

MITIGATION PLAN
Final

March 22, 2021

OAK HILL DAIRY MITIGATION SITE
Gaston County, NC
NCDEQ Contract No. 7867
DMS ID No. 100120

Catawba River Basin
HUC 03050102

USACE Action ID No. SAW-2019-00833
NC DWR Project No. 2019-0863
RFP #: 16-007704 (Issued: 9/6/2018)

PREPARED FOR:

NC Department of Environmental Quality
Division of Mitigation Services
5 Ravenscroft Drive, Ste 102
Asheville, NC 28801

DEPARTMENT OF THE ARMY
WILMINGTON DISTRICT, CORPS OF ENGINEERS
69 DARLINGTON AVENUE
WILMINGTON, NORTH CAROLINA 28403-1343

REPLY TO
ATTENTION OF:

March11, 2021

Regulatory Division

Re: NCIRT Review and USACE Approval of the NCDMS Oak Hill Dairy Mitigation Site / Gaston Co./ SAW-2019-00833/ NCDMS Project # 100120

Mr. Tim Baumgartner
North Carolina Division of Mitigation Services
1652 Mail Service Center
Raleigh, NC 27699-1652

Dear Mr. Baumgartner:

The purpose of this letter is to provide the North Carolina Division of Mitigation Services (NCDMS) with all comments generated by the North Carolina Interagency Review Team (NCIRT) during the 30-day comment period for the Oak Hill Dairy Draft Mitigation Plan, which closed on February 18, 2021. These comments are attached for your review.

Based on our review of these comments, we have determined that no major concerns have been identified with the Draft Mitigation Plan, which is considered approved with this correspondence. However, several minor issues were identified, as described in the attached comment memo, which must be addressed in the Final Mitigation Plan.

The Final Mitigation Plan is to be submitted with the Preconstruction Notification (PCN) Application for Nationwide permit approval of the project along with a copy of this letter. Issues identified above must be addressed in the Final Mitigation Plan. All changes made to the Final Mitigation Plan should be summarized in an errata sheet included at the beginning of the document. If it is determined that the project does not require a Department of the Army permit, you must still provide a copy of the Final Mitigation Plan, along with a copy of this letter, to the USACE Mitigation Office at least 30 days in advance of beginning construction of the project. Please note that this approval does not preclude the inclusion of permit conditions in the permit authorization for the project, particularly if issues mentioned above are not satisfactorily addressed. Additionally, this letter provides initial approval for the Mitigation Plan, but this does not guarantee that the project will generate the requested amount of mitigation credit. As you are aware, unforeseen issues may arise during construction or monitoring of the project that may require maintenance or reconstruction that may lead to reduced credit.

Thank you for your prompt attention to this matter, and if you have any questions regarding this letter, the mitigation plan review process, or the requirements of the Mitigation Rule, please call me at 919-554-4884, ext 60.

Sincerely,

Kim Browning
Mitigation Project Manager
for Ronnie Smith, Deputy Chief
USACE Regulatory Division

Enclosures

Electronic Copies Furnished:

NCIRT Distribution List
Matthew Reid, Paul Wiesner—NCDMS
Jake McLean—WEI

March 22, 2021

ATTN: CESAW-RG/Browning
Ms. Kim Browning
US Army Corps of Engineers – Wilmington District
69 Darlington Avenue
Wilmington, NC 28403-1343

RE: Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102
Gaston County, NC
Response to NCIRT Comments during 30-day Mitigation Plan Review
USACE Action ID No: SAW-2019-00833
DWR Project ID: 7867
NCDMS Project No: 100120

Dear Ms. Browning:

Wildlands Engineering, Inc. (Wildlands) has reviewed the IRT's comments on the draft mitigation plan and draft construction documents for the Oak Hill Dairy Mitigation Site (Site). We have made the necessary revisions to the report and draft plans and we are submitting revised versions of the documents along with this letter. Below are responses to each of the IRT's comments from the U.S. Army Corps of Engineers memo dated February 23, 2021. The original comments are provided below in italics followed by our responses.

***WRC COMMENTS**, OLIVIA MUNZER & TRAVIS WILSON:*

1. *I'd like to see more forbs (i.e., pollinator species) in the seed mix.*

   Wildlands Response: To address this and other subsequent comments, Wildlands has made the following adjustments to seed mix:

   Riparian mix- Add Purple coneflower (Echinacea purpurea) at 1 Ib/ac
   Add common yarrow (Achillea millefolium) at 1 lb/ac
   Remove Fox sedge (Carex vulpinoidea)
   Wetland mix- Reduce smartweed (Polygonum pensylvanicum) to 0.5 Ib/ac
   Reduce common rush (Juncus effusus) to 1.5 lb/ac
   Add Narrowleaf sunflower (Helianthus augustifolia) at 1 Ib/ac

2. *Cherrybark oak isn't known west of Mecklenburg. Consider an alternative.*

   Wildlands Response: We will substitute water oak (Quercus nigra).

3. *In the buffer, the soil moisture may not be wet enough for OBL species, such as tag alder, and even some FACW trees, such as swamp chestnut oak.*

Wildlands Response: Tag alder has been removed from the open area buffer zone and will only be used in wetland 1 which is the wettest area of the Site. Elderberry and spicebush are being increased in other areas. See our response to comment 5 as it relates to swamp chestnut oak.

4. *Seems like a high % of sycamore.*

   Wildlands Response: Please see the revised planting table and the response to comment 5; the % of sycamore has been reduced to 15%.

5. *Since the target communities include mesic-oak-hickory, add some hickories, white oak, scarlet oak, etc.*

   Wildlands Response: The following changes to the planting plan address this comment, the two prior, and later related comments by WRC and others:
   - Open area buffer zone-
     - Reduce sycamore to 15%
     - Remove swamp chestnut oak
     - Add bitternut hickory (Carya cordiformis) at 5%
     - Add sourwood (Oxydendrum arborem) at 5%
     - Add white oak (Quercus alba) at 5%
     - Remove tag alder/replace with elderberry
   - Wetland Planting Zone
     - Substitute water oak (Quercus nigra) for cherrybark oak

   Both bitternut hickory and white oak grow in a range of soils that include bottomland and streamside areas. Both of these would also be climax species for the oak hickory community type.

6. *Do not plant tall fescue or orchardgrass as these are invasive sp.*

   Wildlands Response: Wildlands has often used this combination of seeding for rehabilitation seeding in pasture and disturbed areas outside of the conservation easement. Part of our commitment to landowners is reestablishing stands of grass on disturbed areas outside of the easement and these species are recommended by NCDEQ and USDA for this purpose – at this time we rely on this approach, have not seen any negative impacts to easements and cannot agree to halt the use of these species.

7. *That specific rye (Secale cereale) is allelopathic.*

   Wildlands Response: Secale cereale is specified in the ESC manual, and the manual goes on to state that the alternative, annual ryegrass, is not recommended for use in NC due to it being overcompetitive. Wildlands welcomes and would consider using suggested alternatives.

8. *HDPE is shown for one of the culverts; WRC prefers the use of CMP or RCP for this type of crossing.*

    Wildlands Response: The culverts in question are replacement of culverts outside of the easement area. These culverts, in their current condition, are extremely steep and also in poor condition and at risk of failure. No commitment to replace these was made as part of the project proposal. The proposed culverts constitute a significant improvement for both stability and passage but are not credited activities nor activities that require permitting (they are replacement of existing culverts with the same size and footprint replacements). We will consider this comment when ordering materials, and intend at this time to use CMP or RCP unless unacceptable to the landowner on whose property these improvements are proposed. Given the circumstances, we are not committing to a certain pipe material for these and the landowner must approve any changes we propose.

USACE COMMENTS*, KIM BROWNING:*

1. *Design Sheet 4.2: The legend of symbols does not include the triangles shown on the drawing. I assume these areas are the BMP planting call-out.*

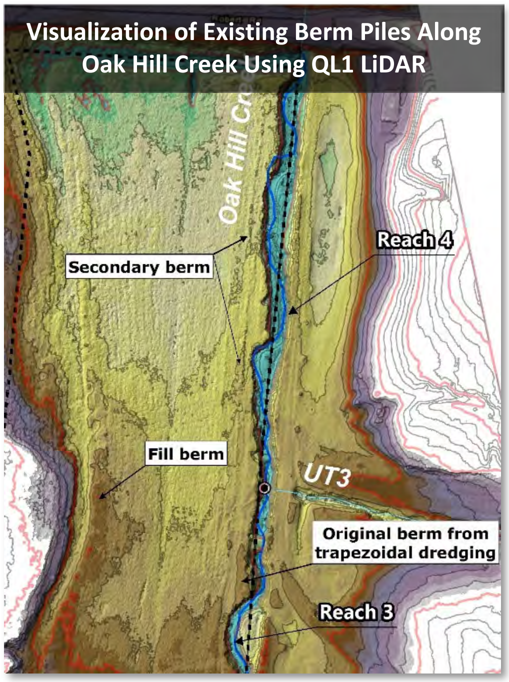
    Wildlands Response: The BMP hatch has been added to the planting sheets (Sheets 4.2 – 4.5) and the BMP planting scheme was added to the Planting List (Sheet 4.1).

2. *UT1B, page 20: Given that this reach has a Medium NCSAM score, a 15 ft buffer on one side, intermittent cattle access and contains kudzu, preservation is not appropriate for this reach. A lower level of enhancement at 8:1 would be more appropriate. Please update credit tables.*

    Wildlands Response: The report and references have been updated to reflect this suggestion that UT1B be credited as an enhancement II reach at a ratio of 8:1. As a result, two photo points have been included as part of the monitoring components for UT1B which are reflected in Table 30 and Figure 11.

3. *Section 3.3 is very helpful in understanding current conditions. The inclusion of photos in section 3.3.2 would be welcome, to include photos of the berms that have been built up as a result of dredging.*

    Wildlands Response: An image of a hillshaded QL1 LiDAR surface (shown below) was added to Section 6.7.4 (Existing Wetland Manipulation and Drainage) to illustrate areas of remnant berm piles located in the lower valley along the mainstem of Oak Hill Creek.



4. *Section 5.0 & Table 15: I like the wording of the goals and objectives in this section; However, Table 15 discusses the functions supported, including the physiochemical and biological 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 that uplift in these areas is implied.*

   Wildlands Response: The following statement was added to the paragraph prefacing Table 15 to qualify that potential benefits of biological and physicochemical functional uplift are implied: "It should be noted that potential benefits resulting in the uplift of biological and physicochemical functions are presumed since these functions will not be directly measured during monitoring."

5. *Section 6.6.9 and Design Sheet 6.3 discusses replacement of culverts. On Sheet 2.15 it appears that these crossings are outside the project area. Please note that if a new culvert is being installed in an area that did not previously have a crossing, is outside the project easement, or if the culvert will be larger and therefore have a larger impact, a Department of the Army Permit may be required for this crossing as it would not be covered under the NWP-27. Since it appears that these culvert replacements are an integral part of the design for UT2 and UT3, USACE considers these part of this project; therefore, you may submit the NWP-14 permit application along with the NWP-27 if it helps expedite the permitting process. Or as an alternative, you may submit the permit for the culverts to the Gaston County USACE PM.*

   Wildlands Response: The four new culverts are proposed on Sheets 2.14 & 2.15 & 6.3. Sheet 6.3 depicts three of these (pipes #1-3). Pipes #2-3 are replacement of drainage pipes on ephemeral drainages and therefore do not require permitting. Pipe #1 is replacement of an existing pipe in a perennial channel (UT3). Sheet 2.14 depicts replacement of an existing pipe in a perennial channel (UT2). <u>The replacements on UT2 & UT3 are in the same location (footprint), and of the same size (length) as the existing pipes.</u> If these activities were stand alone, we would typically consider this a non-reporting situation, or otherwise a NW3 maintenance request. We will work with USACE to adequately permit these as they recommend but consider the comment largely not applicable.

6. *Pages 8, 11 & 16: It's concerning that runoff from the dairy waste lagoon and cattle feedlot currently outlet directly into the stream. The addition of the BMPs will be important for filtering runoff (thank you for the detail in Section 6.8). Is there currently a potential violation of State water quality rules? Without touring the dairy operation it's difficult to discern whether the BMPs will address the underlying problem. Although the lagoon has only over-topped the dam once, a grassed waterway seems inadequate to filter the runoff from the lagoon and adjacent fields. Additionally, does the landowner spray the adjacent fields with lagoon nutrients? A more thorough explanation of land use practices would be helpful to understand the operation better. If the fields are sprayed, please include a waste management spray map to ensure that proper setbacks from the buffer and stream are being implemented. a. Page 36 states that it may take several years to a decade before BMP capacity is reduced such that performance suffers. Once the site is transferred to Stewardship, will the landowner be responsible for maintenance of the BMPs? Please address this in Section*

   Wildlands Response: The lagoon is a no discharge facility designed for the 25-year 24-hour event or greater. It is not piped and has no discharge to streams, wetlands or floodplain. The cattle "feedlot" is merely a feeding area where hay is put out for cattle in the pasture. In the last two years, the dairy has added a large metal roofed barn for feeding and milking, expanding capacity over their original smaller wooden barn, and reducing the need to feed some of their herd outdoors in the feeding area in question. Wildlands has no reason to believe that there are any regulatory violations associated with the Site, but at the same time recognized a benefit to having treatment of the field draining the outdoor feeding area, and a backup system for the lagoon in place as provided by the proposed BMPs. The dairy operation is registered and covered under the cattle waste management system general permit (see response to EPA comment 3 for details). Under this permit no discharge is permitted except by an event exceeding the design storm (25-year 24-hour event). Presumably, the overtopping event mentioned in the report, which is the only event in a period of many decades, falls under that caveat. The facility has developed and maintains a Certified Animal Waste Management Plan consistent with all applicable regulatory requirements and standards. Land application is primarily on a separate location and application records and compliance with standards are part of facility compliance, presumably reviewed by the state during Site review (last completed on 12/21/20).

   These BMPs are designed with volume storage and stabilized outlets that disperse flow with the long-term intent being that they serve as flow distributing filter strips that augment the wooded buffer being established. Additional land beyond the required buffer have been obtained for this purpose. While volume storage "performance" may be reduced over time, overall treatment is likely to continue to be effective given that vegetated filter strips have been shown to provide effective as pollutant removal practices.

   BMP Maintenance: No long-term maintenance of the BMPs is anticipated. As stated on page 39, the intent is to observe and fine-tune BMP function as necessary during monitoring such that the practices are not eroding and are vegetating and spreading out flow as intended.

   Some of the language in Section 6.8 of the mitigation plan has been refined to address various comments with regards to BMPs and BMP maintenance.

7. *Section 3.3.1: Why are UT2 and UT3 not being proposed for credit? Is it because there is a concern with channel instability with flood events? Due to concerns with aquatic species passage, the use of RCP is preferrable to HDPE.*

   Wildlands Response: There is no concern with channel instability. From inception, UT2 and UT3 have always been proposed for no credit because they are extensions of these streams to the relocated mainstem and Wildlands did not want the relocation of Oak Hill Creek to be viewed as a self-serving way to increase credit generation. For consistency with expectations set earlier in the project we do not intend to pursue credit for UT2 & 3 on this project.

   Wildlands will use CMP or RCP in lieu of HDPE, but only if this is acceptable to the non-participating landowner who is allowing this work to be performed. Any pipe replacement on these tributaries will be a vast improvement over the current pipes which are much steeper and some of which have stability and longevity concerns.

8. *Section 6.7: As a follow-up to our phone conversation February 5, please provide an updated Figure 9 showing the different wetland approaches. Additionally, please label the wetlands to coincide with the Soils Investigation Map in Figure A.*

   Wildlands Response: Wetland approaches have been updated in Figure 9 and they have also been labeled to conform with the Soils Investigation Map in Figure A.

9. *Thank you for the updated grading sheets and revised boundaries as a result of our phone conversation; However, some of the follow-up email was a bit confusing, especially the discussion of the map. We acknowledge that some changes were made to address concerns but didn't necessarily change all the areas we discussed. Please include this correspondence and updated figures in the final mitigation plan. If monitoring data suggests that the wetlands are not on a trajectory for success, we may require a reverification of jurisdictional limits in MY7, prior to the final credit release.*

   Wildlands Response: We understand that when wetland criteria is not met, particularly in later monitoring years, that additional data may be necessary to establish the boundary between areas meeting criteria and areas not meeting. We hold the position that this should only apply in obvious areas of underperformance since reverification of jurisdictional limits cannot serve to expand credited wetlands but only reduce the credited area. We have often installed additional gages or conducted abbreviated evaluations to this end.

10. *Please include an additional wetland gauge and veg plot in the creation area around the vicinity of UT3.*

    Wildlands Response: One wetland gauge and one mobile veg plot was added in the wetland creation area around the vicinity of UT3 and can be seen in the updated Monitoring Components Map (Figure 11)

    Table 29: Several areas were noted to contain invasive species, such as Chinese privet, bamboo, Japanese honeysuckle, Japanese knotweed, English ivy, marsh dewflower, multiflora rose and kudzu.

Please include a performance standard that addresses invasive control with levels no more than 5% of the easement, and no tolerance for kudzu. This will need to be maintained offsite as well.

Wildlands Response: Wildlands is already in the process of treating invasives and is committed to successful management of this challenge on the site. In Appendix 8, Wildlands agrees to manage invasives to ensure the survival of woody species and a threshold of ensuring that no more than 1% of the planted acreage is at risk from invasives species proliferation. This is a robust commitment- certainly if 5% of the acreage was covered with kudzu or knotweed, then greater than 1% of the planted acreage would be affected. We have concerns about agreeing to new standards that must be measured, tabulated, and which may not prove attainable for given species such as marsh dewflower (note that no adverse effects have been documented as it relates to woody species establishment when it comes to marsh dewflower proliferation). We request that the Corps reconsider this additional requirement, and we acknowledge and understand the lack of tolerance for kudzu. Likewise, we understand the need to treat invasives offsite at our discretion in order to manage future on-site infestation and plan to do so.

We have added to the Invasive Species Plan in Appendix 8 that with the exception of marsh dewflower Wildlands will target a treatment level such that invasive species coverage is below a threshold of 5% for the Site at closeout.

11. *Appendix 10: If BMP maintenance is anticipated, please update this section.*

    Wildlands Response: No maintenance is anticipated; the response to comment 6 addresses BMP maintenance in more detail. EPA Comment 11 pertains to this as well.

12. *Figure 11: Please correct the Wetland Rehabilitation ratio from 1:5 to 1.5:1.*

    Wildlands Response: Figures 10 and 11 have been updated accordingly.

***<u>EPA Comments</u>**<u>, Todd Bowers:</u>*

1. *Section 3.2/Page 5: Arundinaria gigantea, giant cane, was noted on-site. Was there any discussion or consideration of transplanting this species and using it some locations such as in the vicinity of UT2, UT3 or within the BMPs?*

   Wildlands Response: *Arundinaria gigantea* is not a plant species that Wildlands has significant experience transplanting on mitigation sites and questions remain on how successful it might be after transplanting. Likewise, concerns have been raised about monocultures developing if transplanting is highly successful. For these reasons, discussion of transplanting *Arundinaria gigantea* has not been included in the Mitigation Plan or proposed on the Site.

2. *Section 3.3/Page 13: The NCSID form for UT1B "upper" only scores 15.5 here for the"intermittent" portion. This is below the score of 19 normally utilized to denote intermittent streams. Please note if best professional judgement if the score is to be overridden.*

   Wildlands Response: The score on the NCSID form for UT1B Upper was calculated incorrectly and omitted the score from "Section C. Biology" of the assessment. When the Biology score is added to the assessment, the total points sum to 21.5 and scores as an intermittent stream. The NCSID form has been corrected and is located in Appendix 3.

3. *Section 4.0/Page 17: Is there a Clean Water Act Section 402 NPDES permit associated with the adjacent cattle operation?*

   Wildlands Response: As summarized in table below, the cattle operation (Eaker Dairy, Inc.) has an active Cattle Waste Management System General Permit. The permit number is AWC36004 and expires in 2024. Records indicate that it was last inspected on 12/21/20. Please also refer to our response to Corps comment 6.

Eaker Dairy, Inc:

Animal Feed Operation Permits

Facility:	Eaker Dairy, Inc.
Owner:	Eaker Dairy Inc
Permit #:	AWC360004
Permit Type:	Cattle State COC
Permit Status:	Active
Originally Issued:	6/7/2001
Effective Until:	9/30/2019
Expiration Date:	9/29/2024
Facility Status:	Active
Owner Type:	Non-Government
County:	Gaston
DEQ Region:	Mooresville
Last Inspected:	12/21/2020
Description:	Cattle - Milk Cow
Allowable Count:	1,000
Total Live Weight:	1,400,000

4. *Table 16/Page 20: Preservation is the proposed approach for UT1B and the mitigation activities associated with this reach are quite extensive. How is preservation justified? I am also concerned with the rather narrow buffer along the right bank that I am unclear as to how this was derived as appropriate.*

   Wildlands Response: The narrow buffer along the right bank was indicated by easement figures at the proposal stage based on negotiated landowner easement conditions. It was deemed preferable to obtain some protection for this area and settle for a narrow buffer. As noted in USACE Browning comment 2, multiple activities are required in this area. Per suggestions from USACE and DWR, UT1B has been designated a low-level enhancement (EII) reach at an 8:1 credit ratio. The mitigation plan has been updated accordingly.

5. *Table 16/Page 21: Please add ratios for wetland re-establishment and creation.*

   Wildlands Response: Table 16 has been updated accordingly.

6. *Section 6.6.8/Page 31: The 15-foot easement for UT1B is only for minimum crediting. At 10:1 this needs to be reduced further (30%?) to account for the thin buffer along the right bank. I remain dubious about crediting this mostly intermittent reach at the preservation ratio even at 10:1, however since UT 2 and UT3 are being built for no credit this may provide balance in crediting for the site. I may have missed some discussions with the IRT that could shed light on this.*

   Wildlands Response: USACE has suggested UTB1 be designated as a low-level enhancement reach at an 8:1 credit ratio and the mitigation plan has been updated accordingly to reflect this suggestion. Normal enhancement for this level of enhancement may be in the 4:1 range based on the proposed activities. Wildlands is not proposing credit for UT2 & UT3.

7. *Section 6.9/Page 37: Please correlate the target community types with the Planting List Planting Zones of Table 28.*

   Wildlands Response: The Species correlating to target communities have been added to the beginning of Section 6.9 for reference to the species in Table 28.

8. *Table 30/Page 42: I am a bit uncomfortable with no monitoring proposed for UT2 and UT3 even if no credit is being sought. These reaches should have some minimum amount of monitoring (initial longitudinal profile would be a good start; visual assessments are a must) to ensure they are stable and not contributing any adverse effects towards Oak Hill Creek. I also recommend including a monitoring component to ensure the BMPs are functioning as proposed.*

   Wildlands Response: Footnote 6 has been added to Table 30 to clarify additional visual assessment requirements for UT2, UT3, and the proposed BMPs:

   "6. Visual assessment to include UT2 and UT3 as well as photos of BMP inlets and outlets for the as-built and MY1 reports."

   A topographic survey of UT2 & UT3 will be performed as part of the as-built and will serve as a baseline. The total vertical drop from these tributaries to the mainstem channel is only 1' and grade control riffles are proposed – as such, detailed longitudinal profile data is not judged to be necessary to track vertical stability.

9. *Table 32/Page 45: Reiterating my misgivings for 10:1 preservation credit for an intermittent stream with thin riparian buffer.*

   Wildlands Response: Noted, please see prior responses related to the updating of UT1B from a preservation reach (10:1 credit ratio) to an enhancement II reach (8:1 credit ration). There is considerable work required and we believe that the proposed credit is consistent with the level of work proposed which may otherwise garner a higher ratio with a wider buffer in place.

10. *Figure 9: Please add ratios for wetland re-establishment and creation. Please add ratios for stream work. The ditch legend color differences are not readily apparent on the map.*

    Wildlands Response: Figure 9 has been updated to include: ratios for wetland re-establishment and creation, stream crediting ratios, and revised symbology for ditches proposed to be filled for clarification.

11. *Appendix 10: Recommend adding BMPs to the maintenance plan even if they will likely not need any upkeep to keep them functioning properly.*

    Wildlands Response: USACE responses to comments 6 & 12 address BMP maintenance.

12. *General Note: Are the fences for the site to exclude cattle corresponding with the conservation easement boundaries? Are fences to be installed along the internal crossing boundaries as depicted in Sheets 2.2 and 2.10?*

    Wildlands Response: A fencing plan has been added to the Planset depicting planned locations for fencing and gates at the Site (see Sheet 6.4 in Revised Planset). Note that landowners have not decided with certainty if they will continue to graze the right side of UT1. They reserve the right to accomplish cattle exclusion from the conservation easement via a method other than fencing (e.g. removal). Gates may be moved or resized at the designer's discretion.

13. *General Note: recommend adding a legend for BMP planting zones and providing a species list for these zones.*

    Wildlands Response: See response to comment 1, USACE Kim Browning above.

14. *Sheet 4.1 Planting List: Recommend adding target plant communities to correlate with planting zones. Recommend adding plant list for the BMP planting zone.*

    Wildlands Response: The species correlating to plant communities have been added to the beginning of Section 6.9 of the Mitigation Plan.

    Notes for which species should be planted in the BMP areas are now included on the Planting List Sheet in the Planset (Sheet 4.1). Planting is specified as herbaceous plugs and wetland seed mix within the basin, and livestakes and wetland seed mix along the banks. Sheet 5.3 provides a detail for the BMP and serves as a guide on the specific locations within the BMP where plugs and livestakes should be planted.

<u>DWR Comments</u>*<u>, Erin Davis:</u>*

1. *DMS Comments Page 2 – DWR shares DMS' concern about the 10-ft building setback from the proposed easement. Have there been discussions with the landowner and DEQ Stewardship specifically regarding this deviation from the recommended 15-ft setback and any implications for long-term management/potential future encroachment requests?*

    Wildlands Response: DMS has reviewed this with their Stewardship staff and they have indicated that Stewardship is OK with the easement as drawn in this case. The landowner is being reminded that the clearance on the easement is tight in this area and that future encroachment will not be permitted for building-related activities.

2. *DMS Comments Page 5 – DWR recommends adding a few alternate species to the planting list for review and approval in the Final Mitigation Plan, particularly if they are a "more suitable plant species for a community".*

   Wildlands Response: Wildlands has added community appropriate species in the course of addressing other comments. As necessary, percentages will be adjusted and if required additional alternate species will be reviewed with the IRT for approval prior to substitution.

3. *Page 2, Section 3.1 – DWR appreciates the level of detail provided, including descriptions of historic, existing and future watershed land use.*

   Wildlands Response: Comment noted.

4. *Page 12, UT1 – DWR supports removal of black walnut clusters onsite since we have observed projects where they have inhibited the establishment of high restoration value planted species.*

   Wildlands Response: Comment noted. In doing research on walnut toxicity, it appears that many of the trees and shrubs proposed for planting, particularly some of the more dominant species such as river birch and sycamore, are tolerant of its allelopathic qualities. Also, the chemical (Juglone) that has leached out via leaf litter as well as the roots takes several years to fully break down. We anticipate removing many of the walnut clusters but do not consider complete removal imperative for long term success of the project.

5. *Page 16, Section 3.5 – DWR appreciates the level of detail provided in this section, as well as efforts made to have the stream crossings as internal easement breaks, collocate crossings and remove one of the OH utility lines. Please confirm that the sewer easement can be internal to the project. Also, is there any anticipated NCDOT maintenance for the culverts under Roy Eaker Road and Robert Road?*

   Wildlands Response: DMS' standard conservation easement template allows for this under paragraph P which is referenced below. This carries the additional benefit that cattle must be excluded from the internal crossing area.

P. Crossing Areas. "Grantor reserves the right to the Internal Crossing Areas as shown on the "Conservation Easement Survey for the State of North Carolina NCDEQ: Division of Mitigation Services, ________________ Site, SPO File No. XX-XX, DMS Site ID No. __________ Property of _________________________ and recorded in the _____________County, North Carolina Register of Deeds at Plat Book ______ Page________ for the following purposes:

- Motorized vehicle crossing;
- Utility crossings to include overhead and buried electrical, water lines and sewer lines;
- Cattle crossing so long as fencing across a culvert in the Crossing Area prevents cattle access to the stream, or a ford crossing is kept gated and cattle are only present in the stream only under supervision while rotating cattle between pastures; and/or
- Installation, maintenance, or replacement of a culvert or ford crossing.

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.

Wildlands is not aware of any anticipated maintenance of these structures. At Robert Road, there will be no fencing on the right bank of the stream and the last length of stream is uncredited due to insufficient width. NCDOT would have to coordinate access beyond their right-of-way if required for maintenance at Roy Eaker Road or Robert Road.

6. *Page 27, Section 6.5 – Again, DWR appreciates the site specific discussion presented, including bank slope adjustment and wetland credit area setback in anticipation of levy formation.*

   Wildlands Response: Comment noted.

7. *Page 31, Section 6.6.8 – Based on the UT1B reach description on Page 13, DWR does not believe the reach reflects the high quality condition appropriate for preservation credit. Given the current reach condition and potential uplift from the work proposed, DWR would support an enhancement credit ratio of 8:1.*

   Wildlands Response: Wildlands has revised the mitigation plan accordingly to reflect that UT1B be credited at an 8:1 ratio as enhancement II – see response to USACE comment 2.

8. *Page 31, Section 6.6.9 – DWR would not oppose crediting the proposed UT2 and UT3 extension reaches since it will result in additional instream habitat and the work is associated with restoring Oak Hill Creek to its proper valley position. If credit is pursued, additional baseline information and proposed monitoring should be included in the Final Mitigation Plan. Also, please note that depending on the final UT2 and UT3 culvert design (location and total impact), a separate 401 Water Quality Certification may be needed to cover the proposed work.*

   Wildlands Response: Please refer to the response to USACE comment 7 related to the omission of crediting for UT2 and UT3 and USACE comment 5 related to proposed culverts which are all replacement structures with no additional jurisdictional impacts beyond the original footprint of the existing structures.

9. *Page 35, Section 6.7.5 – a. Was levy formation resulting in reduced overbank flow a consideration in proposed wetland design and proposed uplift? Does the setback of the wetland credit areas take into consideration the drainage effect along proposed Priority 2 stream sections?*

   Wildlands Response: The primary factor controlling wetland and floodplain hydrology at the Site are the incised streams and human manipulation of the floodplain topography (ditch construction and berm/sidecast pile areas). Natural levy formation may play a role in stream incision at the Site, but was not considered to be a more important factor than human manipulation of the stream channels. All wetland credit areas were setback from proposed stream channels and Priority 2 areas to avoid the drainage effect from those areas.

   b. Also, similar to P2 bench cuts, DWR is concerned with soil development and associated vegetation establishment in proposed wetland grading areas. Please include a discussion on soil restoration addressing compaction and poor soil quality.

   Wildlands Response: Wildlands' wetland grading specifications typically require compaction to be addressed upon completion of wetland grading. Depending on available equipment, wetland areas are loosened/roughened with a field disk or chisel plow. Poor soil quality areas are noted during construction and are typically addressed with soil amendments or the harvesting and re-application of topsoil if deemed necessary by the Designer.

   c. Based on DWR's field notes from the IRT site walk, we questioned whether UT1/Wetland 2 was eligible for reestablishment credit based on current soil characteristics. Based on the bright soil color and lack of indicators observed, we felt that creation was a more appropriate credit type. Additionally, a substantial area of this wetland is proposed to be graded beyond 12 inches. DWR supports the hillside toe area associated with the F3 indicator borings as reestablishment, and the remaining area as creation.

   Wildlands Response: The existing floodplain topography in this location, soil boring data, and aerial photography all suggest that wetlands existed at the original floodplain surface prior to manipulation with this data and interpretation noted in the mitigation plan and subsequent agency dialogue that has been added to Appendix 7. This is the rationale for proposing reestablishment crediting where deeper excavation is necessary. The presence of brighter soils in the upper profile lead agency representative to indicate that new evidence/justification would need to be presented to support an approach other than creation.
   We believe that our subsequent soil investigation, research and analysis support the original proposed approach, in this instance, and point to specific anthropogenic impacts that led to the current Site conditions where hydric soils have been buried. This grading also supports a holistic stream valley grading approach that will improve stream stability by establishing a natural floodplain width consistent with less altered floodplain areas within the corridor. As such, we request that the entire area proposed remain eligible for reestablishment crediting.

   d. DWR also has concerns with the potential functional uplift associated with Wetland 4, given that it is adjacent to an enhancement I reach with a P2 section (hydroperiod concern) and a substantial area will be graded beyond 12 inches (veg establishment concern).

Wildlands Response: Wetland soil indicators currently exist within the proposed wetland 4 boundary. The design will raise the thalweg of the stream in this area and increase stream access to the floodplain when compared to existing conditions. Poor soil quality areas will be noted during construction and are typically addressed with soil amendments or the re-application of topsoil if deemed necessary by the Designer.

10. *Page 36, Section 6.8 – Given the adjacent land use, the proposed BMPs are critical project features. DWR appreciates that the easement was expanded to accommodate BMP 2. Please clearly state if the designed BMPs will require maintenance beyond the monitoring period. If so, consultation with DEQ Stewardship is needed.*

    Wildlands Response: No maintenance will be required for BMPs beyond initial adaptive management as necessary during the monitoring period. The long-term function of these BMPs, if or when volume storage is reduced, will be as vegetated filter strips.

11. *Page 37, Section 6.9 – In addition to early successional species, DWR would like to see the inclusion of climax species from the selected target communities in the planting plan.*

    Wildlands Response: Please see the updated planting plan based on this and other comments.

12. *Page 39, Section 6.10 – DWR values the addition of this section. DWR is also concerned with the presence of so many invasive species onsite, particularly bamboo, kudzu and Japanese knotweed. Please expand on your discussion of risks associated with these invasives for site management and long-term functional uplift.*

    Wildlands Response: We have added additional discussion about the risks and proposed risk reduction activities to be performed in Section 6.10. Beyond monitoring, Wildlands continues to invest significant resources into Stewardship staff and subconsultants to address these types of concerns.

13. *Appendix 8 – We appreciate the level of detail provided for the proposed species treatments. Bamboo, cattail and marsh dewflower were also mentioned in the plan narrative, please add these species to the appendix table.*

    Wildlands Response: Bamboo has been added to the table. Cattail is not a primary target species for treatment except in project streams although it may be treated to reduce the likelihood of a monoculture establishing and/or due to impacts to targeted density of woody plant growth. Methods will be determined if treatment becomes necessary. Marsh dewflower is synonymous with Asian spiderwort. We have had limited success treating this species despite repeated treatments.

14. *Figure 11 –*

    a. DWR understands that 16 veg plots are proposed to cover the 19.9 acre planted area. However, we request two additional permanent veg plots: 1) within the UT1 Reach 1 wetland creation area and 2) within the Wetland 4 (Oak Hill Creek Reach 1).

    Wildlands Response: As requested, two permanent veg plots were added in the designated wetland locations on Reaches 1 of UT1 and Oak Hill Creek.

b. DWR requests photos of the BMP inlets and outlets in the as-built and MY1 report.

Wildlands Response: As stated in a response to a prior comment, Footnote 6 has been added to Table 30 to clarify additional visual assessment requirements for the proposed BMPs (and UT2 and UT3):"6. Visual assessment to include UT2 and UT3 as well as photos of BMP inlets and outlets for the as-built and MY1 reports."

15. *Sheet 2.2 & 2.10 – Please callout proposed easement breaks and show culvert locations on profiles.*

    Wildlands Response: Callouts have been added to profiles indicating easement break stationing. Culverts have been added to profiles to depict location and size.

16. *Sheet 2.4 & 2.8 – Please add a callout for the BMP outlet structure.*

    Wildlands Response: Callouts have been added to Sheets 2.4 and 2.8 indicating the approximate locations of the BMP outlet structure.

17. *Sheet 2.8 – Does the rectangle grading line along the UT1 left bank near Station 208+50 denote a concentrated flow connection? Do you anticipate any riprap placement in this area?*

    Wildlands Response: This was an errant line related to design sketching not meant to be included in the planset. However, this area is expected to receive much of the outlet flow from the nearby BMP. At Oak Hill Dairy, Wildlands prefers to use broad and low slope conveyances from the BMP to the stream to encourage as diffuse of flow across the buffer as possible. These conveyances are expected to be stabilized with a combination of vegetation and erosion control matting. If matting and vegetation prove to be inadequate, some riprap may be used to stabilize select areas as a secondary option.

18. *Sheet 3.1 – 3.4 – Please add callouts for existing ditches and known drain tile locations. If possible, please also call out approximate locations of proposed wetland ditch plugs.*

    Wildlands Response: Figure 2 shows existing ditch locations at the Site and Figure 9 shows which ditches are proposed for removal or plugging and which ditches will remain in place. A note indicating to remove all subsurface drains was added to Sheet 3.4. The Wetland Ditch Plug detail is meant to guide the backfilling of ditches or relic channels at the Site and will be applied throughout these areas rather than in specific locations.

19. *Sheet 4.1 –a. Based on past projects, has there been any concern with seeding Polygonum pensylvanicum due to its height (up to 4 FT) and establishment rate inhibiting/ competing with planted woody stems? b. DWR requests that no species (excluding live stakes) account for more than 20 percent of a specified planting zone in order to promote diversity (e.g. Sycamore).*

    Wildlands Response: This is a good point; we have seen it get tall and compete in certain settings and have reduced the percentage. For the wetland seed mix, Polygonum was reduced in favor of a pollinator species to help address WRC comment 1.

20. *Sheet 5.4 – DWR appreciates the inclusion of the Floodplain Roughening detail, including the callout for LWD placement.*

    Wildlands Response: Comment noted.

21. *Sheet 5.6 – Wetland Ditch Plug – Does this detail also apply to existing/relic channel plugs? If channel plugs are proposed, we would like to see approximate locations shown on the plan view drawings.*

    Wildlands Response: The Wetland Ditch Plug detail is meant to guide the backfilling of ditches or relic channels at the Site and will be applied throughout these areas rather than in specific locations. Wildlands wants to ensure that contractors are using suitable backfill material, removing organic debris from the channels, and compacting the backfill material properly.

22. *Design Plan – Please include an overview fencing plan showing proposed fence and existing fence to remain, as well as approximate locations of anticipated gates.*

    Wildlands Response: See comment 12, Todd Bowers EPA above.

Please contact me at (828) 545-3865 if you have any questions.

Sincerely,

Jacob D. McLean

Jacob McLean, PE, CFM

PREPARED BY:

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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 DMS operations and procedures for the delivery of compensatory mitigation.

Contributing Staff:

Jake McLean, PE, CFM *Project Manager*
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1.0 Introduction

The Oak Hill Dairy Mitigation Site (Site) is in Gaston County approximately 2 miles northeast of Cherryville and 7 miles southwest of Lincolnton (Figure 1). The Site is within the NC Division of Mitigation Services (DMS) Lower Indian Creek targeted local watershed Hydrologic Unit Code (HUC) 03050102050010 and the NC Division of Water Resources (DWR) Subbasin 03-08-35, and will provide stream and wetland credits in the Catawba 03 Expanded Service Area. The project proposes to restore, enhance, and preserve impaired streams. Wetland re-establishment is proposed to restore a stream-wetland complex, and best management practices (BMPs) are proposed at points of concentrated agricultural runoff. The existing streams are presented in Figure 2. The work proposed on the Site will provide 4,618.933 stream credits and 7.680 riparian wetland credits and will be protected in perpetuity by a 20.4-acre conservation easement.

Table 1: Project Attribute Table Part 1

Project Information	
Project Name	Oak Hill Dairy Mitigation Site
County	Gaston
Project Area (acres)	20.4
Project Coordinates (latitude and longitude)	35.403339 N, 81.351724 W
Planted Acreage (acres of woody stems planted)	19.9

2.0 Basin Characterization and Site Selection

The Site is in the Catawba 03 Expanded Service Area, which is composed of a mix of forested land (47%), agricultural land (30%), urban areas (18%). Forested land is predominantly located within the upper portion of the basin, while the agricultural land and urban areas are more concentrated to the central and lower portions of the basin, respectively. The major developed areas include Hickory, Newton, Lincolnton, Gastonia, and Belmont, and the main roadways consist of US-321, I-40, and I-85. Indian Creek, the receiving waters for the Site which is shown in Figure 1, is 303(d) listed as impaired for exceeding the narrative criteria to protect aquatic life in fresh water, which means the water is not suitable for aquatic life propagation and maintenance of biological integrity. Multiple conservation and watershed planning documents outline water quality goals and objectives for the broader Catawba River basin and the smaller Indian Creek basin as summarized below:

- The 2007 (amended 2013) Catawba River Basin Restoration Priorities (RBRP) lists restoring impaired waters by removing conditions causing sediment impairments and improving management to reduce direct cattle impacts to streams as goals for the watershed. Indian Creek is discussed specifically in the RBRP with the priority to improve agricultural non-point source pollution on this rural creek.
- The 2015 North Carolina Wildlife Resource Commission's (NCWRC) Wildlife Action Plan (WAP) notes that sedimentation, loss of riparian woody vegetation, water withdrawals, channelization and/or relocation, point source pollution, and nutrient loading are the primary causes of stream habitat degradation in the Catawba River basin.
- The 2008-2010 Indian Creek and Howards Creek Local Watershed Plan (LWP) documents identified major functional stressors in the watershed as channelization and stream dredging; incised channels and unstable stream banks; degraded and deforested riparian buffers;

degraded wetlands; livestock access to riparian buffers and streams; and fecal coliform and nutrient inputs.

- The Site is located in subwatershed I-14, as defined in the Indian Creek and Howards Creek LWP. Subwatershed I-14 is specifically prioritized in the document as being a good candidate for agricultural BMPs.
- The Site was identified in the Indian Creek and Howards Creek LWP Project Atlas as R-104 (Oak Hill Creek and UT1). R-104 was ranked in the highest priority category (Tier 1) for a potential stream restoration project in the Indian Creek watershed with the recommendation of bank stabilization, channel realignment and reconnection with the floodplain, and riparian buffer restoration.

The Site was selected due to its ability to support local watershed objectives and goals by excluding livestock, creating stable stream banks, restoring a forest in agriculturally maintained buffer areas, and implementing agricultural BMPs. These actions will reduce fecal, nutrient, and sediment inputs to project streams, and ultimately to Indian Creek, South Fork Catawba River, and the Catawba River, as well as reconnect instream and terrestrial habitats on the Site. Restoration of the Site is directly in line with recommended management strategies outlined in the LWP and RBRP.

3.0 Baseline and Existing Conditions

3.1 Watershed Conditions

The Site watershed (Table 2 and Figure 3) is situated on the partially developed, northeast edge of Cherryville in Gaston County, within the Piedmont. The Piedmont is characterized by gently rolling, well-rounded hills with long low ridges, with elevations ranging anywhere from 300 to 1500 feet above sea level. The Site topography and relief are typical for the region, as illustrated in Figure 4. Generally, valleys onsite are unconfined and alluvial, and valley slopes tend to flatten as elevation decreases.

Site streams are classified as Class C waters and are protected for secondary recreation, fishing and fish consumption, wildlife, aquatic life, and agriculture.

The Site watershed includes the subwatersheds of Oak Hill Creek, UT1, UT1B and UT1A. Land use within the overall watershed includes a mix of forest, agriculture, and some development, including single-family homes and commercial use along NC 150 (Lincolnton Highway). While the land use of the Site watershed is predominantly rural, Oak Hill Creek drains a large portion of the town of Cherryville and may be considered an urban channel with an estimated 11.6% impervious cover in its 1.7-square mile watershed (Figure 3).

The Oak Hill Creek subwatershed is the largest contributing drainage area to the Site, the majority of which lies offsite to the south. The southern and eastern headwaters of this subwatershed are bound by a combination of Tot Delinger Road, Lincolnton Highway (NC 150), single-family neighborhoods and a large commercial trucking facility, all of which comprise the largest proportion of impervious area contributing to Oak Hill Creek. The central, flatter portion of the Oak Hill Creek subwatershed is occupied by the Cherryville Golf and Country Club which has minimal riparian buffers and has expanded within the last decade with the clearing of additional forest land.

The subwatershed of UT1 is 0.5 square miles where it enters the site and is bound to the west by Tot Delinger Road and to the east by Roy Eaker Road which are generally bordered by low density residential land use. The subwatershed contains a larger proportion of forest land compared to Oak Hill Creek. Most of the riparian corridor along UT1 that drains to the Site contains a forested buffer. The forested buffer narrows within the downstream half of the subwatershed along the left floodplain, including within the project Site, where active cattle pastures are situated.

Subwatersheds UT1A and UT1B are small drainage areas that flow into UT1. UT1A drains active cattle pasture and feeding area on the Site and UT1B drains residential and forested land as well as a grass field.

The Oak Hill Creek watershed is located just outside of the city limits of Cherryville but within its extraterritorial jurisdictional (ETJ) boundary. According to the Gaston County 2035 Comprehensive Land Use Plan, some expansion of existing commercial and residential land uses is expected in the future, but the area is likely to be balanced by the preservation of agricultural lands and open space, and thus continue to serve more as a "rural development pocket" (Gaston County Planning & Development Services, 2016). The land within these watersheds is zoned for Highway Business, Manufactured Home Parks, Manufacturing, and Residential Limited.

A review of historic aerials (Appendix 1) from 1950 to 2016 shows that onsite streams have remained in the same landscape position for the past 60 years. The agricultural management of the land has also remained consistent with the following exceptions:

- The dairy waste lagoon that exists today on the project parcel (just south of the larger pond) was constructed between 2006 and 2009. The lagoon is a no-discharge facility.
- The larger pond in the northeast corner of the Site (that is routed under Robert Road, and joins Oak Hill Creek offsite) was constructed between 1964 and 1973.
- Most of the larger structures on the project parcels were constructed between 1973 and 1976, but the two large feed barns located to the south and west of the waste lagoon were built in the last 15 years.

Table 2: Project Attribute Table Part 2

Project Watershed Summary Information				
Physiographic Province	Piedmont			
Ecoregion	Southern Outer Piedmont			
River Basin	Catawba River			
USGS HUC (8 digit, 14 digit)	03050102, 03050102050010			
NCDWR Sub-basin	03-08-35			
Stream Thermal Regime	Warm			
Project Drainage Area (acres)	1,070 (Oak Hill Creek)			
Project Drainage Area Percentage of Impervious Area	11.6% (Oak Hill Creek)			
2011 NLCD Land Use Classification	Oak Hill Creek	UT1	UT1A	UT1B
Forested	40%	54%	-	65%
Agricultural	24%	32%	84%	-
Developed	36%	14%	16%	35%

Note: Land Use Source – National Land Cover Database 2016 (NLCD 2016), Multi-Resolution Land Characteristics (MRLC) consortium, https://www.mrlc.gov/national-land-cover-database-nlcd-2016 and visual assessment of the 2019 aerial.

3.2 Landscape Characteristics

The Site is in the Cat Square terrane of the Piedmont physiographic province which is composed of deformed metamorphic rocks that have been intruded by younger granitic rocks. The underlying geology of the Site is mapped as Cherryville Granite (Mc) from the Mississippian Period (330 to 360 million years in age). The formation is described as massive to weakly foliated; containing pegmatites that are lithium bearing on the eastern side of the formation. Site streams are predominantly gravel-bed streams, although a bimodal distribution reflects the large quantity of fines coming from both upstream and within the Site. No exposed bedrock was observed within the Site.

The soils in ecoregion 45b, Southern Outer Piedmont, consist of mostly quaternary to tertiary aged sandy clay, clay, micaceous clay, and sandy saprolites with rock outcrops and joint block boulders. The predominant Site floodplain soils on site are described in Table 3 below and depicted in Figure 5. Large portions of active cattle pasture bordering the Site are mapped as Wedowee and Pacolet Sandy Loam soils which are highly susceptible to erosion in bare areas and could be indicative of the high sediment load observed within the channel.

Table 3: Project Soil Types

Soil Name	Description
Appling Sandy Loam	This series consists of Appling Sandy Loam (ApB) on a small section of UT1A floodplain. ApB is composed of well drained soils on smooth ridges ranging in slopes of 1 to 6 %. The upper 10 inches is a brown sandy loam surface layer. The shrink-well potential is low and permeability is moderate.
Chewacla Loam	This series consists of Chewacla Loam (ChA) on slopes ranging from 0 to 2 %. The majority of Oak Hill Creek and UT1 is Chewacla Loam; somewhat poorly drained soils located on floodplains. This soil is frequently flooded, permeability is moderate, and the shrink-swell potential is low. The upper 10 inches is loam and the below is sandy clay loam until bedrock with a depth of more than 5 feet.
Helena Sandy Loam	This series consists of Helena Sandy Loam (HeB) along UT1A. This soil is moderately well drained and found on smooth ridges, toe slopes and drainageways. The permeability is slow, and the shrink-swell potential is high. There is a moderate hazard of erosion in bare areas, as the soil is found on slopes ranging from 1 to 6 %. The upper 8 to 12 inches is sandy loam with a subsoil of clay and clay loam.
Lloyd Sandy Clay Loam	This series consists of Lloyd Sandy Clay Loam (LdB2) found on the outer floodplain of UT1A. The soil is well drained and found on interfluves on slopes ranging from 2 to 8%. The upper 7 inches is clay loam with subsoil of clay and is moderately eroded.
Pacolet Sandy Clay Loam	This series consists of Pacolet Sandy Clay Loam (PaD2) along UT1. The soil is well drained and found on narrow ridges and side slopes ranging from 8 to 15%. The permeability is moderate, and the shrink-swell potential is low. The upper 7 inches is sandy clay loam with subsoil of clay and is moderately eroded.
Pacolet Sandy Loam	This series consists of Pacolet Sandy Loam (PaE) along Oak Hill Creek and UT1. The soil is well drained on narrow ridges and steep side slopes ranging from 15 to 25%. This soil has a moderate permeability and low shrink-swell potential. The upper 6 inches is sandy loam with a subsoil of clay. There is a very severe hazard of erosion where vegetation is removed.
Wedowee Sandy Loam	This series consists Wedowee Sandy Loam (WeD) found along Oak Hill Creek. The soil is well drained and found on narrow ridges and side slopes ranging from 6 to 15%. The permeability and shrink-swell potential are moderate. There is high hazard of erosion in bare areas. The upper 7 inches is sandy loam with a subsoil of clay loam.
Worsham Loam	This series consists of Worsham Loam (WoA) along Oak Hill Creek. The soil is poorly drained and found on uplands around intermittent drainageways with slopes of 0 to 2%. The permeability is very slow, and the shrink-swell potential is moderate. The upper 6 inches is loam with a subsoil of clay loam.

Source: Gaston County Soil Survey, USDA-NRCS, http://efotg.nrcs.usda.gov

In general, the cattle pastures on the Site are dominated by pasture grasses such as fescue and millet species with scattered trees along the top of bank. Row crop fields have previously been planted with corn. Mature canopy species within these areas are primarily black walnut (*Juglans nigra*), tulip poplar (*Liriodendron tulipifera*), river birch (*Betula nigra*), willow oak (*Quercus phellos*), sweet gum (*Liquidambar styraciflua*), and sycamore (*Platanus occidentalis*). Shrub species are primarily Chinese privet (*Ligustrum sinense*), multiflora rose (*Rosa multiflora*), and thickets of blackberry (*Rubus spp*.) In addition to pasture grasses, the ground cover in these areas include some river cane (*Arundinaria gigantea*), horsenettle (*Solanum carolinense*), beefsteak (*Perilla frutescens*), English ivy (*Hedera helix*), and Japanese honeysuckle (*Lonicera japonica*).

3.3 Project Resources

3.3.1 *Existing Streams*

In May 2020, Wildlands investigated on-site jurisdictional waters of the United States (US) within the proposed project area. The Site contains six unnamed tributaries (UT's) that have been assigned the following names for the project: Oak Hill Creek, UT1, UT1A, and UT1B, UT2, and UT3. All tributaries were deemed perennial except for UT1B which was deemed intermittent until just upstream of its confluence with UT1 where it transitions to perennial flow.

Oak Hill Creek is the mainstem drainage of the Site; it originates off site and flows north and then east through the project area. UT1 enters the Site through a culvert under Roy Eaker Road and flows east to join Oak Hill Creek. UT1A originates off site and flows southeast to join UT1. UT1B is a small channel that enters the Site through a culvert under Roy Eaker Road and flows east to join UT1. UT2 and UT3 are small tributaries that drain into Oak Hill Creek from the right floodplain in the downstream third of the project; mitigation credit is not being pursued for these two tributaries but both are proposed to be extended in length to tie into the realigned mainstem channel of Oak Hill Creek. Jurisdictional stream features are shown on Figure 2 and supporting documentation is provided in Appendices 2 and 3.

Geomorphic surveys were conducted on Site streams to characterize their existing condition. Existing streams and cross section locations are illustrated in Figure 2. NCDWR stream assessment forms and NCSAM forms are in Appendix 3 and reach specific cross sections and geomorphic summaries are provided in Appendix 4.

<u>*Oak Hill Creek Reach 1*</u>

Oak Hill Creek Reach 1 begins at the upstream property boundary and terminates at a sanitary sewer crossing. An advancing headcut has been arrested by a concrete-encased sewer crossing. The reach has a meandering geometry with consistent and severe outer meander bend erosion. A high existing terrace has eroded on the left bank and the valley wall on the right. Due to mid- and side-channel bar formation in the ever-widening channel bottom, erosion of the lower bench was also observed. Hydraulic modeling shows that this bench is not activated by flows less than the 10-year event. The reach is bordered by a semi-wooded to forested buffer on the right bank, where it is against the forested valley wall in many cases. The buffer along the left floodplain is fragmented, consisting of a broad fallow field with a few clusters of mature trees. The reach lacks consistent woody vegetation and rooting depth along the left bank. The right bank lacks canopy shading in places allowing for competition from invasive species establishment.

The channel classified as a Rosgen B4c-type channel due to the benches that have formed within the overwide, incised channel; and is confined to one-third of its original floodprone area due to moderate entrenchment.

Instream habitats include riffles and pools, undercut banks with root mats, woody debris, and leaf packs. Tree of heaven (*Ailanthus altissima*) and privet were commonly observed throughout the reach along both banks. Japanese knotweed (*Polygonum cuspidatum*) and kudzu (*Pueraria montana*) are present in the lower portion of the reach near the sanitary sewer crossing.


Oak Hill Creek – Reach 1

Table 4: Oak Hill Creek (OHC) Reach 1 Attribute Table

Reach Summary Information	
Parameters	**Oak Hill Creek**
Length of Reach (Linear Feet)	581
Valley confinement (Confined, moderately confined, unconfined)	Moderately confined
Drainage area (acres)	608
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Medium
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	14.4
Bank Height Ratio (ft/ft)	2.4
Gradient (ft/ft)	0.0070
Reachwide d50 (mm)	22.6
Stream Classification (Existing and Proposed)	B4c/C4
Evolutionary Trend	V – aggradation and widening
FEMA Zone Classification	AE


Oak Hill Creek – Reach 1 Downstream Limits

Oak Hill Creek Reach 2

Oak Hill Creek Reach 2 begins downstream of the sanitary sewer easement where a riprap/concrete nick point is present; the reach extends downstream to the confluence with UT1. As discussed in Section 6.7, the reach was ditched prior to 1950 based on visual interpretation of aerial photography (Appendix 1). Reach 2 is actively widening as a result of severely eroding outside bends. Reach 2 has a high bank height ratio and relative confinement except for the building point and side channel bars. Both banks lack deep-rooted vegetation and point bars are infested with kudzu. Closer to the confluence, Chinese privet is dominant along the banks. Pockets of other invasive species, including tree of heaven and Japanese knotweed, were also observed. Mixed with the privet, some mature vegetation is present in a narrow buffer along the tops of banks. Large woody debris is sparse along Reach 2. Riffles and pools are present, but of poor quality due to embeddedness with fines.

A linear wetland (Wetland B) is located along the left valley toe of Oak Hill Creek Reach 2. Based on soil borings and review of aerial photography (1984, 1993, Appendix 1), this wetland appears to be the remnants of a ditch that used to drain the proposed wetland re-establishment areas and which likely extended the length of the valley down to Robert Road. The linear feature drains into UT1 Reach 2. In the same vicinity, a wood tile drain empties into Oak Hill Creek at the tortuous outside bend.

Table 5: OHC Reach 2 Attribute Table

Reach Summary Information	
Parameters	**Oak Hill Creek**
Length of Reach (Linear Feet)	431
Valley confinement (Confined, moderately confined, unconfined)	Unconfined
Drainage area (acres)	614
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	7.6
Bank Height Ratio (ft/ft)	2.0
Gradient (ft/ft)	0.0057
Reachwide d50 (mm)	2.5
Stream Classification (Existing and Proposed)	G4c/C4
Evolutionary Trend	IV – degradation and widening
FEMA Zone Classification	AE

Oak Hill Creek Reach 3

Oak Hill Creek Reach 3 begins at the confluence of UT1 and extends downstream along the right side of the valley to the UT3 confluence. Historical aerial imagery suggests Reach 3 was ditched prior to 1950 (Appendix 1). In some areas where trees and privet have held the banks together, the banks are wooded. In other areas, and beyond the banks, there is a corn field on the left floodplain and fallow fields on the right.

The instream habitat and overall channel stability continues to degrade downstream, with more fine sediment in the bed of the channel, frequent areas of bank erosion and incision, and the presence of mid-channel bars. Some undercut banks and leaf packs provide instream habitat. Privet continues to be a dominant bank species, with tree of heaven and morning glory (*Ipomoea indica*) noted as other invasive species of concern. The dairy's large waste lagoon is situated atop the left valley of Oak Hill Creek Reach 3. It is designed with no discharge and is required to be sized for at least a 25-year 24-hour event. If overtopped, under current conditions ditches would convey runoff to Oak Hill Creek, bypassing the left floodplain of Oak Hill Creek Reaches 3 and 4 (Figure 2). This ditch also collects local drainage from upland fields along the entire left valley. The adjacent landowner's driveway parallels the creek toward the downstream reach limits, and concrete slabs have been used to armor the banks to protect the driveway.

Table 6: OHC Reach 3 Attribute Table

Reach Summary Information	
Parameters	**Oak Hill Creek**
Length of Reach (Linear Feet)	882
Valley confinement (Confined, moderately confined, unconfined)	Unconfined
Drainage area (acres)	988
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	12.9
Bank Height Ratio (ft/ft)	2.6
Gradient (ft/ft)	0.0052
Reachwide d50 (mm)	8.0
Stream Classification (Existing and Proposed)	C4/C4
Evolutionary Trend	IV – degradation and widening
FEMA Zone Classification	AE

Oak Hill Creek Reach 4

OHC Reach 4 begins at the confluence of UT3 and terminates downstream at a culvert beneath Robert Road. Reach 4 has severe bank erosion in some areas and, although was classified as a Rosgen E5-type channel due to active widening resulting in an entrenchment ratio greater than 2.2, it is incised with a bank height ratio of 2.6. The entire length of Reach 4 immediately abuts a gravel driveway on the right top of bank with only a narrow row of trees, and portions of the channel bordering the driveway have been armored with stone or concrete to halt on-going bank erosion. Erosion from debris jams and the incised channel condition is common. In many of the locations within the reach that have deep-rooted vegetation, the vegetation is being undercut and lacks sufficient root depth to prevent long term widening. Reach 4 is similar to OHC Reach 3 with respect to drainage area, channel dimension, pattern, and profile but classified out as a sand bed channel due to the impact of upstream bank erosion throughout the Site. Throughout its length, the stream centerline of Reach 4 is roughly coincident with the Site property boundary.

Table 7: OHC Reach 4 Attribute Table

Reach Summary Information	
Parameters	**Oak Hill Creek**
Length of Reach (Linear Feet)	523
Valley confinement (Confined, moderately confined, unconfined)	Unconfined
Drainage area (acres)	1,070
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	11.2
Bank Height Ratio (ft/ft)	2.3
Gradient (ft/ft)	0.0050
Reachwide d50 (mm)	1.7
Stream Classification (Existing and Proposed)	E5/C4
Evolutionary Trend	IV – degradation and widening
FEMA Zone Classification	AE

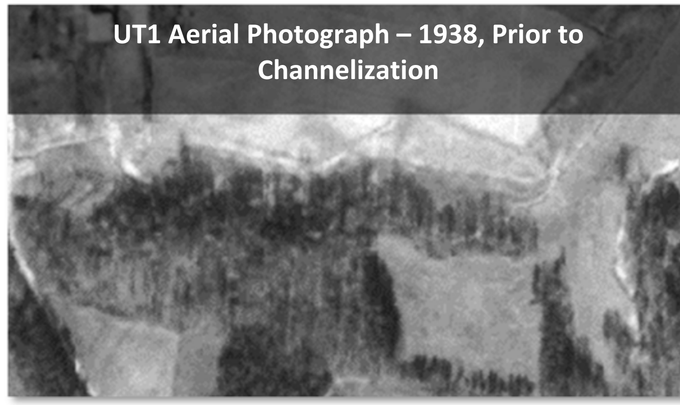
UT1 Reach 1

UT1 Reach 1 enters the Site from a perched culvert under Roy Eaker Road. An overhead electric line and power pole are present on the left top of bank at the top of the reach. The stream drops 9 inches over the culvert outlet and is incised with eroding areas downstream of the culvert. Alternating lateral bars are forming within the incised channel, and varied habitats are present although they are embedded with fines from bank erosion. Very little woody debris is present in the reach. Although cattle are currently fenced from the stream, the fencing is near the top of bank and cattle are actively grazing and impacting the left riparian zone. The left bank has infestations of Chinese privet. The right riparian zone has a row of trees but is impacted by kudzu within the trees and in the adjacent areas. Large sand and mud deposits are present at and below the UT1/UT1A confluence due to the large volume of fine sediment supply coming from the UT1A intensive cattle operations on the uplands, and from UT1A instream erosion. Downstream of UT1A, UT1 Reach 1 shifts across to the right side of the valley where it is joined by UT1B from the right bank. The UT1B confluence is surrounded by an existing wetland area (Wetland F) with cattails along the right floodplain of UT1 Reach 1.

Table 8: UT1 Reach 1 Attribute Table

Reach Summary Information	
Parameters	**UT1**
Length of Reach (Linear Feet)	252
Valley confinement (Confined, moderately confined, unconfined)	Unconfined
Drainage area (acres)	302
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	23.4
Bank Height Ratio (ft/ft)	2.4
Gradient (ft/ft)	0.0077
Reachwide d50 (mm)	3.2
Stream Classification (Existing and Proposed)	F4/C4
Evolutionary Trend	V – aggradation and widening
FEMA Zone Classification	N/A

The project reach is classified as a Rosgen F4-type stream channel and is laterally and vertically unstable with headcuts present in the lower reaches of Reach 1 and upper reaches of Reach 2. It is incised and overwide in many areas. Short steep, riffles were observed in tight, actively eroding meander bends.



UT1 Reach 2

UT1 Reach 2 begins at the confluence of UT1B and terminates at its confluence with Oak Hill Creek. As noted in the Hydric Soils Report (Appendix 5), aerial photography indicates that UT1 was relocated from the middle/right side of the valley to the left valley toe between 1950-1956. Based on the topography and soil characteristics, spoils may have been side cast into the historic floodplain creating an unnatural high spot through the middle of the valley and leaving remnant wetland pockets. Presently, the upstream half of the reach generally flows along the toe of the right valley wall while the downstream half of the reach flows along the toe of the left valley wall. UT1 Reach 2 is bordered by five small wetland areas (Wetlands B, C, D, E, and F), many of these coincident with linear drainage features thought to have been created to draw water off historically wet areas of the floodplain. Downstream of UT1A, there is a draw on the left floodplain that contributes runoff from the cattle feedlot into UT1. Several cattle sloughs or wallow areas were observed along the tops of both banks throughout the entire length of UT1 Reach 1. This is consistent with landowner verbal confirmation that cattle are allowed access seasonally to flash graze areas in order to manage kudzu and other vegetation.

Table 9: UT1 Reach 2 Attribute Table

Reach Summary Information	
Parameters	**UT1**
Length of Reach (Linear Feet)	1,706
Valley confinement (Confined, moderately confined, unconfined)	Unconfined
Drainage area (acres)	333
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	5.9
Bank Height Ratio (ft/ft)	2.4
Gradient (ft/ft)	0.0070
Reachwide d50 (mm)	3.3
Stream Classification (Existing and Proposed)	G4/C4
Evolutionary Trend	IV – degradation and widening
FEMA Zone Classification	N/A[1]

[1] UT1 Reach 2 is located in the backwater of Oak Hill Creek Zone AE FEMA floodplain

The stream was classified as a Rosgen G4-type channel based on its degree of incision. Privet along the banks throughout much of the reach appears to have slowed the rate of channel widening over time; however, the channel is vertically unstable with several advancing headcuts in the upper half of the reach and laterally unstable where it has previously undermined privet and other bank vegetation. While the valley is broad throughout the reach corridor, channel pattern is minimal. Meander pools should be present but are rare, and pool spacing is tight. Riffles and pools typically occur in locations inconsistent with stable planform geometry.

Habitat along UT1 consists of riffles with some overhanging roots and pools. Riffles are often embedded with fines and large woody debris is scarce. Riparian vegetation consists of a single line of mature vegetation at the top of bank, with maintained crop fields to the left and fallow fields and black walnuts (*Juglans* nigra) to the right. The understory and banks are dominated by privet and the right valley wall and floodplain edge has a severe infestation of English ivy (*Hedera helix*).

<u>*UT1A*</u>
The Site was extended upstream from the location originally specified in the DMS technical proposal and initial NCIRT site walk and currently encompasses the UT1A jurisdictional stream boundary which is in a bamboo thicket (*Phyllostachys aurea*). At this location, UT1A drops approximately two feet at an existing knickpoint. As it emerges from the thicket downstream, it bisects a small wetland area (Wetland J), likely a result of erosion and cattle wallowing immediately below the existing fence line. An existing residence on the right floodplain is occupied and must remain – the easement has been set 10 feet off the residence. UT1A flows within the primary feedlot for the dairy and is utilized by cattle for drinking; the adjacent areas are impacted by the concentrated activity. Except for a few stand-alone trees, UT1A is devoid of riparian vegetation and a shaded canopy. The stream is incised and overly wide, and the bed and banks are severely trampled with toe and valley slope erosion. In the bamboo section, some bedform and habitat is present, but these give way to silted and braided runs with no bedform throughout the remainder of the reach. Fine sediments are embedding any underlying bedform material from consistent erosion and sedimentation of the adjacent upland areas. At the lower limits of the reach, UT1A flows through a marshy, herbaceous area influenced by debris and sediment trapped by the existing fence.


UT1A near Upstream Limits

Table 10: UT1A Attribute Table

Reach Summary Information	
Parameters	**UT1A**
Length of Reach (Linear Feet)	482
Valley confinement (Confined, moderately confined, unconfined)	Confined
Drainage area (acres)	12
Perennial, Intermittent, Ephemeral	Perennial
NCSAM Score/Stream Function	Low
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	51.0


UT1A

Reach Summary Information	
Parameters	UT1A
Bank Height Ratio (ft/ft)	9.6
Gradient (ft/ft)	0.0250
Reachwide d50 (mm)	Silt[1]
Stream Classification (Existing and Proposed)	F6b/E4b
Evolutionary Trend	IV – degradation and widening
FEMA Zone Classification	N/A

[1] Sediment was visually classified

UT1B

UT1B enters the Site as an intermittent stream, dropping approximately two feet from the culvert under Roy Eaker Road. The reach classifies as a stable Rosgen Cb type channel, has low banks and is connected to the floodplain. The stream flows along the right valley wall, paralleling UT1, and becomes perennial approximately 100 LF upstream of the stream's confluence with UT1. Leaf packs dominate instream habitat, with some small gravels and sand for substrate. A patch of kudzu is present in the floodplain along Roy Eaker Road. The right valley wall has a single row of mature woody species, and the left floodplain is predominantly grasses and early successional woody species as well as privet. UT1B drops over several small headcuts as it enters UT1.

Table 11: UT1B Attribute Table

Reach Summary Information	
Parameters	UT1B
Length of Reach (Linear Feet)	292
Valley confinement (Confined, moderately confined, unconfined)	Moderately confined
Drainage area (acres)	4
Perennial, Intermittent, Ephemeral	Intermittent /Perennial*
NCSAM Score/Stream Function	Medium
NCDWR Water Quality Classification	C
Width to Depth Ratio (ft/ft)	22
Bank Height Ratio (ft/ft)	1.0
Gradient (ft/ft)	0.0229
Reachwide d50 (mm)	Silt/Sand
Stream Classification (Existing and Proposed)	Cb/Cb
Evolutionary Trend	I - Premodified
FEMA Zone Classification	N/A

*Note: Upstream 206 LF of channel is intermittent

3.3.2 *Existing Wetlands*

Wildlands delineated potential wetland waters of the United States within and immediately adjacent to the proposed project easement (assessment area) using the USACE Routine On-Site Determination method presented in the 1987 Corps of Engineers delineation manual and the subsequent Regional Supplement for the Eastern Mountain and Piedmont Region. The Preliminary Jurisdictional Determination (PJD) was issued on December 7th. See Appendix 2 for the approved PJD, existing wetland data is summarized in Table 12.

A total of 7 existing wetland features (Wetlands A, B, C, D, F, J, and K) were documented within the assessment area (appendix 2). On-site wetland features exhibit indicators of wetland hydrology, hydrophytic vegetation, and hydric soils. Indicators of wetland hydrology observed in existing wetlands include aquatic fauna, drainage patterns, surface soil cracks, sparsely vegetated concave surface, stunted or stressed plants, high water table, water-stained leaves, crayfish burrows, saturation, geomorphic position, FAC-neutral test, sediment deposits, and surface water. Dominant hydrophytic vegetation species within wetlands include sugarberry (Celtis laevigata), American elm (Ulmus americana), jewelweed (*Impatiens capensis*), arrowhead (*Sagittaria latifolia*), and jointleaf rush (*Juncus articulatus*). Soils within on-site wetlands exhibit one of the following hydric soil indicators: depleted matrix, redox dark surface, and piedmont floodplain soils.

Existing wetlands were evaluated using the North Carolina Wetland Assessment Method (NCWAM), which evaluates field conditions relative to reference condition to generate function ratings for specific wetland types. Using the NCWAM dichotomous key and best professional judgement, existing wetlands were classified based on the reference wetland type if the area was not disturbed. On-site wetlands were all classified as Bottomland Hardwood Forest or Headwater Forests. On-site wetlands scored as low to medium functioning systems when compared to reference conditions because of impairments to two of the three primary functions (hydrology, water quality, and habitat). Water quality and habitat functions generally received low scores due to cattle grazing, lack of native vegetative communities, and poor connectivity to other natural areas. NCWAM field assessment forms and the rating calculator outputs are included in Appendix 3.

Table 12: Project Attribute Table Part 4

Wetland	Size of Wetland (acres)	Wetland Type (NCWAM Rating)	Wetland NCWAM Rating	Mapped Soil Series	Drainage Class	Soil Hydric Status	Source of Hydrology	Method: Vegetative Enhancement or Preservation
A	2.203	Bottomland Hardwood Forest	Low	Chewacla loam, Wedowee sandy loam, Worsham loam	Somewhat poorly drained, Well drained, Poorly drained	No, No, Yes	Groundwater/ Overbank	Enhancement
B	0.138	Headwater Forest	Low	Chewacla loam, Pacolet sandy clay loam, Pacolet sandy loam	Somewhat poorly drained, Well drained, Well drained	No, No, No	Groundwater	Enhancement
C	0.021	Headwater Forest	Low	Chewacla loam, Pacolet sandy loam	Somewhat poorly drained, Well drained	No, No	Groundwater	Enhancement

Wetland	Size of Wetland (acres)	Wetland Type (NCWAM Rating)	Wetland NCWAM Rating	Mapped Soil Series	Drainage Class	Soil Hydric Status	Source of Hydrology	Method: Vegetative Enhancement or Preservation
D	0.028	Headwater Forest	Low	Pacolet sandy loam	Well Drained	No	Groundwater	Enhancement
F	0.131	Headwater Forest	Low	Chewacla loam	Somewhat poorly drained	No	Groundwater	Enhancement
J	0.047	Headwater Forest	Low	Helena sandy loam	Moderately well drained	No	Groundwater/ Overbank	Enhancement
K[1]	<0.000	Bottomland Hardwood Forest	N/A	Chewacla loam	Somewhat poorly drained	No	Groundwater	None

[1] Wetland K is within the assessment area of the pJD and is anticipated to be impacted by project activities. No WAM form was completed as no wetland mitigation credit is being sought for Wetland K.

3.4 Overall Functional Uplift Potential

The primary physical stressors on site are incision and entrenchment from historic channelization coupled with historic and on-going agricultural operations that have drained the site and maintained narrow or non-existent riparian buffers. These stressors led to low NCSAM scores for most project stream reaches and low NCWAM scores for project wetlands. Without intervention, Oak Hill Creek and its tributaries will continue to widen, which will further diminish riparian wetland hydrology. Ultimately, functional uplift for this Site is linked to improvement in and maintenance of hydrologic connectivity between streams and riparian wetlands. Additionally, establishing a riparian buffer will protect and enhance this connectivity. Functional uplift for the site will be achieved through the following:

- Restoring degraded stream channels to reduce erosion and reconnecting streams to their historic floodplains to restore hydrologic connectivity to riparian wetlands;
- Reducing bank erosion and associated pollutants;
- Planting riparian buffers to shade streams, filter upland runoff, stabilize streambanks with deep-rooted vegetation, and promote woody debris in system;
- Cattle exclusion;
- Establishing BMP’s to provide additional treatment of upland runoff; and
- Protecting the site with a conservation easement.

These project components are described in Section 5 in terms of goals, objectives, and outcomes for the project and in greater detail in Section 6 as the project site mitigation work plan.

3.5 Site Constraints to Functional Uplift

The following potential Site constraints have been identified and will be addressed as part of this project.

Due to the tie in elevations and degree of incision onsite, some Priority 2 restoration will be necessary along portions of UT1 and Oak Hill Creek in transitioning to Priority 1 restoration. Establishing vegetation on Priority Level 2 stream restoration can be a challenge. Wildlands has prepared a Vegetation and Planting Plan (Section 6.9) to address this potential constraint. Priority Level 2 restoration may have a limited floodplain on some projects. As described in Section 6.6 Design Implementation, Wildlands will construct floodplains that are at least 4 times bankfull width and have a slope that is flatter than 5:1.

The Site is currently in active row crop and cattle operation. Care was taken to minimize the number of stream crossings to those that are necessary for the landowners to maintain their farming operations in a sustainable manner. Two internal easement crossings are proposed at the Site to maintain landowner access and use of the adjoining property, and to accommodate an existing sanitary sewer line easement (20-feet in width) that intersects Oak Hill Creek at the juncture of Reach 1 and 2. At this time, livestock will be excluded from the proposed ford crossing since the landowner does not intend to use it and its adjacent areas for this purpose in the short term. The UT1 crossing will be fenced and gated based on the current intent to use this crossing for livestock rotation post-construction. The crossings are summarized and numbered below in Table 13 and depicted on Figure 9. All crossings will be designed to reduce barriers to sediment transport, promote aquatic organism passage, and increase the long-term stability of the crossings.

Table 13: Summary of Site Easement Crossings and Breaks

No.	Width (ft)	Location	Internal or External	Crossing Type
1	50	Oak Hill Creek Reach 1/2	Internal	Ford
2	30	UT1 Reach 2	Internal	Culvert crossing

There are two structures in the right floodplain of UT1A – a small, occupied house near the upstream project boundary and an old barn approximately halfway down the reach. The landowner has agreed to demolish the old barn as part of the project. The easement has been narrowed in the vicinity of the house.

Utilities within the project area include an existing sanitary sewer that crosses Oak Hill Creek Reach 1 at its reach break with and overhead utilities along Roy Eaker Road and Robert Road. Internal easement crossing 1 has been aligned to encompass the sanitary sewer easement. The overhead utility line along Roy Eaker Road that extends across UT1 Reach 1 is no longer in service and will be removed from the easement. The conservation easement boundary has been set to exclude the overhead utility on Robert Road.

Two BMPs are proposed for the Site to intercept and treat stormwater runoff from the dairy's outdoor feeding area bordering UT1A and UT1 Reach 1, and in the subwatershed of the dairy's no-discharge waste lagoon that would overtop to the creek through ditches in the case of an event exceeding the design volume of the lagoon. Treated runoff from these two proposed BMPs will outlet into restored wetland areas and a vegetated floodplain buffer to provide additional attenuation and potential pollutant load filtering benefits before entering the stream channel. More details pertaining to the proposed BMPs can be found in Section 6.8.

The entire easement area can be accessed for construction, monitoring, and long-term stewardship from Robert Road and Roy Eaker Road.

4.0 Regulatory Considerations

Table 14, below, is a summary of regulatory considerations for the Site. These considerations are expanded upon in Sections 4.1-4.3.

Table 14: Regulatory Considerations Attribute Table

Regulatory Considerations			
Parameters	**Applicable?**	**Resolved?**	**Supporting Docs?**
Water of the United States - Section 404	Yes	No	PCN[1]
Water of the United States - Section 401	Yes	No	PCN[1]
Endangered Species Act	Yes	Yes	Appendix 6
Historic Preservation Act	Yes	Yes	Appendix 6
Coastal Zone Management Act	No	N/A	N/A
FEMA Floodplain Compliance	Yes	No	N/A
Essential Fisheries Habitat	No	N/A	N/A

1. PJD submitted to USACE on 8/10/20. PCN to be provided to NCIRT with Final Mitigation Plan.

4.1 Biological and Cultural Resources

A Categorical Exclusion for the Site was approved on August 20, 2019. This document included investigation into the presence of threatened and endangered species on Site protected under the Endangered Species Act of 1973, as well as any historical resources protected under the National Historic Preservation Act of 1966. The biological conclusion for the Site, per the Categorical Exclusion research and response by US Fish and Wildlife Service, is that "the action agency determines that this project may affect the Northern Long-Eared Bat (NLEB), but that any resulting incidental take of the NLEB is not prohibited by the finial 4(d) rule." The conclusion for cultural resources per the Categorical Exclusion research and response by the State Historic Preservation Office is that they are aware of "no historic resources which would be affected by this project." The signed Categorical Exclusion checklist and summary are provided in Appendix 6. As stated on the Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form provided in the Categorical Exclusion, approximately 1.24 acres of trees will be cleared during the construction of the project. A complete copy of the Categorical Exclusion document, including additional information and regulatory communications, is available upon request.

4.2 FEMA Floodplain Compliance and Hydrologic Trespass

The Site is represented on the Gaston County Flood Maps 3710269100K and 3710269000J. All four project stream reaches of Oak Hill Creek are mapped in a Zone AE Special Flood Hazard Area (SFHA) and the downstream 400 LF of UT1 Reach 2 is included in the backwater of Oak Hill Creek's mapped floodplain (Figure 6). UT1, UT1A and UT1B do not have designated SFHAs. Effective hydraulic modeling for Oak Hill Creek has been obtained from the NC Floodplain Mapping Program. Based on modeling of the existing and proposed conditions, a Conditional Letter of Map Revision (CLOMR) is anticipated to address minor rises during extreme flood events. The rises anticipated under these large flows is on the order of 1-3" with no impact to structures. Wildlands and the County will notify the two affected landowners through the CLOMR Property Owner Notification process and through Wildlands' own outreach, as deemed appropriate. Upstream of Oak Hill Creek Reach 1, a rise of 1-3" has been modeled for the proposed case under the 100-year base flood. This is a naturalized and wooded area with no developed land impacted. On the right floodplain of Oak Hill Creek in Reaches 3 and 4, the increase in base flood elevation has been modeled as 0.01'. In this same area along Reaches 3 and 4, Wildlands has coordinated the installation of new culverts on UT2 and UT3 to address the poor condition of existing pipes and to simultaneously raise the new pipes in order to prevent excessive backwater of baseflow onto the adjacent landowner. Sufficient existing gradient exists in this area to accomplish the required grade adjustments and Wildlands has coordinated these activities with the landowner and will obtain a temporary easement to make these adjustments to UT2 & 3. UT1 Reach 1 will be tied into an existing headcut at the culvert outlet but will not back up water above the elevation of the existing culvert at Roy Eaker Road. UT1A raises the stream up to an existing knick point but this is contained within the proposed easement. A LOMR will be completed after construction using as-built survey data.

4.3 401/404

Jurisdictional waters will be impacted with realignment of the stream channel, structure installation and bank, floodplain and wetland grading. Wetlands on the Site that are within the conservation easement and outside of the limits of disturbance will be flagged during construction to prevent unintended impacts. This will be denoted in the final construction plans. The Pre-Construction Notification, including this data, will be submitted to the NCIRT with the Final Mitigation Plan.

5.0 Mitigation Site Goals and Objectives

The project will improve stream and wetland functions through stream restoration, conversion of agricultural fields into riparian buffer, and restoring wetlands within the broad floodplains of Oak Hill Creek and UT1. Project goals are desired project outcomes and are verifiable through measurement and/or visual assessment. Objectives are activities that will result in the accomplishment of goals. The project will be monitored after construction to evaluate performance as described in Section 8 of this report. The project goals and related objectives are described in Table 15. It should be noted that potential benefits resulting in the uplift of biological and physicochemical functions are presumed since these functions will not be directly measured during monitoring.

Table 15: Mitigation Goals and Objectives

Goal	Objective	Expected Outcomes	Functions Supported
Exclude livestock from stream channels and riparian wetlands.	Install livestock fencing as needed to exclude livestock from stream channels, wetlands, and riparian areas, or remove livestock from adjacent fields.	Reduce agricultural and sediment inputs to the project, which will reduce likelihood of accumulated fines and excessive algal blooms from nutrients. Reduce sediment inputs from bank erosion and degradation. Provide riparian and wetland habitat. Support all stream and wetland functions.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology
Restore and enhance native vegetation in wetlands and floodplains.	Convert active cattle pasture and crop fields to forested riparian buffers and riparian wetlands along all Site streams, which will slow and treat sediment laden runoff from adjacent pastures and crop fields before entering streams. Protect and enhance existing forested riparian buffers. Treat invasive species.	Reduce sediment inputs from bank erosion and runoff. Increase nutrient cycling and storage in floodplain. Provide riparian and wetland habitat. Add a source of LWD and organic material to stream. Support stream and wetland functions.	Hydrology (local), Hydraulic, Geomorphology, Physicochemical, Biology

Goal	Objective	Expected Outcomes	Functions Supported
Improve the stability of stream channels.	Construct stream channels that will maintain a stable pattern and profile considering the hydrologic and sediment inputs to the system, the landscape setting, and the watershed conditions. Add bank revetments and instream structures to protect restored/ enhanced streams.	Reduce sediment inputs from bank erosion. Reduce shear stress on channel boundary. Support all stream functions above hydrology.	Hydraulic, Geomorphology, Physicochemical, Biology
Improve instream habitat.	Install habitat features such as constructed steps, cover logs, and brush toes on restored reaches. Add woody materials to channel beds. Construct pools of varying depth.	Increase and diversify available habitats for macroinvertebrates, fish, and amphibians. Promote aquatic species migration and recolonization from refugia, leading to colonization and increase in biodiversity over time. Add complexity including LWD to the streams.	Geomorphology, Biology
Reconnect channels with floodplains and riparian wetlands.	Reconstruct stream channels with appropriate bankfull dimensions and depth relative to the existing floodplain.	Reduce shear stress on channel; Hydrate adjacent wetland areas; Filter pollutants out of overbank flows.	Hydraulic, Geomorphology, Physicochemical, Biology
Restore wetland hydrology, soils, and plant communities.	Restore and enhance riparian wetlands by raising stream beds, plugging and filling existing agricultural ditches, removing berm material over relic hydric soils, and planting native wetland species.	Improve terrestrial habitat.	Hydrology, Physicochemical, Biology
Treat concentrated agricultural runoff.	Install stormwater BMPs in areas of concentrated agricultural runoff to treat runoff before it enters the stream channel.	Reduce agricultural and sediment inputs to the project, which will reduce likelihood of accumulated fines and excessive algal blooms from nutrients.	Hydrology, Hydraulic, Geomorphology, Physicochemical, Biology
Permanently protect the project site from harmful uses.	Establish a conservation easement on the Site. Exclude livestock from Site streams and wetlands and remove crop fields from the riparian buffer.	Protect Site from encroachment on the riparian corridor and direct impact to streams and wetlands. Support all stream functions.	Hydraulic, Geomorphic, Physicochemical, Biology

6.0 Design Approach and Mitigation Work Plan

This Section presents the proposed collective design approach for streams, wetlands, BMPs, and planting, as well as considerations for land and project risk management for this Site.

The design approach was developed to meet the goals and objectives described in Section 5 which were formulated based on the potential for uplift described in Section 3.4. The design is also intended to provide the expected outcomes in Section 5, though these are not tied to performance criteria.

The design focus is the reconnection of streams to their historic floodplains to raise the groundwater table on the Site and contribute more frequent overbank flow to site floodplain and wetland resources. Restoration of site hydrology will be further supported by filling agricultural drainage swales and removing drainage tiles. The floodplains and wetlands will be planted with native herbaceous; tree and shrub species and invasive species will be treated. Instream structures will be constructed in the channels to help maintain stable channel morphology, improve aquatic habitat, and enhance channel bedform. Cattle will be excluded from the Site, eliminating wallow areas within the streams and wetlands. Proposed stormwater BMPs will treat upland runoff entering the Site from areas used for feeding and grazing of cattle. The entire project area will be protected in perpetuity by a conservation easement. Table 16 summarizes the stressors of each project reach and the applicable mitigation activities expected to address those stressors.

Table 16: Stream and Wetland Stressors and Restoration Approach

Project Reach	Primary Stressors/Impairments	Approach	Mitigation Activities
OHC R1	Intermittent cattle access, channel incision/channelization, bank erosion, poor buffer quality/lack of buffer, invasive species	EI	Restoring dimension and profile, creating a floodplain bench, add wood and habitat structures to channel, treating invasive species, planting buffers, terminating intermittent use for grazing, protecting with conservation easement
OHC R2	Intermittent cattle access, channelization, incision, bank erosion, poor buffer quality/lack of buffer, invasive species	R	Restoring dimension, pattern, profile, and floodplain access, treating invasive species, planting buffers, terminating intermittent use for grazing, protecting with conservation easement
OHC R3	Intermittent cattle access to edge of channel, channelization, incision, bank erosion, poor buffer quality/lack of buffer, invasive species	R	Restoring dimension, pattern, profile, and floodplain access, treating invasive species, planting buffers, proposed stormwater BMP, terminating intermittent use for grazing, protecting with conservation easement
OHC R4	Intermittent cattle access to edge of channel, channelization, incision, bank erosion, poor buffer quality/lack of buffer, invasive species	R	Restoring dimension, pattern, profile and floodplain access, treating invasive species, planting buffers, terminating intermittent use for grazing, protecting with conservation easement
UT1 R1	Intermittent cattle access, channelization, incision, bank erosion, poor buffer quality/lack of buffer, invasive species	R	Restoring dimension, pattern, profile, and floodplain access, planting buffers, terminating intermittent use for grazing, protecting with conservation easement
UT1 R2	Intermittent cattle access, active head cutting, channelization, incision, bank erosion, poor buffer quality/lack of buffer, invasive species	R	Cattle exclusion, restoring dimension, pattern, profile, and floodplain access, planting buffers, proposed stormwater BMP, protecting with conservation easement
UT1A	Cattle access, active head cutting and incision, bank erosion, cattle impacts (wallowing and trampling), lack of bedform, non-existent buffer	R	Cattle exclusion, restoring dimension, pattern, and profile, planting buffers, protecting with conservation easement

Project Reach	Primary Stressors/Impairments	Approach	Mitigation Activities
UT1B	Intermittent cattle access, poor buffer quality/lack of buffer, invasive species	EII	Treating invasive species, planting buffers, terminating intermittent use for grazing, protecting with conservation easement
Wetland Rehabilitation (1.5:1 Credit)	Moderate vegetation quality, decreased hydrology due to drainage features and incised channels, intermittent cattle impacts	RH	Rehabilitate wetlands by raising of stream bed elevations, plugging/filling drainage features, removal of berm material, planting and supplemental planting of native wetland vegetation community, treating invasive species, terminating intermittent use for grazing, protecting with easement
Wetland Rehabilitation (1:1 Credit)	Maintained vegetation for agriculture, decreased hydrology due to drainage features and incised channels, upland runoff from dairy operations, intermittent cattle impacts	RH	Rehabilitate wetlands by raising of stream bed elevations, plugging/filling drainage features, removing active cultivation and vegetation management impacts through easement, removal of berm material, planting native wetland vegetation community, treating invasive species, terminating intermittent use for grazing, protecting with conservation easement, proposed stormwater BMP (upgradient of wetlands A, G & H)
Wetland Re-establishment (1:1 Credit)	Maintained vegetation for agriculture, decreased hydrology due to drainage features and incised channels, upland runoff from agricultural areas, intermittent cattle impacts	RE	Re-establish wetlands by raising of stream bed elevations, plugging/filling drainage features, removal of berm material, planting native wetland vegetation community, treating invasive species, terminating intermittent use for grazing, protecting with conservation easement
Wetland Creation (3:1)	Maintained vegetation for agriculture, decreased hydrology due to drainage features and incised channels, intermittent cattle impacts	C	Create wetlands by raising stream bed elevations, plugging/filling drainage features, removal of berm material, planting native wetland vegetation community, treating invasive species, terminating intermittent use for grazing, protecting with conservation easement

6.1 Stream Design Approach Overview

A combination of analog, empirical and analytical approaches for stream restoration design were employed. Reference reaches were identified to serve as an acceptable range for design parameters. Channels were sized based on design discharge hydrologic analysis and empirical approaches including applying regional curve equations. Designs were then verified and/or modified based on a sediment transport analysis. These design approaches have been used on many successful stream restoration projects and are appropriate for the goals and objectives for this Site.

6.2 Reference Streams

Reference streams provide geomorphic parameters of a stable system, which can be used to inform design of stable channels of similar stream types in similar landscapes and watersheds. Ten reference reaches were identified for this Site (Figure 7) and used to support the design of Oak Hill Creek and its tributaries. These reference reaches were chosen because of their similarities to the Site streams including drainage area, valley slope, morphology, and bed material. All selected reference reaches are located in the North Carolina Piedmont physiographic province where the Site is, except for Boyd Branch, which is located in the Blue Ridge or mountain province. Boyd Branch was included as a reference reach for Oak Hill Creek Reach 1 due similarities in drainage area, valley type, width, and slope between the two streams. Geomorphic parameters for these reference reaches are summarized in Appendix 4. The reference reaches to be used for the specific streams are summarized below in Table 17.

Table 17: Stream Reference Data Used in Development of Design Parameters

Reference Reach	Stream Type	Landscape Position	Chosen For	Used For	Used on streams
Boyd Branch	E4	Low slope, alluvial valley. Flowing into larger mainstem	Gravel bed, similar landscape position and valley slope ranges	Q, Dimension, Pattern, Profile	OHC R1
Deep Creek Mitigation Site	C5	Wide, low slope, alluvial valley, bottomland forested wetland channel flowing into larger mainstem	Wetland hydrology and habitat function. Similar landscape position and valley slope ranges	Q, Dimension, Pattern, Profile	UT1 R1 & R2
Foust Upstream	C4	Wide, low slope, alluvial valley	Channel dimension, similar landscape position and valley slope ranges	Q, Dimension	OHC R3
Lake Norman Group Camp Tributary	E5b	Headwater, moderate slope, alluvial valley.	Stable pattern within confined valley. Similar landscape position and valley slope ranges	Q, Dimension, Pattern, Profile	UT1A
Long Branch	C/E4	Wide, low slope alluvial valley	Similar land use, landscape position and valley slope ranges	Q, Dimension, Pattern, Profile	OHC R2
Timber Trib (mid-reach)	B4	Headwater, moderate slope, alluvial valley	Gravel bed with examples of varied habitat structures (woody debris, rock riffles, and meander pools). Similar landscape position and valley slope ranges	Q, Dimension, Profile	UT1A
UT to Catawba River Reach 1	E5	Wide, low slope alluvial valley	Examples of woody debris pool structures, pattern, and similar landscape position	Q, Dimension, Pattern, Profile	OHC R3 & R4
UT to Catawba River Reach 2	E3b/C3b	Wide, low slope, alluvial valley	Landscape position, habitat structures, pattern	Q, Pattern, Profile	OHC R4
UT to Varnals Creek	C4/E4	Headwater, low slope, alluvial valley. Flowing into larger mainstem	Gravel bed with similar drainage area	Q, Dimension, Pattern	UT1 R1
Cooleemee Plantation	C5	Moderately wide, low slope, alluvial valley, flowing into larger mainstem	Similar landscape position, valley type and valley slope	Dimension, Pattern, Profile	UT1 R1 & R2

6.3 Design Discharge Analysis

Multiple methods were used to estimate bankfull discharges for restoration reaches including regional curve data (Harman et al. 1999 and Walker, unpublished), a regional flood frequency analysis using U.S. Geological Survey (USGS) gage sties, and reference reach data. The methods were compared, and a design discharge was selected based on the results of the different methods. Slightly larger design discharges relative to drainage areas were established for the mainstem project reaches (Oak Hill Creek Reaches 1 – 4) to drive designs of slightly larger channels (by width) for these reaches to the extent of impervious area or urban influence on storm runoff within the headwaters of the Oak Hill Creek subwatershed. Results of each method and the final design discharges are shown in Table 18 and illustrated in Figure 8.

Table 18: Summary of Design Bankfull Discharge Analysis

Discharge Estimate Method		OHC R1 (608 ac)	OHC R2 (614 ac)	OHC R3 (988 ac)	OHC R4 (1070 ac)	UT1 R1 (302 ac)	UT1 R2 (333 ac)	UT1A (12 ac)
NCSU Rural Piedmont Regional Curve (cfs)		86	86	122	129	52	55	5
NRCS Piedmont/Mountain Regional Curve		54	54	78	83	31	33	2
Regional Flood Frequency Analysis (cfs)	**1.2-year event**	75	75	107	113	45	48	4
	1.5-year event	106	107	151	160	64	69	6
Reference Reach Regional Curve (cfs)		61	61	87	92	36	39	3
Final Design Q		**90**	**88**	**149**	**156**	**42**	**51**	**7**

6.4 Design Channel Morphological Parameters

Reference reach data and designer experience were used to develop design morphologic parameters for each of the enhancement I and restoration reaches. Key morphological parameters are summarized in Tables 19 - 25. Complete design morphological parameters are included in Appendix 4.

