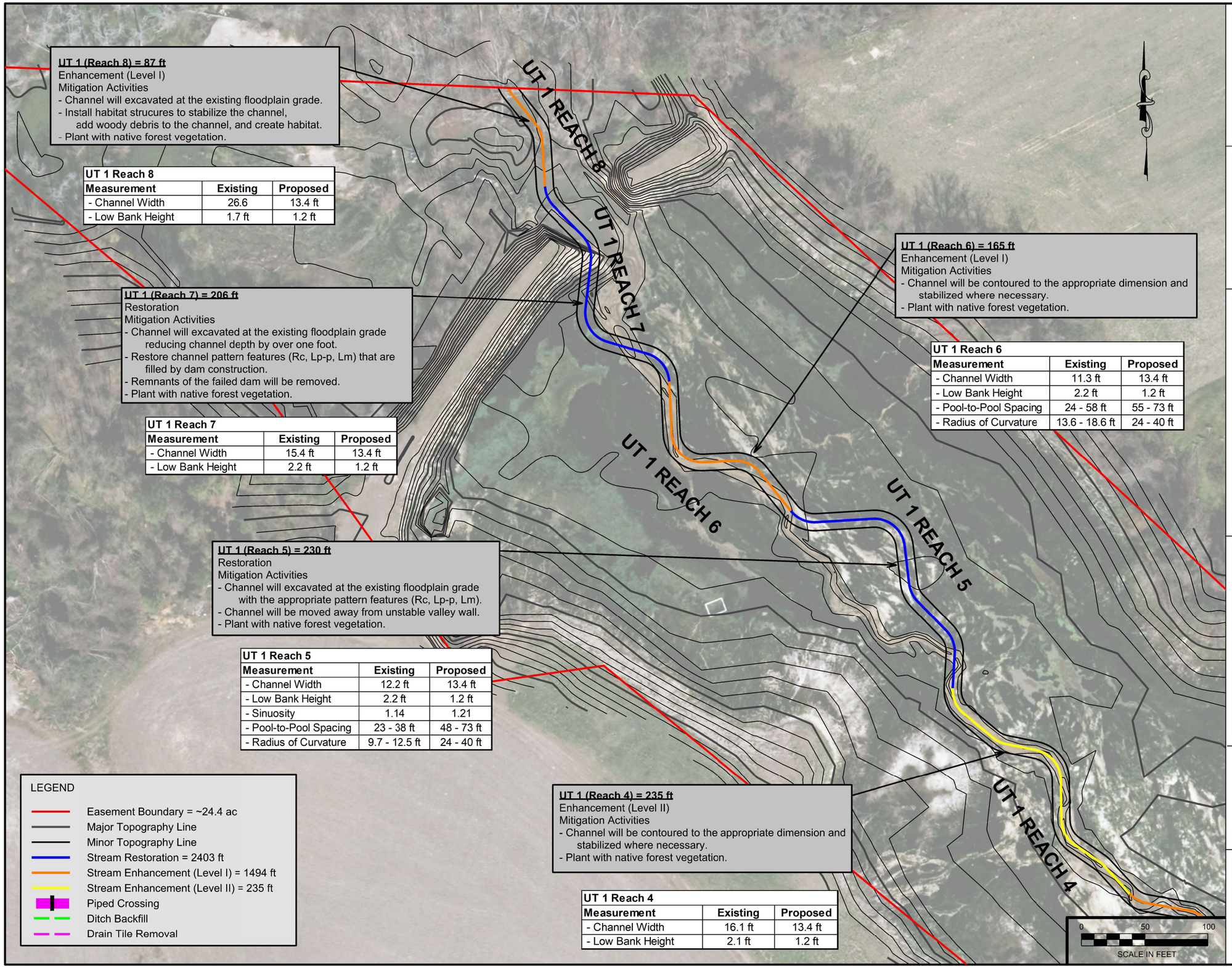
Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:

MITIGATION JUSTIFICATION

Scale:	FIGURE NO.
AS SHOWN	6C
Date: Mar 2020	
Project No.: 20-003	



UT 1 (Reach 8) = 87 ft
Enhancement (Level I)
Mitigation Activities
- Channel will excavated at the existing floodplain grade.
- Install habitat strucures to stabilize the channel, add woody debris to the channel, and create habitat.
- Plant with native forest vegetation.

UT 1 Reach 8		
Measurement	**Existing**	**Proposed**
- Channel Width	26.6	13.4 ft
- Low Bank Height	1.7 ft	1.2 ft

UT 1 (Reach 7) = 206 ft
Restoration
Mitigation Activities
- Channel will excavated at the existing floodplain grade reducing channel depth by over one foot.
- Restore channel pattern features (Rc, Lp-p, Lm) that are filled by dam construction.
- Remnants of the failed dam will be removed.
- Plant with native forest vegetation.

UT 1 Reach 7		
Measurement	**Existing**	**Proposed**
- Channel Width	15.4 ft	13.4 ft
- Low Bank Height	2.2 ft	1.2 ft

UT 1 (Reach 6) = 165 ft
Enhancement (Level I)
Mitigation Activities
- Channel will be contoured to the appropriate dimension and stabilized where necessary.
- Plant with native forest vegetation.

UT 1 Reach 6		
Measurement	**Existing**	**Proposed**
- Channel Width	11.3 ft	13.4 ft
- Low Bank Height	2.2 ft	1.2 ft
- Pool-to-Pool Spacing	24 - 58 ft	55 - 73 ft
- Radius of Curvature	13.6 - 18.6 ft	24 - 40 ft

UT 1 (Reach 5) = 230 ft
Restoration
Mitigation Activities
- Channel will excavated at the existing floodplain grade with the appropriate pattern features (Rc, Lp-p, Lm).
- Channel will be moved away from unstable valley wall.
- Plant with native forest vegetation.

UT 1 Reach 5		
Measurement	**Existing**	**Proposed**
- Channel Width	12.2 ft	13.4 ft
- Low Bank Height	2.2 ft	1.2 ft
- Sinuosity	1.14	1.21
- Pool-to-Pool Spacing	23 - 38 ft	48 - 73 ft
- Radius of Curvature	9.7 - 12.5 ft	24 - 40 ft

UT 1 (Reach 4) = 235 ft
Enhancement (Level II)
Mitigation Activities
- Channel will be contoured to the appropriate dimension and stabilized where necessary.
- Plant with native forest vegetation.

UT 1 Reach 4		
Measurement	**Existing**	**Proposed**
- Channel Width	16.1 ft	13.4 ft
- Low Bank Height	2.1 ft	1.2 ft

LEGEND
- Easement Boundary = ~24.4 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 2403 ft
- Stream Enhancement (Level I) = 1494 ft
- Stream Enhancement (Level II) = 235 ft
- Piped Crossing
- Ditch Backfill
- Drain Tile Removal

0 50 100
SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

MITIGATION JUSTIFICATION

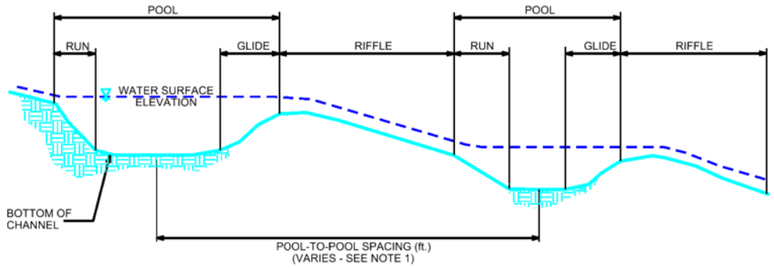
Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

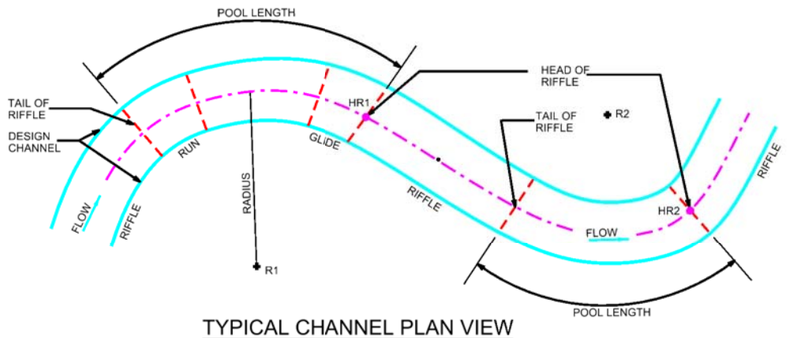
6D



TYPICAL CHANNEL PROFILE

NOTES:

1. POOL-TO-POOL SPACING IS MEASURED FROM CENTER OF POOL BEND TO CENTER OF POOL BEND.

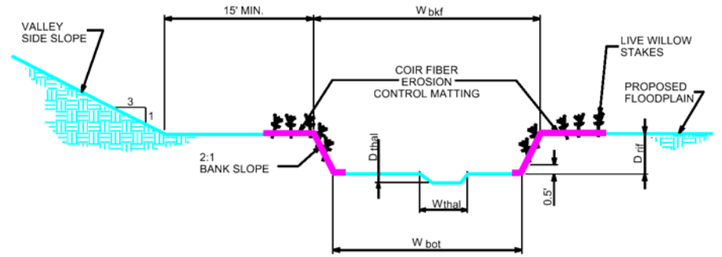


TYPICAL CHANNEL PLAN VIEW

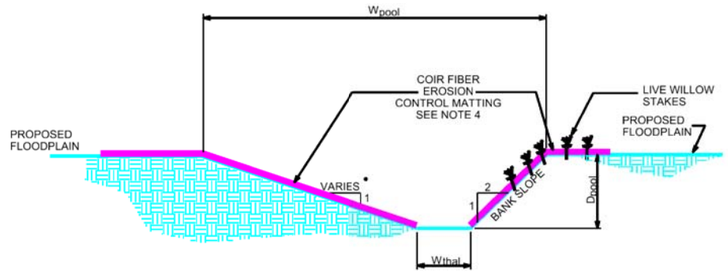
CHANNEL PLAN VIEW NOTES:

1. THE CONTRACTOR SHALL LAYOUT THE CHANNEL ALIGNMENT BY LOCATING THE RADII AND SCRIBING THE CENTER LINE FOR EACH POOL BEND. THE CONNECTING TANGENT SECTIONS SHALL COMPLETE THE LAYOUT OF THE CHANNEL.

2. FIELD ADJUSTMENTS OF THE ALIGNMENT MAY BE REQUIRED TO SAVE TREES OR AVOID OBSTACLES. THE STAKE-OUT SHALL BE APPROVED BY THE CONSTRUCTION MANAGER BEFORE CONSTRUCTION OF THE CHANNEL.



TYPICAL RIFFLE CROSS-SECTION



TYPICAL POOL CROSS-SECTION

CHANNEL CONSTRUCTION NOTES:

1. MATERIAL EXCAVATED FROM CHANNEL AND FLOODPLAIN SHALL BE USED TO BACKFILL EXISTING CHANNEL.

2. BANK PROTECTION SHALL CONSIST OF NATURAL COIR FIBER MATTING.

CROSS-SECTION DIMENSIONS

REACH	Wbkf (ft.)	Wbot (ft.)	Driff (ft.)	Dthal (ft.)	Dpool (ft.)	Wpool (ft.)	Wthal (ft.)
UT 1 Upstream of UT 2	7.4	4.6	0.6	0.1	0.9	8.9	3.5
UT 1 Downstream of UT 2	13.4	8.6	1.1	0.1	1.6	16.1	6.5
UT 2	8.3	5.1	0.7	0.1	1.0	9.9	3.9
UT 3	9.6	6.0	0.8	0.1	1.2	11.5	4.3

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:

PROPOSED DIMENSION, PATTERN, AND PROFILE

Scale: NA

Date: Mar 2020

Project No.: 20-003

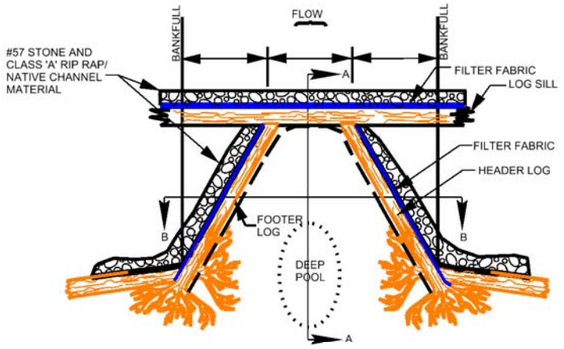
FIGURE NO.

7

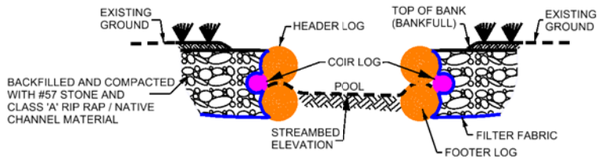
LOG CROSS VANE

SCALE:NTS

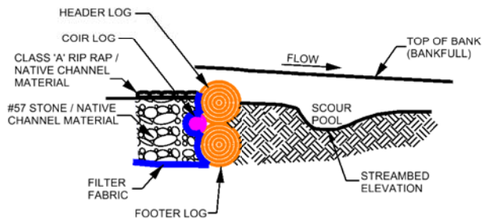
PLAN VIEW



NOTES:
1. HEADER AND FOOTER LOGS SHALL BE A MINIMUM OF 18" DIAMETER AND SHALL BE A HARDWOOD SPECIES. (FOOTER LOG MAY BE SUBSTITUTED WITH PINE)
2. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
3. ALL STONES ARE TO BE STRUCTURE STONES.
4. FILTER FABRIC SHALL BE PLACED ON THE UPSTREAM SIDE OF THE STRUCTURE TO PREVENT WASHOUT OF SEDIMENT THROUGH LOG GAPS. FILTER FABRIC SHALL EXTEND FROM THE BOTTOM OF THE FOOTER TO THE FINISHED GRADE ELEVATION AND SHALL BE PLACED THE ENTIRE LENGTH OF THE STRUCTURE.
5. PERPENDICULAR ROOTWAD LOGS ARE REQUIRED IF THE LOG VANE ARM DOES NOT HAVE A ROOTBALL TO TIE INTO THE BANK.



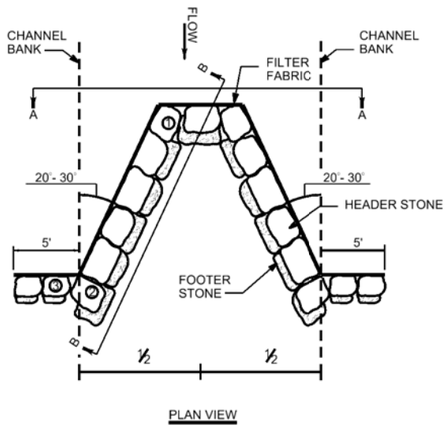
SECTION B-B



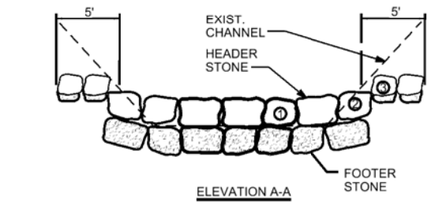
SECTION A-A

REACH	ARM LENGTH (FT.)	CHANNEL DEPTH (FT.)
UT 1 Upstream of UT 2	8	0.6-0.9
UT 1 Downstream of UT 2	14	1.2 - 1.6
UT 2 and 3	9	0.7 - 1.1

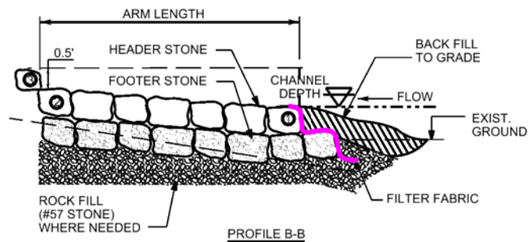
NOTE:
HEADER AND FOOTER STONES ARE LARGE, ANGULAR BOULDERS MEASURING A MINIMUM OF 24" ALONG THE SHORTEST DIMENSION.



PLAN VIEW

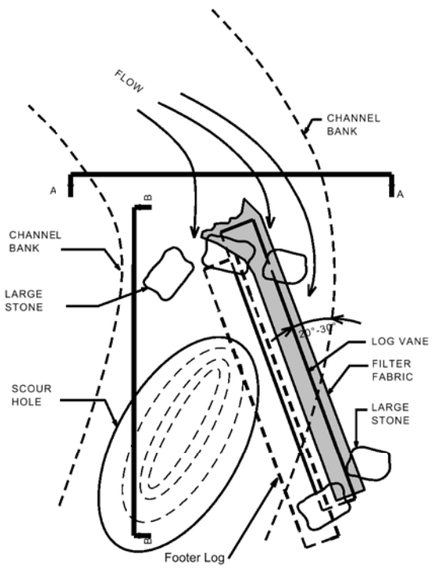


ELEVATION A-A



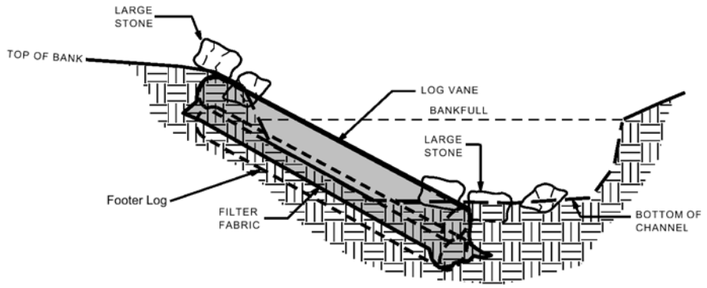
PROFILE B-B

TYPICAL CROSS-VANE

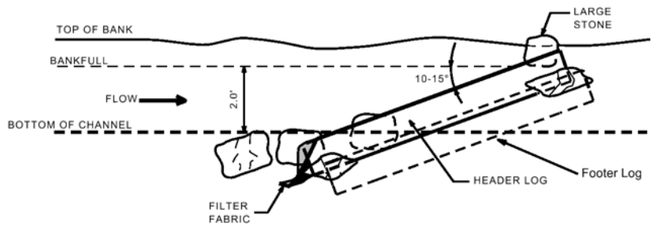


NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

PLAN VIEW
SCALE: N.T.S.



CROSS-SECTION A-A
SCALE: N.T.S.



PROFILE B-B
SCALE: N.T.S.

NOTE:
FILTER FABRIC TOED IN AND DRAPED ON UPSTREAM SIDE OF LOG VANE PRIOR TO BACKFILL.

TYPICAL LOG VANE

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:

TYPICAL STRUCTURE DETAILS

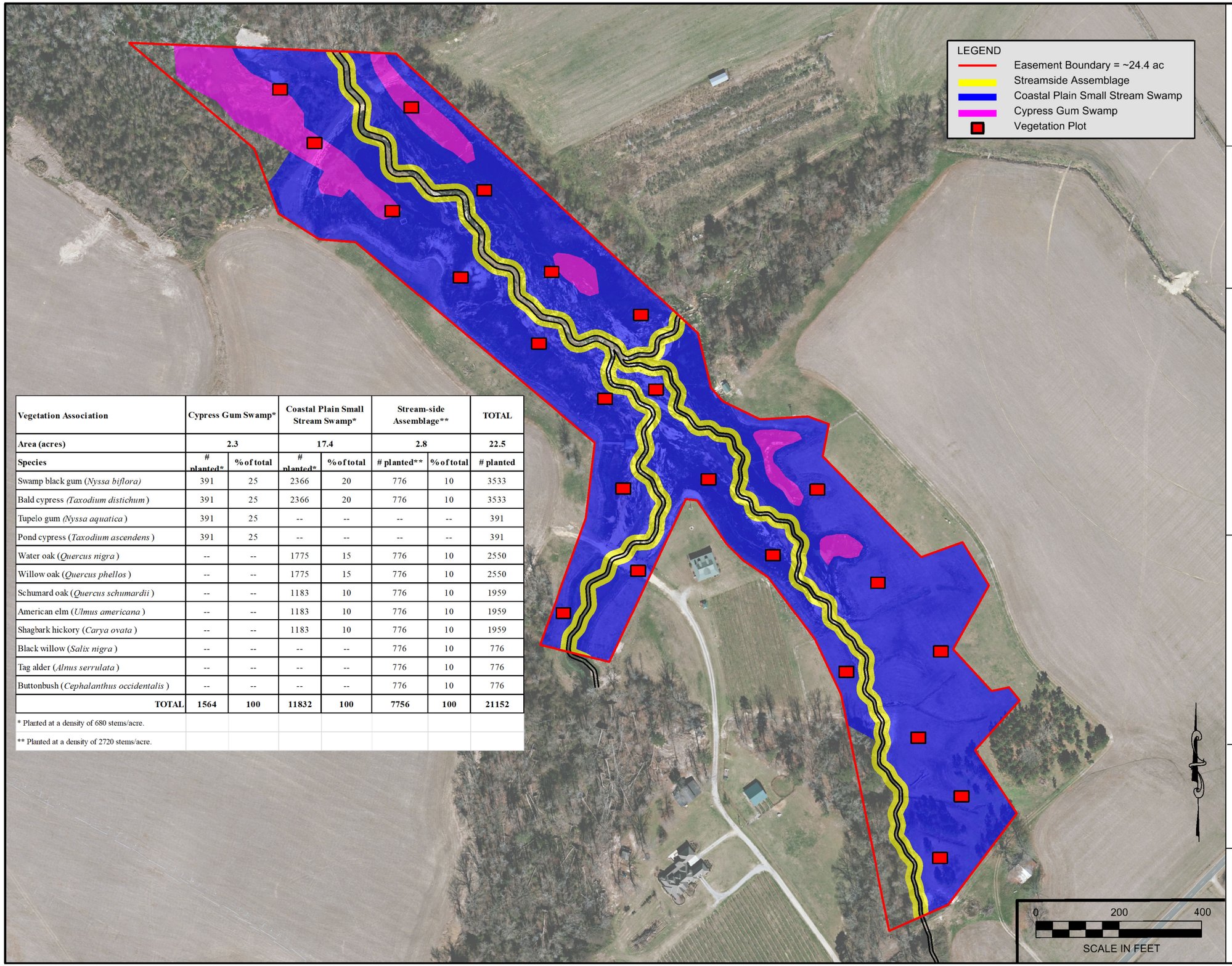
Scale: NO SCALE

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

8



Vegetation Association	Cypress Gum Swamp*		Coastal Plain Small Stream Swamp*		Stream-side Assemblage**		TOTAL
Area (acres)	2.3		17.4		2.8		22.5
Species	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Swamp black gum (*Nyssa biflora*)	391	25	2366	20	776	10	3533
Bald cypress (*Taxodium distichum*)	391	25	2366	20	776	10	3533
Tupelo gum (*Nyssa aquatica*)	391	25	--	--	--	--	391
Pond cypress (*Taxodium ascendens*)	391	25	--	--	--	--	391
Water oak (*Quercus nigra*)	--	--	1775	15	776	10	2550
Willow oak (*Quercus phellos*)	--	--	1775	15	776	10	2550
Schumard oak (*Quercus schumardii*)	--	--	1183	10	776	10	1959
American elm (*Ulmus americana*)	--	--	1183	10	776	10	1959
Shagbark hickory (*Carya ovata*)	--	--	1183	10	776	10	1959
Black willow (*Salix nigra*)	--	--	--	--	776	10	776
Tag alder (*Alnus serrulata*)	--	--	--	--	776	10	776
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	776	10	776
TOTAL	1564	100	11832	100	7756	100	21152

* Planted at a density of 680 stems/acre.

** Planted at a density of 2720 stems/acre.

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

PLANTING PLAN

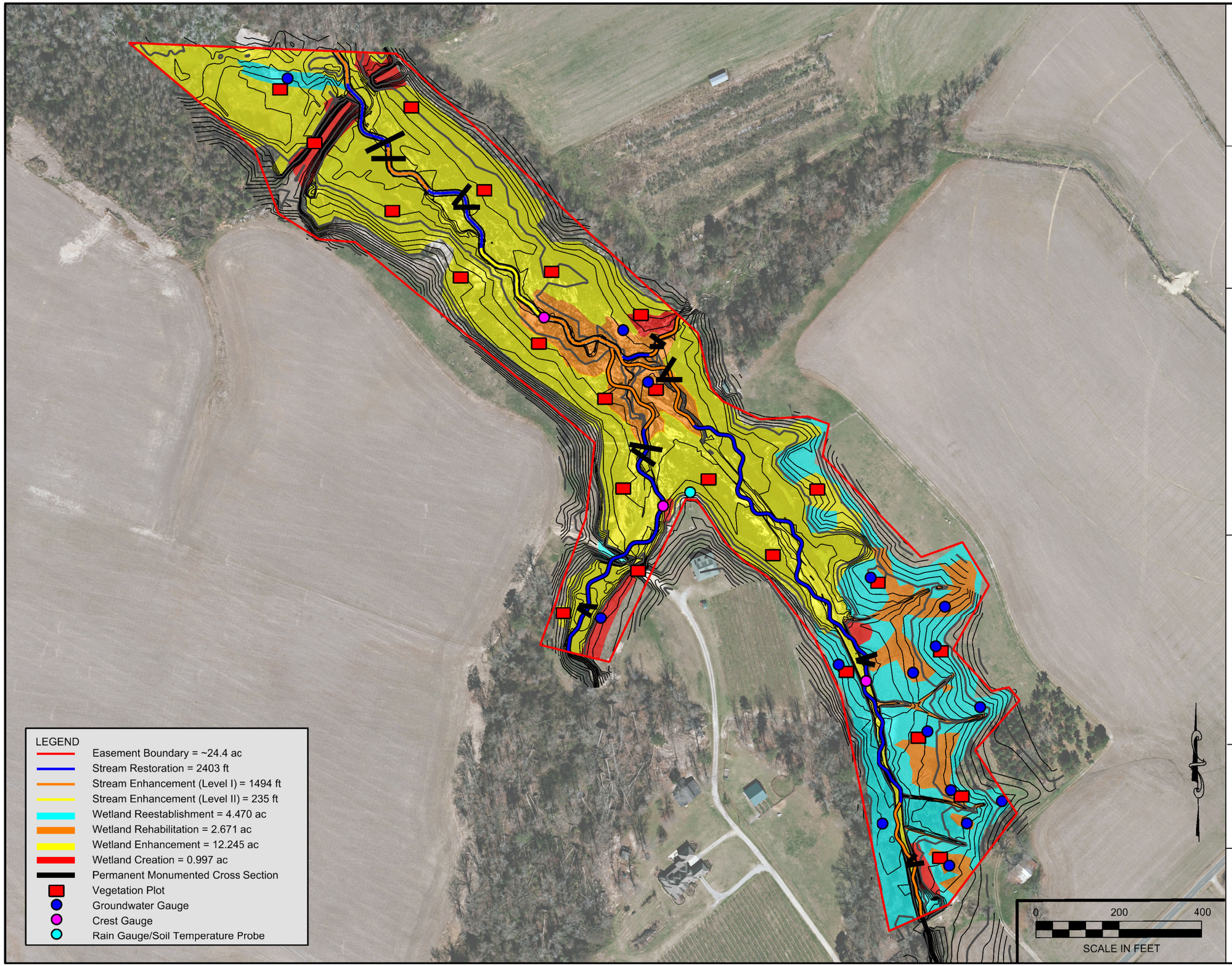
Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

9



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

MONITORING PLAN

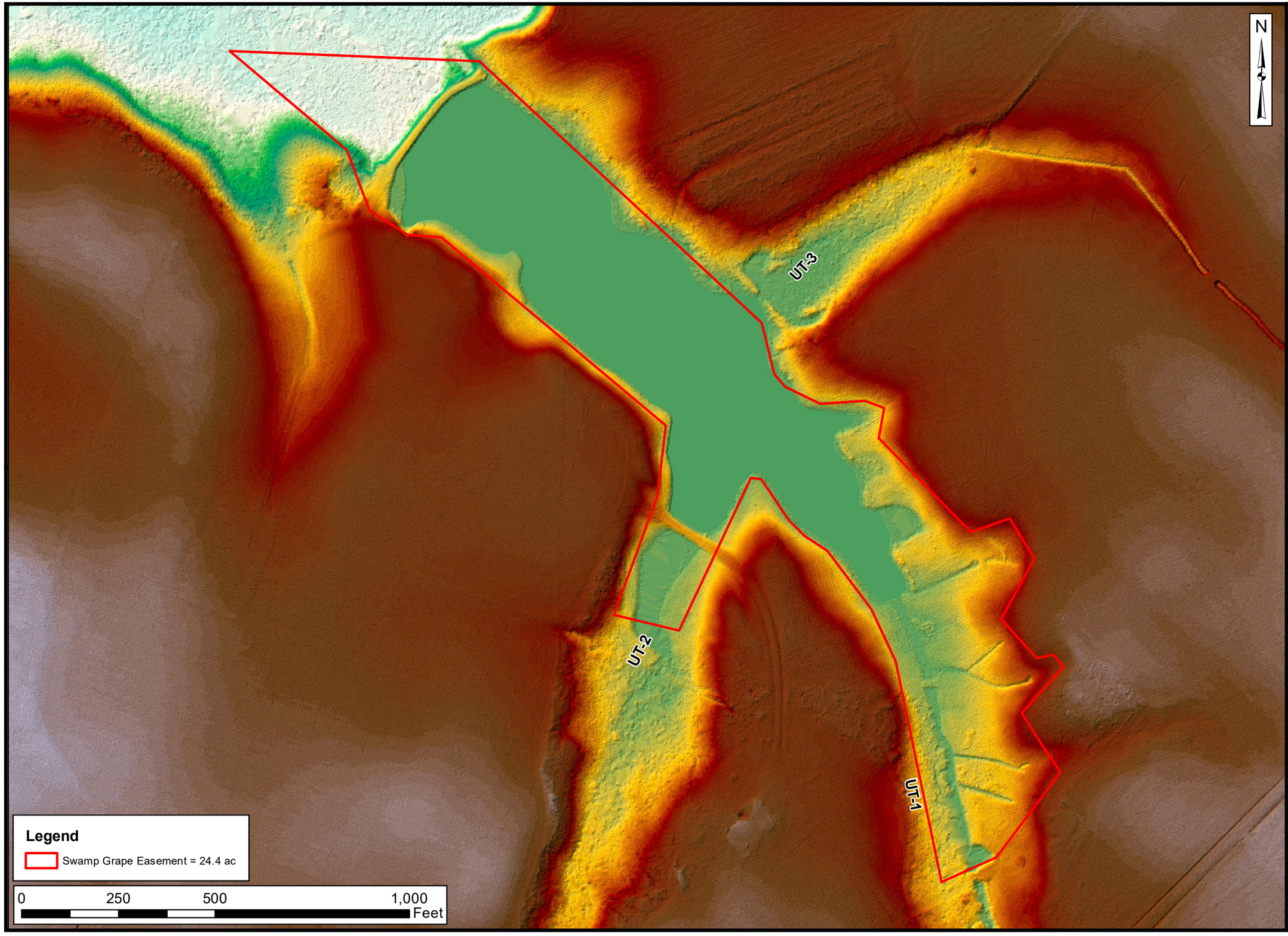
Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

10



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

LIDAR

Drawn by: KRJ

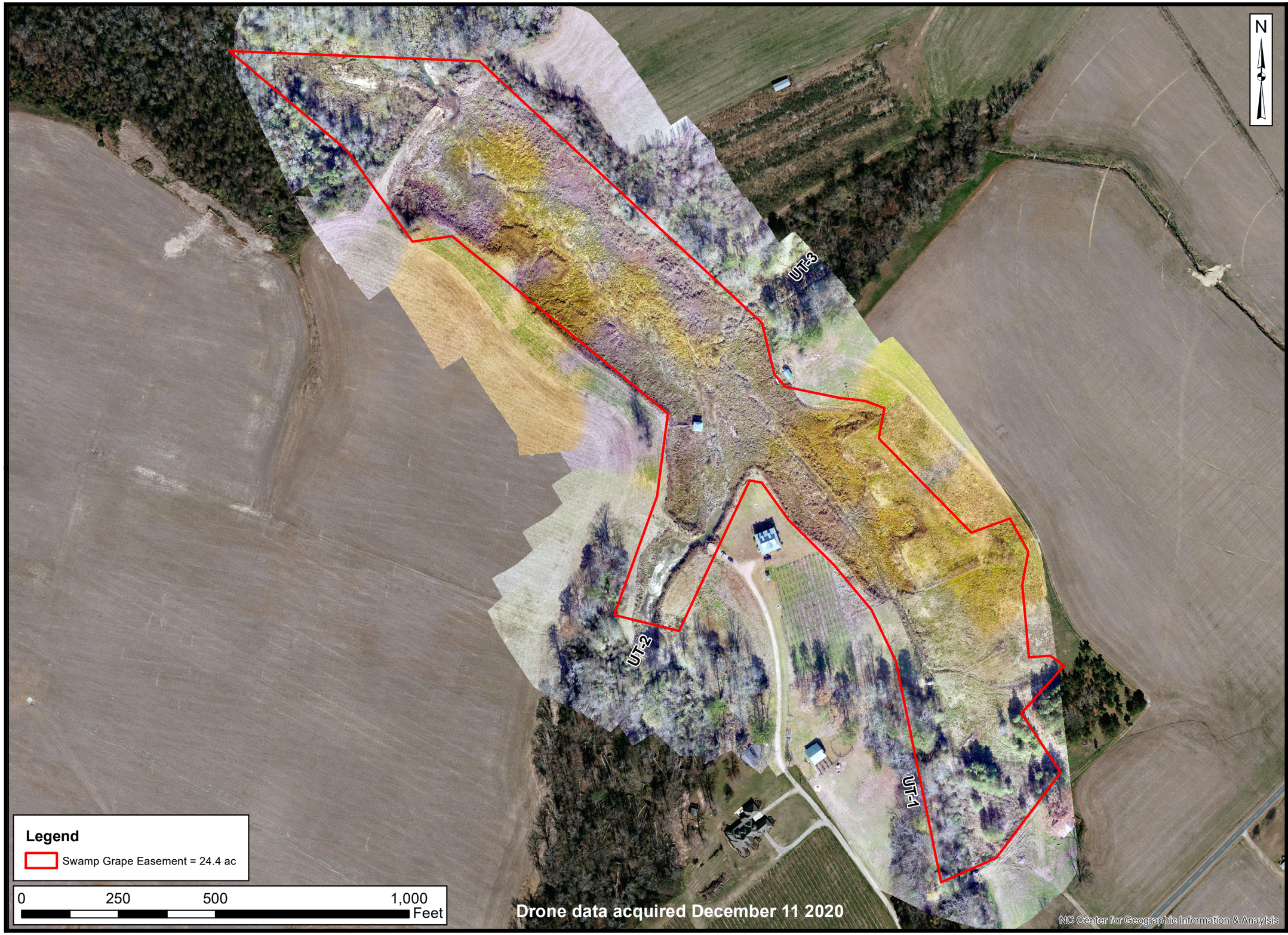
Date: DEC 2020

Scale: 1:2800

Project No.: 20-003

FIGURE

11



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

Drone-Based Orthomosaic

Drawn by: JMH

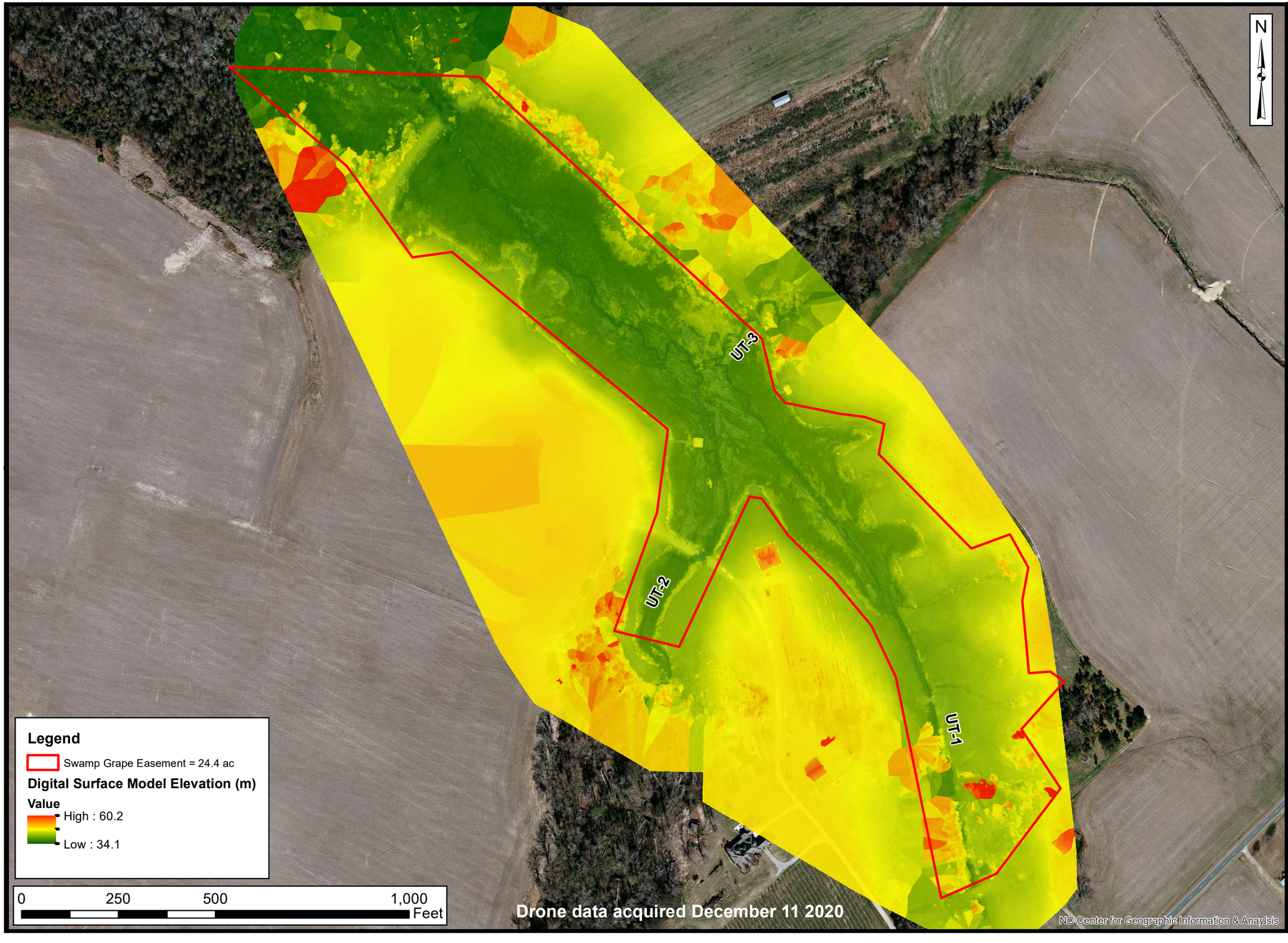
Date: DEC 2020

Scale: 1:2800

Project No.: 20-003

FIGURE

12



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

Drone-Based Surface Model

Drawn by: JMH

Date: DEC 2020

Scale: 1:2800

Project No.: 20-003

FIGURE

13

APPENDIX B - EXISTING STREAM & WETLAND DATA

Table B1. Swamp Grape Morphological Stream Characteristics
Existing Stream Cross-section Data
NC SAM Forms
NC WAM Forms
BEHI/NBS Data
Soil Boring Logs

Table B1. Swamp Grape Site Morphological Stream Characteristics

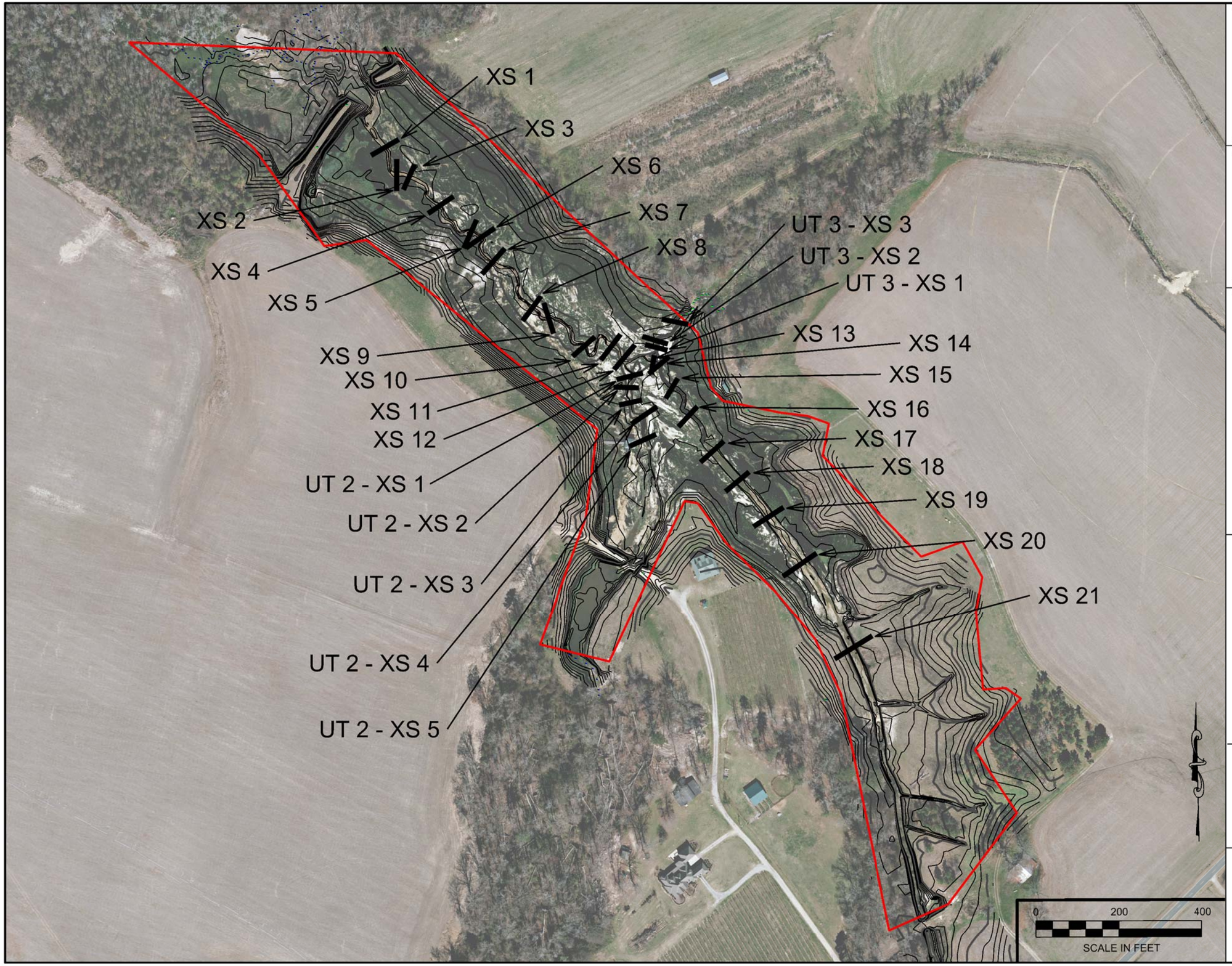
Variables	REFERENCE - JORDAN CREEK	REFERENCE- MCREA LAND COMPANY	Existing (UT 1 upstream)	Proposed (UT 1 upstream)	Existing (UT 1 downstream)	Proposed (UT 1 downstream)
Stream Type	E 5	E 5	F 5	Ce 5	Eg 5	Ce 5
Drainage Area (mi^2)	16.90	0.20	0.30	0.30	1.53	1.53
Bankfull Discharge (cfs)	44.3	4.3	3.5	3.5	12.1	12.1
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	44.9	4.8	3.9	3.9	12.9	12.9
Existing Cross-Sectional Area ($A_{existing}$)	44.9	4.2-5.4	8.5 - 56.8	3.9	14.2 - 30.5	12.9
Bankfull Width (W_{bkf})	Mean: 20.8 Range: 20.1 - 21.5	Mean: 6.0 Range: 5.4-6.6	Mean: 13.2 Range: 5.2 to 17.6	Mean: 7.4 Range: 6.8 to 7.9	Mean: 12.2 Range: 10.2 to 20.3	Mean: 13.4 Range: 12.4 to 14.4
Bankfull Mean Depth (D_{bkf})	Mean: 2.2 Range: 2.1 - 2.2	Mean: 0.8 Range: 0.8-0.8	Mean: 0.3 Range: 0.2 to 0.8	Mean: 0.5 Range: 0.5 to 0.6	Mean: 1.1 Range: 0.6 to 1.3	Mean: 1.0 Range: 0.9 to 1.0
Bankfull Maximum Depth (D_{max})	Mean: 2.8 Range: 2.7 - 2.9	Mean: 1.1 Range: 1.0-1.1	Mean: 0.7 Range: 0.4 to 1.5	Mean: 0.7 Range: 0.6 to 0.9	Mean: 1.8 Range: 1.1 to 2.4	Mean: 1.2 Range: 1.2 to 1.6
Pool Width (W_{pool})	Mean: 22.0 Range: 19.6 - 24.4	Mean: 7.8 Range: 7.1-8.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 8.9 Range: 7.4 to 11.8	Mean: 14.6 Range: 12.9 to 15.4	Mean: 16.1 Range: 13.4 to 21.5
Maximum Pool Depth (D_{pool})	Mean: 4.8 Range: 3.6 - 6.0	Mean: 1.5 Range: 1.3-1.6		Mean: 0.9 Range: 0.8 to 1.1	Mean: 2.1 Range: 1.9 to 2.4	Mean: 1.6 Range: 1.4 to 1.9
Width of Floodprone Area (W_{fpa})	Mean: 250 Range:	Mean: 75.0 Range:	Mean: 20 Range: 8 to 50	Mean: 100 Range: 50 to 150	Mean: 150 Range: 50 to 150	Mean: 150 Range: 100 to 200
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 12.0 Range: 11.6 - 12.4	Mean: 12.6 Range: 11.4-13.9	Mean: 1.5 Range: 1.0 to 9.3	Mean: 13.5 Range: 7.3 to 19.0	Mean: 12.3 Range: 2.8 to 14.7	Mean: 11.2 Range: 8.0 to 13.9
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 9.7 Range: 9.1 - 10.2	Mean: 7.5 Range: 6.8-8.3	Mean: 44.0 Range: 6.5 to 88.0	Mean: 14.0 Range: 12.0 to 16.0	Mean: 11.1 Range: 7.8 to 33.8	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.3 Range:	Mean: 1.3 Range: 1.3-1.4	Mean: 2.1 Range: 1.3 to 3.0	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.6 Range: 1.4 to 2.3	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range:	Mean: 1.0 Range:	Mean: 2.8 Range: 1.5 to 6.6	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.3 Range: 1.0 to 1.8	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 2.2 Range: 1.7 - 2.8	Mean: 1.8 Range: 1.6-2.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.7 Range: 1.5 to 2.0	Mean: 1.9 Range: 1.7 to 2.2	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 1.1 Range: 0.9 - 1.2	Mean: 1.3 Range: 1.2-1.4		Mean: 1.2 Range: 1.0 to 1.6	Mean: 1.2 Range: 1.1 to 1.3	Mean: 1.2 Range: 1.0 to 1.6
Pool Area / Bankfull Cross Sectional Area	Mean: 1.3 Range: 1.2 - 1.5	Mean: 1.4 Range: 1.4-1.5		Mean: 1.3 Range: 1.1 to 1.5	Mean: 1.2 Range: 1.2 to 1.2	Mean: 1.3 Range: 1.1 to 1.5

Variables	REFERENCE - JORDAN CREEK	REFERENCE- MCREA LAND COMPANY	Existing (UT 1 upstream)	Proposed (UT 1 upstream)	Existing (UT 1 downstream)	Proposed (UT 1 downstream)
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	Med: 89.1 Range: 49-152	Med: 21.1 Range: 10.6-38.9	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 29.6 Range: 22.2 to 44.3	Mean: 28.1 Range: 9.5 to 64.0	Med: 53.8 Range: 40.3 to 80.6
Meander Length (L_m)	Med: 114.5 Range: 63-166	Med: 35.4 Range: 23.3-44.4		Med: 44.3 Range: 36.9 to 59.1	Mean: 56.3 Range: 45.5 to 89.2	Med: 80.6 Range: 67.2 to 107.5
Belt Width (W_{belt})	Med: 99.0 Range: 75-134	Med: 13.7 Range: 11.7-16.6		Med: 22.2 Range: 14.8 to 29.6	Mean: 34.9 Range: 21.5 to 62.0	Med: 40.3 Range: 26.9 to 53.8
Radius of Curvature (R_c)	Med: 26.4 Range: 13-53	Med: 6.5 Range: 4.5-12.7		Med: 22.2 Range: 14.8 to 36.9	Mean: 19.6 Range: 6.2 to 125.7	Med: 40.3 Range: 26.9 to 67.2
Sinuosity (Sin)	1.60	1.13	1.01	1.15	1.30	1.15
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 4.3 Range: 2.4 - 7.3	Med: 3.5 Range: 1.8-6.5	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 6.0	Mean: 2.3 Range: 0.8 to 5.2	Med: 4.0 Range: 3.0 to 6.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 5.5 Range: 3.0 - 8.0	Med: 5.9 Range: 3.9-7.4		Med: 6.0 Range: 5.0 to 8.0	Mean: 4.6 Range: 3.7 to 7.3	Med: 6.0 Range: 5.0 to 8.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 4.5 Range: 3.6 - 5.4	Med: 2.3 Range: 2.0-2.8		Med: 3.0 Range: 2.0 to 4.0	Mean: 2.9 Range: 1.8 to 5.1	Med: 3.0 Range: 2.0 to 4.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.3 Range: 0.6 - 2.6	Med: 1.1 Range: 0.8-2.1		Med: 3.0 Range: 2.0 to 5.0	Mean: 1.6 Range: 0.5 to 10.3	Med: 3.0 Range: 2.0 to 5.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0008	0.0077	0.0061	0.0054	0.0028	0.0031
Valley Slope (S_{valley})	0.0013	0.0087	0.0062	0.0062	0.0036	0.0036
Riffle Slope (S_{riffle})	Mean: 0.0008 Range: 0.0003 - 0.0018	Mean: 0.0026 Range: 0-0.0712	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 0.0086 Range: 0.0065 to 0.0097	Not Measured	Mean: 0.0050 Range: 0.0038 to 0.0056
Pool Slope (S_{pool})	Mean: 0.0006 Range: 0 - 0.0014	Mean: 0.0020 Range: 0-0.0057		Mean: 0.0005 Range: 0.0000 to 0.0038		Mean: 0.0003 Range: 0.0000 to 0.0022
Run Slope (S_{run})	Mean: 0.0026 Range: 0 - 0.0038	Mean: 0.006 Range: 0-0.1700		Mean: 0.0032 Range: 0.0000 to 0.0065		Mean: 0.0019 Range: 0.0000 to 0.0038
Glide Slope (S_{glide})	Mean: 0.0000 Range: 0 - 0.0001	Mean: 0.0002 Range: 0-0.0075		Mean: 0.0006 Range: 0.0000 to 0.0043		Mean: 0.0003 Range: 0.0000 to 0.0025
Profile Ratios						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.1 Range: 0.4 - 2.3	Mean: 0.30 Range: 0-9.28	No distinct repetitive pattern of riffles and pools due to channel incision	Mean: 1.60 Range: 1.2 to 1.8	Not Measured	Mean: 1.60 Range: 1.2 to 1.8
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.8 Range: 0 - 1.8	Mean: 0.30 Range: 0-0.74		Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 3.50 Range: 0 - 5.1	Mean: 0.78 Range: 0-22.15		Mean: 0.60 Range: 0.0 to 1.2		Mean: 0.60 Range: 0.0 to 1.2
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.00 Range: 0 - 0.2	Mean: 0.03 Range: 0-0.97		Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8

Table B1 continued. Swamp Grape Site Morphological Stream Characteristics

Variables	REFERENCE - JORDAN CREEK	REFERENCE- MCREA LAND COMPANY	Existing (UT 2)	Proposed (UT 2)	Existing (UT 3)	Proposed (UT 3)
Stream Type	E 5	E 5	Cg 5	Ce 5	Eg 5	Ce 5
Drainage Area (mi^2)	16.90	0.20	0.41	0.41	0.61	0.61
Bankfull Discharge (cfs)	44.3	4.3	4.5	4.5	6.1	6.1
Dimension Variables						
Bankfull Cross-Sectional Area (A_{bkf})	44.9	4.8	4.9	4.9	6.6	6.6
Existing Cross-Sectional Area ($A_{existing}$)	44.9	4.2-5.4	4.9 - 10.1	4.9	6.6 - 10.1	6.6
Bankfull Width (W_{bkf})	Mean: 20.8 Range: 20.1 - 21.5	Mean: 6.0 Range: 5.4-6.6	Mean: 7.5 Range: 6.9 to 7.9	Mean: 8.3 Range: 7.7 to 8.9	Mean: 7.8 Range: 6.8 to 8.8	Mean: 9.6 Range: 8.9 to 10.3
Bankfull Mean Depth (D_{bkf})	Mean: 2.2 Range: 2.1 - 2.2	Mean: 0.8 Range: 0.8-0.8	Mean: 0.6 Range: 0.6 to 0.7	Mean: 0.6 Range: 0.6 to 0.6	Mean: 0.9 Range: 0.7 to 1.0	Mean: 0.7 Range: 0.6 to 0.7
Bankfull Maximum Depth (D_{max})	Mean: 2.8 Range: 2.7 - 2.9	Mean: 1.1 Range: 1.0-1.1	Mean: 1.4 Range: 1.2 to 1.7	Mean: 0.8 Range: 0.7 to 1.0	Mean: 1.3 Range: 1.2 to 1.4	Mean: 0.9 Range: 0.8 to 1.1
Pool Width (W_{pool})	Mean: 22.0 Range: 19.6 - 24.4	Mean: 7.8 Range: 7.1-8.5	Mean: 9.0 Range: 6.0 to 12.0	Mean: 9.9 Range: 8.3 to 13.3	Mean: 7.6 Range: 7.6 to 7.6	Mean: 11.5 Range: 9.6 to 15.4
Maximum Pool Depth (D_{pool})	Mean: 4.8 Range: 3.6 - 6.0	Mean: 1.5 Range: 1.3-1.6	Mean: 2.0 Range: 1.8 to 2.2	Mean: 1.0 Range: 0.9 to 1.2	Mean: 1.6 Range: 1.6 to 1.6	Mean: 1.2 Range: 1.0 to 1.4
Width of Floodprone Area (W_{fpa})	Mean: 250 Range:	Mean: 75.0 Range:	Mean: 75 Range: 50 to 75	Mean: 150 Range: 100 to 200	Mean: 31 Range: 27.0 to 35	Mean: 150 Range: 100 to 200
Dimension Ratios						
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 12.0 Range: 11.6 - 12.4	Mean: 12.6 Range: 11.4-13.9	Mean: 9.5 Range: 6.7 to 10.9	Mean: 18.1 Range: 13.0 to 22.6	Mean: 4.1 Range: 3.1 to 5.1	Mean: 15.6 Range: 11.2 to 19.5
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 9.7 Range: 9.1 - 10.2	Mean: 7.5 Range: 6.8-8.3	Mean: 12.5 Range: 9.9 to 13.2	Mean: 14.0 Range: 12.0 to 16.0	Mean: 9.7 Range: 6.8 to 12.6	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.3 Range:	Mean: 1.3 Range: 1.3-1.4	Mean: 2.3 Range: 2.0 to 2.4	Mean: 1.3 Range: 1.2 to 1.5	Mean: 1.6 Range: 1.4 to 1.7	Mean: 1.3 Range: 1.2 to 1.5
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range:	Mean: 1.0 Range:	Mean: 1.3 Range: 1.1 to 1.4	Mean: 1.0 Range: 1.0 to 1.3	Mean: 1.6 Range: 1.4 to 1.8	Mean: 1.0 Range: 1.0 to 1.3
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 2.2 Range: 1.7 - 2.8	Mean: 1.8 Range: 1.6-2.0	Mean: 3.3 Range: 3.0 to 3.7	Mean: 1.7 Range: 1.5 to 2.0	Mean: 1.9 Range: 1.9 to 1.9	Mean: 1.7 Range: 1.5 to 2.0
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 1.1 Range: 0.9 - 1.2	Mean: 1.3 Range: 1.2-1.4	Mean: 1.2 Range: 0.8 to 1.6	Mean: 1.2 Range: 1.0 to 1.6	Mean: 1.0 Range: 1.0 to 1.0	Mean: 1.2 Range: 1.0 to 1.6
Pool Area / Bankfull Cross Sectional Area	Mean: 1.3 Range: 1.2 - 1.5	Mean: 1.4 Range: 1.4-1.5	Mean: 1.3 Range: 1.3 to 1.3	Mean: 1.3 Range: 1.1 to 1.5	Mean: 1.3 Range: 1.3 to 1.3	Mean: 1.3 Range: 1.1 to 1.5

Variables	REFERENCE - JORDAN CREEK	REFERENCE- MCREA LAND COMPANY	Existing (UT 2)	Proposed (UT 2)	Existing (UT 3)	Proposed (UT 3)
Pattern Variables						
Pool to Pool Spacing (L_{p-p})	Med: 89.1 Range: 49-152	Med: 21.1 Range: 10.6-38.9	No distinct repetitive pattern of riffles and pools	Med: 33.1 Range: 24.8 to 49.7	Mean: 25.1 Range: 11.3 to 34.6	Med: 38.4 Range: 28.8 to 57.7
Meander Length (L_m)	Med: 114.5 Range: 63-166	Med: 35.4 Range: 23.3-44.4		Med: 49.7 Range: 41.4 to 66.3	Mean: 42.2 Range: 28.9 to 56.0	Med: 57.7 Range: 48.1 to 76.9
Belt Width (W_{belt})	Med: 99.0 Range: 75-134	Med: 13.7 Range: 11.7-16.6		Med: 24.8 Range: 16.6 to 33.1	Mean: 23.7 Range: 23.2 to 24.7	Med: 28.8 Range: 19.2 to 38.4
Radius of Curvature (R_c)	Med: 26.4 Range: 13-53	Med: 6.5 Range: 4.5-12.7		Med: 24.8 Range: 16.6 to 41.4	Mean: 12.4 Range: 7.8 to 34.6	Med: 28.8 Range: 19.2 to 48.1
Sinuosity (Sin)	1.60	1.13	1.02	1.20	1.17	1.15
Pattern Ratios						
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 4.3 Range: 2.4 - 7.3	Med: 3.5 Range: 1.8-6.5	No distinct repetitive pattern of riffles and pools	Med: 4.0 Range: 3.0 to 6.0	Mean: 3.2 Range: 1.4 to 4.4	Med: 4.0 Range: 3.0 to 6.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 5.5 Range: 3.0 - 8.0	Med: 5.9 Range: 3.9-7.4		Med: 6.0 Range: 5.0 to 8.0	Mean: 5.4 Range: 3.7 to 7.2	Med: 6.0 Range: 5.0 to 8.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 4.5 Range: 3.6 - 5.4	Med: 2.3 Range: 2.0-2.8		Med: 3.0 Range: 2.0 to 4.0	Mean: 3.0 Range: 3.0 to 3.2	Med: 3.0 Range: 2.0 to 4.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.3 Range: 0.6 - 2.6	Med: 1.1 Range: 0.8-2.1		Med: 3.0 Range: 2.0 to 5.0	Mean: 1.6 Range: 1.0 to 4.4	Med: 3.0 Range: 2.0 to 5.0
Profile Variables						
Average Water Surface Slope (S_{ave})	0.0008	0.0077	0.0041	0.0035	0.0077	0.0039
Valley Slope (S_{valley})	0.0013	0.0087	0.0042	0.0042	0.0125	0.0125
Riffle Slope (S_{riffle})	Mean: 0.0008 Range: 0.0003 - 0.0018	Mean: 0.0026 Range: 0-0.0712	No distinct repetitive pattern of riffles and pools	Mean: 0.0056 Range: 0.0042 to 0.0063	Not Measured	Mean: 0.0062 Range: 0.0047 to 0.0070
Pool Slope (S_{pool})	Mean: 0.0006 Range: 0 - 0.0014	Mean: 0.0020 Range: 0-0.0057		Mean: 0.0004 Range: 0.0000 to 0.0025		Mean: 0.0004 Range: 0.0000 to 0.0027
Run Slope (S_{run})	Mean: 0.0026 Range: 0 - 0.0038	Mean: 0.006 Range: 0-0.1700		Mean: 0.0021 Range: 0.0000 to 0.0042		Mean: 0.0023 Range: 0.0000 to 0.0047
Glide Slope (S_{glide})	Mean: 0.0000 Range: 0 - 0.0001	Mean: 0.0002 Range: 0-0.0075		Mean: 0.0004 Range: 0.0000 to 0.0028		Mean: 0.0004 Range: 0.0000 to 0.0031
Profile Ratios						
Riffle Slope/ Water Surface Slope (S_{riffle}/S_{ave})	Mean: 1.1 Range: 0.4 - 2.3	Mean: 0.30 Range: 0-9.28	No distinct repetitive pattern of riffles and pools	Mean: 1.60 Range: 1.2 to 1.8	Not Measured	Mean: 1.60 Range: 1.2 to 1.8
Pool Slope/Water Surface Slope (S_{pool}/S_{ave})	Mean: 0.8 Range: 0 - 1.8	Mean: 0.30 Range: 0-0.74		Mean: 0.10 Range: 0.0 to 0.7		Mean: 0.10 Range: 0.0 to 0.7
Run Slope/Water Surface Slope (S_{run}/S_{ave})	Mean: 3.50 Range: 0 - 5.1	Mean: 0.78 Range: 0-22.15		Mean: 0.60 Range: 0.0 to 1.2		Mean: 0.60 Range: 0.0 to 1.2
Glide Slope/Water Surface Slope (S_{glide}/S_{ave})	Mean: 0.00 Range: 0 - 0.2	Mean: 0.03 Range: 0-0.97		Mean: 0.11 Range: 0.0 to 0.8		Mean: 0.11 Range: 0.0 to 0.8



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

Cross Section Locations

Scale: As Shown

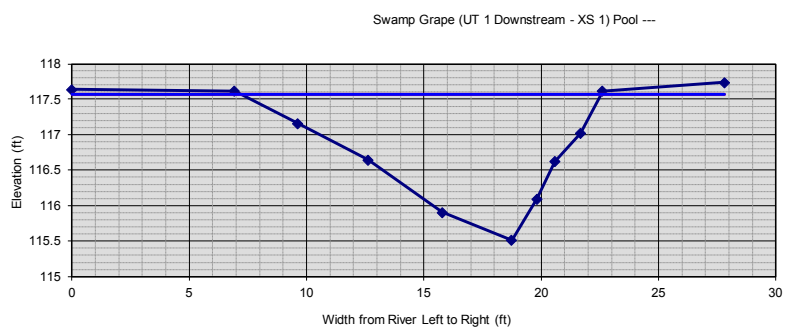
Date: Mar 2020

Project No.: 20-003

FIGURE NO.

B1

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 1)
	Pool

	---
description:	Swamp Grape (UT 1 Downstream - XS 1)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	82.36064	117.6394
	☐	6.931201	82.38708	117.6129
	☐	9.619909	82.84044	117.1596
	☐	12.61334	83.35582	116.6442
	☐	15.78409	84.09445	115.9056
	☐	18.74182	84.48821	115.5118
	☐	19.81835	83.90395	116.0961
	☐	20.58208	83.37777	116.6222
	☐	21.67234	82.98009	117.0199
	☐	22.61459	82.38647	117.6135
	☐	27.81857	82.26114	117.7389
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

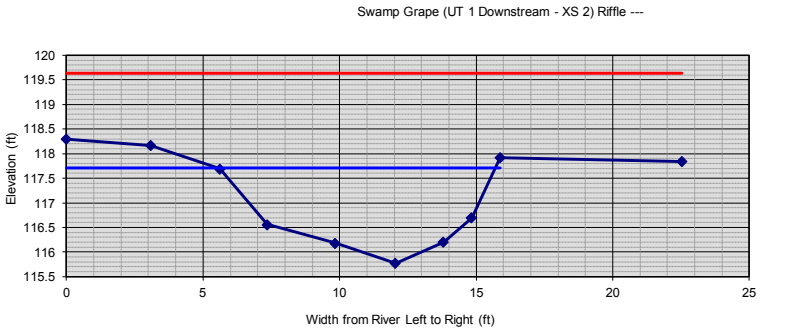
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
82.43	82.38			
117.57	117.62			

dimensions			
16.0	x-section area	1.0	d mean
15.4	width	16.1	wet P
2.1	d max	1.0	hyd radi
2.1	bank ht	14.8	w/d ratio
0.0	W flood prone area	0.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	0.0 fric. factor
0.000	Manning's n from channel material	

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 2)
	Riffle

	---
description:	Swamp Grape (UT 1 Downstream - XS 2)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	81.69336	118.3066
	☐	3.081762	81.83052	118.1695
	☐	5.616587	82.30478	117.6952
	☐	7.353365	83.43773	116.5623
	☐	9.831571	83.81455	116.1855
	☐	12.05065	84.22128	115.7787
	☐	13.80266	83.79364	116.2064
	☐	14.83719	83.30408	116.6959
	☐	15.88316	82.07861	117.9214
	☑	22.53508	82.1571	117.8429
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

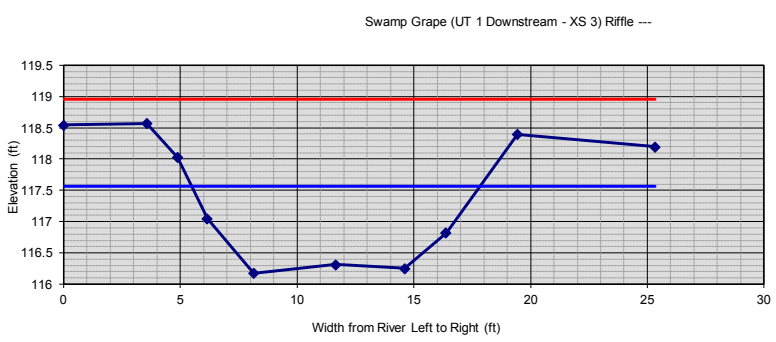
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
82.29	82.08	150.0		
117.71	117.92			

dimensions			
12.9	x-section area	1.3	d mean
10.2	width	11.2	wet P
1.9	d max	1.2	hyd radi
2.1	bank ht	8.0	w/d ratio
150.0	W flood prone area	14.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
0.0	threshold grain size (mm)

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	0.0 fric. factor
0.000	Manning's n from channel material	

Cross Section



section: **Swamp Grape (UT 1 Downstream - XS 3)**
Riffle

---

description: **Swamp Grape (UT 1 Downstream - XS 3)**
height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	81.45567	118.5443
	☐	3.577482	81.42392	118.5761
	☐	4.888618	81.97328	118.0267
	☐	6.156568	82.95571	117.0443
	☐	8.15506	83.82358	116.1764
	☐	11.65965	83.68619	116.3138
	☐	14.62048	83.74566	116.2543
	☐	16.38157	83.18088	116.8191
	☐	19.44606	81.60419	118.3958
	☐	25.34766	81.80329	118.1967
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

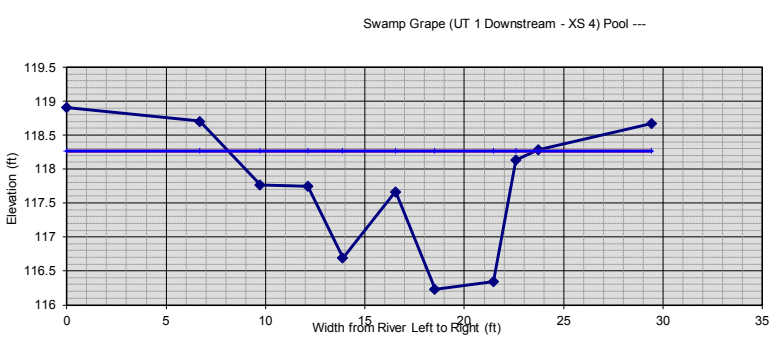
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
82.43	81.6	150.0		
117.57	118.4			

dimensions			
12.9	x-section area	1.0	d mean
12.4	width	13.0	wet P
1.4	d max	1.0	hyd radi
2.2	bank ht	11.8	w/d ratio
150.0	W flood prone area	12.1	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Downstream - XS 4)**
Pool

---

description: **Swamp Grape (UT 1 Downstream - XS 4)**
height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	81.08702	118.913
	☐	6.70286	81.29351	118.7065
	☐	9.730872	82.23322	117.7668
	☐	12.12332	82.25368	117.7463
	☐	13.88736	83.30752	116.6925
	☐	16.53969	82.33196	117.668
	☐	18.52403	83.76784	116.2322
	☐	21.47972	83.65566	116.3443
	☐	22.6073	81.86525	118.1347
	☐	23.7229	81.71312	118.2869
	☐	29.42507	81.32707	118.6729
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

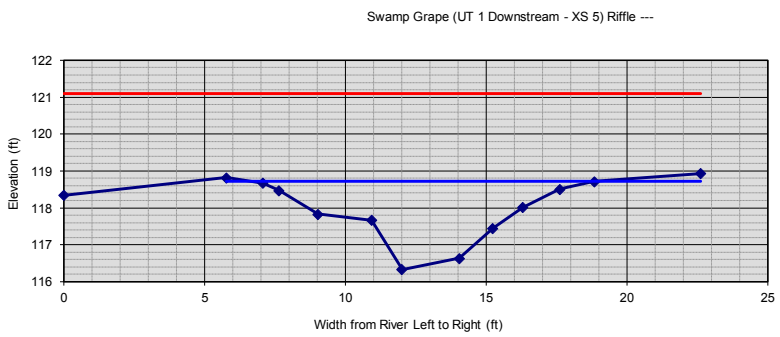
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
81.735	81.735			
118.265	118.265			

dimensions			
16.0	x-section area	1.0	d mean
15.4	width	17.4	wet P
2.0	d max	0.9	hyd radi
2.0	bank ht	~~14.9~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
~~0~~	measured D84 (mm)		
~~0.0~~	relative roughness	~~0.0~~	fric. factor
~~0.000~~	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 5)
	Riffle

	---
description:	Swamp Grape (UT 1 Downstream - XS 5)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	0	81.65539	118.3446
	☐	5.778724	81.17831	118.8217
	☐	7.075052	81.32596	118.674
	☐	7.642251	81.52313	118.4769
	☐	9.02423	82.16828	117.8317
	☐	10.92499	82.3334	117.6666
	☐	12.01535	83.66021	116.3398
	☐	14.04157	83.36437	116.6356
	☐	15.23896	82.54926	117.4507
	☐	16.29704	81.99048	118.0095
	☐	17.61423	81.4884	118.5116
	☐	18.83534	81.28115	118.7189
	☐	22.61101	81.06075	118.9392
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

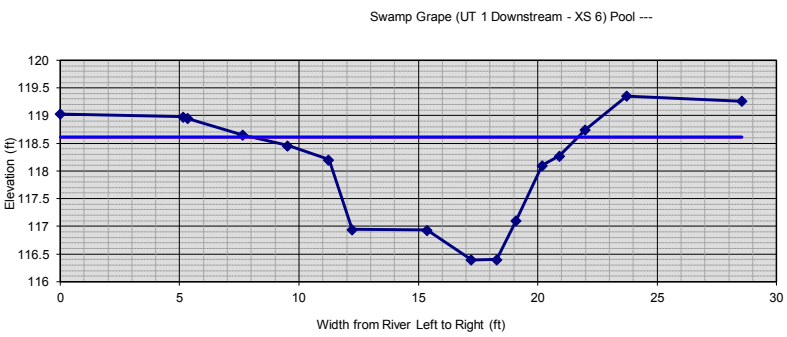
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
81.28	81.18	150.0		
118.72	118.82			

dimensions			
12.9	x-section area	1.1	d mean
12.2	width	13.5	wet P
2.4	d max	1.0	hyd radi
2.5	bank ht	11.5	w/d ratio
150.0	W flood prone area	12.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 6)
	Pool

	---
description:	Swamp Grape (UT 1 Downstream - XS 6)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	80.96858	119.0314
	☐	5.167593	81.01884	118.9812
	☐	5.332171	81.05059	118.9494
	☐	7.660337	81.3501	118.6499
	☐	9.535189	81.54086	118.4591
	☐	11.25022	81.79626	118.2037
	☐	12.22434	83.0568	116.9432
	☐	15.36523	83.06775	116.9322
	☐	17.22486	83.60807	116.3919
	☐	18.27553	83.59747	116.4025
	☐	19.08571	82.89901	117.101
	☐	20.1877	81.89807	118.1019
	☐	20.91907	81.72569	118.2743
	☐	21.99685	81.25267	118.7473
	☐	23.72176	80.63753	119.3625
	☐	28.54364	80.73787	119.2621
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

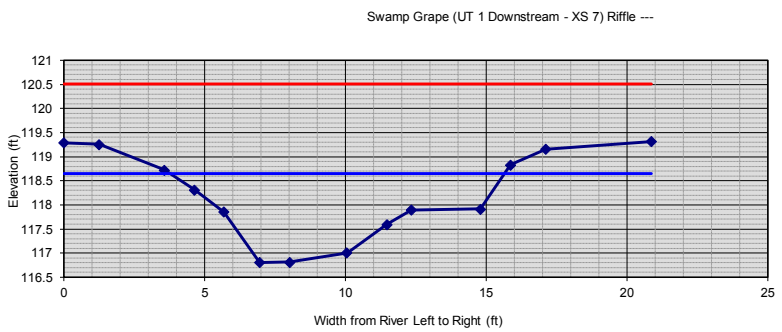
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
81.38	81.02			
118.62	118.98			

dimensions			
16.0	x-section area	1.2	d mean
13.8	width	15.2	wet P
2.2	d max	1.1	hyd radi
2.6	bank ht	~~11.8~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
~~0~~	measured D84 (mm)		
~~0.0~~	relative roughness	~~0.0~~	fric. factor
~~0.000~~	Manning's n from channel material		

Cross Section



section:	**Swamp Grape (UT 1 Downstream - XS 7)**
	Riffle

	---
description:	**Swamp Grape (UT 1 Downstream - XS 7)**
height of instrument (ft):	**200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**80.70746**	119.2925
	☐	**1.251236**	**80.74416**	119.2558
	☐	**3.564928**	**81.27626**	118.7237
	☐	**4.637254**	**81.68609**	118.3139
	☐	**5.681282**	**82.1412**	117.8588
	☐	**6.954849**	**83.18869**	116.8113
	☐	**8.028675**	**83.18541**	116.8146
	☐	**10.06133**	**82.99398**	117.006
	☐	**11.47892**	**82.40082**	117.5992
	☐	**12.34674**	**82.10325**	117.8967
	☐	**14.80233**	**82.08357**	117.9164
	☐	**15.85837**	**81.16851**	118.8315
	☐	**17.1125**	**80.84236**	119.1576
	☐	**20.86511**	**80.67784**	119.3222
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

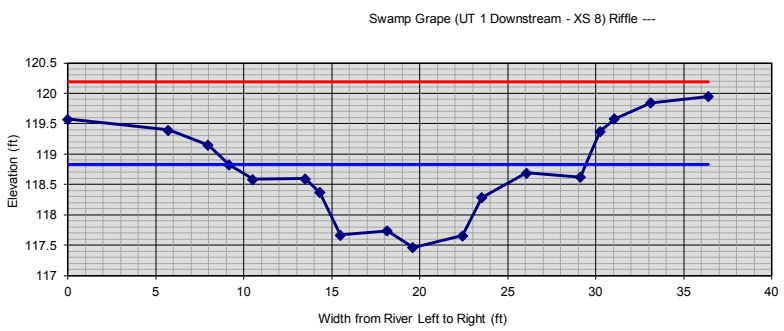
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
81.34	**80.84**	**150.0**		
118.66	119.16			

dimensions			
12.9	x-section area	1.1	d mean
11.9	width	12.9	wet P
1.8	d max	1.0	hyd radi
2.3	bank ht	11.1	w/d ratio
150.0	W flood prone area	12.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 8)
	Riffle

	---
description:	Swamp Grape (UT 1 Downstream - XS 8)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	80.42832	119.5717
	☐	5.724167	80.60822	119.3918
	☐	7.976399	80.85627	119.1437
	☐	9.169209	81.17899	118.821
	☐	10.52137	81.41695	118.583
	☐	13.49061	81.40804	118.592
	☐	14.32662	81.63319	118.3668
	☐	15.47389	82.33421	117.6658
	☐	18.15053	82.26233	117.7377
	☐	19.60759	82.53025	117.4698
	☐	22.42282	82.34497	117.655
	☐	23.51441	81.71559	118.2844
	☐	26.05739	81.30923	118.6908
	☐	29.11742	81.38139	118.6186
	☐	30.25309	80.62983	119.3702
	☐	31.06139	80.42316	119.5768
	☐	33.10943	80.16015	119.8399
	☐	36.40134	80.04834	119.9517
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

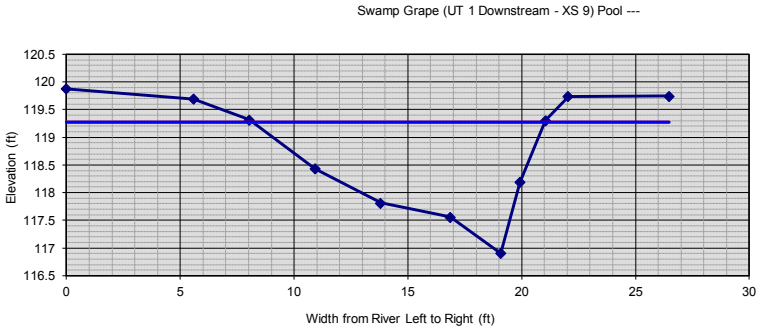
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
81.17	80.86	75.0		
118.83	119.14			

dimensions			
12.9	x-section area	0.6	d mean
20.3	width	20.8	wet P
1.4	d max	0.6	hyd radi
1.7	bank ht	32.0	w/d ratio
75.0	W flood prone area	3.7	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 9)
	Pool

	---
description:	Swamp Grape (UT 1 Downstream - XS 9)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	80.11654	119.8835
	☐	5.586807	80.308	119.692
	☐	8.026516	80.68521	119.3148
	☐	10.92429	81.56972	118.4303
	☐	13.81222	82.18874	117.8113
	☐	16.86089	82.44255	117.5574
	☐	19.09158	83.09508	116.9049
	☐	19.93412	81.81066	118.1893
	☐	21.05206	80.69357	119.3064
	☐	22.04773	80.26038	119.7396
	☐	26.48388	80.25506	119.7449
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

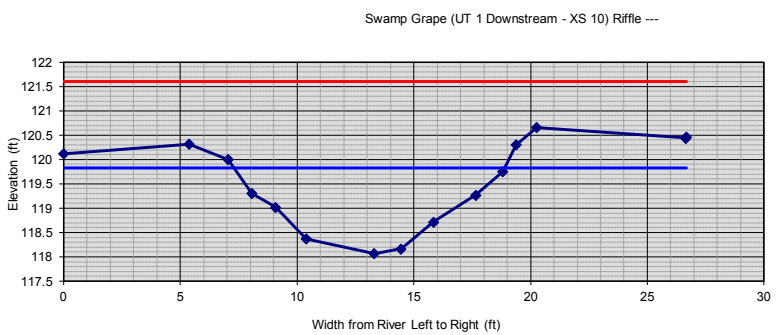
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.72	80.31			
119.28	119.69			

dimensions			
16.0	x-section area	1.2	d mean
12.9	width	14.3	wet P
2.4	d max	1.1	hyd radi
2.8	bank ht	~~10.4~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
~~0~~	measured D84 (mm)		
~~0.0~~	relative roughness	~~0.0~~	fric. factor
~~0.000~~	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 10)
	Riffle

	---
description:	Swamp Grape (UT 1 Downstream - XS 10)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	79.8801	120.1199
	☐	5.374308	79.68125	120.3188
	☐	7.048509	79.99991	120.0001
	☐	8.060977	80.69452	119.3055
	☐	9.078984	80.97507	119.0249
	☐	10.38931	81.62943	118.3706
	☐	13.31005	81.93344	118.0666
	☐	14.46239	81.83459	118.1654
	☐	15.84723	81.28053	118.7195
	☐	17.65455	80.7268	119.2732
	☐	18.81308	80.24892	119.7511
	☐	19.38917	79.69264	120.3074
	☐	20.2632	79.33508	120.6649
	☐	26.64163	79.55466	120.4453
	☐	26.67648	79.53453	120.4655
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

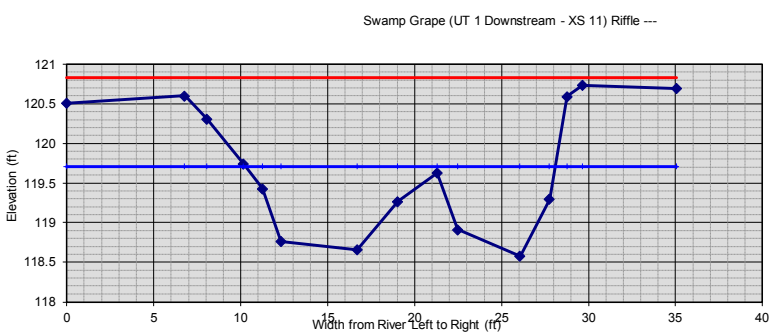
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.165	79.68	150.0		
119.835	120.32			

dimensions			
12.9	x-section area	1.1	d mean
11.6	width	12.3	wet P
1.8	d max	1.0	hyd radi
2.3	bank ht	10.5	w/d ratio
150.0	W flood prone area	12.9	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 1 Downstream - XS 11)
	Riffle

	---
description:	Swamp Grape (UT 1 Downstream - XS 11)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	79.49025	120.5098
	☐	6.78021	79.39763	120.6024
	☐	8.063115	79.69027	120.3097
	☐	10.14006	80.25533	119.7447
	☐	11.25364	80.56896	119.431
	☐	12.31037	81.23716	118.7628
	☐	16.70914	81.34147	118.6585
	☐	19.0403	80.72991	119.2701
	☐	21.30507	80.37289	119.6271
	☐	22.47698	81.08655	118.9135
	☐	26.06441	81.41721	118.5828
	☐	27.76023	80.70523	119.2948
	☐	28.76454	79.40797	120.592
	☐	29.66478	79.26172	120.7383
	☐	35.06882	79.30721	120.6928
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

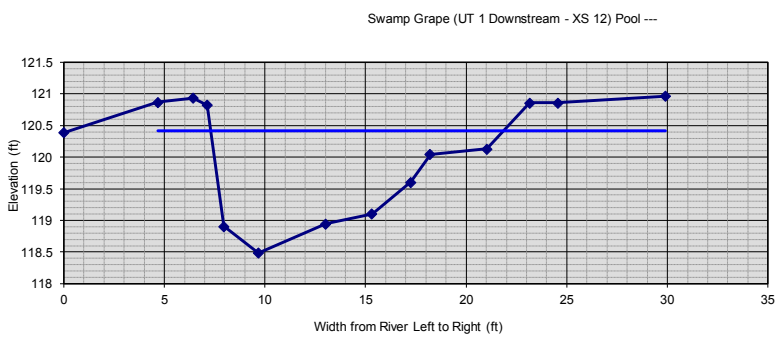
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.29	79.4	50.0		
119.71	120.6			

dimensions			
12.9	x-section area	0.7	d mean
17.8	width	18.7	wet P
1.1	d max	0.7	hyd radi
2.0	bank ht	24.7	w/d ratio
50.0	W flood prone area	2.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Downstream - XS 12)**

Pool

---

description: **Swamp Grape (UT 1 Downstream - XS 12)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☑	**0**	**79.6109**	120.3891
	☐	**4.692222**	**79.12896**	120.871
	☐	**6.43679**	**79.06499**	120.935
	☐	**7.141948**	**79.17526**	120.8247
	☐	**7.962268**	**81.09351**	118.9065
	☐	**9.685676**	**81.51313**	118.4869
	☐	**13.0328**	**81.0512**	118.9488
	☐	**15.32391**	**80.89766**	119.1023
	☐	**17.25391**	**80.39548**	119.6045
	☐	**18.21495**	**79.9536**	120.0464
	☐	**21.04078**	**79.86679**	120.1332
	☐	**23.15645**	**79.1399**	120.8601
	☐	**24.55576**	**79.14103**	120.859
	☐	**29.89593**	**79.02721**	120.9728
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

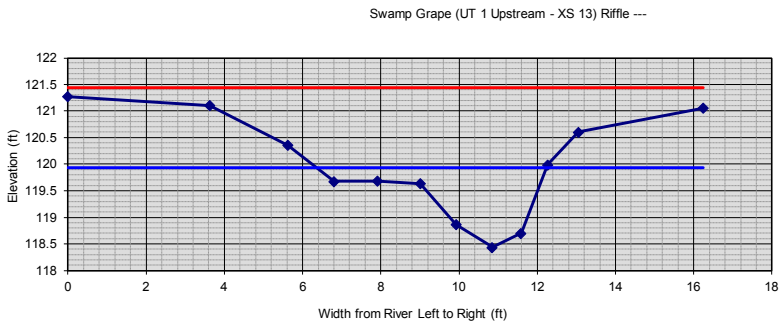
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.58	**79.18**			
120.42	120.82			

dimensions			
16.0	x-section area	1.1	d mean
14.6	width	15.9	wet P
1.9	d max	1.0	hyd radi
2.3	bank ht	~~13.2~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor, f/u*
~~0.0~~	threshold grain size (mm)

bed sediment material		
~~0~~	measured D84 (mm)	
~~0.0~~	relative roughness	~~0.0~~ fric. factor
~~0.000~~	Manning's n from channel material	