Table 19: Summary of Design Morphologic Parameters for OHC R1

Parameter	Existing Parameters	Reference Parameters	Proposed Parameters
	OHC R1	**Boyd Branch**	**OHC R1**
Contributing Drainage Area (acres)	608	576	608
Channel/Reach Classification	B4c	E4	C4
Design Discharge Width (ft)	19.9	15.1	20
Design Discharge Depth (ft)	1.4	1.1	1.4
Design Discharge Area (ft^2)	27.5	14.6	28.4
Design Discharge Velocity (ft/s)	3.5	3.5	3.2
Design Discharge (cfs)	98	51	90
Channel Slope (ft/ft)	0.0070	0.0090	0.0040
Sinuosity	1.3	1.6	1.2
Width/Depth Ratio	14.4	15.9	14.0

Parameter	Existing Parameters	Reference Parameters	Proposed Parameters
	OHC R1	Boyd Branch	OHC R1
Bank Height Ratio	2.4	1.0	1.0 – 1.1
Entrenchment Ratio	2.0	2.65	2.2 – 5.0
d50 (mm)	22.6	25	-

Table 20: Summary of Design Morphologic Parameters for OHC R2

Parameter	Existing Parameters	Reference Parameters	Proposed Parameters
	OHC R2	Long Branch	OHC R2
Contributing Drainage Area (acres)	614	954	614
Channel/Reach Classification	G4c	C/E4	C4
Design Discharge Width (ft)	14.6	16.7	23
Design Discharge Depth (ft)	1.9	1.7	1.5
Design Discharge Area (ft^2)	28.1	34.6	33.4
Design Discharge Velocity (ft/s)	3.4	3.8	2.6
Design Discharge (cfs)	94	113	88
Channel Slope (ft/ft)	0.0057	0.0040	0.0055
Sinuosity	1.65	1.60	1.20
Width/Depth Ratio	7.6	10.85	16.0
Bank Height Ratio	2.0	1.4	1.0 – 1.1
Entrenchment Ratio	5.4	3.4	2.2 – 5.0
d50 (mm)	2.5	25	-

Table 21: Summary of Design Morphologic Parameters for OHC R3

Parameter	Existing Parameters	Reference Parameters		Proposed Parameters
	OHC R3	Foust Upstream	UT to Catawba River Reach 1	OHC R3
Contributing Drainage Area (acres)	988	896	1024	988
Channel/Reach Classification	C4	C4	E5	C4
Design Discharge Width (ft)	19.3	18.5 - 19.4	9.7 - 12.4	25
Design Discharge Depth (ft)	1.5	1.2 - 1.3	1.2 - 1.4	1.8
Design Discharge Area (ft^2)	29.1	23.9 - 24.1	11.4 - 17.5	43.9
Design Discharge Velocity (ft/s)	3.3	4.0	5.5	3.4
Design Discharge (cfs)	95	95	80	149
Channel Slope (ft/ft)	0.0052	0.0090	0.0050	0.0055
Sinuosity	1.15	-	1.10	1.20

Parameter	Existing Parameters	Reference Parameters		Proposed Parameters
	OHC R3	Foust Upstream	UT to Catawba River Reach 1	OHC R3
Width/Depth Ratio	12.9	14.3 - 15.7	8.1 - 8.9	14.0
Bank Height Ratio	2.6	-	0.9 - 1.4	1.0 – 1.1
Entrenchment Ratio	2.6	2.9 - 5.3	5.4 - 6.4	2.2 – 5.0
d50 (mm)	8.0	61	1.8	-

Table 22: Summary of Design Morphologic Parameters for OHC R4

Parameter	Existing Parameters	Reference Parameters		Proposed Parameters
	OHC R4	UT to Catawba River Reach 1	UT to Catawba River Reach 2	OHC R4
Contributing Drainage Area (acres)	1070	1024	1024	1070
Channel/Reach Classification	E5	E5	E3b/C3b	C4
Design Discharge Width (ft)	19.8	9.7 - 12.4	12.3	25
Design Discharge Depth (ft)	1.8	1.2 - 1.4	1.1	1.8
Design Discharge Area (ft^2)	35.1	11.4 - 17.5	13.2	43.9
Design Discharge Velocity (ft/s)	3.5	5.5	6.1	3.6
Design Discharge (cfs)	122	80	80	156
Channel Slope (ft/ft)	0.0050	0.0050	0.0300	0.0070
Sinuosity	1.16	1.10	1.10	1.20
Width/Depth Ratio	11.2	8.1 - 8.9	11.5	14.0
Bank Height Ratio	2.3	0.9 - 1.4	0.8 - 1.3	1.0 – 1.1
Entrenchment Ratio	4.6	5.4 - 6.4	4.3	2.2 – 5.0
d50 (mm)	1.7	1.8	75.9	-

Table 23: Summary of Design Morphologic Parameters for UT1 Reach 1

Parameter	Existing Parameters	Reference Parameters			Proposed Parameters
	UT1 Reach 1	Cooleemee Plantation	Deep Creek	UT to Varnals Creek	UT1 Reach 1
Contributing Drainage Area (acres)	302	435	429	262	302
Channel/Reach Classification	F4	C5	C5	C4/E4	C4
Design Discharge Width (ft)	15.9	11.7 - 15.9	12.9	9.3 - 10.5	17
Design Discharge Depth (ft)	0.7	0.6 - 0.8	1.4	1.1 - 1.2	1.1
Design Discharge Area (ft^2)	10.7	9.5 - 10.2	17.1	10.3 - 12.3	18.4
Design Discharge Velocity (ft/s)	2.9	1.6	2.4	4.4 - 5.2	2.4
Design Discharge (cfs)	31	16	41	54	42
Channel Slope (ft/ft)	0.0077	0.0027	0.0028	0.0200	0.0060

Parameter	Existing Parameters	Reference Parameters			Proposed Parameters
	UT1 Reach 1	Cooleemee Plantation	Deep Creek	UT to Varnals Creek	UT1 Reach 1
Sinuosity	1.06	1.10	1.60	1.20	1.20
Width/Depth Ratio	23.4	14.4 - 24.8	9.6	8.1 - 9.3	16.0
Bank Height Ratio	2.4	1.1	0.9 - 1.1	1.0	1.0 – 1.1
Entrenchment Ratio	1.5	8.8+	10.5+	5.7 - 10	2.2 – 5.0
d50 (mm)	3.2	0.6	0.2	15	-

Table 24: Summary of Design Morphologic Parameters for UT1 Reach 2

Parameter	Existing Parameters	Reference Parameters		Proposed Parameters
	UT1 Reach 2	Cooleemee Plantation	Deep Creek	UT1 Reach 2
Contributing Drainage Area (acres)	333	435	429	333
Channel/Reach Classification	G4	C5	C5	C4
Design Discharge Width (ft)	9.1	11.7 - 15.9	12.9	17
Design Discharge Depth (ft)	1.5	0.6 - 0.8	1.4	1.1
Design Discharge Area (ft^2)	14.1	9.5 - 10.2	17.1	18.4
Design Discharge Velocity (ft/s)	3.7	1.6	2.4	2.4
Design Discharge (cfs)	52	16	41	51
Channel Slope (ft/ft)	0.0070	0.0027	0.0028	0.0070
Sinuosity	1.15	1.10	1.60	1.20
Width/Depth Ratio	5.9	14.4 - 24.8	9.6	16.0
Bank Height Ratio	2.4	1.1	0.9 - 1.1	1.0 – 1.1
Entrenchment Ratio	1.8	8.8+	10.5+	2.2 – 5.0
d50 (mm)	3.3	0.6	0.2	-

Table 25: Summary of Design Morphologic Parameters for UT1A

Parameter	Existing Parameters	Reference Parameters	Proposed Parameters
	UT1A	Timber Tributary (mid-reach)	UT1A
Contributing Drainage Area (acres)	12	26	12
Channel/Reach Classification	F6b	B4	E4b
Design Discharge Width (ft)	9.9	8.9	5.5
Design Discharge Depth (ft)	0.2	0.5	0.5
Design Discharge Area (ft^2)	1.9	4.6	2.6

Parameter	Existing Parameters	Reference Parameters	Proposed Parameters
	UT1A	Timber Tributary (mid-reach)	UT1A
Design Discharge Velocity (ft/s)	1.6	3.7	2.6
Design Discharge (cfs)	3	17	7
Channel Slope (ft/ft)	0.0250	0.0300	0.0320
Sinuosity	1.07	1.12	1.10
Width/Depth Ratio	51.0	17.0	12.0
Bank Height Ratio	9.6	1.0	1.0 - 1.1
Entrenchment Ratio	1.2	1.5	>1.4 - 2.2
d50 (mm)	Silt	6.5	-

6.5 Sediment Transport Analysis

A qualitative assessment of sediment supply and sources in the project watershed was performed based on visual inspection and review of historic aerial photos. The Oak Hill Creek and UT1 watersheds have not changed considerably in recent decades. Redevelopment or future residential expansion around Cherryville may increase development in both watersheds, particularly UT1 which is less developed.

The Oak Hill Creek watershed has a large portion of its area developed, most notably a large industrial complex with high impervious cover at its headwaters and a golf course in the middle of the watershed. There are several small to medium sized ponds on tributary reaches to the mainstem, mostly associated with the golf course. Between 2011 – 2017, the golf course was expanded to the west and aerial photos indicate stream buffer removal as well as some degree of upland erosion. The rest of the watershed is residential and the main future impacts would be from infill or limited additional residential development.

UT1 is largely forested on the right bank and the left bank is forested in the upper half of the watershed but agricultural in the lower half, immediately upstream of the project.

Observed deposition on the Site indicates that both Oak Hill Creek and UT1 deliver fine and coarse sediment load into the Site. Depositional patterns within the Site are primarily in areas with active widening through outside or undercut bank erosion. In areas that have redeveloped a narrow bottom width and depositional benches, streams have coarser bed sediments and coarse sediment is visible on depositional features. No signs of reachwide or channel aggradation are present within the project area, even in areas that have widened considerably.

The proposed stream restoration is maintaining bankfull sediment capacity by spreading out the vertical drop over perched upstream culverts, sewer crossings and knick points in restoration reaches throughout the length of the project. This is counteracting the typical approach of flattening reach slopes at the top of projects to transition to Priority 1 restoration. As a result, the slopes of the proposed channels are similar to those of the existing channels.

Restored streambanks are being sloped at a gentle 3 or 3.5:1 slope in order to allow for adjustment of channel sediment transport efficiency to the incoming flow and sediment load. In addition, proposed wetlands have been set back off the stream channel to allow for natural levy formation as a second natural response and adjustment to sediment loading.

In the reaches with the finest sediment gradations, on-site sediment sources are being reduced and the slopes were increased which will help move fine sediment. To maintain high quality pools, channel constricting and grade drop features will be utilized in the project. Grade drop features will serve to hold the base channel elevation and sized and designed to prevent downcutting.

Through meander bend construction, a secondary result of the design is re-establishment of 3-dimensional vectors in pools that will help maintain pool depths during intermittent high flows.

A competence analysis was performed to analyze the ability of the proposed streams to transport the sizes of sediment supplied to them. The results of the competence analysis for bankfull flow conditions are shown in Table 26. The competence analysis on these reaches indicates that the reaches will be able to transport the d50 to d84 sediment sizes supplied to them by their watersheds in most cases. In cases where the largest particles can be mobilized, an emphasis was placed on ensuring that adequate grade control is incorporated into the design. The shear stresses for the 10-year and 50-year events were also calculated and will be used to incorporate low mobility material into riffles.

Table 26: Results of Competence Analysis

	OHC R1-2	OHC R3-4	UT1 R1 & 2	UT1A
Abkf (ft^2)	28-33	43.9	18.7	2.6
Wbkf (ft)	20-23	25	16.2	5.5
Dbkf (ft)	1.4-1.5	1.8	1.1	0.5
Schan (ft/ft)	0.004-0.0055	0.0055-0.007	0.006-0.007	0.032
Bankfull Velocity (fps)	2.6-3.3	3.4-3.6	2.5	2.6
Bankfull Shear Stress, t (lb/sq ft)	0.3-0.5	0.7	0.31	0.77
Movable particle size (mm)[1]	32-82	54-117	23-65	59-125
Largest particle from bar sample (mm)	109	77	115	Sand/Silt

[1] Lower moveable particle size is from Shields Curve, larger is from Rosgen

The existing d50 in UT1 Reaches 1 and 2 is approximately 20-30 mm. The 50-year flow has a shear stress of 0.8 lb/sq ft and is capable of moving 60-130 mm particle (2.5 to 5 inches). To promote riffle grade control stability, riffles in UT1 will be supplemented with particle sizes consistent with a weighted mix of NCDOT Class A/B mix (2 to 12 inches) to target a d84 at the upper movable particle range.

The existing d50 in Oak Hill Creek ranges from 20-35 mm. Reach 1 has the highest d50, potentially related to the high input of fine sediment within the project Site reducing the d50 further downstream. In Reaches 1 and 2, the 50-year flow has a shear stress of 0.8-1.8 lb/sq ft and is capable of moving 60-230 mm particle (2.5 to 9 inches). To promote riffle grade control stability, riffles in Oak Hill Creek Reach 1 will be supplemented with particle sizes consistent with a weighted mix of NCDOT Class A/B mix (2 to 12 inches) to target a d84 at the upper movable particle range. In Reaches 3 and 4, the 50-year flow has a shear stress of 1.0–1.6 lb/sq ft, and therefore a similar mix will be incorporated.

The existing d50 in UT1A is sand/silt. UT1A will be constructed with new bed material since the existing bed material has been buried and smothered due to trampling. The 50-year flow has a shear stress of 3.2-3.4 lb/sq ft and is capable of moving 260-370 mm particle (10 to 15 inches). To promote riffle grade control stability, riffles and grade control structures in UT1A will be supplemented with large cobble and small to medium size boulders to provide a low mobility bed.

6.6 Stream Design Implementation

The proposed Site includes a combination of stream restoration and enhancement activities as well as wetland restoration and creation activities detailed in Section 6.7. Project stream reaches proposed for restoration and enhancement are currently impacted by riparian management, past and/or present cattle access, bank erosion, and incision. Activities have been selected to provide the highest degree of ecological uplift to the system. Figure 9 provides an overview of the proposed mitigation activities on the Site.

The majority of the project reaches are proposed for Priority 1 restoration. Priority 2 sections of channel will be constructed where needed to transition grade from off-site tie-in to proposed elevations, avoid hydrologic trespass, and maintain minimum channel slopes. Priority 2 sections of channel only account for a few hundred feet of proposed stream at the Site. Restoration reaches have been designed to create stable, functional stream channels based on reference reach parameters, design discharge analysis, and sediment transport analysis. Dimension, pattern, and profile have been designed for all restoration reaches to provide a cross-sectional area sized for frequent overbank flows, a stable bed with variable bedforms, and well-vegetated bank slopes. Improved vertical and lateral stability will reduce stream channel erosion. Diverse bedforms will be established using in-stream structures appropriate for the geomorphic settings. These structures will provide grade control to prevent incision and serve as habitat features. Pools will have varied depths to increase habitat diversity and mimic natural streams.

In-stream structures for all reaches will include constructed rock riffles, rock sills, log sills, log or rock j-hooks, log vanes, brush toe, geolifts, bank roughening and cover logs. Constructed riffles will be built from excavated on-site rock when possible. Quarry stone may be used if an on-site source cannot be found. Constructed riffles will incorporate woody material and logs, which will provide varied pore spaces within the riffles and benefit hyporheic exchange processes and habitat formation. The diverse range of constructed riffle types will provide grade control, diversity of habitat, and will create varied flow vectors. Log and rock j-hooks will deflect flow vectors away from banks while adding to habitat diversity. Log and rock sills will be used to allow for small grade drops across pools. At select outer meander bends, the channel banks will be constructed with brush toe revetments to reduce erosion potential, encourage pool maintenance, and provide varied pool habitat. Similarly, cover logs will also be used in some meander bends to provide pool habitat variability and stream bank stability. Sod harvested on-site and/or coir fiber matting will be used to provide bank protection.

6.6.1 *OHC Reach 1*

Enhancement I is proposed for Oak Hill Creek Reach 1 and includes the following: bank grading on both banks to reestablish a stable planform geometry and dimension, widespread benching of outer meander banks, and channel structure installation in riffles and bends to adjust channel alignment and protect outer meanders against an urban flow regime and high sediment load. The work in the reach will include subtle but nearly continuous channel realignment, profile manipulation, and structure installation. The left floodplain will also be lowered and benched to increase floodplain activation frequency in order to enhance adjacent riparian wetlands. A mature woody riparian buffer will be established along the left floodplain, and invasive species will be removed along the reach. The Priority 2 area of Oak Hill Creek Reach 1 is limited to approximately the first 100 feet of the reach where the design ties to the existing stream bed.

A 50-foot wide permanent ford crossing is proposed at the downstream limits of Reach 1 in an internal easement break that includes both the sanitary sewer crossing and the ford. The bed of the channel and the banks will be hardened at the ford to produce a firm base for passage of farm vehicles. Grade control will be incorporated to the downstream limits of the ford to hold grade in the crossing. Cattle will be excluded from Reach 1.

6.6.2 *OHC Reach 2*

Oak Hill Creek Reach 2 is proposed for a combination of Priority 1 and 2 restoration to reestablish appropriate channel dimension, pattern and profile. Existing channel grade will be raised subtly in Reach 1 and more significantly at the existing knick point at the beginning of Reach 2 where the concrete-encased sanitary sewer crossing is holding grade. Raising Reach 2 will support proposed wetland approaches. Visible drainage tiles in the left bank will be followed upgradient and removed to further this end.

6.6.3 *OHC Reach 3*

Oak Hill Creek Reach 3 is being realigned away from the valley wall out into the middle of the valley with appropriate dimension, pattern and profile as a Priority 1 floodplain restoration approach. Reach 3 starts at the confluence with UT1 and has a flat broad floodplain. The Priority 1 approach will help reconnect Oak Hill Creek with its historic floodplain and restore hydrology to existing and relic wetlands. BMP 2 is being proposed on the left edge of the floodplain to treat runoff from the adjacent fields and uplands, including the waste lagoon area as described in Section 6.8.

6.6.4 *OHC Reach 4*

Oak Hill Creek Reach 4 will transition from the Priority 1 approach used upstream down to the existing elevation of the Robert Road culvert. A Priority 2 floodplain will be excavated to facilitate the tie-in.

6.6.5 *UT1 Reach 1*

UT1 will be raised starting the perched culvert outlet at the upstream limits. This Priority 1/2 approach with floodplain excavation will be used in Reach 1 to transition to a Priority 1 approach in downstream reaches. Restoration will improve aquatic organism passage by correcting the perched culvert elevation at the upstream end of UT1 and raising the stream will enhance hydrology in existing and proposed creation wetlands at the downstream limits of the reach. Restoration will also provide additional bedform habitat and introduce large woody debris into UT1. Construction of a bankfull channel within this reach will increase sediment transport efficiency over the existing overwide channel bottom with inner berm formation. The overhead electric line and power pole on the left top of bank at the top of the reach and will be permanently removed.

6.6.6 *UT1 Reach 2*

UT1 Reach 2 will start as a Priority 1/2 floodplain approach but rapidly transition to a Priority 1 approach. The channel will be moved off the edge of the valley wall and meandered with an appropriate pattern, dimension and profile through the middle of the valley. BMP 1 will be installed in the left floodplain near the top of Reach 2 to provide volume storage and treatment for drainage from the concentrated feedlot. The cattle present in the left floodplain of this reach which have had intermittent access to the reach for flash grazing, will be excluded from the easement. The high area noted in the existing conditions and Hydric Soils Report (Appendix 5) will be graded down to the prevailing elevation of the historic floodplain. In the downstream 1/3 of the reach, an internal culvert crossing will be installed. At the crossing, the entire right floodplain will be left at grade to allow for flood flows to pass down the floodplain thereby relieving the culvert from carrying high flows.

6.6.7 *UT1A*

Restoration of UT1A will begin at the jurisdictional boundary where the headcut will be stabilized and brought up to grade for a Priority 1 restoration. Wildlands has extended the proposed easement from the original proposal to encompass the entire jurisdictional limits of UT1A and to physically remove and perform follow-up treatment to address the existing bamboo thicket. Priority 1 restoration of this steeper headwater tributary will result in a valley that has an entrenchment ratio exceeding typical B-type streams. An Eb stream type is proposed for this hybrid step-pool approach with some meandering pattern. An existing occupied residence on the right bank must remain and the easement has been narrowed around the structure. Cattle will be entirely excluded from the easement along this stream and the streambed will be dredged to remove built up cow manure that forms the majority of the existing stream bed. Restoration will provide bedform and habitat and introduce large woody debris to UT1A, all of which are absent from the existing channel. BMP 1 is proposed on the left floodplain at the end of the reach where it confluences with UT1. This BMP will include a diversion berm within the left floodplain easement of UT1A to capture additional upland flow from the cattle feeding area and route it into BMP 1.

6.6.8 *UT1B*

UT1B is a stable stream with low banks and is proposed for enhancement II. This stream will be treated for invasive vegetation as the adjacent area is overgrown with kudzu. A narrow right floodplain is being preserved consistent with the proposal easement and greater than the minimum 15' easement required for crediting. The left buffer will be planted with riparian species and the right buffer will be supplemented with native plantings as needed to complement the existing row of trees.

6.6.9 *UT2 and UT3*

Due to the proposed changes in the alignment and profile of Oak Hill Creek, the alignments of UT2 and UT3 would need to be extended and profiles raised in order to continue positive flow to Oak Hill Creek. For both streams, the existing culverts terminated near the existing toe of bank of Oak Hill Creek.

The 36-inch corrugated metal pipe (CMP) culvert at UT2 was in poor condition and will be removed and replaced with a 36-inch High-Density Polyethylene pipe (HDPE) with a downstream invert that is 1.7 feet above the existing invert.

The 30-inch Reinforced Concrete Pipe (RCP) culvert at UT3 was found to be in usable condition, but undersized, especially in regards to aquatic organism passage considerations. The existing culvert will be reused as a flood relief culvert and a new 36-inch HDPE pipe will be the primary culvert. The new design will raise the culvert 2.7 feet above the existing downstream invert. The adjacent landowner's driveway will be modified with new grading to obtain the needed cover over the proposed pipes.

From these proposed downstream inverts, UT2 and UT3 were designed to flow over low slopes (0.5 percent) until their respective confluences with Oak Hill Creek. A major design concern for these small tributaries was instability during flooding events associated with Oak Hill Creek. The constructed parts of these streams will be heavily planted with livestakes and seeded with riparian vegetation to mitigate this risk. Additional transplants from onsite will be preferentially placed in the floodplain immediately upstream of these tributaries. Woody debris will also be mixed in among the heavily planted areas to roughen the floodplain and slow flood waters.

6.7 Wetland Design Approach Overview

The Site includes riparian riverine headwater seep, pocket, and floodplain wetlands that will be re-established and rehabilitated. Proposed wetland restoration and creation areas are adversely impacted by agricultural ditching, historic channel manipulation, channel downcutting, manmade subsurface drainage, cultivation for row crops, and cattle impacts. The proposed approach will include multiple activities to restore site hydrology and vegetation.

Area Proposed for Wetland Restoration

This project includes the re-establishment, rehabilitation, and creation of 9.4-acres of historically altered wetland-riparian complexes on the floodplains of Oak Hill Creek and UT1. Both streams will be constructed through the proposed wetland restoration areas with a priority 1 restoration approach that will raise the water table elevation and restore the natural overbank flooding regime. Ditches and subsurface drainage tiles located within the conservation easement will be filled or removed to improve hydrology. Riparian wetlands within the project area will be planted with native wetland species specific to the target wetland community type of Bottomland Hardwood Forest as outlined in Section 6.9 and invasive species will be treated. Wetland potential and hydrology were assessed with soils analysis and existing groundwater gages. Reference wetland community data was used to propose wetland herbaceous and woody vegetation planting.

Wildlands analyzed information presented below to understand how existing incised streams and farming practices have affected current hydrologic conditions, site topography and hydric soil development. This analysis included evaluation of how stream restoration and management of runoff and drainage at the site could be used to create more favorable future hydrologic conditions for hydric soil development in the proposed wetland areas.

6.7.1 Hydric Soils Investigation

A preliminary hydric soils investigation was conducted in December 2018 by a licensed soil scientist (LSS), followed up by an additional boring study in March 2020 to assess the extent and depth of hydric soil indicators on site. The field assessments have been combined into one summary report and figure (Appendix 5). The findings were used to indicate wetland re-establishment potential and depth of potential overburden material from the historic manipulation of site soils for agricultural purposes. Areas containing hydric soils but lacking a wetland hydrologic regime were likely functional wetlands prior to floodplain fill and drainage activities. Proposed wetland re-establishment areas were mapped as the Chewacla soil series by NRCS. However, hydric soils observed in Wetlands 1 and 3 were more consistent with the Wehadkee soil series while soils in Wetlands 2 and 4 were more consistent with Chewacla. According to the USACE Wilmington District Stream and Wetland Compensatory Mitigation Update (2016), the established Wetland Saturation Threshold for the Chewacla and Wehadkee soil series in the North Carolina Piedmont ranges from 10-16%.

A total of 91 hand augured soil borings were performed as part of the hydric soil investigations. Soil borings were classified as non-hydric within 10 inches of soil surface, hydric soils with a depleted matrix (F3), and hydric soils considered piedmont floodplain soils (F19). At boring locations, the depth below the existing land surface to hydric soil indicator was noted. The report from the LSS (Appendix 5) supports Wildlands' proposed wetland restoration plans and provides supporting data for the specific approaches and activities proposed. Along UT1, the review of historic aerial photography coupled with field observations of topography and soils are indicative of fill placement over historic wetlands.

6.7.2 Reference Wetlands

An existing wetland approximately 7 miles from the Site, and adjacent to Wildlands' Owl's Den Mitigation Site in Lincoln County, is a mature Piedmont Bottomland Forest reference within the floodplain of Howards Creek. Review of historical aerials and field conditions reveal no recent disturbance to the wetland. Mature vegetation is established and the natural flooding regime has been preserved. The hydrology of this system is intermittently, temporarily, or seasonally flooded. While the hydrology data collected at the Owl's Den reference site indicates that it is wetter than what is anticipated at Oak Hill Diary, the vegetation provides a good reference on a site that exhibits similar soil types and topographic form to the Oak Hill Site.

The vegetation at the reference site is being used as a basis for the planting plan for the wetland restoration and creation on the project Site. The existing vegetation communities at the reference site are typical of a Bottomland Hardwood Forest and include mature canopy tree species, subcanopy and shrub species, as well as an herbaceous layer. Dominant canopy species include river birch, green ash, sycamore, box elder, and red maple. Understory species include ironwood and spicebush. The herbaceous layer within the reference wetland includes arrow arum, jewelweed, and lizard's tail, with microstegium also present.

6.7.3 Measured Hydrologic Data

Seven groundwater monitoring gages were installed throughout the Site on December 20, 2019 and monitored through September 8, 2020. The location of the existing groundwater gages is shown in Figure 2. Gages were placed throughout the existing floodplain at the site to evaluate the existing groundwater elevations throughout the growing season (March 20 to November 14 (239 days) for Gastonia, North Carolina). Table 27 summarizes the available groundwater data.

For the 2020 growing season, none of the seven groundwater gages installed on the Site met the Wetland Saturation Threshold. Groundwater gages #1 and #3 were located in the floodplain along Reach 3 and Reach 4 of Oak Hill Creek and logged more consecutive and cumulative days with the water table within 12 inches of the ground surface than the other gages. These gages also have a more muted response to rainfall suggesting a strong toe of slope hydrology that results in a more prolonged and evenly distributed hydrologic input under current conditions. Groundwater gage #2 was located closer to Oak Hill Creek in a position influenced by natural levy formation or manmade side-casting and much closer to the drawdown influence of the incised Oak Hill Creek. Gage #4 appears to have good potential to meet criteria based on a more prolonged drawdown after rainfall and a water table that is drastically affected by site drainage. It is adversely impacted by the downstream ditch and subsurface wood drain tile lowering hydrology in existing Wetland B. Gages #5-7 were not very close to achieving prolonged saturation within the upper 12" of the soil column. Gage #5 is adjacent to the start of the ditch draining existing Wetland B and is also perpendicular and in close proximity to a meander bend in Oak Hill Creek that is incised five feet below the grade of the floodplain on which gage #5 is situated - a wooden drainage tile is visible in the left bank of the creek coming from the direction of the gage. Gages #6 & 7 are located approximately 5' below the adjacent incised UT1 channel. This high ground was noted in the LSS' report as a topographic anomaly attributable to historic channel manipulation for agricultural purposes (Appendix 5). These gages are in narrower valleys before the confluence of the Oak Hill Creek with UT1. The drawdown influence is corresponding more pronounced from incised and ditched creek channels located in closer proximity. At the same time, the hillslope hydrology is less pronounced than the influence of the 15 acres of ephemeral flow entering the Site near gages #1 & 3.

Table 27: Existing Groundwater Monitoring Gage Data and Analysis Results

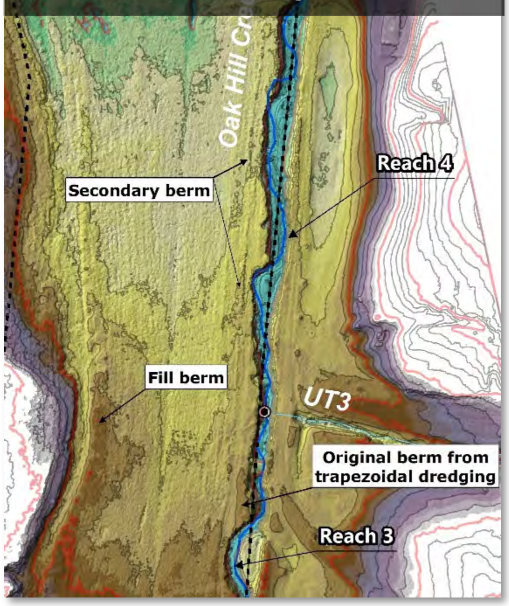
Gage	Consecutive Days in Growing Season Wells Met Groundwater Depth Criterion Under Normal Rainfall Conditions (Days)	Consecutive Percent Growing Season Wells Groundwater Depth Criterion Under Normal Rainfall Conditions (%)
1	15	6.3%
2	4	1.7%
3	24	10.0%
4	2	0.8%
5	2	0.8%
6	1	0.4%
7	1	0.4%

6.7.4 Existing Wetland Manipulation and Drainage

1950 Aerial Depicting Dredging along Entire Length of Oak Hill Creek

Agricultural manipulation at the Site includes the moving and straightening of the streams. Historical aerials suggest the stream had been altered (ditched) prior to the earliest available aerial from 1938. Subsequent photos in 1950 and 1956 show signs of ditching in Oak Hill Creek prior to 1950 (see photo to right), and relocation and straightening of UT1 between the two dates to its present approximate location. The straightening of the channels likely involved side-casting of dredged material to confine the channel and may have established a lower channel grade or led to subsequent down-cutting and a resulting lowering of the groundwater table on the Site. Multiple headcuts are still advancing upstream of gages #6 & 7 on UT1, and the existing culvert at Roy Eaker Road is perched indicating prior headcutting as well. Remnant piles of dredged material, or berms, can be visualized along Oak Hill Creek using recent Quality Level 1 (QL1) LiDAR as shown in the image to the lower left.

Visualization of Existing Berm Piles Along Oak Hill Creek Using QL1 LiDAR



This channel manipulation has led to a lower water table throughout much of the site as evidenced by hydric soil indicators and a decrease in the frequency of floodplain activation, primary factors for the absence of functioning floodplain wetland complexes at the Site.

Several low gradient ditches at the Site drain wet areas of the floodplain. Many of these ditches show up as linear wetlands in the PJD as they have not been recently maintained, are very wet, and have wetland vegetation. The largest example of this is a ditch that runs along the toe of the valley in the left floodplain of Oak Hill Creek Reach 3 and Reach 4. This ditch captures water at the toe of slope and routes it to an outlet ditch that parallels Robert Road. This water is then channeled to the culvert under Robert Road at the downstream limits of the Site. As such, toe of slope hydrology bypasses the left floodplain of Oak Hill Creek Reach 3 and Reach 4. Similar ditches also occur in the left floodplain of Oak Hill Creek Reach 1 and Reach 2 and the right floodplain of UT1 Reach 2.

1984 Infrared Photo Depicting Drainage Ditches on Left Side and Center of Valley

6.7.5 *Proposed Wetland Design*

The proposed stream work and wetland grading will restore wetland hydrology to filled and drained areas of the site. Priority 1 stream restoration of profile and cross-section will increase the frequency of overbank flooding. This stream restoration approach will also reduce groundwater flow gradient from the toe of slope and floodplain wetland areas to the stream, resulting in less drawdown in the water table across the Site. Grading to remove ditches and subsurface drainage features within the Site will also improve the wetland hydrology. The proposed grading will eliminate linear ditches and plug ditch outlets to the stream, remove or reduce side cast material from ditch and stream banks, and remove areas of field fill and crowning. This work will promote a more natural infiltration and groundwater flow regime through the site and remove overburden from buried hydric soils. Wetland vegetation establishment will be enhanced by addressing soil compaction and any poor-quality soils that are found during construction. Compaction will be addressed by loosening or roughening the ground with available equipment and poor-quality soils will be addressed with soil amendments or with the re-application of harvested topsoil.

In all wetland rehabilitation and re-establishment areas (areas credited at both 1:1 and 1.5:1 ratios), grading cuts of greater than 12 inches account for 16.8% of the area. These cut areas are mostly relegated to the berms and sidecast piles found in the left floodplain of Oak Hill Creek Reaches 3 and 4 and the right floodplain of UT1 as shown in Figure 10. Grading in these areas was dictated by the stream design, where the proposed stream bankfull was placed at the existing low point in the valley. Sidecast piles from maintenance of the existing stream and the wetland toe ditch created high points on either side of the proposed stream greater than 12 inches. These high points will be removed to connect the proposed stream to existing wetlands and to allow the stream access to a majority of the floodplain during flood stages. Creation wetland areas contain more extensive grading with areas of grading greater than 12 inches accounting for about 31.8% of the total creation area.

Wetland rehabilitation at a credit ratio of 1:1 was proposed for existing wetlands that were delineated in the left floodplain along Oak Hill Creek Reaches 3 and 4. While no expansion of wetland area will occur in the 1:1 wetland rehabilitation area, wetland function will uplift by a large margin in these areas. A majority of the area proposed at 1:1 wetland rehabilitation consists of an agricultural field that is plowed and planted in some years or an existing ditch at the toe of slope. NC WAM forms indicate that these areas are very low or poor functioning in all categories. Existing wetlands in other areas of the Site were found to be in better condition and are proposed as wetland rehabilitation at a 1.5:1 credit ratio.

Collectively, the proposed changes to the Site are anticipated to enhance the hydrology to meet targets consistent with the formation and support of wetlands and the targeted communities.

In many areas within the site, the LSS hydric soil assessment indicated hydric indicators below 10" and there was less obvious evidence of prior area-specific manipulation. Wildlands' review of historic and topographic data, and the distribution of remnant wetlands throughout the site led us to the conclusion that some or many of these areas were potentially part of historic wetlands, or that proposed site activities are likely to result in wetland formation in many of these areas supporting floodplain wetland functions. For this reason, we have proposed wetland creation in select areas where assessment data was insufficient to support re-establishment.

6.8 Stormwater BMPs

Two stormwater BMPs are proposed for the Site, as depicted on Figure 9.

Runoff from the dairy's outdoor feeding area on the left side of UT1A enters UT1A as dispersed overland flow and enters the left floodplain of UT1 through an existing swale. BMP 1 will be established within the conservation easement at the outlet of the existing swale to capture and treat the drainage from this area. Approximately 3 acres drains to the proposed BMP 1, including the farmhouse and other upland areas. BMP 1 has been designed to provide initial volume storage and initial and long-term treatment and to step the runoff down from the terrace onto the left floodplain of UT1. It will be outlet to a flow dispersing feature onto the floodplain to filter through the riparian buffer into UT1.

BMP 2 will be installed outside of the proposed wetland re-establishment along Oak Hill Creek Reach 3 and will slow and provide initial volume storage and initial and long-term treatment for the contributing 15-acre drainage that starts near the dairy waste lagoon and includes adjacent fields, both fallow and in crop production. The waste lagoon is designed for a 25-year 24-hour storm and, unless flows exceed the lagoon capacity, there is no discharge from the lagoon. Stormwater runoff from the fields, entering the proposed BMP at the downstream limits of an NRCS grassed swale practice. While the waste lagoon is designed not to overtop, it has overtopped on one prior instance in the last several decades and the BMP provides an additional buffer to the wetlands and floodplain of Oak Hill Creek and treats a significant area of fallow or cultivated land that may be used in the future for grazing. Additional easement has been obtained in this area for the BMP. The outlet of BMP 2 will be designed for diffusion of the collected outflow into the adjacent floodplain and wetlands and a high flow outlet to manage large rainfall events in a stable manner.

The two BMPs will be planted with wetland seeding, plugs and livestakes. No direct mitigation credit is requested for BMPs.

The primary maintenance risks for the BMPs are erosion issues throughout the BMP system as well as sediment loads filling the BMP basins and reducing volume capacity over long-term time scales. Minimizing maintenance is a major design criterion for the BMPs.

To reduce erosion associated with BMP systems and to promote vegetation establishment, the banks of the BMP basins will be laid back as much as practical. Slopes steeper than 4:1 will be stabilized with erosion control matting. All areas associated with the BMP systems that have been disturbed will be seeded and will be monitored for vegetation establishment after construction has been completed. Areas without sufficient vegetation will be prepared and re-seeded until adequate vegetation is established.

The BMP overflow areas were designed with low slopes from the BMP basin to the Conservation Easement boundaries to reduce the risk of scour or downcutting in the overflow conveyance. Due to existing topography at the site, conveyance areas upslope of the BMPs will have higher slopes and a potential for headcuts. Potential nick points in the upslope conveyances will be addressed with structures (rock steps, etc), pools, the addition of rock to harden the conveyance bed in key areas, and erosion control matting where needed.

Sediment loads filling the BMP basin are likely unavoidable over long-term time scales and should be interpreted as the BMP functioning properly. BMP basins will not be maintained for sediment and the initial volume storage, once filled, will be replaced by the increased function of the floodplain as a vegetated filter strip as the floodplain vegetation matures. Due to the relative size of the BMPs compared to the contributing watersheds, it is expected that it may take several years to a decade before BMP volume capacity is reduced such that filtration and vegetative uptake become the dominating treatment mechanism.

6.9 Vegetation, Planting Plan, and Land Management

Non-forested areas within the conservation easement will be planted, which includes additional buffer areas beyond the minimum requirement of 50 feet from top of bank. Riparian buffers will be planted with early successional native vegetation chosen to develop a forested riparian zone. The specific species composition to be planted was selected based on the target community type, observation of occurrence of species in riparian buffers adjacent to the Site, availability of nursery stock, and best professional judgement on species establishment and anticipated Site conditions in the early years following project implementation. Species chosen for the planting plan are listed on table 28 below and on Sheet 4.1 of the Preliminary Plans located in Appendix 12. Wildlands used the following community types and associated speciesfor selection for the site:

- Piedmont/Low Mountain Alluvial Forest

  Canopy trees include but not limited to *Betula nigra, Platanus occidentalis, Liquidambar styraciflua, Liriodendron tulipifera, Ulmus americana, Celtis laevigata, Juglans nigra, Fraxinus pennsylvanica, Carya cordiformis, Carya ovata, Quercus imbricaria,* and *Acer rubrum*. Subcanopy trees typically found in mesic mixed hardwood forest include *Acer negundo, Acer floridanum, Acer rubrum, Asimina triloba, Ilex opaca,* and *Carpinus caroliniana.*

- Mesic Mixed Hardwood Forest

  Canopy trees include but not limited to *Fagus grandifolia, Quercus rubra, Liridondron tulipifera, Acer rubrum, Acer saccharum, Tsuga canadensis*. Subcanopy trees in mixed hardwood forest include *Cornus florida, Ostrya virginiana, Evonymus americana, Kalmia latifolia*.

- Piedmont Bottomland Forest

  Canopy trees include but not limited to *Liriodendron tulipifera, Liquidambar styraciflua, Quercus pagoda, Quercus michauxii, Ulmus american, Celtis laevigata, Fraxinus pennsylvanica, Pinus taeda, Carya Ovata,* and *Craya cordiformus.* Subcanopy trees typically found in bottomland forest include *Carpinus caroliniana, Acer floridanum, Acer rubrum, Cornus florida, Ilex opaca,* and *Asiminia triloba*.

- Dry – Mesic Oak – Hickory Forest
  Canopy trees include but not limited to *Quercus alba, rubra, velutina, and muehlenbergii, Carya alba (tomentosa), glabra, and ovalis, Liriodendron tulipifera, Liquidambar styraciflua* and various *Pinus species.* Subcanopy trees typically include *Acer rubrum, Cornus florida, Oxydendrum arborem, Ilex opaca, and Nyssa sylvatica.*

The riparian buffer and most wetland areas will be planted with bare root seedlings. In addition, the stream banks will be planted with live stakes and the channel toe will be planted with multiple herbaceous species. Permanent native herbaceous seed will be spread on streambanks, floodplain areas, and wetlands including all disturbed areas within the project easement. Bare root seedlings and live stakes will be planted in the dormant season between November 15 and March 15. Figure 12 illustrates the proposed planting zones throughout the Site.

Land management activities on the site will largely focus on treating invasive plant populations and pasture grasses. Existing invasive plant populations on the site include Bamboo (*Phyllostachys aurea*), Chinese privet (*Ligustrum sinense*), Japanese honeysuckle (*Lonicera japonica*), Japanese knotweed (*Polygonum cuspidatum*), kudzu (*Pueraria montana*), English ivy (*Hedera helix*) and marsh dewflower (*Murdannia keisak*). Limited populations of multiflora rose (*Rosa multiflora*) also exist on the site. Some of the existing invasive species and pasture grasses along restoration and enhancement reaches will be treated preconstruction, while others will be treated primarily by mechanical removal during construction. The extent of invasive species coverage will be monitored, mapped, and controlled as necessary throughout the required monitoring period. Please refer to Appendix 8 for the post construction invasive species plan. Additional monitoring and maintenance issues regarding vegetation are in Sections 8 and 9 and Appendix 10.

Table 28: Planting List

Species	Common Name	Wetland Indicator
Open Buffer Planting Zone		
Acer negundo	Boxelder	FAC
Platanus occidentalis	Sycamore	FACW
Betula nigra	River Birch	FACW
Liriodendron tulipifera	Tulip Poplar	FACU
Quercus Phellos	Willow Oak	FAC
Oxydendrum arboretum	Sourwood	UPL
Disopyros virginiana	Persimmon	FAC
Populus deltoides	Eastern Cottonwood	FAC
Carya cordiformis	Bitternut Hickory	FACU
Quercus alba	White Oak	FACU
Alnus serrulata	Tag Alder	OBL
Hamamelis Virginiana	Witch Hazel	FACU
Cornus florida	Flowering Dogwood	FACU
Lindera benzoin	Spicebush	FAC
Amelanchier arborea	Serviceberry	FAC
Partially Vegetated Buffer Planting Zone		
Carpinus caroliniana	American Hornbeam	FAC
Euonymus americana	Strawberry Bush	FAC
Lindera benzoin	Spicebush	FAC
Fagus grandifolia	American Beech	FACU
Ulmus rubra	Slippery Elm	FAC
Hamamelis virginiana	Witchhazel	FACU
Calycanthus floridus	Sweetshrub	FACU
Cornus florida	Flowering Dogwood	FACU
Asima triloba	Pawpaw	FAC
Quercus rubra	Northern Red Oak	FACU

Species	Common Name	Wetland Indicator
Wetland Planting Zone		
Plantanus occidentalis	Sycamore	FACW
Betula nigra	River Birch	FACW
Quercus phellos	Willow Oak	FAC
Ulmus americana	American Elm	FACW
Nyssa sylvatica	Black Gum	FAC
Quercus michauxii	Swamp Chestnut Oak	FACW
Acer negundo	Boxelder	FAC
Quercus pagota	Cherrybark Oak	FACW
Celtis laevigata	Sugerberry	FACW
Alnus serrulate	Tag Alder	OBL
Lindera benzoin	Spicebush	FAC
Cephalanthus occidentalis	Buttonbush	OBL
Sambucus canadensis	Elderberry	FAC
Streambank Planting Zone		
Salix nigra	Black Willow	OBL
Cornus amomum	Silky Dogwood	FACW
Salix sericea	Silky Willow	OBL
Cephalanthus occidentalis	Buttonbush	OBL
Sambucus canadensis	Elderberry	FAC
Juncus effusus	Common Rush	FACW
Carex crinita	Fringed Sedge	OBL
Carex lurida	Lurid Sedge	OBL
Carex lupulina	Hop Sedge	OBL
Scirpus cyperinus	Woolgrass	FACW

6.10 Project Risk Management

The risks for the final design, construction and monitoring and long-term success of this project have been considered and evaluated for mitigation and minimization of identified risks. The summary below discusses common and perceived project-specific risks, including permitting issues, easement issues, instability or compromised function of stream or wetland assets, issues with crossing stability or use, adjacent and upstream land use considerations, and invasive species concerns.

Urban flows from Oak Hill Creek are a concern to the stability of channels and floodplains, particularly on a short-term basis after construction due to flashy flows and an increased frequency of out-of-bank events. Wildlands modified the approach to Reach 1 to include more comprehensive floodplain establishment and address the issue with existing benching being inaccessible at flows below the 10-year USGS return interval. Wildlands anticipates that a good stand of vegetation can be established on floodplains to help reduce high flow impacts. In addition, floodplain roughening will be proposed on floodplains using onsite wood and brush, live wattles or cuttings during the first dormant season, and/or through shaping of hummocky topography to mimic natural floodplain roughness. A related concern is the stability of crossings. In order to reduce crossing risk, Wildlands and the landowners were able to agree on changing out a proposed culvert on Oak Hill Creek Reach 1 for a ford. The ford will allow for more natural floodplain grading and should be a more stable option on this creek influenced by an urban flow regime. Both Oak Hill Creek and UT1 crossings have been designed so that the wide floodplains can serve as a flood bypass of the proposed crossings. On UT1, this will allow flows in excess of bankfull to access a wide floodplain on the right-hand side of the crossing, thereby relieving the structure of excess stresses from high flow events or debris.

Wildlands had some concerns during development of the proposal that existing heavy use and cultivated upland activities could impact project assets during heavy rainfall. As a result, two BMPs were proposed to reduce the annual impact of upland runoff on water quality and to spread out and disperse more these more concentrated flow paths over a broader area that would allow the natural buffer to function as intended. Wildlands will observe BMP function and make minor adjustments as necessary to ensure that the practices function sustainably on their own after vegetation establishes.

Invasive species management is a primary consideration on this Site. Primary risks are species spread during construction and that species would compete with growth of native species, particularly woody species. To combat these risks, Wildlands is performing pre-construction treatment and will perform mechanical removal on areas within and beyond the easement boundary, and vigorous post-construction inspection and treatment to reduce address initial vulnerability. Wildlands will perform regular inspection and persistent treatment throughout the monitoring period to address the general risks posed by competition from invasive species.

All stream and wetland projects have some risk for beaver colonization. There is no onsite evidence of current or past beaver activity in the project limits. If beaver move into the project areas, Wildlands will follow the Maintenance Plan (Appendix 10) to address the issue.

Should utility/roadway maintenance work occur in the future and encroach within the conservation easement, Wildlands will follow the Maintenance Plan to repair disturbed signage or damaged stream areas.

7.0 Performance Standards

The stream and wetland performance standards for the project will follow approved performance standards presented in the DMS Mitigation Plan Template (Version 2.3, June 2017), the Annual Monitoring Template (June 2017), and the Wilmington District Stream and Wetland Compensatory Mitigation Update issued October 2016 by the USACE and NCIRT. Annual monitoring and routine site visits will be conducted by a qualified scientist to assess the condition of the finished project. Specific performance standards that apply to this project are those described in the 2016 Compensatory Mitigation Update including Vegetation (Section V, B, Items 1 through 3) and Stream Channel Stability and Stream Hydrology Performance Standards (Section VI, B, Items 1 through 7). Performance standards for this project are summarized below in Table 29.

Table 29: Summary of Performance Standards

Parameter	Monitoring Feature	Performance Standard
STREAM SPECIFIC PERFORMANCE STANDARDS[1, 2]		
Dimension	Cross-Section Survey	BHR <1.2; ER >2.2 for C/E channels
Pattern and Profile	Visual Assessment	Should indicate stream stability
Substrate	Pebble Counts	Coarser material in riffles; finer particles in pools
Photo Documentation	• Cross-Section Photos • Photo Points	• No excessive erosion or degradation of banks • No mid-channel bars, Stable grade control
Hydrology	Pressure Transducer	• Four bankfull events during the 7-year period; in separate years
WETLAND SPECIFIC PERFORMANCE STANDARDS		
Hydrology	Pressure Transducer	Free groundwater surface within 12 inches of the ground surface for a minimum of 12% (28 consecutive days) of the growing season for Gaston County under normal precipitation conditions. Soil temperature will be recorded with probes and correlated to bud burst and leaf drop observations to corroborate the start and end of the growing season based on USACE guidance. Growing season dates are defined as March 20 to November 14 (239 days) by the Gastonia, North Carolina WETS table for 50% probability of temperatures greater than 28 degrees Fahrenheit. In order to verify the length of the growing season, soil temperature probes will be used per the 2016 USACE Guidance for Compensatory Stream and Wetland Mitigation. Soil temperature probes will be located at a depth of 12 inches. The growing season may be defined as that portion of the year where soil temperature remains above 40 degrees Fahrenheit and when possible should be corroborated with vegetative indicators, including bud burst and leaf drop. The growing season may not begin before March 1 of each year when calculating hydroperiods.
Photo Documentation	Photo Points	Should show wetland stability and planting success.
SITE PERFORMANCE STANDARDS		
Vegetation	Vegetation Plots	MY3 success criteria: 320 planted stems per acre, MY5 success criteria: 260 planted stems per acre, average of 7 feet in height in each plot MY7 success criteria: 210 planted stems per acre, average of 10 feet in height in each plot
Visual Assessment	CCPV	Signs of encroachment, instability, invasive species

1: BHR = bank height ratio, ER = entrenchment ratio

2: The tributaries are designed to incise as they approach the main streams, so this would not be considered a trend towards instability. Riffles may fine over the course of monitoring due to the contribution of upstream watershed sediment sources.

8.0 Monitoring Plan

Project monitoring components are listed in more detail in Table 30. Approximate locations of the proposed vegetation plots and cross section locations are illustrated in Figure 11.

Table 30: Monitoring Components

Parameter	Monitoring Feature	Quantity/Length by Reach								Frequency	Notes
		Oak Hill Reach 1	Oak Hill Reach 2	Oak Hill Reach 3	Oak Hill Reach 4	UT1 Reach 1	UT1 Reach 2	UT1A	UT1B		
Dimension	Riffle Cross-sections	1	1	1	1	1	3	1	N/A	Year 1, 2, 3, 5, and 7	1
	Pool Cross-sections	-	1	1	-	-	2	1	N/A		
Pattern	Pattern	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	2
Profile	Longitudinal Profile	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	N/A	
Substrate	Reach wide (RW) Pebble Count	1 RW	1 RW	1 RW	1 RW	1 RW	1 RW	1 RW	N/A	Year 1, 2, 3, 5, and 7	3
Hydrology	Crest Gage (CG) and/or Transducer (SG)	1 CG				1 CG		1 CG	N/A	Semi-Annual	4
Vegetation	CVS Level 2/Mobile Plots (Permanent/Mobile)	19 Total (13 Permanent, 6 Mobile)							N/A	Year 1, 2, 3, 5, and 7	5
Wetland	Groundwater Gages	11							N/A	3 X per year	
Visual Assessment		Yes								Semi-Annual	6
Exotic and nuisance vegetation										Semi-Annual	7
Project Boundary										Semi-Annual	8
Reference Photos	Photographs	24								Annual	

1. Cross-sections will be permanently marked with rebar to establish location. Surveys will include points measured at all breaks in slope, including top of bank, bankfull, edge of water, and thalweg.
2. Pattern and profile will be assessed visually during semi-annual site visits. Longitudinal profile will be collected during as-built baseline monitoring survey only, unless observations indicate widespread lack of vertical stability (greater than 10% of reach is affected) and profile survey is warranted in additional years to monitor adjustments or survey repair work.
3. Riffle 100-count substrate sampling will be collected during the baseline monitoring only. Substrate assessments in subsequent monitoring years will consist of reachwide substrate monitoring.
4. Crest gages will be monitored using automated pressure transducers. Transducers will set to record bank full events at least twice a day and stream flow at least every 3 hours and will be inspected quarterly or semi-annually. Evidence of bankfull and stream flow events will be documented with a photo when possible.
5. Both mobile and permanent vegetation plots will be utilized to evaluate the vegetation performance for the open areas planted. 2% of the open planted acreage will be monitored with permanent and mobile plots. Permanent vegetation monitoring plot assessments will follow CVS Level 2 protocols. Mobile vegetation monitoring plot assessments will document number of planted stems and species using a circular or 100 m2 square/rectangular plot.
6. Visual assessment to include UT2 and UT3 as well as photos of BMP inlets and outlets for the as-built and MY1 reports.
7. Locations of exotic and nuisance vegetation will be mapped.
8. Locations of vegetation damage, boundary encroachments, etc. will be mapped.

9.0 Long-Term Management Plan

The Site will be transferred to the North Carolina Department of Environmental Quality (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 Statue 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.

The Stewardship Program will periodically install signage as needed to identify boundary markings as needed. Any livestock or associated fencing or permanent crossings will be the responsibility the owner of the underlying fee to maintain.

The Site Protection Instrument can be found in Appendix 9. Activities included in the long-term management plan are included in Table 31.

Table 31: Long-term Management Plan

Long-Term Management Activity	Long-Term Manager Responsibility	Landowner Responsibility
Signage will be installed and maintained along the Site boundary to denote the area protected by the recorded conservation easement.	The long-term steward will be responsible for inspecting the Site boundary during periodic inspections (every one to three years) and for maintaining or replacing signage to ensure that the conservation easement area is clearly marked.	The landowner shall report damaged or missing signs to the long-term manager, as well as contact the long-term manager if a boundary needs to be marked, or clarification is needed regarding a boundary location. If land use changes in future and fencing is required to protect the easement, the landowner is responsible for installing appropriate approved fencing.
The Site will be protected in its entirety and managed under the terms outlined in the recorded conservation easement.	The long-term manager will be responsible for conducting periodic inspections (every one to three years) and for undertaking actions that are reasonably calculated to swiftly correct the conditions constituting a breach. The USACE, and their authorized agents, shall have the right to enter and inspect the Site and to take actions necessary to verify compliance with the conservation easement.	The landowner shall contact the long-term manager if clarification is needed regarding the restrictions associated with the recorded conservation easement.

10.0 Adaptive Management Plan

Upon completion of Site construction, Wildlands will implement the post-construction monitoring defined in Sections 8 and 9. Project maintenance will be performed during the monitoring years to address minor issues as necessary (Appendix 10). If during annual monitoring it is determined the Site's ability to achieve Site performance standards are jeopardized in any other way, Wildlands and DMS will notify the members of the NCIRT and work with the NCIRT to develop contingency plans and remedial actions.

11.0 Determination of Credits

The final stream credits associated with the Site are listed in Table 32. Stream restoration is proposed at a ratio of 1:1 and stream enhancement and at a ratio of 1.5:1 (for EI) and 8:1 (for EII). Wetland re-establishment is proposed at 1:1, rehabilitation is proposed at 1:1 for enhancement of low NCWAM rating wetlands that are currently being farmed or are actively maintained ditches and 1.5:1 for rehabilitation of moderate NCWAM rating wetlands (see Table 12 for NCWAM rating), and creation is proposed at 3:1. No credit is sought for BMPs, nor for proposed channel extensions of UT2 and UT3 to tie into the realigned Oak Hill Creek mainstem channel.

Buffers proposed throughout the Site meet the minimum required 50-foot standard width for Piedmont streams, and in most cases, far exceed it. The credit release schedule is provided in Appendix 13.

Table 32: Project Asset Table

Project Components							
Project Component or Reach ID	**Existing Footage/ Acreage**	**Restoration Footage/ Acreage[1]**	**Mitigation Category**	**Restoration Level**	**Priority Level**	**Mitigation Ratio**	**Proposed Credit**
Oak Hill Creek Reach 1	581	488.527	Warm	EI	P2	1.5	325.685
Oak Hill Creek Reach 2	431	470.085	Warm	R	P1	1	470.085
Oak Hill Creek Reach 3	882	877.051	Warm	R	P1	1	877.051
Oak Hill Creek Reach 4	523	388.273	Warm	R	P1, P2	1	388.273
UT1 Reach 1	252	217.749	Warm	R	P1, P2	1	217.749
UT1 Reach 2	1,706	1,834.520	Warm	R	P1	1	1,834.520
UT1A	482	469.110	Warm	R	P1	1	469.110
UT1B	292	291.680	Warm	EII		8	36.460
Total Stream LF	**5,149**	**5,036.995**					
Wetland Re-establishment	0	4.859	RR	RE	Re-establishment	1	4.859
Wetland Rehabilitation	1.805	1.805	RR	RH	Rehabilitation	1	1.805
Wetland Rehabilitation	0.285	0.284	RR	RH	Rehabilitation	1.5	0.189
Wetland Creation	0	2.481	RR	C	Creation	3	0.827
Total Wetland Acreage	**2.090**	**9.429**					

Project Credits							
Restoration Level	**Stream**			**Riparian Wetland**		**Non-Rip**	**Coastal**
	Warm	**Cool**	**Cold**	**Riverine**	**Non-Riv**	**Wetland**	**Marsh**
Restoration	**4,256.788**						
Re-establishment				**4.859**			
Rehabilitation (1:1 & 1.5:1)				**1.994**			
Enhancement							
Enhancement I	**325.685**						
Enhancement II	**36.460**						
Creation				**0.827**			
Preservation							
Totals	**4,618.933**			**7.680**			

[1] Crossing lengths have been removed from restoration footage.

12.0 References

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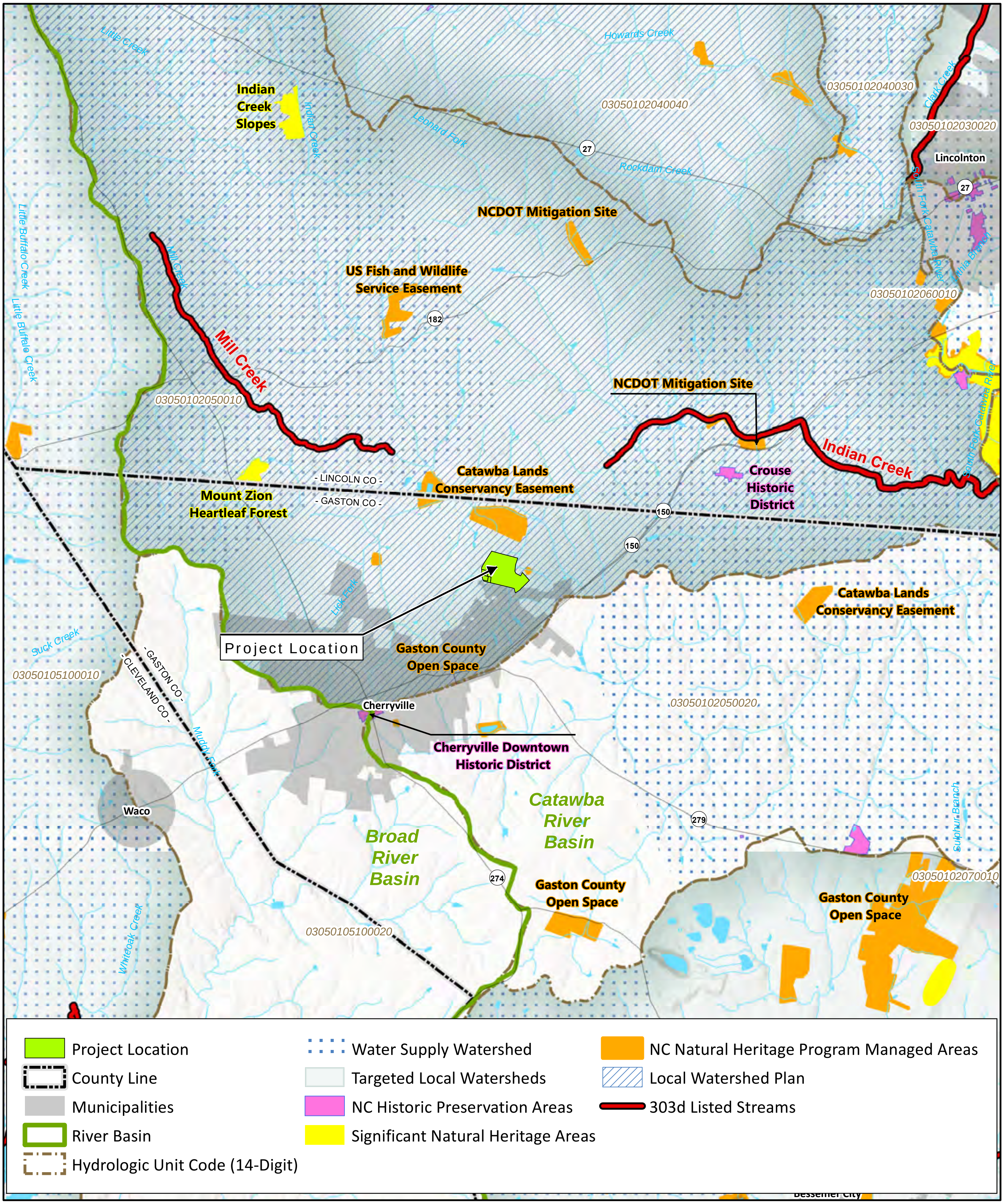
FIGURES



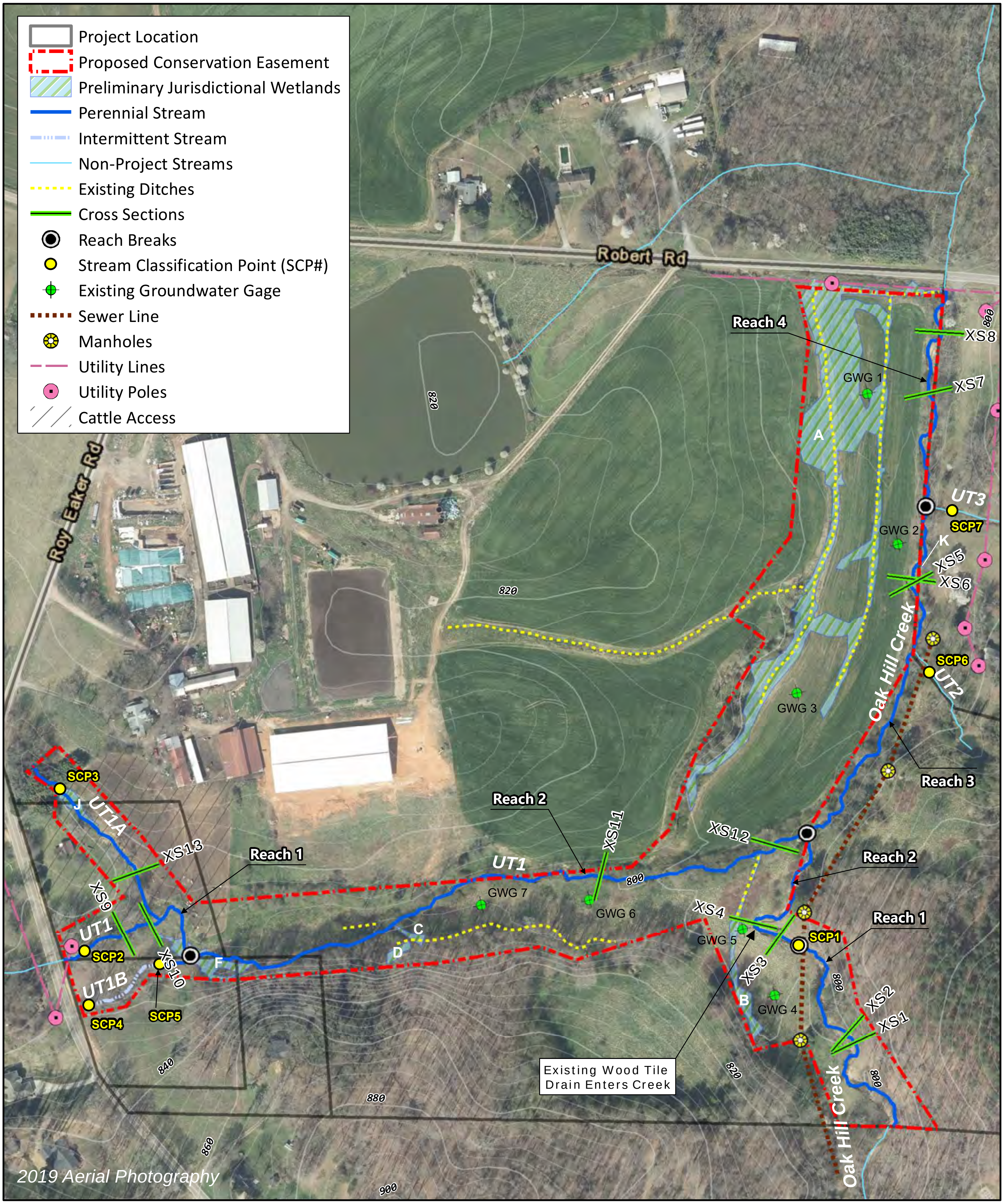
WILDLANDS ENGINEERING

0 0.75 1.5 Miles

N

Figure 1 Vicinity Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC



WILDLANDS ENGINEERING

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Figure 2 Site Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

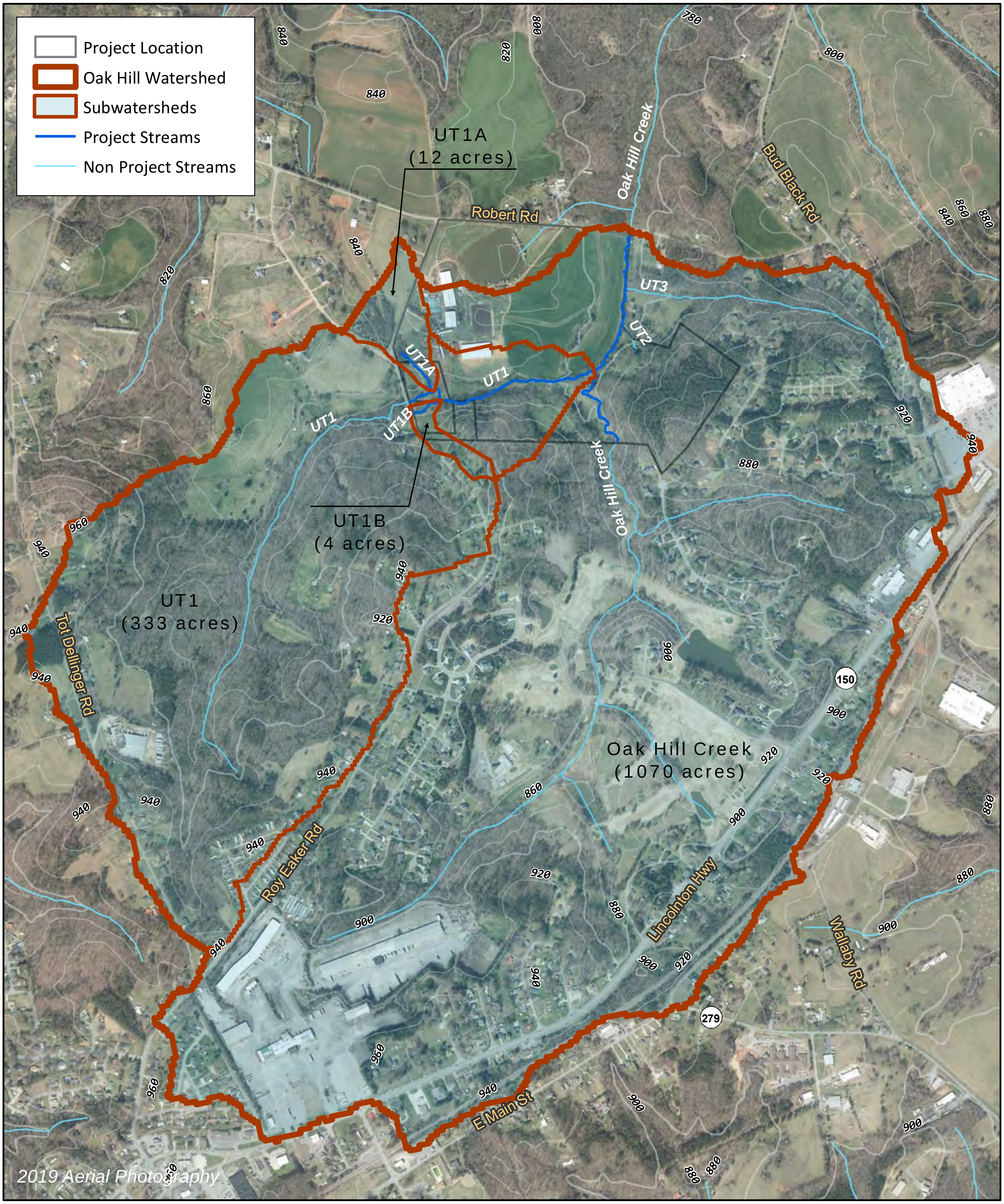
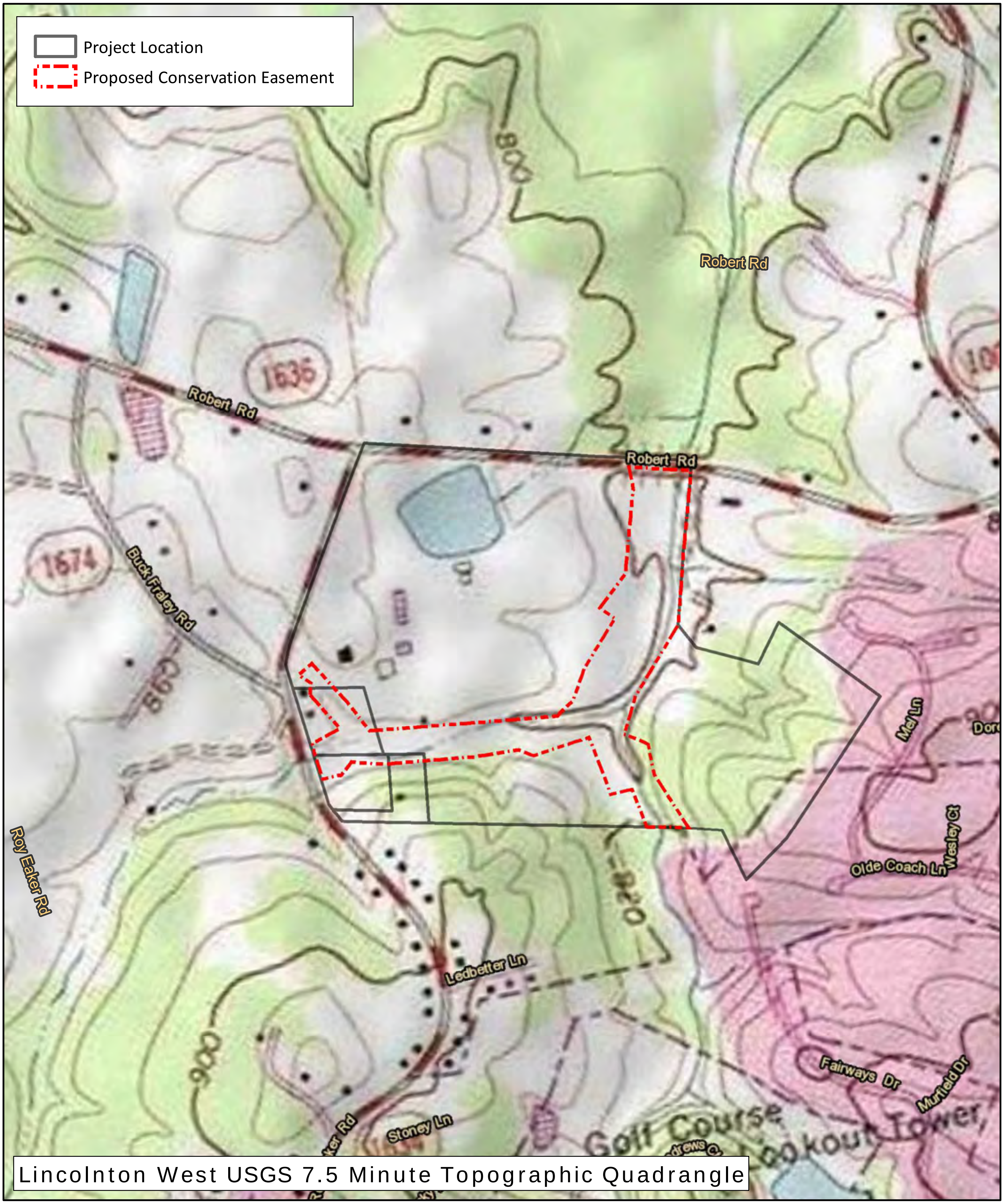


Figure 3 Watershed Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC



WILDLANDS ENGINEERING

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Figure 4 USGS Topographic Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

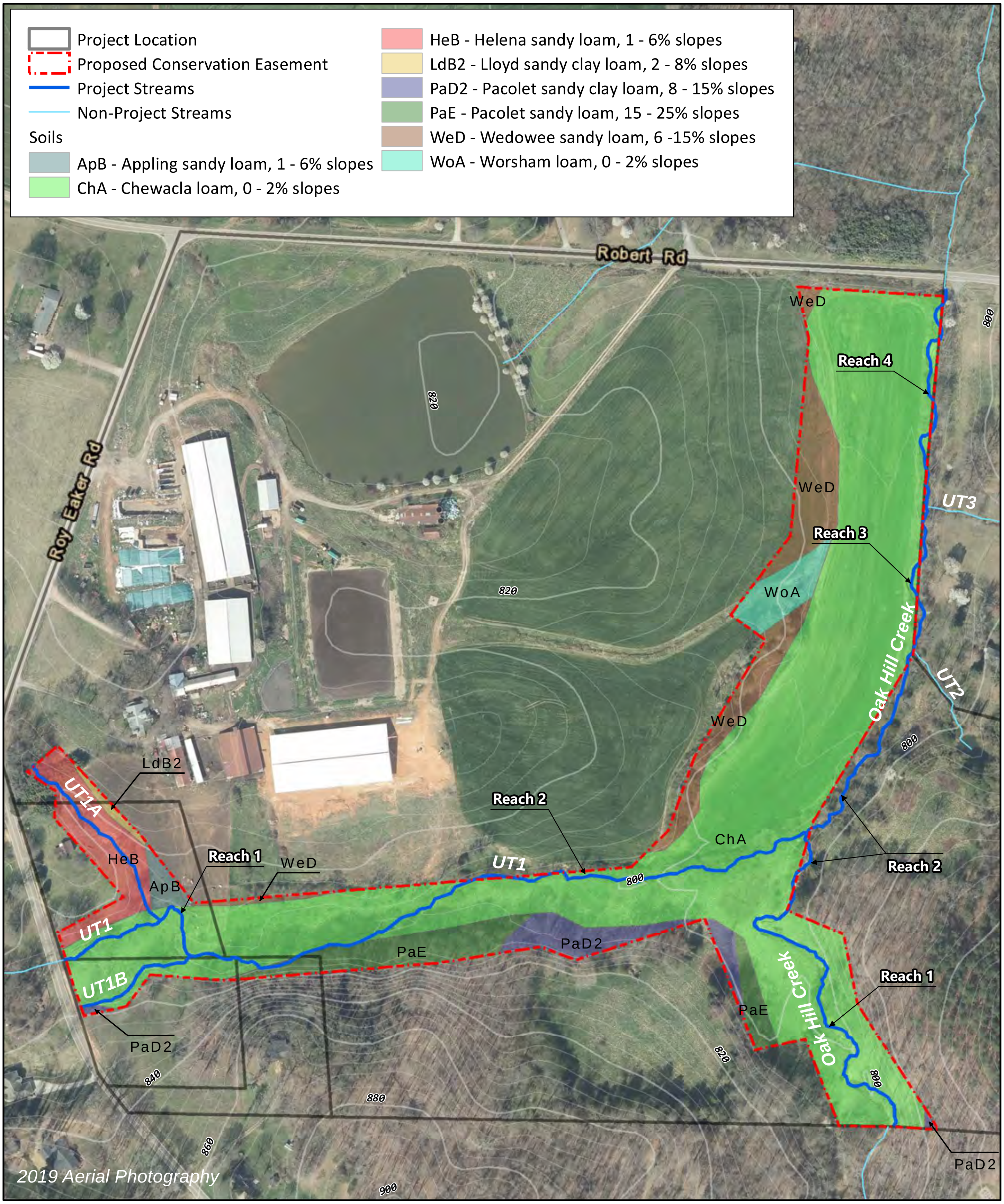
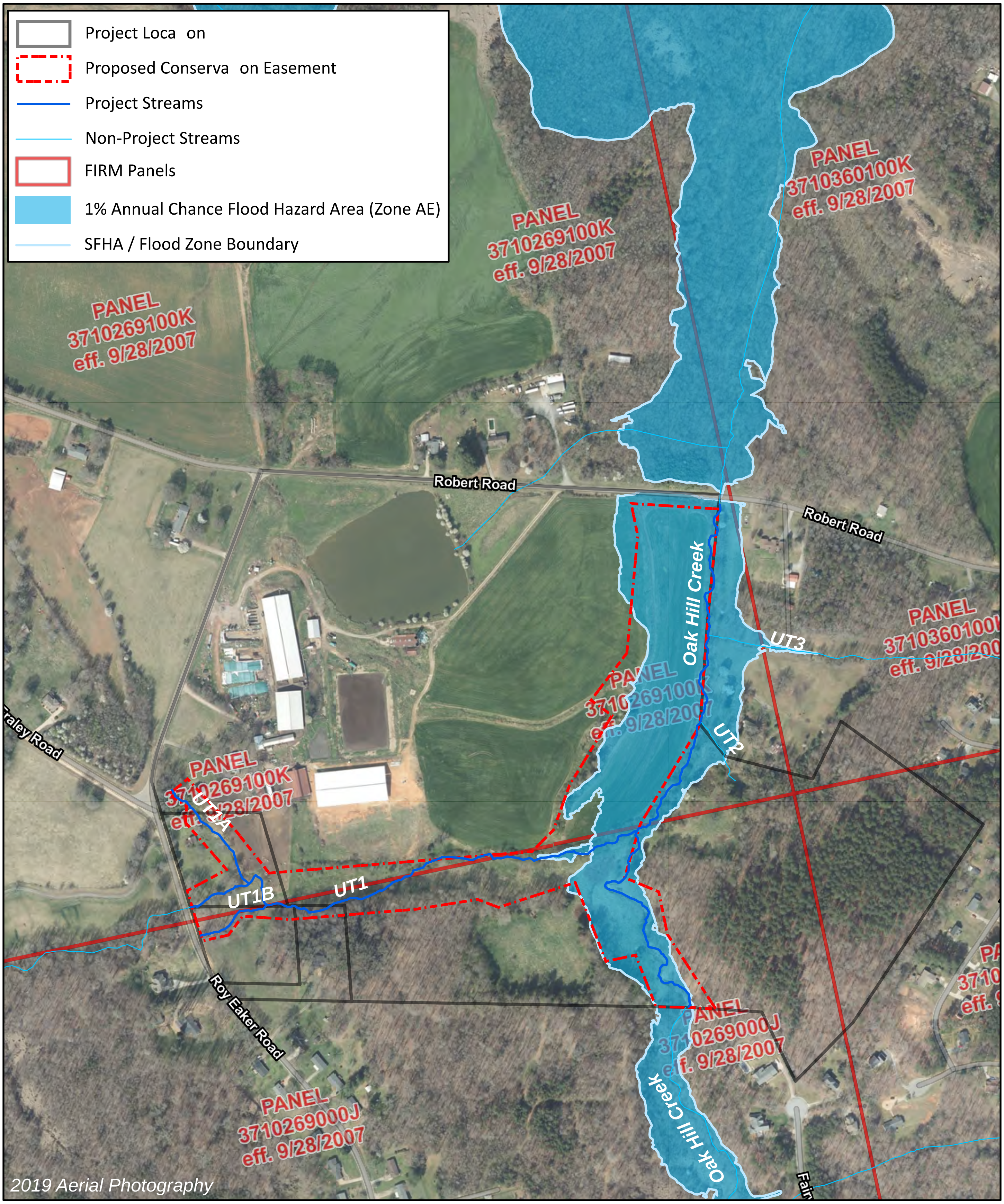


Figure 5 Soils Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

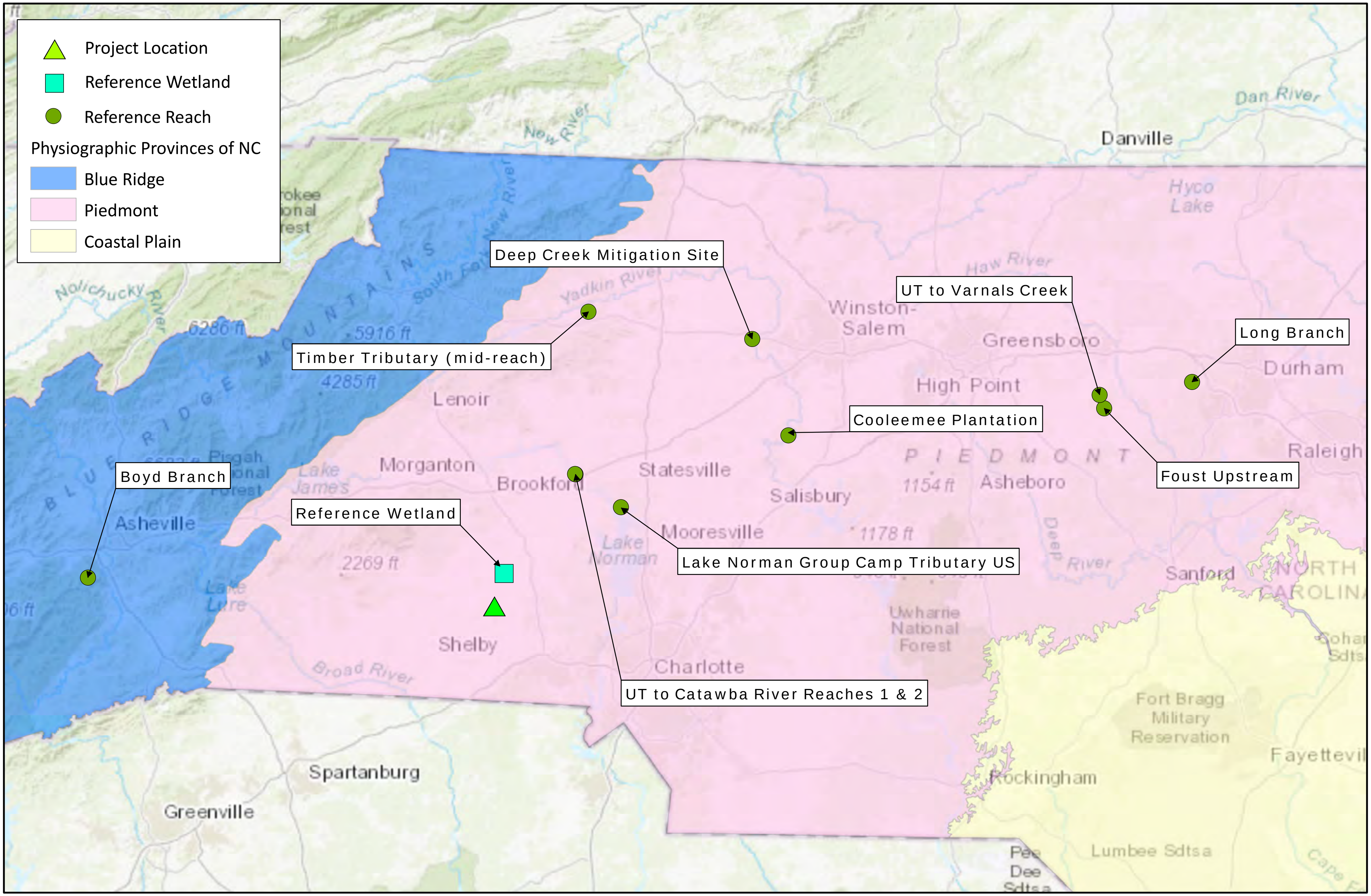


WILDLANDS ENGINEERING

0 250 500 Feet

Figure 6 FEMA Floodplain Map
Oak Hill Mi ga on Site
Catawba River 03050102

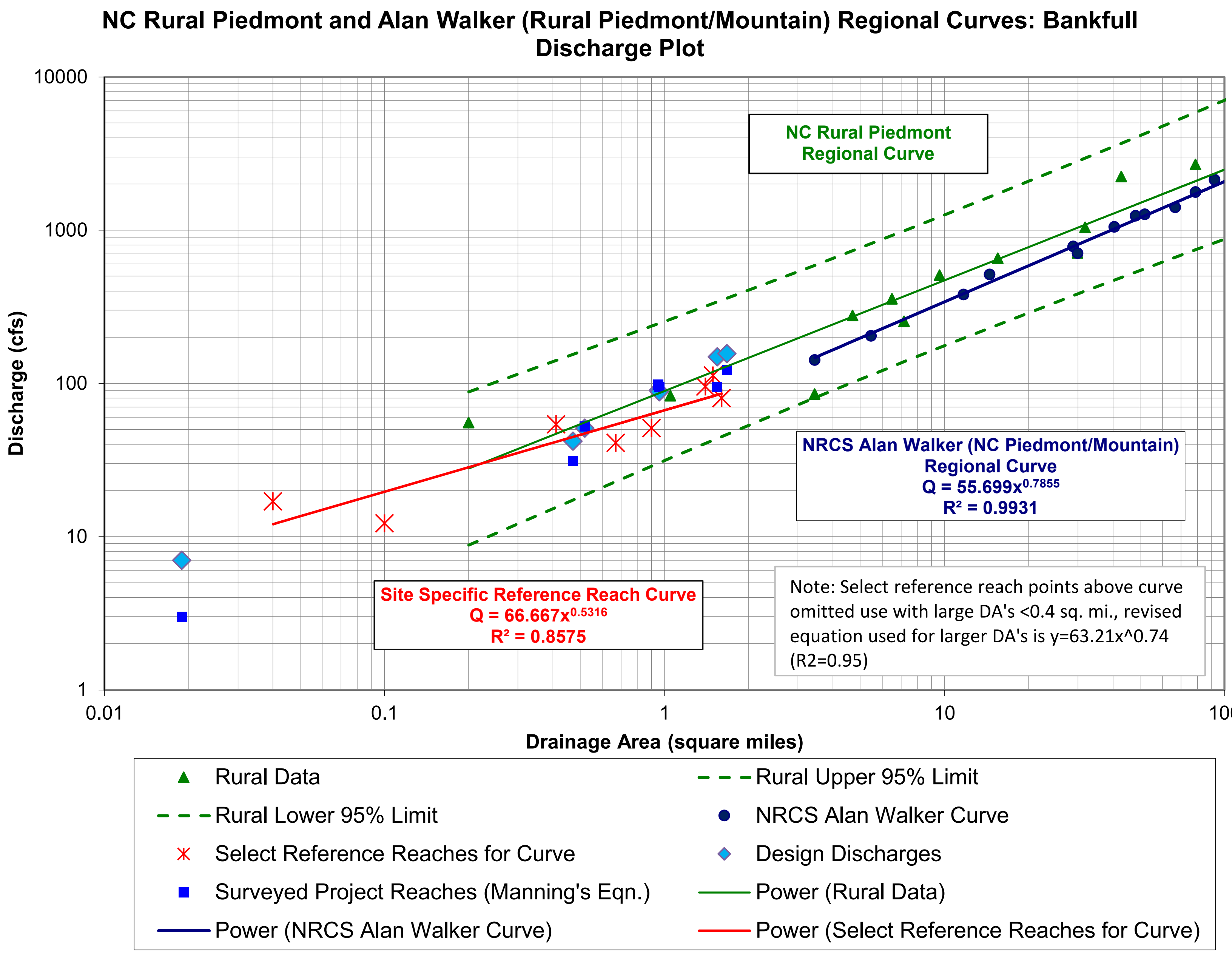
Gaston County, NC



WILDLANDS ENGINEERING

Figure 7 Reference Reach Vicinity Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

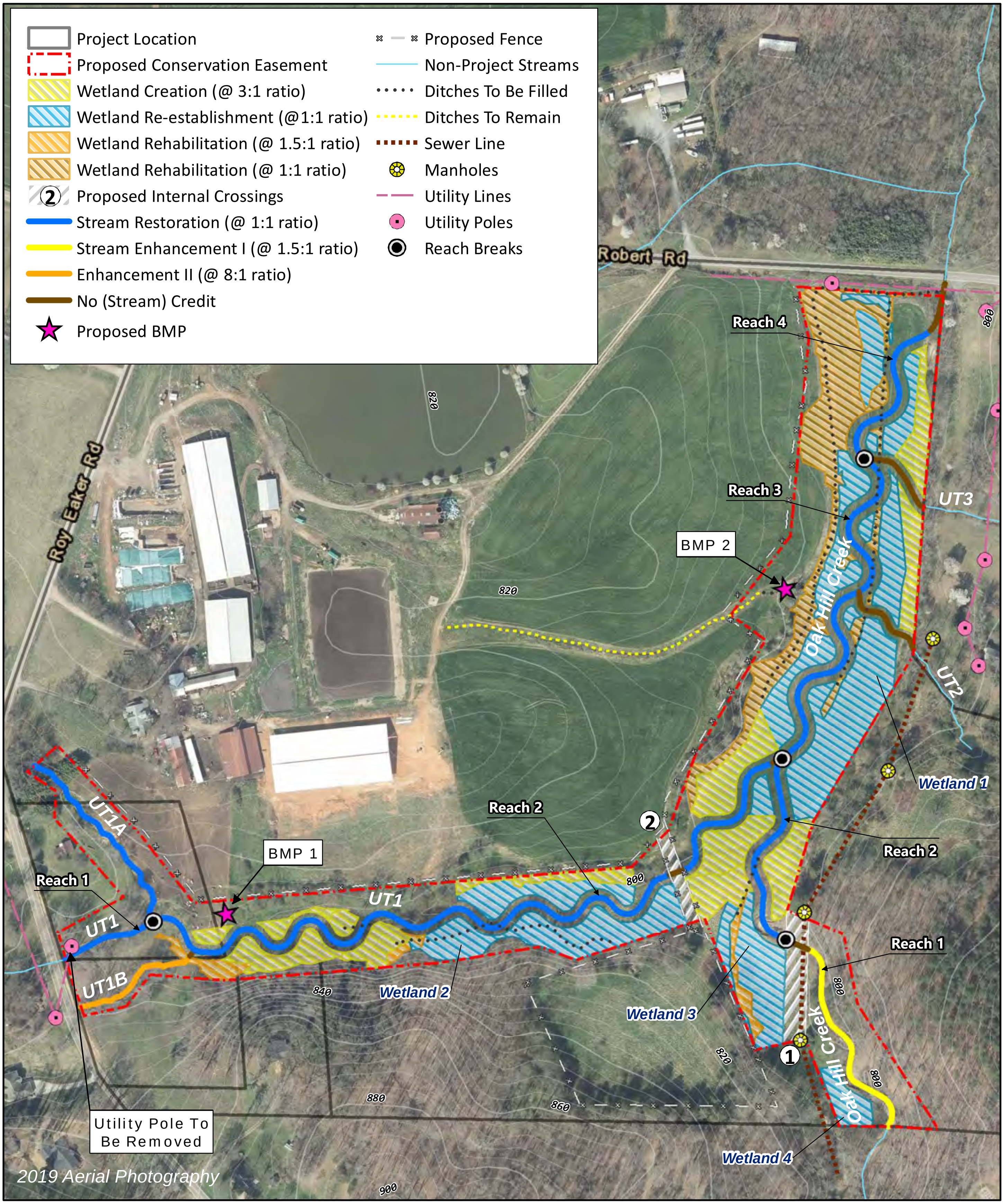
Gaston County, NC



WILDLANDS ENGINEERING

Figure 8 Discharge Analysis
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC



WILDLANDS ENGINEERING

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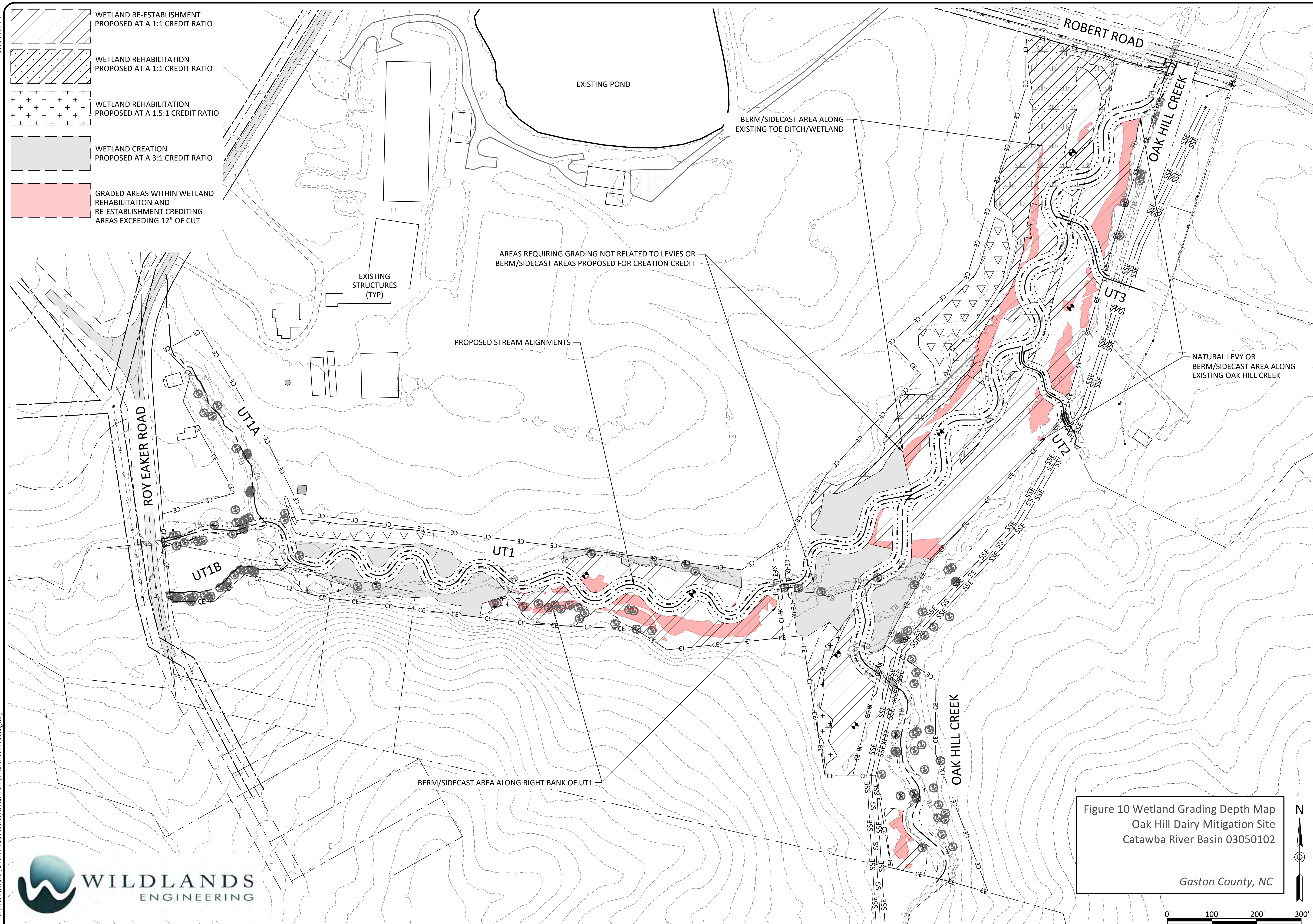
Figure 9 Concept Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC



January 11, 2021

X:\shared\Projects\005-02182 Oak Hill Dairy\Cadd\Plans\02182-Wetland Grading.dwg

WILDLANDS ENGINEERING
167-B Haywood Rd
Asheville, NC 28806
Tel: 828.774.5547
License No. F-0831

PRELIMINARY DO NOT USE FOR CONSTRUCTION

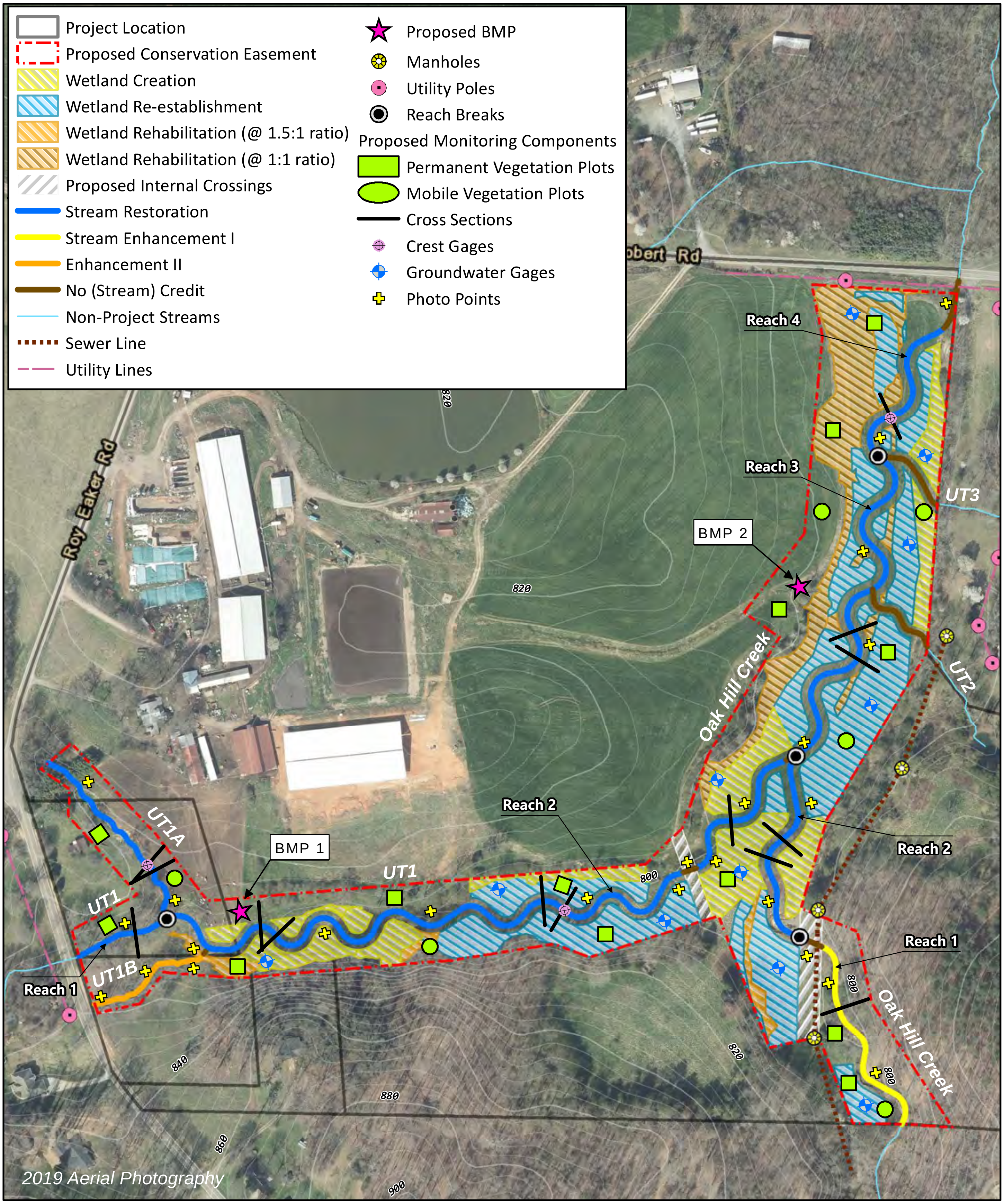
Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Overview
Wetland Grading Exceeding 12" Exhibit

Revisions:

Date: December 4, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

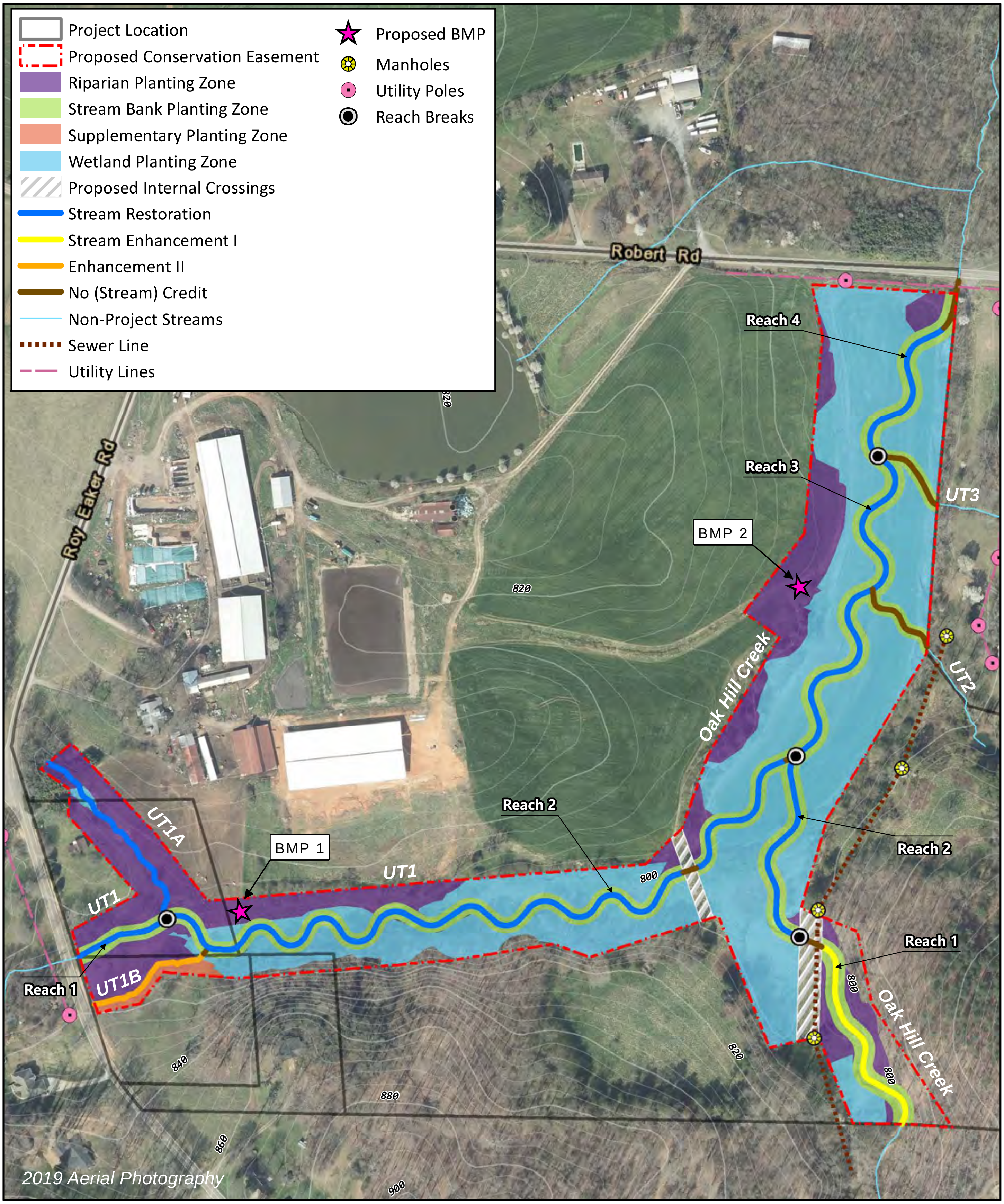
Sheet 1



WILDLANDS ENGINEERING

Figure 11 Monitoring Components Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

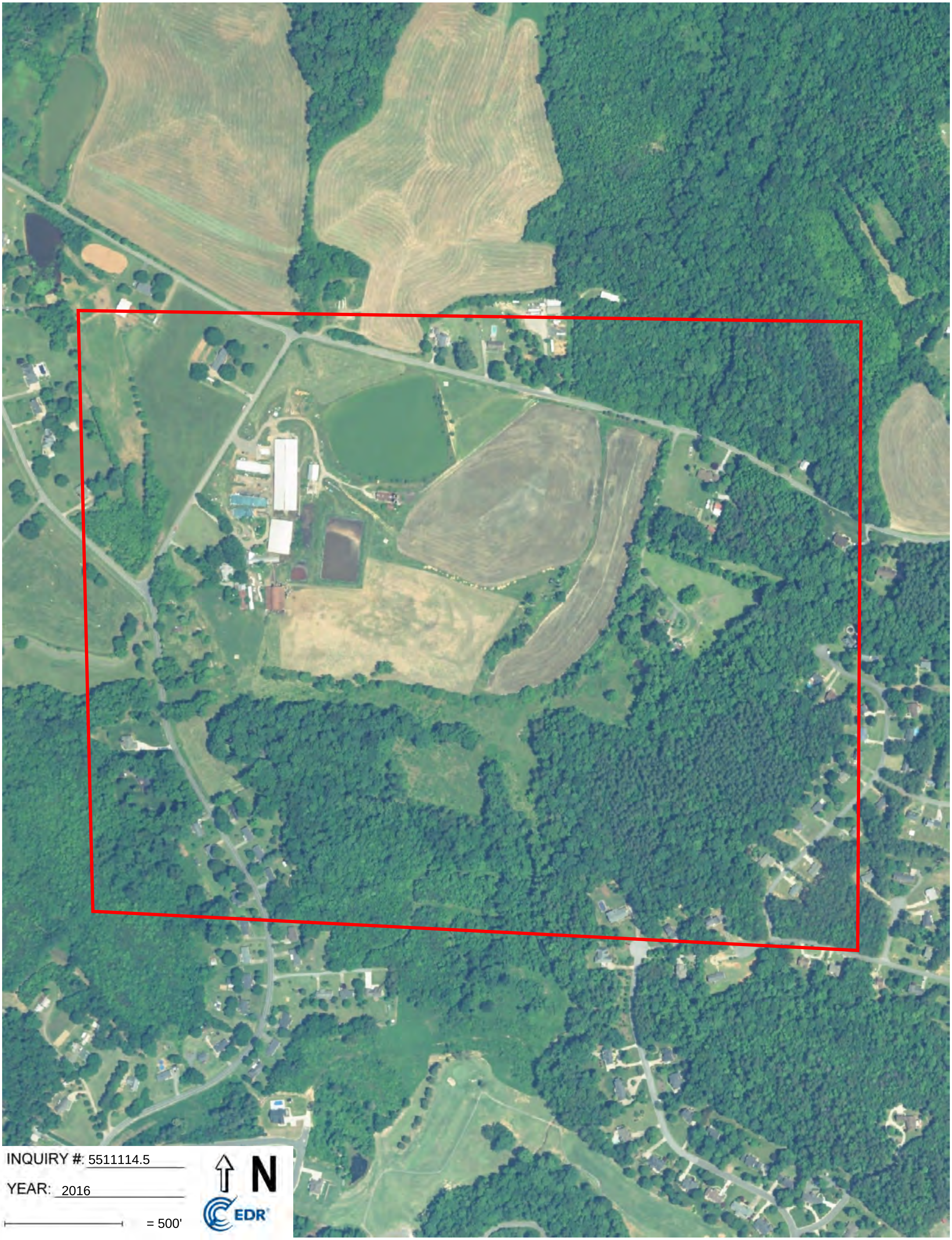


WILDLANDS ENGINEERING

Figure 12 Proposed Planting Zone Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

APPENDIX 1 – Historic Aerial Photos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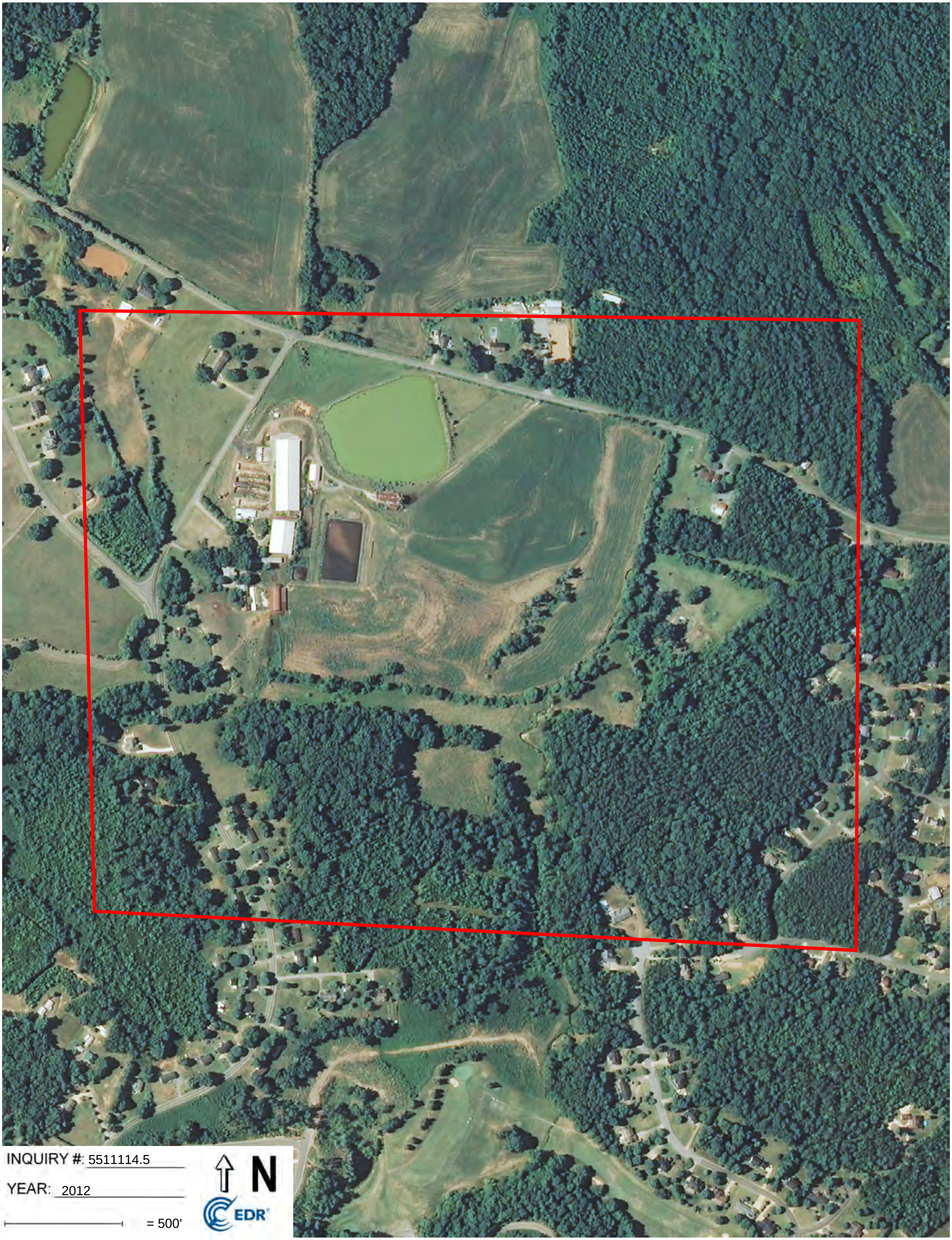
EDR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EDR

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YEAR: 2009

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N

EDR


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EDR
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EDR

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EDR

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YEAR: 1973

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YEAR: 1964

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EDR

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EDR

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N

EDR


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EDR

APPENDIX 2 – Preliminary Jurisdictional Determination

U.S. ARMY CORPS OF ENGINEERS
WILMINGTON DISTRICT

Action Id. **SAW-2019-00833** County: **Gaston** U.S.G.S. Quad: **NC- Lincolnton West**

NOTIFICATION OF JURISDICTIONAL DETERMINATION

Requestor:	**North Carolina Department of Environmental Quality**
	Matthew Reid
Address:	**5 Ravenscroft Dr Suite 102**
	Asheville, NC 28801
Telephone Number:	**(828) 231-7912**
E-mail:	**matthew.reid@ncdenr.gov**

Size (acres)	**57**	Nearest Town	**Cherryville**
Nearest Waterway	**Indian Creek**	River Basin	**Santee**
USGS HUC	**03050102**	Coordinates	Latitude: **35.403670**
			Longitude: **-81.351360**

Location description: **Project is located at 610 Roy Eaker Road, Cherryville, Gaston County, North Carolina. Parcels includes PINs2691-90-0340, 2690-89-1706, 2690-79-8897 and 3601-00-0464.**

Indicate Which of the Following Apply:

A. Preliminary Determination

☒ There appear to be **waters** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). The **waters** have been delineated, and the delineation has been verified by the Corps to be sufficiently accurate and reliable. The approximate boundaries of these waters are shown on the enclosed delineation map dated **12/7/2020**. Therefore this preliminary jurisdiction determination may be used in the permit evaluation process, including determining compensatory mitigation. For purposes of computation of impacts, compensatory mitigation requirements, and other resource protection measures, a permit decision made on the basis of a preliminary JD will treat all waters and wetlands that would be affected in any way by the permitted activity on the site as if they are jurisdictional waters of the U.S. This preliminary determination is not an appealable action under the Regulatory Program Administrative Appeal Process (Reference 33 CFR Part 331). However, you may request an approved JD, which is an appealable action, by contacting the Corps district for further instruction.

☐ There appear to be **waters** on the above described project area/property, that may be subject to Section 404 of the Clean Water Act (CWA)(33 USC § 1344) and/or Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403). However, since the **waters** have not been properly delineated, this preliminary jurisdiction determination may not be used in the permit evaluation process. Without a verified wetland delineation, this preliminary determination is merely an effective presumption of CWA/RHA jurisdiction over all of the **waters** at the project area, which is not sufficiently accurate and reliable to support an enforceable permit decision. We recommend that you have the **waters** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

B. Approved Determination

☐ There are Navigable Waters of the United States within the above described project area/property subject to the permit requirements of Section 10 of the Rivers and Harbors Act (RHA) (33 USC § 403) and Section 404 of the Clean Water Act (CWA)(33 USC § 1344). Unless there is a change in law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ There are **waters**on the above described project area/property subject to the permit requirements of Section 404 of the Clean Water Act (CWA) (33 USC § 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐We recommend you have the **waters** on your project area/property delineated. As the Corps may not be able to accomplish this wetland delineation in a timely manner, you may wish to obtain a consultant to conduct a delineation that can be verified by the Corps.

☐The **waters** on your project area/property have been delineated and the delineation has been verified by the Corps. The approximate boundaries of these waters are shown on the enclosed delineation map dated **DATE**. We strongly suggest you have this delineation surveyed. Upon completion, this survey should be reviewed and verified by the Corps. Once verified, this survey will provide an accurate depiction of all areas subject to CWA jurisdiction on your property which, provided there is no change in the law or our published regulations, may be relied upon for a period not to exceed five years.

☐ The **waters** have been delineated and surveyed and are accurately depicted on the plat signed by the Corps Regulatory Official identified below on **DATE**. Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ There are no waters of the U.S., to include wetlands, present on the above described project area/property which are subject to the permit requirements of Section 404 of the Clean Water Act (33 USC 1344). Unless there is a change in the law or our published regulations, this determination may be relied upon for a period not to exceed five years from the date of this notification.

☐ The property is located in one of the 20 Coastal Counties subject to regulation under the Coastal Area Management Act (CAMA). You should contact the Division of Coastal Management in **Morehead City, NC, at (252) 808-2808** to determine their requirements.

Placement of dredged or fill material within waters of the US, including wetlands, without a Department of the Army permit may constitute a violation of Section 301 of the Clean Water Act (33 USC § 1311). Placement of dredged or fill material, construction or placement of structures, or work within navigable waters of the United States without a Department of the Army permit may constitute a violation of Sections 9 and/or 10 of the Rivers and Harbors Act (33 USC § 401 and/or 403). If you have any questions regarding this determination and/or the Corps regulatory program, please contact **Krystynka B Stygar at 252-545-0507 or krystynka.b.stygar@usace.army.mil**.

C. Basis For Determination: Basis For Determination: Based on information submitted by the applicant and available to the U.S. Army Corps of Engineers, the project area exhibits criteria for waters of the U.S. as defined in 33 CFR 328, the 1987 Wetland Delineation Manual, and/or Regional Supplement to the 1987 Manual: Eastern Piedmont and Mountains v2.0. See preliminary jurisdictional determination form dated 12/7/2020 included in the file.

D. Remarks: None.

E. Attention USDA Program Participants

This delineation/determination has been conducted to identify the limits of Corps' Clean Water Act jurisdiction for the particular site identified in this request. The delineation/determination may not be valid for the wetland conservation provisions of the Food Security Act of 1985. If you or your tenant are USDA Program participants, or anticipate participation in USDA programs, you should request a certified wetland determination from the local office of the Natural Resources Conservation Service, prior to starting work.

F. Appeals Information (This information applies only to approved jurisdictional determinations as indicated in B. above)

This correspondence constitutes an approved jurisdictional determination for the above described site. If you object to this determination, you may request an administrative appeal under Corps regulations at 33 CFR Part 331. Enclosed you will find a Notification of Appeal Process (NAP) fact sheet and request for appeal (RFA) form. If you request to appeal this determination you must submit a completed RFA form to the following address:

US Army Corps of Engineers
South Atlantic Division
Attn: Phillip Shannin, Review Officer
60 Forsyth Street SW, Room 10M15
Atlanta, Georgia 30303-8801

In order for an RFA to be accepted by the Corps, the Corps must determine that it is complete, that it meets the criteria for appeal under 33 CFR part 331.5, and that it has been received by the Division Office within 60 days of the date of the NAP. Should you decide to submit an RFA form, it must be received at the above address by **Not applicable**.

It is not necessary to submit an RFA form to the Division Office if you do not object to the determination in this correspondence.

Corps Regulatory Official: Krysta Stygar

Date of JD: **12/7/2020** Expiration Date of JD: **Not applicable**

SAW-2019-00833
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 http://corpsmapu.usace.army.mil/cm_apex/f?p=136:4:0

Copy furnished:

Agent: **Wildlands Engineering Inc**
Ian Eckardt
Address: **1430 S Mint Street, Suite 104**
Charlotte, NC 28203
Telephone Number: **(704) 332-7754 ext. 108**
E-mail: **ieckardt@wildlandseng.com**

Owner
Cameron & Rusty Eaker Jr & SR
Address: **610 Roy Eaker Road**
Cherryville, NC 28021
Telephone Number: **(704) 472-8820**

NOTIFICATION OF ADMINISTRATIVE APPEAL OPTIONS AND PROCESS AND REQUEST FOR APPEAL		
Applicant: **North Carolina Department of Environmental Quality**, **Matthew Reid**	File Number: **SAW-2019-00833**	Date: **12/7/2020**

Attached is:		See Section below
☐	INITIAL PROFFERED PERMIT (Standard Permit or Letter of permission)	A
☐	PROFFERED PERMIT (Standard Permit or Letter of permission)	B
☐	PERMIT DENIAL	C
☐	APPROVED JURISDICTIONAL DETERMINATION	D
☒	PRELIMINARY JURISDICTIONAL DETERMINATION	E

SECTION I - The following identifies your rights and options regarding an administrative appeal of the above decision. Additional information may be found at or http://www.usace.army.mil/Missions/CivilWorks/RegulatoryProgramandPermits.aspx or the Corps regulations at 33 CFR Part 331.

A: INITIAL PROFFERED PERMIT: You may accept or object to the permit.

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- OBJECT: If you object to the permit (Standard or LOP) because of certain terms and conditions therein, you may request that the permit be modified accordingly. You must complete Section II of this form and return the form to the district engineer. Your objections must be received by the district engineer within 60 days of the date of this notice, or you will forfeit your right to appeal the permit in the future. Upon receipt of your letter, the district engineer will evaluate your objections and may: (a) modify the permit to address all of your concerns, (b) modify the permit to address some of your objections, or (c) not modify the permit having determined that the permit should be issued as previously written. After evaluating your objections, the district engineer will send you a proffered permit for your reconsideration, as indicated in Section B below.

B: PROFFERED PERMIT: You may accept or appeal the permit

- ACCEPT: If you received a Standard Permit, you may sign the permit document and return it to the district engineer for final authorization. If you received a Letter of Permission (LOP), you may accept the LOP and your work is authorized. Your signature on the Standard Permit or acceptance of the LOP means that you accept the permit in its entirety, and waive all rights to appeal the permit, including its terms and conditions, and approved jurisdictional determinations associated with the permit.
- APPEAL: If you choose to decline the proffered permit (Standard or LOP) because of certain terms and conditions therein, you may appeal the declined permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

C: PERMIT DENIAL: You may appeal the denial of a permit under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the division engineer. This form must be received by the division engineer within 60 days of the date of this notice.

D: APPROVED JURISDICTIONAL DETERMINATION: You may accept or appeal the approved JD or provide new information.

- ACCEPT: You do not need to notify the Corps to accept an approved JD. Failure to notify the Corps within 60 days of the date of this notice, means that you accept the approved JD in its entirety, and waive all rights to appeal the approved JD.
- APPEAL: If you disagree with the approved JD, you may appeal the approved JD under the Corps of Engineers Administrative Appeal Process by completing Section II of this form and sending the form to the district engineer. This form must be received by the division engineer within 60 days of the date of this notice.

E: PRELIMINARY JURISDICTIONAL DETERMINATION: You do not need to respond to the Corps regarding the preliminary JD. The Preliminary JD is not appealable. If you wish, you may request an approved JD (which may be appealed), by contacting the Corps district for further instruction. Also you may provide new information for further consideration by the Corps to reevaluate the JD.

SECTION II - REQUEST FOR APPEAL or OBJECTIONS TO AN INITIAL PROFFERED PERMIT

REASONS FOR APPEAL OR OBJECTIONS: (Describe your reasons for appealing the decision or your objections to an initial proffered permit in clear concise statements. You may attach additional information to this form to clarify where your reasons or objections are addressed in the administrative record.)

ADDITIONAL INFORMATION: The appeal is limited to a review of the administrative record, the Corps memorandum for the record of the appeal conference or meeting, and any supplemental information that the review officer has determined is needed to clarify the administrative record. Neither the appellant nor the Corps may add new information or analyses to the record. However, you may provide additional information to clarify the location of information that is already in the administrative record.

POINT OF CONTACT FOR QUESTIONS OR INFORMATION:

If you have questions regarding this decision and/or the appeal process you may contact:	If you only have questions regarding the appeal process you may also contact:
District Engineer, Wilmington Regulatory Division **Attn: Krystynka B Stygar** **Charlotte Regulatory Office** **U.S Army Corps of Engineers** **8430 University Executive Park Drive, Suite 615** **Charlotte, North Carolina 28262**	Mr. Phillip Shannin, Administrative Appeal Review Officer CESAD-PDO U.S. Army Corps of Engineers, South Atlantic Division 60 Forsyth Street, Room 10M15 Atlanta, Georgia 30303-8801 Phone: (404) 562-5137

RIGHT OF ENTRY: Your signature below grants the right of entry to Corps of Engineers personnel, and any government consultants, to conduct investigations of the project site during the course of the appeal process. You will be provided a 15-day notice of any site investigation, and will have the opportunity to participate in all site investigations.

_______________________________ Signature of appellant or agent.	Date:	Telephone number:

For appeals on Initial Proffered Permits send this form to:

District Engineer, Wilmington Regulatory Division, **Attn: Krystynka B Stygar, 8430 University Executive Park Drive, Suite 615, Charlotte North Carolina, 28262**

For Permit denials, Proffered Permits and Approved Jurisdictional Determinations send this form to:

Division Engineer, Commander, U.S. Army Engineer Division, South Atlantic, Attn: Mr. Phillip Shannin, Administrative Appeal Officer, CESAD-PDO, 60 Forsyth Street, Room 10M15, Atlanta, Georgia 30303-8801
Phone: (404) 562-5137

PRELIMINARY JURISDICTIONAL DETERMINATION (PJD) FORM

BACKGROUND INFORMATION

A. REPORT COMPLETION DATE FOR PJD: 09/14/2020

B. NAME AND ADDRESS OF PERSON REQUESTING PJD: North Carolina Department of Environmental Quality, Matthew Reid, 5 Ravenscroft Dr Suite 102, Asheville, NC 28801

C. DISTRICT OFFICE, FILE NAME, AND NUMBER: Wilmington District, Oak Hill Dairy Mitigation Site, SAW-2019-00833

D. PROJECT LOCATION(S) AND BACKGROUND INFORMATION: Project is located at 610 Roy Eaker Road, Cherryville, Gaston County, North Carolina. Parcels includes PINs2691-90-0340, 2690-89-1706, 2690-79-8897 and 3601-00-0464.

(USE THE TABLE BELOW TO DOCUMENT MULTIPLE AQUATIC RESOURCES AND/OR AQUATIC RESOURCES AT DIFFERENT SITES)

State: NC County: Gaston City: Cherryville
Center coordinates of site (lat/long in degree decimal format): Latitude: 35.403670 Longitude: -81.351360

Universal Transverse Mercator:
UTM 17

Name of nearest waterbody: Indian Creek

E. REVIEW PERFORMED FOR SITE EVALUATION (CHECK ALL THAT APPLY):

☐Office (Desk) Determination. Date:

☒Field Determination. Date(s): December 7, 2020

TABLE OF AQUATIC RESOURCES IN REVIEW AREA WHICH "MAY BE" SUBJECT TO REGULATORY JURISDICTION

Site Number	Latitude (decimal degrees)	Longitude (decimal degrees)	Estimated amount of aquatic resources in review area (acreage and linear feet, if applicable	Type of aquatic resources (i.e., wetland vs. non-wetland waters)	Geographic authority to which the aquatic resource “may be” subject (i.e., Section 404 or Section 10/404)
Oak Hill Creek	35.402567	-81.351576	2451 LF	Non-wetland waters	Section 404
UT 1	35.403349	-81.356898	1958 LF	Non-wetland waters	Section 404
UT 1A	35.404366	-81.356856	455 LF	Non-wetland waters	Section 404
UT 1B (intermittent)	35.403016	-81.356944	206 LF	Non-wetland waters	Section 404
UT 1B (perennial)	35.403181	-81.356358	89 LF	Non-wetland waters	Section 404
UT 2	35.404079	-81.350221	90 LF	Non-wetland waters	Section 404
UT 3	35.405039	-81.349823	88 LF	Non-wetland waters	Section 404
Wetland A	35.404531	-81.351076	2.203 Acres	Wetland	Section 404
Wetland B	35.402112	-81.352008	0.138 acres	Wetland	Section 404

Wetland C	35.403028	-81.354322	0.021 acres	Wetland	Section 404
Wetland D	35.402999	-81.354572	0.028 acres	Wetland	Section 404
Wetland F	35.403134	-81.355993	0.131 acres	Wetland	Section 404
Wetland J	35.404293	-81.356829	0.047 acres	Wetland	Section 404
Wetland K	35.404741	-81.350125	0.0004 acres	Wetland	Section 404

1. The Corps of Engineers believes that there may be jurisdictional aquatic resources in the review area, and the requestor of this PJD is hereby advised of his or her option to request and obtain an approved JD (AJD) for that review area based on an informed decision after having discussed the various types of JDs and their characteristics and circumstances when they may be appropriate.
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 AJD for the activity, the permit applicant is hereby made aware that: (1) the permit applicant has elected to seek a permit authorization based on a PJD, which does not make an official determination of jurisdictional aquatic resources; (2) the applicant has the option to request an AJD before accepting the terms and conditions of the permit authorization, and that basing a permit authorization on an AJD could possibly result in less compensatory mitigation being required or different special conditions; (3) 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) 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) undertaking any activity in reliance upon the subject permit authorization without requesting an AJD constitutes the applicant's acceptance of the use of the PJD; (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 PJD constitutes agreement that all aquatic resources in the review area affected in any way by that activity will be treated as jurisdictional, and waives 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 AJD or a PJD, the JD will be processed as soon as practicable. Further, an AJD, 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. If, during an administrative appeal, it becomes appropriate to make an official determination whether geographic jurisdiction exists over aquatic resources in the review area, or to provide an official delineation of jurisdictional aquatic resources in the review area, the Corps will provide an AJD to accomplish that result, as soon as is practicable. This PJD finds that there *"may be"* waters of the U.S. and/or that there *"may be"* navigable waters of the U.S. on the subject review area, and identifies all aquatic features in the review area that could be affected by the proposed activity, based on the following information:
3.

SUPPORTING DATA. Data reviewed for PJD (check all that apply) Checked items are included in the administrative record and are appropriately cited:

☒Maps, plans, plots or plat submitted by or on behalf of the PJD requestor:

Map: **Wildlands Engineering INC**

☒ Data sheets prepared/submitted by or on behalf of the PJD requestor. Datasheets:

☒ Office concurs with data sheets/delineation report.

☐ Office does not concur with data sheets/delineation report. Rationale:________________

☐ 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: **1:24,000 Scale Lincolnton, West Quadrangle**

☒ Natural Resources Conservation Service Soil Survey. Citation: **NRCS Web Soil Survey website**

☒ National wetlands inventory map(s). Cite name: **National Wetlands Inventory website (2020)**

☐ State/local wetland inventory map(s):_____________________

☐ FEMA/FIRM maps:

☐ 100-year Floodplain Elevation is:_______________ (National Geodetic Vertical Datum of 1929)

☒ Photographs: ☒ Aerial (Name & Date): **2019 aerial on GIS figures**

or ☒ Other (Name & Date): **Site photos**

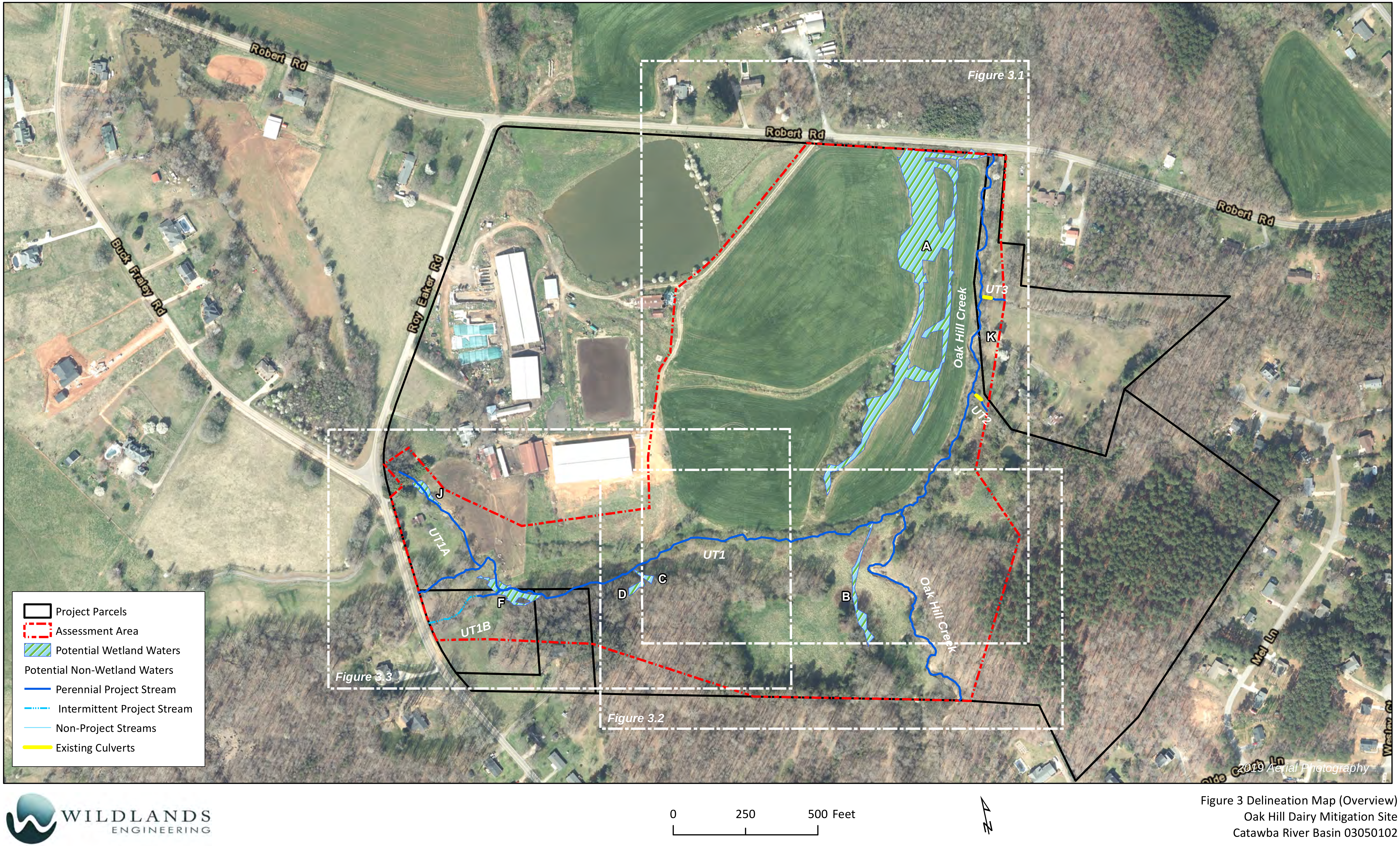
☐ Previous determination(s). File no. and date of response letter:________________________

☐ Other information (please specify):

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 staff member completing PJD 12/7/2020	Signature and date of person requesting PJD (REQUIRED, unless obtaining the signature is impracticable)[1]

[1] Districts may establish timeframes for requester to return signed PJD forms. If the requester does not respond within the established time frame, the district may presume concurrence and no additional follow up is necessary prior to finalizing an action.



WILDLANDS ENGINEERING

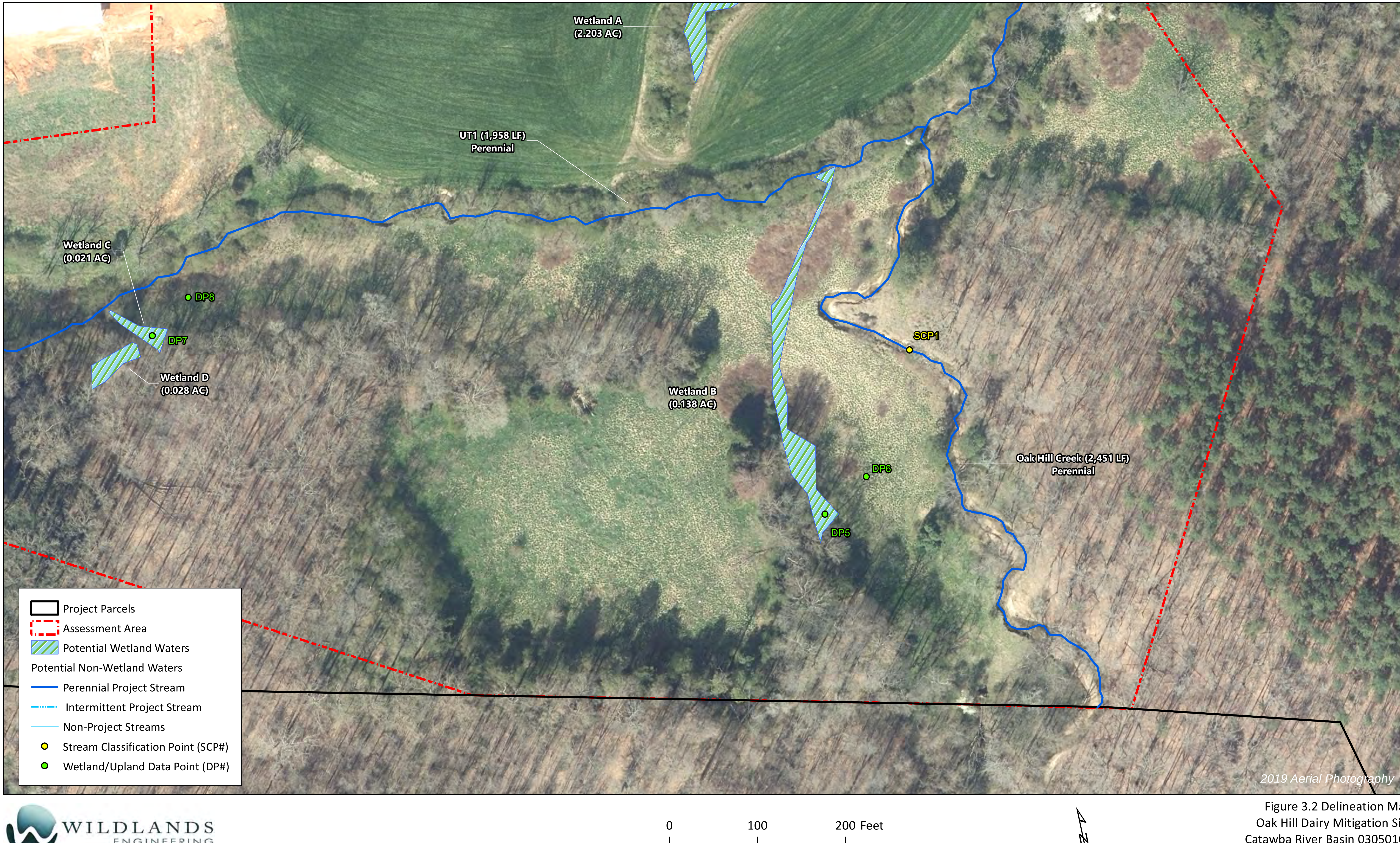
Figure 3 Delineation Map (Overview)
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

WILDLANDS ENGINEERING

Figure 3.1 Delineation Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

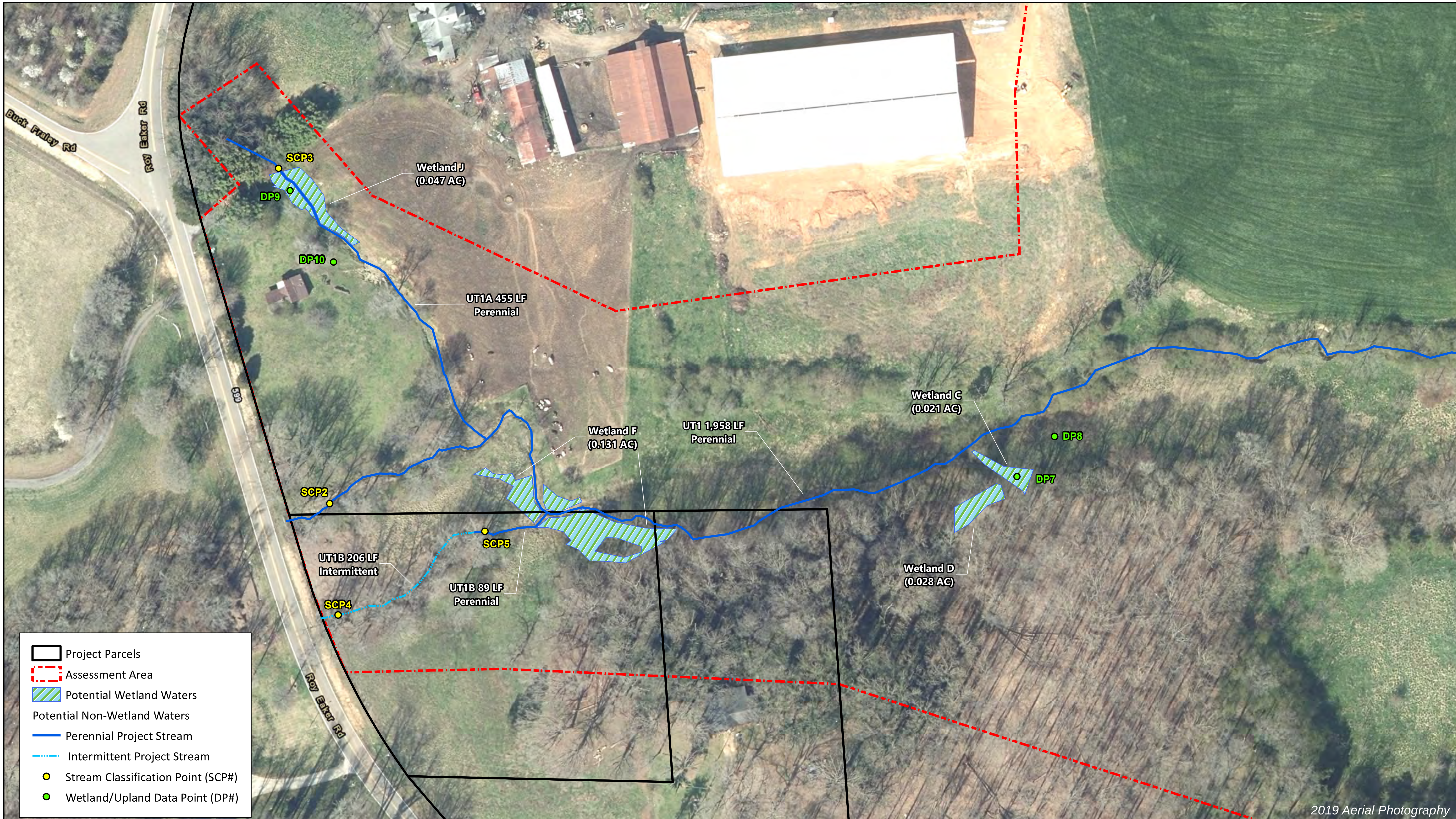
Gaston County, NC



WILDLANDS ENGINEERING

Figure 3.2 Delineation Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

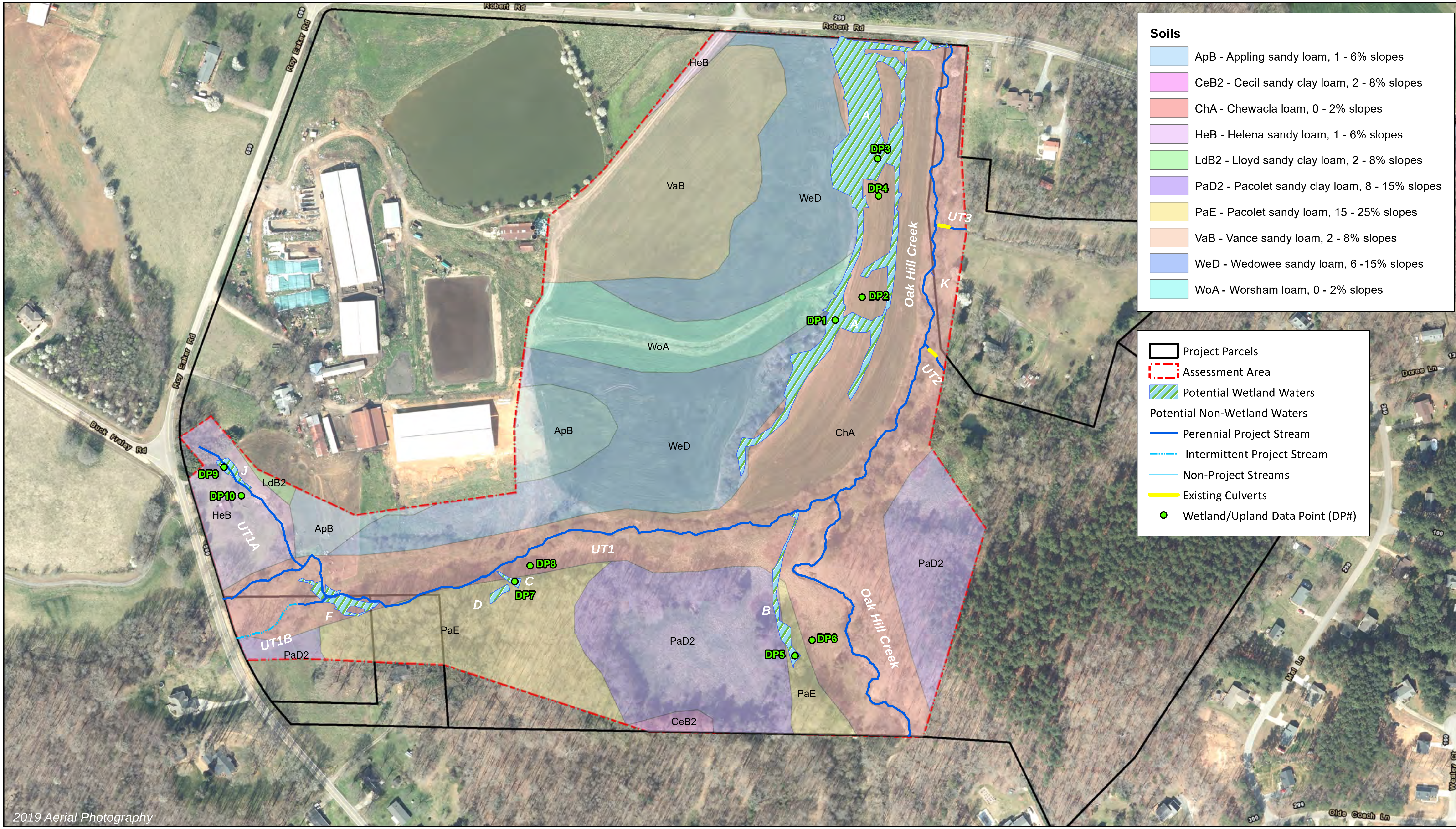
Gaston County, NC



WILDLANDS ENGINEERING

Figure 3.3 Delineation Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC



WILDLANDS ENGINEERING

Figure 4 Soils Map
Oak Hill Dairy Mitigation Site
Catawba River Basin 03050102

Gaston County, NC

APPENDIX 3 – DWR, NCSAM, and NCWAM Identification Forms

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2018	Project/Site: Oak Hill Dairy	Latitude: 35.40269
Evaluator: M Caddell	County: Gaston	Longitude: -81.35156
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 42	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other *e.g. Quad Name*: Oak Hill Trib

A. Geomorphology (Subtotal = 22.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 9)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 10.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: 1 crayfish, 5+ mayfly, 2 scud, damselfly, aquatic worm

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2018	Project/Site: Oak Hill	Latitude: 35.40331
Evaluator: M.Caddell	County: Gaston	Longitude: -81.35741
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 40.5	Stream Determination (circle one) Ephemeral Intermittent Perennial	Other UT1 *e.g. Quad Name:*

A. Geomorphology (Subtotal = 21)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

B. Hydrology (Subtotal = 10)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 9.5)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Start at Ray Farley Road Crossing, 3 salamanders (small) found, damselfly (2), scud (2).

Sketch:

NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2018	Project/Site: Oak Hill Dairy	Latitude: 35.40434
Evaluator: M Caddell	County: Gaston	Longitude: -81.35694
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 33	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** *e.g. Quad Name:* UT1A

A. Geomorphology (Subtotal = 15)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

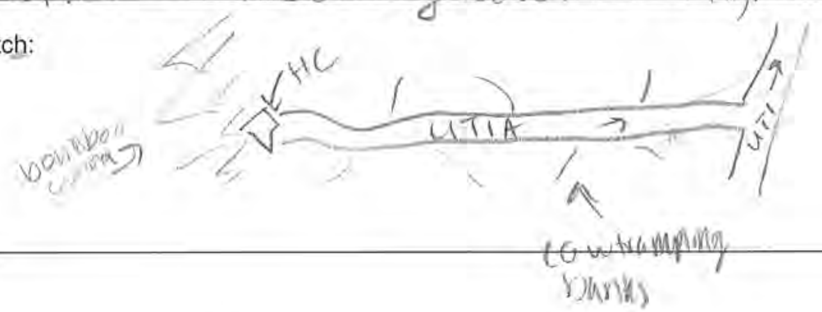
B. Hydrology (Subtotal = 11)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: No macros found - open cattle pasture with no buffer and sandy substrate. High water table seeping from banks.

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2018	Project/Site: Oak Hill Dairy	Latitude: 35.40302
Evaluator: M Caddell	County: Gaston	Longitude: -81.35694
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 5.5+8.5+7.5= 21.5 MC 2/26/21	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	Other UT1B *e.g. Quad Name:* upper

A. Geomorphology (Subtotal = 5.5)	Absent	Weak	Moderate	Strong
1[a] Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

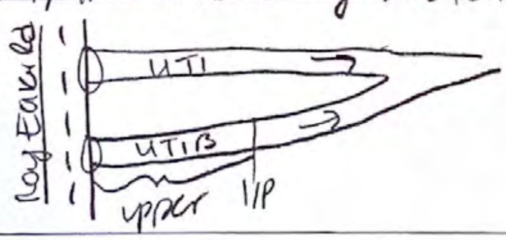
B. Hydrology (Subtotal = 8.5)	Absent	Weak	Moderate	Strong
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 7.5)	Absent	Weak	Moderate	Strong
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: Sandy substrate, 2+ scud, 1 salamander, redox features in soil, iron oxidizing bacteria present

Sketch:



NC DWQ Stream Identification Form Version 4.11

Date: 12/17/2018	**Project/Site:** Oak Hill Dairy	**Latitude:** 35.40327
Evaluator: M. Caddell	**County:** Gaston	**Longitude:** -81.35636
Total Points: *Stream is at least intermittent if ≥ 19 or perennial if ≥ 30** 30.5	**Stream Determination (circle one)** Ephemeral Intermittent Perennial	**Other** UT1B *e.g. Quad Name:* lower

A. Geomorphology (Subtotal = 10.0)	Absent	Weak	Moderate	Strong
1[a]. Continuity of channel bed and bank	0	1	2	3
2. Sinuosity of channel along thalweg	0	1	2	3
3. In-channel structure: ex. riffle-pool, step-pool, ripple-pool sequence	0	1	2	3
4. Particle size of stream substrate	0	1	2	3
5. Active/relict floodplain	0	1	2	3
6. Depositional bars or benches	0	1	2	3
7. Recent alluvial deposits	0	1	2	3
8. Headcuts	0	1	2	3
9. Grade control	0	0.5	1	1.5
10. Natural valley	0	0.5	1	1.5
11. Second or greater order channel	No = 0		Yes = 3	

[a] artificial ditches are not rated; see discussions in manual

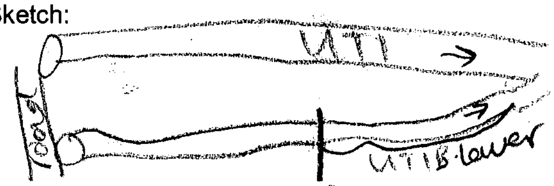
B. Hydrology (Subtotal = 10.5)				
12. Presence of Baseflow	0	1	2	3
13. Iron oxidizing bacteria	0	1	2	3
14. Leaf litter	1.5	1	0.5	0
15. Sediment on plants or debris	0	0.5	1	1.5
16. Organic debris lines or piles	0	0.5	1	1.5
17. Soil-based evidence of high water table?	No = 0		Yes = 3	

C. Biology (Subtotal = 10.0)				
18. Fibrous roots in streambed	3	2	1	0
19. Rooted upland plants in streambed	3	2	1	0
20. Macrobenthos (note diversity and abundance)	0	1	2	3
21. Aquatic Mollusks	0	1	2	3
22. Fish	0	0.5	1	1.5
23. Crayfish	0	0.5	1	1.5
24. Amphibians	0	0.5	1	1.5
25. Algae	0	0.5	1	1.5
26. Wetland plants in streambed	FACW = 0.75; OBL = 1.5 Other = 0			

*perennial streams may also be identified using other methods. See p. 35 of manual.

Notes: 10+ scud, aquatic worms, 1 left handed snail, several [illegible]

Sketch:



I/P @ step/debris jam, more defined bed and banks

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): Oak Hill Dairy
2. Date of evaluation: 12-18-19
3. Applicant/owner name: NCDMS
4. Assessor name/organization: IE/EW/HR (Wildlands Engineering)
5. County: Gaston
6. Nearest named water body on USGS 7.5-minute quad: Indian Creek
7. River basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.402022,-81.351344

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Oak Hill Crk Reach 1
10. Length of assessment reach evaluated (feet): 250
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3-6' ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 25-50'
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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> 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 and 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 LB	Vegetated RB	Wooded LB	Wooded 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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	Oak Hill Dairy	Date of Assessment	12-18-19
Stream Category	Pa3	Assessor Name/Organization	IE/EW/HR (Wildlands Engineering)

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

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

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): Oak Hill Dairy 2. Date of evaluation: 12-18-19
3. Applicant/owner name: NC DMS 4. Assessor name/organization: IE/EW/HR (Wildlands Engineering)
5. County: Gaston 6. Nearest named water body
7. River basin: Catawba on USGS 7.5-minute quad: Indian Creek
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.403192,-81.354470

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): Oak Hill Crk Reach 2 10. Length of assessment reach evaluated (feet): 500
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 4-6 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 20-30 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 LB	Vegetated RB	Wooded LB	Wooded RB	
☒A	☒A	☐A	☐A	≥ 100 feet wide <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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 <u>or</u> predominantly herbaceous species <u>or</u> 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 <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> 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	Oak Hill Dairy	Date of Assessment	12-18-19
Stream Category	Pa3	Assessor Name/Organization	IE/EW/HR (Wildlands Engineering)

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**LOW**	
(4) Floodplain Access	**LOW**	
(4) Wooded Riparian Buffer	**LOW**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**MEDIUM**	
(4) Sediment Transport	**MEDIUM**	
(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	**HIGH**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**HIGH**	
(2) Indicators of Stressors	**NO**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**MEDIUM**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**MEDIUM**	
(3) In-stream Habitat	**MEDIUM**	
(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): Oak Hill Dairy
2. Date of evaluation: 12-18-19
3. Applicant/owner name: NC DMS
4. Assessor name/organization: IE/EW/HR (Wildlands Engineering)
5. County: Gaston
6. Nearest named water body on USGS 7.5-minute quad: Indian Creek
7. River basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.405118,-81.350040

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT1
10. Length of assessment reach evaluated (feet): 500
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3-4 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 12-20
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	Oak Hill Dairy	Date of Assessment	12-18-19
Stream Category	Pa3	Assessor Name/Organization	IE/EW/HR (Wildlands Engineering)

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

Function Class Rating Summary	USACE/ All Streams	NCDWR Intermittent
(1) Hydrology	**LOW**	
(2) Baseflow	**HIGH**	
(2) Flood Flow	**LOW**	
(3) Streamside Area Attenuation	**MEDIUM**	
(4) Floodplain Access	**MEDIUM**	
(4) Wooded Riparian Buffer	**MEDIUM**	
(4) Microtopography	**LOW**	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(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	**MEDIUM**	
(2) Baseflow	**HIGH**	
(2) Streamside Area Vegetation	**HIGH**	
(3) Upland Pollutant Filtration	**HIGH**	
(3) Thermoregulation	**MEDIUM**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(2) Intertidal Zone Filtration	NA	
(1) Habitat	**LOW**	
(2) In-stream Habitat	**LOW**	
(3) Baseflow	**HIGH**	
(3) Substrate	**MEDIUM**	
(3) Stream Stability	**LOW**	
(3) In-stream Habitat	**LOW**	
(2) Stream-side Habitat	**MEDIUM**	
(3) Stream-side Habitat	**MEDIUM**	
(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): Oak Hill Dairy
2. Date of evaluation: 12-19-19
3. Applicant/owner name: NC DMS
4. Assessor name/organization: IE (Wildlands Engineering)
5. County: Gaston
6. Nearest named water body on USGS 7.5-minute quad: Indian Creek
7. River basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach):

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT1A (trampled feed lot trib)
10. Length of assessment reach evaluated (feet): 200
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 3-6 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 3-10
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 LB	Vegetated RB	Wooded LB	Wooded RB	
☐A	☒A	☐A	☐A	≥ 100 feet wide <u>or</u> 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 <u>or</u> 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 <u>or</u> 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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 <u>or</u> predominantly herbaceous species <u>or</u> 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 <u>or</u> communities with non-native invasive species present, but not dominant, over a large portion of the expected strata <u>or</u> communities missing understory but retaining canopy trees.
☒C	☒C	Vegetation is severely disturbed in terms of species diversity or proportions. Mature canopy is absent <u>or</u> communities with non-native invasive species dominant over a large portion of expected strata <u>or</u> communities composed of planted stands of non-characteristic species <u>or</u> communities inappropriately composed of a single species <u>or</u> 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	Oak Hill Dairy	Date of Assessment	12-19-19
Stream Category	Pb1	Assessor Name/Organization	IE (Wildlands Engineering)

Notes of Field Assessment Form (Y/N)	NO
Presence of regulatory considerations (Y/N)	NO
Additional stream information/supplementary measurements included (Y/N)	NO
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	NA	
(3) Stream Stability	**LOW**	
(4) Channel Stability	**LOW**	
(4) Sediment Transport	**MEDIUM**	
(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	**LOW**	
(2) Indicators of Stressors	**YES**	
(2) Aquatic Life Tolerance	**HIGH**	
(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): Oak Hill Dairy
2. Date of evaluation: 12-19-19
3. Applicant/owner name: NC DMS
4. Assessor name/organization: IE (Wildlands Engineering)
5. County: Gaston
6. Nearest named water body on USGS 7.5-minute quad: Indian Creek
7. River basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.403169,-81.356542

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT1B (Intermittent)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 0.5-1.0 ☒Unable to assess channel depth.
12. Channel width at top of bank (feet): 2-3
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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> 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 LB	Vegetated RB	Wooded LB	Wooded 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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	Oak Hill Dairy	Date of Assessment	12-19-19
Stream Category	Pa1	Assessor Name/Organization	IE (Wildlands Engineering)

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

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

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): Oak Hill Dairy
2. Date of evaluation: 12-19-19
3. Applicant/owner name: NC DMS
4. Assessor name/organization: IE (Wildlands Engineering)
5. County: Gaston
6. Nearest named water body on USGS 7.5-minute quad: Indian Creek
7. River basin: Catawba
8. Site coordinates (decimal degrees, at lower end of assessment reach): 35.403203,-81.356171

STREAM INFORMATION: (depth and width can be approximations)

9. Site number (show on attached map): UT1B (Perennial)
10. Length of assessment reach evaluated (feet): 100
11. Channel depth from bed (in riffle, if present) to top of bank (feet): 1 - 3 ☐Unable to assess channel depth.
12. Channel width at top of bank (feet): 2-3
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 <u>or</u> fill to the point of obstructing flow <u>or</u> a channel choked with aquatic macrophytes <u>or</u> ponded water <u>or</u> 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 LB	Vegetated RB	Wooded LB	Wooded 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 LB	Abuts RB	< 30 feet LB	< 30 feet RB	30-50 feet LB	30-50 feet 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	Oak Hill Dairy	Date of Assessment	12-19-19
Stream Category	Pa1	Assessor Name/Organization	IE (Wildlands Engineering)

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

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

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Oak Hill Dairy Mitigation Site	Date of Evaluation	5/15/2020
Applicant/Owner Name	Wildlands Engineering, Inc.	Wetland Site Name	Wetland A
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Jordan Hessler
Level III Ecoregion	Piedmont	Nearest Named Water Body	Indian Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050102
County	Gaston	NCDWR Region	Mooresville
◯ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.404531/-81.351076

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately 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 of 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 for each group below. 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 foot 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 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). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

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 dainage and/or overbank flow from affectio 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.

7b. How much of the first 50 feet from the bank is weltand? (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 tributary 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. 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 <u>or</u> 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 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 evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric 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, fields (pasture open and agriculture), or 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 directiions? 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, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> 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)

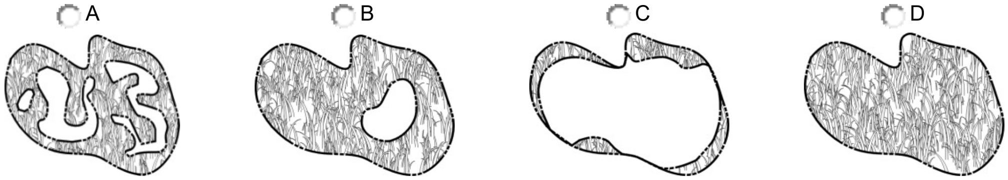
Include both natural debris and man-placed natural debris.

( ) 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

Wetland A encompases a toe ditch and a plowed agricultural field that is planted in corn.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland A	Date	5/15/2020
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Jordan Hessler

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)	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	**MEDIUM**
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	**LOW**

Function Rating Summary

Function	Metrics/Notes	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 WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:		NCDWR #:	
Project Name	Oak Hill Dairy Mitigation Site	Date of Evaluation	5/15/2020
Applicant/Owner Name	Wildlands Engineering, Inc. (WEI)	Wetland Site Name	Wetland G,H, and I
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Jordan Hessler/WEI
Level III Ecoregion	Piedmont	Nearest Named Water Body	Indian Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050102
County	Gaston	NCDWR Region	Mooresville
○ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.405663/-81.350422

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately 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 of 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 for each group below. 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 foot 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 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). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

WS	5M	2M	
[x] A	[x] A	[x] A	≥ 10% impervious surfaces
[x] B	[x] B	[x] B	Confined animal operations (or other local, concentrated source of pollutants)
[x] C	[x] C	[x] C	≥ 20% coverage of pasture
[ ] D	[ ] D	[ ] D	≥ 20% coverage of agricultural land (regularly plowed land)
[x] E	[x] E	[x] 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 dainage and/or overbank flow from affectio 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.

7b. How much of the first 50 feet from the bank is weltand? (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 tributary 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. 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 <u>or</u> 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 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 evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric 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, fields (pasture open and agriculture), or 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 directiions? 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, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> 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)

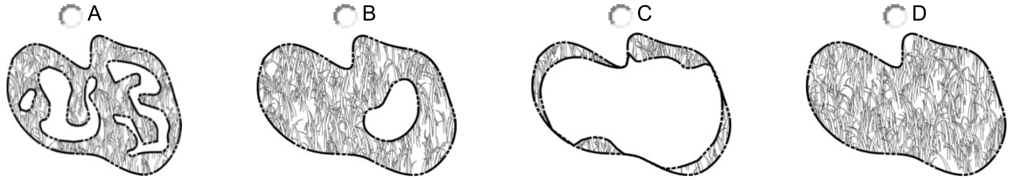
Include both natural debris and man-placed natural debris.

( ) 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

Wetlands G, H, and I are all within an agricultural field recently planted in corn. In addition, a ditch has been excavated and connects all three wetlands to drain to Wetland A.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland G,H, and I	Date	5/15/2020
Wetland Type	Bottomland Hardwood Forest	Assessor Name/Organization	Jordan Hessler/WEI

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)	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	**MEDIUM**
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	**LOW**

Function Rating Summary

Function	Metrics/Notes	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 WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:	NCDWR #:
Project Name: Oak Hill Dairy Mitigation Site	Date of Evaluation: 5/15/2020
Applicant/Owner Name: Wildlands Engineering, Inc. (WEI)	Wetland Site Name: Wetland B
Wetland Type: Headwater Forest	Assessor Name/Organization: Jordan Hessler/WEI
Level III Ecoregion: Piedmont	Nearest Named Water Body: Indian Creek
River Basin: Catawba	USGS 8-Digit Catalogue Unit: 03050102
County: Gaston	NCDWR Region: Mooresville
◯ Yes ◉ No Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees): 35.402112/-81.352008

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately 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 of 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 for each group below. 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 foot 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 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 <u>and</u> within the watershed draining to the assessment area (5M), and within 2 miles <u>and</u> within the watershed draining to the assessment area (2M). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

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 <u>or</u> hydrologic alterations that prevent dainage <u>and/or</u> overbank flow from affectio 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.

7b. How much of the first 50 feet from the bank is weltand? (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 <u>or</u> 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 tributary or other open water sheltered or exposed?
- ◉ Sheltered – adjacent open water with width < 2500 feet <u>and</u> no regular boat traffic.
- ◯ Exposed – adjacent open water with width ≥ 2500 feet <u>or</u> 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. 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 <u>or</u> 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 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 evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric 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, fields (pasture open and agriculture), or 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 directiions? 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, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> 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)

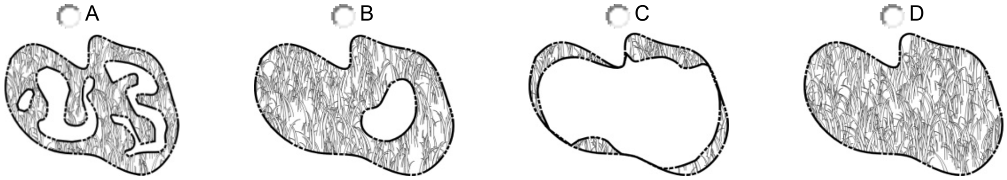
Include both natural debris and man-placed natural debris.

○ 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 <u>and</u> 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 <u>and</u> overland flow are severely altered in the assessment area.

Notes

Wetland B is in active cattle grazing. The wetland has been ditched to drain to UT1 and the incision on UT1 and Oak Hill Creek would make overbank flooding very rare if at all.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland B	Date	5/15/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jordan Hessler/WEI

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)	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	**HIGH**
Water Quality	Pathogen Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	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	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#: NCDWR #:

Project Name	Oak Hill Dairy Mitigation Site	Date of Evaluation	5/15/2020
Applicant/Owner Name	Wildlands Engineering, Inc. (WEI)	Wetland Site Name	Wetland C, D, and E
Wetland Type	Headwater Forest	Assessor Name/Organization	Jordan Hessler/WEI
Level III Ecoregion	Piedmont	Nearest Named Water Body	Indian Creek
River Basin	Catawba	USGS 8-Digit Catalogue Unit	03050102
County	Gaston	NCDWR Region	Mooresville
◯ Yes ◉ No	Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees)	35.403028/-81.354322

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately 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 of 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 for each group below. 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 foot 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 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). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

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 dainage and/or overbank flow from affectio 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.

7b. How much of the first 50 feet from the bank is weltand? (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 tributary 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. 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 <u>or</u> 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 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 evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric 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, fields (pasture open and agriculture), or 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 directiions? 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, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> 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)

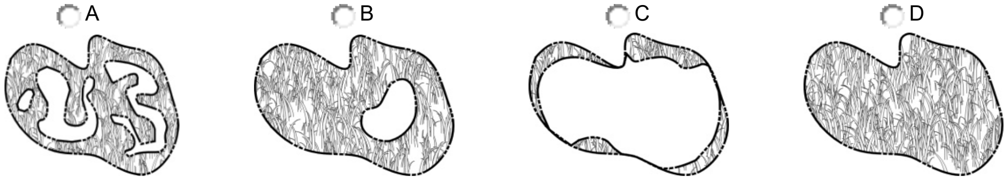
Include both natural debris and man-placed natural debris.

( ) 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 <u>and</u> 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 <u>and</u> overland flow are severely altered in the assessment area.

Notes

Wetland C, D, and E is in a fallow field that was previously used for agriculture.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland C, D, and E	Date	5/15/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jordan Hessler/WEI

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)	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	**HIGH**
Water Quality	Pathogen Change	Condition	**LOW**
		Condition/Opportunity	**LOW**
		Opportunity Presence? (Y/N)	**NO**
	Particulate Change	Condition	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	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	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**MEDIUM**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

NC WAM WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:	NCDWR #:
Project Name: Oak Hill Dairy Mitigation Site	Date of Evaluation: 5/15/2020
Applicant/Owner Name: Wildlands Engineering, Inc. (WEI)	Wetland Site Name: Wetland F
Wetland Type: Headwater Forest	Assessor Name/Organization: Jordan Hessler/WEI
Level III Ecoregion: Piedmont	Nearest Named Water Body: Indian Creek
River Basin: Catawba	USGS 8-Digit Catalogue Unit: 03050102
County: Gaston	NCDWR Region: Mooresville
○ Yes ◉ No Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees): 35.403028/-81.354322

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately 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 of 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 for each group below. 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 foot 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 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). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

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 dainage and/or overbank flow from affectio 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.

7b. How much of the first 50 feet from the bank is weltand? (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 tributary 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. 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 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 evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric 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, fields (pasture open and agriculture), or 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 directiions? 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)

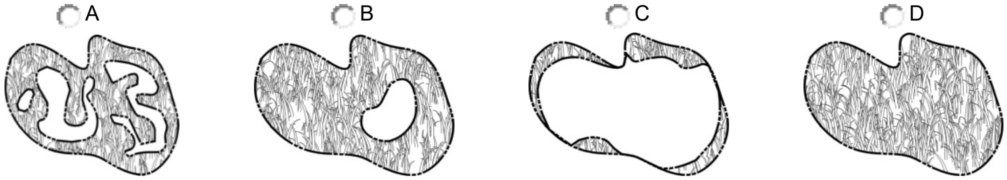
Include both natural debris and man-placed natural debris.

( ) 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

Wetland F is heavily impacted by grazing cattle.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland F	Date	5/15/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jordan Hessler/WEI

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)	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	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	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	**LOW**

Function Rating Summary

Function	Metrics/Notes	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 WETLAND ASSESSMENT FORM
Accompanies User Manual Version 5

USACE AID#:	NCDWR #:
Project Name: Oak Hill Dairy Mitigation Site	Date of Evaluation: 5/15/2020
Applicant/Owner Name: Wildlands Engineering, Inc. (WEI)	Wetland Site Name: Wetland J
Wetland Type: Headwater Forest	Assessor Name/Organization: Jordan Hessler/WEI
Level III Ecoregion: Piedmont	Nearest Named Water Body: Indian Creek
River Basin: Catawba	USGS 8-Digit Catalogue Unit: 03050102
County: Gaston	NCDWR Region: Mooresville
○ Yes ● No Precipitation within 48 hrs?	Latitude/Longitude (deci-degrees): 35.404293/-81.356829

Evidence of stressors affecting the assessment area (may not be within the assessment area)
Please circle and/or make note on last page if evidence of stressors is apparent. Consider departure from reference, if appropriate, in recent past (for instance, approximately 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 of 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 for each group below. 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 foot 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 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). Effective riparian buffers are considered to be 50 feet wide in the Coastal Plain and Piedmont ecoregions and 30 feet wide in the Blue Ridge Mountains ecoregion.

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 dainage and/or overbank flow from affectio 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.

7b. How much of the first 50 feet from the bank is weltand? (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 tributary 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. 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 <u>or</u> 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 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 evaluates whether the wetland is well connected (Well) and/or loosely connected (Loosely) to the landscape patch, the contiguous metric 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, fields (pasture open and agriculture), or 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 directiions? 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, <u>or</u> expected species are unnaturally absent (planted stands of non-characteristic species <u>or</u> at least one stratum inappropriately composed of a single species), <u>or</u> 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)

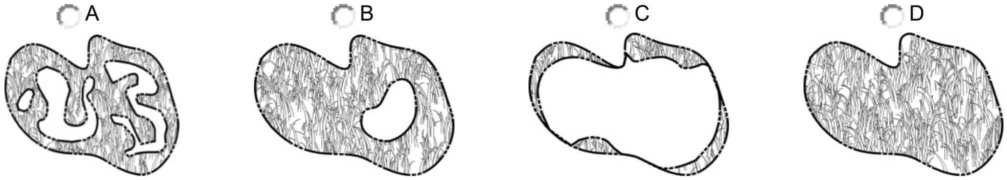
Include both natural debris and man-placed natural debris.

( ) 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 <u>and</u> 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 <u>and</u> overland flow are severely altered in the assessment area.

Notes

Wetland J is a trampled hillside headwater wetland along UT1a. The wetland is heavily impacted by grazing cattle.

NC WAM Wetland Rating Sheet
Accompanies User Manual Version 5.0

Wetland Site Name	Wetland J	Date	5/15/2020
Wetland Type	Headwater Forest	Assessor Name/Organization	Jordan Hessler/WEI

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)	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	**LOW**
		Condition/Opportunity	NA
		Opportunity Presence? (Y/N)	NA
	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	**LOW**

Function Rating Summary

Function	Metrics/Notes	Rating
Hydrology	Condition	**LOW**
Water Quality	Condition	**LOW**
	Condition/Opportunity	**LOW**
	Opportunity Presence? (Y/N)	**NO**
Habitat	Condition	**LOW**

Overall Wetland Rating **LOW**

APPENDIX 4 – Supplementary Design Information

Existing Conditions Geomorphic Parameters

Oak Hill Dairy

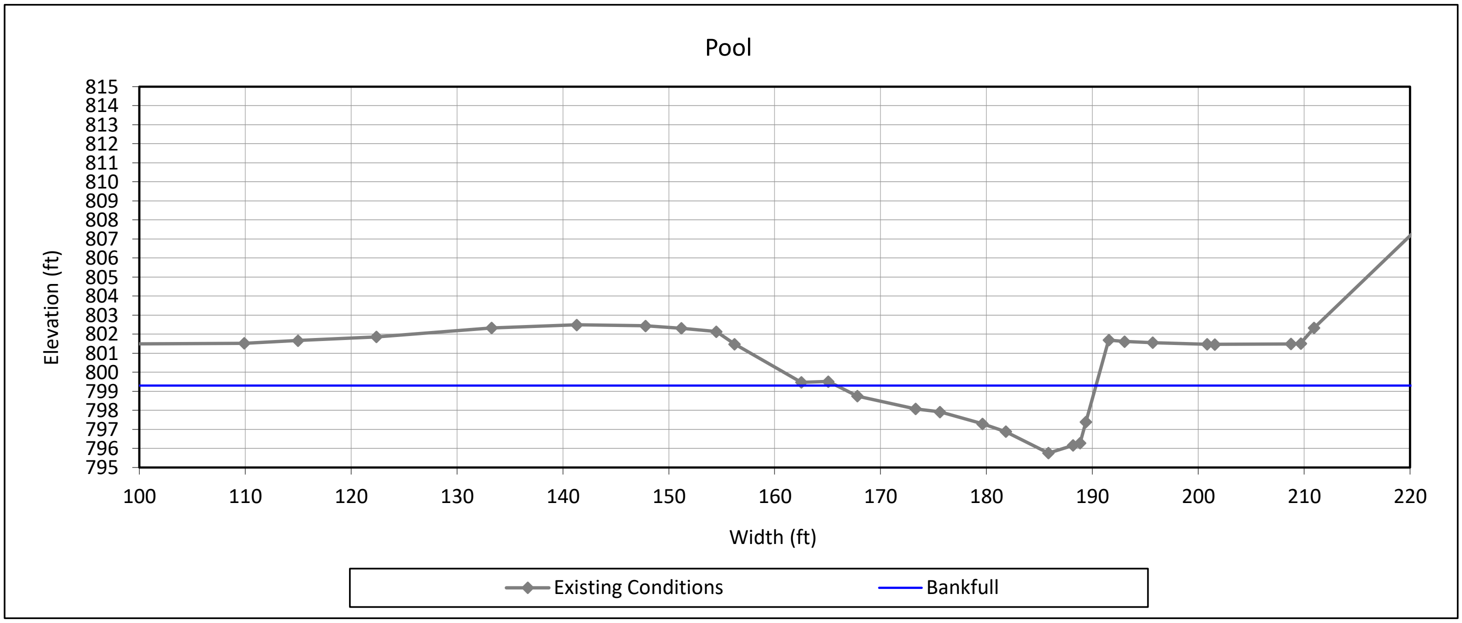
Parameter	Notation	Units	Oak Hill Creek Reach 1		Oak Hill Creek Reach 2		Oak Hill Creek Reach 3		Oak Hill Creek Reach 4		UT1 Reach 1		UT1 Reach 2		UT1A		UT1B	
			min	max	min	max	min	max	min	max	min	max	min	max	min	max	min	max
stream type			B4c		E4		C4		E5		F4		G4		F5b		Cb	
drainage area	DA	sq mi	0.95		0.96		1.54		1.67		0.47		0.52		0.02		0.01	
bankfull cross-sectional area	A_{bkf}	SF	27.5		28.1		29.1		35.1		10.7		14.1		1.9		1.1	
avg velocity during bankfull event	v_{bkf}	fps	3.5		4.7		3.3		3.5		2.9		3.7		1.6		2.0	
width at bankfull	w_{bkf}	feet	19.9		14.6		19.3		19.8		15.9		9.1		9.9		4.8	
maximum depth at bankfull	d_{max}	feet	1.7		3.0		2.2		2.3		1.6		2.2		0.4		0.4	
mean depth at bankfull	d_{bkf}	feet	1.4		1.9		1.5		1.8		0.7		1.5		0.2		0.2	
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14.4		7.6		12.9		11.2		23.4		5.9		51.0		22.0	
low bank height		feet	4.2		5.9		5.5		5.3		3.9		5.4		3.7		0.4	
bank height ratio	BHR		2.4		2.0		2.6		2.3		2.4		2.4		9.6		1.0	
floodprone area width	w_{fpa}	feet	40.0		79.0		49.8		90.7		24.5		16.2		12.2		16.0	
entrenchment ratio	ER		2.0		5.4		2.6		4.6		1.5		1.8		1.2		3.3	
max pool depth at bankfull	d_{pool}	feet	3.5		4.4		3.7		3.1		1.6	1.7	3.0		N/A			
pool depth ratio	d_{pool}/d_{bkf}		2.5		2.3		2.5		1.7		2.3	2.4	2.0		N/A			
pool width at bankfull	w_{pool}	feet	24.5		18.7		13.7		17.9		16.2		12.9		N/A			
pool width ratio	w_{pool}/w_{bkf}		1.2		1.3		0.7		0.9		1.0		1.4		N/A			
Bkf pool cross-sectional area	A_{pool}	SF	44.2		59.1		29.9		40.3		13.5		17.9		N/A			
pool area ratio	A_{pool}/A_{bkf}		1.6		2.1		1.3		1.1		1.3		1.3		N/A			
pool-pool spacing	p-p	feet	27.8	153.0	48.0	86.0	83.0	117.0	31.0	122.0	35.5	58.3	19.3	57.0	N/A	N/A		
pool-pool spacing ratio	$p\text{-}p/W_{bkf}$		1.4	7.7	3.3	5.9	4.3	6.1	1.6	6.2	2.2	3.7	2.1	6.3	N/A	N/A		
valley slope	S_{valley}	feet/ foot	0.0085		0.0062		0.0060		0.0024		0.0133		0.0081		0.0338			
channel slope	$S_{channel}$	feet/ foot	0.0070		0.0050		0.0060		0.0071		0.0045		0.0070		0.0250		0.0229	
sinuosity	K		1.21		1.14		1.15		1.15		1.03		1.15		1.07			
belt width	w_{blt}	feet	60.0	70.0	36.0	52.0	26.0	40.0	17.0	33.0	18.0	31.0	14.5	15.5	N/A	N/A		
meander width ratio	w_{blt}/w_{bkf}		3.0	3.5	2.5	3.6	1.3	2.1	0.9	1.7	1.1	1.9	1.6	1.7	N/A	N/A		
meander length	L_m	feet	150.0	175.0	134.0	150.0	128.0	220.0	113.0	120.0	56.0	70.0	30.0	51.0	N/A	N/A		
meander length ratio	L_m/w_{bkf}		7.5	8.8	9.2	10.3	6.6	11.4	5.7	6.1	3.5	4.4	3.3	5.6	N/A	N/A		
Linear Wavelength	LW		137.0	212.0	111.0	123.0	109.0		76.0	87.0	74.0	112.0	67.0	99.0	N/A	N/A		
Linear Wavelength Ratio	LW/w_{bkf}		6.9	10.7	7.6	8.4	5.6		3.8	4.4	4.7	7.0	7.4	10.9	N/A	N/A		
radius of curvature	R_c	feet	33.0	47.0	20.0	25.0	15.0	38.0	20.0	44.0	18.0	30.0	18.0	30.0	N/A	N/A		
radius of curvature ratio	R_c/ w_{bkf}		1.7	2.4	1.4	1.7	0.8	2.0	1.0	2.2	1.1	1.9	2.0	3.3	N/A	N/A		

Notes: (1) For UT1A, stream pattern parameters other than sinuosity not reported due to limited channel pattern inherent of stream types (step-pool morphology) located within steep valleys.

(2) UT1A is a channelized and cattle-trampled stream channel with limited bed form profile variability - no pool parameters obtained. Stream profile parameters not reported for Enhancement II reaches.

(3) Stream parameters not reported for preservation reach UT1B.

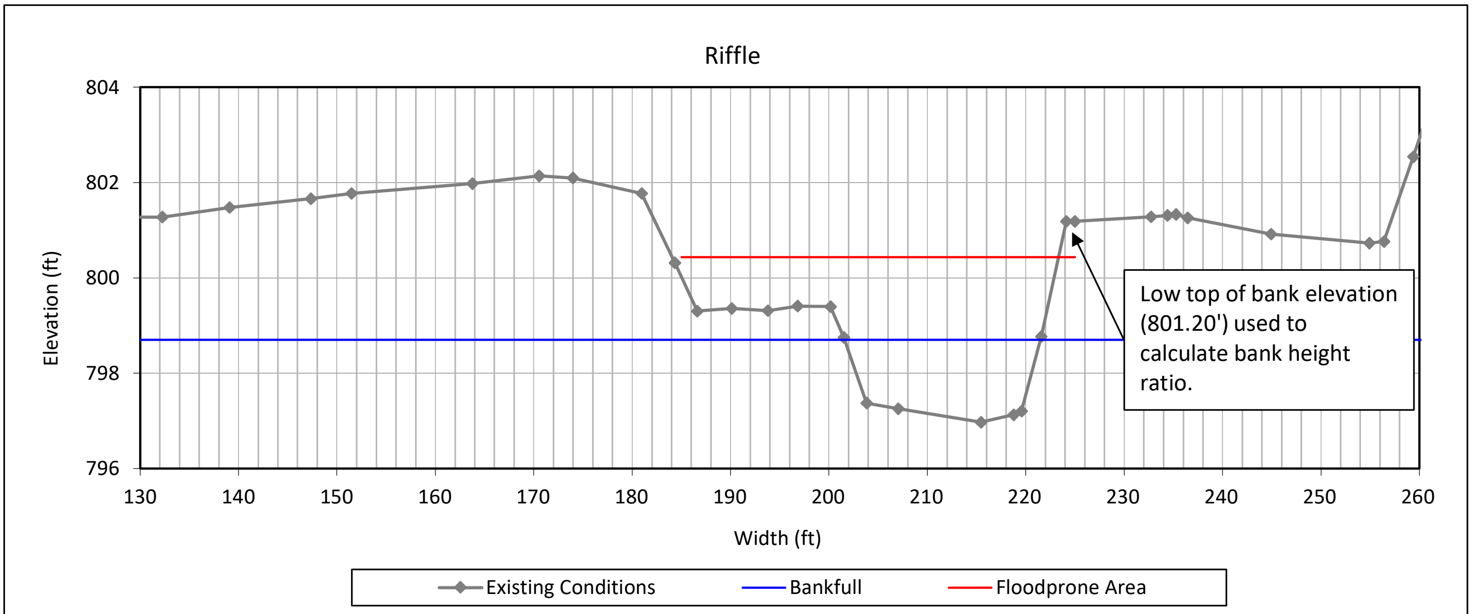
Cross Section 1, OHC Reach 1



Bankfull Dimensions	
44.2	x-section area (ft.sq.)
24.5	width (ft)
1.8	mean depth (ft)
3.5	max depth (ft)
26.8	wetted perimeter (ft)
1.6	hyd radi (ft)
13.6	width-depth ratio
1.7	low bank height ratio

View Upstream

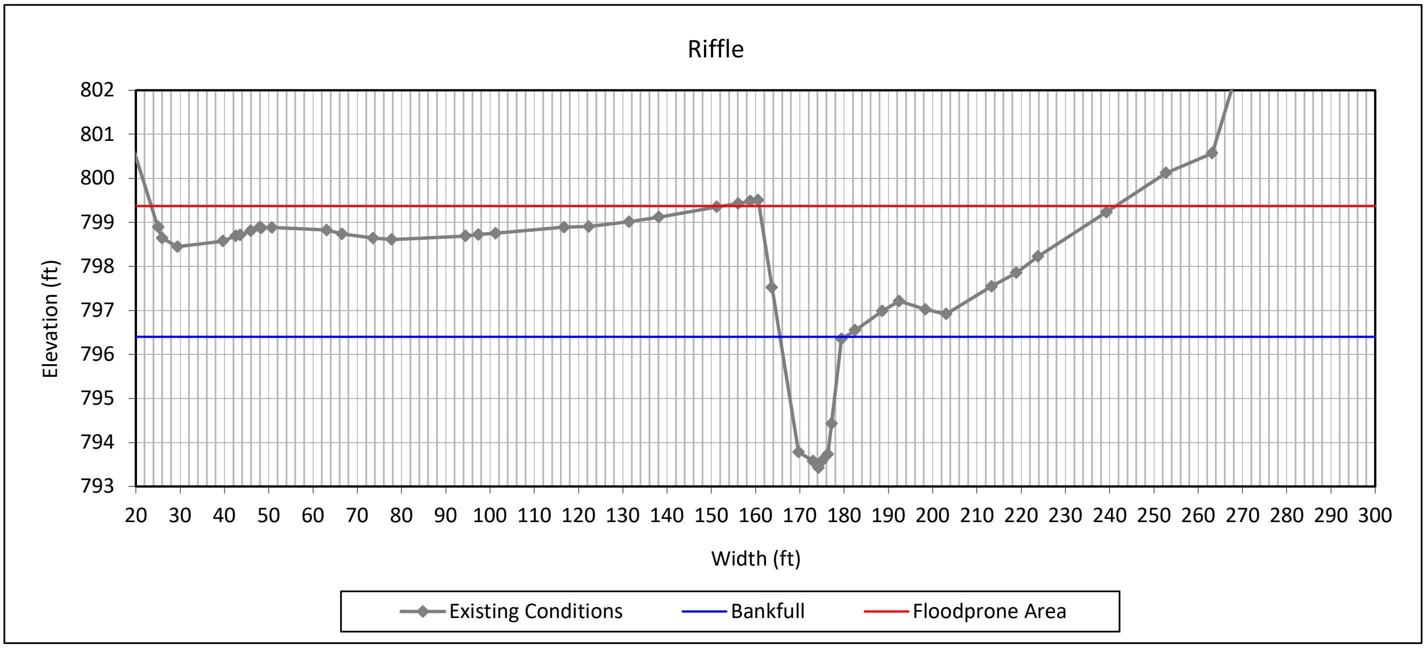
Cross Section 2, OHC Reach 1



Bankfull Dimensions	
27.5	x-section area (ft.sq.)
19.9	width (ft)
1.4	mean depth (ft)
1.7	max depth (ft)
20.8	wetted perimeter (ft)
1.3	hyd radi (ft)
14.4	width-depth ratio
40.0	W flood prone area (ft)
2.0	entrenchment ratio
2.4	low bank height ratio

View Upstream

Cross Section 3, OHC Reach 2

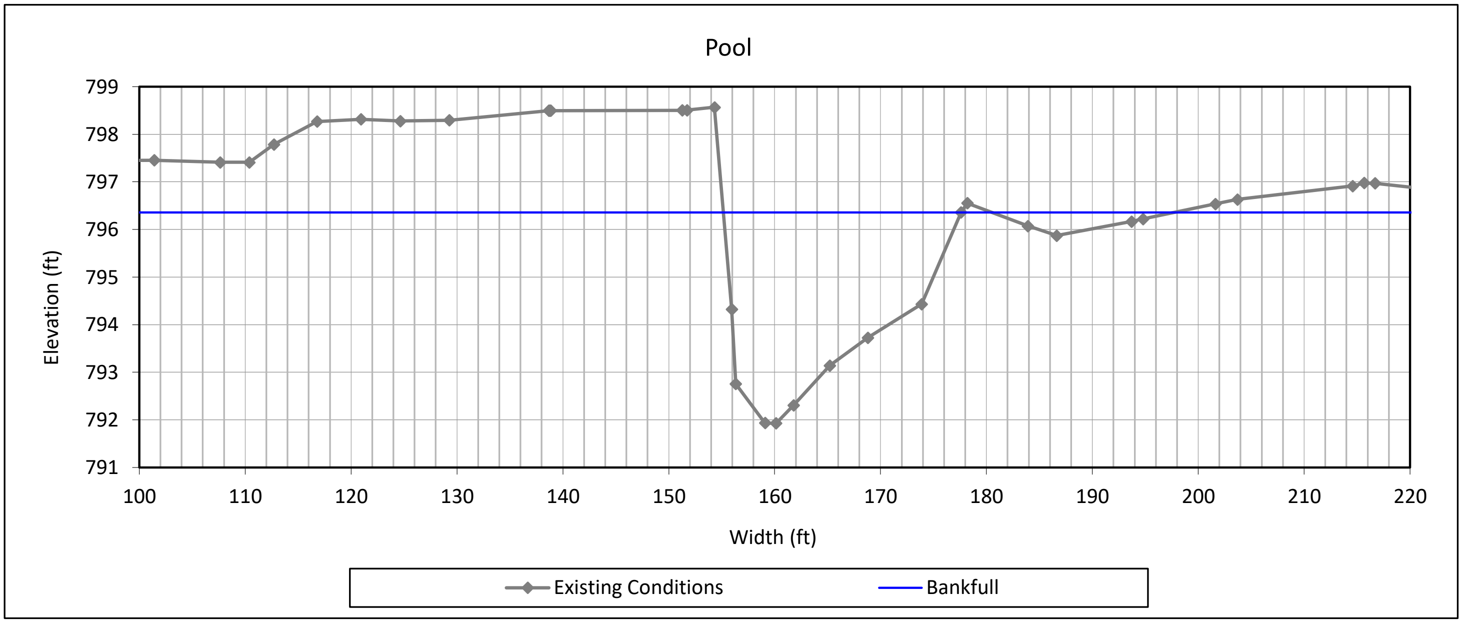


Bankfull Dimensions

28.1	x-section area (ft.sq.)
14.6	width (ft)
1.9	mean depth (ft)
3.0	max depth (ft)
16.4	wetted perimeter (ft)
1.7	hyd radi (ft)
7.6	width-depth ratio
79.0	W flood prone area (ft)
5.4	entrenchment ratio
2.0	low bank height ratio

View Upstream

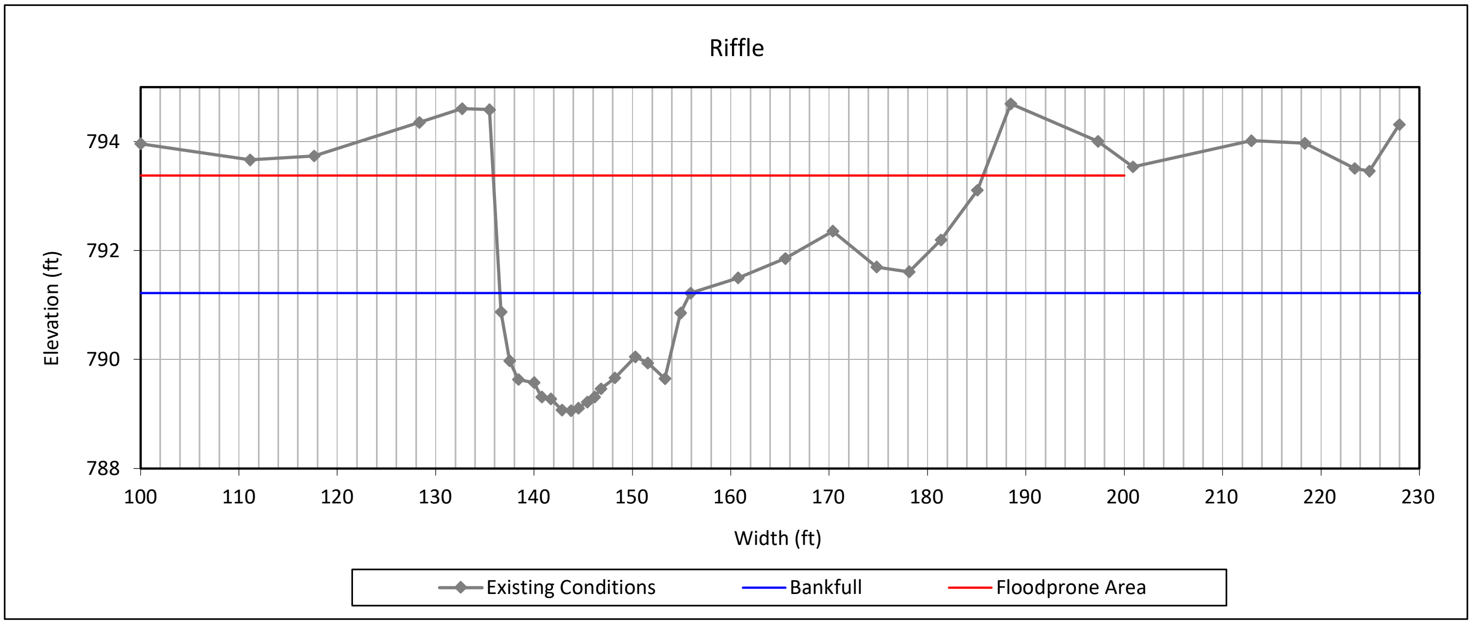
Cross Section 4, OHC Reach 2



Bankfull Dimensions	
59.1	x-section area (ft.sq.)
18.7	width (ft)
3.2	mean depth (ft)
4.4	max depth (ft)
21.7	wetted perimeter (ft)
2.7	hyd radi (ft)
5.9	width-depth ratio
1.0	low bank height ratio

View Downstream

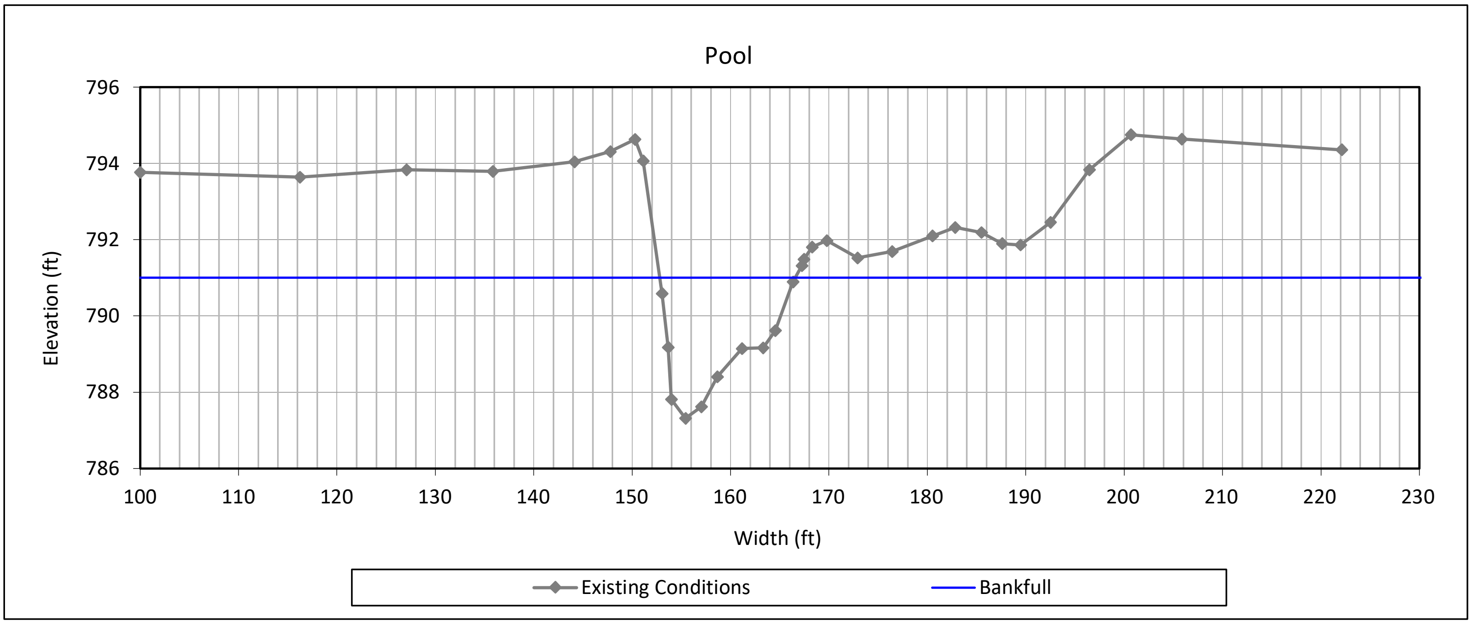
Cross Section 5, OHC Reach 3



Bankfull Dimensions	
29.1	x-section area (ft.sq.)
19.3	width (ft)
1.5	mean depth (ft)
2.2	max depth (ft)
20.4	wetted perimeter (ft)
1.4	hyd radi (ft)
12.8	width-depth ratio
49.8	W flood prone area (ft)
2.6	entrenchment ratio
2.6	low bank height ratio

View Downstream

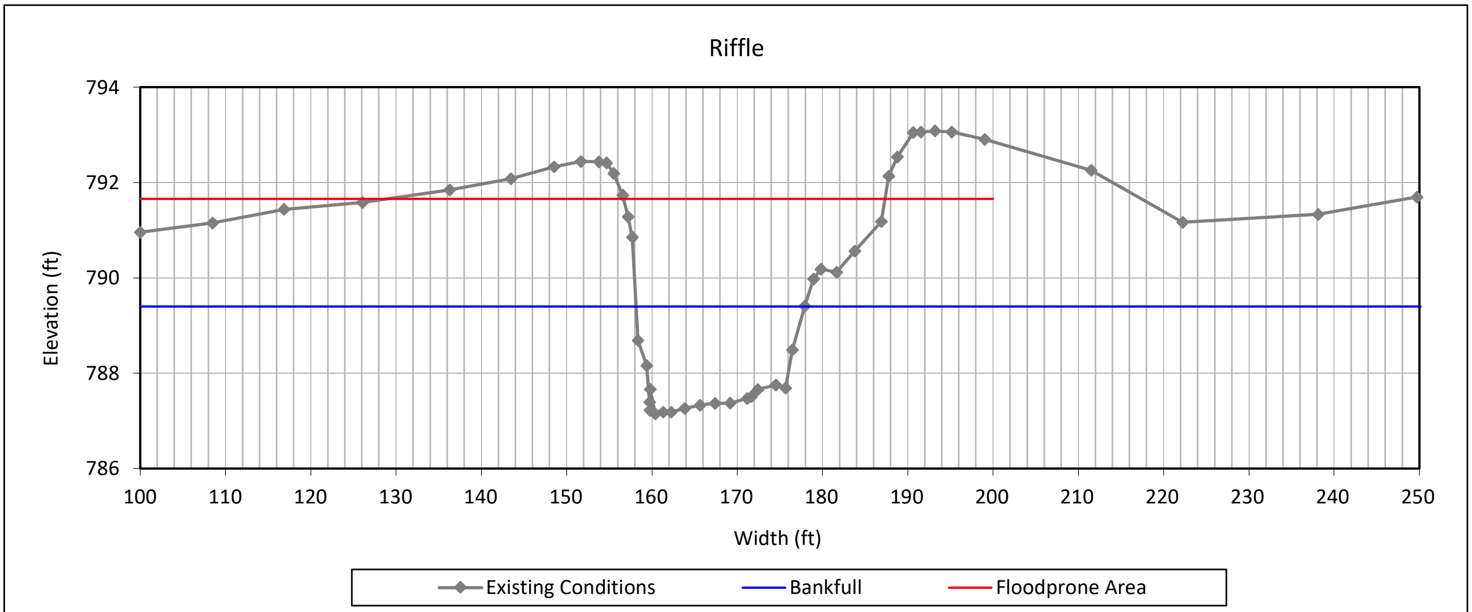
Cross Section 6, OHC Reach 3



Bankfull Dimensions	
29.9	x-section area (ft.sq.)
13.7	width (ft)
2.2	mean depth (ft)
3.7	max depth (ft)
16.9	wetted perimeter (ft)
1.8	hyd radi (ft)
6.3	width-depth ratio
122.1	W flood prone area (ft)
8.9	entrenchment ratio
2.0	low bank height ratio

View Downstream

Cross Section 7, OHC Reach 4

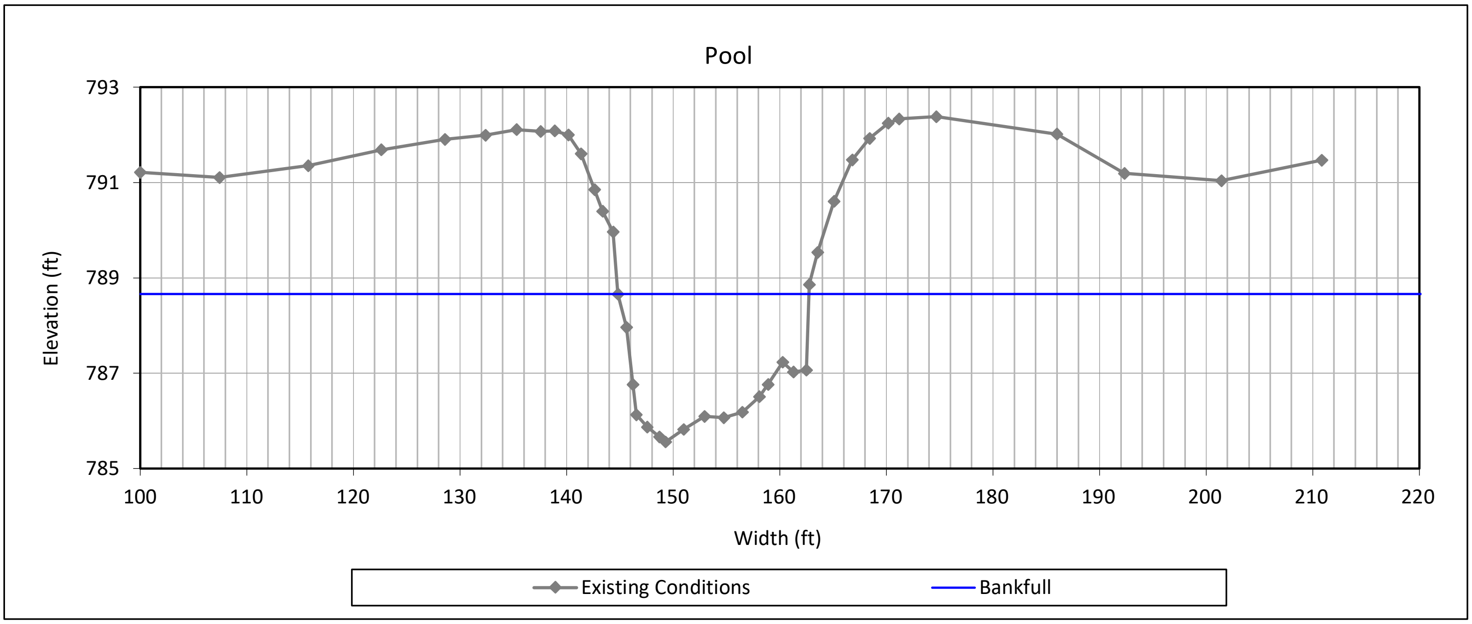


Bankfull Dimensions

35.1	x-section area (ft.sq.)
19.8	width (ft)
1.8	mean depth (ft)
2.3	max depth (ft)
22.3	wetted perimeter (ft)
1.6	hyd radi (ft)
11.2	width-depth ratio
90.7	W flood prone area (ft)
4.6	entrenchment ratio
2.3	low bank height ratio