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 13)**
Riffle

---
description: **Swamp Grape (UT 1 Upstream - XS 13)**
height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.72177	121.2782
	☐	3.632693	78.89998	121.1
	☐	5.620846	79.64584	120.3542
	☐	6.80532	80.32394	119.6761
	☐	7.923845	80.31902	119.681
	☐	9.011296	80.36256	119.6374
	☐	9.927557	81.13224	118.8678
	☐	10.85524	81.55891	118.4411
	☐	11.58967	81.29885	118.7012
	☐	12.27187	80.00922	119.9908
	☐	13.05849	79.39778	120.6022
	☐	16.24537	78.94816	121.0518
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

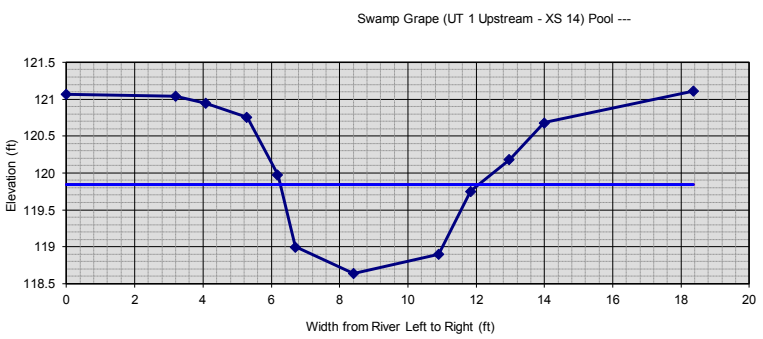
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.06	79.4	25.0		
119.94	120.6			

dimensions			
3.9	x-section area	0.7	d mean
5.9	width	7.1	wet P
1.5	d max	0.5	hyd radi
2.2	bank ht	8.9	w/d ratio
25.0	W flood prone area	4.2	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 14)**
Pool

---
description: **Swamp Grape (UT 1 Upstream - XS 14)**
height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.93356	121.0664
	☐	3.203332	78.95753	121.0425
	☐	4.08524	79.05276	120.9472
	☐	5.289732	79.24385	120.7561
	☐	6.193492	80.0268	119.9732
	☐	6.703229	81.00201	118.998
	☐	8.417221	81.35735	118.6427
	☐	10.90509	81.09894	118.9011
	☐	11.8377	80.24513	119.7549
	☐	12.97872	79.81733	120.1827
	☐	14.00052	79.3186	120.6814
	☐	18.37312	78.89051	121.1095
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

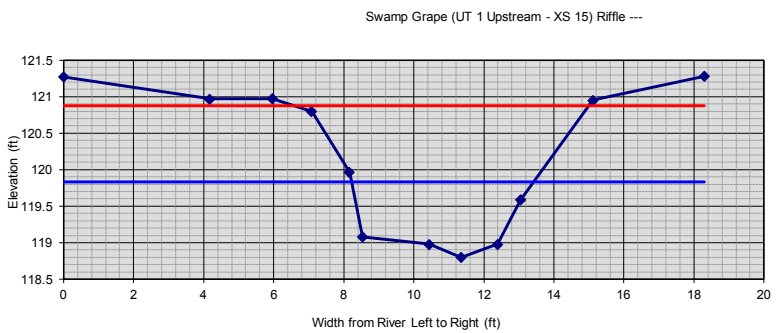
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.15	79.32			
119.85	120.68			

dimensions			
5.1	x-section area	0.9	d mean
5.8	width	6.7	wet P
1.2	d max	0.8	hyd radi
2.0	bank ht	~~6.6~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
~~0~~	measured D84 (mm)		
~~0.0~~	relative roughness	~~0.0~~	fric. factor
~~0.000~~	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 15)**

Riffle

---

description: **Swamp Grape (UT 1 Upstream - XS 15)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**78.72582**	121.2742
	☐	**4.178158**	**79.02802**	120.972
	☐	**5.963117**	**79.02574**	120.9743
	☐	**7.084949**	**79.20229**	120.7977
	☐	**8.166746**	**80.03523**	119.9648
	☐	**8.535787**	**80.91962**	119.0804
	☐	**10.43561**	**81.02008**	118.9799
	☐	**11.3525**	**81.19567**	118.8043
	☐	**12.3915**	**81.01917**	118.9808
	☐	**13.04905**	**80.41268**	119.5873
	☐	**15.11673**	**79.04622**	120.9538
	☐	**18.30627**	**78.7171**	121.2829
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

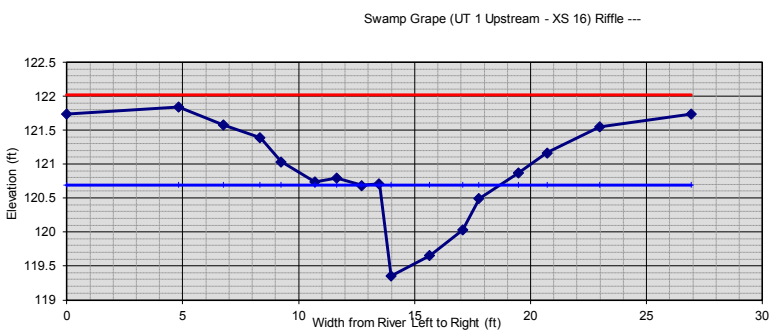
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.16	**79.2**	**8.0**		
119.84	120.8			

dimensions			
3.9	x-section area	0.8	d mean
5.2	width	6.1	wet P
1.0	d max	0.6	hyd radi
2.0	bank ht	6.9	w/d ratio
8.0	W flood prone area	1.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 16)**

Riffle

---

description: **Swamp Grape (UT 1 Upstream - XS 16)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**78.2601**	121.7399
	☐	**4.816518**	**78.15183**	121.8482
	☐	**6.765092**	**78.42252**	121.5775
	☐	**8.340306**	**78.61153**	121.3885
	☐	**9.233542**	**78.96319**	121.0368
	☐	**10.6946**	**79.2598**	120.7402
	☐	**11.64649**	**79.20656**	120.7934
	☐	**12.71607**	**79.31542**	120.6846
	☐	**13.474**	**79.28843**	120.7116
	☐	**13.99585**	**80.64187**	119.3581
	☐	**15.65669**	**80.34501**	119.655
	☐	**17.0801**	**79.96697**	120.033
	☐	**17.78416**	**79.50681**	120.4932
	☐	**19.48742**	**79.12958**	120.8704
	☐	**20.71235**	**78.83074**	121.1693
	☐	**22.98876**	**78.45191**	121.5481
	☐	**26.94369**	**78.26261**	121.7374
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

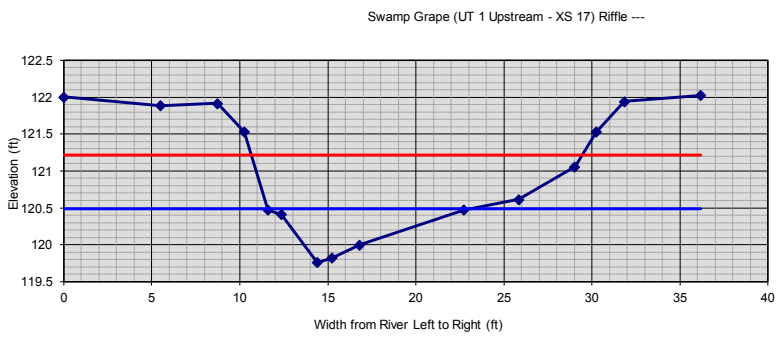
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.31	**78.26**	**50.0**		
120.69	121.74			

dimensions			
3.9	x-section area	0.7	d mean
5.4	width	6.5	wet P
1.3	d max	0.6	hyd radi
2.4	bank ht	7.5	w/d ratio
50.0	W flood prone area	9.3	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 17)**

Riffle

---

description: **Swamp Grape (UT 1 Upstream - XS 17)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**77.99495**	122.005
	☐	**5.506638**	**78.11256**	121.8874
	☐	**8.745243**	**78.08411**	121.9159
	☐	**10.25332**	**78.4684**	121.5316
	☐	**11.59704**	**79.52998**	120.47
	☐	**12.36566**	**79.58914**	120.4109
	☐	**14.40158**	**80.23716**	119.7628
	☐	**15.22749**	**80.17808**	119.8219
	☐	**16.81972**	**80.00145**	119.9985
	☐	**22.71475**	**79.52952**	120.4705
	☐	**25.84962**	**79.38306**	120.6169
	☐	**29.03895**	**78.94286**	121.0571
	☐	**30.25757**	**78.4714**	121.5286
	☐	**31.85848**	**78.05885**	121.9411
	☐	**36.19496**	**77.97023**	122.0298
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

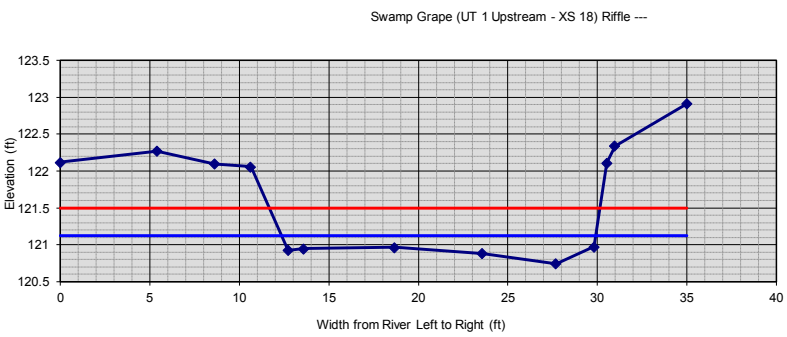
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.51	**78.08**	**18.0**		
120.49	121.92			

dimensions			
3.9	x-section area	0.3	d mean
11.6	width	11.7	wet P
0.7	d max	0.3	hyd radi
2.2	bank ht	34.5	w/d ratio
18.0	W flood prone area	1.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 18)**

Riffle

---

description: **Swamp Grape (UT 1 Upstream - XS 18)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**77.88398**	122.116
	☐	**5.412091**	**77.73015**	122.2699
	☐	**8.629372**	**77.90199**	122.098
	☐	**10.63537**	**77.9432**	122.0568
	☐	**12.72368**	**79.07626**	120.9237
	☐	**13.60497**	**79.05051**	120.9495
	☐	**18.67663**	**79.03703**	120.963
	☐	**23.57448**	**79.119**	120.881
	☐	**27.68196**	**79.25109**	120.7489
	☐	**29.82164**	**79.0249**	120.9751
	☐	**30.51196**	**77.89033**	122.1097
	☐	**30.97453**	**77.66216**	122.3378
	☐	**35.01083**	**77.08743**	122.9126
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

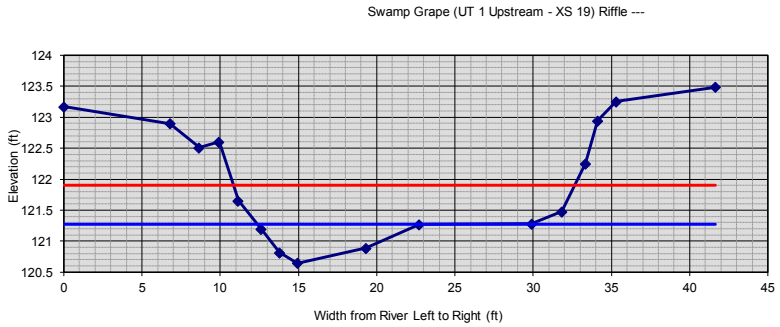
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
78.875	**77.9**	**18.0**		
121.125	122.1			

dimensions			
3.9	x-section area	0.2	d mean
17.6	width	17.7	wet P
0.4	d max	0.2	hyd radi
1.4	bank ht	79.1	w/d ratio
18.0	W flood prone area	1.0	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	**Swamp Grape (UT 1 Upstream - XS 19)**
	Riffle

	---
description:	**Swamp Grape (UT 1 Upstream - XS 19)**
height of instrument (ft):	**200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**76.82741**	123.1726
	☐	**6.811911**	**77.10361**	122.8964
	☐	**8.661895**	**77.49206**	122.5079
	☐	**9.925146**	**77.39611**	122.6039
	☐	**11.15832**	**78.34487**	121.6551
	☐	**12.62846**	**78.80928**	121.1907
	☐	**13.78517**	**79.18559**	120.8144
	☐	**14.93611**	**79.35053**	120.6495
	☐	**19.29887**	**79.11091**	120.8891
	☐	**22.72865**	**78.73038**	121.2696
	☐	**29.89871**	**78.71683**	121.2832
	☐	**31.82475**	**78.52377**	121.4762
	☐	**33.33097**	**77.75022**	122.2498
	☐	**34.13324**	**77.05658**	122.9434
	☐	**35.30974**	**76.74899**	123.251
	☐	**41.65168**	**76.51552**	123.4845
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

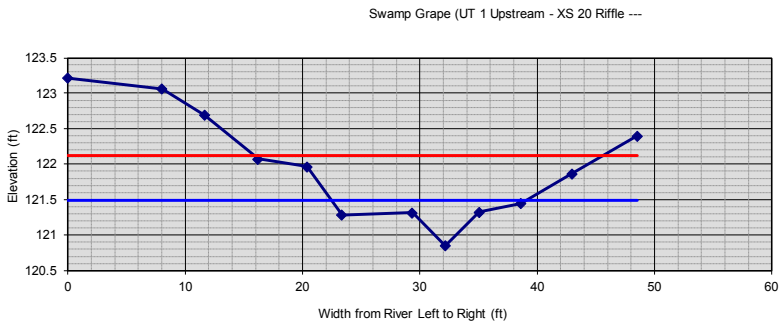
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
78.72	**77.4**	**22.0**		
121.28	122.6			

dimensions			
3.9	x-section area	0.2	d mean
15.9	width	16.0	wet P
0.6	d max	0.2	hyd radi
2.0	bank ht	64.5	w/d ratio
22.0	W flood prone area	1.4	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 20**
Riffle

---

description: **Swamp Grape (UT 1 Upstream - XS 20**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**76.78511**	123.2149
	☐	**8.035492**	**76.93902**	123.061
	☐	**11.66057**	**77.30901**	122.691
	☐	**16.22645**	**77.92738**	122.0726
	☐	**20.3928**	**78.03455**	121.9654
	☐	**23.36861**	**78.7173**	121.2827
	☐	**29.364**	**78.6841**	121.3159
	☐	**32.17004**	**79.14257**	120.8574
	☐	**35.04458**	**78.67449**	121.3255
	☐	**38.60029**	**78.55428**	121.4457
	☐	**42.96539**	**78.13235**	121.8676
	☐	**48.53227**	**77.60038**	122.3996
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

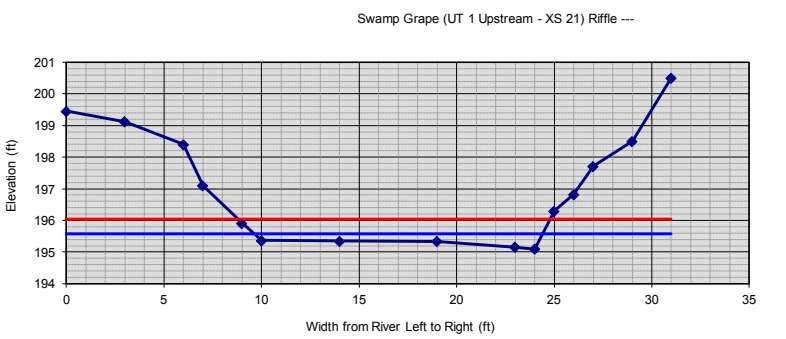
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
78.51	**77.6**	**30.0**		
121.49	122.4			

dimensions			
3.9	x-section area	0.2	d mean
16.6	width	16.7	wet P
0.6	d max	0.2	hyd radi
1.5	bank ht	70.7	w/d ratio
30.0	W flood prone area	1.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 1 Upstream - XS 21)**
Riffle

---

description: **Swamp Grape (UT 1 Upstream - XS 21)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**-1.5**	**0.35**	199.65
	☐	**0**	**0.54**	199.46
	☐	**3**	**0.88**	199.12
	☐	**6**	**1.6**	198.4
	☐	**7**	**2.9**	197.1
	☐	**9**	**4.09**	195.91
	☐	**10**	**4.63**	195.37
	☐	**14**	**4.65**	195.35
	☐	**19**	**4.66**	195.34
	☐	**23**	**4.84**	195.16
	☐	**24**	**4.91**	195.09
	☐	**25**	**3.7**	196.3
	☐	**26**	**3.18**	196.82
	☐	**27**	**2.29**	197.71
	☐	**29**	**1.5**	198.5
	☐	**31**	**-0.5**	200.5
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

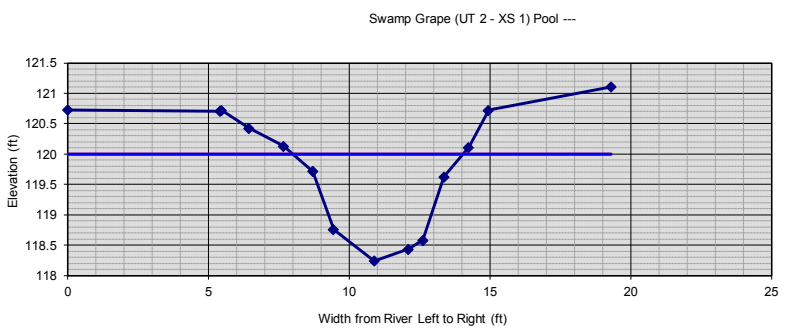
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
4.425	**1.6**	**16.0**		
195.575	198.4			

dimensions			
3.9	x-section area	0.3	d mean
14.8	width	15.1	wet P
0.5	d max	0.3	hyd radi
3.3	bank ht	56.1	w/d ratio
16.0	W flood prone area	1.1	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section: **Swamp Grape (UT 2 - XS 1)**

Pool

---

description: **Swamp Grape (UT 2 - XS 1)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	79.27525	120.7248
	☐	5.407175	79.29454	120.7055
	☐	5.4541	79.27999	120.72
	☐	6.426082	79.57647	120.4235
	☐	7.660046	79.86788	120.1321
	☐	8.704446	80.28306	119.7169
	☐	9.435847	81.24425	118.7557
	☐	10.88185	81.75159	118.2484
	☐	12.09784	81.56155	118.4385
	☐	12.61237	81.41478	118.5852
	☐	13.35548	80.37312	119.6269
	☐	14.23385	79.8906	120.1094
	☐	14.94202	79.28312	120.7169
	☐	19.29085	78.89342	121.1066
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

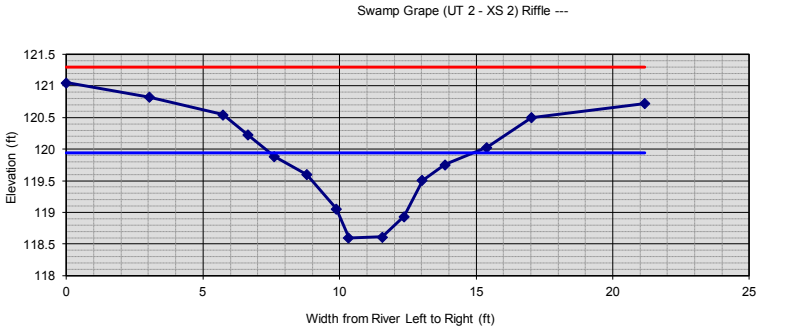
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80	79.3			
120	120.7			

dimensions			
6.4	x-section area	1.1	d mean
6.0	width	7.3	wet P
1.8	d max	0.9	hyd radi
2.5	bank ht	~~5.7~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material		
~~0~~	measured D84 (mm)	
~~0.0~~	relative roughness	~~0.0~~ fric. factor
~~0.000~~	Manning's n from channel material	

Cross Section



section: **Swamp Grape (UT 2 - XS 2)**

Riffle

---

description: **Swamp Grape (UT 2 - XS 2)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.946	121.054
	☐	3.034918	79.17855	120.8214
	☐	5.741408	79.45578	120.5442
	☐	6.642037	79.77244	120.2276
	☐	7.622004	80.11702	119.883
	☐	8.804865	80.40089	119.5991
	☐	9.886065	80.94429	119.0557
	☐	10.34013	81.40325	118.5968
	☐	11.57018	81.38951	118.6105
	☐	12.35956	81.06135	118.9387
	☐	13.03093	80.492	119.508
	☐	13.86536	80.2445	119.7555
	☐	15.39738	79.97289	120.0271
	☐	17.02459	79.4985	120.5015
	☐	21.18271	79.27493	120.7251
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

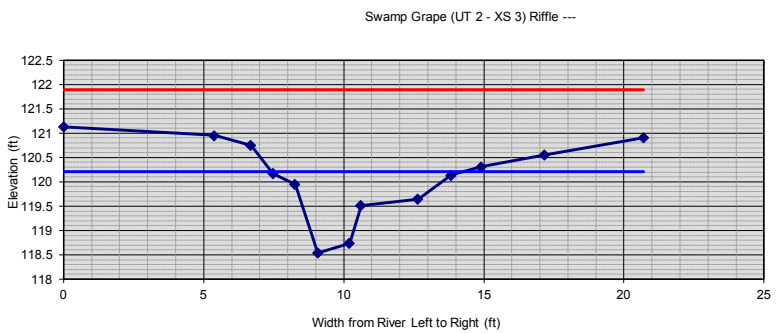
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
80.05	79.5	50.0		
119.95	120.5			

dimensions			
4.9	x-section area	0.6	d mean
7.5	width	8.2	wet P
1.4	d max	0.6	hyd radi
1.9	bank ht	11.6	w/d ratio
50.0	W flood prone area	6.6	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	0.0 fric. factor
0.000	Manning's n from channel material	

Cross Section



section: **Swamp Grape (UT 2 - XS 3)**

Riffle

---

description: **Swamp Grape (UT 2 - XS 3)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.86775	121.1323
	☐	5.375116	79.04227	120.9577
	☐	6.684147	79.24539	120.7546
	☐	7.470761	79.82948	120.1705
	☐	8.264389	80.05247	119.9475
	☐	9.079521	81.46111	118.5389
	☐	10.2035	81.25929	118.7407
	☐	10.61275	80.48375	119.5163
	☐	12.64787	80.35426	119.6457
	☐	13.83317	79.8569	120.1431
	☐	14.91206	79.68588	120.3141
	☐	17.16206	79.4487	120.5513
	☐	20.71315	79.09105	120.9089
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

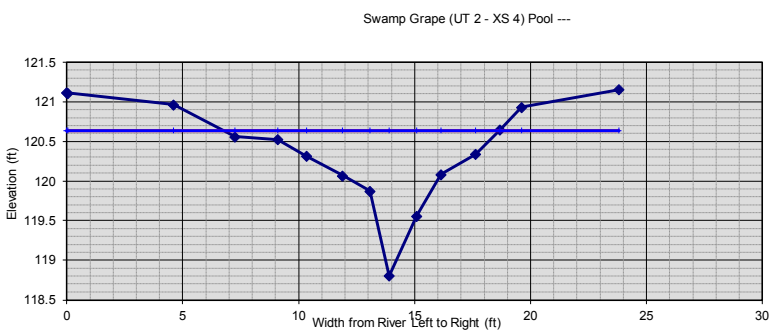
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.78	79.56	75.0		
120.22	120.44			

dimensions			
4.9	x-section area	0.7	d mean
6.9	width	8.4	wet P
1.7	d max	0.6	hyd radi
1.9	bank ht	9.8	w/d ratio
75.0	W flood prone area	10.8	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material		
0	measured D84 (mm)	
0.0	relative roughness	0.0 fric. factor
0.000	Manning's n from channel material	

Cross Section



section: **Swamp Grape (UT 2 - XS 4)**

Pool

---

description: **Swamp Grape (UT 2 - XS 4)**

height of instrument (ft): **200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.88488	121.1151
	☐	0.065074	78.88988	121.1101
	☐	4.60491	79.0363	120.9637
	☐	7.245471	79.44005	120.5599
	☐	9.096545	79.4769	120.5231
	☐	10.34178	79.68768	120.3123
	☐	11.90809	79.93423	120.0658
	☐	13.07987	80.127	119.873
	☐	13.90532	81.1955	118.8045
	☐	15.09161	80.44181	119.5582
	☐	16.13824	79.91785	120.0822
	☐	17.63897	79.6605	120.3395
	☐	18.68868	79.35681	120.6432
	☐	19.60836	79.07033	120.9297
	☐	23.81112	78.8463	121.1537
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

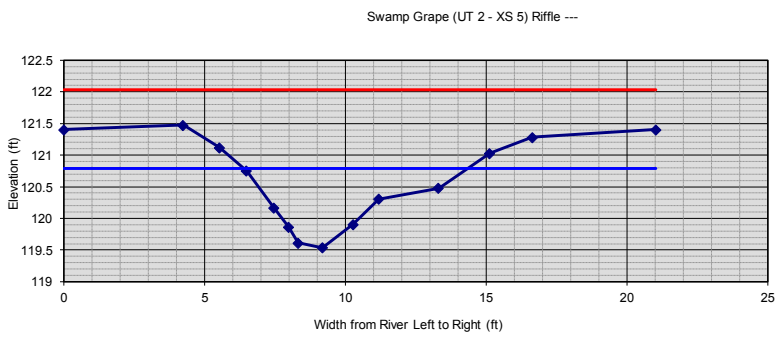
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.36	79.04			
120.64	120.96			

dimensions			
6.4	x-section area	0.5	d mean
12.0	width	12.9	wet P
1.8	d max	0.5	hyd radi
2.2	bank ht	~~22.2~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material		
~~0~~	measured D84 (mm)	
~~0.0~~	relative roughness	~~0.0~~ fric. factor
~~0.000~~	Manning's n from channel material	

Cross Section



section:	Swamp Grape (UT 2 - XS 5)
	Riffle

	---
description:	Swamp Grape (UT 2 - XS 5)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.59696	121.403
	☐	4.241776	78.52264	121.4774
	☐	5.533048	78.8805	121.1195
	☐	6.494133	79.24651	120.7535
	☐	7.457523	79.83118	120.1688
	☐	7.971978	80.13466	119.8653
	☐	8.32636	80.38756	119.6124
	☐	9.178662	80.4591	119.5409
	☐	10.27616	80.09584	119.9042
	☐	11.17857	79.6953	120.3047
	☐	13.30838	79.52194	120.4781
	☐	15.12623	78.96882	121.0312
	☐	16.64042	78.71716	121.2828
	☐	21.02096	78.59403	121.406
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

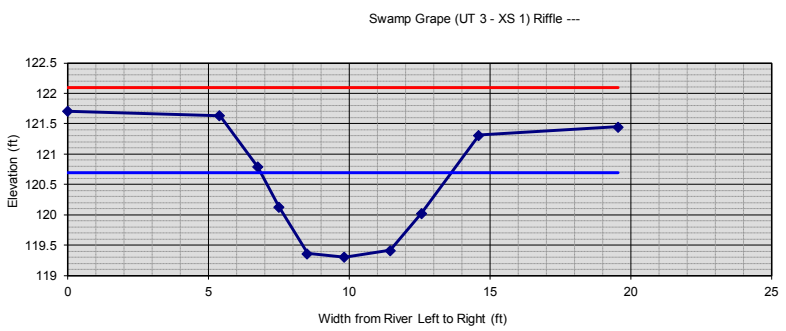
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.21	78.97	75.0		
120.79	121.03			

dimensions			
4.9	x-section area	0.6	d mean
7.9	width	8.5	wet P
1.2	d max	0.6	hyd radi
1.5	bank ht	12.8	w/d ratio
75.0	W flood prone area	9.5	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 3 - XS 1)
	Riffle

	---
description:	Swamp Grape (UT 3 - XS 1)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.29729	121.7027
	☐	5.395544	78.37072	121.6293
	☐	6.739332	79.2093	120.7907
	☐	7.499675	79.86702	120.133
	☐	8.507942	80.63958	119.3604
	☐	9.824783	80.69045	119.3095
	☐	11.44502	80.58761	119.4124
	☐	12.55726	79.9771	120.0229
	☐	14.59818	78.69185	121.3082
	☐	19.53427	78.55552	121.4445
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

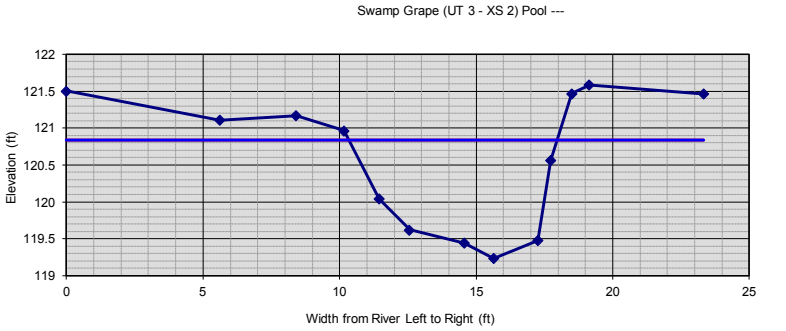
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.3	78.69	35.0		
120.7	121.31			

dimensions			
6.6	x-section area	1.0	d mean
6.8	width	7.6	wet P
1.4	d max	0.9	hyd radi
2.0	bank ht	7.0	w/d ratio
35.0	W flood prone area	5.2	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

Cross Section



section:	Swamp Grape (UT 3 - XS 2)
	Pool

	---
description:	Swamp Grape (UT 3 - XS 2)
height of instrument (ft):	200.00

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	0	78.49702	121.503
	☐	5.623961	78.89233	121.1077
	☐	8.416589	78.83215	121.1678
	☐	10.16023	79.03545	120.9646
	☐	11.45572	79.9593	120.0407
	☐	12.56841	80.38008	119.6199
	☐	14.56694	80.55707	119.4429
	☐	15.65155	80.76252	119.2375
	☐	17.26419	80.52408	119.4759
	☐	17.73138	79.43836	120.5616
	☐	18.50539	78.53276	121.4672
	☐	19.15142	78.41444	121.5856
	☐	23.32477	78.53566	121.4643
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

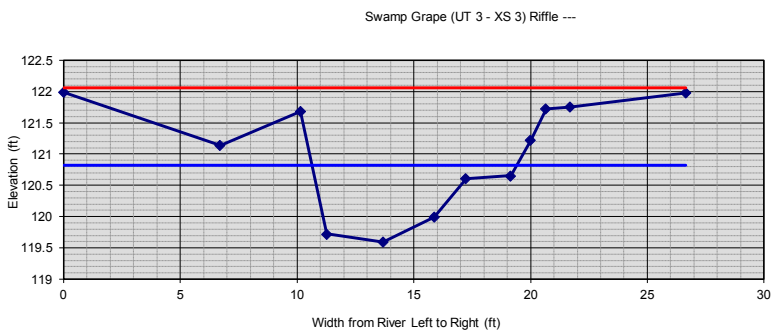
FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.16	79.03			
120.84	120.97			

dimensions			
8.6	x-section area	1.1	d mean
7.6	width	8.9	wet P
1.6	d max	1.0	hyd radi
1.7	bank ht	~~6.8~~	w/d ratio
~~0.0~~	W flood prone area	~~0.0~~	ent ratio

hydraulics	
~~0.0~~	velocity (ft/sec)
~~0.0~~	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
~~0.000~~	unit stream power (lbs/ft/sec)
~~0.00~~	Froude number
~~0.0~~	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
~~0~~	measured D84 (mm)		
~~0.0~~	relative roughness	~~0.0~~	fric. factor
~~0.000~~	Manning's n from channel material		

Cross Section



section:	**Swamp Grape (UT 3 - XS 3)**
	Riffle

	---
description:	**Swamp Grape (UT 3 - XS 3)**
height of instrument (ft):	**200.00**

notes	omit pt.	distance (ft)	FS (ft)	elevation
	☐	**0**	**78.00498**	121.995
	☐	**6.704435**	**78.86121**	121.1388
	☐	**10.1481**	**78.3191**	121.6809
	☐	**11.26404**	**80.27645**	119.7235
	☐	**13.68913**	**80.40448**	119.5955
	☐	**15.88284**	**80.00373**	119.9963
	☐	**17.23216**	**79.39413**	120.6059
	☐	**19.15181**	**79.34613**	120.6539
	☐	**20.00406**	**78.77799**	121.222
	☐	**20.65868**	**78.27882**	121.7212
	☐	**21.70041**	**78.24376**	121.7562
	☐	**26.66009**	**78.01863**	121.9814
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			
	☐			

FS bankfull	FS top of bank	W fpa (ft)	channel slope (%)	Manning's "n"
79.17	**78.32**	**27.0**		
120.83	121.68			

dimensions			
6.6	x-section area	0.7	d mean
8.8	width	9.7	wet P
1.2	d max	0.7	hyd radi
2.1	bank ht	11.7	w/d ratio
27.0	W flood prone area	3.1	ent ratio

hydraulics	
0.0	velocity (ft/sec)
0.0	discharge rate, Q (cfs)
0.00	shear stress ((lbs/ft sq)
0.00	shear velocity (ft/sec)
0.000	unit stream power (lbs/ft/sec)
0.00	Froude number
0.0	friction factor u/u*
~~0.0~~	threshold grain size (mm)

check from channel material			
0	measured D84 (mm)		
0.0	relative roughness	0.0	fric. factor
0.000	Manning's n from channel material		

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Swamp Grape
2. Date of evaluation: 1/2/19
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: AXE/WGL
5. County: Robeson
6. Nearest named water body on USGS 7.5-minute quad: Wilkinson Creek
7. River basin: Lumber 04
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.56490, -79.350402

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SAM 1 (UT 1 Downstream)
10. Length of assessment reach evaluated (feet): 1000
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1 to 1.5 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 12
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☐Size 2 (0.1 to < 0.5 mi^2) ☒Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☒A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☐B Not A

3. Feature Pattern – assessment reach metric

☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric

☐A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☒B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☒A	☒A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☐B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☒J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS************************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☒	☐	☐	☐	Silt/clay (< 0.062 mm)
☐	☒	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☒Yes ☐No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☒	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☒B	☒B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☒C	☒C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

- ☐A Streams and/or springs (jurisdictional discharges)
- ☐B Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
- ☐C Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
- ☒D Evidence of bank seepage or sweating (iron in water indicates seepage)
- ☒E Stream bed or bank soil reduced (dig through deposited sediment if present)
- ☐F None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

- ☒A Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
- ☐B Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
- ☐C Urban stream (≥ 24% impervious surface for watershed)
- ☐D Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
- ☐E Assessment reach relocated to valley edge
- ☐F None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

- ☐A Stream shading is appropriate for stream category (may include gaps associated with natural processes)
- ☐B Degraded (example: scattered trees)
- ☒C Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Swamp Grape	Date of Assessment	1/2/19
Stream Category	Ia3	Assessor Name/Organization	AXE/WGL

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**HIGH**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**HIGH**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**MEDIUM**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Swamp Grape
2. Date of evaluation: 2/21/2020
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: AXE/WGL
5. County: Robeson
6. Nearest named water body on USGS 7.5-minute quad: Wilkinson Creek
7. River basin: Lumber 04
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.561806, -79.347243

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SAM 2 (UT 1 Upstream)
10. Length of assessment reach evaluated (feet): 500
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 25
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)

☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric

☒A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☐B Not A

3. Feature Pattern – assessment reach metric

☒A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☐B Not A

4. Feature Longitudinal Profile – assessment reach metric

☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric

Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).

☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
☐B Excessive sedimentation (burying of stream features or intertidal zone)
☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
☐D Odor (not including natural sulfide odors)
☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in “Notes/Sketch” section.
☒F Livestock with access to stream or intertidal zone
☐G Excessive algae in stream or intertidal zone
☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
☐I Other: ____________________ (explain in “Notes/Sketch” section)
☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐B Multiple sticks and/or leaf packs and/or emergent vegetation
☐C Multiple snags and logs (including lap trees)
☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
☒E Little or no habitat

Check for Tidal Marsh Streams Only

☐F 5% oysters or other natural hard bottoms
☐G Submerged aquatic vegetation
☐H Low-tide refugia (pools)
☐I Sand bottom
☐J 5% vertical bank along the marsh
☐K Little or no habitat

************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*******************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
☒A Riffle-run section **(evaluate 11c)**
☒B Pool-glide section **(evaluate 11d)**
☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but $\leq$ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☒	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☐A	☐A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☒C	☒C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☐A	☐A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☒B	☒B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☐Y	☒Y	Are wetlands present in the streamside area?
☒N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☐B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☒E	Assessment reach relocated to valley edge
☐F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☒B	Degraded (example: scattered trees)
☐C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)

Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☒B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☐E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☒A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☐C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)

Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).

If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☐

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☒D	☒D	☒D	☒D	☒D	☒D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)

Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☒A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☐C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)

Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)

Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☒B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☐C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)

25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Swamp Grape	Date of Assessment	2/21/2020
Stream Category	Ia2	Assessor Name/Organization	AXE/WGL

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**LOW**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Streamside Area Vegetation	**LOW**	
(3) Upland Pollutant Filtration	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**MEDIUM**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**MEDIUM**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Swamp Grape
2. Date of evaluation: 2/21/2020
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: AXE/WGL
5. County: Robeson
6. Nearest named water body on USGS 7.5-minute quad: Wilkinson Creek
7. River basin: Lumber 04
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.564065, -79.349276

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SAM 3 (UT 3)
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 7
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. Streamside Area Interaction – streamside area metric
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☒B	☒B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☐C	☐C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] or too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) or floodplain/intertidal zone unnaturally absent or assessment reach is a man-made feature on an interstream divide

7. Water Quality Stressors – assessment reach/intertidal zone metric
Check all that apply.

- ☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
- ☒B Excessive sedimentation (burying of stream features or intertidal zone)
- ☐C Noticeable evidence of pollutant discharges entering the assessment reach and causing a water quality problem
- ☐D Odor (not including natural sulfide odors)
- ☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in "Notes/Sketch" section.
- ☐F Livestock with access to stream or intertidal zone
- ☐G Excessive algae in stream or intertidal zone
- ☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
- ☐I Other: _____ (explain in "Notes/Sketch" section)
- ☐J Little to no stressors

8. Recent Weather – watershed metric (skip for Tidal Marsh Streams)
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

- ☐A Drought conditions and no rainfall or rainfall not exceeding 1 inch within the last 48 hours
- ☐B Drought conditions and rainfall exceeding 1 inch within the last 48 hours
- ☒C No drought conditions

9. Large or Dangerous Stream – assessment reach metric
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. Natural In-stream Habitat Types – assessment reach metric
10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

- ☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
- ☐B Multiple sticks and/or leaf packs and/or emergent vegetation
- ☐C Multiple snags and logs (including lap trees)
- ☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
- ☒E Little or no habitat

Check for Tidal Marsh Streams Only

- ☐F 5% oysters or other natural hard bottoms
- ☐G Submerged aquatic vegetation
- ☐H Low-tide refugia (pools)
- ☐I Sand bottom
- ☐J 5% vertical bank along the marsh
- ☐K Little or no habitat

**************************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS*********************************

11. Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**

- ☒A Riffle-run section **(evaluate 11c)**
- ☒B Pool-glide section **(evaluate 11d)**
- ☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☒	☐	Sand (.062 – 2 mm)
☐	☐	☒	☐	☐	Silt/clay (< 0.062 mm)
☐	☒	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☒A	☒A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☒B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☒F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☒C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Swamp Grape	Date of Assessment	2/21/2020
Stream Category	Ia2	Assessor Name/Organization	AXE/WGL

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**HIGH**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**MEDIUM**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC SAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 2.1

USACE AID #: NCDWR #:

INSTRUCTIONS: Attach a sketch of the assessment area and photographs. Attach a copy of the USGS 7.5-minute topographic quadrangle, and circle the location of the stream reach under evaluation. If multiple stream reaches will be evaluated on the same property, identify and number all reaches on the attached map, and include a separate form for each reach. See the NC SAM User Manual for detailed descriptions and explanations of requested information. Record in the "Notes/Sketch" section if supplementary measurements were performed. See the NC SAM User Manual for examples of additional measurements that may be relevant.

NOTE EVIDENCE OF STRESSORS AFFECTING THE ASSESSMENT AREA (do not need to be within the assessment area).

PROJECT/SITE INFORMATION:

1. Project name (if any): Swamp Grape
2. Date of evaluation: 2/21/2020
3. Applicant/owner name: Restoration Systems
4. Assessor name/organization: AXE/WGL
5. County: Robeson
6. Nearest named water body on USGS 7.5-minute quad: Wilkinson Creek
7. River basin: Lumber 04
8. Site coordinates (decimal degrees, at lower end of assessment reach): 34.564348, -79.349068

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): SAM 4 (UT 2)
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 6
13. Is assessment reach a swamp steam? ☐Yes ☒No
14. Feature type: ☒Perennial flow ☐Intermittent flow ☐Tidal Marsh Stream

STREAM CATEGORY INFORMATION:

15. NC SAM Zone: ☐ Mountains (M) ☐ Piedmont (P) ☒ Inner Coastal Plain (I) ☐ Outer Coastal Plain (O)
16. Estimated geomorphic valley shape (**skip for Tidal Marsh Stream**):
☒A  (more sinuous stream, flatter valley slope)
☐B  (less sinuous stream, steeper valley slope)
17. Watershed size: **(skip for Tidal Marsh Stream**) ☐Size 1 (< 0.1 mi^2) ☒Size 2 (0.1 to < 0.5 mi^2) ☐Size 3 (0.5 to < 5 mi^2) ☐Size 4 (≥ 5 mi^2)

ADDITIONAL INFORMATION:

18. Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.
☐Section 10 water ☐Classified Trout Waters ☐Water Supply Watershed (☐I ☐II ☐III ☐IV ☐V)
☐Essential Fish Habitat ☐Primary Nursery Area ☐ High Quality Waters/Outstanding Resource Waters
☐Publicly owned property ☐NCDWR Riparian buffer rule in effect ☐Nutrient Sensitive Waters
☐Anadromous fish ☐303(d) List ☐CAMA Area of Environmental Concern (AEC)
☐Documented presence of a federal and/or state listed protected species within the assessment area.
List species:
☐Designated Critical Habitat (list species)
19. Are additional stream information/supplementary measurements included in "Notes/Sketch" section or attached? ☒Yes ☐No

1. Channel Water – assessment reach metric (skip for Size 1 streams and Tidal Marsh Streams)
☒A Water throughout assessment reach.
☐B No flow, water in pools only.
☐C No water in assessment reach.

2. Evidence of Flow Restriction – assessment reach metric
☐A At least 10% of assessment reach in-stream habitat or riffle-pool sequence is severely affected by a flow restriction or fill to the point of obstructing flow or a channel choked with aquatic macrophytes or ponded water or impoundment on flood or ebb within the assessment reach (examples: undersized or perched culverts, causeways that constrict the channel, tidal gates, debris jams, beaver dams).
☒B Not A

3. Feature Pattern – assessment reach metric
☐A A majority of the assessment reach has altered pattern (examples: straightening, modification above or below culvert).
☒B Not A

4. Feature Longitudinal Profile – assessment reach metric
☒A Majority of assessment reach has a substantially altered stream profile (examples: channel down-cutting, existing damming, over widening, active aggradation, dredging, and excavation where appropriate channel profile has not reformed from any of these disturbances).
☐B Not A

5. Signs of Active Instability – assessment reach metric
Consider only current instability, not past events from which the stream has currently recovered. Examples of instability include active bank failure, active channel down-cutting (head-cut), active widening, and artificial hardening (such as concrete, gabion, rip-rap).
☐A < 10% of channel unstable
☐B 10 to 25% of channel unstable
☒C > 25% of channel unstable

6. **Streamside Area Interaction – streamside area metric**
Consider for the Left Bank (LB) and the Right Bank (RB).

LB	RB	
☐A	☐A	Little or no evidence of conditions that adversely affect reference interaction
☐B	☐B	Moderate evidence of conditions (examples: berms, levees, down-cutting, aggradation, dredging) that adversely affect reference interaction (examples: limited streamside area access, disruption of flood flows through streamside area, leaky or intermittent bulkheads, causeways with floodplain constriction, minor ditching [including mosquito ditching])
☒C	☒C	Extensive evidence of conditions that adversely affect reference interaction (little to no floodplain/intertidal zone access [examples: causeways with floodplain and channel constriction, bulkheads, retaining walls, fill, stream incision, disruption of flood flows through streamside area] <u>or</u> too much floodplain/intertidal zone access [examples: impoundments, intensive mosquito ditching]) <u>or</u> floodplain/intertidal zone unnaturally absent <u>or</u> assessment reach is a man-made feature on an interstream divide

7. **Water Quality Stressors – assessment reach/intertidal zone metric**
Check all that apply.

☐A Discolored water in stream or intertidal zone (milky white, blue, unnatural water discoloration, oil sheen, stream foam)
☒B <u>Excessive</u> sedimentation (burying of stream features or intertidal zone)
☐C Noticeable evidence of pollutant discharges entering the assessment reach <u>and</u> causing a water quality problem
☐D Odor (not including natural sulfide odors)
☐E Current published or collected data indicating degraded water quality in the assessment reach. Cite source in “Notes/Sketch” section.
☐F Livestock with access to stream or intertidal zone
☐G Excessive algae in stream or intertidal zone
☐H Degraded marsh vegetation in the intertidal zone (removal, burning, regular mowing, destruction, etc)
☐I Other: ____________________ (explain in “Notes/Sketch” section)
☐J Little to no stressors

8. **Recent Weather – watershed metric (skip for Tidal Marsh Streams)**
For Size 1 or 2 streams, D1 drought or higher is considered a drought; for Size 3 or 4 streams, D2 drought or higher is considered a drought.

☐A Drought conditions <u>and</u> no rainfall or rainfall not exceeding 1 inch within the last 48 hours
☐B Drought conditions <u>and</u> rainfall exceeding 1 inch within the last 48 hours
☒C No drought conditions

9. **Large or Dangerous Stream – assessment reach metric**
☐Yes ☒No Is stream is too large or dangerous to assess? If Yes, skip to Metric 13 (Streamside Area Ground Surface Condition).

10. **Natural In-stream Habitat Types – assessment reach metric**

10a. ☒Yes ☐No Degraded in-stream habitat over majority of the assessment reach (examples of stressors include excessive sedimentation, mining, excavation, in-stream hardening [for example, rip-rap], recent dredging, and snagging) **(evaluate for Size 4 Coastal Plain streams only, then skip to Metric 12)**

10b. **Check all that occur** (occurs if > 5% coverage of assessment reach) **(skip for Size 4 Coastal Plain streams)**

☐A Multiple aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐B Multiple sticks and/or leaf packs and/or emergent vegetation
☐C Multiple snags and logs (including lap trees)
☐D 5% undercut banks and/or root mats and/or roots in banks extend to the normal wetted perimeter
☒E Little or no habitat

Check for Tidal Marsh Streams Only

☐F 5% oysters or other natural hard bottoms
☐G Submerged aquatic vegetation
☐H Low-tide refugia (pools)
☐I Sand bottom
☐J 5% vertical bank along the marsh
☐K Little or no habitat

**********************************REMAINING QUESTIONS ARE NOT APPLICABLE FOR TIDAL MARSH STREAMS****************************

11. **Bedform and Substrate – assessment reach metric (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**

11a. ☒Yes ☐No Is assessment reach in a natural sand-bed stream? **(skip for Coastal Plain streams)**

11b. Bedform evaluated. **Check the appropriate box(es).**
☒A Riffle-run section **(evaluate 11c)**
☒B Pool-glide section **(evaluate 11d)**
☐C Natural bedform absent **(skip to Metric 12, Aquatic Life)**

11c. In riffle sections, check all that occur below the normal wetted perimeter of the assessment reach – whether or not submerged. **Check at least one box in each row (skip for Size 4 Coastal Plain streams and Tidal Marsh Streams)**. Not Present (NP) = absent, Rare (R) = present but ≤ 10%, Common (C) = > 10-40%, Abundant (A) = > 40-70%, Predominant (P) = > 70%. Cumulative percentages should not exceed 100% for each assessment reach.

NP	R	C	A	P	
☒	☐	☐	☐	☐	Bedrock/saprolite
☒	☐	☐	☐	☐	Boulder (256 – 4096 mm)
☒	☐	☐	☐	☐	Cobble (64 – 256 mm)
☐	☒	☐	☐	☐	Gravel (2 – 64 mm)
☐	☐	☐	☐	☒	Sand (.062 – 2 mm)
☐	☒	☐	☐	☐	Silt/clay (< 0.062 mm)
☐	☒	☐	☐	☐	Detritus
☒	☐	☐	☐	☐	Artificial (rip-rap, concrete, etc.)

11d. ☒Yes ☐No Are pools filled with sediment? (**skip for Size 4 Coastal Plain streams and Tidal Marsh Streams**)

12. Aquatic Life – assessment reach metric (skip for Tidal Marsh Streams)

12a. ☒Yes ☐No Was an in-stream aquatic life assessment performed as described in the User Manual?
If No, select one of the following reasons and skip to Metric 13. ☐No Water ☐Other: _____

12b. ☐Yes ☒No Are aquatic organisms present in the assessment reach (look in riffles, pools, then snags)? If Yes, check all that apply. If No, skip to Metric 13.

1	>1	Numbers over columns refer to "individuals" for Size 1 and 2 streams and "taxa" for Size 3 and 4 streams.
☐	☐	Adult frogs
☐	☐	Aquatic reptiles
☐	☐	Aquatic macrophytes and aquatic mosses (include liverworts, lichens, and algal mats)
☐	☐	Beetles
☐	☐	Caddisfly larvae (T)
☐	☐	Asian clam (*Corbicula*)
☐	☐	Crustacean (isopod/amphipod/crayfish/shrimp)
☐	☐	Damselfly and dragonfly larvae
☐	☐	Dipterans
☐	☐	Mayfly larvae (E)
☐	☐	Megaloptera (alderfly, fishfly, dobsonfly larvae)
☐	☐	Midges/mosquito larvae
☐	☐	Mosquito fish (*Gambusia*) or mud minnows (*Umbra pygmaea*)
☐	☐	Mussels/Clams (not *Corbicula*)
☐	☐	Other fish
☐	☐	Salamanders/tadpoles
☐	☐	Snails
☐	☐	Stonefly larvae (P)
☐	☐	Tipulid larvae
☐	☐	Worms/leeches

13. Streamside Area Ground Surface Condition – streamside area metric (skip for Tidal Marsh Streams and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB). Consider storage capacity with regard to both overbank flow and upland runoff.

LB	RB	
☒A	☒A	Little or no alteration to water storage capacity over a majority of the streamside area
☐B	☐B	Moderate alteration to water storage capacity over a majority of the streamside area
☐C	☐C	Severe alteration to water storage capacity over a majority of the streamside area (examples: ditches, fill, soil compaction, livestock disturbance, buildings, man-made levees, drainage pipes)

14. Streamside Area Water Storage – streamside area metric (skip for Size 1 streams, Tidal Marsh Streams, and B valley types)
Consider for the Left Bank (LB) and the Right Bank (RB) of the streamside area.

LB	RB	
☒A	☒A	Majority of streamside area with depressions able to pond water ≥ 6 inches deep
☐B	☐B	Majority of streamside area with depressions able to pond water 3 to 6 inches deep
☐C	☐C	Majority of streamside area with depressions able to pond water < 3 inches deep

15. Wetland Presence – streamside area metric (skip for Tidal Marsh Streams)
Consider for the Left Bank (LB) and the Right Bank (RB). Do not consider wetlands outside of the streamside area or within the normal wetted perimeter of assessment reach.

LB	RB	
☒Y	☒Y	Are wetlands present in the streamside area?
☐N	☐N	

16. Baseflow Contributors – assessment reach metric (skip for Size 4 streams and Tidal Marsh Streams)
Check all contributors within the assessment reach or within view of <u>and</u> draining to the assessment reach.

☒A	Streams and/or springs (jurisdictional discharges)
☐B	Ponds (include wet detention basins; do not include sediment basins or dry detention basins)
☐C	Obstruction passing flow during low-flow periods within the assessment area (beaver dam, leaky dam, bottom-release dam, weir)
☐D	Evidence of bank seepage or sweating (iron in water indicates seepage)
☒E	Stream bed or bank soil reduced (dig through deposited sediment if present)
☐F	None of the above

17. Baseflow Detractors – assessment area metric (skip for Tidal Marsh Streams)
Check all that apply.

☐A	Evidence of substantial water withdrawals from the assessment reach (includes areas excavated for pump installation)
☐B	Obstruction not passing flow during low-flow periods affecting the assessment reach (ex: watertight dam, sediment deposit)
☐C	Urban stream (≥ 24% impervious surface for watershed)
☐D	Evidence that the streamside area has been modified resulting in accelerated drainage into the assessment reach
☐E	Assessment reach relocated to valley edge
☒F	None of the above

18. Shading – assessment reach metric (skip for Tidal Marsh Streams)
Consider aspect. Consider "leaf-on" condition.

☐A	Stream shading is appropriate for stream category (may include gaps associated with natural processes)
☐B	Degraded (example: scattered trees)
☒C	Stream shading is gone or largely absent

19. Buffer Width – streamside area metric (skip for Tidal Marsh Streams)
Consider "vegetated buffer" and "wooded buffer" separately for left bank (LB) and right bank (RB) starting at the top of bank out to the first break.

Vegetated		Wooded		
LB	RB	LB	RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide or extends to the edge of the watershed
☐B	☐B	☐B	☐B	From 50 to < 100 feet wide
☐C	☐C	☐C	☐C	From 30 to < 50 feet wide
☐D	☐D	☐D	☐D	From 10 to < 30 feet wide
☐E	☐E	☒E	☒E	< 10 feet wide or no trees

20. Buffer Structure – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Vegetated" Buffer Width).

LB	RB	
☐A	☐A	Mature forest
☐B	☐B	Non-mature woody vegetation or modified vegetation structure
☒C	☒C	Herbaceous vegetation with or without a strip of trees < 10 feet wide
☐D	☐D	Maintained shrubs
☐E	☐E	Little or no vegetation

21. Buffer Stressors – streamside area metric (skip for Tidal Marsh Streams)
Check all appropriate boxes for left bank (LB) and right bank (RB). Indicate if listed stressor abuts stream (Abuts), does not abut but is within 30 feet of stream (< 30 feet), or is between 30 to 50 feet of stream (30-50 feet).
If none of the following stressors occurs on either bank, check here and skip to Metric 22: ☒

Abuts		< 30 feet		30-50 feet		
LB	RB	LB	RB	LB	RB	
☐A	☐A	☐A	☐A	☐A	☐A	Row crops
☐B	☐B	☐B	☐B	☐B	☐B	Maintained turf
☐C	☐C	☐C	☐C	☐C	☐C	Pasture (no livestock)/commercial horticulture
☐D	☐D	☐D	☐D	☐D	☐D	Pasture (active livestock use)

22. Stem Density – streamside area metric (skip for Tidal Marsh Streams)
Consider for left bank (LB) and right bank (RB) for Metric 19 ("Wooded" Buffer Width).

LB	RB	
☐A	☐A	Medium to high stem density
☐B	☐B	Low stem density
☒C	☒C	No wooded riparian buffer or predominantly herbaceous species or bare ground

23. Continuity of Vegetated Buffer – streamside area metric (skip for Tidal Marsh Streams)
Consider whether vegetated buffer is continuous along stream (parallel). Breaks are areas lacking vegetation > 10 feet wide.

LB	RB	
☒A	☒A	The total length of buffer breaks is < 25 percent.
☐B	☐B	The total length of buffer breaks is between 25 and 50 percent.
☐C	☐C	The total length of buffer breaks is > 50 percent.

24. Vegetative Composition – streamside area metric (skip for Tidal Marsh Streams)
Evaluate the dominant vegetation within 100 feet of each bank or to the edge of the watershed (whichever comes first) as it contributes to assessment reach habitat.

LB	RB	
☐A	☐A	Vegetation is close to undisturbed in species present and their proportions. Lower strata composed of native species, with non-native invasive species absent or sparse.
☐B	☐B	Vegetation indicates disturbance in terms of species diversity or proportions, but is still largely composed of native species. This may include communities of weedy native species that develop after clear-cutting or clearing or communities with non-native invasive species present, but not dominant, over a large portion of the expected strata or communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent or communities with non-native invasive species dominant over a large portion of expected strata or communities composed of planted stands of non-characteristic species or communities inappropriately composed of a single species or no vegetation.

25. Conductivity – assessment reach metric (skip for all Coastal Plain streams)
25a. ☐Yes ☒No Was conductivity measurement recorded?
If No, select one of the following reasons. ☐No Water ☐Other: _____

25b. Check the box corresponding to the conductivity measurement (units of microsiemens per centimeter).
☐A < 46 ☐B 46 to < 67 ☐C 67 to < 79 ☐D 79 to < 230 ☐E ≥ 230

Notes/Sketch:

Draft NC SAM Stream Rating Sheet
Accompanies User Manual Version 2.1

Stream Site Name	Swamp Grape	Date of Assessment	2/21/2020
Stream Category	Ia2	Assessor Name/Organization	AXE/WGL

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	YES
NC SAM feature type (perennial, intermittent, Tidal Marsh Stream)	Perennial

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**HIGH**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**LOW**	
(4) Stream Geomorphology	**MEDIUM**	
(2) Stream/Intertidal Zone Interaction	NA	
(2) Longitudinal Tidal Flow	NA	
(2) Tidal Marsh Stream Stability	NA	
(3) Tidal Marsh Channel Stability	NA	
(3) Tidal Marsh Stream Geomorphology	NA	
(1) Water Quality	**LOW**	
(2) Baseflow	**MEDIUM**	
(2) Streamside Area Vegetation	**MEDIUM**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**LOW**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**MEDIUM**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**LOW**	
(3) Stream-side Habitat	**LOW**	
(3) Thermoregulation	**LOW**	
(2) Tidal Marsh In-stream Habitat	NA	
(3) Flow Restriction	NA	
(3) Tidal Marsh Stream Stability	NA	
(4) Tidal Marsh Channel Stability	NA	
(4) Tidal Marsh Stream Geomorphology	NA	
(3) Tidal Marsh In-stream Habitat	NA	
(2) Intertidal Zone	NA	
Overall	**LOW**	

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Swamp Grape	Date of Evaluation	4/10/2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	WAM 1
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Keith/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Wilkinson Creek
River Basin	Lumber	USGS 8-Digit Catalogue Unit	03040204
County	Robeson	NCDWR Region	Fayetteville
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	34.56172, -79.34701

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☒ Yes ☐ No

Regulatory Considerations - Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.

☐ Anadromous fish
☒ Federally protected species or State endangered or threatened species
☐ NCDWR riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

☒ Blackwater
☐ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ☐ Yes ☒ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☒A	☐A	Not severely altered
☐B	☒B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☐A	☐A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☒C	☒C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☐C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☒D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ☐A Sandy soil
- ☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ☐C Loamy or clayey soils not exhibiting redoximorphic features
- ☐D Loamy or clayey gleyed soil
- ☐E Histosol or histic epipedon

4b.
- ☐A Soil ribbon < 1 inch
- ☒B Soil ribbon ≥ 1 inch

4c.
- ☒A No peat or muck presence
- ☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☒A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☐C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☐B	☐B	☐B	Confined animal operations (or other local, concentrated source of pollutants
☐C	☐C	☐C	≥ 20% coverage of pasture
☒D	☒D	☒D	≥ 20% coverage of agricultural land (regularly plowed land)
☐E	☐E	☐E	≥ 20% coverage of maintained grass/herb
☐F	☐F	☐F	≥ 20% coverage of clear-cut land
☐G	☐G	☐G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent drainage and/or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? (Wetland buffer need only be present on one side of the .water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ☐A ≥ 50 feet
- ☒B From 30 to < 50 feet
- ☐C From 15 to < 30 feet
- ☐D From 5 to < 15 feet
- ☐E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☐Yes ☒No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☐A	☐A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☒E	☒E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☒B Evidence of saturation, without evidence of inundation
☐C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☐A	☒A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☐I	☐I	☐I	From 0.1 to < 0.5 acre
☒J	☐J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☒K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☐A	☒A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☒F	☐F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directions? If the assessment area is clear cut, select option "C."

☐A 0
☐B 1 to 4
☒C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☒B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☐C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☒A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☒A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☐B	☐B	Moderate density shrub layer
	☒C	☒C	Shrub layer sparse or absent
Herb	☒A	☒A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☒B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☐B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☒C Majority of canopy trees are < 6 inches DBH or no trees.

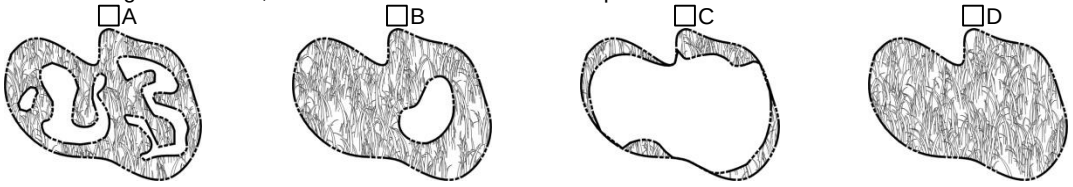
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A ☐B ☐C ☐D



22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.
☐A Overbank and overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☐C Overland flow is severely altered in the assessment area.
☒D Both overbank and overland flow are severely altered in the assessment area.

Notes
Assesment area is in cow pasture adjacent to incised stream. Stream incision has removed the majority of hydrology from the wetland. Livestock activity has caused excessive soil compaction throughout assessment area.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	WAM 1	Date of Assessment	4/10/2020
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Keith/Axiom

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	YES
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	NO
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-surface Storage and Retention	Condition	**LOW**
Water Quality	Pathogen Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence (Y/N)	**NO**
	Soluble Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence (Y/N)	**NO**
	Physical Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**LOW**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM FIELD ASSESSMENT RESULTS
Accompanies User Manual Version 5.0

USACE AID #		NCDWR#	
Project Name	Swamp Grape	Date of Evaluation	4/10/2020
Applicant/Owner Name	Restoration Systems	Wetland Site Name	WAM 2 (Old Pond)
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Keith/Axiom
Level III Ecoregion	Southeastern Plains	Nearest Named Water Body	Wilkinson Creek
River Basin	Lumber	USGS 8-Digit Catalogue Unit	03040204
County	Robeson	NCDWR Region	Fayetteville
☐ Yes ☒ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	34.56311, -79.34826

Evidence of stressors affecting the assessment area (may not be within the assessment area)

Please circle and/or make note on the last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, within 10 years). Noteworthy stressors include, but are not limited to the following.

- Hydrological modifications (examples: ditches, dams, beaver dams, dikes, berms, ponds, etc.)
- Surface and sub-surface discharges into the wetland (examples: discharges containing obvious pollutants, presence of nearby septic tanks, underground storage tanks (USTs), hog lagoons, etc.)
- Signs of vegetation stress (examples: vegetation mortality, insect damage, disease, storm damage, salt intrusion, etc.)
- Habitat/plant community alteration (examples: mowing, clear-cutting, exotics, etc.)

Is the assessment area intensively managed? ☐ Yes ☒ No

Regulatory Considerations - Were regulatory considerations evaluated? ☒Yes ☐No If Yes, check all that apply to the assessment area.

☐ Anadromous fish
☒ Federally protected species or State endangered or threatened species
☐ NCDWR riparian buffer rule in effect
☐ Abuts a Primary Nursery Area (PNA)
☐ Publicly owned property
☐ N.C. Division of Coastal Management Area of Environmental Concern (AEC) (including buffer)
☐ Abuts a stream with a NCDWQ classification of SA or supplemental classifications of HQW, ORW, or Trout
☐ Designated NCNHP reference community
☐ Abuts a 303(d)-listed stream or a tributary to a 303(d)-listed stream

What type of natural stream is associated with the wetland, if any? (check all that apply)

☒ Blackwater
☐ Brownwater
☐ Tidal (if tidal, check one of the following boxes) ☐ Lunar ☐ Wind ☐ Both

Is the assessment area on a coastal island? ☐ Yes ☒ No

Is the assessment area's surface water storage capacity or duration substantially altered by beaver? ☐ Yes ☒ No

Does the assessment area experience overbank flooding during normal rainfall conditions? ☒ Yes ☐ No

1. Ground Surface Condition/Vegetation Condition – assessment area condition metric

Check a box in each column. Consider alteration to the ground surface (GS) in the assessment area and vegetation structure (VS) in the assessment area. Compare to reference wetland if applicable (see User Manual). If a reference is not applicable, then rate the assessment area based on evidence an effect.

GS	VS	
☒A	☒A	Not severely altered
☐B	☐B	Severely altered over a majority of the assessment area (ground surface alteration examples: vehicle tracks, excessive sedimentation, fire-plow lanes, skidder tracks, bedding, fill, soil compaction, obvious pollutants) (vegetation structure alteration examples: mechanical disturbance, herbicides, salt intrusion [where appropriate], exotic species, grazing, less diversity [if appropriate], hydrologic alteration)

2. Surface and Sub-Surface Storage Capacity and Duration – assessment area condition metric

Check a box in each column. Consider surface storage capacity and duration (Surf) and sub-surface storage capacity and duration (Sub). Consider both increase and decrease in hydrology. A ditch ≤ 1 foot deep is considered to affect surface water only, while a ditch > 1 foot deep is expected to affect both surface and sub-surface water. Consider tidal flooding regime, if applicable.

Surf	Sub	
☒A	☒A	Water storage capacity and duration are not altered.
☐B	☐B	Water storage capacity or duration are altered, but not substantially (typically, not sufficient to change vegetation).
☐C	☐C	Water storage capacity or duration are substantially altered (typically, alteration sufficient to result in vegetation change) (examples: draining, flooding, soil compaction, filling, excessive sedimentation, underground utility lines).

3. Water Storage/Surface Relief – assessment area/wetland type condition metric (skip for all marshes)

Check a box in each column. Select the appropriate storage for the assessment area (AA) and the wetland type (WT).

	AA	WT	
3a.	☐A	☐A	Majority of wetland with depressions able to pond water > 1 deep
	☐B	☐B	Majority of wetland with depressions able to pond water 6 inches to 1 foot deep
	☐C	☒C	Majority of wetland with depressions able to pond water 3 to 6 inches deep
	☒D	☐D	Depressions able to pond water < 3 inches deep

3b. ☐A Evidence that maximum depth of inundation is greater than 2 feet
☐B Evidence that maximum depth of inundation is between 1 and 2 feet
☒C Evidence that maximum depth of inundation is less than 1 foot

4. Soil Texture/Structure – assessment area condition metric (skip for all marshes)

Check a box from each of the three soil property groups below. Dig soil profile in the dominant assessment area landscape feature. Make soil observations within the top 12 inches. Use most recent National Technical Committee for Hydric Soils guidance for regional indicators.

4a.
- ☐A Sandy soil
- ☒B Loamy or clayey soils exhibiting redoximorphic features (concentrations, depletions, or rhizospheres)
- ☐C Loamy or clayey soils not exhibiting redoximorphic features
- ☐D Loamy or clayey gleyed soil
- ☐E Histosol or histic epipedon

4b.
- ☐A Soil ribbon < 1 inch
- ☒B Soil ribbon ≥ 1 inch

4c.
- ☒A No peat or muck presence
- ☐B A peat or muck presence

5. Discharge into Wetland – opportunity metric

Check a box in each column. Consider surface pollutants or discharges (Surf) and sub-surface pollutants or discharges (Sub). Examples of sub-surface discharges include presence of nearby septic tank, underground storage tank (UST), etc.

Surf	Sub	
☒A	☒A	Little or no evidence of pollutants or discharges entering the assessment area
☐B	☐B	Noticeable evidence of pollutants or discharges entering the wetland and stressing, but not overwhelming the treatment capacity of the assessment area
☐C	☐C	Noticeable evidence of pollutants or discharges (pathogen, particulate, or soluble) entering the assessment area and potentially overwhelming the treatment capacity of the wetland (water discoloration, dead vegetation, excessive sedimentation, odor)

6. Land Use – opportunity metric (skip for non-riparian wetlands)

Check all that apply (at least one box in each column). Evaluation involves a GIS effort with field adjustment. Consider sources draining to assessment area within entire upstream watershed (WS), within 5 miles and within the watershed draining to the assessment area (5M), and within 2 miles and within the watershed draining to the assessment area (2M).

WS	5M	2M	
☐A	☐A	☐A	≥ 10% impervious surfaces
☐B	☐B	☐B	Confined animal operations (or other local, concentrated source of pollutants
☐C	☐C	☐C	≥ 20% coverage of pasture
☒D	☒D	☒D	≥ 20% coverage of agricultural land (regularly plowed land)
☐E	☐E	☐E	≥ 20% coverage of maintained grass/herb
☐F	☐F	☐F	≥ 20% coverage of clear-cut land
☐G	☐G	☐G	Little or no opportunity to improve water quality. Lack of opportunity may result from little or no disturbance in the watershed or hydrologic alterations that prevent drainage and/or overbank flow from affecting the assessment area.

7. Wetland Acting as Vegetated Buffer – assessment area/wetland complex condition metric (skip for non-riparian wetlands)

7a. Is assessment area within 50 feet of a tributary or other open water?
☒Yes ☐No If Yes, continue to 7b. If No, skip to Metric 8.
Wetland buffer need only be present on one side of the water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.

7b. How much of the first 50 feet from the bank is wetland? (Wetland buffer need only be present on one side of the .water body. Make buffer judgment based on the average width of wetland. Record a note if a portion of the buffer has been removed or disturbed.)
- ☒A ≥ 50 feet
- ☐B From 30 to < 50 feet
- ☐C From 15 to < 30 feet
- ☐D From 5 to < 15 feet
- ☐E < 5 feet or buffer bypassed by ditches

7c. Tributary width. If the tributary is anastomosed, combine widths of channels/braids for a total width.
☒≤ 15-feet wide ☐> 15-feet wide ☐ Other open water (no tributary present)

7d. Do roots of assessment area vegetation extend into the bank of the tributary/open water?
☒Yes ☐No

7e. Is stream or other open water sheltered or exposed?
☒Sheltered – adjacent open water with width < 2500 feet and no regular boat traffic.
☐Exposed – adjacent open water with width ≥ 2500 feet or regular boat traffic.

8. Wetland Width at the Assessment Area – wetland type/wetland complex condition metric (evaluate WT for all marshes and Estuarine Woody Wetland only; evaluate WC for Bottomland Hardwood Forest, Headwater Forest, and Riverine Swamp Forest only)

Check a box in each column for riverine wetlands only. Select the average width for the wetland type at the assessment area (WT) and the wetland complex at the assessment area (WC). See User Manual for WT and WC boundaries.

WT	WC	
☒A	☒A	≥ 100 feet
☐B	☐B	From 80 to < 100 feet
☐C	☐C	From 50 to < 80 feet
☐D	☐D	From 40 to < 50 feet
☐E	☐E	From 30 to < 40 feet
☐F	☐F	From 15 to < 30 feet
☐G	☐G	From 5 to < 15 feet
☐H	☐H	< 5 feet

9. Inundation Duration – assessment area condition metric (skip for non-riparian wetlands)

Answer for assessment area dominant landform.

☐A Evidence of short-duration inundation (< 7 consecutive days)
☐B Evidence of saturation, without evidence of inundation
☒C Evidence of long-duration inundation or very long-duration inundation (7 to 30 consecutive days or more)

10. Indicators of Deposition – assessment area condition metric (skip for non-riparian wetlands and all marshes)

Consider recent deposition only (no plant growth since deposition).

☒A Sediment deposition is not excessive, but at approximately natural levels.
☐B Sediment deposition is excessive, but not overwhelming the wetland.
☐C Sediment deposition is excessive and is overwhelming the wetland.

11. Wetland Size – wetland type/wetland complex condition metric

Check a box in each column. Involves a GIS effort with field adjustment. This metric evaluates three aspects of the wetland area: the size of the wetland type (WT), the size of the wetland complex (WC), and the size of the forested wetland (FW) (if applicable, see User Manual). See the User Manual for boundaries of these evaluation areas. If assessment area is clear-cut, select "K" for the FW column.

WT	WC	FW (if applicable)	
☒A	☒A	☐A	≥ 500 acres
☐B	☐B	☐B	From 100 to < 500 acres
☐C	☐C	☐C	From 50 to < 100 acres
☐D	☐D	☐D	From 25 to < 50 acres
☐E	☐E	☐E	From 10 to < 25 acres
☐F	☐F	☐F	From 5 to < 10 acres
☐G	☐G	☐G	From 1 to < 5 acres
☐H	☐H	☐H	From 0.5 to < 1 acre
☐I	☐I	☐I	From 0.1 to < 0.5 acre
☐J	☐J	☐J	From 0.01 to < 0.1 acre
☐K	☐K	☒K	< 0.01 acre or assessment area is clear-cut

12. Wetland Intactness – wetland type condition metric (evaluate for Pocosins only)

☐A Pocosin is the full extent (≥ 90%) of its natural landscape size.
☐B Pocosin type is < 90% of the full extent of its natural landscape size.

13. Connectivity to Other Natural Areas – landscape condition metric

13a. **Check appropriate box(es) (a box may be checked in each column).** Involves a GIS effort with field adjustment. This metric evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous naturally vegetated area and open water (if appropriate). Boundaries are formed by four-lane roads, regularly maintained utility line corridors the width of a four-lane road or wider, urban landscapes, maintained fields (pasture and agriculture), or open water > 300 feet wide.

Well	Loosely	
☒A	☒A	≥ 500 acres
☐B	☐B	From 100 to < 500 acres
☐C	☐C	From 50 to < 100 acres
☐D	☐D	From 10 to < 50 acres
☐E	☐E	< 10 acres
☐F	☐F	Wetland type has a poor or no connection to other natural habitats

13b. **Evaluate for marshes only**.

☐Yes ☐No Wetland type has a surface hydrology connection to open waters/stream or tidal wetlands.

14. Edge Effect – wetland type condition metric (skip for all marshes and Estuarine Woody Wetland)

May involve a GIS effort with field adjustment. Estimate distance from wetland type boundary to artificial edges. Artificial edges include non-forested areas ≥ 40 feet wide such as fields, development, roads, regularly maintained utility line corridors, and clear-cuts. Consider the eight main points of the compass. Artificial edge occurs within 150 feet in how many directions? If the assessment area is clear cut, select option "C."

☐A 0
☐B 1 to 4
☒C 5 to 8

15. Vegetative Composition – assessment area condition metric (skip for all marshes and Pine Flat)

☐A Vegetation is close to reference condition in species present and their proportions. Lower strata composed of appropriate species, with exotic plants absent or sparse within the assessment area.
☒B Vegetation is different from reference condition in species diversity or proportions, but still largely composed of native species characteristic of the wetland type. This may include communities of weedy native species that develop after clearcutting or clearing. It also includes communities with exotics present, but not dominant, over a large portion of the expected strata.
☐C Vegetation severely altered from reference in composition, or expected species are unnaturally absent (planted stands of non-characteristic species or at least one stratum inappropriately composed of a single species), or exotic species are dominant in at least one stratum.

16. Vegetative Diversity – assessment area condition metric (evaluate for Non-tidal Freshwater Marsh only)

☒A Vegetation diversity is high and is composed primarily of native species (< 10% cover of exotics).
☐B Vegetation diversity is low or has > 10% to 50% cover of exotics.
☐C Vegetation is dominated by exotic species (> 50 % cover of exotics).

17. Vegetative Structure – assessment area/wetland type condition metric

17a. Is vegetation present?
☒Yes ☐No If Yes, continue to 17b. If No, skip to Metric 18.

17b. Evaluate percent coverage of assessment area vegetation **for all marshes only**. Skip to 17c for non-marsh wetlands.
☐A ≥ 25% coverage of vegetation
☐B < 25% coverage of vegetation

17c. **Check a box in each column for each stratum**. Evaluate this portion of the metric **for non-marsh wetlands**. Consider structure in airspace above the assessment area (AA) and the wetland type (WT) separately.

	AA	WT	
Canopy	☐A	☐A	Canopy closed, or nearly closed, with natural gaps associated with natural processes
	☐B	☐B	Canopy present, but opened more than natural gaps
	☒C	☒C	Canopy sparse or absent
Mid-Story	☐A	☐A	Dense mid-story/sapling layer
	☐B	☐B	Moderate density mid-story/sapling layer
	☒C	☒C	Mid-story/sapling layer sparse or absent
Shrub	☐A	☐A	Dense shrub layer
	☒B	☒B	Moderate density shrub layer
	☐C	☐C	Shrub layer sparse or absent
Herb	☒A	☒A	Dense herb layer
	☐B	☐B	Moderate density herb layer
	☐C	☐C	Herb layer sparse or absent

18. Snags – wetland type condition metric (skip for all marshes)

☐A Large snags (more than one) are visible (> 12 inches DBH, or large relative to species present and landscape stability).
☒B Not A

19. Diameter Class Distribution – wetland type condition metric (skip for all marshes)

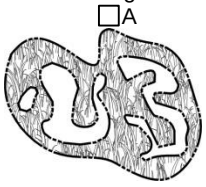
☐A Majority of canopy trees have stems > 6 inches in diameter at breast height (DBH); many large trees (> 12 inches DBH) are present.
☐B Majority of canopy trees have stems between 6 and 12 inches DBH, few are > 12 inch DBH.
☒C Majority of canopy trees are < 6 inches DBH or no trees.

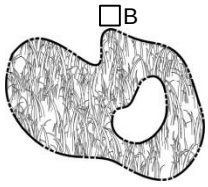
20. Large Woody Debris – wetland type condition metric (skip for all marshes)

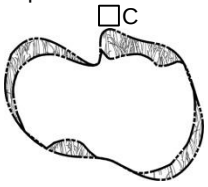
Include both natural debris and man-placed natural debris.
☐A Large logs (more than one) are visible (> 12 inches in diameter, or large relative to species present and landscape stability).
☒B Not A

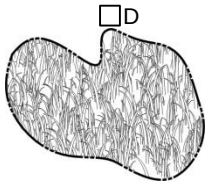
21. Vegetation/Open Water Dispersion – wetland type/open water condition metric (evaluate for Non-Tidal Freshwater Marsh only)

Select the figure that best describes the amount of interspersion between vegetation and open water in the growing season. Patterned areas indicate vegetated areas, while solid white areas indicate open water.

☐A 

☐B 

☐C 

☐D 

22. Hydrologic Connectivity – assessment area condition metric (evaluate for riparian wetlands and Salt/Brackish Marsh only)

Examples of activities that may severely alter hydrologic connectivity include intensive ditching, fill, sedimentation, channelization, diversion, man-made berms, beaver dams, and stream incision. Documentation required if evaluated as B, C, or D.
☐A Overbank and overland flow are not severely altered in the assessment area.
☐B Overbank flow is severely altered in the assessment area.
☒C Overland flow is severely altered in the assessment area.
☐D Both overbank and overland flow are severely altered in the assessment area.

Notes
Assesment area in old pond bed and bound by agriculture fields and pasturland.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	WAM 2 (Old Pond)	Date of Assessment	4/10/2020
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Keith/Axiom

Notes on Field Assessment Form (Y/N)	YES
Presence of regulatory considerations (Y/N)	YES
Wetland is intensively managed (Y/N)	NO
Assessment area is located within 50 feet of a natural tributary or other open water (Y/N)	YES
Assessment area is substantially altered by beaver (Y/N)	NO
Assessment area experiences overbank flooding during normal rainfall conditions (Y/N)	YES
Assessment area is on a coastal island (Y/N)	NO

Sub-function Rating Summary

Function	Sub-function	Metrics	Rating
Hydrology	Surface Storage and Retention	Condition	**LOW**
	Sub-surface Storage and Retention	Condition	**LOW**
Water Quality	Pathogen Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence (Y/N)	**NO**
	Particulate Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Soluble Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Physical Change	Condition	**MEDIUM**
		Condition/Opportunity	**MEDIUM**
		Opportunity Presence (Y/N)	**NO**
	Pollution Change	Condition	NA
		Condition/Opportunity	NA
		Opportunity Presence (Y/N)	NA
Habitat	Physical Structure	Condition	**LOW**
	Landscape Patch Structure	Condition	**MEDIUM**
	Vegetation Composition	Condition	**MEDIUM**

Function Rating Summary

Function	Metrics	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**MEDIUM**
	Condition/Opportunity	**MEDIUM**
	Opportunity Presence (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

Site		Swamp Grape Site						
Stream		UT 1 Right Bank				Bank Length	2913	
Observers		WGL				Date	18-May-20	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	177	right	Low	Low	0	177	2	0.0
2	451	right	Mod	Low	0.02	274	2	11.0
3	468	right	High	High	0.11	17	2	3.7
4	566	right	Mod	Low	0.02	98	2	3.9
5	584	right	High	High	0.11	18	2	4.0
6	620	right	Mod	Low	0.02	36	2.5	1.8
7	637	right	High	High	0.11	17	2.5	4.7
8	661	right	Mod	Low	0.02	24	2.5	1.2
9	689	right	High	Extreme	0.13	28	2.5	9.1
10	787	right	Mod	Low	0.02	98	2.5	4.9
11	819	right	High	High	0.11	32	2.5	8.8
12	1000	right	Mod	Low	0.02	181	2.5	9.1
13	1032	right	High	High	0.11	32	2.5	8.8
14	1184	right	Mod	Low	0.02	152	3	9.1
15	1215	right	High	Extreme	0.13	31	3	12.1
16	1327	right	Mod	Low	0.02	112	2.5	5.6
17	1347	right	High	High	0.11	20	2.5	5.5
18	1377	right	Mod	Low	0.02	30	2.5	1.5
19	1393	right	High	High	0.11	16	2	3.5
20	1489	right	Mod	Low	0.02	96	2	3.8
21	1506	right	High	High	0.11	17	2	3.7
22	1606	right	Mod	Low	0.02	100	2	4.0
23	2192	right	Low	Low	0	586	2	0.0
24	2913	right	V High	Extreme	1.5	721	4	4326.0
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		4445.8
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		164.7
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		214.1
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.073

Site		Swamp Grape Site						
Stream		UT 1 Left Bank				Bank Length	2935	
Observers		WGL				Date	18-May-20	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	349	left	Low	Low	0	349	2	0.0
2	384	left	High	High	0.11	35	2	7.7
3	473	left	Mod	Low	0.02	89	2	3.6
4	490	left	High	High	0.11	17	2	3.7
5	600	left	Mod	Low	0.02	110	2	4.4
6	630	left	High	High	0.11	30	2	6.6
7	689	left	Mod	Low	0.02	59	2	2.4
8	711	left	High	High	0.11	22	2	4.8
9	979	left	Mod	Low	0.02	268	2	10.7
10	1014	left	High	High	0.11	35	2.5	9.6
11	1065	left	Mod	Low	0.02	51	2.5	2.6
12	1108	left	High	High	0.11	43	2.5	11.8
13	1142	left	Mod	Low	0.02	34	2.5	1.7
14	1178	left	High	Extreme	0.13	36	2.5	11.7
15	1298	left	Mod	Low	0.02	120	2.5	6.0
16	1326	left	High	High	0.11	28	2	6.2
17	1372	left	Mod	Low	0.02	46	2	1.8
18	1389	left	High	High	0.11	17	2	3.7
19	1525	left	Mod	Mod	0.05	136	2	13.6
20	1557	left	High	High	0.11	32	2	7.0
21	1660	left	Mod	Low	0.02	103	2	4.1
22	2210	left	Low	Low	0	550	2	0.0
23	2935	left	V High	Extreme	0.15	725	4	435.0
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		558.8
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		20.7
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		26.9
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.009

Site		Swamp Grape Site						
Stream		UT 2			Bank Length		1774	
Observers		WGL			Date		18-May-20	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	24	right	Mod	Low	0.02	24	2.5	1.2
2	42	right	High	High	0.11	18	2.5	5.0
3	151	right	Mod	Low	0.02	109	2.5	5.5
4	179	right	High	High	0.11	28	2.5	7.7
5	257	right	Mod	Low	0.02	78	2	3.1
6	892	right	Low	Low	0	635	1.5	0.0
7								
8	92	Left	Mod	Low	0.02	92	2.5	4.6
9	102	Left	High	High	0.11	10	2.5	2.8
10	136	Left	Mod	Low	0.02	34	2.5	1.7
11	154	Left	High	High	0.11	18	2.5	5.0
12	258	Left	Mod	Low	0.02	104	2	4.2
13	882	Left	Low	Low	0	624	1.5	0.0
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		40.6
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		1.5
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		2.0
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.001

Site		Swamp Grape Site						
Stream		UT 3			Bank Length		295	
Observers		WGL			Date		18-May-20	
	Station	Bank	BEHI	NBS	Erosion Rate	Length	Bank Height	Erosion
1	78	right	Mod	Low	0.02	78	2	3.1
2	97	right	High	High	0.11	19	2	4.2
3	145	right	Mod	Low	0.02	48	2	1.9
4								
5								
6								
7								
8	18	Left	Mod	Low	0.02	18	2	0.7
9	37	Left	High	High	0.11	19	2	4.2
10	81	Left	Mod	Low	0.02	44	2	1.8
11	103	Left	High	High	0.11	22	2	4.8
12	150	Left	Mod	Low	0.02	47	2	1.9
13								
14								
15								
16								
17								
18								
19								
20								
21								
22								
23								
24								
Sum erosion sub-totals for each BEHI/NBS						Total Erosion (ft3/yr)		22.6
Divide total erosion (ft3) by 27						Total Erosion (yd/yr)		0.8
Multiply Total erosion (yard3) by 1.3						Total Erosion (tons/yr)		1.1
Erosion per unit length						Total Erosion (Tons/yr/ft)		0.004

BEHI/NBS Summary

Stream Reach	Erosion Rate (tons/year)
UT 1 right bank	214.1
UT 1 left bank	26.9
UT 2	2.0
UT 3	1.1
Total	**244.0**

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile A (34.564094, -79.349134)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-4	10 YR 7/1	90	10 YR 5/8	5	C	PL	Sand
			10 YR 5/1	5	C	M	
4-7	10 YR 4/2	95	10 YR 3/6	5	C	PL	Silty Clay
12-26	10 YR 4/1	95	10 YR 5/1	5	D	M	Fine Sandy Clay
26+	10 YR 6/1	97	10 YR 4/6	3	C	M	Sand

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile B (34.56437, -79.349416)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling				Texture
	Color	%	Color	%	Type	Location	
0-3	10 YR 7/1	95	10 YR 6/8	5	C	P	Sand
3-18	10 YR 5/1	95	10 YR 3/6	5	C	P	sandy loam
18+	10 YR 7/1	97	10 YR 5/6	3	C	M	sand

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile C (34.562827, -79.347331)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-6	10 YR 4/2	99	10 YR 4/4	1	C	P	Sandy loam
6-8	10 YR 4/2	95	10 YR 3/1	3	C	M	sandy loam
			10 YR 5/4	2	C	M	
8-14	10 YR 4/1	40	10 YR 5/1	10	C	M	clay loam
	10 YR 6/1	40	10 YR 5/6	10	C	M	
14+	10 YR 4/1	85	10 YR 3/2	15	C	M	sand

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile D (34.562558, -79.346803)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-4	10 YR 3/2	95	10 YR 5/1	3	D	M	loamy sand
			10 YR 4/4	2	C	P	
4-8	10 YR 3/1	100					loamy sand
8-12	10 YR 6/2	80	10 YR 4/1	20	C	M	sand
12-20	10 YR 6/2	100					sand
20+	10 YR 7/1	100					sand

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile E (34.562126, -79.346997)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-4	10 YR 3/2	99	10 YR 3/3	1	C	P	sandy loam
4-7	10 YR 3/2	95	10 YR 7/1	5	D	M	loamy sand
7-13	10 YR 5/1	70	10 YR 6/1	30	D	M	loamy sand
13-18	10 YR 6/1	95	10 YR 5/1	5	C	M	sand
18+	10 YR 7/1	100					sand

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile F (34.561372, -79.346721)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-1	10 YR 3/2	97	10 YR 3/4	3	C	P	sandy loam
1-9	10 YR 5/2	90	10 YR 6/1	5			sand
			10 YR 5/1	4	D	M	
			10 YR 5/6	1	C	M	
9-18	10 YR 5/1	70	10 YR 5/6	30	C	M	sand
18+	Gley 5/1	90	10 YR 5/2	10	D	M	sand

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile G (34.561135, -79.346555)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-3	10 YR 3/1	97	10 YR 4/4	3	C	P	sandy loam
3-9	10 YR 3/1	95	10 YR 6/1	3	D	P	loamy sand
			10 YR 4/4	2	C	P	
9-24	10 YR 6/2	70	10 YR 5/2	29	C	M	sand
			10 YR 5/3	1			
24+	10 YR 7/1	97	10 YR 5/6	3	C	M	sandy clay

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

AXIOM ENVIRONMENTAL, INC
218 Snow Avenue
Raleigh, North Carolina 27603
919-215-1693

Axiom Environmental, Inc.

SOIL BORING LOG

Date: 5/10/2020

Project/Site: Swamp Grape

County, State: Robeson County, NC

Sampling Point/ Coordinates: **Soil Profile H (34.560936, -79.346756)**

Investigator: W. Grant Lewis

Soil Series: Bibb

Notes: Location is shown on Figure 4.

Depth (inches)	Matrix		Mottling		Type	Location	Texture
	Color	%	Color	%			
0-8	10 YR 5/1	95	10 YR 4/4	5	C	P	sandy loam
8-16	10 YR 4/1	90	10 YR 6/1	8	D	M	loamy sand
			10 YR 3/4	2	C	P	
16+	10 YR 7/1	97	10 YR 5/1	2	C	M	sand
			10 YR 6/4	1	C	M	

Type: C=Concentration, D=Depletion, RM=Reduced Matrix, MS=Masked Sand Grains. Locaction: PL=Pore Lining, M=Matrix.

North Carolina Licensed Soil Scientist

Number: 1233

Signature: W Grant Lewis

Name/Print: W. Grant Lewis

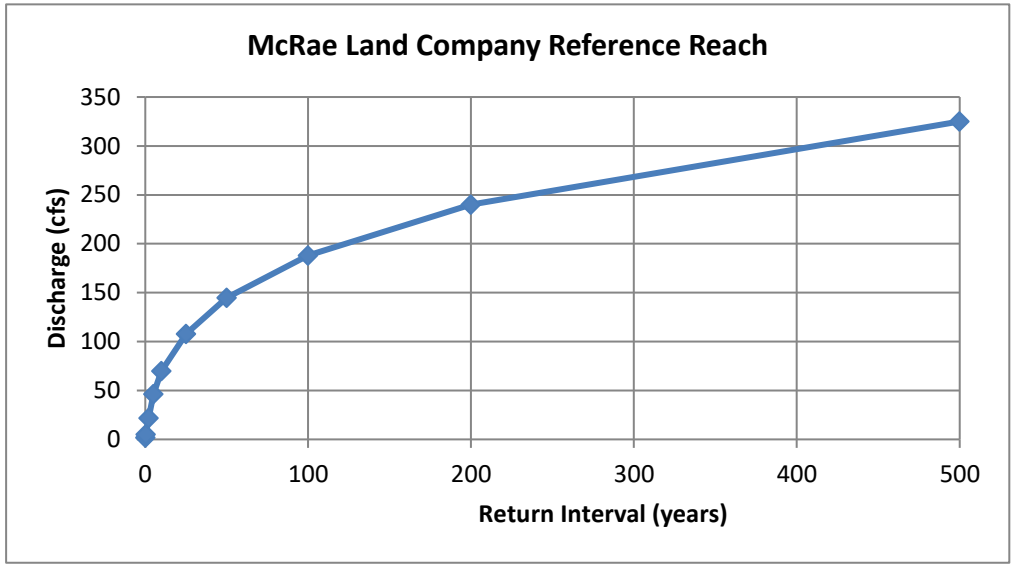
APPENDIX C - FLOOD FREQUENCY ANALYSIS DATA

Reference Reaches
Flood Frequency Analaysis-Regional Regression Equation (USGS 2004)

McRae Land Reference Reach

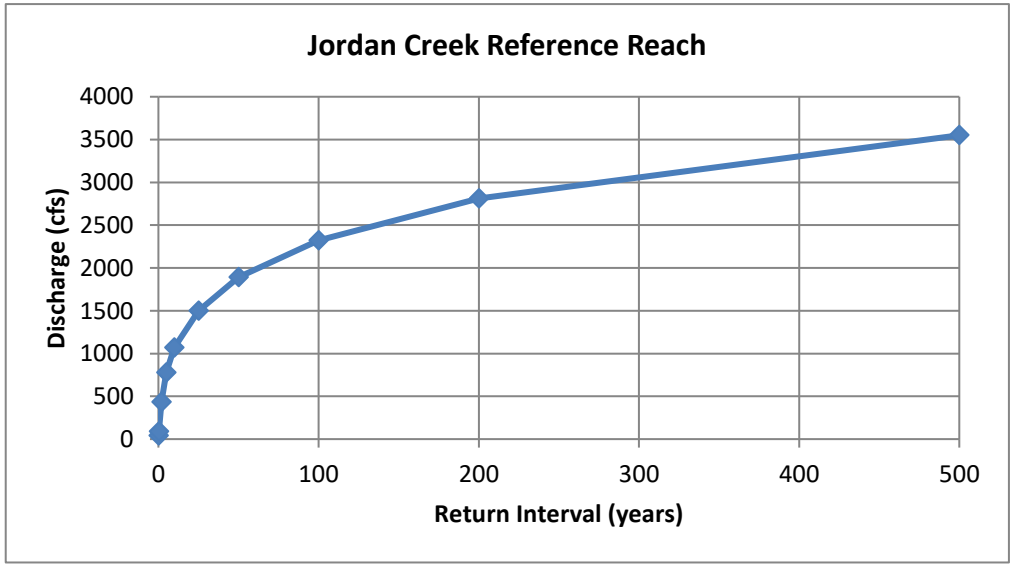
Return Interval (years)	Discharge (cfs)
0.1	**2**
0.3	**5**
2	21.9
5	46.4
10	69.9
25	108
50	145
100	188
200	240
500	325

Note: Bold values are interpolated.



Jordan Creek Reference Reach

Return Interval (years)	Discharge (cfs)
0.1	**40**
0.3	**90**
2	434
5	777
10	1070
25	1500
50	1890
100	2320
200	2810
500	3550



APPENDIX D - JURISDICTIONAL DETERMINATION INFO

0ATTACHMENT

PRELIMINARY JURISDICTIONAL DETERMINATION FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PRELIMINARY JURISDICTIONAL DETERMINATION (JD): October 6, 2020

B. NAME AND ADDRESS OF PERSON REQUESTING PRELIMINARY JD:
Grant Lewis- Axiom Environmental, Inc.
218 Snow Ave
Raleigh, NC 27603

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington District, Swamp Grape Mitigation, SAW-2019-00904

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION:
Located off Kitchen Road in Rowland, Robeson County, NC

(USE THE ATTACHED TABLE TO DOCUMENT MULTIPLE WATERBODIES AT DIFFERENT SITES)

State: North Carolina County/parish/borough: Robeson County City: Rowland

Center coordinates of site (lat/long in degree decimal format):
Lat 34.5639ºN, Long. 79.3490ºW

Name of nearest waterbody: Wilkinson Creek

Identify (estimate) amount of waters in the review area:
Non-wetland waters: 3941 linear feet: 3-12 width (ft)
Cowardin Class: R3UB1/2
Stream Flow: Perennial
Wetlands: 15.891 acres
Cowardin Class: PEM/PSS/PFO
Surface waters: N/A

Name of any water bodies on the site that have been identified as Section 10 waters:
Tidal: 0
Non-Tidal: 0

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐ Office (Desk) Determination.
☒Date: Field Determination.
Date(s): June 9, 2020 with Grant Lewis (Axiom Environmental, Inc.)

1. The Corps of Engineers believes that there may be jurisdictional waters of the United States on the subject site, and the permit applicant or other affected party who requested this preliminary JD is hereby advised of his or her option to request and obtain an approved jurisdictional determination (JD) for that site. Nevertheless, the permit applicant or other person who requested this preliminary JD has declined to exercise the option to obtain an approved JD in this instance and at this time.

2. In any circumstance where a permit applicant obtains an individual permit, or a Nationwide General Permit (NWP) or other general permit verification requiring "pre-construction notification" (PCN), or requests verification for a non-reporting NWP or other general permit, and the permit applicant has not requested an approved JD for the activity, the permit applicant is hereby made aware of the following: (1) the permit applicant has elected to seek a permit authorization based on a preliminary JD, which does not make an official determination of jurisdictional waters; (2) that the applicant has the option to request an approved JD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an approved JD could possibly result in less compensatory mitigation being required or different special conditions; (3) that the applicant has the right to request an individual permit rather than accepting the terms and conditions of the NWP or other general permit authorization; (4) that the applicant can accept a permit authorization and thereby agree to comply with all the terms and conditions of that permit, including whatever mitigation requirements the Corps has determined to be necessary; (5) that undertaking any activity in reliance upon the subject permit authorization without requesting an approved JD constitutes the applicant's acceptance of the use of the preliminary JD, but that either form of JD will be processed as soon as is practicable; (6) accepting a permit authorization (e.g., signing a proffered individual permit) or undertaking any activity in reliance on any form of Corps permit authorization based on a preliminary JD constitutes agreement that all wetlands and other water bodies on the site affected in any way by that activity are jurisdictional waters of the United States, and precludes any challenge to such jurisdiction in any administrative or judicial compliance or enforcement action, or in any administrative appeal or in any Federal court; and (7) whether the applicant elects to use either an approved JD or a preliminary JD, that JD will be processed as soon as is practicable. Further, an approved JD, a proffered individual permit (and all terms and conditions contained therein), or individual permit denial can be administratively appealed pursuant to 33 C.F.R. Part 331, and that in any administrative appeal, jurisdictional issues can be raised (see 33 C.F.R. 331.5(a)(2)). If, during that administrative appeal, it becomes necessary to make an official determination whether CWA jurisdiction exists over a site, or to provide an official delineation of jurisdictional waters on the site, the Corps will provide an approved JD to accomplish that result, as soon as is practicable. This preliminary JD finds that there *"may be"* waters of the United States on the subject project site, and identifies all aquatic features on the site that could be affected by the proposed activity, based on the following information:

SUPPORTING DATA. Data reviewed for preliminary JD (check all that apply - checked items should be included in case file and, where checked and requested, appropriately reference sources below):

☒ Maps, plans, plots or plat submitted by or on behalf of the applicant/consultant: .

☒ Data sheets prepared/submitted by or on behalf of the applicant/consultant.

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report.

☐ Data sheets prepared by the Corps: .

☐ Corps navigable waters' study: .

☐ U.S. Geological Survey Hydrologic Atlas: .

☐ USGS NHD data.

☐ USGS 8 and 12 digit HUC maps.

☒ U.S. Geological Survey map(s). Cite scale & quad name: Rowland, NC (1997) 7.5-minute topographic quadrangle.

☒ USDA Natural Resources Conservation Service Soil Survey. Citation: Web Soil Survey (online at http://websoilsurvey.nrcs.usda.gov), and Soil Survey of Robeson County (2018)

☐ National wetlands inventory map(s). Cite name: .

☐ State/Local wetland inventory map(s): .

☐ FEMA/FIRM maps: .

☐ 100-year Floodplain Elevation is: (National Geodetic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): NC OneMap 2017 Orthoimagery. or ☐ Other (Name & Date): .

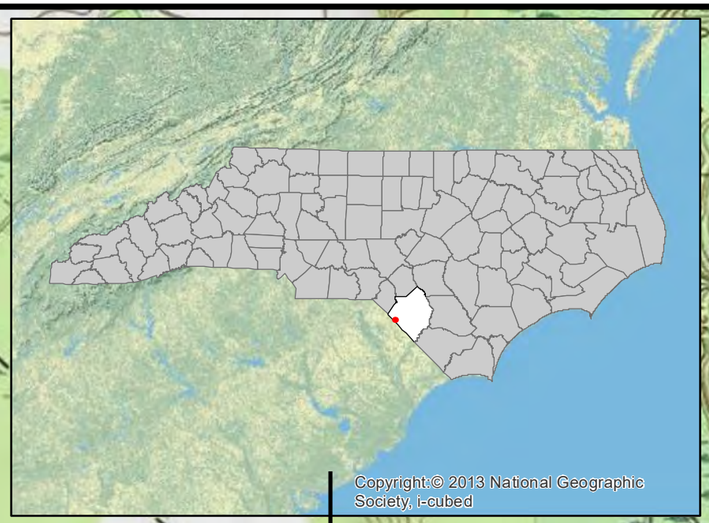
☐ Previous determination(s). File no. and date of response letter: .

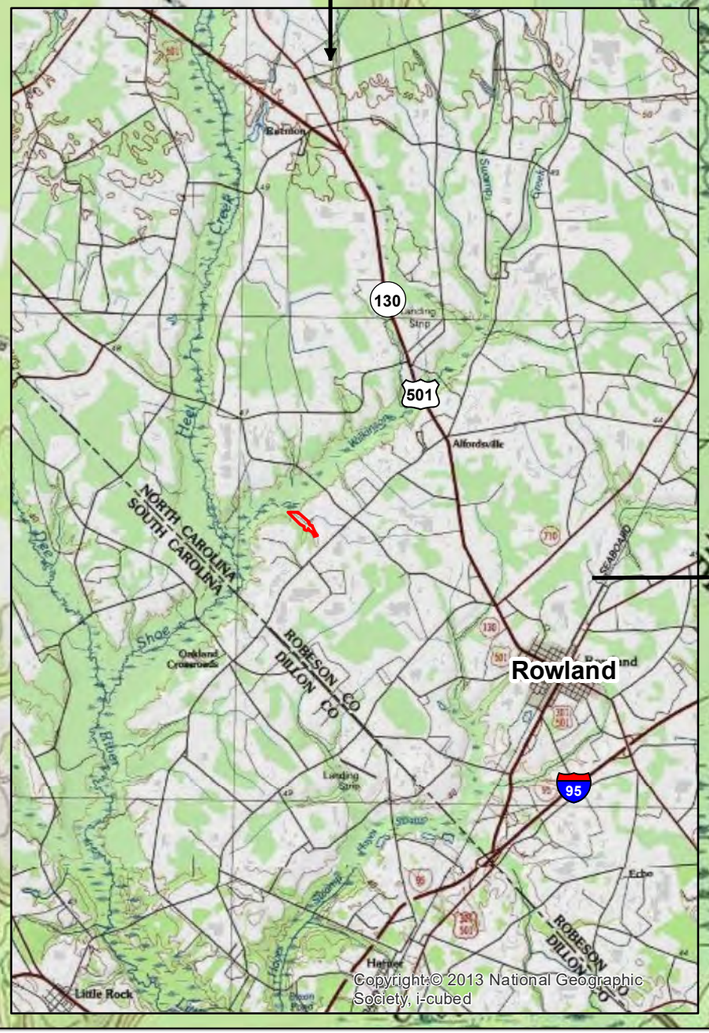
☒ Other information (please specify): **Lidar Image & Site visit**

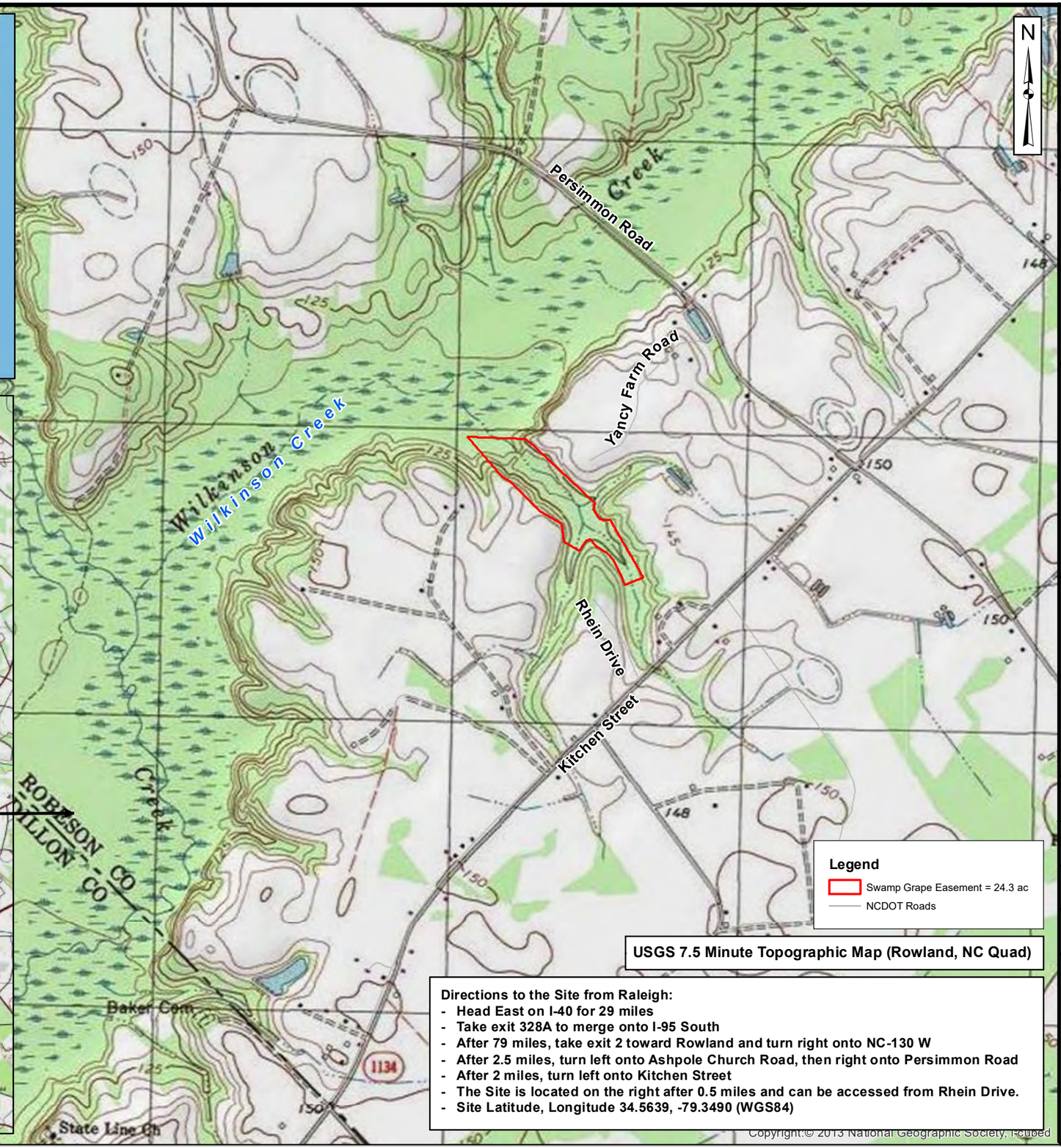
IMPORTANT NOTE: The information recorded on this form has not necessarily been verified by the Corps and should not be relied upon for later jurisdictional determinations.

Signature and date of Regulatory Project Manager (REQUIRED)	Signature and date of person requesting preliminary JD (REQUIRED, unless obtaining the signature is impracticable)

Site number	Latitude	Longitude	Cowardin Class	Estimated amount of aquatic resource in review area	Class of aquatic resource
1. UT-1	34.560778	-79.346953	R3UB1/2	2966 feet length, 4-12 feet avg width	non-section 10 – non-wetland
2. UT-2	34.562403	-79.349674	R3UB1/2	826 feet length, 4-6 feet avg width	non-section 10 – non-wetland
3. UT-3	34.564474	-79.348954	R3UB1/2	149 feet length, 4-6 feet avg width	non-section 10 – non-wetland
4. Wetland GA	34.561526	-79.346808	PEM	0.356 acre	non-section 10 wetland
5. Wetland GB	34.561183	-79.346589	PEM	0.031 acre	non-section 10 wetland
6. Wetland GC	34.561082	-79.346829	PEM /PSS	0.018 acre	non-section 10 wetland
7. Wetland GD	34.560864	-79.346655	PEM	0.130 acre	non-section 10 wetland
8. Wetland GG	34.561957	-79.34684	PSS	0.087 acre	non-section 10 wetland
9. Wetland GH	34.562561	-79.346963	PEM	0.757 acre	non-section 10 wetland
10. Wetland GL	34.564463	-79.349952	PEM/PFO	14.512 acre	non-section 10 wetland







USGS 7.5 Minute Topographic Map (Rowland, NC Quad)

Directions to the Site from Raleigh:
- **Head East on I-40 for 29 miles**
- **Take exit 328A to merge onto I-95 South**
- **After 79 miles, take exit 2 toward Rowland and turn right onto NC-130 W**
- **After 2.5 miles, turn left onto Ashpole Church Road, then right onto Persimmon Road**
- **After 2 miles, turn left onto Kitchen Street**
- **The Site is located on the right after 0.5 miles and can be accessed from Rhein Drive.**
- **Site Latitude, Longitude 34.5639, -79.3490 (WGS84)**

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

SITE LOCATION

Drawn by: KRJ

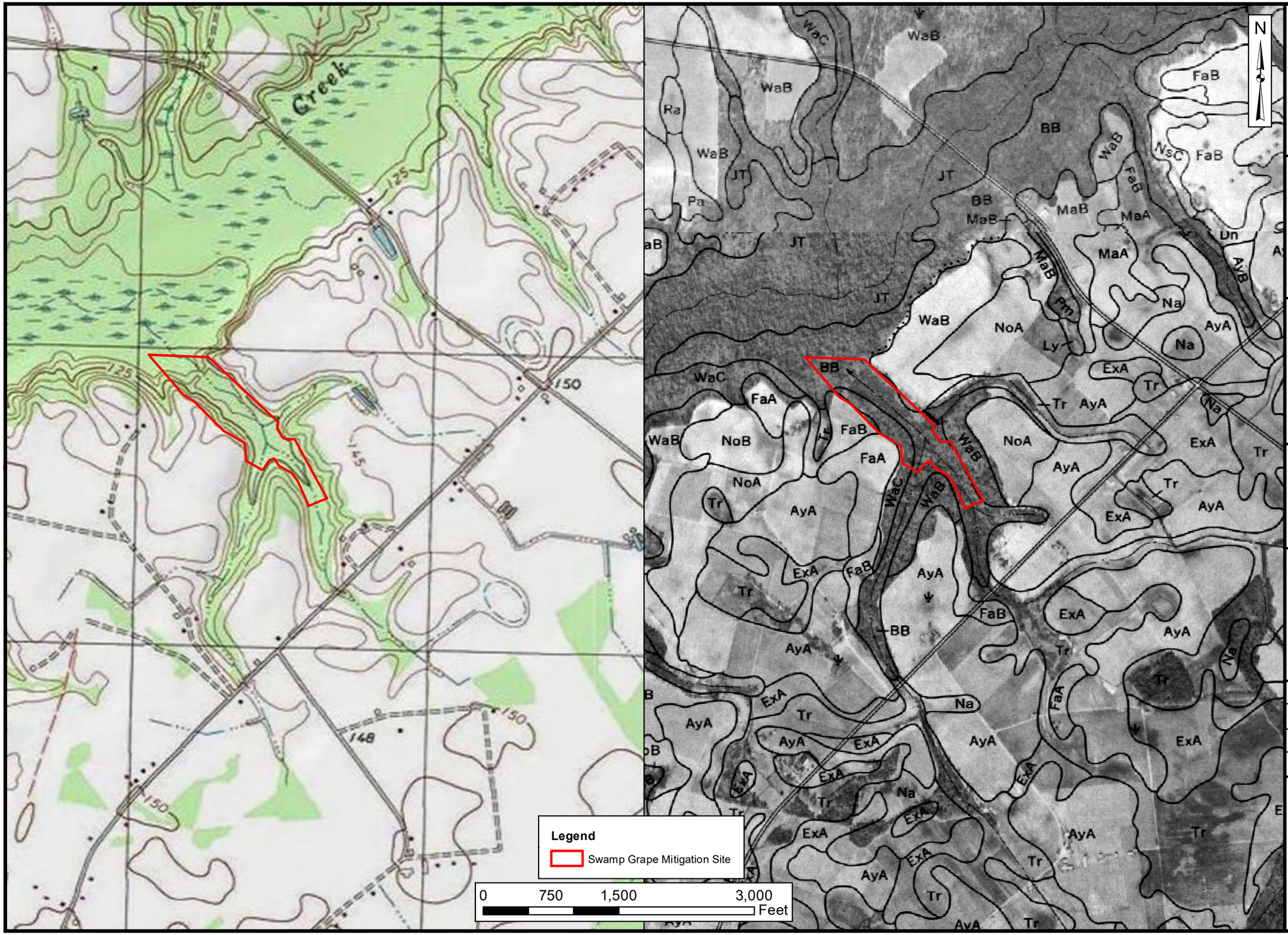
Date: APR 2019

Scale: 1:20,000

Project No.: 18-002.10

FIGURE

1



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

PROJECT MAPPING

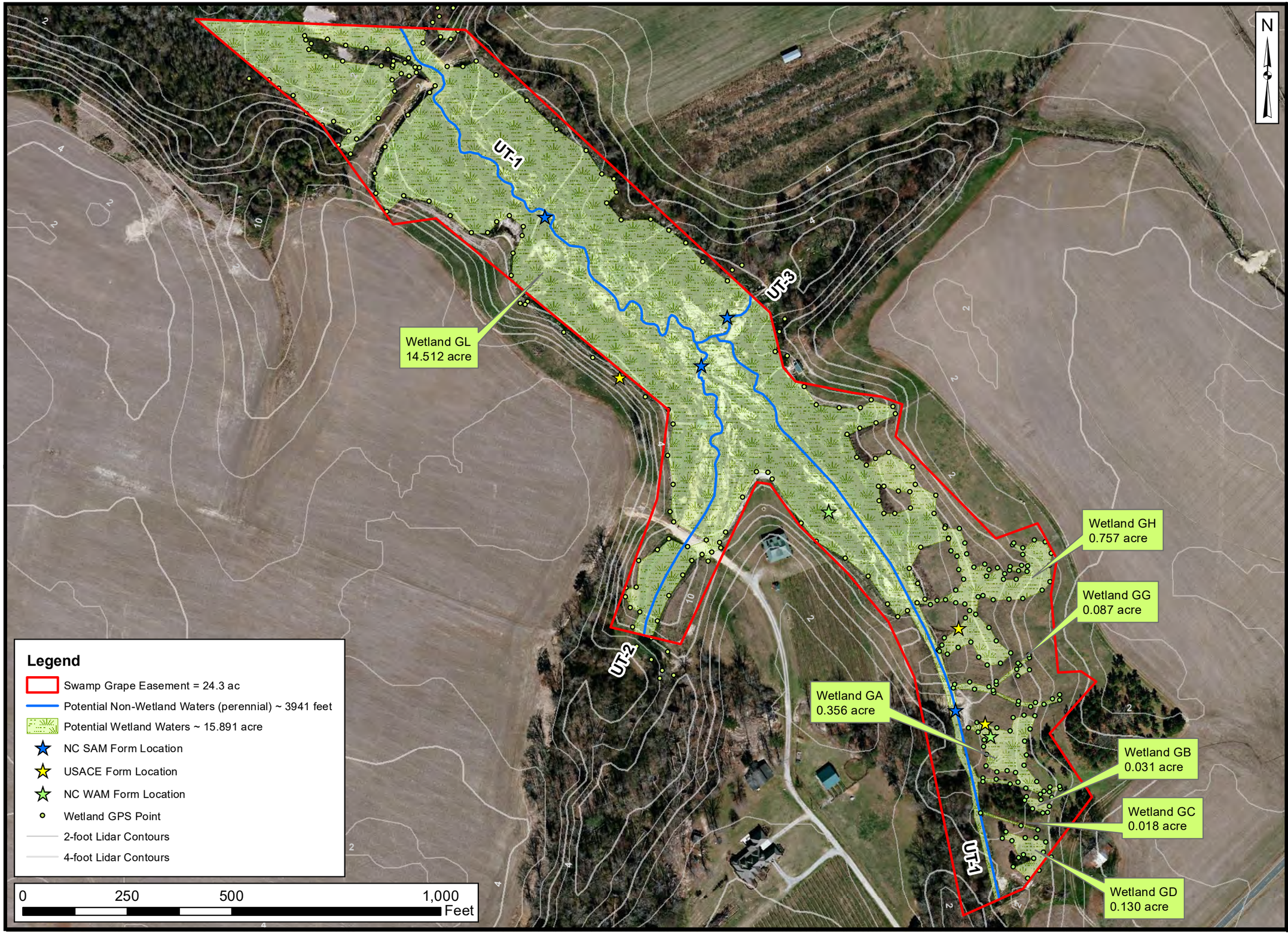
Notes:

Background Imagery Source:
1. Rowland, NC (1997) 7.5-minute topographic quadrangle provided by the U.S. Geological Survey.
2. Soil Survey of Robeson County (1978), sheets 44 and 51, provided by the Natural Resource Conservation Service (NRCS).

Drawn by:	AEK
Date:	JAN 2020
Scale:	1:3200
Project No.:	18-002.10

FIGURE

2



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

Potential Waters of the U.S.

Notes:

Background Imagery Source: 2017 aerial photography provided by the NC OneMap program (online, provided by the NC Geographic Information Coordination Council).

Drawn by:	AEK
Date:	APR 2020
Scale:	1:2600
Project No.:	20-003

FIGURE

3

APPENDIX E - CATEGORICAL EXCLUSION DOCUMENT

Swamp Grape Stream & Wetland Mitigation Site

Robeson County, North

Carolina DMS Project No. 100115

Categorical Exclusion/ERTR

Prepared for:

North Carolina Department of Environmental Quality

Division of Mitigation Services

1652 Mail Service Center

Raleigh, NC 27699-1652

Janurary 2020

TASK 1 b.) Categorical Exclusion Summary:

Part 1: General Project Information

(Attached) Part 2: All Projects

Regulation/Questions

Coastal Zone Management Act
Not applicable – project is not located within a CAMA county.

CERCLA
No Issue within project boundaries – please see the attached Executive Summary from a Limited Phase 1 Site Assessment performed by Environmental Data Resources, Inc. on June 10th, 2019.

National Historic Preservation Act (Section 106)
No Issue – please see attached letter from Ramona M. Bartos- State of the Historic Preservation Office dated May 31st, 2019

Uniform Act
Please see the attached letter, sent to the landowner on June 7th, 2019.

Part 3: Ground-Disturbing Activates Regulation/Questions

American Indian Religious Freedom Act (AIRFA)
Not applicable – project is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians.

Antiquities Act (AA)
Not applicable – project is not located on Federal land.

Archaeological Resources Protection Act (ARPA)
Not applicable – project is not located on federal or Indian lands.

Endangered Species Act (ESA)
There are five known federally protected species occurring in Robeson County, NC and our summary is that the project may affect, but is not likely to adversly affect any protected species. An updated biological conclusion letter was sent to USFWS Raleigh Field Office on February 5th, 2020 and they agreed with our findings documented via email exchange. The NCWRC also determind that it is unlikely that stream and wetland mitigation will adversely affect any federal or state-listed species. Their recommendations will be followed during the contructions of the site.

Executive Order 13007 (Indian Sacred Sites)

Not applicable – project is not located in a county claimed as "territory" by the Eastern Band of Cherokee Indians.

Farmland Protection Policy Act (FPPA)

Please find the attached Form AD-1006 and letter from Milton Cortes of the NRCS dated May 30th, 2019.

Fish and Wildlife Coordination Act (FWCA)

Please find the attached letter to the USFWS. A biological survey indicated the project is to have "No affect or is unlikely to adversly affect any federally-listed endangered or threatened species."

Land & Water Conservation Fund Act (Section 6(f))

Not applicable

Magnuson-Stevens Fishery Conservation and management Act (Essential Fish Habitat)

Not applicable – project is not located within an estuarine system

Migratory Bird Treaty Act (MBTA)

USFWS has no recommendation with the project relative to the MBTA

Wilderness Act

Not applicable – the project is not located within a Wilderness area.

Appendix A

Categorical Exclusion Form for Division of Mitigation Services Projects
Version 2

Note: Only Appendix A should to be submitted (along with any supporting documentation) as the environmental document.

Part 1: General Project Information	
Project Name:	Swamp Grape Mitigation Site
County Name:	Robeson County
DMS Number:	#100115
Project Sponsor:	Restoration Systems, LLC
Project Contact Name:	JD Hamby
Project Contact Address:	1101 Haynes St. Ste. 211 Raleigh, NC 27604
Project Contact E-mail:	jhamby@restorationsystems.com
DMS Project Manager:	Lindsay Crocker Lindsay.Crocker@ncdenr.gov

Project Description

The Site is proposed to include 3,701 feet of combined restored and enhanced stream channel along with 10.1 acres of reestablished and enhanced riparian wetlands. Site alterations include the cessation irrigation source for row crop production, removal of the earthen dam, restoration of wetlands, and planting native, woody vegetation within the entire 21.5 acre Site easement. Mitigation outlined in this report will result in net gains in hydrology, water quality, and habitat functions, and are designed to provide 3,061 Stream Mitigation Units and 10.0 Non-riparian Wetland Mitigation Units.

For Official Use Only

Reviewed By:

2/21/2020 — **Date**

 — **DMS Project Manager**

Conditional Approved By:

Date

For Division Administrator FHWA

☐ **Check this box if there are outstanding issues**

Final Approval By:

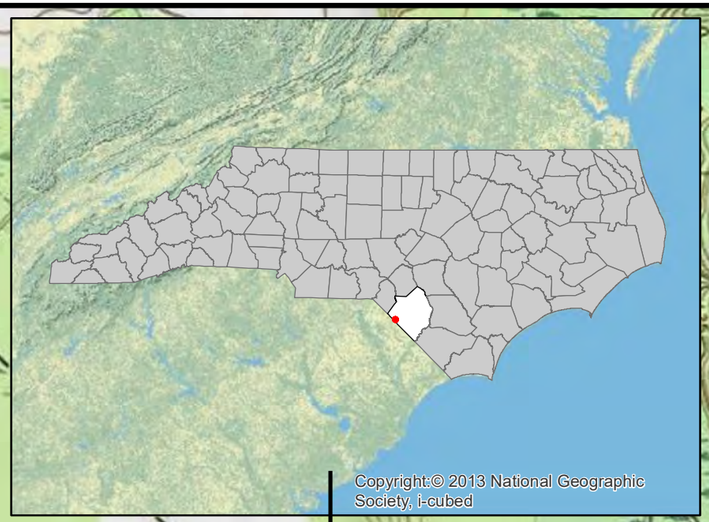
2-21-20 — **Date**

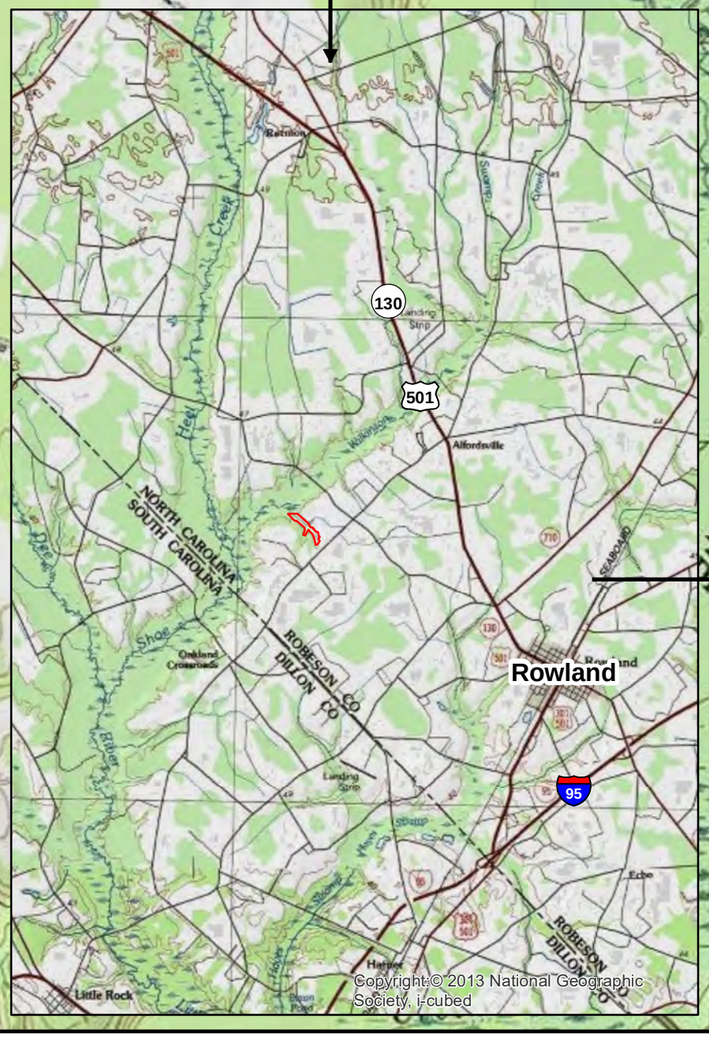
Donald W. Brew — **For Division Administrator FHWA**

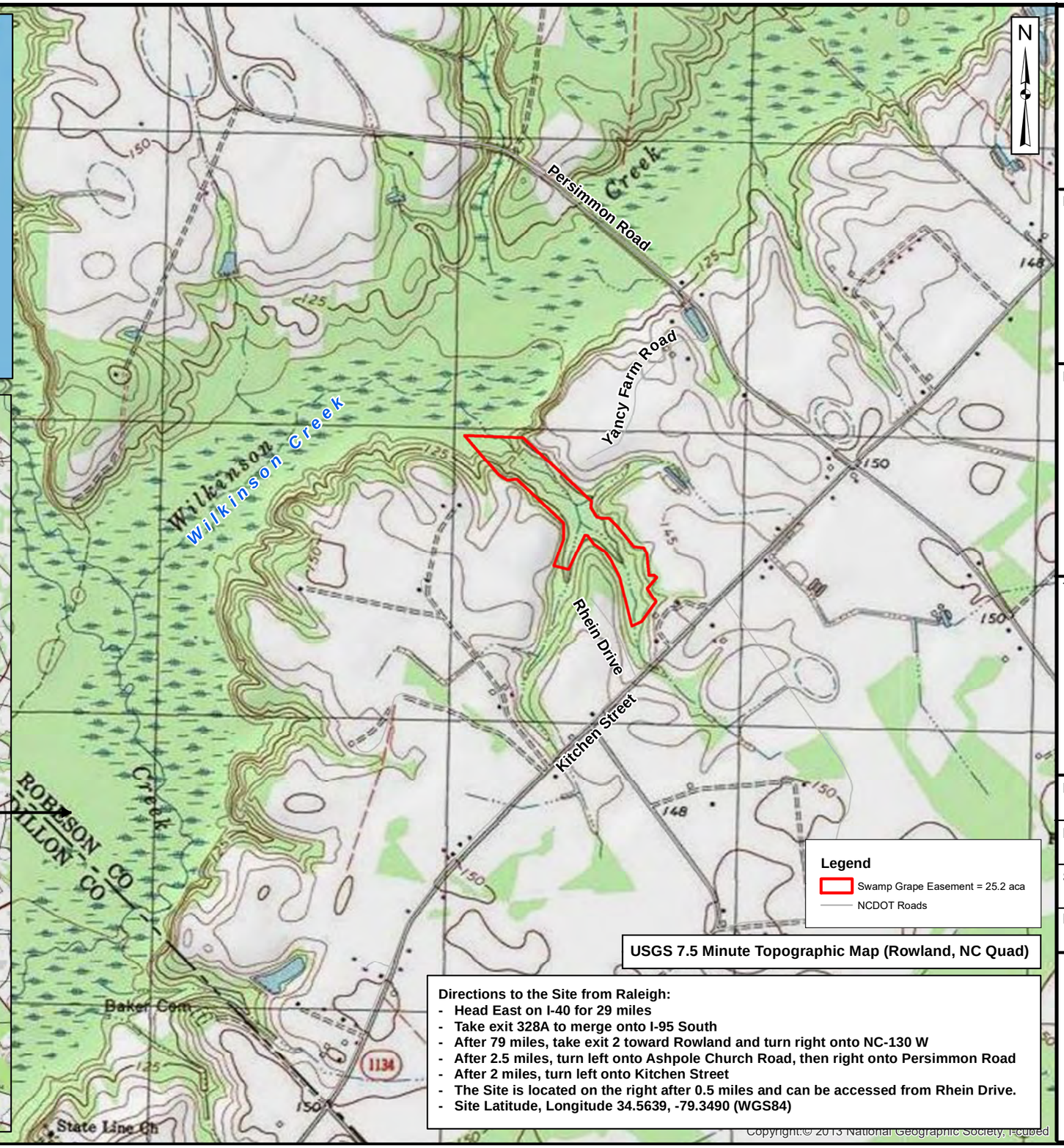
Part 2: All Projects Regulation/Question	Response
Coastal Zone Management Act (CZMA)	
1. Is the project located in a CAMA county?	☐ Yes ☑ No
2. Does the project involve ground-disturbing activities within a CAMA Area of Environmental Concern (AEC)?	☐ Yes ☐ No ☑ N/A
3. Has a CAMA permit been secured?	☐ Yes ☐ No ☑ N/A
4. Has NCDCM agreed that the project is consistent with the NC Coastal Management Program?	☐ Yes ☐ No ☑ N/A
Comprehensive Environmental Response, Compensation and Liability Act (CERCLA)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Has the zoning/land use of the subject property and adjacent properties ever been designated as commercial or industrial?	☐ Yes ☑ No ☐ N/A
3. As a result of a limited Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☑ No ☐ N/A
4. As a result of a Phase I Site Assessment, are there known or potential hazardous waste sites within or adjacent to the project area?	☐ Yes ☐ No ☑ N/A
5. As a result of a Phase II Site Assessment, are there known or potential hazardous waste sites within the project area?	☐ Yes ☐ No ☑ N/A
6. Is there an approved hazardous mitigation plan?	☐ Yes ☐ No ☑ N/A
National Historic Preservation Act (Section 106)	
1. Are there properties listed on, or eligible for listing on, the National Register of Historic Places in the project area?	☐ Yes ☑ No
2. Does the project affect such properties and does the SHPO/THPO concur?	☐ Yes ☐ No ☑ N/A
3. If the effects are adverse, have they been resolved?	☐ Yes ☐ No ☑ N/A
Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)	
1. Is this a "full-delivery" project?	☑ Yes ☐ No
2. Does the project require the acquisition of real estate?	☑ Yes ☐ No ☐ N/A
3. Was the property acquisition completed prior to the intent to use federal funds?	☐ Yes ☑ No ☐ N/A
4. Has the owner of the property been informed: * prior to making an offer that the agency does not have condemnation authority; and * what the fair market value is believed to be?	☑ Yes ☐ No ☐ N/A

Part 3: Ground-Disturbing Activities Regulation/Question	Response
American Indian Religious Freedom Act (AIRFA)	
1. Is the project located in a county claimed as "territory" by the Eastern Band of Cherokee Indians?	☐ Yes ☑ No
2. Is the site of religious importance to American Indians?	☐ Yes ☐ No ☑ N/A
3. Is the project listed on, or eligible for listing on, the National Register of Historic Places?	☐ Yes ☐ No ☑ N/A
4. Have the effects of the project on this site been considered?	☐ Yes ☐ No ☑ N/A
Antiquities Act (AA)	
1. Is the project located on Federal lands?	☐ Yes ☑ No
2. Will there be loss or destruction of historic or prehistoric ruins, monuments or objects of antiquity?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Archaeological Resources Protection Act (ARPA)	
1. Is the project located on federal or Indian lands (reservation)?	☐ Yes ☑ No
2. Will there be a loss or destruction of archaeological resources?	☐ Yes ☐ No ☑ N/A
3. Will a permit from the appropriate Federal agency be required?	☐ Yes ☐ No ☑ N/A
4. Has a permit been obtained?	☐ Yes ☐ No ☑ N/A
Endangered Species Act (ESA)	
1. Are federal Threatened and Endangered species and/or Designated Critical Habitat listed for the county?	☑ Yes ☐ No
2. Is Designated Critical Habitat or suitable habitat present for listed species?	☑ Yes ☐ No ☐ N/A
3. Are T&E species present or is the project being conducted in Designated Critical Habitat?	☐ Yes ☑ No ☐ N/A
4. Is the project "likely to adversely affect" the specie and/or "likely to adversely modify" Designated Critical Habitat?	☐ Yes ☐ No ☑ N/A
5. Does the USFWS/NOAA-Fisheries concur in the effects determination?	☐ Yes ☐ No ☑ N/A
6. Has the USFWS/NOAA-Fisheries rendered a "jeopardy" determination?	☐ Yes ☐ No ☑ N/A

Executive Order 13007 (Indian Sacred Sites)	
1. Is the project located on Federal lands that are within a county claimed as "territory" by the EBCI?	☐ Yes ☑ No
2. Has the EBCI indicated that Indian sacred sites may be impacted by the proposed project?	☐ Yes ☐ No ☑ N/A
3. Have accommodations been made for access to and ceremonial use of Indian sacred sites?	☐ Yes ☐ No ☑ N/A
Farmland Protection Policy Act (FPPA)	
1. Will real estate be acquired?	☑ Yes ☐ No
2. Has NRCS determined that the project contains prime, unique, statewide or locally important farmland?	☑ Yes ☐ No ☐ N/A
3. Has the completed Form AD-1006 been submitted to NRCS?	☑ Yes ☐ No ☐ N/A
Fish and Wildlife Coordination Act (FWCA)	
1. Will the project impound, divert, channel deepen, or otherwise control/modify any water body?	☑ Yes ☐ No
2. Have the USFWS and the NCWRC been consulted?	☑ Yes ☐ No ☐ N/A
Land and Water Conservation Fund Act (Section 6(f))	
1. Will the project require the conversion of such property to a use other than public, outdoor recreation?	☐ Yes ☑ No
2. Has the NPS approved of the conversion?	☐ Yes ☐ No ☑ N/A
Magnuson-Stevens Fishery Conservation and Management Act (Essential Fish Habitat)	
1. Is the project located in an estuarine system?	☐ Yes ☑ No
2. Is suitable habitat present for EFH-protected species?	☐ Yes ☐ No ☑ N/A
3. Is sufficient design information available to make a determination of the effect of the project on EFH?	☐ Yes ☐ No ☑ N/A
4. Will the project adversely affect EFH?	☐ Yes ☐ No ☑ N/A
5. Has consultation with NOAA-Fisheries occurred?	☐ Yes ☐ No ☑ N/A
Migratory Bird Treaty Act (MBTA)	
1. Does the USFWS have any recommendations with the project relative to the MBTA?	☐ Yes ☑ No
2. Have the USFWS recommendations been incorporated?	☐ Yes ☐ No ☑ N/A
Wilderness Act	
1. Is the project in a Wilderness area?	☐ Yes ☑ No
2. Has a special use permit and/or easement been obtained from the maintaining federal agency?	☐ Yes ☐ No ☑ N/A







USGS 7.5 Minute Topographic Map (Rowland, NC Quad)

Directions to the Site from Raleigh:
- **Head East on I-40 for 29 miles**
- **Take exit 328A to merge onto I-95 South**
- **After 79 miles, take exit 2 toward Rowland and turn right onto NC-130 W**
- **After 2.5 miles, turn left onto Ashpole Church Road, then right onto Persimmon Road**
- **After 2 miles, turn left onto Kitchen Street**
- **The Site is located on the right after 0.5 miles and can be accessed from Rhein Drive.**
- **Site Latitude, Longitude 34.5639, -79.3490 (WGS84)**

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

SITE LOCATION

Drawn by: KRJ

Date: APR 2019

Scale: 1:20,000

Project No.: 18-002.10

FIGURE

1

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

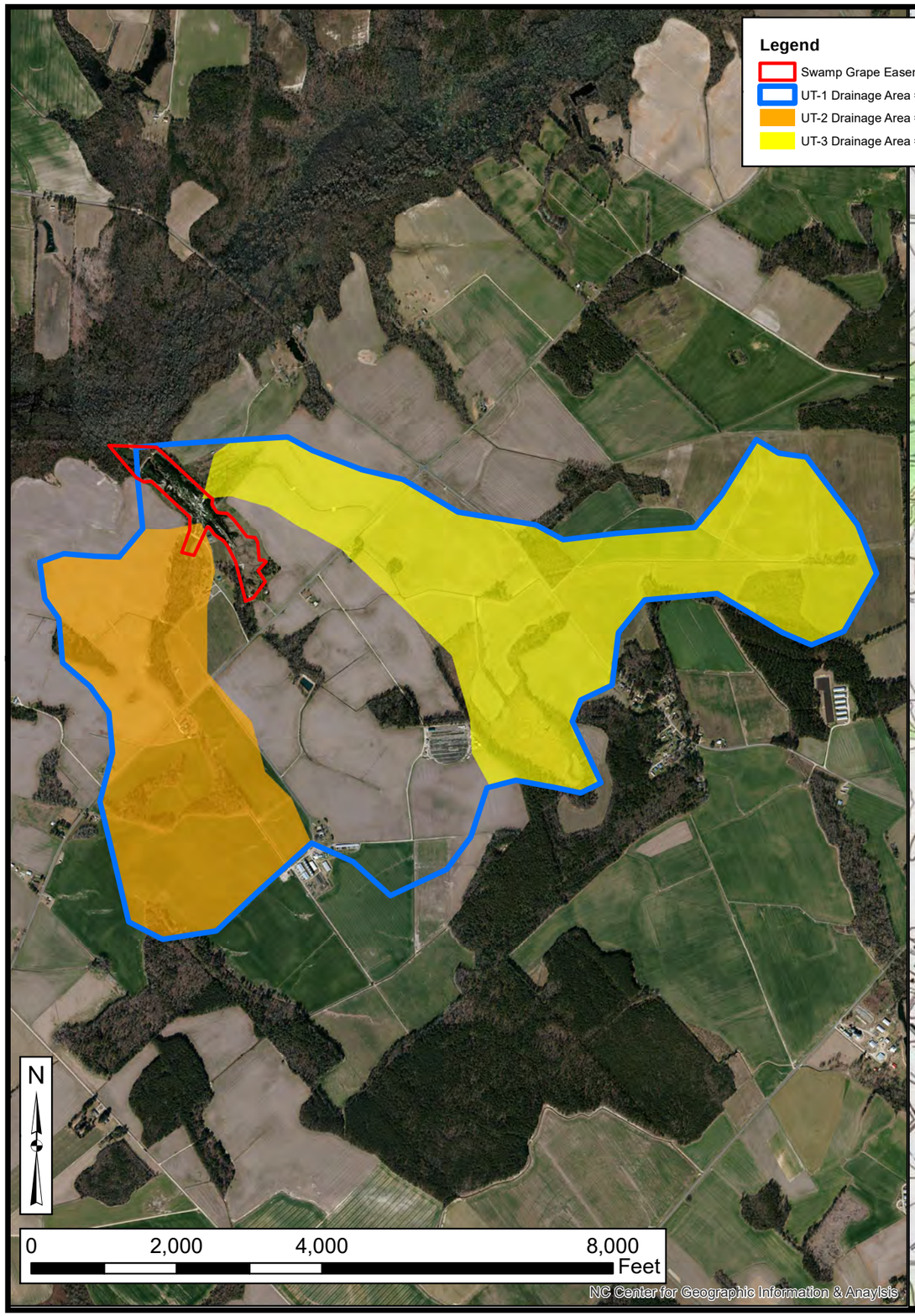
Date: APR 2019

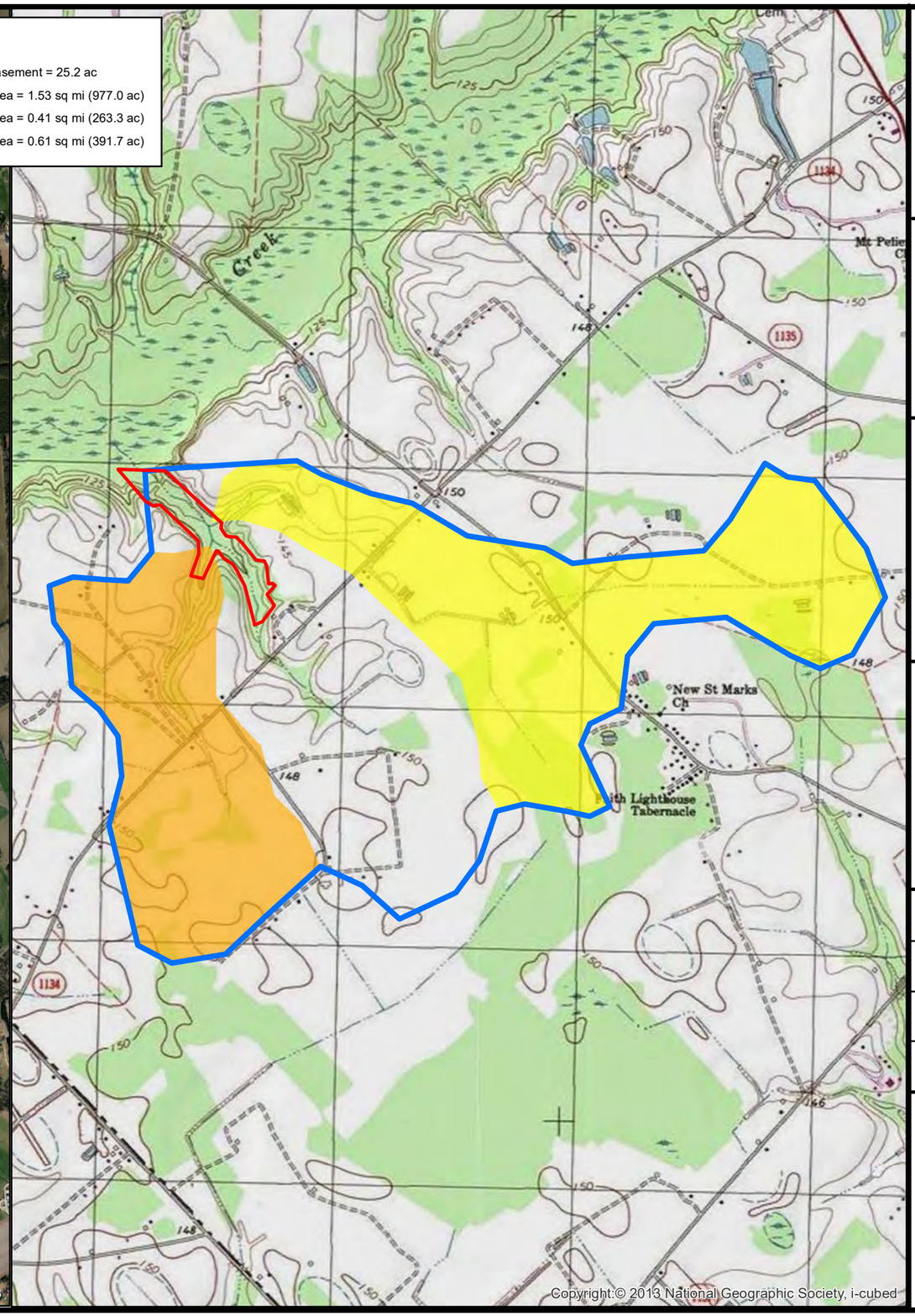
Scale: 1:260,000

Project No.: 18-002.10

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: KRJ

Date: APR 2019

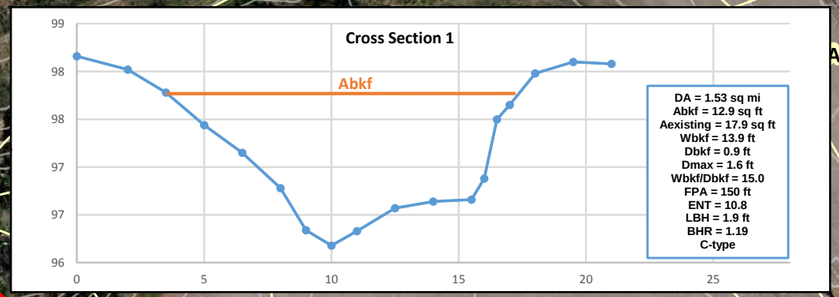
Scale: 1:21,000

Project No.: 18-002.10

FIGURE

3

Soil Map Unit	Soil Series
AyA	Aycock very fine sandy loam
BB	Bibb soils
FaB	Faceville fine sandy loam
WaB, WaC	Wagram loamy sand



N

NCSAM Form #1
Score: Low

XS-1

UT-1

UT-3

UT-2

WaC
WaB
FaA
FaB
NoB
NoA
BB
AyA
ExA

Legend

- Swamp Grape Easement = 25.2 ac
- Streams = 3817 ft
- Existing Ditches
- Existing Impacted Hydric Soils = 5.0 ac
- Hydric Soil with Overburden = 1.0 sc
- Existing Wetland = 14.1 ac
- Cross Sections
- NCSAM Form Location
- Soil Profile
- Existing Foot Path
- Soil Boundary
- 2-foot Lidar Contours

0 300 600 Feet

NC Center for Geographic Information & Anaylsis

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

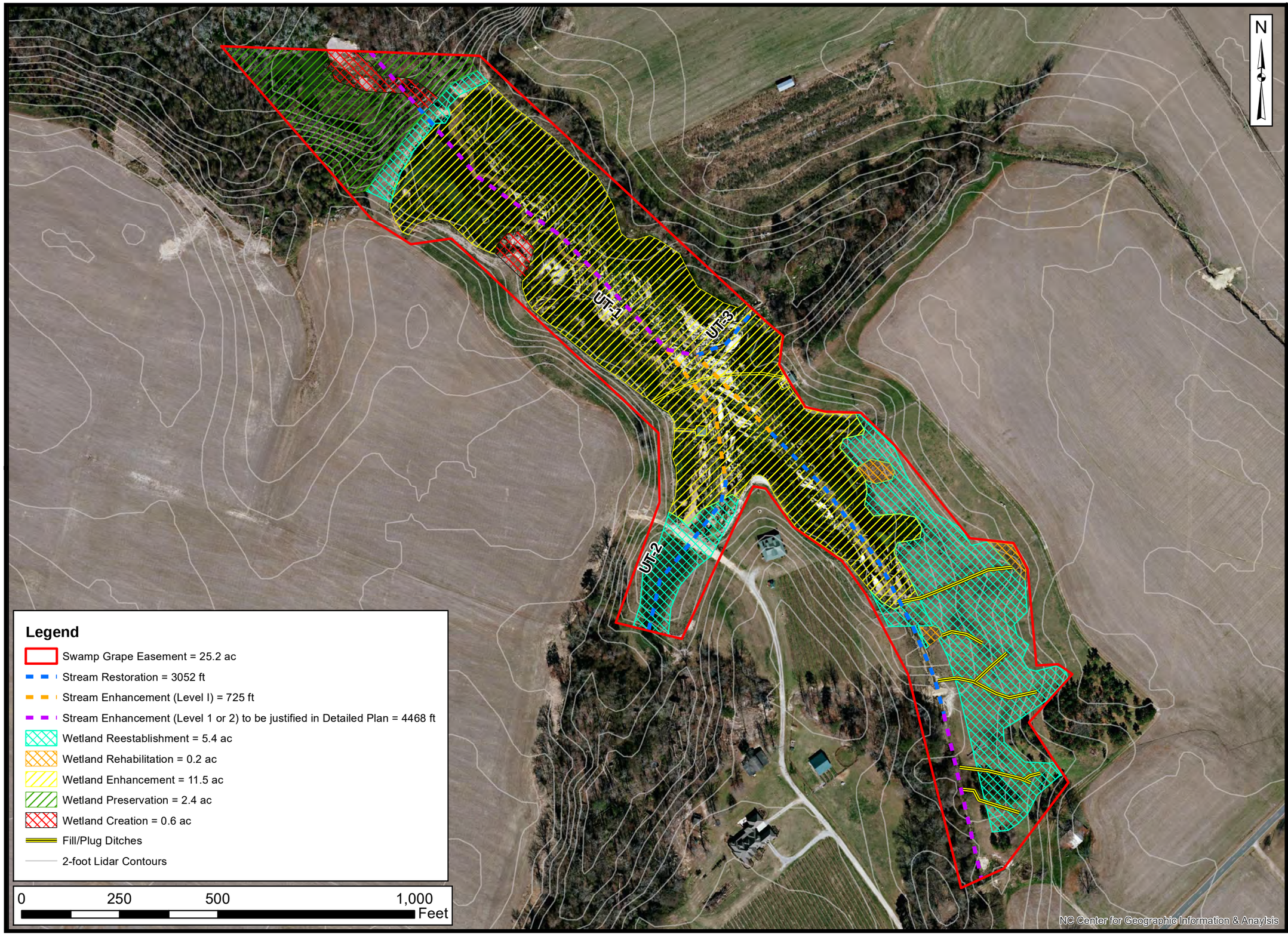
Date: APR 2019

Scale: 1:3200

Project No.: 18-002.10

FIGURE

4



Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

PROPOSED CONDITIONS

Drawn by: KRJ

Date: APR 2019

Scale: 1:2300

Project No.: 18-002.10

FIGURE

5

June 7th, 2019

Mr. Bodenhamer
6547 Kitchen St. Road
Rowland, NC
28383

Dear Mr. Bodenhamer,

The purpose of this letter is to notify you that Restoration Systems, LLC, in offering to purchase your property in Robeson County, North Carolina, does not have the power to acquire it by eminent domain. Also, Restoration Systems' offer to purchase your property is based on what we believe to be its fair market.

If you have any questions, please feel free to call me at 919-334-9122

Sincerely,

JD Hamby
Project Manager

United States Department of the Interior

FISH AND WILDLIFE SERVICE

Raleigh Field Office
P.O. Box 33726
Raleigh, NC 27636-3726

Date: 2/5/2020

Self-Certification Letter

Project Name Swamp Grape

Dear Applicant:

Thank you for using the U.S. Fish and Wildlife Service (Service) Raleigh Ecological Services online project review process. By printing this letter in conjunction with your project review package, you are certifying that you have completed the online project review process for the project named above in accordance with all instructions provided, using the best available information to reach your conclusions. This letter, and the enclosed project review package, completes the review of your project in accordance with the Endangered Species Act of 1973 (16 U.S.C. 1531-1544, 87 Stat. 884), as amended (ESA), and the Bald and Golden Eagle Protection Act (16 U.S.C. 668-668c, 54 Stat. 250), as amended (Eagle Act). This letter also provides information for your project review under the National Environmental Policy Act of 1969 (P.L. 91-190, 42 U.S.C. 4321-4347, 83 Stat. 852), as amended. A copy of this letter and the project review package must be submitted to this office for this certification to be valid. This letter and the project review package will be maintained in our records.

The species conclusions table in the enclosed project review package summarizes your ESA and Eagle Act conclusions. Based on your analysis, mark all the determinations that apply:

- ☐ "no effect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- ☑ "may affect, not likely to adversely affect" determinations for proposed/listed species and/or proposed/designated critical habitat; and/or
- ☐ "may affect, likely to adversely affect" determination for the Northern long-eared bat (Myotis septentrionalis) and relying on the findings of the January 5, 2016, Programmatic Biological Opinion for the Final 4(d) Rule on the Northern long-eared bat;
- ☑ "no Eagle Act permit required" determinations for eagles.

We certify that use of the online project review process in strict accordance with the instructions provided as documented in the enclosed project review package results in reaching the appropriate determinations. Therefore, we concur with the “no effect” or “not likely to adversely affect” determinations for proposed and listed species and proposed and designated critical habitat; the “may affect” determination for Northern long-eared bat; and/or the “no Eagle Act permit required” determinations for eagles. Additional coordination with this office is not needed. Candidate species are not legally protected pursuant to the ESA. However, the Service encourages consideration of these species by avoiding adverse impacts to them. Please contact this office for additional coordination if your project action area contains candidate species. Should project plans change or if additional information on the distribution of proposed or listed species, proposed or designated critical habitat, or bald eagles becomes available, this determination may be reconsidered. This certification letter is valid for 1 year. Information about the online project review process including instructions, species information, and other information regarding project reviews within North Carolina is available at our website http://www.fws.gov/raleigh/pp.html. If you have any questions, you can write to us at Raleigh@fws.gov or please contact Leigh Mann of this office at 919-856-4520, ext. 10.

Sincerely,

/s/Pete Benjamin

Pete Benjamin
Field Supervisor
Raleigh Ecological Services

Enclosures - project review package

Project Name: Swamp Grape #100115
Date: 6/5/2019

Species Name	Conclusion	ESA Section 7/Eagle Act Determination	Notes/Documentation
Red-cockaded woodpecker *(Picoides borealis)* Endangered	No suitable habitat	No effect	See notes below*
Wood stork *(Mycteria americana)* Threatened	Suitable habitat present, species not present	Not likely to adversely affect	See notes below**
Michaux's sumac *(Rhus michauxii)* Endangered	Suitable habitat present, species not present	Not likely to adversely affect	See notes below***
Bald Eagle *(Haliaeetus leucocephalus)*	Unlikely to disturb bald eagles	No Eagle Act permit required	No nest within action area
American Alligator *(Alligator mississippiensis)*	Suitable habitat present, species not present	Not likely to adversely affect	A qualified biologist conducted surveys and indicated absence.

This [document] provides a summary of the results of an Axiom Environmental, Inc. (Axiom) federally protected species survey at the Swamp Grape Mitigation Site. The approximately 20.5-acre site is located east of N.C. Highway 501 in Robeson County, NC.

*Red-cockaded Woodpecker

Habitat for red-cockaded woodpecker typically occupies open, mature stands of southern pines, particularly longleaf pine, for foraging and nesting/roosting habitat. The red-cockaded woodpecker excavates cavities for nesting and roosting in living pine trees, aged 60 years or older, and which are contiguous with pine stands at least 30 years of age to provide foraging habitat. The site supports scattered pines greater than 30 years old and a few pines greater than 60 years old. These pines are located sparsely among a primarily hardwood forest, resulting in unsuitable nesting and foraging habitat for red-cockaded woodpeckers. In addition, an investigation of these pines on May 21, 2019, found no evidence of red-cockaded woodpecker nesting/roosting. A review of NCNHP records dated May 24, 2019 indicates no occurrences of this species within 1.0 mile of the site.

**Wood stork

Wood stork is primarily associated with freshwater and estuarine habitats that are used for nesting, roosting, and foraging. Wood storks do not breed in North Carolina, however, a few disperse to southeastern North Carolina following the breeding season. Because of their specialized feeding behavior, wood storks forage most effectively in shallow-water areas with highly concentrated prey. Ideal foraging conditions are characterized by water that is relatively calm, open, and having water depths between 5 and 15 inches. The western side of site supports a small open water area with wetlands occurring throughout the entire site. This is considered suitable habitat. An investigation of the site was conducted by Axiom biologists on May 21, 2019 and found no evidence of wood stork foraging or roosting. As of May 24, 2019, the NCNHP has no record of this species within 1.0 mile of the site.

***Michaux's Sumac

Habitat for Michaux's sumac consists of rocky, open, upland woods on acidic or circumneutral, well-drained sands or sandy loam soils, particularly where disturbance (such as mowing, grazing, clearing, or periodic fire) maintains an open habitat. Suitable habitat for Michaux's sumac occurs within open areas of the site, residential yards, and the edge of agricultural fields and the remnant pond. Systematic surveys performed within areas of suitable habitat were performed by Axiom biologists on May 21, 2019, and identified no individuals. As of May 24, 2019, the NCNHP has no record of this species within 1.0 mile of the site.

United States Department of the Interior

FISH AND WILDLIFE SERVICE
Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
Phone: (919) 856-4520 Fax: (919) 856-4556

In Reply Refer To:
Consultation Code: 04EN2000-2019-SLI-0818
Event Code: 04EN2000-2020-E-01352
Project Name: Swamp Grape

February 05, 2020

Subject: Updated list of threatened and endangered species that may occur in your proposed project location, and/or may be affected by your proposed project

To Whom It May Concern:

The species list generated pursuant to the information you provided identifies threatened, endangered, proposed and candidate species, as well as proposed and final designated critical habitat, that may occur within the boundary of your proposed project and/or may be affected by your proposed project. The species list fulfills the requirements of the U.S. Fish and Wildlife Service (Service) under section 7(c) of the Endangered Species Act (Act) of 1973, as amended (16 U.S.C. 1531 *et seq.*).

New information based on updated surveys, changes in the abundance and distribution of species, changed habitat conditions, or other factors could change this list. Please feel free to contact us if you need more current information or assistance regarding the potential impacts to federally proposed, listed, and candidate species and federally designated and proposed critical habitat. Please note that under 50 CFR 402.12(e) of the regulations implementing section 7 of the Act, the accuracy of this species list should be verified after 90 days. This verification can be completed formally or informally as desired. The Service recommends that verification be completed by visiting the ECOS-IPaC website at regular intervals during project planning and implementation for updates to species lists and information. An updated list may be requested through the ECOS-IPaC system by completing the same process used to receive the enclosed list.

Section 7 of the Act requires that all federal agencies (or their designated non-federal representative), in consultation with the Service, insure that any action federally authorized, funded, or carried out by such agencies is not likely to jeopardize the continued existence of any federally-listed endangered or threatened species. A biological assessment or evaluation may be prepared to fulfill that requirement and in determining whether additional consultation with the Service is necessary. In addition to the federally-protected species list, information on the species' life histories and habitats and information on completing a biological assessment or

evaluation and can be found on our web page at http://www.fws.gov/raleigh. Please check the web site often for updated information or changes

If your project contains suitable habitat for any of the federally-listed species known to be present within the county where your project occurs, the proposed action has the potential to adversely affect those species. As such, we recommend that surveys be conducted to determine the species' presence or absence within the project area. The use of North Carolina Natural Heritage program data should not be substituted for actual field surveys.

If you determine that the proposed action may affect (i.e., likely to adversely affect or not likely to adversely affect) a federally-protected species, you should notify this office with your determination, the results of your surveys, survey methodologies, and an analysis of the effects of the action on listed species, including consideration of direct, indirect, and cumulative effects, before conducting any activities that might affect the species. If you determine that the proposed action will have no effect (i.e., no beneficial or adverse, direct or indirect effect) on federally listed species, then you are not required to contact our office for concurrence (unless an Environmental Impact Statement is prepared). However, you should maintain a complete record of the assessment, including steps leading to your determination of effect, the qualified personnel conducting the assessment, habitat conditions, site photographs, and any other related articles.

Please be aware that bald and golden eagles are protected under the Bald and Golden Eagle Protection Act (16 U.S.C. 668 *et seq.*), and projects affecting these species may require development of an eagle conservation plan (http://www.fws.gov/windenergy/eagle_guidance.html). Additionally, wind energy projects should follow the wind energy guidelines (http://www.fws.gov/windenergy/) for minimizing impacts to migratory birds and bats.

Guidance for minimizing impacts to migratory birds for projects including communications towers (e.g., cellular, digital television, radio, and emergency broadcast) can be found at: http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/towers.htm; http://www.towerkill.com; and http://www.fws.gov/migratorybirds/CurrentBirdIssues/Hazards/towers/comtow.html.

Not all Threatened and Endangered Species that occur in North Carolina are subject to section 7 consultation with the U.S Fish and Wildlife Service. Atlantic and shortnose sturgeon, sea turtles,when in the water, and certain marine mammals are under purview of the National Marine Fisheries Service. If your project occurs in marine, estuarine, or coastal river systems you should also contact the National Marine Fisheries Service, http://www.nmfs.noaa.gov/

We appreciate your concern for threatened and endangered species. The Service encourages Federal agencies to include conservation of threatened and endangered species into their project planning to further the purposes of the Act. Please include the Consultation Tracking Number in the header of this letter with any request for consultation or correspondence about your project that you submit to our office. If you have any questions or comments, please contact John Ellis of this office at john_ellis@fws.gov.

Attachment(s):

- Official Species List

Official Species List

This list is provided pursuant to Section 7 of the Endangered Species Act, and fulfills the requirement for Federal agencies to "request of the Secretary of the Interior information whether any species which is listed or proposed to be listed may be present in the area of a proposed action".

This species list is provided by:

Raleigh Ecological Services Field Office
Post Office Box 33726
Raleigh, NC 27636-3726
(919) 856-4520

Project Summary

Consultation Code: 04EN2000-2019-SLI-0818

Event Code: 04EN2000-2020-E-01352

Project Name: Swamp Grape

Project Type: STREAM / WATERBODY / CANALS / LEVEES / DIKES

Project Description: This proposal describes the Swamp Grape Stream & Wetland Mitigation Site (Site) and is designed specifically to assist in fulfilling North Carolina Department of Environment and Natural Resources (NCDENR) Division of Mitigation Services (NCDMS) mitigation goals. The Site is located within 14-digit Cataloging Unit and Targeted Local Watershed 03040204048010, approximately 4 miles northwest of Rowland and 2.5 miles southwest of Alfordsville along the southwest edge of Robeson County near the North Carolina and South Carolina border. The Site is not located within a Regional or Local Watershed Planning area. The Site is situated along warm water, unnamed tributaries to Wilkinson Creek.

Project Location:

Approximate location of the project can be viewed in Google Maps: https://www.google.com/maps/place/34.5634127240389N79.34829046493127W

Counties: Robeson, NC

Endangered Species Act Species

There is a total of 4 threatened, endangered, or candidate species on this species list.

Species on this list should be considered in an effects analysis for your project and could include species that exist in another geographic area. For example, certain fish may appear on the species list because a project could affect downstream species.

IPaC does not display listed species or critical habitats under the sole jurisdiction of NOAA Fisheries[1], as USFWS does not have the authority to speak on behalf of NOAA and the Department of Commerce.

See the "Critical habitats" section below for those critical habitats that lie wholly or partially within your project area under this office's jurisdiction. Please contact the designated FWS office if you have questions.

---

1. NOAA Fisheries, also known as the National Marine Fisheries Service (NMFS), is an office of the National Oceanic and Atmospheric Administration within the Department of Commerce.

Birds

NAME	STATUS
Red-cockaded Woodpecker *Picoides borealis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/7614	Endangered
Wood Stork *Mycteria americana* Population: AL, FL, GA, MS, NC, SC No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/8477	Threatened

Reptiles

NAME	STATUS
American Alligator *Alligator mississippiensis* No critical habitat has been designated for this species. Species profile: https://ecos.fws.gov/ecp/species/776	Similarity of Appearance (Threatened)

Flowering Plants

NAME	STATUS
Michaux's Sumac *Rhus michauxii*	Endangered

No critical habitat has been designated for this species.
Species profile: https://ecos.fws.gov/ecp/species/5217

Critical habitats

THERE ARE NO CRITICAL HABITATS WITHIN YOUR PROJECT AREA UNDER THIS OFFICE'S JURISDICTION.

NC DEPARTMENT OF
NATURAL AND CULTURAL RESOURCES

Roy Cooper, **Governor**
Susi Hamilton, **Secretary**
Walter Clark, **Director, Land and Water Stewardship**

NCNHDE-7765

December 17, 2018

Phillip Perkinson
Axiom Environmental Inc.
218 Snow Avenue
Raleigh, NC 27612
RE: Bodenhammer; 18-002

Dear Phillip Perkinson:

The North Carolina Natural Heritage Program (NCNHP) appreciates the opportunity to provide information about natural heritage resources for the project referenced above.

Based on the project area mapped with your request, a query of the NCNHP database, indicates that there are no records for rare species, important natural communities, natural areas, and/or conservation/managed areas within the proposed project boundary. Please note that although there may be no documentation of natural heritage elements within the project boundary, it does not imply or confirm their absence; the area may not have been surveyed. The results of this query should not be substituted for field surveys where suitable habitat exists. In the event that rare species are found within the project area, please contact the NCNHP so that we may update our records.

The attached 'Potential Occurrences' table summarizes rare species and natural communities that have been documented within a one-mile radius of the property boundary. The proximity of these records suggests that these natural heritage elements may potentially be present in the project area if suitable habitat exists. Tables of natural areas and conservation/managed areas within a one-mile radius of the project area, if any, are also included in this report.

If a Federally-listed species is found within the project area or is indicated within a one-mile radius of the project area, the NCNHP recommends contacting the US Fish and Wildlife Service (USFWS) for guidance. Contact information for USFWS offices in North Carolina is found here: https://www.fws.gov/offices/Directory/ListOffices.cfm?statecode=37.

Please note that natural heritage element data are maintained for the purposes of conservation planning, project review, and scientific research, and are not intended for use as the primary criteria for regulatory decisions. Information provided by the NCNHP database may not be published without prior written notification to the NCNHP, and the NCNHP must be credited as an information source in these publications. Maps of NCNHP data may not be redistributed without permission.

The NC Natural Heritage Program may follow this letter with additional correspondence if a Dedicated Nature Preserve, Registered Heritage Area, Clean Water Management Trust Fund easement, or Federally-listed species are documented near the project area.

If you have questions regarding the information provided in this letter or need additional assistance, please contact Rodney A. Butler at rodney.butler@ncdcr.gov or 919-707-8603.

Sincerely,
NC Natural Heritage Program

Natural Heritage Element Occurrences, Natural Areas, and Managed Areas Within a One-mile Radius of the Project Area
Bodenhammer
Project No. 18-002
December 17, 2018
NCNHDE-7765

Element Occurrences Documented Within a One-mile Radius of the Project Area

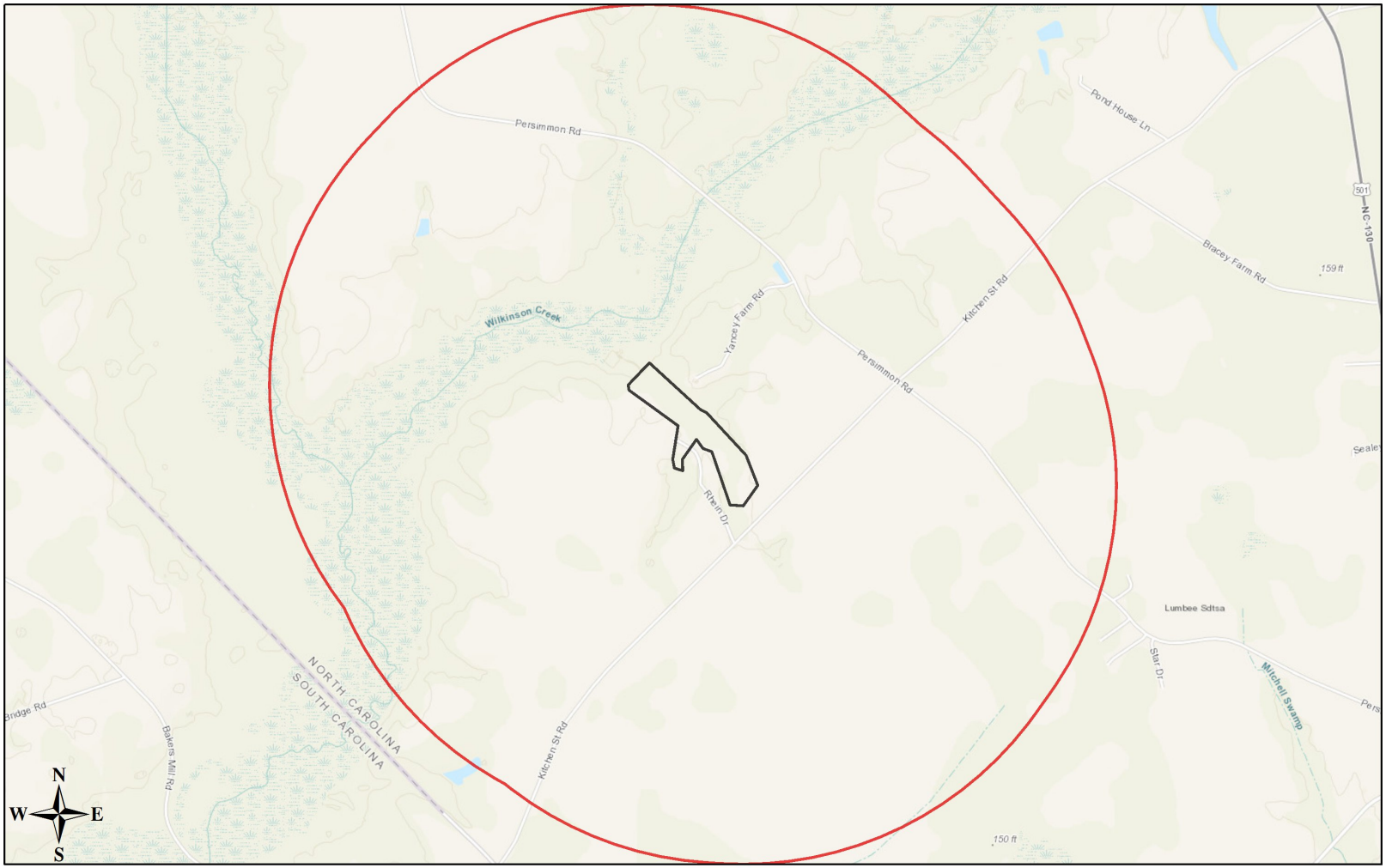
Taxonomic Group	EO ID	Scientific Name	Common Name	Last Observation Date	Element Occurrence Rank	Accuracy	Federal Status	State Status	Global Rank	State Rank
Dragonfly or Damselfly	33769	Somatochlora georgiana	Coppery Emerald	2004-Pre	H?	5-Very Low	---	Significantly Rare	G3G4	S2?
Dragonfly or Damselfly	33789	Triacanthagyna trifida	Phantom Darner	2004-Pre	H?	5-Very Low	---	Significantly Rare	G5	S1?

No Natural Areas are Documented Within a One-mile Radius of the Project Area

No Managed Areas are Documented Within a One-mile Radius of the Project Area

Definitions and an explanation of status designations and codes can be found at https://ncnhde.natureserve.org/content/help. Data query generated on December 17, 2018; source: NCNHP, Q4 Oct 2018. Please resubmit your information request if more than one year elapses before project initiation as new information is continually added to the NCNHP database.

NCNHDE-7765: Bodenhammer



December 17, 2018

Project Boundary

Buffered Project Boundary

1:24,322

0 0.2 0.4 0.8 mi

0 0.325 0.65 1.3 km

Sources: Esri, HERE, Garmin, Intermap, increment P Corp., GEBCO, USGS, FAO, NPS, NRCAN, GeoBase, IGN, Kadaster NL, Ordnance Survey, Esri Japan, METI, Esri China (Hong Kong), swisstopo, © OpenStreetMap contributors, and the GIS User Community

From: Mann, Leigh on behalf of Raleigh, FW4
To: John Hamby
Subject: Swamp Grape
Date: Monday, February 10, 2020 2:21:13 PM

Mr. Hamby,

The biologist reviewed your packet submitted for this project and agreed with your findings. You can use the self certification letter for you records for this project. If you have any questions please feel free to contact us.

Respectfully,

Leigh Mann
Office Automation
USFWS Raleigh ES FO
551-F Pylon Drive
Raleigh, NC 27606
Office: 1-919-856-4520 ext. 10
Fax: 1-919-856-4556
leigh_mann@fws.gov

April 26th, 2019

Gabriela Garrison
Eastern Piedmont Coordinator
North Carolina Wildlife Resources Commission
Sandhills Dept, P.O. Box 149
Hoffman, NC 28347

Re: Swamp Grape Stream and Wetland Mitigation Project, Robeson County, NC

Dear Ms. Garrison:

The purpose of this letter is to request concurrence from the North Carolina Wildlife Recourse Commission concerning a stream and wetland restoration project located in Robeson County for the N.C. Division of Mitigation Services. The project will restore stream channels and riparian wetlands in a drained lake bed and forested areas. Please review and comment on any possible issues that might emerge with respect to the Fish and Wildlife Coordination Act from the potential stream restoration project. Attached is a USGS base map with the projects 21.5 acre footprint identified. The Site is located approximately 4 miles northwest of Rowland and 2.5 miles southwest of Alfordsville along the southwest edge of Robeson County near the North Carolina and South Carolina border. Site land use consists of a breached agriculture pond, disturbed forest, horse pasture, and row crops. The pond was breached in August 2018 during hurricane Florence. All Site hydrology drains to warm water, unnamed tributaries to Wilkinson Creek.