View Downstream

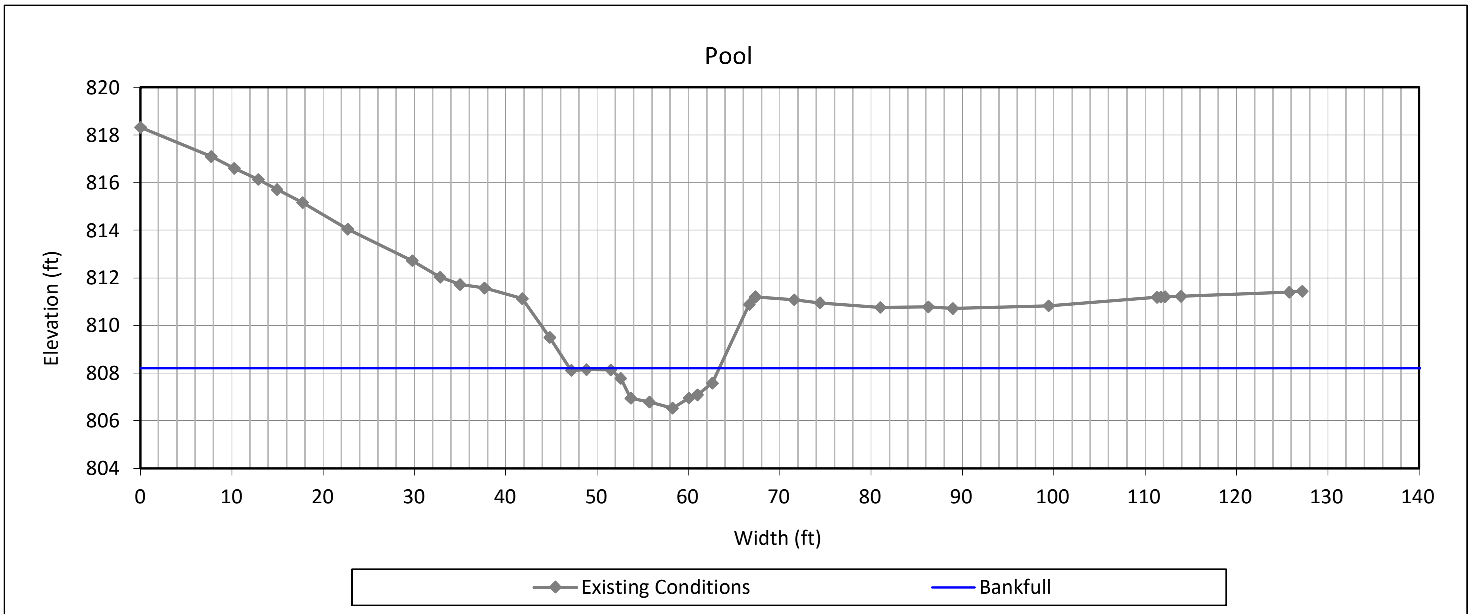
Cross Section 8, OHC Reach 4



Bankfull Dimensions	
40.3	x-section area (ft.sq.)
17.9	width (ft)
2.3	mean depth (ft)
3.1	max depth (ft)
21.0	wetted perimeter (ft)
1.9	hyd radi (ft)
8.0	width-depth ratio
68.5	W flood prone area (ft)
3.8	entrenchment ratio
2.1	low bank height ratio

View Downstream

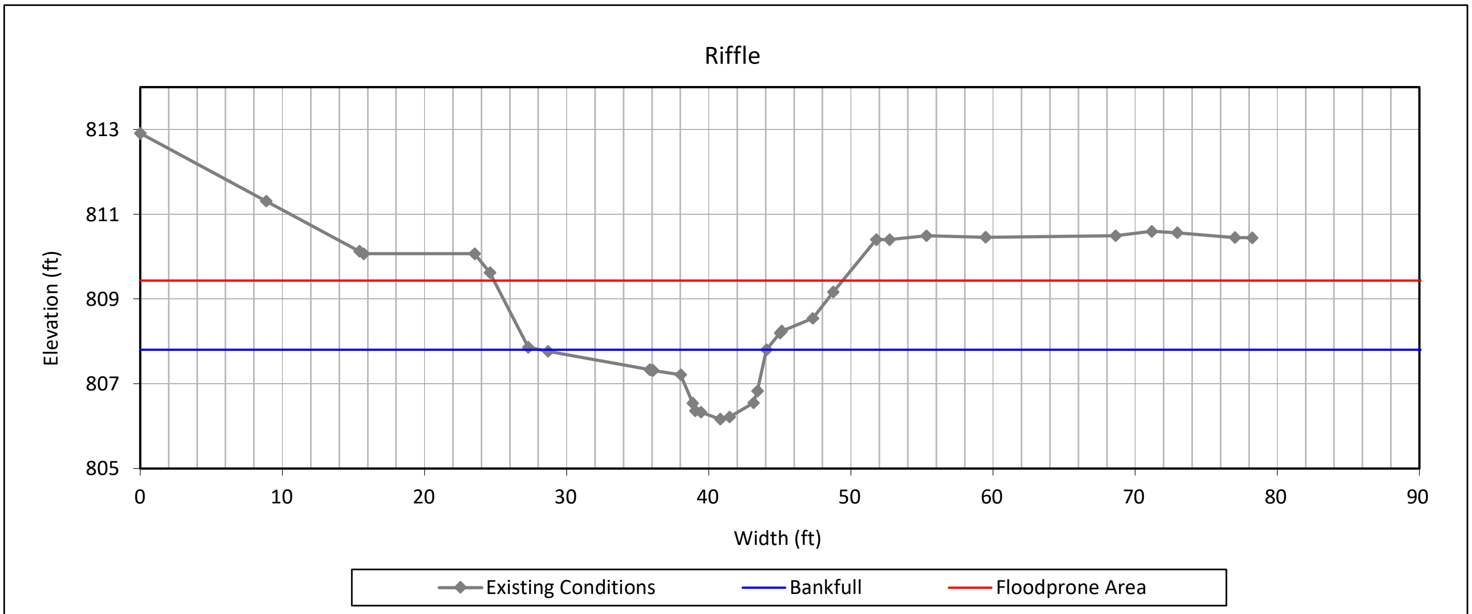
Cross Section 9, UT1 Reach 1



Bankfull Dimensions	
13.5	x-section area (ft.sq.)
16.2	width (ft)
0.8	mean depth (ft)
1.7	max depth (ft)
16.9	wetted perimeter (ft)
0.8	hyd radi (ft)
19.5	width-depth ratio
23.8	W flood prone area (ft)
1.5	entrenchment ratio
2.8	low bank height ratio

View Downstream

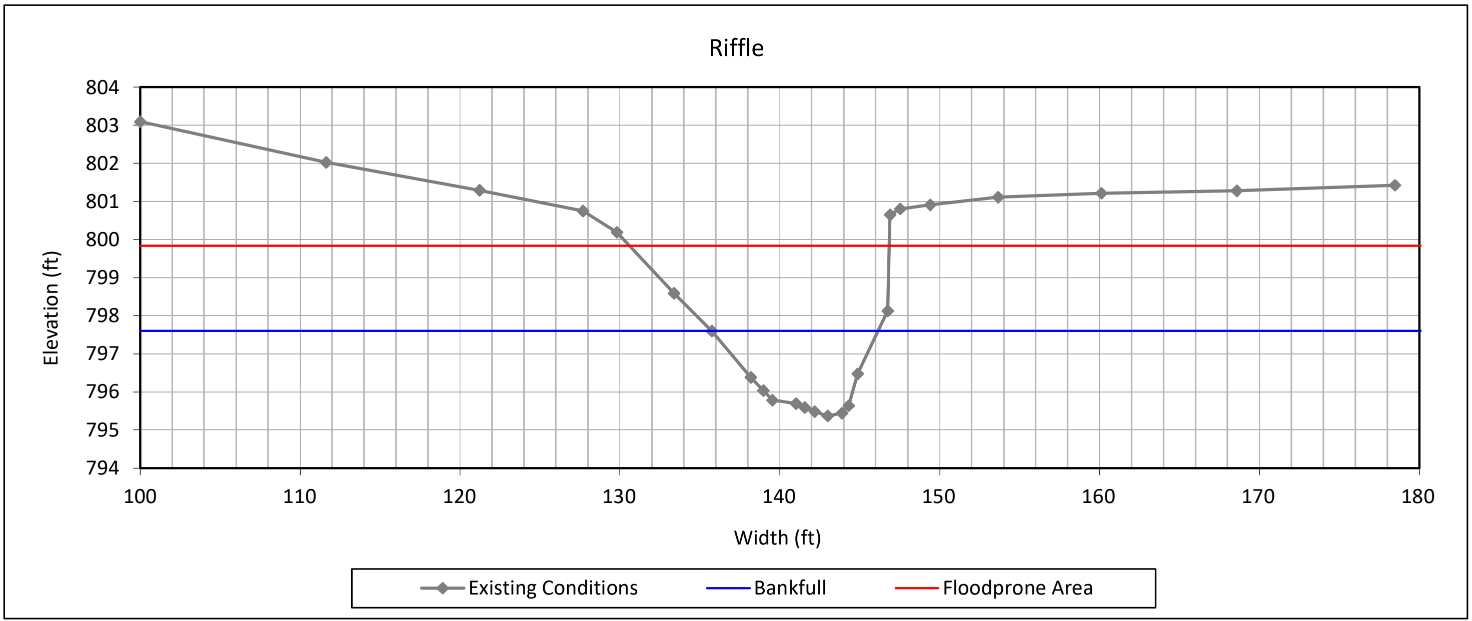
Cross Section 10, UT1 Reach 1



Bankfull Dimensions	
10.7	x-section area (ft.sq.)
15.9	width (ft)
0.7	mean depth (ft)
1.6	max depth (ft)
16.9	wetted perimeter (ft)
0.6	hyd radi (ft)
23.4	width-depth ratio
24.5	W flood prone area (ft)
1.5	entrenchment ratio
2.4	low bank height ratio

View Downstream

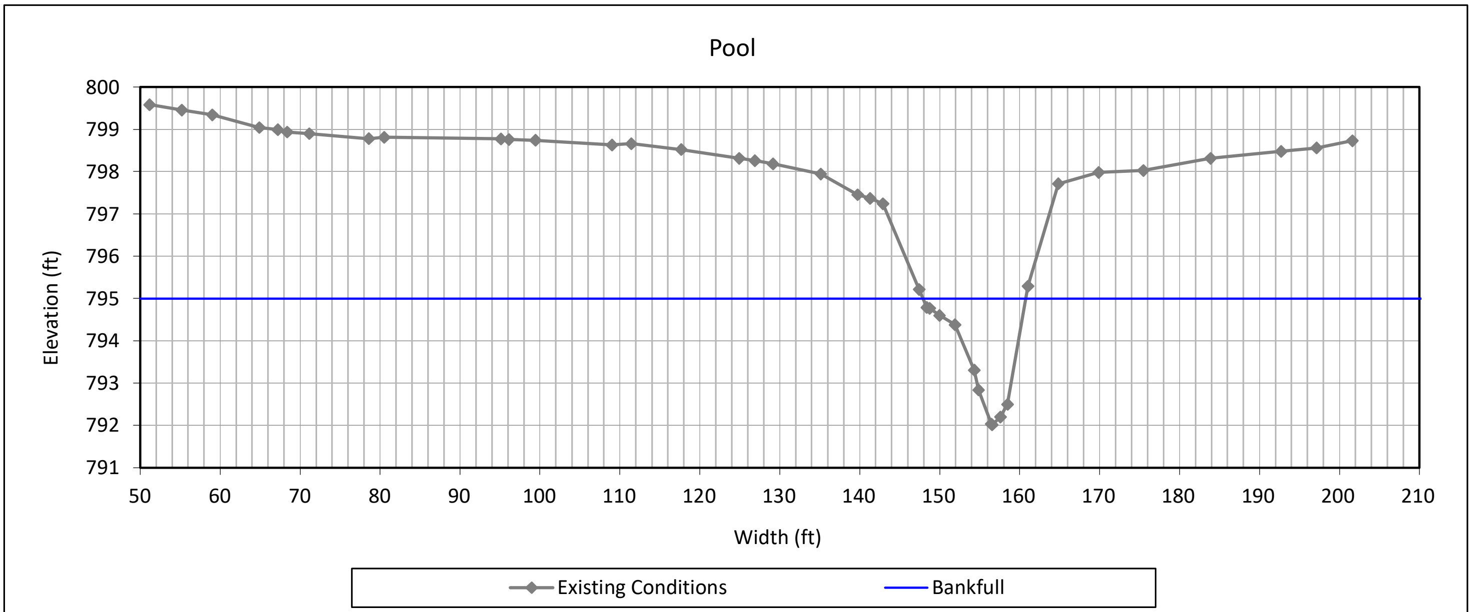
Cross Section 11, UT1 Reach 2



Bankfull Dimensions	
14.1	x-section area (ft.sq.)
9.1	width (ft)
1.5	mean depth (ft)
2.2	max depth (ft)
10.1	wetted perimeter (ft)
1.4	hyd radi (ft)
5.9	width-depth ratio
16.2	W flood prone area (ft)
1.8	entrenchment ratio
2.4	low bank height ratio

View Downstream

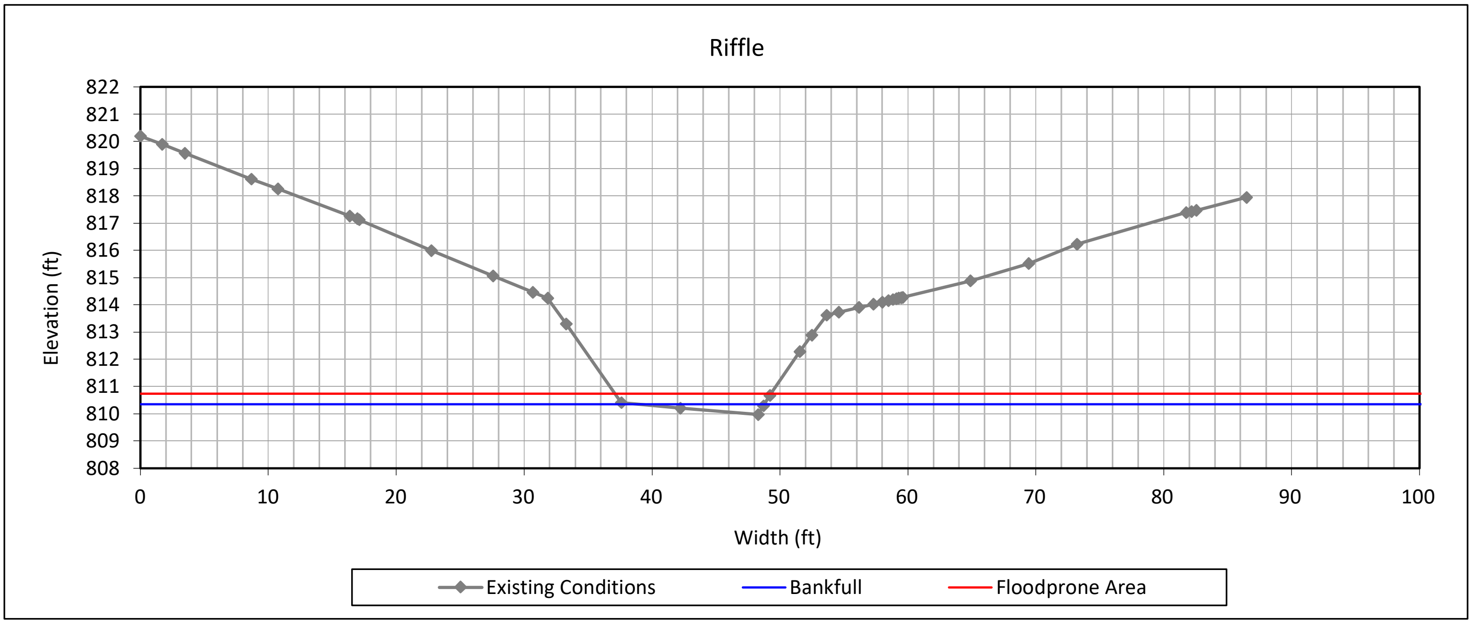
Cross Section 12, UT1 Reach 2



Bankfull Dimensions	
17.9	x-section area (ft.sq.)
12.9	width (ft)
1.4	mean depth (ft)
3.0	max depth (ft)
14.7	wetted perimeter (ft)
1.2	hyd radi (ft)
9.2	width-depth ratio
2.8	entrenchment ratio
1.8	low bank height ratio

View Downstream

Cross Section 13, UT1A



Bankfull Dimensions	
1.9	x-section area (ft.sq.)
9.9	width (ft)
0.2	mean depth (ft)
0.4	max depth (ft)
10.1	wetted perimeter (ft)
0.2	hyd radi (ft)
51.0	width-depth ratio
12.2	W flood prone area (ft)
1.2	entrenchment ratio
9.6	low bank height ratio

View Downstream

Reachwide and Cross-Section Pebble Count Plots

Oak Hill Dairy

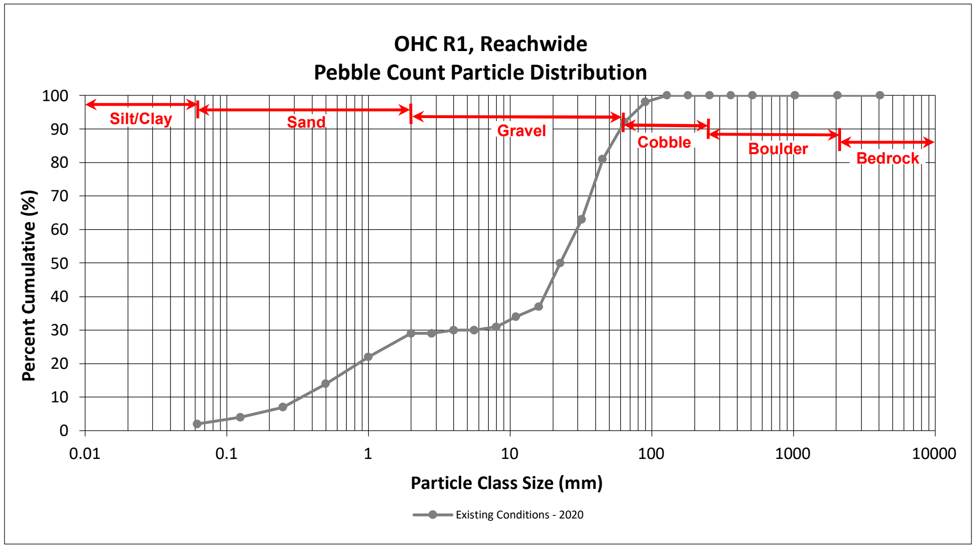
DMS Project No. 100120

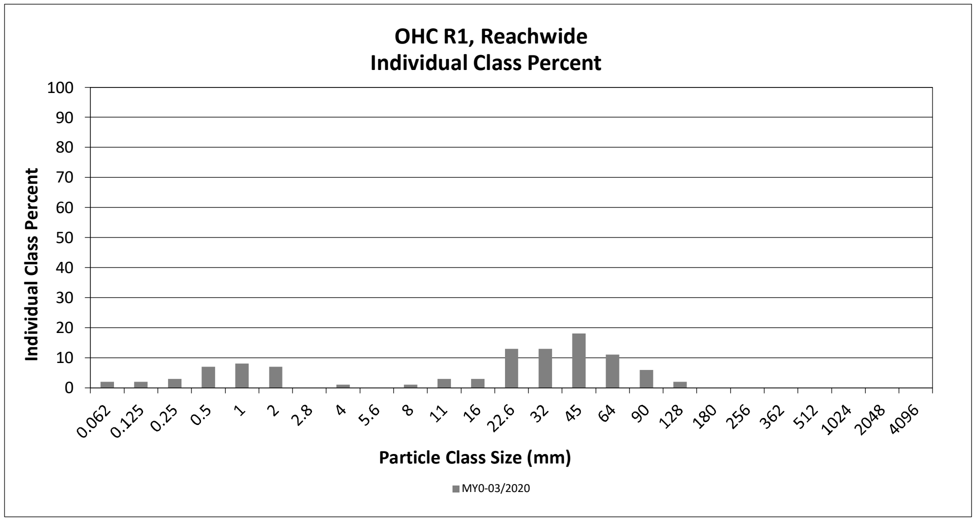
Existing Conditions - 2020

OHC R1, Reachwide

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool	Particle Count Total	Reach Summary Class Percentage	Reach Summary Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	1	1	2	2	2
SAND	Very fine	0.062	0.125		2	2	2	4
SAND	Fine	0.125	0.250		3	3	3	7
SAND	Medium	0.25	0.50		7	7	7	14
SAND	Coarse	0.5	1.0		8	8	8	22
SAND	Very Coarse	1.0	2.0		7	7	7	29
GRAVEL	Very Fine	2.0	2.8					29
GRAVEL	Very Fine	2.8	4.0		1	1	1	30
GRAVEL	Fine	4.0	5.6					30
GRAVEL	Fine	5.6	8.0		1	1	1	31
GRAVEL	Medium	8.0	11.0	1	2	3	3	34
GRAVEL	Medium	11.0	16.0		3	3	3	37
GRAVEL	Coarse	16.0	22.6	7	6	13	13	50
GRAVEL	Coarse	22.6	32	10	3	13	13	63
GRAVEL	Very Coarse	32	45	14	4	18	18	81
GRAVEL	Very Coarse	45	64	10	1	11	11	92
COBBLE	Small	64	90	5	1	6	6	98
COBBLE	Small	90	128	2		2	2	100
COBBLE	Large	128	180					100
COBBLE	Large	180	256					100
BOULDER	Small	256	362					100
BOULDER	Small	362	512					100
BOULDER	Medium	512	1024					100
BOULDER	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.59
D_{35} =	12.46
D_{50} =	22.6
D_{84} =	49.5
D_{95} =	75.9
D_{100} =	128.0





Reachwide and Cross-Section Pebble Count Plots

Oak Hill Dairy

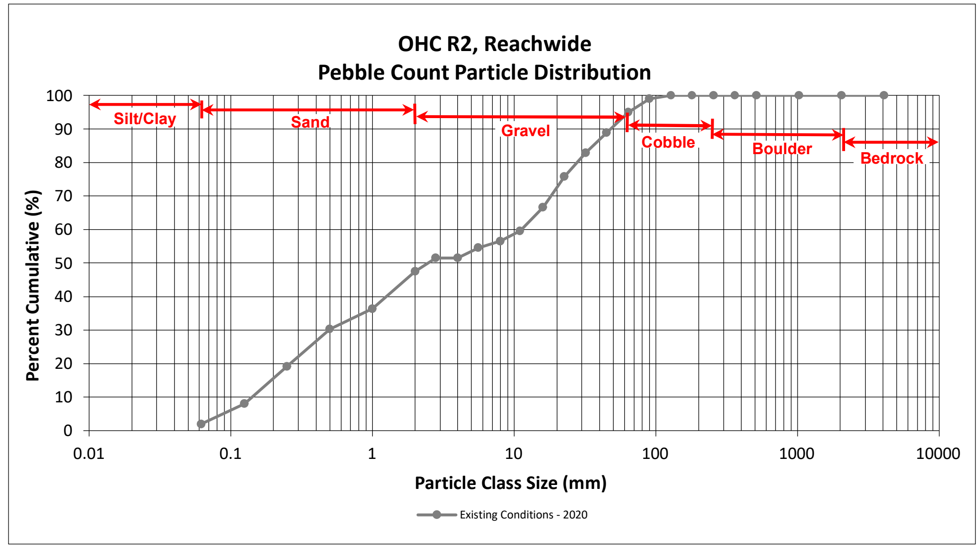
DMS Project No. 100120

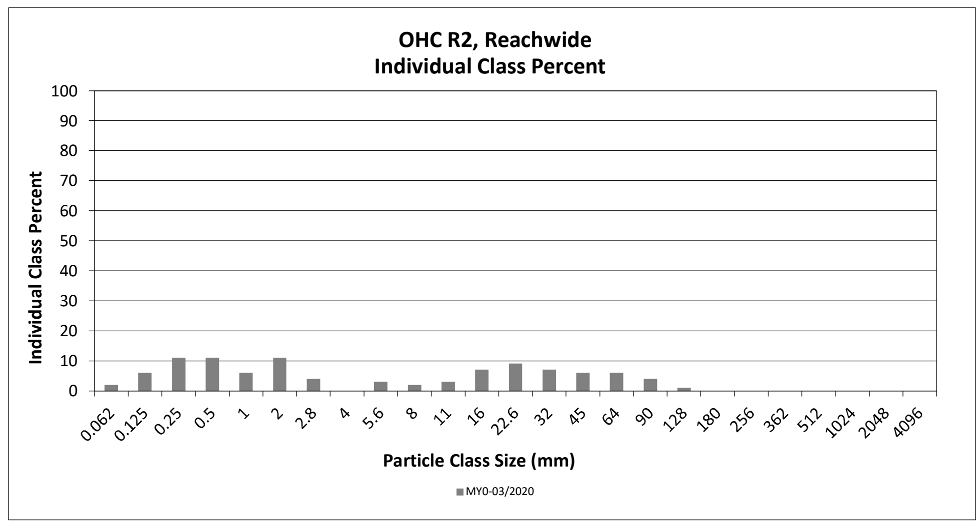
Existing Conditions - 2020

OHC R2, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2		2	2	2
SAND	Very fine	0.062	0.125		6	6	6	8
	Fine	0.125	0.250		11	11	11	19
	Medium	0.25	0.50		11	11	11	30
	Coarse	0.5	1.0		6	6	6	36
	Very Coarse	1.0	2.0	4	7	11	11	47
GRAVEL	Very Fine	2.0	2.8		4	4	4	52
	Very Fine	2.8	4.0					52
	Fine	4.0	5.6	1	2	3	3	55
	Fine	5.6	8.0	2		2	2	57
	Medium	8.0	11.0	2	1	3	3	60
	Medium	11.0	16.0	7		7	7	67
	Coarse	16.0	22.6	8	1	9	9	76
	Coarse	22.6	32	7		7	7	83
	Very Coarse	32	45	5	1	6	6	89
	Very Coarse	45	64	6		6	6	95
COBBLE	Small	64	90	4		4	4	99
	Small	90	128	1		1	1	100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**49**	**50**	**99**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.20
D_{35} =	0.86
D_{50} =	2.5
D_{84} =	34.2
D_{95} =	64.3
D_{100} =	128.0





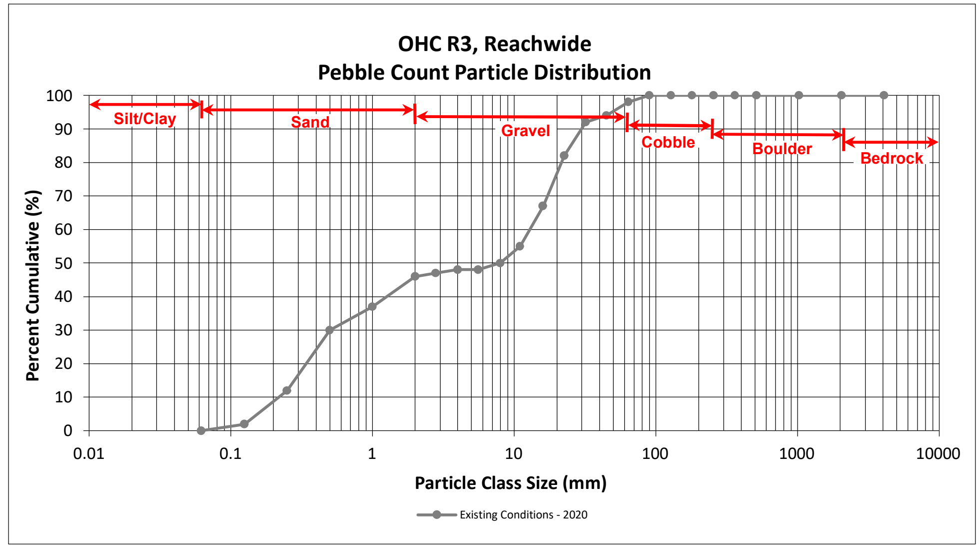
Reachwide and Cross-Section Pebble Count Plots

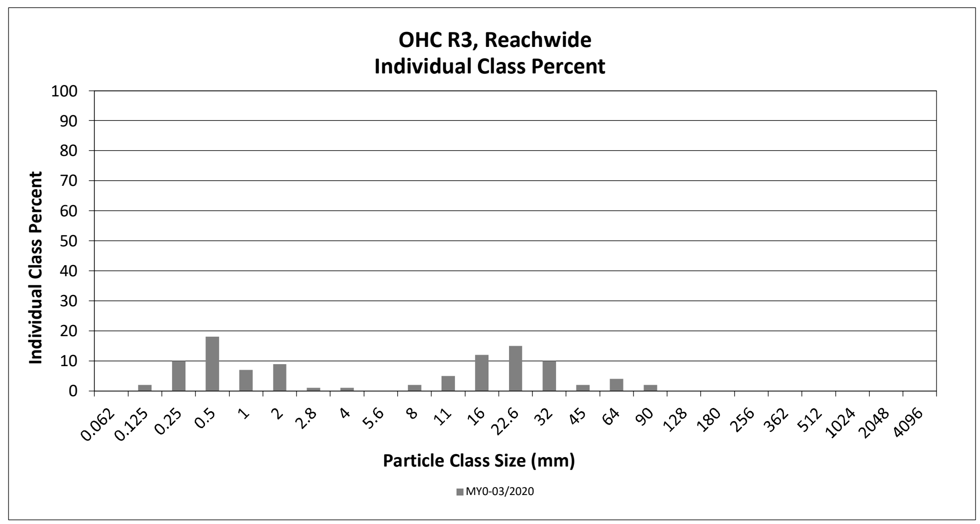
Oak Hill Dairy
DMS Project No. 100120
Existing Conditions - 2020

OHC R3, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062					0
SAND	Very fine	0.062	0.125		2	2	2	2
	Fine	0.125	0.250		10	10	10	12
	Medium	0.25	0.50		18	18	18	30
	Coarse	0.5	1.0		7	7	7	37
	Very Coarse	1.0	2.0		9	9	9	46
GRAVEL	Very Fine	2.0	2.8		1	1	1	47
	Very Fine	2.8	4.0		1	1	1	48
	Fine	4.0	5.6					48
	Fine	5.6	8.0	1	1	2	2	50
	Medium	8.0	11.0	3	2	5	5	55
	Medium	11.0	16.0	9	3	12	12	67
	Coarse	16.0	22.6	10	5	15	15	82
	Coarse	22.6	32	10		10	10	92
	Very Coarse	32	45	2		2	2	94
	Very Coarse	45	64	3	1	4	4	98
COBBLE	Small	64	90	2		2	2	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	40	60	100	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	0.29
D_{35} =	0.82
D_{50} =	8.0
D_{84} =	24.2
D_{95} =	49.1
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Oak Hill Dairy

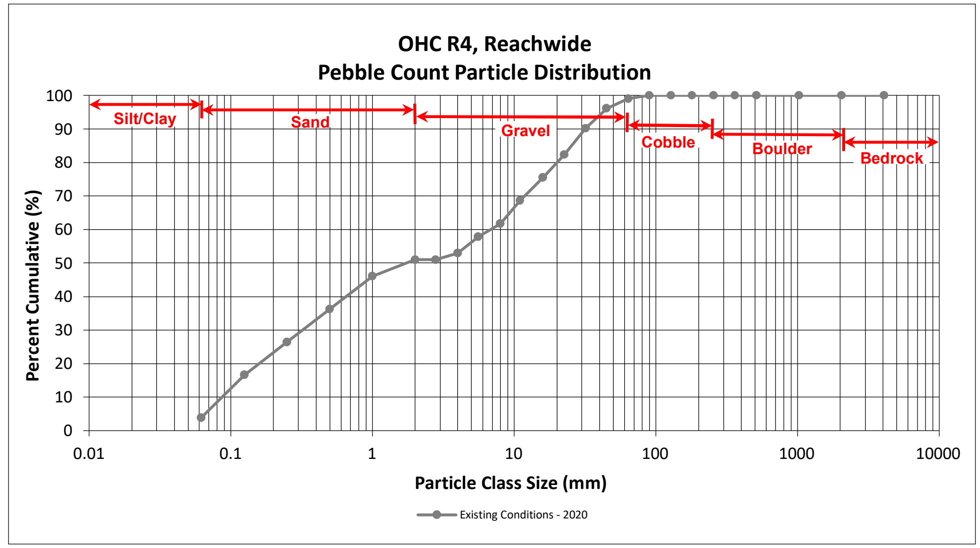
DMS Project No. 100120

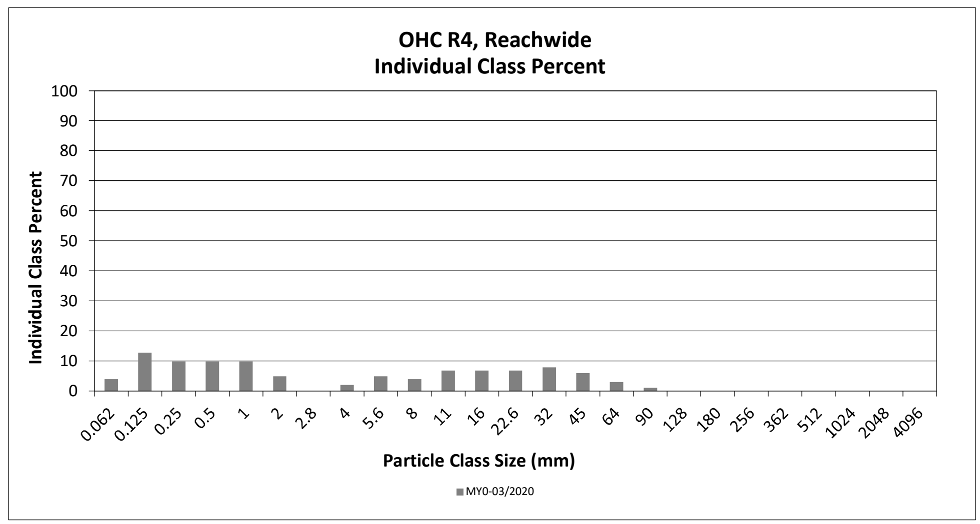
Existing Conditions - 2020

OHC R4, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062		4	4	4	4
SAND	Very fine	0.062	0.125		13	13	13	17
	Fine	0.125	0.250	1	9	10	10	26
	Medium	0.25	0.50		10	10	10	36
	Coarse	0.5	1.0		10	10	10	46
	Very Coarse	1.0	2.0		5	5	5	51
GRAVEL	Very Fine	2.0	2.8					51
	Very Fine	2.8	4.0	1	1	2	2	53
	Fine	4.0	5.6	3	2	5	5	58
	Fine	5.6	8.0	2	2	4	4	62
	Medium	8.0	11.0	5	2	7	7	69
	Medium	11.0	16.0	4	3	7	7	75
	Coarse	16.0	22.6	7		7	7	82
	Coarse	22.6	32	8		8	8	90
	Very Coarse	32	45	5	1	6	6	96
	Very Coarse	45	64	3		3	3	99
COBBLE	Small	64	90	1		1	1	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**40**	**62**	**102**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.12
D_{35} =	0.46
D_{50} =	1.7
D_{84} =	24.3
D_{95} =	42.3
D_{100} =	90.0





Reachwide and Cross-Section Pebble Count Plots

Oak Hill Dairy

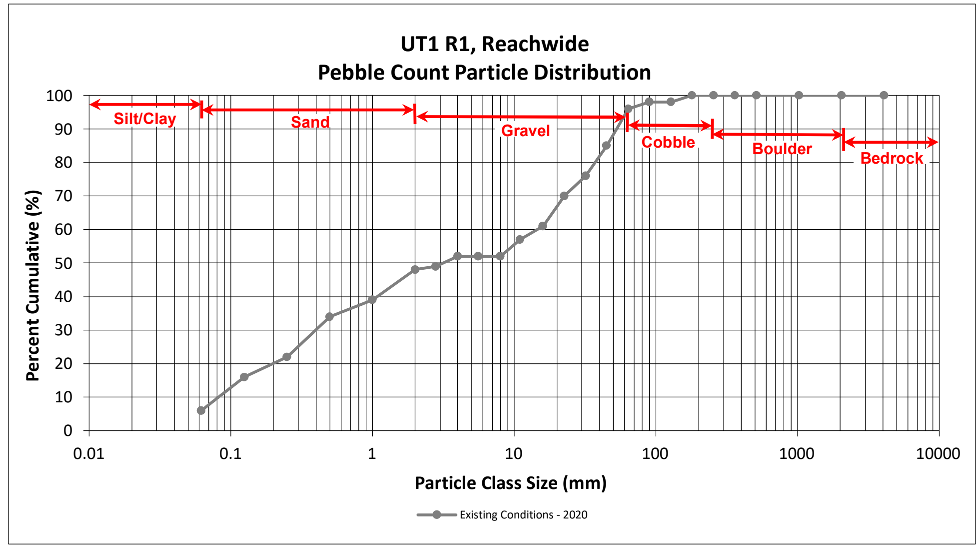
DMS Project No. 100120

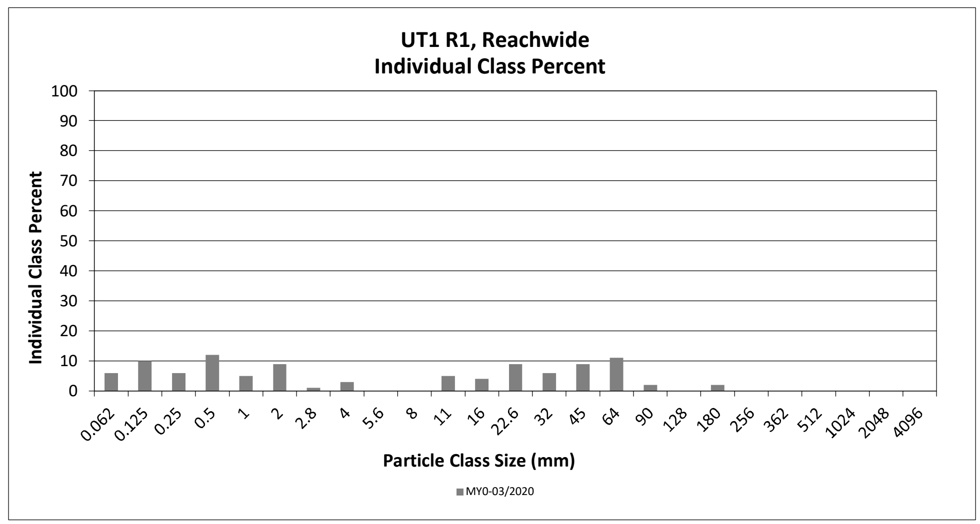
Existing Conditions - 2020

UT1 R1, Reachwide

Particle Class		Diameter (mm)		Particle Count			Reach Summary	
		min	max	Riffle	Pool	Total	Class Percentage	Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	3	3	6	6	6
SAND	Very fine	0.062	0.125	3	7	10	10	16
	Fine	0.125	0.250		6	6	6	22
	Medium	0.25	0.50	1	11	12	12	34
	Coarse	0.5	1.0		5	5	5	39
	Very Coarse	1.0	2.0	2	7	9	9	48
GRAVEL	Very Fine	2.0	2.8	1		1	1	49
	Very Fine	2.8	4.0	2	1	3	3	52
	Fine	4.0	5.6					52
	Fine	5.6	8.0					52
	Medium	8.0	11.0	2	3	5	5	57
	Medium	11.0	16.0	1	3	4	4	61
	Coarse	16.0	22.6	8	1	9	9	70
	Coarse	22.6	32	6		6	6	76
	Very Coarse	32	45	7	2	9	9	85
	Very Coarse	45	64	11		11	11	96
COBBLE	Small	64	90	2		2	2	98
	Small	90	128					98
	Large	128	180	1	1	2	2	100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	**50**	**50**	**100**	**100**	**100**

Reachwide	
Channel materials (mm)	
D_{16} =	0.13
D_{35} =	0.57
D_{50} =	3.2
D_{84} =	43.3
D_{95} =	62.0
D_{100} =	180.0





Reachwide and Cross-Section Pebble Count Plots

Oak Hill Dairy

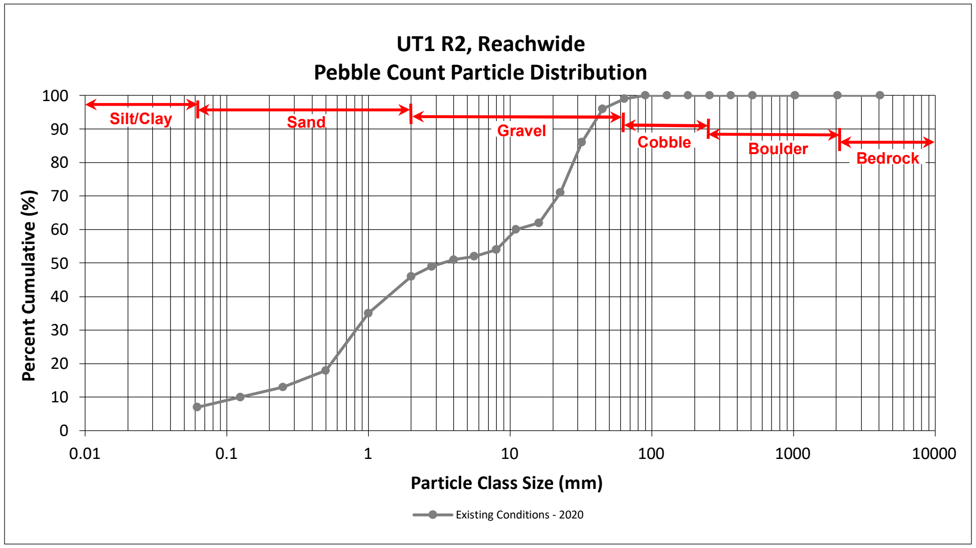
DMS Project No. 100120

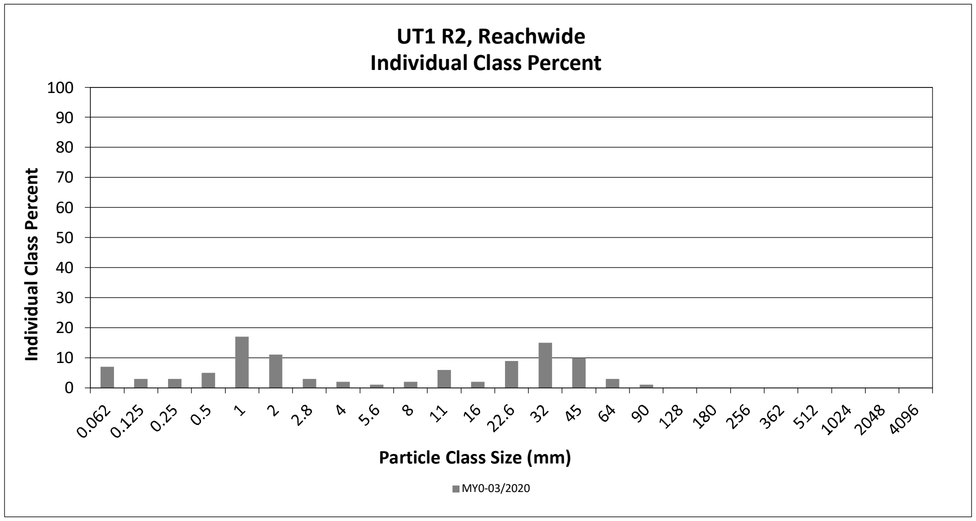
Existing Conditions - 2020

UT1 R2, Reachwide

Particle Class		Diameter (mm) min	Diameter (mm) max	Particle Count Riffle	Particle Count Pool	Particle Count Total	Reach Summary Class Percentage	Reach Summary Percent Cumulative
SILT/CLAY	Silt/Clay	0.000	0.062	2	5	7	7	7
SAND	Very fine	0.062	0.125	2	1	3	3	10
	Fine	0.125	0.250		3	3	3	13
	Medium	0.25	0.50	1	4	5	5	18
	Coarse	0.5	1.0	3	14	17	17	35
	Very Coarse	1.0	2.0	1	10	11	11	46
GRAVEL	Very Fine	2.0	2.8		3	3	3	49
	Very Fine	2.8	4.0		2	2	2	51
	Fine	4.0	5.6	1		1	1	52
	Fine	5.6	8.0		2	2	2	54
	Medium	8.0	11.0	5	1	6	6	60
	Medium	11.0	16.0	1	1	2	2	62
	Coarse	16.0	22.6	7	2	9	9	71
	Coarse	22.6	32	13	2	15	15	86
	Very Coarse	32	45	10		10	10	96
	Very Coarse	45	64	3		3	3	99
COBBLE	Small	64	90	1		1	1	100
	Small	90	128					100
	Large	128	180					100
	Large	180	256					100
BOULDER	Small	256	362					100
	Small	362	512					100
	Medium	512	1024					100
	Large/Very Large	1024	2048					100
BEDROCK	Bedrock	2048	>2048					100
			Total	50	50	100	100	100

Reachwide	
Channel materials (mm)	
D_{16} =	0.38
D_{35} =	1.00
D_{50} =	3.3
D_{84} =	30.5
D_{95} =	43.5
D_{100} =	90.0





Discharge Analysis Summary Table - Oak Hill Dairy Creek Mitigation Site

Weighted (0-5)			OHC R1	OHC R2	OHC R3	OHC R4	UT1 R1	UT1 R2	UT1A	Little Trib (UT3)	Pond Trib (UT2)
		DA (acres)	608	614	988	1070	302	333	12	77	9
		DA (sq. mi.)	0.95	0.96	1.54	1.67	0.47	0.52	0.02	0.12	0.01
			Qbkf (cfs)	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*	*Qbkf (cfs)*
1	***USGS Peak Discharge Estimation for NC Rural Piedmont***	**1-yr event**	24	25	36	39	14	15	1	4	1
		1.2-yr event	75	75	107	113	45	48	4	16	3
		1.5-yr event	106	107	151	160	64	69	6	24	5
		1.8-yr event	130	131	184	195	79	84	8	29	7
		2-yr event	142	143	201	213	86	92	9	32	7
1	***Manning's Equation at Surveyed Riffle XS from Mecklenburg Spreadsheets***	**XS1**									
		XS2	98								
		XS3		94							
		XS4									
		XS5			95						
		XS6									
		XS7				122					
		XS8									
		XS9									
		XS10					31				
		XS11						52			
		XS12									
		XS13							3		
3	***Piedmont Regional Curve***	**low range**	30	30	43	46	18	19	2	7	1
		exact calc	86	86	122	129	52	55	5	19	4
		high range	244	245	344	364	148	159	15	56	13
0	***Alan Walker Curve***	**exact calc**	54	54	78	83	31	33	2	11	2
NA	***Max Q - Determined from Manning's Equation at Surveyed TOB***		654	676	863	635	381	333	446		
0	***Qbkf from Reference Reach Curve***		61	61	87	92	36	39	3	13	3
			Note: Select reference reach points above curve omitted use with large DA's >0.4 sq.mi., revised equation used for large DA's is y=63.21x^0.74 (R2=0.95)								
	Weighted Design Q		86	86	113	124	46	53	4	19	4
	Final Design Q		90	88	149	156	42	51	7	19	5

Oak Hill Dairy Mitigation Site - Reference Reach Geomorphic Parameters																						
	Notation	*Units*	Boyd Branch		Deep Creek Mitigation Site		Long Branch		Timber Trib (mid-reach)		UT to Catawba River Reach 1		UT to Catawba River Reach 2		UT to Varnals Creek		Lake Norman Group Camp Tributary US		Foust Upstream		Cooleemee Plantation	
			min	max	min	max	min	max	min	max	min	max	min	max	min	max	Min	Max	min	max	min	max
stream type			E4		C5		C/E4		B4		E5		E3b/C3b		C4/E4		E5		C4		C5	
drainage area	DA	*sq mi*	0.90		0.67		1.49		0.04		1.6		1.6		0.41		0.10		1.40		0.68	
design discharge	Q	*cfs*	51		40.9		101	124	17		80		80		54		12		95		26	
bankfull cross-sectional area	A_{bkf}	*SF*	13.8	15.4	17.1		101	34.6	4.6		11.4	17.5	13.2		10.3	12.3	3.4	3.6	23.9	24.1	13.6	14.9
average velocity during bankfull event	v_{bkf}	*fps*	3.2	3.8	2.4		3.6	4	3.7		5.54		6.06		4.4	5.2	3.5		4.0		1.8	
Cross-Section																						
width at bankfull	w_{bkf}	*feet*	13.5	16.6	12.9		14.8	18.6	8.9		9.7	12.4	12.3		9.3	10.5	4.2	4.4	18.5	19.4	14.7	18.1
maximum depth at bankfull	d_{max}	*feet*	1.7	1.9	2.3		1.9	2.9	0.7		1.7		1.73		1.5	1.7	1	1.2	1.8	2.1	1.6	
mean depth at bankfull	d_{bkf}	*feet*	0.8	1.1	1.4		1.3	2.1	0.5		1.2	1.4	1.07		1.1	1.2	0.8		1.2	1.3	0.8	1.0
bankfull width to depth ratio	w_{bkf}/d_{bkf}		11.8	20	9.6		7.9	13.8	17		8.1	8.9	11.5		8.1	9.3	5.2	5.5	14.3	15.7	14.6	24.1
depth ratio	d_{max}/d_{bkf}	*feet*	1.7	2.1	1.6	1.8	1.4	1.5	1.4		1.2	1.4	1.62		1.4		1.3	1.5	1.4	1.7	1.6	2.0
bank height ratio	BHR		1.0		0.9	1.1	1.2	1.5	1		0.9	1.4	0.77	1.26	1	1	0.9	1.1	-		1.0	
floodprone area width	w_{fpa}	*feet*	37	41	135		>50		13.6		52	79	53		60	100	8.6	10.6	55.0	101.2	140+	
entrenchment ratio	ER		2.5	2.8	10.5+		>3.4		1.5		5.36	6.37	4.31		5.7	10	2	2.5	2.9	5.3	8.8+	
Slope																						
valley slope	S_{valley}	*feet/ foot*	0.012		0.0068		0.006		0.0406		0.011		0.029		0.02		0.0200		-		0.0034	
channel slope	S_{chnl}	*feet/ foot*	0.009		0.0028		0.004		0.0334		0.005		0.027		0.017		0.0200		0.0090		0.0027	
Profile																						
riffle slope	S_{riffle}	*feet/ foot*	0.0150	0.0280	0.002	0.009	0.013	0.012	0.02	0.15	0.01	0.06	0.01	0.35	0.024	0.057	0.01	0.12	-		0.0027	0.0130
riffle slope ratio	S_{riffle}/S_{chnl}		1.7	3.1	0.7	3.4	3.3	3	0.69	4.49	2.5	13.3	0.5	12.8	1.4	3.4	0.6	7.3	-		1.0	4.8
pool slope	S_p	*feet/ foot*	0.0008	0.0020	0	0.0025	0.0003	0.003	0	0.082	0.001	0.003	0.002	0.022	0	0.015	0.0000	0.0104	-		0.0000	0.0130
pool slope ratio	S_p/S_{chnl}		0.1	0.2	0	0.9	0.1	0.8	0	2.46	0.3	0.7	0.1	0.8	0	0.9	0	0.6	-		0.0	4.8
pool-to-pool spacing	L_{p-p}	*feet*	260.0	345.0	29	103	50	105	6	49.4	31	60	19.3	46.4	7.8	82.2	8.5	57.8	-		19.0	35.0
pool spacing ratio	L_{p-p}/W_{bkf}		19.3	25.6	2.2	8	3.4	7.1	0.7	5.6	2.8	5.4	1.6	3.8	0.5	5.6	0.8	5.1	-		0.0	4.8
pool cross-sectional area	A_{pool}	*SF*	20.1		19.6		25.5	33.4	-	-	18.1		-		22	22.7	-	-	29.2	34.9	14.8	
pool area ratio	A_{pool}/A_{bkf}		1.3	1.5	1.1		1	1.3	-	-	1	1.6	-		1.8	1.9	-	-	1.2	1.5	1.0	
maximum pool depth	d_{pool}	*feet*	2.6	3.0	3.2		2.2		-	-	2.5		-		2.5	2.6	-	-	2.5	2.9	2.0	
pool depth ratio	d_{pool}/d_{bkf}		2.4	3.8	2.4		0.8	1.2	-	-	1.8	2.1	-		3	3.1	-	-	1.9	2.3	2.2	
pool width at bankfull	w_{pool}	*feet*	16.0	20.2	19.6		16.2	18.8	-	-	10.4		-		15.1	18.6	-	-	15.3	20.5	13.3	
pool width ratio	w_{pool}/w_{bkf}		1.2		1.5		0.9	1.3	-	-	0.8	1.1	-		1	1.3	-	-	0.8	1.1	0.8	
Pattern																						
sinuosity	K		1.60		1.6		1.3		1.12		1.1		1.1		1.2		1.6		-		1.10	
belt width	w_{blt}	feet	42.0	100.0	45	71	60		-	-	55		23		14.6	44.5	15.5	16.5	-		22.0	30.0
meander width ratio	w_{blt}/W_{bkf}		2.8	6.6	3.5	5.5	3.2	4.1	-	-	4.4	5.7	1.8		1	3	3.6	3.8	-		1.3	1.8
linear wavelength (formerly meander length)	L_m	feet	60.0	107.0	95	130	66	191	-	-	65	107	52	79	16.4	46.6	31	34	-		-	
linear wavelength ratio (formerly meander length ratio)	L_m/W_{bkf}		4.0	7.1	7.4	10.1	4.5	10.3	-	-	6.7	8.6	4.2	6.4	1.1	3.2	7.2	7.9	-		-	
meander length		feet	66.0	139.0	-	-	-	-	-	-	-	-	-	-	-	-	---	---	-		58.0	70.0
meander length ratio			4.4	9.2	-	-	-	-	-	-	-	-	-	-	-	-	---	---	-		3.5	4.3
radius of curvature	R_c	feet	18.7	91.0	18	33	16	87	-	-	31	56	29	52	8.3	47.3	8	11.8	-		14.0	38.0
radius of curvature ratio	R_c/W_{bkf}		1.2	6.0	1.4	2.6	1.1	4.7	-	-	2.8	5.1	2.4	4.2	0.57	3.2	1.9	2.7	-		0.9	2.3
Particle Size Distribution from Reach-wide Pebble Count																						
d50 Description			Medium/Coarse Gravel		Fine Sand		Very Coarse Gravel		Fine Gravel		Very Coarse Sand		Small Cobble		Medium Gravel		Fine Gravel		Very Coarse Gravel		-	
	d_{16}	mm	-		Silt/Clay		8.1		0.49		0.3		0.5		2.9		0.21		9.6		-	
	d_{35}	mm	-		0.15		26.6		3.5		0.4		29.8		9.2		2.8		37		-	
	d_{50}	mm	-		0.2		41.6		6.5		1.8		75.9		15		5.2		61		-	
	d_{84}	mm	-		1.1		124.8		48		12.8		170.8		56		85		130		-	
	d_{95}	mm	-		8.9		225.5		83		25.2		332		88		120		1100		-	
	d_{100}	mm	-		22.6		-		128		90		2048		256		-		-		-	

Table 1: OHC Reach 1

	Notation	Units	Designed Conditions		
			min	max	design
stream type			C4		
drainage area	DA	sq mi	0.95		
bankfull design discharge	Q_{bkf}	cfs	90.0		
Cross-Section Features					
bankfull cross-sectional area	A_{bkf}	SF	28.4		
average velocity during bankfull event	v_{bkf}	fps	3.2		
width at bankfull	w_{bkf}	feet	20.0		
mean depth at bankfull	d_{bkf}	feet	1.4		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14		
maximum depth at bankfull	d_{max}	feet	1.7	2.1	
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5
bank height ratio	BHR		1.0	1.0	
floodprone area width	w_{fpa}	feet	44	100	
entrenchment ratio	ER		2.2	5.0	
Slope					
valley slope	S_{valley}	feet/ foot	0.0054		
channel slope	$S_{channel}$	feet/ foot	0.004	0.004	0.004
Riffle Features					
riffle slope	S_{riffle}	feet/ foot	0.0048	0.0136	
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4	
Pool Features					
pool slope	S_{pool}	feet/ foot	0.0000	0.0016	
pool slope ratio	$S_{poo}l/S_{channel}$		0.00	0.40	
pool-to-pool spacing	L_{p-p}	feet	32	124	
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2	
maximum pool depth at bankfull	d_{pool}	feet	2.8	4.3	
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0	
pool width at bankfull	w_{pool}	feet	20.0	32.0	
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6	
pool cross-sectional area at bankfull	A_{pool}	SF	31.2	70.9	
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5	
Pattern Features					
sinuosity	K		1.20	1.30	1.20
belt width	w_{blt}	feet	40	132	
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6	
linear wavelength	LW	feet	120	240	
linear wavelength ratio	LW/w_{bkf}		6.0	12.0	
meander length	L_m	feet	150	300	
meander length ratio	L_m/w_{bkf}		7.5	15.0	
radius of curvature	R_c	feet	40	60	
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0	

Table 1: OHC Reach 2

	Notation	Units	Designed Conditions		
			min	max	design
stream type			C4		
drainage area	DA	sq mi	0.96		
bankfull design discharge	Q_{bkf}	cfs	88.0		
Cross-Section Features					
bankfull cross-sectional area	A_{bkf}	SF	33.4		
average velocity during bankfull event	v_{bkf}	fps	2.6		
width at bankfull	w_{bkf}	feet	23.0		
mean depth at bankfull	d_{bkf}	feet	1.5		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		16		
maximum depth at bankfull	d_{max}	feet	1.7	2.3	
max depth ratio	d_{max}/d_{bkf}		1.2	1.6	1.5
bank height ratio	BHR		1.0	1.0	
floodprone area width	w_{fpa}	feet	51	115	
entrenchment ratio	ER		2.2	5.0	
Slope					
valley slope	S_{valley}	feet/ foot	0.0058		
channel slope	$S_{channel}$	feet/ foot	0.005	0.006	0.0055
Riffle Features					
riffle slope	S_{riffle}	feet/ foot	0.0066	0.0187	
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4	
Pool Features					
pool slope	S_{pool}	feet/ foot	0.0000	0.0022	
pool slope ratio	$S_{poo}l/S_{channel}$		0.00	0.40	
pool-to-pool spacing	L_{p-p}	feet	37	143	
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2	
maximum pool depth at bankfull	d_{pool}	feet	2.9	4.4	
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0	
pool width at bankfull	w_{pool}	feet	23.0	36.8	
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6	
pool cross-sectional area at bankfull	A_{pool}	SF	36.7	83.4	
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5	
Pattern Features					
sinuosity	K		1.20	1.30	1.20
belt width	w_{blt}	feet	46	152	
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6	
linear wavelength	LW	feet	138	276	
linear wavelength ratio	LW/w_{bkf}		6.0	12.0	
meander length	L_m	feet	173	345	
meander length ratio	L_m/w_{bkf}		7.5	15.0	
radius of curvature	R_c	feet	46	69	
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0	

Table 1: OHC Reach 3

	Notation	Units	Designed Conditions		
			min	max	design
stream type			C4		
drainage area	DA	sq mi	1.54		
bankfull design discharge	Q_{bkf}	cfs	149.0		
Cross-Section Features					
bankfull cross-sectional area	A_{bkf}	SF	43.9		
average velocity during bankfull event	v_{bkf}	fps	3.4		
width at bankfull	w_{bkf}	feet	25.0		
mean depth at bankfull	d_{bkf}	feet	1.8		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14		
maximum depth at bankfull	d_{max}	feet	2.1	2.6	
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5
bank height ratio	BHR		1.0	1.0	
floodprone area width	w_{fpa}	feet	55	125	
entrenchment ratio	ER		2.2	5.0	
Slope					
valley slope	S_{valley}	feet/ foot	0.0067		
channel slope	$S_{channel}$	feet/ foot	0.004	0.007	0.0055
Riffle Features					
riffle slope	S_{riffle}	feet/ foot	0.0066	0.0187	
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4	
Pool Features					
pool slope	S_{pool}	feet/ foot	0.0000	0.0022	
pool slope ratio	$S_{poo}l/S_{channel}$		0.00	0.40	
pool-to-pool spacing	L_{p-p}	feet	40	155	
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2	
maximum pool depth at bankfull	d_{pool}	feet	3.5	5.3	
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0	
pool width at bankfull	w_{pool}	feet	25.0	40.0	
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6	
pool cross-sectional area at bankfull	A_{pool}	SF	48.2	109.6	
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5	
Pattern Features					
sinuosity	K		1.20	1.30	1.20
belt width	w_{blt}	feet	50	165	
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6	
linear wavelength	LW	feet	150	300	
linear wavelength ratio	LW/w_{bkf}		6.0	12.0	
meander length	L_m	feet	188	375	
meander length ratio	L_m/w_{bkf}		7.5	15.0	
radius of curvature	R_c	feet	50	75	
radius of curvature ratio	$R_c/\ w_{bkf}$		2.0	3.0	

Table 1: OHC Reach 4

	Notation	Units	Designed Conditions		
			min	max	design
stream type			C4		
drainage area	DA	sq mi	1.67		
bankfull design discharge	Q_{bkf}	cfs	156.0		
Cross-Section Features					
bankfull cross-sectional area	A_{bkf}	SF	43.9		
average velocity during bankfull event	v_{bkf}	fps	3.6		
width at bankfull	w_{bkf}	feet	25.0		
mean depth at bankfull	d_{bkf}	feet	1.8		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		14		
maximum depth at bankfull	d_{max}	feet	2.1	2.6	
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.5
bank height ratio	BHR		1.0	1.0	
floodprone area width	w_{fpa}	feet	55	125	
entrenchment ratio	ER		2.2	5.0	
Slope					
valley slope	S_{valley}	feet/ foot	0.0085		
channel slope	$S_{channel}$	feet/ foot	0.004	0.007	0.007
Riffle Features					
riffle slope	S_{riffle}	feet/ foot	0.0084	0.0238	
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4	
Pool Features					
pool slope	S_{pool}	feet/ foot	0.0000	0.0028	
pool slope ratio	$S_{pool}/S_{channel}$		0.00	0.40	
pool-to-pool spacing	L_{p-p}	feet	40	155	
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2	
maximum pool depth at bankfull	d_{pool}	feet	3.5	5.3	
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0	
pool width at bankfull	w_{pool}	feet	25.0	40.0	
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6	
pool cross-sectional area at bankfull	A_{pool}	SF	48.2	109.6	
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5	
Pattern Features					
sinuosity	K		1.20	1.30	1.20
belt width	w_{blt}	feet	50	165	
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6	
linear wavelength	LW	feet	150	300	
linear wavelength ratio	LW/w_{bkf}		6.0	12.0	
meander length	L_m	feet	188	375	
meander length ratio	L_m/w_{bkf}		7.5	15.0	
radius of curvature	R_c	feet	50	75	
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0	

Table 1: UT1 R1 / R2

	Notation	Units	Designed Conditions		
			min	max	design
stream type			C4		
drainage area	DA	sq mi	0.47 - 0.52		
bankfull design discharge	Q_{bkf}	cfs	42.0 - 51.0		
Cross-Section Features					
bankfull cross-sectional area	A_{bkf}	SF	18.4		
average velocity during bankfull event	v_{bkf}	fps	2.4		
width at bankfull	w_{bkf}	feet	17.0		
mean depth at bankfull	d_{bkf}	feet	1.1		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		16		
maximum depth at bankfull	d_{max}	feet	1.3	1.6	
max depth ratio	d_{max}/d_{bkf}		1.2	1.5	1.6
bank height ratio	BHR		1.0	1.0	
floodprone area width	w_{fpa}	feet	37	85	
entrenchment ratio	ER		2.2	5.0	
Slope					
valley slope	S_{valley}	feet/ foot	0.0061 / 0.0086		
channel slope	$S_{channel}$	feet/ foot	0.006	0.007	0.0065
Riffle Features					
riffle slope	S_{riffle}	feet/ foot	0.0078	0.0221	
riffle slope ratio	$S_{riffle}/S_{channel}$		1.2	3.4	
Pool Features					
pool slope	S_{pool}	feet/ foot	0.0000	0.0026	
pool slope ratio	$S_{poo}l/S_{channel}$		0.00	0.40	
pool-to-pool spacing	L_{p-p}	feet	27	105	
pool spacing ratio	L_{p-p}/w_{bkf}		1.6	6.2	
maximum pool depth at bankfull	d_{pool}	feet	2.2	3.3	
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.0	
pool width at bankfull	w_{pool}	feet	17.0	27.2	
pool width ratio	w_{pool}/w_{bkf}		1.0	1.6	
pool cross-sectional area at bankfull	A_{pool}	SF	20.3	46.1	
pool area ratio	A_{pool}/A_{bkf}		1.1	2.5	
Pattern Features					
sinuosity	K		1.20	1.30	1.20
belt width	w_{blt}	feet	34	112	
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6	
linear wavelength	LW	feet	102	204	
linear wavelength ratio	LW/w_{bkf}		6.0	12.0	
meander length	L_m	feet	128	255	
meander length ratio	L_m/w_{bkf}		7.5	15.0	
radius of curvature	R_c	feet	34	51	
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0	

Table 1: UT1A

	Notation	Units	Designed Conditions		
			min	max	design
stream type			E4b		
drainage area	DA	sq mi	0.02		
bankfull design discharge	Q_{bkf}	cfs	7.0		
Cross-Section Features					
bankfull cross-sectional area	A_{bkf}	SF	2.6		
average velocity during bankfull event	v_{bkf}	fps	2.6		
width at bankfull	w_{bkf}	feet	5.5		
mean depth at bankfull	d_{bkf}	feet	0.5		
bankfull width to depth ratio	w_{bkf}/d_{bkf}		12		
maximum depth at bankfull	d_{max}	feet	0.6	0.8	
max depth ratio	d_{max}/d_{bkf}		1.2	1.6	1.5
bank height ratio	BHR		1.0	1.1	
floodprone area width	w_{fpa}	feet	8	12	
entrenchment ratio	ER		1.4	2.2	
Slope					
valley slope	S_{valley}	feet/ foot	0.035		
channel slope	$S_{channel}$	feet/ foot	0.032	0.032	0.032
Riffle Features					
riffle slope	S_{riffle}	feet/ foot	0.026	0.064	
riffle slope ratio	$S_{riffle}/S_{channel}$		0.8	2.0	
Pool Features					
pool slope	S_{pool}	feet/ foot	0.0000	0.003	
pool slope ratio	$S_{pool}l/S_{channel}$		0.00	0.10	
pool-to-pool spacing	L_{p-p}	feet	8	14	
pool spacing ratio	L_{p-p}/w_{bkf}		1.5	2.5	
maximum pool depth at bankfull	d_{pool}	feet	1.0	1.7	
pool depth ratio	d_{pool}/d_{bkf}		2.0	3.5	
pool width at bankfull	w_{pool}	feet	5.5	8.3	
pool width ratio	w_{pool}/w_{bkf}		1.0	1.5	
pool cross-sectional area at bankfull	A_{pool}	SF	3.9	6.6	
pool area ratio	A_{pool}/A_{bkf}		1.5	2.5	
Pattern Features					
sinuosity	K		1.00	1.20	1.10
belt width	w_{blt}	feet	11	36	
meander width ratio	w_{blt}/w_{bkf}		2.0	6.6	
linear wavelength	LW	feet	33	66	
linear wavelength ratio	LW/w_{bkf}		6.0	12.0	
meander length	L_m	feet	41	83	
meander length ratio	L_m/w_{bkf}		7.5	15.0	
radius of curvature	R_c	feet	11	17	
radius of curvature ratio	R_c/ w_{bkf}		2.0	3.0	

APPENDIX 5 – Wetland Design Documents and Data

S&EC
Soil & Environmental Consultants, PA
11010 Raven Ridge Road • Raleigh, North Carolina 27614 • Phone: (919) 846-5900 • Fax: (919) 846-9467
www.SandEC.com

HYDRIC SOIL INVESTIGATION

Oak Hill Dairy Project Site
601 Roy Eaker Rd., Cherryville, NC
PIEDMONT
Catawba River Basin
Gaston County, North Carolina

Prepared for:
Mr. Eric Neuhaus
Wildlands Engineering, Inc.
167-B Haywood Road
Asheville, NC 28806

SWS PCP EDUCATION EXPERIENCE PWS ETHICS KEVIN C. MARTIN 000851 PROFESSIONAL WETLAND SCIENTIST

LICENSED SOIL SCIENTIST KEVIN C. MARTIN 1003 STATE OF NORTH CAROLINA

January 5th, 2019
Revised May 29th, 2020
Revised October 12th, 2020

INTRODUCTION

Soil & Environmental Consultants, PA (S&EC, PA) was retained to perform an evaluation to assess the presence and extent of hydric soils onsite. Proposed Wetland area 1 is currently planted in winter wheat or fallow and Proposed Wetland 3 is mostly fescue grass. Proposed Wetland areas 2 and 4 have been maintained in the past but currently have mostly herbaceous vegetation with some small saplings intermixed. Proposed Wetland areas 1 and 3 contained hydric soil indicators F3, F19 or both within 10" of the surface while Proposed Wetland areas 2 & 4 contained some borings with hydric soil indicators present at depths greater than 10" but less than or equal to 18". (see attached Figure A - Soil Investigation Map)

METHODOLOGY

On December 27th, 2018 and March 6th, 2020 Kevin Martin (LSS, PWS) of S&EC, PA performed hydric soil evaluations at the site. Ninety-one Hand auger borings were advanced on the property at locations as appropriate to approximately estimate the location and extent of hydric soils within the project area (see attached Figure A - Soil Investigation Map). Each soil boring was evaluated to assess the presence or absence of hydric soil indicators. Hydric soil indicators were identified utilizing the NRCS Field Indicators of Hydric Soils in the Unities States - A Guide for Identifying and Delineating Hydric Soils (Version 8.2, 2018).

All areas evaluated are mapped as the somewhat poorly drained Chewacla soil series (Fine-loamy, mixed, active, thermic Fluvaquentic Dystrudepts) except for a few small areas along the western perimeter of Proposed Wetland 1 that were mapped as the well-drained Pacolet soil series. Most hydric soils observed onsite within Proposed Wetlands areas 1 and 3 were more like the Wehadkee soil series (Fine-loamy, mixed, active, nonacid, thermic Fluvaquentic Endoaquepts) because they contained **a horizon with a** dominant chroma of 2 or less in the upper 20 inches of the soil. While most of the soils in Proposed Wetland area 2 and 4 were more like the Chewacla soil series since they have a horizon with a dominant chroma of more than 2 in the upper 20 inches of the soil.

Non hydric soils observed along the perimeter of the Proposed Wetland areas 1 and 3 were most like the well to moderately well drained Congaree soil series. The Congaree soils were generally present close to the streams.

RESULTS

Approximately 91 soil borings were performed within the study area. Soil characteristics were evaluated and all areas identified as containing hydric soils met the hydric soil criteria described below.

Soil boring locations are indicated on the attached Figure A - Soil Investigation Map. The type of hydric soil indicator at each boing is shown on the Soil Investigation Map. The depth to the hydric soil indicator(s) for each boring is listed within Table 1 – Depth to Hydric Soil Indicator and Type.

Red circles on the Map – are borings where hydric soil indicators were not observed in the top 10" of the soil profile. Hydric indicators may have been observed below 10" of the soil surface depending on the boring location (see the attached table for further details).

Orange circles on the Map – are borings where hydric soil indicators were not observed in the top 10" of the soil profile, but were observed within 18" of the current soil surface. This area seems to contain a buried hydric soil that existed prior to 1956. A review of aerial photos in 1938 and 1951 show that the stream in this area was at a different location (further south) than its present location. The realignment of the stream appears to have resulted in side-cast material from the rerouted stream being deposited in this area. One can still see an "unnatural" landsurface elevation change adjacent to where the original stream location appears to have been. This explains why the area at toeslope of the upland south of the existing stream contains hydric soils but the area between there and the stream contain hydric indicators deeper in the soil profile. Soil profile description bh57N is typical of this area. Soil profile description bh66N is believed to be at a point where the pre1956 stream was originally located. (see the attached Table 1 – Depth to Hydric Soil Indicator and Type for further details).

Blue Plus Signs and Blue Circles- are hydric soil areas containing a depleted matrix (F3) indicator within 10" of current land surface (these borings may also have had the F19 indicator above the F3, see the attached Table 1 for details of where this occurred). Soil profile BH15 and bh56A are representative of these areas.

Green Triangles and Green Circles- are hydric soils areas containing a Piedmont floodplain indicator F19 within 10" but not a depleted matrix F3 within 10" (these borings may have also had the F3 indicator below the F19 indicator, see the attached Table 1 for further details). Soil profile description BH16 is typical of this area.

Indicator F3: Depleted Matrix

Technical Description: A layer that has a depleted matrix with 60 percent

or more chroma of 2 or less and that has a minimum thickness of either:

(a) 2 in. (5 cm) if the 2 in. (5 cm) is entirely within the upper 6 in. (15 cm)

of the soil, or

(b) 6 in. (15 cm) starting within 10 in. (25 cm) of the soil surface.

Indicator F19: Piedmont Floodplain Soils

On flood plain, a mineral layer at least 15 cm (6 inches) thick, starting at a depth $\leq$25cm (10 inches) from the soil surface, with a matrix (60 percent or more of the volume) chroma of less than 4 and 20 percent or more distinct or prominent redox concentrations occurring as soft masses or pore linings.

Table 1 - Depth to Hydric Soil Indicator and Type

Boring Name	Depth to Hydric Indicator	Documented Profiles
BH1	0" - F3	
BH2	3" - F3	
bh2N	2"- F3	
BH3	Non-Hydric	
BH4	0" - F3	
BH5	0" - F3	
BH6	24"+	
bh6N	0"- F19, 2"- F3	
BH7	8" - F19	
bh7N	4"- F3	
BH8	6" - F19, 10" - F3	
bh8N	14"- F19	
BH9	0" - F19, 8" - F3	
BH10	0" - F3	
bh10N	0"- F3, 14"- F3	
BH11	0" - F3	
bh11N	0"- F3	
BH12	8" - F3	
BH13	12" - F3	
BH14	12" - F19	
bh14N	0"- F3	
BH15	0" - F3	Soil Profile #1 - Wehadkee
bh15N	0"- F3	
BH16	4" - F19	Soil Profile #2 - Chewacla
BH17	0" - F3	
bh17N	0"- F3	
BH18	0" - F19, 6" - F3	
bh18N	2"- F19, 12"- F3	
BH19	12" - F19	
bh19N	Non-hydric	
BH20	4" - F19, 8" - F3	
bh20N	0"- F3	
BH21	0" - F3	
BH22	0" - F3, 4" - F19 8" - F3	
BH23	4" - F19, 9" - F3	

Table 1 - Depth to Hydric Soil Indicator and Type (Continued)

Boring Name	Depth to Hydric Indicator	Documented Profiles
BH24	6" - F19, 12" - F3	
BH25	10" - F19	
BH26	Non-Hydric	
BH27	6" - F19, 18" - F3	
BH28	15" - F3	
BH29	4" - F19, 8" - F3	
bh29N	0"- F3, 4"- F19	
BH30	4" - F19, 7" - F3	
bh30N	0"- F3, 4"- F19	
BH31	16" - F3	
BH32	3" - F19, 5" - F3	
BH33	7" - F3	
bh33N	0"- F3	
BH34	10" - F3	
bh34N	0"- F3	
BH35	13" - F3	
BH36	4" - F3	
BH37	15" - F3	
bh37N	5"- F19	
BH38	14" - F3	
bh38N	2"- F3	
BH39	15" - F3	
bh39N	6"- F3	
BH40	13" - F3	
BH41	3" - F3	
BH42	6" - F3	
bh42N	4"- F19, 7"- F3	
BH43	0" - F3	
bh43N	8"- F19, 10"- F3	
BH44	6" - F3	
BH45	14" - F3	
bh45N	8"- F19	
BH46	9" - F19	
bh46N	9"- F19	
bh47N	8"- F19, 14"- F3	
bh56N	10"- F3	
bh56N-A	0"- F3	Soil Profile #4 - Wehadkee
bh57N	12"- F3	Soil Profile #3 - Chewacla but with buried F3
bh58N	20"- F3	

Table 1 - Depth to Hydric Soil Indicator and Type (Continued)

Boring Name	Depth to Hydric Indicator	Documented Profiles
bh59N	11"- F3	
bh60N	16"- F3	
bh61N	15"- F3	
bh62N	19"- F3	
bh64N	2"- F3	
bh65N	10"- F3	
bh66N	14"- F3	Soil Profile #5 - Chewacla but with buried F3
bh66N-A	0"- F3	
bh67N	15"- F3	
bh68N	18"- F3	
bh77N	4"- F19, 6"- F3	
bh78N	3"- F19, 7"- F3	
bh80N	1"- F3	
bh81N	14"- F3	
bh82N	2"- F3	
bh83N	12"- F19, 16"- F3	
bh84N	9"- F3	

Soil Profile #1 / Boring Location BH15
Hydric Soil Indicator: F3
Series and Taxonomic Class: Wehadkee – Fine-loamy, mixed, active, nonacid, thermic Fluvaquentic Endoaquepts

Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-2	A	2.5Y 3/2	95	7.5YR 4/6	5	C	PL	Sandy Clay Loam	
2-8	Bg	2.5Y 5/2	80	7.5YR 4/6&5/8	20	C	M	Clay Loam	
8-14	C1	2.5Y 6/3	80	7.5YR 4/6	20	C	M	Loamy sand	
14-24+	C2	2.5Y 6/2	70	7.5YR 4/6	30	C	M	Clay loam	

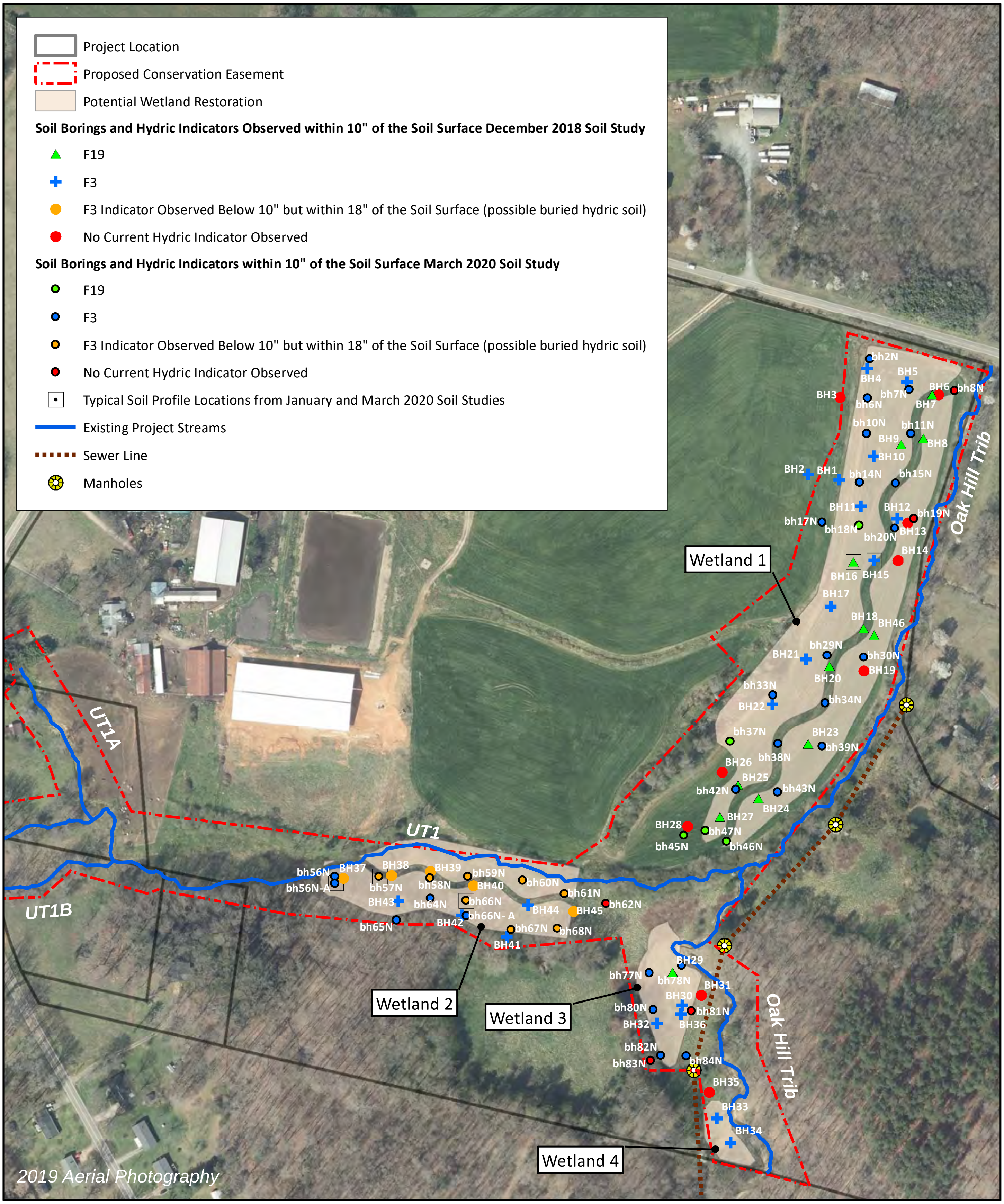
Soil Profile #2 / Boring Location BH16 Hydric Soil Indicator: F19 Series and Taxonomic Class: Chewacla – Fine-loamy, mixed, active thermic Fluvaquentic Dystrudepts									
Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-1	Ap	2.5Y 3/2	100			D	M	Sandy Loam	
1-22+	Bw	10YR 5/3	70	7.5YR 5/6 7.5YR 3/3	20 10	C	M	Clay Loam	

Soil Profile #3 / Boring Location bh57N Hydric Soil Indicator: F3 but below 10”, technically meets F19 but not believed to be in an active floodplain, Buried hydric due to reshaping and/or filling Series and Taxonomic Class: Chewacla - Fluvaquentic Dystrudepts									
Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-6	A	10YR 4/6	80	7.5YR 5/6 10YR 5/3	15 5			Sandy Clay Loam	
6-12	Bw	2.5Y 5/3	70	7.5YR 5/6 2.5Y 5/2	20 10	C D	M M	Sandy Clay Loam	
12-18+	Bg	2.5Y 6/2	70	7.5YR 4/6 7.5R 5/8	15 15	C C	M PL	Sandy Clay Loam	

Soil Profile #4 / Boring Location bh56A – 30’ south
Hydric Soil Indicator: F3
Series and Taxonomic Class: Wehadkee – Fine-loamy, mixed, active, nonacid, thermic Fluvaquentic Endoaquepts

Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-10	A	2.5Y 4/2	70	7.5YR 3/4	30	C	PL & M	Sandy Clay Loam	
10-14+	Bg	5Y 3/1	95	7.5YR 3/4	5	C	PL & M	Lt. Sandy Clay Loam	

Soil Profile #5 / Boring Location bh66N Hydric Soil Indicator: F3 but below 10”, Possibly Buried hydric at old stream channel or mixed 0-14” due to reshaping and/or filling, Series and Taxonomic Class: Chewacla - Fluvaquentic Dystrudepts									
Horizon Depth (inches)	Horizon	Matrix Color (moist)	%	Redox Features				Texture	Notes
				Color (moist)	%	Type	Location		
0-6	A	10YR 5/4	70	10YR 5/3 7.5YR 4/6	15 25			Sandy Loam	
6-12	C	7.5YR 4/4	60	10YR 5/3 7.5YR 4/6	15 25			Loamy Sand	
12-14	IIC	2.5Y 5/3	60	7.5YR 4/4	40	C	M & PL	Sandy clay loam	
14-20+	Ab	2.5Y 5/2	80	7.5YR 4/6	20	C	M & PL	Sandy Clay Loam	

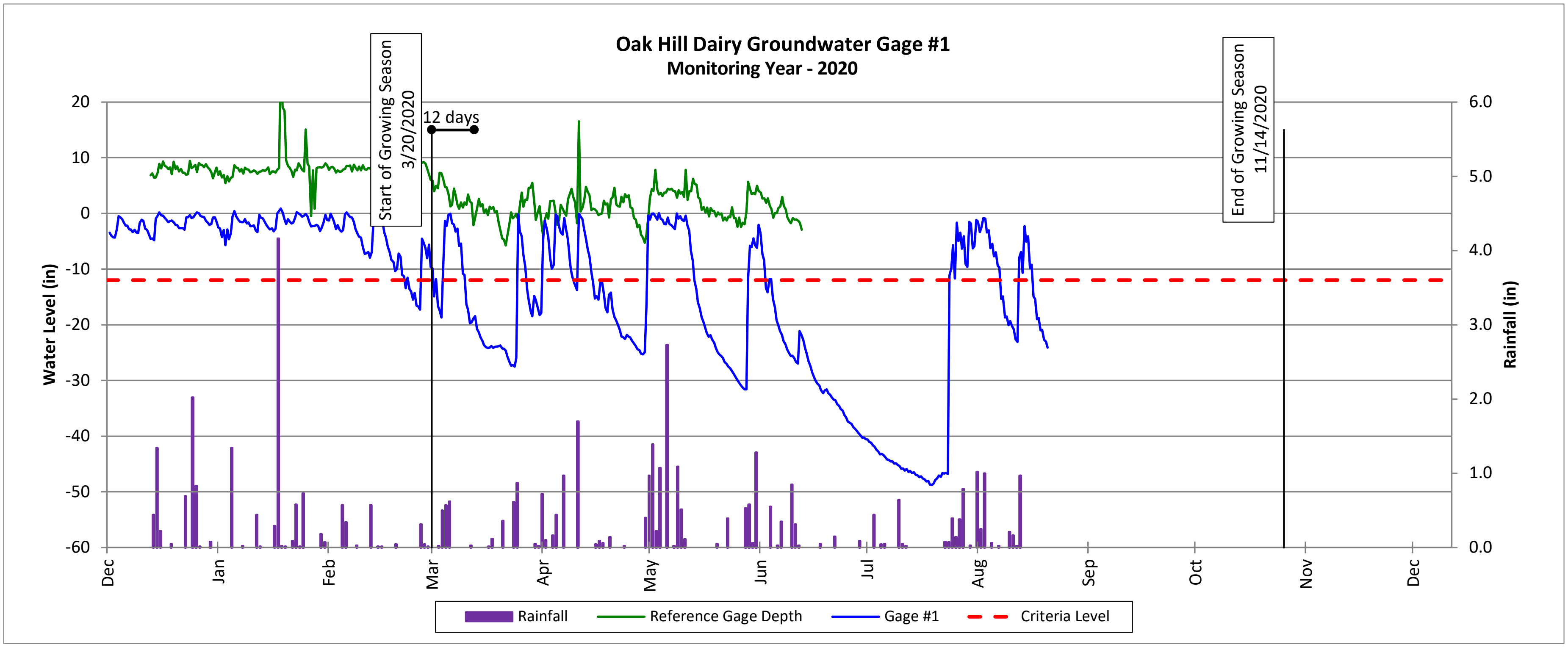


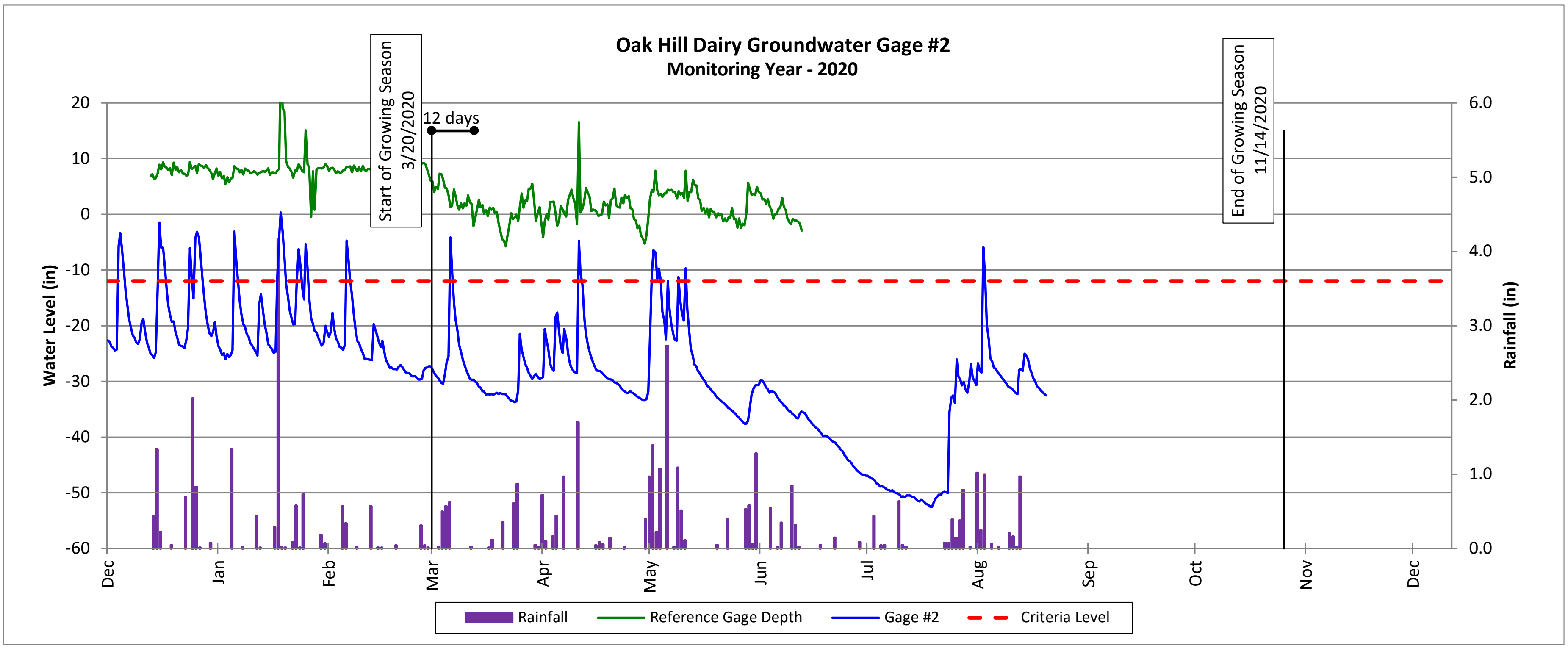
WILDLANDS ENGINEERING

Figure A
Soil Investigation Map
Oak Hill Dairy Mitigation Site
Catawba River Basin (03050102)

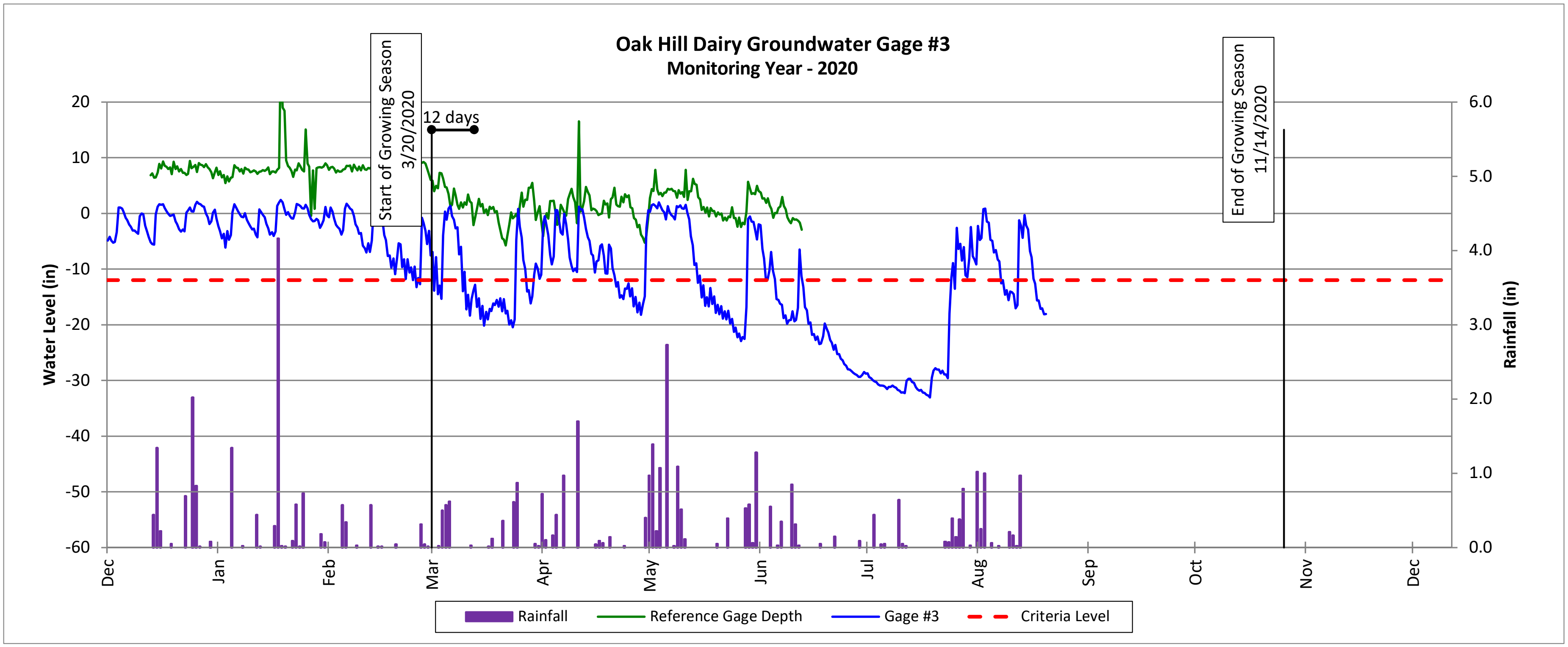
Gaston County, NC

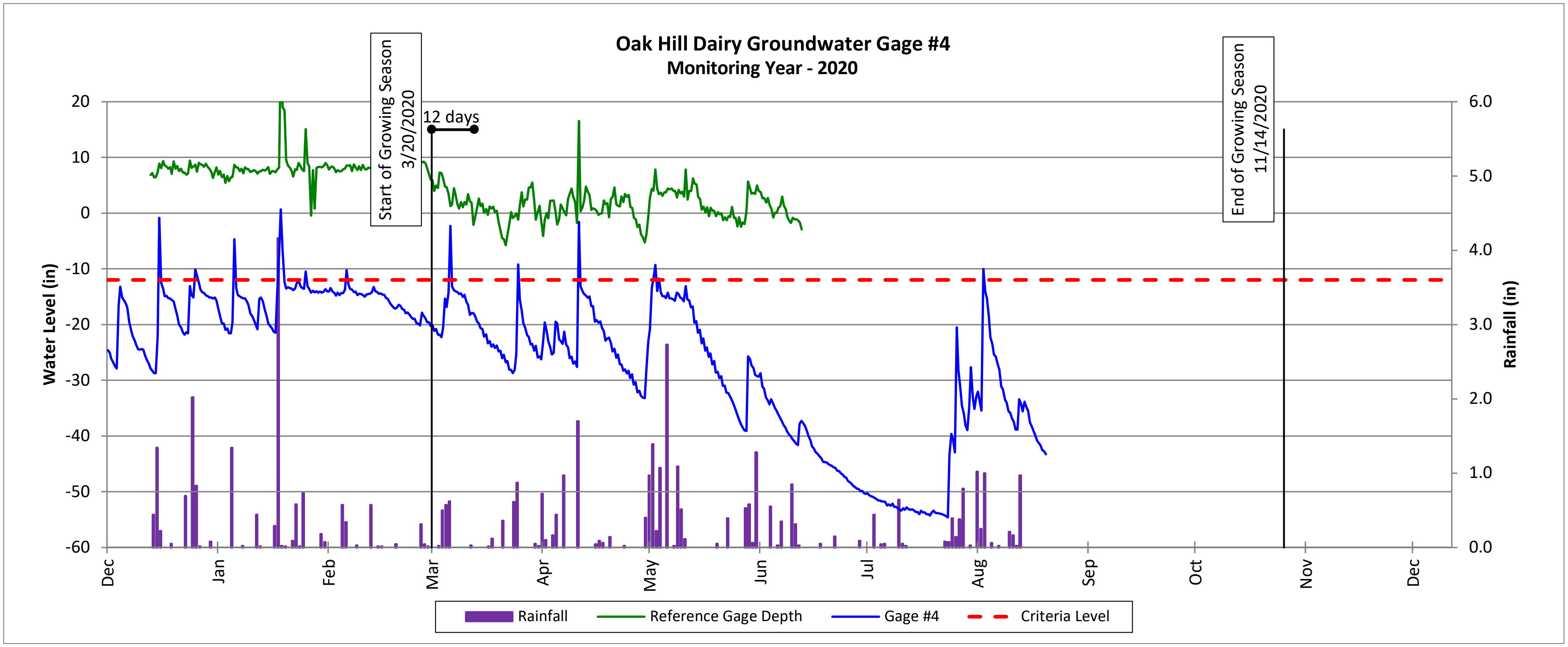
Groundwater Gage Plots
Oak Hill Dairy
DMS Project No. 100120
Monitoring Year - 2020





Oak Hill Dairy Groundwater Gage #2
Monitoring Year - 2020
Start of Growing Season 3/20/2020
12 days
End of Growing Season 11/14/2020
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Rainfall
Reference Gage Depth
Gage #2
Criteria Level


Oak Hill Dairy Groundwater Gage #3
Monitoring Year - 2020
Start of Growing Season 3/20/2020
12 days
End of Growing Season 11/14/2020
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Rainfall
Reference Gage Depth
Gage #3
Criteria Level



Oak Hill Dairy Groundwater Gage #4
Monitoring Year - 2020
Start of Growing Season 3/20/2020
12 days
End of Growing Season 11/14/2020
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec
Jan
Feb
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Apr
May
Jun
Jul
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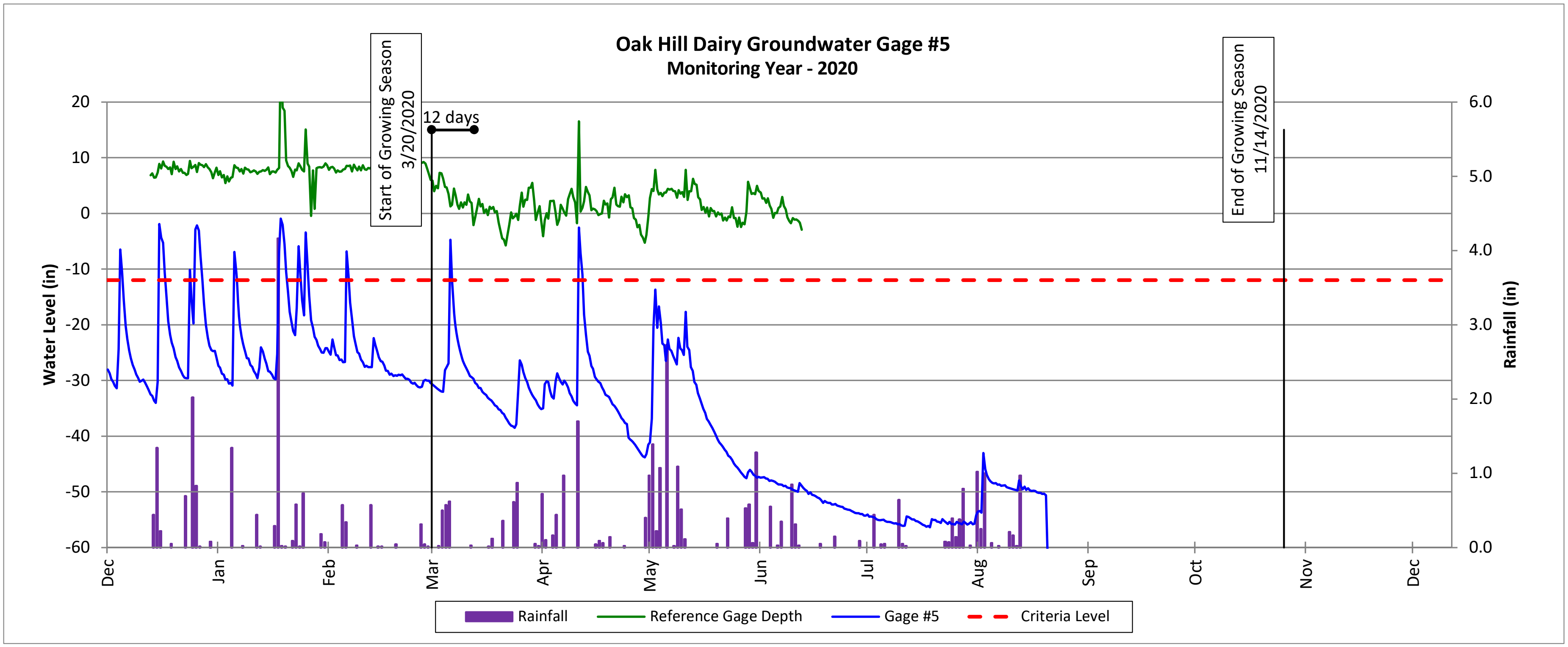
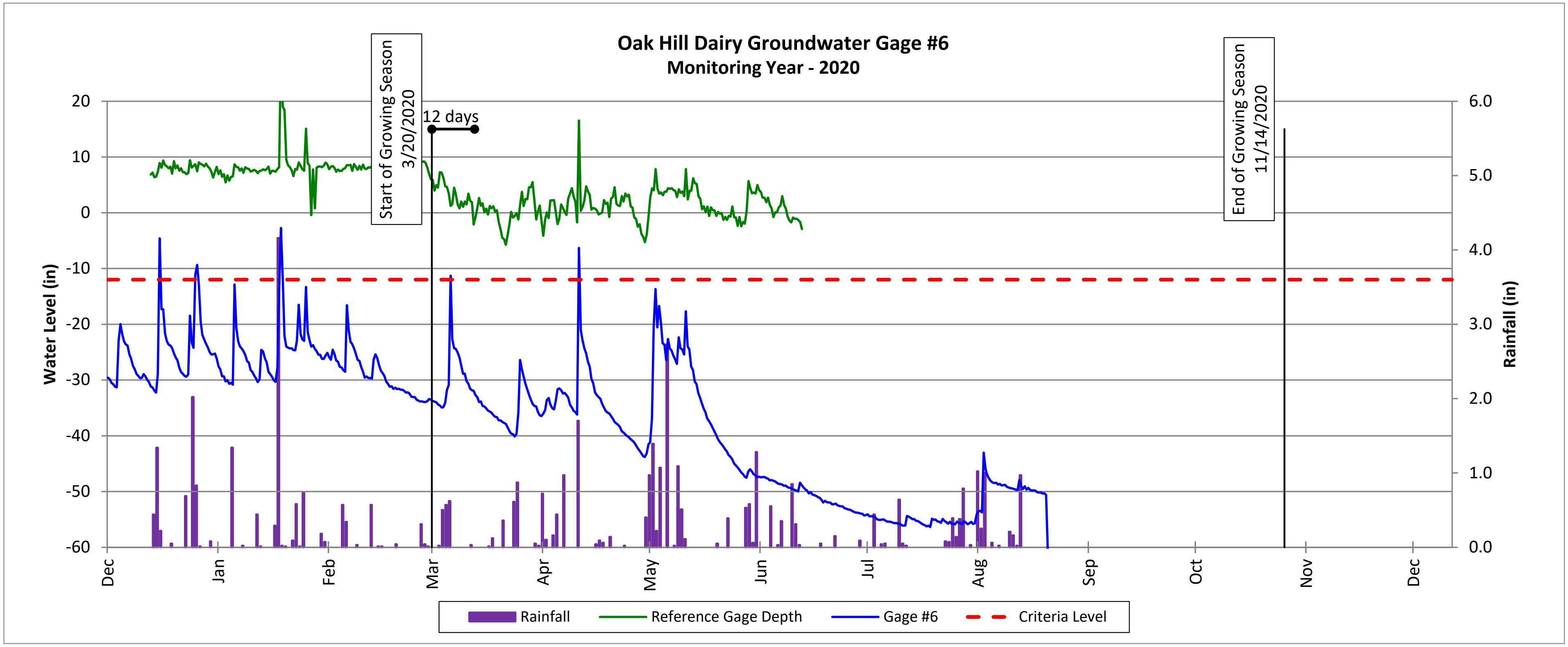
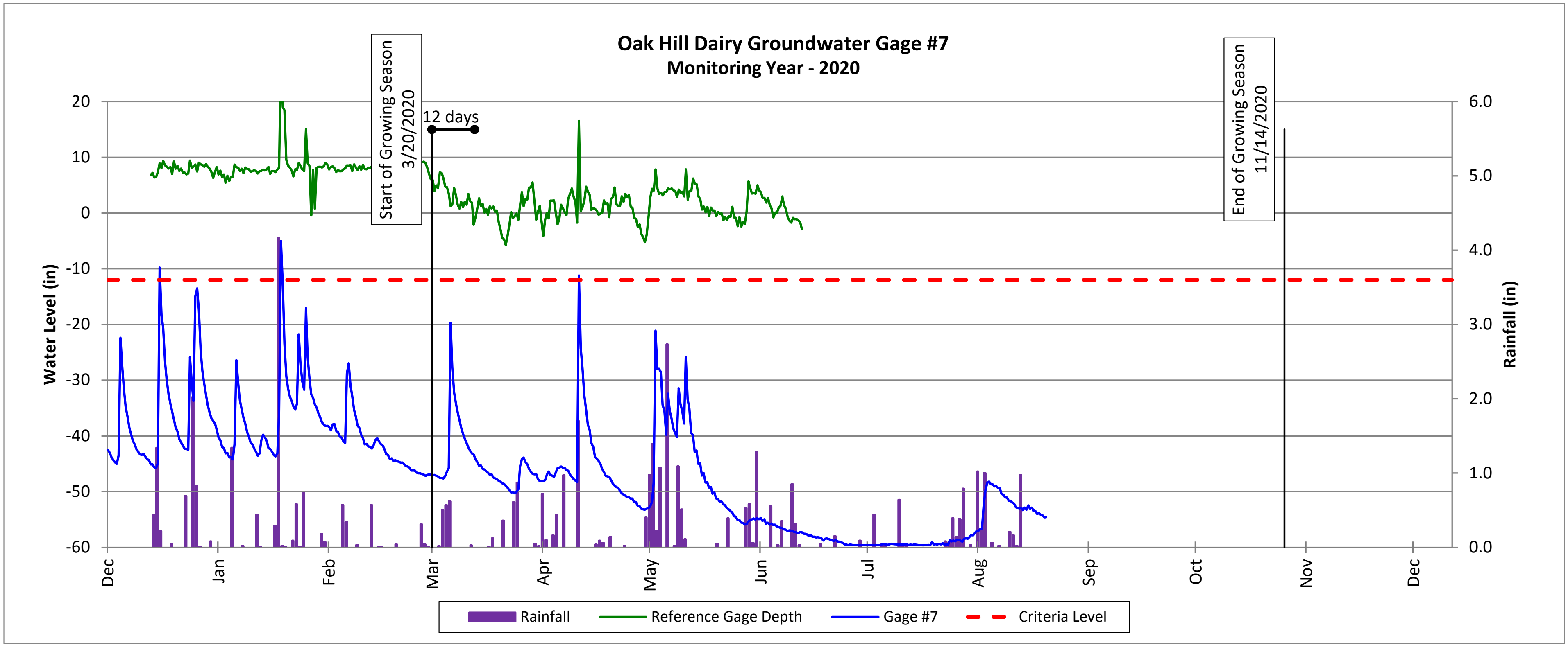
Sep
Oct
Nov
Dec
Rainfall
Reference Gage Depth
Gage #4
Criteria Level



Oak Hill Dairy Groundwater Gage #5
Monitoring Year - 2020
Start of Growing Season 3/20/2020
12 days
End of Growing Season 11/14/2020
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Rainfall
Reference Gage Depth
Gage #5
Criteria Level


Oak Hill Dairy Groundwater Gage #6
Monitoring Year - 2020
Start of Growing Season 3/20/2020
12 days
End of Growing Season 11/14/2020
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Rainfall
Reference Gage Depth
Gage #6
Criteria Level



Oak Hill Dairy Groundwater Gage #7
Monitoring Year - 2020
Start of Growing Season 3/20/2020
12 days
End of Growing Season 11/14/2020
Water Level (in)
Rainfall (in)
20
10
0
-10
-20
-30
-40
-50
-60
6.0
5.0
4.0
3.0
2.0
1.0
0.0
Dec
Jan
Feb
Mar
Apr
May
Jun
Jul
Aug
Sep
Oct
Nov
Dec
Rainfall
Reference Gage Depth
Gage #7
Criteria Level

APPENDIX 6 – Categorical Exclusion Checklist and Summary

Categorical Exclusion Form for Ecosystem Enhancement Program 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:	Oak Hill Dairy Mitigation Site
County Name:	Gaston County
DMS Number:	100120
Project Sponsor:	Wildlands Engineering, Inc.
Project Contact Name:	Kirsten Gimbert
Project Contact Address:	1430 S. Mint Street, Suite 104, Charlotte, NC 28203
Project Contact E-mail:	kgimbert@wildlandseng.com
DMS Project Manager:	Matthew Reid

Project Description

The Oak Hill Dairy Mitigation Site is a stream and wetland mitigation project involving stream preservation, enhancement II, and restoration, wetland re-establishment, and stormwater BMPs. The adjacent land use is currently agricultural fields that is extensively impacted by cattle grazing and crop land. This project will improve water quality and ecology in this water supply watershed through cattle exclusion, buffer reforestation, reconnecting streams to the historic floodplain, restoring stream shape and function, and installation of two agricultural BMPs to treat overland flow from dairy feedlot.

For Official Use Only

Reviewed By:

8/21/2019 — Matthew Reid

Date — **DMS Project Manager**

Conditional Approved By:

Date — **For Division Administrator FHWA**

☐ **Check this box if there are outstanding issues**

Final Approval By:

Donald W. Brew — 8-20-19

Date — **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 species 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

Oak Hill Dairy Mitigation Site
Categorical Exclusion

SUMMARY

Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA)

The Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides a Federal “Superfund” to clean up uncontrolled or abandoned hazardous-waste sites as well as accidents, spills, and other emergency releases of pollutants and contaminants into the environment.

As the Oak Hill Dairy Mitigation Site is a full-delivery project; an EDR Radius Map Report with Geocheck was ordered for the site through Environmental Data Resources, Inc on December 12, 2018. Neither the target property nor the adjacent properties were listed in any of the Federal, State, or Tribal environmental databases searched by the EDR. The assessment revealed no evidence of any “recognized environmental conditions” in connection with the target property.

The target property, Eaker Dairy, Inc., has an active NPDES permit (National Pollutant Discharge Elimination System) and an active AOP (Air Operating Permit) associated with the cattle waste lagoon located on the target property. The lagoon is located outside of the Oak Hill Dairy conservation easement and will not be disturbed by the stream and wetland mitigation project. The dairy is in full compliance with their NPDES and AOC permits.

The Executive Summary of the EDR report is included in the Appendix. The full report is available if needed.

National Historic Preservation Act (Section 106)

The National Historic Preservation Act declares a national policy of historic preservation to protect, rehabilitate, restore, and reuse districts, sites, buildings, structures, and objects significant in American architecture, history, archaeology, and culture, and Section 106 mandates that federal agencies take into account the effect of an undertaking on a property that is included in, or is eligible for inclusion in, the National Register of Historic Places.

The State Historic Preservation Office (SHPO) responded to a United States Army Corps of Engineers public notice requesting comment on the Oak Hill Dairy Mitigation Site on July 12, 2019. SHPO stated they were aware of “no historic resources which would be affected by the project” and would have no further comment. All correspondence related to Section 106 is included in the Appendix.

Uniform Relocation Assistance and Real Property Acquisition Policies Act (Uniform Act)

These acts, collectively known as the Uniform Act, provide for uniform and equitable treatment of persons displaced from their homes, businesses, non-profit associations, or farms by federal and federally-assisted programs, and establish uniform and equitable land acquisition policies.

Oak Hill Dairy Mitigation Site is a full-delivery project that includes land acquisition. Notification of the fair market value of the project property and the lack of condemnation authority by Wildlands was included in the signed Option Agreements for the project properties. A copy of the relevant section of each of the Option Agreements are included in the Appendix.

American Indian Religious Freedom Act (AIRFA)

The American Indian Religious Freedom Act provides for the protection and preservation of places of religious importance to American Indians, Eskimos, and Native Hawaiians.

The Cherokee Nation Tribal Historic Preservation Office (THPO) commented on the project, July 17, 2019, in response to the United States Army Corps of Engineers (USACE) public notice for the project. The Cherokee Nation THPO stated they “did not foresee this project imparting impacts to Cherokee cultural resources at this time.” NCDMS requested additional review and comment from the Eastern Band of Cherokee Indians THPO and the United Keetoowah Band of Cherokee THPO with respect to any archeological or religious resources related to the Oak Hill Dairy Mitigation Site on June 19, 2019. At this time, DMS has not received a response from either the Eastern Bank of Cherokee or the Untied Keetoowah Band of Cherokee.

All correspondence related to AIRFA is included in the Appendix.

Endangered Species Act (ESA)

Section 7 of the ESA requires federal agencies, in consultation with and with the assistance of the Secretary of the Interior or of Commerce, as appropriate, to ensure that actions they authorize, fund or carry out are not likely to jeopardize the continued existence of threatened or endangered species or result in the destruction or adverse modification of critical habitat for these species.

The Gaston County listed endangered species includes the bog turtle (*Glyptemys muhlenbergii*), the northern long-eared bat (NLEB) (*Myotis septentrionalis*), the dwarf-flowered heartleaf (*Hexastylis naniflora*), and the Schweinitz's sunflower (Helianthus schweinitzii). The United States Fish and Wildlife Service (USFWS) does not currently list any Critical Habitat Designations for the Federally listed species within Gaston County nor are there any current known occurrences of the above listed species within a 2-mile radius of the project site. The project site is located more than 40 miles from the nearest known hibernaculum for the NLEB. (https://www.fws.gov/asheville/htmls/project_review/NLEB_in_WNC.html).

Results of a pedestrian survey conducted on June 18, 2019, indicated that the project area provides potential summer roosting for the NLEB and areas of suitable habitat for the bog turtle, the dwarf-flowered heartleaf, and the Schweinitz's sunflower. No individuals or populations of the four above referenced species were documented on-site.

NLEB

Wildlands determined the project "may affect, not likely to adversely affect" the NLEB. Forested habitats containing trees at least 3-inch dbh in the project area provide suitable habitat for NLEB. Due to the decline of the NLEB population from the White Nose Syndrome (WNS), the United States Fish and Wildlife Service (USFWS) has issued the finalization of a special rule under section 4(d) of the ESA to addresses the effects to the NLEB resulting from purposeful and incidental take based on the occurrence of WNS. Because the project is located within a WNS zone and will include the removal/clearing of trees, it is subject to the final 4(d) ruling. As previously stated, a review of NCNHP records did not indicate any known NLEB populations within 2.0 mile of the study area; therefore, the project is eligible to use the NLEB 4(d) Rule Streamlined Consultation Form to meet regulatory requirements for section 7(a)(2) compliance 4(d) consultation. The completed NLEB 4(d) Consultation Form was submitted to the USFWS by the Federal Highway Administration (FHWA) on July 17, 2019.

Bog Turtle

Wildlands determined the project "may affect, not likely to adversely affect" the bog turtle; however, it is listed due to similarity of appearance and is not subject to Section 7 consultation.

Dwarf-flowered heartleaf and the Scweinitz's sunflower

Wildlands determined the project will have "no effect" on the two listed plant species (dwarf-flowered heartleaf and the Schweinitz's sunflower). Though the survey was performed outside of the blooming season for the sunflower, no populations resembling the species were found on-site; therefore, Wildlands is confident with the determination of "no effect" outside of the blooming season for this species.

To meet regulatory requirements, a scoping letter requesting comment from the USFWS was sent on June 14, 2019. No response from the USFWS was received within the 45-day response period. Therefore, the signing of the NLEB 4(d) Rule Streamlined Consultation Form by the FHWA determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule. A FHWA signed 4(d) Consultation Form and the correspondence associated with this determination are included in the Appendix.

Farmland Protection Policy Act (FPPA)

The FPPA requires that, before taking or approving any federal action that would result in conversion of farmland, the agency must examine the effects of the action using the criteria set forth in the FPPA, and, if there are adverse effects, must consider alternatives to lessen them.

Oak Hill Dairy Mitigation Site includes the conversion of prime farmland. As such, Form AD-1006 has been completed and submitted to the Natural Resources Conservation Service (NRCS). The completed form and correspondence documenting its submittal is included in the Appendix.

Fish and Wildlife Coordination Act (FWCA)

The FWCA requires consultation with the USFWS and the appropriate state wildlife agency on projects that alter or modify a water body. Reports and recommendations prepared by these agencies document project effects on wildlife and identify measures that may be adopted to prevent loss or damage to wildlife resources.

The Oak Hill Dairy Mitigation Site includes stream and wetland restoration. Wildlands requested comment on the project from both the USFWS and the North Carolina Wildlife Resources Commission (NCWRC) on June 14, 2019. No response from the USFWS was received within the 45-day response period. Therefore, Wildlands assumes USFWS has no comments regarding associated laws and do not have any information relevant to the project at the current time. NCWRC responded to the scoping letter on August 7, 2019 that they have no known records of state or federally-listed rare, threatened, or endangered species within or near the project area. All correspondence with the two agencies is included in the appendix.

Migratory Bird Treaty Act (MBTA)

The MBTA makes it unlawful for anyone to kill, capture, collect, possess, buy, sell, trade, ship, import, or export any migratory bird. The indirect killing of birds by destroying their nests and eggs is covered by the MBTA, so construction in nesting areas during nesting seasons can constitute a taking.

Wildlands requested comment on the Oak Hill Dairy Mitigation Site from the USFWS in regard to migratory birds on June 14, 2019. The USFWS has not responded at this time. All correspondence with USFWS is included in the Appendix.

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

July 12, 2019

Kimberly Browning
Wilmington District Corps of Engineers
Mitigation Field Office
3331 Heritage Trade Drive
Wake Forest, NC 27587

Re: Oak Hill Dairy Mitigation Site, Roy Eaker Road and Robert Road, Cherryville, SAW 2019-00833, Gaston County, ER 19-1969

Dear Ms. Browning:

We have received a public notice 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

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CHEROKEE NATION®
P.O. Box 948 • Tahlequah, OK 74465-0948 • 918-453-5000 • cherokee.org

Office of the Chief

Bill John Baker
Principal Chief
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S. Joe Crittenden
Deputy Principal Chief
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July 17, 2019

Paul Wiesner
Western Regional Supervisor
North Carolina Department of Environmental Quality
Western DMS Field Office
5 Ravenscroft Drive, Suite 102
Asheville, NC 28801

Re: Oak Hill Dairy Mitigation Site

Mr. Paul Wiesner:

The Cherokee Nation (Nation) is in receipt of your correspondence about **Oak Hill Dairy Mitigation Site**, and appreciates the opportunity to provide comment upon this project. Please allow this letter to serve as the Nation's interest in acting as a consulting party to this proposed project.

The Nation maintains databases and records of cultural, historic, and pre-historic resources in this area. Our Historic Preservation Office reviewed this project, cross referenced the project's legal description against our information, and found no instances where this project intersects or adjoins such resources. Thus, the Nation does not foresee this project imparting impacts to Cherokee cultural resources at this time.

However, the Nation requests that the North Carolina Department of Environmental Quality (NCDEQ) halt all project activities immediately and re-contact our Offices for further consultation if items of cultural significance are discovered during the course of this project.

Additionally, the Nation requests that NCDEQ conduct appropriate inquiries with other pertinent Tribal and Historic Preservation Offices regarding historic and prehistoric resources not included in the Nation's databases or records.

If you require additional information or have any questions, please contact me at your convenience. Thank you for your time and attention to this matter.

Wado,

Elizabeth Toombs

Elizabeth Toombs, Tribal Historic Preservation Officer
Cherokee Nation Tribal Historic Preservation Office
elizabeth-toombs@cherokee.org
918.453.5389

North Carolina Wildlife Resources Commission

Gordon Myers, Executive Director

07 August 2019

Ms. Kirstin Gimbert
Wildlands Engineering
1430 South Mint Street, Suite 104
Charlotte, North Carolina 28203

Subject: Request for Project Review and Comments
Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Dear Ms. Gimbert,

Biologists with the North Carolina Wildlife Resource Commission (NCWRC) received your request to review and comment on any possible concerns regarding the Oak Hill Dairy Mitigation Site. Biologists with NCWRC have reviewed the provided documents. Comments are provided in accordance with provisions of the Fish and Wildlife Coordination Act (48 Stat. 401, as amended; 16 U.S.C. 661-667e) and North Carolina General Statutes (G.S. 113-131 et seq.).

The Oak Hill Dairy Mitigation Site is located southeast of the intersection of Roy Eaker Road and Robert Road in Cherryville, Gaston County, North Carolina. The site occurs within an existing livestock pasture/dairy feedlot, agricultural fields, and forested area. The project will provide in-kind mitigation for unavoidable impacts to streams and wetlands within the Catawba River Basin (HUC 03050102). The project will restore, enhance, or preserve portions of Oak Hill Creek, its unnamed tributaries, and wetlands. Two stormwater BMP’s are proposed for the project to filter runoff from the dairy feedlot.

We have no known state or federally-listed rare, threatened, or endangered species within or near the project area. The lack of records from the site does not imply or confirm the absence of federal or state-listed species. An on-site survey is the only means to determine if the proposed project may impact federal or state rare, threatened, or endangered species.

Based upon the information provided to NCWRC, it is unlikely that stream and wetland mitigation will adversely affect any federal or state-listed species. However, we recommend leaving snags and mature trees or if necessary, remove tees outside the maternity roosting season for bats (May 15 – August 15). We recommend that riparian buffers are as wide as possible, given site constraints and landowner needs. NCWRC generally recommends a woody buffer of 100 feet on perennial streams to maximize the benefits of buffers, including bank stability, stream shading, treatment of overland runoff, and wildlife habitat.

The use of biodegradable and wildlife-friendly sediment and erosion control devices is strongly recommended. Silt fencing, fiber rolls and/or other products should have loose-weave netting that is made of natural fiber materials with movable joints between the vertical and horizontal twines. Silt fencing that has been reinforced with plastic or metal mesh should be avoided as it impedes the movement of terrestrial wildlife species. Excessive silt and sediment loads can have detrimental effects on aquatic resources including destruction of spawning habitat, suffocation of eggs, and clogging of gills.

Stream and wetland mitigation projects often improve water quality and aquatic habitat. Establishing native, forested buffers in riparian areas will help protect water quality, improve aquatic and terrestrial habitats, and provide a travel corridor for wildlife species. Provided measures are taken to minimize erosion and sedimentation from construction/restoration activities, we do not anticipate the project to result in significant adverse impacts to aquatic and terrestrial wildlife resources.

Thank you for the opportunity to provide comments. If I can be of additional assistance, please call (919) 707-0364 or email olivia.munzer@ncwildlife.org.

Sincerely,

Olivia Munzer
Western Piedmont Habitat Conservation Coordinator
Habitat Conservation Program

Kirsten Gimbert

From:	Brew, Donnie (FHWA) <Donnie.Brew@dot.gov>
Sent:	Wednesday, July 17, 2019 8:04 AM
To:	claire_ellwanger (claire_ellwanger@fws.gov)
Cc:	Reid, Matthew; Kirsten Gimbert; Jake McLean
Subject:	NLEB 4(d) rule consultation - Oak Hill Dairy site, Gaston County
Attachments:	Oak Hill Dairy site - NLEB Consultation form 7-17-19.pdf; Oak Hill Figure 1 Site Map.pdf; Oak Hill Figure 2 USGS Map.pdf

Good morning Claire,

The purpose of this message is to notify your office that FHWA will use the streamlined consultation framework for the Oak Hill Dairy Site in Gaston County, NC.

Attached is a completed NLEB 4(d) Rule Streamlined Consultation form along with site maps/figures.

Thank you,

Donnie

Notifying the Service Under the Framework
Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form
Federal agencies (or designated non-federal representatives) should use the Northern Long-Eared Bat 4(d) Rule Streamlined Consultation form to notify the Service of their project and meet the requirements of the framework.

Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form (Word document)

Information requested in the Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form serves to

(1) notify the field office that an action agency will use the streamlined framework;

(2) describe the project with sufficient detail to support the required determination; and

(3) enable the USFWS to track effects and determine if reinitiation of consultation for the 4(d) rule is required. This form requests the minimum amount of information required for the Service to be able to track this information.

Providing information in the Streamlined Consultation Form does not address section 7(a)(2) compliance for any other listed species.

Donnie Brew
Preconstruction & Environment Engineer
Federal Highway Administration

310 New Bern Ave, Suite 410
Raleigh, NC 27601
donnie.brew@dot.gov
919-747-7017

Please consider the environment before printing this email.

Northern Long-Eared Bat 4(d) Rule Streamlined Consultation Form

Federal agencies should use this form for the optional streamlined consultation framework for the northern long-eared bat (NLEB). This framework allows federal agencies to rely upon the U.S. Fish and Wildlife Service's (USFWS) January 5, 2016, intra-Service Programmatic Biological Opinion (BO) on the final 4(d) rule for the NLEB for section 7(a)(2) compliance by: (1) notifying the USFWS that an action agency will use the streamlined framework; (2) describing the project with sufficient detail to support the required determination; and (3) enabling the USFWS to track effects and determine if reinitiation of consultation is required per 50 CFR 402.16.

This form is not necessary if an agency determines that a proposed action will have no effect to the NLEB or if the USFWS has concurred in writing with an agency's determination that a proposed action may affect, but is not likely to adversely affect the NLEB (i.e., the standard informal consultation process). Actions that may cause prohibited incidental take require separate formal consultation. Providing this information does not address section 7(a)(2) compliance for any other listed species.

Information to Determine 4(d) Rule Compliance:	**YES**	**NO**
1. Does the project occur wholly outside of the WNS Zone[1]?	☐	☒
2. Have you contacted the appropriate agency[2] to determine if your project is near known hibernacula or maternity roost trees?	☒	☐
3. Could the project disturb hibernating NLEBs in a known hibernaculum?	☐	☒
4. Could the project alter the entrance or interior environment of a known hibernaculum?	☐	☒
5. Does the project remove any trees within 0.25 miles of a known hibernaculum at any time of year?	☐	☒
6. Would the project cut or destroy known occupied maternity roost trees, or any other trees within a 150-foot radius from the maternity roost tree from June 1 through July 31.	☐	☒

You are eligible to use this form if you have answered yes to question #1 **or** yes to question #2 **and** no to questions 3, 4, 5 and 6. The remainder of the form will be used by the USFWS to track our assumptions in the BO.

Agency and Applicant[3] (Name, Email, Phone No.): FHWA, Donnie Brew, Donnie.brew@dot.gov, 919-747-7017

Project Name: Oak Hill Dairy Mitigation Site

Project Location (include coordinates if known): latitude 35.40305, longitude 81.35226

Basic Project Description (provide narrative below or attach additional information):

The Oak Hill Dairy Mitigation Site is being developed to provide stream and wetland mitigation. Wildlands' approach to the project involves a multi-tiered approach including preservation, enhancement II, restoration, and wetland re-establishment. In addition, two stormwater BMPs are proposed for the project to filter runoff from the dairy feedlot. The area surrounding the streams and channels proposed for stream and wetland mitigation is currently agricultural fields, and extensively impacted by cattle grazing and crop land. The dairy's primary waste lagoon drains to the proposed easement, and much of the floodplain has been manipulated and ditched for crop drainage. This project will improve water quality and ecology in this water supply watershed through cattle exclusion, buffer reforestation, reconnecting streams to the historic floodplain, restoring stream shape and function, and installation of two agricultural best management practices (BMP) to treat overland flow. Construction of the stream restoration project will include some tree removal (>3"DBH) – approximately 1.24 acres.

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[1] http://www.fws.gov/midwest/endangered/mammals/nleb/pdf/WNSZone.pdf

[2] See http://www.fws.gov/midwest/endangered/mammals/nleb/nhisites.html

[3] If applicable - only needed for federal actions with applicants (e.g., for a permit, etc.) who are party to the consultation.

General Project Information	YES	NO
Does the project occur within 0.25 miles of a known hibernaculum? (42 miles)	☐	☒
Does the project occur within 150 feet of a known maternity roost tree?	☐	☒
Does the project include forest conversion[4]? (if yes, report acreage below)	☒	☐
Estimated total acres of forest conversion	1.24 ac	
If known, estimated acres[5] of forest conversion from April 1 to October 31		
If known, estimated acres of forest conversion from June 1 to July 31[6]		
Does the project include timber harvest? (if yes, report acreage below)	☐	☒
Estimated total acres of timber harvest		
If known, estimated acres of timber harvest from April 1 to October 31		
If known, estimated acres of timber harvest from June 1 to July 31		
Does the project include prescribed fire? (if yes, report acreage below)	☐	☒
Estimated total acres of prescribed fire		
If known, estimated acres of prescribed fire from April 1 to October 31		
If known, estimated acres of prescribed fire from June 1 to July 31		
Does the project install new wind turbines? (if yes, report capacity in MW below)	☐	☒
Estimated wind capacity (MW)		

Agency Determination:

By signing this form, the action agency determines that this project may affect the NLEB, but that any resulting incidental take of the NLEB is not prohibited by the final 4(d) rule.

If the USFWS does not respond within 30 days from submittal of this form, the action agency may presume that its determination is informed by the best available information and that its project responsibilities under 7(a)(2) with respect to the NLEB are fulfilled through the USFWS January 5, 2016, Programmatic BO. The action agency will update this determination annually for multi-year activities.

The action agency understands that the USFWS presumes that all activities are implemented as described herein. The action agency will promptly report any departures from the described activities to the appropriate USFWS Field Office. The action agency will provide the appropriate USFWS Field Office with the results of any surveys conducted for the NLEB. Involved parties will promptly notify the appropriate USFWS Field Office upon finding a dead, injured, or sick NLEB.

Signature: [signature] Date Submitted: 7-17-19

[4] Any activity that temporarily or permanently removes suitable forested habitat, including, but not limited to, tree removal from development, energy production and transmission, mining, agriculture, etc. (see page 48 of the BO).

[5] If the project removes less than 10 trees and the acreage is unknown, report the acreage as less than 0.1 acre.

[6] If the activity includes tree clearing in June and July, also include those acreage in April to October.

APPENDIX 7 – NCIRT Communications

MEETING NOTES

MEETING: Post-Contract IRT Site Walk
Oak Hill Dairy Mitigation Site
Cataloging Units 03050101, 03050102 and 03050103 (Catawba ESA); Gaston County, NC
DEQ Contract No. 7867
DMS Project No. 100120
Wildlands Project No. 005-02182

DATE: *On-site Meeting:* Monday, July 22, 2019 @ 2:00 PM – 4:30 PM
Meeting Notes Distributed: Wednesday July 24, 2019

LOCATION: 610 Roy Eaker Road (Roy Eaker Road / Robert Road)
Cherryville, NC 28021

Attendees
Todd Tugwell, USACE
Kimberly Browning, USACE
Mac Haupt, NC Department of Environmental Quality
Erin Davis, NC Department of Environmental Quality
Matthew Reid, DMS Project Manager
Paul Wiesner, DMS
Kirsten Ullman, DMS
Periann Russell, DMS
Olivia Munzer, WRC
Shawn Wilkerson, Wildlands Engineering
Eric Neuhaus, Wildlands Engineering
Jake McLean, Wildlands Engineering

Materials
- Wildlands Engineering Technical Proposal dated 1/9/2019 in response to RFP #16-007704
- Preliminary Hydric Soil Investigation dated 1/5/2019 prepared by Soil & Environmental Consultants

Meeting Notes
1. It was noted that the site scored highly on the scoring form. Wildlands that the site was a high priority site identified within a local watershed plan.
2. The site walk proceeded from downstream to upstream along the mainstem. Wildlands indicated that the mainstem would be located away from the existing driveway out into the field to support wetland hydrology (priority 1) with priority 2 segments at the lower end of the reach to transition to the existing road crossing.
3. Todd/Mac noted that levees are typical along streams in the piedmont with Chewacla soils and indicated that Wildlands should consider putting a gage in the existing/proposed near stream area to document water levels and anticipate potential levy formation on the restored stream.

4. Test pits in wetland 1 yielded shallow hydric indicators, particularly off the existing stream levy.
5. Along mainstem Oak Hill Creek Reach 1 (enhancement 2), in response to IRT and DMS comment about proposed activities being more typical of enhancement 1 level effort, Wildlands indicated that enhancement 2 credit is being sought because the treatments are non-continuous in this reach. As an example, it was pointed out that essentially no channel work is proposed at the top of the reach, including an area with minor erosion into weathered bedrock. Wildlands indicated that the primary activity proposed in the reach is stabilizing/grading outside meanders. (As an aside, IRT members encouraged Wildlands to provide workplan in E1/E2 reaches in the future, as was recently provided on Dynamite Creek, as they found this helpful in defining the specifics of reach treatments).
6. Evidence of historic drain tiles (wooden) were noted in the bank along this same enhancement 2 reach-entering from the wetland 3 (left) side of the creek. Shawn noted that he'd seen tiles further downstream as well.
7. Todd indicated that Wildlands should be aware of the potential buffer impacts of the proposed crossing at the mainstem reach 1/2 break; the crossing is at a skew to match the skew of the sewerline crossing.
8. Todd indicated that upstream portion of Wetland 3 should be gaged to provide evidence of wetland hydrology.
9. Wildlands would need to prove proposed wetland 2 is relic within area of deeper hydric soils for re-establishment. Portions of wetland 2 with deeper hydric soils proposed for grading over 6 inches without new evidence/justification would likely push into wetland creation with a higher mitigation ratio. Todd and Mac both commented about the existing data and the borings conducted during the visit pointing to a higher "risk" that hydric soils would not develop and/or that hydrologic criteria could not be met. It was stated that design data and post-project data will have to support approach and presented at the mitigation plan stage for IRT review.
10. Wildlands indicated that BMP 2 would be a depression to capture and treat runoff from feeding and concentrated cattle use area.
11. IRT indicated that JD on UT1B would be important information in validating approach. Wildlands indicated that UT1B was added to the project to preserve the source of hydrology against future impacts should it be left out.
12. IRT asked how Wildlands justifies the restoration approach on upper part of UT1 (near UT1A) pointing to some stable bed and bench features in the upper portion of the reach. Wildlands responded that the culvert at the head of the reach is perched, and raising the stream at the top of the project, and moving to a priority 1 as far upstream as possible, is important to the overall project approach.
13. Obvious evidence of cattle in the creek was noted in UT1.
14. Several discrete invasive species infestations were observed throughout the project area (kudzu, knotweed, bamboo), including privet throughout the project area.
15. The group walked along UT1A which is slated for restoration and was an obvious wallow pit for cattle and extremely degraded.
16. In summarizing the site visit, the approaches to project were agreed to with the exception of a section of wetland 2 which is expected to be classified as creation due to the grading depth required to be completed to reach hydric layers.

Jacob Wiseman

From: Jake McLean
Sent: Thursday, February 11, 2021 08:49 AM
To: Browning, Kimberly D CIV USARMY CESAW (USA); Tugwell, Todd J CIV USARMY CESAW (US)
Cc: Reid, Matthew; Jacob Wiseman
Subject: FW: Oak Hill Dairy Site / Gaston Co / SAW-2019-00833
Attachments: Oak Hill Wetland Grading XS 2.11.21.pdf; Oak Hill Wetland Grading Map 2.11.21.pdf; Oak Hill Dairy Revised Asset Table 2.11.21.pdf; Oak Hill Wetland 1 Grading_revised boundary_2.11.21.pdf

As a follow-up to our phone call last Friday we revisited things on our end and summarizing some of the discussion, our follow-up efforts and some modifications:

<u>UT1/Wetland 2</u>
We believe our data supports the argument that this was filled. This data consists of (1) LSS report, (2) Sheet 3.3 showing narrow floodplain that doesn't jive with the rest of the valley, (3) historic aerials described by LSS report.

<u>Lower Oak Hill Creek/Wetland 1</u>
We didn't discuss the sidecast pile next to the ditch in the far left portion of the floodplain. There didn't seem to be concerns about the approach. This sidecast area accounts for 12,000 sq ft (or ~1/2) of the remaining total cut exceeding 12" in the Wetland 1 reestablishment and rehabilitation areas. We are still proposing this for reestablishment credit as this is an obvious narrow linear feature along the length of the ditch and we are not proposing to cut below the natural floodplain elevation.

We discussed the existing left creek bank at the lower end of the project and the LSS borings/boring map. Predominant concerns were that the map indicates "no hydric indicator observed" and that the removal of natural deposition or excavation to hydric soils that are not associated with disturbed or relic wetlands does not constitute restoration.

Wildlands reviewed mapping, soil boring tables, and prepared 4 cross sections that go through the red-dotted borings (BH19, BH14, BH13/bh19N, BH6/bh8N). Plan and cross section maps (1 & 2) are attached.

Two notes with regards to interpretation of the map-
(1) as stated in the LSS report, red circles are borings where hydric soil indicators were not observed in the top 10" but may have been observed below 10" (boring tables provide details) - 3 of the 6 red-dotted borings have hydric soil indicators at 12" of depth, 2 have hydric soil indicators deeper, 1 is non-hydric (the LSS defines non-hydric as indicators >24" of depth).
(2) there was some concern that the areas would be orange if they were buried hydric soils - orange was only used in the case of Wetland #2 to indicate findings associated with a specific line of investigation associated with relocation of UT1.

The aerial photo from 1950 in Appendix 1 shows the dredging of Oak Hill Creek and existing topography is consistent with berms that would have been built up as a result of this effort. It is also noted that the field has been under a high level of disturbance for decades, with row crops and at times a drainage ditch down the middle of the valley. The valley contours suggest that berms were used to confine the creek channel and ditches to keep the field dry and the valley itself extends beyond the right channel bank (the creek was moved to the parcel boundary but not to the valley wall).

However, we acknowledge that our data is insufficient in the area in question to make a stronger argument for restoration closer to the bank where the berm is higher and cut depths exceed 12" over much of the area. As a results we have converted 0.50 acres from reestablishment to creation in this area.

The remaining areas of localized grading in excess of 12", apart from UT1 and the left floodplain ditch (which are significant but discussed above), total to ~6% of the reestablishment areas. These are mostly areas that we believe have been built up and which are inconsistent with the natural valley surface and are being graded as much for floodplain continuity as anything.

Let me know if you have any questions about what we've done here. If you feel that it fairly represents things then please feel free to forward to Erin or let me know it's ok and I'll send to her.

Thanks for your efforts,
Jake

From: Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>
Sent: Wednesday, February 3, 2021 3:44 PM
To: Jake McLean <jmclean@wildlandseng.com>
Cc: Reid, Matthew <matthew.reid@ncdenr.gov>; Wiesner, Paul <paul.wiesner@ncdenr.gov>
Subject: RE: Oak Hill Dairy Site / Gaston Co / SAW-2019-00833

Hi Jake
I'm reviewing the Oak Hill Dairy draft mit plan and I was hoping you could provide a table that coincides with the Wetland Grading figure with a breakdown of areas graded over 12". Perhaps broken out as acres of rehabilitation and acres of re-establishment, along with percentages. I'm trying to get an overall idea of what percent of the areas proposed for rehab & reestablishment require more earth moving. Will you also clarify if the deeper cut is due to stream channel re-alignment and low grade, or is it to unearth hydric soils? I recall the field visit and the discussion of questionable soils, so I was surprised to see some of the areas proposed for rehab rather than creation.
Also, please confirm whether the utility pole is located within the easement near UT1.
I'll be around most of tomorrow and Friday if you want to discuss. I'd rather get clarity on these questions now rather than going back and forth with response to comments once the review is done.
Thanks
Kim

Kim Browning
Mitigation Project Manager, Regulatory Division I U.S. Army Corps of Engineers 919-413-6392

-----Original Message-----
From: Haywood, Casey M CIV (USA) <Casey.M.Haywood@usace.army.mil>
Sent: Tuesday, January 19, 2021 9:55 AM
To: Tugwell, Todd J CIV USARMY CESAW (USA) <Todd.J.Tugwell@usace.army.mil>; Browning, Kimberly D CIV USARMY CESAW (USA) <Kimberly.D.Browning@usace.army.mil>; Davis, Erin B <erin.davis@ncdenr.gov>; Casey Haywood <cmhaywood.usace@gmail.com>; Bowers, Todd <bowers.todd@epa.gov>; Byron Hamstead <byron_Hamstead@fws.gov>; Wilson, Travis W. <travis.wilson@ncwildlife.org>; Munzer, Olivia

<olivia.munzer@ncwildlife.org>
Cc: Reid, Matthew <matthew.reid@ncdenr.gov>; Wiesner, Paul <paul.wiesner@ncdenr.gov>; Jake McLean <jmclean@wildlandseng.com>; Eric Neuhaus <eneuhaus@wildlandseng.com>; Shawn Wilkerson <swilkerson@wildlandseng.com>; McLendon, C S CIV USARMY CESAW (USA) <Scott.C.McLendon@usace.army.mil>; Jones, M Scott (Scott) CIV USARMY CESAW (USA) <Scott.Jones@usace.army.mil>; Smith, Ronnie D CIV USARMY CESAW (USA) <Ronnie.D.Smith@usace.army.mil>
Subject: NOTICE of Draft Mitigation Plan Review / NCDMS Oak Hill Dairy Site / Gaston Co / SAW-2019-00833

Good afternoon,

The below referenced Draft Mitigation Plan has been posted by NCDMS on the Draft Mitigation Plan Review section of the DMS & IRT SharePoint Site and on RIBITS. Per Section 332.8(g) of the 2008 Mitigation Rule, this review period will remain open for 30 calendar days from this email notification. Please provide comments by 5 PM on the 30-day comment deadline shown below. When providing comments please indicate if your concerns are great enough that you intend to initiate the Dispute Resolution Process described in Section 332.8(3) of the Mitigation Rule. Comments provided after the 30-day comment deadline (shown below) may not be considered. This comment period may be extended at the request of NCDMS if they determine that additional time is necessary to make changes to the Draft Mitigation Plan.

At the conclusion of this comment period, a copy of all comments will be provided to NCDMS and the NCIRT of the District Engineer's intent to approve or disapprove this project. More information, including instructions to access and use the SharePoint Site, and a flow chart detailing the process are included in the updated document attached to this email notice.

30-Day Comment Start Date: January 19, 2021

30-Day Comment Deadline: February 18, 2021

60-Day Intent to Approve Deadline: March 20, 2021

Project information is as follows:

Oak Hill Dairy Mitigation Site

DMS Project # 100120

Institution Date: 4/23/2019

RFQ# 16-007704 (Issued: 9/3/2018)

Catawba River Basin

Cataloging Unit 03050102

Gaston County, North Carolina

USACE Action ID: SAW- 2019-00833

DWR#: 20190863

Proposed Mitigation Project Credits:

4,611.641 SMU (warm)

8.055 WMU (riparian)

Full Delivery Provider: Wildlands Engineering, Inc. - Contact: Jake McLean, jmclean@wildlandseng.com <mailto:jmclean@wildlandseng.com> , (828) 774-5547

NCDEQ - DMS Project Manager: Matthew Reid, matthew.reid@ncdenr.gov <mailto:matthew.reid@ncdenr.gov> , (828) 231-7912

The full Mitigation Plan has been uploaded to the IRT/ NCDEQ SharePoint Mitigation Plan Review page and can be accessed here:

IRT SharePoint page:

https://ncconnect.sharepoint.com/sites/IRT-DMS/SitePages/Home.aspx
<Blockedhttps://ncconnect.sharepoint.com/sites/IRT-DMS/SitePages/Home.aspx>

OakHillDairy_100120_MPDraft_2021.pdf

https://ncconnect.sharepoint.com/sites/IRT-DMS/IRT%20Upload%20Documents%20Here/Forms/AllItems.aspx?id=%2Fsites%2FIRT%2DDMS%2FIRT%20Upload%20Documents%20Here%2FOak%20Hill%20Dairy%20%28100120%29%2FOakHillDairy%5F100120%5FDraftMP%5F2021%2Epdf&parent=%2Fsites%2FIRT%2DDMS%2FIRT%20Upload%20Documents%20Here%2FOak%20Hill%20Dairy%20%28100120%29 <Blockedhttps://ncconnect.sharepoint.com/sites/IRT-DMS/IRT%20Upload%20Documents%20Here/Forms/AllItems.aspx?id=%2Fsites%2FIRT%2DDMS%2FIRT%20Upload%20Documents%20Here%2FOak%20Hill%20Dairy%20%28100120%29%2FOakHillDairy%5F100120%5FDraftMP%5F2021%2Epdf&parent=%2Fsites%2FIRT%2DDMS%2FIRT%20Upload%20Documents%20Here%2FOak%20Hill%20Dairy%20%2810012

0%29>

Please contact the mitigation office if you have questions.

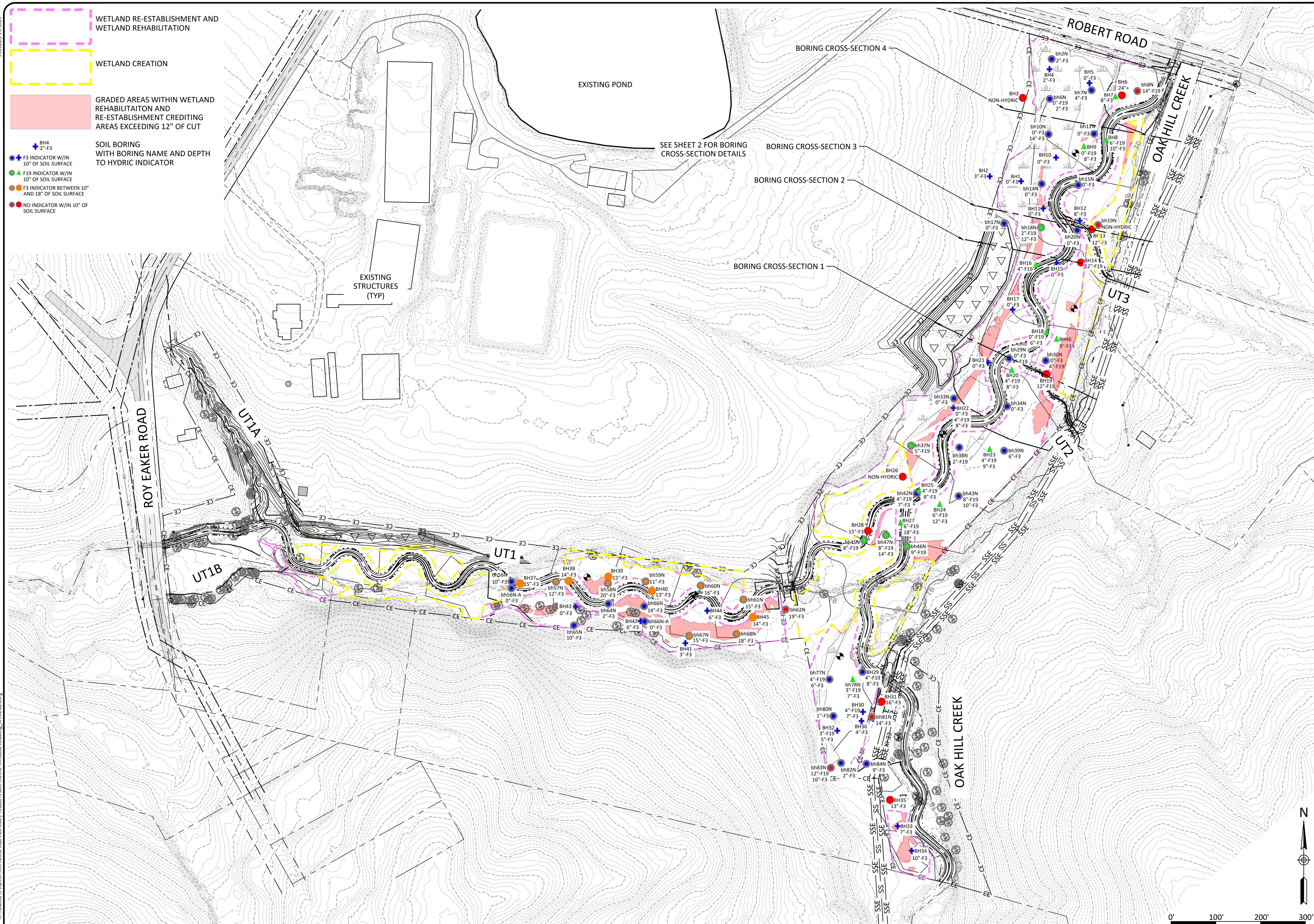
V/r,

Casey Haywood

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

3331 Heritage Trade Dr, Ste. 105 I Wake Forest, NC 27587 I

BUILDING STRONG (r)



February 11, 2021

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Asheville, NC 28806
Tel: 828.774.5547
License No. F-0831

PRELIMINARY DO NOT USE FOR CONSTRUCTION

Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Overview
Wetland Grading and Soil Borings Exhibit

Revisions:

Date:	December 4, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Sheet 1

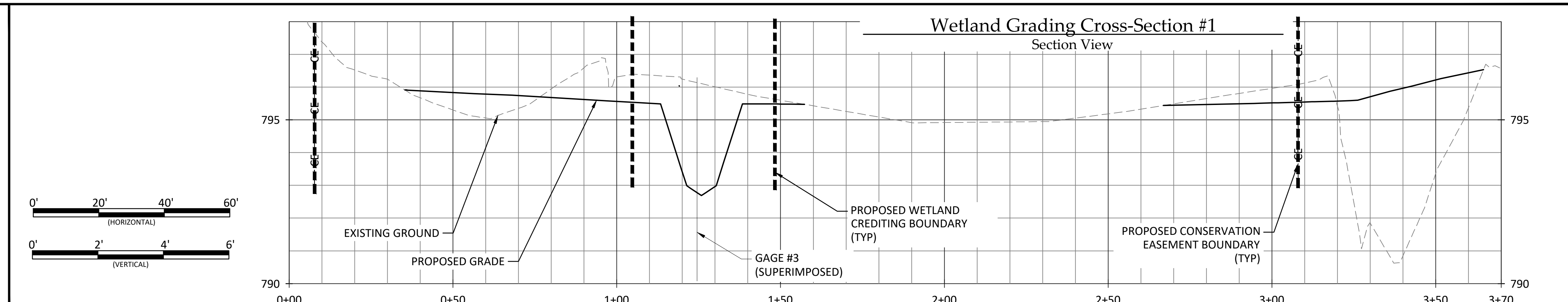
February 11, 2021

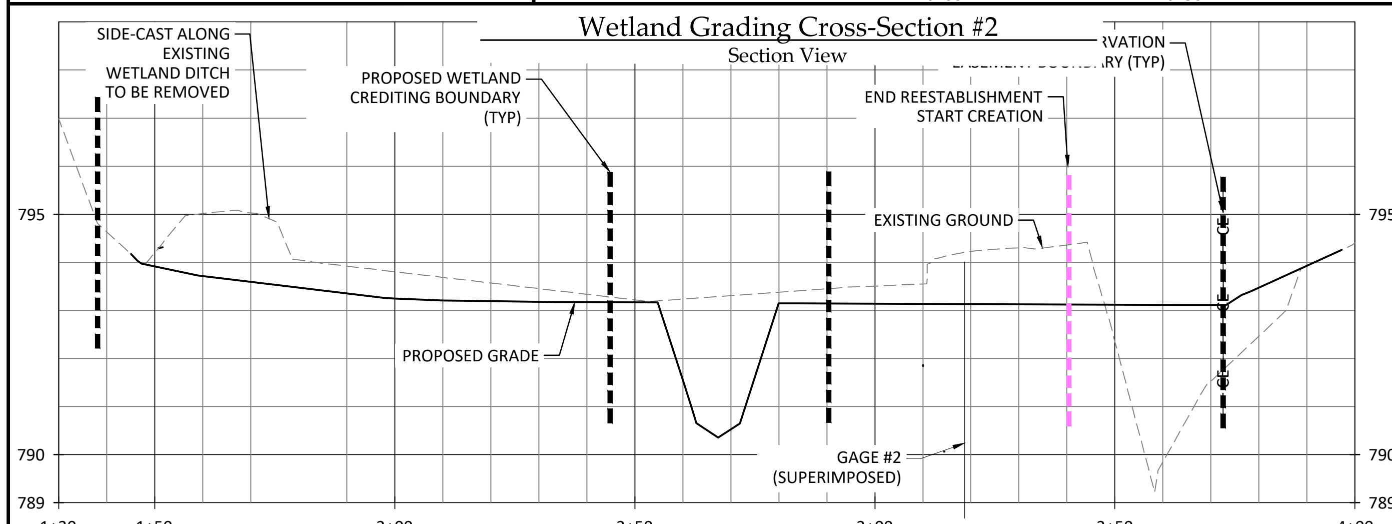
WETLAND RE-ESTABLISHMENT PROPOSED AT A 1:1 CREDIT RATIO

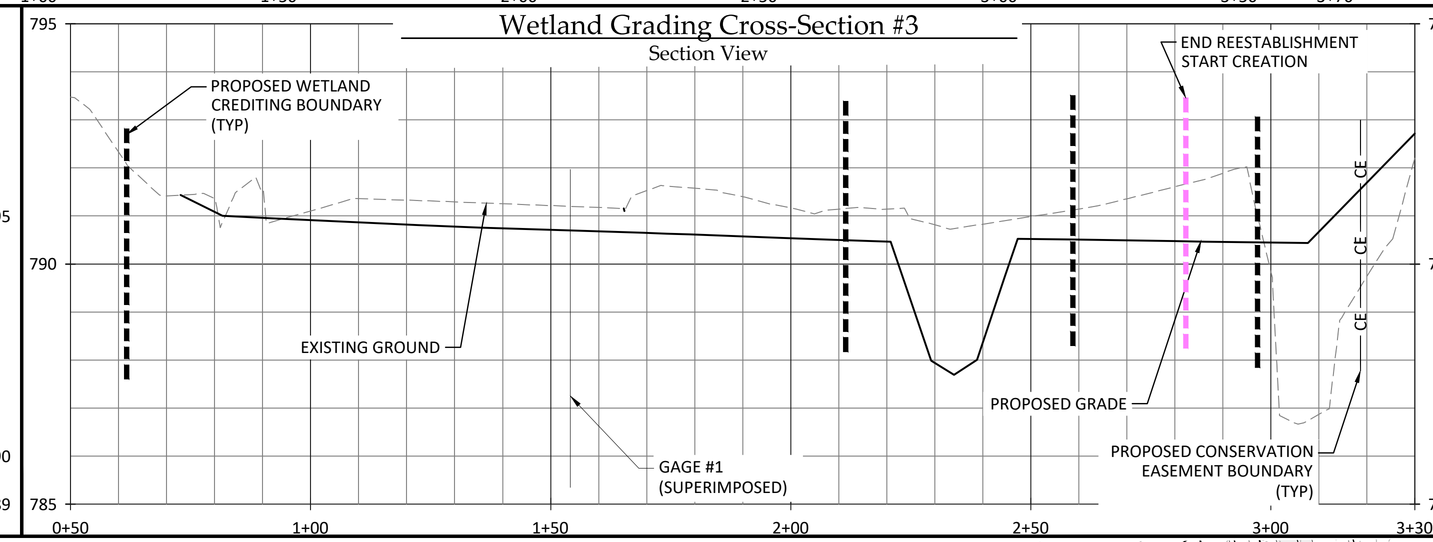
WETLAND REHABILITATION PROPOSED AT A 1:1 CREDIT RATIO

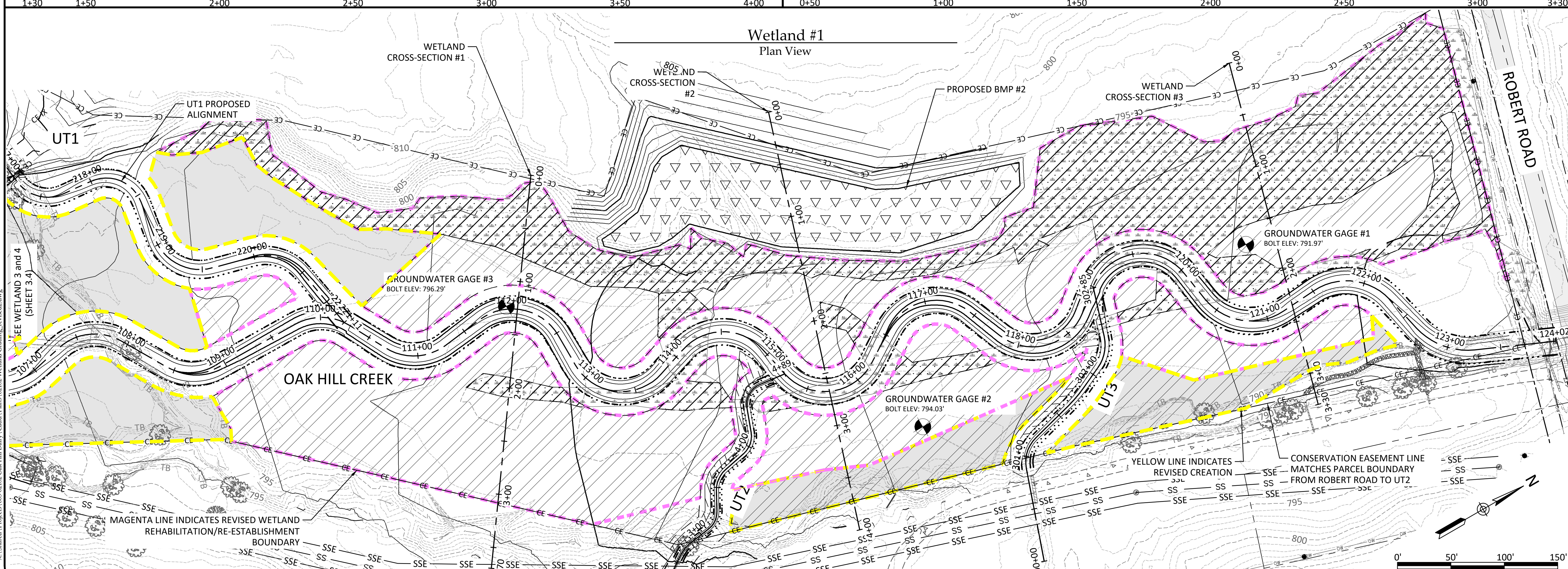
WETLAND REHABILITATION PROPOSED AT A 1.5:1 CREDIT RATIO

WETLAND CREATION PROPOSED AT A 3:1 CREDIT RATIO









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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Wetland 1
Wetland Grading

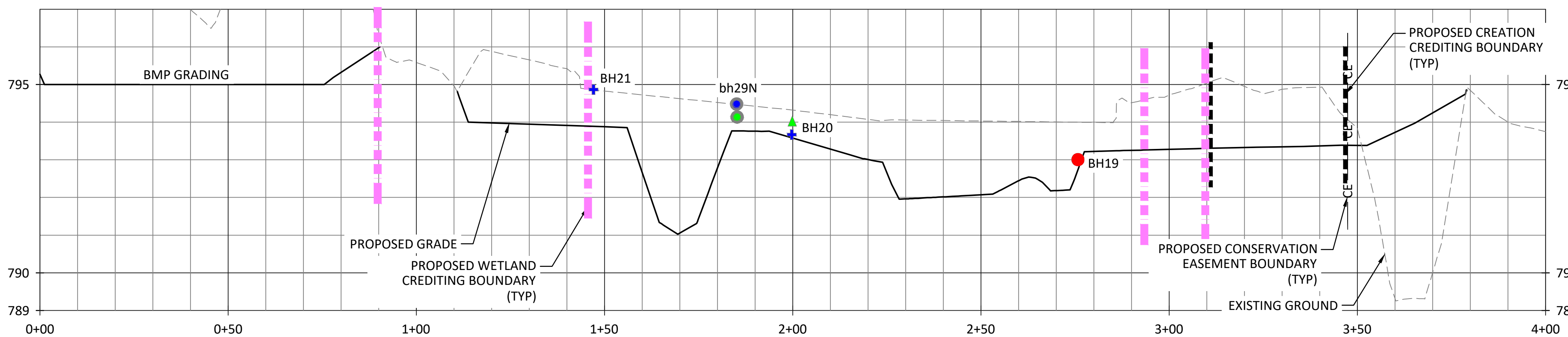
Revisions:

Date: January 14, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

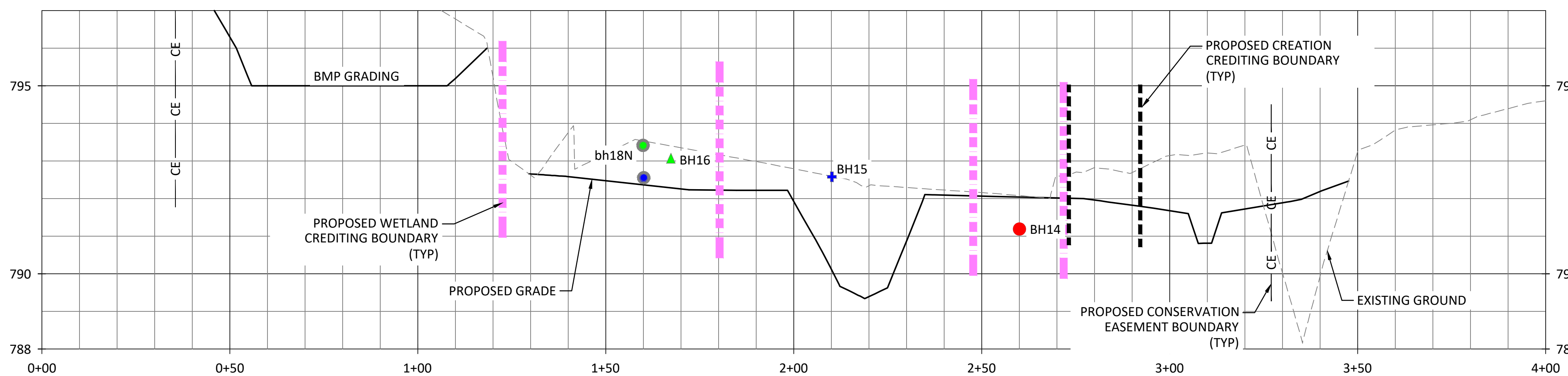
Sheet 3.2

February 11, 2021

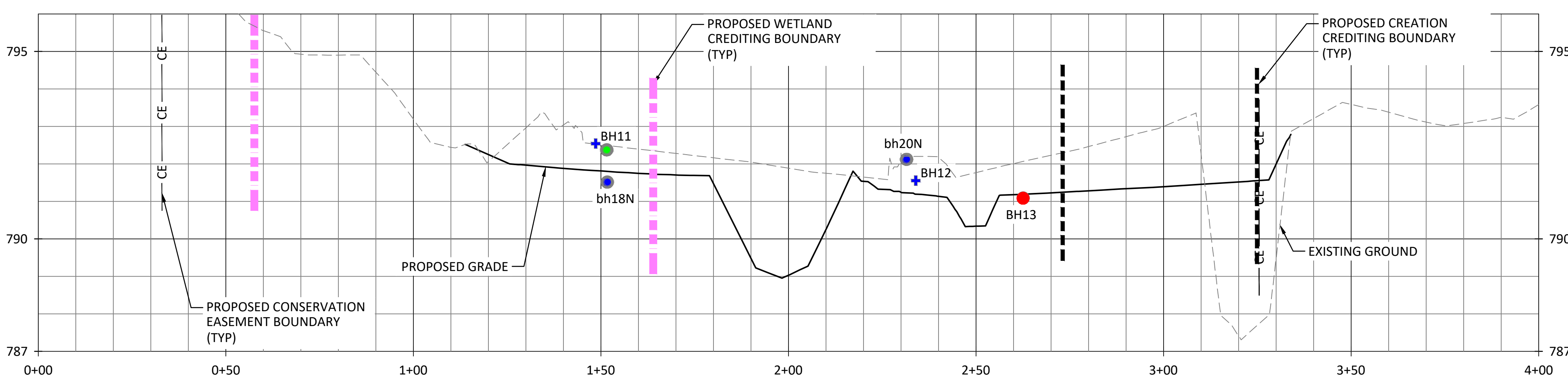
BORING
CROSS-SECTION 1



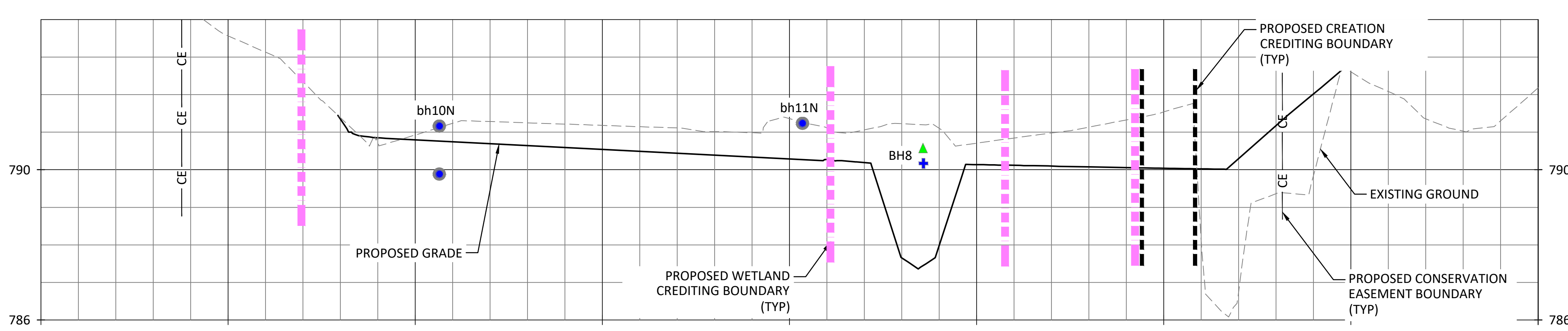
BORING
CROSS-SECTION 2

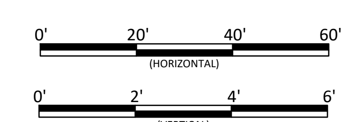


BORING
CROSS-SECTION 3



BORING
CROSS-SECTION 4





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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Cross-Sections
Wetland Grading and Soil Borings Exhibit

Revisions:

Date: February 10, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

2

Sheet

APPENDIX 8 – Invasive Species Treatment Plan

Appendix 8 Invasive Species Plan

Annual monitoring and semi-annual site visits will be conducted to assess the condition of the finished project. These site inspections may identify the presence of invasive vegetation. If, during the monitoring period, invasive species threaten the survivability of planted woody vegetation in an area that exceeds 1% of the planted easement acreage, the invasive species shall be treated. Smaller areas may be treated at the discretion of the project engineer and biologist, if deemed in the best interest of the Site. Generally, the treatment plan shall follow the below guidelines in Table 1 for common invasive species found in riparian areas; however, the treatment may be changed based on the professional judgement of the project engineer and biologist. For invasive species not listed in the below table that threaten the survivability of the planted woody vegetation, Wildlands shall notify DMS of the invasive species observed and the plan for treatment prior to treating the species. All invasive species treatment will be reported in the following year's monitoring plan.

Table 1. Invasive Species Treatment – *Oak Hill Dairy Mitigation Site*

Invasive Species	Recommended Removal Technique
Multiflora Rose *(Rosa multiflora)*	Foliar treatment of large populations with 4% glyphosate solution. Cut stump treatment is time consuming, though effective. Treat in spring/summer. Biocontrol using viral pathogen of rose-rosette disease transmitted by European Rose Chalcid wasp is an option. Rose-rosette disease is also vectored by native mites.
Japanese Knotweed (*Polygonum cuspidatum*)	For stems too tall for foliar sprays, cut large stems and immediately treat the stump tops with one of the following herbicides: a glyphosate herbicide or Garlon 3A as a 25-percent solution (3 quarts per 3-gallon mix). ORTHO BrushB-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps and available in retail garden stores (safe to surrounding plants). A subsequent foliar application of glyphosate will be required to control new seedlings and resprouts.
Tree of Heaven (*Ailanthus altissima*)	Large trees - Make stem injections and then apply Garlon 3A when safety to surrounding vegetation is desired, or Pathway* or Arsenal AC* in dilutions and cut-spacings specified on the herbicide label (midsummer best, late winter somewhat less effective). For felled trees, apply the herbicides to stem and stump tops immediately after cutting. Seedlings and saplings - Thoroughly wet all leaves with the following herbicide in water with a surfactant (July to October): Garlon 4 as a 1- to 2-percent solution (4 to 8 ounces per 3-gallon mix) or Garlon 3A as a 2-percent solution (8 ounces per 3-gallon mix).
Honeysuckle (*Lonicera japonica*)	Small infestations of *L. japonica* can be pulled by hand. Monitor to remove any re-sprouts. Care should be taken to bag and remove the plants, including mature fruits to prevent re-establishment. Large infestations of *L. japonica* will usually require a combination of cut stump and foliar herbicide treatments. Where vines have grown into the tree canopy, cut each stem as close to the ground as possible. Treat the freshly cut surface of the rooted stem with a 25 percent solution of glyphosate or triclopyr. Remove the twining vines to prevent them from girdling and killing desirable vegetation. Groundcovers of *L. japonica* can be treated with a foliar solution of 2 percent glyphosate or triclopyr plus a 0.5 percent non-ionic surfactant to thoroughly wet all the leaves.
Chinese Privet (*Ligustrum sinense*)	Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: a glyphosate herbicide as a 3-percent solution (12 ounces per 3-gallon mix) in the late fall or early winter when safety to surrounding vegetation is desired, or elsewhere, Arsenal AC* as a 1-percent solution (4 ounces per 3-gallon mix). Backpack mist blowers can broadcast glyphosate as a 3-percent solution (12 ounces per 3-gallon mix) or Escort XP* at 1 ounce per acre (0.2 dry ounces per 3-gallon mix and 10 gallons per acre) during winter for safety

Invasive Species	Recommended Removal Technique
	to dormant hardwoods. Summer applications of glyphosate may not be as effective as other times and require a higher percent solution. The best time for Arsenal AC* and Escort XP* is summer to fall. For stems too tall for foliar sprays and when safety to surrounding vegetation is desired, apply a basal spray of Garlon 4 as a 20-percent solution (5 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted); or undiluted Pathfinder II. Elsewhere, apply Stalker* as a 6- to 9-percent solution (1.5 to 2 pints per 3-gallon mix) in a labeled basal oil product, vegetable oil or mineral oil with a penetrant, or fuel oil or diesel fuel (where permitted) to young bark as a basal spray making certain to treat all stems in a clump; or cut and immediately treat the stump tops with Arsenal AC* as a 5-percent solution (20 ounces per 3-gallon mix) or Velpar L* as a 10-percent solution in water (1 quart per 3-gallon mix) with a surfactant. When safety to surrounding vegetation is desired, immediately treat stump tops and sides with Garlon 3A or with a glyphosate herbicide as a 20-percent solution (5 pints per 3-gallon mix) in water with a surfactant. ORTHO Brush-B-Gon and Enforcer Brush Killer are effective undiluted for treating cut-stumps and available in retail garden stores (safe to surrounding plants). For large stems, make stem injections using Arsenal AC* or when safety to surrounding vegetation is desired, Garlon 3A or a glyphosate herbicide using dilutions and cut-spacings specified on the herbicide label (anytime except March and April). An EZ-Ject tree injector can help to reach the lower part of the main stem; otherwise, every branching trunk must be hack-and-squirt injected.
Kudzu (*Pueraria montana*)	Small patches of *P. montana* that are not well-established can usually be eliminated by persistent weeding, mowing, or grazing during the growing season. The spread of a well-established infestation of *P. montana* can be controlled the same way, but cutting will typically not kill the roots of larger plants. For vines in tree canopies, cut the vines near the ground and apply a 50 percent solution of triclopyr to the stumps. This procedure remains effective at lower temperatures as long as the ground is not frozen. Large infestations can be effectively controlled with a foliar solution of 2 to 3 percent glyphosate or triclopyr plus a 0.5 percent non-ionic surfactant to thoroughly wet all leaves. The ambient air temperature should be above 65 degrees Fahrenheit. After the above ground vegetation is controlled and it is possible to dig and cut into the central root crown, apply a 50 percent solution of glyphosate or triclopyr to the wound. The most successful chemical control of *P. montana* can be achieved with a foliar solution of 0.75 percent clopyralid plus a 0.5 percent non-ionic surfactant. Monitor all treatments in subsequent years for re-sprouting.
English Ivy (*Hedera helix*)	Thoroughly wet all leaves (until runoff) with one of the following herbicides in water with a surfactant (July to October for successive years): Garlon 3A or Garlon 4 as a 3- to 5-percent solution (12 to 20 ounces per 3-gallon mix) or a glyphosate herbicide as a 4-percent solution (1 pint per 3-gallon mix). Use a string trimmer to reduce growth layers and injure leaves for improved herbicide uptake. Cut large vines and apply these herbicides to cut surfaces. Or apply basal sprays of Garlon 4 as a 20-percent solution in a labeled basal oil product, vegetable oil, kerosene, or diesel fuel (where permitted) (5 pints per 3-gallon mix); or apply undiluted Pathfinder II to large vines, avoiding the bark of desirable trees.
Johnson Grass (*Sorghum halepense*)	Recommended control procedures: Thoroughly wet all leaves with one of the following herbicides in water with a surfactant (June to October with multiple applications applied to regrowth). • Recommendation for mature grass control: apply Outrider* as a broadcast spray at 0.75 to 2 ounces per acre (0.2 to 0.6 dry ounce per 3-gallon mix) plus a nonionic surfactant to actively growing Johnsongrass. For handheld and high-volume sprayers, apply 1 ounce of Outrider per 100 gallons of water plus a nonionic surfactant at 0.25 percent. Outrider is a selective herbicide that can be applied over the top of certain other grasses to kill Johnsongrass, or apply Plateau as a 0.25-percent solution (1 ounce per 3-gallon mix) when plants are 18 to 24 inches (45 to 60 cm) tall or larger.

Invasive Species	Recommended Removal Technique
	• Recommendation for seedling control: apply Journey as a 0.3-percent solution (1.2 ounces per 3-gallon mix) before Johnsongrass sprouts and when desirable species are dormant or apply a glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) directed at the infestation.
Asian Spiderwort, also known as Marsh Dewflower (*Murdannia kiesk*)	Foliar applications – Thoroughly wet all leaves with one of the following herbicides in water with a surfactant: 2-3% aquatic labeled glyphosate. Do not remove mechanically. Spiderwort spreads readily in disturbed areas through fragmentation and seed dispersal.
Bamboo (*Phyllostachys sand Bambusa spp.)*	Mechanical removal during construction will be the primary method of treatment. For post-project treatment, wet leaves with Arsenal AC as 1-percent solution (4 ounces per 3-gallon mix), glyphosate herbicide as a 2-percent solution (8 ounces per 3-gallon mix) or combination of the two. Treat resprouts. Also effective is cut and treat using double-strength batch of same herbicide(s).

APPENDIX 9 – Site Protection Instrument

Appendix 9 Site Protection Instrument

The land required for construction, management, and stewardship of this mitigation project includes portions of the Eaker family parcels listed in Table 1. These properties are optioned for purchase of a conservation easement by Wildlands Engineering, Inc. (Wildlands). Wildlands will record a conservation easement on the parcels to encompass the streams and wetlands being restored, enhanced, created and preserved along with their corresponding buffers. A Temporary Access and Construction Easement will also been signed by the Lineberger family, which will allow Wildlands to relocate the stream channel, fill the old channel along the Lineberger/Eaker property line and make culvert grade modifications as necessary.

Table 1: Site Protection Instrument – *Oak Hill Dairy Mitigation Site*

Property Owner	Parcel ID Number	County	Under Option to Purchase by Wildlands?	Memorandum of Option/Temporary Access and Conservation Easement Deed Book (DB) and Page Number (PG)	Acreage to be Protected
Cameron Rusty Eaker, Jr. and Cameron Rusty Eaker, Sr.	2691900380 2691708250 2690798897 2690891706	Gaston	Yes	DB: 5017 PG: 1617-1623	18.8[1]
Harold R. Lineberger & Wife Patsy E. Lineberger	3601000464	Gaston	Yes[2]	N/A	N/A

[1] The original acreage has been increased and a revision to the option agreement signed for the new acreage.
[2] Wildlands has a signed agreement for option to purchase permanent easement or utilize land for temporary access for the purpose of construction. At present, only temporary construction easement is anticipated on Lineberger.

All site protection instruments require 60-day advance notification to the USACE and or DMS prior to any action to void, amend, or modify the document. No such action shall take place unless approved by the State.

APPENDIX 10 – Maintenance Plan

Appendix 10 Maintenance Plan

The site shall be visited semi-annually 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:

Table 1. Maintenance Plan – *Oak Hill Dairy Mitigation Site*

Component/ Feature	Maintenance through project close-out
Stream	Routine channel maintenance and repair activities may include chinking of in-stream structures to prevent piping, securing of loose coir matting, and supplemental installations of live stakes and other target vegetation along the channel – these shall be conducted where success criteria are threatened or at the discretion of the Designer. Areas where storm water and floodplain flows intercept the channel may also require maintenance to prevent bank failures and head-cutting. Beaver activity will be monitored and beaver dams on project streams will typically be removed, at the discretion of the Designer, during the monitoring period to allow for bank stabilization and stream development outside of this type of influence.
Wetlands	Routine wetland maintenance and repair activities may include supplemental installations of target vegetation within the wetland. Areas where storm water and floodplain flows intercept the wetland may also require maintenance to prevent scour that adversely and persistently threatens wetland habitat or function.
Vegetation	Vegetation shall be maintained to ensure the health and vigor of the targeted community. Routine vegetation maintenance and repair activities may include supplemental planting, pruning, mulching, and fertilizing. Exotic invasive plant species requiring treatment per the Invasive Species Treatment Plan (Appendix 8) shall be treated in accordance with that plan and with NC Department of Agriculture (NCDA) rules and regulations.
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.

APPENDIX 11 – Financial Assurance

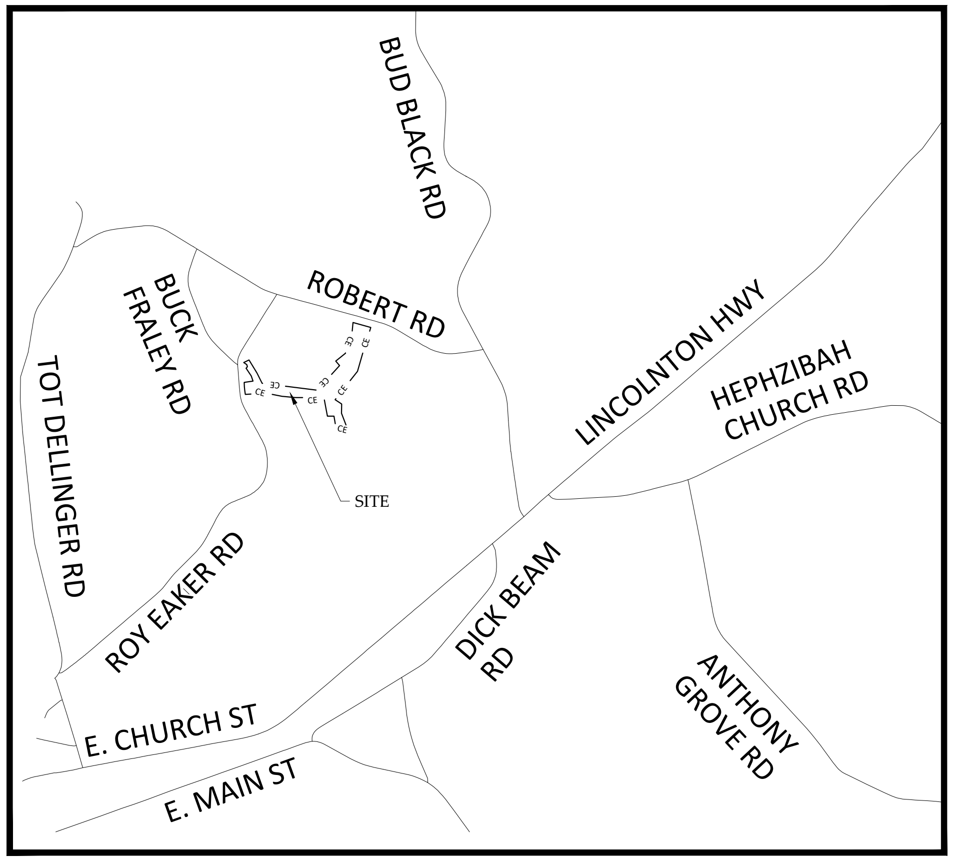
Appendix 11 Financial Assurances

Pursuant to Section IV H and Appendix III of the Division of Mitigation Service's In-Lieu Fee Instrument dated July 28, 2010, the North Carolina Department of Environment and Natural Resources has provided the US Army Corps of Engineers Wilmington District with a formal commitment to fund projects to satisfy mitigation requirements assumed by DMS. This commitment provides financial assurance for all mitigation projects implemented by the program.

APPENDIX 12 – Preliminary Plans

Oak Hill Dairy Mitigation Site

Gaston County, North Carolina
for
NCDEQ
Division of Mitigation Services



Vicinity Map
Not to Scale

N

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PRELIMINARY PLANS
ISSUED March 22, 2021

Sheet Index

Project Directory

Engineering:
Wildlands Engineering, Inc
License No. F-0831
167-B Haywood Rd
Asheville, NC 28806
Jake Mclean, PE, CFM
828-774-5547

Surveying:
Kee Mapping and Surveying, PA
88 Central Avenue
Asheville, NC 28801
Phillip B. Kee, PLS
828-645-8275

Owner:
NCDEQ - NC DMS
217 West Jones Street, Suite 300A
Raleigh, NC 27603
Mathew Reid
828-231-7912

NCDEQ Contract No. 7867

DMS ID No. 100120

USACE Action ID No. SAW-2019-00833

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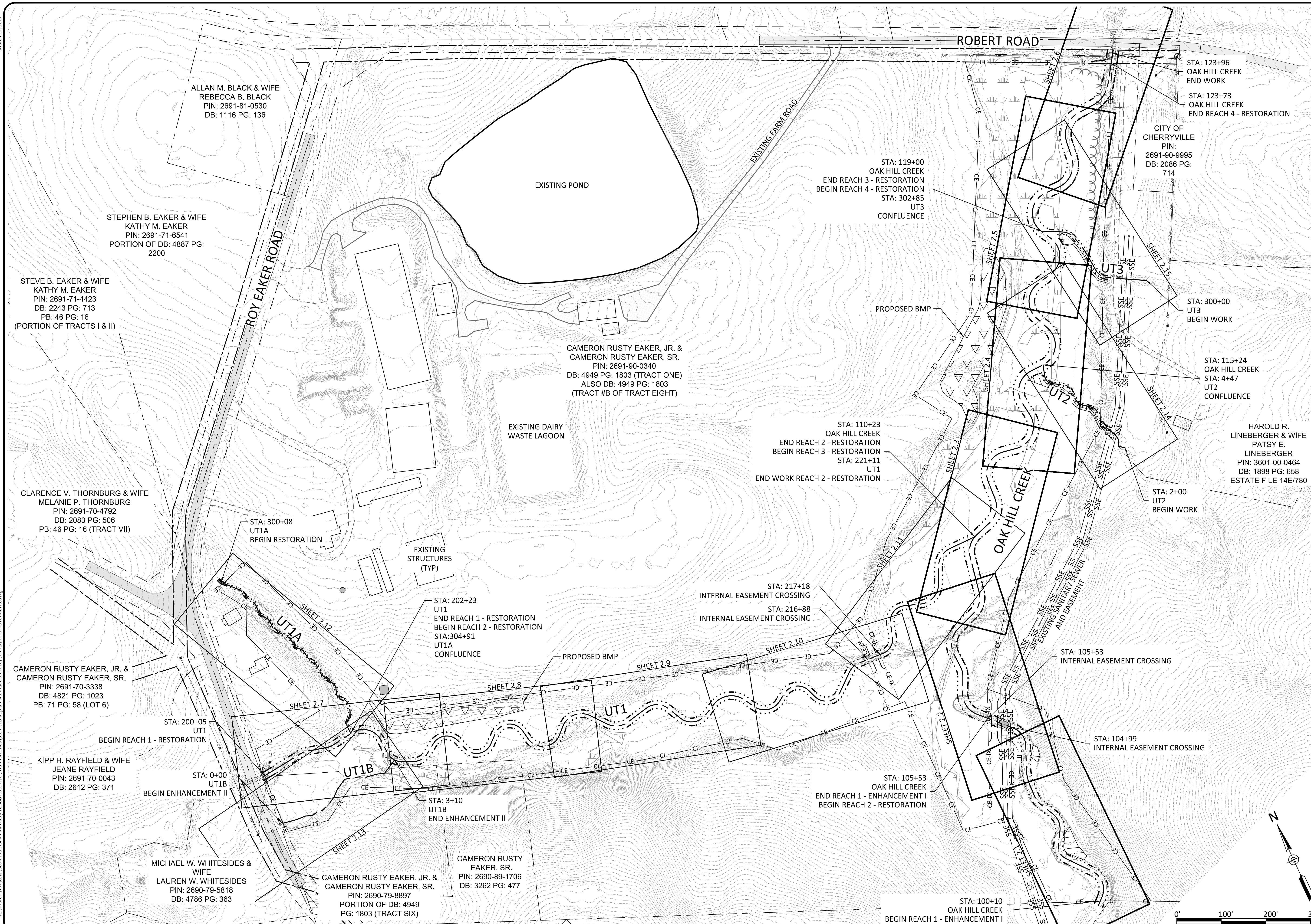
Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Title Sheet

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Revisions:

Sheet 0.1



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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Project Overview

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

0.2

Sheet

March 19, 2021

PROJECT NOTES:
Topographic survey was completed by Kee Mapping and Surveying, PA in July 2019.
Parcel boundary survey completed by Kee Mapping and Surveying, PA in October 2019.
Conservation easement survey completed by Kee Mapping and Surveying, PA in October 2020.

Topographic data supplemented with Lidar data from Feb - April 2017.

Riffle selection will be varied based on available materials at the Engineers' discretion. Field coordination will be required.