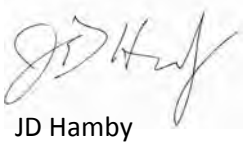
The Site is located in the Atlantic Southern Loam Plains portion of the Southeastern Plains ecoregion of North Carolina. Regional physiography is characterized by dissected, smooth and irregular plains; broad interstream divides; Carolina bays; and mostly gentle side slopes dissected by many small, low to moderate gradient sandy-bottomed streams (Griffith et al. 2002). Onsite elevations range from a high of 140 feet National Geodetic Vertical Datum (NGVD) at the upper reaches to a low of approximately 115 feet NGVD at the Site outfall (USGS Rowland, North Carolina 7.5-minute topographic quadrangle)

The Site is proposed to include 3,701 feet of combined restored and enhanced stream channel along with 10.1 acres of reestablished and enhanced riparian wetlands. Site alterations include the cessation irrigation source for row crop production, removal of the earthen dam, restoration of wetlands, and planting native, woody vegetation within the entire 21.5 acre Site easement. Mitigation outlined in this report will result in net gains in hydrology, water quality, and habitat functions, and are designed to provide 3,061 Stream Mitigation Units and 10.0 Non-riparian Wetland Mitigation Units.

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced Project Manager with any questions that you may have concerning the extent of site disturbance associated with this project. If we do not hear from you within 30 days, we will assume you have no comments on the project. Your valuable time and cooperation are much appreciated.

Yours truly,

Restoration Systems, LLC



JD Hamby
Project Manager
jhamby@restorationsytems.com
919-755-9490

Attachments: Location and USGS Map

John Hamby

From: Garrison, Gabriela <gabriela.garrison@ncwildlife.org>
Sent: Wednesday, May 22, 2019 2:09 PM
To: John Hamby
Subject: RE: [External] Swamp Grape Stream and Wetland Project

Hi JD,
I apologize for the delay in response. We have no objection to this project.
Thank you!
Gabriela

Gabriela Garrison
Eastern Piedmont Habitat Conservation Coordinator

NC Wildlife Resources Commission
Sandhills Depot, P.O. Box 149
Hoffman, NC 28347
Office and Cell: 910-409-7350
gabriela.garrison@ncwildlife.org

www.ncwildlife.org

From: John Hamby <jhamby@restorationsystems.com>
Sent: Friday, April 26, 2019 10:41 AM
To: Garrison, Gabriela <gabriela.garrison@ncwildlife.org>
Subject: [External] Swamp Grape Stream and Wetland Project

Good Afternoon Gabriela,

The purpose of this email is to request concurrence from the North Carolina Wildlife Recourse Commission concerning a stream restoration project located in Robeson County for the N.C. Division of Mitigation Services. Attached you will find a letter outlining a few of the details of the project. The project will restore streams and riparian wetlands in existing pasturelands and forested areas. Please review and comment on any possible issues that might emerge with respect to the Fish and Wildlife Coordination Act from the potential stream restoration project. If we do not receive a response within 30 days, we will assume your department has no comment.

Thank you for your time,

JD

John *"JD"* Hamby | Project Manager
1101 Haynes St. Suite 211 | Raleigh, NC 27604
tel: 919.334.9111 | cell: 919.801.4754 | fax: 919.755.9492
email: jhamby@restorationsystems.com

April 24th, 2019

Renee Gledhill-Earley,
Environmental Review Coordinator
North Carolina State Historic Preservation Office
109 East Jones Street
Raleigh, NC 27699-4617
Sent electronically to Environmental.Review@ncdcr.gov

Re: Swamp Grape Stream and Wetland Mitigation Project, Robeson County, NC

Dear Renee,

The purpose of this letter is to request written concurrence from the State Historic Preservation Office (SHPO) for the Swamp Grape Stream and Wetland Mitigation Project in Robeson County, a Full-Delivery project for the N.C. Davison of Mitigation Services. Please review and comment on any possible issues that might emerge with respect to SHPO from a potential stream restoration project depicted on the attached mapping.

Project Name:	Swamp Grape Stream and Wetland Mitigation Project
Project Location:	Site Latitude, Longitude 34.335125, -79.205717 (WGS84)
Project Contact:	JD Hamby, Restoration Systems LLC, 1101 Haynes St. Suite 211, Raleigh, NC 27604

Project Description: The project has been identified for the purpose of providing in-kind mitigation for unavoidable stream channel and wetland impacts. Permits from the NC DWR and USACE will be obtained to restore waters of the US. Soil and erosion control permits will also be obtained. The project encompasses ~20 acres of drain hydric soils, formerly used as an irrigation. Several thousand feet of stream and several acres of wetlands will be restored.

The term “cultural resources” refers to prehistoric or historic archaeological sites, structures, or artifact deposits over 50 years old. “Significant” cultural resources are those that are eligible or potentially eligible for inclusion in the National Register of Historic Places. Evaluations of site significance are made with reference to the eligibility criteria of the National Register (36 CFR 60) and in consultation with the North Carolina State Historic Preservation Office (SHPO).

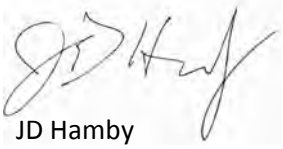
Field visits were conducted in Spring 2019 to conduct evaluations for presence of structures or features that may be eligible for the National Register of Historic Places. No structures were identified within the Site boundaries that may be eligible for the National Register. In addition to field reviews for historically relevant structures, a records search was conducted at the SHPO office to determine if documented

occurrences of historic structures or artifacts occur within, or adjacent to the Site. The SHPO records identify no features within the Site boundaries and no features within a one mile radius of the Site.

Typical SHPO coordination will occur prior to construction activities to determine if any significant cultural resources are present; however, no constraints are expected at this time. We thank you in advance for your timely response and cooperation. Please feel free to contact me with any questions that you may have concerning the extent of site disturbance associated with this project.

Yours truly,

RESTORATION SYSTEMS, LLC



JD Hamby
Project Manager
jhamby@restorationsytems.com
919-755-9490

Attachments – USGS Map, Existing Conditions

North Carolina Department of Natural and Cultural Resources

State Historic Preservation Office

Ramona M. Bartos, Administrator

Governor Roy Cooper
Secretary Susi H. Hamilton

Office of Archives and History
Deputy Secretary Kevin Cherry

May 31, 2019

JD Hamby
Restoration Systems, LLC
1101 Haynes Street, Suite 211
Raleigh, NC 27604

Re: Swamp Grape Stream and Wetland Mitigation, Robeson County, ER 19-1524

Dear Mr. Hanby:

Thank you for your letter of April 24, 2019, concerning the above project.

We have conducted a review of the project and are aware of no historic resources which would be affected by the project. Therefore, we have no comment on the project as proposed.

The above comments are made pursuant to Section 106 of the National Historic Preservation Act and the Advisory Council on Historic Preservation's Regulations for Compliance with Section 106 codified at 36 CFR Part 800.

Thank you for your cooperation and consideration. If you have questions concerning the above comment, contact Renee Gledhill-Earley, environmental review coordinator, at 919-807-6579 or environmental.review@ncdcr.gov. In all future communication concerning this project, please cite the above referenced tracking number.

Sincerely,

Renee Gledhill-Earley

for Ramona Bartos, Deputy
State Historic Preservation Officer

April 25th, 2019

Milton Cortes
USDA Natural Resources Conservation Service 4407
Bland Road
Suite 117
Raleigh, NC 27609

Re: Swamp Grape Stream and Wetland Mitigation Site, Robeson County, NC

Restoration Systems, LLC (RS), of Raleigh, NC has been awarded a contract by DMS to provide Stream and Wetland Mitigation Units at the Brahma Stream and Wetland Mitigation Site in Alamance County, North Carolina.
One of the earliest tasks to be performed by RS is completion of an environmental screening and preparation/submittal of a Categorical Exclusion (CE) document. This document is specifically required by the Federal Highway Administration (FHWA) to ensure compliance with various federal environmental laws and regulations. DMS must demonstrate that its projects comply with federal mandates as a precondition to FHWA reimbursement of compensatory mitigation costs borne by the North Carolina Department of Transportation to offset its projects' unavoidable impacts to streams and wetlands.

In order for the project to proceed, RS is obligated to coordinate with the NRCS to complete Form AD-1006 in compliance with the Farmland Protection Policy Act on behalf of the FHWA. The purpose of this letter is to request your assistance in completion of the Form.

Project Location & Description

The Site is located approximately 4 miles northwest of Rowland and 2.5 miles southwest of Alfordsville along the southwest edge of Robeson County near the North Carolina and South Carolina border. Site land use consists of a breached agriculture pond, disturbed forest, horse pasture, and row crops. The pond was breached in August 2018 during hurricane Florence. All Site hydrology drains to warm water, unnamed tributaries to Wilkinson Creek.

The Site is located in the Atlantic Southern Loam Plains portion of the Southeastern Plains ecoregion of North Carolina. Regional physiography is characterized by dissected, smooth and irregular plains; broad interstream divides; Carolina bays; and mostly gentle side slopes dissected by many small, low to moderate gradient sandy-bottomed streams (Griffith et al. 2002). Onsite elevations range from a high of 140 feet National Geodetic Vertical Datum (NGVD) at the upper reaches to a low of approximately 115 feet NGVD at the Site outfall (USGS Rowland, North Carolina 7.5-minute topographic quadrangle)

Restoration Means & Methods

Stream restoration efforts are designed to restore a stable stream that approximates hydrodynamics, stream geometry, and local microtopography relative to reference conditions. Restoration at the Site will entail 1) notching the dam to dewater sediments; 2) removal of the dam to the elevation of the adjacent floodplain; 3) excavating sediment that is unsuitable for channel bank construction; 4) backfilling areas of sediment removed with soil suitable for channel construction (if necessary); 5) excavation of the design channel, 6) stabilization of

the channel with coir matting, seed, and mulch; and 7) installation of structures.

The dam was breached in the summer of 2018 during hurricane Florence; however, landowners are reconstructing the dam for irrigation purposes. Therefore, the dam will be notched and the pond bed will be seeded with temporary grasses to stabilize sediments remaining in the pond. Care will be taken during notching of the dam to drain the maximum amount of water, thereby allowing sediments to dewater.

Once the pond has dewatered and sediments have stabilized, the dam will be removed with finished grades matching elevations of the valley and floodplain above and below the dam location. Material removed from the dam, if suitable, may be used as channel backfill for reaches of stream to be abandoned during Priority I stream restoration efforts. If additional backfill remains, the material will be stockpiled outside of the easement, or spread evenly across the adjacent property and seeded for stabilization. Erosion control measures, such as silt fence, seeding, and mulching will be implemented on all stockpiled or spread soil materials.

A determination on sediment quantity and quality within the abandoned pond will be made concerning the ability to work within, or to stabilize the sediment for stream construction. If sediment is deemed unsuitable for channel construction, the sediment will be removed from the vicinity of the design channel and spread along the outer margins of the pond. Subsequently, suitable soil material will be placed in the location of the design channel such that design channel banks will be stabilized without liquefaction. The removal of unsuitable material, installation of suitable material, and excavation of the design channel may occur simultaneously to reduce impacts of machinery on the pond bed.

Excavation of the design channel will occur in the pond bed similar to other reaches of restored stream, with stabilization using approved erosion control materials and techniques.

Bare-root seedlings will be planted at a density of approximately 680 stems per acre on 8-foot centers. Planting will be performed between November 15 and March 15 to allow plants to stabilize during the dormant period and set root during the spring season. Potential species planted within the Site may include the following.

Should you have any questions or if any additional information is needed to complete the form, please feel free to contact me at the office 919.334.9111. If we do not hear from you within 45 days, we will assume you have no comments on the project. Your valuable time and cooperation are much appreciated.

Yours truly,

RESTORATION SYSTEMS, LLC

JD Hamby
Project Manager
jhamby@restorationsytems.com
919-334-9111

Attachments- Location and Condition Maps
AD-1006 Form

John Hamby

From: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Sent: Thursday, May 30, 2019 5:02 PM
To: John Hamby
Subject: RE: Swamp Grape Stream and Wetland Mitigation Site
Attachments: AD1006_Swamp Grape Easement.pdf

Importance: High

John:

Please find attached the Farmland Conversion Impact Rating for the Swamp Grape Stream and Wetland Mitigation Site.

If we can be of further assistance please let us know.

Best Regards;

Milton Cortes

State Soil Scientist
USDA NRCS
4407 Bland Rd., Suite 117
Raleigh, NC 27609
Desk: 919-873-2171

From: John Hamby <jhamby@restorationsystems.com>
Sent: Thursday, April 25, 2019 5:25 PM
To: Cortes, Milton - NRCS, Raleigh, NC <milton.cortes@usda.gov>
Subject: Swamp Grape Stream and Wetland Mitigation Site

Good Afternoon Milton,

Attached I hope you will find all the necessary documents for our farmland impact evaluation attached above.

If you have any questions, feel free to call or email me.

Best Regards,

JD

___ ___ ___ ___ ___ ___ ___ ___ ___ ___ ___
John *"JD"* Hamby | Project Manager
1101 Haynes St. Suite 211 | Raleigh, NC 27604
tel: 919.334.9111 | cell: 919.801.4754 | fax: 919.755.9492
email: jhamby@restorationsystems.com

U.S. Department of Agriculture

FARMLAND CONVERSION IMPACT RATING

PART I *(To be completed by Federal Agency)*	Date Of Land Evaluation Request 4/25/19
Name Of Project Swamp Grape Stream and Wetland Mitigation Site	Federal Agency Involved Federal Highway Administration
Proposed Land Use Stream and Wetland Restoration	County And State Robeson County, NC
PART II *(To be completed by NRCS)*	Date Request Received By NRCS

Does the site contain prime, unique, statewide or local important farmland? *(If no, the FPPA does not apply -- do not complete additional parts of this form).*	Yes ☑	No ☐	Acres Irrigated none	Average Farm Size 282 acres
Major Crop(s) CORN	Farmable Land In Govt. Jurisdiction Acres: 493,220	% 81	Amount Of Farmland As Defined in FPPA Acres: 469,352	% 77
Name Of Land Evaluation System Used Robeson Co. NC LESA	Name Of Local Site Assessment System N/A		Date Land Evaluation Returned By NRCS May 30, 2019 By eMail	

PART III *(To be completed by Federal Agency)*	Alternative Site Rating Site A	Site B	Site C	Site D
A. Total Acres To Be Converted Directly	0.5			
B. Total Acres To Be Converted Indirectly	21.0			
C. Total Acres In Site	21.5	0.0	0.0	0.0
PART IV *(To be completed by NRCS)* Land Evaluation Information				
A. Total Acres Prime And Unique Farmland	0.8			
B. Total Acres Statewide And Local Important Farmland	4.6			
C. Percentage Of Farmland In County Or Local Govt. Unit To Be Converted	0.0			
D. Percentage Of Farmland In Govt. Jurisdiction With Same Or Higher Relative Value	81.2			
PART V *(To be completed by NRCS)* Land Evaluation Criterion Relative Value Of Farmland To Be Converted *(Scale of 0 to 100 Points)*				

PART VI *(To be completed by Federal Agency)* Site Assessment Criteria *(These criteria are explained in 7 CFR 658.5(b)*	Maximum Points				
1. Area In Nonurban Use	15	15			
2. Perimeter In Nonurban Use	10	10			
3. Percent Of Site Being Farmed	20	5			
4. Protection Provided By State And Local Government	20	0			
5. Distance From Urban Builtup Area	15	14			
6. Distance To Urban Support Services	15	10			
7. Size Of Present Farm Unit Compared To Average	10	6			
8. Creation Of Nonfarmable Farmland	10	0			
9. Availability Of Farm Support Services	5	4			
10. On-Farm Investments	20	15			
11. Effects Of Conversion On Farm Support Services	10	0			
12. Compatibility With Existing Agricultural Use	10	1			
TOTAL SITE ASSESSMENT POINTS	160				
PART VII *(To be completed by Federal Agency)*					
Relative Value Of Farmland *(From Part V)*	100				
Total Site Assessment *(From Part VI above or a local site assessment)*	160				
TOTAL POINTS *(Total of above 2 lines)*	260	95	0	0	0

Site Selected:	Date Of Selection	Was A Local Site Assessment Used? Yes ☐ No ☐

Reason For Selection:

(See Instructions on reverse side)

This form was electronically produced by National Production Services Staff

Clear Form

Form AD-1006 (10-83)

Swamp Grape
6392 Kitchen St Road
Rowland, NC 28383

Inquiry Number: 5677241.2s
June 07, 2019

EDR Summary Radius Map Report

6 Armstrong Road, 4th floor
Shelton, CT 06484
Toll Free: 800.352.0050
www.edrnet.com

TABLE OF CONTENTS

Thank you for your business.
Please contact EDR at 1-800-352-0050
with any questions or comments.

EXECUTIVE SUMMARY

A search of available environmental records was conducted by Environmental Data Resources, Inc (EDR). The report was designed to assist parties seeking to meet the search requirements of EPA's Standards and Practices for All Appropriate Inquiries (40 CFR Part 312), the ASTM Standard Practice for Environmental Site Assessments (E 1527-13), the ASTM Standard Practice for Environmental Site Assessments for Forestland or Rural Property (E 2247-16), the ASTM Standard Practice for Limited Environmental Due Diligence: Transaction Screen Process (E 1528-14) or custom requirements developed for the evaluation of environmental risk associated with a parcel of real estate.

TARGET PROPERTY INFORMATION

ADDRESS

6392 KITCHEN ST ROAD
ROWLAND, NC 28383

COORDINATES

Latitude (North):	34.5639000 - 34° 33' 50.04''
Longitude (West):	79.3490000 - 79° 20' 56.40''
Universal Tranverse Mercator:	Zone 17
UTM X (Meters):	651462.4
UTM Y (Meters):	3825725.0
Elevation:	122 ft. above sea level

USGS TOPOGRAPHIC MAP ASSOCIATED WITH TARGET PROPERTY

Target Property:	TP
Source:	U.S. Geological Survey

AERIAL PHOTOGRAPHY IN THIS REPORT

Portions of Photo from:	20140517, 20150601
Source:	USDA

MAPPED SITES SUMMARY

Target Property Address:
6392 KITCHEN ST ROAD
ROWLAND, NC 28383

Click on Map ID to see full detail.

MAP ID	SITE NAME	ADDRESS	DATABASE ACRONYMS	RELATIVE ELEVATION	DIST (ft. & mi.) DIRECTION

NO MAPPED SITES FOUND

EXECUTIVE SUMMARY

TARGET PROPERTY SEARCH RESULTS

The target property was not listed in any of the databases searched by EDR.

SURROUNDING SITES: SEARCH RESULTS

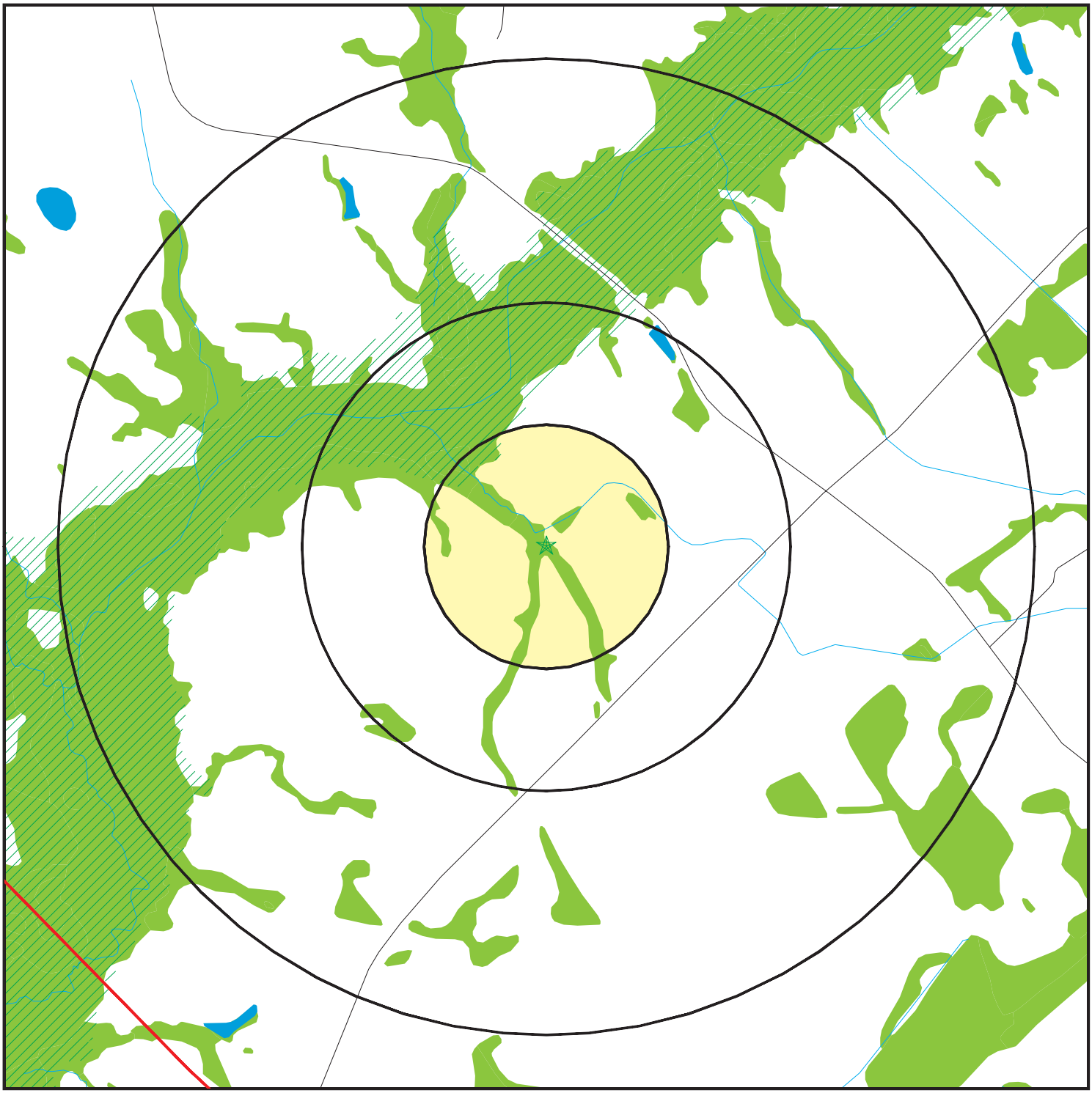
Surrounding sites were not identified.

Unmappable (orphan) sites are not considered in the foregoing analysis.

Count: 0 records. ORPHAN SUMMARY

City	EDR ID	Site Name	Site Address	Zip	Database(s)
		NO SITES FOUND			

OVERVIEW MAP - 5677241.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- National Priority List Sites
- Dept. Defense Sites

0 1/4 1/2 1 Miles

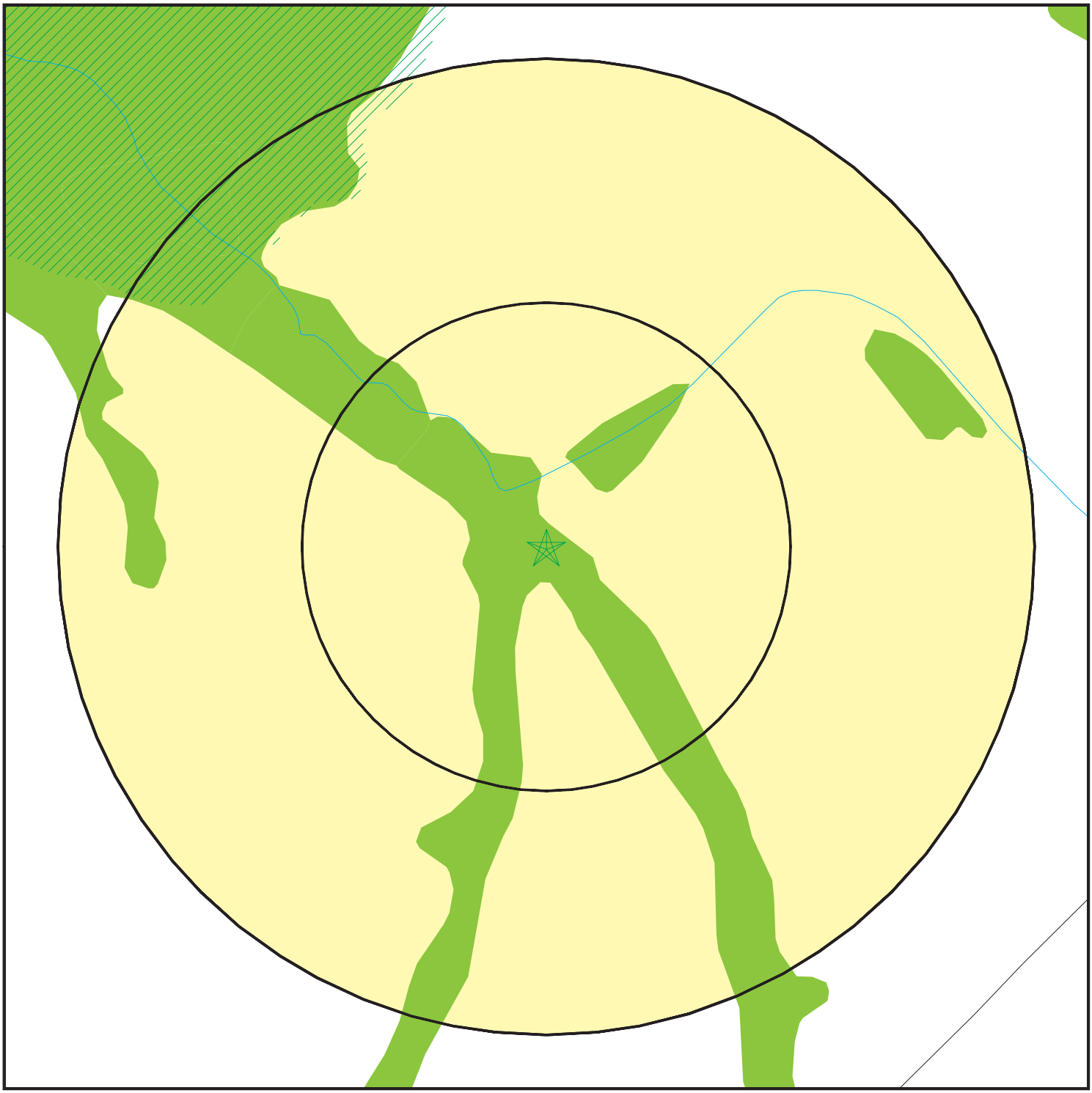
- Indian Reservations BIA
- County Boundary
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Swamp Grape ADDRESS: 6392 Kitchen St Road Rowland NC 28383 LAT/LONG: 34.5639 / 79.349	CLIENT: Restoration Systems, LLC CONTACT: JD Hamby INQUIRY #: 5677241.2s DATE: June 07, 2019 10:01 pm

DETAIL MAP - 5677241.2S



- Target Property
- Sites at elevations higher than or equal to the target property
- Sites at elevations lower than the target property
- Manufactured Gas Plants
- Sensitive Receptors
- National Priority List Sites
- Dept. Defense Sites

0 1/16 1/8 1/4 Miles

- Indian Reservations BIA
- 100-year flood zone
- 500-year flood zone
- National Wetland Inventory
- State Wetlands
- Hazardous Substance Disposal Sites

N

This report includes Interactive Map Layers to display and/or hide map information. The legend includes only those icons for the default map view.

SITE NAME: Swamp Grape ADDRESS: 6392 Kitchen St Road Rowland NC 28383 LAT/LONG: 34.5639 / 79.349	CLIENT: Restoration Systems, LLC CONTACT: JD Hamby INQUIRY #: 5677241.2s DATE: June 07, 2019 10:02 pm

APPENDIX F - FEMA COORDINATION

From: dixon.ivey@co.robeson.nc.us
To: Grant Lewis
Subject: RE: Swamp Grape Stream Restoration Site FEMA floodplain checklist
Date: Tuesday, May 26, 2020 2:01:42 PM

Good afternoon Mr. Lewis. I apologize for not marking the correct action required. Per our conversation pertaining to the dam removal at Wilkins Creek, no action will be required.

-----Original Message-----
From: Grant Lewis <glewis@axiomenvironmental.org>
Sent: Tuesday, May 26, 2020 8:48 AM
To: dixon.ivey@co.robeson.nc.us
Subject: RE: Swamp Grape Stream Restoration Site FEMA floodplain checklist

Hello Dixon;

I have been trying to reach you for the past couple weeks to discuss the FEMA floodplain checklist you signed and returned to my attention. I would like to discuss your recommendations for the project. On the floodplain checklist you were supposed to check if we needed to do a CLOMR/LOMR, No Rise, or No Action. I am happy to update the form if we can discuss the project, or you may resend the form with an updated signature block. Whatever is easier for you.

Please give me a call at 919-215-1693 to determine the best way forward with the project and EEP checklist.

Thank you for your time.
Grant

Grant Lewis
Senior Project Manager
Axiom Environmental, Inc.
218 Snow Avenue
Raleigh, North Carolina 27603
glewis@axiomenvironmental.org
(919) 215-1693 (cell)

-----Original Message-----
From: dixon.ivey@co.robeson.nc.us <dixon.ivey@co.robeson.nc.us>
Sent: Thursday, April 30, 2020 10:18 AM
To: Grant Lewis <glewis@axiomenvironmental.org>
Subject: RE: Swamp Grape Stream Restoration Site FEMA floodplain checklist

-----Original Message-----
From: Grant Lewis <glewis@axiomenvironmental.org>
Sent: Thursday, April 30, 2020 8:22 AM
To: dixon.ivey@co.robeson.nc.us
Cc: Crocker, Lindsay <Lindsay.Crocker@ncdenr.gov>; Dow, Jeremiah J <jeremiah.dow@ncdenr.gov>; John Hamby <jhamby@restorationsystems.com>

Subject: Swamp Grape Stream Restoration Site FEMA floodplain checklist

Hello Dixon;

I am working on a stream restoration project in Robeson County for the NC Department of Environmental Quality. Part of my due diligence is compiling the attached EEP Floodplain Requirements Checklist and submitting it to the Local Floodplain Administrator for review.

Please review and sign the last page of the checklist and submit to my attention. I appreciate your time in this matter and look forward to working with you on this project.

Thank you.

Grant Lewis

Grant Lewis

Senior Project Manager

Axiom Environmental, Inc.

218 Snow Avenue

Raleigh, North Carolina 27603

glewis@axiomenvironmental.org <mailto:glewis@axiomenvironmental.org>

(919) 215-1693 (cell)

Axiom Environmental, Inc.

Axiom Environmental, Inc.

218 Snow Avenue, Raleigh, North Carolina 27603 919-215-1693

April 30, 2020

Dixon Ivey
Robeson County Director Planning & Inspections
415 Country Club Rd
Lumberton, NC 28360

Re: Swamp Grape Stream and Wetland mitigation project
Robeson County **20-003**
FEMA Floodplain Requirements Checklist

Dear Mr. Ivey:

The purpose of this letter is to request concurrence from the Robeson County concerning a stream and wetland restoration site located in Robeson County. The Site encompasses approximately 26.7 acres of breached agriculture pond, disturbed forest, horse pasture, and row crops along unnamed tributaries to Wilkinson Creek. Proposed activities at the Site include the restoration of perennial and stream channels, enhancement of perennial stream channel, and restoration/enhancement of riparian wetlands.

Stream reaches are depicted on the attached figures and lengths/priority are as follows:

Reach	**Length**	**Priority**
UT 1	2966	Restoration and Enhancement (Level I and II)
UT 2	826	Restoration and Enhancement (Level I)
UT 3	149	Restoration and Enhancement (Level I)

FEMA mapping was reviewed to determine if the project is located in a FEMA study area (DFIRM panel number 8288). Based on existing floodplain mapping, the lower reaches of the Site below the breached dam are in Special Flood Hazard Area. Flood elevations in the Special Flood Hazard Area are likely to be controlled by the discharge of Wilkinson Creek and are not expected to be altered by project activities; however, we request guidance from your organization as to how to mover forward with the project.

We thank you in advance for your timely response and cooperation. Please feel free to contact the below referenced NC DMS Project Manager with any questions that you may have concerning the extent of site disturbance associated with this project.

Yours truly,

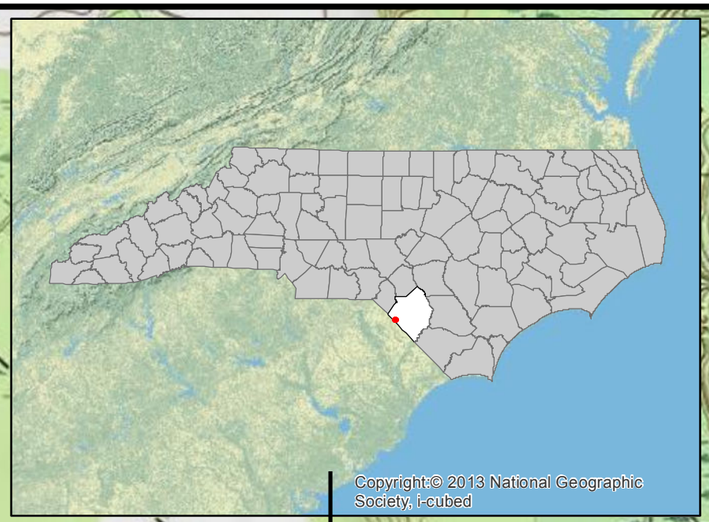
AXIOM ENVIRONMENTAL

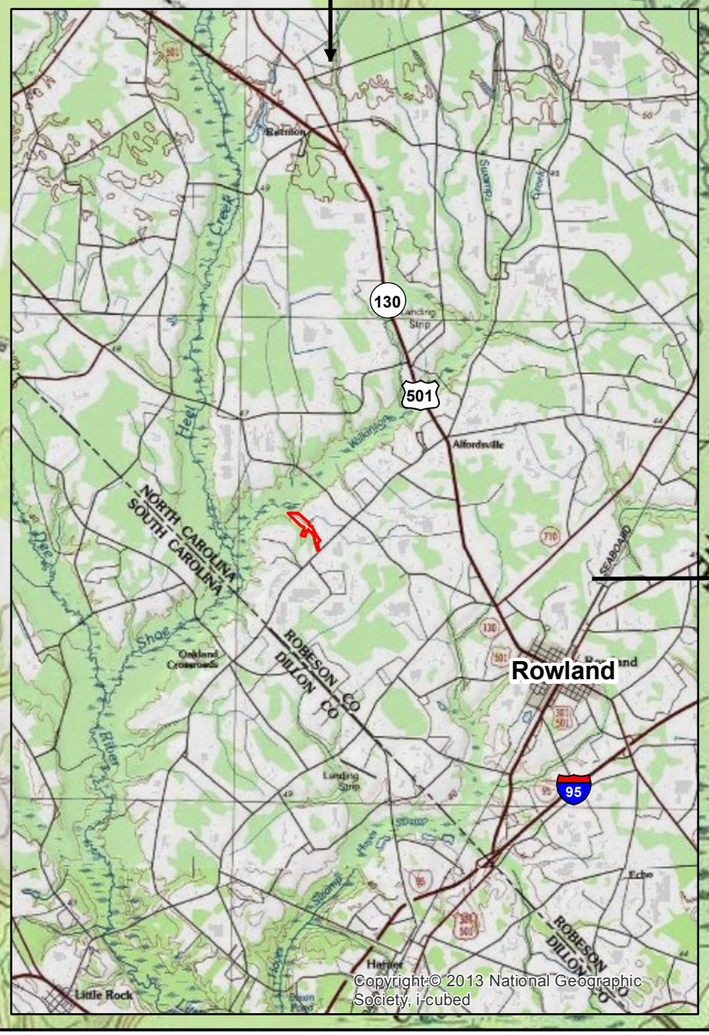
W. Grant Lewis
Senior Project Manager

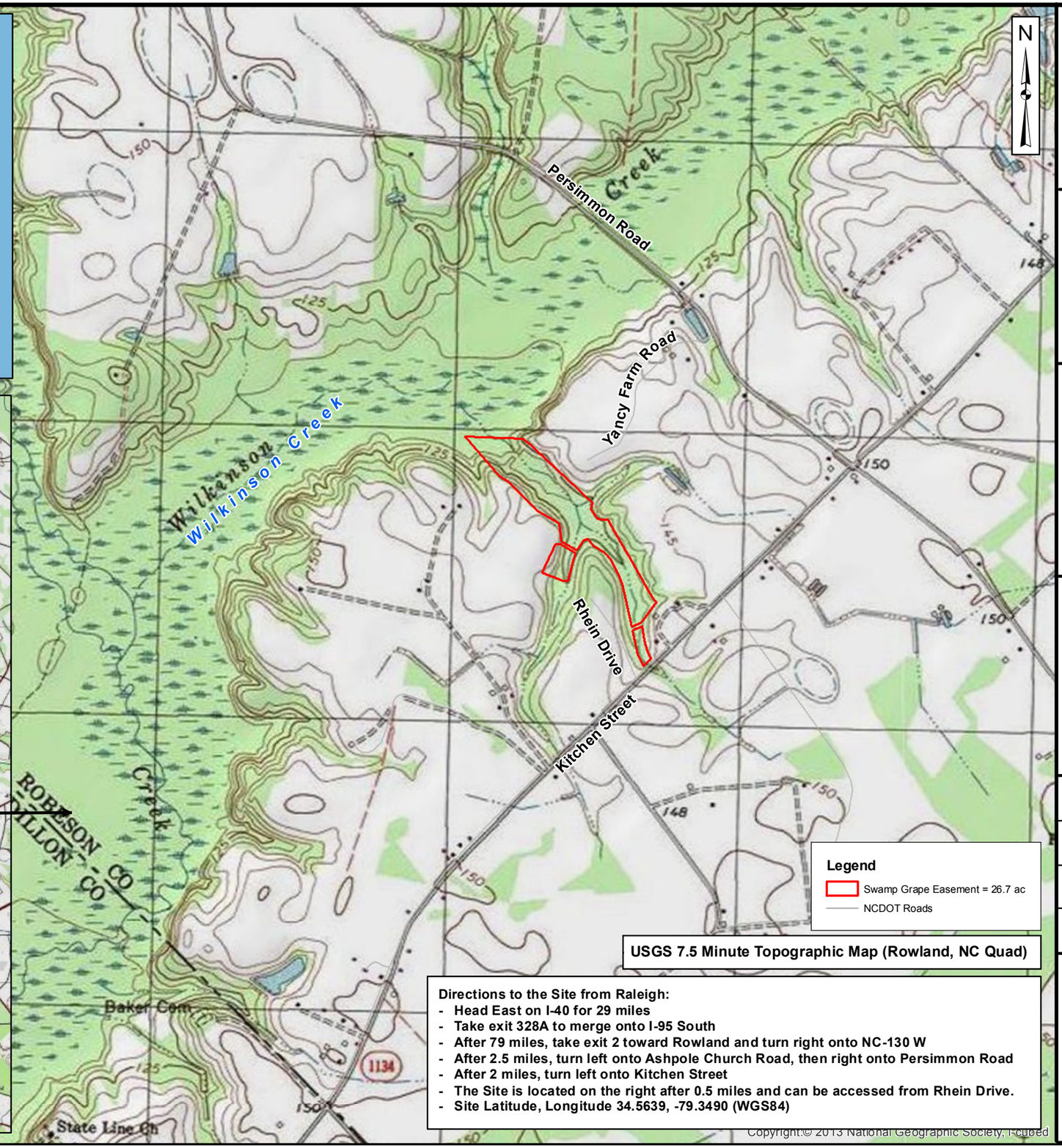
Attachments

- Figure 1 Site Location
- Figure 2 Hydrologic Unit Map
- Figure 3 Topography and Drainage Area
- Figure 4 Existing Conditions
- Figure 5 Proposed Conditions
- EEP Floodplain Requirements Checklist

Cc JD Hamby
Lindsay Crocker
Jeremiah Dow







Legend

- Swamp Grape Easement = 26.7 ac
- NCDOT Roads

USGS 7.5 Minute Topographic Map (Rowland, NC Quad)

Directions to the Site from Raleigh:

- **Head East on I-40 for 29 miles**
- **Take exit 328A to merge onto I-95 South**
- **After 79 miles, take exit 2 toward Rowland and turn right onto NC-130 W**
- **After 2.5 miles, turn left onto Ashpole Church Road, then right onto Persimmon Road**
- **After 2 miles, turn left onto Kitchen Street**
- **The Site is located on the right after 0.5 miles and can be accessed from Rhein Drive.**
- **Site Latitude, Longitude 34.5639, -79.3490 (WGS84)**

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

SITE LOCATION

Drawn by: KRJ

Date: DEC 2018

Scale: 1:20,000

Project No.: 18-002.10

FIGURE

1

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

HYDROLOGIC UNIT MAP

Drawn by: KRJ

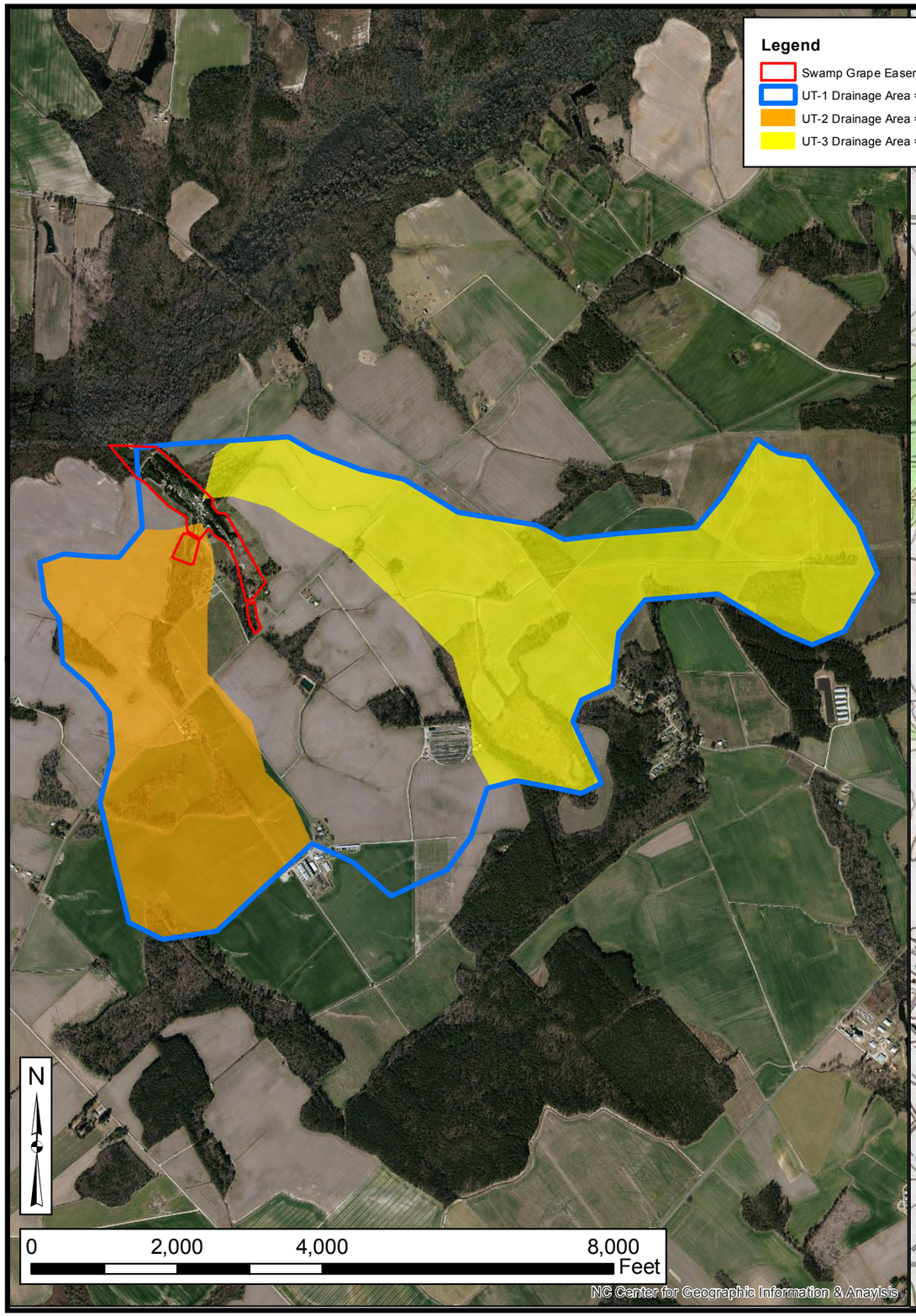
Date: DEC 2018

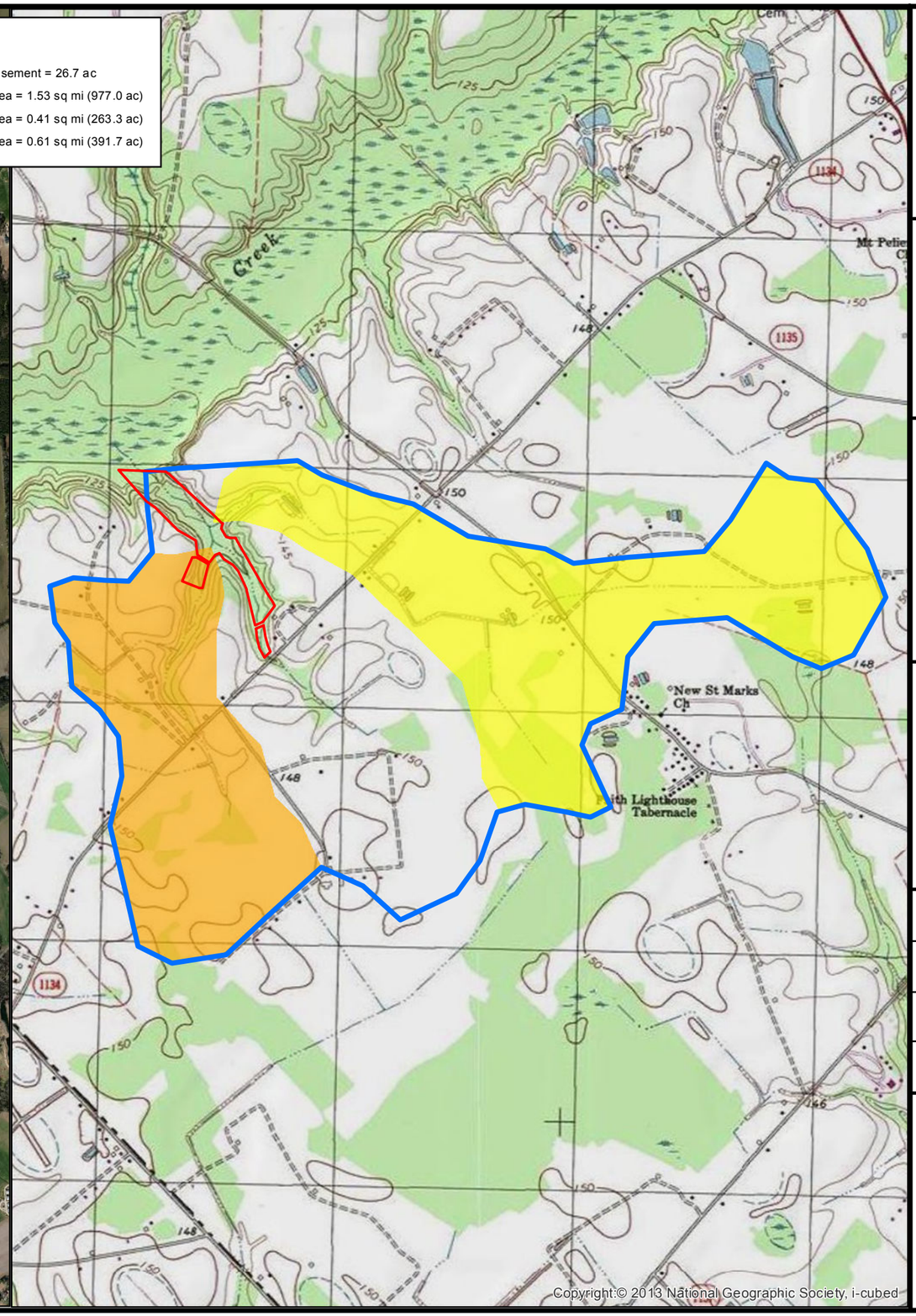
Scale: 1:260,000

Project No.: 18-002.10

FIGURE

2





Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

TOPOGRAPHY AND DRAINAGE AREA

Drawn by: KRJ

Date: DEC 2018

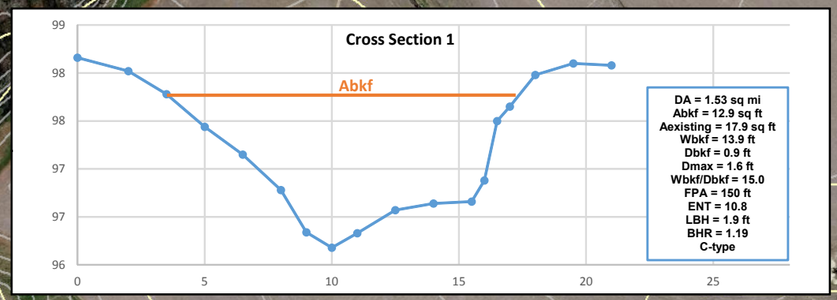
Scale: 1:21,000

Project No.: 18-002.10

FIGURE

3

Soil Map Unit	Soil Series
AyA	Aycock very fine sandy loam
BB	Bibb soils
FaB	Faceville fine sandy loam
WaB, WaC	Wagram loamy sand



NCSAM Form #1
Score: Low

XS-1

UT-1
UT-2
UT-3

WaC
WaB
FaA
FaB
Tr
W
BB
NoB
NoA
AyA
Ly
ExA

N

Legend

- Swamp Grape Easement = 26.7 ac
- Existing Streams = 4738 ft
- Existing Ditches
- Existing Wetlands = 0.2 ac
- Existing Impacted Hydric Soils = 15.1 ac
- Cross Sections
- NCSAM Form Location
- Soil Profile
- Existing Foot Path
- Soil Boundary
- 2-foot Lidar Contours

0 300 600 1,200 Feet

NC Center for Geographic Information & Analysis

Axiom Environmental, Inc.

Prepared for:

RESTORATION SYSTEMS | LLC

Project:

SWAMP GRAPE MITIGATION SITE

Robeson County, NC

Title:

EXISTING CONDITIONS AND SOILS

Drawn by: KRJ

Date: DEC 2018

Scale: 1:3200

Project No.: 18-002.10

FIGURE

4

UT 1 (Reach 8) = 87 ft
Enhancement (Level I)
Mitigation Activities
- Channel will excavated at the existing floodplain grade
- Install habitat strucures to stabilize the channel, add woody debris to the channel, and create habitat.
- Plant with native forest vegetation.

UT 1 (Reach 7) = 206 ft
Restoration
Mitigation Activities
- Channel will excavated at the existing floodplain grade reducing channel depth by over one foot.
- Restore channel pattern features (Rc, Lp-p, Lm) that are filled by dam construction.
- Remnants of the failed dam will be removed.
- Plant with native forest vegetation.

UT 1 (Reach 5) = 230 ft
Restoration
Mitigation Activities
- Channel will excavated at the existing floodplain grade with the appropriate pattern features (Rc, Lp-p, Lm) .
- Channel will be moved away from unstable valley wall.
- Plant with native forest vegetation.

Soil Stabilization

UT 1 (Reach 4) = 235 ft
Enhancement (Level II)
Mitigation Activities
- Channel will be contoured to the appropriate dimension and stabilized where necessary.
- Plant with native forest vegetation.

UT 2 (Reach 2) = 266 ft
Enhancement (Level I)
Mitigation Activities
- Excavate channel at proper dimension, reducing channel depth from 1.9 ft to 0.8 ft.
- Adjust channel pattern from Lp-p of 8-35 ft to 24-49 ft and Rc from 4-8 ft to 18-20 ft.
- The channel into UT 1 across an inner bend.
- Plant with native vegetation

UT 2 (Reach 1) = 684 ft
Restoration
Mitigation Activities
- Pond will be excavated to remove unconsolidated sediments.
- Pond will be backfilled with stable soil material.
- Channel will excavated within the stabilized pond bed.
- Remove remnants of the road crossing/dam.
- Remove dock and gazebo.
- Tie to the downstream floodplain with step-down habitat strucures.
- Plant with native forest vegetation.

UT 1 (Reach 6) = 165 ft
Enhancement (Level I)
Mitigation Activities
- Channel will be contoured to the appropriate dimension and stabilized where necessary.
- Plant with native forest vegetation.

UT 3 (Reach 2) = 68 ft
Restoration
Mitigation Activities
- Channel will excavated to tie UT 3 with UT 1 across and inner bend.
- Plant with native forest vegetation.

UT 3 (Reach 1) = 133 ft
Enhancement (Level I)
Mitigation Activities
- Tie to upstream channel elevation at the property line.
- Contour the channel to the appropriate dimension and reduce channel depth from 2.1 ft to 0.9 ft.
- Ease radius of curvature from 8-14 ft to 19-28 ft.
- Install habitat strucures to stabilize the channel, add woody debris to the channel, and create habitat.
- Plant with native forest vegetation.

UT 1 (Reach 3) = 546 ft
Enhancement (Level I)
Mitigation Activities
- Channel will excavated at the existing floodplain grade.
- Reduce channel depth from 2.1 ft to 1.2 ft.
- Adjust channel pattern and reduce Lp-p and Rc.
- Habitat strucures will be installed to stabilize the channel, add woody debris to the channel, and create habitat.
- Plant with native forest vegetation.

UT 1 (Reach 2) = 1215 ft
Restoration
Mitigation Activities
- Channel will excavated at the existing floodplain grade.
- In middle reaches, some floodplain excavation will be necessary to tie into elevations of the historic pond bed.
- Floodplain fill in the pond bed will be required to raise the floodplain to the historic elevation prior to settling and liquifaction.
- Step-down habitat strucures will be installed to tie the upper UT 1 Reach 2 floodplain to the lower reaches.
- Ditches will be backfilled and drain tile removed.
- Livestock removal from area.
- Plant with native forest vegetation in pasture areas.

Powerline moved outside of conservation easement boundaries.

UT 1 (Reach 1) = 298 ft
Enhancement (Level I)
Mitigation Activities
- Piped channel crossing installed in upper reach.
- Channel will be backfilled approximately 5.5 ft.
- Channel width will be decreased from 30.1 ft to 7.4 ft.
- Ditches will be backfilled and drain tile removed.
- Livestock removal from area.
- Plant with native forest vegetation in pasture areas.

LEGEND

- Easement Boundary = ~24.4 ac
- Major Topography Line
- Minor Topography Line
- Stream Restoration = 2403 ft
- Stream Enhancement (Level I) = 1495 ft
- Stream Enhancement (Level II) = 235 ft
- Wetland Reestablishment = 5.322 ac
- Wetland Rehabilitation = 1.379 ac
- Wetland Enhancement = 13.689 ac
- Piped Crossing
- Ditch Backfill
- Drain Tile Removal
- Log Cross Vane
- Log Vane

0 200 400
SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County North Carolina

Title:

RESTORATION PLAN

Scale: AS SHOWN

Date: Mar 2020

Project No.: 20-003

FIGURE NO.

5

EEP Floodplain Requirements Checklist

This form was developed by the National Flood Insurance program, NC Floodplain Mapping program and Ecosystem Enhancement Program to be filled for all EEP projects. The form is intended to summarize the floodplain requirements during the design phase of the projects. The form should be submitted to the Local Floodplain Administrator with three copies submitted to NFIP (attn. State NFIP Engineer), NC Floodplain Mapping Unit (attn. State NFIP Coordinator) and NC Ecosystem Enhancement Program.

Project Location

Name of project:	Swamp Grape Site
Name if stream or feature:	UTs to Wilkinson Creek
County:	Robeson
Name of river basin:	Lumber
Is project urban or rural?	Rural
Name of Jurisdictional municipality/county:	Lumberton/Robeson
DFIRM panel number for entire site:	8288
Consultant name:	Axiom Environmental, Inc.
Phone number:	919-215-1693
Address:	218 Snow Avenue Raleigh, NC 27603

Design Information

Provide a general description of project (one paragraph). Include project limits on a reference orthophotograph at a scale of 1" = 500". (See Attached)

Summarize stream reaches or wetland areas according to their restoration priority.
(See Attached)

Example

Reach	Length	Priority
Example: Reach A	*1000*	*One (Restoration)*
Example: Reach B	*2000*	*Three (Enhancement)*

Floodplain Information

Is project located in a Special Flood Hazard Area (SFHA)?

(•) Yes ( ) No

The lower reaches

If project is located in a SFHA, check how it was determined:

- [ ] Redelineation
- [ ] Detailed Study
- [ ] Limited Detail Study
- [ ] Approximate Study
- [x] Don't know

List flood zone designation:

Check if applies:

- [x] AE Zone
  - (•) Floodway
  - ( ) Non-Encroachment
  - ( ) None
- [ ] A Zone
  - ( ) Local Setbacks Required
  - ( ) No Local Setbacks Required

If local setbacks are required, list how many feet:

Does proposed channel boundary encroach outside floodway/non-encroachment/setbacks?

( ) Yes (•) No

Land Acquisition (Check)

☐ State owned (fee simple)

☐ Conservation easment (Design Bid Build)

☑ Conservation Easement (Full Delivery Project)

Note: if the project property is state-owned, then all requirements should be addressed to the Department of Administration, State Construction Office (attn: Herbert Neily, (919) 807-4101)

Is community/county participating in the NFIP program?

◉ Yes ○ No

Note: if community is not participating, then all requirements should be addressed to NFIP (attn: State NFIP Engineer, (919) 715-8000

Name of Local Floodplain Administrator: Dixon Ivey
Phone Number: 910-272-6522

Floodplain Requirements

This section to be filled by designer/applicant following verification with the LFPA

☐ No Action

☐ No Rise

☐ Letter of Map Revision

☐ Conditional Letter of Map Revision

Dixon Ivey

☐ Other Requirements

List other requirements:

Comments:

Name: W. Grant Lewis Signature: W Grant Lewis

Title: President Date: 4/30/2020

APPENDIX G - FINANCIAL ASSURANCES

Pursuant to Section IV H and Appendix III of the NCDEQ DMS (formerly Ecosystem Enhancement Program) In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environmental Quality (NCDEQ) has provided the USACE-Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by NCDEQ DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

APPENDIX H - SITE PROTECTION INSTRUMENT

Excise Tax: $_____

STATE OF NORTH CAROLINA **DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT**

ROBESON COUNTY

SPO File Number:
DMS Project Number: 100115

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this _____day of _____, 2021, by Aaron Gregory Bodenhamer and wife Beverly R. Bodenhamer, ("**Grantor**"), whose mailing address is 6392 S. Kitchen Street, Rowland, NC 28383, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection

and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract between Restoration Systems, LLC, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604, and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7869.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environmental Quality, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Rowland Township, Robeson County, North Carolina (the "**Property**"), and being more particularly described as that certain parcel of land containing approximately 16.37 acres and being conveyed to the Grantor by deed as recorded in **Deed Book 1593 at Page 155** of the Robeson County Registry, North Carolina; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of **Wilkinson Creek**.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

BEING ALL of Conservation Easement Area 2 containing a total of approximately **0.9 acres** as shown on the plats of survey entitled "Conservation Easement for the State of North Carolina Division of Mitigation Services over a Portion of the Lands of Aaron Gregory Bodenhamer, Current Owner per D.B. 1593, PG. 155 (PIN 829955333900) and Louie Arthur Bodenhamer, Widower, Current Owner per D.B. 1082, Pg. 891 (PIN 829936273300) and D.B. 1607, Pg. 167 (PIN 829966485300) DMS Project ID No. 100115, SPO Numbers [XX-XX], Swamp Grape", in Rowland Township, Robeson County, North Carolina, dated [_____ ___, 2021] by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Robeson County, North Carolina Register of Deeds at **Plat Book [_____], Pages [_____].**

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the

use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat**.**

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. **Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities on the property to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover

damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are

the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

_____ (SEAL)
Aaron Gregory Bodenhamer

_____ (SEAL)
Beverly R. Bodenhamer

NORTH CAROLINA
COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that Aaron Gregory Bodenhamer and wife Beverly R. Bodenhamer, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the _____ day of _____, 2021.

_____
Notary Public

My commission expires:

_____

Exhibit A

Conservation Easement Area 2

BEING ALL of Conservation Easement 2 of the Swamp Grape Site over a portion of the land of the Aaron Gregory Bodenhamer (PIN No. 829955333900), lying and being situated in Rowland Township, Robeson County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No.130 and being the Northwesternmost corner of the Conservation Easement Area 2 and being located South 53°23'13" East 606.08 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=296,010.4546', E=1,894,884.0842' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 130), South 88°00'50" East 63.59' to a concrete marker; thence South 88°00'50" East 13.49' to a non-monumented corner; thence South 07°23'16" East 99.93' to a non-monumented corner; thence South 25°00'11" East 79.38' to a non-monumented corner; thence South 04°13'53" East 75.89' to a non-monumented corner; thence South 16°03'58" East 221.05' to a non-monumented corner; thence South 66°02'01" West 95.37' to an iron stake; thence North 11°38'01" West 511.04' to an iron stake, which is the Point of Beginning (Point No. 130), having an area of 0.90 acres, more or less.

THE FOREGOING CONSERVATION EASEMENT AREA as shown on plat of survey titled "Conservation Easement for the State of North Carolina Division of Mitigation Services over a Portion of the Lands of Aaron Gregory Bodenhamer, Current Owner per D.B. 1593, PG. 155 (PIN 829955333900) and Louie Arthur Bodenhamer, Widower, Current Owner per D.B. 1082, Pg. 891 (PIN 829936273300) and D.B. 1607, Pg. 167 (PIN 829966485300) DMS Project ID No. 100115, SPO Numbers [XX-XX], Swamp Grape", in Rowland Township, Robeson County, North Carolina, dated [_____ ___, 2021] by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Robeson County, North Carolina Register of Deeds at **Plat Book [_____], Pages [_____].**

Excise Tax: $_____

STATE OF NORTH CAROLINA	**DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS PROVIDED PURSUANT TO FULL DELIVERY MITIGATION CONTRACT**
ROBESON COUNTY	

SPO File Number:
DMS Project Number: 100115

Prepared by: Office of the Attorney General
Property Control Section
Return to: NC Department of Administration
State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

THIS DEED OF CONSERVATION EASEMENT AND RIGHT OF ACCESS, made this _____day of _____, 2021, by Louie Arthur Bodenhamer widower, ("**Grantor**"), whose mailing address is 6547 S. Kitchen Street, Rowland, NC 28383, to the State of North Carolina, ("**Grantee**"), whose mailing address is State of North Carolina, Department of Administration, State Property Office, 1321 Mail Service Center, Raleigh, NC 27699-1321. The designations of Grantor and Grantee as used herein shall include said parties, their heirs, successors, and assigns, and shall include singular, plural, masculine, feminine, or neuter as required by context.

WITNESSETH:

WHEREAS, pursuant to the provisions of N.C. Gen. Stat. § 143-214.8 et seq., the State of North Carolina has established the Division of Mitigation Services (formerly known as the Ecosystem Enhancement Program and Wetlands Restoration Program) within the Department of Environment and Natural Resources for the purposes of acquiring, maintaining, restoring, enhancing, creating and preserving wetland and riparian resources that contribute to the protection

and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; and

WHEREAS, this Conservation Easement from Grantor to Grantee has been negotiated, arranged and provided for as a condition of a full delivery contract Restoration Systems, LLC, a North Carolina limited liability company, 1101 Haynes Street, Suite 211, Raleigh, NC 27604 and the North Carolina Department of Environmental Quality, to provide stream, wetland and/or buffer mitigation pursuant to the North Carolina Department of Environmental Quality Purchase and Services Contract Number 7869.

WHEREAS, The State of North Carolina is qualified to be the Grantee of a Conservation Easement pursuant to N.C. Gen. Stat. § 121-35; and

WHEREAS, the Department of Environment and Natural Resources and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Understanding, (MOU) duly executed by all parties on November 4, 1998. This MOU recognized that the Wetlands Restoration Program was to provide effective compensatory mitigation for authorized impacts to wetlands, streams and other aquatic resources by restoring, enhancing and preserving the wetland and riparian areas of the State; and

WHEREAS, the Department of Environment and Natural Resources, the North Carolina Department of Transportation and the United States Army Corps of Engineers, Wilmington District entered into a Memorandum of Agreement, (MOA) duly executed by all parties in Greensboro, NC on July 22, 2003, which recognizes that the Division of Mitigation Services (formerly Ecosystem Enhancement Program) is to provide for compensatory mitigation by effective protection of the land, water and natural resources of the State by restoring, enhancing and preserving ecosystem functions; and

WHEREAS, the Department of Environment and Natural Resources, the U.S. Army Corps of Engineers, the U.S. Environmental Protection Agency, the U.S. Fish and Wildlife Service, the North Carolina Wildlife Resources Commission, the North Carolina Division of Water Quality, the North Carolina Division of Coastal Management, and the National Marine Fisheries Service entered into an agreement to continue the In-Lieu Fee operations of the North Carolina Department of Natural Resources' Division of Mitigation Services (formerly Ecosystem Enhancement Program) with an effective date of 28 July, 2010, which supersedes and replaces the previously effective MOA and MOU referenced above; and

WHEREAS, the acceptance of this instrument for and on behalf of the State of North Carolina was granted to the Department of Administration by resolution as approved by the Governor and Council of State adopted at a meeting held in the City of Raleigh, North Carolina, on the 8th day of February 2000; and

WHEREAS, the Division of Mitigation Services in the Department of Environmental Quality, which has been delegated the authority authorized by the Governor and Council of State to the Department of Administration, has approved acceptance of this instrument; and

WHEREAS, Grantor owns in fee simple certain real property situated, lying, and being in Rowland Township, Robeson County, North Carolina (the "**Property**"), and being more particularly described as those certain parcels of land containing a total of approximately 220.4 acres and being conveyed to the Grantor by deeds as recorded in **Deed Book 1607 at Page 167** and **Deed Book 1082 at Page 891** of the Robeson County Registry, North Carolina; and

WHEREAS, Grantor is willing to grant a Conservation Easement and Right of Access over the herein described areas of the Property, thereby restricting and limiting the use of the areas of the Property subject to the Conservation Easement to the terms and conditions and purposes hereinafter set forth, and Grantee is willing to accept said Easement and Access Rights. The Conservation Easement shall be for the protection and benefit of the waters of **Wilkinson Creek**.

NOW, THEREFORE, in consideration of the mutual covenants, terms, conditions, and restrictions hereinafter set forth, Grantor unconditionally and irrevocably hereby grants and conveys unto Grantee, its successors and assigns, forever and in perpetuity, a Conservation Easement along with a general Right of Access.

The Conservation Easement Area consists of the following:

BEING ALL of Conservation Easement Area 1 containing a total of approximately 23.38 acreas, Conservation Easement Area 3 containing approximately 0.11 acres, and Conservation Easement Area 4 containing approximately 0.29 acres, for a total of approximately **23.78 acres,** as shown on the plat of survey titled "Conservation Easement for the State of North Carolina Division of Mitigation Services over a Portion of the Lands of Aaron Gregory Bodenhamer, Current Owner per D.B. 1593, PG. 155 (PIN 829955333900) and Louie Arthur Bodenhamer, Widower, Current Owner per D.B. 1082, Pg. 891 (PIN 829936273300) and D.B. 1607, Pg. 167 (PIN 829966485300), DMS Project ID No. 100115, SPO Numbers [XX-XX], Swamp Grape", in Rowland Township, Robeson County, North Carolina, dated [____ ___, 2021] by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Robeson County, North Carolina Register of Deeds at **Plat Book [_____], Pages [_____].**

See attached "**Exhibit A**", Legal Description of area of the Property hereinafter referred to as the "Conservation Easement Area"

The purposes of this Conservation Easement are to maintain, restore, enhance, construct, create and preserve wetland and/or riparian resources in the Conservation Easement Area that contribute to the protection and improvement of water quality, flood prevention, fisheries, aquatic habitat, wildlife habitat, and recreational opportunities; to maintain permanently the Conservation Easement Area in its natural condition, consistent with these purposes; and to prevent any use of the Easement Area that will significantly impair or interfere with these purposes. To achieve these purposes, the following conditions and restrictions are set forth:

I. DURATION OF EASEMENT

Pursuant to law, including the above referenced statutes, this Conservation Easement and Right of Access shall be perpetual and it shall run with, and be a continuing restriction upon the use of, the Property, and it shall be enforceable by the Grantee against the Grantor and against Grantor's heirs, successors and assigns, personal representatives, agents, lessees, and licensees.

II. GRANTOR RESERVED USES AND RESTRICTED ACTIVITIES

The Conservation Easement Area shall be restricted from any development or usage that would impair or interfere with the purposes of this Conservation Easement. Unless expressly reserved as a compatible use herein, any activity in, or use of, the Conservation Easement Area by the Grantor is prohibited as inconsistent with the purposes of this Conservation Easement. Any rights not expressly reserved hereunder by the Grantor have been acquired by the Grantee. Any rights not expressly reserved hereunder by the Grantor, including the rights to all mitigation credits, including, but not limited to, stream, wetland, and riparian buffer mitigation units, derived from each site within the area of the Conservation Easement, are conveyed to and belong to the Grantee. Without limiting the generality of the foregoing, the following specific uses are prohibited, restricted, or reserved as indicated:

A. Recreational Uses. Grantor expressly reserves the right to undeveloped recreational uses, including hiking, bird watching, hunting and fishing, and access to the Conservation Easement Area for the purposes thereof.

B. Motorized Vehicle Use. Motorized vehicle use in the Conservation Easement Area is prohibited except within a Crossing Area(s) or Road or Trail as shown on the recorded survey plat**.**

C. Educational Uses. The Grantor reserves the right to engage in and permit others to engage in educational uses in the Conservation Easement Area not inconsistent with this Conservation Easement, and the right of access to the Conservation Easement Area for such purposes including organized educational activities such as site visits and observations. Educational uses of the property shall not alter vegetation, hydrology or topography of the site.

D. **Damage to Vegetation.** Except within Crossing Area(s) as shown on the recorded survey plat and as related to the removal of non-native plants, diseased or damaged trees, or vegetation that destabilizes or renders unsafe the Conservation Easement Area to persons or natural habitat, all cutting, removal, mowing, harming, or destruction of any trees and vegetation in the Conservation Easement Area is prohibited.

E. Industrial, Residential and Commercial Uses. All industrial, residential and commercial uses are prohibited in the Conservation Easement Area.

F. Agricultural Use. All agricultural uses are prohibited within the Conservation Easement Area including any use for cropland, waste lagoons, or pastureland.

G. New Construction. There shall be no building, facility, mobile home, antenna, utility pole, tower, or other structure constructed or placed in the Conservation Easement Area.

H. **Roads and Trails.** There shall be no construction or maintenance of new roads, trails, walkways, or paving in the Conservation Easement.

All existing roads, trails and crossings within the Conservation Easement Area shall be shown on the recorded survey plat.

I. Signs. No signs shall be permitted in the Conservation Easement Area except interpretive signs describing restoration activities and the conservation values of the Conservation Easement Area, signs identifying the owner of the Property and the holder of the Conservation Easement, signs giving directions, or signs prescribing rules and regulations for the use of the Conservation Easement Area.

J. Dumping or Storing. Dumping or storage of soil, trash, ashes, garbage, waste, abandoned vehicles, appliances, machinery, or any other material in the Conservation Easement Area is prohibited.

K. Grading, Mineral Use, Excavation, Dredging. There shall be no grading, filling, excavation, dredging, mining, drilling, hydraulic fracturing; removal of topsoil, sand, gravel, rock, peat, minerals, or other materials.

L. Water Quality and Drainage Patterns. There shall be no diking, draining, dredging, channeling, filling, leveling, pumping, impounding or diverting, causing, allowing or permitting the diversion of surface or underground water in the Conservation Easement Area. No altering or tampering with water control structures or devices, or disruption or alteration of the restored, enhanced, or created drainage patterns is allowed. All removal of wetlands, polluting or discharging into waters, springs, seeps, or wetlands, or use of pesticide or biocides in the Conservation Easement Area is prohibited. In the event of an emergency interruption or shortage of all other water sources, water from within the Conservation Easement Area may temporarily be withdrawn for good cause shown as needed for the survival of livestock on the Property.

M. Subdivision and Conveyance. Grantor voluntarily agrees that no further subdivision, partitioning, or dividing of the Conservation Easement Area portion of the Property owned by the Grantor in fee simple ("fee") that is subject to this Conservation Easement is allowed. Any future transfer of the Property shall be subject to this Conservation Easement and Right of Access and to the Grantee's right of unlimited and repeated ingress and egress over and across the Property to the Conservation Easement Area for the purposes set forth herein.

N. Development Rights. All development rights are permanently removed from the Conservation Easement Area and are non-transferrable.

O. Disturbance of Natural Features. Any change, disturbance, alteration or impairment of the natural features of the Conservation Easement Area or any intentional introduction of non-native plants, trees and/or animal species by Grantor is prohibited.

The Grantor may request permission to vary from the above restrictions for good cause shown, provided that any such request is not inconsistent with the purposes of this Conservation

Easement, and the Grantor obtains advance written approval from the Division of Mitigation Services, 1652 Mail Services Center, Raleigh, NC 27699-1652.

III. GRANTEE RESERVED USES

A. Right of Access, Construction, and Inspection. The Grantee, its employees and agents, successors and assigns, receive a perpetual Right of Access to the Conservation Easement Area over the Property at reasonable times to undertake any activities on the property to restore, construct, manage, maintain, enhance, protect, and monitor the stream, wetland and any other riparian resources in the Conservation Easement Area, in accordance with restoration activities or a long-term management plan. Unless otherwise specifically set forth in this Conservation Easement, the rights granted herein do not include or establish for the public any access rights.

B. Restoration Activities. These activities include planting of trees, shrubs and herbaceous vegetation, installation of monitoring wells, utilization of heavy equipment to grade, fill, and prepare the soil, modification of the hydrology of the site, and installation of natural and manmade materials as needed to direct in-stream, above ground, and subterraneous water flow.

C. Signs. The Grantee, its employees and agents, successors or assigns, shall be permitted to place signs and witness posts on the Property to include any or all of the following: describe the project, prohibited activities within the Conservation Easement, or identify the project boundaries and the holder of the Conservation Easement.

D. Fences. Conservation Easements are purchased to protect the investments by the State (Grantee) in natural resources. Livestock within conservations easements damages the investment and can result in reductions in natural resource value and mitigation credits which would cause financial harm to the State. Therefore, Landowners (Grantor) with livestock are required to restrict livestock access to the Conservation Easement area. Repeated failure to do so may result in the State (Grantee) repairing or installing livestock exclusion devices (fences) within the conservation area for the purpose of restricting livestock access. In such cases, the landowner (Grantor) must provide access to the State (Grantee) to make repairs.

E. Crossing Area(s). The Grantee is not responsible for maintenance of crossing area(s), however, the Grantee, its employees and agents, successors or assigns, reserve the right to repair crossing area(s), at its sole discretion and to recover the cost of such repairs from the Grantor if such repairs are needed as a result of activities of the Grantor, his successors or assigns.

IV. ENFORCEMENT AND REMEDIES

A. Enforcement. To accomplish the purposes of this Conservation Easement, Grantee is allowed to prevent any activity within the Conservation Easement Area that is inconsistent with the purposes of this Conservation Easement and to require the restoration of such areas or features in the Conservation Easement Area that may have been damaged by such unauthorized activity or use. Upon any breach of the terms of this Conservation Easement by Grantor, the Grantee shall, except as provided below, notify the Grantor in writing of such breach and the Grantor shall have ninety (90) days after receipt of such notice to correct the damage caused by such breach. If the

breach and damage remains uncured after ninety (90) days, the Grantee may enforce this Conservation Easement by bringing appropriate legal proceedings including an action to recover damages, as well as injunctive and other relief. The Grantee shall also have the power and authority, consistent with its statutory authority: (a) to prevent any impairment of the Conservation Easement Area by acts which may be unlawful or in violation of this Conservation Easement; (b) to otherwise preserve or protect its interest in the Property; or (c) to seek damages from any appropriate person or entity. Notwithstanding the foregoing, the Grantee reserves the immediate right, without notice, to obtain a temporary restraining order, injunctive or other appropriate relief, if the breach is or would irreversibly or otherwise materially impair the benefits to be derived from this Conservation Easement, and the Grantor and Grantee acknowledge that the damage would be irreparable and remedies at law inadequate. The rights and remedies of the Grantee provided hereunder shall be in addition to, and not in lieu of, all other rights and remedies available to Grantee in connection with this Conservation Easement.

B. Inspection. The Grantee, its employees and agents, successors and assigns, have the right, with reasonable notice, to enter the Conservation Easement Area over the Property at reasonable times for the purpose of inspection to determine whether the Grantor is complying with the terms, conditions and restrictions of this Conservation Easement.

C. Acts Beyond Grantor's Control. Nothing contained in this Conservation Easement shall be construed to entitle Grantee to bring any action against Grantor for any injury or change in the Conservation Easement Area caused by third parties, resulting from causes beyond the Grantor's control, including, without limitation, fire, flood, storm, and earth movement, or from any prudent action taken in good faith by the Grantor under emergency conditions to prevent, abate, or mitigate significant injury to life or damage to the Property resulting from such causes.

D. Costs of Enforcement. Beyond regular and typical monitoring expenses, any costs incurred by Grantee in enforcing the terms of this Conservation Easement against Grantor, including, without limitation, any costs of restoration necessitated by Grantor's acts or omissions in violation of the terms of this Conservation Easement, shall be borne by Grantor.

E. No Waiver. Enforcement of this Easement shall be at the discretion of the Grantee and any forbearance, delay or omission by Grantee to exercise its rights hereunder in the event of any breach of any term set forth herein shall not be construed to be a waiver by Grantee.

V. MISCELLANEOUS

A. This instrument sets forth the entire agreement of the parties with respect to the Conservation Easement and supersedes all prior discussions, negotiations, understandings or agreements relating to the Conservation Easement. If any provision is found to be invalid, the remainder of the provisions of the Conservation Easement, and the application of such provision to persons or circumstances other than those as to which it is found to be invalid, shall not be affected thereby.

B. Grantor is responsible for any real estate taxes, assessments, fees, or charges levied upon the Property. Grantee shall not be responsible for any costs or liability of any kind related to the

ownership, operation, insurance, upkeep, or maintenance of the Property, except as expressly provided herein. Upkeep of any constructed bridges, fences, or other amenities on the Property are the sole responsibility of the Grantor. Nothing herein shall relieve the Grantor of the obligation to comply with federal, state or local laws, regulations and permits that may apply to the exercise of the Reserved Rights.

C. Any notices shall be sent by registered or certified mail, return receipt requested to the parties at their addresses shown herein or to other addresses as either party establishes in writing upon notification to the other.

D. Grantor shall notify Grantee in writing of the name and address and any party to whom the Property or any part thereof is to be transferred at or prior to the time said transfer is made. Grantor further agrees that any subsequent lease, deed, or other legal instrument by which any interest in the Property is conveyed is subject to the Conservation Easement herein created.

E. The Grantor and Grantee agree that the terms of this Conservation Easement shall survive any merger of the fee and easement interests in the Property or any portion thereof.

F. This Conservation Easement and Right of Access may be amended, but only in writing signed by all parties hereto, or their successors or assigns, if such amendment does not affect the qualification of this Conservation Easement or the status of the Grantee under any applicable laws, and is consistent with the purposes of the Conservation Easement. The owner of the Property shall notify the State Property Office and the U.S. Army Corps of Engineers in writing sixty (60) days prior to the initiation of any transfer of all or any part of the Property or of any request to void or modify this Conservation Easement. Such notifications and modification requests shall be addressed to:

Division of Mitigation Services Program Manager
NC State Property Office
1321 Mail Service Center
Raleigh, NC 27699-1321

and

General Counsel
US Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403

G. The parties recognize and agree that the benefits of this Conservation Easement are in gross and assignable provided, however, that the Grantee hereby covenants and agrees, that in the event it transfers or assigns this Conservation Easement, the organization receiving the interest will be a qualified holder under N.C. Gen. Stat. § 121-34 et seq. and § 170(h) of the Internal Revenue Code, and the Grantee further covenants and agrees that the terms of the transfer or assignment will be such that the transferee or assignee will be required to continue in perpetuity the conservation purposes described in this document.

VI. QUIET ENJOYMENT

Grantor reserves all remaining rights accruing from ownership of the Property, including the right to engage in or permit or invite others to engage in only those uses of the Conservation Easement Area that are expressly reserved herein, not prohibited or restricted herein, and are not inconsistent with the purposes of this Conservation Easement. Without limiting the generality of the foregoing, the Grantor expressly reserves to the Grantor, and the Grantor's invitees and licensees, the right of access to the Conservation Easement Area, and the right of quiet enjoyment of the Conservation Easement Area,

TO HAVE AND TO HOLD, the said rights and easements perpetually unto the State of North Carolina for the aforesaid purposes,

AND Grantor covenants that Grantor is seized of said premises in fee and has the right to convey the permanent Conservation Easement herein granted; that the same is free from encumbrances and that Grantor will warrant and defend title to the same against the claims of all persons whomsoever.

IN TESTIMONY WHEREOF, the Grantor has hereunto set his hand and seal, the day and year first above written.

_____ (SEAL)
Louie Arthur Bodenhamer

NORTH CAROLINA
COUNTY OF _____

I, _____, a Notary Public in and for the County and State aforesaid, do hereby certify that Louie Arthur Bodenhamer, Grantor, personally appeared before me this day and acknowledged the execution of the foregoing instrument.

IN WITNESS WHEREOF, I have hereunto set my hand and Notary Seal this the _____ day of _____, 2021.

_____
Notary Public

My commission expires:

_____

Exhibit A

Conservation Easement Area 1

BEING ALL of Conservation Easement 1 of the Swamp Grape Site over a portion of the land of the Louie Arthur Bodenhamer (PIN No. 829936273300), lying and being situated in Rowland Township, Robeson County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 30 and being a Southern corner of the Conservation Easement Area 1 and being located South 21°58'05" West 231.10 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=296,010.4546', E=1,894,884.0842' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 30), North 76°14'59" West 172.68' to an iron stake; thence North 19°55'39" East 325.70' to an iron stake; thence North 07°24'33" East 182.42' to an iron stake; thence North 50°00'52" West 756.84' to an iron stake; thence North 85°30'30" West 87.61' to an iron stake; thence North 57°39'36" West 115.93' to an iron stake; thence North 20°35'53" West 167.19' to an iron stake; thence North 49°48'38" West 395.84' to an iron stake; thence South 87°39'36" East 645.19' to an iron stake; thence South 47°11'04" East 993.02' to an iron stake; thence South 13°36'52" East 136.47' to an iron stake; thence South 41°33'54" East 42.63' to an iron stake; thence South 64°05'49" East 99.73' to an iron stake; thence North 86°30'30" East 60.25' to an iron stake; thence South 44°26'56" East 128.73' to an iron stake; thence South 44°26'56" East 342.35' to an iron stake; thence South 44°26'56" East 182.54' to an iron stake; thence South 29°02'08" West 105.92' to an iron stake; thence South 42°34'36" East 136.50' to an iron stake; thence North 78°02'31" East 42.93' to an iron stake; thence South 39°14'15" East 40.50' to an iron stake; thence South 41°49'01" West 160.44' to an iron stake; thence South 33°19'52" East 182.57' to an iron stake; thence South 36°56'45" West 275.12' to an iron stake; thence South 66°02'01" West 60.02' to a non-monumented corner; thence North 16°03'58" West 221.05' to a non-monumented corner; thence North 04°13'53" West 75.89' to a non-monumented corner; thence North 25°00'11" West 79.38' to a non-monumented corner; thence North 07°23'16" West 99.93' to a non-monumented corner; thence North 88°00'50" West 13.49' to a concrete marker; thence North 88°00'50" West 63.59' to an iron stake; thence North 11°38'01" West 70.14' to an iron stake; thence North 25°17'41" West 147.10' to an iron stake; thence North 36°50'32" West 188.44' to an iron stake; thence North 56°05'12" West 71.63' to an iron stake; thence North 45°22'08" West 57.65' to an iron stake; thence North 34°02'36" West 126.64' to an iron stake; thence North 84°13'20" West 27.13' to an iron stake; thence South 25°07'57" West 434.63' to an iron stake, which is the Point of Beginning (Point No. 30), having an area of 23.38 acres, more or less.

Conservation Easement Area 3

BEING ALL of Conservation Easement 3 of the Swamp Grape Site over a portion of the land of the Louie Arthur Bodenhamer (PIN No. 829966485300), lying and being situated in Rowland

Township, Robeson County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No.10 and being the Southernmost corner of the Conservation Easement Area 3 and being located North 56°27'14" East 512.85 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=296,010.4546', E=1,894,884.0842' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 10), North 44°26'56" West 128.73' to an iron stake; thence North 86°30'30" East 55.28' to an iron stake; thence South 70°01'13" East 53.73' to an iron stake; thence South 11°24'46" West 78.46' to an iron stake, which is the Point of Beginning (Point No. 10), having an area of 0.11 acres, more or less.

Conservation Easement Area 4

BEING ALL of Conservation Easement 4 of the Swamp Grape Site over a portion of the land of the Louie Arthur Bodenhamer (PIN No. 829966485300), lying and being situated in Rowland Township, Robeson County, North Carolina and particularly described as follows (all distances are ground distances unless otherwise noted):

Beginning at an iron stake (Point of Beginning) labeled as Point No. 14 and being the Southernmost corner of the Conservation Easement Area 4 and being located South 83°26'55" East 800.23 feet from an iron stake with a blue cap (Point No. 101) with N.C. Grid Coordinates N=296,010.4546', E=1,894,884.0842' (NAD '83, 2011).