Existing Features

- Existing Thalweg
- Existing Property Line
- Existing Major Contour (100)
- Existing Minor Contour
- Existing Overhead Utility (OW)
- Existing Power Pole
- Existing Fence (X)
- Existing Storm Pipe
- Existing Gravel Road
- Existing Wetland
- Existing Tree
- Existing Concrete\Riprap
- Existing Building
- Existing Treeline
- Existing Groundwater Gage
- Existing NCDOT Right of Way
- Existing Top Of Bank (TB)
- Existing Bottom of Bank (BB)
- Existing Sanitary Sewer (SS)
- Existing Sanitary Sewer Right of Way (SSE)

Proposed Features

- Proposed Conservation Easement (CE)
- Proposed Thalweg Alignment (10+00)
- Proposed Bankfull
- Proposed Major Contour (100)
- Proposed Minor Contour
- Proposed Fence and Gate
- Proposed Fence Removal (X)
- Proposed Permanent Ford Crossing (F) See Sheet 6.1
- Proposed Stream Crossing - Culvert See Sheet 6.2 & 6.3
- Proposed BMP Area
- Proposed Floodplain Roughening See Detail 2, Sheet 5.4

Proposed Structures

- Proposed Various Constructed Riffles Per Plans See Sheet 5.1
- Proposed Brush Toe See Sheet 5.3
- Proposed Bank Roughening See Detail 2, Sheet 5.4
- Proposed Geolift See Detail 1, Sheet 5.4
- Proposed Log Sill See Detail 2, Sheet 5.2
- Proposed Rock Sill (or) See Detail 1, Sheet 5.2
- Proposed Log J-Hook See Detail 4, Sheet 5.2
- Proposed Log Vane See Detail 3, Sheet 5.6
- Proposed Tree Removal
- Proposed Tree Save (SAF)

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

General Notes and Symbols

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Sheet 0.3

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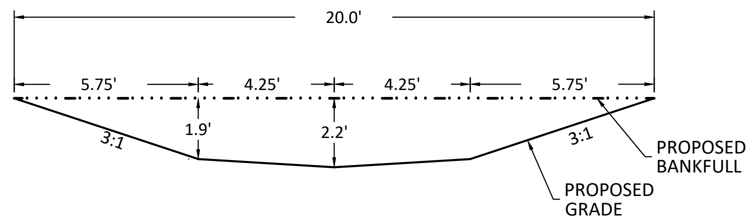
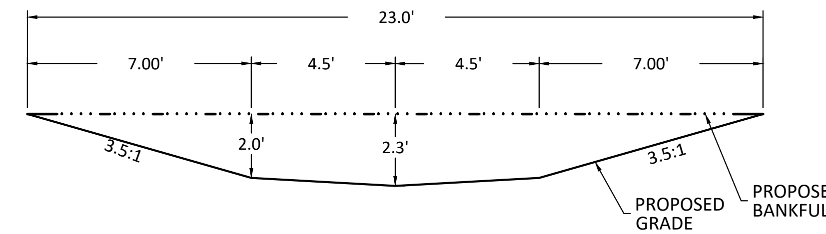


Oak Hill Creek Reach 1 - Riffle

STA 100+10 to 105+53
Not to Scale



Oak Hill Creek Reach 2 - Riffle

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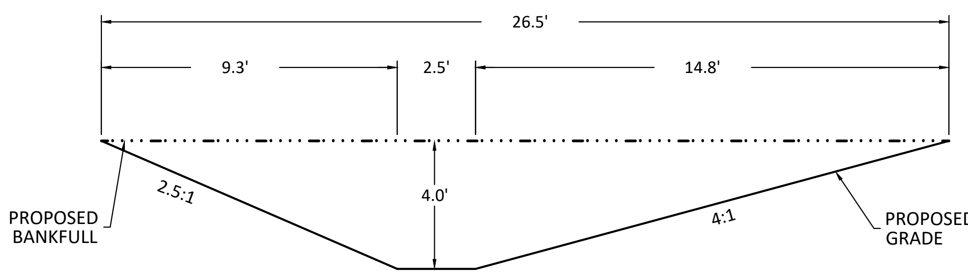

Oak Hill Creek Reach 1 - Meander Pool

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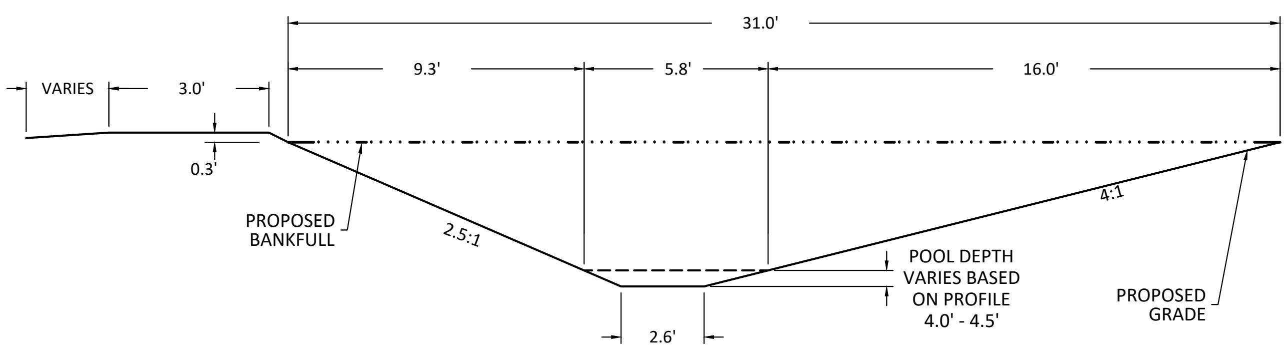

Oak Hill Creek Reach 2 - Meander Pool

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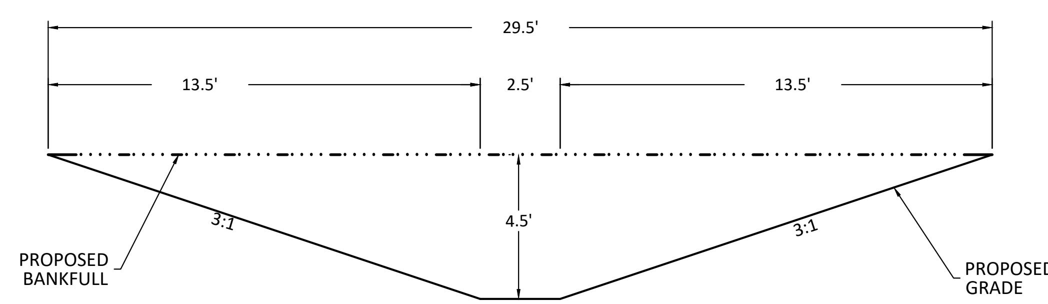

Oak Hill Creek Reaches 1 & 2 - In-Line Pool

STA 100+10 to 110+23
Not to Scale

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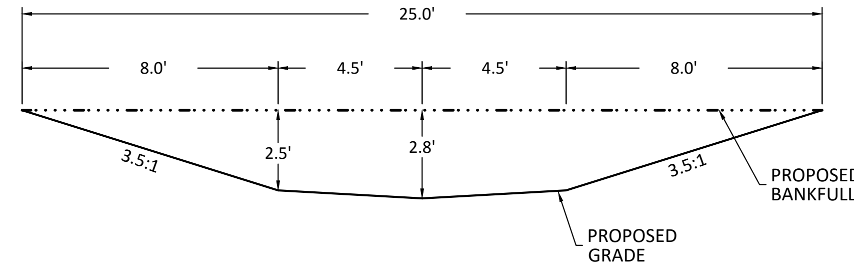
Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Oak Hill Creek Reaches 1 & 2
Typical Sections

Revisions:

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Sheet 1.1



Oak Hill Creek Reaches 3 & 4 - Riffle

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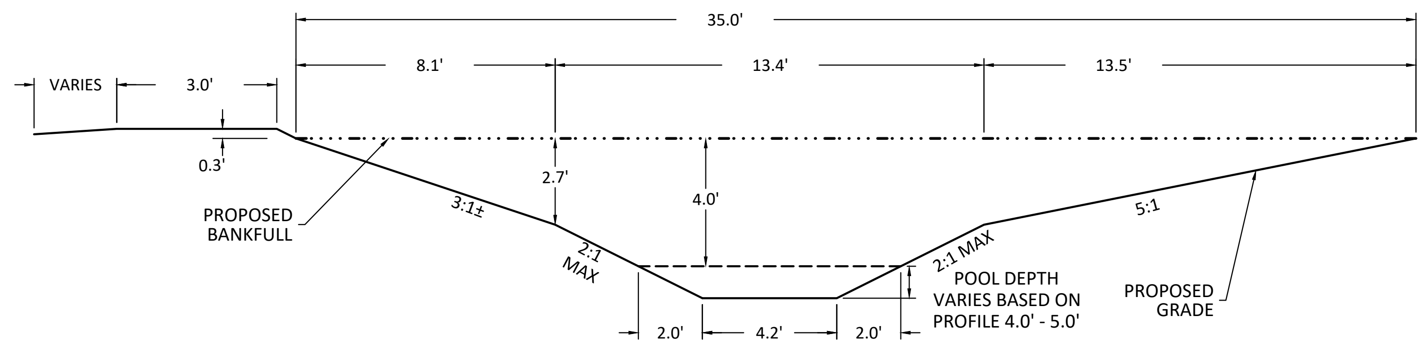

Oak Hill Creek Reaches 3 & 4 - Meander Pool

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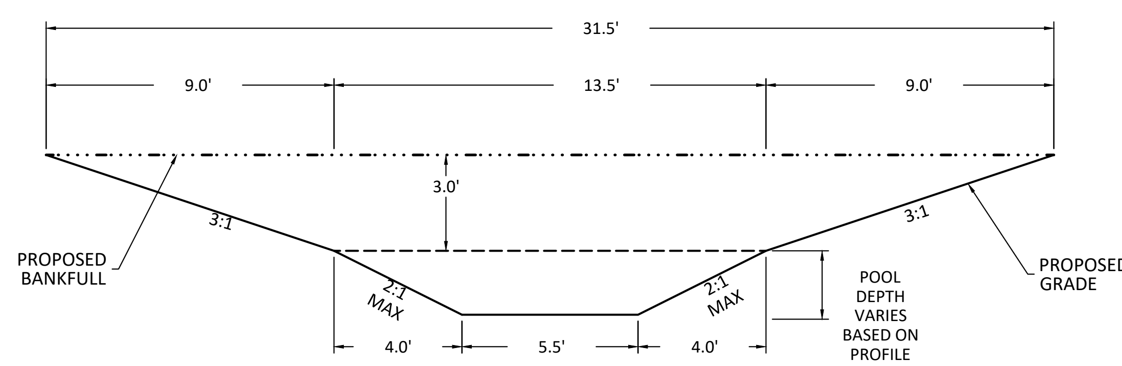

Oak Hill Creek Reach 3 & 4 - In-Line Pool

STA 110+23 to 123+73
Not to Scale

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Oak Hill Creek Reaches 3 & 4
Typical Sections

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Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
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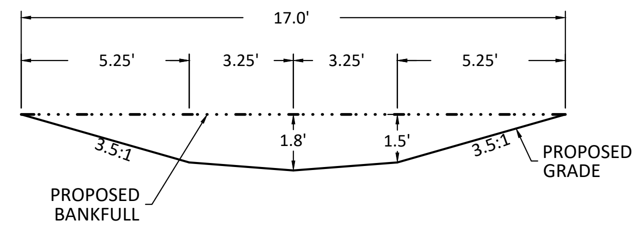
Sheet 1.2

March 19, 2021



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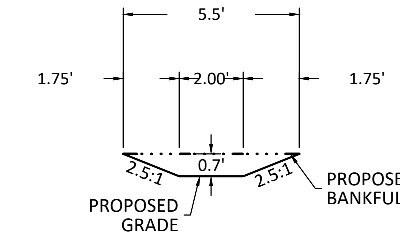

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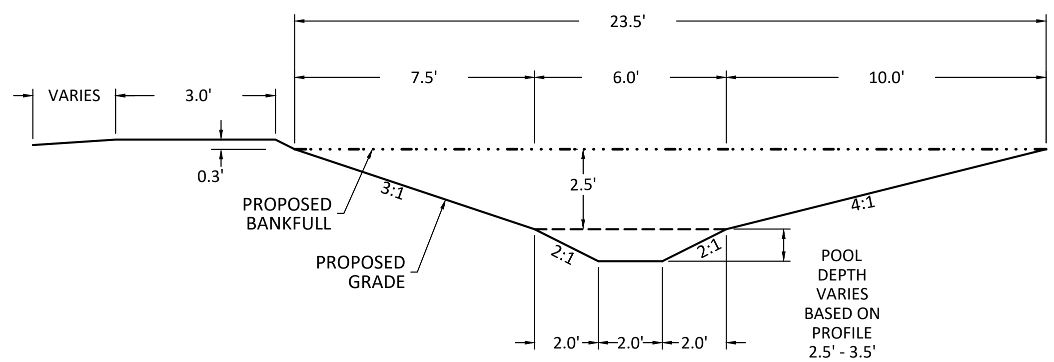

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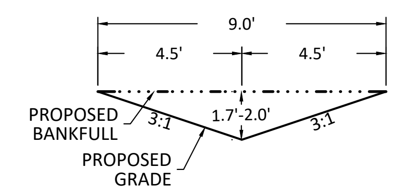

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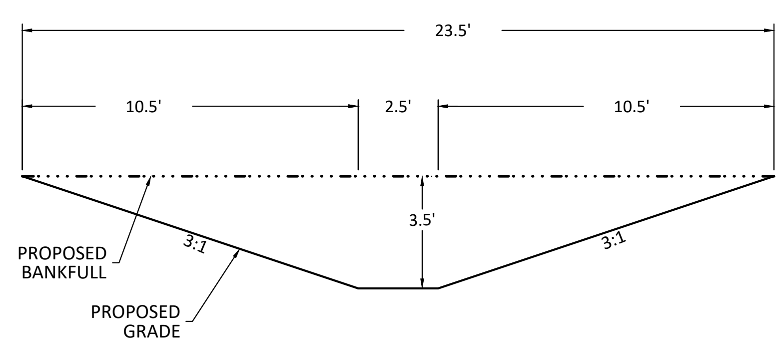

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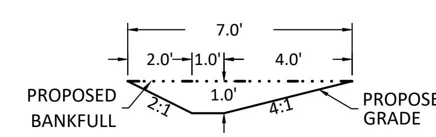

UT1A - Meander Pool
STA 300+08 to 304+91
Not to Scale

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT1 and UT1A Typical Sections

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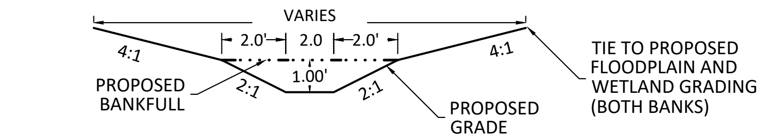
Sheet 1.3



UT2 - Riffle
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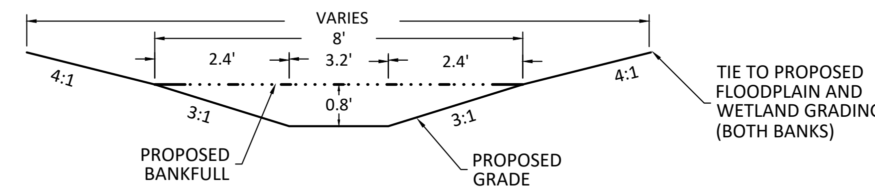

UT3 - Riffle
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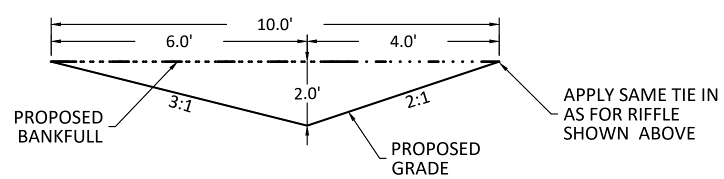

UT2 - Meander Pool
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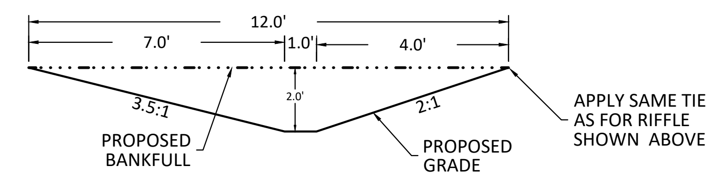

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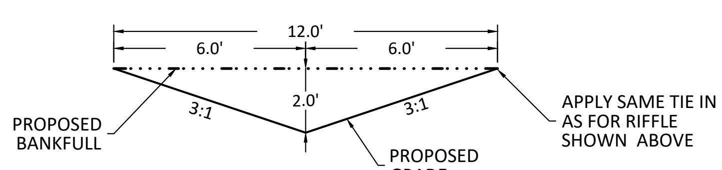

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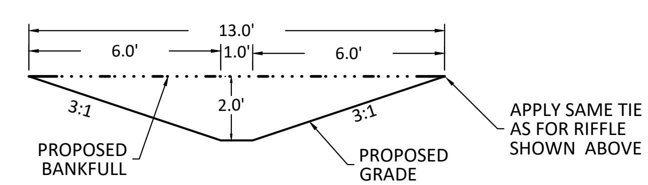

UT3 - In-line Pool
STA 300+32 to 302+85
Not to Scale

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT2 and UT3
Typical Sections

Revisions:

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Sheet 1.4

March 19, 2021

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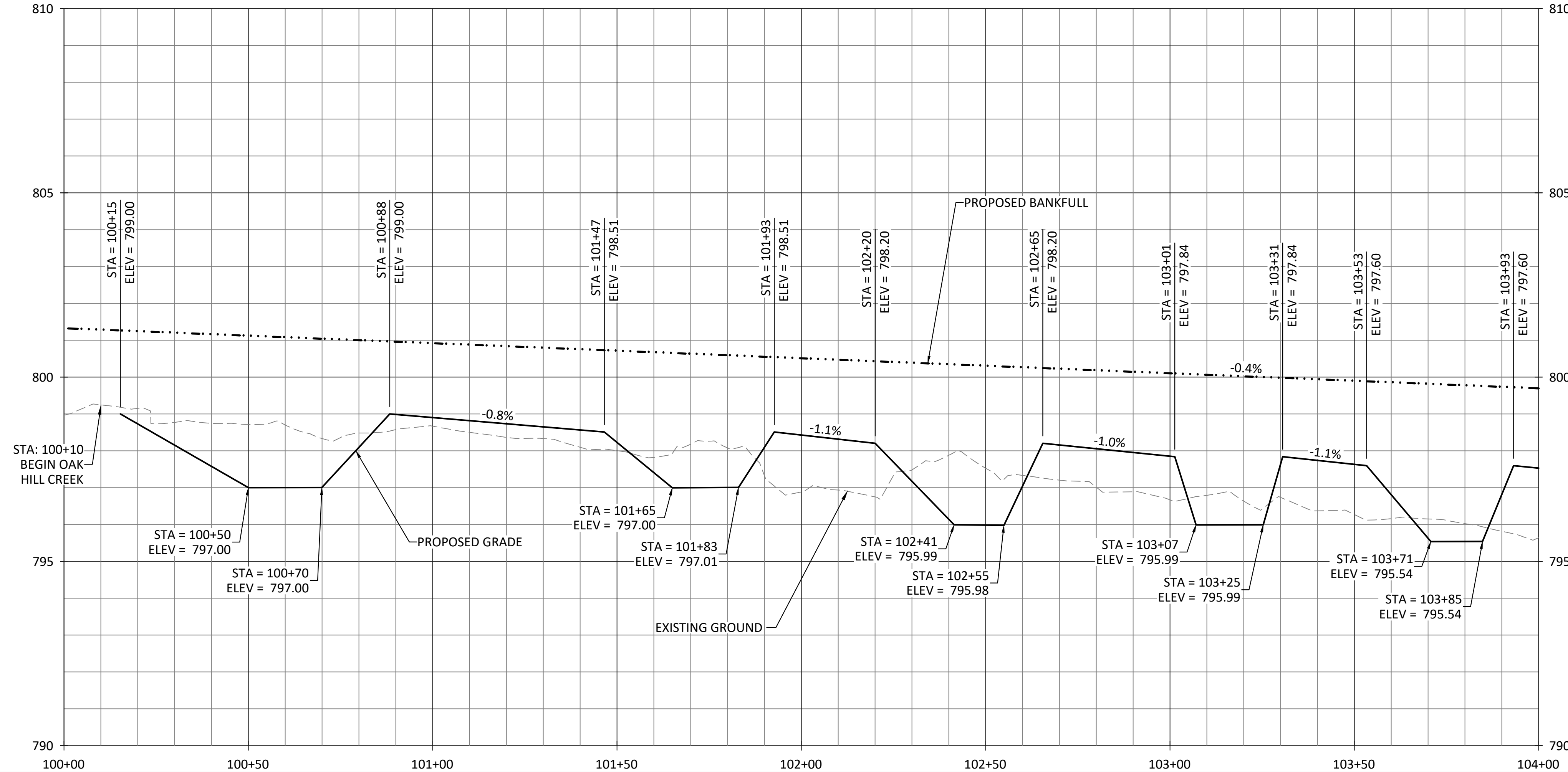
March 19, 2021



0' 2' 4' 6'
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

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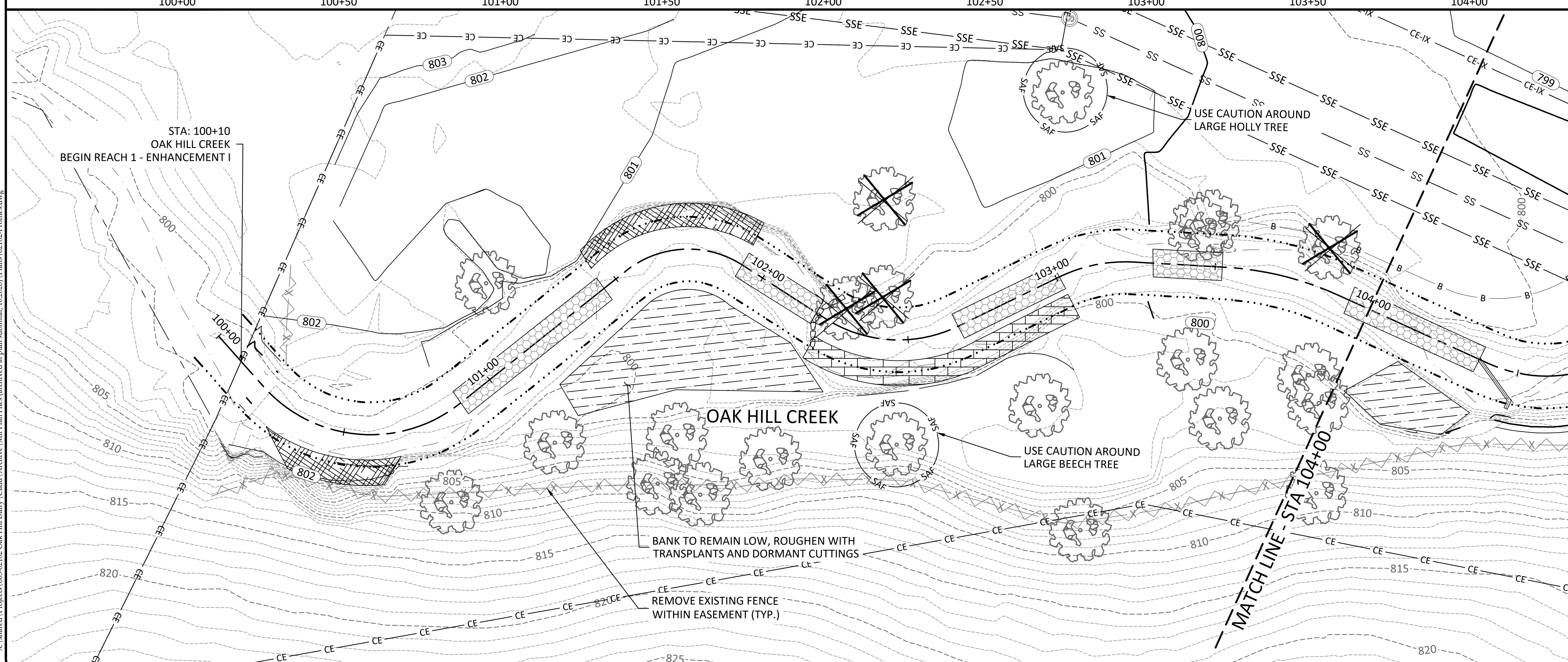

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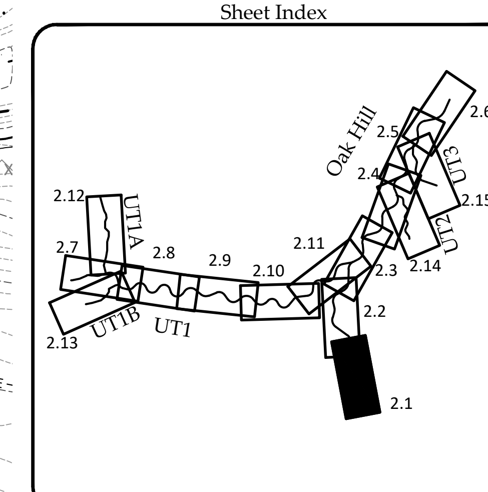

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Oak Hill Creek
Stream Plan and Profile

Revisions:

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Job Number:	005-02182
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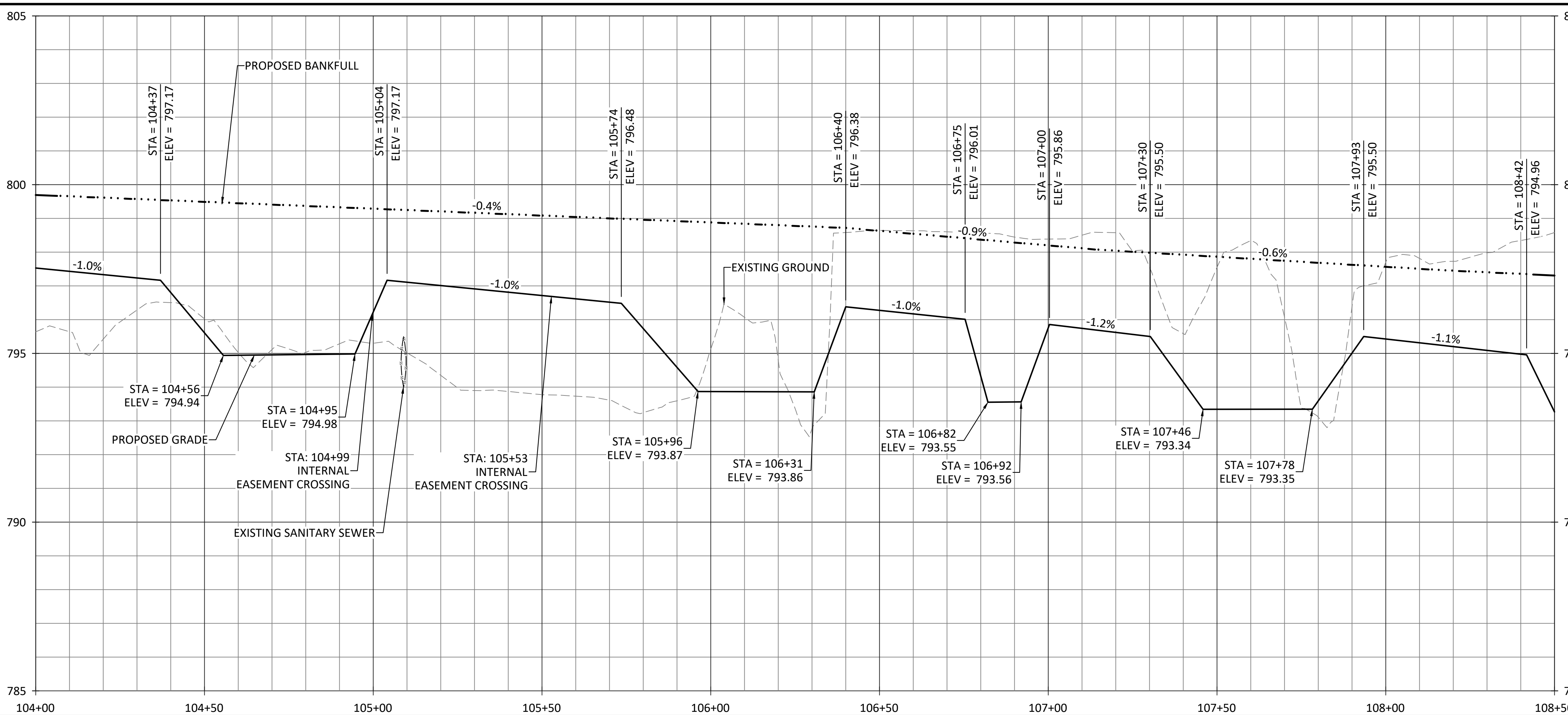
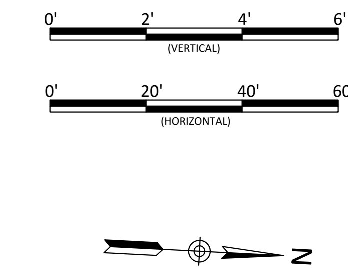
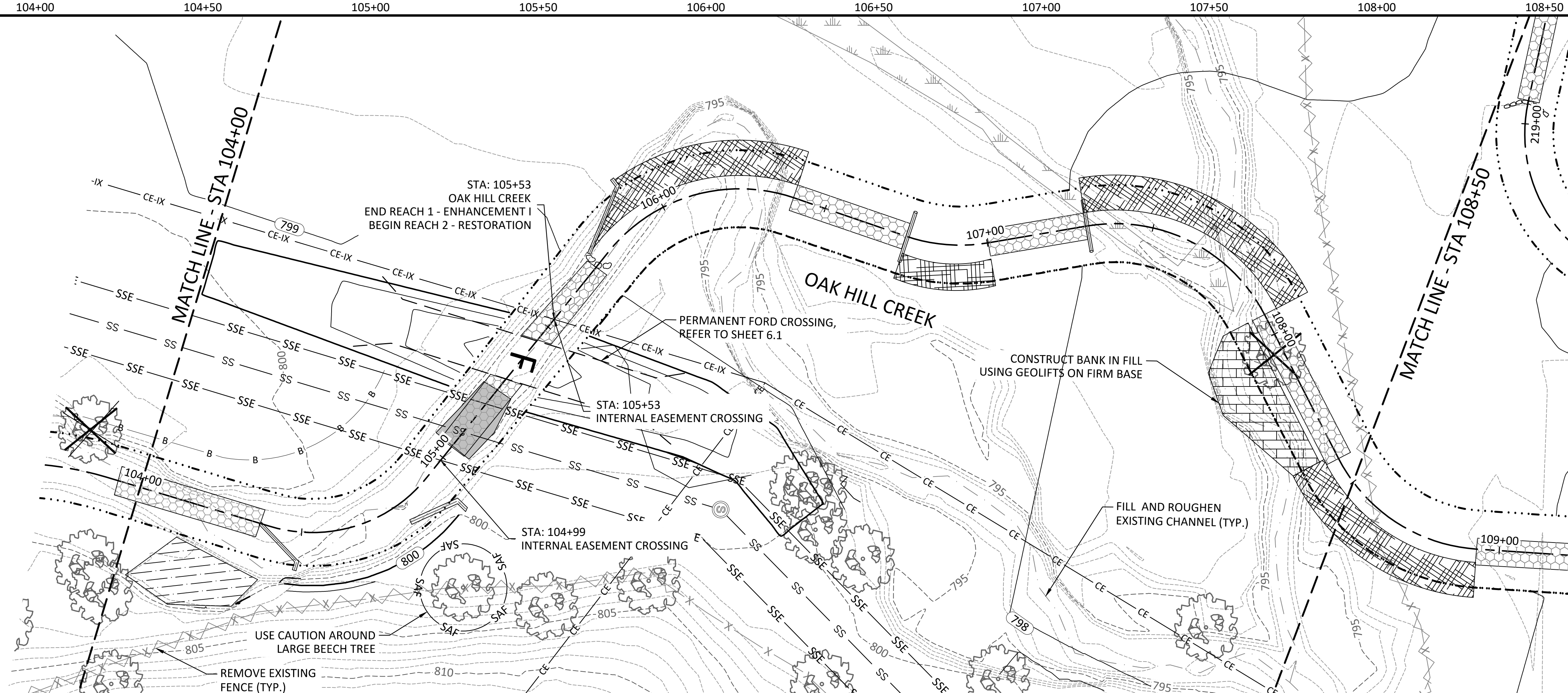
Checked By:	ER

Sheet 2.1







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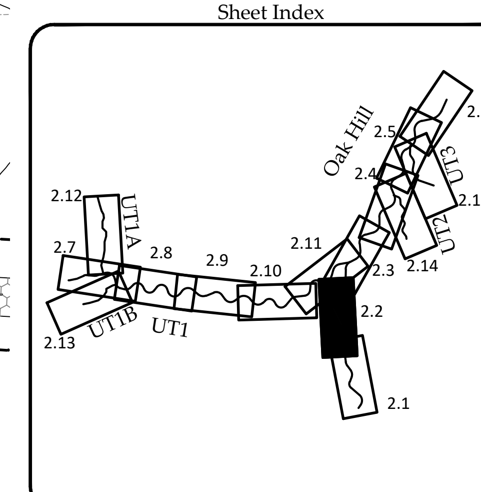

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Oak Hill Creek
Stream Plan and Profile

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

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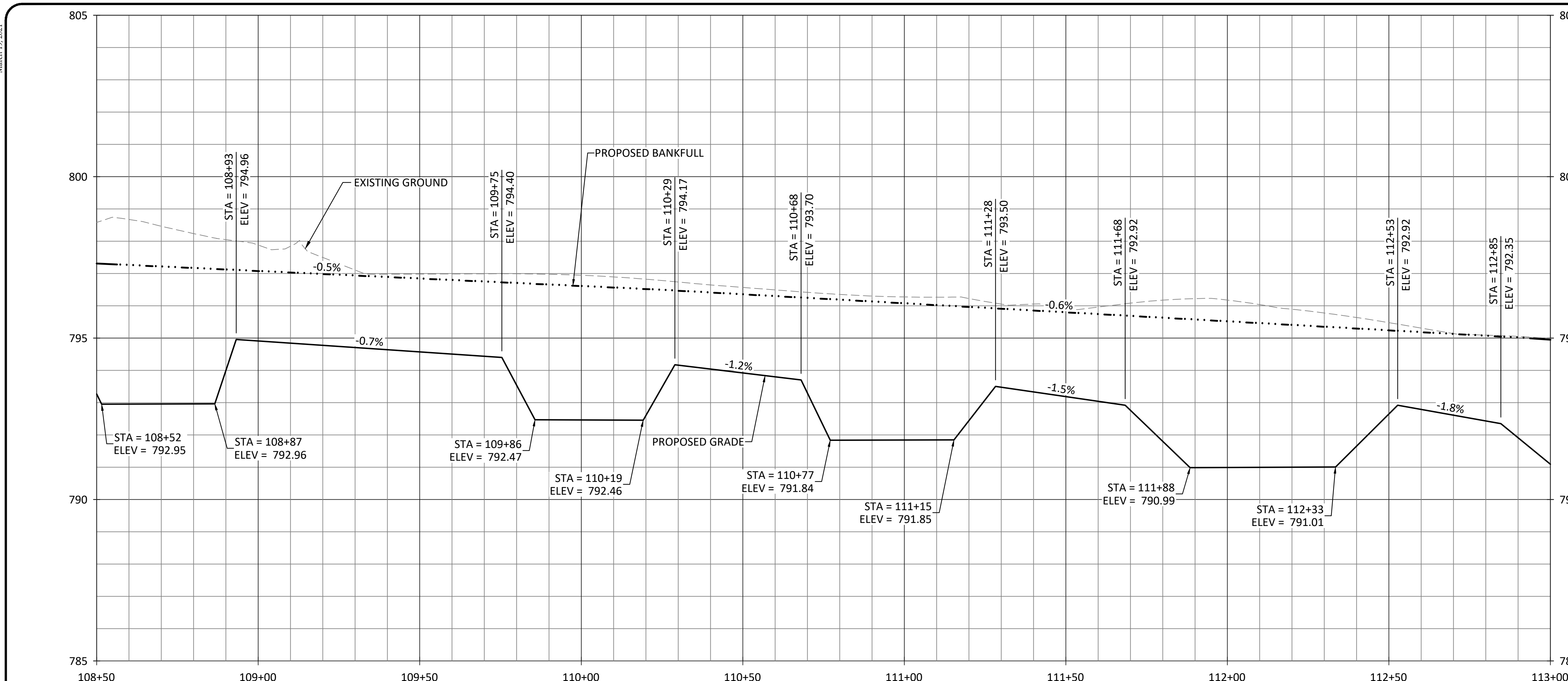

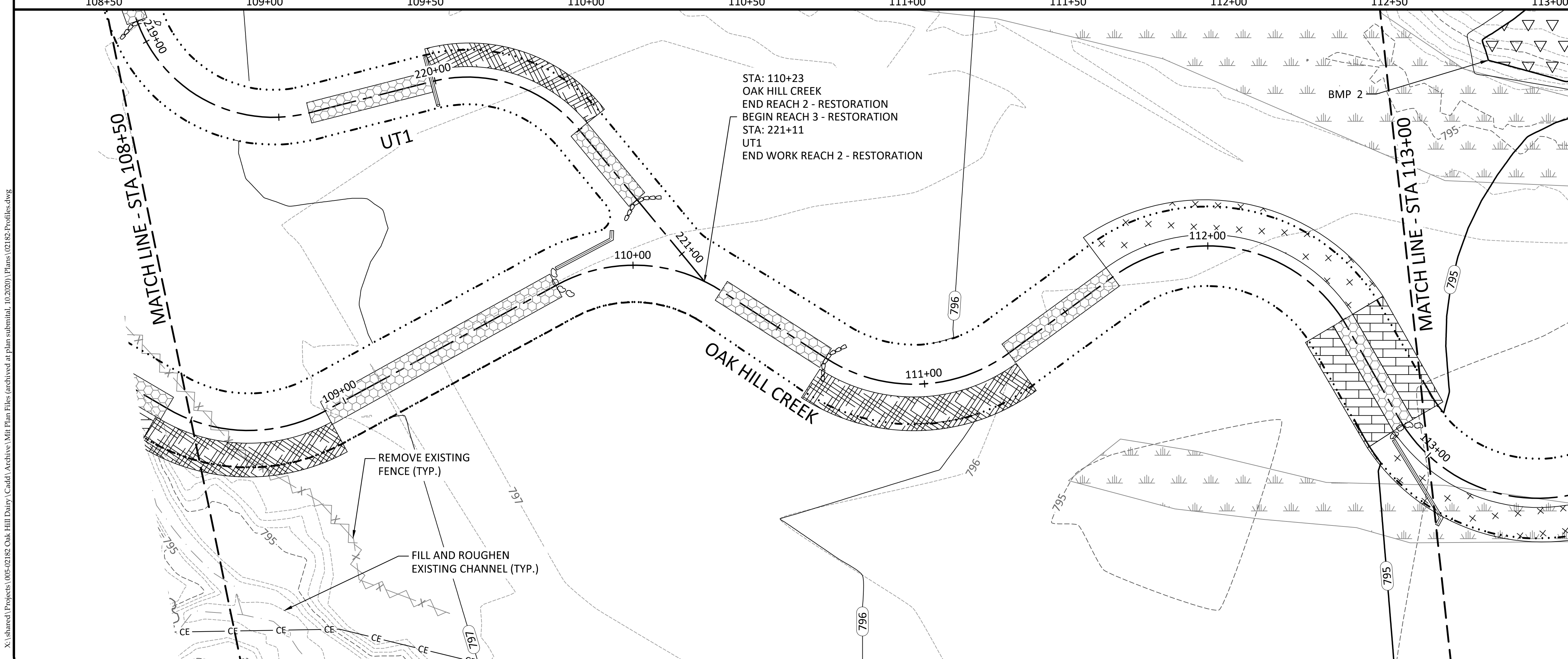

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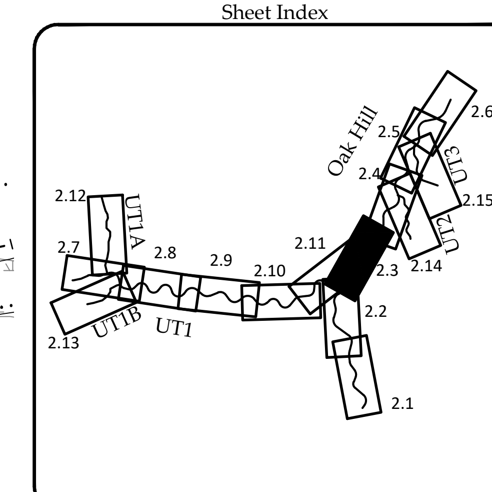

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Drawn By:	JDW
Checked By:	ER

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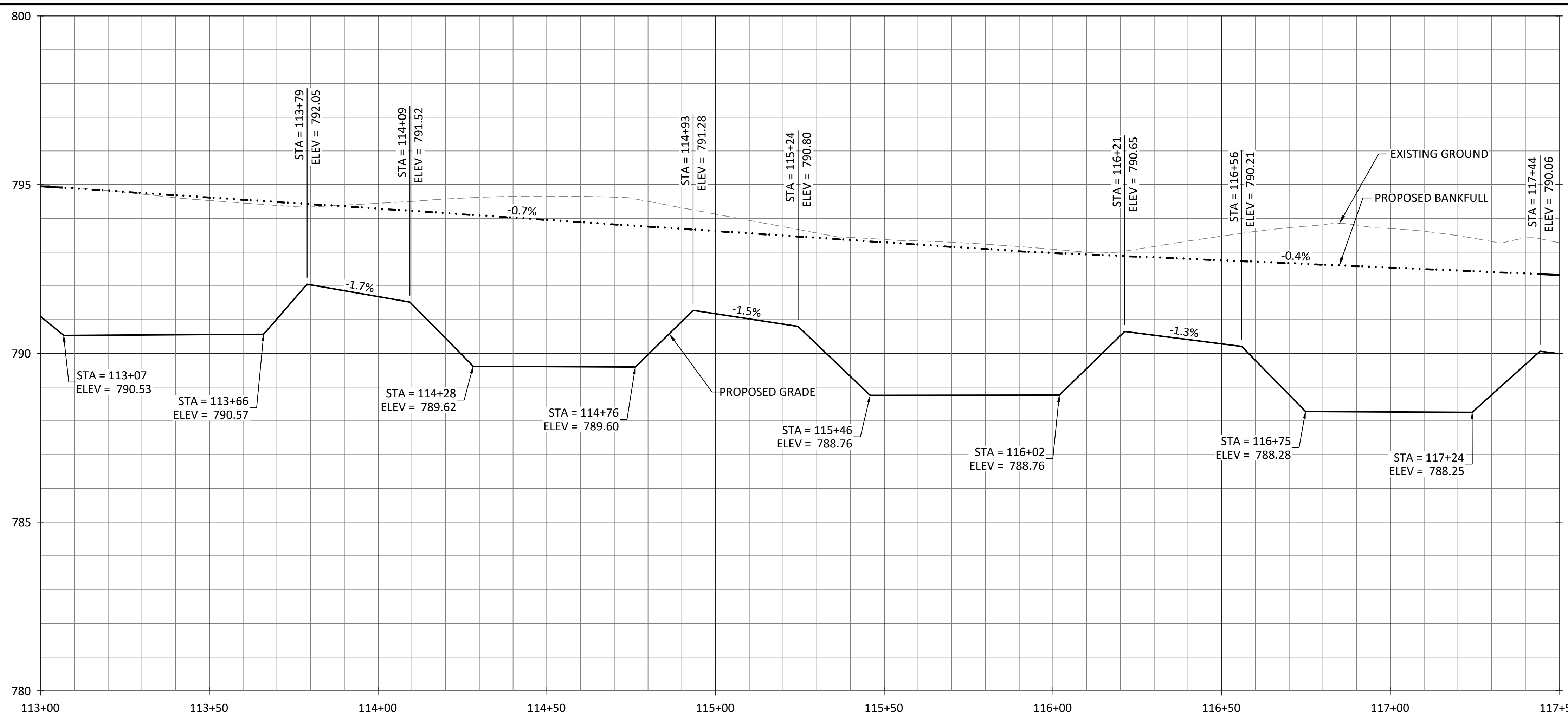
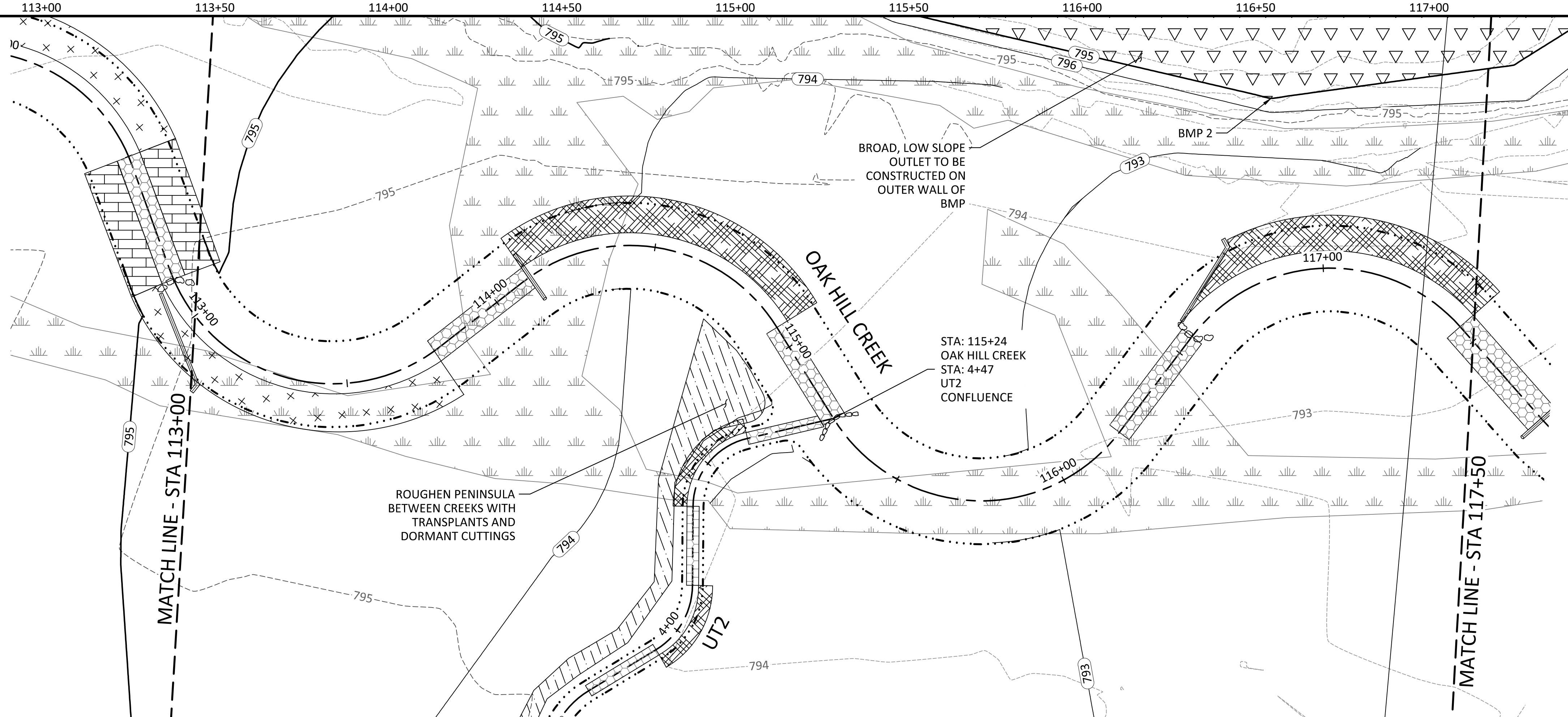
March 19, 2021





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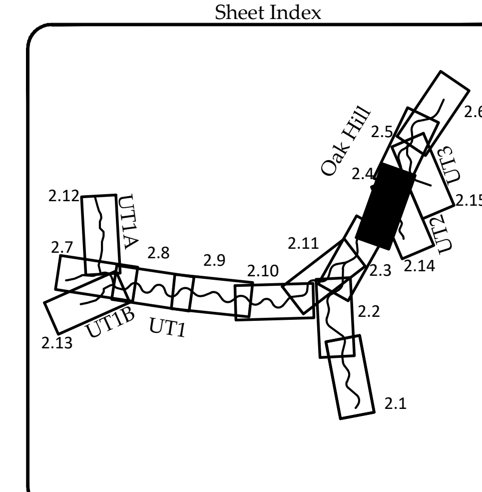

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Oak Hill Creek
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Revisions:

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

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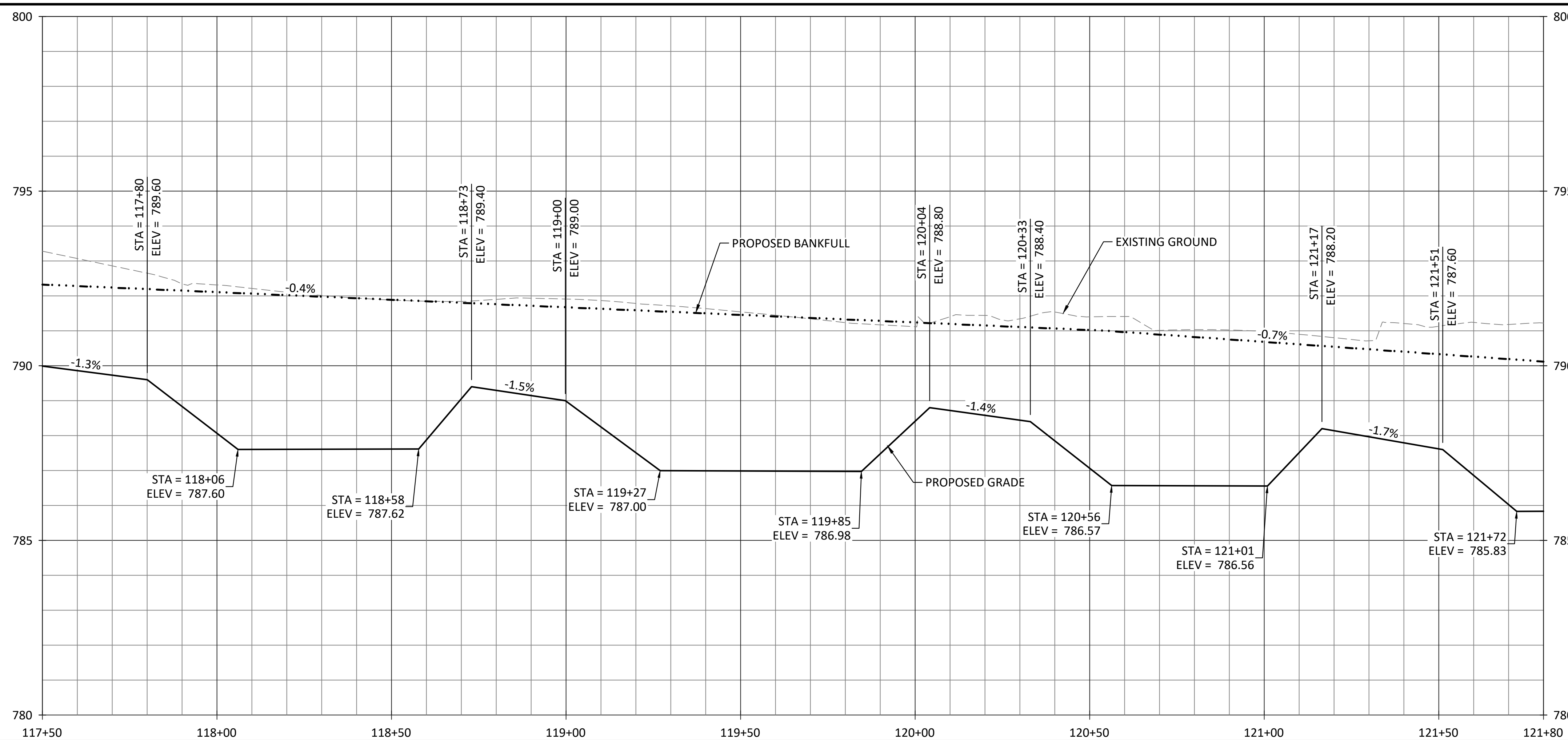

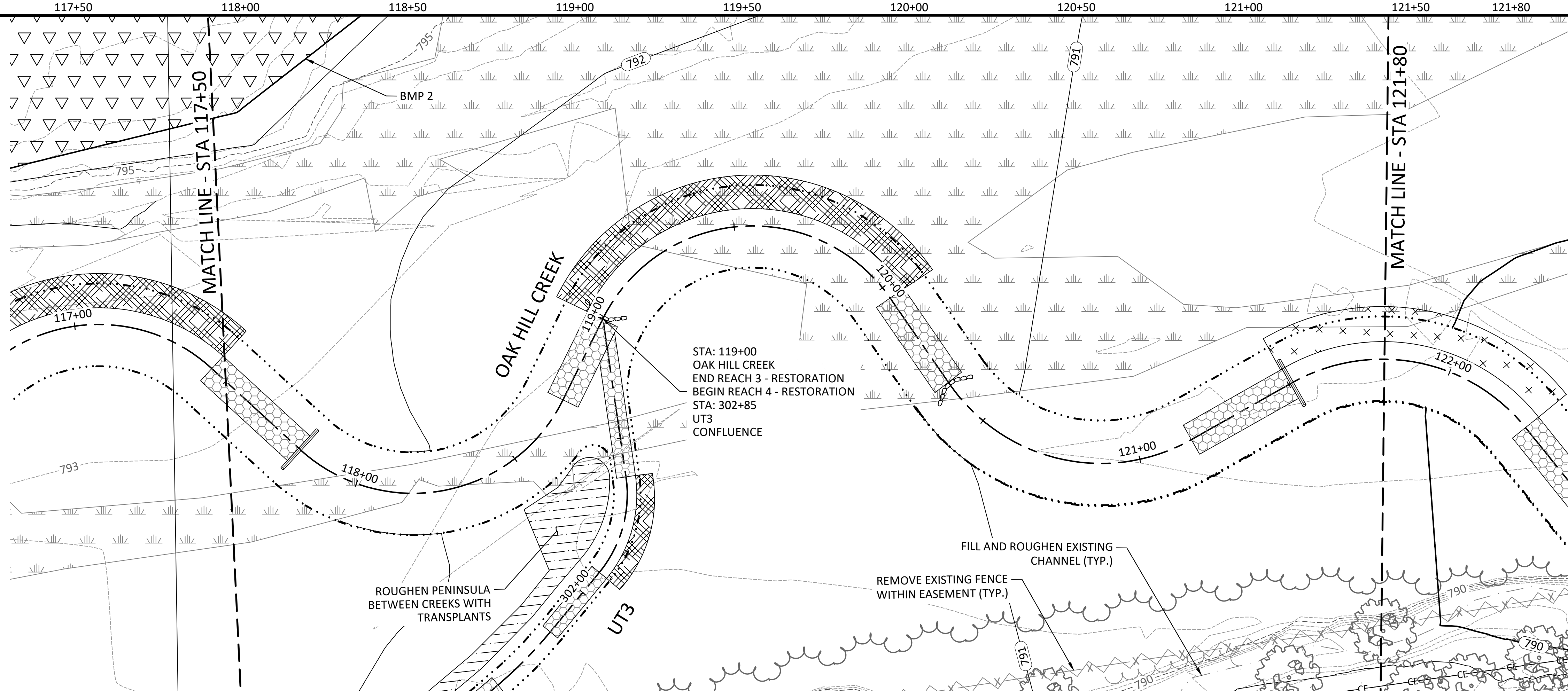

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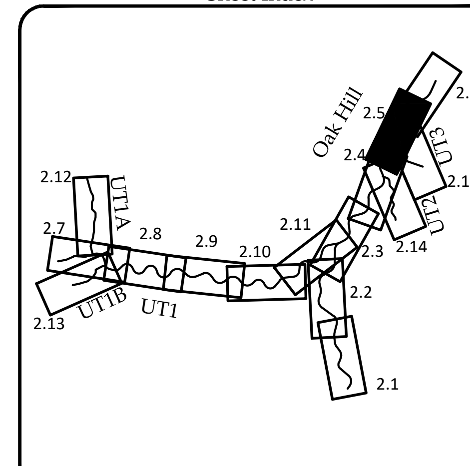

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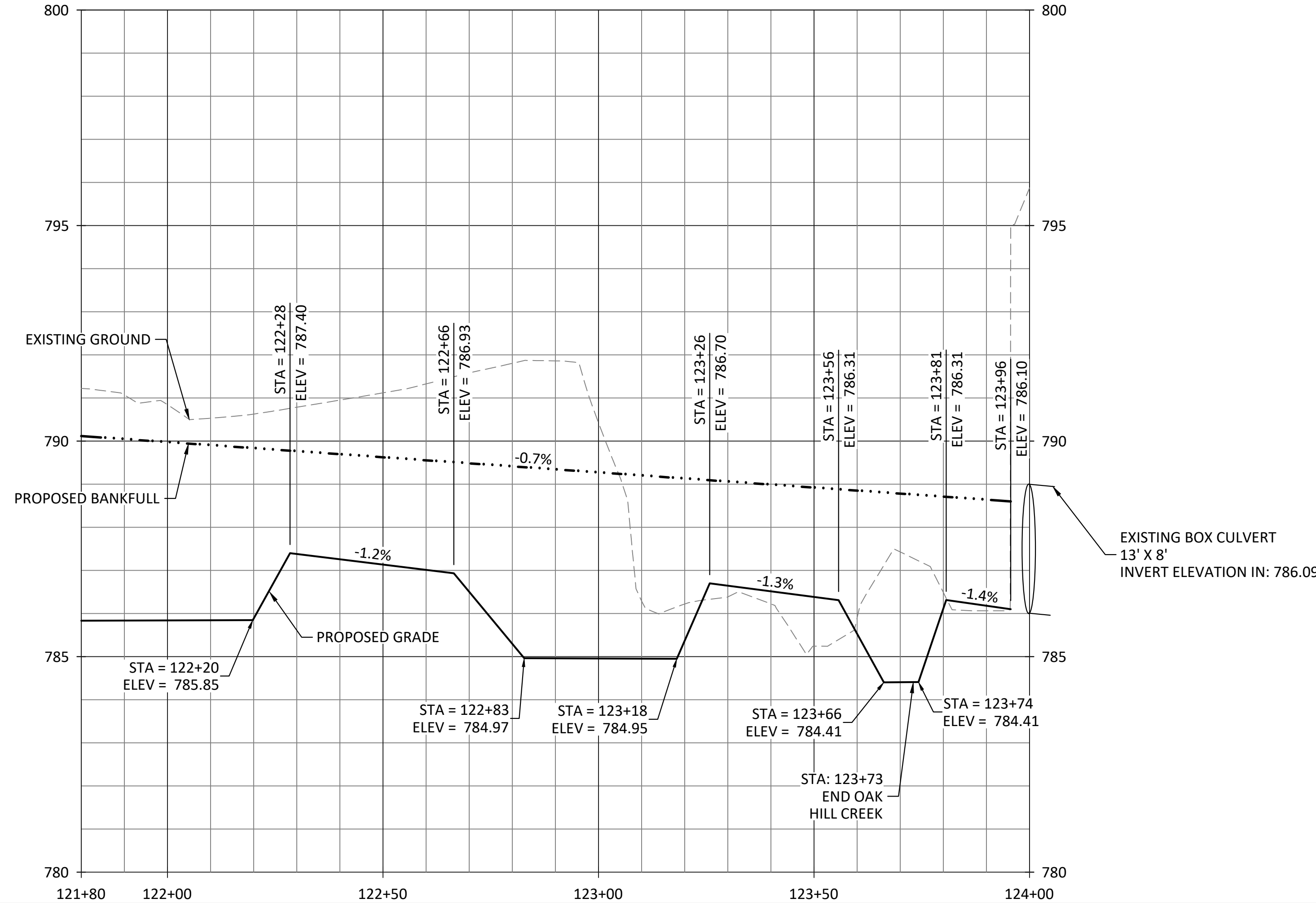

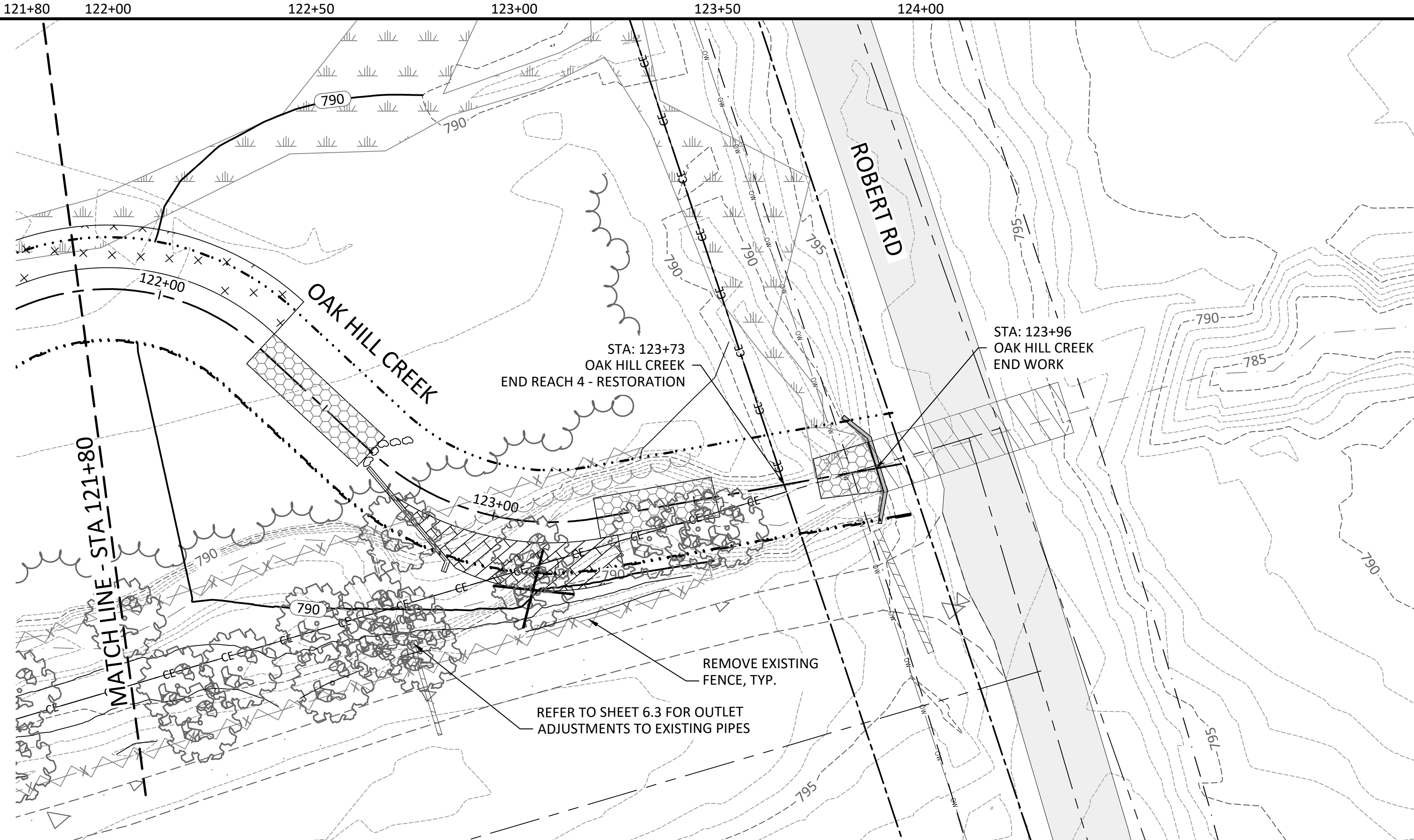

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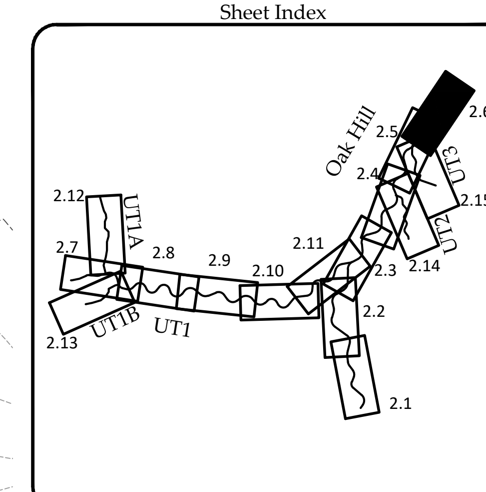

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Oak Hill Dairy Mitigation Site
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Oak Hill Creek
Stream Plan and Profile

Revisions:

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
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Checked By: ER

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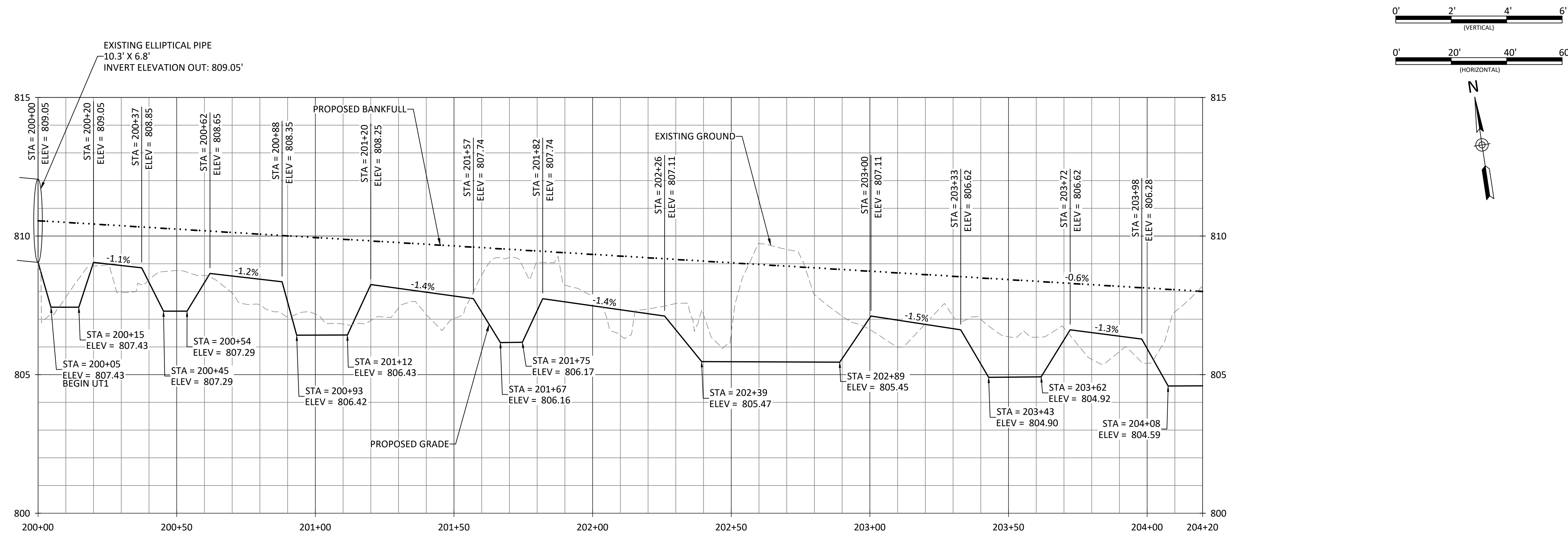

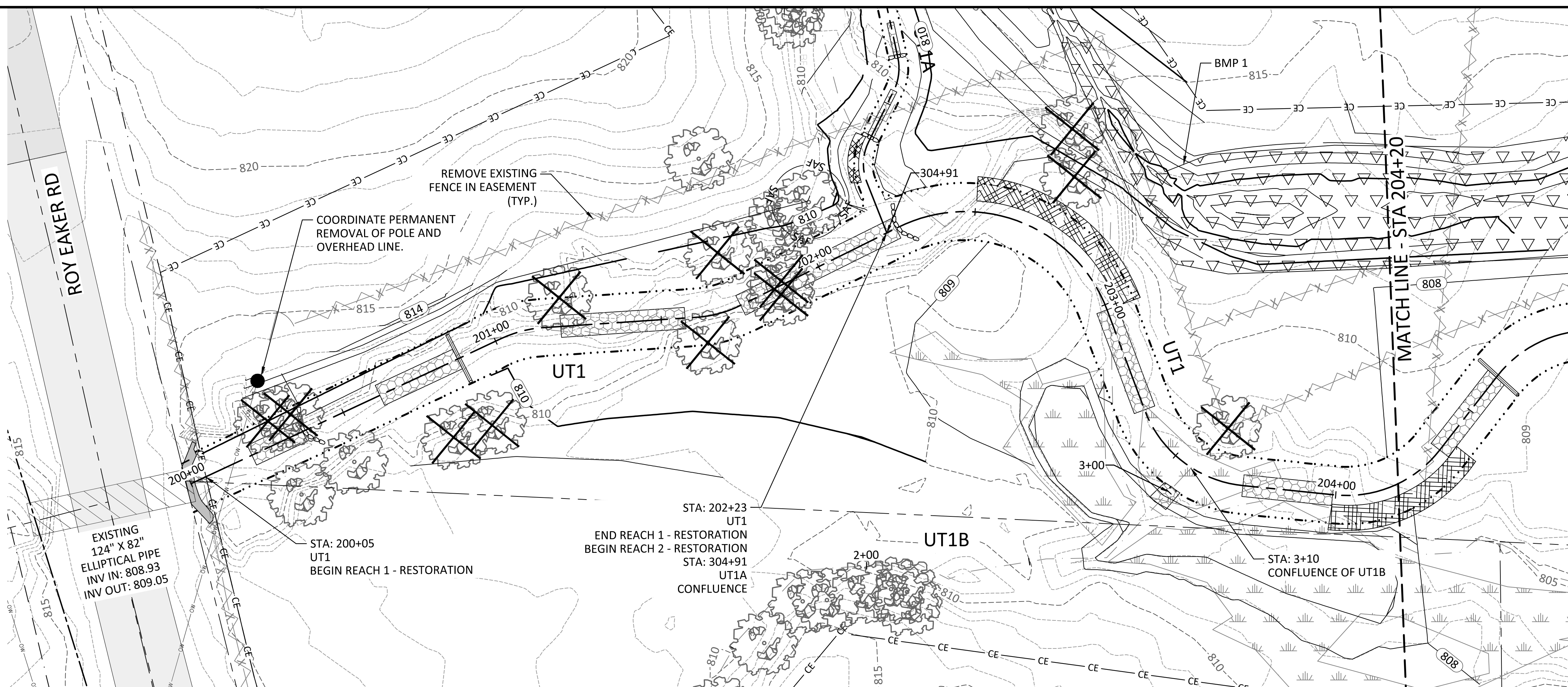

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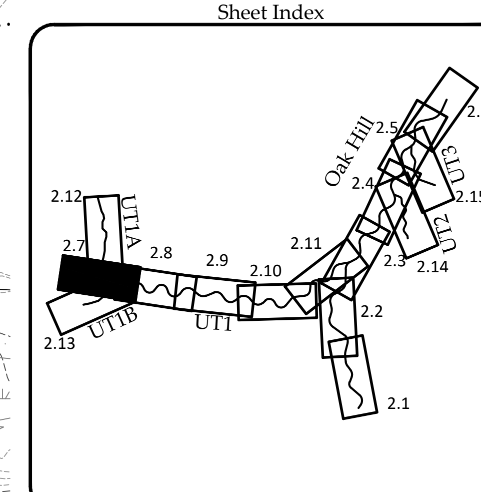

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT1
Stream Plan and Profile

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Drawn By:	JDW
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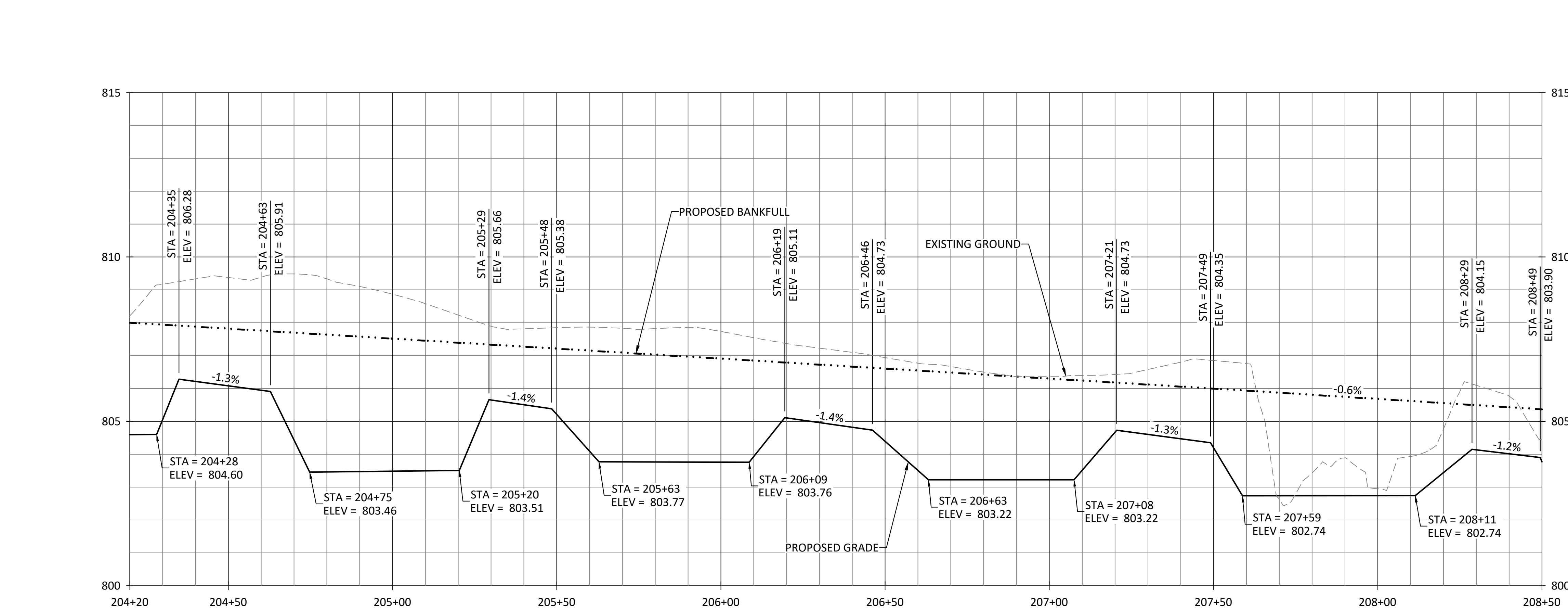

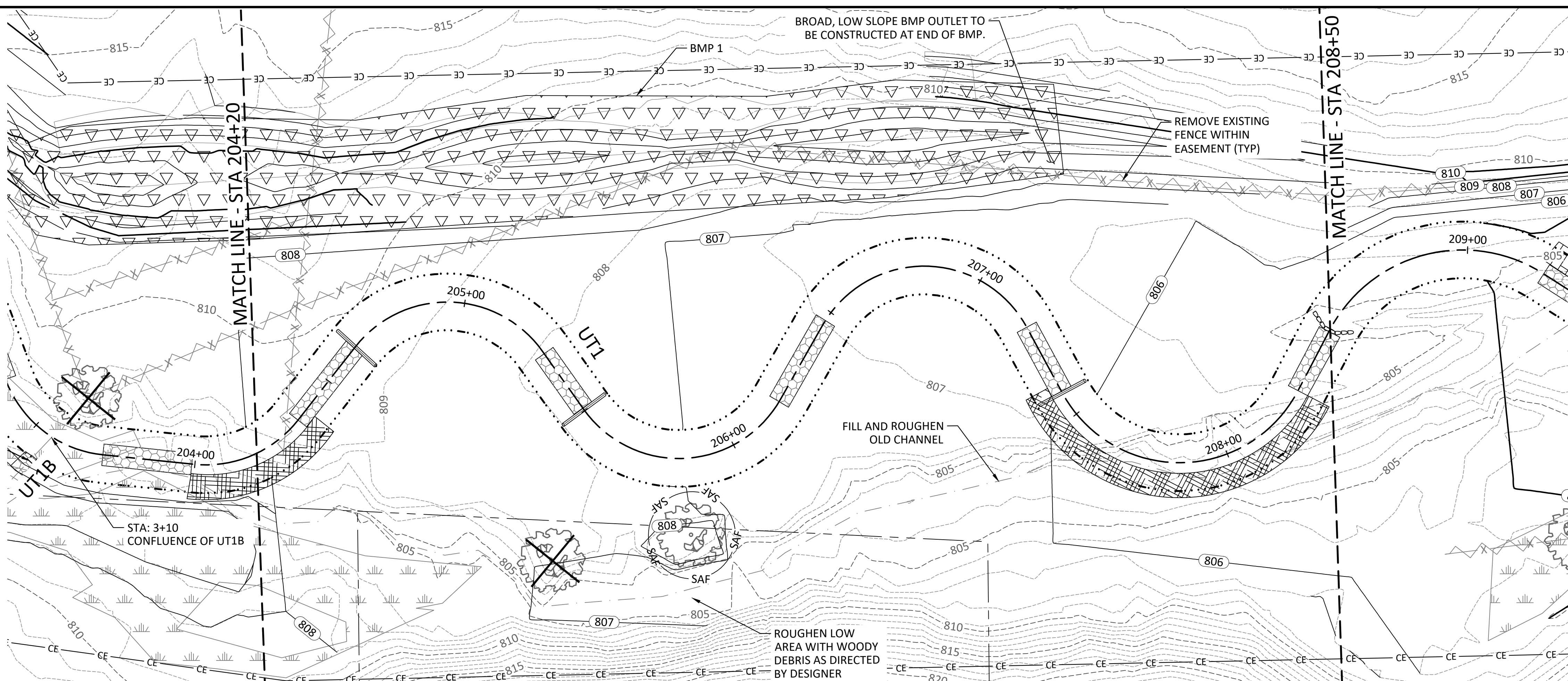

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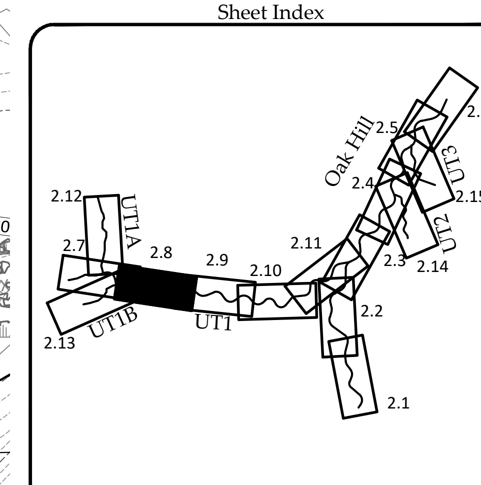

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Oak Hill Dairy Mitigation Site
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UT1
Stream Plan and Profile

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Checked By:	ER

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March 19, 2021

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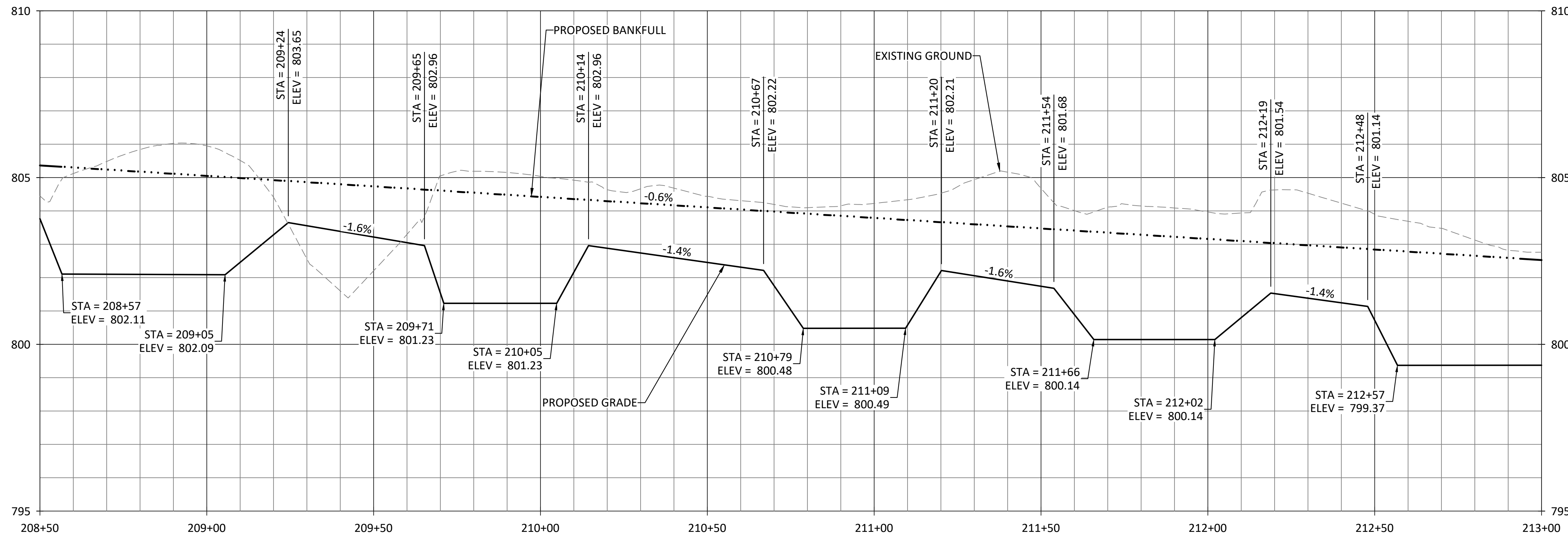
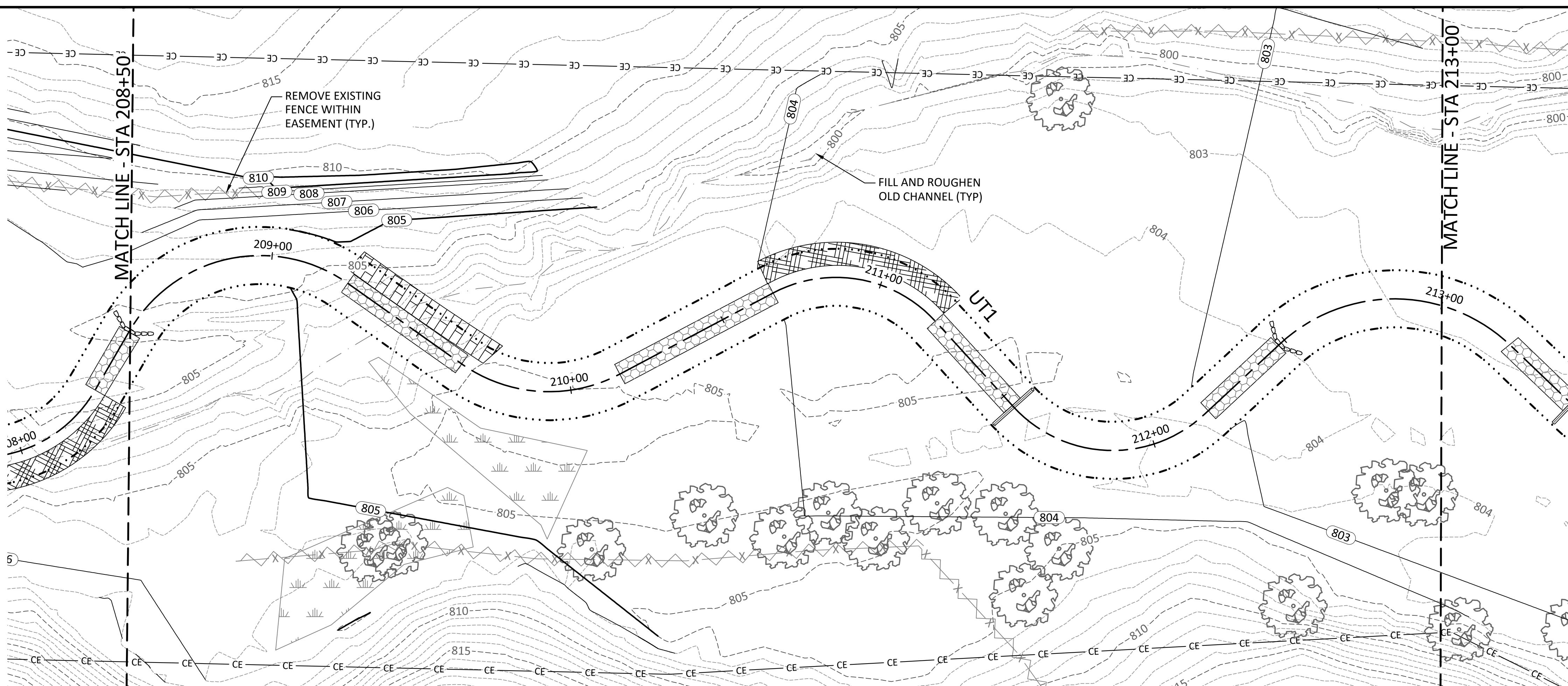
(VERTICAL)

0' 20' 40' 60'
(HORIZONTAL)

N





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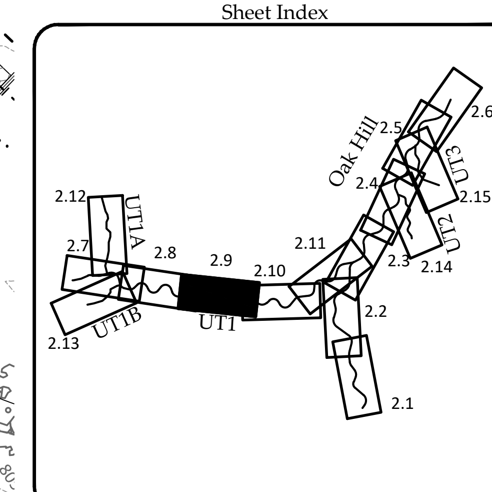

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UT1
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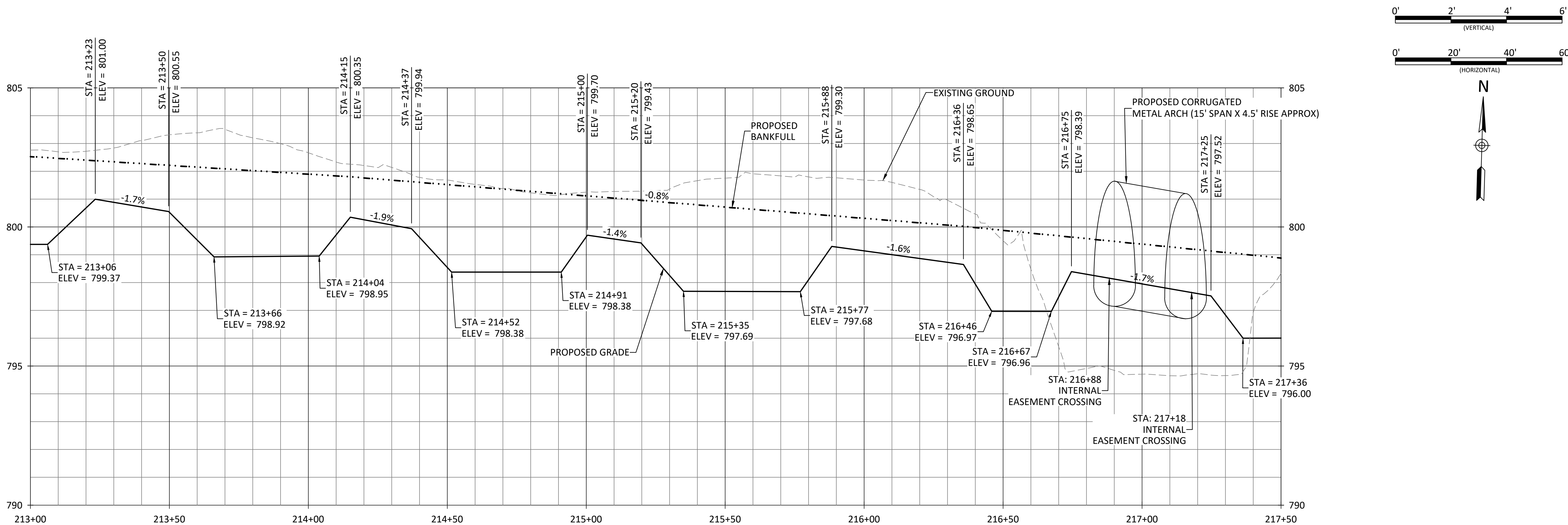

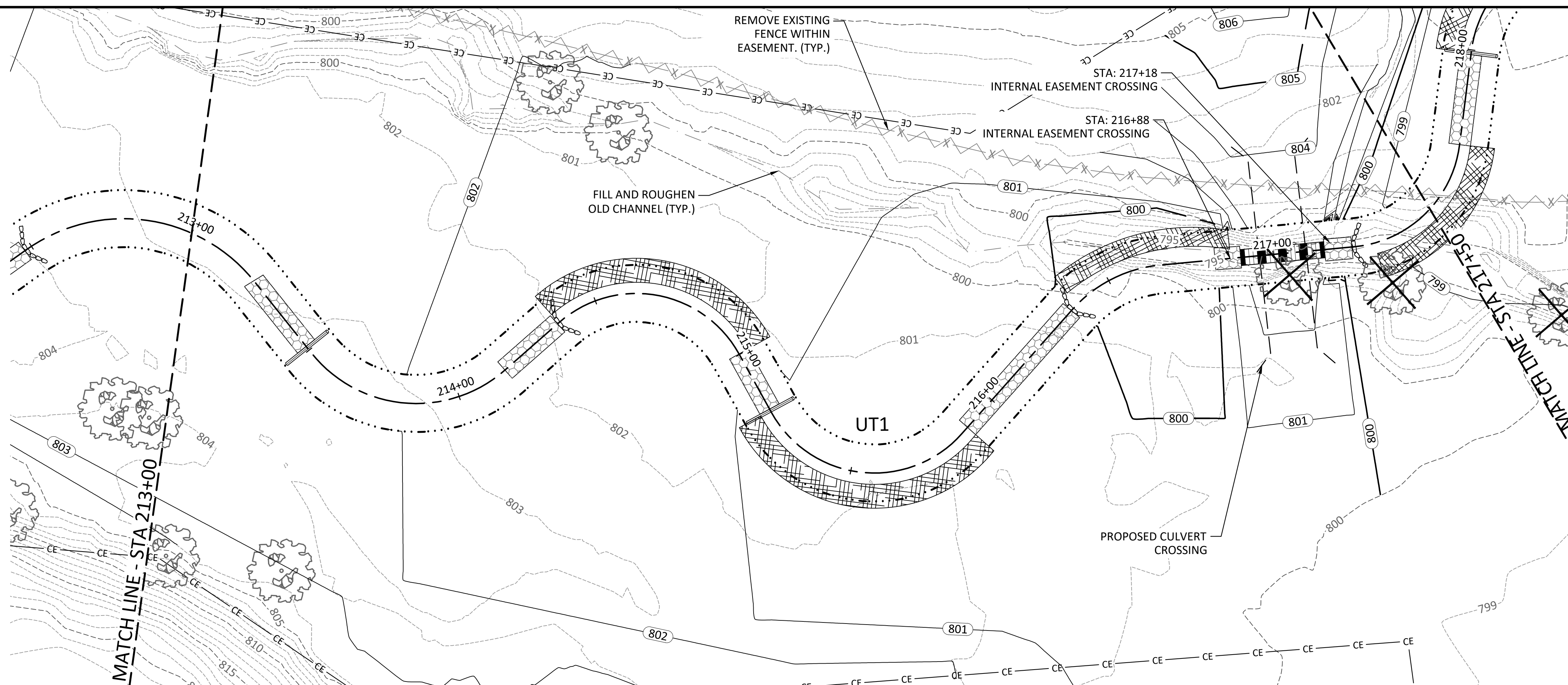

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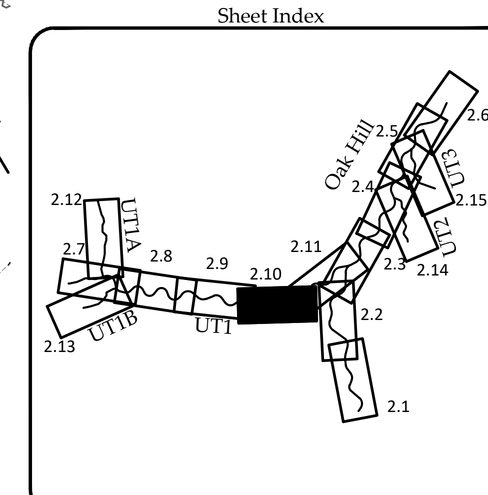

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Stream Plan and Profile

Revisions:

Date:	March 22, 2021
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Drawn By:	JDW
Checked By:	ER

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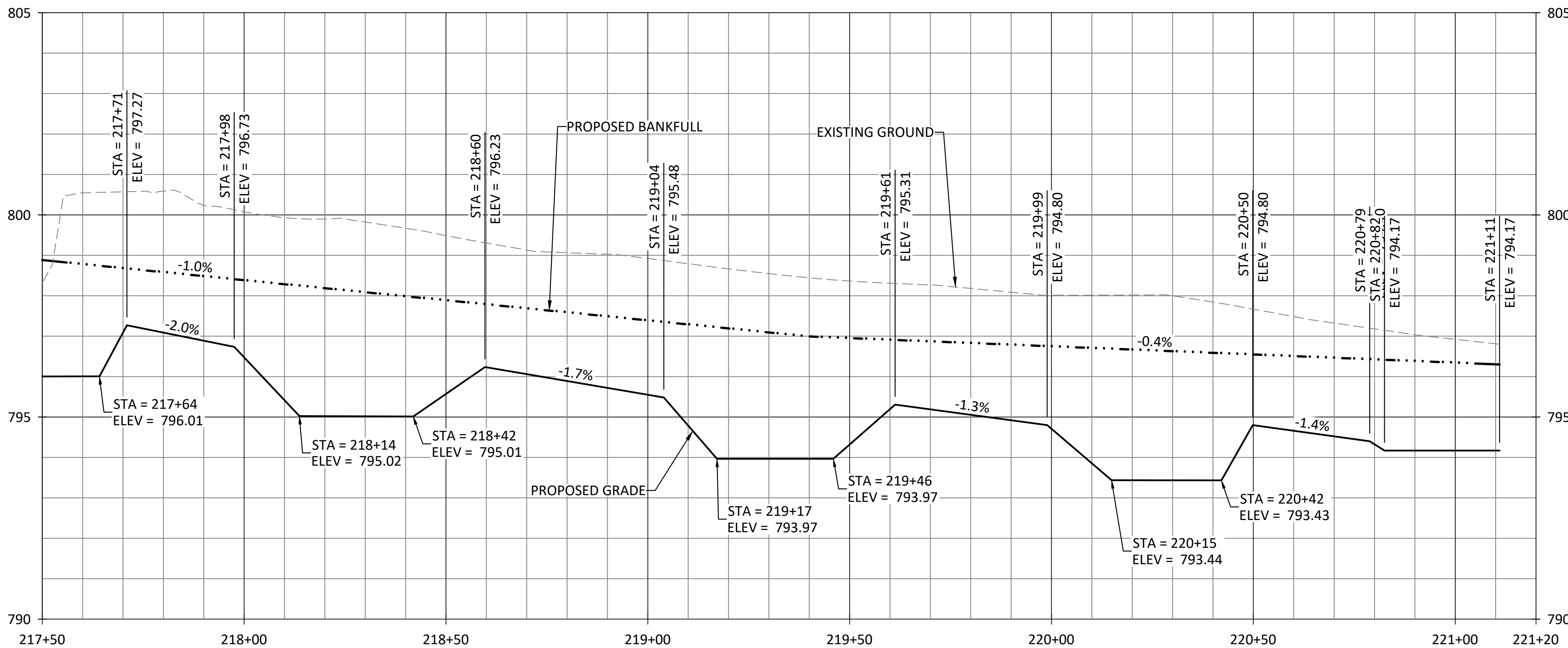

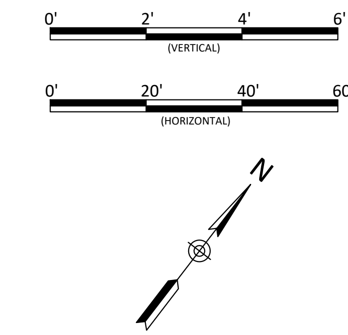

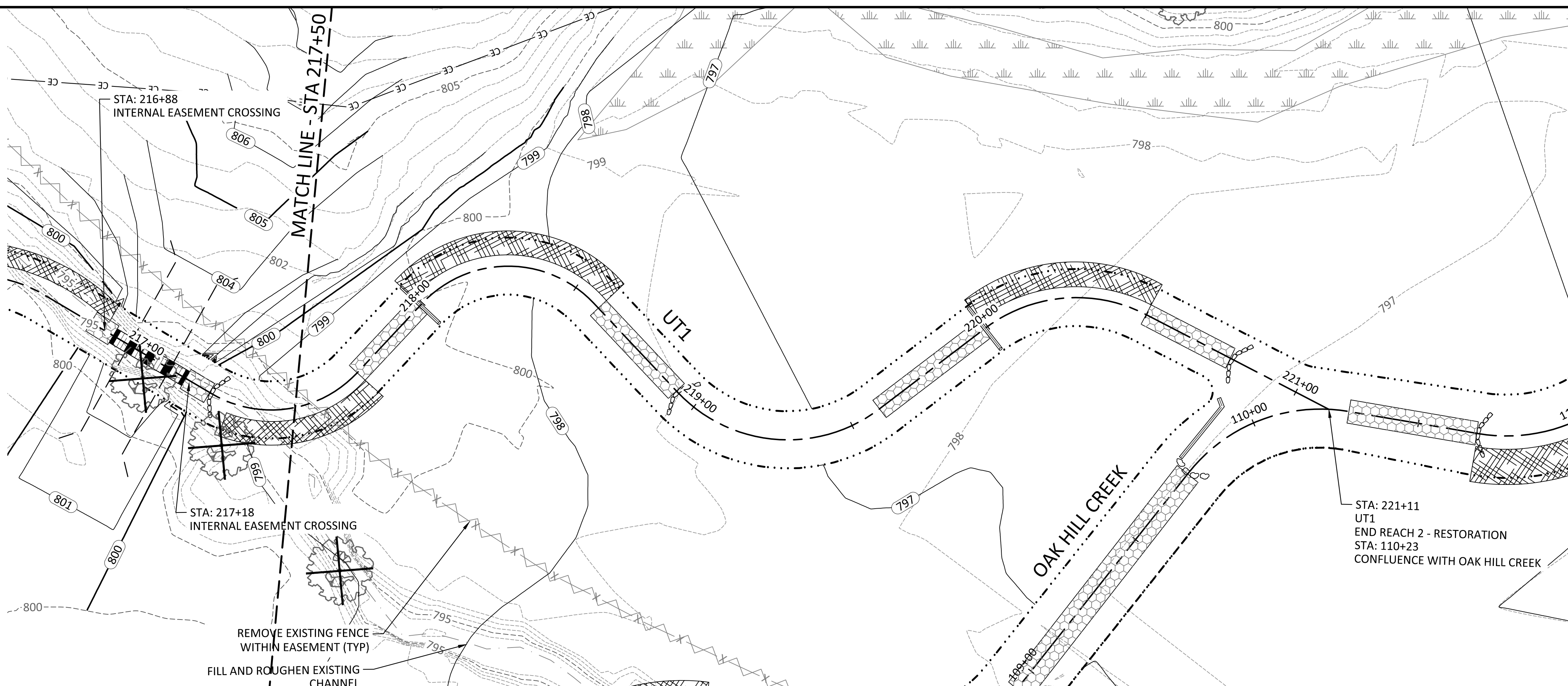

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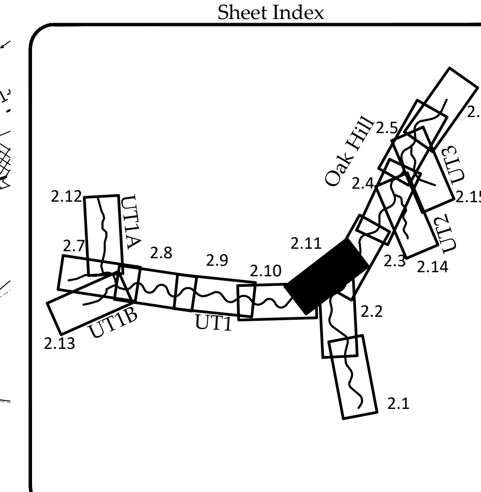

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Oak Hill Dairy Mitigation Site
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Drawn By: JDW
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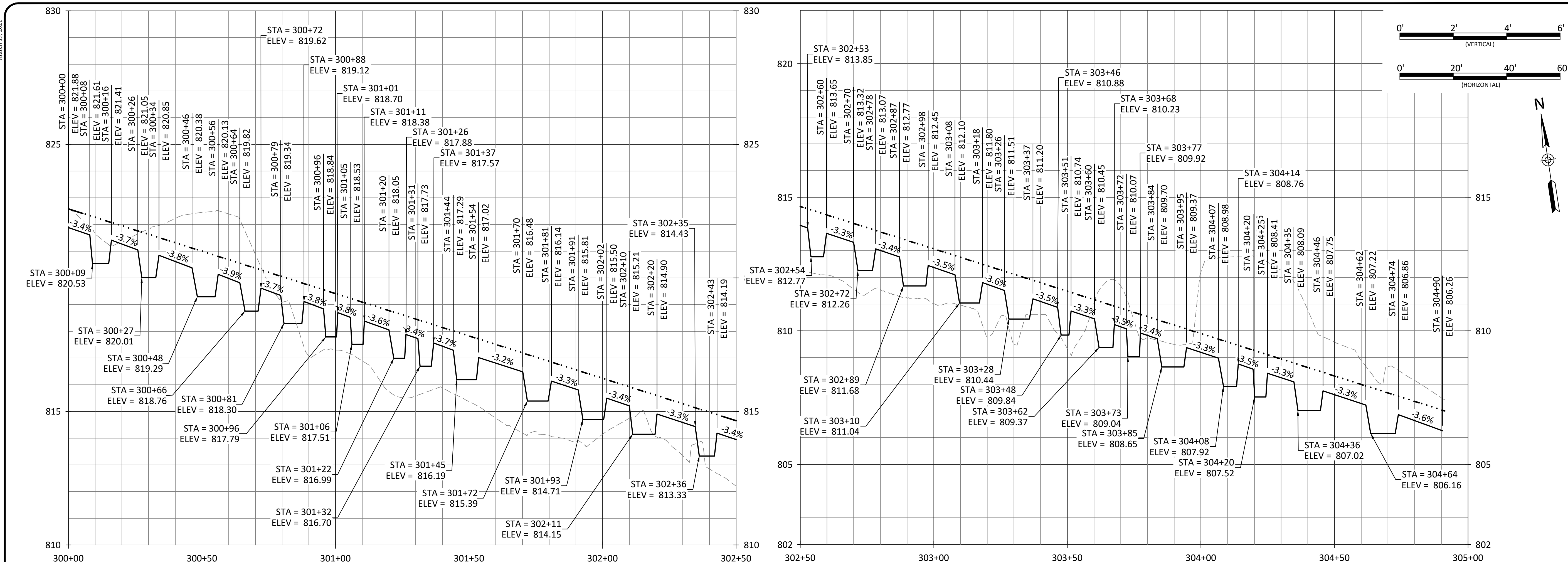

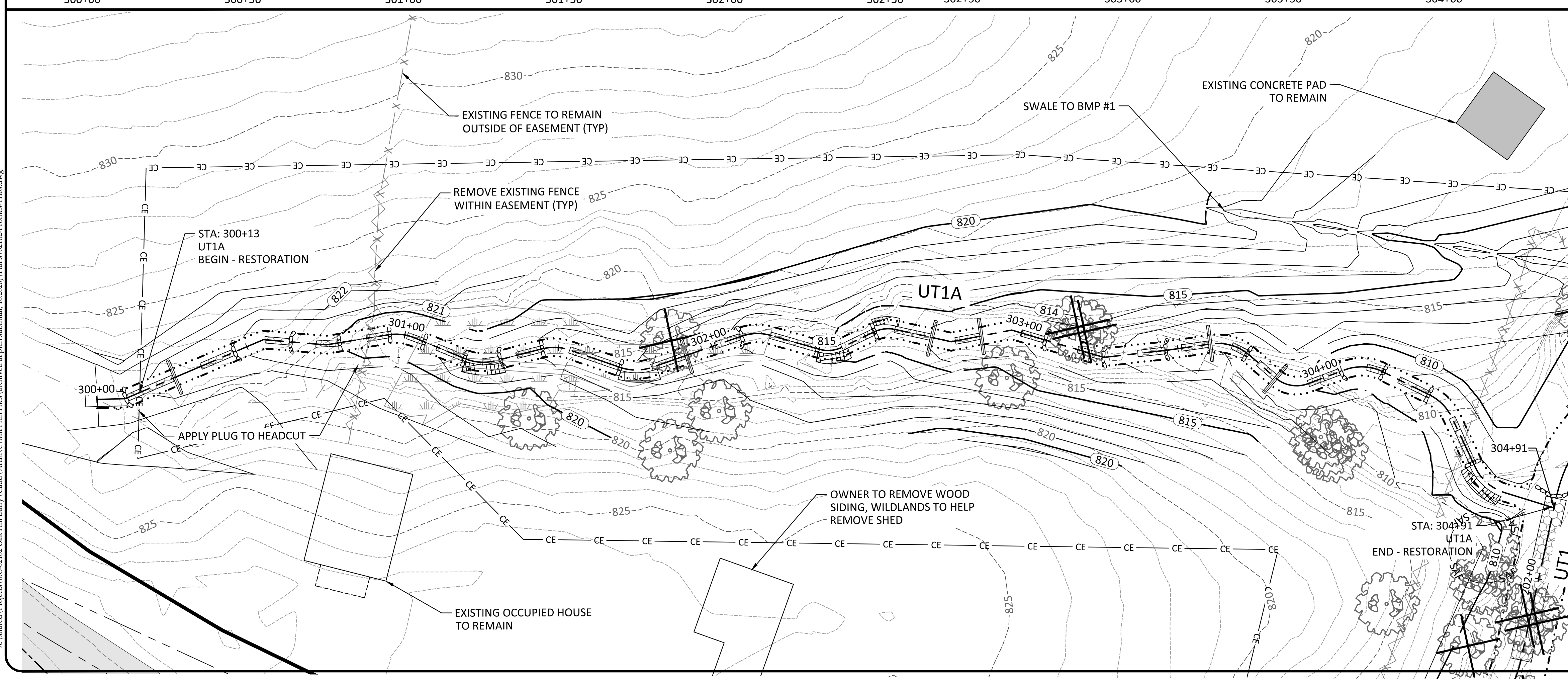

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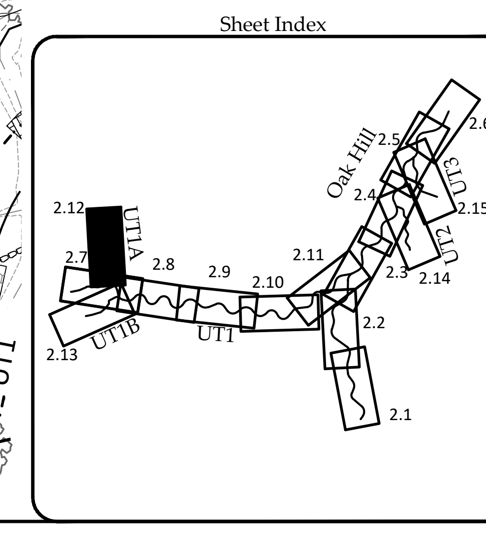

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Oak Hill Dairy Mitigation Site
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UT1A
Stream Plan and Profile

Revisions:

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Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