Thence from the Point of Beginning (Point No. 14), North 44°26'56" West 182.54' to an iron stake; thence North 69°48'53" East 105.45' to an iron stake; thence South 31°18'01" East 122.15' to an iron stake; thence South 29°02'08" West 71.29' to an iron stake, which is the Point of Beginning (Point No. 14), having an area of 0.29 acres, more or less.

ALL OF THE FOREGOING CONSERVATION EASEMENT AREAS as shown on plat of survey titled "Conservation Easement for the State of North Carolina Division of Mitigation Services over a Portion of the Lands of Aaron Gregory Bodenhamer, Current Owner per D.B. 1593, PG. 155 (PIN 829955333900) and Louie Arthur Bodenhamer, Widower, Current Owner per D.B. 1082, Pg. 891 (PIN 829936273300) and D.B. 1607, Pg. 167 (PIN 829966485300) DMS Project ID No. 100115, SPO Numbers [XX-XX], Swamp Grape", in Rowland Township, Robeson County, North Carolina, dated [_____ ___, 2021] by John A. Rudolph, PLS Number L-4194, K2 Design Group, and recorded in the Robeson County, North Carolina Register of Deeds at Plat Book [_____], Pages [_____].

AND SUCH CONSERVATION EASEMENT AREAS TOGETHER WITH those certain new fifteen (15) feet-wide non-exclusive access easements labeled as "ACCESS EASEMENT 1", "ACCESS EASEMENT 2", and "ACCESS EASEMENT 3", as well as any other access easements shown on the plat hereinafter referenced, all for ingress, egress, and regress and all as

shown on the foregoing plat of survey recorded in Plat Book [____], Pages [____] Robeson County Register of Deeds.

APPENDIX I - CREDIT RELEASE SCHEDULE

The schedules below list the updated credit release schedules for stream and wetland mitigation projects developed by bank and ILF sites in North Carolina:

Credit Release Schedule and Milestones for Wetlands					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCDMS**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%	15%	65%
6*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%	5%	70%
7	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%	15%	85%
8*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%	5%	90%
9	Year 7 monitoring report demonstrates that performance standards have been met	10%	100%	10%	100%

*Please note that vegetation plot data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

Credit Release Schedule and Milestones for Streams					
Credit Release Milestone	**Release Activity**	**Banks**		**ILF/NCDMS**	
		Interim Release	**Total Released**	**Interim Release**	**Total Released**
1	Site Establishment (includes all required criteria stated above)	15%	15%	0%	0%
2	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan	15%	30%	30%	30%
3	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%	10%	40%
4	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%	10%	50%
5	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%	10%	60%
6*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)	5%	65% (75%**)
7	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)	10%	75% (85%**)
8*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)	5%	80% (90%**)
9	Year 7 monitoring report demonstrates that channels are stable, performance standards have been met	10%	90% (100%**)	10%	90% (100%**)

*Please note that vegetation data may not be required with monitoring reports submitted during these monitoring years unless otherwise required by the Mitigation Plan or directed by the NCIRT.

**10% reserve of credits to be held back until the bankfull event performance standard has been met.

APPENDIX J - MAINTENANCE PLAN

Maintenance Plan

The Site shall be monitored on a regular basis and a physical inspection of the site shall be conducted a minimum of once per year throughout the post-construction monitoring period until performance standards are met. These site inspections may identify site components and features that require routine maintenance. Routine maintenance should be expected most often in the first two years following site construction and may include the following:

Component/Feature	**Maintenance through project close-out**
Stream	Routine channel maintenance and repair activities may include securing of loose coir matting and supplemental installations of live stakes and other target vegetation along the channel. Areas where stormwater and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted plant community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species shall be controlled by mechanical and/or chemical methods. Any vegetation control requiring herbicide application will be performed in accordance with NC Department of Agriculture (NCDA) rules and regulations.
Beaver	Beaver and associated dams are to be removed as they colonize and until the project is closed.
Site Boundary	Site boundaries shall be identified in the field to ensure clear distinction between the mitigation site and adjacent properties. Boundaries may be identified by fence, marker, bollard, post, tree- blazing, or other means as allowed by site conditions and/or conservation easement. Boundary markers disturbed, damaged, or destroyed will be repaired and/or replaced on an as needed basis.
Road Crossing	Road crossings above the site may be maintained only as allowed by Conservation Easement or existing easement, deed restrictions, rights of way, or corridor agreements.
Drop Structure	Routine maintenance and repair activities may include removal of debris and supplemental installation of live stakes and other target vegetation along the channel. Undermining of the structure may require repair or replacement.

APPENDIX K - IRT SITE VISIT NOTES

From:	Tugwell, Todd J CIV USARMY CESAW (US)
To:	Crocker, Lindsay; Davis, Erin B; Haupt, Mac
Cc:	Wilson, Travis W.; Baumgartner, Tim; Raymond Holz (rholz@restorationsystems.com); Grant Lewis; Alex Baldwin; Browning, Kimberly D CIV USARMY CESAW (USA)
Subject:	RE: Swamp Grape Post-Post-Contract notes for review #100115
Date:	Thursday, November 7, 2019 12:34:36 PM

Lindsay,
I have looked at the comments. One thing I just wanted to note is that I don't believe the majority of the wetland within the old pond bed will be rehabilitation, and the minutes seem oriented toward demonstrating that these areas will be rehabilitation. There may be some areas where sufficient uplift can be justified, but overall I think the functions within the pond bed are already present, so planting may be the major source of uplift (meaning enhancement). Also, the last bullet about removal of the infrastructure, including pipe and dock, would not really be justification for significant uplift.

Todd

-----Original Message-----
From: Crocker, Lindsay [mailto:Lindsay.Crocker@ncdenr.gov]
Sent: Wednesday, November 06, 2019 2:44 PM
To: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Haupt, Mac <mac.haupt@ncdenr.gov>
Cc: Wilson, Travis W. <travis.wilson@ncwildlife.org>; Baumgartner, Tim <tim.baumgartner@ncdenr.gov>; Raymond Holz (rholz@restorationsystems.com) <rholz@restorationsystems.com>; Grant Lewis (glewis@axiomenvironmental.org) <glewis@axiomenvironmental.org>; Alex Baldwin <abaldwin@restorationsystems.com>; Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Subject: [Non-DoD Source] Swamp Grape Post-Post-Contract notes for review #100115

IRT Members,

Please review the attached notes from the 10/29/2019 site visit that will serve as a basis for developing the Mitigation Plan with your approval. Let us know if you have any additional comments for consideration.

Thank you all for your patience in working through this project with us,

Lindsay

Lindsay Crocker

Project Manager

NC DEQ Division of Mitigation Services

217 West Jones St., Raleigh, NC 27603

Office 919.707.8944

Cell 919.594.3910

lindsay.crocker@ncdenr.gov <mailto:lindsay.crocker@ncdenr.gov>

From:	Haupt, Mac
To:	Crocker, Lindsay; Tugwell, Todd J CIV USARMY CESAW (US); Davis, Erin B
Cc:	Wilson, Travis W.; Baumgartner, Tim; Raymond Holz (rholz@restorationsystems.com); Grant Lewis; Alex Baldwin; Kim Browning
Subject:	RE: Swamp Grape Post-Post-Contract notes for review #100115
Date:	Friday, November 8, 2019 9:47:55 AM

Lindsay,

I believe most of the wetlands on stream right of upper UT1 now shown as re-establishment will likely be rehabilitation at best. As you said, this will be dependent upon the PJD. Also, I agree with Todd that the wetlands in the pond bottom are mostly enhancement.

Also, as Erin suggested at the end of the site visit it would be preferable to extend the wetlands to the wood-line upstream of UT2. This would rely on the landowner willing to move the crossing they wanted in this area.

Thanks,
Mac

From: Crocker, Lindsay
Sent: Wednesday, November 6, 2019 2:44 PM
To: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Haupt, Mac <mac.haupt@ncdenr.gov>
Cc: Wilson, Travis W. <travis.wilson@ncwildlife.org>; Baumgartner, Tim <tim.baumgartner@ncdenr.gov>; Raymond Holz (rholz@restorationsystems.com) <rholz@restorationsystems.com>; Grant Lewis (glewis@axiomenvironmental.org) <glewis@axiomenvironmental.org>; Alex Baldwin <abaldwin@restorationsystems.com>; Kim Browning <Kimberly.D.Browning@usace.army.mil>
Subject: Swamp Grape Post-Post-Contract notes for review #100115

IRT Members,

Please review the attached notes from the 10/29/2019 site visit that will serve as a basis for developing the Mitigation Plan with your approval. Let us know if you have any additional comments for consideration.

Thank you all for your patience in working through this project with us,

Lindsay

Lindsay Crocker
Project Manager
NC DEQ Division of Mitigation Services
217 West Jones St., Raleigh, NC 27603
Office 919.707.8944
Cell 919.594.3910

lindsay.crocker@ncdenr.gov

Supplementary Site Visit Notes

TO: NC DMS

FROM: Restoration Systems

DATE: November 6, 2019

RE: Swamp Grape Stream & Wetland Mitigation Site Visit, October 29th, 2019

On May 30th, 2019, Restoration Systems (RS) held a post-contract site visit for the Swamp Grape Mitigation Site (Site) with the North Carolina Inter-agency Review Team (IRT). A significant portion of the Site encompasses a breached agricultural pond. Failure of the pond's earthen impoundment occurred during Hurricane Florence in September of 2018. RS and its consultant Axiom Environmental (Axiom) assessed the Site leading up to the May visit as if the breached impoundment was restorable, and the agricultural pond could be re-established.

Though evaluated for compensatory mitigation, IRT members raised concerns regarding the permitting of the pond in 1999. Todd Tugwell of the U.S. Army Corps (Corps) relayed the IRT's concerns to the local Corps representative, Mickey Sugg, who conducted an internal review of the property. Mr. Sugg determined the Corps did not permit the construction but concluded the Corps would take no action against the landowner given the property's current condition. Moreover, if the landowner wanted to reconstruct the earthen impoundment, a Section 404 Permit would be required for the entire footprint of the pond. With clarity regarding the historical permitting, RS re-evaluated the Site based on its current condition. RS presented on preliminary findings during the September 2019 state-wide IRT meeting, and IRT members requested a second site visit, which occurred on October 29th, 2019. The following notes are a summary of the October site visit.

Attendees:

USACE:
- Todd Tugwell

NC DWR:
- Mac Haupt
- Erin Davis

Axiom Environmental:
- Grant Lewis

NC DMS:
- Lindsay Crocker
- Jeff Schaffer
- Jeremiah Dow
- Tim Baumgartner

Restoration Systems:
- JD Hamby
- Alex Baldwin
- Raymond Holz

Site Visit Notes:

- Under RFP 16-007705, DMS awarded RS' Option 2, consisting of 3,061 SMUs and 10 RWMUs within a 20.5-acre easement. Under the revised evaluation, the easement size increased to 25.25 acres. The revised acreage is within the total amount Proposed under Option 1 of RS technical proposal, which proposed a 26.7-acre easement. The expanded footprint is aimed at generating sufficient wetland mitigation credit to satisfy contract thresholds with DMS.
- DMS noted that due to the nature of impacts, 75% of the contracted wetland credit must be derived from "R" credit type (Re-establishment, Rehabilitation, or Creation).

Stream Notes:

- UT-1:
  - The condition of the upper reach calls for more design and channel work than currently proposed. An E1 approach or even R would be more favorable than E2.
  - The slope of the banks should be shallower, and the channel brought up to at least the elevation of the culvert.
  - Todd wants to see the justification of the channel design at the lower end of the reach just above the confluence, with defined success criteria in the mitigation plan (this goes for all E1/E2 reaches).

- UT-2:
  - The channel banks will be rebuilt following the low point in the valley.
  - Mac does not want to see parallel channels unless the topography would justify it.

- UT-3:
  - IRT agreed that removing the dam at the property line would benefit the reach.

- Main Channel (below the confluence of tribs 1, 2, & 3)
  - Todd and Mac had concerns as to the level of work to be done, and whether that justified E1 at a ratio of 1.5:1.
  - E2 at a ratio of 2.5:1 might be more appropriate in some areas.
  - The mitigation plan will match the proposed design to the needs of the stream rather than the needs of the crediting.
  - Lots of trees, wood, cross-veins, etc. will be added in this reach to improve habitat.
  - The entire dam will be removed to achieve floodplain access. The clay will be used throughout the site for ditch plugs, and for stream structures.
  - Justification will be needed as to the design below the dam. It was agreed below the dam is within the broader floodplain of Wilkinson Creek, which may drive the appropriate approach within this area. An ordinary high-water mark and channel exist currently.

Wetland Notes:

- The wetland mitigation potential and crediting strategy were discussed at length. Several areas shown as enhancement may fall under the definition of Rehabilitation if functional improvements are justified, but at a lower ratio (2:1). These should be explored in the Mitigation Plan as applicable.
- Erin encouraged us to include removing deep areas of legacy sediment within pond bed and downstream of breached dam for wetland Creation at a 3:1 ratio, especially in areas where non-hydric sandy sediments have deposited in order to promote tree growth.
- Prior to the start of 2020 growing season it was agreed that wells should be placed in existing wetland pockets proposed for Rehabilitation to determine a baseline condition.

- Mac voiced concern about the source of hydrology in the drained hydric soils above the furthest upstream ditch along UT-1.
- A majority of the drained area along UT-1 was highly manipulated soils with hydrological inputs from springs at the top of the slope directed into the existing ditch network.
- It was agreed that the mitigation plan should include verbiage about "Marsh like areas" that will likely develop in the wetter areas throughout the site. The mitigation plan will include success criteria for these areas based on the percentage of the wetland area; a threshold percentage will be determined for these areas not to exceed.
- Erin indicated that management of monoculture of Juncus could be tied to rehabilitation credit success.
- Todd stated that sandy sediment removal could only provide Re-establishment credit if Johnston or Bibb soils could be documented below, but overall he discouraged seeking Rehabilitation credit in those areas but would consider creation at a 3:1 ratio.
- Re-establishment of wetlands in the dam footprint at a 1:1 ratio would need to be justified
- Removal of the dock, irrigation pipe, and other remnant infrastructure should be incorporated areas as part of the project's wetland approach.

Proposed Swamp Grape Credit Ratios & Notes

Stream Ratios		
Reach	**Ratio**	**Notes**
UT-1 (Upper Reach)*	E2 @ 2.5:1 / E1 @ 1.5:1	Based on IRT feedback, RS will provide as much functional uplift as is possible with the goal of raising the channel and re-establishing the stream to his historic floodplain as quickly as possible. This reach will begin as an E2 and transition to an E1 into a full new channel design restoration reach below.
UT-1 (Middle Reach)	R @ 1:1	Stream restoration with a new channel design through the ditched portion of UT-1 (Figure 1 – Appendix B)
UT-1 (Lower Reach)	E1 @ 1.5:1	Stream Pattern and dimension restoration, restore habitat, the design will be mindful of confluence location of UT-1, 2, & 3.
UT-2 (Upper Reach)	R @ 1:1	Stream restoration through impounded water, removal of the failed crossing.
UT-2 (Lower Reach)	E1 @ 1.5:1	Stream Pattern and dimension restoration, restore habitat, the design will be mindful of confluence location of UT-1, 2, & 3.
UT-3	R @ 1:1	Stream restoration to confluence of UT-1 & 2 (Figure 2 - Appendix B)
Main Channel (Upper Reach)**	E1 @ 1.5:1	The overall functional uplift approach to the Main Channel will be a mix of E1 and E2 determined by what is appropriate according to existing stream conditions. During detailed planning there will be small sections of E1 mapped in the Lower Reach, and small sections of E2 mapped in the Upper Reach.
Main Channel (Lower Reach)**	E2 @ 2.5:1	

Wetland Ratios		
Area	**Ratio**	**Notes**
Re-establishment (along UT-1, UT-2, and underneath the dam footprint)	1:1	Restoration of wetland hydrology by filling of existing ditches and removal of fill sediment ≤ 12-inches in depth, and restoration of hydrophytic vegetation
Rehabilitation (in pockets along UT-1 determined by PJD)	1.5:1	Restoration of hydrophytic vegetation and enhancement of wetland hydrology through filling of ditches and reconnecting the stream to the floodplain. High functional improvement
Rehabilitation and/or Enhancement (through the middle of the site in the old pond bed)	2:1	Restoration of hydrophytic vegetation, including treatment of Juncus effuses monoculture and enhancement of wetland hydrology by reconnecting the stream to the floodplain, installation of in-stream structures, development of marsh and shallow water habitat, and improved hyporheic zone. Lower functional improvement.
Creation (in pockets in areas of sandy sediment determined by the PJD)	3:1	Removal of legacy fill sediment that is >12-inches in depth in order to restore wetland hydrology and promote restoration of hydrophytic vegetation
Preservation (below the existing dam)*	N/A	Not applicable to RS' DMS Contract

Attachments;

A.) Correspondence with Mickey Sugg – US Army Corps
B.) October 2019 Pattern and Dimension Analysis
C.) Revised Mitigation Treatment Figure

Attachment;

A.) Correspondence with Mickey Sugg – US Army Corps

Ray Holz

From: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>
Sent: Friday, July 19, 2019 10:12 AM
To: Crocker, Lindsay
Subject: RE: [External] RE: Louie Bodenhamer Property- Swamp Grape

CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to report.spam@nc.gov<mailto:report.spam@nc.gov>

Lindsay, give me a call. I heard back from Mickey and had a chance to speak with Ray, but wanted to pass on the info to you as well.

Todd - 919-949-9005

-----Original Message-----
From: Crocker, Lindsay [mailto:Lindsay.Crocker@ncdenr.gov]
Sent: Friday, July 19, 2019 7:38 AM
To: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>
Subject: [Non-DoD Source] Re: [External] RE: Louie Bodenhamer Property- Swamp Grape

Thanks Todd.

Get Outlook for Android <Blockedhttps://aka.ms/ghei36>

_____

From: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>
Sent: Friday, July 19, 2019 7:24:51 AM
To: Mickey Sugg; Crocker, Lindsay; Kim Browning
Subject: [External] RE: Louie Bodenhamer Property- Swamp Grape

CAUTION: External email. Do not click links or open attachments unless you verify. Send all suspicious email as an attachment to report.spam@nc.gov<mailto:report.spam@nc.gov>

Thanks Mickey. I'll reach out to the provider today.
Todd

-----Original Message-----
From: Sugg, Mickey T CIV USARMY CESAW (USA)
Sent: Thursday, July 18, 2019 4:43 PM
To: Tugwell, Todd J CIV USARMY CESAW (US) <Todd.J.Tugwell@usace.army.mil>; Crocker, Lindsay <Lindsay.Crocker@ncdenr.gov>; Browning, Kimberly D CIV USARMY CESAW (US) <Kimberly.D.Browning@usace.army.mil>
Subject: Louie Bodenhamer Property- Swamp Grape

Good afternoon,

I spoke with Mr. Louie Bodenhamer today concerning his breached pond. Based on aerials and absence of any record of Corps dealings on the property, I informed him that authorization from our office would be required to replace/repair the breach and re-impound the site. In regards to the existing berm and pre-Florence work in the stream & wetlands, it is outside our 5-year statute of limitation for unauthorized work so no enforcement action will be taken for that past

work. Informing me that there was an old breached berm (impounded in the 30s), he confirmed that the pond was reconstructed ~2000 at the advice of Robeson County Ag. Dept (think he may be referring to NRCS) when he purchased the property.

With this said, we will likely send the Bodenhamer's a letter restating our permit requirements. Not sure what that does to the mitigation proposal, but I'll leave that up to the IRT.

If you have any questions, call me. I'm out tomorrow & all next week.
-mickey

Mickey Sugg, Chief
Wilmington Regulatory Field Office
U.S. Army Corps of Engineers
69 Darlington Avenue
Wilmington, NC 28403
(910) 251-4811 (direct line)
(910) 251-4025 (fax)

"The Wilmington District is committed to providing the highest level of support to the public. To help us ensure we continue to do so, please complete the Customer Satisfaction Survey located at:
"Blockedhttp://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0 "

Attachment;

B.) October 2019 Pattern and Dimension Analysis

Table 1. Swamp Grape Morphological Stream Characteristics
Lumber 03040204

Variables	REFERENCE - UT TO ANGOLA CREEK	*REFERENCE - MILL CREEK	*REFERENCE - UT TO WILD CAT	*REFERENCE - UT TO HOG SWAMP	Existing UT 1 Upstream	PROPOSED UT 1 Upstream	Existing UT 3	PROPOSED UT 3
Stream Type	E 6	E 5	E 5	E 5	F 5	E/C 5	Eg 5	E/C 5
Drainage Area (mi^2)	2.09	1.92	0.44	0.08	0.30	0.30	0.73	0.73
Bankfull Discharge (cfs)	11.5	19.8	7.8	1.6	3.3	3.3	6.4	6.4
Dimension Variables								
Bankfull Cross-Sectional Area (A_{bkf})	12.2	21.0	8.5	1.8	3.6	3.6	6.9	6.9
Bankfull Width (W_{bkf})	Mean: 12.3 Range: 8.8 - 13.6	Mean: 11.3 Range:	Mean: 8.2 Range:	Mean: 3.8 Range:	Mean: 15.0 Range: 14.6 to 17.6	Mean: 7.1 Range: 6.6 to 7.6	Mean: 7.6 Range: 6.9 to 8.3	Mean: 9.8 Range: 9.1 to 10.5
Bankfull Mean Depth (D_{bkf})	Mean: 1.3 Range: 1.0 - 1.4	Mean: 1.9 Range:	Mean: 1.0 Range:	Mean: 0.5 Range:	Mean: 0.3 Range: 0.3 to 0.3	Mean: 0.5 Range: 0.5 to 0.5	Mean: 0.8 Range: 0.7 to 0.8	Mean: 0.7 Range: 0.7 to 0.8
Bankfull Maximum Depth (D_{max})	Mean: 1.9 Range: 1.8 - 2.1	Mean: 2.6 Range:	Mean: 1.6 Range:	Mean: 0.7 Range:	Mean: 0.6 Range: 0.6 to 0.6	Mean: 0.7 Range: 0.6 to 0.9	Mean: 1.5 Range: 1.5 to 1.5	Mean: 1.0 Range: 0.8 to 1.2
Pool Width (W_{pool})	Mean: 11.2 Range: 8.7 - 11.5	Mean: 11.9 Range:	Mean: 8.8 Range:	Mean: 3.8 Range:	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 7.8 Range: 7.1 to 9.9	Mean: 6.4 Range: 6.3 to 6.5	Mean: 10.8 Range: 9.8 to 13.8
Maximum Pool Depth (D_{pool})	Mean: 2.9 Range: 2.8 - 3.0	Mean: 3.1 Range:	Mean: 1.8 Range:	Mean: 1.1 Range:		Mean: 1.0 Range: 0.7 to 1.1	Mean: 1.8 Range: 1.7 to 1.8	Mean: 1.3 Range: 0.9 to 1.5
Width of Floodprone Area (W_{fpa})	Mean: 300.0 Range: 300 - 300	Mean: 300 Range:	Mean: 130.0 Range:	Mean: 100.0 Range:	Mean: 19.3 Range: 16.5 to 25.5	Mean: 70 Range: 50.0 to 100.0	Mean: 150.0 Range: 150.0 to 150.0	Mean: 70 Range: 50.0 to 100.0
Dimension Ratios								
Entrenchment Ratio (W_{fpa}/W_{bkf})	Mean: 24.4 Range: 22.1 - 34.1	Mean: 26.5 Range:	Mean: 15.9 Range:	Mean: 26.6 Range:	Mean: 1.3 Range: 1.1 to 1.4	Mean: 9.9 Range: 7.0 to 14.1	Mean: 19.9 Range: 18.1 to 21.7	Mean: 7.1 Range: 5.1 to 10.2
Width / Depth Ratio (W_{bkf}/D_{bkf})	Mean: 9.7 Range: 6.8 - 12.3	Mean: 6.1 Range:	Mean: 8.0 Range:	Mean: 7.9 Range:	Mean: 50.0 Range: 48.7 to 58.7	Mean: 14.0 Range: 12.0 to 16.0	Mean: 10.2 Range: 8.6 to 11.9	Mean: 14.0 Range: 12.0 to 16.0
Max. D_{bkf} / D_{bkf} Ratio	Mean: 1.5 Range: 1.4 - 1.9	Mean: 1.4 Range:	Mean: 1.5 Range:	Mean: 1.4 Range:	Mean: 2.0 Range: 2.0 to 2.0	Mean: 1.4 Range: 1.2 to 1.7	Mean: 2.0 Range: 1.9 to 2.1	Mean: 1.4 Range: 1.2 to 1.7
Low Bank Height / Max. D_{bkf} Ratio	Mean: 1.0 Range: 1.0 - 1.0	Mean: 1.0 Range:	Mean: 1.0 Range:	Mean: 1.0 Range:	Mean: 3.3 Range: 1.5 to 5.5	Mean: 1.0 Range: 1.0 to 1.2	Mean: 1.3 Range: 1.2 to 1.3	Mean: 1.0 Range: 1.0 to 1.2
Maximum Pool Depth / Bankfull Mean Depth (D_{pool}/D_{bkf})	Mean: 2.2 Range: 2.2 - 2.3	Mean: 1.7 Range:	Mean: 1.7 Range:	Mean: 2.2 Range:	No distinct repetitive pattern of riffles and pools due to staightening activities	Mean: 1.9 Range: 1.3 to 2.2	Mean: 2.3 Range: 2.3 to 2.4	Mean: 1.9 Range: 1.3 to 2.2
Pool Width / Bankfull Width (W_{pool}/W_{bkf})	Mean: 0.9 Range: 0.7 - 0.9	Mean: 1.0 Range:	Mean: 1.1 Range:	Mean: 1.0 Range:		Mean: 1.1 Range: 1.0 to 1.4	Mean: 0.8 Range: 0.8 to 0.8	Mean: 1.1 Range: 1.0 to 1.4
Pool Area / Bankfull Cross Sectional Area	Mean: 1.9 Range: 1.4 - 2.0	Mean: Range:	Mean: Range:	Mean: Range:		Mean: 1.6 Range: 1.3 to 1.9	Mean: 1.0 Range: 1.0 to 1.0	Mean: 1.6 Range: 1.3 to 1.9

Table 1 continued. Swamp Grape Morphological Stream Characteristics
Lumber 03040204

Variables	REFERENCE - UT TO ANGOLA CREEK	*REFERENCE - MILL CREEK	*REFERENCE - UT TO WILD CAT	*REFERENCE - UT TO HOG SWAMP	Existing UT 1 Upstream	PROPOSED UT 1 Upstream	Existing UT 3	PROPOSED UT 3
Pattern Variables					**Pattern Variables**		**Pattern Variables**	
Pool to Pool Spacing (L_{p-p})	Med: 64.6 Range: 34.5 - 137.1	Med: 36.2 Range: 11.4 - 61.0	Med: 15.3 Range: 14.0 - 16.6	Med: 16.0 Range: 9.0-23.0	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 28.4 Range: 21.3 to 56.8	Med: 38.6 Range: 25.2 to 46.7	Med: 39.3 Range: 29.5 to 78.6
Meander Length (L_m)	Med: 132.2 Range: 71.9 - 191.4	Med: 55.2 Range: 37.7 - 72.6	Med: 25.8 Range: 22.5 - 29.0	Med: 41.0 Range: 12.0-70.0		Med: 60.3 Range: 42.6 to 99.4	Med: 70.5 Range: 59.0 to 77.7	Med: 83.5 Range: 59.0 to 137.6
Belt Width (W_{belt})	Med: 48.2 Range: 26.6 - 76.6	Med: 21.1 Range: 15.1 - 27.0	Med: 16.6 Range: 13.8 - 19.4	Med: 10.8 Range: 5.6-16.0		Med: 21.3 Range: 10.6 to 35.5	Med: 29.2 Range: 29.0 to 29.3	Med: 29.5 Range: 14.7 to 49.1
Radius of Curvature (R_c)	Med: 22.9 Range: 6.6 - 44.8	Med: 19.8 Range: 9.7 - 29.8	Med: 13.1 Range: 10.9 - 15.3	Med: 25.0 Range: 4.4-45.6		Med: 21.3 Range: 14.2 to 71.0	Med: 12.1 Range: 7.8 to 16.5	Med: 29.5 Range: 19.7 to 98.3
Sinuosity (Sin)	1.17	1.18	1.15	1.24	1.00	1.17	1.14	1.09
Pattern Ratios					**Pattern Ratios**		**Pattern Ratios**	
Pool to Pool Spacing/ Bankfull Width (L_{p-p}/W_{bkf})	Med: 5.3 Range: 2.8 - 11.1	Med: 3.2 Range: 1.0 - 5.4	Med: 1.9 Range: 1.7 - 2.0	Med: 4.2 Range: 2.4-6.1	No distinct repetitive pattern of riffles and pools due to staightening activities	Med: 4.0 Range: 3.0 to 8.0	Med: 5.1 Range: 3.3 to 6.1	Med: 4.0 Range: 3.0 to 8.0
Meander Length/ Bankfull Width (L_m/W_{bkf})	Med: 10.7 Range: 5.8 - 15.6	Med: 4.9 Range: 3.3 - 6.4	Med: 3.1 Range: 2.7 - 3.5	Med: 10.9 Range: 3.2-18.6		Med: 8.5 Range: 6.0 to 14.0	Med: 9.3 Range: 7.8 to 10.2	Med: 8.5 Range: 6.0 to 14.0
Meander Width Ratio (W_{belt}/W_{bkf})	Med: 3.9 Range: 2.2 - 6.2	Med: 1.9 Range: 1.3 - 2.4	Med: 2.0 Range: 1.7 - 2.4	Med: 2.8 Range: 1.5-4.2		Med: 3.0 Range: 1.5 to 5.0	Med: 3.8 Range: 3.8 to 3.9	Med: 3.0 Range: 1.5 to 5.0
Radius of Curvature/ Bankfull Width (Rc/W_{bkf})	Med: 1.9 Range: 0.5 - 3.6	Med: 1.8 Range: 0.9 - 2.6	Med: 1.6 Range: 1.3 -1.9	Med: 6.6 Range: 1.2-12.1		Med: 3.0 Range: 2.0 to 10.0	Med: 1.6 Range: 1.0 to 2.2	Med: 3.0 Range: 2.0 to 10.0

* References were measured for Brown Marsh Swamp (NCDMS Contract No. 16-D06038) that was successfully closed out in 2012.

Existing Channel

Existing Channel
Sinuosity = 1.00
Width = 15.0 ft
Radius = NA

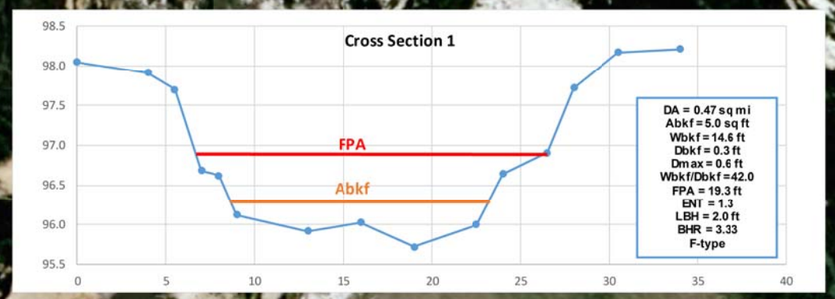
Proposed Channel
Sinuosity = 1.17
Width = 7.1 ft
Radius = 14 to 20 ft

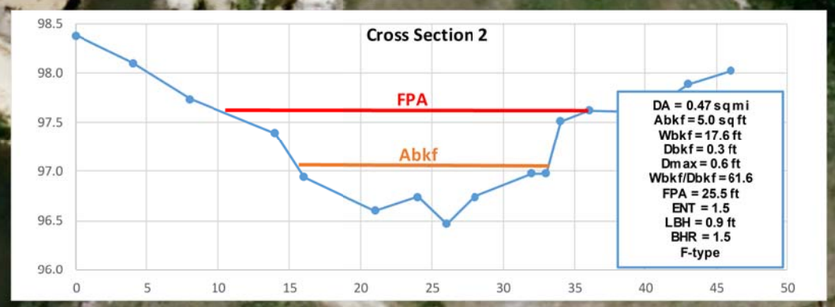
XS 1

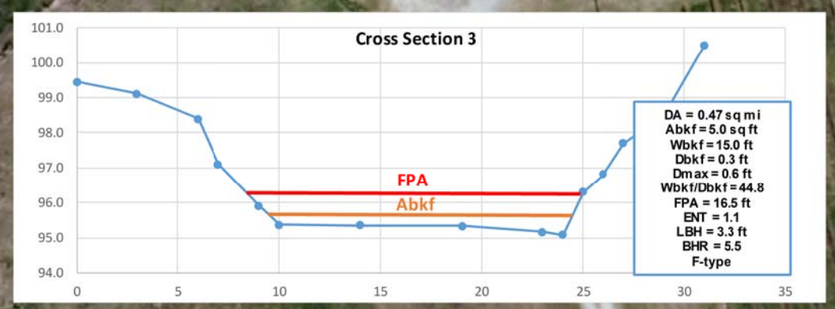
XS 2

XS 3

Design Channel







0 50 100
SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:

Proposed Channel

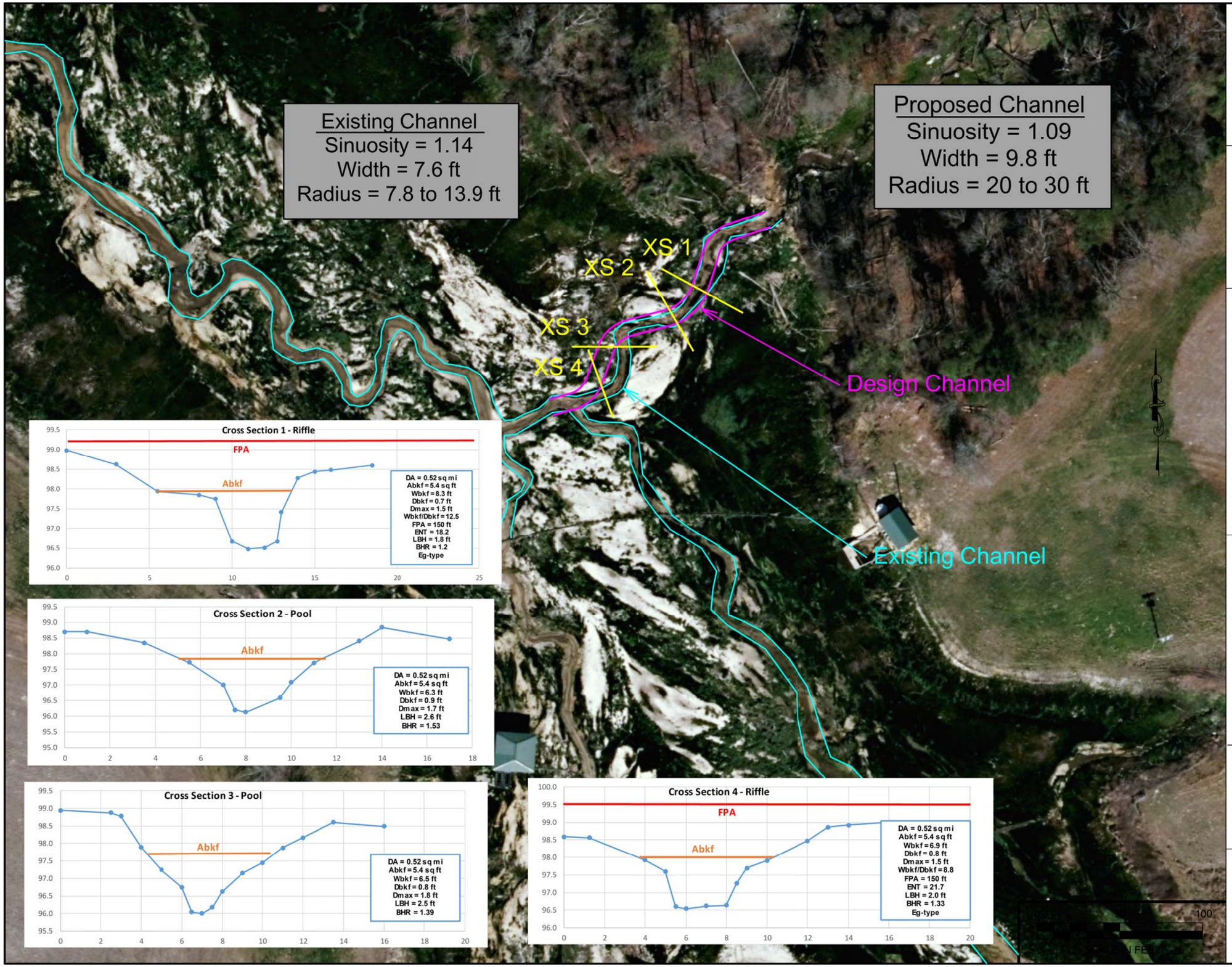
Scale: as shown

Date: Sept 2019

Project No.: 18-002.10

FIGURE NO.

1



Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:

Proposed Channel

Scale:	FIGURE NO.
as shown	2
Date: Sept 2019	
Project No.: 18-002.10	

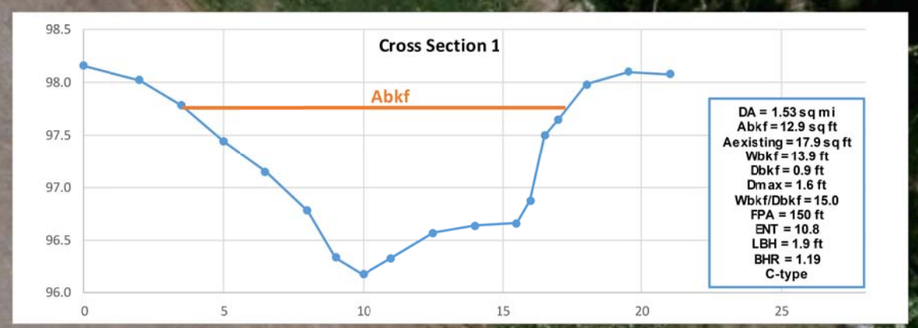
Proposed Channel
Sinuosity = 1.15
Width = 12.5 ft
Radius = 24 to 37 ft

Design Channel

Existing Channel
Sinuosity = 1.14
Width = 13.9 ft
Radius = 8.3 to 23.4 ft

XS 1

Existing Channel



0 50 100
SCALE IN FEET

Axiom Environmental, Inc.

RESTORATION SYSTEMS | LLC

NOTES/REVISIONS

Project:

Swamp Grape Mitigation Site

Robeson County
North Carolina

Title:
Proposed Channel

Scale: as shown

Date: Sept 2019

Project No.: 18-002.10

FIGURE NO.
3

Attachment;

C.) Revised Mitigation Treatment Figure

Removal of historic dam across entire valley. Stream Restoration within the footprint, and wetland Re-establishment

Sandy sediment removal could provide wetland credit if Johnston or Bibb soils are documented below, Consider Creation at a 3:1 ratio.

Other pockets of excess legacy sediment will be documented within the historic pond bed, and proposed for Creation, if appropriate.

UT-3 breached dam to-be removed with landowner consent

Wetland gauges will be installed to monitor the current hydroperiod of jurisdictional wetlands & throughout the Site. Gauges will be installed prior to the start ofthe 2020 growing season.

Final wetland mitigation credit will be dependent on an approved PJD. Jurisdictional wetlands affected by existing ditches will be credited at 1.5:1 under Rehabilitation

UT-3

UT-1

Main Channel

Utilize topography at UT-1 & UT-2 confluence to determine the appropriate channel confluence

Stream Approach E1 vs E2 TBD. Beyond dam, system dependent on Wilkinson Creek

In general E-2 approach w/ small segments of E-1

In general E-1 approach w/ small segments of E-2.

Pond Infrastructure removal, elimination of Juncus monoculture, hardwood swamp vegetation, installation of in-stream structures, and expansion of hydrology will provide functional argument for Rehabilitation and/or Enhancement in pond bottom

UT-2

UT-1

The condition of the upper reach warrants more than an E2 approach. Dependent upon detailed topographic survey, RS will work to provide as much functional lift in this area as is feasible.

Legend

- Revised Proposed Easement: 25.25 Acres
- Existing Ditches (to-be filled)

Stream Mitigation Treatment

- Full Restoration
- E1 Pattern + Dimension Work
- E1/E2 - Defined & Justified in the Mitigation Plan

Wetland Mitigation Treatment

- Re-Establishment - 1:1 Ratio
- Rehabilitation - 1.5:1 Ratio
- Rehabilitation or Enhancement - 2:1 Ratio w/ Justification
- Creation - 3:1 Ratio
- Preservation - N/A for Crediting

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 188 ft
DATE: 11-2019
SITE: L-03-001

Swamp Grape: 10-29-2019 Site Visit Proposed Mitigation Treatments

Feet
0 40 80 160 240 320

Aerial Imagery: (c) ESRI
Coordinate System: NAD_1983_SP_NC_FIPS_3200_Ft.

Proposed Mitigation Credits

Mitigation Type	Quantity	Mit. Ratio	Credits
SMU	**l. ft.**		
-Restoration	1735.8	1.00	1996.2
-E1	630.1	2.00	362.3
-E1/E2	1505.3	7.50	200.7
	3,871		**2,559.2**
Riparian Wetland	**Ac.**		
-Re-Establishment	5.438	1.0	5.44
-Rehabilitation	0.213	1.5	0.14
-Creation	0.555	3.0	0.19
-Enhancement	11.484	3.0	3.83
-Preservation	2.422	10.0	0.24
	20.1		**9.84**

Legend

- Revised Proposed Easement: 25.25 Acres

Proposed Stream Mitigation Treatment

- Full Restoration
- E1 Pattern + Dimension Work
- E1/E2 - Defined & Justified in the Mitigation Plan

Proposed Wetland Mitigation Treatment

- Re-Establishment - 1:1 Ratio
- Rehabilitation - 1.5:1 Ratio
- Enhancement - 3:1 Ratio
- Creation - 3:1 Ratio
- Preservation - 10:1 Ratio

RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
PHONE : 919.755.9490
FAX : 919.755.9492

SCALE: 1 in = 250 ft
DATE: 11-2019
SITE: L-03-001

Swamp Grape: Proposed Mitigation Post, Second IRT Site Visit

Feet
0 62.5 125 250 375 500

Aerial Imagery: (c) ESRI
Coordinate System: NAD_1983_SP_NC_FIPS_3200_Ft.

Task 1 a.) Inter-Agency Post Contract Site Visit: Site Visit Notes

As specified within RFP #16-007705, an on-site meeting with regulatory agencies and DMS staff was conducted on May 30th, 2019. Below is a list of attendees and general site visit notes.

Attendees:

USACE:
- Todd Tugwell

NC DWR:
- Mac Haupt
- Erin Davis

NC DMS:
- Lindsay Crocker
- Jeff Schaffer
- Jeremiah Dow

NC WRC:
- Travis Wilson

Restoration Systems:
- JD Hamby
- Alex Baldwin
- Worth Creech
- Raymond Holz

Axiom Environmental
- Grant Lewis
- Kenan Jernigan

Site Visit Notes:

- Members of the IRT evaluated this site for wetland and stream restoration potential on an agricultural pond site that was recently breached and is slated for reconstruction if Mitigation is not conducted.
- Initial discussion of 1999 pond improvements occurred, USACE needs to vet if coordination occurred with the Agency or was necessary – Todd Tugwell to call Wilmington office for background information.
- RS provided communication between landowner and Federal NRCS/ State Conservation District on pond repair assistance (attached). IRT asked for detailed timeline of land use and pond breach for consideration (attached in table below).
- Last pond breach occurred September 15th, 2018 and site is within the 12-month period of being reconstructed on maintenance exemption.
- There was discussion that because this site will be re-built as a pond if not constructed for mitigation, it may be evaluated as if the existing land use is an agricultural pond rather than a drained pond. For purposes of impacts and crediting, review of the site was conducted as if the pond was still established.

Stream Notes:
- IRT concurred with single thread stream system as proposed.
- It was agreed that the entire dam within the floodplain would be removed to achieve floodplain access and flow.
- Attention to soil stability will be a priority when juncus is treated to allow tree growth.

- Travis Wilson said he had concerns with functional gain of proposed stream restoration within middle/upper reach of UT-1 and indicated that the EI approach and ratio may extend higher upstream than proposed. RS will collect additional data such as reference site, NC SQT, to justify restoration / EI line in the Mitigation Plan.

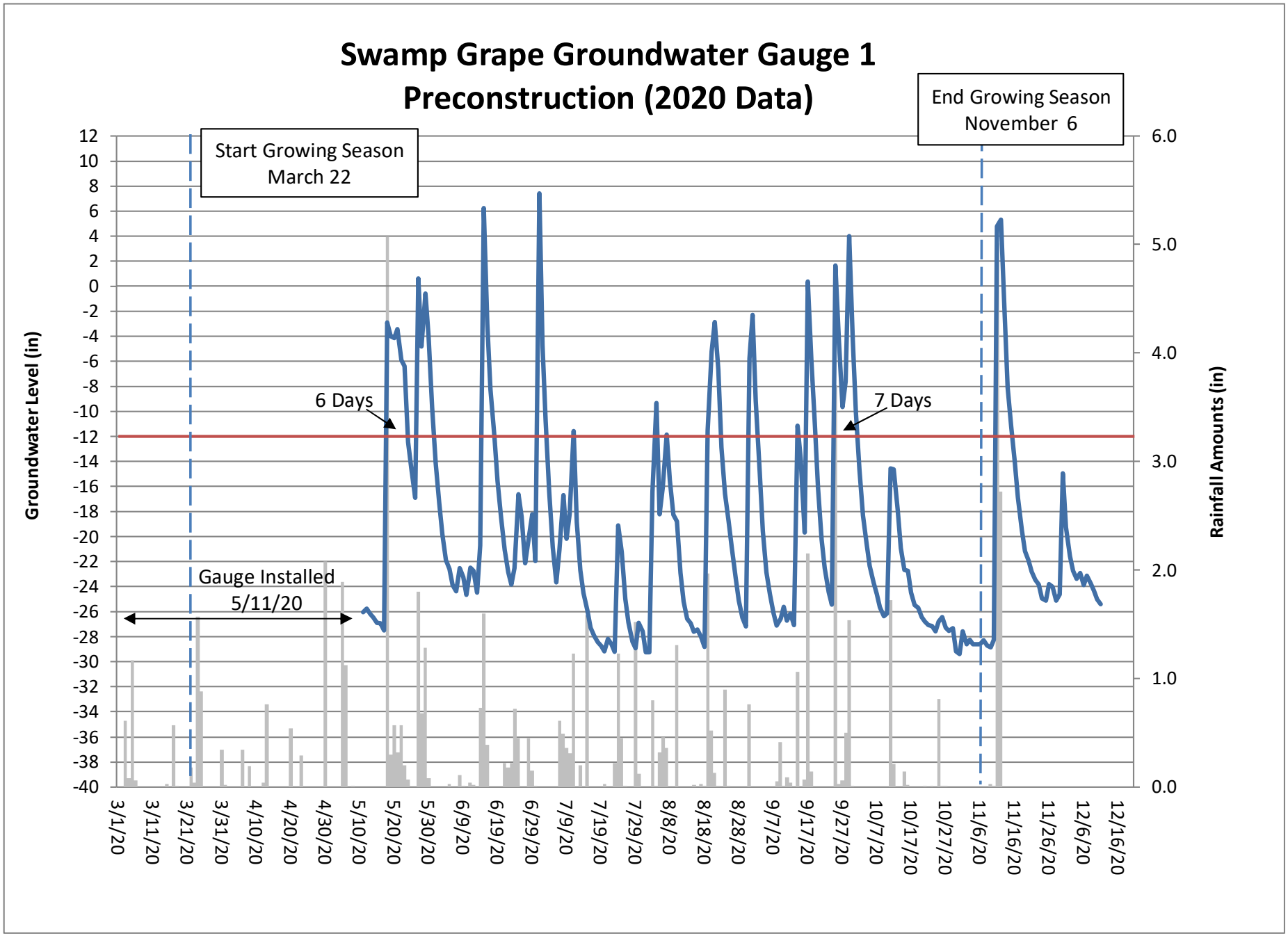
Wetland Notes:

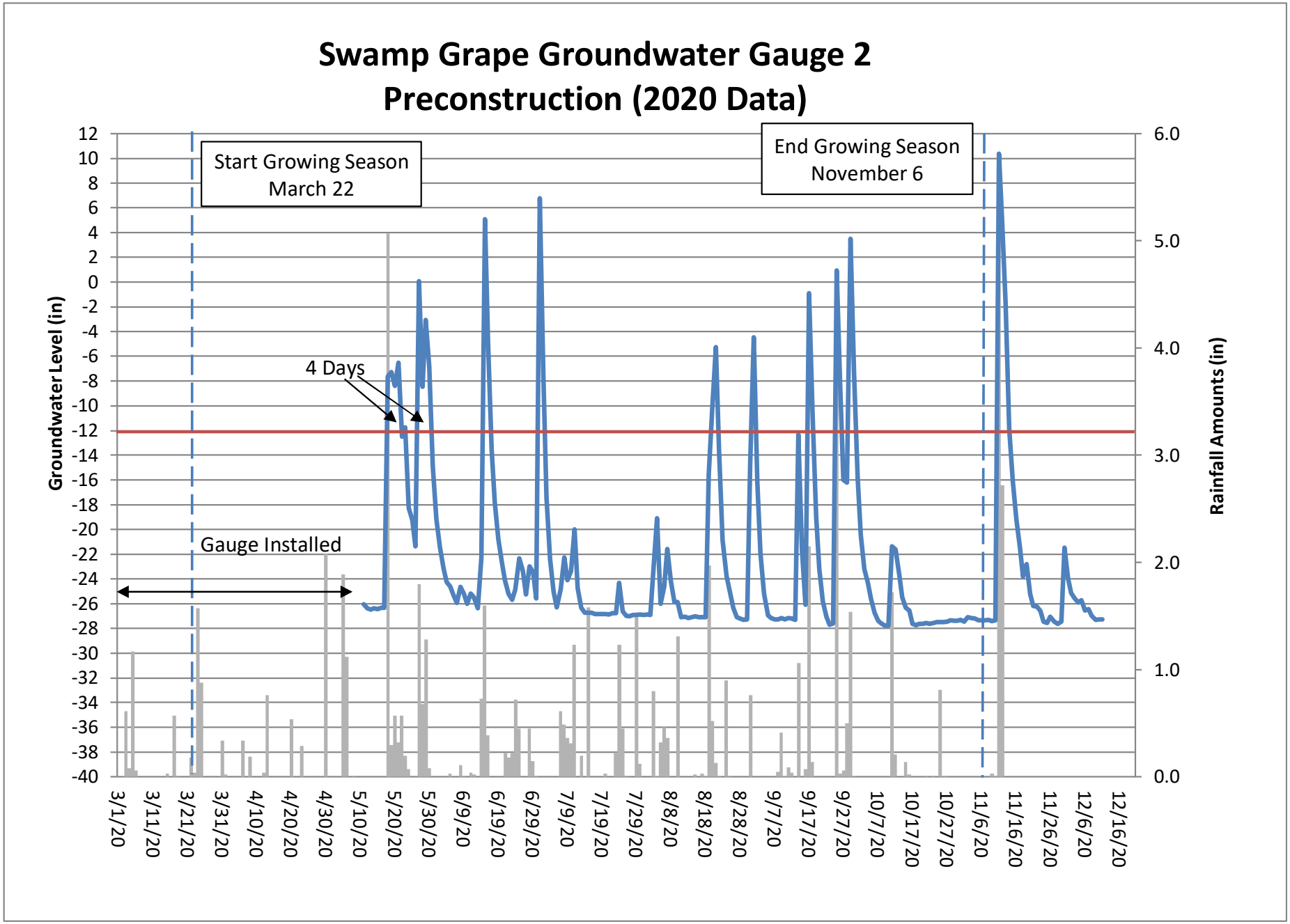
- The wetland mitigation potential and crediting strategy were discussed at length. If this site is evaluated as an existing pond, then the wetland approach would be defined as re-establishment which typically has a 1:1 ratio. Tugwell pointed out that in the past, this land use has received a lower ratio. There was also discussion that this may fall under more of a definition of rehabilitation which typically a ratio of 1.5:1. Todd, Mac, and Erin agreed that they would like to review definitions and discuss in the office before determining the final ratio. RS and DMS expressed that time is of the essence from a contract and landowner decision standpoint.
- Mac noted that removal of legacy sediment within pond bed and downstream of breached dam may need to occur for wetland restoration, especially in areas where non-hydric sandy sediments have deposited. Areas would be delineated during detailed wetland mapping by Axiom.
- General discussion occurred regarding crediting of wetland below an impoundment. Crediting must account for existing function of open water. USACE and DWR to review precedence/policy and provide final comment. USACE typically waits one year after pond removal for Jurisdiction Delineation approval to wait and see what's jurisdiction and what's not, i.e., pond bed drying period.
- Todd noted potential concern with existing wetlands on right side might be affected (reduced in size) by dam breach. Monitoring to occur in this area.

Timeline of Ag. Pond and breaches

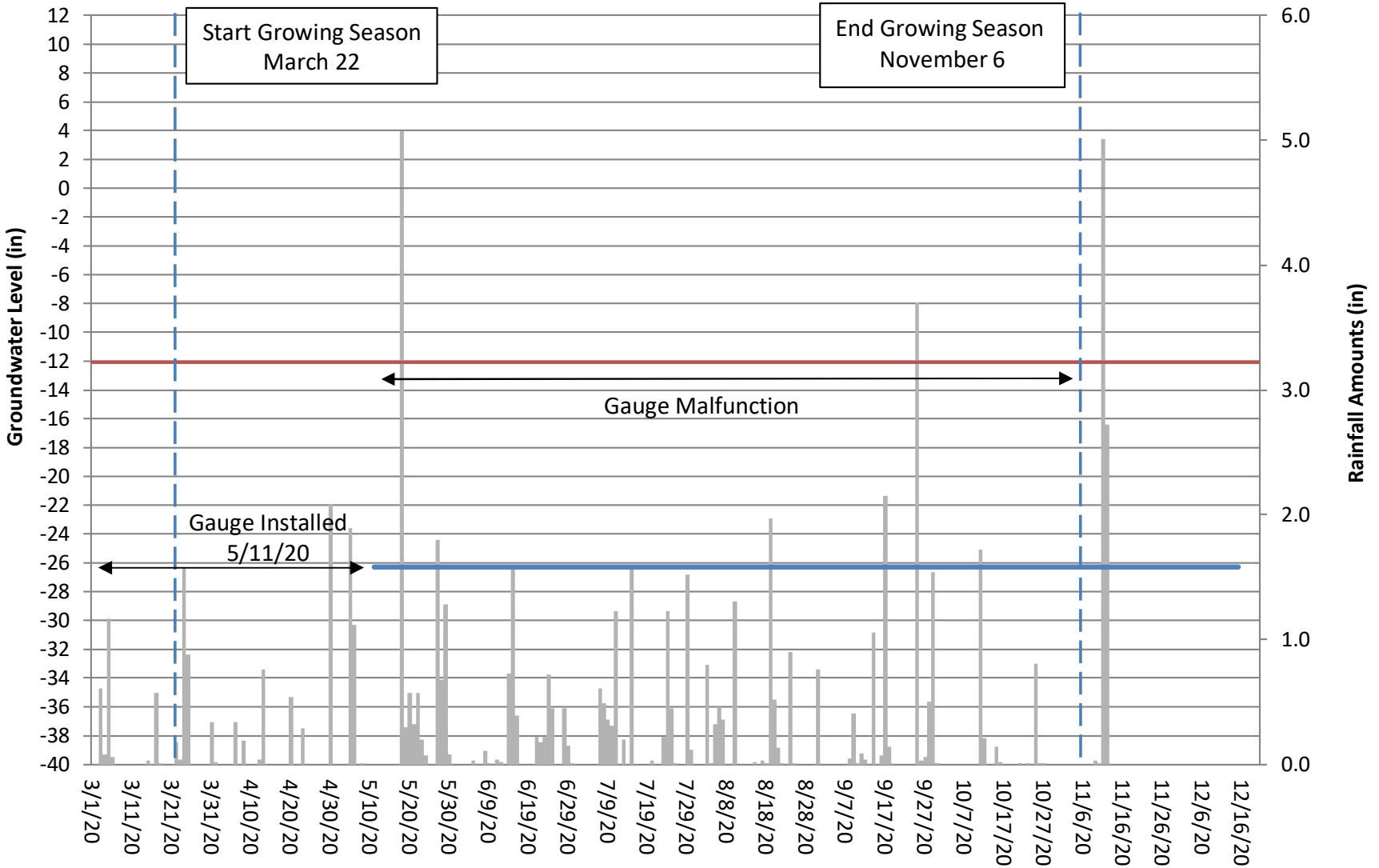
Weather Event	Dam Failure Occurrence	Notes
Hurricane Florence	September 2018	Dam rebuild pending
Hurricane Matthew	October 2016	Dam rebuilt 2017
Hurricane Bertha/Fran/Bonnie/Floyd & El Nino Events	Late Summer 1996	Following a breach in the dam during the 1996 hurricane season, due to wet winters brought about by El Nino weather events and 3 hurricane landfalls (Bertha, Fran, & Bonnie) between July 1996 and the 1999 aerial photograph and one hurricane afterward the photograph (Floyd), the proper resources and conditions to remove all debris and rebuild the dam weren't present until 2000.

APPENDIX L – PRECONSTRUCTION GROUNDWATER GRAPHS

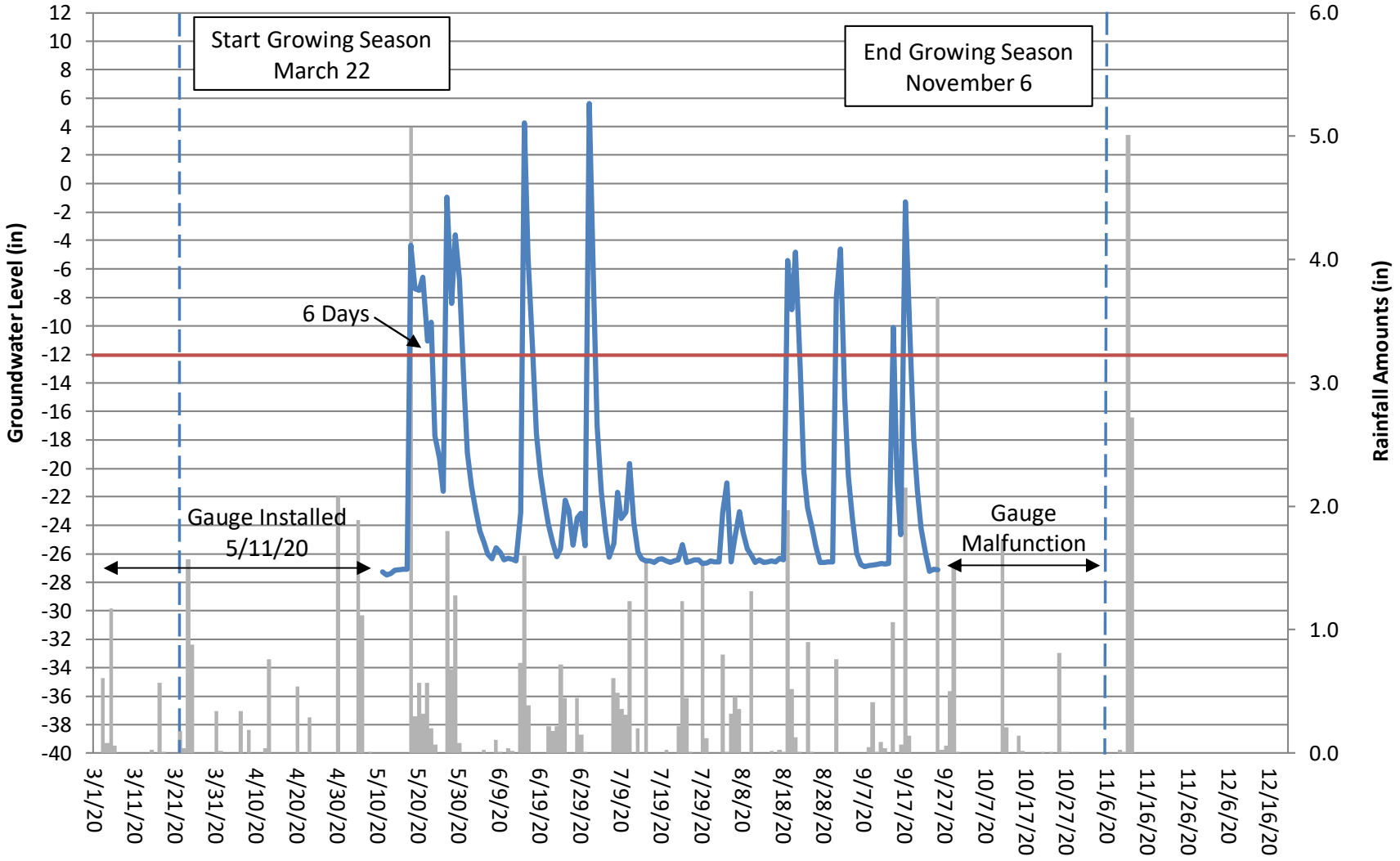

Swamp Grape Groundwater Gauge 1
Preconstruction (2020 Data)
Start Growing Season
March 22
End Growing Season
November 6
6 Days
7 Days
Gauge Installed
5/11/20
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/20
3/11/20
3/21/20
3/31/20
4/10/20
4/20/20
4/30/20
5/10/20
5/20/20
5/30/20
6/9/20
6/19/20
6/29/20
7/9/20
7/19/20
7/29/20
8/8/20
8/18/20
8/28/20
9/7/20
9/17/20
9/27/20
10/7/20
10/17/20
10/27/20
11/6/20
11/16/20
11/26/20
12/6/20
12/16/20

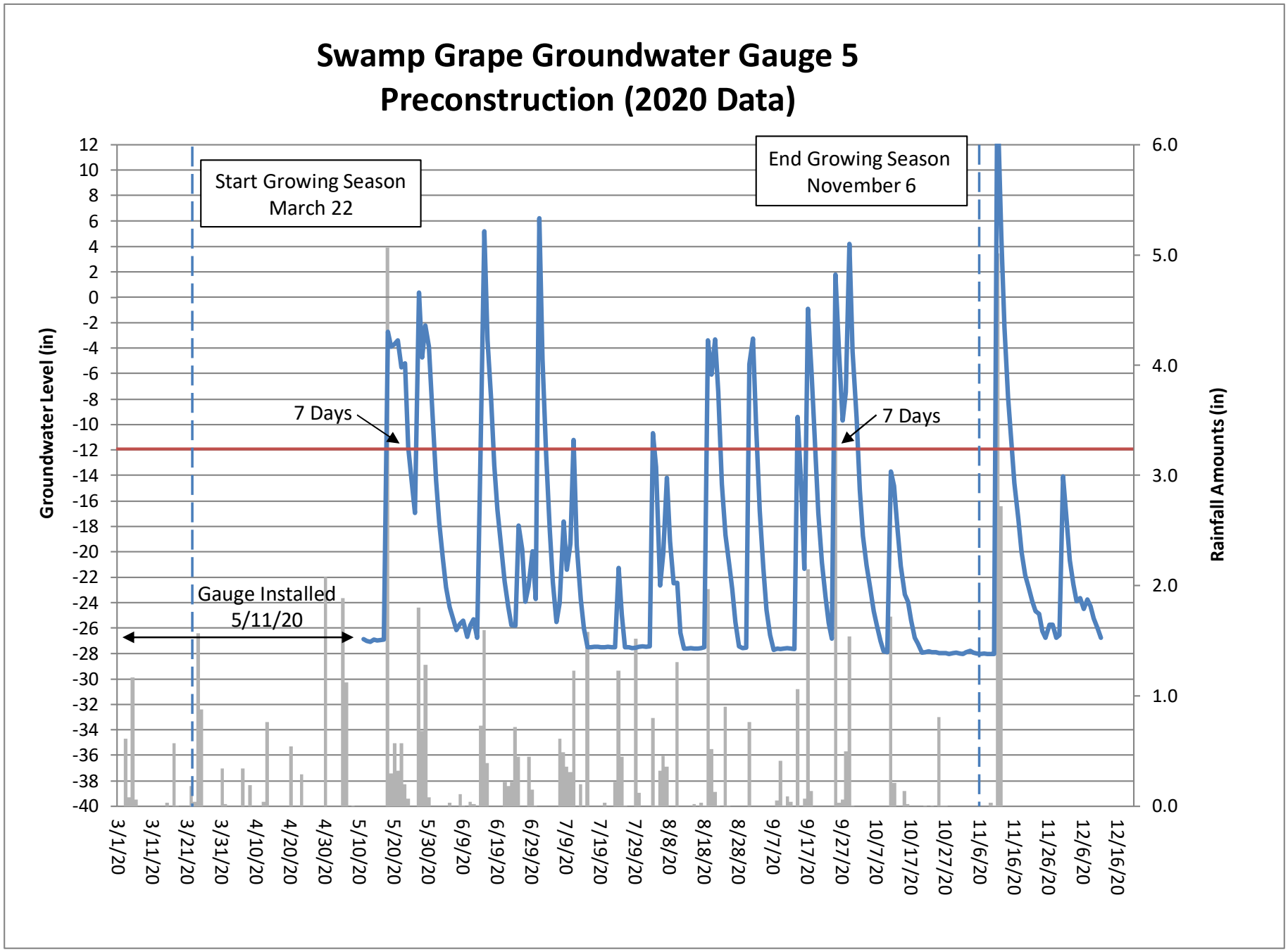

Swamp Grape Groundwater Gauge 2
Preconstruction (2020 Data)
Start Growing Season
March 22
End Growing Season
November 6
4 Days
Gauge Installed
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/20
3/11/20
3/21/20
3/31/20
4/10/20
4/20/20
4/30/20
5/10/20
5/20/20
5/30/20
6/9/20
6/19/20
6/29/20
7/9/20
7/19/20
7/29/20
8/8/20
8/18/20
8/28/20
9/7/20
9/17/20
9/27/20
10/7/20
10/17/20
10/27/20
11/6/20
11/16/20
11/26/20
12/6/20
12/16/20

Swamp Grape Groundwater Gauge 3
Preconstruction (2020 Data)

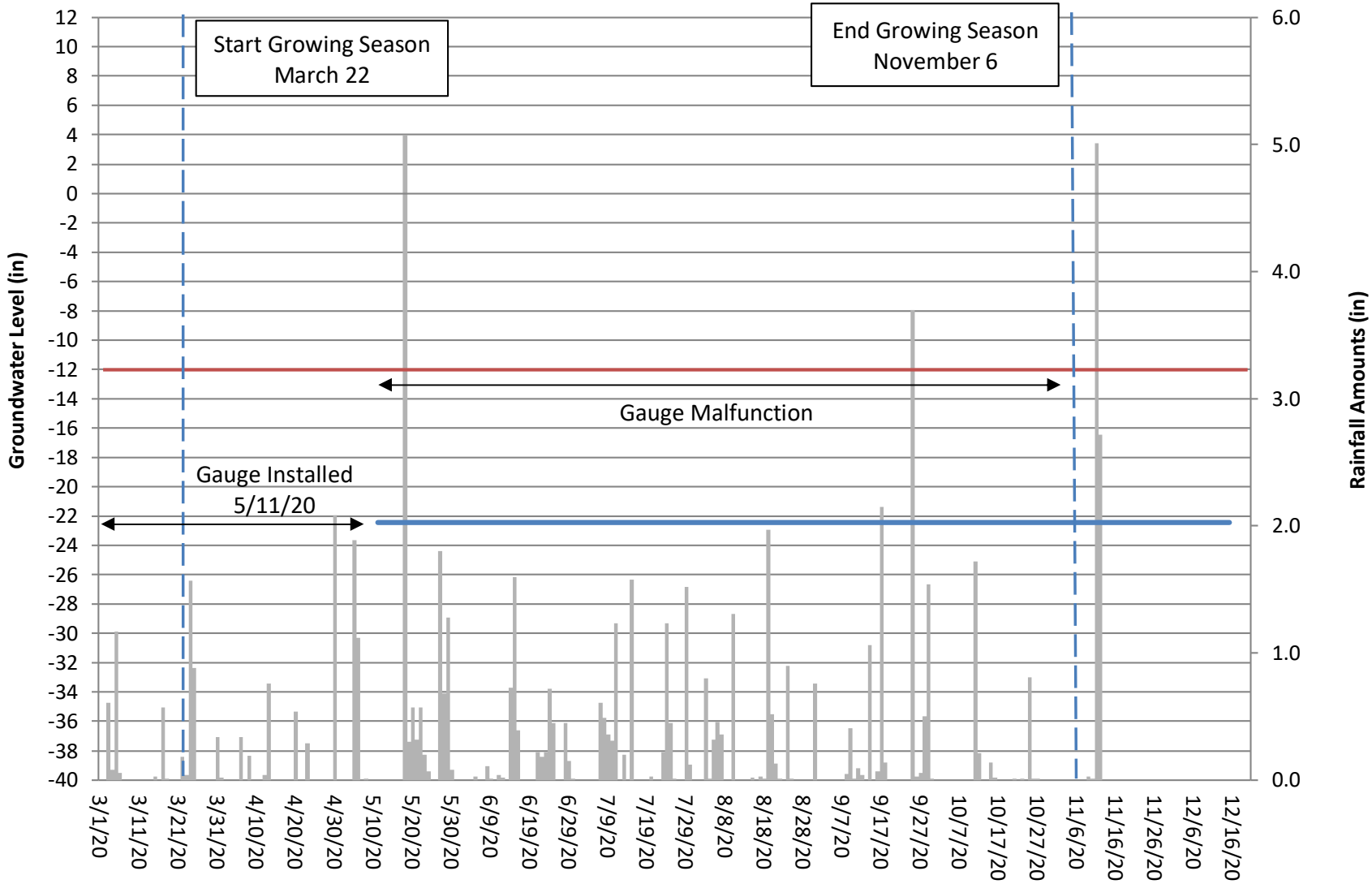


Swamp Grape Groundwater Gauge 4
Preconstruction (2020 Data)

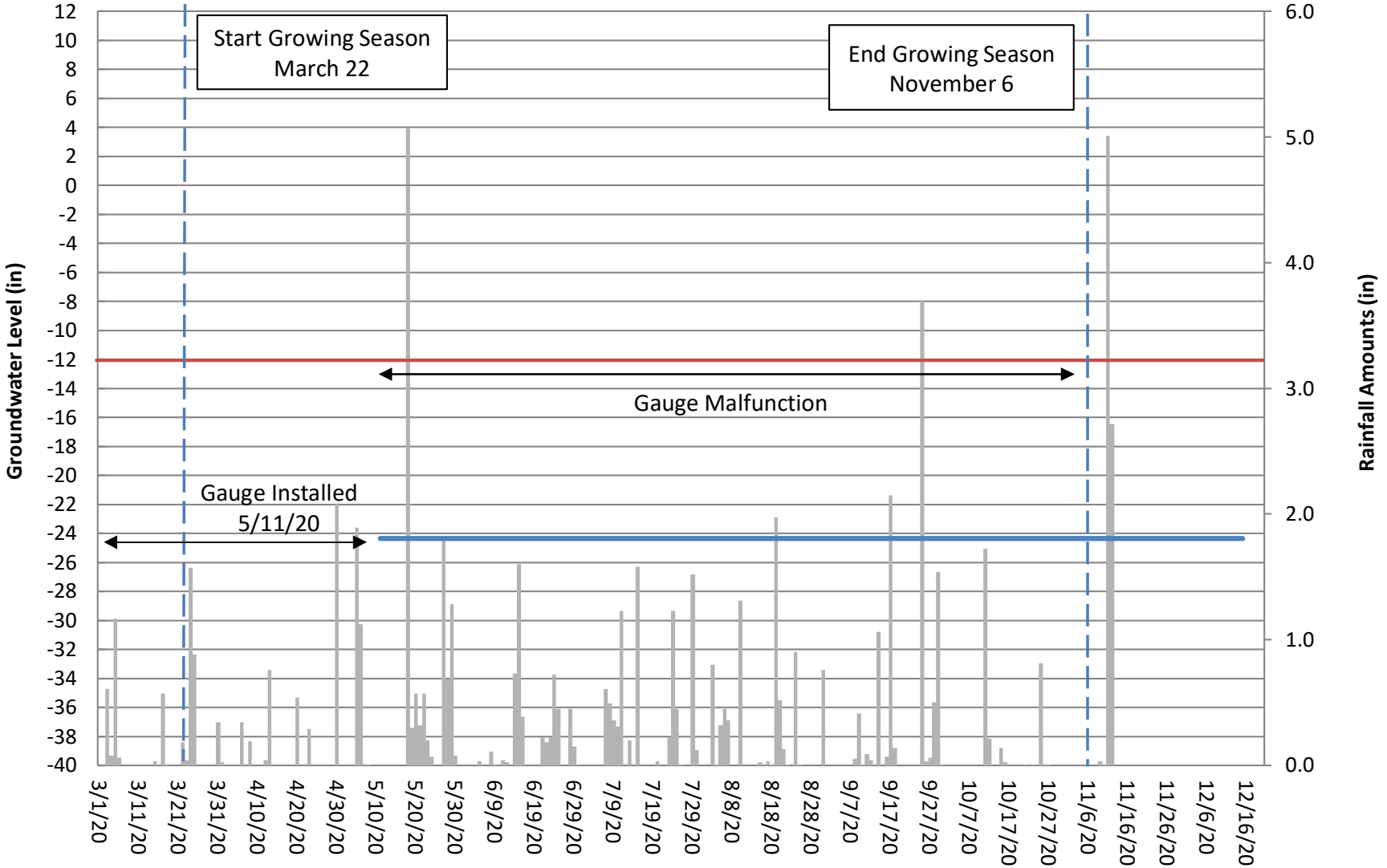


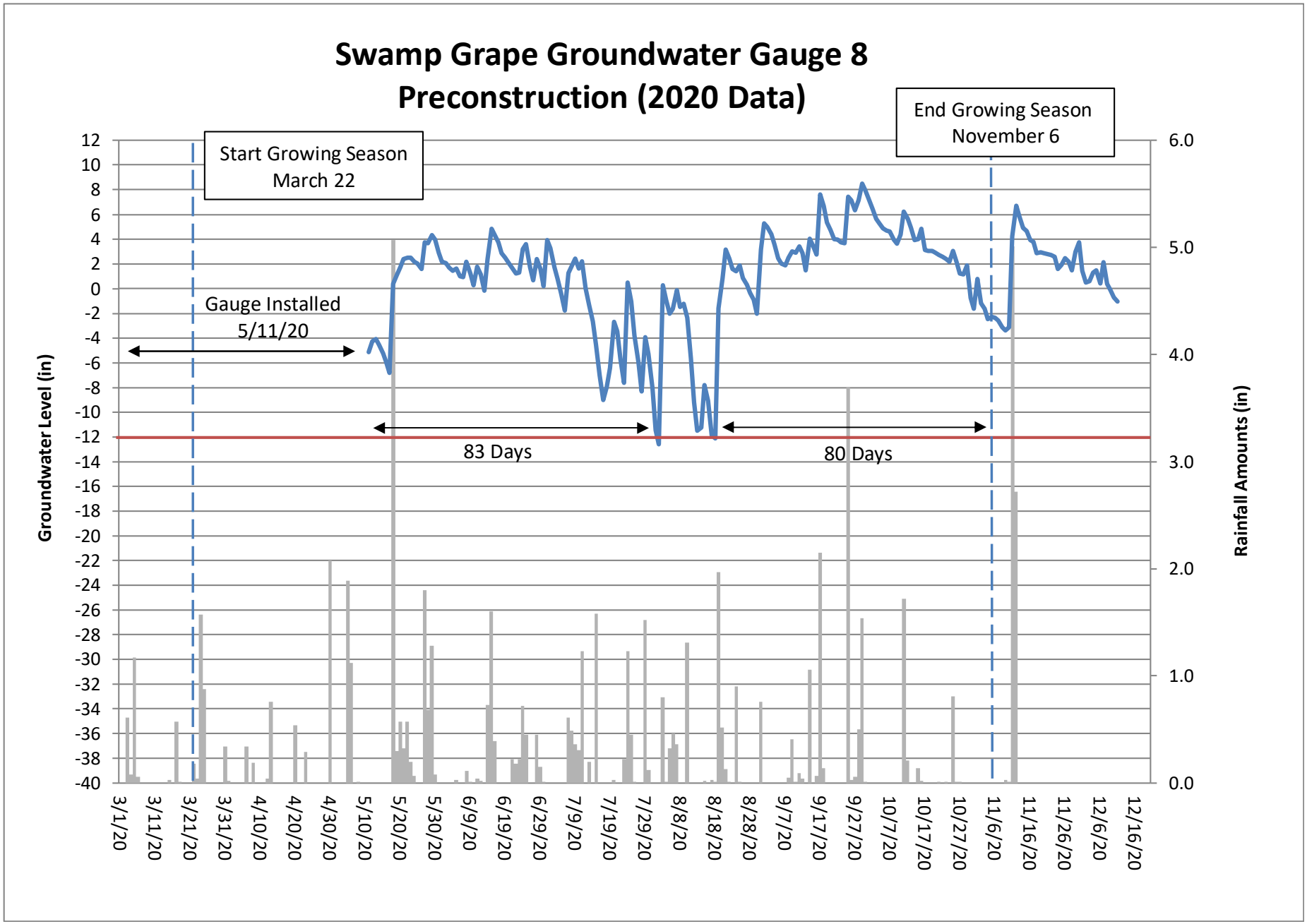

Swamp Grape Groundwater Gauge 5
Preconstruction (2020 Data)
Start Growing Season
March 22
End Growing Season
November 6
7 Days
7 Days
Gauge Installed
5/11/20
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/20
3/11/20
3/21/20
3/31/20
4/10/20
4/20/20
4/30/20
5/10/20
5/20/20
5/30/20
6/9/20
6/19/20
6/29/20
7/9/20
7/19/20
7/29/20
8/8/20
8/18/20
8/28/20
9/7/20
9/17/20
9/27/20
10/7/20
10/17/20
10/27/20
11/6/20
11/16/20
11/26/20
12/6/20
12/16/20

Swamp Grape Groundwater Gauge 6
Preconstruction (2020 Data)

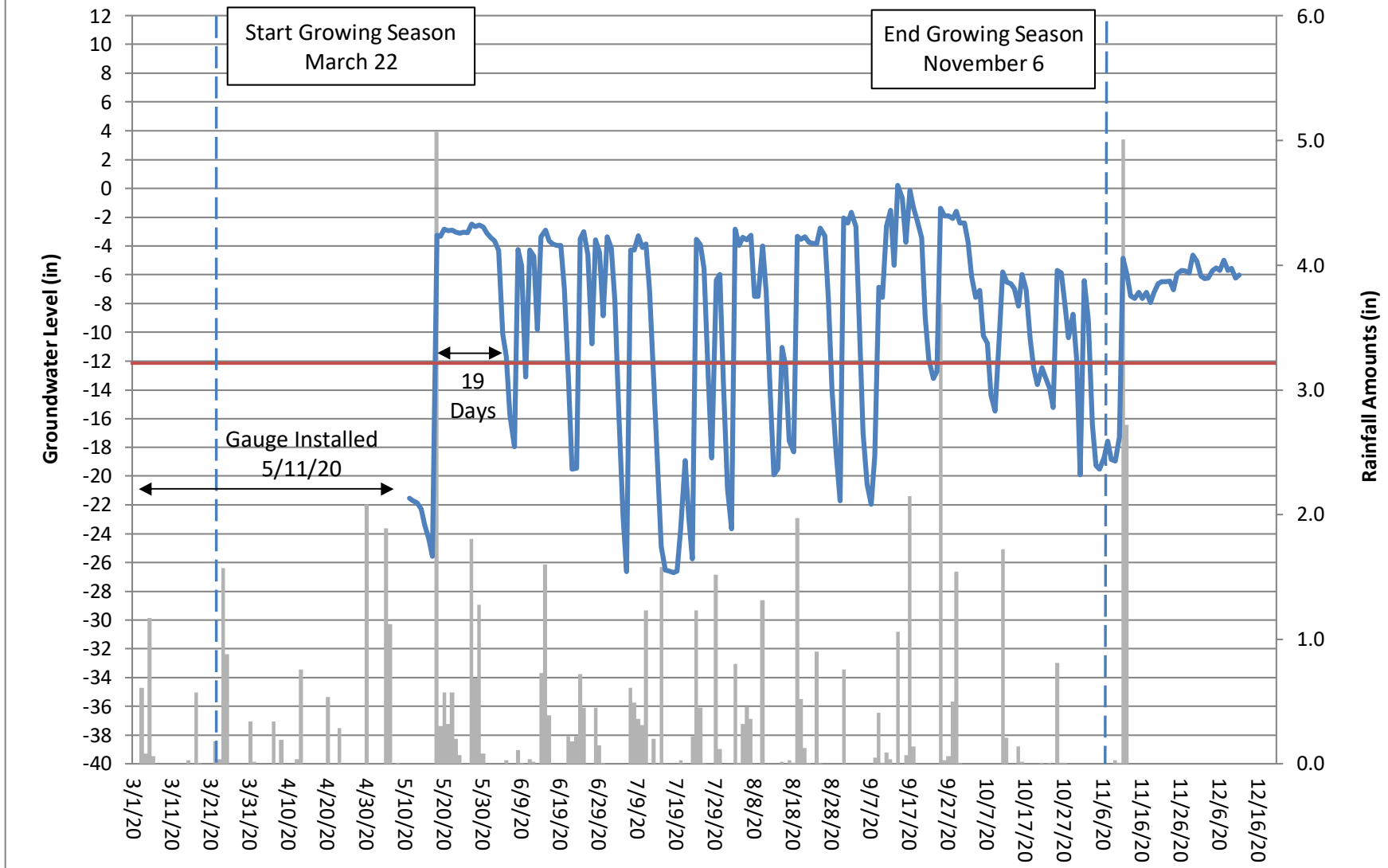


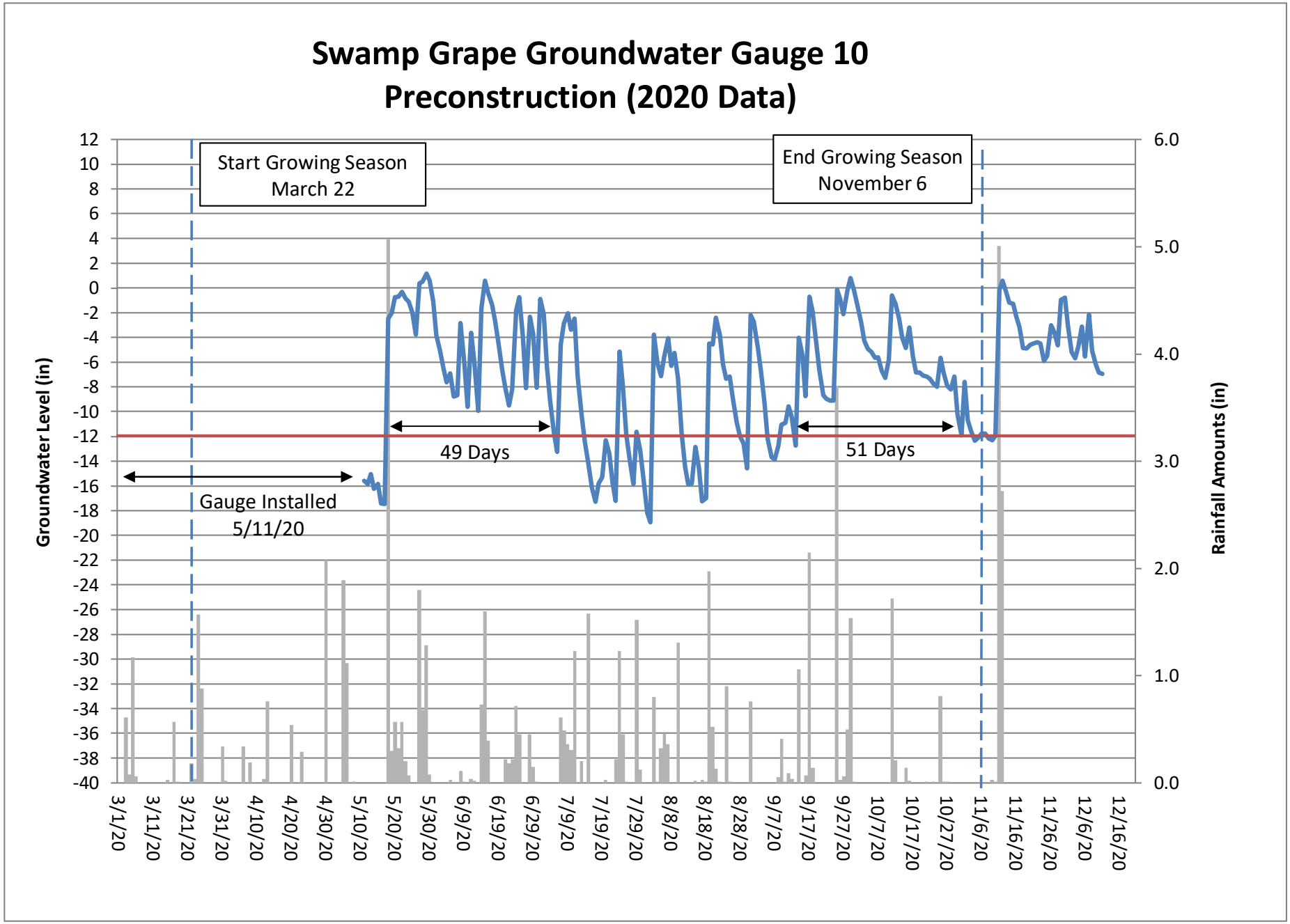
Swamp Grape Groundwater Gauge 7
Preconstruction (2020 Data)