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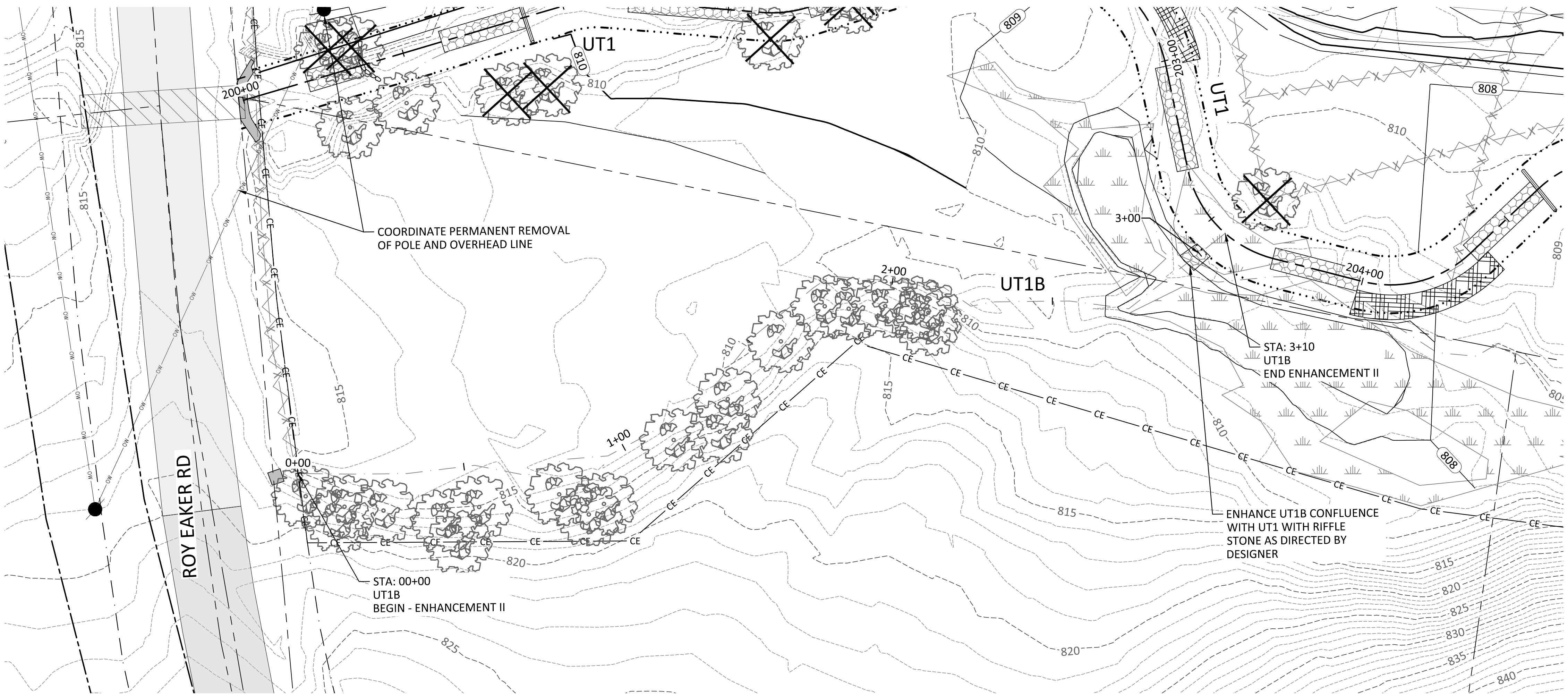

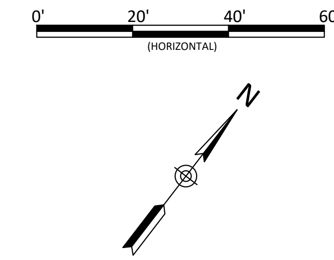

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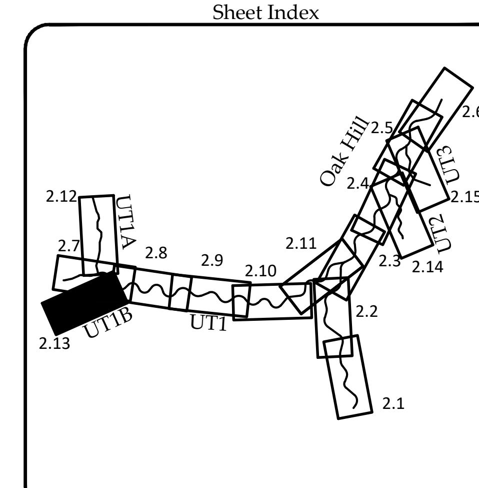

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT1B
Stream Plan and Profile

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Drawn By:	JDW
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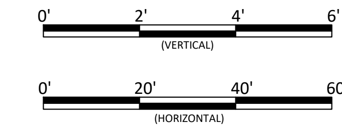

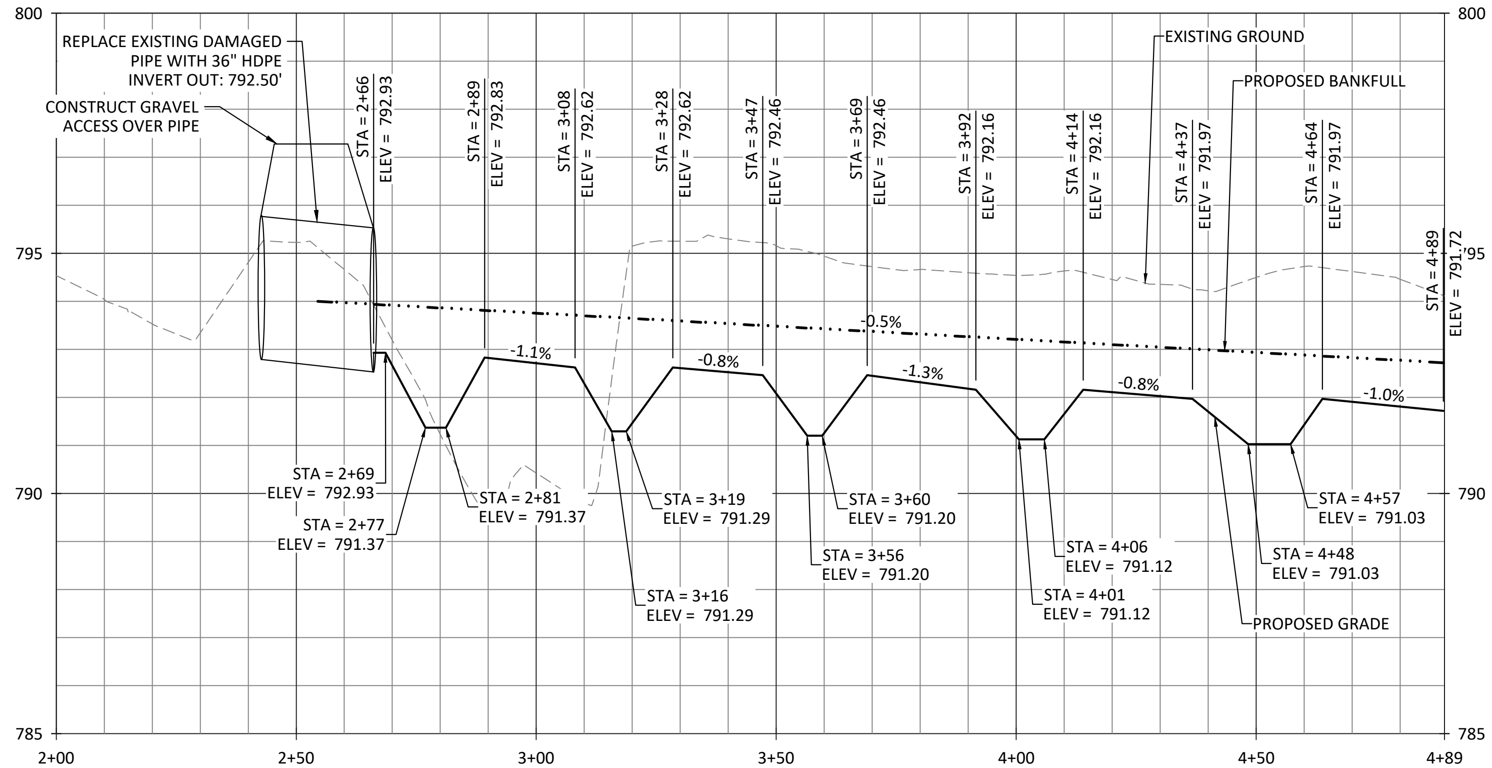

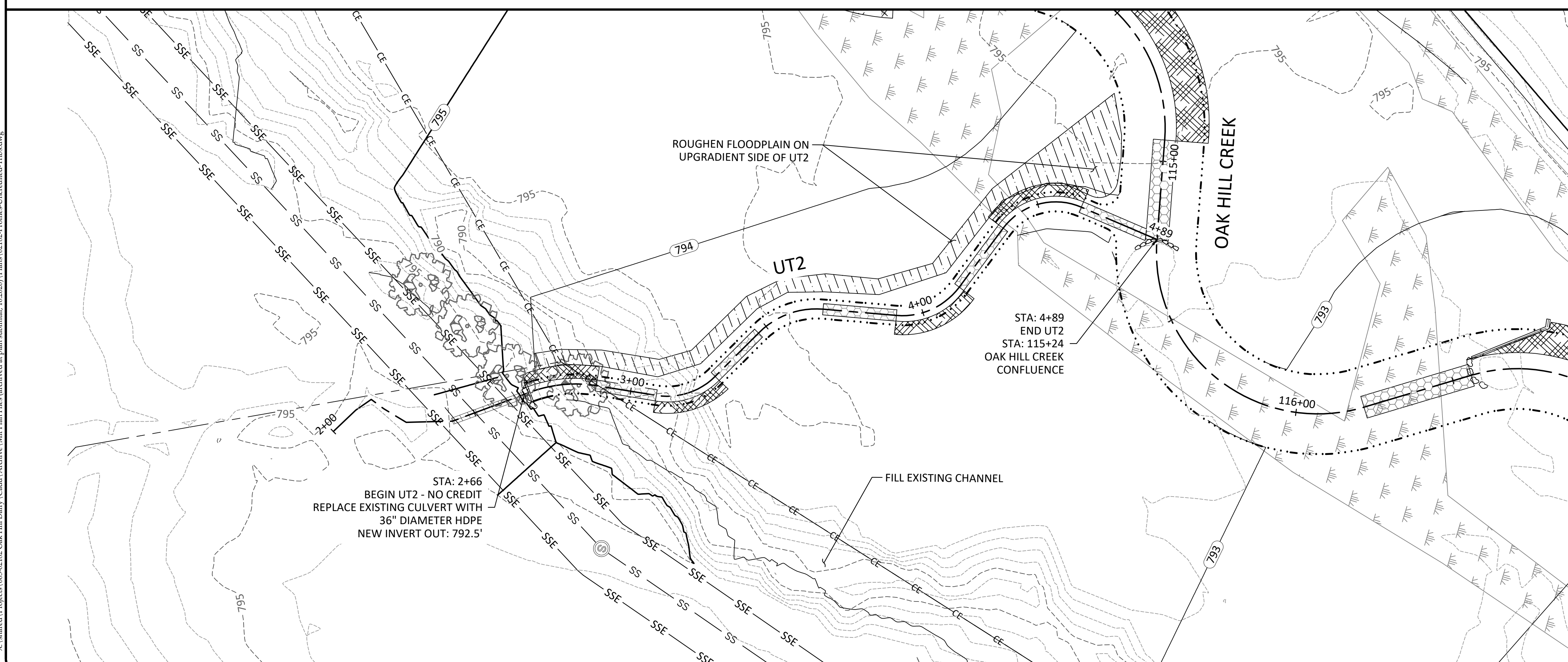

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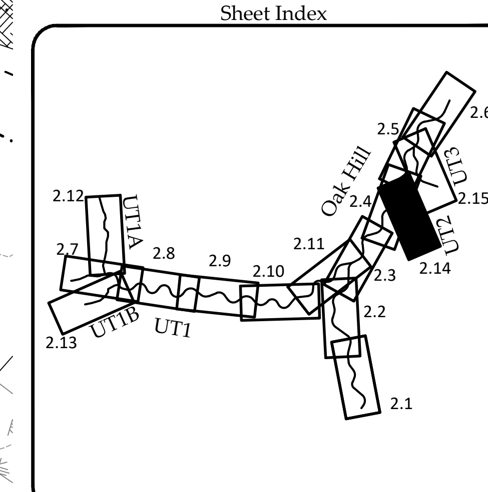

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT2
Stream Plan and Profile

Revisions:

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Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

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March 19, 2021

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(VERTICAL)

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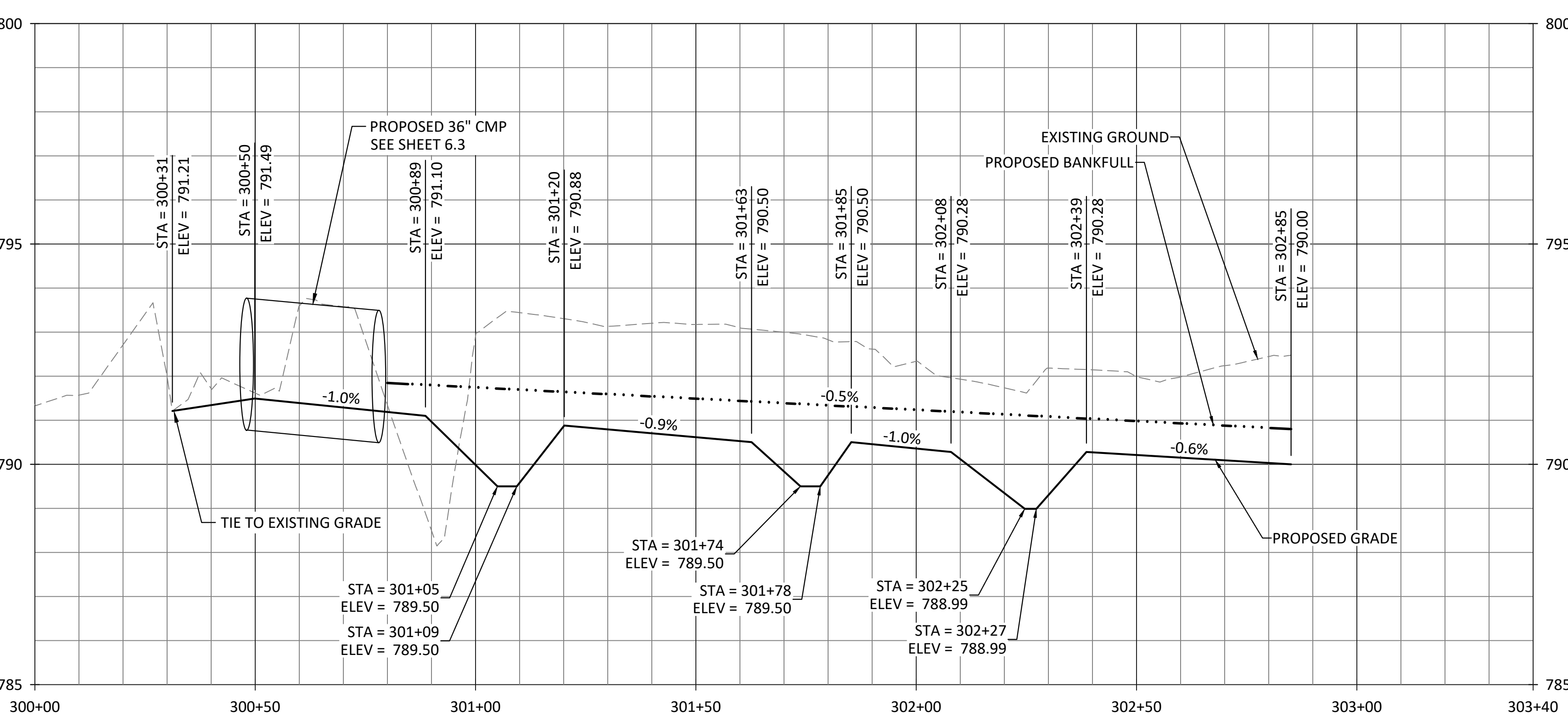
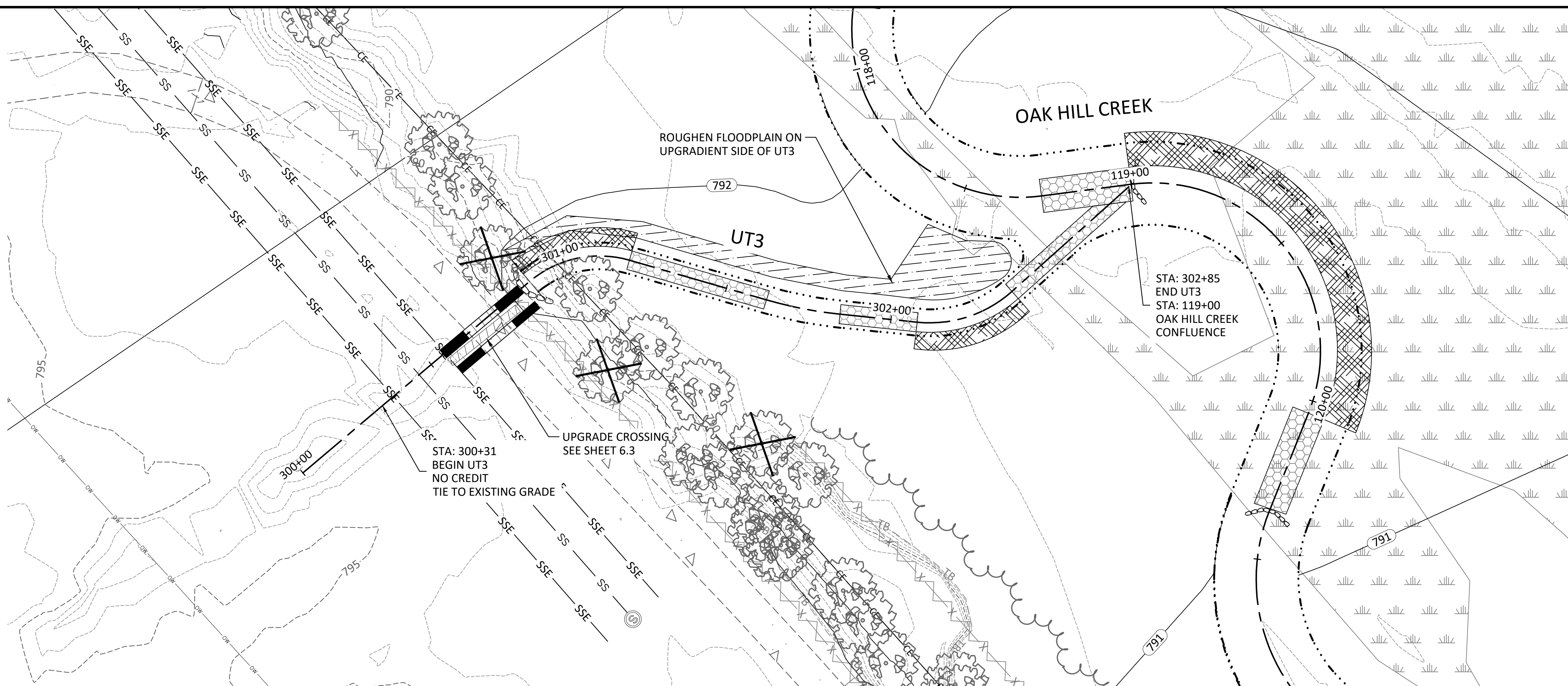
(HORIZONTAL)





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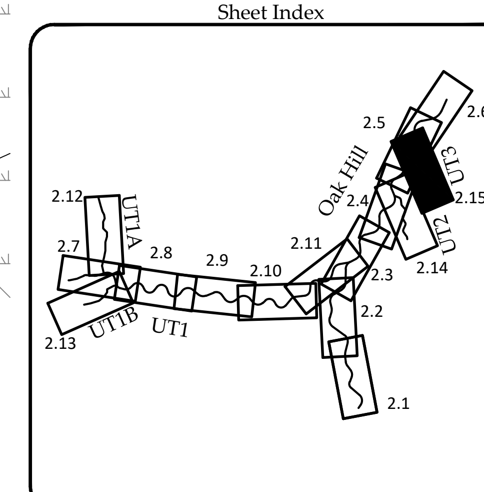

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT3
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WETLAND REHABILITATION PROPOSED AT A 1:1 CREDIT RATIO

WETLAND REHABILITATION PROPOSED AT A 1.5:1 CREDIT RATIO

WETLAND CREATION PROPOSED AT A 3:1 CREDIT RATIO

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Overview
Wetland Grading

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Revisions:

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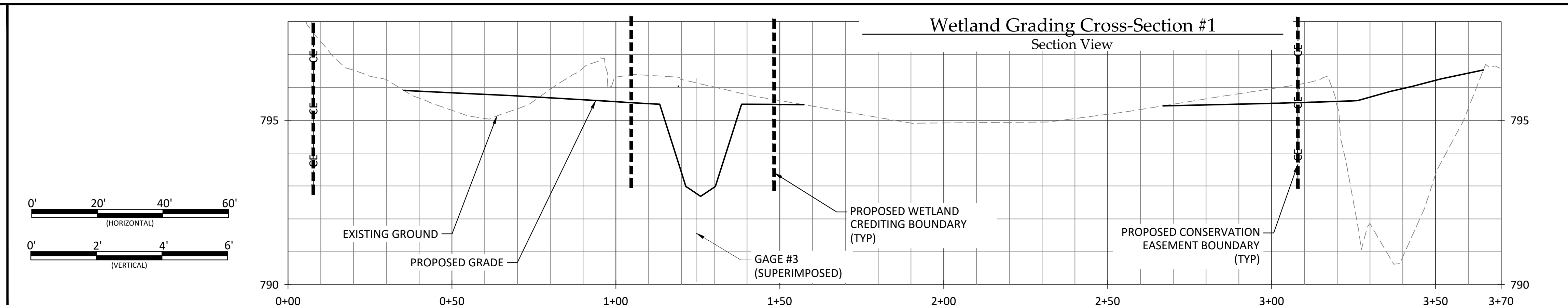

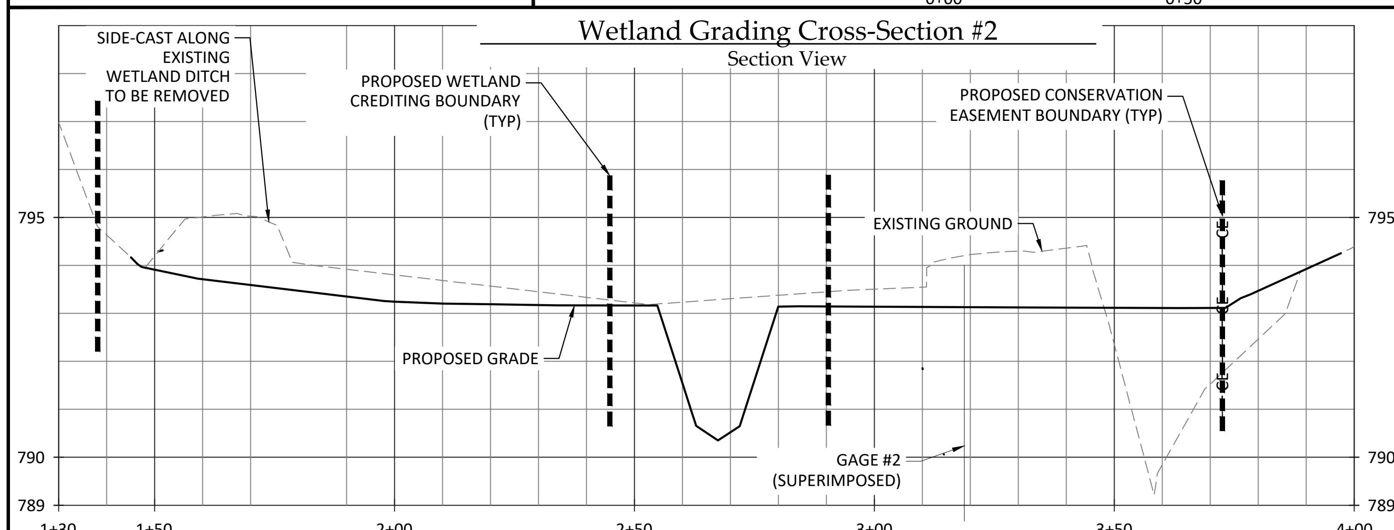

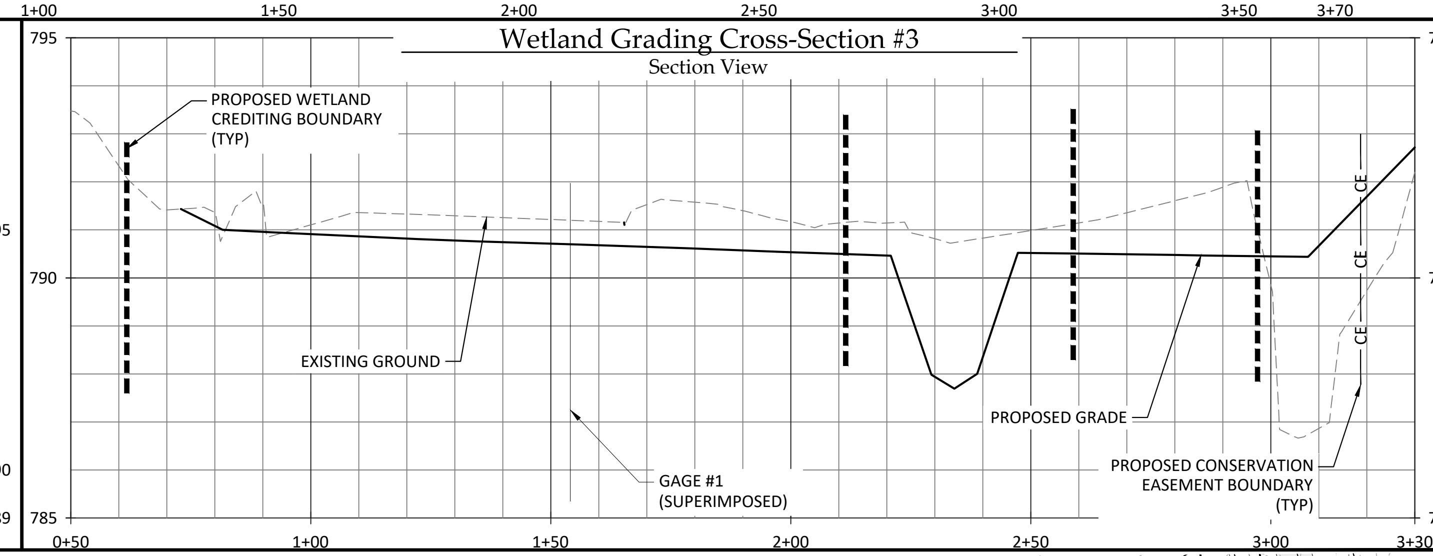

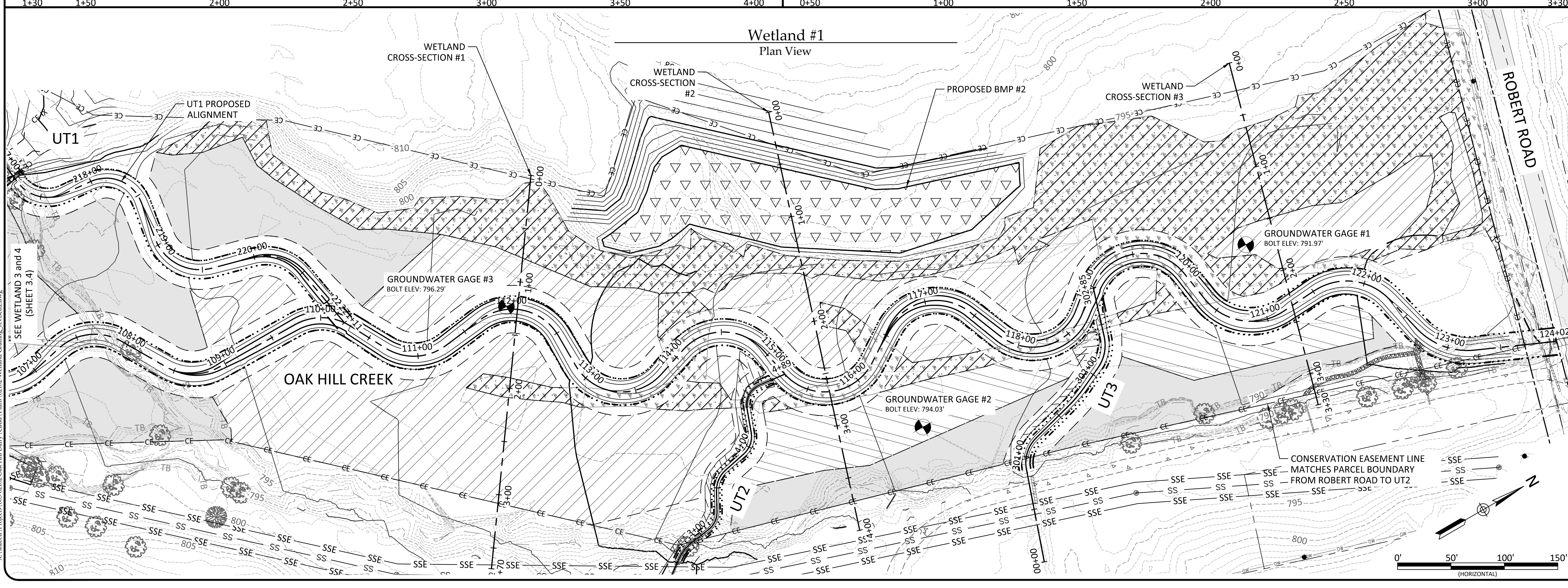

Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Wetland 1
Wetland Grading

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Date:	March 22, 2021
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Drawn By:	JDW
Checked By:	ER

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Sheet 3.2

March 19, 2021

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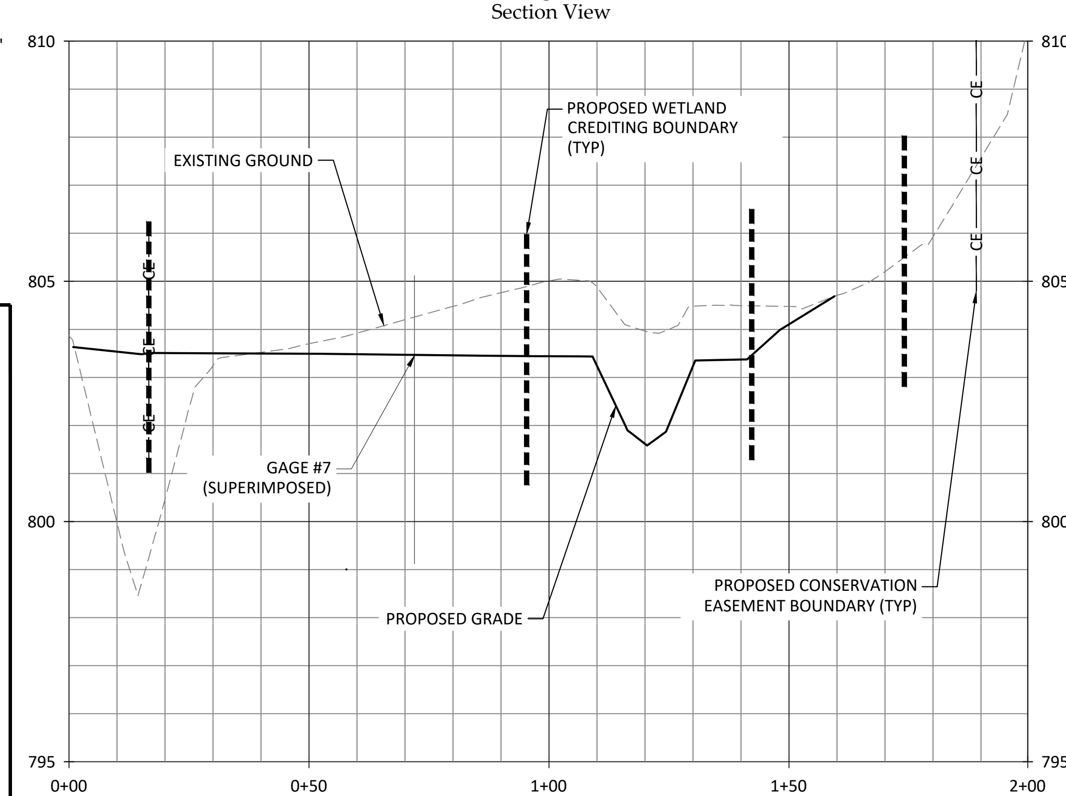
(HORIZONTAL)
0' 2' 4' 6'
(VERTICAL)

Wetland Grading Cross-Section #4
Section View



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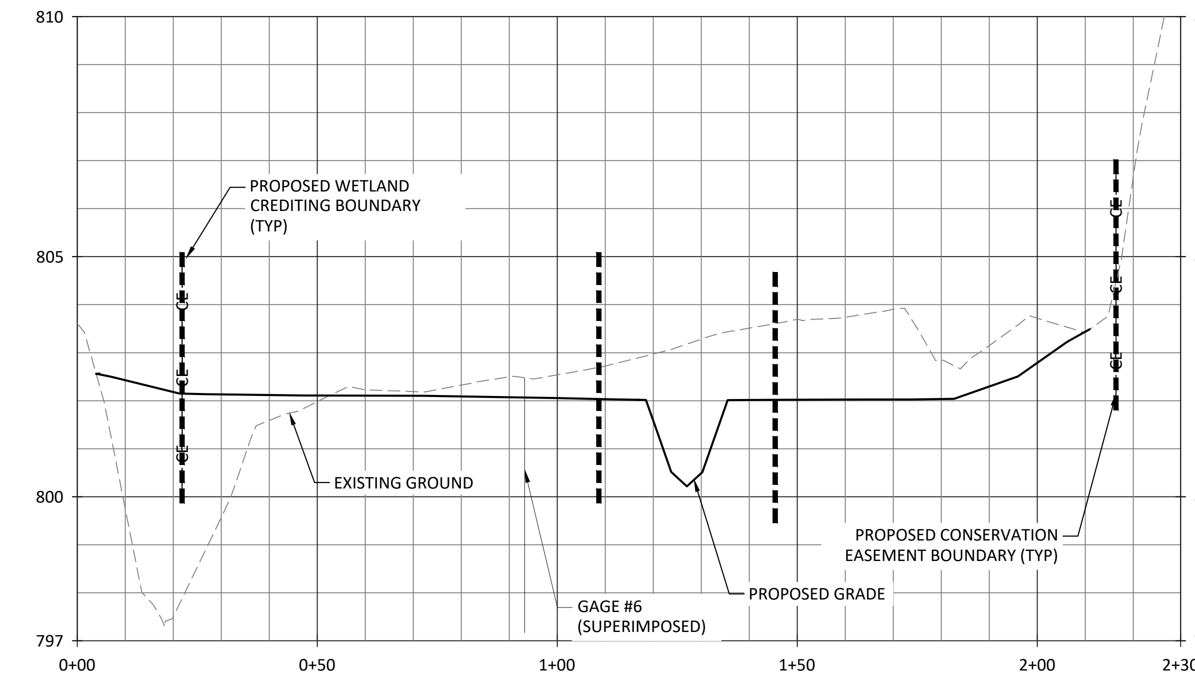
Section View



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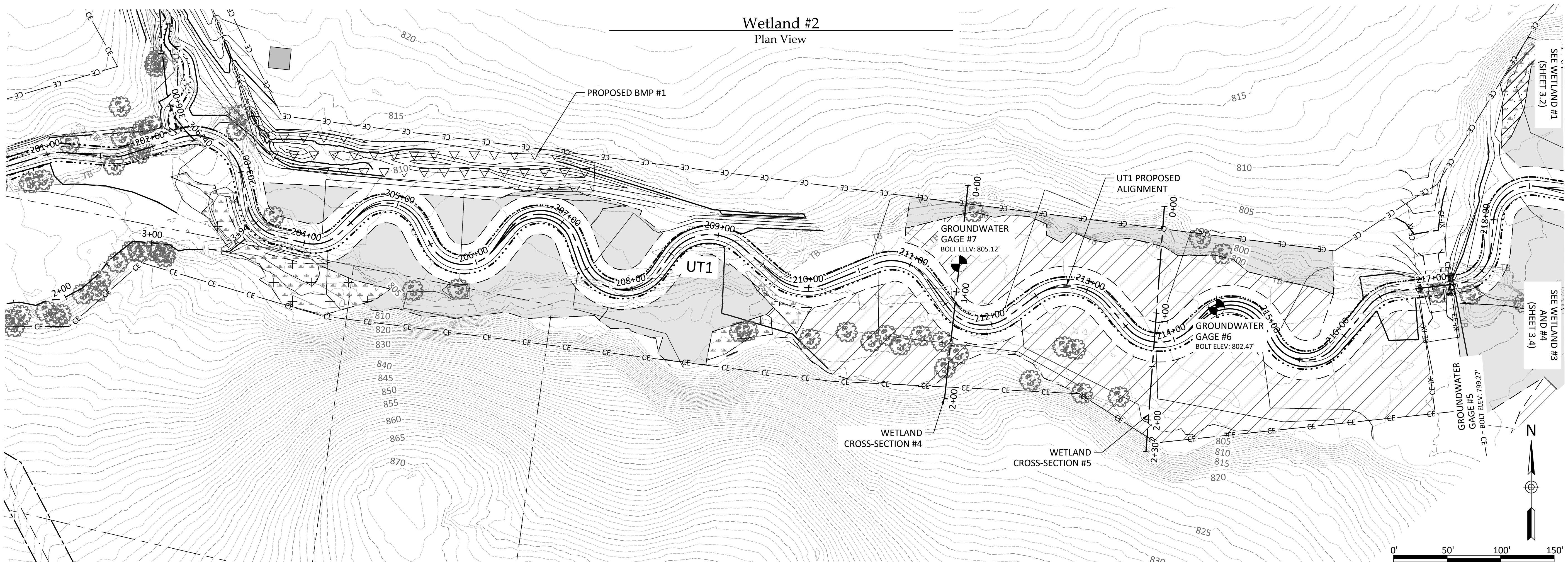
WETLAND REHABILITATION PROPOSED AT A 1:1 CREDIT RATIO

WETLAND REHABILITATION PROPOSED AT A 1.5:1 CREDIT RATIO

WETLAND CREATION PROPOSED AT A 3:1 CREDIT RATIO

Wetland #2
Plan View



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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

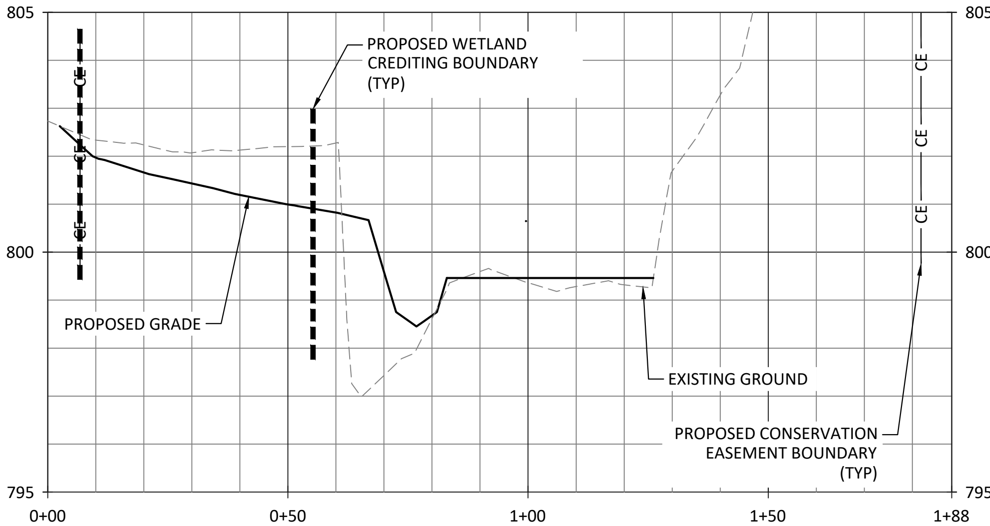
Wetland 2
Wetland Grading

Revisions:

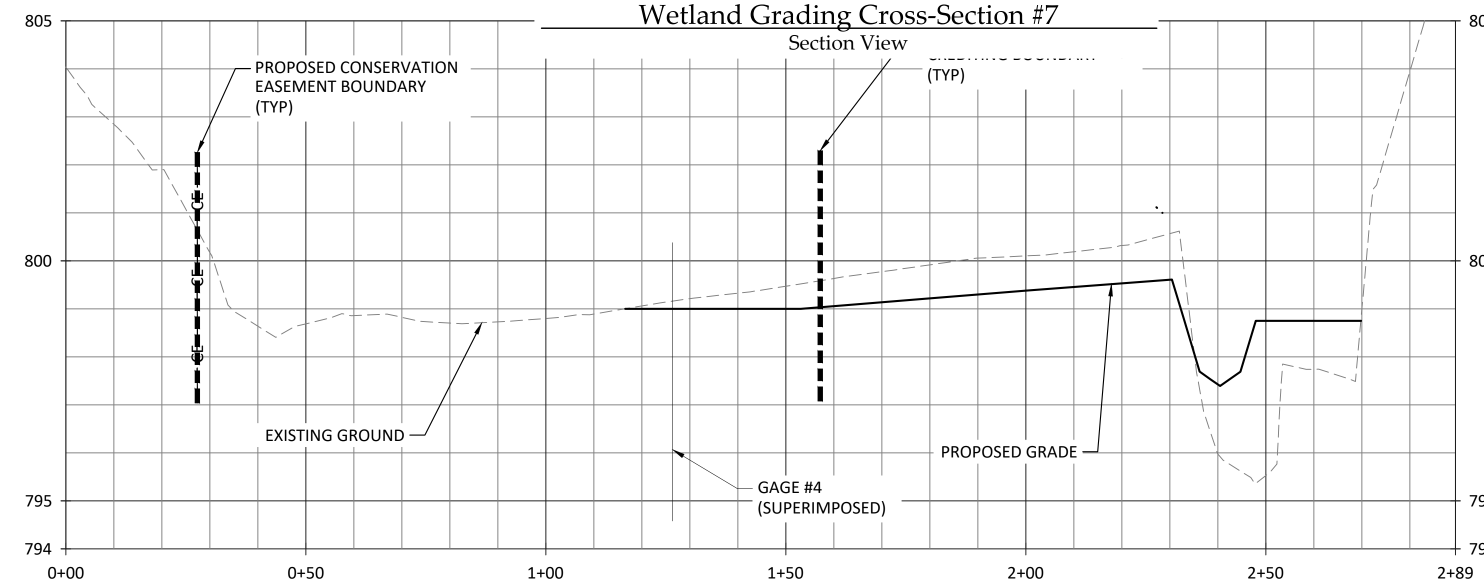
Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Sheet 3.3

Wetland Grading Cross-Section #6
Section View



Wetland Grading Cross-Section #7
Section View



0' 20' 40' 60' (HORIZONTAL)

0' 2' 4' 6' (VERTICAL)

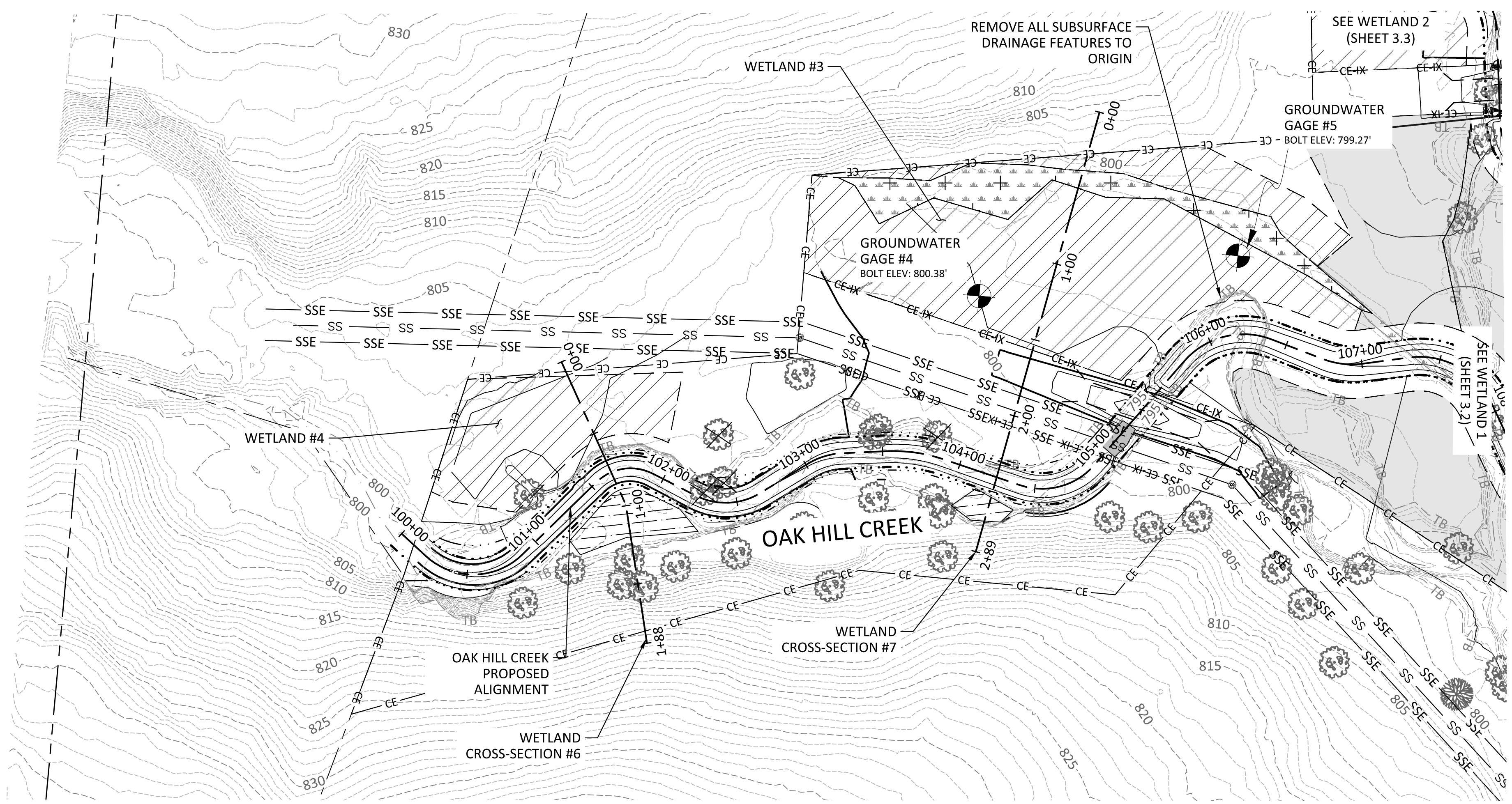
WETLAND RE-ESTABLISHMENT PROPOSED AT A 1:1 CREDIT RATIO

WETLAND REHABILITATION PROPOSED AT A 1:1 CREDIT RATIO

WETLAND REHABILITATION PROPOSED AT A 1.5:1 CREDIT RATIO

WETLAND CREATION PROPOSED AT A 3:1 CREDIT RATIO

Wetland #3 and #4
Plan View



N

0' 50' 100' 150' (HORIZONTAL)

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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Wetland 3-4
Wetland Grading

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Sheet 3.4

March 19, 2021

Open Area Buffer Planting

Open Buffer Planting Zone Trees							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Acer negundo	Boxelder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Liriodendron tulipifera	Tulip Poplar	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	2%
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Oxydendrum arboreum	Sourwood	12 ft.	6-12 ft.	0.25"-1.0"	Canopy		5%
Diospyros virginiana	Persimmon	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	5%
Populus deltoides	Eastern Cottonwood	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Carya cordiformis	Bitternut Hickory	12 ft.	6-12 ft.	0.25"-1.0"	Canopy		5%
Quercus alba	White Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy		5%
					Total		90%

Open Buffer Planting Zone Small Trees / Shrubs							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Alnus serrulata	XXXX	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	OBL	2%
Hamamelis virginiana	Witch Hazel	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	2%
Cornus florida	Flowering Dogwood	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	2%
Lindera benzoin	Spicebush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	2%
Amelanchier arborea	Serviceberry	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	2%
					Total		10%

Notes:
(1) Substitute species: Sweetshrub, northern red oak, slippery elm.
(2) Transplants from on-site to be used at Designer's discretion for streambank and floodplain planting.
(3) Percentages of each species may be varied at Designer's discretion but shall not exceed 20% per each species.
(4) Designer may substitute container plantings or other plantings for bare roots.

Partially Vegetated Buffer Area Planting

Open Buffer Planting Zone Trees							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Carpinus caroliniana	American Hornbeam	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FAC	10%
Euonymus americana	Strawberry Bush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	10%
Lindera benzoin	Spicebush	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FAC	10%
Fagus grandifolia	American Beech	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
Ulmus rubra	Slippery Elm	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Hamamelis virginiana	Witchhazel	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	10%
Calycanthus floridus	Sweetshrub	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FACU	10%
Cornus florida	Flowering Dogwood	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FACU	10%
Asima triloba	Pawpaw	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	FAC	10%
Quercus rubra	Northern Red Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACU	10%
					Total		100%

Wetland Planting

Wetland Planting Zone Trees							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Platanus occidentalis	Sycamore	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Betula nigra	River Birch	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	15%
Quercus phellos	Willow Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	10%
Ulmus americana	American Elm	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	10%
Nyssa sylvatica	Black Gum	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	5%
Quercus michauxii	Swamp Chestnut Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	8%
Acer negundo	Boxelder	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FAC	5%
Quercus nigra	Water Oak	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	7%
Celtis laevigata	Sugarberry	12 ft.	6-12 ft.	0.25"-1.0"	Canopy	FACW	5%
					Total		80%

Wetland Planting Zone Small Trees/Shrubs							
Bare Root							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Caliper Size	Stratum	Wetland Indicator	# of Stems
Alnus serrulata	Tag Alder (2)	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	OBL	5%
Lindera benzoin	Spicebush	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	5%
Cephalanthus occidentalis	Buttonbush	12 ft.	6-12 ft.	0.25"-1.0"	Sub-Canopy	OBL	5%
Sambucus canadensis	Elderberry	12 ft.	6-12 ft.	0.25"-1.0"	Shrub	FAC	5%
					Total		20%

Notes:
(1) Substitute species: Silky willow, silky dogwood.
(2) Tag Alder shall be limited to Wetland 1 or other wetter areas of the site as designated by Designer.
(3) Transplants from on-site to be used at Designer's discretion for streambank and floodplain planting.
(4) Percentages of each species may be varied at Designer's discretion but shall not exceed 20% per each species.
(5) Designer may substitute container plantings or other plantings for bare roots.

TEMPORARY SEEDING		
APPROVED DATE	TYPE	PLANTING RATE (lbs/acre)
Jan 1 – May 1	Rye Grain (Secale Cereale)	120
	Ladino clover (Trifolium Repens)	5
	Crimson Clover (Trifolium incarnatum)	5
	Straw Mulch	4,000
May 1 – Aug 15	German Millet (*Setaria italica*)	40
	Ladino clover (Trifolium Repens)	5
	Crimson Clover (Trifolium incarnatum)	5
	Straw Mulch	4,000
Aug 15 – Dec 31	Rye Grain (*Secale Cereale*)	120
	Ladino clover (Trifolium Repens)	5
	Crimson Clover (Trifolium incarnatum)	5
	Straw Mulch	4,000

Note:
Rates of fertilizer and lime if necessary can be found in the site preparation plan included in the specification documents.

Best Management Practice (BMP) Planting

Notes:
(1) See Detail 3, Sheet 5.3 for BMP construction and planting details.
(2) Apply "Wetland Seeding - Open Canopy" seed mix to all disturbed areas of BMP including bottom of basin.
(3) Apply "Riparian Corridor Planting - Herbaceous Plugs and Livestakes" species in areas shown in detail.

Riparian Corridor Planting (Streambanks)

Streambank Planting Zone							
Live Stakes							
Species	Common Name	Max Spacing	Indiv. Spacing	Min. Size	Stratum	Wetland Indicator	% of Stems
Salix nigra	Black Willow	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	OBL	25%
Cornus amomum	Silky Dogwood	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	FACW	20%
Salix sericea	Silky Willow	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	OBL	25%
Cephalanthus occidentalis	Buttonbush	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	OBL	15%
Sambucus canadensis	Elderberry	8 ft.	6-8 ft.	0.5"-1.5" cal.	Shrub	FAC	15%
					Total		100%
Herbaceous Plugs							
Juncus effusus	Common Rush	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	FACW	40%
Carex crinita	Fringed Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	OBL	10%
Carex lurida	Lurid Sedge	5 ft.	3-5 ft.	1.0"- 2.0" plug	Herb	OBL	20%
Carex lupulina	Hop Sedge	5 ft.	3-5 ft.	1.0"-2.0" plug	Herb	OBL	15%
Scirpus cyperinus	Woolgrass	5 ft	3-5 ft.	1.0"-2.0" plug	Herb	FACW	15%
					Total		100%

Note: See live staking and herbaceous plugs detail.

Permanent Seeding

Riparian Seeding - Open Canopy					
Pure Live Seed (21 lbs/ acre)					
Approved Date	Species Name	Common Name	Stratum	Wetland Indicator	Density (lbs/acre)
All Year	*Schizachyrium scoparium*	Little Bluestem	Herb	FACU	4.0
All Year	*Panicum virgatum*	Switchgrass	Herb	FAC	2.0
All Year	*Panicum rigidulum*	Redtop Panicgrass	Herb	FACW	1.0
All Year	*Rudbeckia hirta*	Blackeyed Susan	Herb	FACU	1.0
All Year	*Coreopsis lanceolata*	Lanceleaf Coreopsis	Herb	FACU	1.0
All Year	*Echinacea purpurea*	Purple coneflower	Herb	UPL	1.0
All Year	*Panicum clandestinum*	Deertongue	Herb	FAC	2.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	FACW	2.0
All Year	*Sorghastrum nutans*	Indiangrass	Herb	FACU	3.0
All Year	*Bidens aristosa*	Bur-Marigold	Herb	FACW	1.0
All Year	*Helianthus angustifolia*	Narrowleaf Sunflower	Herb	FACW	1.0
All Year	*Coreopsis tinctoria*	Plains corepsis	Herb	FAC	1.0
All Year	*Achillea millefolium*	Common yarrow	Herb	FACU	1.0

Wetland Seeding - Open Canopy					
Pure Live Seed (19 lbs/ acre)					
Approved Date	Species Name	Common Name	Stratum	Wetland Indicator	Density (lbs/acre)
All Year	*Coleataenia anceps*	Beaked Panicgrass	Herb	FAC	3.0
All Year	*Carex vulpinoidea*	Fox Sedge	Herb	OBL	2.0
All Year	*Elymus virginicus*	Virginia Wild Rye	Herb	FACW	4.0
All Year	*Bidens aristosa*	Bur-Marigold	Herb	FACW	3.0
All Year	*Panicum cirgatum*	Switchgrass	Herb	FAC	2.0
All Year	*Polygonum pensylvanicum*	Smartweed	Herb	FACW	0.5
All Year	*Juncus effusus*	Common Rush	Herb	OBL	1.5
All Year	*Panicum dichotomiflorum*	Panicgrass	Herb	FACW	2.0
All Year	Helianthus augustifolia	Narrowleaf sunflower	Herb	FACW	1.0

Notes:
(1) Apply Permanent Riparian seeding in all disturbed areas within Conservation Easement.
(2) Apply Permanent seeding in all other disturbed areas outside of Easement per specification.

Stabilization Seeding

Stabilization Seeding		
Pure Live Seed (32 lbs/ac)		
Species Name	Common Name	lbs/acre
Festuca arundinacea	Fescue (KY 31)	20
Dactylis glomerata	Orchard Grass	12

Notes:
(1) Apply Pasture Seeding for grading outside Conservation Easement, utility easements, and stream crossings.
(2) Install temporary seed and mulch with all permanent seed.

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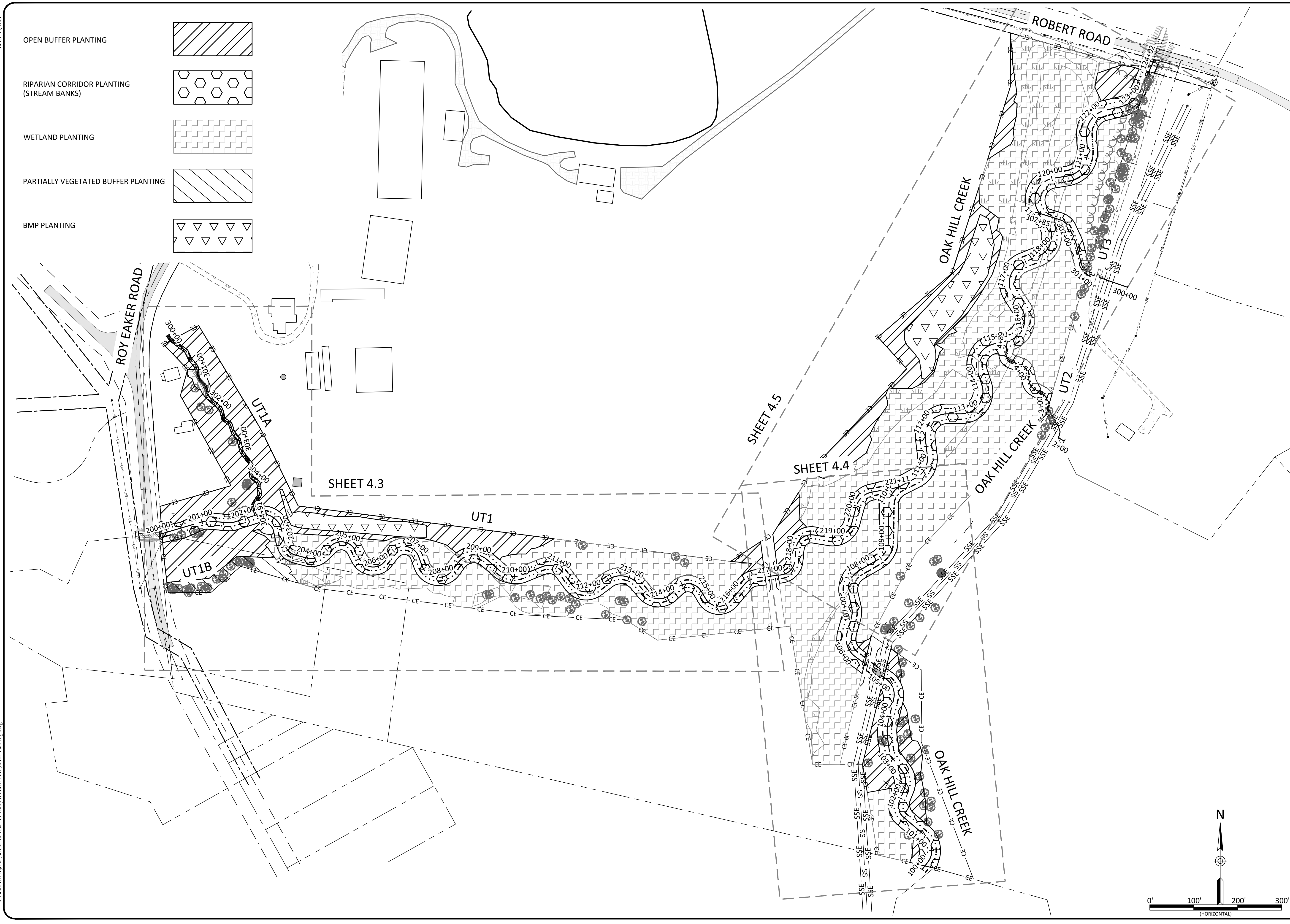
Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Planting List

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Sheet 4.1



March 19, 2021

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Planting Overview

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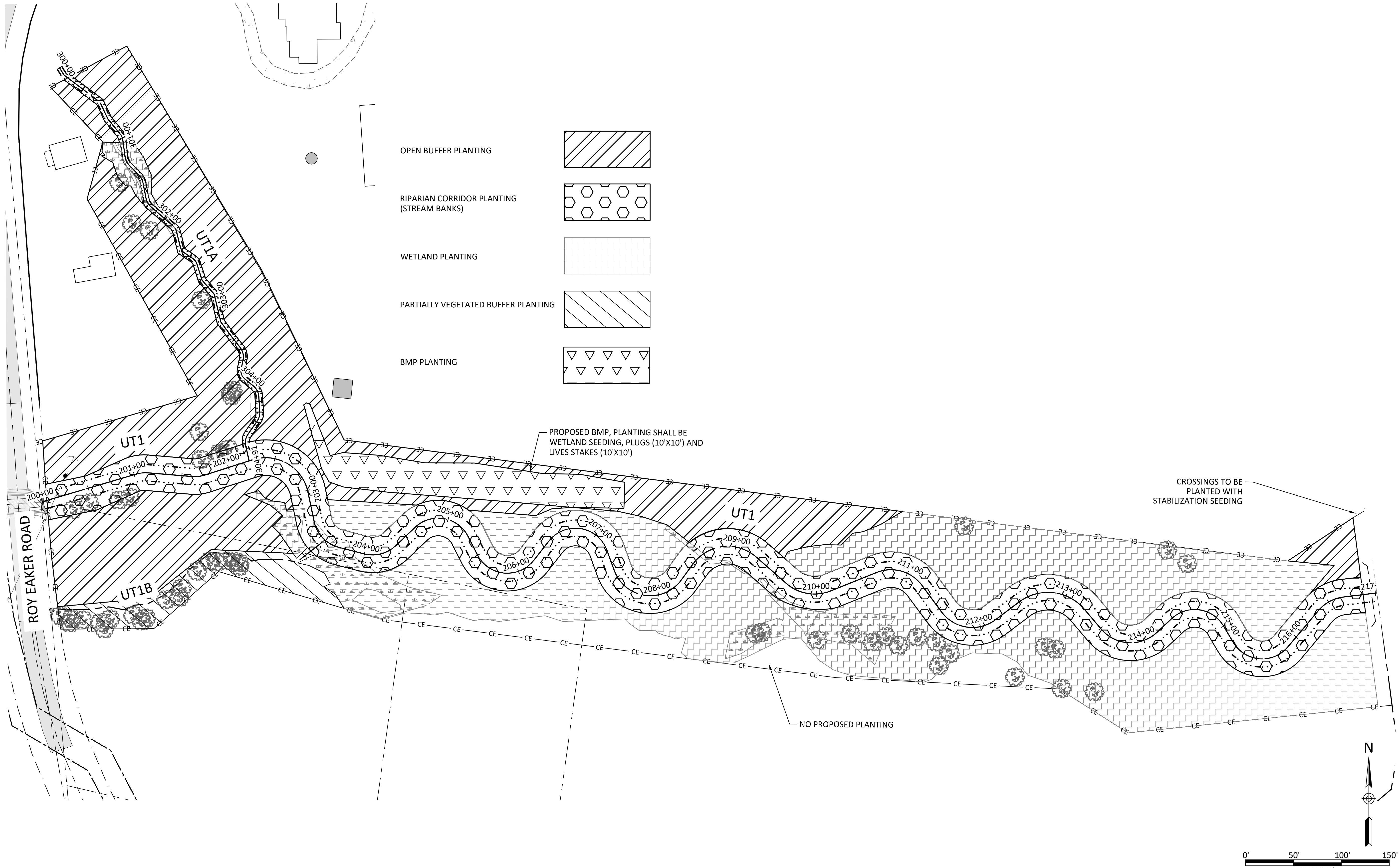
Sheet 4.2

March 19, 2021



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Oak Hill Dairy Mitigation Site
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Planting Plan

Revisions:

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Job Number: 005-02182
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Drawn By: JDW
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Sheet 4.3

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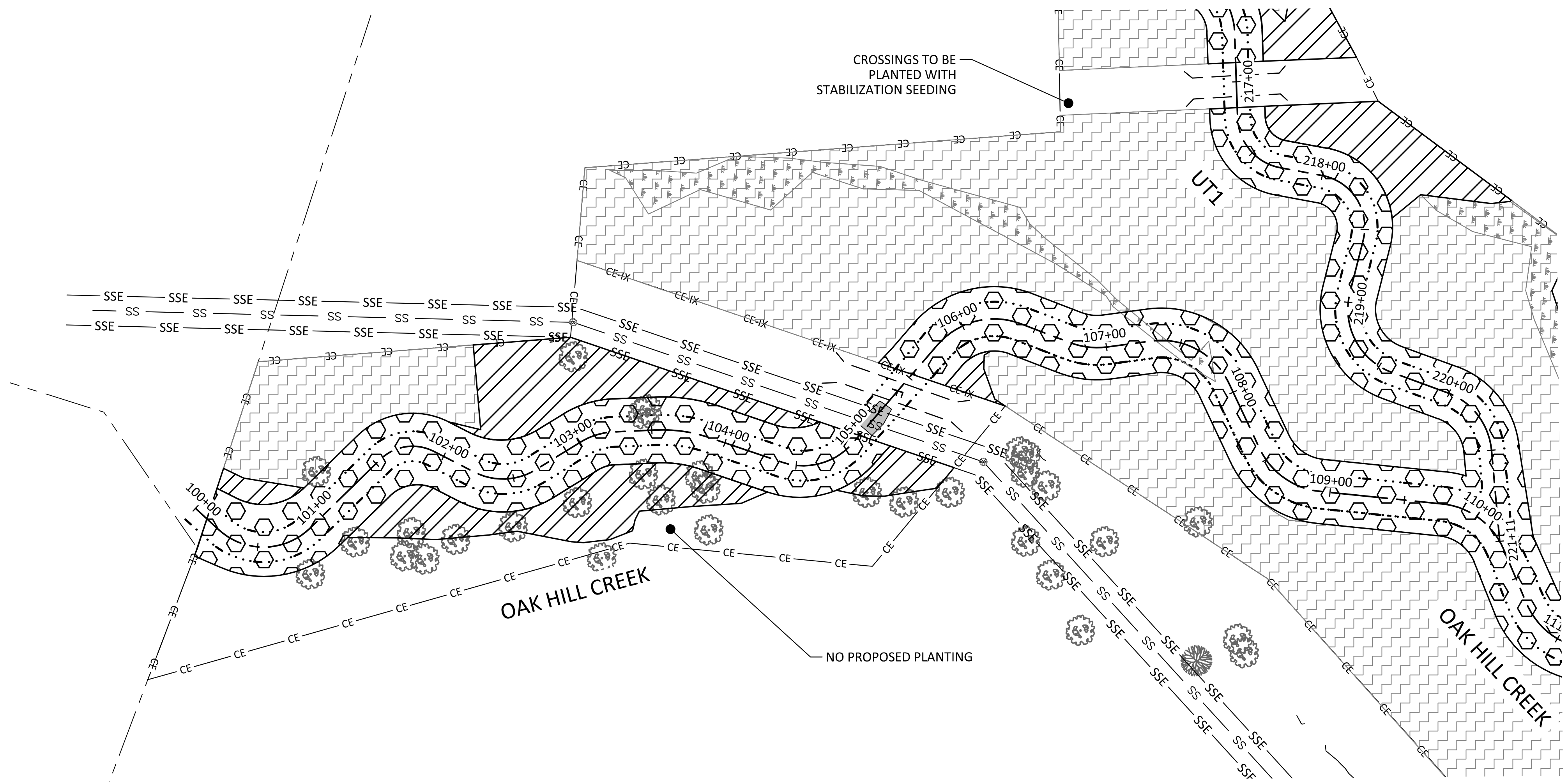
OPEN BUFFER PLANTING

RIPARIAN CORRIDOR PLANTING
(STREAM BANKS)

WETLAND PLANTING

PARTIALLY VEGETATED BUFFER PLANTING

BMP PLANTING



0' 50' 100' 150'
(HORIZONTAL)

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Gaston County, North Carolina

Planting Plan

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4.4
Sheet

March 19, 2021

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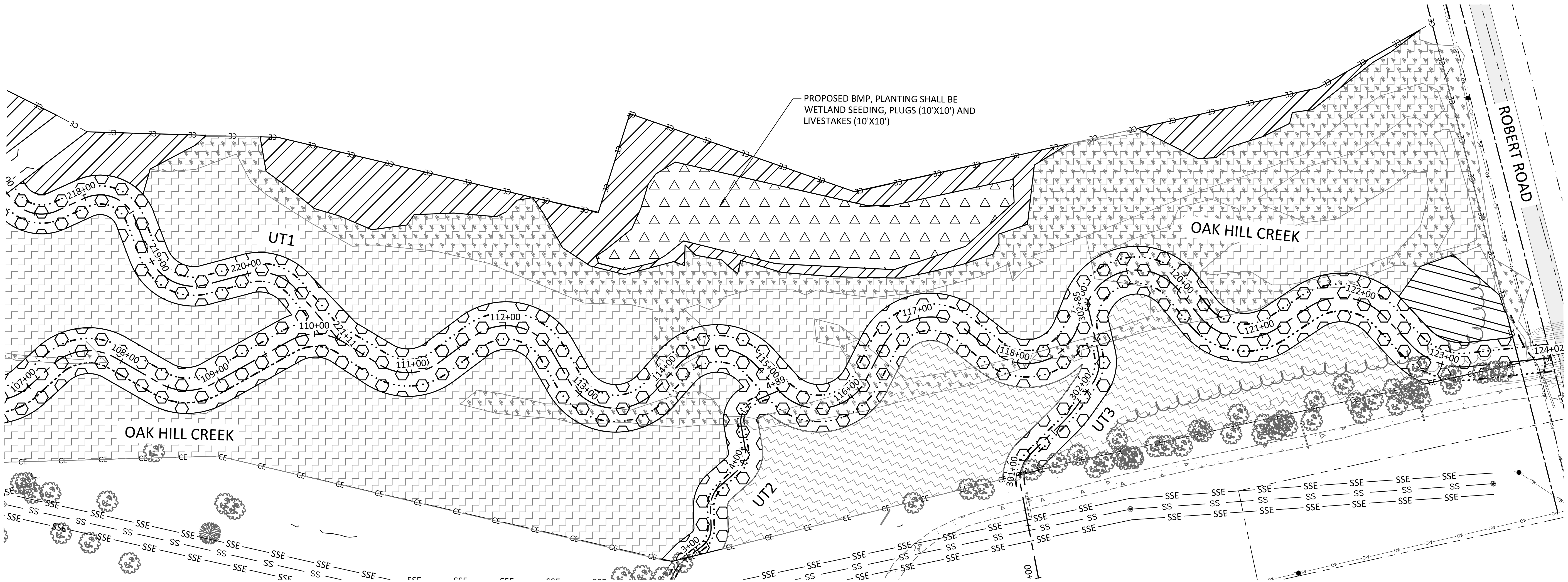
OPEN BUFFER PLANTING

RIPARIAN CORRIDOR PLANTING (STREAM BANKS)

WETLAND PLANTING

PARTIALLY VEGETATED BUFFER PLANTING

BMP PLANTING



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Oak Hill Dairy Mitigation Site
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Planting Plan

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Sheet 4.5

March 19, 2021
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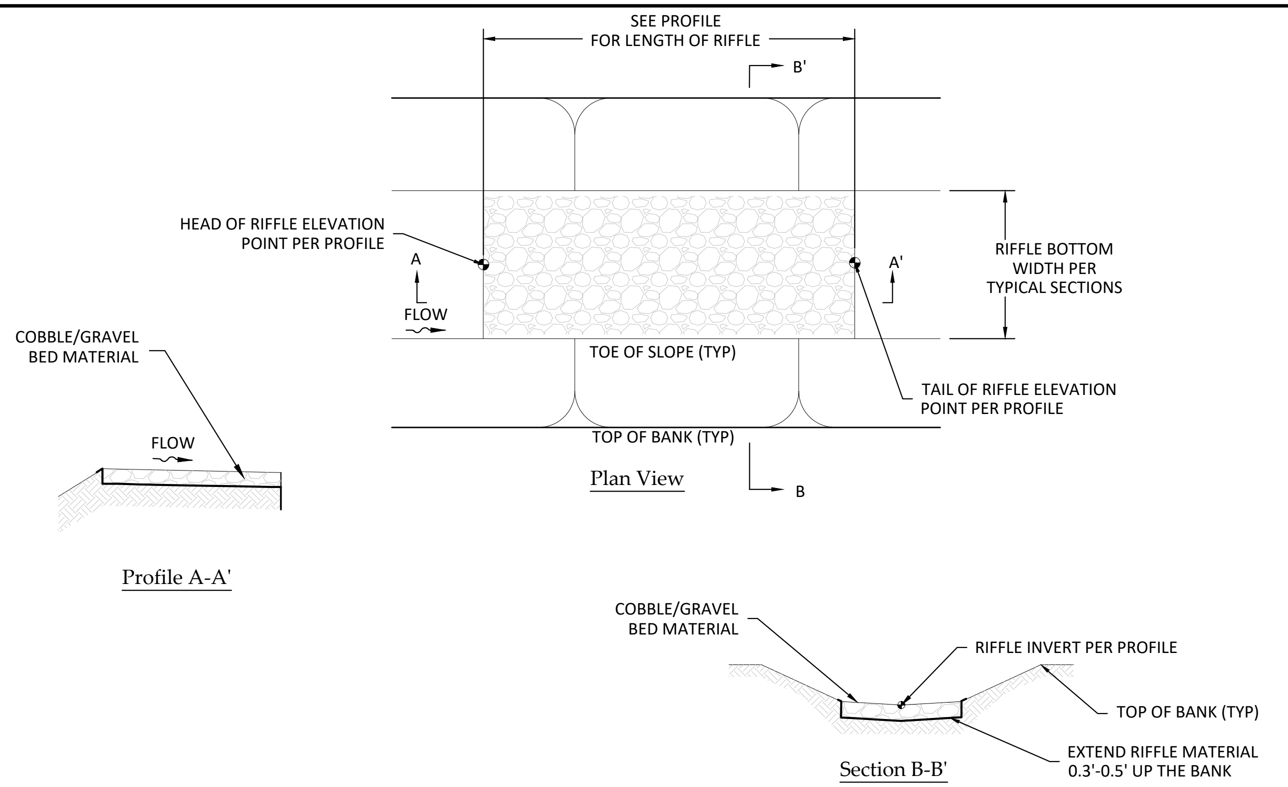
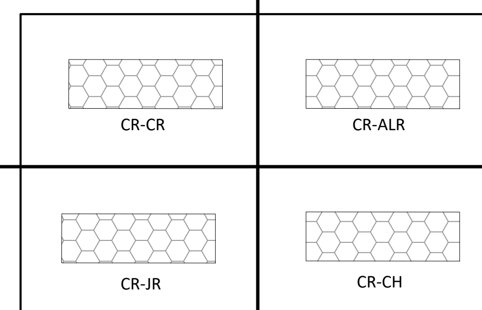
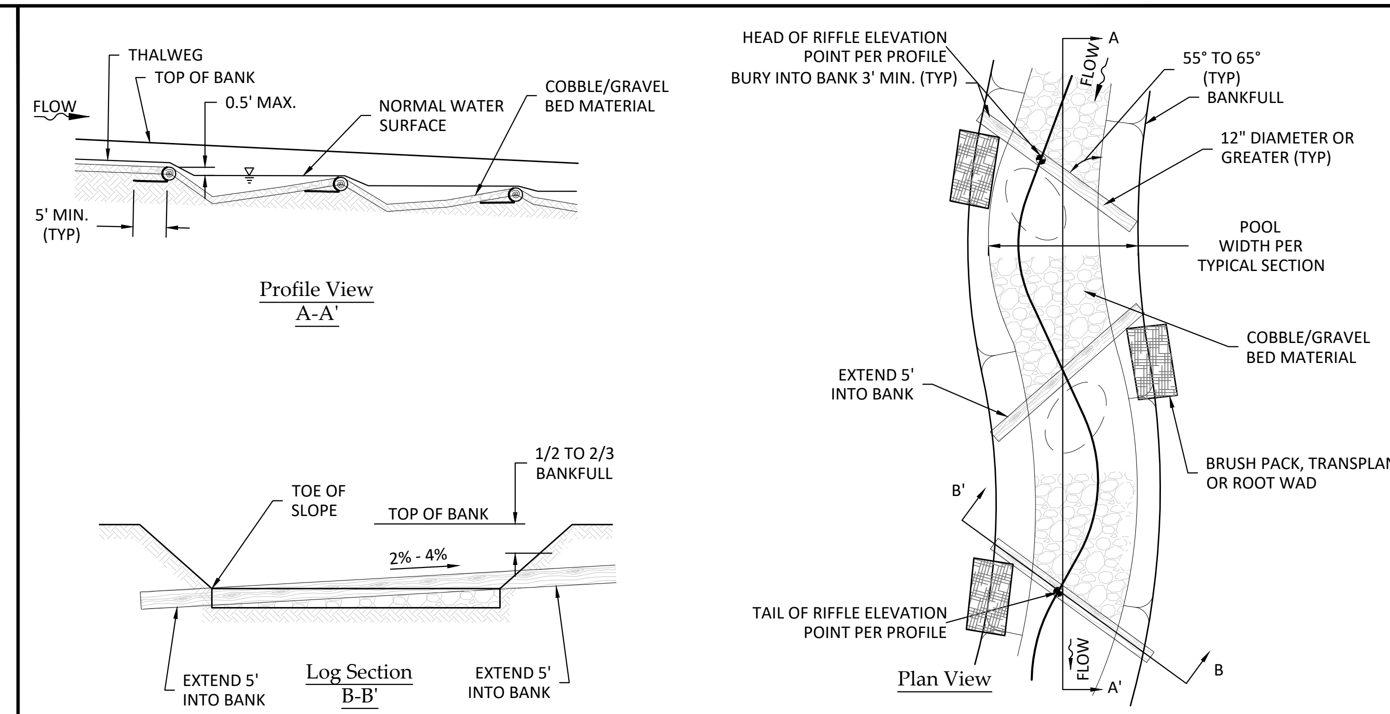


NOTES:

- IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL FOR THIS FINAL STRUCTURE.

1 / 5.1 Constructed Riffle
Not to Scale

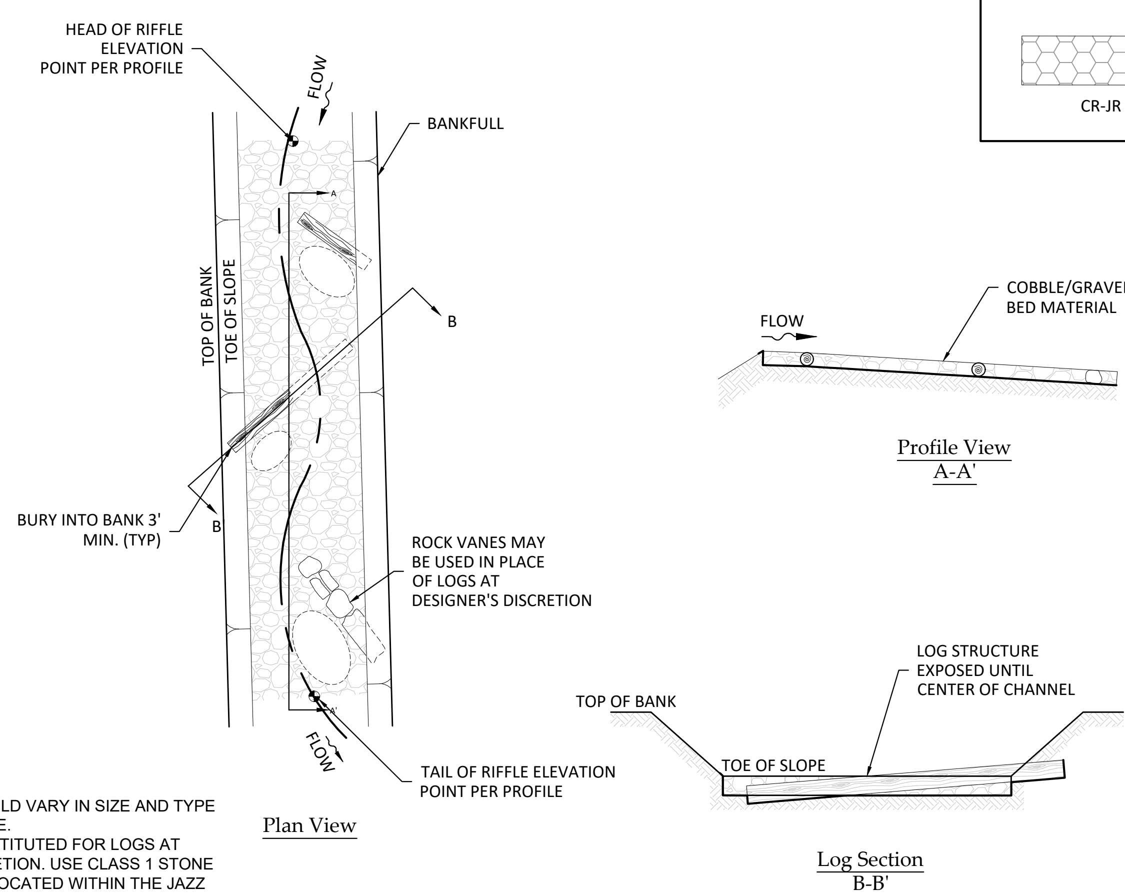




2 / 5.1 Angled Log Riffle
Not to Scale

NOTES:

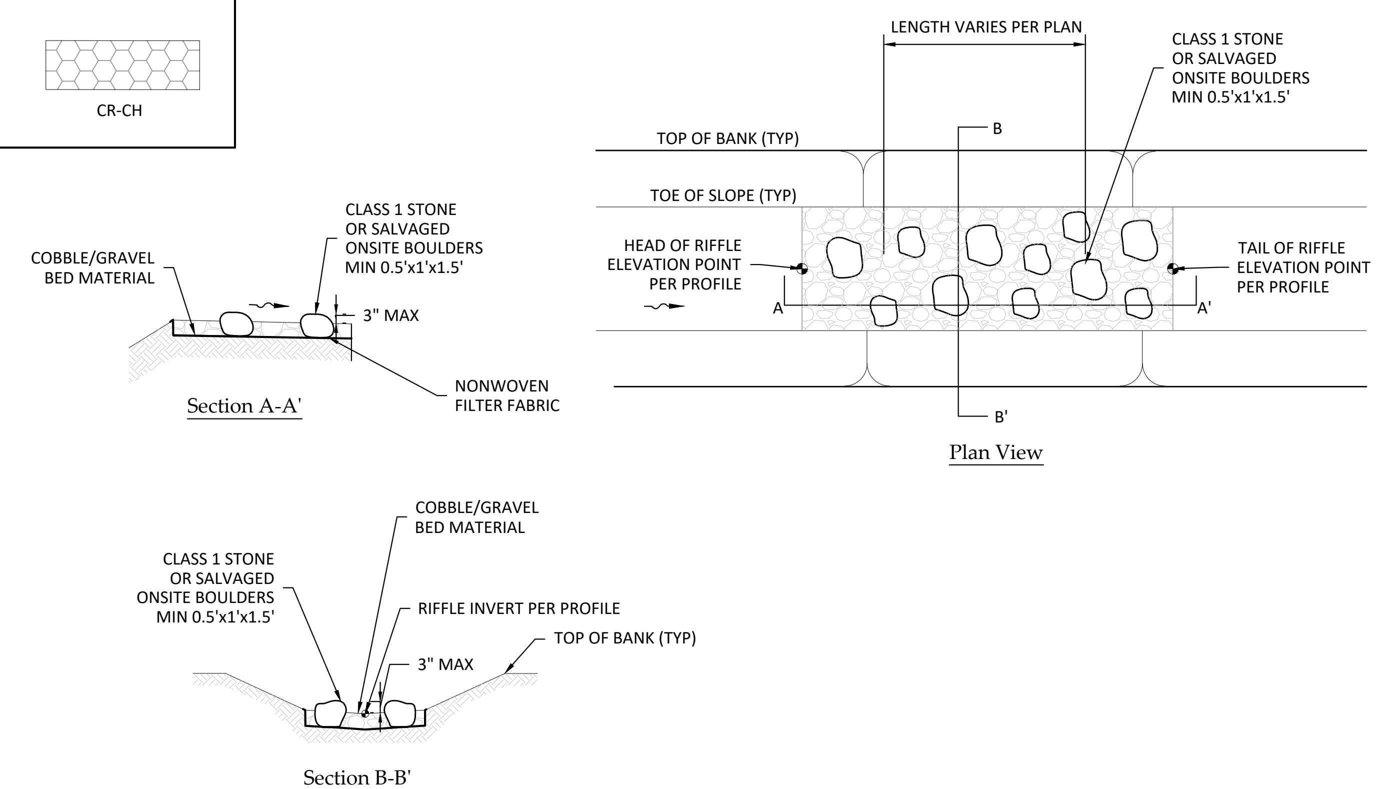
- IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL FOR THIS FINAL STRUCTURE.



NOTES:

- STRUCTURES SHOULD VARY IN SIZE AND TYPE WITHIN EACH RIFFLE.
- ROCK MAY BE SUBSTITUTED FOR LOGS AT DESIGNER'S DISCRETION. USE CLASS 1 STONE FOR ROCK VANES LOCATED WITHIN THE JAZZ RIFFLE.
- IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL FOR THIS FINAL STRUCTURE.

3 / 5.1 Jazz Riffle Structure
Not to Scale



4 / 5.1 Chunky Riffle
Not to Scale

NOTES:

- IF ONSITE LARGE STONE IS NOT AVAILABLE FOR BOULDERS RIFFLE SHOULD BE CHANGED TO JAZZ RIFFLE OR OTHER PER DESIGNER'S DIRECTION.
- IF A RIFFLE ENDS WITH A SILL IT WILL BE SHOWN IN THE PLANS. REFER TO LOG/ROCK SILL DETAIL FOR THIS FINAL STRUCTURE.

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Oak Hill Dairy Mitigation Site
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Details

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Job Number: 005-02182
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Checked By: ER

Sheet 5.1

March 7, 2012

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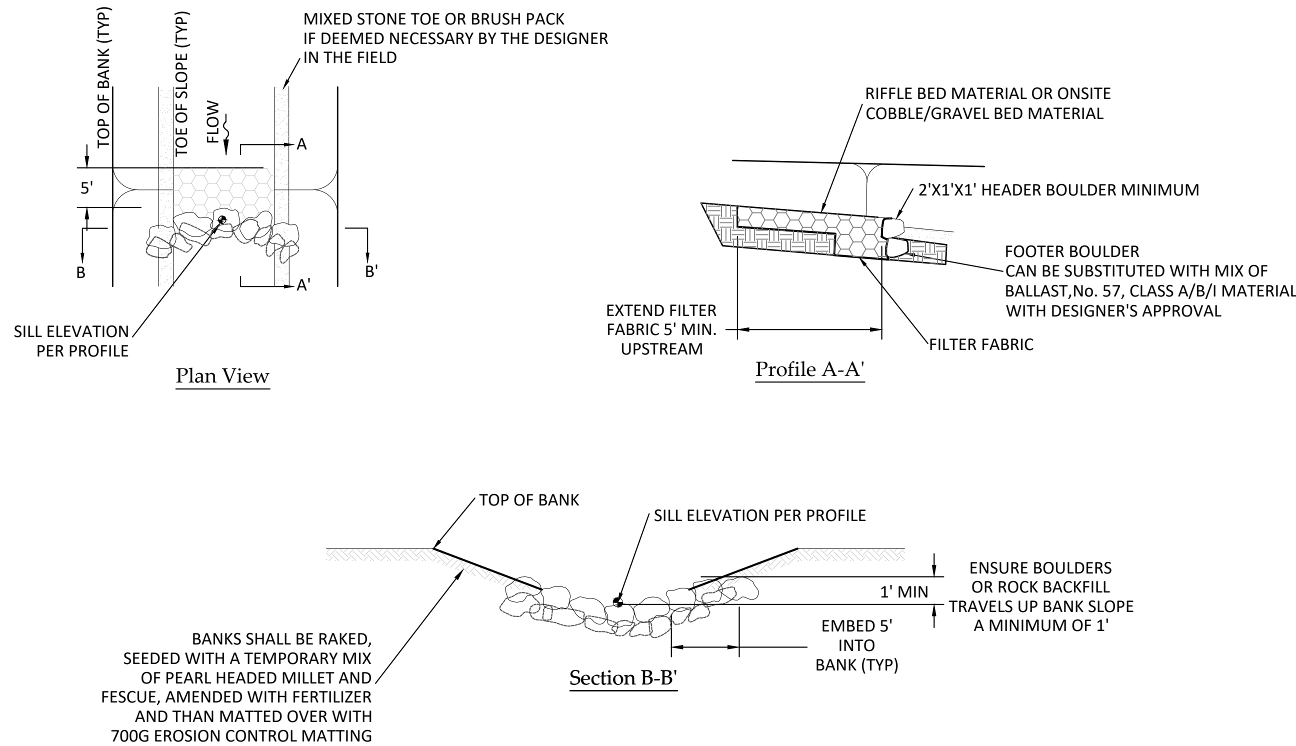
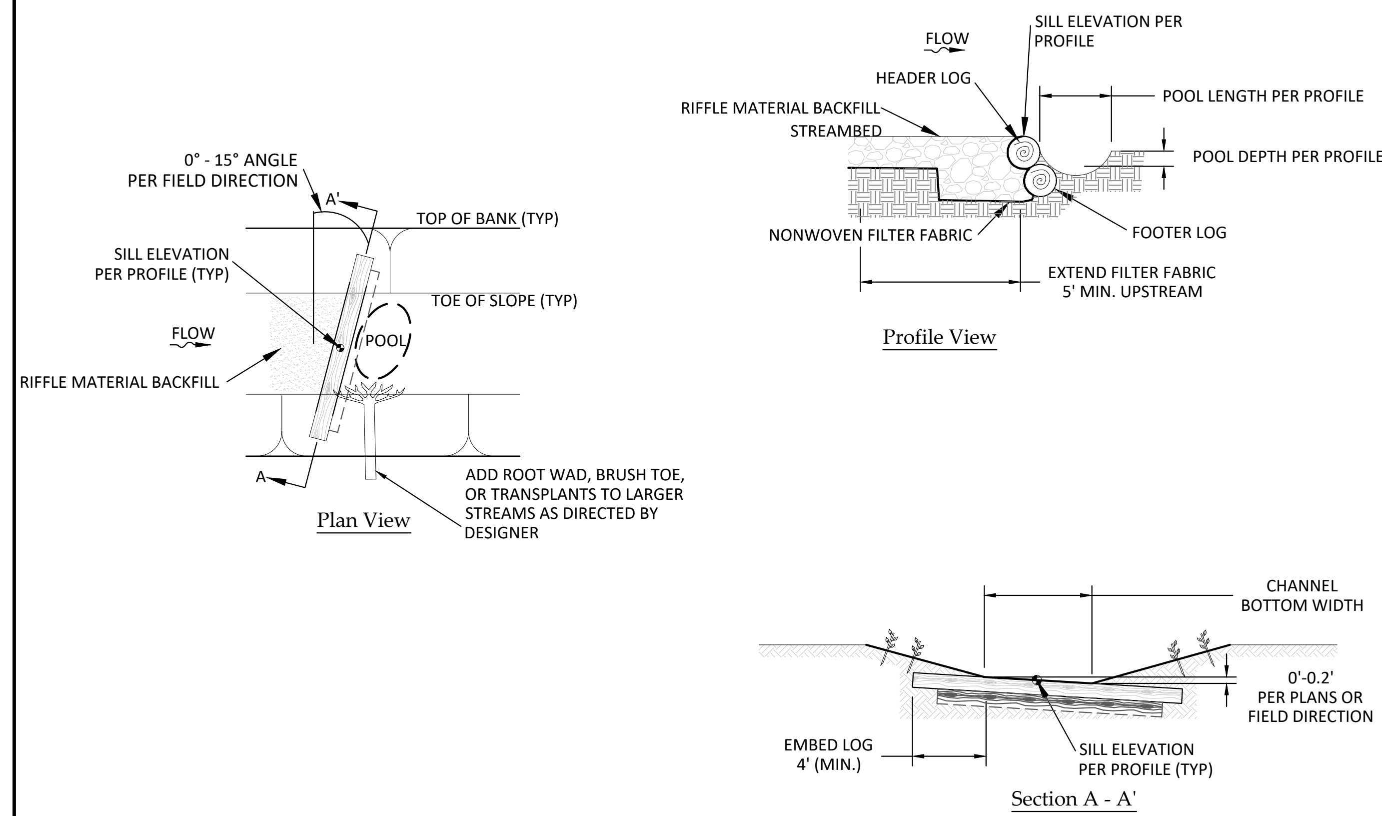


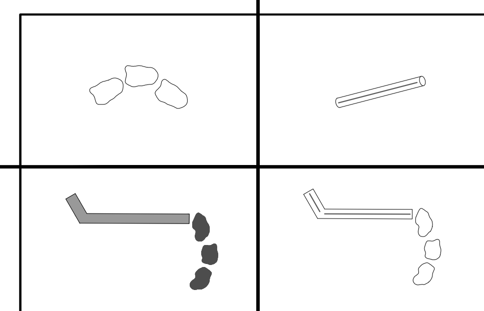
1 / 5.2 **Rock Sill**
Not to Scale

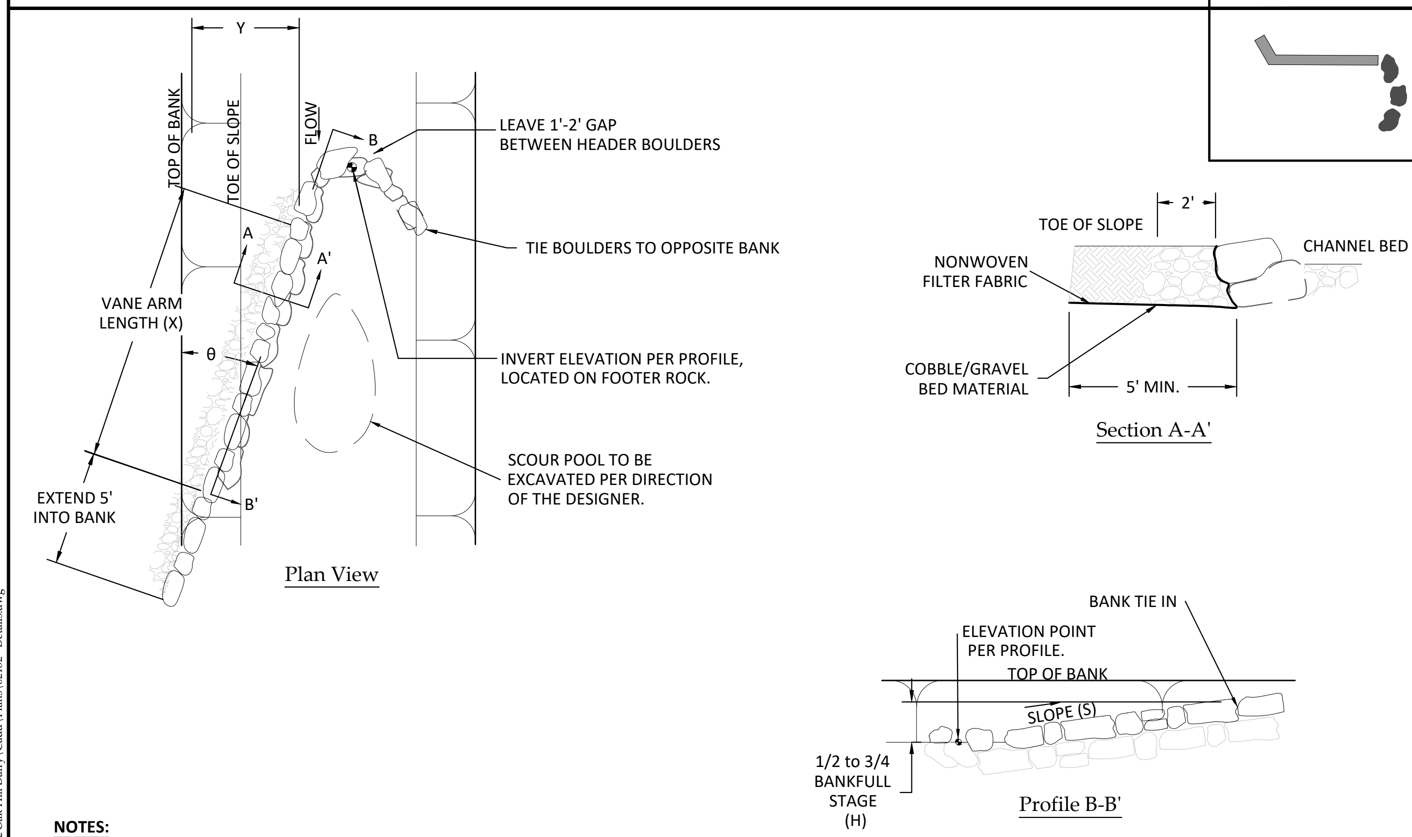


2 / 5.2 **Log Sill**
Not to Scale

NOTES:

- ALL LOGS MUST BE 12" MINIMUM DIAMETER

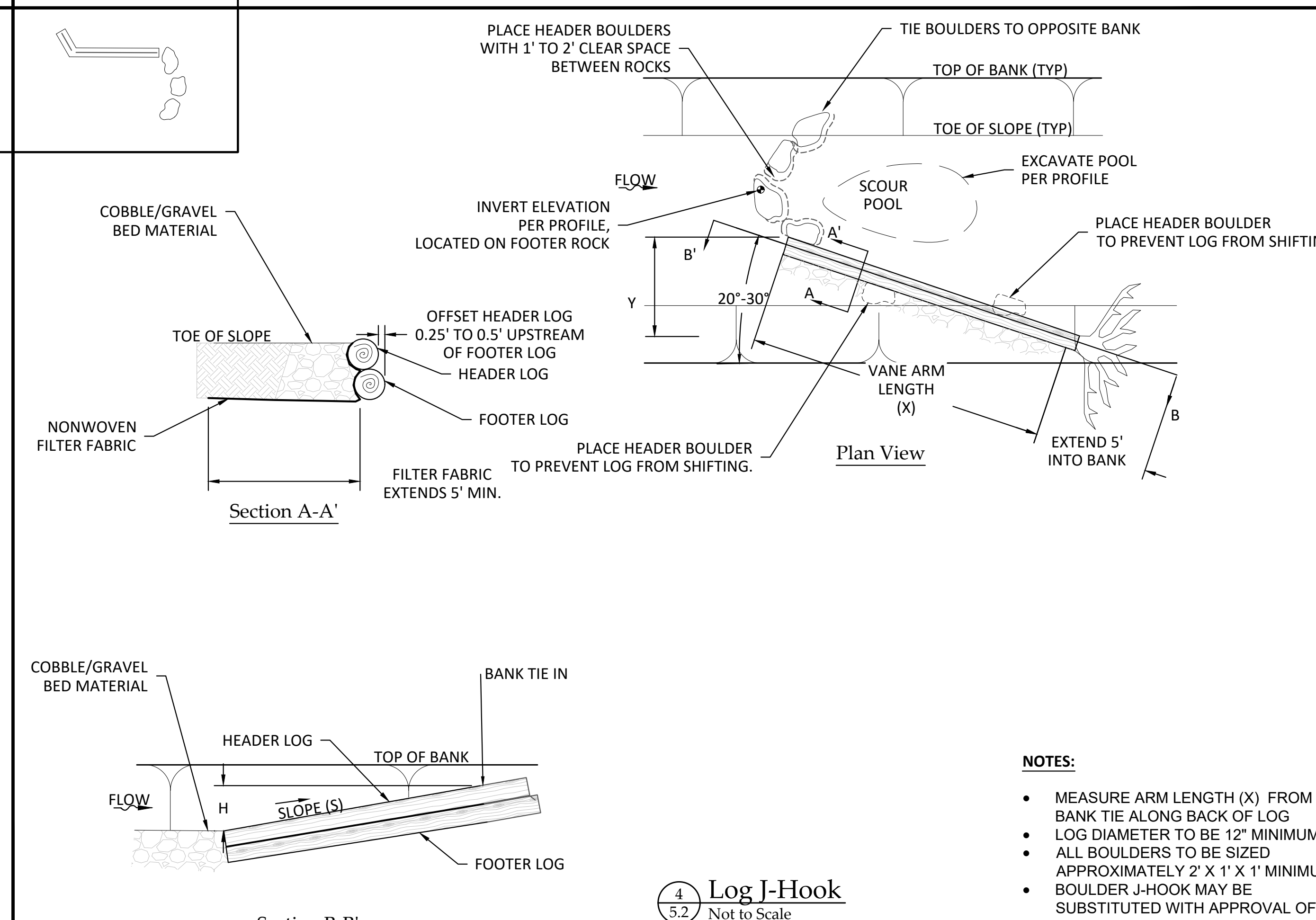




NOTES:

- MEASURE ARM LENGTH (X) FROM BANK TIE ALONG BACK OF BOULDERS
- BOULDER J-HOOK TO BE CONSTRUCTED AS ALTERNATIVE TO LOG J-HOOK ONLY AND WITH APPROVAL OF DESIGNER
- ALL BOULDERS TO BE SIZED APPROXIMATELY 2' X 1' X 1' MINIMUM

3 / 5.2 **Rock J-Hook**
Not to Scale



4 / 5.2 **Log J-Hook**
Not to Scale

NOTES:

- MEASURE ARM LENGTH (X) FROM BANK TIE ALONG BACK OF LOG
- LOG DIAMETER TO BE 12" MINIMUM
- ALL BOULDERS TO BE SIZED APPROXIMATELY 2' X 1' X 1' MINIMUM
- BOULDER J-HOOK MAY BE SUBSTITUTED WITH APPROVAL OF DESIGNER.

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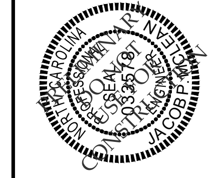

Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Details

Revisions:

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Sheet 5.2

March 7, 2012

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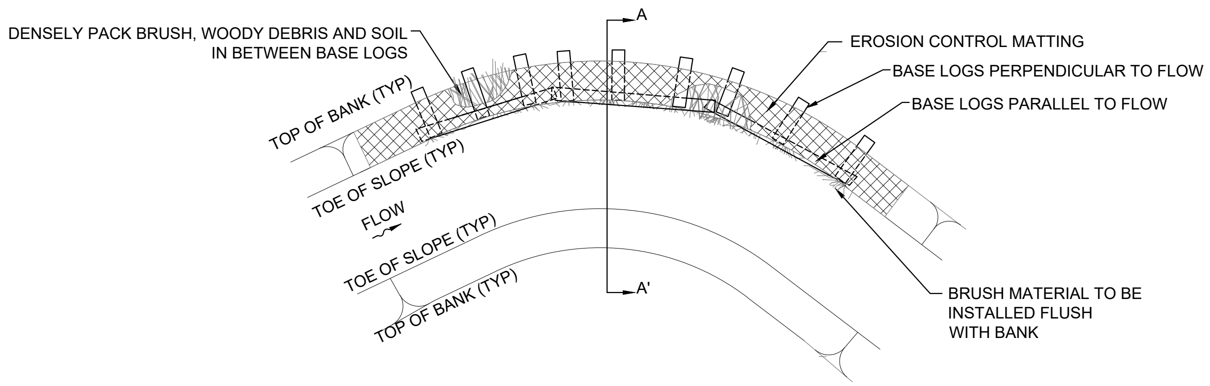
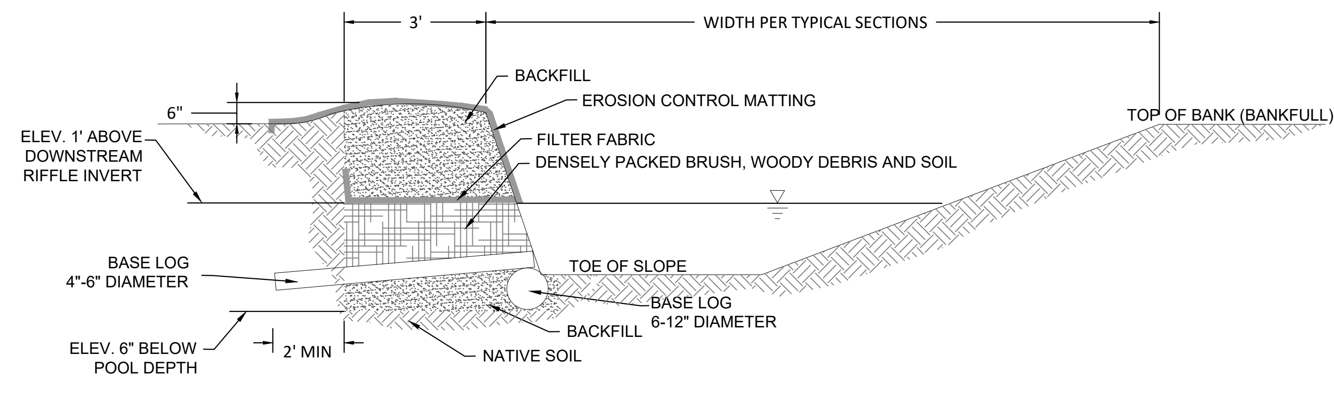
March 7, 2012



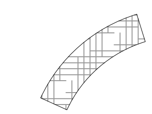
Plan View



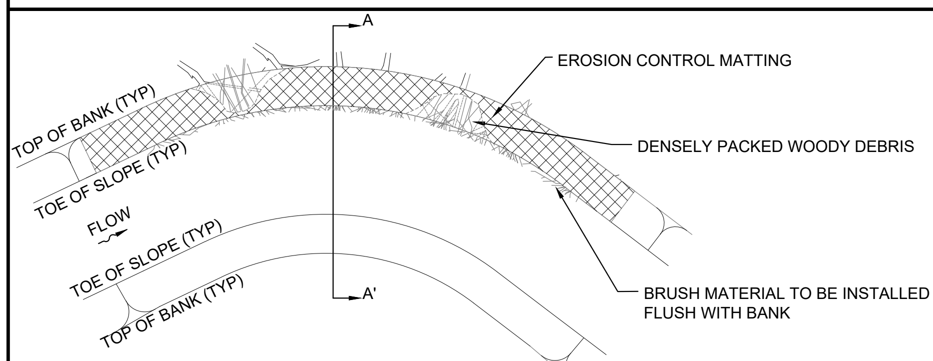
Section A-A'

NOTES:

- LARGE STREAMS INCLUDE ALL OAK HILL DAIRY AND UT1 REACHES
- OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
- INSTALL BASE LOGS PARALLEL TO FLOW AT TOE OF SLOPE. DIAMETER 6"-12".
- INSTALL BASE LOGS PERPENDICULAR TO FLOW AT INTERVALS ALONG BANK, RESTING ON TOP OF PARALLEL BASE LOGS. BASE LOGS SHALL BE 6"-12" DIAMETER.
- INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE AND SOIL TO FILL ANY VOID SPACE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
- BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
- INSTALL FILTER FABRIC OVER BRUSH/WOODY DEBRIS.
- INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
- SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.



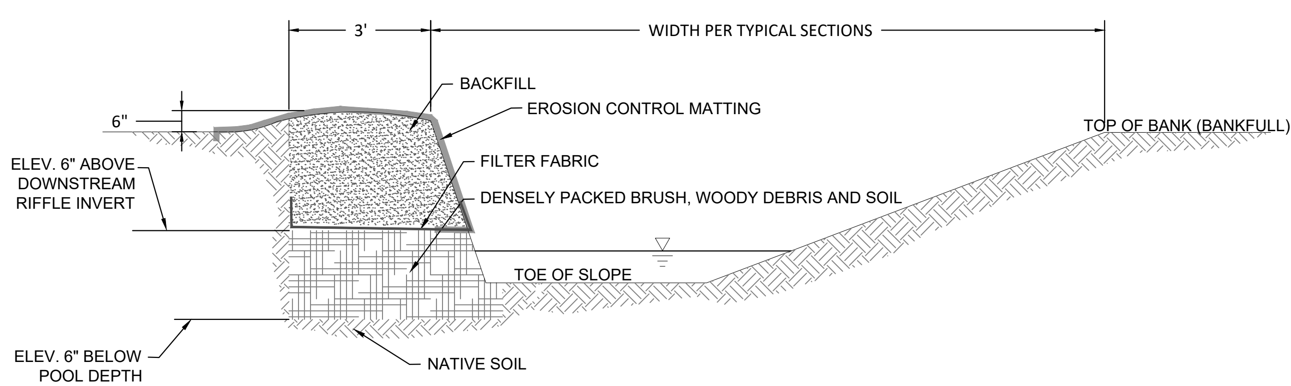
1 / 5.3 **Brush Toe** - Oak Hill Creek, UT1
Not to Scale



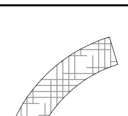
Plan View

NOTES:

- SMALL STREAMS INCLUDE UT1A, UT2, AND UT3.
- BACKFILL/GEOLIFT MAY BE REPLACED BY SOD MATS WITH DESIGNER APPROVAL ON BRUSH TOE-SMALL ONLY.
- OVEREXCAVATE 3' OUTSIDE OF TOP OF BANK (BANKFULL).
- INSTALL A DENSE LAYER OF BRUSH/WOODY DEBRIS, WHICH SHALL CONSIST OF SMALL BRANCHES AND ROOTS COLLECTED ON-SITE AND SOIL TO FILL ANY VOID SPACE. LIGHTLY COMPACT BRUSH/WOODY DEBRIS LAYER.
- BRUSH SHOULD BE ALIGNED SO STEMS ARE ROUGHLY PARALLEL AND IS INSTALLED POINTING SLIGHTLY UPSTREAM.
- INSTALL FILTER FABRIC OVER BRUSH/WOODY DEBRIS.
- INSTALL EARTH BACKFILL OVER BRUSH/WOODY LAYER ACCORDING TO TYPICAL SECTION DIMENSIONS.
- SEED, MULCH AND INSTALL EROSION CONTROL MATTING AND BANK STABILIZATION PER PLANS.

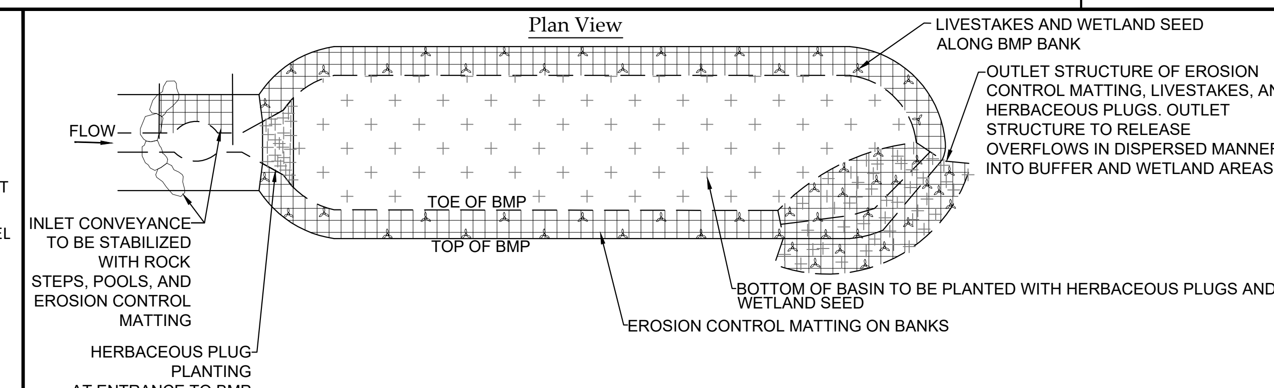


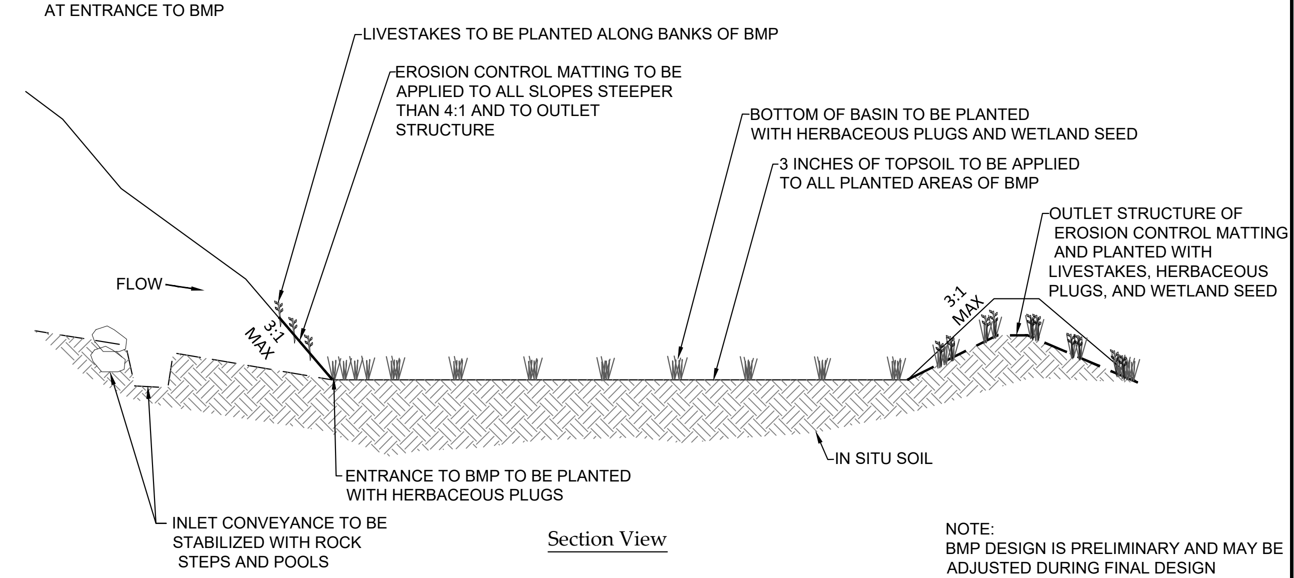
Section A-A'



2 / 5.3 **Brush Toe** - UT1A, UT2, UT3
Not to Scale

Plan View





Section View

NOTE:
BMP DESIGN IS PRELIMINARY AND MAY BE ADJUSTED DURING FINAL DESIGN

3 / 5.3 **Best Management Practice**
Not to Scale

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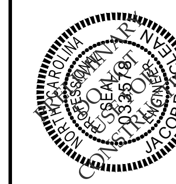

Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Details

Revisions:

Date:	March 22, 2021
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Project Engineer:	JM
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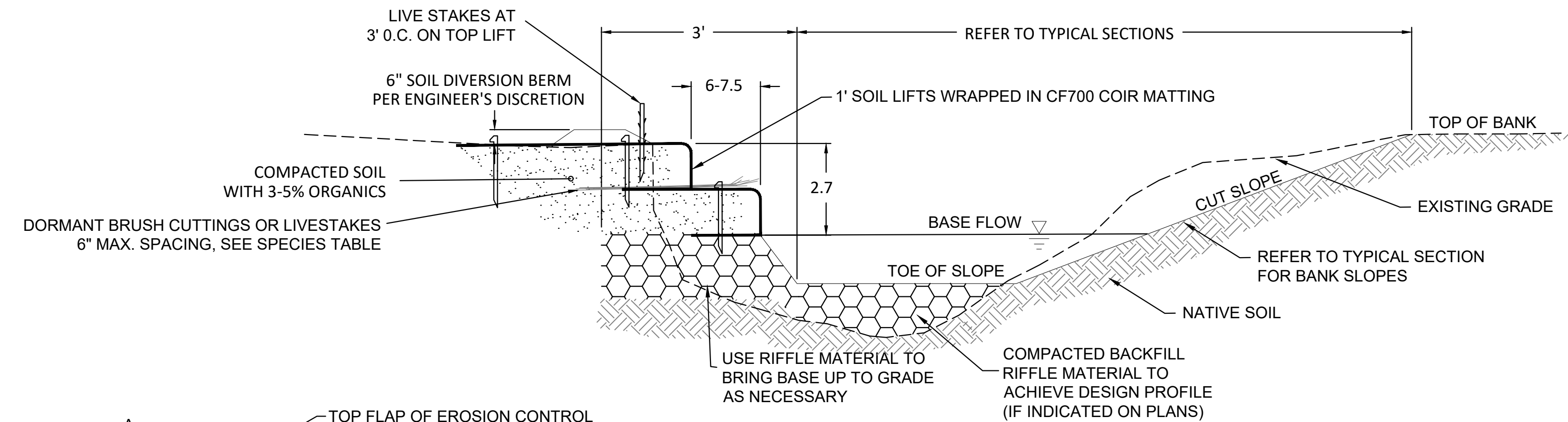
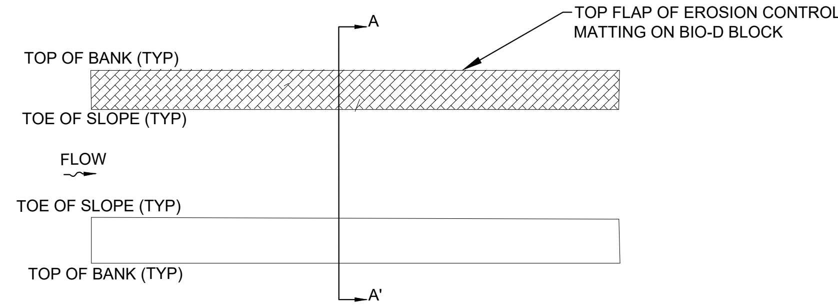


Section A-A'

NOTES:
1. OVEREXCAVATE BEYOND TOE OF BANK.
2. CLASS 1/A/B AND GRAVEL MIX OR EQUAL STONE MAY BE SUBSTITUTED FOR OR SUPPLEMENT BRUSH TOE WHERE ON-SITE BRUSH IS LIMITED (AT DISCRETION OF ENGINEER) - MUST BE MIXED WITH ONSITE OR GRADED MATERIAL TO FILL VOIDS.
3. INSTALL TOPSOIL NEAR TOP OF BRUSH, PLACE LIVE CUTTINGS WITH GOOD CONTACT TO SOIL. CUTTINGS TO BE A MIX OF SILKY DOGWOOD, SILKY WILLOW AND NINEBARK AND AT LEAST 36" LONG.
4. NUMBER OF LIFTS AND LIFT OFFSETS MAY BE ADJUSTED BY ENGINEER BASED ON FIELD CONDITIONS.
5. SEED AND MULCH TOP OF EACH LIFT BEFORE SECURING MATTING.

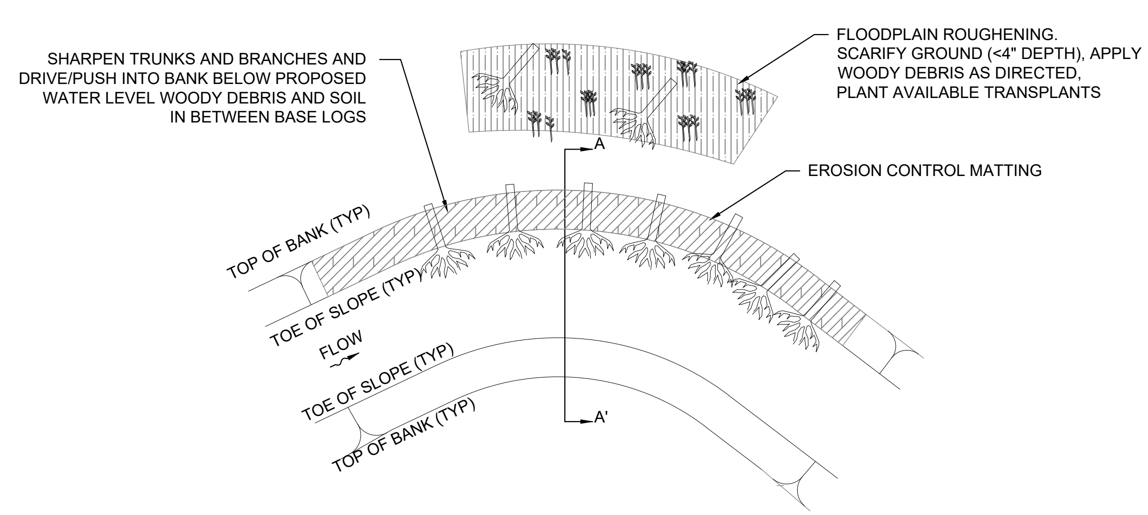


Plan View

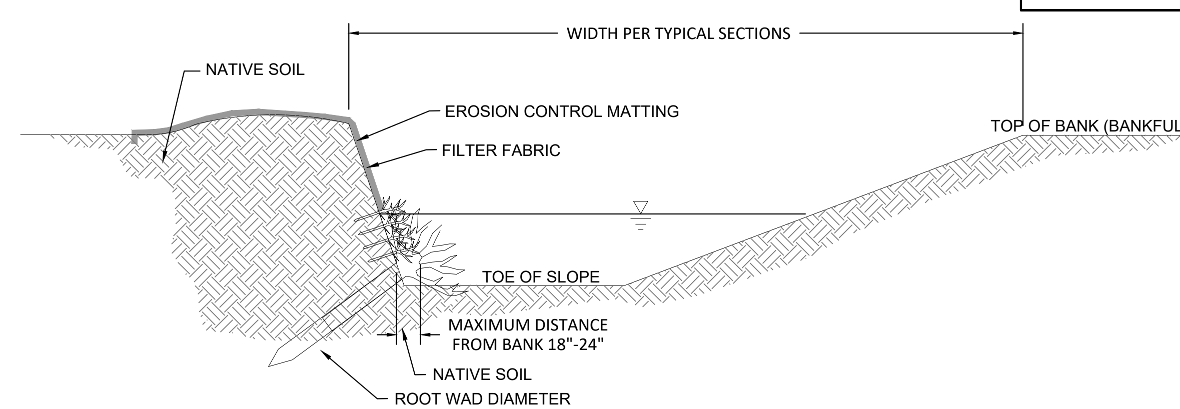
Geolift			
Live Brush Cuttings or livestakes			
Species Name	**Common Name**	**Stratum**	**Percentage of Stems**
Cornus amomum	Silky Dogwood	Shrub	70
Salix sericea	Silky Willow	Shrub	30

NOTES:
1. IF BUILT IN SUMMER, USE LIVESTAKES AT 1' SPACING DURING SUBSEQUENT DORMANT SEASON. IF BUILT IN DORMANT SEASON USE LIVE BRUSH CUTTING AT 6" SPACING.

1 / 5.4 Geolift
Not to Scale



Plan View



Section A-A'

NOTES:
- BUILD TYPICAL SECTION IN CUT
- SECURE MATTING TO UPPER BANK
- DRIVE VARIED SIZE ROOTWADS AND BRANCHES INTO CHANNEL TOE BETWEEN WSF AND LOWER LIMITS OF CUT FOR POOL
- CREATE NON-UNIFORM ROUGHENED BANK CONDITIONS TO REDUCE NEAR BANK VELOCITY

2 / 5.4 Bank and Floodplain Roughening
Not to Scale

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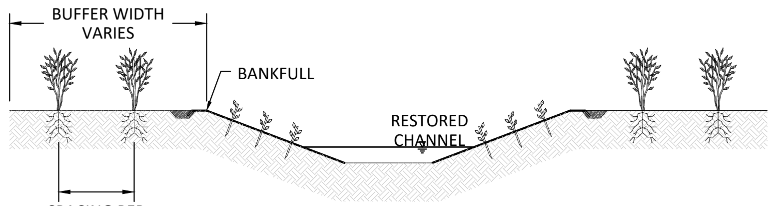
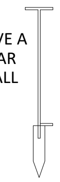


Section View

DIBBLE BAR

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.

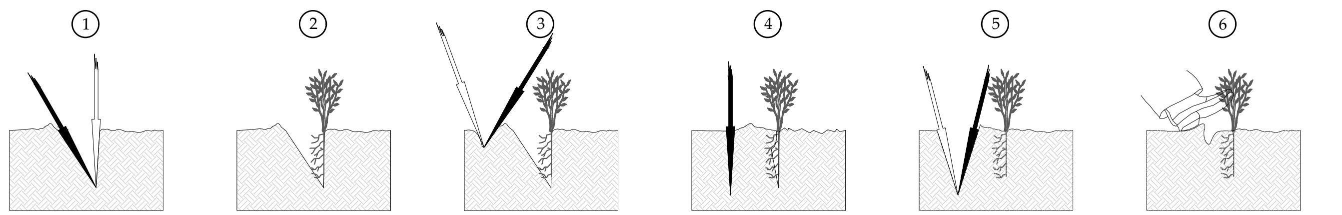


ROOTING PRUNING

ALL ROOTS SHALL BE PRUNED TO AN APPORIATE LENGTH TO PREVENT J-ROOTING.

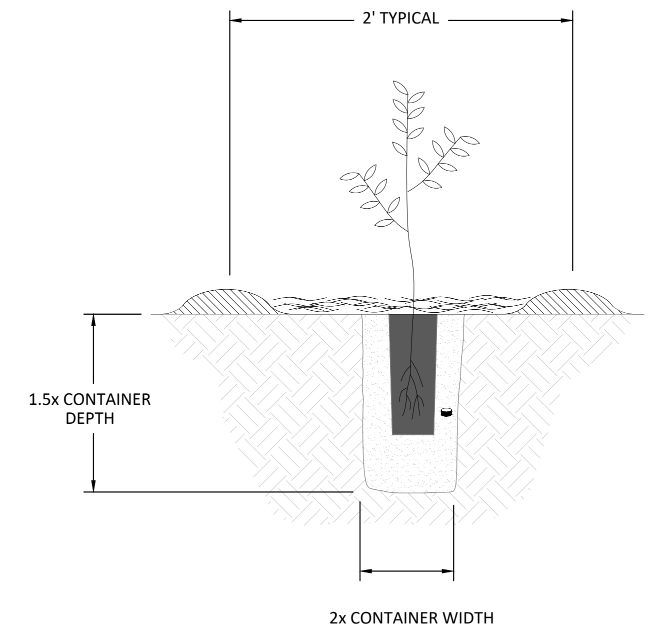
NOTES:

1. ALL SOILS WITHIN THE BUFFER PLANTING AREA SHALL BE DISKED, AS REQUIRED, PRIOR TO PLANTING.
2. ALL PLANTS SHALL BE PROPERLY HANDLED PRIOR TO INSTALLATION TO INSURE SURVIVAL.

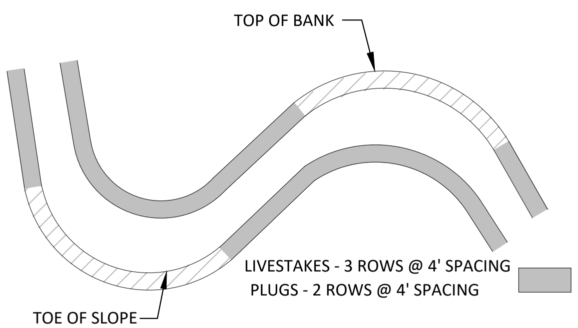


1. INSERT THE DIBBLE, OR SHOVEL, STRAIGHT DOWN INTO THE SOIL TO THE FULL DEPTH OF THE BLADE AND PULL BACK ON THE HANDLE TO OPEN THE PLANTING HOLE. (DO NOT ROCK THE SHOVEL BACK AND FORTH AS THIS CAUSES SOIL IN THE PLANTING HOLE TO BE COMPACTED, INHIBITING ROOT GROWTH.
2. REMOVE THE DIBBLE, OR SHOVEL, AND PUSH THE SEEDLING ROOTS DEEP INTO THE PLANTING HOLE. PULL THE SEEDLING BACK UP TO THE CORRECT PLANTING DEPTH (THE ROOT COLLAR SHOULD BE 1 TO 3 INCHES BELOW THE SOIL SURFACE). GENTLY SHAKE THE SEEDLING TO ALLOW THE ROOTS TO STRAIGHTEN OUT. DO NOT TWIST OR SPIN THE SEEDLING OR LEAVE THE ROOTS J-ROOTED.
3. INSERT THE DIBBLE, OR SHOVEL, SEVERAL INCHES IN FRONT OF THE SEEDLING AND PUSH THE BLADE HALFWAY INTO THE SOIL. TWIST AND PUSH THE HANDLE FORWARD TO CLOSE THE TOP OF THE SLIT TO HOLD THE SEEDLING IN PLACE.
4. PUSH THE DIBBLE, OR SHOVEL, DOWN TO THE FULL DEPTH OF THE BLADE.
5. PULL BACK ON THE HANDLE TO CLOSE THE BOTTOM OF THE PLANTING HOLD. THEN PUSH FORWARD TO CLOSE THE TOP, ELIMINATING AIR POCKETS AROUND THE ROOT.
6. REMOVE THE DIBBLE, OR SHOVEL, AND CLOSE AND FIRM UP THE OPENING WITH YOUR HEEL. BE CAREFUL TO AVOID DAMAGING THE SEEDLING.

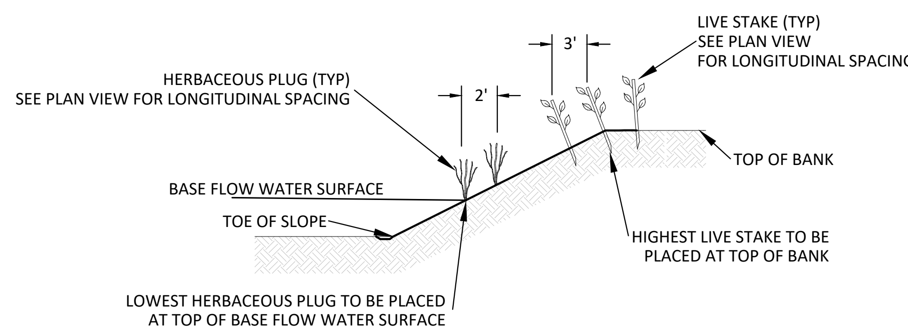
1/5.5 Bare Root Planting
Not to Scale



2/5.5 Containerized Planting
Not to Scale



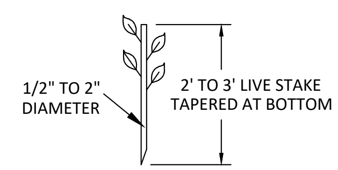
Plan View - Large Streams
(Oak Hill Creek and UT1)



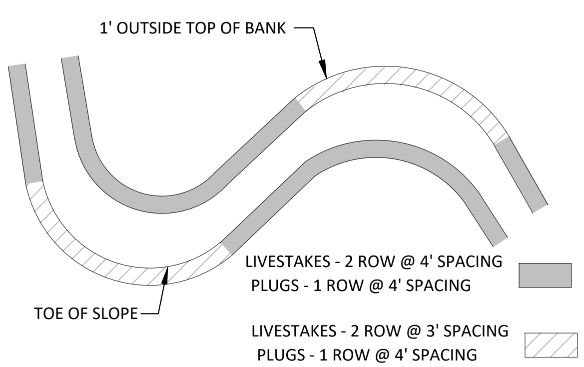
Section View - Large Streams
(Oak Hill Creek and UT1)

NOTES:

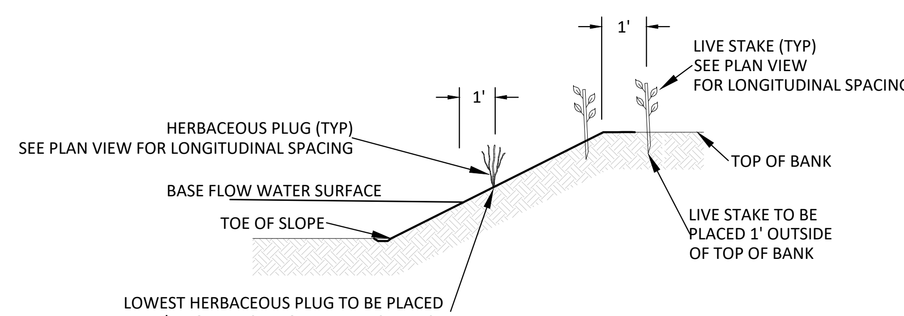
- LIVE STAKES TO BE PLANTED IN AREAS AS SHOWN ON PLANS AND DIRECTED BY THE DESIGNER.



Live Stake Detail



Plan View - Small Streams
(UT1A, UT1B, UT2, AND UT3)

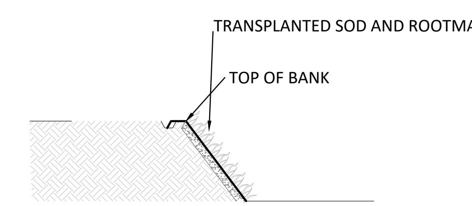


Section View - Small Streams
UT1A, UT1B, UT2, AND UT3)

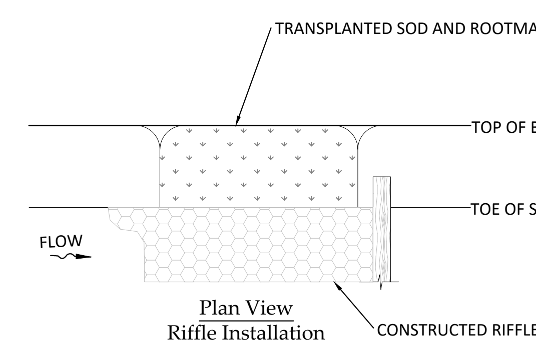
3/5.5 Live Staking & Herbaceous Plugs
Not to Scale

NOTES:

- PREPARE THE BANK WHERE THE SOD MAT WILL BE TRANSPLANTED BY RAKING & FERTILIZING.
- EXCAVATE TRANSPLANT SOD MATS WITH A WIDE BUCKET AND AS MUCH ADDITIONAL SOIL MATERIAL AS POSSIBLE.
- PLACE TRANSPLANT ON THE BANK TO BE STABILIZED.
- FILL IN ANY HOLES AROUND THE TRANSPLANT AND COMPACT.
- ANY LOOSE SOIL LEFT IN THE STREAM SHOULD BE REMOVED.
- PLACE MULTIPLE TRANSPLANTS CLOSE TOGETHER SUCH THAT THEY TOUCH.



Section View
Riffle Installation



Plan View
Riffle Installation

4/5.5 Transplanted Sod Mats
Not to Scale

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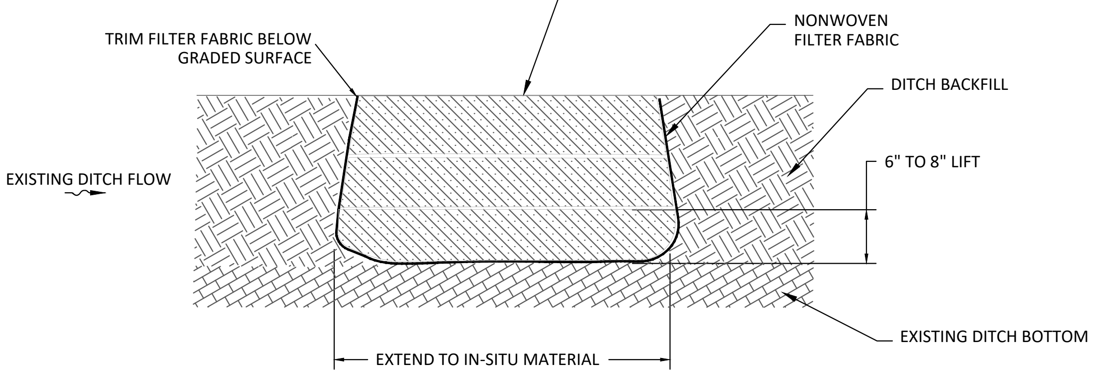
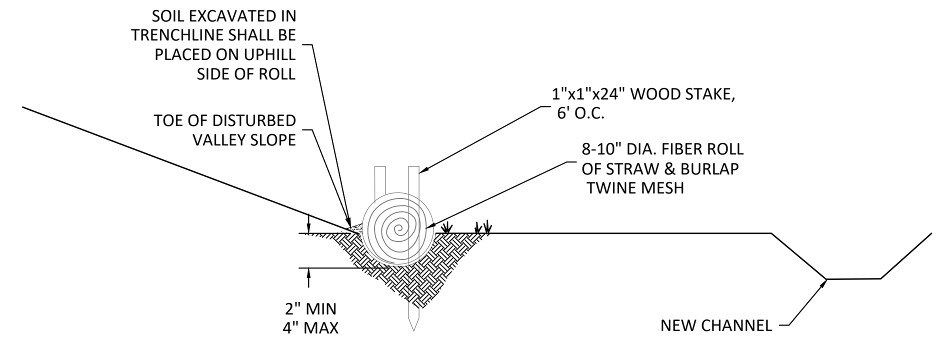


NOTES:

- CLAY MATERIAL TO BE APPROVED BY DESIGNER OR ON-SITE INSPECTOR.
- ALL WOODY AND HERBACEOUS VEGETATION MUST BE REMOVED FROM AREA TO BE PLUGGED PRIOR TO INSTALLATION
- PLUG SHOULD EXTEND FROM TOP OF DITCH TO TOP OF DITCH WITHIN THE DITCH CROSS SECTION

1 / 5.6 Wetland Ditch Plug
Not to Scale



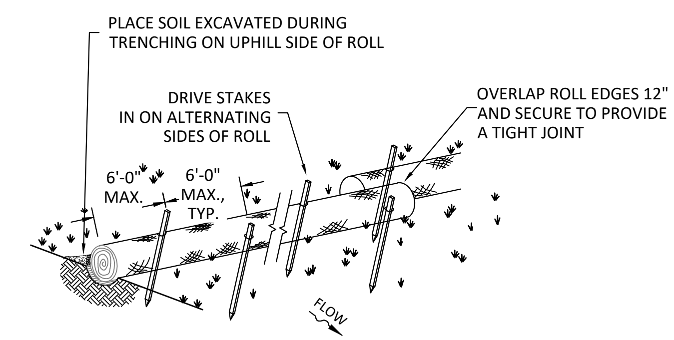
Section View

NOTES:

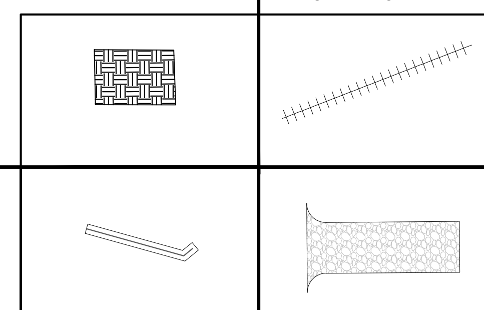
- WATTLES TO BE PLACED TO ADDRESS TEMPORARY OR MINOR EROSION CONTROL ISSUES. WATTLES TO BE PLACED AS DIRECTED BY DESIGNER OR AS DIRECTED BY CONTRACTOR'S EROSION CONTROL SELF-INSPECTION REPORTS

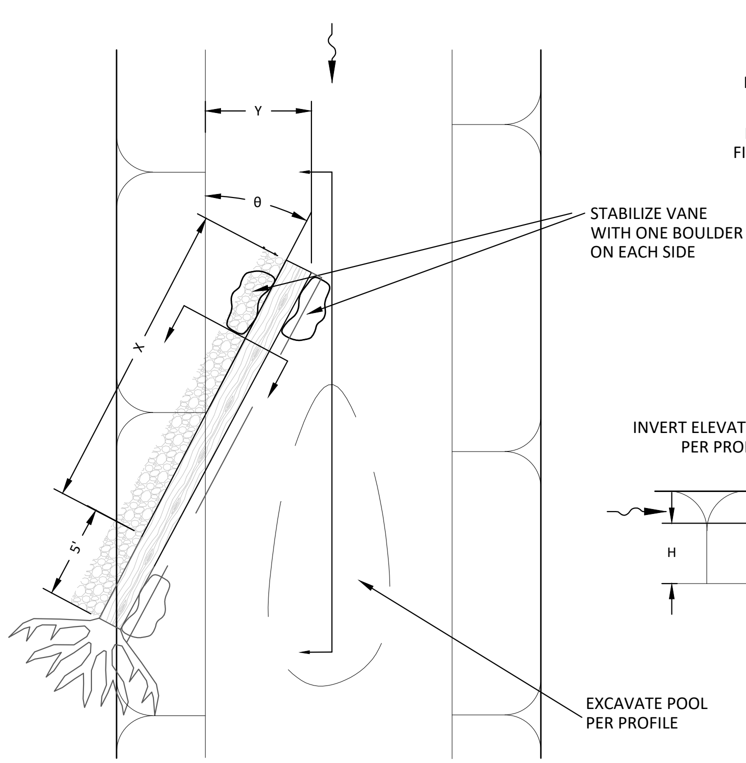
MAINTENANCE NOTES:

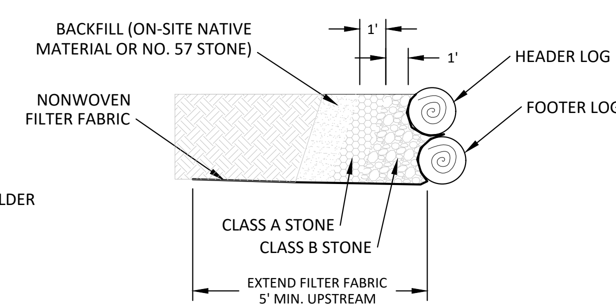
- ALL INSTALLED WATTLES SHOULD BE INSPECTED AT LEAST ONCE WEEKLY OR AFTER 1" OF PRECIPITATION WITHIN 24 HOURS.
- IF TRAPPED EXCESS SEDIMENT ON THE UPGRADIENT SIDE OF THE WATTLE IS GREATER THAN 6" DEEP OR HALF THE TOTAL HEIGHT OF THE WATTLE, THE SEDIMENT SHOULD BE REMOVED AND DISPOSED OF ON SITE.
- MONITOR FOR RUNOFF PIPING AROUND OR UNDER INSTALLED WATTLES

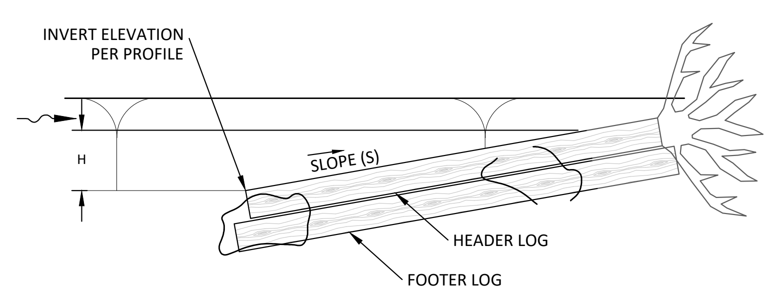


2 / 5.6 Straw Wattles
Not to Scale









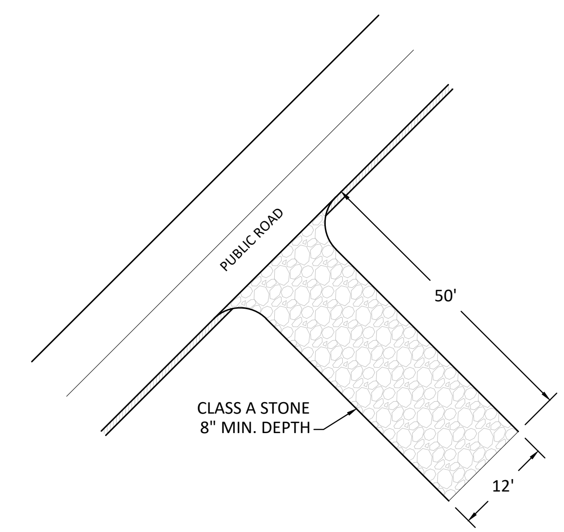
3 / 5.6 Log Vane
Not to Scale

NOTES:

- PROVIDE TURNING RADIUS SUFFICIENT TO ACCOMMODATE LARGE TRUCKS.
- LOCATE CONSTRUCTION ENTRANCE AT ALL POINTS OF INGRESS AND EGRESS UNTIL SITE IS STABILIZED. PROVIDE FREQUENT CHECKS OF THE DEVICE AND TIMELY MAINTENANCE.
- MUST BE MAINTAINED IN A CONDITION WHICH WILL PREVENT TRACKING OR DIRECT FLOW OF MUD ONTO STREETS. PERIODIC TOP DRESSING WITH STONE WILL BE NECESSARY.
- ANY MATERIAL TRACKED ONTO THE ROADWAY MUST BE CLEANED IMMEDIATELY.
- USE CLASS A STONE OR OTHER COARSE AGGREGATE APPROVED BY THE DESIGNER.
- PLACE FILTER FABRIC BENEATH STONE.

MAINTENANCE NOTES:

- ALL CONSTRUCTION ENTRANCES SHOULD BE INSPECTED AT LEAST ONCE WEEKLY OR AFTER 1" OF PRECIPITATION WITHIN 24 HOURS.
- EXCESS SEDIMENT ON THE CONSTRUCTION ENTRANCE SHOULD BE REMOVED OR ADDITIONAL ROCK APPLIED TO CAP ENTRANCE
- REPAIR RUTS OR POTHOLES ALONG CONSTRUCTION ENTRANCE, ESPECIALLY AT THE INTERFACE BETWEEN THE CONSTRUCTION ENTRANCE AND PUBLIC ROAD
- REMOVE ANY SEDIMENT TRACKED ONTO PUBLIC ROAD IMMEDIATELY.



4 / 5.6 Construction Entrance
Not to Scale

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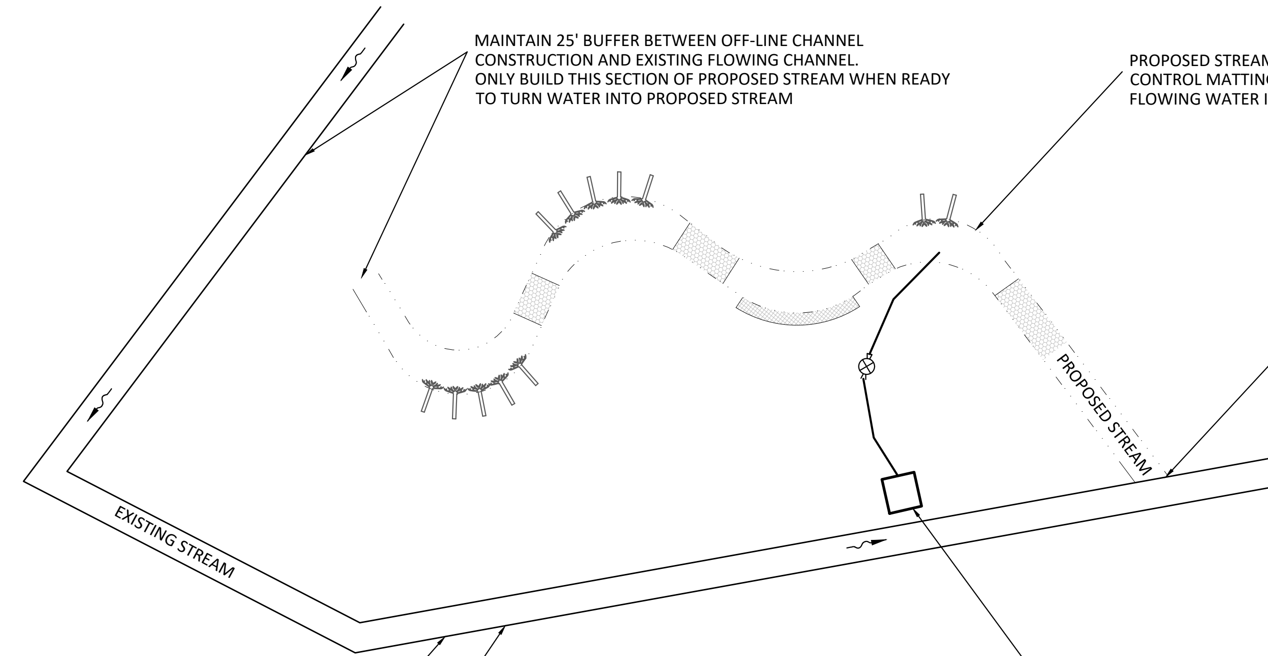
SURFACE WATER DIVERSION SEQUENCE:

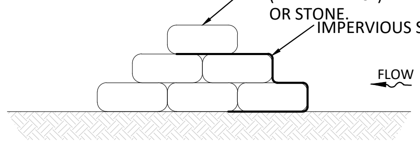
1. IMPLEMENT SURFACE WATER DIVERSION WHERE REQUIRED BY THE SPECIFICATIONS OR AS DIRECTED BY THE DESIGNER.
2. IDENTIFY THE EXPECTED ACTIVE WORK AREA OF THE STREAM FOR EACH WORK DAY. THE CONTRACTOR SHALL DISTURB ONLY AS MUCH CHANNEL AS CAN BE STABILIZED WITH SEEDING, MULCH, AND EROSION CONTROL MATTING BY THE END OF EACH WORK DAY.
3. CONSTRUCT OFF-LINE CHANNEL ACCORDING TO THE PLANS AND IN THE DRY WHILE WATER CONTINUES DOWN THE EXISTING STREAM. USE CARE NEAR ACTIVE STREAM TO PREVENT SEDIMENT SPILLAGE INTO STREAM. MAINTAIN 25' BETWEEN THE BEGINNING OF ACTIVE CONSTRUCTION AND THE UPSTREAM TIE OUT POINT UNTIL SECTION OF PROPOSED OFF-LINE STREAM IS FULLY CONSTRUCTED AND STABILIZED.
4. IDENTIFY WHERE OFF-LINE PORTION OF STREAM WILL TIE BACK INTO THE EXISTING DITCH/STREAM. PROCEED WITH OFF-LINE CONSTRUCTION UNTIL REACHING THIS DOWNSTREAM TIE OUT POINT. CONSULT DESIGNER OR CONSTRUCTION SEQUENCE TO DETERMINE TIE OUT POINTS. STABILIZE THE DOWNSTREAM TIE OUT POINT.
5. HARVEST MATERIAL FROM EXISTING DITCH/STREAM BY UTILIZING THE PUMP-AROUND SYSTEM DETAIL (DETAIL 2, SHEET 5.7). APPLY HARVESTED MATERIAL TO PROPOSED STREAM.
6. WHILE STILL PUMPING AROUND, CONSTRUCT THE LAST 25' OF PROPOSED STREAM TO COMPLETE THE UPSTREAM TIE OUT TO THE EXISTING DITCH/STREAM.
7. AFTER WATER HAS BEEN TURNED INTO PROPOSED STREAM, BEGIN BACKFILLING EXISTING STREAM FROM UPSTREAM TO DOWNSTREAM.

NOTES:

- ACTIVE WORK AREAS THAT ARE OFF-LINE MUST BE DEWATERED USING A GRASSED FILTER STRIP OR DEWATERING BAG.
- SURFACE WATER DIVERSION MAY ONLY BE USED IN LOCATIONS WHERE PROPOSED STREAM IS FULLY OFF-LINE OF EXISTING STREAM



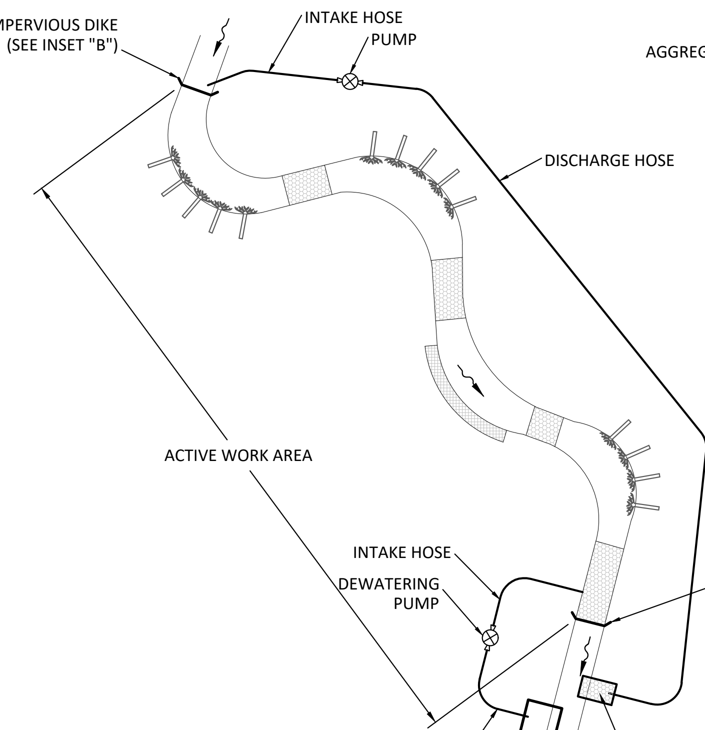
1/5.7 Surface Water Diversion
Not to Scale



Inset "B"
Impervious Dike

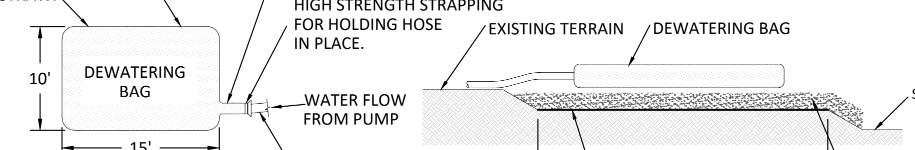
PUMP-AROUND SEQUENCE:

1. IMPLEMENT PUMP-AROUND WHERE REQUIRED BY THE SPECIFICATIONS OR AS DIRECTED BY THE DESIGNER.
2. IDENTIFY THE EXPECTED ACTIVE WORK AREA OF THE STREAM FOR EACH WORK DAY. THE CONTRACTOR SHALL DISTURB ONLY AS MUCH CHANNEL AS CAN BE STABILIZED WITH SEEDING, MULCH, AND EROSION CONTROL MATTING BY THE END OF EACH WORK DAY. STREAM WORK SHOULD NOT BE PERFORMED, AND PUMP-AROUND SHOULD NOT BE IMPLEMENTED, IF STREAM FLOW EXCEEDS PUMP CAPACITY.
3. MOBILIZE PUMP-AROUND EQUIPMENT TO THE ACTIVE WORK AREA. POSITION PUMP INTAKE JUST UPSTREAM OF THE ACTIVE WORK AREA AND POSITION DISCHARGE HOSE DOWNSTREAM OF THE ACTIVE WORK AREA. STABILIZE OUTLET AREA OF DISCHARGE HOSE AS SHOWN IN DETAIL. PUMP AND HOSES MUST HAVE SUFFICIENT CAPACITY TO HANDLE TYPICAL BASE FLOW CONDITIONS IN THE RESPECTIVE STREAMS, OR ANY CONDITION UNDER WHICH THE CONTRACTOR DESIRES TO CONTINUE WORK.
4. INSTALL IMPERVIOUS DIKES DOWNSTREAM OF THE INTAKE HOSE AND UPSTREAM OF THE DISCHARGE HOSE. ENSURE NO WATER BYPASSES DIKES AND ACTIVE WORK AREA IS ISOLATED FROM THE FLOWING STREAM.
5. START PUMP AND BEGIN PUMPING AROUND IMMEDIATELY AFTER IMPERVIOUS DIKE INSTALLATION. MONITOR PUMP AND WATER LEVELS AT THE UPSTREAM IMPERVIOUS DIKE THROUGHOUT THE DAY. ADJUST DIKE OR PUMP SIZE AS NEEDED TO ENSURE THAT ALL STREAM FLOW BYPASSES THE ACTIVE WORK AREA.
6. DE-WATER THE ACTIVE WORK AREA BY POSITIONING A SEPARATE PUMP NEAR THE DOWNSTREAM END OF THE ACTIVE WORK AREA. WATER PUMPED FORM THE ACTIVE WORK AREA SHOULD PASS THOROUGH A DE-WATERING BAG BEFORE DISCHARGING TO THE STREAM. SEE DETAIL AND SPECIFICATIONS FOR PROPER DE-WATERING BAG TYPE AND INSTALLATION. THE ACTIVE WORK AREA SHOULD BE DE-WATERED WHENEVER A SUFFICIENT AMOUNT OF WATER ACCUMULATES IN THE ACTIVE WORK ZONE TO IMPEDE CONSTRUCTION PROGRESS.
7. WITH FLOW DIVERTED, HARVEST COBBLE AND GRAVEL MATERIALS FROM THE BED OF THE DE-WATERED CHANNEL FOR RE-USE IN CONSTRUCTED RIFFLES AND OTHER IN-STREAM STRUCTURES.
8. COMPLETE ALL STREAM GRADING AND IN-STREAM STRUCTURES WITHIN THE ACTIVE WORK AREA.
9. WHEN STREAM WORK WITHIN THE ACTIVE WORK AREA IS COMPLETE, FULLY STABILIZE THE NEWLY CONSTRUCTED CHANNEL BEFORE SHUTTING DOWN THE PUMP-AROUND SYSTEM. STABILIZATION CONSISTS OF SEEDING, MULCHING, AND INSTALLING EROSION CONTROL MATTING ALONG GRADED BANKS AS INDICATED IN THE DETAILS.
10. ONCE THE ACTIVE WORK AREA IS STABILIZED, TURN OFF PUMPS AND REMOVE IMPERVIOUS DIKES. MOBILIZE THE SYSTEM TO THE NEXT ACTIVE WORK AREA.

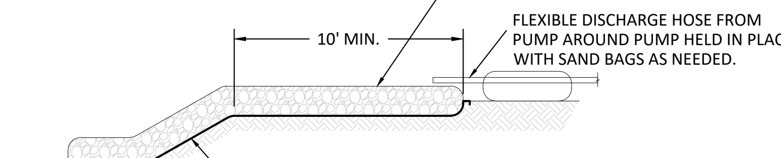


Plan View

2/5.7 Pump Around System
Not to Scale



Inset "A"
Dewatering Bag



Inset "C"
Stabilized Outlet

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Gaston County, North Carolina

Details

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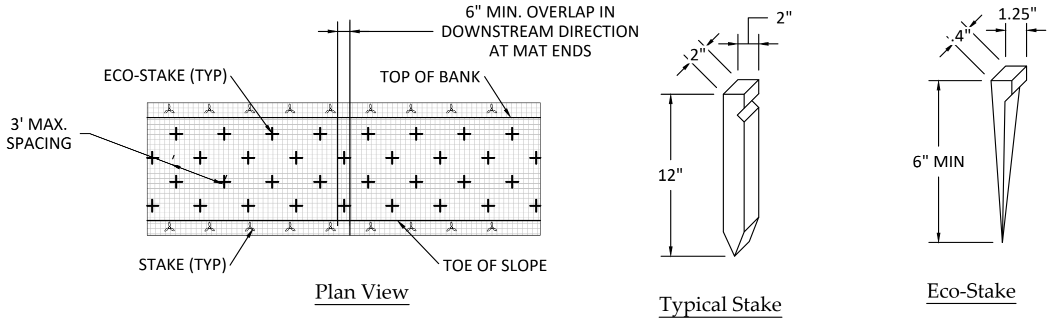
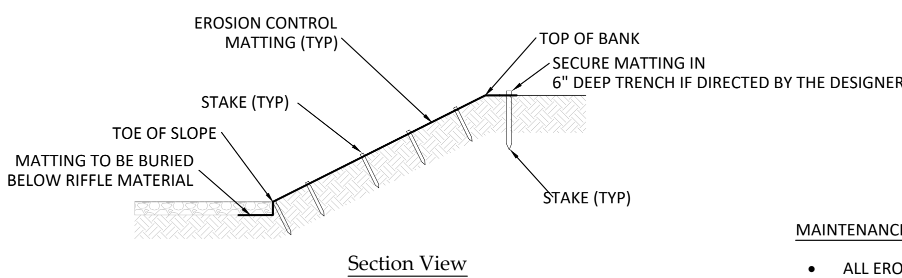
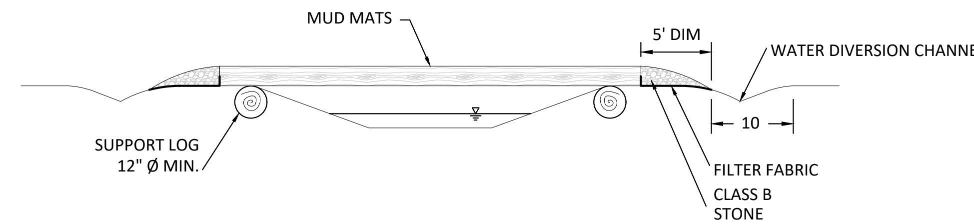




MAINTENANCE NOTES:

- ALL EROSION CONTROL MATTING SHOULD BE INSPECTED AT LEAST ONCE WEEKLY OR AFTER 1" OF PRECIPITATION WITHIN 24 HOURS.
- ANY MATTING FAILURES SHOULD BE REPAIRED WITHIN 24 HOURS.
- TENTING (EROSION OCCURRING UNDERNEATH INSTALLED MATTING) WILL REQUIRE PEELING BACK MATTING, REPAIRING ANY RILLS, AND REAPPLYING THE MATTING.

1/5.8 Erosion Control Matting
Not to Scale

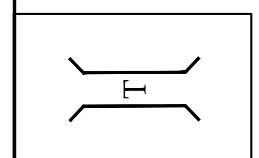


NOTES:

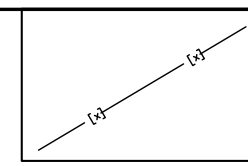
- CONSTRUCT STREAM CROSSING WHEN FLOW IS AT OR BELOW NORMAL BASEFLOW.
- BRIDGE MATS SHALL BE PLACED FROM ABOVE RATHER THAN DRAGGED INTO PLACE.
- MINIMIZE CLEARING AND EXCAVATION OF STREAMBANKS. DO NOT EXCAVATE CHANNEL BOTTOM.
- INSTALL STREAM CROSSING PERPENDICULAR TO THE FLOW.
- MAINTAIN CROSSING SO THAT RUNOFF IN THE CONSTRUCTION ROAD DOES NOT ENTER CHANNEL. SMALL DIVERSION CHANNELS, ADDITIONAL ROCK, OR STRAW/COIR WATTLES MAY BE REQUIRED. INSTALL AS DIRECTED.
- STABILIZE AN ACCESS RAMP OF CLASS B STONE TO THE EDGE OF THE MUD MAT.
- CONTRACTOR SHALL DETERMINE APPROPRIATE RAMP ANGLE ACCORDING TO EQUIPMENT USED.
- ADDRESS STEEP TRANSITIONS TO THE CROSSING THAT PRESENT AN EROSION OR SEDIMENTATION RISK WITH APPROPRIATE COUNTERMEASURES SUCH AS STONE OR END OF DAY COVER OR SEDIMENT BARRIER APPLICATIONS.

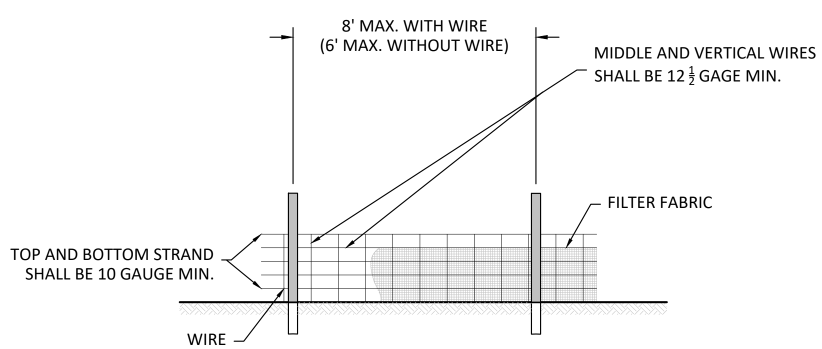
MAINTENANCE NOTES:

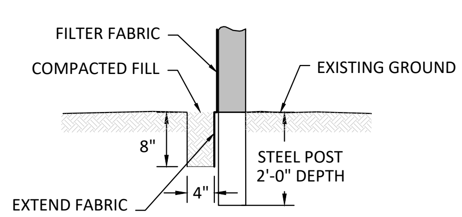
- ALL TEMPORARY STREAM CROSSINGS SHOULD BE INSPECTED AT LEAST ONCE WEEKLY OR AFTER 1" OF PRECIPITATION WITHIN 24 HOURS.
- IF EXCESSIVE SEDIMENT IS BEING TRACKED ON TOP OF MATS THEN REMOVE WITH SHOVEL AND DISPOSE OF PROPERLY.
- TERRACE SLOPES ENTERING AND EXITING FROM CROSSINGS MUST BE WELL MAINTAINED. DIVERT SURFACE RUNOFF AWAY FROM CROSSINGS, APPLY WATTLES OR SURFACE STONE AS NECESSARY.



2/5.8 Temporary Stream Crossing - Timber Mat
Not to Scale







NOTES:

- USE WIRE A MINIUM OF 32" IN WIDTH AND WITH A MINIMUM OF 6 LINES OF WIRES WITH 12" STAY SPACING.
- USE FILTER FABRIC A MINIMUM OF 36" IN WIDTH AND FASTEN ADEQUATELY TO THE WIRES AS DIRECTED BY THE DESIGNER.
- PROVIDE 5' STEEL POST OF THE SELF-FASTENER ANGLE STEEL TYPE. ANGLE STEEL TYPE.

MAINTENANCE NOTES:

- ALL SILT FENCE SHOULD BE INSPECTED AT LEAST ONCE WEEKLY OR AFTER 1" OF PRECIPITATION WITHIN 24 HOURS.
- TEARS IN THE FENCE, UNTRENCHED AREAS, OR OTHER FENCE FAILURES SHOULD BE REPAIRED WITHIN 24 HOURS.
- SEDIMENT TRAPPED BEHIND SILT FENCE SHOULD BE CAREFULLY REMOVED ONCE DEPTH REACHES 6".

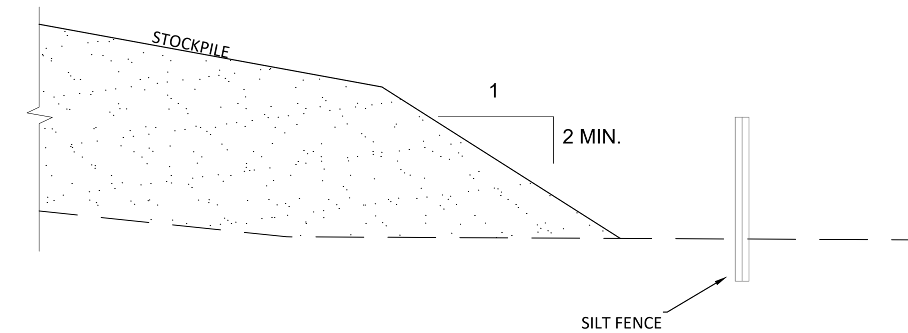
3/5.8 Temporary Silt Fence
Not to Scale

NOTES:

- SILT FENCE SHALL BE PLACED ON DOWNSLOPE SIDE OF ALL STOCKPILES.
- STOCKPILES SHALL BE LOCATED A MINIMUM OF 50 FEET FROM STORMWATER DRAINS OR INLETS.

MAINTENANCE NOTES:

- ALL STOCKPILE AREAS AND SILT FENCES SHALL BE INSPECTED AT LEAST ONCE PER WEEK OR AFTER 1" OF PRECIPITATION WITHIN 24 HOURS.
- SILT FENCE SHOULD BE INSPECTED FOR TEARS, UNTRENCHED AREAS, OR OTHER FAILURES AND REPAIRED WITHIN 24 HOURS
- SEDIMENT SHALL BE REMOVED FROM BEHIND THE SILT FENCE ONCE DEPTH REACHES 6"
- ANY SOIL STOCKPILES LEFT IN PLACE FOR LONGER THAN 7 DAYS SHALL BE SEEDED AND MULCHED OR OTHERWISE STABILIZED.



4/5.8 Stockpile and Staging Areas
Not to Scale

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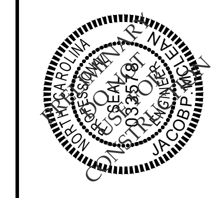

Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Details

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5.8
Sheet

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 (SDOs)	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 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 documented in the manner described:

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

In addition to the E&SC Plan documents above, the following items shall be kept on the site

and available for agency 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 30 days. 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.

(c) All data used to complete the Notice of Intent and older 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).

(a) 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.

(b) Anticipated bypasses and unanticipated bypasses.

(c) 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 Division's Emergency Response personnel at (800) 662-7956, (800) 858-0368 or (919) 733-3300.

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.

NCG01 SELF-INSPECTION, RECORDKEEPING AND REPORTING

EFFECTIVE: 04/01/19

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Gaston County, North Carolina

NCG01
Details

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Project Engineer: JM
Drawn By: JDW
Checked By: ER

Sheet 5.9

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

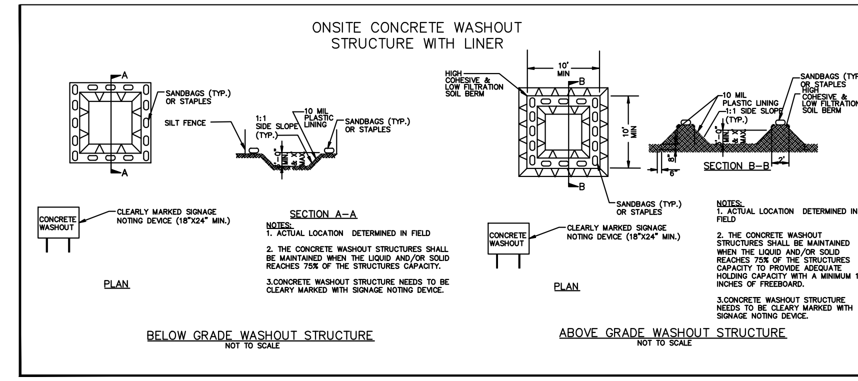
1. Do not dump paint and other liquid waste into storm drains, streams or wetlands.
2. Locate paint washouts at least 50 feet away from storm drain inlets and surface waters unless no other alternatives are reasonably available.
3. Contain liquid wastes in a controlled area.
4. Containment must be labeled, 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.



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.

NCG01 GROUND STABILIZATION AND MATERIALS HANDLING

EFFECTIVE: 04/01/19

March 7, 2012

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License No. F-0831

Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

NCG01
Details

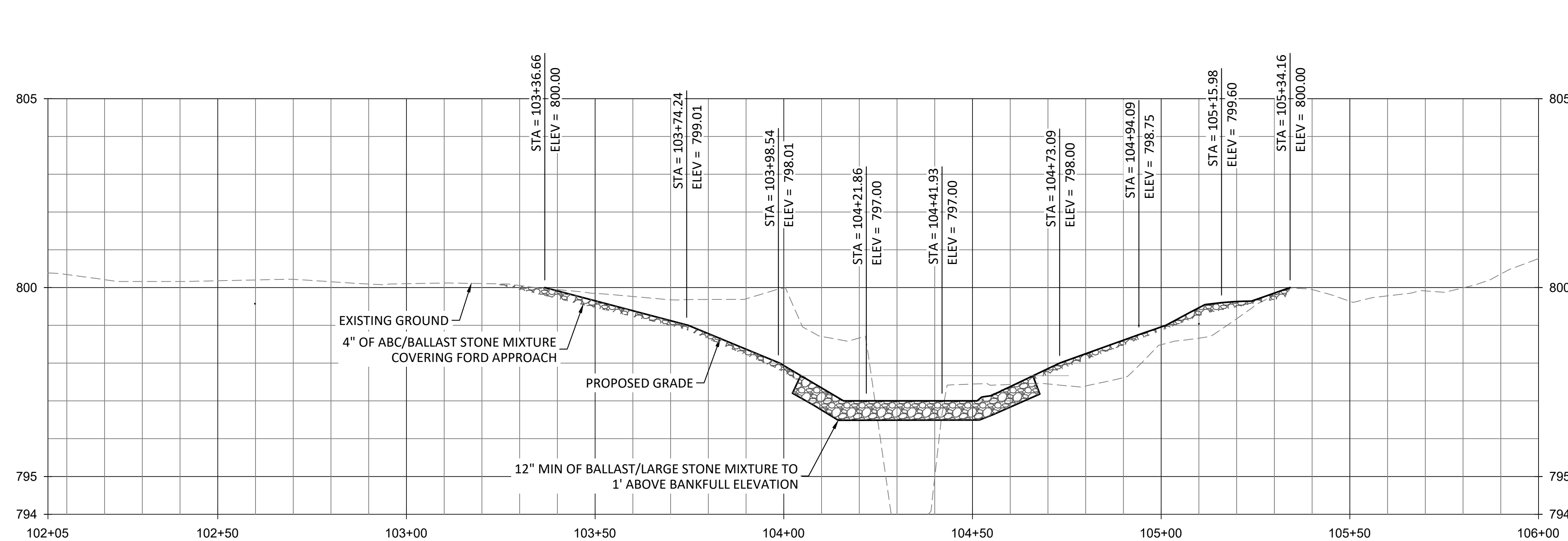
Revisions:

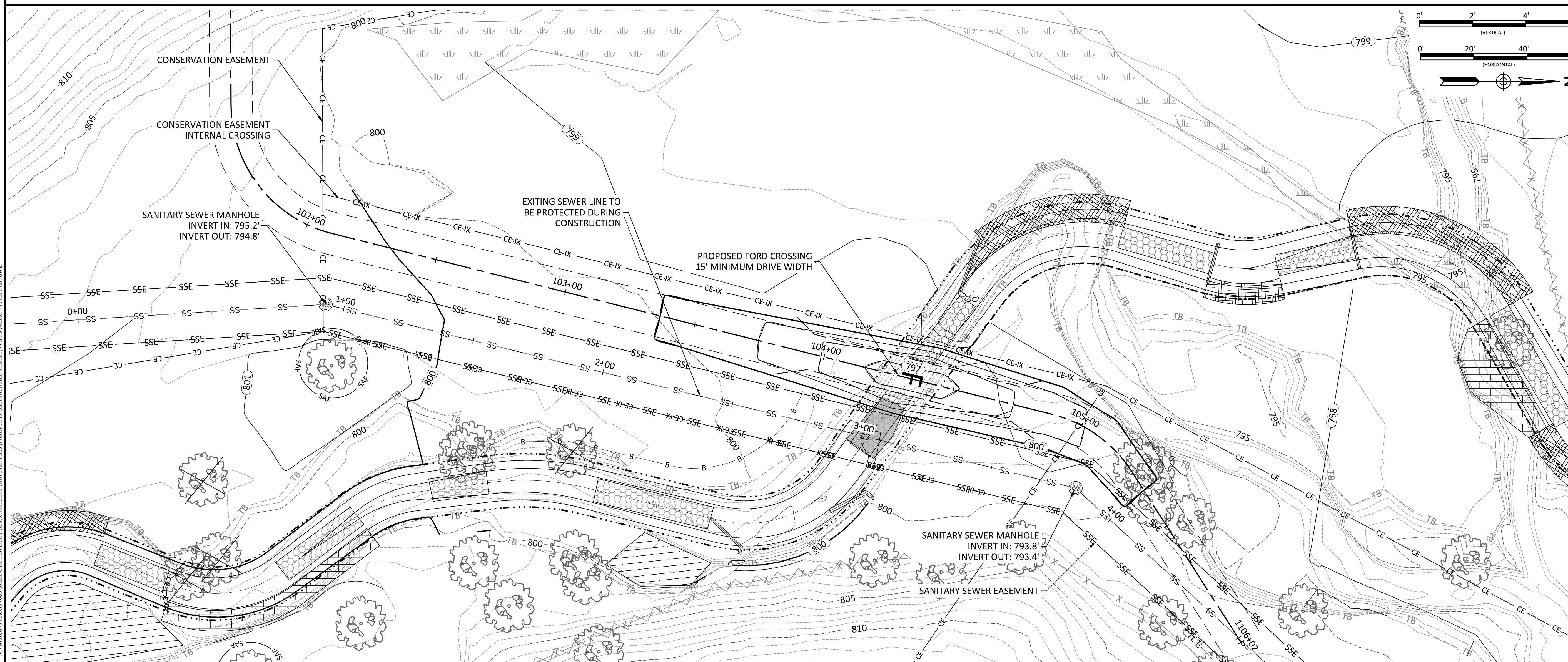
Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Sheet 5.10

March 19, 2021

NOTE:
DESIGN IS PRELIMINARY AND MAY BE RESIZED OR LAYOUT ADJUSTED DURING FINAL DESIGN





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JACOB M. MCLEAN
NORTH CAROLINA PROFESSIONAL ENGINEER SEAL 045791

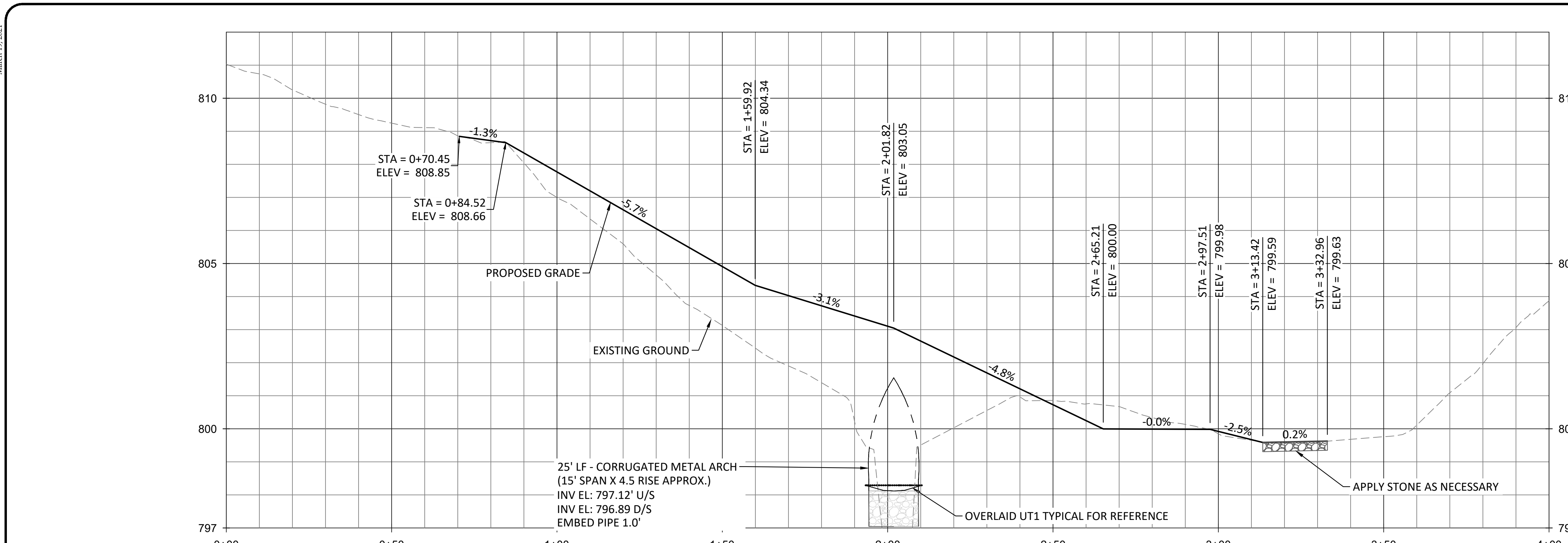
Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Oak Hill Creek
Stream Crossings

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

6.1
Sheet



NOTE:
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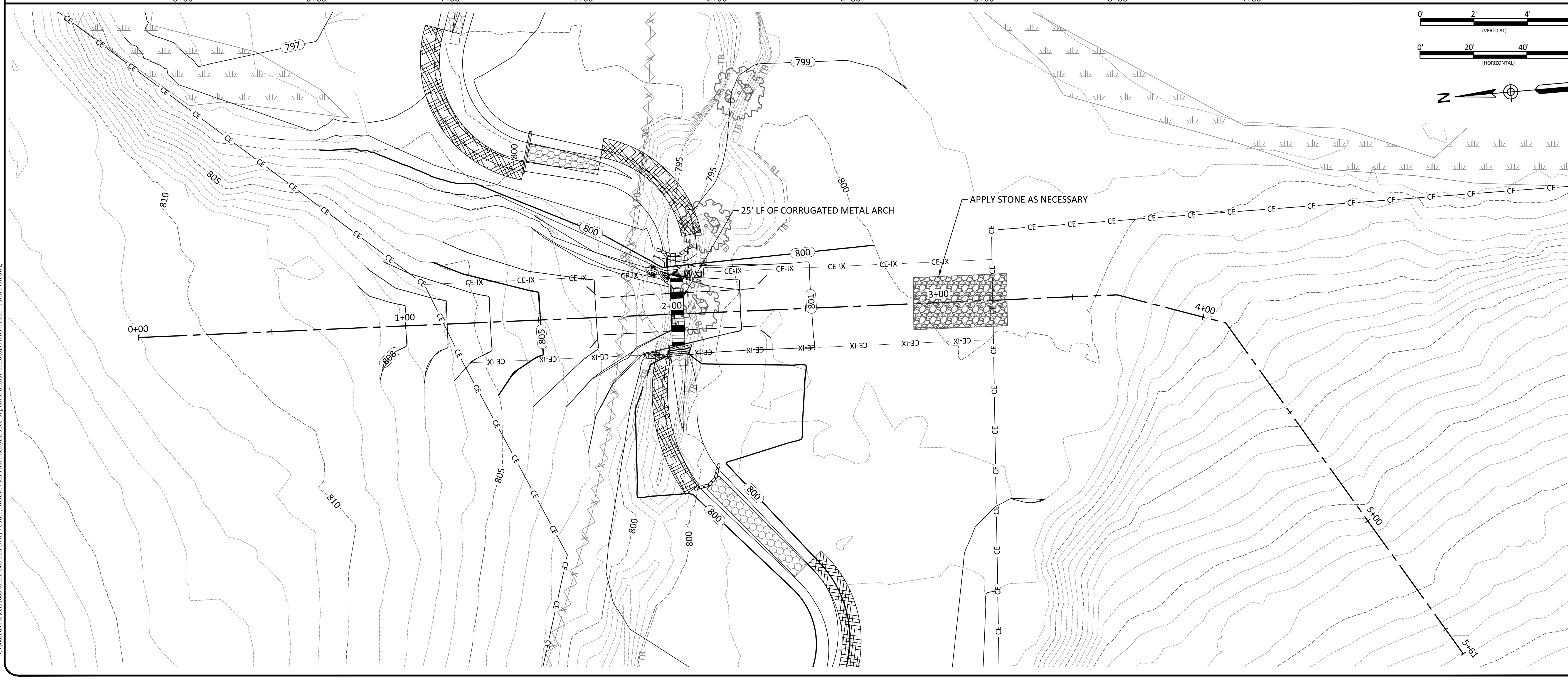
FINAL DESIGN



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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

UT1
Stream Crossings

Date: March 22, 2021
Job Number: 005-02182
Project Engineer: JM
Drawn By: JDW
Checked By: ER

Revisions:

Sheet 6.2

March 19, 2021

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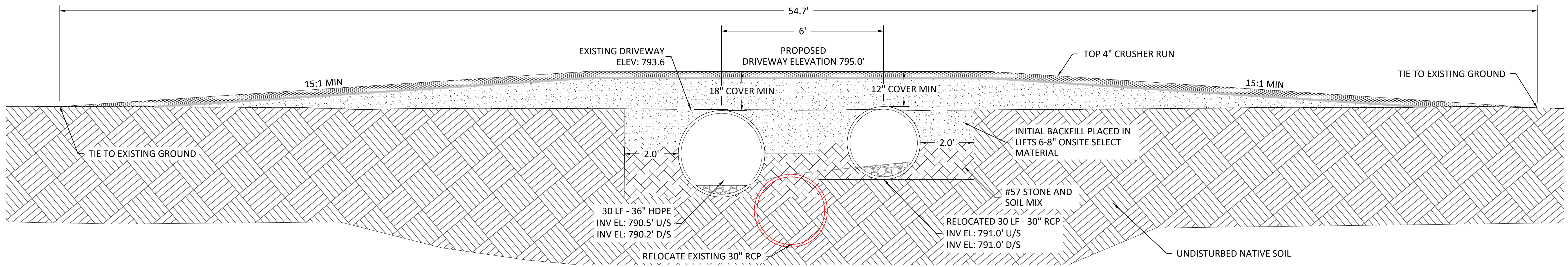
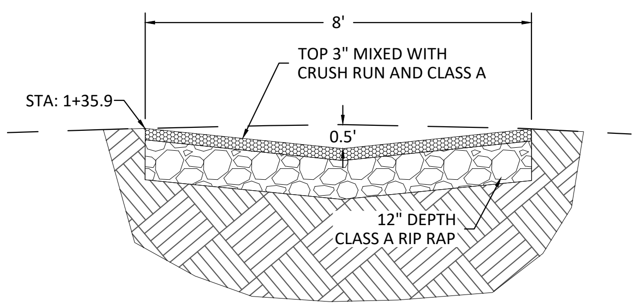
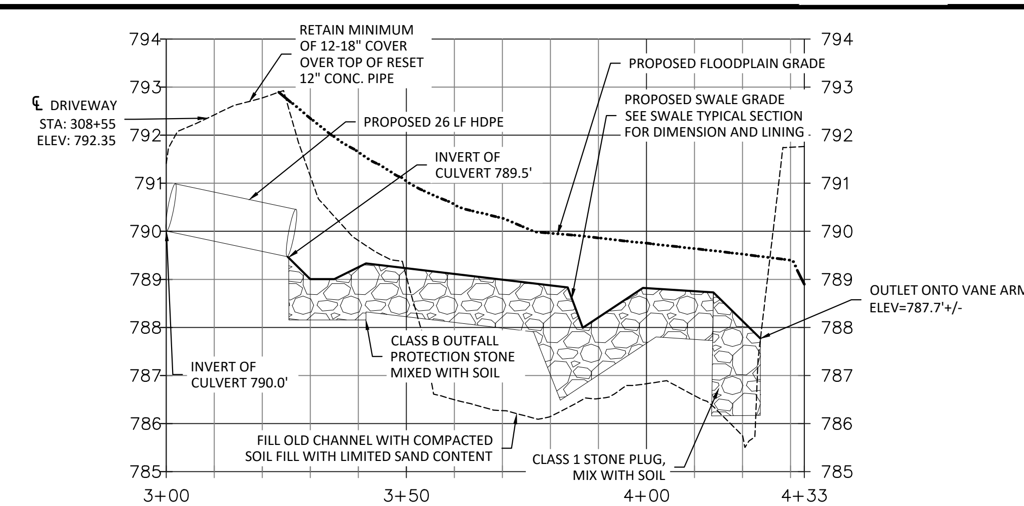
March 19, 2021



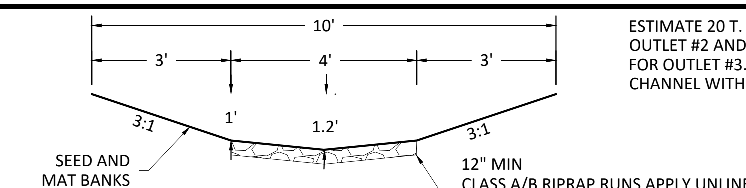
Section View
Crossing/Pipe #1



Section View
Overflow Channel for Pipe #1

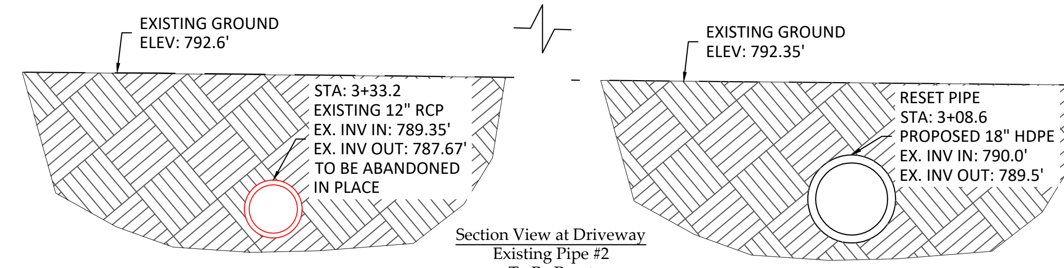


Profile View
Pipe #2 & Swale

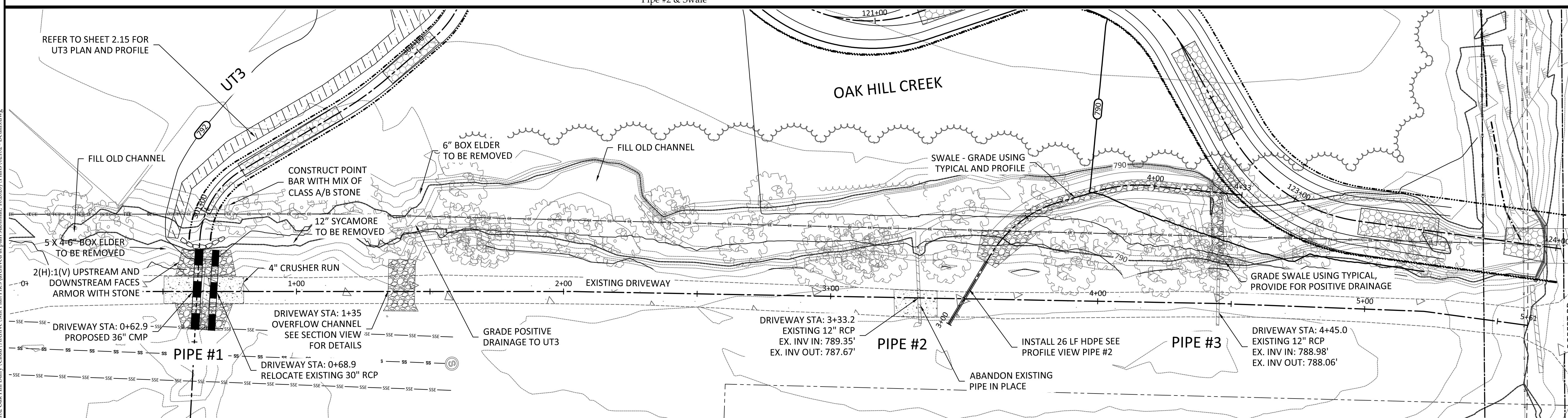


Swale Typical Section
Below Pipe #2 & #3

ESTIMATE 20 T. CLASS B FOR
OUTLET #2 AND 5 T. CLASS B
FOR OUTLET #3. ROUGHEN
CHANNEL WITH WOOD



Section View at Driveway
Existing Pipe #2
To Be Reset



Plan View

1 / 6.3 Permanent Culvert Crossing - UT3 (Gravel Driveway)
Not to Scale

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Oak Hill Dairy Mitigation Site
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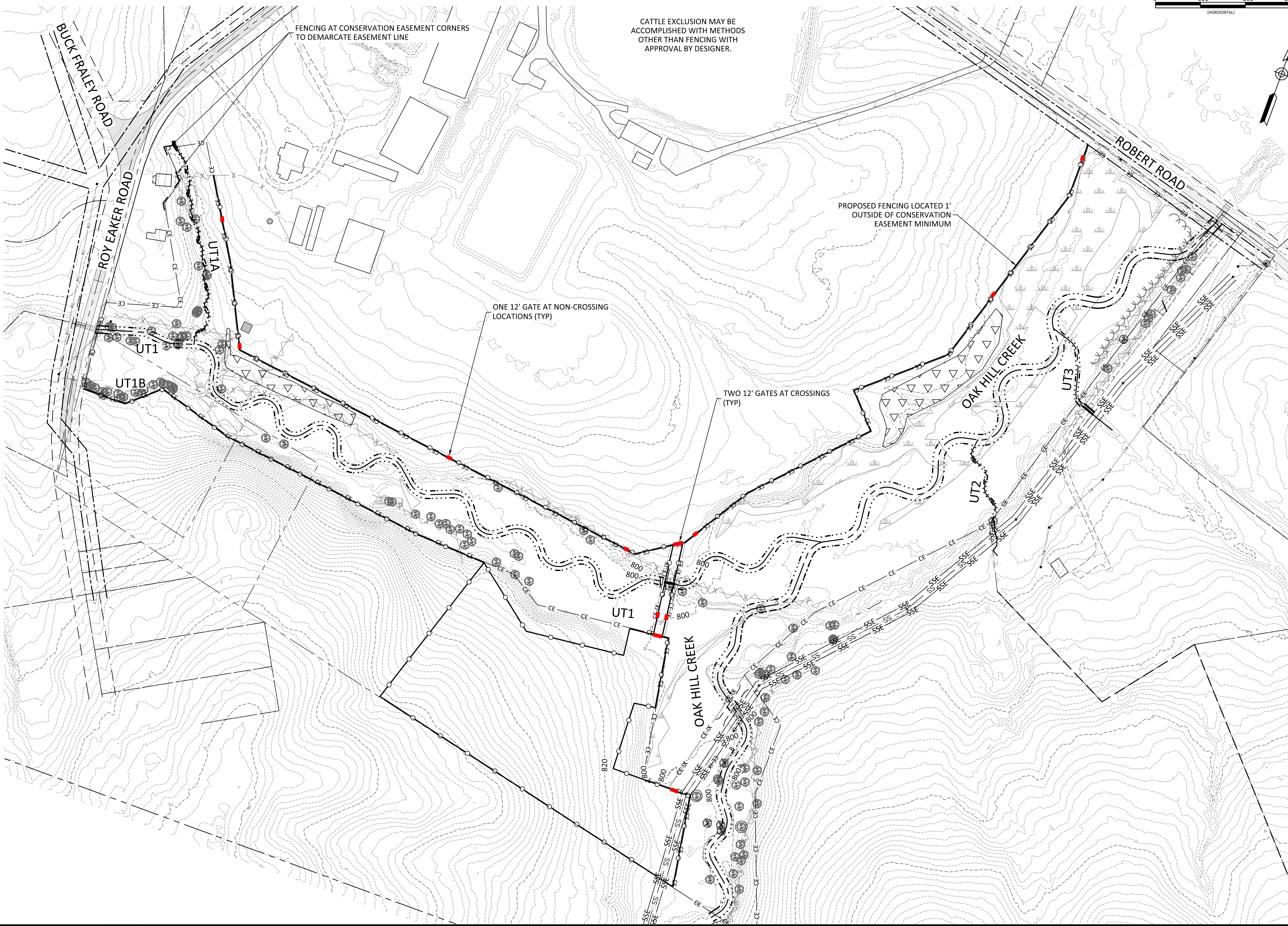
Permanent Culvert Crossings - UT3
Stream Crossings

Revisions:

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Sheet 6.3



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Oak Hill Dairy Mitigation Site
Gaston County, North Carolina

Fencing Plan

Date:	March 22, 2021
Job Number:	005-02182
Project Engineer:	JM
Drawn By:	JDW
Checked By:	ER

Revisions:

Sheet 6.4

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APPENDIX 13 – Credit Release Schedule

Appendix 13 - Credit Release Schedule and Supporting Information

All credit releases will be based on the total credit generated as reported by the as-built survey of the mitigation site. Under no circumstances shall any mitigation project be debited until the necessary Department of the Army (DA) authorization has been received for its construction or the District Engineer (DE) has otherwise provided written approval for the project in the case where no DA authorization is required for construction of the mitigation project. The DE, in consultation with the Interagency Review Team (IRT), will determine if performance standards have been satisfied sufficiently to meet the requirements of the release schedules below. In cases where some performance standards have not been met, credits may still be released depending on the specifics of the case. Monitoring may be required to restart or be extended, depending on the extent to which the site fails to meet the specified performance standard. The release of project credits will be subject to the criteria described as follows:

Table A: Credit Release Schedule – Stream Credits – *Oak Hill Dairy Mitigation Site*

Credit Release Milestone	Monitoring Year	Credit Release Activity	Interim Release	Total Released
1	0	Site Establishment	0%	0%
2	0	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan – see requirements below	30%	30%
3	1	Year 1 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	40%
4	2	Year 2 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	50%
5	3	Year 3 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	60%
6	4*	Year 4 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	65% (75%**)
7	5	Year 5 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	75% (85%**)
8	6*	Year 6 monitoring report demonstrates that channels are stable and interim performance standards have been met	5%	80% (90%**)
9	7	Year 7 monitoring report demonstrates that channels are stable and interim performance standards have been met	10%	90% (100%**)

*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

Table B: Credit Release Schedule – Wetland Credits – *Oak Hill Dairy Mitigation Site*

Credit Release Milestone	Monitoring Year	Credit Release Activity	Interim Release	Total Released
1	0	Site Establishment	0%	0%
2	0	Completion of all initial physical and biological improvements made pursuant to the Mitigation Plan – see requirements below	30%	30%
3	1	Year 1 monitoring report demonstrates that interim performance standards have been met	10%	40%

Credit Release Milestone	Monitoring Year	Credit Release Activity	Interim Release	Total Released
4	2	Year 2 monitoring report demonstrates that interim performance standards have been met	10%	50%
5	3	Year 3 monitoring report demonstrates that interim performance standards have been met	15%	65%
6	4*	Year 4 monitoring report demonstrates that interim performance standards have been met	5%	70%
7	5	Year 5 monitoring report demonstrates that interim performance standards have been met	15%	85%
8	6*	Year 6 monitoring report demonstrates that interim performance standards have been met	5%	90%
9	7	Year 7 monitoring report demonstrates that interim performance standards have been met	10%	100%

*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.

1.1 Initial Allocation of Released Credits

For this NCDMS project, no initial release of credits is provided. To account for this, the 15% credit release typically associated with the site establishment is held until completion of all initial physical and biological improvements made pursuant to the Mitigation Plan. In order for NCDMS to receive the 30% release (shown in Tables A and B as Milestone 2), they must comply with the credit release requirements stated in Section IV(I)(3) of the approved NCDMS instrument.

1.2 Subsequent Credit Releases

All subsequent credit releases must be approved by the DE, in consultation with the IRT, based on a determination that required performance standards have been achieved.

The following conditions apply to credit release schedules:

a. A reserve of 10% of site’s total stream credits will be release after four bankfull events have occurred, in separate years, provided the channel is stable and all other performance standards are met. In the event that less than four bankfull events occur during the monitoring period, release of these reserve credits is at the discretion of the NCIRT.
b. After the second milestone, the credit releases are scheduled to occur on an annual basis, assuming that the annual monitoring report has been provided to the USACE in accordance with Section IV (General Monitoring Requirements) of this document, and that the monitoring report demonstrates that interim performance standards are being met and that no other concerns have been identified on-site during the visual monitoring. All credit releases require written approval from the USACE.
c. The credits associated with the final credit release milestone will be released only upon a determination by the USACE, in consultation with the NCIRT, of functional success as defined in the Mitigation Plan.

As projects approach milestones associated with credit release, the DMS will submit a request for credit release to the DE along with documentation substantiating achievement of criteria required for release to occur. This documentation will be included with the annual monitoring report.