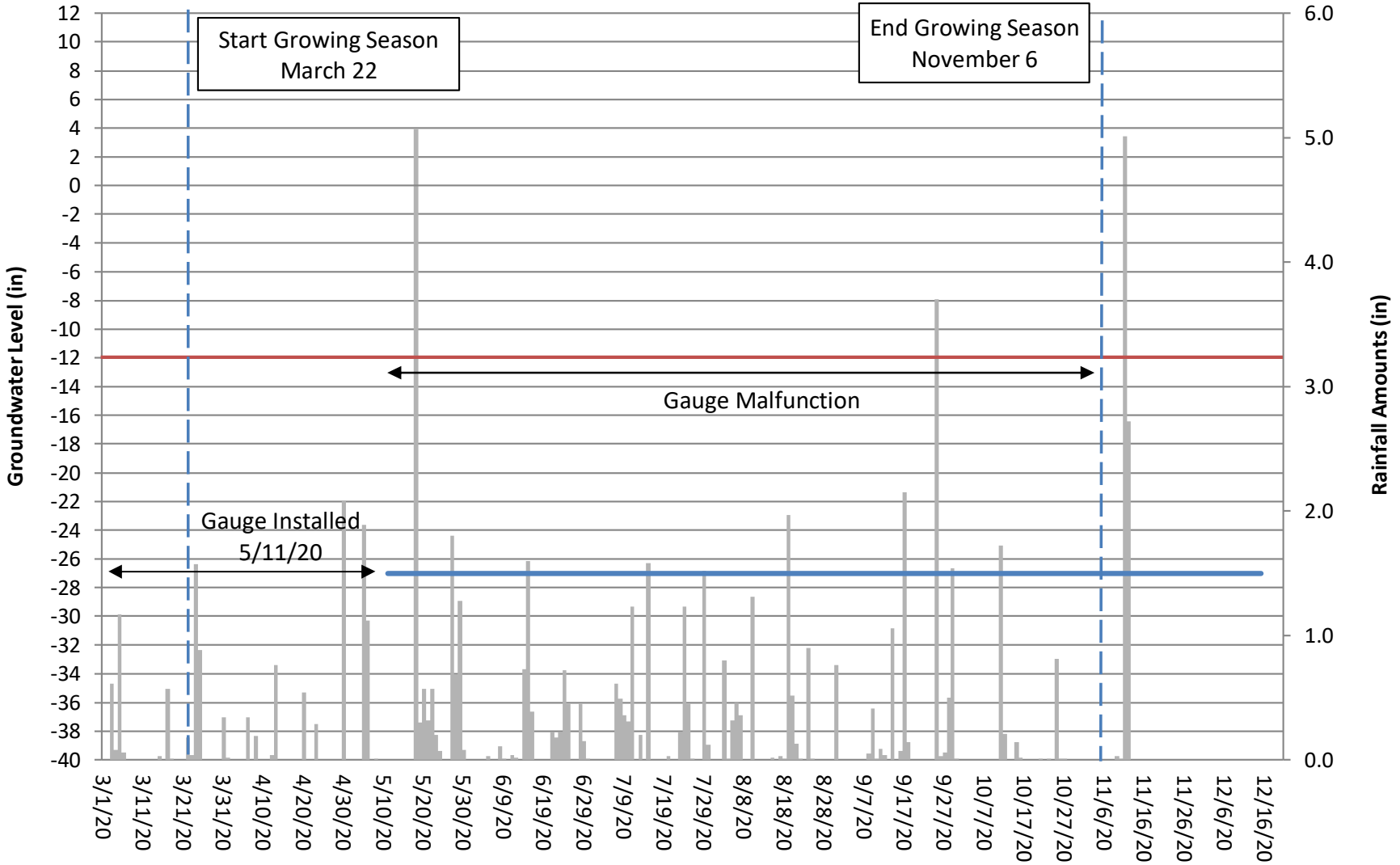

Swamp Grape Groundwater Gauge 8
Preconstruction (2020 Data)
Start Growing Season
March 22
End Growing Season
November 6
Gauge Installed
5/11/20
83 Days
80 Days
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/20
3/11/20
3/21/20
3/31/20
4/10/20
4/20/20
4/30/20
5/10/20
5/20/20
5/30/20
6/9/20
6/19/20
6/29/20
7/9/20
7/19/20
7/29/20
8/8/20
8/18/20
8/28/20
9/7/20
9/17/20
9/27/20
10/7/20
10/17/20
10/27/20
11/6/20
11/16/20
11/26/20
12/6/20
12/16/20

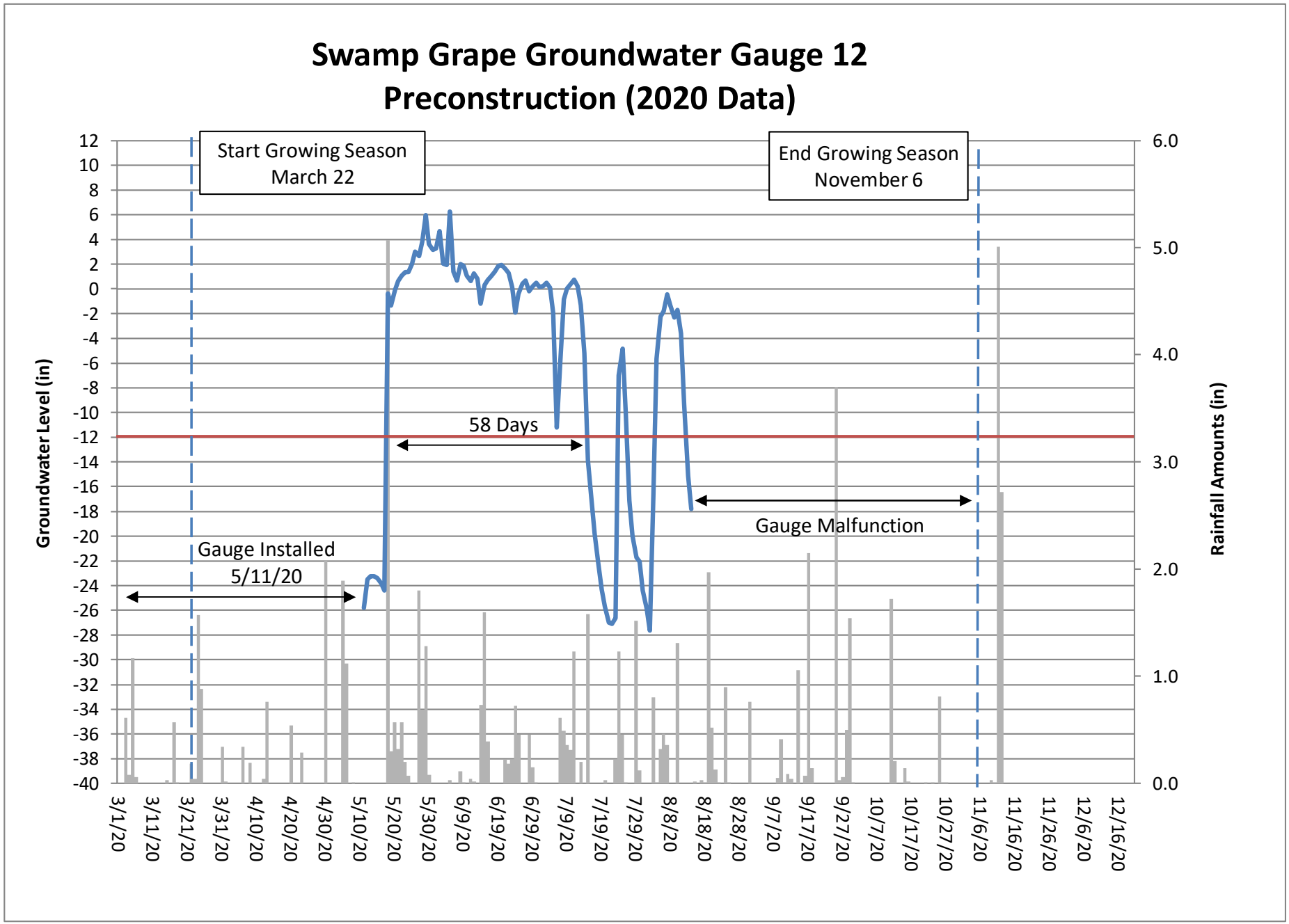
Swamp Grape Groundwater Gauge 9
Preconstruction (2020 Data)




Swamp Grape Groundwater Gauge 10
Preconstruction (2020 Data)
Start Growing Season
March 22
End Growing Season
November 6
49 Days
51 Days
Gauge Installed
5/11/20
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/20
3/11/20
3/21/20
3/31/20
4/10/20
4/20/20
4/30/20
5/10/20
5/20/20
5/30/20
6/9/20
6/19/20
6/29/20
7/9/20
7/19/20
7/29/20
8/8/20
8/18/20
8/28/20
9/7/20
9/17/20
9/27/20
10/7/20
10/17/20
10/27/20
11/6/20
11/16/20
11/26/20
12/6/20
12/16/20

Swamp Grape Groundwater Gauge 11
Preconstruction (2020 Data)



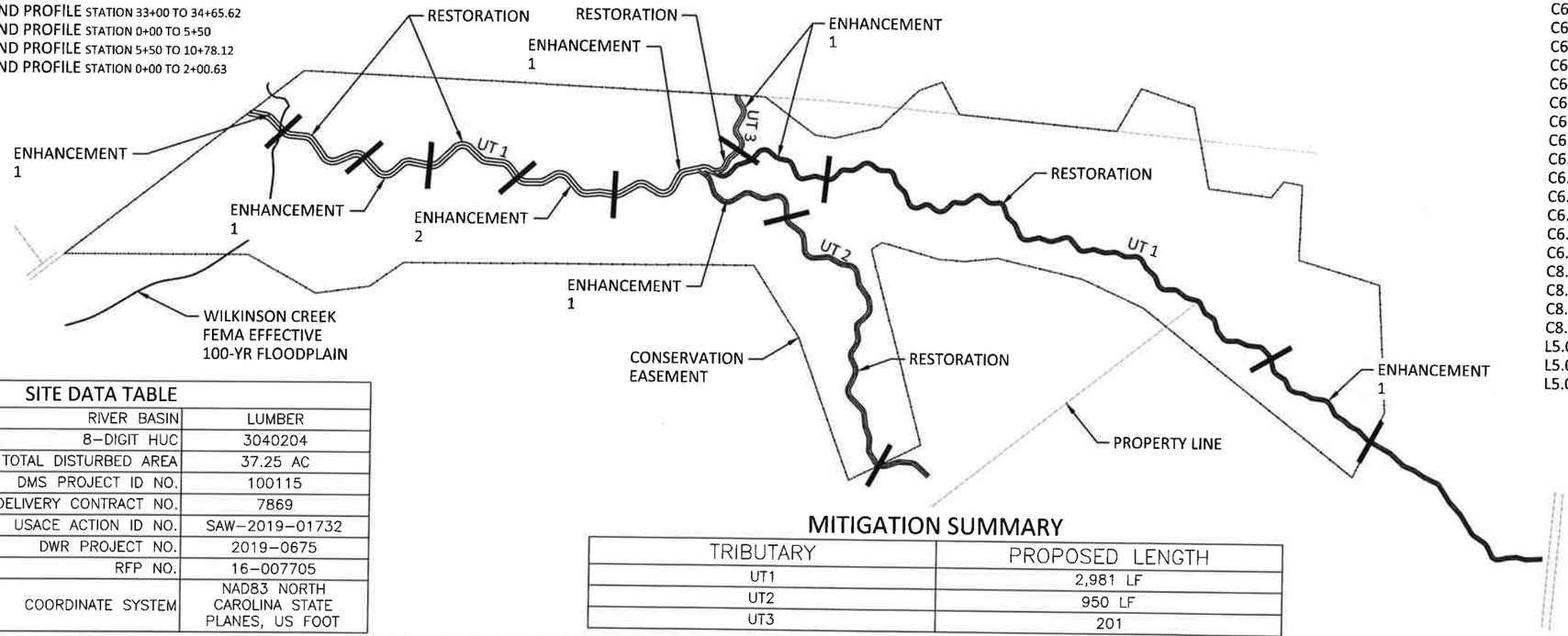

Swamp Grape Groundwater Gauge 12
Preconstruction (2020 Data)
Start Growing Season
March 22
End Growing Season
November 6
58 Days
Gauge Installed
5/11/20
Gauge Malfunction
Groundwater Level (in)
Rainfall Amounts (in)
12
10
8
6
4
2
0
-2
-4
-6
-8
-10
-12
-14
-16
-18
-20
-22
-24
-26
-28
-30
-32
-34
-36
-38
-40
6.0
5.0
4.0
3.0
2.0
1.0
0.0
3/1/20
3/11/20
3/21/20
3/31/20
4/10/20
4/20/20
4/30/20
5/10/20
5/20/20
5/30/20
6/9/20
6/19/20
6/29/20
7/9/20
7/19/20
7/29/20
8/8/20
8/18/20
8/28/20
9/7/20
9/17/20
9/27/20
10/7/20
10/17/20
10/27/20
11/6/20
11/16/20
11/26/20
12/6/20
12/16/20

APPENDIX M - CONSTRUCTION PLANS

NC DEPARTMENT OF ENVIRONMENTAL QUALITY
DIVISION OF MITIGATION SERVICES

CONSTRUCTION PLANS
SWAMP GRAPE SITE
ROBESON COUNTY
DATE: FEBRUARY 5,2021

SHEET INDEX

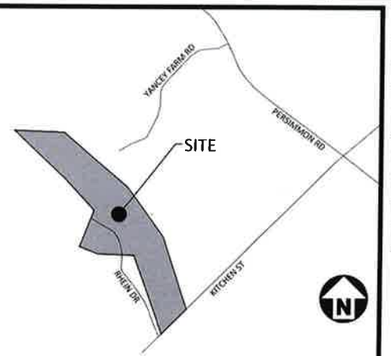


SITE DATA TABLE	
RIVER BASIN	LUMBER
8-DIGIT HUC	3040204
TOTAL DISTURBED AREA	37.25 AC
DMS PROJECT ID NO.	100115
FULL DELIVERY CONTRACT NO.	7869
USACE ACTION ID NO.	SAW-2019-01732
DWR PROJECT NO.	2019-0675
RFP NO.	16-007705
COORDINATE SYSTEM	NAD83 NORTH CAROLINA STATE PLANES, US FOOT

MITIGATION SUMMARY

TRIBUTARY	PROPOSED LENGTH
UT1	2,981 LF
UT2	950 LF
UT3	201

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 2000'

RESTORATION LEVEL	STREAM (LF)	RIPARIAN WETLAND (AC)	NON-RIPARIAN WETLAND (AC)
RESTORATION	2,403	–	–
ENHANCEMENT I	1,495	–	–
ENHANCEMENT II	235	–	–
REESTABLISHMENT	–	4.470	–
REHABILITATION	–	2.671	–
ENHANCEMENT	–	12.245	–
CREATION	–	0.997	
TOTALS	4,133	20.383	–
MITIGATION UNITS	3228.8330	12.7060	–

MCADAMS
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

AXIOM ENVIRONMENTAL, INC.
218 SNOW AVENUE
RALEIGH, NC 27603
CONTACT: GRANT LEWIS
PHONE: 919. 215. 1693

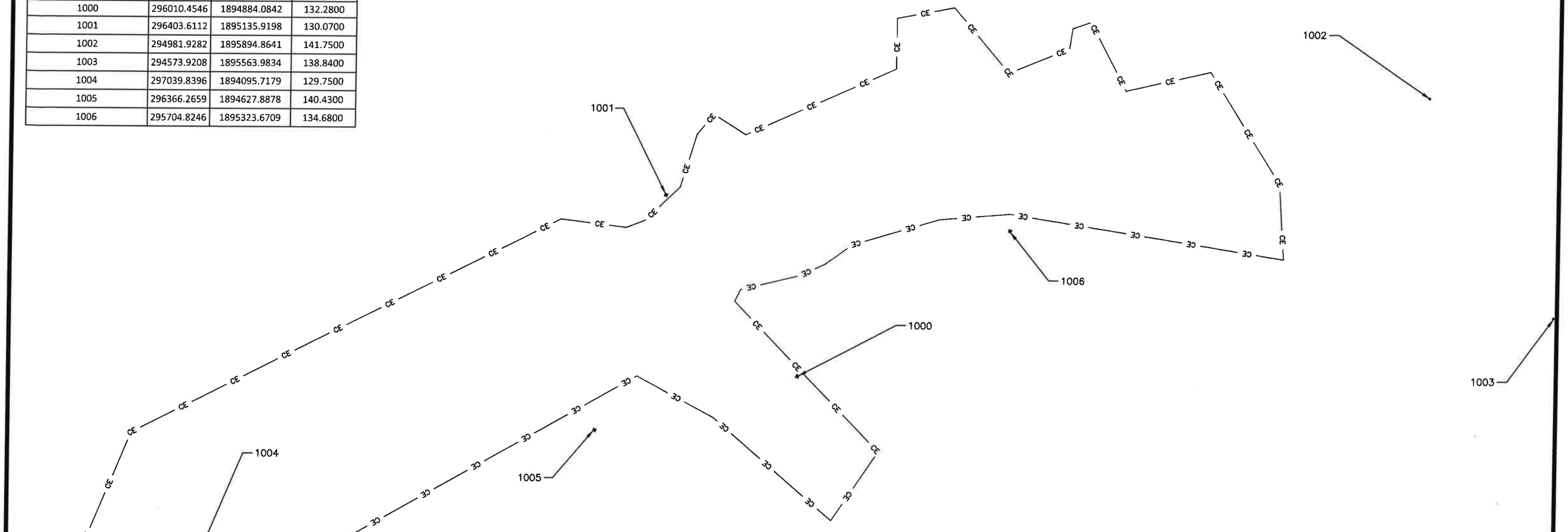
Axiom Environmental, Inc.

CLIENT
RESTORATION SYSTEMS, LLC
1101 HAYNES ST, SUITE 211
RALEIGH, NC 27604
CONTACT: WORTH CREECH
PHONE: 919. 389. 3888

RESTORATION SYSTEMS LLC

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
2-5-21

CONTROL POINT LOCATIONS			
CONTROL POINT	NORTHING	EASTING	ELEVATION
1000	296010.4546	1894884.0842	132.2800
1001	296403.6112	1895135.9198	130.0700
1002	294981.9282	1895894.8641	141.7500
1003	294573.9208	1895563.9834	138.8400
1004	297039.8396	1894095.7179	129.7500
1005	296366.2659	1894627.8878	140.4300
1006	295704.8246	1895323.6709	134.6800



GENERAL NOTES:

1. EXISTING CONDITIONS COMPLETED BY THE JOHN R. MCADAMS COMPANY.
2. COORDINATE SYSTEM: NAD83 NORTH CAROLINA STATE PLANES, US FOOT
3. TOPOGRAPHY AND SPOT ELEVATIONS SHOWN ARE FROM AN ACTUAL FIELD SURVEY COMPLETED BY K2 DESIGN GROUP.
4. PLANIMETRICS, UTILITIES, INVERTS AND BUILDING INFORMATION (SHOWN FOR REFERENCE) WAS COMPLIED FROM AUTOCAD FILES PROVIDED TO MCADAMS FROM OTHERS. MCADAMS MAKES NO WARRANTY ABOUT THE ACCURACY OF THE INFORMATION SHOWN PROVIDED BY OTHERS.
5. PRIOR TO CONSTRUCTION, THE SITE CONTRACTOR SHALL FIELD VERIFY ALL SUBSURFACE INFORMATION IN THE PROJECT AREA TO ENSURE ITS ACCURACY AND DETERMINE ITS ACTUAL FIELD LOCATION.
6. FLOOD NOTE: A PORTION OF THE EASEMENT IS LOCATED IN A SPECIAL FLOOD HAZARD ZONE. IT IS LOCATED IN ZONE "AE" AS DEFINED BY F.E.M.A F.I.R.M COMMUNITY PANEL #3710828800J DATED JANUARY 19, 2005.

GRAPHIC SCALE
0 100 200 400
1 inch = 200 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-ESMT
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1" = 200'
DATE	02.05.2021

CONSERVATION EASEMENT AND CONTROL POINTS EXHIBIT

C1.00

LEGEND AND SYMBOLS

- LD — LD — LIMITS OF DISTURBANCE
- X — X — X — X — PROPOSED FENCE
- EXISTING FLOODPLAIN
- EXISTING PROPERTY LINE
- DEMOLITION LINE
- CE — CE — PROPOSED CONSERVATION EASEMENT
- PROPOSED ACCESS EASEMENT
- SD — SD — EXISTING STORM DRAINAGE
- OU — OU — EXISTING OVERHEAD ELECTRIC
- OU — OU — EXISTING OVERHEAD ELECTRIC TO BE RELOCATED
- OU — OU — PROPOSED OVERHEAD ELECTRIC
- EXISTING STREAM CENTERLINE
- PROPOSED STREAM CENTERLINE
- PROPOSED TOP OF BANK
- 250 MAJOR CONTOUR
- 252 MINOR CONTOUR
- 250 EXISTING MAJOR CONTOUR
- 252 EXISTING MINOR CONTOUR
- PROPOSED LOG CROSS VANE
- PROPOSED LOG VANE
- WETLAND REHABILITATION AREA
- APPROVED JD WETLANDS
- HYDRIC SOILS
- WETLAND CREATION AREA
- DEPOSITED SEDIMENT

EROSION CONTROL LEGEND

- SILT FENCE OUTLET
- IMPERVIOUS DIKE
- P-14 PUMP AROUND PUMP
- SF — SF — SF — SILT FENCE
- STAGING/STOCKPILE AREA
- EROSION CONTROL BLANKET
- HAUL ROAD
- CHANNEL PLUG
- CONSTRUCTION ENTRANCE/EXIT

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

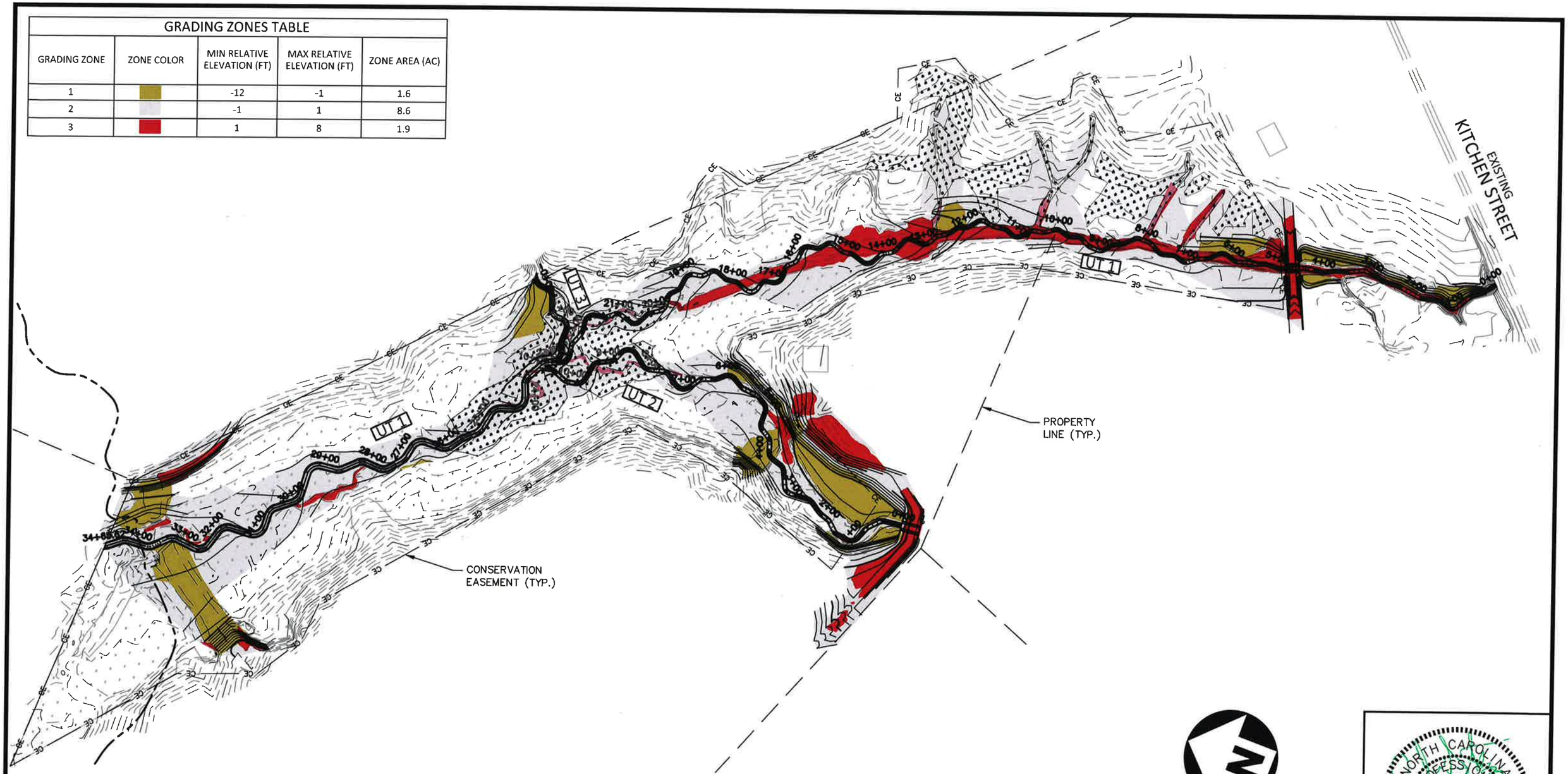
PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-S1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

SITE PLAN
LEGEND AND SYMBOLS

C2.00

GRADING ZONES TABLE				
GRADING ZONE	ZONE COLOR	MIN RELATIVE ELEVATION (FT)	MAX RELATIVE ELEVATION (FT)	ZONE AREA (AC)
1		-12	-1	1.6
2		-1	1	8.6
3		1	8	1.9



GRAPHIC SCALE
0 100 200 400
1 inch = 200 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

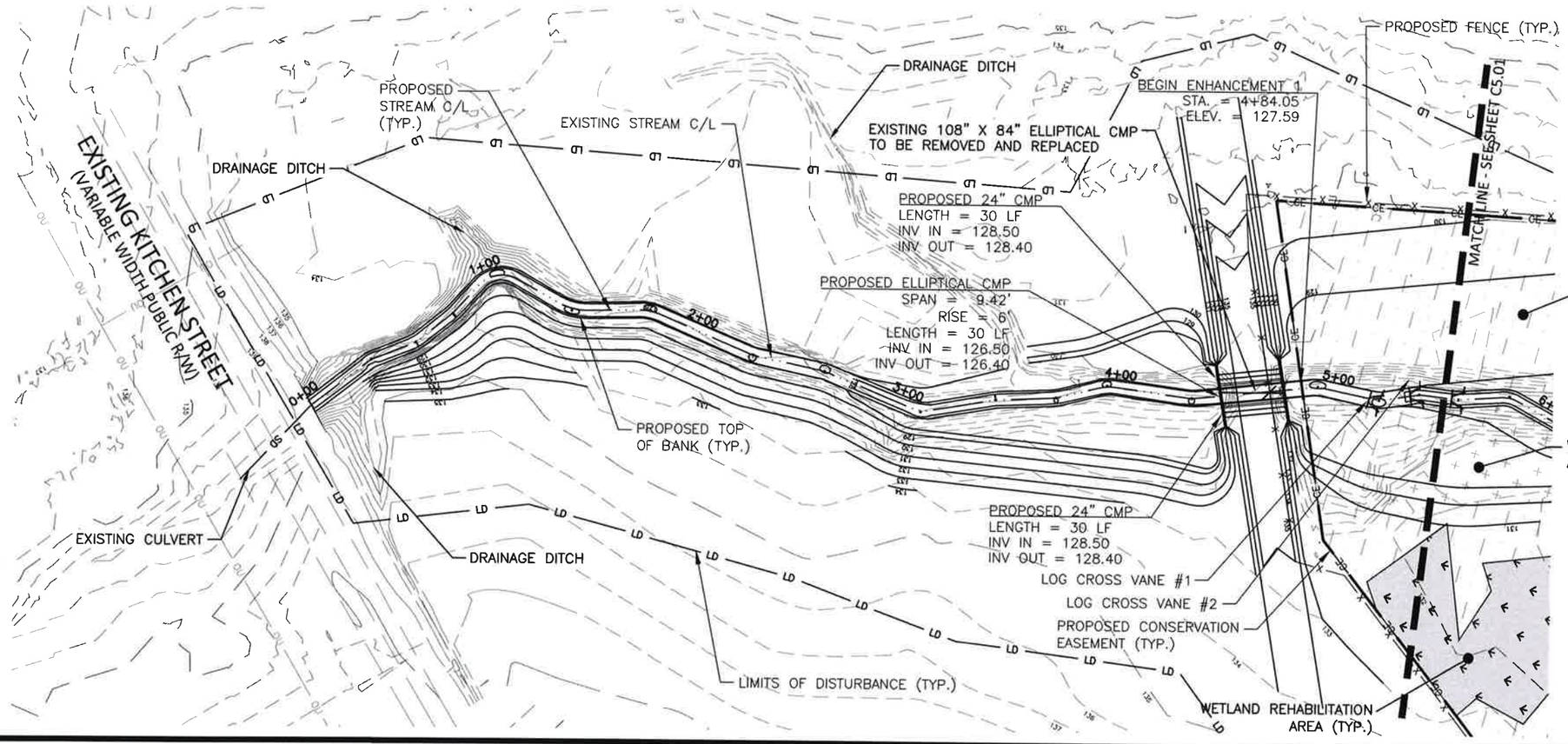
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-G1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1" = 200'
DATE	02.05.2021

GRADING PLAN

C3.00



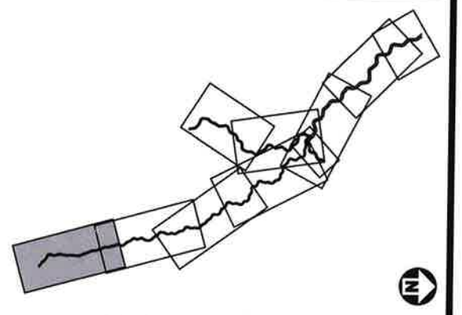
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #1	517.57	127.52
LOG CROSS VANE #2	536.69	127.49

GRAPHIC SCALE

0 30 60 120

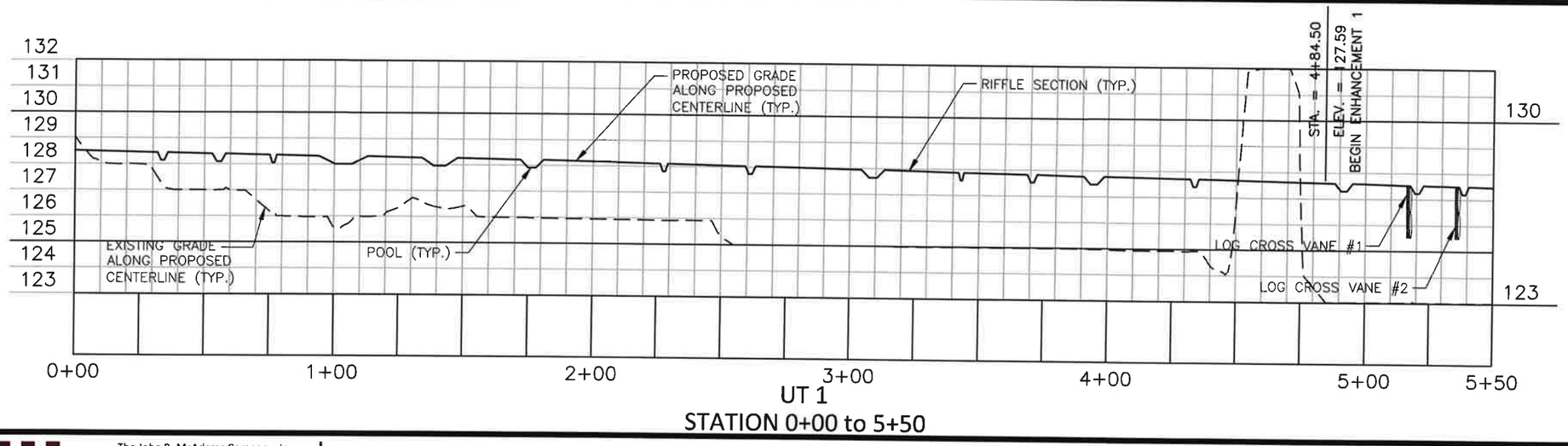
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'



UT 1

STATION 0+00 to 5+50

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

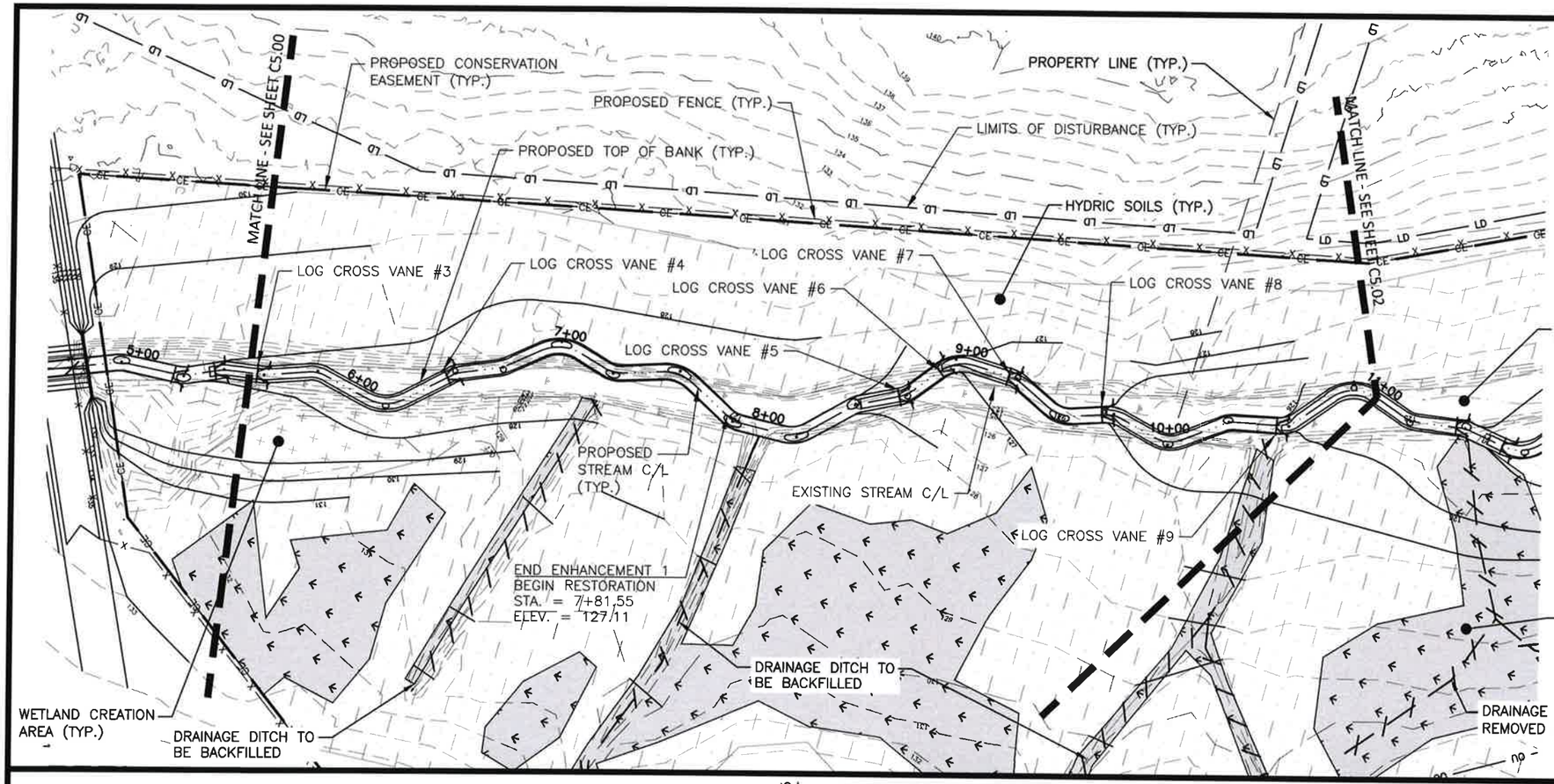
PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE

UNNAMED TRIBUTARY 1

STA. 00+00 THRU STA. 5+50

C5.00



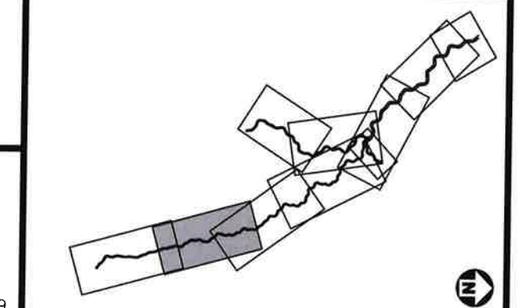
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #3	555.38	127.46
LOG CROSS VANE #4	646.29	127.31
LOG CROSS VANE #5	864.76	126.93
LOG CROSS VANE #6	885.93	126.67
LOG CROSS VANE #7	919.44	126.41
LOG CROSS VANE #8	968.04	126.08
LOG CROSS VANE #9	1050.77	125.65

GRAPHIC SCALE

0 30 60 120

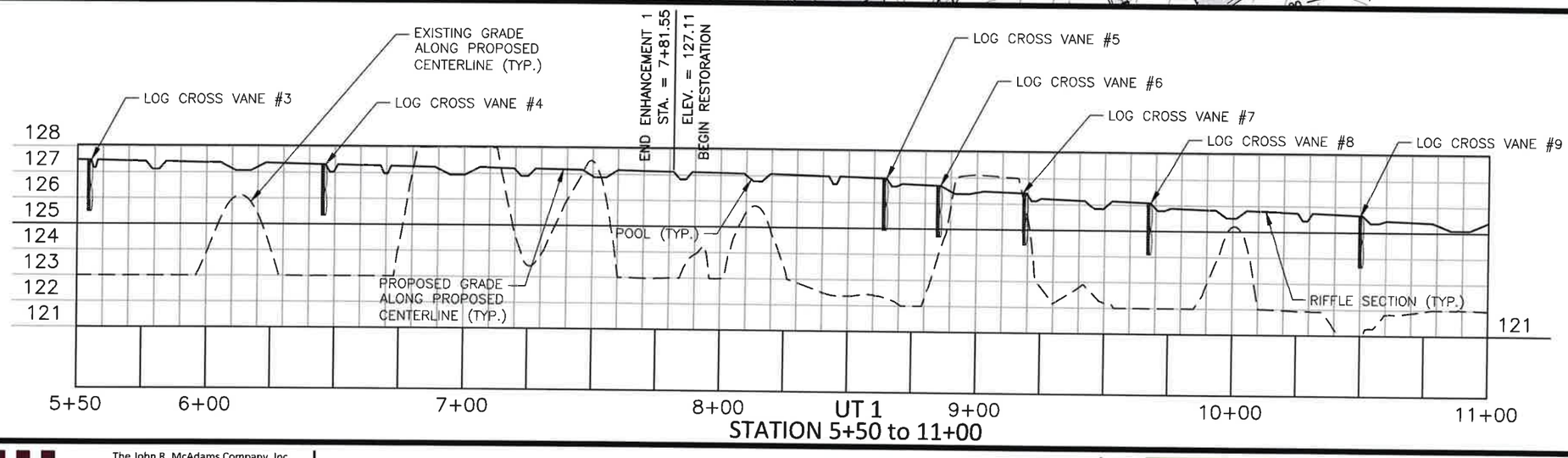
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'



NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

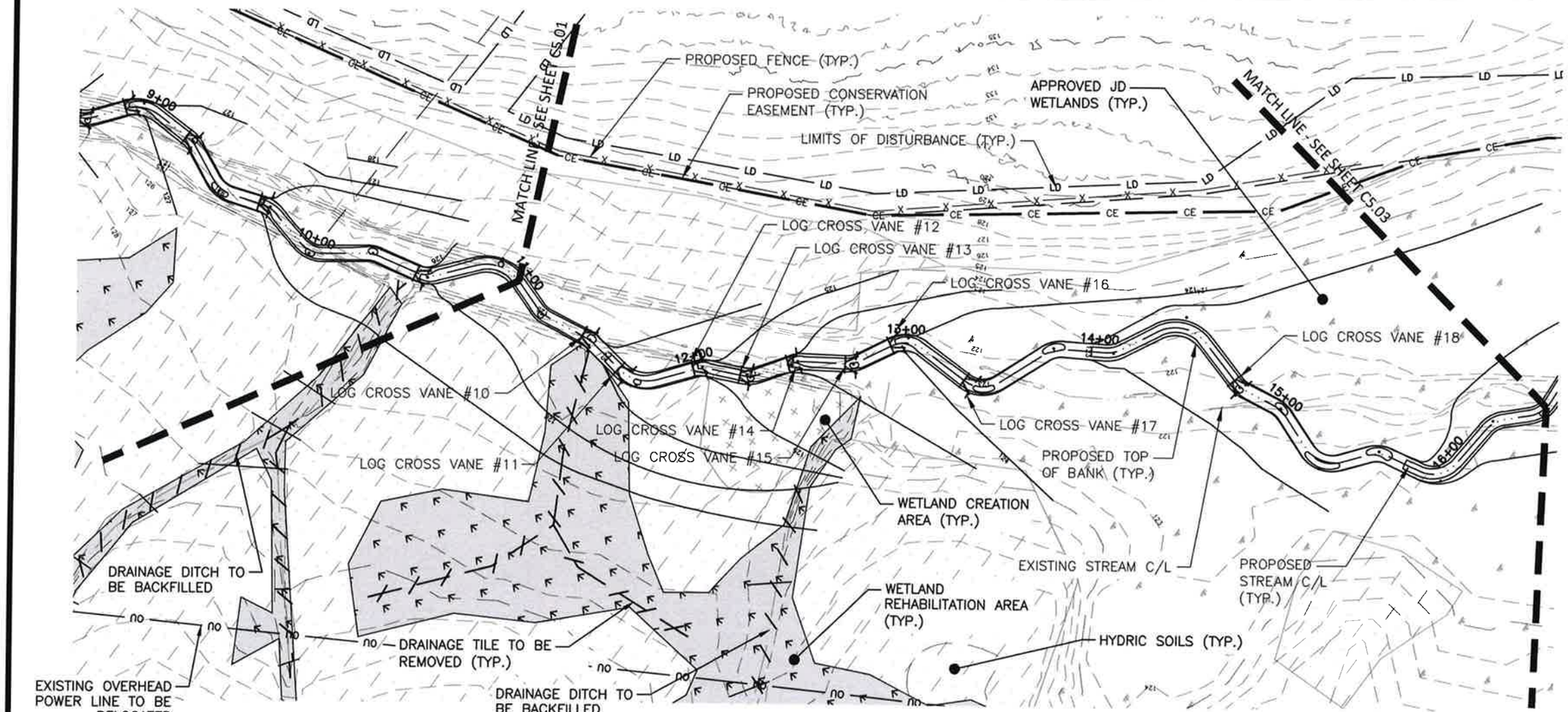
PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

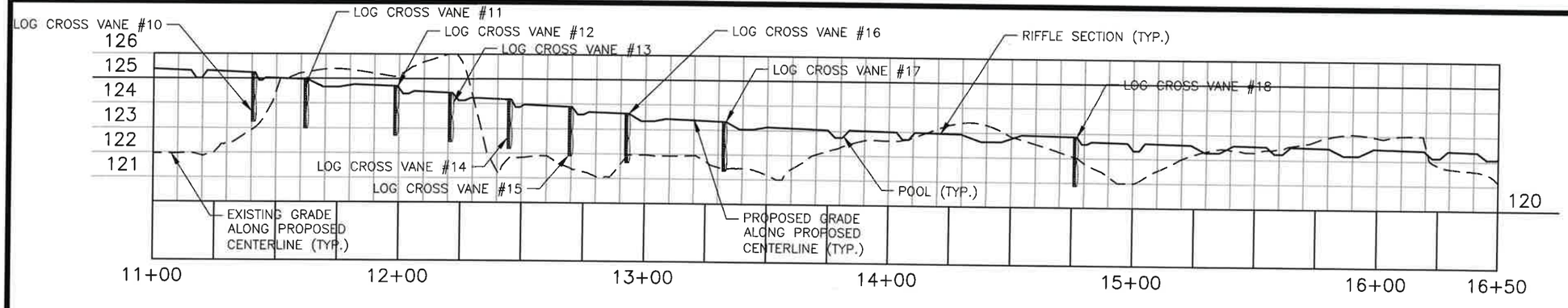
PLAN AND PROFILE

UNNAMED TRIBUTARY 1

STA. 5+50 THRU STA. 11+00

C5.01



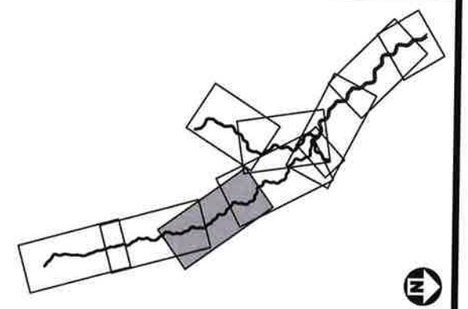


UT 1
STATION 11+00 to 16+50

UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #10	1141.33	125.24
LOG CROSS VANE #11	1162.66	124.97
LOG CROSS VANE #12	1199.25	124.70
LOG CROSS VANE #13	1221.52	124.44
LOG CROSS VANE #14	1245.46	124.17
LOG CROSS VANE #15	1270.22	123.89
LOG CROSS VANE #16	1293.33	123.63
LOG CROSS VANE #17	1333.11	123.33
LOG CROSS VANE #18	1476.93	122.86

GRAPHIC SCALE
0 30 60 120
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
2.5.21

McAdams
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187
www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN
CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

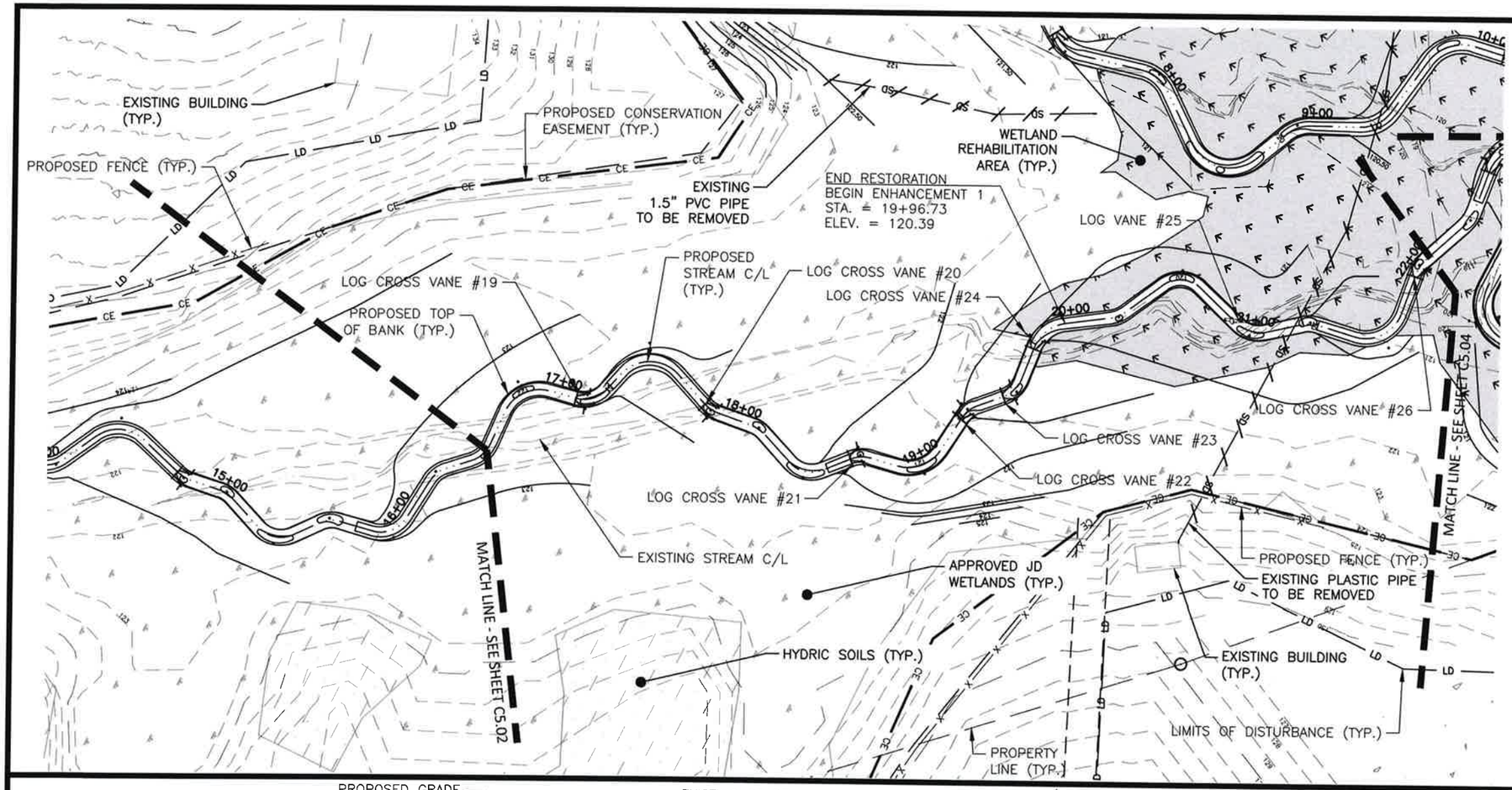
RS RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE
UNNAMED TRIBUTARY 1
STA. 11+00 THRU STA. 16+50

C5.02



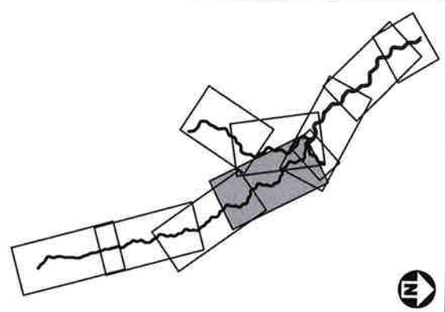
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #19	1707.55	122.21
LOG CROSS VANE #20	1782.48	121.87
LOG CROSS VANE #21	1863.09	121.45
LOG CROSS VANE #22	1927.01	121.10
LOG CROSS VANE #23	1949.55	120.85
LOG CROSS VANE #24	1977.40	120.59
LOG VANE #25	2091.69	120.09
LOG CROSS VANE #26	2196.63	119.82

GRAPHIC SCALE

0 30 60 120

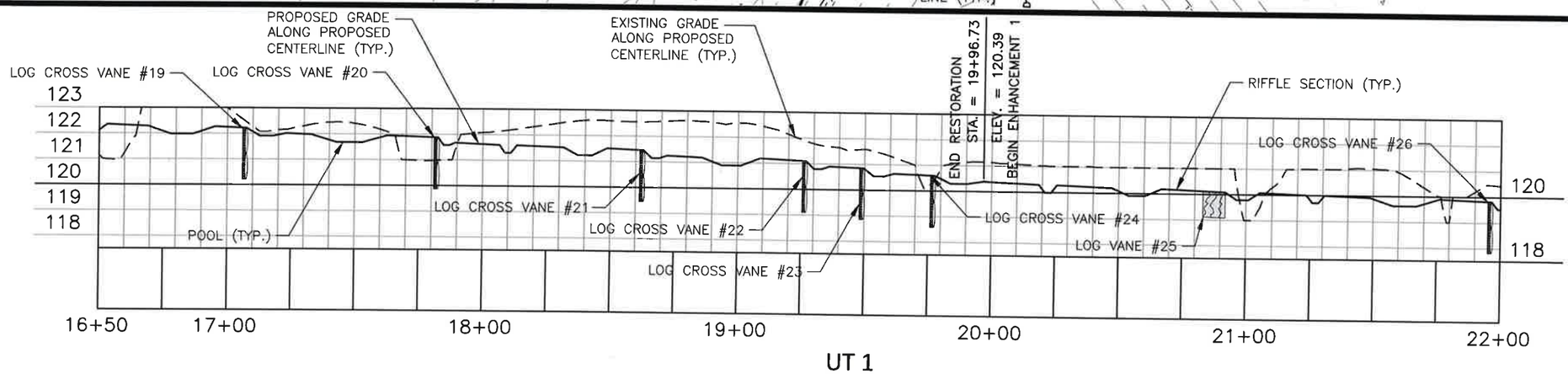
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'



UT 1

STATION 16+50 to 22+00

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

2.5.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

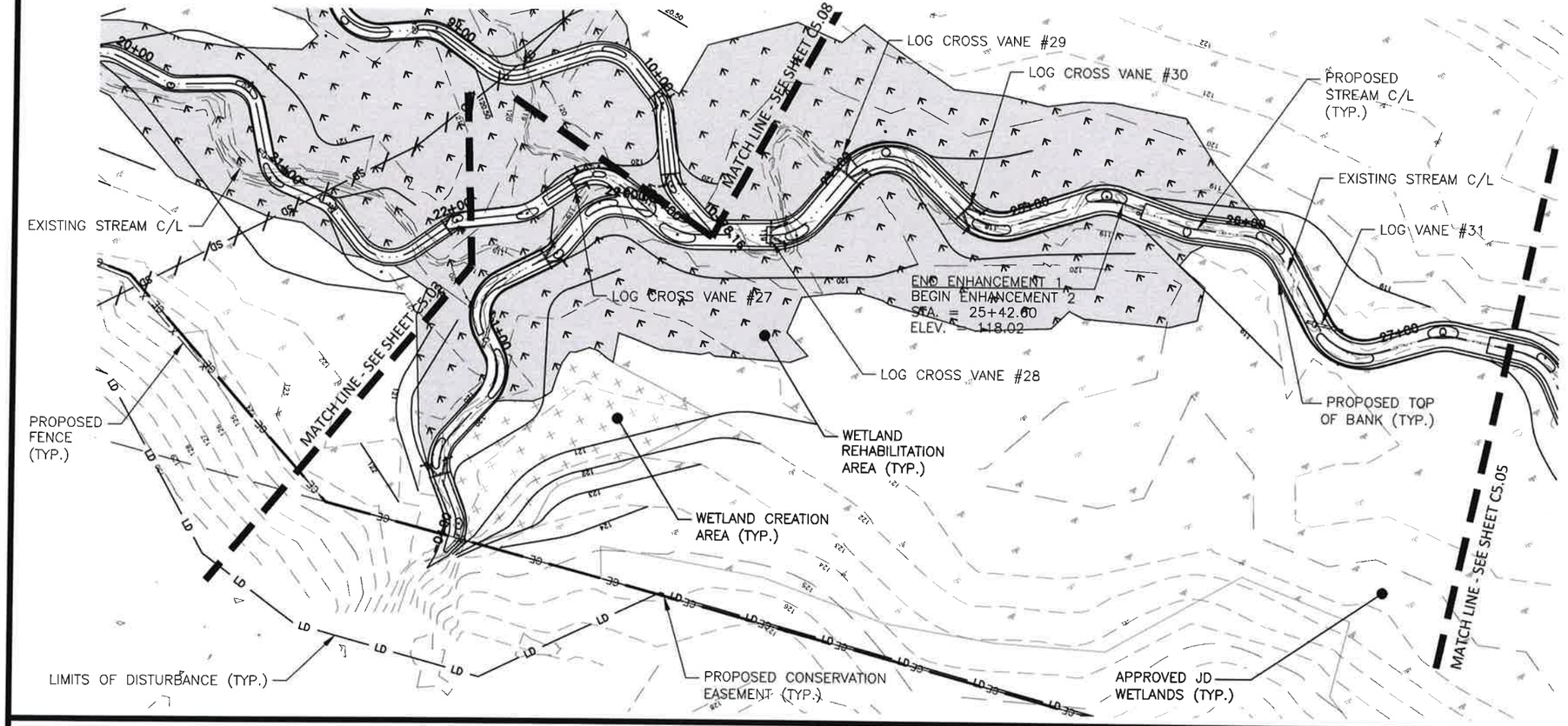
PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE

UNNAMED TRIBUTARY 1

STA. 16+50 THRU STA. 22+00

C5.03



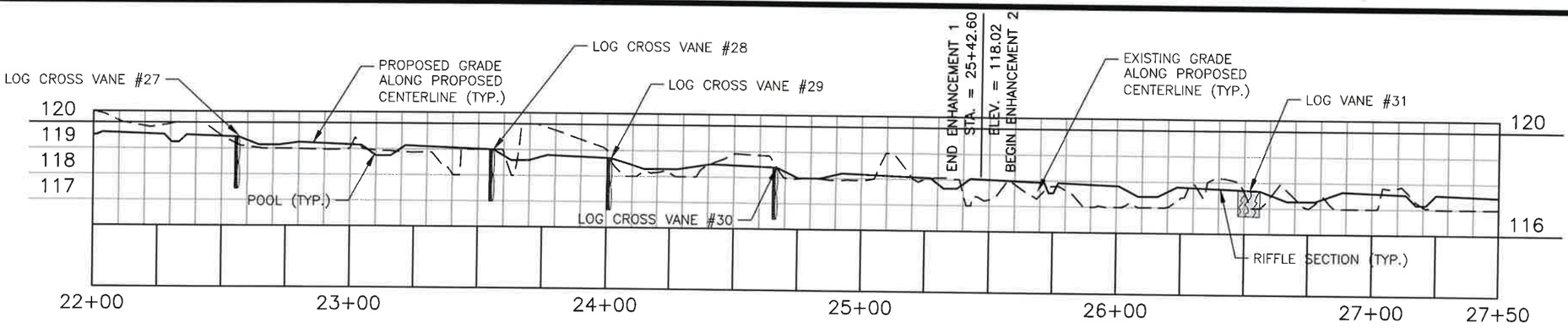
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #27	2256.47	119.44
LOG CROSS VANE #28	2355.79	118.99
LOG CROSS VANE #29	2401.50	118.69
LOG CROSS VANE #30	2466.42	118.39
LOG VANE #31	2656.04	117.67

GRAPHIC SCALE

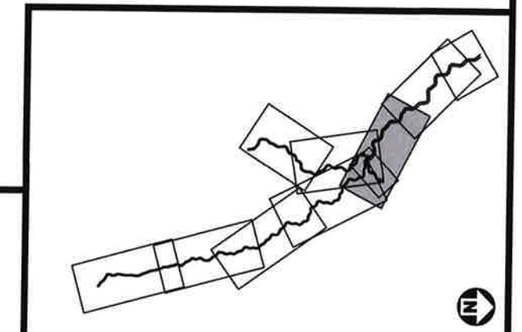
0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



UT 1
STATION 22+00 to 27+50



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

MCADAMS
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

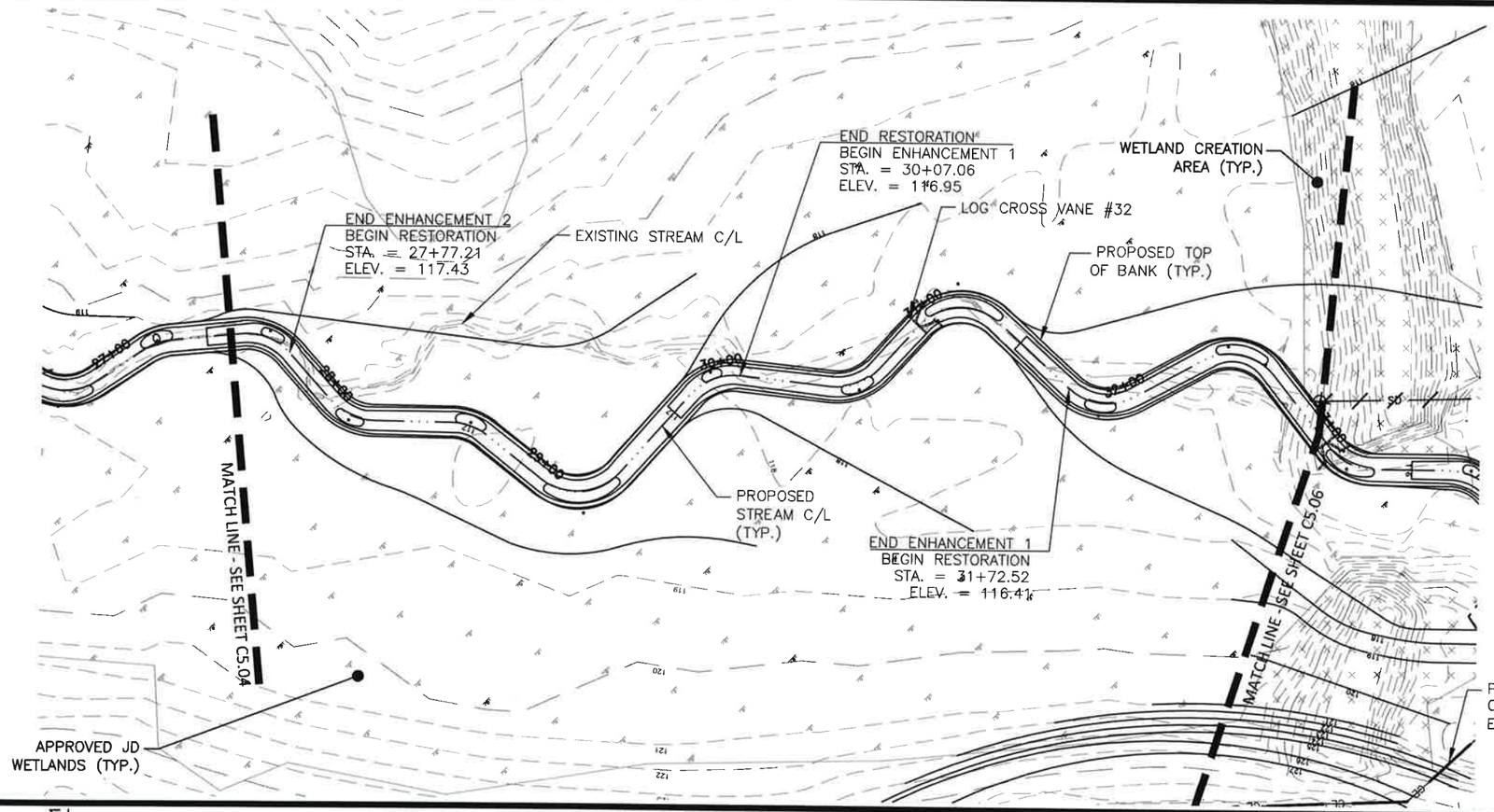
RESTORATION SYSTEMS LLC

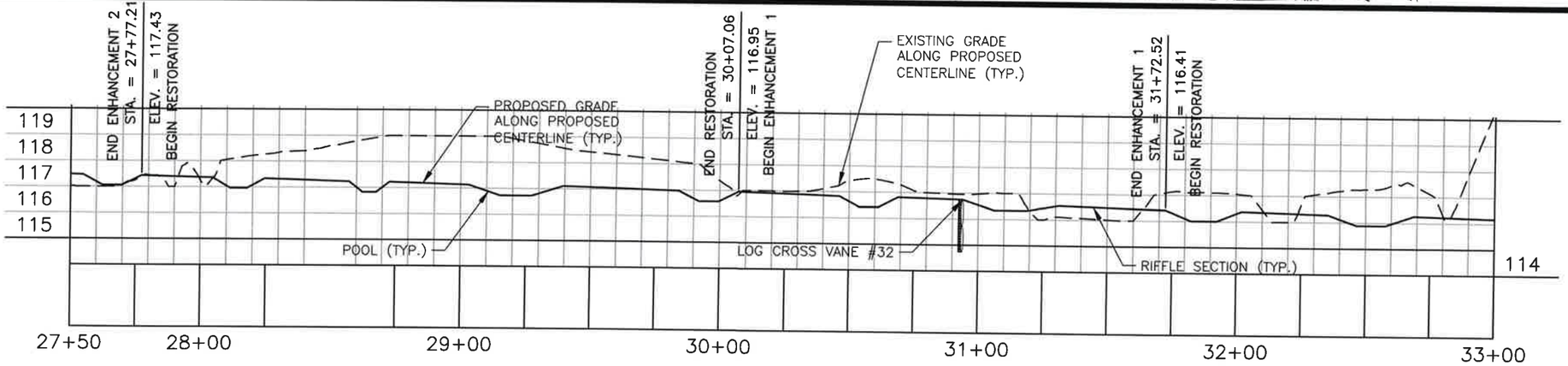
Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE
UNNAMED TRIBUTARY 1
STA. 22+00 THRU STA. 27+50

C5.04



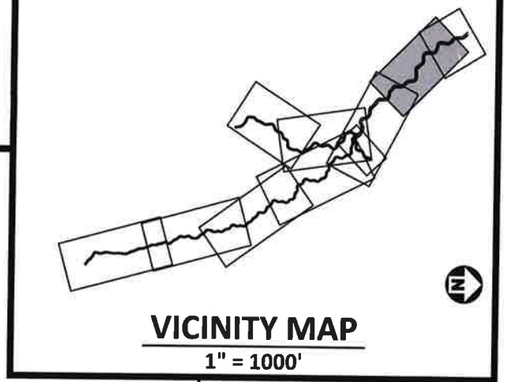


UT 1
STATION 27+50 to 33+00

UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #32	3093.77	116.74

GRAPHIC SCALE
0 30 60 120
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

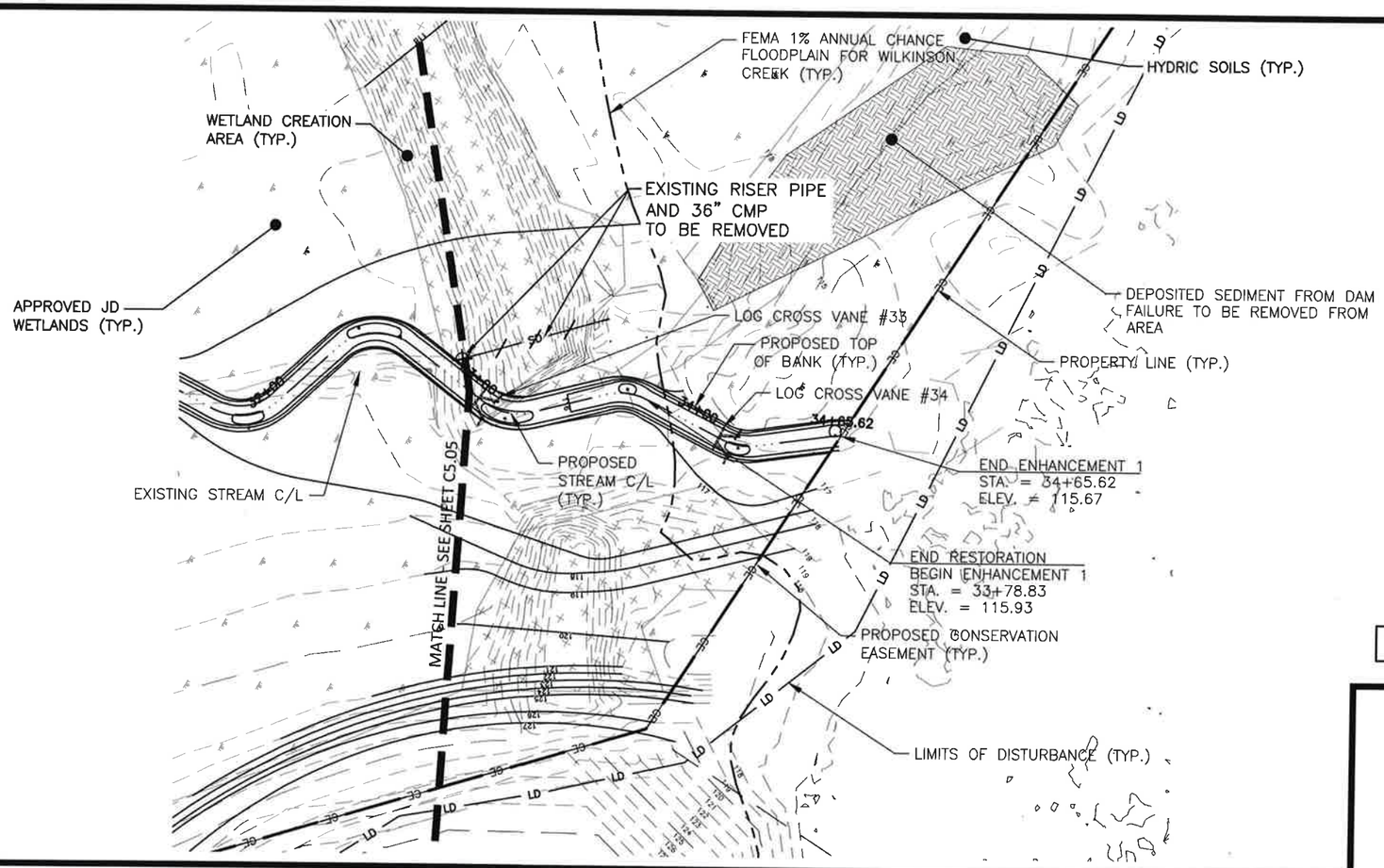
RESTORATION SYSTEMS | LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE
UNNAMED TRIBUTARY 1
STA. 27+50 THRU STA. 33+00

C5.05



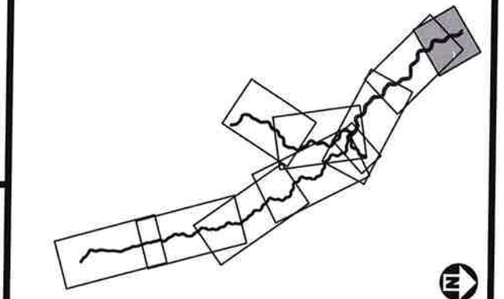
UT1 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #33	3307.63	116.15
LOG CROSS VANE #34	3414.91	115.83

GRAPHIC SCALE

0 30 60 120

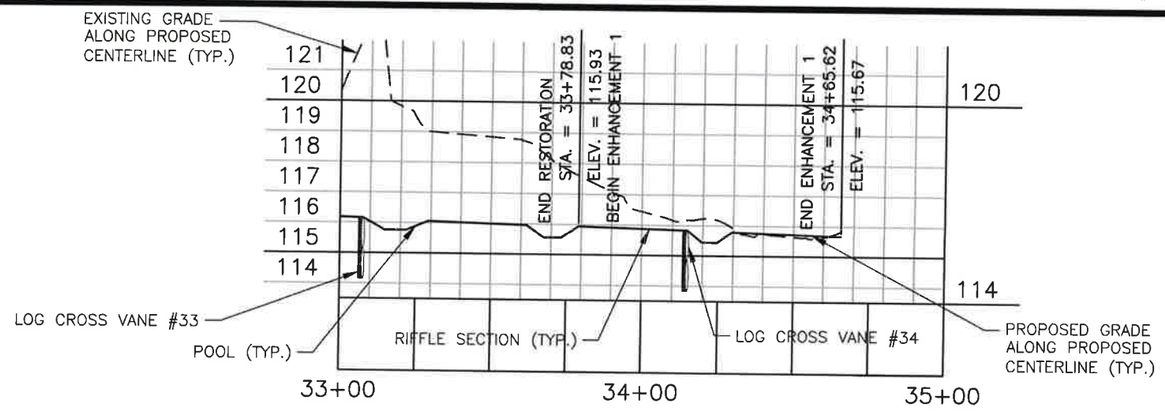
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'



UT 1

STATION 33+00 to 34+65.62

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

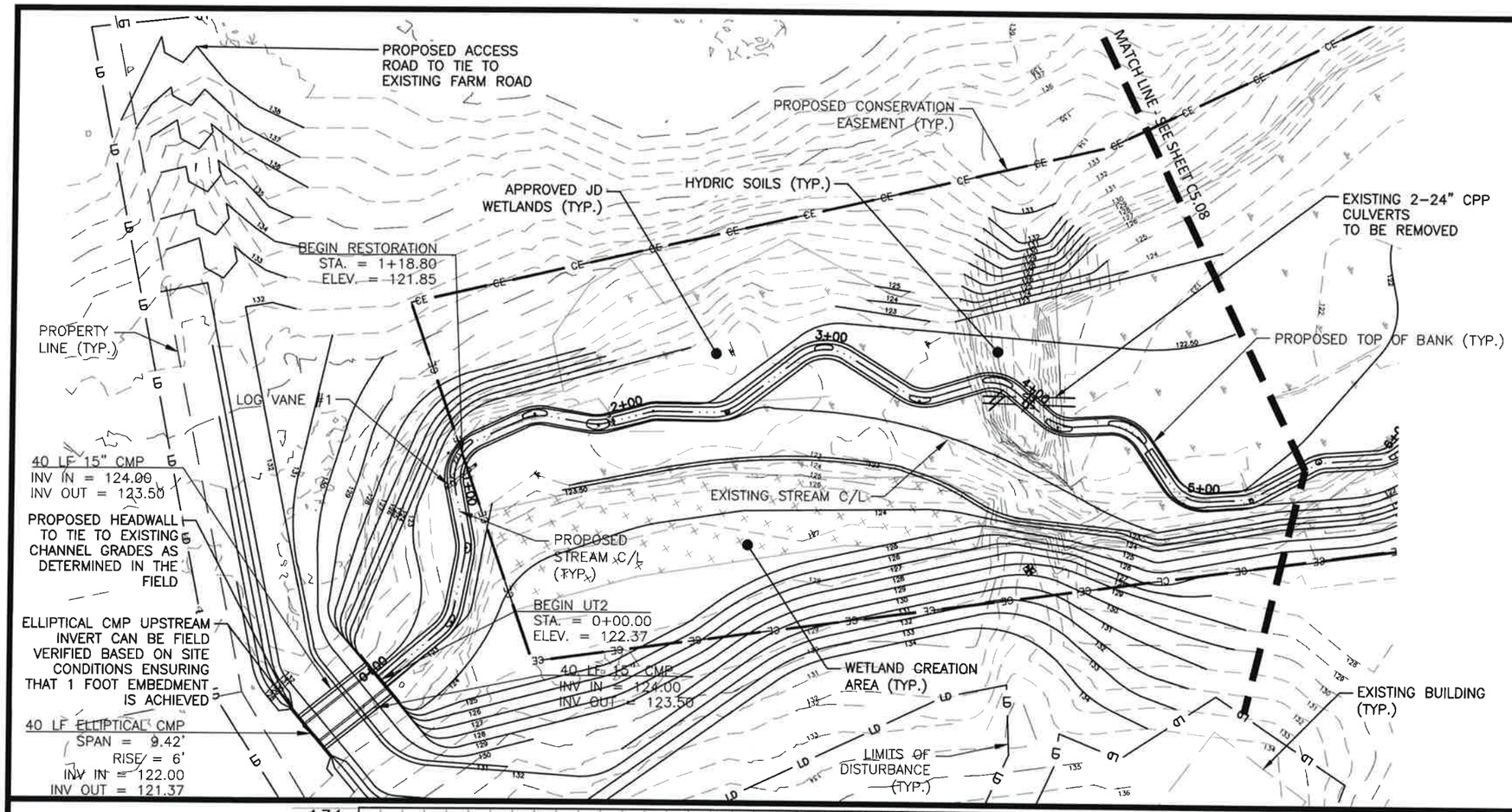
PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE

UNNAMED TRIBUTARY 1

STA. 33+00 THRU STA. 34+65.62

C5.06



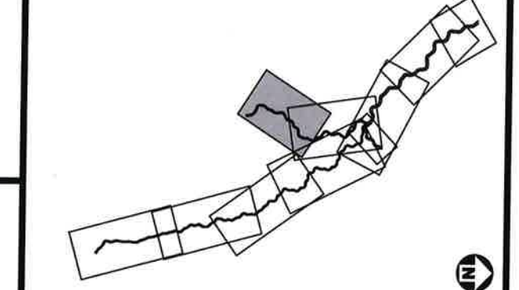
UT2 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG VANE #1	102.95	122.15

GRAPHIC SCALE

0 30 60 120

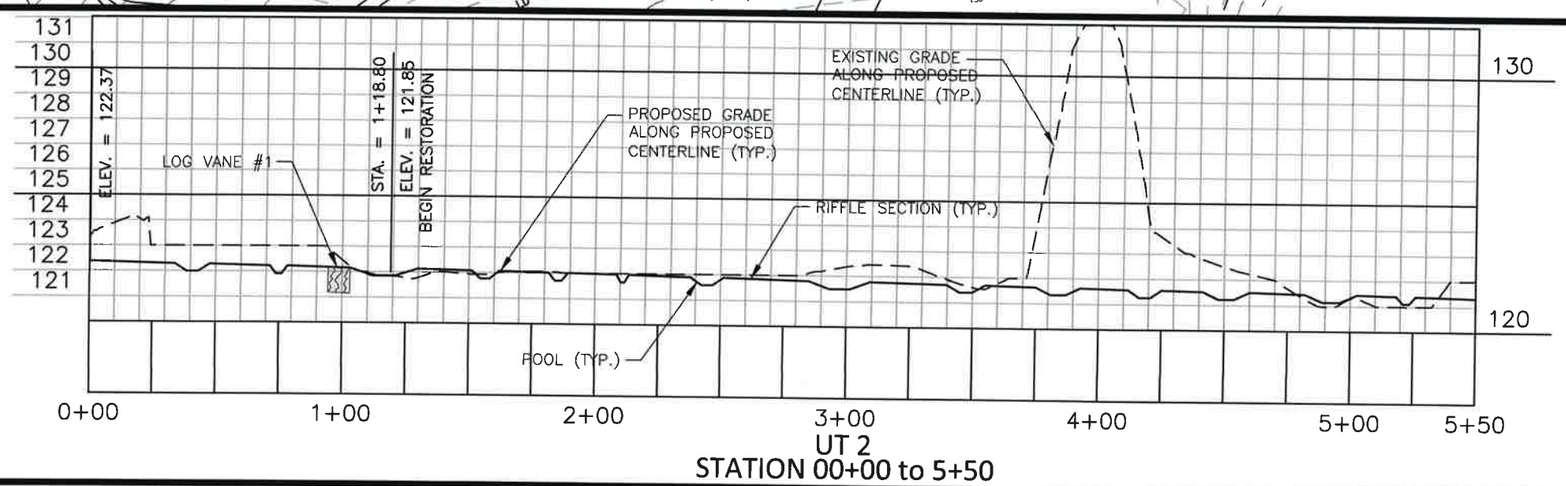
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'



UT 2

STATION 00+00 to 5+50

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=60'
DATE	02.05.2021

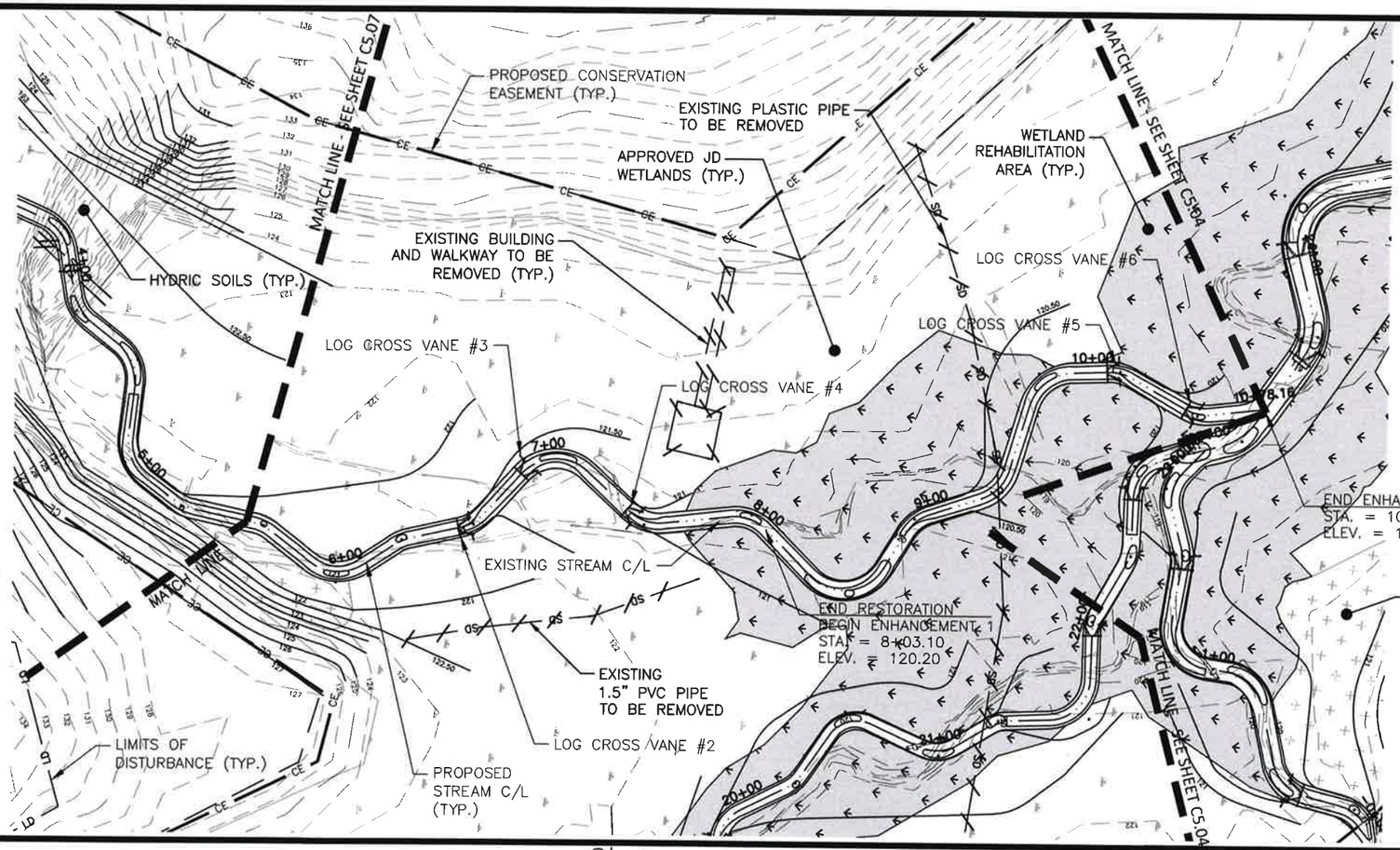
PLAN AND PROFILE

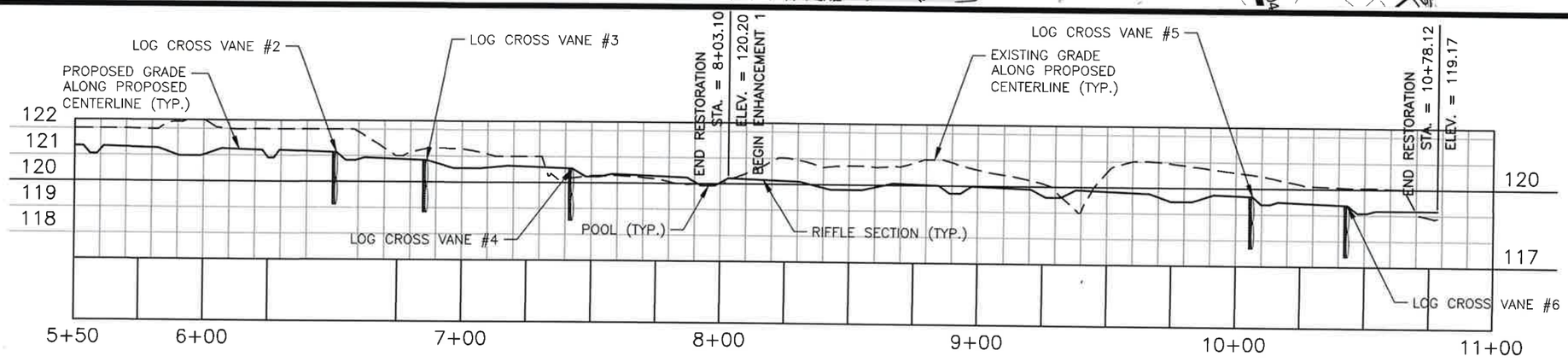
UNNAMED TRIBUTARY 2

STA. 00+00 THRU STA. 5+50

C5.07

UT2 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #2	651.31	121.12
LOG CROSS VANE #3	686.22	120.83
LOG CROSS VANE #4	742.61	120.53
LOG CROSS VANE #5	1006.57	119.68
LOG CROSS VANE #6	1043.45	119.37

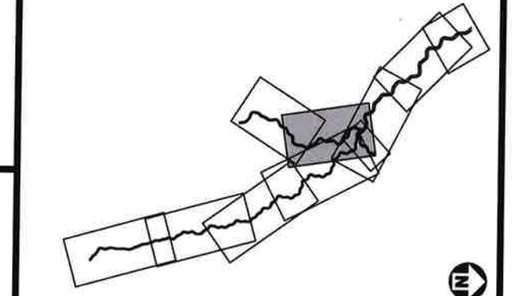




UT 2
STATION 5+50 to 10+78.12

GRAPHIC SCALE
0 30 60 120
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

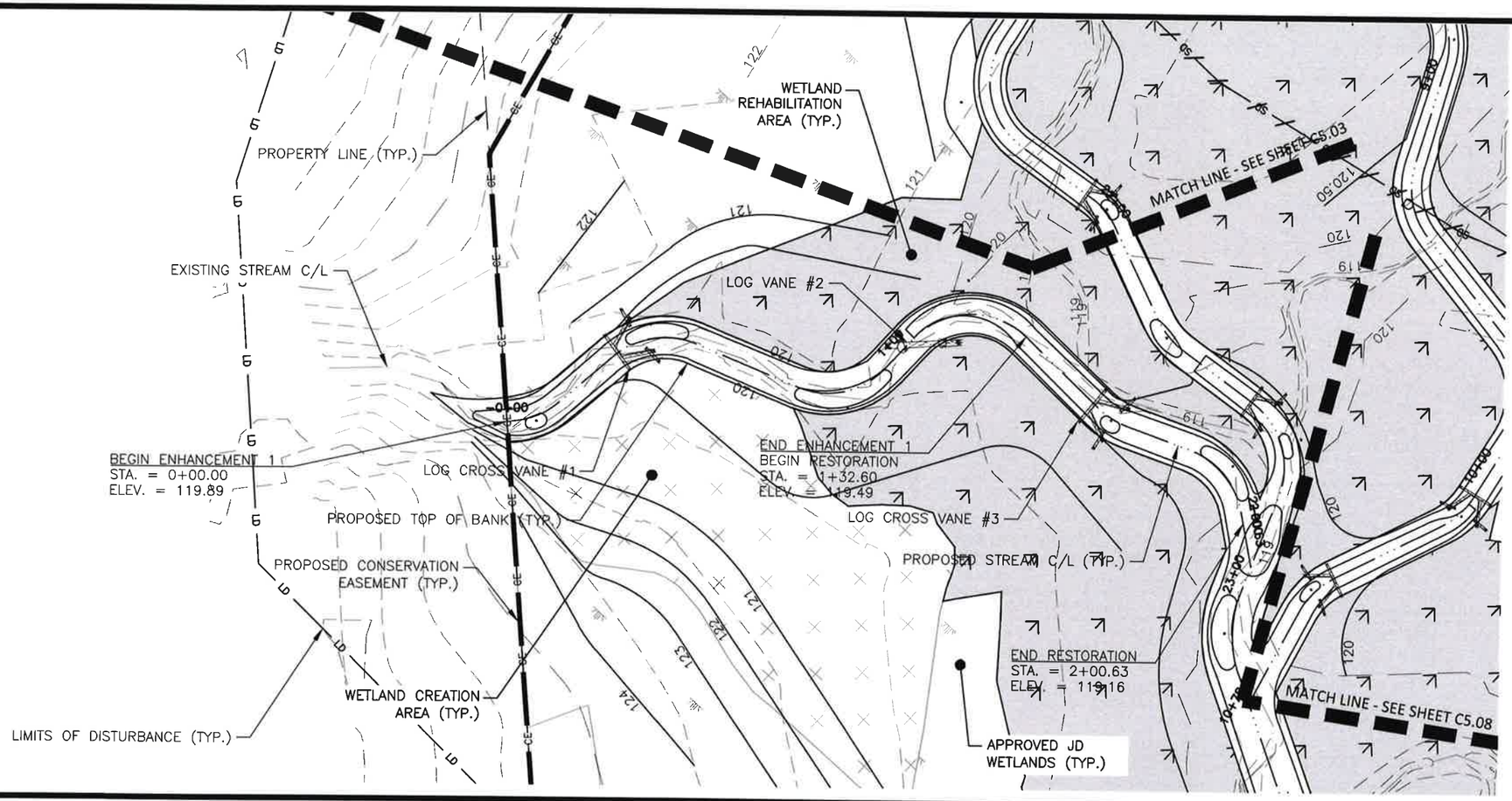
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60' / 1"=50'
DATE	02.05.2021

PLAN AND PROFILE
UNNAMED TRIBUTARY 2
STA. 5+50 THRU STA. 10+78.12

C5.08



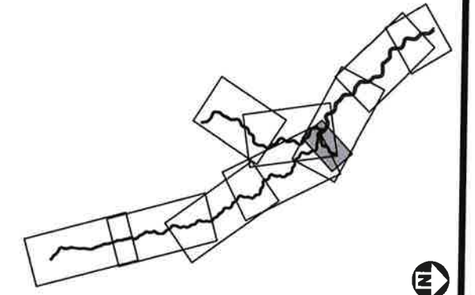
UT3 STRUCTURE LOCATIONS		
STRUCTURE TYPE	STATION	ELEVATION
LOG CROSS VANE #1	28.37	119.83
LOG VANE #2	104.13	119.51
LOG CROSS VANE #3	155.99	119.42

GRAPHIC SCALE

0 15 30 60

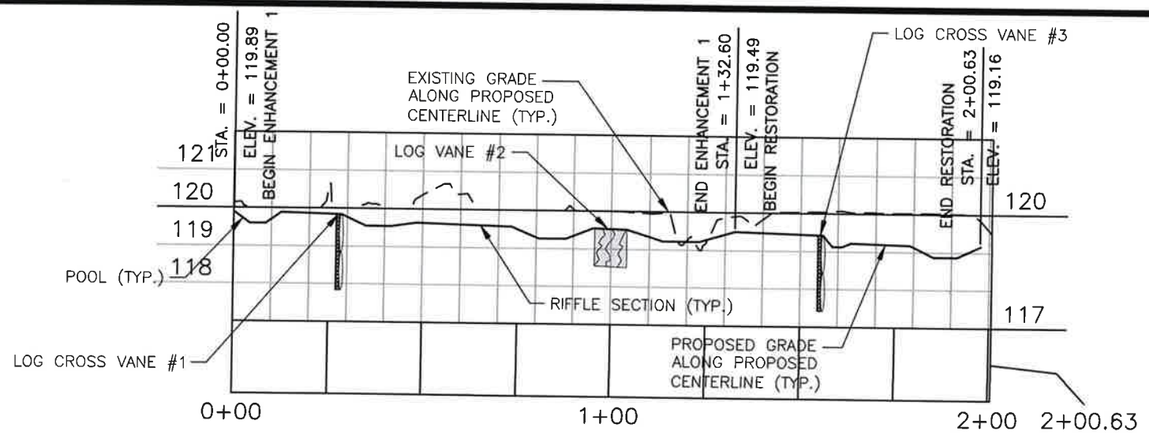
1 inch = 30 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'



UT 3

STATION 00+00 to 2+00.63

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

2.2.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-P1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=30' / 1"=40'
DATE	02.05.2021

PLAN AND PROFILE

UNNAMED TRIBUTARY 3

STA. 00+00 THRU STA. 2+00.63

C5.09

GENERAL NOTES:

1. CONTRACTOR SHALL OBTAIN ALL NECESSARY LICENSES AND PERMITS REQUIRED TO COMPLETE THE WORK INCLUDED IN THE CONTRACT DOCUMENTS AT THE CONTRACTOR'S EXPENSE.
2. IT IS THE CONTRACTOR'S RESPONSIBILITY TO VERIFY THAT THEY AND THEIR SUBCONTRACTOR'S HAVE THE CORRECT/MOST UP-TO-DATE PLANS AVAILABLE.
3. CONTRACTOR SHALL GIVE MINIMUM 72 HOURS NOTICE TO NC DEMLR AND PROJECT ENGINEER PRIOR TO CONSTRUCTION.
4. ALL WORK WITHIN JURISDICTIONAL BOUNDARIES (WETLAND AND STREAMS) SHALL BE PERFORMED IN STRICT ACCORDANCE WITH APPROVED NATIONWIDE PERMIT NO. SAW-2019-01732.
5. CONSTRUCTION OPERATIONS SHALL BE CARRIED OUT IN SUCH A MANNER THAT EROSION AND WATER POLLUTION IS MINIMIZED.
6. CONTRACTOR SHALL MINIMIZE DISTURBANCE TO EXISTING BUFFER VEGETATION AND CONSTRUCTION CORRIDOR TO THE MAXIMUM EXTENT PRACTICAL.
7. THERE MAY BE WETLANDS WITHIN THIS SITE. IT IS THE OWNER'S RESPONSIBILITY FOR WETLANDS JURISDICTION AND PERMIT DISTURBANCE PRIOR TO ANY GRADING ACTIVITY.
8. IF THE CONTRACTOR, IN THE COURSE OF WORK, FINDS ANY DISCREPANCIES IN THE PLANS OR NOTES GIVEN BY THE PROJECT ENGINEER, IT SHALL BE HIS/HER DUTY IMMEDIATELY INFORM THE PROJECT ENGINEER, IN WRITING, AND THE PROJECT ENGINEER WILL PROMPTLY VERIFY THE SAME. ANY WORK DONE AFTER SUCH DISCOVERY, UNTIL AUTHORIZED, WILL BE AT THE CONTRACTOR'S RISK.
9. ANY DAMAGE TO PRIVATE PROPERTY AND/OR EXISTING UTILITIES INCURRED DURING CONSTRUCTION ACTIVITIES SHALL BE THE SOLE RESPONSIBILITY OF THE CONTRACTOR.
10. ALL MECHANIZED EQUIPMENT OPERATED NEAR SURFACE WATERS SHALL BE INSPECTED AND MAINTAINED REGULARLY TO PREVENT CONTAMINATION OF SURFACE WATERS FROM FUELS, LUBRICANTS, HYDRAULIC FLUIDS, OR OTHER TOXIC MATERIALS. CONSTRUCTION SHALL BE STAGED IN ORDER TO MINIMIZE THE EXPOSURE OF EQUIPMENT TO SURFACE WATERS TO THE MAXIMUM EXTENT PRACTICABLE. FUELING, LUBRICATION, AND GENERAL EQUIPMENT MAINTENANCE SHALL BE PERFORMED IN A MANNER TO PREVENT, TO THE MAXIMUM EXTENT PRACTICABLE, CONTAMINATION OF SURFACE WATERS BY FUELS AND OILS.
11. HEAVY EQUIPMENT WORKING IN WETLANDS SHALL BE PLACED ON MATS OR OTHER MEASURES SHALL BE TAKEN TO MINIMIZE SOIL DISTURBANCE.

CONSTRUCTION SEQUENCE:

1. OBTAIN PLAN APPROVAL AND OTHER APPLICABLE PERMITS.
2. OBTAIN AN APPROVED (STAMPED) EROSION & SEDIMENT CONTROL PLAN AND KEEP IT ON-SITE EITHER IN THE INSPECTION BOX, CONSTRUCTION OFFICE, OR WITH THE CONTRACTOR..
3. SCHEDULE AND HOLD AN ON-SITE PRE-CONSTRUCTION CONFERENCE AT LEAST ONE WEEK PRIOR TO BEGINNING ANY LAND-DISTURBING ACTIVITIES. THE CONFERENCE SHOULD BE ATTENDED BY THE NC DEMLR EROSION CONTROL INSPECTOR, THE GENERAL CONTRACTOR, ANY SUBCONTRACTORS, THE ENGINEER, AND A REPRESENTATIVE OF THE OWNER.
4. CONTRACTOR SHALL NOTIFY "NC811" (811) OR (1-800-632-4949) AT LEAST 3 FULL BUSINESS DAYS PRIOR TO BEGINNING CONSTRUCTION OR EXCAVATION TO HAVE EXISTING UTILITIES LOCATED. CONTRACTOR SHALL CONTACT ANY LOCAL UTILITIES THAT PROVIDE THEIR OWN LOCATOR SERVICES INDEPENDENT OF "NC811". REPORT ANY DISCREPANCIES TO THE ENGINEER IMMEDIATELY.
5. CONTRACTOR IS RESPONSIBLE TO CONTACT AND COORDINATE WITH LUMBEE RIVER ELECTRIC COMPANY FOR THE RELOCATION OF THE EXISTING POWER LINE. SEE SHEETS C6.06, C6.08 AND C6.10 FOR APPROXIMATE LOCATION.
6. ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE ENGINEER IF ANY DISCREPANCIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION, FOR NECESSARY PLAN OR GRADE CHANGES. NO EXTRA COMPENSATION SHALL BE PAID TO THE CONTRACTOR FOR ANY WORK DONE DUE TO DIMENSIONS OR GRADES SHOWN INCORRECTLY ON THESE PLANS IF SUCH NOTIFICATION HAS NOT BEEN GIVEN.
7. ESTABLISH CONSTRUCTION ENTRANCE (SEE DETAIL ON SHEET C6.13) AND STAGING AREAS ACCORDING TO THE EROSION CONTROL PLANS. TEMPORARY DRIVEWAY PERMIT FOR CONSTRUCTION ENTRANCES IN NCDOT RIGHT OF WAY MUST BE PRESENTED AT PRE-CONSTRUCTION MEETING.
8. INSTALL SILT FENCE, INLET PROTECTION, SEDIMENT TRAPS, DIVERSION DITCHES, TREE PROTECTION, AND OTHER MEASURES AS SHOWN ON PLANS, CLEARING ONLY AS NECESSARY TO INSTALL THESE DEVICES.
9. LIMITS OF DISTURBANCE SHALL BE MARKED BY SAFETY FENCING EITHER WITH SILT FENCE OR ORANGE TREE PROTECTION FENCE (SEE DETAIL ON SHEET C6.14).
10. USE THE AREA DESIGNATED ON THE PLANS FOR ALL STAGING ACTIVITIES RELATED TO THE PROJECT.
11. PARK ALL CONSTRUCTION EQUIPMENT, INCLUDING TRUCKS AND HEAVY EQUIPMENT WITHIN THE LIMITS OF DISTURBANCE.
12. WHEN ACCESS TO A CONSTRUCTION AREA REQUIRES CROSSING A DELINEATED JURISDICTIONAL FEATURE, IMPACTS SHALL BE MINIMIZED BY PLACING A TEMPORARY STREAM/WETLAND CROSSING ACROSS THE FEATURE PRIOR TO ACCESSING THE AREA WITH HEAVY EQUIPMENT PER APPROVED PLANS AND SPECIFICATIONS. SEE DETAIL SHEETS C6.13 AND C6.17 FOR TEMPORARY STREAM AND WETLAND CROSSINGS.
13. INSTALL REMAINING EROSION CONTROL MEASURES AS SHOWN ON SHEETS C6.03THROUGH C6.12. CLEAR AND GRUB ONLY AS NECESSARY TO INSTALL THESE DEVICES.
14. BEGIN GRADING ACTIVITIES. IN GENERAL, THE CONTRACTOR SHALL WORK FROM UPSTREAM TO DOWNSTREAM AND CONSTRUCTION IN A LIVE CHANNEL UTILIZE A PUMP-AROUND OR FLOW DIVERSION MEASURE AS SHOWN ON THE PLANS. MAINTAIN AND ADJUST E & SC MEASURES AS GRADING PROGRESSES. SEE TABLE 1 - WORKING SECTIONS ON C6.01 FOR SUGGESTED WORK SECTION STATIONS AND PROGRESSION.
15. CONTRACTOR SHALL EXCAVATE THE PROPOSED CHANNEL AND MODIFY PORTIONS OF THE EXISTING CHANNEL BASED ON RIFFLE ELEVATIONS IN SECTIONS NO GREATER THAN 300' IN LENGTH AT A TIME (EXCEPT WHERE LONGER SECTIONS ARE NECESSARY TO MAINTAIN CONSTRUCTABILITY).
16. CONTRACTOR SHALL BEGIN CONSTRUCTION ON MAIN STEM REACHES AND PROCEED IN A DOWNSTREAM DIRECTION UNTIL THE REACH IS COMPLETED. THE CONTRACTOR MAY CONCURRENTLY WORK ON SEPARATE REACHES AS LONG AS NO MORE IS DISTURBED THAN CAN BE STABILIZED IN THAT SAME DAY. TRIBUTARIES TO THE MAIN STEMS CAN THEN BE CONSTRUCTED TO MAKE STABLE CONFLUENCES WITH THE MAIN STEM REACHES.
17. AT THE END OF EACH WORKING DAY, THE CONTRACTOR WILL BE RESPONSIBLE FOR THE APPLICATION OF SEED AND STRAW, AS APPLICABLE, TO NEWLY ESTABLISHED STREAMBANKS AND DISTURBED AREAS. EROSION CONTROL MATTING WILL BE INSTALLED ON TOP OF THE SEED AND STRAW IN ACCORDANCE WITH THE EROSION CONTROL CONSTRUCTION SEQUENCE.
18. WORK SECTIONS THAT INVOLVE THE CONSTRUCTION OF A CONFLUENCE OF TWO OR MORE REACHES MAY REQUIRE THE USE OF TWO OR MORE PUMP-AROUND OPERATIONS.
19. GRADING OF SOME PORTIONS OF THE PROPOSED FLOODPLAIN MAY NEED TO BE DELAYED UNTIL AFTER WORK IN SUBSEQUENT SECTIONS HAS BEEN COMPLETED, ESPECIALLY NEAR THE CONFLUENCES. HAUL ROADS AND TEMPORARY SILT FENCE MAY ALSO NEED TO BE REMOVED BEFORE THE PROPOSED FLOODPLAIN CAN BE COMPLETED AND/OR UNUSED EXISTING CHANNEL BE FILLED.
20. PONDS SHALL BE DEWATERED PRIOR TO DAM REMOVAL. SEE EXISTING CONDITION & DEMOLITION NOTES ON SHEET C6.01FOR DAM REMOVAL METHODS.
21. AFTER EXCAVATING THE CHANNEL TO DESIGN GRADES, INSTALLING IN-STREAM STRUCTURES, SEED AND MULCH, MATTING, AND TRANSPLANTS, THE NEW CHANNEL CAN RECEIVE FLOW AFTER APPROVAL BY THE ENGINEER.
22. WATER WILL BE TURNED INTO THE CONSTRUCTED CHANNEL ONCE THE AREA IN AND AROUND THE NEW CHANNEL HAS BEEN STABILIZED. NO WATER SHALL BE TURNED INTO ANY SECTION OF CHANNEL PRIOR TO THE CHANNEL BEING COMPLETELY STABILIZED WITH ALL STRUCTURES INSTALLED.
23. ANY GRADING ACTIVITIES ADJACENT TO THE STREAM CHANNEL SHALL BE COMPLETED PRIOR TO TURNING WATER INTO THE NEW STREAM CHANNEL SEGMENTS. THE CONTRACTOR SHALL NOT GRADE OR ROUGHEN ANY AREAS WHERE EXCAVATION ACTIVITIES HAVE NOT BEEN COMPLETED.
24. CONTRACTOR SHALL IMPROVE AND CONSTRUCT THE FARM ROADS AND PERMANENT CROSSINGS BY INSTALLING CULVERTS, STABILIZING SIDE SLOPES, AND MODIFYING THE FARM ROAD BED ACCORDING TO THE PLANS AND SPECIFICATIONS. PERMANENT STREAM CROSSINGS WILL BE INSTALLED WHILE THE WORKING SECTION CONTAINING THE CROSSING HAS BEEN DEWATERED. ADJUST HAUL ROADS AND ASSOCIATED SILT FENCE AS NECESSARY WHEN PERMANENT STREAM CROSSINGS ARE INSTALLED.
25. THE CONTRACTOR SHALL DILIGENTLY AND CONTINUOUSLY MAINTAIN ALL EROSION CONTROL DEVICES AND STRUCTURES.
26. FOR PHASED EROSION CONTROL PLANS, CONTRACTOR SHALL MEET WITH EROSION CONTROL INSPECTOR PRIOR TO COMMENCING WITH EACH PHASE OF EROSION CONTROL MEASURES.
27. WHEN APPLICABLE, THE LAND DEVELOPMENT INSPECTOR SHOULD BE CALLED TO CONDUCT INSPECTIONS ON STORM DRAINAGE, SIDEWALKS, DRIVE WAY IMPROVEMENTS, AND ALL ASPECTS OF ROAD CONSTRUCTION.
28. STABILIZE SITE AS AREAS ARE BROUGHT TO FINISHED GRADE. AT THE CONCLUSION OF GRADING AND CONSTRUCTION OR IF LAND-DISTURBING ACTIVITY STOPPED FOR MORE THAN 14 CONSECUTIVE CALENDAR DAYS, PERMANENT VEGETATIVE COVER SHALL BE INSTALLED ACCORDING TO SHEETS L5.00 THROUGH L5.02.
29. CONTRACTOR SHALL PLANT WOODY VEGETATION AND LIVE STAKES, ACCORDING TO PLANTING DETAILS AND SPECIFICATIONS. THE CONTRACTOR SHALL COMPLETE THE LIVE STAKING AND REFORESTATION (BARE-ROOT PLANTING) PHASE OF THE PROJECT AND APPLY PERMANENT SEEDING AT THE APPROPRIATE TIME OF YEAR.
30. COORDINATE WITH EROSION CONTROL INSPECTOR PRIOR TO REMOVAL OF ANY EROSION CONTROL MEASURES.
31. STABILIZE ALL DISTURBED AREAS. REMOVE STAGING AREA AND CONSTRUCTION ENTRANCE.
32. REMOVE ALL EROSION CONTROL MEASURES AND CALL THE NC DEMLR OFFICE FOR FINAL INSPECTION ONCE PERMANENT VEGETATION HAS BEEN ESTABLISHED.
33. DEMOBILIZE ALL EQUIPMENT AND MATERIALS FROM SITE.
34. ALL EROSION CONTROL MEASURES SHALL BE CONSTRUCTED IN ACCORDANCE WITH THE N. C. EROSION AND SEDIMENT CONTROL PLANNING AND DESIGN MANUAL.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

McADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL NOTES

C6.00

TABLE 1 - WORKING SECTIONS

Order of Progress	Pump Station #	Reach	Begin Station	End Station	Construction Notes
1	P-1	UT1	0+00	3+00	
2	P-2	UT1	3+00	4+37	
3	P-3	UT2	0+00	2+50	Construct UT2 Crossing
4	P-4	UT2	2+50	5+50	UT2 enhancements and stop before confluence
5	P-5	UT2	5+50	8+25	
6	P-6	UT2	8+25	10+16	
7	P-7	UT1	4+37	4+90	Construct UT1 Crossing
8	P-8	UT1	4+90	7+90	
9	P-9	UT1	7+90	10+90	
10	P-10	UT1	10+90	13+90	
11	P-11	UT1	13+90	16+90	
12	P-12	UT1	16+90	18+80	
13	P-13	UT1	18+80	21+12	
14	P-14	UT1	21+12	22+73	UT1 enhancements and stop before confluence
15	P-15	UT3	0+00	1+79	UT3 enhancements and stop before confluence
16	P-16	UT3	1+79	2+00	Operate pump stations P-17, P-18, and P-19 simultaneously to build confluence of UT1, UT2, and UT3
17	P-17	UT1	22+73	23+50	
18	P-18	UT2	10+16	10+78	
19	P-19	UT1	23+50	26+50	
20	P-20	UT1	26+50	29+50	
21	P-21	UT1	29+50	32+36	
22	P-22	UT1	32+36	34+66	

CHANNEL CONSTRUCTION (PUMP AROUND):

1. INSTALL PUMP AROUND ALONG 200' TO 300' OF STREAM CHANNEL, OR NO MORE THAN CAN BE CONSTRUCTED IN ONE (1) WORKING DAY (DEWATERING AND PUMP AROUND DETAILS ON SHEETS C6.15 AND C.16). SUGGESTED CONSTRUCTION SEQUENCE PROVIDED ON TABLE 1 - WORKING SECTIONS ON SHEET C6.01.
2. RIPRAP APRONS WILL BE CONSTRUCTED TO IMPEDE ANY EROSION OF THE CHANNEL AND STREAM BANKS BY THE WATER DIVERTED FROM THE PUMP-AROUND PROCEDURE.
3. WORK SECTIONS THAT INVOLVE THE CONSTRUCTION OF A CONFLUENCE OR TWO REACHES MAY REQUIRE THE USE OF TWO PUMP-AROUND OPERATIONS.
4. HARVEST MATERIAL FROM THE BOTTOM OF THE EXISTING CHANNEL TO BE PLACED IN THE BOTTOM OF THE PROPOSED CHANNEL. THIS SHALL INCLUDE THE SURFACE MATERIAL AND UP TO ONE (1) FOOT BELOW TO INCLUDE THE HYPORHEIC ZONE. ADDITIONAL RIVER STONE SHALL BE MIXED WITH EXISTING CHANNEL MATERIAL AS NECESSARY.
5. IN-STREAM STRUCTURES WILL BE INSTALLED ACCORDING TO THE DETAILS PRESENTED ON SHEETS C8.00 THRU C8.02.
6. FILL EXISTING CHANNEL ON THE SAME WORKING DAY AS COMPLETING THE PROPOSED CHANNEL. IN NO EVENT SHALL THE EXISTING CHANNEL BE FILLED PRIOR TO THE COMPLETE CONSTRUCTION OF THE CORRESPONDING PROPOSED CHANNEL.
7. ANY EXCAVATED MATERIAL CONTAINING MANMADE MATERIAL IS NOT SUITABLE MATERIAL FOR CHANNEL FILL AND MUST BE DISPOSED OF OFFSITE UNLESS OTHERWISE DIRECTED BY OWNER.
8. IN ANY SECTION WHERE THE NEW CHANNEL ALIGNMENT CROSSES THE EXISTING CHANNEL A CLAY PLUG WILL BE INSTALLED IN THE EXISTING CHANNEL AS PER DETAIL ON SHEET C6.18.
9. THE PROPOSED CHANNEL BANKS SHALL BE STABILIZED WITH EROSION CONTROL MATTING AND TEMPORARY SEEDING UPON COMPLETION OF EACH SECTION AS PER DETAIL ON SHEETS C6.19 AND L5.01.
10. COMPLETE ALL EARTHWORK, STRUCTURE INSTALLATION, AND STABILIZATION IN THE PUMP AROUND AREA.
11. AT A MINIMUM, 20-FOOT LENGTHS OF EXISTING CHANNEL SHOULD BE FILLED EVERY 50-FEET OR AS DIRECTED BY THE ENGINEER.
12. CONTRACTOR SHALL NOTIFY ENGINEER UPON DISCOVERY OF ANY CONSTRAINTS DISCOVERED IN THE CONSTRUCTION OF THE PROPOSED CHANNEL OR STRUCTURE PLACEMENT AND ADJUSTMENTS CAN BE MADE ON SITE.
13. GRADING OF THE PROPOSED FLOODPLAIN MAY NEED TO BE DELAYED UNTIL AFTER WORK IN SUBSEQUENT SECTIONS HAS BEEN COMPLETED, ESPECIALLY NEAR CONFLUENCES. HAUL ROADS AND TEMPORARY SILT FENCE MAY ALSO NEED TO BE REMOVED BEFORE THE PROPOSED FLOODPLAIN CAN BE COMPLETED AND/OR UNUSED EXISTING CHANNEL CAN BE FILLED.

EXISTING CONDITION & DEMOLITION NOTES:

1. THERE SHALL BE NO DEMOLITION ACTIVITIES UNTIL AFTER A PRE-CONSTRUCTION MEETING HAS TAKEN PLACE.
2. ALL MATERIAL TO BE DEMOLISHED SHALL BE REMOVED FROM THE SITE AND DISPOSED OF AT A PERMITTED SITE IN ACCORDANCE WITH ALL LOCAL, STATE AND FEDERAL LAWS.
3. EXISTING UTILITIES AND STRUCTURES SHOWN, BOTH UNDERGROUND AND ABOVE GROUND, ARE BASED ON A FIELD SURVEY AND THE BEST AVAILABLE RECORD DRAWINGS. THE CONTRACTOR SHALL VERIFY FIELD CONDITIONS PRIOR TO BEGINNING RELATED CONSTRUCTION. ANY DISCREPANCIES SHALL BE REPORTED TO THE ENGINEER IMMEDIATELY.
4. PONDS SHALL BE DEWATERED PRIOR TO DAM REMOVAL USING THE FOLLOWING METHODS:
   - 4.1. FOR PONDS WITH AN OUTLET STRUCTURE, OPEN THE OUTLET STRUCTURE TO DEWATER THE POND AT RATE THAT DOES NOT CAUSE EXCESSIVE EROSION DOWNSTREAM OF THE DAM.
   - 4.2. FOR PONDS WITHOUT AN OUTLET STRUCTURE OR THAT REQUIRE SUPPLEMENTAL DRAWDOWN, USE A PUMP AND TEMPORARY FLEXIBLE HOSE TO DEWATER THE POND INTO THE DOWNSTREAM CHANNEL. A RIPRAP DISSIPATION PAD SHALL BE USED AT THE OUTLET OF THE TEMPORARY FLEXIBLE HOSE. DEWATER AT A RATE THAT DOES NOT CAUSE EXCESSIVE EROSION DOWNSTREAM OF THE DISCHARGE POINT.
5. CONTRACTOR RESPONSIBLE TO CONTACT LUBMEE RIVER ELECTRIC COMPANY TO COORDINATE THE RELOCATION OF THE EXISTING POWER LINE.

SITE PREPARATION: CLEARING & TOPSOIL/SUBSOIL EXCAVATION

1. ALL SHRUBS AND SMALL TREES DESIGNATED BY THE DESIGNER WILL BE SAVED FOR TRANSPLANTING. PLANTS THAT ARE TO BE TRANSPLANTED WILL BE MARKED WITH HIGHLY VISIBLE TAPE.
2. ANY UNUSABLE TREES & BRUSH REMOVED DURING CLEARING & GRUBBING OF SITE SHALL BE CHIPPED ON SITE AND HAULED OFF SITE FOR DISPOSAL.
3. CONTRACTOR SHALL MANAGE EXCAVATED TOPSOIL SEPARATELY FROM EXCAVATED SUBSOIL. EXCAVATED TOPSOIL SHALL BE PLACED WITHIN THE DESIGNATED TEMPORARY STOCKPILE AREAS AWAY FROM THE CHANNEL TO BE FILLED (SEE PLANS). TOPSOIL SHALL BE FREE OF STONES OVER 1" IN DIAMETER, ROOTS, STICKS, RUBBISH, STIFF CLAY, AND EXTRANEOUS MATTER.
4. EXCAVATED SUBSOIL SHALL BE PLACED NEAR THE CHANNEL TO BE FILLED. ONCE THE NEW STREAM IS CONSTRUCTED, SUBSOIL SHALL BE USED TO FILL THE EXISTING CHANNEL FIRST, THEN STOCKPILED TOPSOIL SHALL BE USED FOR THE FINAL 6 INCHES OF FILL TO ACHIEVE DESIGN GRADES AND CREATE A SOIL BASE FOR VEGETATION.
5. IMPORTED TOPSOIL SHALL HAVE A LOAMY TEXTURE AND HAVE SAND, SILT, AND CLAY PERCENTAGES THAT MEET THE U.S. DEPARTMENT OF AGRICULTURE CHARACTERISTICS OF A LOAMY SOIL. ORGANIC CONTENT SHALL NOT BE LESS THAN 1.5% BY WEIGHT. PH RANGE SHALL BE FROM 6-7.5. IF PH IS LESS THAN 6, LIME SHALL BE ADDED. SOLUBLE SALTS SHALL NOT EXCEED 500PPM. IMPORTED TOPSOIL SHALL BE FREE OF DEBRIS, ROOTS, PLANTS, STICKS, RUBBISH, STIFF CLAYS, AND STONES OVER 1 INCH IN DIAMETER.
6. CONTRACTOR SHALL HARVEST AND STOCKPILE NATIVE CHANNEL SUBSTRATE (COBBLE, STONE, ETC.) FOR USE IN PROPOSED IN-STREAM STRUCTURES.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.3.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL NOTES

C6.01

EROSION & SEDIMENT CONTROL NOTES:

1. GRADING AND EROSION CONTROL METHODS SHALL ADHERE TO THE NORTH CAROLINA DEPARTMENT OF ENVIRONMENTAL QUALITY (NC DEQ) DIVISION OF ENERGY, MINERAL, AND LAND RESOURCES (NC DEMLR) STANDARDS AND SPECIFICATIONS.
2. EROSION AND SEDIMENT CONTROL (E & SC) PERMIT AND A CERTIFICATE OF COVERAGE (COC) MUST BE OBTAINED BEFORE ANY LAND DISTURBANCE ACTIVITIES.
3. WHEN PROJECT IS COMPLETE, THE PERMITEE SHALL VISIT DEQ.NC.GOV/NCG01 TO SUBMIT AN ELECTRONIC NOTICE OF TERMINATION (E-NOT). A $100 ANNUAL GENERAL FEE WILL BE CHARGED UNTIL THE E-NOT HAS BEEN FILLED OUT.
4. E & SC DEVICES MUST BE INSTALLED AND INSPECTED PRIOR TO ANY GRADING ON SITE. THE CONTRACTOR SHALL CALL FOR AN INSPECTION BY NC DEMLR ONCE INITIAL MEASURES ARE IN PLACE.
5. A COPY OF THE APPROVED EROSION CONTROL PLAN MUST BE ON FILE AT THE JOB SITE AT ALL TIMES. FAILURE TO FOLLOW THE APPROVED PLAN SEQUENCE AND DETAILS COULD SUBJECT THE CONTRACTOR TO FINES AND PENALTIES ISSUED BY DWR.
6. CONSTRUCTION, MAINTENANCE, AND REMOVAL OF ALL EROSION CONTROL DEVICES ARE THE RESPONSIBILITY OF THE GRADING CONTRACTOR UNLESS OTHERWISE NOTED.
7. ANY GRADING BEYOND THE DENUDED LIMITS SHOWN ON THE PLAN IS A VIOLATION OF THE APPROVED EROSION CONTROL PLAN AND IS SUBJECT TO A FINE BY THE NC DMLER.
8. DISTURBANCE OUTSIDE OF THE SITE PROPERTY LIMITS OR PUBLIC R/W SHALL ONLY BE ALLOWED BY SIGNED GRADING AGREEMENTS AND/OR EASEMENTS BETWEEN THE DEVELOPER AND OFFSITE PROPERTY OWNER.
9. THE CONTRACTOR IS RESPONSIBLE TO MAINTAIN SAFE OPEN ACCESS TO ALL PROPERTIES ALONG ADJACENT PROPERTIES DURING CONSTRUCTION PERIOD FOR IMPROVEMENTS.
10. STAGING AREAS, STOCKPILE AREAS, CONSTRUCTION ENTRANCES, AND ACCESS ROAD WILL BE IDENTIFIED AND LOCATED ACCORDING TO THE EROSION CONTROL PLANS AND LANDOWNER. VARIANCES WILL BE ALLOWED ASSUMING BOTH THE CONTRACTOR AND THE ENGINEER VERBALLY AGREE.
11. CONTRACTOR SHALL SEED AND STABILIZE ALL STEEP SLOPES (GREATER THAN 3H:1V) WITHIN 7 DAYS, 10 DAYS FOR MODERATE SLOPES (3H:1V OR LESS) AND WITHIN 14 CALENDAR DAYS EVERYWHERE ELSE ACCORDING TO THE TEMPORARY SEEDING SCHEDULE ON SHEET L5.01.
12. FOR ANY LAND DISTURBING ACTIVITY WHERE GRADING ACTIVITIES HAVE BEEN COMPLETED, TEMPORARY OR PERMANENT GROUND COVER (SHEET L5.01) SUFFICIENT TO RESTRAIN EROSION SHALL BE PROVIDED AS SOON AS PRACTICAL, BUT IN NO CASE LATER THAN SEVEN (7) DAYS AFTER COMPLETING THE WORK. STABILIZATION IS THE BEST FORM OF EROSION CONTROL. TEMPORARY SEEDING IS NECESSARY TO ACHIEVE EROSION CONTROL ON LARGE DENUDED AREAS AND ESPECIALLY WHEN SPECIFICALLY REQUIRED AS PART OF THE CONSTRUCTION SEQUENCE ON THE PLAN.
13. THE EROSION CONTROL INSPECTOR MAY REQUIRE ADDITIONAL FIELD MEASURES AS NECESSARY TO PROVIDE ADEQUATE PROTECTION FROM RECEIVING WATER COURSES.
14. PROTECTION OF EXISTING VEGETATION: AT THE START OF GRADING INVOLVING THE STRIPPING OF TOPSOIL OR LOWERING OF EXISTING GRADE AROUND A TREE, A CLEAN, SHARP, VERTICAL CUT SHALL BE MADE AT THE EDGE OF THE TREE SAVE AREA AT THE SAME TIME AS OTHER EROSION CONTROL MEASURES ARE INSTALLED. THE TREE PROTECTION FENCING SHALL BE INSTALLED ON THE SIDE OF THE CUT FARTHEST AWAY FROM THE TREE TRUNK AND SHALL REMAIN IN PLACE UNTIL ALL CONSTRUCTION IN THE VICINITY OF THE TREES IS COMPLETE. NO STORAGE OF MATERIALS, FILL, OR EQUIPMENT AND NO TRESPASSING SHALL BE ALLOWED WITHIN THE BOUNDARY OF THE PROTECTED AREA AND SHALL BE POSTED ON THE PROTECTION FENCE. A PROTECTION FENCE CONSTRUCTED OF MATERIAL RESISTANT TO DEGRADATION BY SUN, WIND, AND MOISTURE FOR THE DURATION OF THE CONSTRUCTION, SHALL BE INSTALLED AT THE SAME TIME AS THE EROSION CONTROL MEASURES AND SHALL BE IN PLACE UNTIL ALL CONSTRUCTION IN THE VICINITY OF THE TREES IS COMPLETE.
15. A CONSTRUCTION SEQUENCE HAS BEEN PROVIDED (SEE SHEET C6.00 AND C6.01). INSTALLATION OF ALL PROPOSED E & SC MEASURES IN THE SEQUENCE(S) PROVIDED AND MAINTENANCE OF THOSE DEVICES IS REQUIRED. THE CONTRACTOR MAY BE ALLOWED, WITH PRIOR APPROVAL FROM THE OWNER, TO COORDINATE CHANGES TO THE PLAN WITH THE ON-SITE E & SC INSPECTOR AND THE ENGINEER.
16. CONTRACTOR SHALL INSPECT AND REPAIR ALL EROSION CONTROL DEVICES AT LEAST ONCE PER WEEK AND AFTER EVERY SIGNIFICANT RAINFALL EVENT. EACH DEVICE IS TO BE MAINTAINED OR REPLACED IF SEDIMENT ACCUMULATION HAS REACHED ONE HALF THE CAPACITY OF THE DEVICE.
17. CONTRACTOR WILL FIELD LOCATE ALL SILT FENCE OUTLETS AT LOW POINTS IN SILT FENCE AND A MINIMUM OF EVERY 100 LINEAR FEET TO PROVIDE RELIEF FROM CONCENTRATED FLOWS. SILT FENCE OUTLETS SHOWN ON THESE PLANS ARE BASED ON THE BEST TOPOGRAPHIC INFORMATION AVAILABLE AT THE TIME OF DESIGN. CONTRACTOR TO FIELD VERIFY AND ADJUST LOCATIONS OF SILT FENCE OUTLETS AND/OR PLACE ADDITIONAL OUTLETS TO INSURE THAT ALL LOW SPOTS ALONG THE SILT FENCE HAVE AN OUTLET.
18. WASHED STONE AND WIRE BACKING SHALL BE USED WITH SILT FENCE WHENEVER SILT FENCE IS PLACE AT THE TOE OF A SLOPE >10' VERTICAL OR ALONG ANY CHANNEL OR WATER COURSE WHERE 50' OF BUFFER IS NOT PROVIDED.
19. ALL DIMENSIONS AND GRADES SHOWN ON THE PLANS SHALL BE FIELD VERIFIED BY THE CONTRACTOR PRIOR TO CONSTRUCTION. CONTRACTOR SHALL NOTIFY THE OWNER IF ANY DISCREPANCIES EXIST PRIOR TO PROCEEDING WITH CONSTRUCTION FOR NECESSARY PLAN OR GRADE CHANGES. NO EXTRA COMPENSATION SHALL BE PAID TO THE CONTRACTOR FOR ANY WORK DONE DUE TO DIMENSIONS OR GRADES SHOWN INCORRECTLY ON THESE PLANS IF SUCH NOTIFICATION HAS NOT BEEN GIVEN.
20. NO DEBRIS SHALL BE TRACKED ONTO PUBLIC RIGHT OF WAY. IF THE SITUATION OCCURS WHERE MUD, ROCKS AND DEBRIS IS TRACKED ONTO PAVEMENT, THE CONTRACTOR SHALL CLEAN THE PAVEMENT AND INSTALL ADDITIONAL MEASURES TO PREVENT FUTURE OCCURRENCES.
21. INSTALL SILT FENCE FOR ALL STAGING AND STOCKPILE AREAS (SEE DETAIL ON SHEET C6.14). ANY STOCKPILE AREAS SHALL USE TWO (2) ROWS OF SILT FENCE.
22. IF CONCRETE WASHOUTS ARE UTILIZED, THESE AREAS ARE TO BE WITHIN THE LIMITS OF DISTURBANCE AND SHOULD BE LOCATED AT LEAST 50 FT. AWAY FROM STORM DRAIN INLETS AND SURFACE WATER.

EROSION & SEDIMENT CONTROL MAINTENANCE PLAN:

1. QUALIFIED PERSONNEL, ON A DAILY BASIS WILL EVALUATE ALL TEMPORARY EROSION AND SEDIMENT CONTROL PRACTICES FOR STABILITY AND OPERATION.
2. INSPECT AND MAINTAIN ALL EROSION CONTROL MEASURES EVERY 7 DAYS AND AFTER EACH SIGNIFICANT RAINFALL (0.5" OR GREATER) AND DOCUMENT WITH INSPECTION REPORTS AND WRITTEN LOGS SHALL BE KEPT.
3. A RAIN GAUGE WILL ALSO BE KEPT ON-SITE AND DAILY RAINFALL AMOUNTS WILL BE RECORDED.
4. ANY REPAIRS NEEDED WILL BE PERFORMED IMMEDIATELY TO MAINTAIN ALL PRACTICES AS DESIGNED.
5. THE CONTRACTOR SHALL BE RESPONSIBLE FOR THE MAINTENANCE OF TEMPORARY ON-SITE E & SC MEASURES.
6. THE CONTRACTOR SHALL BE RESPONSIBLE FOR IMPLEMENTING AND FOLLOWING THE APPROVED E & SC PLAN.
7. A COPY OF THE COMBINED SELF-INSPECTION MONITORING FORM CAN BE FOUND ON THE NC DEMLR WEBSITE AT: HTTPS://DEQ.NC.GOV/ABOUT/DIVISIONS/ENERGY-MINERAL-LAND-RESOURCES/EROSION-SEDIMENT-CONTROL/FORMS

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

MCADAMS
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187
www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

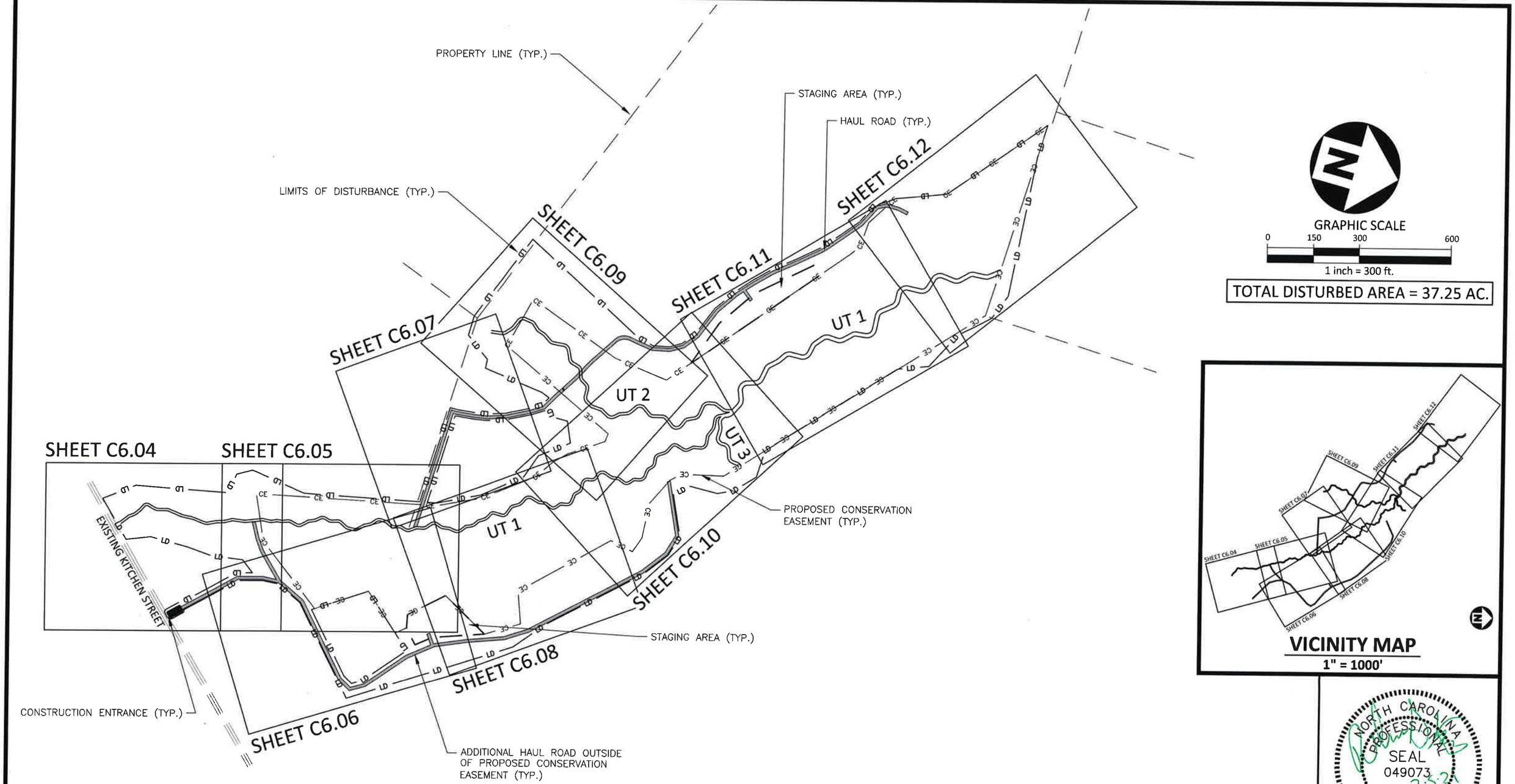
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL NOTES

C6.01



GRAPHIC SCALE

0 150 300 600

1 inch = 300 ft.

TOTAL DISTURBED AREA = 37.25 AC.

VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=300'
DATE	02.05.2021

EROSION CONTROL OVERALL PLAN

C6.03

INSTALL EROSION CONTROL BLANKET ON UT 1 RIGHT BANK ACCORDING TO DETAIL SHEET C6.19. TEMPORARY SEE, AND PLANTINGS PER SHEETS L5.01 AND L5.02

DRAINAGE DITCH

PROPOSED STREAM C/L (TYP.)

EXISTING STREAM C/L

DRAINAGE DITCH

EXISTING 108" X 84" ELLIPTICAL CMP TO BE REMOVED AND REPLACED

PROPOSED CONSERVATION EASEMENT (TYP.)

PROPOSED FENCE (TYP.)

PROPOSED 24" CMP SEE SHEET C5.00

PROPOSED ELLIPTICAL CMP SEE SHEET C5.00 AND C8.03

PROPOSED 24" CMP SEE SHEET C5.00 AND C8.03

UT 1

1+00

2+00

3+00

4+00

5+00

P-1

P-2

P-7

P-8

EXISTING KITCHEN STREET (VARIABLE WIDTH PUBLIC R/W)

PROPOSED TOP OF BANK (TYP.)

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

DRAINAGE DITCH

EXISTING CULVERT

LIMITS OF DISTURBANCE (TYP.)

SEE SHEET C6.05

ACCESS EASEMENT 1
NEW 15' WIDE NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS & REGRESS ALONG CENTERLINE TO BE CONVEYED TO THE STATE OF NORTH CAROLINA AND TO BODENHAMER, THE TRACT WITH PIN No. 829936273300 (D.B. 1082, PG. 891) (AREA = 0.75 ACRES +/- BY CO

SILT FENCE OUTLET (TYP.)

SILT FENCE (TYP.)

HAUL ROAD (TYP.)

TEMPORARY CONSTRUCTION ENTRANCE (TYP.)

EXISTING BUILDING FOOTPRINT

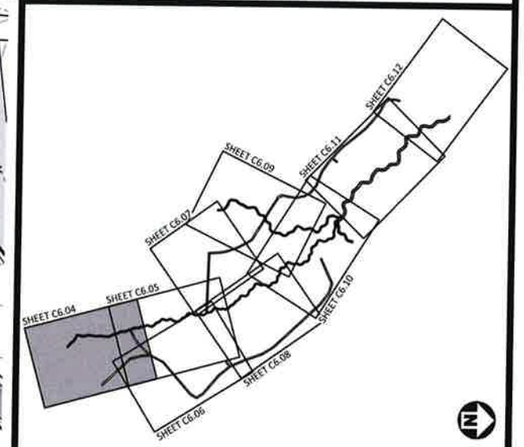
EXISTING OVERHEAD UTILITIES

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.04

EXISTING 108" X 84" ELLIPTICAL CMP TO BE REMOVED AND REPLACED

PROPOSED 24" CMP SEE SHEET C5.00 AND C8.03

PROPOSED ELLIPTICAL CMP SEE SHEET C5.00 AND C8.03

PROPOSED 24" CMP SEE SHEET C5.00 AND C8.03

PROPOSED CONSERVATION EASEMENT (TYP.)

PROPOSED TOP OF BANK (TYP.)

PROPOSED FENCE (TYP.)

LIMITS OF DISTURBANCE (TYP.)

PROPERTY LINE (TYP.)

HAUL ROAD (TYP.)

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

CHANNEL PLUG (TYP.)

UT/1

EXISTING STREAM C/L

PROPOSED STREAM C/L (TYP.)

DRAINAGE DITCH TO BE BACKFILLED

DRAINAGE TILE TO BE REMOVED (TYP.)

EXISTING OVERHEAD UTILITIES TO BE RELOCATED (TYP.)

HAUL ROAD (TYP.)

SILT FENCE (TYP.)

EXISTING BUILDING FOOTPRINT

SILT FENCE OUTLET (TYP.)

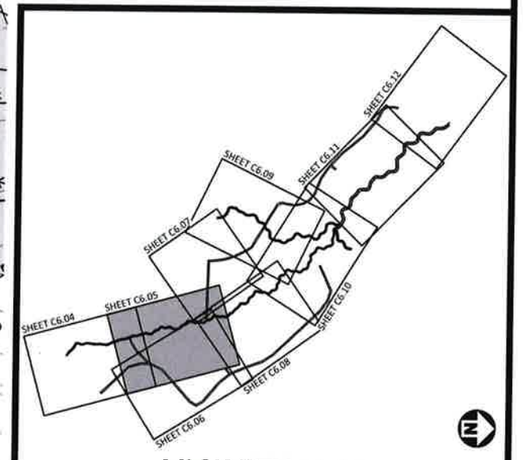
ACCESS EASEMENT 1
NEW 15' WIDE NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS & REGRESS ALONG CENTERLINE TO BE CONVEYED TO THE STATE OF NORTH CAROLINA AND TO BODENHAMER, THE TRACT WITH PIN No. 829936273300 (D.B. 1082, PG. 891) (AREA = 0.75 ACRES +/- BY CO

EXISTING OVERHEAD UTILITIES

SEE SHEET C6.04
SEE SHEET C6.06
SEE SHEET C6.08
SEE SHEET C6.06

GRAPHIC SCALE
0 30 60 120
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.05

SEE SHEET C6.04

SEE SHEET C6.05

SEE SHEET C6.08

PROPOSED TOP OF BANK (TYP.)

CHANNEL PLUG (TYP.)

PROPOSED STREAM C/L (TYP.)

DRAINAGE DITCH TO BE BACKFILLED

EXISTING STREAM C/L

UT 1

EXISTING BUILDING FOOTPRINT

EXISTING OVERHEAD UTILITIES

PROPOSED FENCE (TYP.)

EXISTING OVERHEAD UTILITIES TO BE RELOCATED (TYP.)

DRAINAGE DITCH TO BE BACKFILLED

EXISTING OVERHEAD UTILITIES TO BE RELOCATED (TYP.)

DRAINAGE TILE TO BE REMOVED (TYP.)

SILT FENCE (TYP.)

PROPOSED CONSERVATION EASEMENT (TYP.)

SILT FENCE OUTLET (TYP.)

DOUBLE ROW SILT FENCE (TYP.)

ADDITIONAL HAUL ROAD OUTSIDE OF PROPOSED CONSERVATION EASEMENT (TYP.)

PROPERTY LINE (TYP.)

LIMITS OF DISTURBANCE (TYP.)

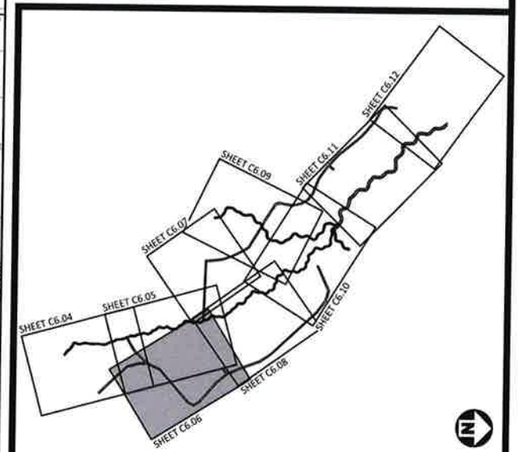
APPROXIMATE OVERHEAD POWER LINE RELOCATION. (TYP.)

PROPOSED STAGING AREA (TYP.)

ACCESS EASEMENT 1
NEW 15' WIDE NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS & REGRESS ALONG CENTERLINE TO BE CONVEYED TO THE STATE OF NORTH CAROLINA AND TO BODENHAMER, THE TRACT WITH PIN No. 829936273300 (D.B. 1082, PG. 891) (AREA = 0.75 ACRES +/- BY CO

GRAPHIC SCALE
0 30 60 120
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
2.2.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

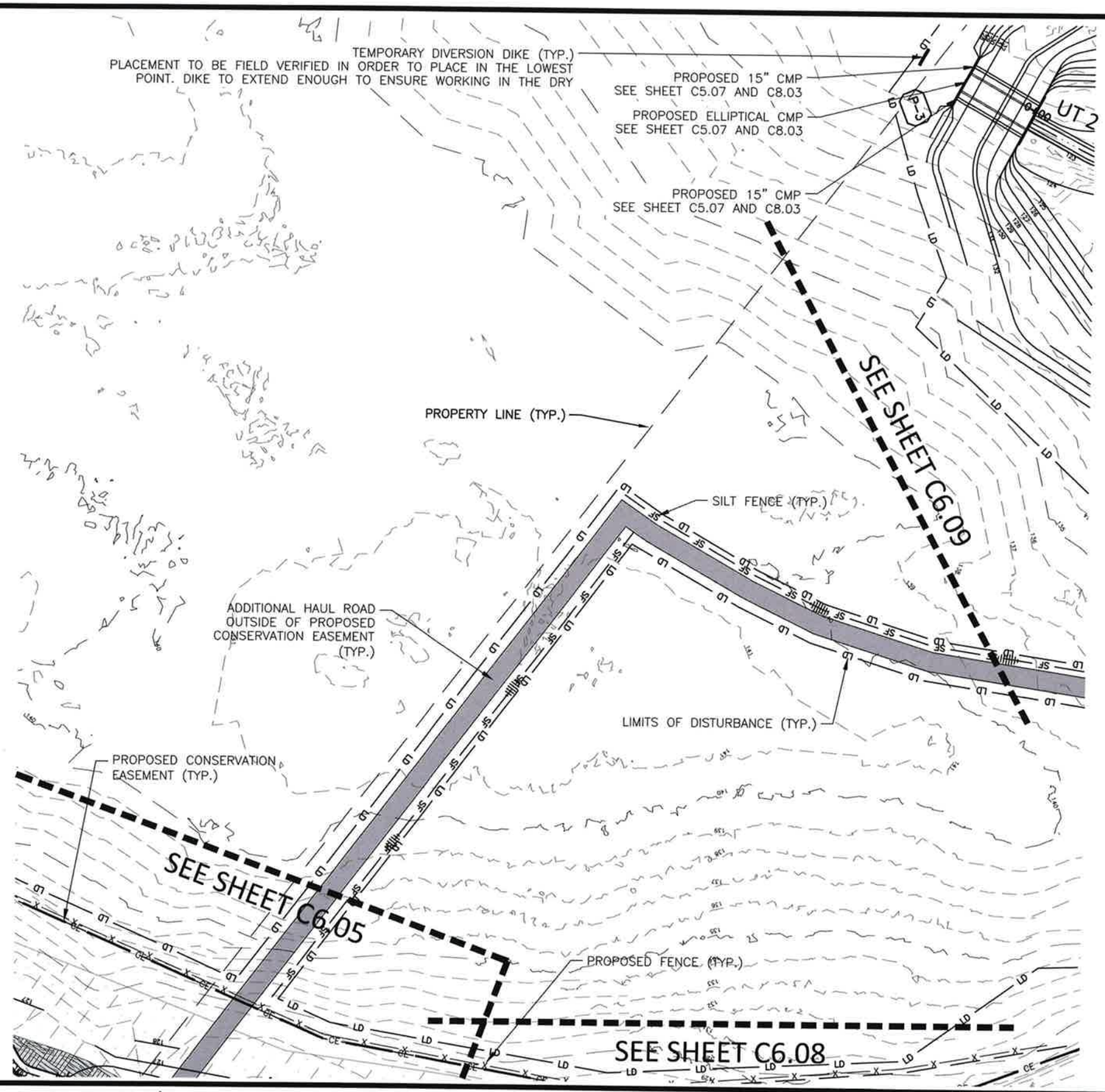
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.06

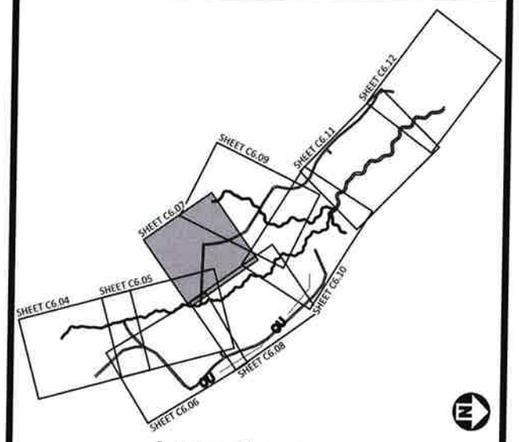


GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.07

SEE SHEET C6.07

SEE SHEET C6.05

SEE SHEET C6.06

SEE SHEET C6.10

P-10

P-11

P-12

UT 1

10+00

11+00

12+00

13+00

14+00

15+00

16+00

17+00

EXISTING STREAM C/L

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

CHANNEL PLUG (TYP.)

PROPOSED TOP OF BANK (TYP.)

PROPOSED STREAM C/L (TYP.)

DRAINAGE TILE TO BE REMOVED (TYP.)

DRAINAGE DITCH TO BE BACKFILLED

DOUBLE ROW SILT FENCE (TYP.)

SILT FENCE OUTLET (TYP.)

PROPERTY LINE (TYP.)

PROPOSED CONSERVATION EASEMENT (TYP.)

EXISTING OVERHEAD UTILITIES TO BE RELOCATED (TYP.)

PROPOSED FENCE (TYP.)

APPROXIMATE OVERHEAD POWER LINE RELOCATION (TYP.)

HAUL ROAD (TYP.)

PROPOSED STAGING AREA (TYP.)

LIMITS OF DISTURBANCE (TYP.)

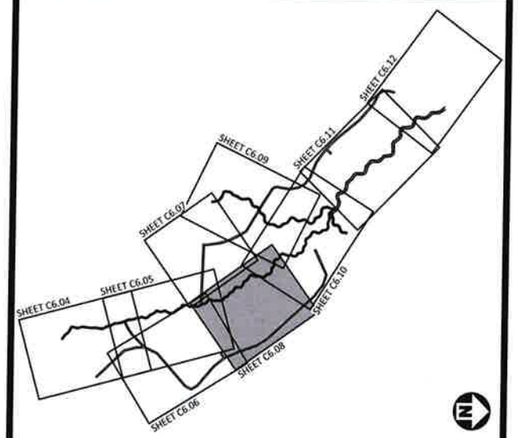
ACCESS EASEMENT 1
NEW 15' WIDE NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS & REGRESS ALONG CENTERLINE TO BE CONVEYED TO THE STATE OF NORTH CAROLINA AND TO BODENHAMER, THE TRACT WITH PIN No. 829936273300 (D.B. 1082, PG. 891) (AREA = 0.75 ACRES +/- BY CO

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.08

PROPERTY LINE (TYP.)

LIMITS OF DISTURBANCE (TYP.)

HAUL ROAD (TYP.)

DOUBLE ROW SILT FENCE (TYP.)

EXISTING PLASTIC PIPE TO BE REMOVED

PROPOSED CONSERVATION EASEMENT (TYP.)

EXISTING BUILDING AND WALKWAY TO BE REMOVED (TYP.)

PROPOSED STREAM C/L (TYP.)

EXISTING 2-24" CPP CULVERTS TO BE REMOVED

PROPOSED TOP OF BANK (TYP.)

UT 2

EXISTING STREAM C/L

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

SEE SHEET C6.10

EXISTING 1.5" PVC PIPE TO BE REMOVED

PROPOSED 15" RCP SEE SHEET C5.07 AND C8.03

PROPOSED ELLIPTICAL RCP SEE SHEET C5.07 AND C8.03

PROPOSED 15" RCP SEE SHEET C5.07 AND C8.03

SEE SHEET C6.07

TEMPORARY DIVERSION DIKE LOCATION (TYP.)
PLACEMENT TO BE VERIFIED IN ORDER TO PLACE IN THE LOWEST POINT. DIKE TO EXTEND ENOUGH TO ENSURE WORKING IN THE DRY

SILT FENCE OUTLET (TYP.)

EXISTING BUILDING FOOTPRINT

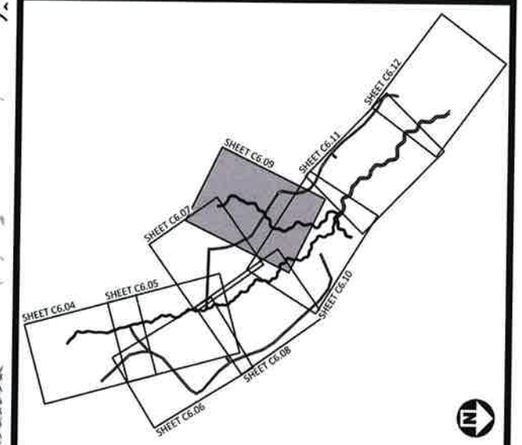
UT 1

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.09

SEE SHEET C6.09

SEE SHEET C6.08

SEE SHEET C6.11

PROPOSED FENCE (TYP.)

CHANNEL PLUG (TYP.)

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

EXISTING STREAM C/L

PROPOSED STREAM C/L (TYP.)

PROPOSED TOP OF BANK (TYP.)

UT 1

UT 2

UT 3

EXISTING 1.5" PVC PIPE TO BE REMOVED

EXISTING BUILDING AND WALKWAY TO BE REMOVED (TYP.)

PROPOSED STAGING AREA (TYP.)

DOUBLE ROW SILT FENCE (TYP.)

EXISTING PLASTIC PIPE TO BE REMOVED

SILT FENCE OUTLET(TYP.)

PROPOSED CONSERVATION EASEMENT (TYP.)

HAUL ROAD (TYP.)

PROPERTY LINE (TYP.)

EXISTING OVERHEAD UTILITIES TO BE RELOCATED (TYP.)

PROPOSED OVERHEAD UTILITIES (TYP.)

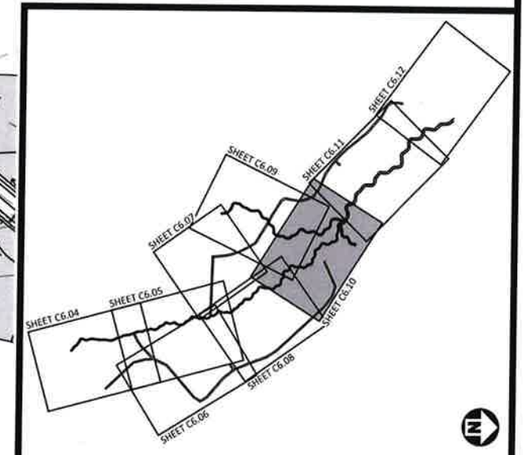
EXISTING BUILDING FOOTPRINT

ACCESS EASEMENT 1
NEW 15' WIDE NON-EXCLUSIVE ACCESS EASEMENT FOR INGRESS, EGRESS & REGRESS ALONG CENTERLINE TO BE CONVEYED TO THE STATE OF NORTH CAROLINA AND TO BODENHAMER, THE TRACT WITH PIN No. 829936273300 (D.B. 1082, PG. 891) (AREA = 0.75 ACRES +/- BY CO

LIMITS OF DISTURBANCE (TYP.)

GRAPHIC SCALE
0 30 60 120
1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP
1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS
2.5.21

McAdams
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187
www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RS RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.10

HAUL ROAD (TYP.)

PROPOSED STAGING AREA (TYP.)

SILT FENCE OUTLET (TYP.)

DOUBLE ROW SILT FENCE (TYP.)

PROPOSED TOP OF BANK (TYP.)

PROPOSED STREAM C/L (TYP.)

EXISTING STREAM C/L

CHANNEL PLUG (TYP.)

UT 1

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

PROPOSED CONSERVATION EASEMENT (TYP.)

LIMITS OF DISTURBANCE (TYP.)

SEE SHEET C6.10

SEE SHEET C6.12

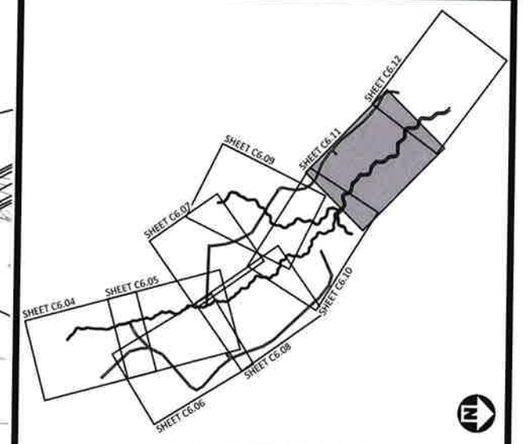
P-19 P-20 P-22

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

McAdams

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RS RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.11

HAUL ROAD (TYP.)

EXISTING PIPE TO BE REMOVED

FEMA 1% ANNUAL CHANGE FLOODPLAIN FOR WILKINSON CREEK (TYP.)

PROPERTY LINE (TYP.)

PROPOSED CONSERVATION EASEMENT (TYP.)

SEE SHEET C6.11

TEMPORARY DIVERSION DIKE LOCATION (TYP.)

EXISTING RISER PIPE AND 36" CMP TO BE REMOVED

DEPOSITED SEDIMENT FROM DAM FAILURE TO BE REMOVED FROM AREA

UT 1

P-22

CHANNEL PLUG (TYP.)

LIMITS OF DISTURBANCE (TYP.)

EXISTING STREAM C/L

PROPOSED STREAM C/L (TYP.)

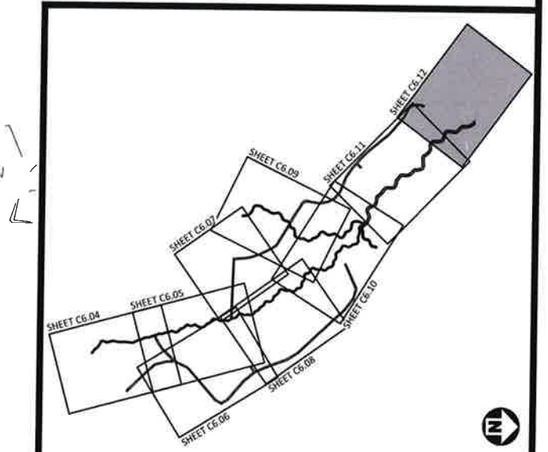
PROPOSED TOP OF BANK (TYP.)

GRAPHIC SCALE

0 30 60 120

1 inch = 60 ft.

TOTAL DISTURBED AREA = 37.25 AC.



VICINITY MAP

1" = 1000'

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

McADAMS

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

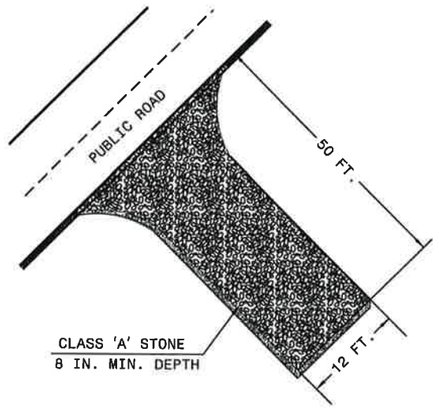
RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	1"=60'
DATE	02.05.2021

EROSION CONTROL PLAN

C6.12



NOTES

1. PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
2. LOCATE ENTRANCES TO PROVIDE FOR UTILIZATION BY ALL CONSTRUCTION VEHICLES.
3. MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOPDRESSING WITH STONE WILL BE NECESSARY.
4. ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED UP IMMEDIATELY.
5. LOCATE GRAVEL CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
6. NUMBER AND LOCATION OF CONSTRUCTION ENTRANCES TO BE DETERMINED BY THE ENGINEER.
7. USE CLASS 'A' STONE OR OTHER COARSE AGGREGATE APPROVED BY THE ENGINEER.
8. INSTALL CONSTRUCTION ENTRANCES IN A WAY TO PREVENT VEHICLES FROM BYPASSING CONSTRUCTION ENTRANCE LEAVING PROJECT SITE.

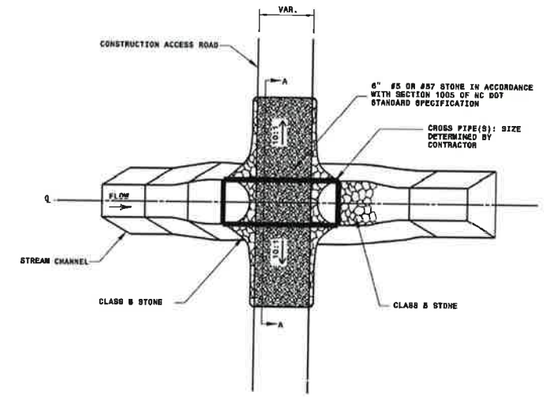
NOTE: PLACE GEOTEXTILE FOR DRAINAGE BENEATH STONE

1-18 STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.

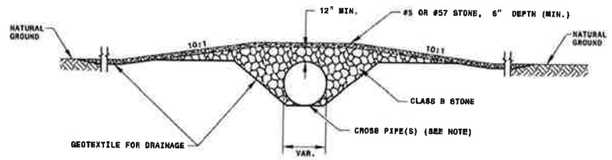
ROADWAY STANDARD DRAWING FOR
GRAVEL CONSTRUCTION ENTRANCE

SHEET 1 OF 1
1607.01

CONSTRUCTION ENTRANCE
N.T.S.



PLAN VIEW



SECTION A-A
NOT TO SCALE

NOTES

PIPE(S) FOR TEMPORARY STREAM CROSSING SHALL BE DESIGNED TO PASS THE PEAK OR BANKFULL FLOW, WHICHEVER IS LESS, FROM A 2-YEAR PEAK STORM, WITHOUT OVER TOPPING.

1-18 STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR
TEMPORARY STREAM CROSSING

SHEET 1 OF 1
1645.01

TEMPORARY STREAM CROSSING
N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

MCADAMS
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

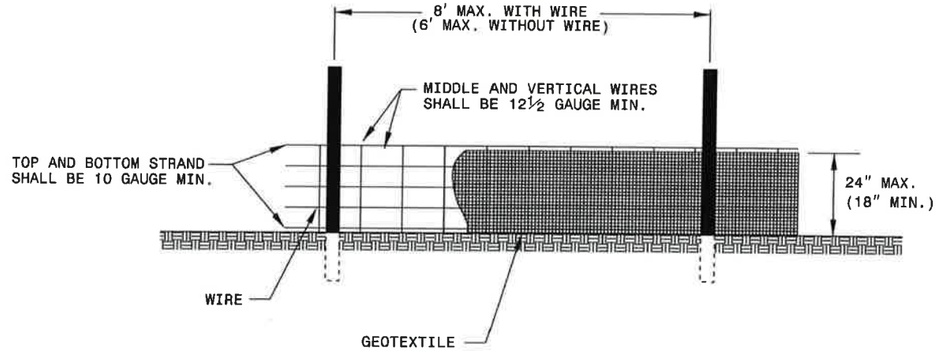
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

C6.13



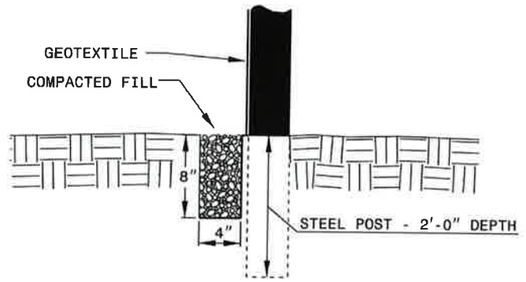
NOTES

USE GEOTEXTILE A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE POSTS AND WIRE AS DIRECTED.

USE WIRE A MINIMUM OF 32" IN WIDTH AND WITH A MINIMUM OF 5 LINE WIRES WITH 12" VERTICAL SPACING.

PROVIDE 5'-0" STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE.

FOR MECHANICAL SLICING METHOD INSTALLATION, GEOTEXTILE SHALL BE A MAXIMUM OF 18" ABOVE GROUND SURFACE.



EXTENSION OF GEOTEXTILE AND WIRE INTO TRENCH

1-18 STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR
TEMPORARY SILT FENCE

SHEET 1 OF 1
1605.01

TEMPORARY SILT FENCE
N.T.S.

NOTES

USE NO. 5 OR NO. 57 STONE FOR SEDIMENT CONTROL STONE.

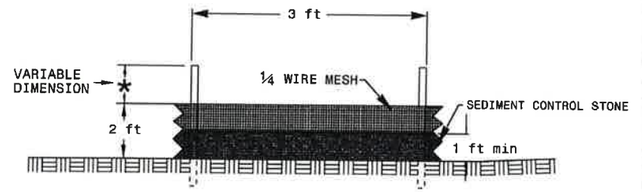
USE HARDWARE CLOTH 24 GAUGE WIRE MESH WITH ¼ INCH MESH OPENINGS.

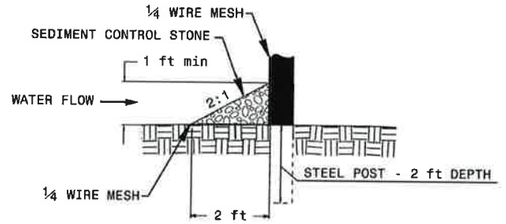
INSTALL 5 FT. SELF FASTENER ANGLE STEEL POST 2 FT. DEEP MINIMUM.

ATTACH HARDWARE CLOTH TO POSTS WITH WIRE STAPLE OR OTHER ACCEPTABLE METHODS.

SPACE POSTS A MAXIMUM OF 3 FT.

FOR INSTALLATION BETWEEN SECTIONS OF SILT FENCE, EXTEND SEDIMENT CONTROL STONE A MINIMUM OF 12" ON EACH SIDE OF SPECIAL SEDIMENT CONTROL FENCE SECTION.





1-18 STATE OF NORTH CAROLINA DEPT. OF TRANSPORTATION DIVISION OF HIGHWAYS RALEIGH, N.C.

ROADWAY STANDARD DRAWING FOR
SPECIAL SEDIMENT CONTROL FENCE

SHEET 1 OF 1
1606.01

SILT FENCE OUTLET
N.T.S.

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN
CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

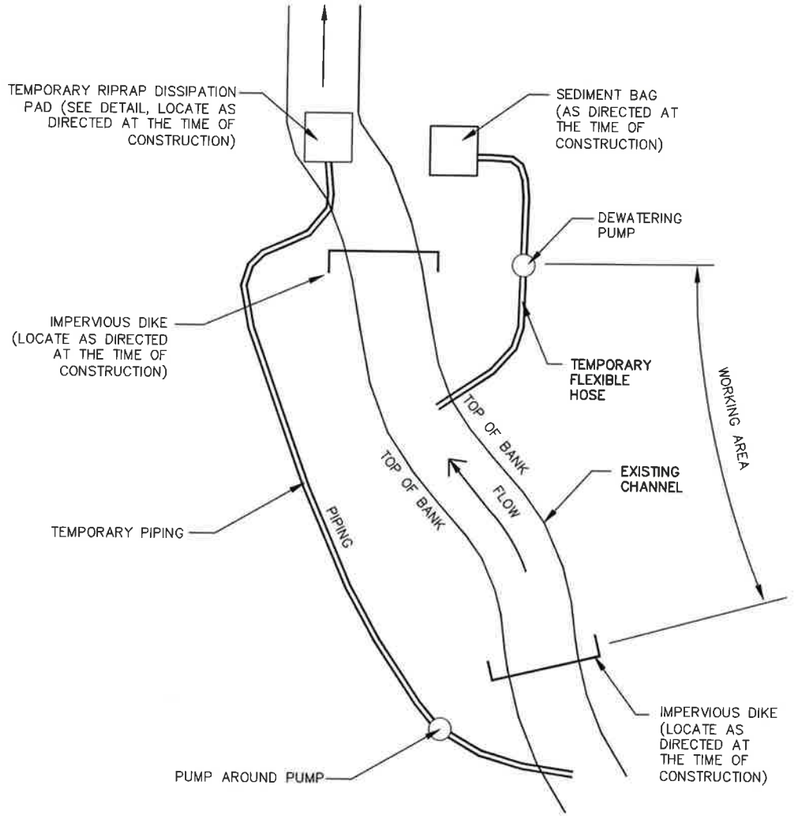
C6.14

NOTES:

1. EXCAVATION SHALL BE PERFORMED IN ONLY DRY SECTIONS OF CHANNEL UNLESS DRAINAGE AREA EXCEEDS 6 SQUARE MILES.
2. IMPERVIOUS DIKES SHOULD BE USED TO ISOLATE WORK AREAS FROM STREAM FLOW.
3. THE CONTRACTOR SHALL NOT DISTURB MORE AREA THAN CAN BE STABILIZED IN ONE WORKING DAY.
4. EACH PUMP AROUND PUMP SHOULD ADEQUATELY CONVEY BASE FLOW VOLUMES.
5. PUMP AROUND OPERATIONS SHOULD NOT BE UNDERTAKEN IF SIGNIFICANT RAINFALL IS FORECAST IN THE CONSTRUCTION PERIOD.

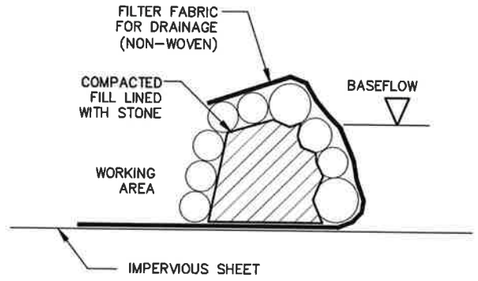
SEQUENCE OF CONSTRUCTION FOR TYPICAL PUMP AROUND

1. INSTALL SEDIMENT BAG AT THE DOWNSTREAM END OF THE DESIGNATED PROJECT WORKING AREA.
2. THE CONTRACTOR WILL INSTALL THE PUMP AROUND PUMP AND THE THE TEMPORARY PIPING THAT WILL CONVEY THE BASE FLOW FROM UPSTREAM OF THE WORK SITE TO THE SEDIMENT BAG.
3. INSTALL UPSTREAM IMPERVIOUS DIKE AND BEGIN PUMPING OPERATIONS FOR STREAM DIVERSION.
4. INSTALL THE DOWNSTREAM IMPERVIOUS DIKE AND PUMPING APPARATUS IF NEEDED TO DEWATER THE ENTRAPPED AREA. THE PUMP AND HOSE FOR THIS PURPOSE SHALL BE OF SUFFICIENT SIZE TO DEWATER THE WORK AREA. THIS WATER WILL ALSO FLOW INTO A SEDIMENT BAG.
5. THE CONTRACTOR WILL PERFORM STREAM RESTORATION WORK IN ACCORDANCE WITH THE PLAN AND FOLLOWING THE GENERAL CONSTRUCTION SEQUENCE.
6. THE CONTRACTOR WILL EXCAVATE ANY ACCUMULATED SEDIMENT AND DEWATER BEFORE REMOVAL OF THE IMPERVIOUS DIKE. REMOVE IMPERVIOUS DIKES, PUMPS, AND TEMPORARY FLEXIBLE HOSE/PIPING STARTING WITH THE DOWNSTREAM DIKE FIRST.
7. ONCE THE WORKING AREA IS COMPLETED, REMOVE THE STILLING BASINS AND STABILIZE DISTURBED AREAS TO SPECIFICATIONS AS SHOWN ON PLANS.



TYPICAL PUMP AROUND SETUP

N.T.S.



IMPERVIOUS DIKE DETAIL
(PROFILE VIEW)

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

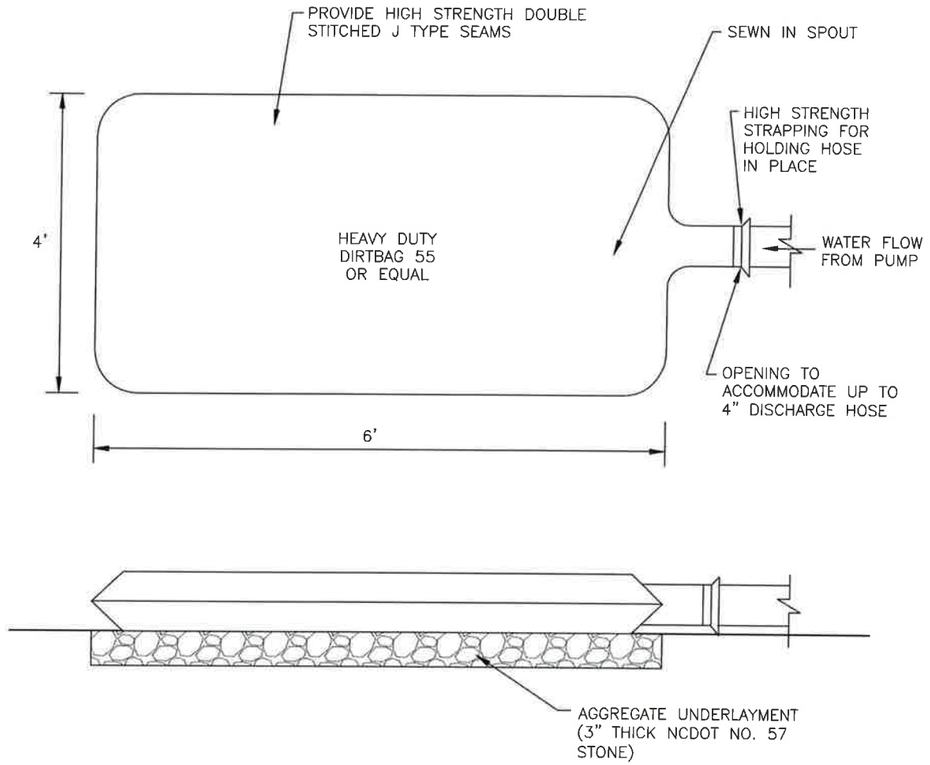
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

C6.15



NOTES

1. THE DEWATERING BAG SHALL BE MADE OF NON-WOVEN GEOTEXTILE WITH A MIN. SURFACE AREA OF 225 SQUARE FEET PER SIDE.
2. ALL STRUCTURAL SEAMS SHALL BE SEWN WITH A DOUBLE STITCH USING A DOUBLE NEEDLE MACHINE WITH HIGH STRENGTH THREAD.
3. THE SEAM STRENGTH SHALL WITHSTAND 100 LB/IN USING ASTM D-4884 TEST METHOD.
4. THE GEOTEXTILE FABRIC SHALL BE 10 OZ NON-WOVEN FABRIC.
5. DISCHARGE FROM THE DEWATERING BAG SHALL BE DIRECTED SUCH THAT PRE-DISTURBANCE HYDROLOGY IS NOT CHANGED.
6. TRANSPORT AND PLACE DEWATERING BAGS WITH CARE TO PREVENT RIPPING OR TEARING THE FABRIC.
7. AVOID INSTALLING ON STEEP SLOPES AS THE BAG MAY ROLL, CAUSING FAILURE.
8. INSERT THE DISCHARGE HOSE A MINIMUM OF 1-FOOT INSIDE THE DEWATERING BAG. DO NOT INSERT MORE THAN ONE DISCHARGE HOSE INTO THE DEWATERING BAG.
9. AVOID USE OF EXCESSIVE FLOW RATES OR OVERFILLING THE DEWATERING BAG. THIS MAY CAUSE THE BAG TO RUPTURE OR CAUSE FAILURE TO THE HOSE TO BAG CONNECTION.

MAINTENANCE

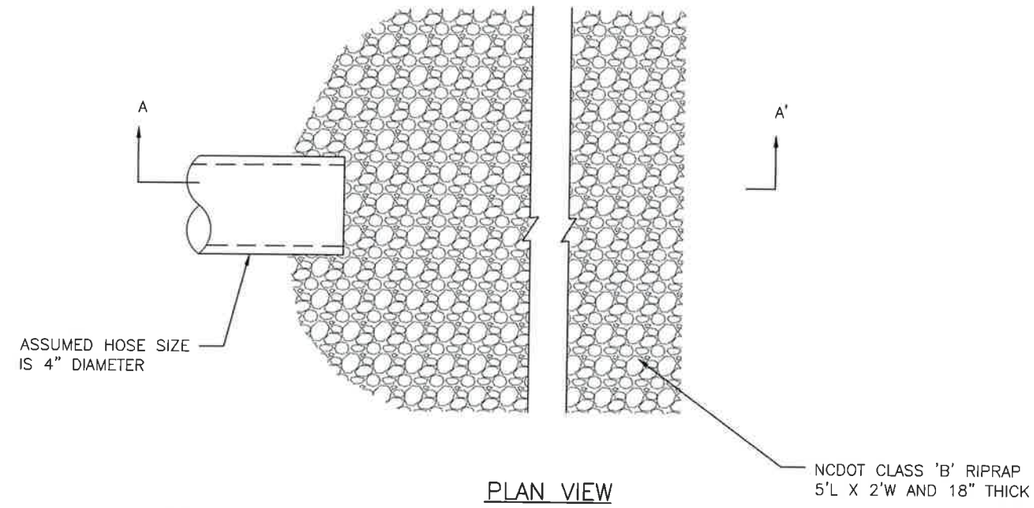
1. FOLLOW ALL MANUFACTURER RECOMMENDATIONS FOR INSPECTION AND MAINTENANCE GUIDELINES. REPLACE DEWATERING BAGS WHEN TRAPPED SEDIMENT HAS ACCUMULATED TO 50% OF THE BAG CAPACITY OR IN ACCORDANCE WITH THE MANUFACTURER'S RECOMMENDATIONS.
2. DEWATERING BAGS ARE FULL WHEN THEY NO LONGER EFFICIENTLY FILTER SEDIMENT OR PASS WATER AT A REASONABLE RATE.

SEDIMENT FILTER BAG DETAIL

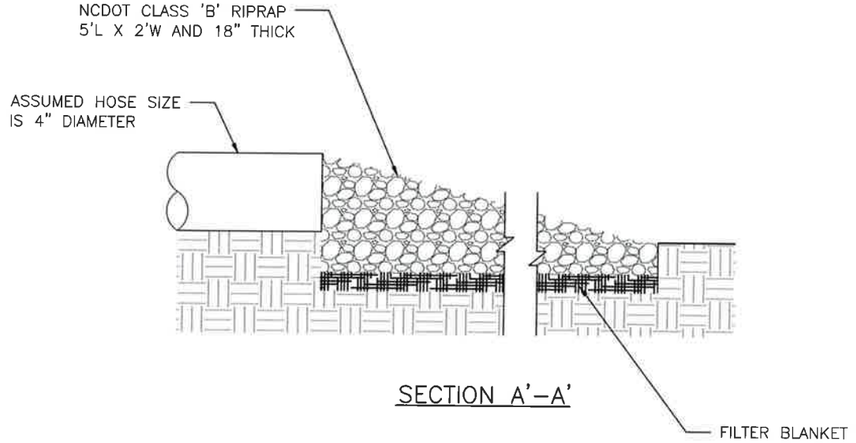
N.T.S.

NOTES

1. IN WELL-DEFINED CHANNEL, EXTEND THE RIPRAP APRON UP THE CHANNEL BANKS TO AN ELEVATION OF 6" ABOVE THE MAXIMUM TAILWATER DEPTH OR TO THE TOP OF BANK WHICHEVER IS LESS.
2. A FILTER BLANKET AND NON-WOVEN GEOTEXTILE FABRIC SHOULD BE INSTALLED BETWEEN THE RIPRAP AND SOIL FOUNDATION. FILTER BLANKET SHALL CONSIST OF MINIMUM 4" THICK LAYER OF STONE (NCDOT #57) UNDERLAIN WITH NON-WOVEN GEOTEXTILE FABRIC.



PLAN VIEW



SECTION A'-A'

TEMPORARY RIPRAP DISSIPATION PAD

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

McAdams
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187
www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

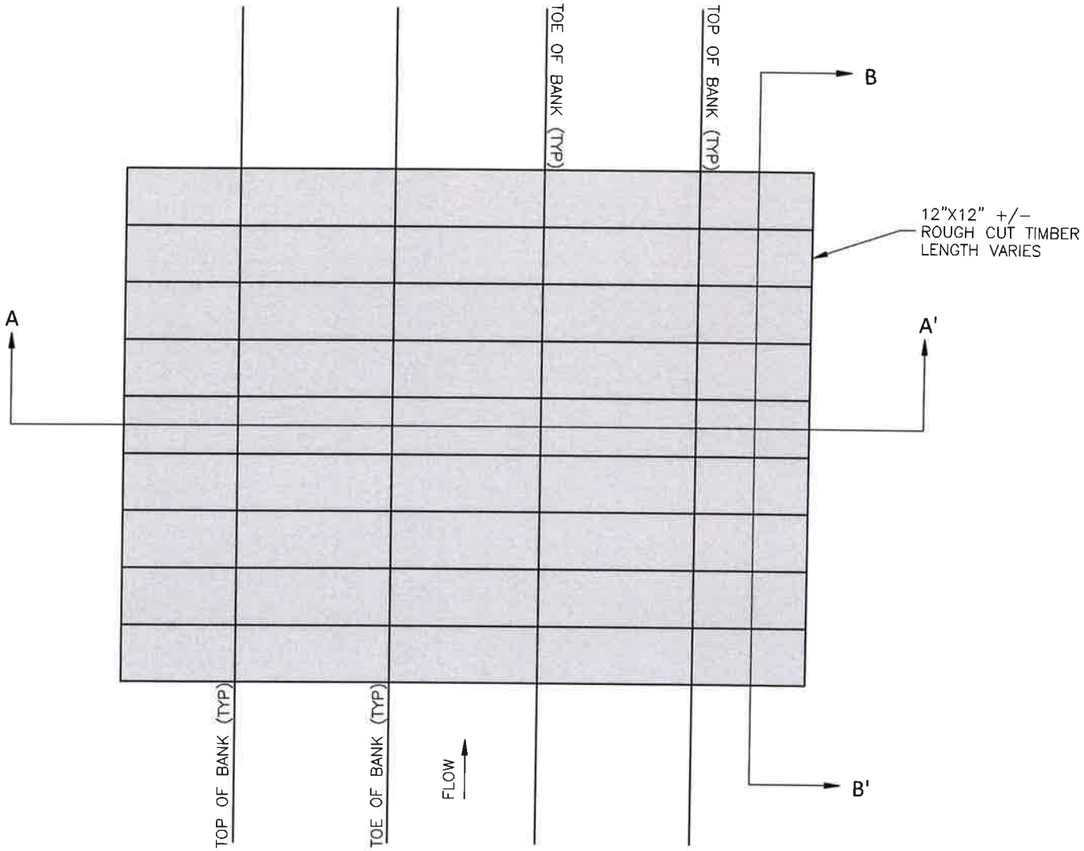
RS RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

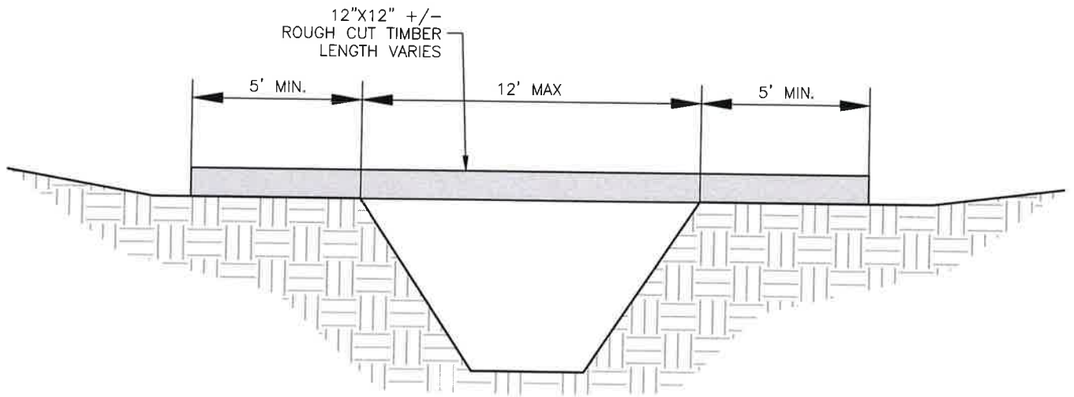
PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

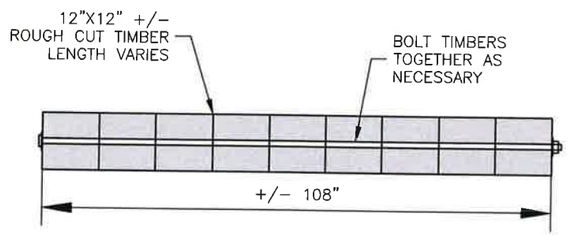
C6.16



PLAN VIEW



SECTION A - A'



SECTION B - B'

NOTE:
DETAIL PROVIDED FOR INFORMATIONAL PURPOSES.
USE OF LOG MAT IS AT THE CONTRACTORS DISCRETION.

LOG MAT
N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN
CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

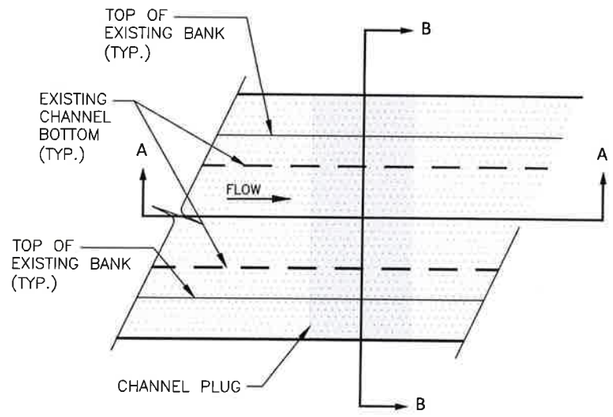
PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

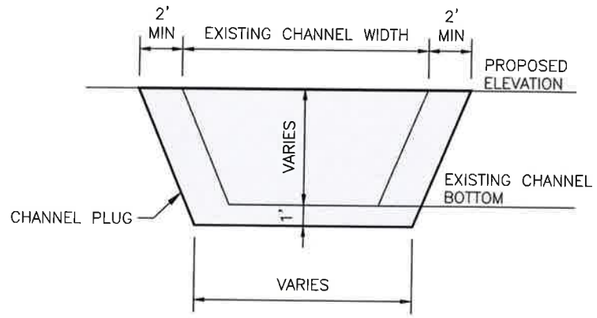
C6.17

CHANNEL PLUG NOTES:

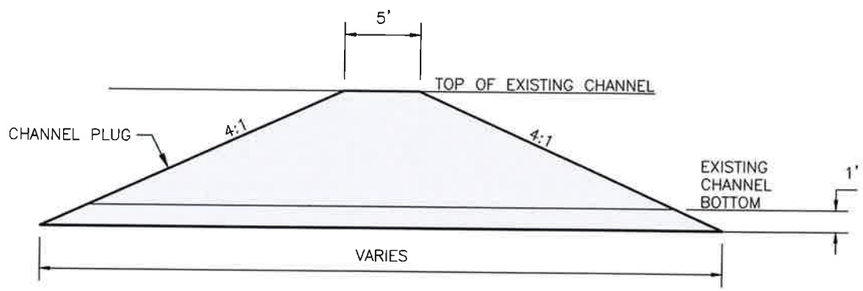
1. CHANNEL PLUGS TO BE LOCATED AS SHOWN ON PLAN SHEETS C6.00 THROUGH C6.12 AND AT OTHER LOCATIONS AS DIRECTED BY THE CONSTRUCTION MANAGER.
2. CHANNEL PLUG MATERIAL SHALL BE CLAY SOIL HARVESTED ON SITE OR BROUGHT INTO THE SITE AS WELL AS MATERIAL USED IN REMOVED ROCK CHECK DAMS IF SUITABLE.
3. CHANNEL MATERIAL SHALL BE FREE OF ALL VISIBLE ORGANIC DEBRIS SUCH AS ROOTS AND LIMBS. SOILS WITH ORGANIC MATTER CONTENT EXCEEDING 5% BY WEIGHT SHALL NOT BE USED.
4. ROCKS AND STONES WITH A DIAMETER GREATER THAN 3 INCHES (IN ANY DIRECTION) SHALL BE REMOVED FROM FILL PRIOR TO COMPACTION.
5. FILL MATERIAL PLACED AT DENSITIES LOWER THAN SPECIFIED MINIMUM DENSITIES OR AT MOISTURE CONTENTS OUTSIDE THE SPECIFIED RANGES OR OTHERWISE NOT CONFORMING TO THE SPECIFIED REQUIREMENTS SHALL BE REMOVED AND REWORKED AND REPLACED WITH ACCEPTABLE MATERIALS.
6. TOPSOIL SHALL BE PLACED ON TOP OF THE SOIL LIFTS IN THE SAME MANOR AS THE REST OF THE GRADED CONSTRUCTION SITE
7. CHANNEL PLUGS WILL BE PLANTED ACCORDING TO THE PLANTING PLAN ON SHEETS L5.00, L5.01, AND L5.02.



PLAN VIEW



SECTION B-B'



SECTION A-A'

IMPERVIOUS CHANNEL PLUG DETAILS

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

C6.18

NOTES:

1. AN EROSION CONTROL BLANKET SHALL BE USED TO STABILIZE THE NEWLY CONSTRUCTED CHANNEL FROM THE TOP OF BANK TO TOE OF SLOPE AND SHALL BE 100% BIODEGRADABLE.
2. THE CHANNEL SIDE SLOPES SHALL BE FINE GRADED, SEEDED, FERTILIZED, AND LIMED PRIOR TO INSTALLING THE EROSION CONTROL BLANKET. REMOVE ROOTS, TWIGS, AND OTHER DEBRIS WHICH WOULD CAUSE BULGES IN THE MATTING AS WELL AS PREVENT THE MATTING FROM BEING LAID FLUSH TO THE FINISHED SURFACE.
3. KEY-IN EDGES OF MATTING A MINIMUM OF 6 INCHES INTO FINISHED GRADE. LAY MATTING SHINGLED DOWNSTREAM TO UPSTREAM, OVERLAPPING AT EDGES A MINIMUM OF 1 FOOT.
4. INSTALL STAKES TO ENSURE GOOD GROUND CONTACT OF THE MATTING TO WITHSTAND MEDIUM TO HIGH FLOWS. STAKES SHALL BE 100% BIODEGRADABLE AND INSTALLED PER THE MANUFACTURER'S SPECIFICATIONS INCLUDING, BUT NOT LIMITED TO, THE MANUFACTURER'S RECOMMENDED DENSITY AND PATTERN.
5. KEY-IN EDGES OF MATTING A MINIMUM OF 6 INCHES, PARTICULARLY NEAR RESTORATION STRUCTURES, BOULDERS, LOGS, ETC. CHECK MATTING FOR LOOSE ENDS, FLAPS, OR OTHER WEAKNESSES OR DAMAGE WHICH MAY CAUSE IT TO BECOME LOOSE UNDER FLOW CONDITIONS.
6. MATTING SHALL BE PLACED ALONG THE OUTSIDE BANK OF ALL BENDS AND ALONG BOTH SIDES OF THE CHANNEL IN TANGENT AREAS.
7. FIELD ADJUSTMENTS TO MATTING LOCATION MAY BE MADE AT THE DISCRETION OF THE DESIGNER.
8. THE EROSION CONTROL BLANKET SHALL CONSIST OF A MACHINE-PRODUCED BLANKET MADE OF COCONUT FIBER AND BE EQUIVALENT OR BETTER THAN THE FOLLOWING SPECIFICATION. SOIL STABILIZATION MATTING WHICH USES PLASTICS, METALS, OR OTHER MAN-MADE MATERIALS IN THE CONSTRUCTION OF THE MATERIAL WILL NOT BE PERMITTED.

WEIGHT = 13.6 OZ/SY

TENSILE STRENGTH DRY (ASTM D 4595) = 780 LBS/FT MACHINE DIRECTION
744 LBS/FT CROSS DIRECTION

TENSILE STRENGTH WET (ASTM D 4595) = 672 LBS/FT MACHINE DIRECTION
648 LBS/FT CROSS DIRECTION

ELONGATION FAILURE WET (ASTM D 4595) = 30% MACHINE DIRECTION
28% CROSS DIRECTION

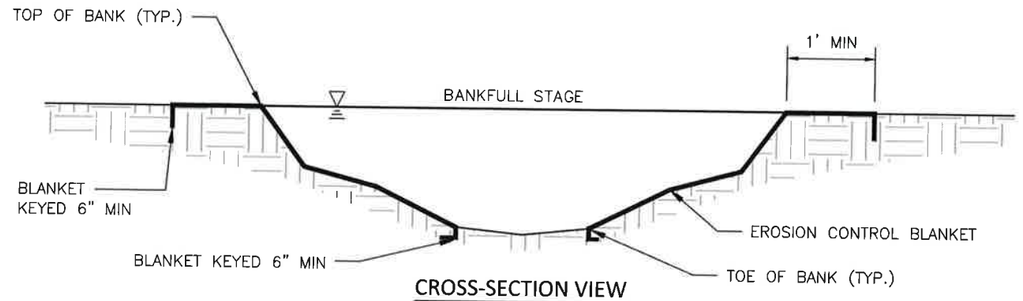
OPEN AREA = 65%

RECOMMENDED SHEAR STRESS = 3LBS/SQ.FT.

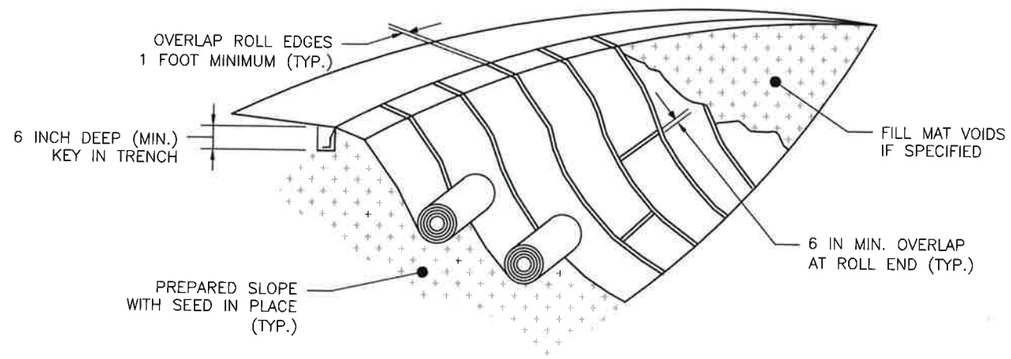
RECOMMENDED FLOW = 8FT/S

RECOMMENDED SLOPE </= 1:1

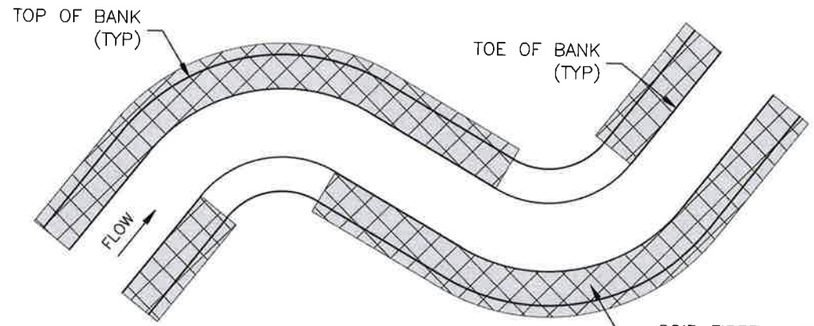
MINIMUM TWINE COUNT PER FOOT = 15X14



CROSS-SECTION VIEW



SLOPE APPLICATION ISOMETRIC VIEW



PLAN VIEW

EROSION CONTROL BLANKET DETAILS

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

C6.19

GROUND STABILIZATION AND MATERIALS HANDLING PRACTICES FOR COMPLIANCE WITH THE NCG01 CONSTRUCTION GENERAL PERMIT

Implementing the details and specifications on this plan sheet will result in the construction activity being considered compliant with the Ground Stabilization and Materials Handling sections of the NCG01 Construction General Permit (Sections E and F, respectively). The permittee shall comply with the Erosion and Sediment Control plan approved by the delegated authority having jurisdiction. All details and specifications shown on this sheet may not apply depending on site conditions and the delegated authority having jurisdiction.

SECTION E: GROUND STABILIZATION

Required Ground Stabilization Timeframes

Site Area Description	Stabilize within this many calendar days after ceasing land disturbance	Timeframe variations
(a) Perimeter dikes, swales, ditches, and perimeter slopes	7	None
(b) High Quality Water (HQW) Zones	7	None
(c) Slopes steeper than 3:1	7	If slopes are 10' or less in length and are not steeper than 2:1, 14 days are allowed
(d) Slopes 3:1 to 4:1	14	-7 days for slopes greater than 50' in length and with slopes steeper than 4:1 -7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed
(e) Areas with slopes flatter than 4:1	14	-7 days for perimeter dikes, swales, ditches, perimeter slopes and HQW Zones -10 days for Falls Lake Watershed unless there is zero slope

Note: After the permanent cessation of construction activities, any areas with temporary ground stabilization shall be converted to permanent ground stabilization as soon as practicable but in no case longer than 90 calendar days after the last land disturbing activity. Temporary ground stabilization shall be maintained in a manner to render the surface stable against accelerated erosion until permanent ground stabilization is achieved.

GROUND STABILIZATION SPECIFICATION

Stabilize the ground sufficiently so that rain will not dislodge the soil. Use one of the techniques in the table below:

Temporary Stabilization	Permanent Stabilization
• Temporary grass seed covered with straw or other mulches and tackifiers • Hydroseeding • Rolled erosion control products with or without temporary grass seed • Appropriately applied straw or other mulch • Plastic sheeting	• Permanent grass seed covered with straw or other mulches and tackifiers • Geotextile fabrics such as permanent soil reinforcement matting • Hydroseeding • Shrubs or other permanent plantings covered with mulch • Uniform and evenly distributed ground cover sufficient to restrain erosion • Structural methods such as concrete, asphalt or retaining walls • Rolled erosion control products with grass seed

POLYACRYLAMIDES (PAMS) AND FLOCCULANTS

1. Select flocculants that are appropriate for the soils being exposed during construction, selecting from the *NC DWR List of Approved PAMS/Flocculants*.
2. Apply flocculants at or before the inlets to Erosion and Sediment Control Measures.
3. Apply flocculants at the concentrations specified in the *NC DWR List of Approved PAMS/Flocculants* and in accordance with the manufacturer's instructions.
4. Provide ponding area for containment of treated stormwater before discharging offsite.
5. Store flocculants in leak-proof containers that are kept under storm-resistant cover or surrounded by secondary containment structures.

EQUIPMENT AND VEHICLE MAINTENANCE

1. Maintain vehicles and equipment to prevent discharge of fluids.
2. Provide drip pans under any stored equipment.
3. Identify leaks and repair as soon as feasible, or remove leaking equipment from the project.
4. Collect all spent fluids, store in separate containers and properly dispose as hazardous waste (recycle when possible).
5. Remove leaking vehicles and construction equipment from service until the problem has been corrected.
6. Bring used fuels, lubricants, coolants, hydraulic fluids and other petroleum products to a recycling or disposal center that handles these materials.

LITTER, BUILDING MATERIAL AND LAND CLEARING WASTE

1. Never bury or burn waste. Place litter and debris in approved waste containers.
2. Provide a sufficient number and size of waste containers (e.g dumpster, trash receptacle) on site to contain construction and domestic wastes.
3. Locate waste containers at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
4. Locate waste containers on areas that do not receive substantial amounts of runoff from upland areas and does not drain directly to a storm drain, stream or wetland.
5. Cover waste containers at the end of each workday and before storm events or provide secondary containment. Repair or replace damaged waste containers.
6. Anchor all lightweight items in waste containers during times of high winds.
7. Empty waste containers as needed to prevent overflow. Clean up immediately if containers overflow.
8. Dispose waste off-site at an approved disposal facility.
9. On business days, clean up and dispose of waste in designated waste containers.

PAINT AND OTHER LIQUID WASTE

1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, sized and placed appropriately for the needs of site.
5. Prevent the discharge of soaps, solvents, detergents and other liquid wastes from construction sites.

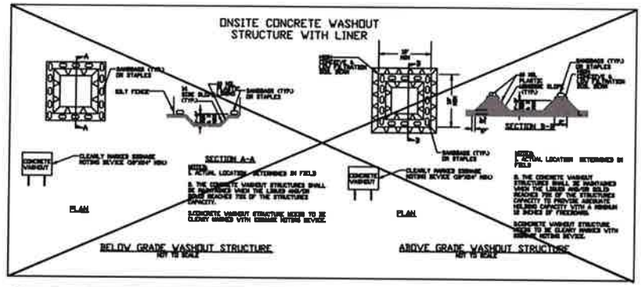
PORTABLE TOILETS

1. Install portable toilets on level ground, at least 50 feet away from storm drains, streams or wetlands unless there is no alternative reasonably available. If 50 foot offset is not attainable, provide relocation of portable toilet behind silt fence or place on a gravel pad and surround with sand bags.
2. Provide staking or anchoring of portable toilets during periods of high winds or in high foot traffic areas.
3. Monitor portable toilets for leaking and properly dispose of any leaked material. Utilize a licensed sanitary waste hauler to remove leaking portable toilets and replace with properly operating unit.

EARTHEN STOCKPILE MANAGEMENT

1. Show stockpile locations on plans. Locate earthen-material stockpile areas at least 50 feet away from storm drain inlets, sediment basins, perimeter sediment controls and surface waters unless it can be shown no other alternatives are reasonably available.
2. Protect stockpile with silt fence installed along toe of slope with a minimum offset of five feet from the toe of stockpile.
3. Provide stable stone access point when feasible.
4. Stabilize stockpile within the timeframes provided on this sheet and in accordance with the approved plan and any additional requirements. Soil stabilization is defined as vegetative, physical or chemical coverage techniques that will restrain accelerated erosion on disturbed soils for temporary or permanent control needs.

NORTH CAROLINA *Environmental Quality*



CONCRETE WASHOUTS

1. Do not discharge concrete or cement slurry from the site.
2. Dispose of, or recycle settled, hardened concrete residue in accordance with local and state solid waste regulations and at an approved facility.
3. Manage washout from mortar mixers in accordance with the above item and in addition place the mixer and associated materials on impervious barrier and within lot perimeter silt fence.
4. Install temporary concrete washouts per local requirements, where applicable. If an alternate method or product is to be used, contact your approval authority for review and approval. If local standard details are not available, use one of the two types of temporary concrete washouts provided on this detail.
5. Do not use concrete washouts for dewatering or storing defective curb or sidewalk sections. Stormwater accumulated within the washout may not be pumped into or discharged to the storm drain system or receiving surface waters. Liquid waste must be pumped out and removed from project.
6. Locate washouts at least 50 feet from storm drain inlets and surface waters unless it can be shown that no other alternatives are reasonably available. At a minimum, install protection of storm drain inlet(s) closest to the washout which could receive spills or overflow.
7. Locate washouts in an easily accessible area, on level ground and install a stone entrance pad in front of the washout. Additional controls may be required by the approving authority.
8. Install at least one sign directing concrete trucks to the washout within the project limits. Post signage on the washout itself to identify this location.
9. Remove leavings from the washout when at approximately 75% capacity to limit overflow events. Replace the tarp, sand bags or other temporary structural components when no longer functional. When utilizing alternative or proprietary products, follow manufacturer's instructions.
10. At the completion of the concrete work, remove remaining leavings and dispose of in an approved disposal facility. Fill pit, if applicable, and stabilize any disturbance caused by removal of washout.

HERBICIDES, PESTICIDES AND RODENTICIDES

1. Store and apply herbicides, pesticides and rodenticides in accordance with label restrictions.
2. Store herbicides, pesticides and rodenticides in their original containers with the label, which lists directions for use, ingredients and first aid steps in case of accidental poisoning.
3. Do not store herbicides, pesticides and rodenticides in areas where flooding is possible or where they may spill or leak into wells, stormwater drains, ground water or surface water. If a spill occurs, clean area immediately.
4. Do not stockpile these materials onsite.

HAZARDOUS AND TOXIC WASTE

1. Create designated hazardous waste collection areas on-site.
2. Place hazardous waste containers under cover or in secondary containment.
3. Do not store hazardous chemicals, drums or bagged materials directly on the ground.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.3.21

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

C6.20

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION A: SELF-INSPECTION

Self-inspections are required during normal business hours in accordance with the table below. When adverse weather or site conditions would cause the safety of the inspection personnel to be in jeopardy, the inspection may be delayed until the next business day on which it is safe to perform the inspection. In addition, when a storm event of equal to or greater than 1.0 inch occurs outside of normal business hours, the self-inspection shall be performed upon the commencement of the next business day. Any time when inspections were delayed shall be noted in the Inspection Record.

Inspect	Frequency (during normal business hours)	Inspection records must include:
(1) Rain gauge maintained in good working order	Daily	Daily rainfall amounts. If no daily rain gauge observations are made during weekend or holiday periods, and no individual-day rainfall information is available, record the cumulative rain measurement for those un-attended days (and this will determine if a site inspection is needed). Days on which no rainfall occurred shall be recorded as "zero." The permittee may use another rain-monitoring device approved by the Division.
(2) E&SC Measures	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the measures inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Indication of whether the measures were operating properly, 5. Description of maintenance needs for the measure, 6. Description, evidence, and date of corrective actions taken.
(3) Stormwater discharge outfalls (SDCs)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	1. Identification of the discharge outfalls inspected, 2. Date and time of the inspection, 3. Name of the person performing the inspection, 4. Evidence of indicators of stormwater pollution such as oil sheen, floating or suspended solids or discoloration, 5. Indication of visible sediment leaving the site, 6. Description, evidence, and date of corrective actions taken.
(4) Perimeter of site	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If visible sedimentation is found outside site limits, then a record of the following shall be made: 1. Actions taken to clean up or stabilize the sediment that has left the site limits, 2. Description, evidence, and date of corrective actions taken, and 3. An explanation as to the actions taken to control future releases.
(5) Streams or wetlands onsite or offsite (where accessible)	At least once per 7 calendar days and within 24 hours of a rain event ≥ 1.0 inch in 24 hours	If the stream or wetland has increased visible sedimentation or a stream has visible increased turbidity from the construction activity, then a record of the following shall be made: 1. Description, evidence and date of corrective actions taken, and 2. Records of the required reports to the appropriate Division Regional Office per Part III, Section C, Item (2)(a) of this permit.
(6) Ground stabilization measures	After each phase of grading	1. The phase of grading (installation of perimeter E&SC measures, clearing and grubbing, installation of storm drainage facilities, completion of all land-disturbing activity, construction or redevelopment, permanent ground cover). 2. Documentation that the required ground stabilization measures have been provided within the required timeframe or an assurance that they will be provided as soon as possible.

NOTE: The rain inspection resets the required 7 calendar day inspection requirement.

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION B: RECORDKEEPING

1. E&SC Plan Documentation

The approved E&SC plan as well as any approved deviation shall be kept on the site. The approved E&SC plan must be kept up-to-date throughout the coverage under this permit. The following items pertaining to the E&SC plan shall be kept on site and available for inspection at all times during normal business hours.

Item to Document	Documentation Requirements
(a) Each E&SC measure has been installed and does not significantly deviate from the locations, dimensions and relative elevations shown on the approved E&SC plan.	Initial and date each E&SC measure on a copy of the approved E&SC plan or complete, date and sign an inspection report that lists each E&SC measure shown on the approved E&SC plan. This documentation is required upon the initial installation of the E&SC measures or if the E&SC measures are modified after initial installation.
(b) A phase of grading has been completed.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate completion of the construction phase.
(c) Ground cover is located and installed in accordance with the approved E&SC plan.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate compliance with approved ground cover specifications.
(d) The maintenance and repair requirements for all E&SC measures have been performed.	Complete, date and sign an inspection report.
(e) Corrective actions have been taken to E&SC measures.	Initial and date a copy of the approved E&SC plan or complete, date and sign an inspection report to indicate the completion of the corrective action.

2. Additional Documentation to be Kept on Site

In addition to the E&SC plan documents above, the following items shall be kept on the site and available for inspectors at all times during normal business hours, unless the Division provides a site-specific exemption based on unique site conditions that make this requirement not practical:

(a) This General Permit as well as the Certificate of Coverage, after it is received.

(b) Records of inspections made during the previous twelve months. The permittee shall record the required observations on the Inspection Record Form provided by the Division or a similar inspection form that includes all the required elements. Use of electronically-available records in lieu of the required paper copies will be allowed if shown to provide equal access and utility as the hard-copy records.

3. Documentation to be Retained for Three Years

All data used to complete the e-NOI and all inspection records shall be maintained for a period of three years after project completion and made available upon request. [40 CFR 122.41]

PART III
SELF-INSPECTION, RECORDKEEPING AND REPORTING

SECTION C: REPORTING

1. Occurrences that Must be Reported

Permittees shall report the following occurrences:

(a) Visible sediment deposition in a stream or wetland.

(b) Oil spills if:
- They are 25 gallons or more,
- They are less than 25 gallons but cannot be cleaned up within 24 hours,
- They cause sheen on surface waters (regardless of volume), or
- They are within 100 feet of surface waters (regardless of volume).

(c) Releases of hazardous substances in excess of reportable quantities under Section 311 of the Clean Water Act (Ref: 40 CFR 110.3 and 40 CFR 117.3) or Section 102 of CERCLA (Ref: 40 CFR 302.4) or G.S. 143-215.85.

(d) Anticipated bypasses and unanticipated bypasses.

(e) Noncompliance with the conditions of this permit that may endanger health or the environment.

2. Reporting Timeframes and Other Requirements

After a permittee becomes aware of an occurrence that must be reported, he shall contact the appropriate Division regional office within the timeframes and in accordance with the other requirements listed below. Occurrences outside normal business hours may also be reported to the Department's Environmental Emergency Center personnel at (800) 858-0368.

Occurrence	Reporting Timeframes (After Discovery) and Other Requirements
(a) Visible sediment deposition in a stream or wetland	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the sediment and actions taken to address the cause of the deposition. Division staff may waive the requirement for a written report on a case-by-case basis. • If the stream is named on the NC 303(d) list as impaired for sediment-related causes, the permittee may be required to perform additional monitoring, inspections or apply more stringent practices if staff determine that additional requirements are needed to assure compliance with the federal or state impaired-waters conditions.
(b) Oil spills and release of hazardous substances per Item 1(b)-(c) above	• ***Within 24 hours***, an oral or electronic notification. The notification shall include information about the date, time, nature, volume and location of the spill or release.
(c) Anticipated bypasses [40 CFR 122.41(m)(3)]	• ***A report at least ten days before the date of the bypass, if possible.*** The report shall include an evaluation of the anticipated quality and effect of the bypass.
(d) Unanticipated bypasses [40 CFR 122.41(m)(3)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that includes an evaluation of the quality and effect of the bypass.
(e) Noncompliance with the conditions of this permit that may endanger health or the environment[40 CFR 122.41(l)(7)]	• ***Within 24 hours***, an oral or electronic notification. • ***Within 7 calendar days***, a report that contains a description of the noncompliance, and its causes; the period of noncompliance, including exact dates and times, and if the noncompliance has not been corrected, the anticipated time noncompliance is expected to continue; and steps taken or planned to reduce, eliminate, and prevent reoccurrence of the noncompliance. [40 CFR 122.41(l)(6). • Division staff may waive the requirement for a written report on a case-by-case basis.

PART II, SECTION G, ITEM (4)
DRAW DOWN OF SEDIMENT BASINS FOR MAINTENANCE OR CLOSE OUT

Sediment basins and traps that receive runoff from drainage areas of one acre or more shall use outlet structures that withdraw water from the surface when these devices need to be drawn down for maintenance or close out unless this is infeasible. The circumstances in which it is not feasible to withdraw water from the surface shall be rare (for example, times with extended cold weather). Non-surface withdrawals from sediment basins shall be allowed only when all of the following criteria have been met:

(a) The E&SC plan authority has been provided with documentation of the non-surface withdrawal and the specific time periods or conditions in which it will occur. The non-surface withdrawal shall not commence until the E&SC plan authority has approved these items,
(b) The non-surface withdrawal has been reported as an anticipated bypass in accordance with Part III, Section C, Item (2)(c) and (d) of this permit,
(c) Dewatering discharges are treated with controls to minimize discharges of pollutants from stormwater that is removed from the sediment basin. Examples of appropriate controls include properly sited, designed and maintained dewatering tanks, weir tanks, and filtration systems,
(d) Vegetated, upland areas of the sites or a properly designed stone pad is used to the extent feasible at the outlet of the dewatering treatment devices described in Item (c) above,
(e) Velocity dissipation devices such as check dams, sediment traps, and riprap are provided at the discharge points of all dewatering devices, and
(f) Sediment removed from the dewatering treatment devices described in Item (c) above is disposed of in a manner that does not cause deposition of sediment into waters of the United States.

NORTH CAROLINA *Environmental Quality*

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

McADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

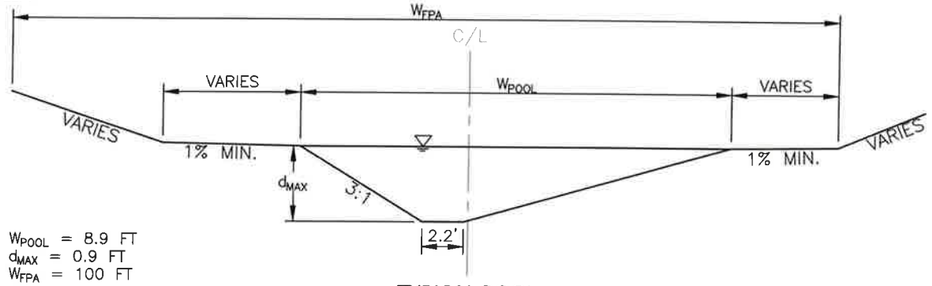
PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-EC2
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

EROSION CONTROL DETAILS

C6.21

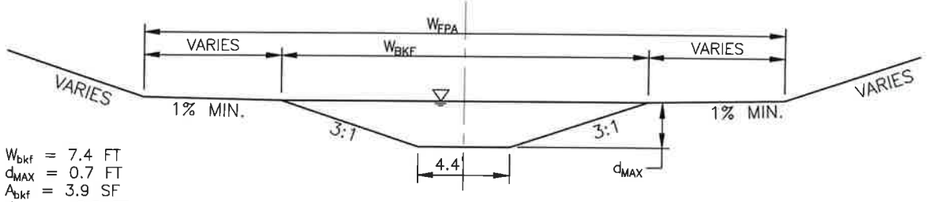
TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT



W_{POOL} = 8.9 FT
d_{MAX} = 0.9 FT
W_{FPA} = 100 FT

TYPICAL POOL

C/L



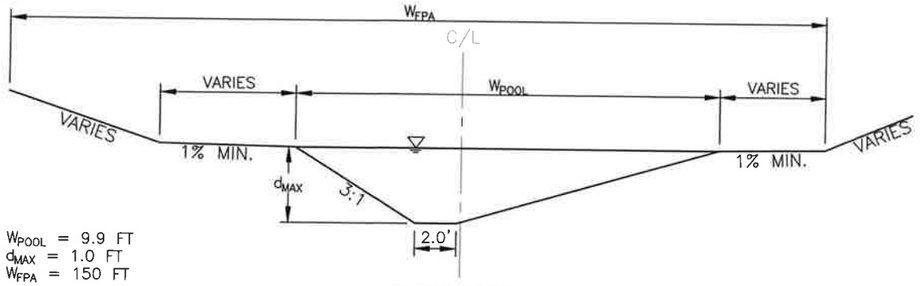
W_{bkf} = 7.4 FT
d_{MAX} = 0.7 FT
A_{bkf} = 3.9 SF
d_{MEAN} = 0.5 FT
W_{FPA} = 100 FT

TYPICAL RIFFLE

UT 1 - UPSTREAM

N.T.S.

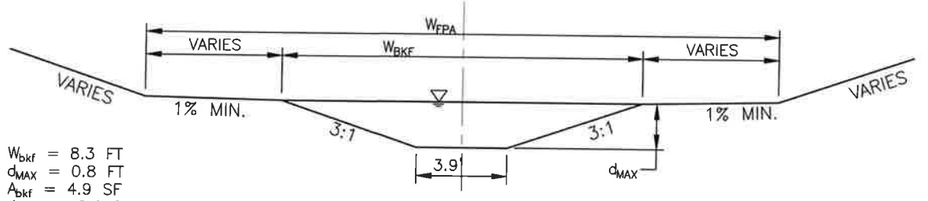
TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT



W_{POOL} = 9.9 FT
d_{MAX} = 1.0 FT
W_{FPA} = 150 FT

TYPICAL POOL

C/L



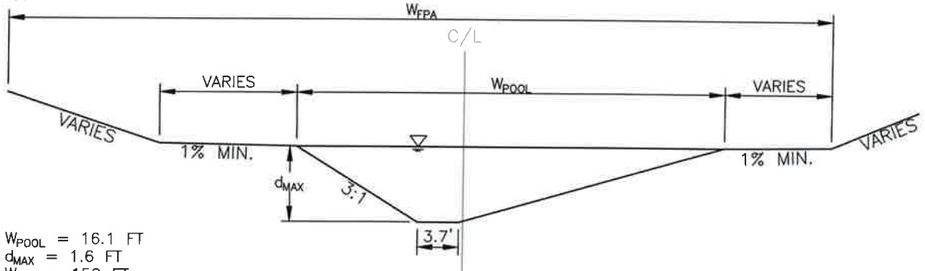
W_{bkf} = 8.3 FT
d_{MAX} = 0.8 FT
A_{bkf} = 4.9 SF
d_{MEAN} = 0.6 FT
W_{FPA} = 150 FT

TYPICAL RIFFLE

UT 2

N.T.S.

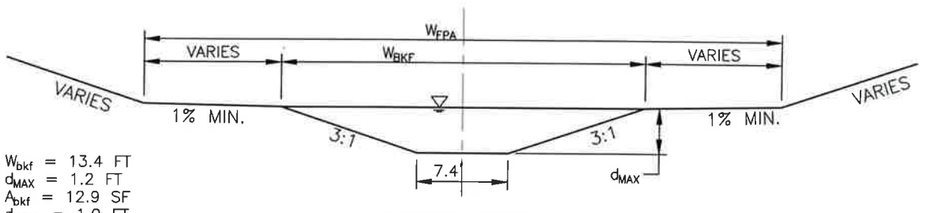
TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT



W_{POOL} = 16.1 FT
d_{MAX} = 1.6 FT
W_{FPA} = 150 FT

TYPICAL POOL

C/L



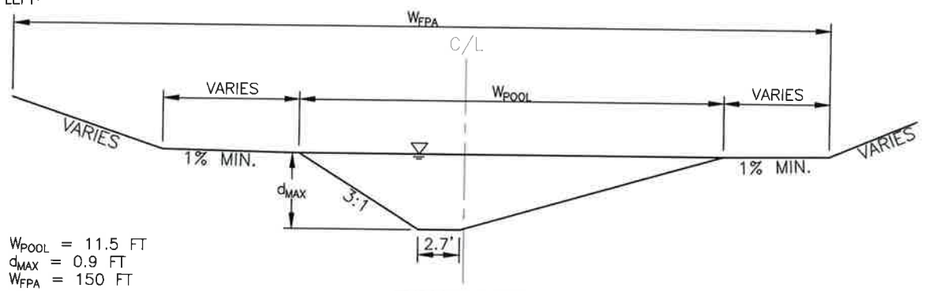
W_{bkf} = 13.4 FT
d_{MAX} = 1.2 FT
A_{bkf} = 12.9 SF
d_{MEAN} = 1.0 FT
W_{FPA} = 150 FT

TYPICAL RIFFLE

UT 1 - DOWNSTREAM

N.T.S.

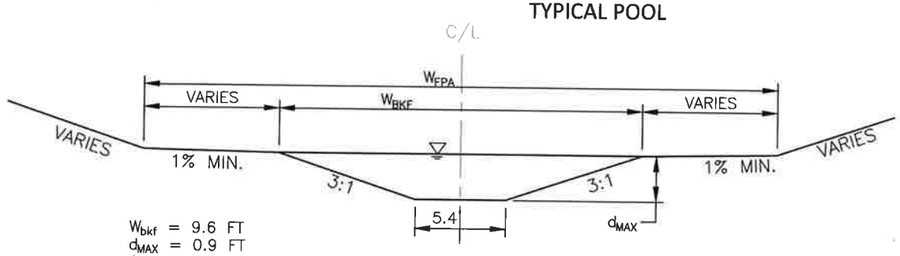
TYPICAL POOL CROSS-SECTION ORIENTATION IS FOR A MEANDER BEND TOWARD STREAM RIGHT AND SHALL BE MIRRORED FOR MEANDER BENDS TOWARDS STREAM LEFT



W_{POOL} = 11.5 FT
d_{MAX} = 0.9 FT
W_{FPA} = 150 FT

TYPICAL POOL

C/L



W_{bkf} = 9.6 FT
d_{MAX} = 0.9 FT
A_{bkf} = 6.6 SF
d_{MEAN} = 0.7 FT
W_{FPA} = 150 FT

TYPICAL RIFFLE

UT 3

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION	
PROJECT NO.	AXI-19010
FILENAME	AXI19010-D1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

STREAM DETAILS

C8.00

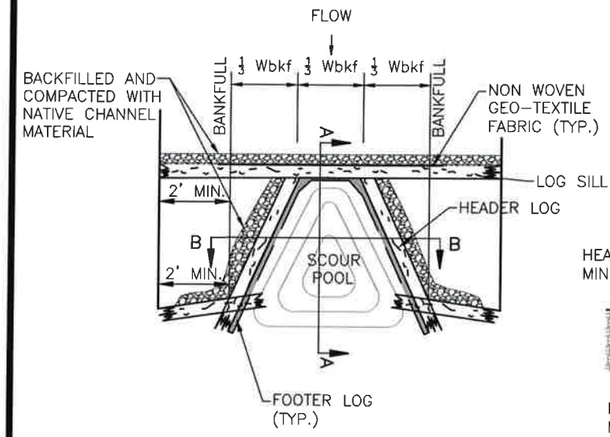
GENERAL NOTES:

1. A LOG CROSS VANE IS A GRADE CONTROL, IN-STREAM STRUCTURE THAT DIRECTS STREAM FLOW AWAY FROM THE STREAM BANKS AND IN TOWARD THE CENTER OF THE CHANNEL.
2. ELEVATION CONTROL POINTS SHALL BE DESIGNATED AT THE UPSTREAM INVERT (CENTER) OF THE CROSS VANE TO ESTABLISH PART OF THE PROFILE. A NOTCH MAY BE CUT INTO THE LOG AT THE INVERT LOCATION. POOL ELEVATION CONTROL POINTS OR EXCAVATION TO A SPECIFIED MAXIMUM POOL DEPTH SHALL BE DESIGNATED TO ESTABLISH THE REMAINING PROFILE. SURVEY OF CONTROL POINTS SHALL BE REQUIRED TO ESTABLISH ACCURATE INSTALLATION WITHIN THE TOLERANCE SPECIFIED BY THE DESIGNER.
3. THE VANE ARM SHALL BE SLOPED 3-5% AND INTERCEPT THE STREAM BANK AT A HEIGHT EQUAL TO BETWEEN ½ BANKFULL STAGE AND BANKFULL STAGE. ELEVATION CONTROL POINTS MAY BE ESTABLISHED AT THE LEFT AND RIGHT STREAM BANK/VANE ARM INTERCEPT POINTS. THE VANE ARM INTERCEPT LOCATION MAY BE OTHERWISE DESCRIBED BY ITS RELATIONSHIP TO BANKFULL STAGE OR BY THE LENGTH AND SLOPE OF THE VANE ARM. BANKFULL IS NOT NECESSARILY THE TOP OF THE STREAM BANK SLOPE.
4. IF THE PLANS DESIGNATE THE USE OF MULTIPLE LOG CROSS VANES A TABLE OF ALL STATION LOCATIONS AND CONTROL POINT ELEVATIONS SHALL BE PROVIDED IN THIS DETAIL OR PROVIDED ELSEWHERE IN THE PLANS AND REFERENCED HEREIN.
5. TYPICAL RIFFLE AND POOL CROSS SECTIONS SHALL BE PROVIDED ELSEWHERE IN THE PLANS TO ESTABLISH THE DIMENSIONS OF THE CHANNEL GRADING INTO WHICH THE LOG CROSS VANES ARE TO BE INSTALLED.
6. LOGS SHALL BE RELATIVELY STRAIGHT HARDWOOD, RECENTLY HARVESTED AND BE A MINIMUM OF 18" DIAMETER. THE LENGTH SHALL BE SUCH THAT THE LOG IS BURIED INTO THE SOIL OF THE STREAM BANK (ON ONE END) AND STREAM BED (ON THE OTHER END) A MINIMUM DISTANCE AS SPECIFIED BY THE DESIGNER. THE INVERT LOG SHALL BE KEYED INTO THE BANK A MINIMUM OF 2 FEET PAST TOP OF BANK WIDTH.
7. A SINGLE LOG MAY BE USED IN LIEU OF A HEADER/FOOTER LOG COMBINATION. A DOUBLE FOOTER LOG MAY BE REQUIRED IN SAND BED STREAMS.
8. NON-WOVEN GEOTEXTILE FABRIC OF A TYPE AND SIZE SPECIFIED BY THE DESIGNER SHALL BE USED TO SEAL THE GAPS BETWEEN THE LOG(S) AND THE STREAM BED, UNDER THE COARSE BACKFILL MATERIAL. THERE SHALL BE NO FILTER FABRIC VISIBLE IN THE FINISHED WORK; EDGES SHALL BE FOLDED, TUCKED, OR TRIMMED AS NEEDED.
9. COARSE BACKFILL OF THE LOG CROSS VANE SHALL BE OF A TYPE, SIZE, AND GRADATION AS SPECIFIED BY THE DESIGNER. COARSE BACKFILL SHALL BE PLACED TO A THICKNESS EQUAL TO THE DEPTH OF THE HEADER (AND ANY FOOTER) LOGS AND SHALL EXTEND OUT FROM THE VANE ARMS TO THE STREAM BANK AND UPSTREAM A DISTANCE SPECIFIED BY THE DESIGNER.
10. AS AN OPTION, FLAT-SIDED BOULDERS OF A SIZE (LENGTH, WIDTH, AND THICKNESS) AS SPECIFIED BY THE DESIGNER MAY BE PLACED AS BALLAST ON TOP OF THE STREAM BANK SIDE OF THE EMBEDDED VANE ARMS. DUCK BILL ANCHORS MAY BE USED IN LIEU OF BALLAST BOULDERS.
11. DUCKBILL ANCHORS WITH GALVANIZED CABLE ATTACHED (OF A GAGE ADEQUATE TO SECURE THE SPECIFIED DIAMETER LOG) MAY BE USED TO SECURE LOGS INTO THE STREAM BED AND/OR BANKS TO THE SPECIFIED DEPTH. FLAT SIDED BOULDERS (LENGTH, WIDTH, AND THICKNESS SPECIFIED BY DESIGNER) CAN BE USED IN LIEU OF THE LOG INVERT/DUCKBILL ANCHOR SYSTEM.

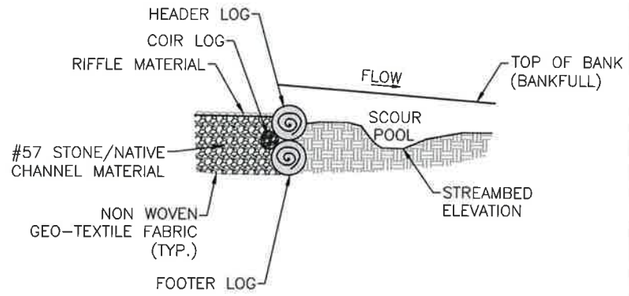
CONSTRUCTION GUIDELINES:

1. THE VANE ARMS OF THE LOG CROSS VANE SHALL BE CONSTRUCTED FIRST, FOLLOWED BY THE LOG INVERT.
2. OVER-EXCAVATE STREAM BED TO A DEPTH EQUAL TO THE TOTAL THICKNESS OF THE HEADER (AND FOOTER IF SPECIFIED) LOGS.
3. PLACE VANE ARM FOOTER LOGS, IF SPECIFIED. THE SLOPE OF THE VANE ARM IS MEASURED ALONG THE VANE ARM WHICH IS INSTALLED AT AN ANGLE TO THE STREAM BANK AND PROFILE.
4. INSTALL VANE ARM HEADER LOG ON TOP OF AND SET SLIGHTLY FORWARD OR BACK FROM THE FOOTER LOG.
5. INSTALL INVERT LOG AND DUCKBILL ANCHOR.
6. NAIL FILTER FABRIC TO THE HEADER LOG USING A GALVANIZED NAIL WITH A PLASTIC CAP. THE SIZE AND GAGE OF NAIL AND NAIL SPACING SHALL BE SPECIFIED BY THE DESIGNER.
7. PLACE COARSE BACKFILL BEHIND LOG(S) ENSURING THAT ANY VOIDS BETWEEN THE LOGS ARE FILLED.
8. IF ANY EROSION CONTROL MATTING IS SPECIFIED FOR USE IN THE VICINITY OF THE VANE ARM INTERCEPT POINTS, ALL MATTING EDGES SHALL BE NEATLY SECURED AROUND THE LOGS.

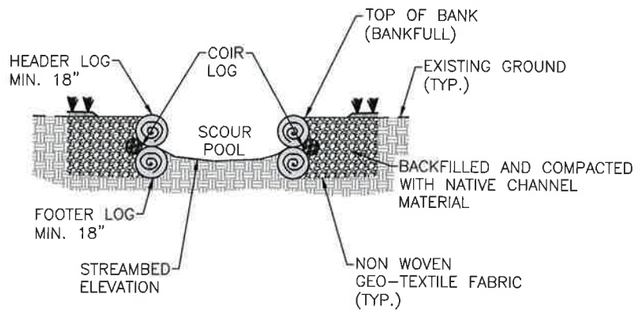
TRIBUTARY	W_{bkf} (FT)
UT1 – UPSTREAM	7.4
UT1 – DOWNSTREAM	13.4
UT2	8.3
UT3	9.6



PLAN VIEW



SECTION A - A



SECTION B - B

LOG CROSS VANE DETAIL

N.T.S.

NOTE: GEOTEXTILE FABRIC (NON–WOVEN) SHALL CONFORM TO THE FOLLOWING SPECIFICATIONS.

MECHANICAL PROPERTIES	TEST METHOD	UNIT	MINIMUM AVERAGE ROLL VALUE	
			MD	CD
GRAB TENSILE STRENGTH	ASTM D 4632	N (lbs)	912 (205)	912 (205)
GRAB TENSILE ELONGATION	ASTM D 4632	%	50	50
TRAPEZOID TEAR STRENGTH	ASTM D 4533	N (lbs)	356 (80)	356 (80)
CBR PUNCTURE STRENGTH	ASTM D 6241	N (lbs)	2225 (500)	
APPARENT OPENING SIZE (AOS)$_1$	ASTM D 4751	mm (U.S. SIEVE)	0.18 (80)	
PERMITTIVITY	ASTM D 4491	sec $^{-1}$	1.1	
FLOW RATE	ASTM D 4491	l/min/m^2 (gal/min/ft^2)	3870 (95)	
UV RESISTANCE (AT 500 HOURS)	ASTM D 4355	% STRENGTH RETAINED	70	

$_1$ASTM D 4751: AOS IS A MAXIMUM OPENING DIAMETER VALUE

PHYSICAL PROPERTIES	TEST METHOD	UNIT	TYPICAL VALUE	
WEIGHT	ASTM D 5261	g/m^2 (oz/yd^2)	271 (8.0)	
THICKNESS	ASTM D 5199	mm (mils)	1.8 (72)	
ROLL DIMENSIONS (WIDTH X LENGTH)	–	ft	12.5 X 360	15 X 300
ROLL AREA	–	m^2 (yd^2)	418 (500)	
ESTIMATED ROLL WEIGHT	–	kg (lb)	120 (265)	

NON-WOVEN GEOTEXTILE FABRIC MATERIAL SPECIFICATIONS

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-D1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

STREAM DETAILS

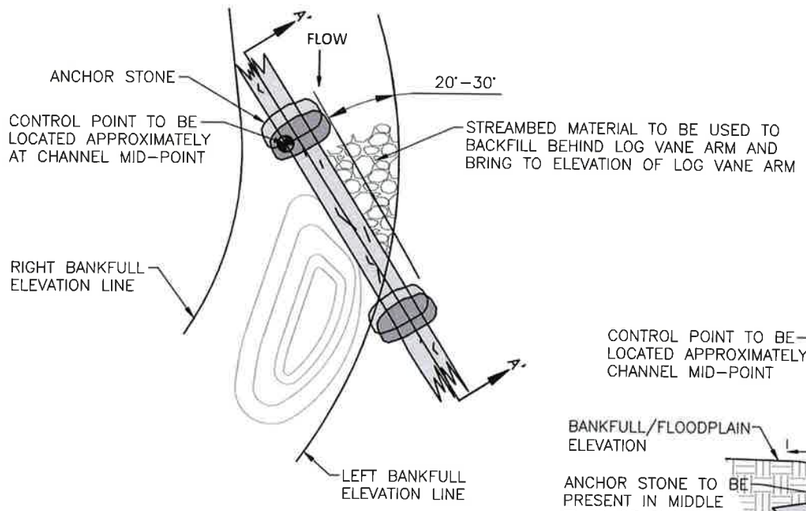
C8.01

GENERAL NOTES

1. LOG VANES WILL BE ANGLED @20-30° FROM STREAM BANK.
2. LOG VANES SHALL BE LARGE ENOUGH TO OCCUPY ⅔ OF THE POOL MAXIMUM DEPTH.
3. LOG VANE WILL BE SLOPED AT 3-5%.
4. SEED AND SOIL STABILIZATION MATTING WILL BE PLACED ALONG STREAM BANKS FOR STABILIZATION PURPOSES WHERE DISTURBANCES HAS OCCURRED AS A RESULT STRUCTURE INSTALLATION.

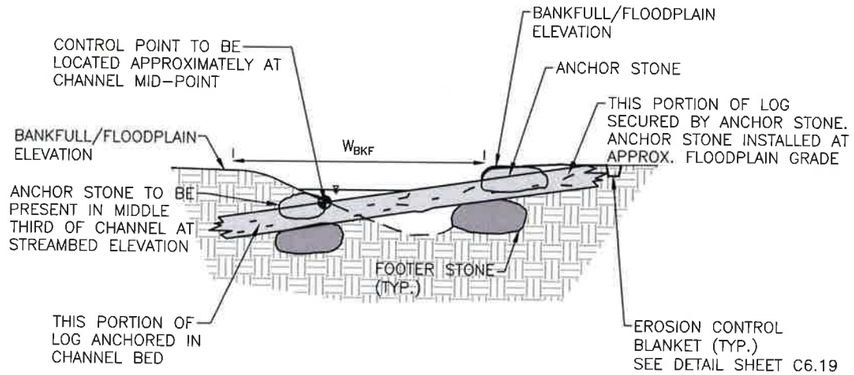
CONSTRUCTION GUIDELINES

1. ALL EROSION AND SEDIMENT CONTROL DEVICES SHOULD BE INSTALLED IN ACCORDANCE WITH AN APPROVED EROSION AND SEDIMENT CONTROL (E&SC) PLAN.
2. FLOW FROM THE STREAM SHOULD BE DIVERTED AWAY FROM THE WORK AREA IN ACCORDANCE WITH THE APPROVED E&SC PLAN AND THE SITE SHOULD BE DEWATERED.
3. LOG VANES SHOULD BE ANGLED 20 TO 30 DEGREES FROM THE UPSTREAM BANK. LOG VANE ARMS SHOULD BE INSTALLED WITH A VERTICAL ANGLE ALONG THE VANE ARM RANGING FROM 3 TO 5 PERCENT. LOG VANES SHOULD SPAN APPROXIMATELY ONE-HALF TO TWO-THIRDS OF THE BANKFULL CHANNEL WIDTH.
4. EXCAVATE THE TRENCH AND PREPARE THE AREA ALONG THE STREAMBANK AND IN THE STREAMBED FOR PLACEMENT OF FOOTER ROCKS. FOOTER ROCKS SHOULD BE INSTALLED AT BOTH THE STREAMBANK AND THALWEG LOCATIONS TO ENSURE PROPER FOOTING OF THE LOG VANE STRUCTURE AND TO ELIMINATE SCOUR AT KEY TIE-IN POINTS.
5. PLACE LOG ONTO THE FOOTER ROCKS SUCH THAT THE LOG VANE ARM THAT TIES INTO THE STREAMBANK WILL BE INSTALLED AT THE BANKFULL ELEVATION AND THE OTHER END OF THE LOG VANE ARM WILL BE EMBEDDED INTO THE STREAMBED AT THE THALWEG ELEVATION AND WILL BE LOCATED WITHIN THE MIDDLE THIRD OF THE BANKFULL CHANNEL WIDTH.
6. ANCHOR ROCKS SHOULD BE INSTALLED ON TOP OF BOTH ENDS OF THE LOG VANE. ANCHOR STONES IN THE STREAMBED WILL BE OFFSET TO THE UPSTREAM SIDE OF THE LOG VANE AND PLACED TO MINIMIZE ROLLING OF ANCHOR STONE AND WILL NOT PROTRUDE FROM THE STREAMBED ELEVATION MORE THAN ONE-THIRD THE THICKNESS OF THE ANCHOR ROCK. ANCHOR ROCKS WILL BE PLACED ALONG THE STREAMBANK POSITION OF THE LOG VANE ARM IN SIMILAR FASHION AND WILL NOT EXTEND MORE THAN ONE-THIRD THE THICKNESS OF THE ANCHOR ROCK.
7. THE LOG VANE ARM THAT TIES INTO THE STREAMBANK SHOULD EXTEND A MINIMUM OF 5 TO 6 FEET INTO THE STREAMBANK. ADDITIONALLY THE THALWEG END OF THE STRUCTURE SHOULD BE EMBEDDED A MINIMUM OF 2 TO 3 FEET. WHEN TWO OR SMALLER LOGS ARE USED TO ACCOMPLISH THE DESIGN SPECIFICATION OF THE LOG VANE, THE LOGS SHOULD BE SECURED TOGETHER WITH CABLES OR REBAR MATERIAL BASED UPON MANUFACTURING SPECIFICATIONS. LOG VANES SHOULD BE ANCHORED INTO THE STREAMBED WITH SUPPORT PILINGS AND/OR DUCKBILL ANCHORS WITH LENGTHS EXCEEDING THE POTENTIAL OF LONG-TERM BED DEGRADATION AND/OR SCOUR DEPTHS.
8. PLACEMENT OF SALVAGED STREAMBED MATERIAL OBTAINED DURING TRENCH EXCAVATIONS WILL BE PLACED ALONG THE UPSTREAM SIDE OF THE LOG VANE ARM AND BETWEEN THE STREAMBANK TO CREATE A UNIFORM SLOPE BETWEEN THE LOG VANE ARM AND THE STREAMBANK. AT THE MINIMUM, STREAMBED GRAVEL WILL BE PLACED TO THE ELEVATION OF THE SLOPING LOG VANE ARM ON THE UPSTREAM SIDE OF THE LOG VANE.
9. SOIL STABILIZATION MATTING WILL BE INSTALLED ALONG THE STREAMBANKS IN THE AREA OF DISTURBANCES AND SHOULD BE SEEDED, MULCHED, AND PLANTED WITH APPROVED LANDSCAPING.
10. REMOVE THE APPROVED E&SC PLAN DEVICES UPON STABILIZATION OF THE CHANNEL IN ACCORDANCE WITH THE APPROVED PLAN.



PLAN VIEW

TRIBUTARY	W_{bkf} (FT)
UT1 – UPSTREAM	7.4
UT1 – DOWNSTREAM	13.4
UT2	8.3
UT3	9.6



SECTION A' - A'

LOG VANE DETAIL

N.T.S.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

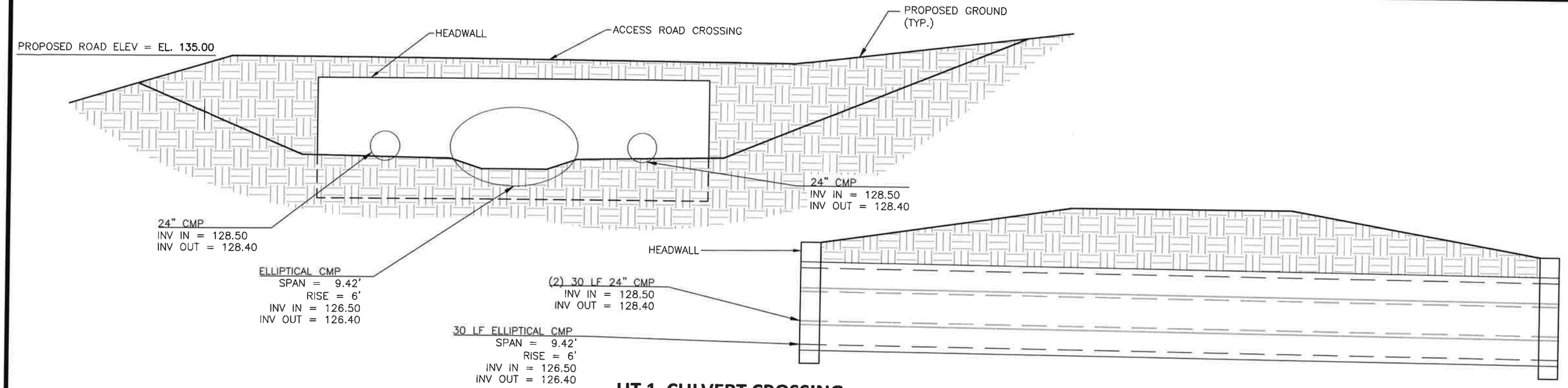
Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-D1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

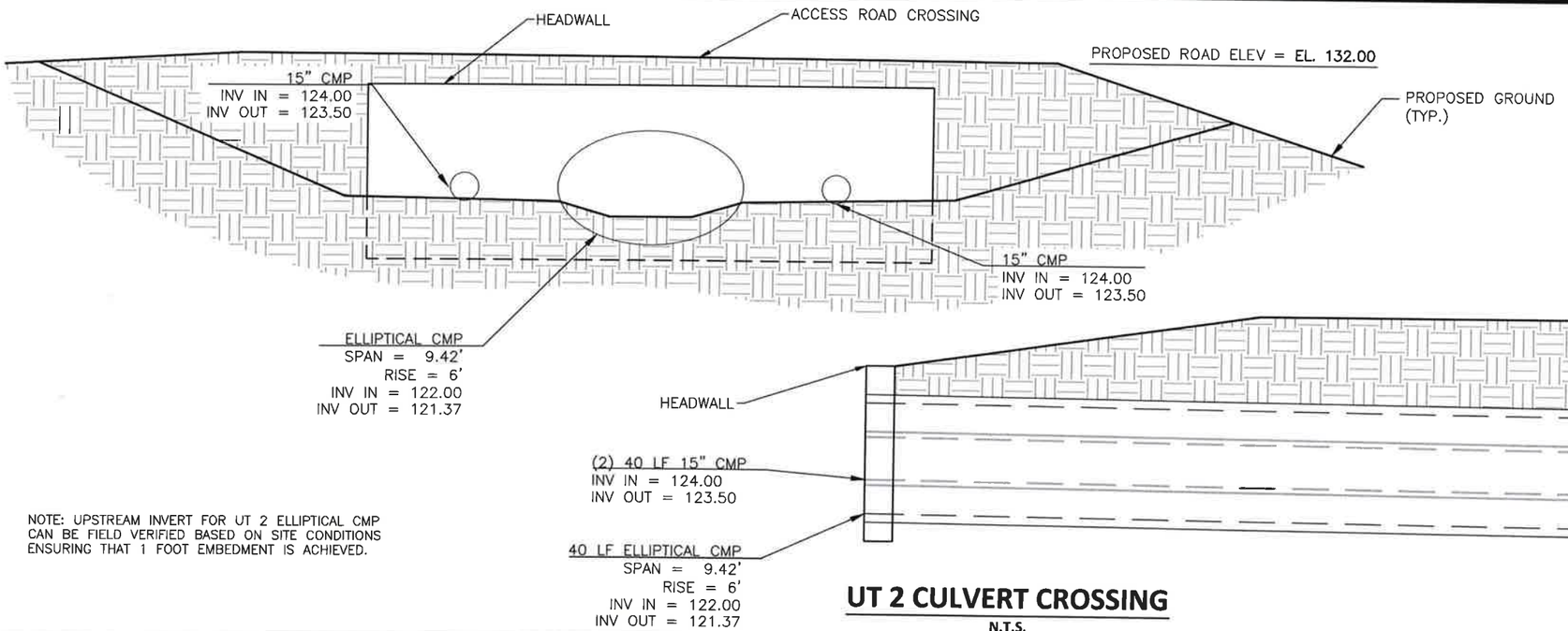
STREAM DETAILS

C8.02



UT 1 CULVERT CROSSING

N.T.S.



NOTE: UPSTREAM INVERT FOR UT 2 ELLIPTICAL CMP CAN BE FIELD VERIFIED BASED ON SITE CONDITIONS ENSURING THAT 1 FOOT EMBEDMENT IS ACHIEVED.

UT 2 CULVERT CROSSING

N.T.S.

GENERAL NOTES

1. INSTALL PERMANENT CROSSING WHILE CONSTRUCTION LOCATION WITHIN STREAM HAS BEEN DEWATERED.
2. IF UNABLE TO INSTALL WHILE LOCATION IS DRY, PLACE MATTING ON EXPOSED SOILS.
3. CONTRACTOR TO INSTALL CROSSING PIPE AND HEADWALL TO MANUFACTURER'S SPECIFICATION THIS INCLUDES SPECIFIED BEDDING AND BACKFILL REQUIREMENTS.
4. ALL MATERIAL TO BE PLACED AND COMPACTED WITHIN ROAD EMBANKMENT SHALL BE FREE FROM ROOTS, STUMPS, WOOD, STONES GREATER THAN 6", AND FROZEN OR OTHER OBJECTIONABLE MATERIAL.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS

ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-D1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

CULVERT DETAILS

C8.03

Vegetation Association	Cypress Gum Swamp*		Coastal Plain Small Stream Swamp*		Stream-side Assemblage**		TOTAL
Area (acres)	2.3		17.4		2.8		22.5
Species	# planted*	% of total	# planted*	% of total	# planted**	% of total	# planted
Swamp black gum (*Nyssa biflora*)	391	25	2366	20	776	10	3533
Bald cypress (*Taxodium distichum*)	391	25	2366	20	776	10	3533
Tupelo gum (*Nyssa aquatica*)	391	25	--	--	--	--	391
Pond cypress (*Taxodium ascendens*)	391	25	--	--	--	--	391
Water oak (*Quercus nigra*)	--	--	1775	15	776	10	2550
Willow oak (*Quercus phellos*)	--	--	1775	15	776	10	2550
Schumard oak (*Quercus schumardii*)	--	--	1183	10	776	10	1959
American elm (*Ulmus americana*)	--	--	1183	10	776	10	1959
Shagbark hickory (*Carya ovata*)	--	--	1183	10	776	10	1959
Black willow (*Salix nigra*)	--	--	--	--	776	10	776
Tag alder (*Alnus serrulata*)	--	--	--	--	776	10	776
Buttonbush (*Cephalanthus occidentalis*)	--	--	--	--	776	10	776
TOTAL	1564	100	11832	100	7756	100	21152

* Planted at a density of 680 stems/acre.

** Planted at a density of 2720 stems/acre.

***NO SPECIES TO ACCOUNT FOR MORE THAN 20% IN THE COASTAL PLAIN SMALL STREAM SWAMP PLANTING ZONE.

GRAPHIC SCALE
0 100 200 400
1 inch = 200 ft.

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS

Axiom Environmental, Inc.
RESTORATION SYSTEMS LLC
The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713
phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187
www.mcadamsco.com
McADAMS

SWAMP GRAPE MITIGATION PLAN
CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

PLANTING PLAN
L5.00

TEMPORARY SEEDING SCHEDULE:

TEMPORARY SEEDING SHALL BE APPLIED AS NEEDED DURING CONSTRUCTION TO STABILIZE BARE OR DISTURBED AREAS OF SOIL AND AT THE COMPLETION OR ALL GRADING AND EARTHWORK ACTIVITIES WITHIN A PARTICULAR AREA OF THE SITE. PERMANENT SEED MAY BE DISTRIBUTED WITH TEMPORARY SEED UPON THE FINAL APPLICATION OF TEMPORARY SEED.

SEEDING DATE	SEEDING MIXTURE	APPLICATION RATE
AUG 15 - APR 15	RYE (GRAIN)	30 LBS/AC
AUG 15 - APR 15	WHEAT	30 LBS/AC
APR 15 - AUG 15	GERMAN MILLET	10 LBS/AC
APR 15 - AUG 15	BROWNTOP MILLET	10 LBS/AC

SEEDING METHODS

1. EVENLY APPLY SEED USING A CYCLONE SEEDER, DRILL, CULTIPACKER SEEDER, OR HYDROSEEDER. THIS MUST BE DONE WITHIN 48 HOURS OF LAND DISTURBING ACTIVITIES.
2. MULCH WITH CLEAN WHEAT STRAW.
3. AFTER SEEDING, APPLY MULCH TO AREAS UNDER HARSH CONDITIONS SUCH AS AREAS THAT HAVE BEEN GRADED, OR THOSE WHICH WILL RECEIVE CONCENTRATED FLOWS. AREAS CONSIDERED TO BE UNDER HARSH CONDITIONS WILL BE CONSIDERED THE AREAS GRADED FOR THE WETLAND VALLEY.
4. RESEED AND MULCH AREAS WHERE SEEDLING EMERGENCE IS LESS THAN 80% COVERAGE, OR WHERE EROSION OCCURS, AS SOON AS POSSIBLE. DO NOT MOW. PROTECT FROM TRAFFIC AS MUCH AS POSSIBLE.

NOTES

1. TEMPORARY ANNUAL SEED SELECTION SHOULD BE BASED ON SEASON OF PROJECT INSTALLATION.
2. A SINGLE SPECIES FOR TEMPORARY COVER IS ACCEPTABLE
3. IN SOME CASES WHERE SEASONS OVERLAP, A MIXTURE OF TWO OR MORE SPECIES MAY BE NECESSARY. HOWEVER, APPLICATION RATES SHOULD NOT EXCEED THE TOTAL RECOMMENDED RATE PER ACRE.
4. TEMPORARY SEED SHOULD BE MIXED AND APPLIED SIMULTANEOUSLY WITH THE PERMANENT SEED MIX IF OPTIMAL PLANTING DATES ALLOW.

PERMANENT SEEDING SCHEDULE:

PLANT MATERIAL SELECTION

1. REFER TO TABLE BELOW FOR APPROPRIATE SELECTIONS OF NATIVE PERMANENT SEEDS.
2. PERMANENT SEED INCLUSION IN THE MIXTURE SHOULD TOTAL 15 LBS OF PURE LIVE SEED (PLS) PER ACRE DRILLED OR 20 LBS PLS/AC BROADCAST APPLIED.
3. AT LEAST 4 SPECIES SHOULD BE SELECTED FOR THE MIXTURE. SELECTION OF MORE THAN 4 SPECIES IS RECOMMENDED FOR INCREASING CHANCES OF SUCCESSFUL VEGETATION ESTABLISHMENT.
4. IF OTHER SPECIES SUCH AS WILDFLOWERS ARE ADDED TO THE MIX, THEY SHOULD NOT BE COUNTED IN THE MINIMUM SEEDING RATE.

SEEDBED PREPARATION

1. DISTURBED SOILS WITHIN RIPARIAN AREAS MUST BE AMENDED TO PROVIDE AN OPTIMUM ENVIRONMENT FOR SEED GERMINATION AND SEEDLING GROWTH.
2. THE pH OF THE SOIL MUST BE SUCH THAT IT IS NOT TOXIC AND NUTRIENTS ARE AVAILABLE.
3. SOIL ANALYSIS SHOULD BE PERFORMED TO DETERMINE NUTRIENT AND LIME NEEDS OF EACH SITE.
4. APPROPRIATE pH LEVELS ARE BETWEEN 5.5 - 7.
5. RIPARIAN BUFFERS REGULATED FOR NUTRIENT MANAGEMENT MAY BE LIMITED TO A SINGLE APPLICATION OF FERTILIZER.
6. SUITABLE MECHANICAL MEANS SUCH AS DISKING, RAKING, OR HARROWING MUST BE EMPLOYED TO LOOSEN COMPACTED SOIL PRIOR TO SEEDING.

PLANTING

1. APPLY SEED UNIFORMLY WITH A CYCLONE SEEDER, DROP-TYPE SPREADER, DRILL, OR HYDROSEEDER ON A FIRM, FRIABLE SEEDBED.
2. IN FINE SOILS, SEEDS SHOULD BE DRILLED 0.25 - 0.5 INCHES. IN COARSE SANDY SOILS, SEEDS SHOULD BE PLANTED NO DEEPER THAN 0.75 INCHES.

MULCH

1. MULCH ALL PLANTINGS IMMEDIATELY AFTER SEEDING.
2. IF PLANTING ON STREAM BANKS STEEPER THAN 10% OR AREAS SUBJECT TO FLOODING, A BIODEGRADABLE ROLLED EROSION CONTROL PRODUCT IS RECOMMENDED TO HOLD SEED AND SOIL IN PLACE.

MAINTENANCE

1. THE RECOMMENDED PERMANENT GRASS SPECIES MAY REQUIRE TWO YEARS FOR ESTABLISHMENT, DEPENDING ON SITE CONDITIONS.
2. INSPECT SEEDED AREAS FOR FAILURE AND MAKE NECESSARY REPAIRS, SOIL AMENDMENTS, AND RE-SEEDINGS.
3. IF WEEDY EXOTIC SPECIES HAVE TAKEN OVER THE AREAS AFTER THE FIRST GROWING SEASON, THE INVASIVE SPECIES MUST BE ERADICATED TO ALLOW NATIVE SPECIES TO GROW.
4. MONITOR THE SITE UNTIL LONG-TERM STABILITY HAS BEEN ESTABLISHED.

FRESHWATER MARSH - COASTAL PLAIN SEMI-PERMANENT IMPOUNDMENT			
POYGONUM SPP.	VARIES	LIMNOBIUM SPONGIA	OBL
PELTANDRA VIRGINICA	OBL	NYMPHOIDES SPP.	OBL
NYMPHAEA ODORATA	OBL	POTAMOGETON SPP.	OBL
NUPHAR LUTEA	OBL	UTRICULARIA SPP.	OBL
CERATOPHYLLUM SPP.	OBL	PONTEDERIA CORDATA	OBL
MYRIOPHYLLUM SPP.	OBL	SAGITTARIA SPP.	OBL
LEMNA SPP.	OBL	CEPHALANTHUS OCCIDENTALIS	OBL
EGERIA DENSA	OBL	ROSA PALUSTRIS	OBL
ELODEA SPP.	OBL	DECODON VERTICILLATUS	OBL

NORTH CAROLINA PROFESSIONAL SEAL 049073 ENGINEER REBECCA STUBBS 2.5.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

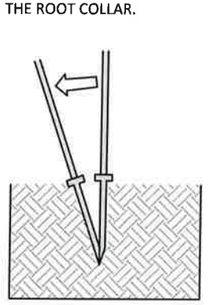
PROJECT NO.	AXI-19010
FILENAME	AXI19010-LS1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

PLANTING NOTES

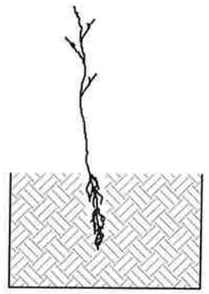
L5.01

NOTES:

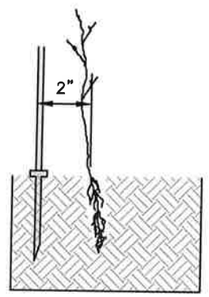
1. AREAS NOTED AS BARE ROOT PLANTINGS WITHIN THE PLANTING ZONE SHALL BE PLANTED WITH SPECIES LISTED ON SHEET L5.00.
2. DURING PLANTING, SEEDLINGS SHALL BE KEPT IN A MOIST CANVAS BAG OR SIMILAR CONTAINER TO PREVENT ROOT SYSTEMS FROM DRYING.
3. PLANTING BAR SHALL HAVE A BLADE WITH A TRIANGULAR CROSS SECTION, AND SHALL BE 12 INCHES LONG, 4 INCHES WIDE AND 1 INCH THICK AT CENTER.
4. ALL SEEDLINGS SHALL BE ROOT PRUNED, IF NECESSARY, SO THAT NO ROOTS EXTEND MORE THAN 10 INCHES BELOW THE ROOT COLLAR.



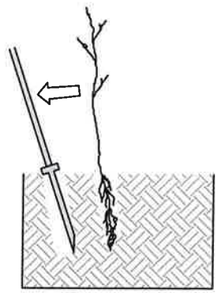
1. INSERT PLANTING BAR 12" INTO THE GROUND AS SHOWN AND PULL HANDLE TOWARD PLANTER.



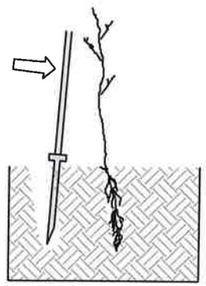
2. REMOVE PLANTING BAR AND PLACE SEEDING AT CORRECT DEPTH.



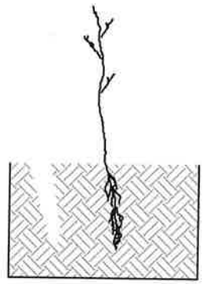
3. INSERT PLANTING BAR 2 INCHES TOWARD PLANTER FROM SEEDING.



4. PULL HANDLE OF BAR TOWARD PLANTER, FIRMING SOIL AT BOTTOM.



5. PUSH HANDLE FORWARD FIRMING SOIL AT TOP



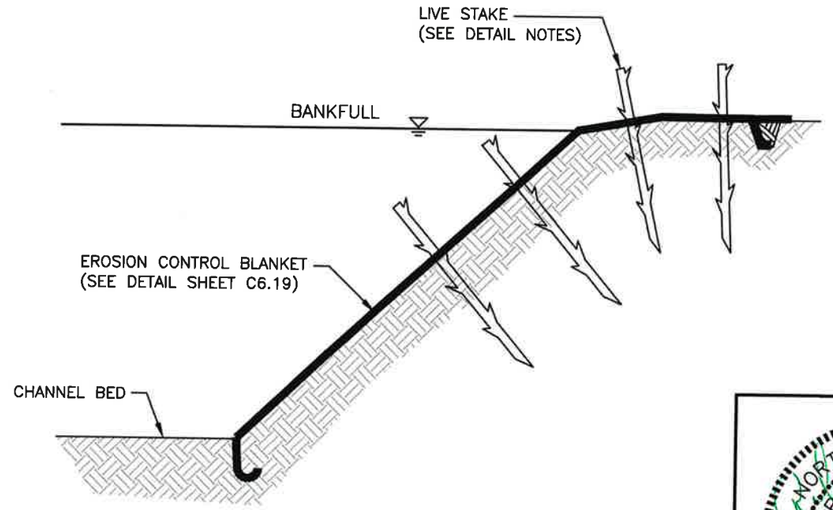
6. LEAVE COMPACTION HOLE OPEN WATER THOROUGHLY.

BARE ROOT PLANTING DETAIL

N.T.S.

NOTES:

1. AREAS NOTED AS LIVE STAKES WITHIN THE PLANTING ZONE SHALL BE PLANTED WITH SPECIES LISTED ON SHEET L5.00.
2. ONE LIVE STAKE SPECIES PER LIVE STAKE AREA. ALTERNATE SPECIES PER LIVE STAKE AREA.
3. ALL LIVE STAKES SHALL BE DORMANT AT TIME OF ACQUISITION AND PLANTING.
4. LIVE STAKES SHALL BE 1/2-2" IN DIAMETER. LIVE STAKES SHALL ALSO BE 2 - 4 FEET IN LENGTH.
5. DURING PREPARATION, THE BASAL ENDS OF THE LIVE STAKES SHALL BE CLEANLY CUT AT AN ANGLE TO FACILITATE EASY INSERTION INTO THE SOIL, WHILE THE TOPS SHALL BE CUT SQUARE OR BLUNT FOR TAMPING. ALL LIMBS SHALL BE REMOVED FROM THE SIDES OF THE LIVE CUTTING PRIOR TO INSTALLATION.
6. CUTTINGS FOR LIVE STAKES SHALL BE HARVESTED IN A MANNER SUCH THAT THEY ARE CUT, IMMEDIATELY PUT INTO WATER TO BE SOAKED FOR 10 DAYS, AND THEN PLANTED IMMEDIATELY AFTER THE 10 DAYS ARE COMPLETED. CUTTINGS SHALL REMAIN WET UNTIL THEY ARE PLANTED. OUTSIDE STORAGE LOCATIONS SHOULD BE CONTINUALLY SHADED AND PROTECTED FROM WIND AND DIRECT SUNLIGHT.
7. LIVE STAKES SHALL BE TAMPED AT AN ANGLE INTO THE GROUND SURFACE WITH A DEAD BLOW HAMMER, WITH BUDS ORIENTED IN AN UPWARD DIRECTION. STAKES SHOULD BE TAMPED UNTIL APPROXIMATELY 3/4 OF THE STAKE LENGTH IS WITHIN THE GROUND. ANY STAKES THAT ARE SPLIT OR DAMAGED DURING INSTALLATION SHALL BE REMOVED AND REPLACED.
8. THE AREA AROUND EACH LIVE STAKE SHALL BE COMPACTED BY FOOT AFTER THE LIVE STAKE HAS BEEN INSTALLED.
9. ONE TO TWO INCHES SHALL BE CUT CLEANLY OFF OF THE TOP OF EACH LIVE STAKE (WITH LOPPERS) AT AN ANGLE OF APPROXIMATELY 15 DEGREES FOLLOWING INSTALLATION.



LIVE STAKE DETAIL

N.T.S.

NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 049073 REBECCA STUBBS 2.5.21

MCADAMS

The John R. McAdams Company, Inc.
2905 Meridian Parkway
Durham, NC 27713

phone 919. 361. 5000
fax 919. 361. 2269
license number: C-0293, C-187

www.mcadamsco.com

SWAMP GRAPE MITIGATION PLAN

CONSTRUCTION DRAWINGS
ROBESON COUNTY, NORTH CAROLINA

RESTORATION SYSTEMS LLC

Axiom Environmental, Inc.

PLAN INFORMATION

PROJECT NO.	AXI-19010
FILENAME	AXI19010-LS1
CHECKED BY	RAS
DRAWN BY	KEG
SCALE	N.T.S.
DATE	02.05.2021

PLANTING DETAILS

L5.02